WBS Number	WBS Name or Description	Base Quantity	Spares Quantity	Total Quantity	Base Unit (K$)	Units	PH.D (days)	PH.M (days)	EN.D (days)	EN.M (days)	SW.D (days)	SW.M (days)	TE.D (days)	TE.M (days)	LA.D (days)	LA.M (days)	Labor (days)	Dev Labor (K$)	Dev Labor (%)	Mfg Labor (K$)	Tot Labor (K$)	Tot Mtrl (K$)	Mtrl+Mfg (K$)	Base Cost (K$)	Contingency (K$)	Contingency (%)	Total Cost (K$)
1	**BTeV Project**					man yrs >	100.9	92.6	84.2	50.0	28.9	8.5	50.2	115.2	3.9	10.9	545.3	13,770.8	16	13,748.7	27,519.5	59,349.1	73,097.8	86,868.6	18,202.9	21.0	105,071.5
	13 May 2000 (5:45 AM) Edits																										
1.1	**Vertex and Toroidal Magnets and Beam Pipe**					man yrs >	0.3	0.9	0.4	1.5	0.0	0.0	0.1	0.4	0.0	0.0	3.7	44.4	3	188.3	232.7	1,079.1	1,267.4	1,311.8	487.7	37.2	1,799.5
1.1.1	**Magnet Acquisition**					man yrs >	0.01	0.05	0.01	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.8	1	12.2	13.0	93.2	105.4	106.2	37.2	35.0	143.4
1.1.1.1	Magnet Disassembly																										107.8
1.1.1.1.1	Fixture Procurement	35	0	35	0.400	machdays	2		2	2							6	0.8	5	0.8	1.6	14.0	14.8	15.6	5.5	35.0	21.1
1.1.1.1.1.1	Coil Handling Fixture		0	0		in total											0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	35.0	0.0
1.1.1.1.1.2	Diagonal Braces		0	0		in total											0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	35.0	0.0
1.1.1.1.1.3	Lifting Lugs	0	0	0		in total											0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	35.0	0.0
1.1.1.1.2	Rigging	31		31	1.800	Rcrewday		10		20							30	0.0	0	8.4	8.4	55.8	64.2	64.2	22.5	35.0	86.7
1.1.1.2	Transport to C0																										35.6
1.1.1.2.1	Coil Transport	3	0	3	1.800	Rcrewday		1		2							3	0.0	0	0.8	0.8	5.4	6.2	6.2	2.2	35.0	8.4
1.1.1.2.2	Iron Block Transport	10	0	10	1.800	Rcrewday		2		5							7	0.0	0	2.1	2.1	18.0	20.1	20.1	7.0	35.0	27.1
1.1.2	**Magnet Modification and Assembly**					man yrs >	0.16	0.03	0.10	0.17	0.00	0.00	0.08	0.12	0.00	0.00	0.65	13.9	8	25.3	39.2	145.0	170.3	184.2	64.5	35.0	248.7
1.1.2.1	Parts Procurement																										99.6
1.1.2.1.1	Pole Insert																										63.5
1.1.2.1.1.1	Soft Iron Acquisition	50	0	50	0.500	ton	2		5								7	1.9	7	0.0	1.9	25.0	25.0	26.9	9.4	35.0	36.4
1.1.2.1.1.2	Pole Fabrication	10	0	10	1.800	Rcrewday		2		5							7	0.0	0	2.1	2.1	18.0	20.1	20.1	7.0	35.0	27.1
1.1.2.1.2	Magnet Mover																										36.1
1.1.2.1.2.1	Magnet Moving Carriage	20	0	20	0.500	ton	1		2								3	0.8	7	0.0	0.8	10.0	10.0	10.8	3.8	35.0	14.5
1.1.2.1.2.2	Heavy Duty Rollers	4	0	4	0.000	borrow			2								2	0.8	100	0.0	0.8	0.0	0.0	0.8	0.3	35.0	1.0
1.1.2.1.2.3	Support Girders	4	0	4	0.500	ton	1			5							6	0.0	0	2.1	2.1	2.0	4.1	4.1	1.4	35.0	5.5
1.1.2.1.2.4	Fabrication	5	0	5	1.800	Rcrewday	1			5							6	0.0	0	2.1	2.1	9.0	11.1	11.1	3.9	35.0	15.0
1.1.2.2	Magnet Reassembly																										149.1
1.1.2.2.1	Fixture Procurement	20	0	20	0.400	machdays	2		10								12	3.9	33	0.0	3.9	8.0	8.0	11.9	4.2	35.0	16.0
1.1.2.2.2	Rigging and Welding	35		35	1.800	Rcrewday		5		20							25	0.0	0	8.4	8.4	63.0	71.4	71.4	25.0	35.0	96.4
1.1.2.2.3	Magnet Measurement																										36.6
1.1.2.2.3.1	Ziptrack	1	0	1			30		2	2			10	20			64	3.1	34	5.9	9.0	0.0	5.9	9.0	3.2	35.0	12.2
1.1.2.2.3.2	Electronics	1	0	1						2			10				12	2.3	73	0.8	3.2	0.0	0.8	3.2	1.1	35.0	4.3
1.1.2.2.3.3	Survey			0						2				10			12	0.0	0	3.4	3.4	0.0	3.4	3.4	1.2	35.0	4.6
1.1.2.2.3.4	Modify Ziptrack	1		1	10.000	fabrication	2		3	1							6	1.2	10	0.4	1.6	10.0	10.4	11.6	4.1	35.0	15.6
1.1.3	**Magnet Transportation, Installation and Testing at C0**					man yrs >	0.01	0.01	0.05	0.04	0.00	0.00	0.00	0.18	0.00	0.00	0.29	5.0	9	15.8	20.8	37.6	53.4	58.4	20.5	35.0	78.9
1.1.3.1	Magnet Cooling																										22.5
1.1.3.1.1	Connect to Main Ring LCW	5	0	5	1.000	Pcrewday	1		2	1				6			10	0.8	10	1.9	2.7	5.0	6.9	7.7	2.7	35.0	10.4
1.1.3.1.2	Hoses and Headers	2	0	2	2.000	manifolds	1		2	1				6			10	0.8	11	1.9	2.7	4.0	5.9	6.7	2.4	35.0	9.1
1.1.3.1.3	Controls	1	0	1					2	1				4			7	0.8	35	1.4	2.2	0.0	1.4	2.2	0.8	35.0	3.0
1.1.3.2	Magnet Power																										45.2
1.1.3.2.1	Power Supplies and Cable	0	0	0																							26.6
1.1.3.2.1.1	Power Supplies and Controls	0	0	0					2	1				6			9	0.8	28	1.9	2.7	0.0	1.9	2.7	1.0	35.0	3.7
1.1.3.2.1.2	Triplex Cable	750	0	750	0.010	ft			1	1							2	0.4	5	0.4	0.8	7.5	7.9	8.3	2.9	35.0	11.2
1.1.3.2.1.3	Triplex Installation	5	0	5	1.500	Ecrewday			2	1							3	0.8	9	0.4	1.2	7.5	7.9	8.7	3.0	35.0	11.7
1.1.3.2.2	High Current Buss Work	1000	0	1000	0.010	feet			2	1				10			13	0.8	6	3.0	3.7	10.0	13.0	13.7	4.8	35.0	18.5
1.1.3.3	Transport to Detector Hall																										11.3
1.1.3.3.1	Labor	2		2	1.800	Rcrewday		2		2				6			10	0.0	0	2.4	2.4	3.6	6.0	6.0	2.1	35.0	8.1
1.1.3.3.2	Survey			0						2				6			8	0.0	0	2.4	2.4	0.0	2.4	2.4	0.8	35.0	3.2
1.1.4	**Beam Pipes**					man yrs >	0.03	0.03	0.03	0.03	0.00	0.00	0.00	0.06	0.00	0.00	0.18	3.1	13	7.4	10.5	13.0	20.4	23.5	8.2	35.0	31.8
1.1.4.1	Tracking Detector Thin Walled Beam Pipe	1	0	1	10.000	fabrication	5	5	5	5				10			30	1.9	12	4.7	6.6	10.0	14.7	16.6	5.8	35.0	22.4
1.1.4.2	Rich and Muon Beam Pipe	3	0	3	1.000	fabrication	2	2	3	3				6			16	1.2	17	2.8	3.9	3.0	5.8	6.9	2.4	35.0	9.4
1.1.5	**Muon Toroids**					man yrs >	0.05	0.03	0.14	0.14	0.00	0.00	0.00	0.08	0.00	0.00	0.44	13.9	2	19.9	33.7	790.3	810.2	824.0	317.0	38.5	1,141.0
1.1.5.1	Soft Iron Acquisition, Toroids + Shielding	132	0	132	5.000	iron slab	5		10								15	3.9	1	0.0	3.9	660.0	660.0	663.9	265.5	40.0	929.4
1.1.5.2	Coil Fabrication	1	0	1	76.300	quote	5	5	20	20							50	7.7	8	8.4	16.2	76.3	84.7	92.5	27.7	30.0	120.2
1.1.5.3	Power to Toroids																										23.7
1.1.5.3.1	Locomotive Cable	500	0	500	0.010	ft				2							2	0.0	0	0.8	0.8	5.0	5.8	5.8	2.0	35.0	7.9
1.1.5.3.2	Cable Installation	5	0	5	1.500	Ecrewday				2							2	0.0	0	0.8	0.8	7.5	8.3	8.3	2.9	35.0	11.3
1.1.5.3.3	LCW for Toroid			0						2				10			12	0.0	0	3.4	3.4	0.0	3.4	3.4	1.2	35.0	4.6
1.1.5.4	Assembly and Transport to Detector Hall	20		20	1.800	Rcrewday	2	3	4	6							15	1.5	4	2.5	4.1	36.0	38.5	40.1	14.0	35.0	54.1
1.1.5.5	Toroid Power																										13.6
1.1.5.5.1	Power Supply and Controls			0					1	1				6			8	0.4	17	1.9	2.3	0.0	1.9	2.3	0.8	35.0	3.1
1.1.5.5.2	Triplex Cable	250		250	0.010	ft				1							1	0.0	0	0.4	0.4	2.5	2.9	2.9	1.0	35.0	3.9
1.1.5.5.3	Triplex Installation	2		2	1.500	Ecrewday			1	1				4			6	0.4	8	1.4	1.8	3.0	4.4	4.8	1.7	35.0	6.5
1.1.6	**ES&H**					man yrs >	0.04	0.16	0.08	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.40	7.7	38	12.7	20.4	0.0	12.7	20.4	7.1	35.0	27.5
1.1.6.1	Mechanical, Gas and Cryogenics (ES&H total in this row)			0			10	40	20	30							100	7.7	38	12.7	20.4	0.0	12.7	20.4	7.1	35.0	27.5
1.1.6.2	Electrical			0													0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	35.0	0.0
1.1.6.3	Environmental	0	0	0													0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	35.0	0.0
1.1.6.4	Radiation Safety			0													0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	35.0	0.0
1.1.6.5	Training			0													0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	35.0	0.0
1.1.7	**Vertex Magnet and Beam Pipe Project Management**					man yrs >	0.00	0.62	0.00	0.90	0.00	0.00	0.00	0.00	0.00	0.00	1.52	0.0	0	95.0	95.0	0.0	95.0	95.0	33.2	35.0	128.2
1.1.7.1	Project Coordination			0				120		150							270	0.0	0	63.3	63.3	0.0	63.3	63.3	22.2	35.0	85.5
1.1.7.2	Project Engineering			0						30							30	0.0	0	12.7	12.7	0.0	12.7	12.7	4.4	35.0	17.1
1.1.7.3	Project Reviews			0				20		30							50	0.0	0	12.7	12.7	0.0	12.7	12.7	4.4	35.0	17.1
1.1.7.4	ES&H Reviews			0				10		10							20	0.0	0	4.2	4.2	0.0	4.2	4.2	1.5	35.0	5.7
1.1.7.5	Travel			0				5		5							10	0.0	0	2.1	2.1	0.0	2.1	2.1	0.7	35.0	2.8
1.2	**Pixel Detector**					man yrs >	31.9	21.0	17.4	7.7	0.8	0.7	9.2	13.0	2.9	1.7	106.2	2,360.2	22	1,756.5	4,116.8	6,464.9	8,221.4	10,581.7	3,671.0	34.7	14,252.6
1.2.1	**Sensors**					man yrs >	4.50	4.00	0.16	0.16	0.00	0.00	0.33	0.32	0.80	0.38	10.65	55.6	3	47.8	103.4	2,075.0	2,122.8	2,178.4	730.6	33.5	2,909.0
1.2.1.1	Detector																										1,275.7
1.2.1.1.1	Development and Prototypes																										453.0
1.2.1.1.1.1	Prototype Run 1	15		15	5.500	wafer	125		10				4		6		145	5.4	6	0.0	5.4	82.5	82.5	87.9	62.4	71.0	150.3
1.2.1.1.1.2	Prototype Run 2	15		15	5.500	wafer	125		10				2	4	5		146	4.8	5	1.0	5.9	82.5	83.5	88.4	62.7	71.0	151.1
1.2.1.1.1.3	Engineering Run (10% test)	15		15	5.500	wafer	150		10				2	5	5		172	4.8	5	1.3	6.1	82.5	83.8	88.6	62.9	71.0	151.5
1.2.1.1.2	Production	160	40	200	2.500	wafer		600		20				60		40	720	0.0	0	28.2	28.2	500.0	528.2	528.2	121.5	23.0	649.7
1.2.1.1.3	Sensor Test Facility																										145.6
1.2.1.1.3.1	LRC Meter	2		2	7.000	each											0	0.0	0	0.0	0.0	14.0	14.0	14.0	0.8	6.0	14.8
1.2.1.1.3.2	Associated electronics	2		2	10.000	total									125		125	13.0	39	0.0	13.0	20.0	20.0	33.0	3.6	11.0	36.6
1.2.1.1.3.3	TCT Test Stand	1		1	25.000	total	150								30		180	3.1	11	0.0	3.1	25.0	25.0	28.1	2.5	9.0	30.7
1.2.1.1.3.4	VME CPU	1		1	4.000	each											0	0.0	0	0.0	0.0	4.0	4.0	4.0	0.2	6.0	4.2

WBS Number	WBS Name or Description	Base Quantity	Spares Quantity	Total Quantity	Base Unit (K$)	Units	PH.D (days)	PH.M (days)	EN.D (days)	EN.M (days)	SW.D (days)	SW.M (days)	TE.D (days)	TE.M (days)	LA.D (days)	LA.M (days)	Labor (days)	Dev Labor (K$)	Dev Labor (%)	Mfg Labor (K$)	Tot Labor (K$)	Tot Mtrl (K$)	Mtrl+Mfg (K$)	Base Cost (K$)	Contingency (K$)	Contingency (%)	Total Cost (K$)
1.2.1.1.3.5	PC	1		1	3.000	each											0	0.0	0	0.0	0.0	3.0	3.0	3.0	0.2	6.0	3.2
1.2.1.1.3.6	Crate	2		2	5.000	each											0	0.0	0	0.0	0.0	10.0	10.0	10.0	0.6	6.0	10.6
1.2.1.1.3.7	Probe Station	1		1	40.000	each									20		0	2.1	5	0.0	2.1	40.0	40.0	42.1	3.4	8.0	45.4
1.2.1.1.4	Irradiation Tests	4		4	4.000	each	75	25					15		10	5	130	4.5	21	0.6	5.1	16.0	16.6	21.1	6.3	30.0	27.4
1.2.1.2	Bump Bonds																0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,633.3
1.2.1.2.1	Development and Prototypes	25	0	25	9.500	wafer	100		10				60				170	17.8	7	0.0	17.8	237.5	237.5	255.3	178.7	70.0	434.0
1.2.1.2.2	Production	250	70	320	2.900	wafer		100		10							110	0.0	0	4.2	4.2	928.0	932.2	932.2	214.4	23.0	1,146.6
1.2.1.2.3	Test and Inspection Fixtures	1		1	30.000	total	400	275		10				10		50	695	0.0	0	12.5	12.5	30.0	42.5	42.5	10.2	24.0	52.7
1.2.2	**Front-End Electronics**					man yrs >	3.12	5.54	6.60	1.70	0.00	0.12	2.22	4.51	0.08	0.50	24.39	767.7	28	492.1	1,259.8	1,518.1	2,010.2	2,777.9	1,201.6	43.3	3,979.5
1.2.2.1	Pixel FPIX ICs																										1,263.7
1.2.2.1.1	Development and Prototypes																										863.3
1.2.2.1.1.1	Prototype Run 1	25		25	1.400	each	50		200				25				275	83.0	70	0.0	83.0	35.0	35.0	118.0	89.7	76.0	207.7
1.2.2.1.1.2	Prototype Run 2	25		25	1.400	each	50		200				25				275	83.0	70	0.0	83.0	35.0	35.0	118.0	89.7	76.0	207.7
1.2.2.1.1.3	Prototype Run 3 (Eng. Run)	3500		3500	0.046	each	50		150				25				225	63.7	28	0.0	63.7	161.0	161.0	224.7	170.8	76.0	395.5
1.2.2.1.1.4	Test Fixtures & Prototype Testing	20		20	1.000	each			50				10				60	21.6	52	0.0	21.6	20.0	20.0	41.6	10.8	26.0	52.4
1.2.2.1.2	Production																										400.4
1.2.2.1.2.1	Testing: Automated and Field	1		1	10.000	total		350		50				80			480	0.0	0	41.4	41.4	10.0	51.4	51.4	10.3	20.0	61.7
1.2.2.1.2.2	Production Run	11000	2500	13500	0.018	each		100		50				25			175	0.0	0	27.5	27.5	245.7	273.2	273.2	65.6	24.0	338.7
1.2.2.2	Rad-Hard Serializer/Transmitter ICs (Developed in WBS 1.10)																										229.1
1.2.2.2.1	Design Reviews and Prototype Testing						100		30								130	11.6	100	0.0	11.6	0.0	0.0	11.6	2.8	24.0	14.4
1.2.2.2.2	Production																										214.7
1.2.2.2.2.1	Testing: Automated and Field	2		2	5.000	total		50		25				20			95	0.0	0	15.6	15.6	10.0	25.6	25.6	5.1	20.0	30.8
1.2.2.2.2.2	Production Serializer/Transmitter ICs	2232	500	2732	0.050	each	0	25	0	20			0	13			58	0.0	0	11.7	11.7	136.6	148.3	148.3	35.6	24.0	183.9
1.2.2.3	Rad-Hard Pixel Control/Monitoring & Timing ICs (Developed in WBS 1.13)																										218.1
1.2.2.3.1	Design Reviews and Prototype Testing						100		30								130	11.6	100	0.0	11.6	0.0	0.0	11.6	2.8	24.0	14.4
1.2.2.3.2	Production																										203.8
1.2.2.3.2.1	Testing: Automated and Field	2		2	5.000	total		100		30				30			160	0.0	0	20.3	20.3	10.0	30.3	30.3	6.1	20.0	36.3
1.2.2.3.2.2	Production Rad-Hard C/M & T ICs	1116	350	1466	0.080	each		30		30				20			80	0.0	0	17.7	17.7	117.3	135.0	135.0	32.4	24.0	167.4
1.2.2.4	Pixel C/M&T and Data Opto-Electronics (Developed in WBS 1.10)																										239.3
1.2.2.4.1	Design Reviews and Prototype Testing						30		30				30				90	18.5	100	0.0	18.5	0.0	0.0	18.5	4.4	24.0	23.0
1.2.2.4.2	Production																										216.4
1.2.2.4.2.1	Testing: Automated and Field	2		2	5.000	total		20		30				30			80	0.0	0	20.3	20.3	10.0	30.3	30.3	6.1	20.0	36.3
1.2.2.4.2.2	Production C/M&T and Data Opto-Electronics	3348	900	4248	0.030	each		30		30				20			80	0.0	0	17.7	17.7	127.4	145.2	145.2	34.8	24.0	180.0
1.2.2.5	Pixel Multi-Chip Modules			0																							1,879.4
1.2.2.5.1	Development and Prototypes			0																							849.0
1.2.2.5.1.1	Prototype Run 1 (with FPIX1)	3		3	7.000	each	30		200				60				290	91.1	81	0.0	91.1	21.0	21.0	112.1	67.3	60.0	179.4
1.2.2.5.1.2	Prototype Run 2 (one module type)	5		5	4.000	each	30		200				60				290	91.1	82	0.0	91.1	20.0	20.0	111.1	66.7	60.0	177.8
1.2.2.5.1.3	Prototype Run 3 (all three module types)	15		15	4.000	each	30		200				60				290	91.1	60	0.0	91.1	60.0	60.0	151.1	72.5	48.0	223.7
1.2.2.5.1.4	Prototype Run 4, 10% System	86		86	0.580	each	110		200				200				510	123.6	71	0.0	123.6	49.9	49.9	173.5	62.5	36.0	235.9
1.2.2.5.1.5	Testing Fixtures and Setup	10		10	1.500	each	100		10				20		20		130	10.6	41	0.0	10.6	15.0	15.0	25.6	6.7	26.0	32.2
1.2.2.5.2	Production																0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,030.4
1.2.2.5.2.1	Testing and Rework	1		1	15.000	total		500		70				200		60	770	0.0	0	87.2	87.2	15.0	102.2	102.2	49.0	48.0	151.2
1.2.2.5.2.2	Production Run	868	80	948	0.400	each		150		60		30		670		65	910	0.0	0	214.9	214.9	379.2	594.1	594.1	285.1	48.0	879.2
1.2.2.6	Front End Radiation Studies	10		10	4.000	each	100	30	150	30			40	20			370	67.2	54	17.7	84.9	40.0	57.7	124.9	25.0	20.0	149.9
1.2.3	**Power, Monitoring and Interlocks**					man yrs >	3.72	3.08	2.00	1.20	0.00	0.00	1.12	1.00	0.12	0.80	13.04	261.1	17	212.9	474.0	1,085.2	1,298.1	1,559.2	480.6	30.8	2,039.8
1.2.3.1	High Voltage Power																										612.6
1.2.3.1.1	Development and Prototypes			1	100.000	total	100		100				50				250	50.2	33	0.0	50.2	100.0	100.0	150.2	69.1	46.0	219.3
1.2.3.1.2	Production			1	250.000	total		100		70				50		50	270	0.0	0	47.9	47.9	250.0	297.9	297.9	95.3	32.0	393.3
1.2.3.2	Low Voltage Power			0																							423.7
1.2.3.2.1	Development and Prototypes			1	70.000	total	100		100				50				250	50.2	42	0.0	50.2	70.0	70.0	120.2	55.3	46.0	175.5
1.2.3.2.2	Production			1	150.000	total		100		70				20		30	220	0.0	0	38.0	38.0	150.0	188.0	188.0	60.2	32.0	248.2
1.2.3.3	RF Shielding																										52.1
1.2.3.3.1	Development and Prototypes	5	0	5	1.000	each	250		20						30		300	10.8	68	0.0	10.8	5.0	5.0	15.8	3.2	20.0	19.0
1.2.3.3.2	Production	62	9	71	0.100	each		250		20						60	330	0.0	0	15.3	15.3	7.1	22.4	22.4	10.7	48.0	33.1
1.2.3.4	Monitoring and Interlocks			0																							283.3
1.2.3.4.1	Development and Prototypes	1		1	20.000	total	300		80				50				430	42.5	68	0.0	42.5	20.0	20.0	62.5	21.9	35.0	84.3
1.2.3.4.1.1	Temperature			0													0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.2.3.4.1.2	Radiation			0													0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.2.3.4.1.3	Voltage			0													0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.2.3.4.1.4	Current			0													0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.2.3.4.1.5	Chilled Water			0													0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.2.3.4.2	Production	1		1	100.000	total		120		60				60		60	300	0.0	0	47.4	47.4	100.0	147.4	147.4	51.6	35.0	199.0
1.2.3.4.2.1	Temperature			0													0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.2.3.4.2.2	Radiation			0													0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.2.3.4.2.3	Voltage			0													0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.2.3.4.2.4	Current			0													0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.2.3.4.2.5	Chilled Water			0													0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.2.3.5	Cables and Connectors																										668.1
1.2.3.5.1	Development and Prototypes																										148.4
1.2.3.5.1.1	Copper	1		1	13.000	total	40		100				70				210	54.8	81	0.0	54.8	13.0	13.0	67.8	14.9	22.0	82.8
1.2.3.5.1.2	Fiber Optics	10	2	12	0.110	each	40		60				20				120	27.8	95	0.0	27.8	1.3	1.3	29.1	6.4	22.0	35.5
1.2.3.5.1.3	Radiation and Vacuum Studies			0			100		40				40				180	24.7	100	0.0	24.7	0.0	0.0	24.7	5.4	22.0	30.2
1.2.3.5.2	Production																										519.6
1.2.3.5.2.1	Copper	1		1	335.000	total		100		40				60			200	0.0	0	32.1	32.1	335.0	367.1	367.1	73.4	20.0	440.5
1.2.3.5.2.2	Fiber Optics	279	28	307	0.110	each		100		40				60			200	0.0	0	32.1	32.1	33.8	65.9	65.9	13.2	20.0	79.1
1.2.4	**Mechanical and Other Systems**					man yrs >	8.72	5.96	4.48	2.76	0.00	0.00	2.10	5.56	1.22	0.00	30.80	585.8	22	644.2	1,230.1	1,402.0	2,046.2	2,632.1	918.7	34.9	3,550.7
1.2.4.1	Pixel Plane																										602.8
1.2.4.1.1	Development and Prototypes																										367.9
1.2.4.1.1.1	Prototype Run 1	3		3	10.000	each	180		50				15		10		245	23.8	44	0.0	23.8	30.0	30.0	53.8	26.9	50.0	80.7
1.2.4.1.1.2	Prototype Run 2	3		3	10.000	each	180		50				15		10		255	23.8	44	0.0	23.8	30.0	30.0	53.8	26.9	50.0	80.7
1.2.4.1.1.3	Prototype Run 3	3		3	10.000	each	180		50				15		10		255	23.8	44	0.0	23.8	30.0	30.0	53.8	26.9	50.0	80.7
1.2.4.1.1.3	Prototype Run 4 (Eng. Run)	6		6	10.000	each	180		50				15		10		245	23.8	28	0.0	23.8	60.0	60.0	83.8	41.9	50.0	125.7

WBS Number	WBS Name or Description	Base Quantity	Spares Quantity	Total Quantity	Base Unit (K$)	Units	PH.D (days)	PH.M (days)	EN.D (days)	EN.M (days)	SW.D (days)	SW.M (days)	TE.D (days)	TE.M (days)	LA.D (days)	LA.M (days)	Labor (days)	Dev Labor (K$)	Dev Labor (%)	Mfg Labor (K$)	Tot Labor (K$)	Tot Mtrl (K$)	Mtrl+Mfg (K$)	Base Cost (K$)	Contingency (K$)	Contingency (%)	Total Cost (K$)
1.2.4.1.2	Production	62	20	82	1.500	each		250		70				100			420	0.0	0	54.9	54.9	123.0	177.9	177.9	56.9	32.0	234.9
1.2.4.2	Pixel Plane Integration																										303.7
1.2.4.2.1	Development and Prototypes	1		1	20.000	total	150		125				50				325	59.9	75	0.0	59.9	20.0	20.0	79.9	24.0	30.0	103.8
1.2.4.2.2	Production	1		1	10.000	total		350		100				400			850	0.0	0	143.8	143.8	10.0	153.8	153.8	46.1	30.0	199.9
1.2.4.3	Pixel Frame																										875.4
1.2.4.3.1	Development and Prototypes	1		1	200.000	each	150		125				100				375	71.5	26	0.0	71.5	200.0	200.0	271.5	217.2	80.0	488.6
1.2.4.3.1.1	Half Frame			0																							0.0
1.2.4.3.1.2	Cooling Connections			0																							0.0
1.2.4.3.1.3	Assembly Fixture			0																							0.0
1.2.4.3.1.3.1	Mechanics			0																							0.0
1.2.4.3.1.3.2	Measurement			0														0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.2.4.3.2	Production	2		2	100.000	each		150		100				200			450	0.0	0	93.0	93.0	200.0	293.0	293.0	93.8	32.0	386.8
1.2.4.4	Detector Mechanical Supports and Precision Movement																										489.3
1.2.4.4.1	Half Frame Motion System																										282.2
1.2.4.4.1.1	Development and Prototypes																										119.8
1.2.4.4.1.1.1	Mechanics	2		2	10.000	each	150		70				25				245	32.8	62	0.0	32.8	20.0	20.0	52.8	19.0	36.0	71.8
1.2.4.4.1.1.2	Monitor	2		2	5.000	each	150		70				25				245	32.8	77	0.0	32.8	10.0	10.0	42.8	5.1	12.0	48.0
1.2.4.4.1.2	Production																										162.4
1.2.4.4.1.2.1	Mechanics	4		4	8.000	each		100		50				80			230	0.0	0	41.4	41.4	32.0	73.4	73.4	23.5	32.0	96.9
1.2.4.4.1.2.2	Monitor	4		4	4.000	each		100		50				80			230	0.0	0	41.4	41.4	16.0	57.4	57.4	8.0	14.0	65.5
1.2.4.4.2	Detector Alignment System																										207.2
1.2.4.4.2.1	Development and Prototypes																										87.9
1.2.4.4.2.1.1	Mechanics	1		1	4.000	each	150		70				20		5		240	32.2	89	0.0	32.2	4.0	4.0	36.2	13.0	36.0	49.2
1.2.4.4.2.1.2	Monitor	1		1	3.000	each	150		70				15		10		235	31.5	91	0.0	31.5	3.0	3.0	34.5	4.1	12.0	38.7
1.2.4.4.2.2	Production																										119.3
1.2.4.4.2.2.1	Mechanics	2		2	4.000	each		100		50				80			230	0.0	0	41.4	41.4	8.0	49.4	49.4	15.8	32.0	65.2
1.2.4.4.2.2.2	Monitor	2		2	3.000	each		100		50				80			230	0.0	0	41.4	41.4	6.0	47.4	47.4	6.6	14.0	54.1
1.2.4.5	Vacuum System																										694.5
1.2.4.5.1	Development and Prototypes																										296.1
1.2.4.5.1.1	Pixel Vacuum Vessel	1		1	10.000	each	40	20	50	20			20	30			180	23.9	48	16.1	40.0	10.0	26.1	50.0	19.0	38.0	69.0
1.2.4.5.1.2	Feed-Throughs			1	100.000	total	80		80				80				240	49.4	33	0.0	49.4	100.0	100.0	149.4	77.7	52.0	227.1
1.2.4.5.2	Production			0																							398.3
1.2.4.5.2.1	Feed-Throughs			1	250.000	total		80		80				80			240	0.0	0	54.1	54.1	250.0	304.1	304.1	94.3	31.0	398.3
1.2.4.6	Fluid System																									12.0	36.9
1.2.4.6.1	Chillers	2		2	8.500	each		20		10				5			35	0.0	0	5.5	5.5	17.0	22.5	22.5	2.7	12.0	25.2
1.2.4.6.2	Pipes, Hoses and Filters	1		1	5.000	each		20		10				5			35	0.0	0	5.5	5.5	5.0	10.5	10.5	1.3	12.0	11.7
1.2.4.7	Mechanical, Radiation and Vacuum Property Testing																										322.0
1.2.4.7.1	Development and Prototypes																										179.3
1.2.4.7.1.1	Material Testing																										52.8
1.2.4.7.1.1.1	Carbon	1		1	3.000	total	10		10				10				30	6.2	67	0.0	6.2	3.0	3.0	9.2	0.7	8.0	9.9
1.2.4.7.1.1.2	Glues	1		1	3.000	total	10		10				10				30	6.2	67	0.0	6.2	3.0	3.0	9.2	0.7	8.0	9.9
1.2.4.7.1.1.3	Piping and Hose	1		1	3.000	total	10		10				10				30	6.2	67	0.0	6.2	3.0	3.0	9.2	0.7	8.0	9.9
1.2.4.7.1.1.4	Cabling	1		1	3.000	total	10		10				10				30	6.2	67	0.0	6.2	3.0	3.0	9.2	0.7	8.0	9.9
1.2.4.7.1.1.5	Others	1		1	6.000	total	10		10				10				30	6.2	51	0.0	6.2	6.0	6.0	12.2	1.0	8.0	13.2
1.2.4.7.1.2	Mechanical Structure Testing			1	80.000	total	200		60				60				320	37.1	32	0.0	37.1	80.0	80.0	117.1	9.4	8.0	126.4
1.2.4.7.1.2.1	Pixel Plane (all mechanical testing)			0													0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.2.4.7.1.2.2	Plane Frame			0													0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.2.4.7.1.2.3	Mechanical Supports			0													0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.2.4.7.1.2.4	Piping and Hose			0													0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.2.4.7.1.2.5	Others			0													0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.2.4.7.2	Production			0																							142.8
1.2.4.7.2.1	Pixel Plane	1		1	5.000	total		20		10				70			100	0.0	0	22.0	22.0	5.0	27.0	27.0	2.2	8.0	29.2
1.2.4.7.2.2	Plane Frame	1		1	5.000	total		20		10				30			60	0.0	0	11.8	11.8	5.0	16.8	16.8	1.3	8.0	18.2
1.2.4.7.2.3	Mechanical Supports	1		1	5.000	total		20		10				20			50	0.0	0	9.3	9.3	5.0	14.3	14.3	1.1	8.0	15.4
1.2.4.7.2.4	Piping and Hose	1		1	5.000	total		20		10				20			50	0.0	0	9.3	9.3	5.0	14.3	14.3	1.1	8.0	15.4
1.2.4.7.2.5	Cabling	1		1	5.000	total		20		10				30			60	0.0	0	11.8	11.8	5.0	16.8	16.8	1.3	8.0	18.2
1.2.4.7.2.6	Pixel Detector System	1		1	5.000	total		20		10				30			60	0.0	0	11.8	11.8	5.0	16.8	16.8	1.3	8.0	18.2
1.2.4.7.2.7	Others	1		1	10.000	total		40		20				30			90	0.0	0	16.1	16.1	10.0	26.1	26.1	2.1	8.0	28.1
1.2.4.8	Other Systems			0																							105.0
1.2.4.8.1	Detector Handling Fixtures	1		1	30.000	total	40		50				20				110	23.9	44	0.0	23.9	30.0	30.0	53.9	10.8	20.0	64.7
1.2.4.8.2	Vacuum Pipe Fixtures	1		1	20.000	total		40		20				20			80	0.0	0	13.5	13.5	20.0	33.5	33.5	6.7	20.0	40.2
1.2.4.9	Mechanical Support Mock Up	1		1	30.000	total	150		100						250		500	64.6	68	0.0	64.6	30.0	30.0	94.6	26.5	28.0	121.1
1.2.5	**Test Beam Studies**					man yrs >	9.12	0.00	2.12	0.00	0.00	0.00	1.92	0.00	0.66	0.00	13.82	333.1	74	0.0	333.1	118.8	118.8	451.9	114.7	25.4	566.6
1.2.5.1	Test Beam, Run 1	1		1	10.000	total	500		120				100		20		740	71.6	88	0.0	71.6	10.0	10.0	81.6	23.7	29.0	105.3
1.2.5.2	Test Beam, Run 2	1		1	10.000	total	500		120				100		20		740	71.6	88	0.0	71.6	10.0	10.0	81.6	23.7	29.0	105.3
1.2.5.3	Test Beam, 10% System	1		1	35.000	total	1250		250				250		125		1875	167.5	83	0.0	167.5	35.0	35.0	202.5	58.7	29.0	261.2
1.2.5.4	Travel	12	2	14	4.200	each											0	0.0	0	0.0	0.0	58.8	58.8	58.8	5.9	10.0	64.7
1.2.5.5	ES&H	1		1	5.000	total	30		40				30				100	22.4	82	0.0	22.4	5.0	5.0	27.4	2.7	10.0	30.1
1.2.6	**Hardware and Software**					man yrs >	1.56	0.56	0.76	0.12	0.80	0.60	1.08	0.64	0.00	0.00	6.12	208.8	51	113.0	321.8	86.8	199.8	408.6	86.2	21.1	494.8
1.2.6.1	Hardware			0																							267.8
1.2.6.1.1	FPIX IC Probe Station Adapter	4	2	6	1.000	each	20	20	50	20			100	50			260	42.5	61	21.1	63.6	6.0	27.1	69.6	13.9	20.0	83.6
1.2.6.1.2	Pixel-Specific Adapters to BTeV Standard Test Stands	12	2	14	1.200	each	20	20	100				100	100			340	61.8	59	25.4	87.2	16.8	42.2	104.0	20.8	20.0	124.8
1.2.6.1.3	Other Test Stands	3		3	8.000	each	50		30				60				140	25.5	52	0.0	25.5	24.0	24.0	49.5	9.9	20.0	59.4
1.2.6.2	Software			0																							227.0
1.2.6.2.1	Monitoring Software	1		1	20.000	lic.,pkg	200	50			100	75					425	36.4	42	29.9	66.3	20.0	49.9	86.3	13.8	16.0	100.1
1.2.6.2.2	Pixel Module Testing Software	10		10	2.000	each	100	50	10	10	100	75	10	10			365	42.6	43	36.6	79.2	20.0	56.6	99.2	27.8	28.0	127.0
1.2.7	**ES&H**					man yrs >	0.28	0.14	0.28	0.14	0.00	0.00	0.28	0.14	0.00	0.00	1.26	43.3	37	23.7	66.9	49.0	72.7	115.9	23.2	20.0	139.1
1.2.7.1	Sensors, Mechanical, Gas and Cryogenics			1	7.000	each	10	5	10	5			10	5			45	6.2	37	3.4	9.6	7.0	10.4	16.6	3.3	20.0	19.9
1.2.7.2	Electrical and Electronics			0																							59.6
1.2.7.2.1	High Voltage Power			1	7.000	each	10	5	10	5			10	5			45	6.2	37	3.4	9.6	7.0	10.4	16.6	3.3	20.0	19.9
1.2.7.2.2	Low Voltage Power			1	7.000	each	10	5	10	5			10	5			45	6.2	37	3.4	9.6	7.0	10.4	16.6	3.3	20.0	19.9
1.2.7.2.3	Front-End Electronics			1	7.000	each	10	5	10	5			10	5			45	6.2	37	3.4	9.6	7.0	10.4	16.6	3.3	20.0	19.9

WBS Number	WBS Name or Description	Base Quantity	Spares Quantity	Total Quantity	Base Unit (K$)	Units	PH.D (days)	PH.M (days)	EN.D (days)	EN.M (days)	SW.D (days)	SW.M (days)	TE.D (days)	TE.M (days)	LA.D (days)	LA.M (days)	Labor (days)	Dev Labor (K$)	Dev Labor (%)	Mfg Labor (K$)	Tot Labor (K$)	Tot Mtrl (K$)	Mtrl+Mfg (K$)	Base Cost (K$)	Contingency (K$)	Contingency (%)	Total Cost (K$)
1.2.7.3	Environmental (including vacuum)			1	7.000	each	10	5	10	5			10	5			45	6.2	37	3.4	9.6	7.0	10.4	16.6	3.3	20.0	19.9
1.2.7.4	Radiation Safety			1	7.000	each	10	5	10	5			10	5			45	6.2	37	3.4	9.6	7.0	10.4	16.6	3.3	20.0	19.9
1.2.7.5	Training			1	7.000	each	10	5	10	5			10	5			45	6.2	37	3.4	9.6	7.0	10.4	16.6	3.3	20.0	19.9
1.2.8	**Transportation to and Installation and Testing at C0**					man yrs >	0.00	0.92	0.00	0.72	0.00	0.00	0.00	0.72	0.00	0.00	2.36	0.0	0	121.7	121.7	20.0	141.7	141.7	52.2	36.8	193.8
1.2.8.1	Transport to C0			1	5.000	total		30		40				40			110	0.0	0	27.0	27.0	5.0	32.0	32.0	12.8	40.0	44.9
1.2.8.2	Install in Magnet			1	5.000	total		20		20				20			60	0.0	0	13.5	13.5	5.0	18.5	18.5	5.9	32.0	24.4
1.2.8.3	Survey			1	5.000	total		30		30				30			90	0.0	0	20.3	20.3	5.0	25.3	25.3	7.1	28.0	32.4
1.2.8.4	Test Pixel System			1	5.000	total		150		90				90			330	0.0	0	60.8	60.8	5.0	65.8	65.8	26.3	40.0	92.2
1.2.9	**Pixel Detector Project Management**					man yrs >	0.84	0.76	1.02	0.92	0.00	0.00	0.10	0.07	0.00	0.00	3.72	104.8	33	101.2	206.1	110.0	211.2	316.1	63.2	20.0	379.3
1.2.9.1	Project Coordination			0			150	150	100	100							500	38.6	48	42.2	80.8	0.0	42.2	80.8	16.2	20.0	97.0
1.2.9.2	Project Engineering			0					100	100							200	38.6	48	42.2	80.8	0.0	42.2	80.8	16.2	20.0	97.0
1.2.9.3	Project Reviews	3		3	5.000	each			4	5			4	4			17	2.5	12	3.1	5.6	15.0	18.1	20.6	4.1	20.0	24.7
1.2.9.4	ES&H Reviews	3		3	5.000	each			2	4			2	4			12	1.2	7	2.7	3.9	15.0	17.7	18.9	3.8	20.0	22.7
1.2.9.5	Travel	30	10	40	2.000	each	60	40	50	20			20	10			200	23.9	21	11.0	34.9	80.0	91.0	114.9	23.0	20.0	137.9
1.3	**RICH Detector**					man yrs >	17.3	27.7	4.6	4.1	0.2	0.1	1.5	3.8	0.4	5.1	64.7	547.9	3.6	828.0	1,375.9	13,676.7	14,504.7	15,052.6	2,090.0	13.9	17,142.5
1.3.1	**Photon Detectors**					man yrs >	2.00	2.75	0.08	0.08	0.00	0.00	0.00	0.00	0.02	1.25	6.19	8.6	0	44.5	53.1	9,697.5	9,742.0	9,750.6	1,424.6	14.6	11,175.2
1.3.1.1	Photon Detector Arrays																										11,175.2
1.3.1.1.1	Photon Detector Acquisition																										10,938.4
1.3.1.1.1.1	Development and Prototypes	1		1	187.000	dev	125										125	0.0	0	0.0	0.0	187.0	187.0	187.0	37.4	20.0	224.4
1.3.1.1.1.2	Production																0	0.0	0	0.0							10,714.0
1.3.1.1.1.2.1	Procurement, Phase 1	188		188	4.497	hpd		25									25	0.0	0	0.0	0.0	845.4	845.4	845.4	169.1	20.0	1,014.5
1.3.1.1.1.2.2	Procurement, Phase 2	1700		1700	4.497	hpd		90									90	0.0	0	0.0	0.0	7,644.9	7,644.9	7,644.9	1,070.3	14.0	8,715.2
1.3.1.1.1.2.3	Procurement, Phase 3 (spares)	192		192	4.497	hpd		10									10	0.0	0	0.0	0.0	863.4	863.4	863.4	120.9	14.0	984.3
1.3.1.1.2	Photon Detector Test Station and Testing																										66.9
1.3.1.1.2.1	Design and Construction	1		1	37.500	station	125								5		130	0.5	1	0.0	0.5	37.5	37.5	38.0	6.1	16.0	44.1
1.3.1.1.2.2	Evaluation of Photon Detectors	1		1	6.700	testing		250								125	375	0.0	0	14.3	14.3	6.7	21.0	21.0	1.9	9.0	22.8
1.3.1.1.3	Photon Detector Mechanical Modules and Support Structure																										153.3
1.3.1.1.3.1	Development and Prototypes	1		1	21.700	dev	125		21								146	8.0	27	0.0	8.0	21.7	21.7	29.7	5.9	20.0	35.7
1.3.1.1.3.2	Production	696	70	766	0.100	structure		188		21						188	397	0.0	0	30.3	30.3	76.6	106.9	106.9	10.7	10.0	117.6
1.3.1.1.4	Photon Detector Pulser System																										16.5
1.3.1.1.4.1	Development and Prototypes	1		1	9.200	dev	125										125	0.0	0	0.0	0.0	9.2	9.2	9.2	1.8	20.0	11.0
1.3.1.1.4.2	Production	1		1	5.000	install		125									125	0.0	0	0.0	0.0	5.0	5.0	5.0	0.5	10.0	5.5
1.3.2	**Front-End Electronics**					man yrs >	1.85	3.84	1.42	1.28	0.00	0.00	0.78	1.20	0.00	0.25	10.63	182.6	15	218.6	401.2	779.6	998.2	1,180.8	180.3	15.3	1,361.1
1.3.2.1	Amplifier/Shaper/Discriminator Boards																										651.3
1.3.2.1.1	Amplifier/Shaper/Discriminator IC Acquisition																										555.0
1.3.2.1.1.1	Development and Prototypes	1		1	0.000	dev	125		60				30				215	30.1	100	0.0	30.1	0.0	0.0	30.1	7.8	26.0	38.0
1.3.2.1.1.2	Production																										517.0
1.3.2.1.1.2.1	Procurement, Phase 1	33904		33904	0.001	asd chan		25		30				10			65	0.0	0	15.2	15.2	33.9	49.1	49.1	12.8	26.0	61.9
1.3.2.1.1.2.2	Procurement, Phase 2	305136		305136	0.001	asd chan		90		20				10			120	0.0	0	11.0	11.0	305.1	316.1	316.1	56.9	18.0	373.0
1.3.2.1.1.2.3	Procurement, Phase 3 (spares)	67808		67808	0.001	asd chan		10		10							20	0.0	0	4.2	4.2	67.8	72.0	72.0	10.1	14.0	82.1
1.3.2.1.2	Amplifier/Shaper/Discriminator Test Station and Testing																										63.1
1.3.2.1.2.1	Design and Construction	1		1	24.200	station	125		20								145	7.7	24	0.0	7.7	24.2	24.2	31.9	8.3	26.0	40.2
1.3.2.1.2.2	Evaluation of ASD ICs	1		1	2.500	testing		563		40							603	0.0	0	16.9	16.9	2.5	19.4	19.4	3.5	18.0	22.9
1.3.2.1.3	Cabling To Data Combiner Boards																										33.3
1.3.2.1.3.1	Data Cables and Connectors	2080	416	2496	0.010	sets	21	21						21			63	0.0	0	5.3	5.3	25.0	30.3	30.3	3.0	10.0	33.3
1.3.2.2	Control/Monitoring & Timing and Data Readout Electronics																										272.1
1.3.2.2.1	BTeV-Standard Control/Monitoring & Timing and Data Readout (TMC2) FPGA																										157.0
1.3.2.2.1.1	Development and Prototypes			0																							77.8
1.3.2.2.1.1.1	Firmware Specific to the RICH Detector						10		60				30				100	30.1	100	0.0	30.1	0.0	0.0	30.1	3.0	10.0	33.1
1.3.2.2.1.1.2	Design and Simulations Reviews			0	0.000	ea	10		30								40	11.6	100	0.0	11.6	0.0	0.0	11.6	1.2	10.0	12.7
1.3.2.2.1.1.3	Prototype Testing			0	0.000	ea	60		60				20				140	27.8	100	0.0	27.8	0.0	0.0	27.8	2.8	10.0	30.6
1.3.2.2.1.1.4	Prototype RICH TMC2 FPGAs	9	1	10	0.120	ea											0	0.0	0	0.0	0.0	1.2	1.2	1.2	0.1	10.0	1.3
1.3.2.2.1.2	Production																	0.0	0	0.0	0.0	0.0	0.0		0.0	0.0	79.2
1.3.2.2.1.2.1	Production Reviews				0.000	ea		10		30				10			50	0.0	0	15.2	15.2	0.0	15.2	15.2	1.5	10.0	16.7
1.3.2.2.1.2.2	Production RICH TMC2 FPGAs	360	36	396	0.041	ea											0	0.0	0	0.0	0.0	16.2	16.2	16.2	1.6	10.0	17.9
1.3.2.2.1.2.3	Production Testing			0	0.000	ea		60		60				60			180	0.0	0	40.6	40.6	0.0	40.6	40.6	4.1	10.0	44.6
1.3.2.2.2	Auxiliary Electronics																										115.2
1.3.2.2.2.1	Development and Prototypes																										24.1
1.3.2.2.2.1.1	Design Reviews			0	0.000	ea	5		10				10				25	6.2	100	0.0	6.2	0.0	0.0	6.2	0.6	10.0	6.8
1.3.2.2.2.1.2	Components	4		4	0.450	ea			10								10	3.9	68	0.0	3.9	1.8	1.8	5.7	0.6	10.0	6.2
1.3.2.2.2.1.3	Prototype Testing			0	0.000	ea	5		20				10				35	10.0	100	0.0	10.0	0.0	0.0	10.0	1.0	10.0	11.0
1.3.2.2.2.2	Production																										91.1
1.3.2.2.2.2.1	Components	360	36	396	0.175	ea				20				20			40	0.0	0	13.5	13.5	69.3	82.8	82.8	8.3	10.0	91.1
1.3.2.3	Data Serializer/Transmitter and C/M&T and Data Opto-Electronics																										138.5
1.3.2.3.1	Development & Prototypes																										27.1
1.3.2.3.1.1	Prototype Data Serializer/Transmitter ICs	4		4	0.050				5				5				10	3.1	94	0.0	3.1	0.2	0.2	3.3	0.8	24.0	4.1
1.3.2.3.1.2	Design Reviews and Prototype Testing						10		30				30				70	18.5	100	0.0	18.5	0.0	0.0	18.5	4.4	24.0	23.0
1.3.2.3.2	Production																										111.4
1.3.2.3.2.1	Testing: Automated and Field	1		1	5.000	total		20		30				30			80	0.0	0	20.3	20.3	5.0	25.3	25.3	5.1	20.0	30.3
1.3.2.3.2.2	Production C/M&T and Data Readout Opto-Electronics	360	54	414	0.030	each		30		30				30			90	0.0	0	20.3	20.3	12.4	32.7	32.7	7.8	24.0	40.5
1.3.2.3.2.3	Production Data Serializer/Transmitter ICs	360	54	414	0.030	each		30		30				30			90	0.0	0	20.3	20.3	12.4	32.7	32.7	7.8	24.0	40.5
1.3.2.4	Front-End Printed Circuit Boards																										81.3
1.3.2.4.1	HPD Base Printed Circuit Board																										81.3
1.3.2.4.1.1	Development and Prototypes	1	0	1	1.500	dev	63		21								83	8.0	84	0.0	8.0	1.5	1.5	9.5	1.0	10.0	10.5
1.3.2.4.1.2	Production	2080	208	2288	0.025	pcb		63								63	125	0.0	0	7.1	7.1	57.2	64.3	64.3	6.4	10.0	70.8
1.3.2.5	Data Combiner Printed Circuit Boards																										217.9
1.3.2.5.1	Development and Prototypes	42	8	50	0.500	ea	30		30				60				120	25.5	50	0.0	25.5	25.0	25.0	50.5	5.1	10.0	55.6
1.3.2.5.2	Production	360	36	396	0.300	ea		40		20				80			140	0.0	0	28.8	28.8	118.8	147.6	147.6	14.8	10.0	162.3
1.3.3	**Power, Monitoring, Cooling and Protection**					man yrs >	1.42	1.75	0.43	0.27	0.00	0.00	0.12	0.67	0.25	0.83	5.74	55.5	5	94.2	149.7	976.0	1,070.2	1,125.7	142.9	12.7	1,268.6
1.3.3.1	High Voltage Power																										766.3
1.3.3.1.1	HV Supply Acquisition																										579.4

WBS Number	WBS Name or Description	Base Quantity	Spares Quantity	Total Quantity	Base Unit (K$)	Units	PH.D (days)	PH.M (days)	EN.D (days)	EN.M (days)	SW.D (days)	SW.M (days)	TE.D (days)	TE.M (days)	LA.D (days)	LA.M (days)	Labor (days)	Dev Labor (K$)	Dev Labor (%)	Mfg Labor (K$)	Tot Labor (K$)	Tot Mtrl (K$)	Mtrl+Mfg (K$)	Base Cost (K$)	Contingency (K$)	Contingency (%)	Total Cost (K$)
1.3.3.1.1.1	Development and Prototypes	1		1	52.000	dev	63		10								73	3.9	7	0.0	3.9	52.0	52.0	55.9	14.5	26.0	70.4
1.3.3.1.1.2	Production	1		1	467.000	system		63									63	0.0	0	0.0	0.0	467.0	467.0	467.0	42.0	9.0	509.0
1.3.3.1.2	HV Cables and Connectors																										171.8
1.3.3.1.2.1	Development and Prototypes	1		1	8.200	dev	63		21						21		104	10.2	55	0.0	10.2	8.2	8.2	18.4	2.9	16.0	21.4
1.3.3.1.2.2	Production	143	29	172	0.710	assembly		125		10						125	260	0.0	0	18.5	18.5	122.1	140.6	140.6	9.8	7.0	150.4
1.3.3.1.3	HV Test Station and Testing																										15.1
1.3.3.1.3.1	Design and Construction	1		1	9.200	station	63										63	0.0	0	0.0	0.0	9.2	9.2	9.2	0.8	9.0	10.0
1.3.3.1.3.2	Evaluation of HV Assemblies	1		1	2.500	testing		63								21	83	0.0	0	2.4	2.4	2.5	4.9	4.9	0.2	5.0	5.1
1.3.3.2	Low Voltage Power																										407.2
1.3.3.2.1	LV Supply Acquisition	696	70	766	0.300	supply	63	21	42	21			5	42			193	17.2	6	19.4	36.6	229.8	249.2	266.4	55.9	21.0	322.4
1.3.3.2.2	LV Cables and Connectors	696	140	836	0.050	sets	21	21	5	5			21	104			177	6.8	9	28.6	35.3	41.8	70.4	77.1	7.7	10.0	84.8
1.3.3.3	Electronics Cooling																										95.1
1.3.3.3.1	Front-End Electronics Cooling																	0.0	0	0.0	0.0	0.0	0.0		0.0	0.0	68.1
1.3.3.3.1.1	Development and Prototypes	1		1	9.200	dev	63		21						42		125	12.4	57	0.0	12.4	9.2	9.2	21.6	2.4	11.0	23.9
1.3.3.3.1.2	Production	1		1	24.200	system		125		21						63	208	0.0	0	15.9	15.9	24.2	40.1	40.1	4.0	10.0	44.1
1.3.3.3.2	Crate and Rack Cooling	1		1	10.000	system	21	21	10	10			5	21			88	5.0	20	9.5	14.5	10.0	19.5	24.5	2.5	10.0	27.0
1.3.4	**Mechanical and Other Systems**					man yrs >	5.58	11.08	0.75	0.24	0.00	0.00	0.04	0.08	0.08	2.58	20.45	76.5	4	104.6	181.1	1,783.1	1,887.7	1,964.3	229.4	11.7	2,193.7
1.3.4.1	Front-End Electronics Racks and Crates																										82.4
1.3.4.1.1	Development and Prototypes	1		1	5.000	crates	63		21				10				93	10.4	67	0.0	10.4	5.0	5.0	15.4	1.5	10.0	16.9
1.3.4.1.2	Production	1		1	50.000	crates		63		10				21			93	0.0	0	9.5	9.5	50.0	59.5	59.5	6.0	10.0	65.5
1.3.4.2	Gas Radiator System																										256.8
1.3.4.2.1	Gas Acquisition																										31.4
1.3.4.2.1.1	Development and Prototypes	250		250	0.004	cu.ft.	21										21	0.0	0	0.0	0.0	0.9	0.9	0.9	0.0	5.0	0.9
1.3.4.2.1.2	Production	3900	390	4290	0.004	cu.ft.		21									21	0.0	0	0.0	0.0	15.2	15.2	15.2	15.2	100.0	30.5
1.3.4.2.2	Gas Circulation and Control System																										212.6
1.3.4.2.2.1	Development and Prototypes	1		1	23.400	system	125		21						21		167	10.2	30	0.0	10.2	23.4	23.4	33.6	2.7	8.0	36.3
1.3.4.2.2.2	Production	1		1	148.400	system		375		5						125	505	0.0	0	16.4	16.4	148.4	164.8	164.8	11.5	7.0	176.3
1.3.4.2.3	Gas Monitoring System																										12.8
1.3.4.2.3.1	Development and Prototypes	1		1	5.000	system	125		5								130	1.9	28	0.0	1.9	5.0	5.0	6.9	0.6	8.0	7.5
1.3.4.2.3.2	Production	1		1	5.000	system		250									250	0.0	0	0.0	0.0	5.0	5.0	5.0	0.4	7.0	5.4
1.3.4.3	Silica Aerogel Radiators																										852.4
1.3.4.3.1	Aerogel Acquisition																										697.2
1.3.4.3.1.1	Development and Prototypes	1		1	35.000	dev	125										125	0.0	0	0.0	0.0	35.0	35.0	35.0	7.0	20.0	42.0
1.3.4.3.1.2	Production																										655.2
1.3.4.3.1.2.1	Procurement, Phase 1	343		343	0.157	tile		25									25	0.0	0	0.0	0.0	53.8	53.8	53.8	10.8	20.0	64.5
1.3.4.3.1.2.2	Procurement, Phase 2	3083		3083	0.157	tile		90									90	0.0	0	0.0	0.0	483.2	483.2	483.2	48.3	10.0	531.5
1.3.4.3.1.2.3	Procurement, Phase 3	343		343	0.157	tile		10									10	0.0	0	0.0	0.0	53.8	53.8	53.8	5.4	10.0	59.1
1.3.4.3.2	Aerogel Test Station and Testing																										89.3
1.3.4.3.2.1	Design and Construction	1		1	33.400	station	125										125	0.0	0	0.0	0.0	33.4	33.4	33.4	3.0	9.0	36.4
1.3.4.3.2.2	Evaluation of Aerogel Tiles	1		1	6.700	testing		375								375	750	0.0	0	42.8	42.8	6.7	49.5	49.5	3.5	7.0	52.9
1.3.4.3.3	Aerogel Mounting and Support Structure																										54.9
1.3.4.3.3.1	Development and Prototypes	1		1	9.200	dev	42		21								63	8.0	47	0.0	8.0	9.2	9.2	17.2	3.4	20.0	20.7
1.3.4.3.3.2	Production	2		2	14.200	structure		83		5							88	0.0	0	2.1	2.1	28.4	30.5	30.5	3.7	12.0	34.2
1.3.4.3.4	Aerogel Monitoring System																										11.0
1.3.4.3.4.1	Development and Prototypes	1		1	9.200	dev	21										21	0.0	0	0.0	0.0	9.2	9.2	9.2	1.8	20.0	11.0
1.3.4.3.4.2	Production	1		1	0.000	install		63									63	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0
1.3.4.4	Mirror Arrays																										687.9
1.3.4.4.1	Mirror Acquisition																										419.8
1.3.4.4.1.1	Development and Prototypes	1		1	20.000	dev	63										63	0.0	0	0.0	0.0	20.0	20.0	20.0	2.0	10.0	22.0
1.3.4.4.1.2	Production	1		1	361.600	mirrors		125									125	0.0	0	0.0	0.0	361.6	361.6	361.6	36.2	10.0	397.8
1.3.4.4.2	Mirror Test Station and Testing																										55.4
1.3.4.4.2.1	Design and Construction	1		1	28.400	station	125										125	0.0	0	0.0	0.0	28.4	28.4	28.4	4.5	16.0	32.9
1.3.4.4.2.2	Evaluation of Mirrors	1		1	6.700	testing		250								125	375	0.0	0	14.3	14.3	6.7	21.0	21.0	1.5	7.0	22.4
1.3.4.4.3	Mirror Mounting and Support Structure																										177.1
1.3.4.4.3.1	Development and Prototypes	1		1	7.700	dev	125		21								146	8.0	51	0.0	8.0	7.7	7.7	15.7	3.1	20.0	18.9
1.3.4.4.3.2	Production	4		4	34.200	structure		250		5						21	276	0.0	0	4.5	4.5	136.8	141.3	141.3	17.0	12.0	158.2
1.3.4.4.4	Mirror Alignment and Monitoring System																										35.6
1.3.4.4.4.1	Development and Prototypes	1		1	6.700	dev	125		21								146	8.0	55	0.0	8.0	6.7	6.7	14.7	2.9	20.0	17.7
1.3.4.4.4.2	Production	1		1	14.200	install		167		5							172	0.0	0	2.1	2.1	14.2	16.3	16.3	1.6	10.0	17.9
1.3.4.5	Gas Vessels																										296.9
1.3.4.5.1	Vessel Superstructures																										103.7
1.3.4.5.1.1	Development and Prototypes	1		1	6.700	dev	63		21								83	8.0	55	0.0	8.0	6.7	6.7	14.7	4.1	28.0	18.9
1.3.4.5.1.2	Production	2		2	37.500	structure		125		5							130	0.0	0	2.1	2.1	75.0	77.1	77.1	7.7	10.0	84.8
1.3.4.5.2	Detector Planes and Enclosures																										131.5
1.3.4.5.2.1	Development and Prototypes	1		1	6.700	dev	63		21								83	8.0	55	0.0	8.0	6.7	6.7	14.7	4.1	28.0	18.9
1.3.4.5.2.2	Production	4		4	23.400	structure		250		21							271	0.0	0	8.8	8.8	93.6	102.4	102.4	10.2	10.0	112.6
1.3.4.5.3	Entrance and Exit Windows																										61.7
1.3.4.5.3.1	Development and Prototypes	1		1	6.700	dev	63		21								83	8.0	55	0.0	8.0	6.7	6.7	14.7	4.1	28.0	18.9
1.3.4.5.3.2	Production	4		4	9.200	structure		250		5							255	0.0	0	2.1	2.1	36.8	38.9	38.9	3.9	10.0	42.8
1.3.4.6	Other Supporting Systems																										17.4
1.3.4.6.1	Detector Alignment	1		1	5.000	system	63		10								73	3.9	44	0.0	3.9	5.0	5.0	8.9	0.9	10.0	9.7
1.3.4.6.2	Other Monitoring	1		1	5.000	system	63		5								68	1.9	28	0.0	1.9	5.0	5.0	6.9	0.7	10.0	7.6
1.3.5	**Test Beam Studies**					man yrs >	2.00	2.00	0.06	0.02	0.00	0.00	0.04	0.02	0.00	0.17	4.31	8.1	10	8.1	16.3	67.0	75.1	83.3	8.3	10.0	91.6
1.3.5.1	Test Beam Detectors	1		1	0.000	use proto	125	125									250	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0
1.3.5.2	Test Beam Electronics	1		1	0.000	use proto	125	125	10	5			10	5			280	6.2	65	3.4	9.6	0.0	3.4	9.6	1.0	10.0	10.5
1.3.5.3	Test Beam Box	1		1	9.200	box	63	63								21	146	0.0	0	2.4	2.4	9.2	11.6	11.6	1.2	10.0	12.7
1.3.5.4	Test Beam Setup	1		1	6.800	setup	63	63								21	146	0.0	0	2.4	2.4	6.8	9.2	9.2	0.9	10.0	10.1
1.3.5.5	Test Beam Software	1		1	0.000	use proto	125	125									250	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0
1.3.5.6	Travel	1		1	50.000	travel											0	0.0	0	0.0	0.0	50.0	50.0	50.0	5.0	10.0	55.0
1.3.5.7	ES&H	1		1	1.000	es&h			5								5	1.9	66	0.0	1.9	1.0	1.0	2.9	0.3	10.0	3.2
1.3.6	**Hardware and Software Specific To RICH Development and Testing**					man yrs >	1.26	1.26	0.08	0.04	0.16	0.08	0.08	0.05	0.00	0.00	3.01	26.9	38	15.2	42.1	28.0	43.2	70.1	13.4	19.1	83.5
1.3.6.1	Hardware																										16.2

WBS Number	WBS Name or Description	Base Quantity	Spares Quantity	Total Quantity	Base Unit (K$)	Units	PH.D (days)	PH.M (days)	EN.D (days)	EN.M (days)	SW.D (days)	SW.M (days)	TE.D (days)	TE.M (days)	LA.D (days)	LA.M (days)	Labor (days)	Dev Labor (K$)	Dev Labor (%)	Mfg Labor (K$)	Tot Labor (K$)	Tot Mtrl (K$)	Mtrl+Mfg (K$)	Base Cost (K$)	Contingency (K$)	Contingency (%)	Total Cost (K$)
1.3.6.1.2	RICH-Specific Adapters to BTeV Standard Test Stands	3	1	4	2.000	ea	5	5	10				10	2			32	6.2	42	0.5	6.7	8.0	8.5	14.7	1.5	10.0	16.2
1.3.6.1.3	Other Test Stands			0	0.000	station											0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	28.0	0.0
1.3.6.2	Software																										67.4
1.3.6.2.1	Monitoring Software	1		1	20.000	lic.,pkg	250	250									500	0.0	0	0.0	0.0	20.0	20.0	20.0	2.0	10.0	22.0
1.3.6.2.2	FEB and DCB Testing Software						60	60	10	10	40	20	10	10			220	20.7	58	14.7	35.5	0.0	14.7	35.5	9.9	28.0	45.4
1.3.7	**ES&H**					man yrs >	0.24	0.24	0.36	0.56	0.00	0.00	0.24	0.24	0.00	0.00	1.88	48.7	34	74.3	123.0	19.5	93.8	142.5	14.2	10.0	156.7
1.3.7.1	Sensors, Mechanical, Gas and Cryogenics																										37.3
1.3.7.1.1	Photon Detector Arrays	4		4	1.000	each	10	10	10	10			10	10			60	6.2	36	6.8	12.9	4.0	10.8	16.9	1.7	10.0	18.6
1.3.7.1.2	Gas Radiator System	4		4	1.000	each	10	10	10	10			10	10			60	6.2	36	6.8	12.9	4.0	10.8	16.9	1.7	10.0	18.6
1.3.7.2	Electrical and Electronics																										73.6
1.3.7.2.1	High Voltage Power	4		4	1.000	each	10	10	20	40			10	10			100	10.0	30	19.4	29.5	4.0	23.4	33.5	3.3	10.0	36.8
1.3.7.2.2	Low Voltage Power	4		4	1.000	each	10	10	20	40			10	10			100	10.0	30	19.4	29.5	4.0	23.4	33.5	3.3	10.0	36.8
1.3.7.3	Environmental (Temp & Humidity)	2		2	1.000	each	10	10	20	30			10	10			90	10.0	37	15.2	25.2	2.0	17.2	27.2	2.7	10.0	30.0
1.3.7.4	Training	30		30	0.050	each	10	10	10	10			10	10			60	6.2	43	6.8	12.9	1.5	8.3	14.4	1.4	10.0	15.9
1.3.8	**Transportation to and Installation and Testing at C0**					man yrs >	0.16	1.96	0.22	0.46	0.00	0.00	0.00	1.36	0.00	0.00	4.16	21.2	7	134.9	156.1	156.0	290.9	312.1	31.2	10.0	343.3
1.3.8.1	Photon Detector Arrays	1		1	4.000	ea	5	120	5	15				60			205	1.9	7	21.6	23.5	4.0	25.6	27.5	2.8	10.0	30.3
1.3.8.2	Gas Radiator System	1		1	2.000	ea	5	40	5	5				20			75	1.9	17	7.2	9.1	2.0	9.2	11.1	1.1	10.0	12.2
1.3.8.3	Silica Aerogel Radiators	1		1	2.000	ea	5	80	5	10				40			140	1.9	11	14.4	16.3	2.0	16.4	18.3	1.8	10.0	20.1
1.3.8.4	Mirror Arrays	1		1	2.000	ea	5	80	5	10				40			140	1.9	11	14.4	16.3	2.0	16.4	18.3	1.8	10.0	20.1
1.3.8.5	Gas Vessels	1		1	4.000	ea	5	80	5	10				80			180	1.9	6	24.5	26.5	4.0	28.5	30.5	3.0	10.0	33.5
1.3.8.6	High Voltage Power	1		1	2.000	ea	5	40	5	5				20			75	1.9	17	7.2	9.1	2.0	9.2	11.1	1.1	10.0	12.2
1.3.8.7	Front-End Electronics	2		2	2.000	ea	5	30	10	60				80			185	3.9	7	45.6	49.5	4.0	49.6	53.5	5.4	10.0	58.9
1.3.8.8	Rigging	20		20	1.800	Rcrewday	2	10	10								22	3.9	10	0.0	3.9	36.0	36.0	39.9	4.0	10.0	43.8
1.3.8.9	Surveying	10		10	10.000	SurveyCrew	2	10	5								17	1.9	2	0.0	1.9	100.0	100.0	101.9	10.2	10.0	112.1
1.3.9	**RICH Detector Project Management**					man yrs >	2.82	2.86	1.15	1.15	0.00	0.00	0.16	0.20	0.00	0.00	8.33	119.8	28	133.5	253.3	170.0	303.5	423.3	45.6	10.8	468.8
1.3.9.1	Project Coordination			0			625	625	156	156							1563	60.3	48	65.9	126.3	0.0	65.9	126.3	12.6	10.0	138.9
1.3.9.2	Project Engineering			0					40	40							80	15.4	48	16.9	32.3	0.0	16.9	32.3	6.5	20.0	38.8
1.3.9.3	Project Reviews	1		1	50.000	reviews	60	60	60	60			20	30			290	27.8	25	32.9	60.7	50.0	82.9	110.7	11.1	10.0	121.8
1.3.9.4	ES&H Reviews	1		1	20.000	reviews	20	30	30	30			20	20			150	16.2	30	17.7	34.0	20.0	37.7	54.0	5.4	10.0	59.4
1.3.9.5	Travel	5		5	20.000	per year											0	0.0	0	0.0	0.0	100.0	100.0	100.0	10.0	10.0	110.0
1.4	**EM Calorimeter Detector**					man yrs >	3.9	4.3	4.5	5.1	0.2	0.2	3.3	14.6	0.0	0.0	36.1	651.0	4	1,481.1	2,132.0	15,337.1	16,818.1	17,469.1	3,548.7	20.3	21,017.8
1.4.1	**Sensors and Interconnections To Front-End Electronics**					man yrs >	1.20	0.89	0.09	0.06	0.00	0.00	0.44	6.48	0.00	0.00	9.15	34.4	0	417.4	451.8	12,220.7	12,638.1	12,672.5	2,289.2	18.1	14,961.7
1.4.1.1	PbWO4 Crystals																										8,774.5
1.4.1.1.1	Prototypes	25	5	30	0.400	each											0	0.0	0	0.0	0.0	12.0	12.0	12.0	0.8	7.0	12.8
1.4.1.1.2	Production	23700	237	23937	0.240	each											0	0.0	0	0.0	0.0	5,744.9	5,744.9	5,744.9	861.7	15.0	6,606.6
1.4.1.1.3	Ovens	30		30	27.000	each											0	0.0	0	0.0	0.0	810.0	810.0	810.0	810.0	100.0	1,620.0
1.4.1.1.4	Development of crystal production in Shandong	1		1	500.000	each											0	0.0	0	0.0	0.0	500.0	500.0	500.0	35.0	7.0	535.0
1.4.1.1.4.1	Wrapping (to be done by production company if necessary)			0		each											0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.4.1.1.4.2	Testing and Assembly (in 1.4.6.1.1)			0		each											0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.4.1.2	Phototubes																										4,497.1
1.4.1.2.1	Test Beam Studies with Sample Phototubes (use prototypes)			0		each											0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.4.1.2.2	Production	23700	237	23937	0.170	each											0	0.0	0	0.0	0.0	4,069.3	4,069.3	4,069.3	406.9	10.0	4,476.2
1.4.1.2.3	Testing and Assembly			0		each	80	25					90	0			195	20.9	100	0.0	20.9	0.0	0.0	20.9	0.0	0.0	20.9
1.4.1.3	Phototube Bases (cluster of eight)																										685.8
1.4.1.3.1	Development and Prototypes	4		4	1.000	each	30		15								45	5.8	59	0.0	5.8	4.0	4.0	9.8	1.0	10.0	10.8
1.4.1.3.2	Production	2963	30	2992	0.200	each		10						60			70	0.0	0	15.2	15.2	598.4	613.7	613.7	61.4	10.0	675.0
1.4.1.4	Crystal Light Pulsar Calibration System																										423.2
1.4.1.4.1	Development and Prototypes	1		1	2.000	each	90							60			150	0.0	0	15.2	15.2	2.0	17.2	17.2	2.4	14.0	19.7
1.4.1.4.2	Production	2	0	2	150.000	each		180						60			240	0.0	0	15.2	15.2	300.0	315.2	315.2	88.3	28.0	403.5
1.4.1.5	PMT/Crystal Gluing																										362.5
1.4.1.5.1	Gluing + Testing	100		100	0.020	each	100	6					10	1410			1526	2.3	1	358.1	360.5	2.0	360.1	362.5	0.0	0.0	362.5
1.4.1.5.2	Testing (in 1.4.1.5.1)			0		each											0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.4.1.6	Ribbon Coax Data Cables from PMTs to PMT Digitizer	29625	296	29921	0.006	foot			5	8			6	16			35	3.3	2	7.4	10.8	172.0	179.5	182.8	20.1	11.0	202.9
1.4.1.7	High Voltage Cables and Connectors	29625	593	30218	0.000	foot			3	6			4	14			27	2.1	15	6.1	8.2	6.0	12.1	14.2	1.6	11.0	15.8
1.4.2	**Front-End Electronics (PMT Digitizer)**					man yrs >	1.22	1.64	2.44	1.44	0.00	0.00	1.16	1.90	0.00	0.00	9.80	302.7	18	272.6	575.3	1,141.9	1,414.4	1,717.2	388.4	22.6	2,105.6
1.4.2.1	QIE Charge-To-Voltage ICs																										554.2
1.4.2.1.1	Development and Prototypes																										285.8
1.4.2.1.1.1	Prototype Run 1	25		25	0.500	each	50		125				25				200	54.1	81	0.0	54.1	12.5	12.5	66.6	29.3	44.0	95.8
1.4.2.1.1.2	Prototype Run 2	25		25	0.500	each	50		125				25				200	54.1	81	0.0	54.1	12.5	12.5	66.6	9.3	14.0	75.9
1.4.2.1.1.3	Prototype Run 3 (Engineering Run)	400		400	0.100	each	75		70				25				170	32.8	45	0.0	32.8	40.0	40.0	72.8	23.3	32.0	96.1
1.4.2.1.1.5	Test Fixtures	10		10	1.000	each			5				10				15	4.3	30	0.0	4.3	10.0	10.0	14.3	3.7	26.0	18.0
1.4.2.1.2	Production																										268.4
1.4.2.1.2.1	Testing: Automated and Field	1		1	10.000	each		100		50				80			230	0.0	0	41.4	41.4	10.0	51.4	51.4	10.3	20.0	61.7
1.4.2.1.2.2	Production Run	23700	5925	29625	0.005	each		100		50				25			175	0.0	0	27.5	27.5	139.2	166.7	166.7	40.0	24.0	206.7
1.4.2.2	8 to 10-Bit Flash ADC ICs																										253.2
1.4.2.2.1	Development and Prototypes	64	6	70	0.030	each			30				40				70	20.9	91	0.0	20.9	2.1	2.1	23.0	3.2	14.0	26.2
1.4.2.2.2	Production	23700	237	23937	0.008	each		20						30			50	0.0	0	7.6	7.6	191.5	199.1	199.1	27.9	14.0	227.0
1.4.2.3	Control/Monitoring & Timing and Data Readout Electronics																										547.2
1.4.2.3.1	BTeV-Standard C/M & T and Data Readout (TMC^2) FPGA																										195.5
1.4.2.3.1.1	Development and Prototypes	4	2	6	0.120	each	80		150				50				280	69.5	99	0.0	69.5	0.7	0.7	70.2	40.4	57.5	110.6
1.4.2.3.1.2	Production	741	74	815	0.017	each		70		90				70			230	0.0	0	55.8	55.8	13.8	69.6	69.6	15.3	22.0	84.9
1.4.2.3.2	Auxiliary Electronics																										351.7
1.4.2.3.2.1	Development and Prototypes	4	2	6	0.400	each	10		40				20				70	20.1	89	0.0	20.1	2.4	2.4	22.5	4.5	20.0	27.0
1.4.2.3.2.2	Production	741	74	815	0.330	each				20				20			40	0.0	0	13.5	13.5	268.8	282.4	282.4	42.4	15.0	324.7
1.4.2.4	Data Serializer/Transmitter and C/M&T and Data Opto-Electronics																										208.7
1.4.2.4.1	Development & Prototypes																										27.1
1.4.2.4.1.1	Prototype Data Serializer/Transmitter ICs	4		4	0.050				5				5				10	3.1	94	0.0	3.1	0.2	0.2	3.3	0.8	24.0	4.1
1.4.2.4.1.2	Design Reviews and Prototype Testing						10		30				30				70	18.5	100	0.0	18.5	0.0	0.0	18.5	4.4	24.0	23.0
1.4.2.4.2	Production																										181.6
1.4.2.4.2.1	Testing: Automated and Field	1		1	5.000	total		20		30				30			80	0.0	0	20.3	20.3	5.0	25.3	25.3	5.1	20.0	30.3
1.4.2.4.2.2	Production C/M&T and Data Readout Opto-Electronics	788	119	907	0.030	each		30		50				50			130	0.0	0	33.8	33.8	27.2	61.0	61.0	14.6	24.0	75.7
1.4.2.4.2.3	Production Data Serializer/Transmitter ICs	788	119	907	0.030	each		30		50				50			130	0.0	0	33.8	33.8	27.2	61.0	61.0	14.6	24.0	75.7
1.4.2.5	32-Channel Front-End Boards (FEBs) (16 FEBs per PMT Chassis)																										542.4
1.4.2.5.1	Development and Prototypes	4	2	6	2.000	each	30		30				60				120	25.5	68	0.0	25.5	12.0	12.0	37.5	10.1	27.0	47.6

WBS Number	WBS Name or Description	Base Quantity	Spares Quantity	Total Quantity	Base Unit (K$)	Units	PH.D (days)	PH.M (days)	EN.D (days)	EN.M (days)	SW.D (days)	SW.M (days)	TE.D (days)	TE.M (days)	LA.D (days)	LA.M (days)	Labor (days)	Dev Labor (K$)	Dev Labor (%)	Mfg Labor (K$)	Tot Labor (K$)	Tot Mtrl (K$)	Mtrl+Mfg (K$)	Base Cost (K$)	Contingency (K$)	Contingency (%)	Total Cost (K$)
1.4.2.5.2	Production	741	74	815	0.450	each		40		20				120			180	0.0	0	38.9	38.9	366.6	405.5	405.5	89.2	22.0	494.7
1.4.3	**Power, Monitoring and Protection**					man yrs >	0.10	0.40	0.24	0.68	0.00	0.00	0.68	1.48	0.00	0.00	3.58	63.0	6	165.7	228.7	846.1	1,011.8	1,074.8	215.0	20.0	1,289.8
1.4.3.1	High Voltage System																										446.3
1.4.3.1.1	Master High Voltage Power Supply (CAEN)	1	1	2	9.520	each				10				20			30	0.0	0	9.3	9.3	19.0	28.3	28.3	5.7	20.0	34.0
1.4.3.1.2	Slave High Voltage Power Supply (CAEN)	1481	59	1541	0.208	each				20				60			80	0.0	0	23.7	23.7	319.9	343.6	343.6	68.7	20.0	412.3
1.4.3.2	PMT Digitizer Chassis, Power Supply and Fans (16 cards per chassis)																										664.4
1.4.3.2.1	Low Voltage Power Supply																0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	439.7
1.4.3.2.1.1	Development and Prototypes	2	1	3	8.000	each			10				20				30	8.5	26	0.0	8.5	24.0	24.0	32.5	6.5	20.0	39.0
1.4.3.2.1.2	Production	47	5	52	6.000	each				20				60			80	0.0	0	23.7	23.7	310.2	333.9	333.9	66.8	20.0	400.7
1.4.3.2.2	Chassis with Cooling & Fans																										141.1
1.4.3.2.2.1	Development and Prototypes	2	1	3	1.300	each			20				40				60	17.0	81	0.0	17.0	3.9	3.9	20.9	4.2	20.0	25.1
1.4.3.2.2.2	Production	47	5	52	1.150	each				40				80			120	0.0	0	37.2	37.2	59.5	96.7	96.7	19.3	20.0	116.0
1.4.3.2.3	Embedded Voltage and Current Monitors (1 per chassis)																										83.7
1.4.3.2.3.1	Development and Prototypes	2	1	3	0.520	each			20				40				60	17.0	92	0.0	17.0	1.6	1.6	18.6	3.7	20.0	22.3
1.4.3.2.3.2	Production	46	5	51	0.275	each				40				80			120	0.0	0	37.2	37.2	14.0	51.2	51.2	10.2	20.0	61.4
1.4.3.3	Temperature Control System (Crystals)					each																					179.0
1.4.3.3.1	Chillers	2		2	35.000	each	10	40	4	15			25	25			119	7.3	8	12.7	20.0	70.0	82.7	90.0	18.0	20.0	108.0
1.4.3.3.2	Controller	2		2	4.000	each	10	40	4	15			25	25			119	7.3	26	12.7	20.0	8.0	20.7	28.0	5.6	20.0	33.6
1.4.3.3.3	Pumps	2		2	8.000	each	5	20	3	10			20	20			78	5.8	19	9.3	15.1	16.0	25.3	31.1	6.2	20.0	37.3
1.4.4	**Mechanical and Other Systems**					man yrs >	0.16	0.04	0.12	0.92	0.00	0.00	0.10	0.90	0.00	0.00	2.24	17.4	2	154.2	171.6	908.4	1,062.6	1,080.0	466.1	43.2	1,546.1
1.4.4.1	Front End Electronics Supports (Racks, Detector Rack Support)					each											0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	39.9
1.4.4.1.1	Development and Prototypes (Stock# 1775-100000)	1		1	0.322	each			20				20				40	12.4	97	0.0	12.4	0.3	0.3	12.7	2.5	20.0	15.2
1.4.4.1.2	Production	20	2	22	0.322	each				20				20			40	0.0	0	13.5	13.5	7.1	20.6	20.6	4.1	20.0	24.7
1.4.4.2	Crystal Support Structure																										1,435.9
1.4.4.2.1	Development and Prototypes	1		1	50.000	each	10			80				80			170	0.0	0	54.1	54.1	50.0	104.1	104.1	21.9	21.0	125.9
1.4.4.2.2	Production	2		2	400.000	each	10			80				80			170	0.0	0	54.1	54.1	800.0	854.1	854.1	427.0	50.0	1,281.1
1.4.4.2.3	Nitrogen Control System	2		2	0.500	each	10			40				40			90	0.0	0	27.0	27.0	1.0	28.0	28.0	0.8	3.0	28.9
1.4.4.3	Chillers for Rack Electronics	2		2	25.000	each	10	10	10	10			5	5			50	5.0	8	5.5	10.5	50.0	55.5	60.5	9.7	16.0	70.2
1.4.5	**Test Beam Studies**					man yrs >	0.12	0.00	0.04	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.28	10.8	28	0.0	10.8	28.0	28.0	38.8	7.8	20.0	46.6
1.4.5.1	Crystal/PMT Mechanical Support	1		1	15.000	each	30		10				30				70	10.8	42	0.0	10.8	15.0	15.0	25.8	5.2	20.0	31.0
1.4.5.2	Travel	10		10	1.200	each											0	0.0	0	0.0	0.0	12.0	12.0	12.0	2.4	20.0	14.4
1.4.5.3	ES&H	1		1	1.000	each											0	0.0	0	0.0	0.0	1.0	1.0	1.0	0.2	20.0	1.2
1.4.6	**Hardware and Software Specific to EM Cal Development and Testing**					man yrs >	0.22	0.20	0.24	0.12	0.24	0.16	0.56	2.84	0.00	0.00	4.58	77.5	21	208.9	286.4	79.0	287.9	365.4	78.1	21.4	443.5
1.4.6.1	Hardware			0		each											0	0.0									382.7
1.4.6.1.1	Crystal Testing (with bases)	3	0	3	17.000	each	25	50	10	20			50	700			855	15.5	6	186.2	201.7	51.0	237.2	252.7	55.6	22.0	308.3
1.4.6.1.2	QIE IC Probe Station Adapter	2	0	2	5.000	each			20				40				60	17.0	63	0.0	17.0	10.0	10.0	27.0	5.4	20.0	32.4
1.4.6.1.3	EM Calorimeter-Specific Adapters to BTeV Standard Test Stands	10	2	12	1.500	each			20				40				60	17.0	49	0.0	17.0	18.0	18.0	35.0	7.0	20.0	42.0
1.4.6.2	Software			0		each																					60.8
1.4.6.2.1	Monitoring Software						30				20	20					70	7.3	48	8.0	15.2	0.0	8.0	15.2	3.0	20.0	18.3
1.4.6.2.2	FEB Testing Software								10	10	40	20	10	10			100	20.7	58	14.7	35.5	0.0	14.7	35.5	7.1	20.0	42.6
1.4.7	**ES&H**					man yrs >	0.30	0.30	0.58	0.58	0.00	0.00	0.16	0.16	0.00	0.00	2.08	65.3	47	71.4	136.6	3.0	74.4	139.6	27.9	20.0	167.5
1.4.7.1	Sensors, Mechanical, Gas and Cryogenics			0			10	10	30	30			20	20			120	16.2	48	17.7	34.0	0.0	17.7	34.0	6.8	20.0	40.8
1.4.7.2	Electrical and Electronics			0																							61.7
1.4.7.2.1	High Voltage Power			0			10	10	20	20			2	2			64	8.2	48	8.9	17.1	0.0	8.9	17.1	3.4	20.0	20.6
1.4.7.2.2	Low Voltage Power			0			10	10	20	20			2	2			64	8.2	48	8.9	17.1	0.0	8.9	17.1	3.4	20.0	20.6
1.4.7.2.3	Front-End Electronics			0			10	10	20	20			2	2			64	8.2	48	8.9	17.1	0.0	8.9	17.1	3.4	20.0	20.6
1.4.7.3	Environmental	1		1	0.500	each	10	10	20	20			2	2			64	8.2	46	8.9	17.1	0.5	9.4	17.6	3.5	20.0	21.2
1.4.7.4	Radiation Safety			0			10	10	20	20			2	2			64	8.2	48	8.9	17.1	0.0	8.9	17.1	3.4	20.0	20.6
1.4.7.5	Training	5		5	0.500	each	15	15	15	15			10	10			80	8.1	42	8.9	17.0	2.5	11.4	19.5	3.9	20.0	23.4
1.4.8	**Transportation to and Installation and Testing at C0**					man yrs >	0.00	0.20	0.00	0.50	0.00	0.00	0.00	0.80	0.00	0.00	1.50	0.0	0	103.6	103.6	0.0	103.6	103.6	20.7	20.0	124.3
1.4.8.4	Sensors (WBS 1.4.8 total costs are in this row)			0				50		125				200			375	0.0	0	103.6	103.6	0.0	103.6	103.6	20.7	20.0	124.3
1.4.8.5	Front-End Electronics			0													0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	0.0
1.4.8.6	Mechanical and Other Systems			0													0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	0.0
1.4.9	**EM Calorimeter Detector Project Management**					man yrs >	0.60	0.60	0.78	0.78	0.00	0.00	0.08	0.08	0.00	0.00	2.92	79.9	29	87.4	167.3	110.0	197.4	277.3	55.5	20.0	332.7
1.4.9.1	Project Coordination			0		each	150	150	100	100							500	38.6	48	42.2	80.8	0.0	42.2	80.8	16.2	20.0	97.0
1.4.9.2	Project Engineering			0					50	50							100	19.3	48	21.1	40.4	0.0	21.1	40.4	8.1	20.0	48.5
1.4.9.3	Project Reviews	3		3	5.000	each			30	30			10	10			80	13.9	32	15.2	29.1	15.0	30.2	44.1	8.8	20.0	52.9
1.4.9.4	ES&H Reviews	3		3	5.000	each			15	15			10	10			50	8.1	25	8.9	17.0	15.0	23.9	32.0	6.4	20.0	38.4
1.4.9.5	Travel	40		40	2.000	each											0	0.0	0	0.0	0.0	80.0	80.0	80.0	16.0	20.0	96.0
1.5	**Muon Detector**					man yrs >	7.5	7.9	3.1	2.0	0.2	0.2	4.0	5.8	0.3	2.6	33.6	553.6	10	670.3	1,223.9	4,355.4	5,025.7	5,579.3	1,139.7	20.4	6,719.0
1.5.1	**Proportional Tube Stations**					man yrs >	0.52	5.35	0.00	0.00	0.00	0.00	0.27	4.01	0.00	0.00	10.15	15.8	1	254.8	270.5	1,929.3	2,184.0	2,199.8	529.4	24.1	2,729.2
1.5.1.1	Planks																										2,491.5
1.5.1.1.1	Development and Prototypes																										125.7
1.5.1.1.1.1	Stainless Tubes	3968	0	3968																							33.2
1.5.1.1.1.1.1	Tube Material	14404	0	14404	0.002	feet	2										2	0.0	0	0.0	0.0	28.5	28.5	28.5	3.4	12.0	31.9
1.5.1.1.1.1.2	Tube Machining	5	0	5	0.240	days	5										5	0.0	0	0.0	0.0	1.2	1.2	1.2	0.2	16.0	1.4
1.5.1.1.1.2	Support Ribs	248	0	248																							7.2
1.5.1.1.1.2.1	Support Rib Material	367	0	367	0.002	pounds	2										2	0.0	0	0.0	0.0	0.6	0.6	0.6	0.1	12.0	0.7
1.5.1.1.1.2.2	Support Rib Machining	23	0	23	0.240	days	6										6	0.0	0	0.0	0.0	5.6	5.6	5.6	0.9	16.0	6.5
1.5.1.1.1.3	Gas Manifolds	248	0	248																							20.7
1.5.1.1.1.3.1	Manifold Material	917	0	917	0.001	pounds	2										2	0.0	0	0.0	0.0	1.2	1.2	1.2	0.1	12.0	1.3
1.5.1.1.1.3.2	Manifold Machining	70	0	70	0.240	days	17										17	0.0	0	0.0	0.0	16.7	16.7	16.7	2.7	16.0	19.4
1.5.1.1.1.4	Crimp Pins	11904	0	11904																							22.2
1.5.1.1.1.4.1	Brass Tubes	11904	0	11904	0.000	each	2										2	0.0	0	0.0	0.0	1.8	1.8	1.8	0.2	14.0	2.0
1.5.1.1.1.4.2	Tube Machining (Impress Double Funnels)	4	0	4	0.240	days	4										4	0.0	0	0.0	0.0	1.0	1.0	1.0	19.2	2000.0	20.2
1.5.1.1.1.5	End Plugs	11904	0	11904																							10.4
1.5.1.1.1.5.1	End Plug Material	992	0	992	0.000	feet	2										2	0.0	0	0.0	0.0	0.3	0.3	0.3	0.0	14.0	0.4
1.5.1.1.1.5.2	End Plug Machining	30	0	30	0.240	days	7										7	0.0	0	0.0	0.0	7.1	7.1	7.1	1.1	16.0	8.3
1.5.1.1.1.5.3	End Plug Assembly	6	0	6	0.240	days	2										2	0.0	0	0.0	0.0	1.5	1.5	1.5	0.2	16.0	1.7
1.5.1.1.1.6	Gas Connectors	496		496																							1.2
1.5.1.1.1.6.1	Material	124	0	124	0.003	feet											0	0.0	0	0.0	0.0	0.4	0.4	0.4	0.0	12.0	0.5
1.5.1.1.1.6.2	Hose Clamps	496	0	496	0.000	each											0	0.0	0	0.0	0.0	0.1	0.1	0.1	0.0	14.0	0.1
1.5.1.1.1.6.3	Machining/Soldering	2	0	2	0.240	days	1										1	0.0	0	0.0	0.0	0.6	0.6	0.6	0.1	16.0	0.6
1.5.1.1.1.7	Plank Pre-Assembly	12	0	12	0.240	days	6										6	0.0	0	0.0	0.0	2.8	2.8	2.8	0.6	20.0	3.3
1.5.1.1.1.8	Stringing	124	0	124																							19.5
1.5.1.1.1.8.1	Sense Wire	27776	0	27776	0.000	feet	2										2	0.0	0	0.0	0.0	5.6	5.6	5.6	0.7	12.0	6.2

WBS Number	WBS Name or Description	Base Quantity	Spares Quantity	Total Quantity	Base Unit (K$)	Units	PH.D (days)	PH.M (days)	EN.D (days)	EN.M (days)	SW.D (days)	SW.M (days)	TE.D (days)	TE.M (days)	LA.D (days)	LA.M (days)	Labor (days)	Dev Labor (K$)	Dev Labor (%)	Mfg Labor (K$)	Tot Labor (K$)	Tot Mtrl (K$)	Mtrl+Mfg (K$)	Base Cost (K$)	Contingency (K$)	Contingency (%)	Total Cost (K$)
1.5.1.1.1.8.2	Crimp Wires	992	0	992	0.000	feet	2										2	0.0	0	0.0	0.0	0.1	0.1	0.1	0.0	14.0	0.1
1.5.1.1.1.8.3	Student Labor	87	0	87	0.120	days	5						5				9	1.1	9	0.0	1.1	10.5	10.5	11.6	1.6	14.0	13.2
1.5.1.1.1.9	Plank Testing	124	0	124																							7.9
1.5.1.1.1.9.1	Tension Measurements	12	0	12	0.120	days	12						12				23	2.7	66	0.0	2.7	1.4	1.4	4.1	0.7	16.0	4.7
1.5.1.1.1.9.2	Efficiency Measurements			0			12						12				23	2.7	100	0.0	2.7	0.0	0.0	2.7	0.4	16.0	3.1
1.5.1.1.2	Production																										2,365.8
1.5.1.1.2.1	Stainless Tubes	79872	13312	93184																							769.9
1.5.1.1.2.1.1	Tube Material	289935	48323	338258	0.002	feet		5									5	0.0	0	0.0	0.0	668.1	668.1	668.1	80.2	12.0	748.3
1.5.1.1.2.1.2	Tube Machining	67	11	78	0.240	days		5									5	0.0	0	0.0	0.0	18.6	18.6	18.6	3.0	16.0	21.6
1.5.1.1.2.2	Support Ribs	4992	832	5824																							117.9
1.5.1.1.2.2.1	Support Rib Material	7382	1230	8612	0.002	pounds		5									5	0.0	0	0.0	0.0	14.8	14.8	14.8	1.8	12.0	16.6
1.5.1.1.2.2.2	Support Rib Machining	312	52	364	0.240	days		55									55	0.0	0	0.0	0.0	87.4	87.4	87.4	14.0	16.0	101.3
1.5.1.1.2.3	Gas Manifolds	4992	832	5824																							334.7
1.5.1.1.2.3.1	Manifold Material	18455	2953	21408	0.001	pounds		5									5	0.0	0	0.0	0.0	27.4	27.4	27.4	3.3	12.0	30.7
1.5.1.1.2.3.2	Manifold Machining	936	156	1092	0.240	days		164									164	0.0	0	0.0	0.0	262.1	262.1	262.1	41.9	16.0	304.0
1.5.1.1.2.4	Crimp Pins	239616	39936	279552																							266.9
1.5.1.1.2.4.1	Brass Tubes	239616	39936	279552	0.000	each		5									5	0.0	0	0.0	0.0	41.9	41.9	41.9	5.9	14.0	47.8
1.5.1.1.2.4.2	Tube Machining (Impress Double Funnels)	71	12	83	0.240	days		5									5	0.0	0	0.0	0.0	19.9	19.9	19.9	199.2	1000.0	219.1
1.5.1.1.2.5	End Plugs	239616	39936	279552																							166.0
1.5.1.1.2.5.1	End Plug Material	19968	3328	23296	0.000	feet		5									5	0.0	0	0.0	0.0	8.2	8.2	8.2	1.1	14.0	9.3
1.5.1.1.2.5.2	End Plug Machining	399	67	466	0.240	days		70									70	0.0	0	0.0	0.0	111.8	111.8	111.8	17.9	16.0	129.7
1.5.1.1.2.5.3	End Plug Assembly	83	14	97	0.240	days		15									15	0.0	0	0.0	0.0	23.3	23.3	23.3	3.7	16.0	27.0
1.5.1.1.2.6	Gas Connectors	9984	1664	11648																							22.5
1.5.1.1.2.6.1	Material	2496	125	2621	0.003	feet		5									5	0.0	0	0.0	0.0	8.6	8.6	8.6	1.0	12.0	9.7
1.5.1.1.2.6.2	Hose Clamps	9984	1664	11648	0.000	each		5									5	0.0	0	0.0	0.0	2.3	2.3	2.3	0.3	14.0	2.7
1.5.1.1.2.6.3	Machining and Soldering	31	5	36	0.240	days		5									5	0.0	0	0.0	0.0	8.7	8.7	8.7	1.4	16.0	10.1
1.5.1.1.2.7	Plank Pre-Assembly	156	26	182	0.240	days		91									91	0.0	0	0.0	0.0	43.7	43.7	43.7	8.7	20.0	52.4
1.5.1.1.2.8	Stringing	2496	416	2912																							514.0
1.5.1.1.2.8.1	Sense Wire	479232	87859	567091	0.000	feet		5									5	0.0	0	0.0	0.0	113.4	113.4	113.4	13.6	12.0	127.0
1.5.1.1.2.8.2	Crimp Wires	19968	3328	23296	0.000	feet		5									5	0.0	0	0.0	0.0	2.3	2.3	2.3	0.3	14.0	2.7
1.5.1.1.2.8.3	Student Labor	1170	195	1365	0.120	days		341						683			1024	0.0	0	173.4	173.4	163.8	337.2	337.2	47.2	14.0	384.4
1.5.1.1.2.9	Plank Testing	2496	416	2912																							79.0
1.5.1.1.2.9.1	Tension Meas.	156	26	182	0.120	days		91									91	0.0	0	0.0	0.0	21.8	21.8	21.8	3.5	16.0	25.3
1.5.1.1.2.9.2	Efficiency Meas.			0				182						182			364	0.0	0	46.2	46.2	0.0	46.2	46.2	7.4	16.0	53.6
1.5.1.1.2.10	Plank Tension Test Stand																										31.8
1.5.1.1.2.10.1	PCs	3	1	4	2.500	each											0	0.0	0	0.0	0.0	10.0	10.0	10.0	1.6	16.0	11.6
1.5.1.1.2.10.2	Labview Software	3	0	3	1.000	each											0	0.0	0	0.0	0.0	3.0	3.0	3.0	0.5	16.0	3.5
1.5.1.1.2.10.3	PCI Readout Card	3	1	4	0.300	each											0	0.0	0	0.0	0.0	1.2	1.2	1.2	0.2	16.0	1.4
1.5.1.1.2.10.4	Wave Generator	3	1	4	1.000	each											0	0.0	0	0.0	0.0	4.0	4.0	4.0	0.6	16.0	4.6
1.5.1.1.2.10.5	Miscellaneous Parts	3	1	4	0.500	each											0	0.0	0	0.0	0.0	2.0	2.0	2.0	0.3	16.0	2.3
1.5.1.1.2.10.6	Assembly			0			20	10					20	10			60	4.6	65	2.5	7.2	0.0	2.5	7.2	1.1	16.0	8.3
1.5.1.1.2.11	Plank Efficiency Test Stand																										10.7
1.5.1.1.2.11.1	Scintillator			0	5.000			2						2			4	0.0	0	0.5	0.5	0.0	0.5	0.5	0.1	16.0	0.6
1.5.1.1.2.11.2	Miscellaneous CAMAC Modules			0	15.000			2						2			4	0.0	0	0.5	0.5	0.0	0.5	0.5	0.1	16.0	0.6
1.5.1.1.2.11.3	Power Supplies			0	5.000			2						2			4	0.0	0	0.5	0.5	0.0	0.5	0.5	0.1	16.0	0.6
1.5.1.1.2.11.4	Phototubes			0	10.000			2						2			4	0.0	0	0.5	0.5	0.0	0.5	0.5	0.1	16.0	0.6
1.5.1.1.2.11.5	Assembly			0			20	10					20	10			60	4.6	65	2.5	7.2	0.0	2.5	7.2	1.1	16.0	8.3
1.5.1.2	Quadrants																										237.7
1.5.1.2.1	Development & Prototypes																										37.0
1.5.1.2.1.1	Aluminum Sheets	18		18																							23.7
1.5.1.2.1.1.1	Material	1016	0	1016	0.002	pounds											0	0.0	0	0.0	0.0	1.6	1.6	1.6	0.2	12.0	1.8
1.5.1.2.1.1.2	Pre-Drilling	18	0	18	0.889	each		18									18	0.0	0	0.0	0.0	16.0	16.0	16.0	3.5	22.0	19.5
1.5.1.2.1.1.3	Machining	8	0	8	0.240	days		8									8	0.0	0	0.0	0.0	2.0	2.0	2.0	0.3	16.0	2.3
1.5.1.2.1.2	Miscellaneous Parts			0																							2.3
1.5.1.2.1.2.1	Spacers	192	0	192	0.008	each		10									10	0.0	0	0.0	0.0	1.5	1.5	1.5	0.3	22.0	1.9
1.5.1.2.1.2.2	Aluminum Side Supports	8	0	8	0.031	each		10									10	0.0	0	0.0	0.0	0.2	0.2	0.2	0.1	22.0	0.3
1.5.1.2.1.2.3	Fasteners	1248	0	1248	0.000	each		2									2	0.0	0	0.0	0.0	0.1	0.1	0.1	0.0	14.0	0.1
1.5.1.2.1.3	Aluminum Sandwich Plates	2		2													0	0.0	0	0.0							0.2
1.5.1.2.1.3.1	Material	28	0	28	0.002	pounds											0	0.0	0	0.0	0.0	0.1	0.1	0.1	0.0	12.0	0.1
1.5.1.2.1.3.2	Machining	0	0	0	0.240	days		2									2	0.0	0	0.0	0.0	0.1	0.1	0.1	0.0	22.0	0.1
1.5.1.2.1.4	Quad Assembly and Testing	2	0	2	0.240	days		5						5			9	0.0	0	1.1	1.1	0.5	1.7	1.7	0.4	22.0	2.1
1.5.1.2.1.5	Assembly Equipment																										8.7
1.5.1.2.1.5.1	Open Bottom Tables	1	0	1	2.000	each		5						5			10	0.0	0	1.3	1.3	2.0	3.3	3.3	0.5	16.0	3.8
1.5.1.2.1.5.2	Lifting Equipment	1	0	1	3.000	each		5						5			10	0.0	0	1.3	1.3	3.0	4.3	4.3	0.7	16.0	5.0
1.5.1.2.2	Production																										200.7
1.5.1.2.2.1	Aluminum Sheets	432	72	504																							114.0
1.5.1.2.2.1.1	Material	24386	4064	28450	0.002	pounds											0	0.0	0	0.0	0.0	45.2	45.2	45.2	5.4	12.0	50.7
1.5.1.2.2.1.2	Pre-Drilling	432	72	504	0.032	each		10									10	0.0	0	0.0	0.0	16.0	16.0	16.0	3.5	22.0	19.5
1.5.1.2.2.1.3	Machining	135	23	158	0.240	days		20									20	0.0	0	0.0	0.0	37.8	37.8	37.8	6.0	16.0	43.8
1.5.1.2.2.2	Miscellaneous Parts																										27.4
1.5.1.2.2.2.1	Acme Rod and Mounts	6	1	7	0.214	each		5									5	0.0	0	0.0	0.0	1.5	1.5	1.5	0.2	16.0	1.7
1.5.1.2.2.2.2	Spacers	1152	192	1344	0.008	each		15									15	0.0	0	0.0	0.0	10.8	10.8	10.8	2.4	22.0	13.1
1.5.1.2.2.2.3	Aluminum Side Supports	192	32	224	0.031	each		15									15	0.0	0	0.0	0.0	7.0	7.0	7.0	1.5	22.0	8.5
1.5.1.2.2.2.4	Fasteners	29952	4992	34944	0.000	each		5									5	0.0	0	0.0	0.0	3.5	3.5	3.5	0.5	14.0	4.0
1.5.1.2.2.3	Aluminum Sandwich Plates	48	8	56													0.0										3.0
1.5.1.2.2.3.1	Material	677	113	790	0.002	pounds		5									5	0.0	0	0.0	0.0	1.3	1.3	1.3	0.2	12.0	1.4
1.5.1.2.2.3.2	Machining	5	1	6	0.240	days		5									5	0.0	0	0.0	0.0	1.3	1.3	1.3	0.3	22.0	1.6
1.5.1.2.2.4	Quad Assembly and Testing	72	0	72	0.240	days		72						72			144	0.0	0	18.3	18.3	17.3	35.6	35.6	7.8	22.0	43.4
1.5.1.2.2.5	Assembly Equipment																										12.9
1.5.1.2.2.5.1	Open Bottom Tables	2	0	2	2.000	each		12						12			24	0.0	0	3.0	3.0	4.0	7.0	7.0	1.1	16.0	8.2
1.5.1.2.2.5.2	Lifting Equipment	1	0	1	1.000	each		12						12			24	0.0	0	3.0	3.0	1.0	4.0	4.0	0.6	16.0	4.7
1.5.2	**Front-End Electronics**					man yrs >	0.81	0.90	1.02	0.82	0.00	0.00	1.02	1.02	0.24	2.33	8.16	163.8	9	217.6	381.5	1,447.4	1,665.0	1,828.9	373.4	20.4	2,202.2
1.5.2.1	ASDQ ICs																										457.0
1.5.2.1.1	Development and Prototypes	80	0	80	0.032	each											0	0.0	0	0.0	0.0	2.6	2.6	2.6	0.6	24.0	3.2
1.5.2.1.2	Production	9984	1497	11481	0.032	each											0	0.0	0	0.0	0.0	366.0	366.0	366.0	87.8	24.0	453.8
1.5.2.2	Control/Monitoring & Timing (C/M&T) and Data Readout Electronics																										200.6
1.5.2.2.1	BTeV-Standard Control/Monitoring & Timing and Data Readout (TMC2) FPGA																										200.6

WBS Number	WBS Name or Description	Base Quantity	Spares Quantity	Total Quantity	Base Unit (K$)	Units	PH.D (days)	PH.M (days)	EN.D (days)	EN.M (days)	SW.D (days)	SW.M (days)	TE.D (days)	TE.M (days)	LA.D (days)	LA.M (days)	Labor (days)	Dev Labor (K$)	Dev Labor (%)	Mfg Labor (K$)	Tot Labor (K$)	Tot Mtrl (K$)	Mtrl+Mfg (K$)	Base Cost (K$)	Contingency (K$)	Contingency (%)	Total Cost (K$)
1.5.2.2.1.1	Development and Prototypes																										110.0
1.5.2.2.1.1.1	Firmware Specific to the Muon Detector	0		0			10		60				30				100	30.1	100	0.0	30.1	0.0	0.0	30.1	17.3	57.5	47.4
1.5.2.2.1.1.2	Design and Simulations Reviews	0		0			10		30								40	11.6	100	0.0	11.6	0.0	0.0	11.6	6.7	57.5	18.2
1.5.2.2.1.1.3	Prototype Testing	10		10	0.100		60		60				20				140	27.8	97	0.0	27.8	1.0	1.0	28.8	14.4	50.0	43.2
1.5.2.2.1.1.4	Prototype Muon TMC2 FPGAs	6	0	6	0.120	each											0	0.0	0	0.0	0.0	0.7	0.7	0.7	0.4	50.0	1.1
1.5.2.2.1.2	Production																										90.7
1.5.2.2.1.2.1	Production Reviews	0		0				10		30				10			50	0.0	0	15.2	15.2	0.0	15.2	15.2	2.3	15.0	17.5
1.5.2.2.1.2.2	Production Muon TMC2 FPGAs	167	34	201	0.041	each											0	0.0	0	0.0	0.0	8.2	8.2	8.2	4.1	50.0	12.4
1.5.2.2.1.2.3	Production Testing	0		0				60		60				60			180	0.0	0	40.6	40.6	0.0	40.6	40.6	20.3	50.0	60.8
1.5.2.3	Data Serializer/Transmitter and C/M&T and Data Opto-Electronics																										109.5
1.5.2.3.1	Development & Prototypes																										27.1
1.5.2.3.1.1	Prototype Data Serializer/Transmitter ICs	4		4	0.050				5				5				10	3.1	94	0.0	3.1	0.2	0.2	3.3	0.8	24.0	4.1
1.5.2.3.1.2	Design Reviews and Prototype Testing						10		30				30				70	18.5	100	0.0	18.5	0.0	0.0	18.5	4.4	24.0	23.0
1.5.2.3.2	Production																										82.5
1.5.2.3.2.1	Testing: Automated and Field	1		1	5.000	total		15		25				25			65	0.0	0	16.9	16.9	5.0	21.9	21.9	4.4	20.0	26.3
1.5.2.3.2.2	Production C/M&T and Data Readout Opto-Electronics	167	25	192	0.030	each		25		25				25			75	0.0	0	16.9	16.9	5.8	22.7	22.7	5.4	24.0	28.1
1.5.2.3.2.3	Production Data Serializer/Transmitter ICs	167	25	192	0.030	each		25		25				25			75	0.0	0	16.9	16.9	5.8	22.7	22.7	5.4	24.0	28.1
1.5.2.4	Auxiliary Front End and Data Combiner Board Electronic Components					each																					472.9
1.5.2.4.1	Development and Prototypes					each																					31.8
1.5.2.4.1.1	Analog Mux	20	10	30	0.002	each											0	0.0	0	0.0	0.0	0.1	0.1	0.1	0.0	10.0	0.1
1.5.2.4.1.2	Octal DAC	100	25	125	0.003	each											0	0.0	0	0.0	0.0	0.3	0.3	0.3	0.0	10.0	0.4
1.5.2.4.1.3	11 input ADC	20	15	35	0.002	each											0	0.0	0	0.0	0.0	0.1	0.1	0.1	0.0	10.0	0.1
1.5.2.4.1.4	Wideband Transistor BFT92	640	2520	3160	0.000	each											0	0.0	0	0.0	0.0	1.5	1.5	1.5	0.1	10.0	1.6
1.5.2.4.1.5	Wideband Transistor BFT25	640	2520	3160	0.001	each											0	0.0	0	0.0	0.0	1.6	1.6	1.6	0.2	10.0	1.8
1.5.2.4.1.6	Protection Push-Pull Diode	640	20	660	0.000	each											0	0.0	0	0.0	0.0	0.1	0.1	0.1	0.0	10.0	0.1
1.5.2.4.1.7	Miscellaneous Analog Circuitry Components (Rs & Cs)	6660	5000	11660	0.000	each											0	0.0	0	0.0	0.0	0.6	0.6	0.6	0.1	10.0	0.6
1.5.2.4.1.8	Analog Mux	21	0	21	0.002	each											0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0
1.5.2.4.1.9	Isolation Transformer	16	0	16	0.003	each											0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0
1.5.2.4.1.10	Connectors & cable	80	0	80	0.014	each											0	0.0	0	0.0	0.0	1.1	1.1	1.1	0.1	10.0	1.2
1.5.2.4.1.11	Data Combiner Board Components	6	0	6	0.560	each	10		40				20				70	20.1	86	0.0	20.1	3.4	3.4	23.4	2.3	10.0	25.8
1.5.2.4.2	Production					each																					441.1
1.5.2.4.2.1	Analog Mux	7488	1125	8613	0.002	each											0	0.0	0	0.0	0.0	16.5	16.5	16.5	1.7	10.0	18.2
1.5.2.4.2.2	Octal DAC	12480	1872	14352	0.002	each											0	0.0	0	0.0	0.0	34.2	34.2	34.2	3.4	10.0	37.6
1.5.2.4.2.3	11 input ADC	2496	375	2871	0.002	each											0	0.0	0	0.0	0.0	6.8	6.8	6.8	0.7	10.0	7.5
1.5.2.4.2.4	Wideband Transistor BFT92	79872	11980	91852	0.000	each											0	0.0	0	0.0	0.0	43.2	43.2	43.2	4.3	10.0	47.5
1.5.2.4.2.5	Wideband Transistor BFT25	79872	11980	91852	0.001	each											0	0.0	0	0.0	0.0	46.8	46.8	46.8	4.7	10.0	51.5
1.5.2.4.2.6	Protection Push-Pull Diode	79872	11980	91852	0.000	each											0	0.0	0	0.0	0.0	7.3	7.3	7.3	0.7	10.0	8.1
1.5.2.4.2.7	Miscellaneous Components (Resistors and Capacitors)	798720	119805	918525	0.000	each											0	0.0	0	0.0	0.0	45.9	45.9	45.9	4.6	10.0	50.5
1.5.2.4.2.8	Analog Mux	4992	750	5742	0.002	each											0	0.0	0	0.0	0.0	11.0	11.0	11.0	1.1	10.0	12.1
1.5.2.4.2.9	Isolation Transformer	2496	375	2871	0.003	each											0	0.0	0	0.0	0.0	8.0	8.0	8.0	0.8	10.0	8.8
1.5.2.4.2.10	Connectors & cable	4992	375	5367	0.014	each											0	0.0	0	0.0	0.0	74.0	74.0	74.0	7.4	10.0	81.4
1.5.2.4.2.11	Data Combiner Board Components	167	34	201	0.466	each				20				20			40	0.0	0	13.5	13.5	93.7	107.2	107.2	10.7	10.0	117.9
1.5.2.5	32-Channel Front End (Amplifier/Discriminator) Boards																										237.5
1.5.2.5.1	Development and Prototypes																										46.7
1.5.2.5.1.1	Fabrication & Assembly																										46.7
1.5.2.5.1.1.1	Set-up Charges (Fabrication)	3		3	0.700	each											0	0.0	0	0.0	0.0	2.1	2.1	2.1	0.2	10.0	2.3
1.5.2.5.1.1.2	Set-up Charges (Assembly)	3		3	0.500	each											0	0.0	0	0.0	0.0	1.5	1.5	1.5	0.2	10.0	1.7
1.5.2.5.1.1.3	Testing Jigs	3		3	2.500	each											0	0.0	0	0.0	0.0	7.5	7.5	7.5	0.8	10.0	8.3
1.5.2.5.1.1.4	Prototype ASDQ Front End Boards	40		40	0.170	each	60						60		60		180	20.2	75	0.0	20.2	6.8	6.8	27.0	7.5	28.0	34.5
1.5.2.5.2	Production																										190.8
1.5.2.5.2.1	Fabrication & Assembly																										190.8
1.5.2.5.2.1.1	Set-up Charges (Fabrication)	1		1	0.700	each											0	0.0	0	0.0	0.0	0.7	0.7	0.7	0.1	10.0	0.8
1.5.2.5.2.1.2	Set-up Charges (Assembly)	1		1	0.500	each											0	0.0	0	0.0	0.0	0.5	0.5	0.5	0.1	10.0	0.6
1.5.2.5.2.1.3	Testing Jigs	1		1	2.500	each											0	0.0	0	0.0	0.0	2.5	2.5	2.5	0.3	10.0	2.8
1.5.2.5.2.1.4	Production ASDQ Front End Boards	2496	375	2871	0.038	each		25						20		280	325	0.0	0	37.0	37.0	108.9	145.9	145.9	40.9	28.0	186.7
1.5.2.6	Plank Interface Cards																										418.1
1.5.2.6.1	Prototype Plank Interface Cards																										9.4
1.5.2.6.1.1	Prototype HV Bias and Signal Board	20	6	26	0.017	each	10						20				30	4.6	91	0.0	4.6	0.4	0.4	5.1	1.4	28.0	6.5
1.5.2.6.1.2	HV Blocking Capacitor	640	48	688	0.000	each											0	0.0	0	0.0	0.0	0.2	0.2	0.2	0.0	10.0	0.2
1.5.2.6.1.3	HV Resistor	640	48	688	0.001	each											0	0.0	0	0.0	0.0	0.8	0.8	0.8	0.1	10.0	0.9
1.5.2.6.1.4	Signal Connector	160	12	172	0.001	each											0	0.0	0	0.0	0.0	0.2	0.2	0.2	0.0	10.0	0.3
1.5.2.6.1.5	Board Coating	20	5	25	0.003	each											0	0.0	0	0.0	0.0	0.1	0.1	0.1	0.0	10.0	0.1
1.5.2.6.1.6	Solder	20	5	25	0.001	each											0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0
1.5.2.6.1.7	Board Machining	20	5	25	0.003	each											0	0.0	0	0.0	0.0	0.1	0.1	0.1	0.0	10.0	0.1
1.5.2.6.1.8	Prototype Termination Card	20	5	25	0.017	each											0	0.0	0	0.0	0.0	0.4	0.4	0.4	0.1	28.0	0.5
1.5.2.6.1.9	HV Blocking Capacitor	640	48	688	0.000	each											0	0.0	0	0.0	0.0	0.2	0.2	0.2	0.0	10.0	0.2
1.5.2.6.1.10	Resistors	640	48	688	0.000	each											0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0
1.5.2.6.1.11	Solder	20	15	35	0.001	each											0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0
1.5.2.6.1.12	Board Machining	20	5	25	0.003	each											0	0.0	0	0.0	0.0	0.1	0.1	0.1	0.0	10.0	0.1
1.5.2.6.1.13	Board Coating	20	5	25	0.003	each											0	0.0	0	0.0	0.0	0.1	0.1	0.1	0.0	10.0	0.1
1.5.2.6.1.14	Testing Jigs	3	1	4	0.100	each											0	0.0	0	0.0	0.0	0.4	0.4	0.4	0.0	10.0	0.4
1.5.2.6.2	Production Plank Interface cards																										408.7
1.5.2.6.2.1	HV Bias and Signal Board	2496	750	3246	0.017	each		5								172	177	0.0	0	19.6	19.6	54.3	73.9	73.9	20.7	28.0	94.6
1.5.2.6.2.2	HV Blocking Capacitor	82368	25500	107868	0.000	each											0	0.0	0	0.0	0.0	30.2	30.2	30.2	3.0	10.0	33.2
1.5.2.6.2.3	HV Resistor	84864	25500	110364	0.001	each											0	0.0	0	0.0	0.0	90.5	90.5	90.5	9.0	10.0	99.5
1.5.2.6.2.4	Signal Connector	22464	6750	29214	0.001	each											0	0.0	0	0.0	0.0	22.8	22.8	22.8	3.2	14.0	26.0
1.5.2.6.2.5	Board Coating	2496	750	3246	0.003	each											0	0.0	0	0.0	0.0	9.7	9.7	9.7	1.4	14.0	11.1
1.5.2.6.2.6	Solder	2496	750	3246	0.001	each											0	0.0	0	0.0	0.0	1.6	1.6	1.6	0.2	14.0	1.9
1.5.2.6.2.7	Board Machining	2496	750	3246	0.003	each											0	0.0	0	0.0	0.0	9.7	9.7	9.7	1.4	14.0	11.1
1.5.2.6.2.8	Production Termination Card	2496	750	3246	0.017	each											0	0.0	0	0.0	0.0	54.3	54.3	54.3	15.2	28.0	69.5
1.5.2.6.2.9	HV Blocking Capacitor	79872	24000	103872	0.000	each											0	0.0	0	0.0	0.0	29.1	29.1	29.1	2.9	10.0	32.0
1.5.2.6.2.10	Resistors	79872	24000	103872	0.000	each											0	0.0	0	0.0	0.0	5.2	5.2	5.2	0.5	10.0	5.7
1.5.2.6.2.11	Solder	2496	750	3246	0.001	each											0	0.0	0	0.0	0.0	1.6	1.6	1.6	0.2	14.0	1.9
1.5.2.6.2.12	Board Machining	2496	750	3246	0.003	each											0	0.0	0	0.0	0.0	9.7	9.7	9.7	1.4	14.0	11.1
1.5.2.6.2.13	Board Coating	2496	750	3246	0.003	each											0	0.0	0	0.0	0.0	9.7	9.7	9.7	1.4	14.0	11.1
1.5.2.7	Front-End EMI Enclosure																										144.5

WBS Number	WBS Name or Description	Base Quantity	Spares Quantity	Total Quantity	Base Unit (K$)	Units	PH.D (days)	PH.M (days)	EN.D (days)	EN.M (days)	SW.D (days)	SW.M (days)	TE.D (days)	TE.M (days)	LA.D (days)	LA.M (days)	Labor (days)	Dev Labor (K$)	Dev Labor (%)	Mfg Labor (K$)	Tot Labor (K$)	Tot Mtrl (K$)	Mtrl+Mfg (K$)	Base Cost (K$)	Contingency (K$)	Contingency (%)	Total Cost (K$)
1.5.2.7.1	Aluminum Enclosure Prototype	20	3	23	0.018	each	3						10				13	2.3	85	0.0	2.3	0.4	0.4	2.7	0.3	10.0	3.0
1.5.2.7.2	Enclosure Hardware	20	3	23	0.002	each											0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	0.1
1.5.2.7.3	Enclosure Machining	20	3	23	0.050	each											0	0.0	0	0.0	0.0	1.2	1.2	1.2	0.1	10.0	1.3
1.5.2.7.4	Aluminum Enclosure Production	2496	375	2871	0.017	each		20								130	150	0.0	0	14.8	14.8	49.4	64.2	64.2	6.4	10.0	70.7
1.5.2.7.5	Enclosure Hardware	2496	375	2871	0.002	each											0	0.0	0	0.0	0.0	5.7	5.7	5.7	0.6	10.0	6.3
1.5.2.7.6	Enclosure Machining	2496	375	2871	0.020	each											0	0.0	0	0.0	0.0	57.4	57.4	57.4	5.7	10.0	63.2
1.5.2.8	416-Channel Data Combiner Boards																0										162.1
1.5.2.8.1	Development and Prototypes	4	2	6	2.000	each	30		30				60				120	25.5	68	0.0	25.5	12.0	12.0	37.5	10.1	27.0	47.6
1.5.2.8.2	Production	167	38	205	0.330	each		40		20				70			130	0.0	0	26.2	26.2	67.7	93.9	93.9	20.7	22.0	114.5
1.5.3	**Power, Cooling and Electronics Protection**					man yrs >	0.04	0.21	0.04	0.08	0.00	0.00	0.00	0.25	0.04	0.24	0.90	4.9	1	31.0	35.9	660.2	691.2	696.1	69.6	10.0	765.7
1.5.3.1	High Voltage						10	20	10	20					10	60	130	4.9	24	15.3	20.2	0.0	15.3	20.2	2.0	10.0	509.9
1.5.3.1.1	CAEN Basic System	2496	375	2871	0.100	each											0	0.0	0	0.0	0.0	287.1	287.1	287.1	28.7	10.0	315.8
1.5.3.1.2	High Voltage Cable	2496	375	2871	0.042	each											0	0.0	0	0.0	0.0	121.2	121.2	121.2	12.1	10.0	133.3
1.5.3.1.3	High Voltage Connector	4992	750	5742	0.006	each											0	0.0	0	0.0	0.0	35.1	35.1	35.1	3.5	10.0	38.6
1.5.3.2	Low Voltage																										245.5
1.5.3.2.1	Low Voltage Prototype System																										4.9
1.5.3.2.1.1	DC-DC Converter	20	5	25	0.035	each		5						10			15	0.0	0	2.5	2.5	0.9	3.4	3.4	0.3	10.0	3.8
1.5.3.2.1.2	12V Power Supply	1	1	2	0.210	each											0	0.0	0	0.0	0.0	0.4	0.4	0.4	0.0	10.0	0.5
1.5.3.2.1.3	Power Cable	20	5	25	0.020	each											0	0.0	0	0.0	0.0	0.5	0.5	0.5	0.1	10.0	0.6
1.5.3.2.1.4	Plugs and Connectors	20	5	25	0.005	each											0	0.0	0	0.0	0.0	0.1	0.1	0.1	0.0	10.0	0.1
1.5.3.2.2	Low Voltage Production System																										240.6
1.5.3.2.2.1	DC-DC Converter	2496	375	2871	0.032	each		20						40			60	0.0	0	10.2	10.2	91.5	101.7	101.7	10.2	10.0	111.9
1.5.3.2.2.2	12V Power Supply	192	30	222	0.204	each											0	0.0	0	0.0	0.0	45.3	45.3	45.3	4.5	10.0	49.8
1.5.3.2.2.3	Power Cable	2496	375	2871	0.020	each											0	0.0	0	0.0	0.0	57.4	57.4	57.4	5.7	10.0	63.2
1.5.3.2.2.4	Plugs and Connectors	2496	375	2871	0.005	each											0	0.0	0	0.0	0.0	14.4	14.4	14.4	1.4	10.0	15.8
1.5.3.3	Cooling																										10.3
1.5.3.3.1	Prototype Cooling System																										1.5
1.5.3.3.1.1	Cooling Fan	2	1	3	0.026	each		2						5			7	0.0	0	1.3	1.3	0.1	1.3	1.3	0.1	10.0	1.5
1.5.3.3.1.2	Power Cord	2	1	3	0.002	each											0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0
1.5.3.3.2	Production Cooling System																										8.8
1.5.3.3.2.1	Cooling Fan	192	30	222	0.026	each		5						7			12	0.0	0	1.8	1.8	5.8	7.6	7.6	0.8	10.0	8.3
1.5.3.3.2.2	Power Cord	192	30	222	0.002	each											0	0.0	0	0.0	0.0	0.4	0.4	0.4	0.0	10.0	0.5
1.5.4	**Mechanical and Other Systems**					man yrs >	0.03	0.13	0.00	0.09	0.00	0.00	0.04	0.18	0.00	0.00	0.46	2.3	3	20.5	22.8	46.0	66.5	68.8	9.7	14.2	78.5
1.5.4.1	Detector Station Mechanical Supports																										37.0
1.5.4.1.1	U-channel Aluminum Supports	24	2	26	0.200	each		5		5				5			15	0.0	0	3.4	3.4	5.2	8.6	8.6	1.4	16.0	10.0
1.5.4.1.2	Roller Mounts and Rollers	36	4	40	0.100	each		5		5				5			15	0.0	0	3.4	3.4	4.0	7.4	7.4	1.2	16.0	8.6
1.5.4.1.3	Side Connectors	48	4	52	0.050	each		2		2				2			6	0.0	0	1.4	1.4	2.6	4.0	4.0	0.6	16.0	4.6
1.5.4.1.4	Threaded Rod	24	2	26	0.100	each		5		5				5			15	0.0	0	3.4	3.4	2.6	6.0	6.0	1.0	16.0	6.9
1.5.4.1.5	Lifters	24	2	26	0.100	each		5		5				5			15	0.0	0	3.4	3.4	2.6	6.0	6.0	1.0	16.0	6.9
1.5.4.2	Gas System																										41.5
1.5.4.2.1	Gas Mixing System																										16.6
1.5.4.2.1.1	MKS Flow Controllers	4	4	8	1.000	each								2			2	0.0	0	0.5	0.5	8.0	8.5	8.5	0.7	8.0	9.2
1.5.4.2.1.2	MKS Readout Module	1	1	2	1.500	each											0	0.0	0	0.0	0.0	3.0	3.0	3.0	0.2	8.0	3.2
1.5.4.2.1.3	Miscellaneous Parts			0	5.000									5			5	0.0	0	1.3	1.3	0.0	1.3	1.3	0.2	14.0	1.4
1.5.4.2.1.4	Assembly			0			5	5					5	5			20	1.2	48	1.3	2.4	0.0	1.3	2.4	0.3	12.0	2.7
1.5.4.2.2	Gas Distribution System																0.0										11.8
1.5.4.2.2.1	Flow Monitors	4	4	8	0.500												0	0.0	0	0.0	0.0	4.0	4.0	4.0	0.3	8.0	4.3
1.5.4.2.2.2	Tubing, Parts			0	15.000												0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	14.0	0.0
1.5.4.2.2.3	Distribution Manifold	1	1	2	2.000												0	0.0	0	0.0	0.0	4.0	4.0	4.0	0.6	14.0	4.6
1.5.4.2.2.4	Assembly			0				5						10			15	0.0	0	2.5	2.5	0.0	2.5	2.5	0.4	14.0	2.9
1.5.4.2.3	Gas Monitoring System	1	1	2	5.000		3						5				8	1.2	10	0.0	1.2	10.0	10.0	11.2	2.0	18.0	13.2
1.5.5	**Test Beam Studies**					man yrs >	2.62	0.00	0.00	0.00	0.00	0.00	1.34	0.00	0.00	0.00	3.96	77.7	41	0.0	77.7	112.8	112.8	190.5	19.9	10.4	210.4
1.5.5.1	Plank Test (S2000)																0.0										24.3
1.5.5.1.1	Gas																0.0										3.0
1.5.5.1.1.1	Argon	3		3	0.100	bottles											0	0.0	0	0.0	0.0	0.3	0.3	0.3	0.0	10.0	0.3
1.5.5.1.1.2	CO2	3		3	0.100	bottles											0	0.0	0	0.0	0.0	0.3	0.3	0.3	0.0	10.0	0.3
1.5.5.1.1.3	CF4	6		6	0.183	bottles											0	0.0	0	0.0	0.0	1.1	1.1	1.1	0.1	10.0	1.2
1.5.5.1.1.4	Argon/CO2 80/20	5		5	0.200	bottles											0	0.0	0	0.0	0.0	1.0	1.0	1.0	0.1	10.0	1.1
1.5.5.1.2	Operation/Analysis			0			80						80				160	18.6	100	0.0	18.6	0.0	0.0	18.6	1.9	10.0	20.4
1.5.5.1.3	Miscellaneous Parts	1		1	0.800	total											0	0.0	0	0.0	0.0	0.8	0.8	0.8	0.1	12.0	0.9
1.5.5.2	Plank Beam Test																0.0										56.1
1.5.5.2.1	Gas																0.0										19.1
1.5.5.2.1.1	Argon	20		20	0.100	bottles											0	0.0	0	0.0	0.0	2.0	2.0	2.0	0.2	10.0	2.2
1.5.5.2.1.2	CO2	20		20	0.100	bottles											0	0.0	0	0.0	0.0	2.0	2.0	2.0	0.2	10.0	2.2
1.5.5.2.1.3	CF4	40		40	0.183	bottles											0	0.0	0	0.0	0.0	7.3	7.3	7.3	0.7	10.0	8.1
1.5.5.2.1.4	Argon/CO2 80/20	30		30	0.200	bottles											0	0.0	0	0.0	0.0	6.0	6.0	6.0	0.6	10.0	6.6
1.5.5.2.2	Operation/Analysis			0			240						80				320	18.6	100	0.0	18.6	0.0	0.0	18.6	1.9	10.0	20.4
1.5.5.2.3	Miscellaneous Parts			0	1.000												0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	12.0	0.0
1.5.5.2.4	Test Stand	1		1	2.000		5						5				10	1.2	37	0.0	1.2	2.0	2.0	3.2	0.3	10.0	3.5
1.5.5.2.5	Housing	1		1	6.000												0	0.0	0	0.0	0.0	6.0	6.0	6.0	0.6	10.0	6.6
1.5.5.2.5	Travel	1		1	6.000												0	0.0	0	0.0	0.0	6.0	6.0	6.0	0.6	10.0	6.6
1.5.5.3	Quadrant Test																0.0										73.4
1.5.5.3.1	Gas			0													0.0										35.9
1.5.5.3.1.1	Argon	40		40	0.100	bottles											0	0.0	0	0.0	0.0	4.0	4.0	4.0	0.4	10.0	4.4
1.5.5.3.1.2	CO2	40		40	0.100	bottles											0	0.0	0	0.0	0.0	4.0	4.0	4.0	0.4	10.0	4.4
1.5.5.3.1.3	CF4	80		80	0.183	bottles											0	0.0	0	0.0	0.0	14.6	14.6	14.6	1.5	10.0	16.1
1.5.5.3.1.4	Argon/CO2 80/20	50		50	0.200	bottles											0	0.0	0	0.0	0.0	10.0	10.0	10.0	1.0	10.0	11.0
1.5.5.3.2	Operation/Analysis			0			240						80				320	18.6	100	0.0	18.6	0.0	0.0	18.6	2.2	12.0	20.8
1.5.5.3.3	Miscellaneous Parts			0	1.000												0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	12.0	0.0
1.5.5.3.4	Test Stand	1		1	2.000		5						5				10	1.2	37	0.0	1.2	2.0	2.0	3.2	0.4	12.0	3.5
1.5.5.3.5	Housing	1		1	6.000	each											0	0.0	0	0.0	0.0	6.0	6.0	6.0	0.6	10.0	6.6
1.5.5.3.5	Travel	1		1	6.000	each											0	0.0	0	0.0	0.0	6.0	6.0	6.0	0.6	10.0	6.6
1.5.5.4	High Rate Studies																0.0										56.5
1.5.5.4.1	Gas			0													0.0										19.1
1.5.5.4.1.1	Argon	20		20	0.100	bottles											0	0.0	0	0.0	0.0	2.0	2.0	2.0	0.2	10.0	2.2
1.5.5.4.1.2	CO2	20		20	0.100	bottles											0	0.0	0	0.0	0.0	2.0	2.0	2.0	0.2	10.0	2.2
1.5.5.4.1.3	CF4	40		40	0.183	bottles											0	0.0	0	0.0	0.0	7.3	7.3	7.3	0.7	10.0	8.1

WBS Number	WBS Name or Description	Base Quantity	Spares Quantity	Total Quantity	Base Unit (K$)	Units	PH.D (days)	PH.M (days)	EN.D (days)	EN.M (days)	SW.D (days)	SW.M (days)	TE.D (days)	TE.M (days)	LA.D (days)	LA.M (days)	Labor (days)	Dev Labor (K$)	Dev Labor (%)	Mfg Labor (K$)	Tot Labor (K$)	Tot Mtrl (K$)	Mtrl+Mfg (K$)	Base Cost (K$)	Contingency (K$)	Contingency (%)	Total Cost (K$)
1.5.5.4.1.4	Argon/CO2 80/20	30		30	0.200	bottles											0	0.0	0	0.0	0.0	6.0	6.0	6.0	0.6	10.0	6.6
1.5.5.4.2	Operation/Analysis			0			80						80				160	18.6	100	0.0	18.6	0.0	0.0	18.6	2.2	12.0	20.8
1.5.5.4.3	Miscellaneous Parts			0	1.000												0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	12.0	0.0
1.5.5.4.4	Test Stand	1		1	2.000		5						5				10	1.2	37	0.0	1.2	2.0	2.0	3.2	0.3	10.0	3.5
1.5.5.4.5	Housing	1		1	6.000	each											0	0.0	0	0.0	0.0	6.0	6.0	6.0	0.6	10.0	6.6
1.5.5.4.5	Travel	1		1	6.000	each											0	0.0	0	0.0	0.0	6.0	6.0	6.0	0.6	10.0	6.6
1.5.6	**Hardware and Software Specific to Muon Development & Testing**					man yrs >	1.20	0.60	0.16	0.04	0.24	0.16	0.14	0.04	0.00	0.00	2.58	45.4	49	22.7	68.1	24.8	47.5	92.9	14.9	16.1	107.8
1.5.6.1	Hardware																0.0										24.4
1.5.6.1.1	Muon Specific Adapters to BTeV Standard Test Stands	6	2	8	0.600	each			30				25				55	17.4	78	0.0	17.4	4.8	4.8	22.2	2.2	10.0	24.4
1.5.6.2	Software																										83.4
1.5.6.2.1	Monitoring Software	10		10	2.000		300	150			20	20					490	7.3	21	8.0	15.2	20.0	28.0	35.2	5.6	16.0	40.9
1.5.6.2.2	FEB & DCB Testing Software								10	10	40	20	10	10			100	20.7	58	14.7	35.5	0.0	14.7	35.5	7.1	20.0	42.6
1.5.7	**ES&H**					man yrs >	0.80	0.28	0.76	0.48	0.00	0.00	0.42	0.28	0.00	0.00	3.02	97.7	49	68.4	166.1	35.0	103.4	201.1	40.2	20.0	241.3
1.5.7.1	Sensors, Mechanical, Gas and Cryogenics	1		1	5.000	material	30	10	30	20			15	10			115	15.1	49	11.0	26.0	5.0	16.0	31.0	6.2	20.0	37.2
1.5.7.2	Electrical and Electronics																0.0										111.7
1.5.7.2.1	High Voltage Power	1		1	5.000	material	30	10	30	20			15	10			115	15.1	49	11.0	26.0	5.0	16.0	31.0	6.2	20.0	37.2
1.5.7.2.2	Low Voltage Power	1		1	5.000	material	30	10	30	20			15	10			115	15.1	49	11.0	26.0	5.0	16.0	31.0	6.2	20.0	37.2
1.5.7.2.3	Front-End Electronics	1		1	5.000	material	30	10	30	20			15	10			115	15.1	49	11.0	26.0	5.0	16.0	31.0	6.2	20.0	37.2
1.5.7.3	Environmental	1		1	5.000	material	30	10	30	20			15	10			115	15.1	49	11.0	26.0	5.0	16.0	31.0	6.2	20.0	37.2
1.5.7.4	Radiation Safety	1		1	5.000	material	30	10	20	10			15	10			95	11.2	49	6.8	18.0	5.0	11.8	23.0	4.6	20.0	27.6
1.5.7.5	Training	1		1	5.000	material	20	10	20	10			15	10			85	11.2	49	6.8	18.0	5.0	11.8	23.0	4.6	20.0	27.6
1.5.8	**Transportation to and Installation and Testing at C0**					man yrs >	0.72	0.00	0.72	0.00	0.00	0.00	0.72	0.00	0.00	0.00	2.16	111.2	74	0.0	111.2	40.0	40.0	151.2	52.5	34.7	203.7
1.5.8.1	Transport to C0	3	1	4	10.000	each	40		40				40				120	24.7	38	0.0	24.7	40.0	40.0	64.7	23.3	36.0	88.0
1.5.8.2	Install			0			20		20				20				60	12.4	100	0.0	12.4	0.0	0.0	12.4	4.0	32.0	16.3
1.5.8.3	Survey			0			30		30				30				90	18.5	100	0.0	18.5	0.0	0.0	18.5	5.2	28.0	23.7
1.5.8.4	Test Muon System			0			90		90				90				270	55.6	100	0.0	55.6	0.0	0.0	55.6	20.0	36.0	75.6
1.5.9	**Muon Detector Project Management**					man yrs >	0.80	0.48	0.36	0.50	0.00	0.00	0.00	0.04	0.00	0.00	2.18	34.7	23	55.3	90.0	60.0	115.3	150.0	30.0	20.0	180.0
1.5.9.1	Project Coordination			0			200		40	40							280	15.4	48	16.9	32.3	0.0	16.9	32.3	6.5	20.0	38.8
1.5.9.2	Project Engineering			0					50	50							100	19.3	48	21.1	40.4	0.0	21.1	40.4	8.1	20.0	48.5
1.5.9.3	Project Reviews	3		3	5.000			30		10							40	0.0	0	4.2	4.2	15.0	19.2	19.2	3.8	20.0	23.1
1.5.9.4	ES&H Reviews	3		3	5.000			30		10							40	0.0	0	4.2	4.2	15.0	19.2	19.2	3.8	20.0	23.1
1.5.9.5	Travel	30	0	30	1.000	each	0	60	0	15			0	10			85	0.0	0	8.9	8.9	30.0	38.9	38.9	7.8	20.0	46.6
1.6	**Forward Tracker Straw Detector**					man yrs >	10.2	7.0	11.9	5.2	0.3	0.2	5.7	40.9	0.2	1.1	82.7	1,509.9	15	3,193.4	4,703.3	5,514.2	8,707.6	10,217.5	1,924.6	18.8	12,142.1
1.6.1	**Detector Stations**					man yrs >	4.24	4.03	5.31	1.16	0.00	0.00	1.42	38.26	0.00	0.00	54.43	595.0	11	2,552.1	3,147.0	2,475.0	5,027.0	5,622.0	904.0	16.1	6,526.0
1.6.1.1	View Modules																										6,371.4
1.6.1.1.1	Development and Prototypes																										744.3
1.6.1.1.1.1	Design																										488.1
1.6.1.1.1.1.1	Detector Elements			0			100	50	64								214	24.7	100	0.0	24.7	0.0	0.0	24.7	2.5	10.0	27.2
1.6.1.1.1.1.2	Tension Plate			0			100	50	64								214	24.7	100	0.0	24.7	0.0	0.0	24.7	2.5	10.0	27.2
1.6.1.1.1.1.3	Inner Gas Manifold (Carbon Fiber Shells)			0			20	20	60	20			20	20			160	27.8	67	13.5	41.3	0.0	13.5	41.3	13.2	32.0	54.5
1.6.1.1.1.1.4	Module Frame			0			60	60	220	20			20	20			400	89.6	87	13.5	103.1	0.0	13.5	103.1	41.2	40.0	144.3
1.6.1.1.1.1.5	Space Frame			0			10	10	30	30			20	20			120	16.2	48	17.7	34.0	0.0	17.7	34.0	3.4	10.0	37.4
1.6.1.1.1.1.6	Assembly Fixtures			0			100		220				10	10			340	87.2	97	2.5	89.8	0.0	2.5	89.8	9.0	10.0	98.8
1.6.1.1.1.1.7	Tooling (Design)			0					220				10	10			240	87.2	97	2.5	89.8	0.0	2.5	89.8	9.0	10.0	98.8
1.6.1.1.1.2	Prototypes			0			180	30	180	180			180	180			930	111.2	48	121.7	232.9	0.0	121.7	232.9	23.3	10.0	256.2
1.6.1.1.2	Production			0																							5,627.1
1.6.1.1.2.1	Detector Elements			0																							2,544.6
1.6.1.1.2.1.1	Straws	78120	7812	85932																							532.5
1.6.1.1.2.1.1.1	Straws Module Type 1	2700	270	2970																							10.7
1.6.1.1.2.1.1.1.1	Kapton Material	224	22	246	0.012	sq ft											0	0.0	0	0.0	0.0	3.0	3.0	3.0	0.6	20.0	3.5
1.6.1.1.2.1.1.1.2	Straw Manufacture	2700	270	2970	0.002	ea											0	0.0	0	0.0	0.0	5.9	5.9	5.9	1.2	20.0	7.1
1.6.1.1.2.1.1.2	Straws Module Type 2	4050	405	4455																							18.6
1.6.1.1.2.1.1.2.1	Kapton Material	495	49	544	0.012	sq ft											0	0.0	0	0.0	0.0	6.6	6.6	6.6	1.3	20.0	7.9
1.6.1.1.2.1.1.2.2	Straw Manufacture	4050	405	4455	0.002	ea											0	0.0	0	0.0	0.0	8.9	8.9	8.9	1.8	20.0	10.7
1.6.1.1.2.1.1.3	Straws Module Type 3	5400	540	5940																							28.3
1.6.1.1.2.1.1.3.1	Kapton Material	879	88	967	0.012	sq ft											0	0.0	0	0.0	0.0	11.7	11.7	11.7	2.3	20.0	14.0
1.6.1.1.2.1.1.3.2	Straw Manufacture	5400	540	5940	0.002	ea											0	0.0	0	0.0	0.0	11.9	11.9	11.9	2.4	20.0	14.3
1.6.1.1.2.1.1.4	Straws Module Type 4	8100	810	8910																							53.0
1.6.1.1.2.1.1.4.1	Kapton Material	1979	198	2177	0.012	sq ft											0	0.0	0	0.0	0.0	26.3	26.3	26.3	5.3	20.0	31.6
1.6.1.1.2.1.1.4.2	Straw Manufacture	8100	810	8910	0.002	ea											0	0.0	0	0.0	0.0	17.8	17.8	17.8	3.6	20.0	21.4
1.6.1.1.2.1.1.5	Straws Module Type 5	9450	945	10395																							67.9
1.6.1.1.2.1.1.5.1	Kapton Material	2693	269	2963	0.012	sq ft											0	0.0	0	0.0	0.0	35.8	35.8	35.8	7.2	20.0	43.0
1.6.1.1.2.1.1.5.2	Straw Manufacture	9450	945	10395	0.002	ea											0	0.0	0	0.0	0.0	20.8	20.8	20.8	4.2	20.0	24.9
1.6.1.1.2.1.1.6	Straws Module Type 6	10620	1062	11682																							82.3
1.6.1.1.2.1.1.6.1	Kapton Material	3401	340	3742	0.012	sq ft											0	0.0	0	0.0	0.0	45.2	45.2	45.2	9.0	20.0	54.3
1.6.1.1.2.1.1.6.2	Straw Manufacture	10620	1062	11682	0.002	ea											0	0.0	0	0.0	0.0	23.4	23.4	23.4	4.7	20.0	28.0
1.6.1.1.2.1.1.7	Straws Module Type 7	37800	3780	41580																							271.7
1.6.1.1.2.1.1.7.1	Kapton Material	10773	1077	11851	0.012	sq ft											0	0.0	0	0.0	0.0	143.3	143.3	143.3	28.7	20.0	171.9
1.6.1.1.2.1.1.7.2	Straw Manufacture	37800	3780	41580	0.002	ea											0	0.0	0	0.0	0.0	83.2	83.2	83.2	16.6	20.0	99.8
1.6.1.1.2.1.2	End Plugs	156240	15624	171864	0.000	ea	5										5	0.0	0	0.0	0.0	63.6	63.6	63.6	10.2	16.0	73.8
1.6.1.1.2.1.3	Sense Wire			0																							830.1
1.6.1.1.2.1.3.1	Wire	230938	230938	461876	0.000	meters	5										5	0.0	0	0.0	0.0	83.1	83.1	83.1	11.6	14.0	94.8
1.6.1.1.2.1.3.2	Wire Joints	78120	7812	85932	0.000	ea	30						10	1302			1342	2.3	1	330.7	333.0	8.6	339.3	341.6	47.8	14.0	389.4
1.6.1.1.2.1.3.3	Wire Guides			0																							345.9
1.6.1.1.2.1.3.3.1	Internal Wire Guide-Twistor	152010	15201	167211	0.001	ea	5							10			15	0.0	0	2.5	2.5	97.0	99.5	99.5	13.9	14.0	113.5
1.6.1.1.2.1.3.3.2	Internal Wire Guide-Twister Sleeves	152010	15201	167211	0.000	ea	5							11			16	0.0	0	2.8	2.8	50.2	53.0	53.0	7.4	14.0	60.4
1.6.1.1.2.1.3.3.3	End Wire Guide-Twistor	231840	23184	255024	0.001	ea	5							12			17	0.0	0	3.0	3.0	147.9	151.0	151.0	21.1	14.0	172.1
1.6.1.1.2.1.4	Module Frame	96	4	100	0.300	ea	50							100			150	0.0	0	25.4	25.4	30.0	55.4	55.4	8.9	16.0	64.3
1.6.1.1.2.1.5	Inner Gas Manifold (Carbon Fiber Shells)	96	4	100	1.000	ea	50							100			150	0.0	0	25.4	25.4	100.0	125.4	125.4	50.2	40.0	175.6
1.6.1.1.2.1.6	End Plates	192	16	208	0.200	ea	50							20			70	0.0	0	5.1	5.1	41.6	46.7	46.7	6.5	14.0	53.2
1.6.1.1.2.1.7	Tension Plates (TP)			0													0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	659.2
1.6.1.1.2.1.7.1	Base Plate, Thin Plate, Kapton flex circuit			0																							240.0
1.6.1.1.2.1.7.1.1	TP Type 1	24	2	26	0.248	ea	10							12			22	0.0	0	3.0	3.0	6.4	9.5	9.5	1.3	14.0	10.8
1.6.1.1.2.1.7.1.2	TP Type 2	24	2	26	0.371	ea	10							12			22	0.0	0	3.0	3.0	9.7	12.7	12.7	1.8	14.0	14.5
1.6.1.1.2.1.7.1.3	TP Type 3	24	2	26	0.495	ea	10							12			22	0.0	0	3.0	3.0	12.9	15.9	15.9	2.2	14.0	18.1
1.6.1.1.2.1.7.1.4	TP Type 4	24	2	26	0.743	ea	10							12			22	0.0	0	3.0	3.0	19.3	22.4	22.4	3.1	14.0	25.5

WBS Number	WBS Name or Description	Base Quantity	Spares Quantity	Total Quantity	Base Unit (K$)	Units	PH.D (days)	PH.M (days)	EN.D (days)	EN.M (days)	SW.D (days)	SW.M (days)	TE.D (days)	TE.M (days)	LA.D (days)	LA.M (days)	Labor (days)	Dev Labor (K$)	Dev Labor (%)	Mfg Labor (K$)	Tot Labor (K$)	Tot Mtrl (K$)	Mtrl+Mfg (K$)	Base Cost (K$)	Contingency (K$)	Contingency (%)	Total Cost (K$)
1.6.1.1.2.1.7.1.5	TP Type 5	24	2	26	0.866	ea	10							12			22	0.0	0	3.0	3.0	22.5	25.6	25.6	3.6	14.0	29.2
1.6.1.1.2.1.7.1.6	TP Type 6	24	2	26	0.974	ea	10							12			22	0.0	0	3.0	3.0	25.3	28.4	28.4	4.0	14.0	32.3
1.6.1.1.2.1.7.1.7	TP Type 7	48	4	52	1.733	ea	20							24			44	0.0	0	6.1	6.1	90.1	96.2	96.2	13.5	14.0	109.7
1.6.1.1.2.1.7.2	Isolation fuse assembly (IFA)			0																							297.3
1.6.1.1.2.1.7.2.1	IFA Type 1	24	5	29	0.383	ea	10		10					12			32	3.9	21	3.0	6.9	11.1	14.1	18.0	2.2	12.0	20.2
1.6.1.1.2.1.7.2.2	IFA Type 2	24	5	29	0.574	ea	10		10					12			32	3.9	16	3.0	6.9	16.6	19.7	23.5	2.8	12.0	26.4
1.6.1.1.2.1.7.2.3	IFA Type 3	24	5	29	0.563	ea	10		10					12			32	3.9	17	3.0	6.9	16.3	19.4	23.2	2.8	12.0	26.0
1.6.1.1.2.1.7.2.4	IFA Type 4	24	5	29	0.844	ea	10		10					12			32	3.9	12	3.0	6.9	24.5	27.5	31.4	3.8	12.0	35.1
1.6.1.1.2.1.7.2.5	IFA Type 5	24	5	29	0.984	ea	10		10					12			32	3.9	11	3.0	6.9	28.5	31.6	35.5	4.3	12.0	39.7
1.6.1.1.2.1.7.2.6	IFA Type 6	24	5	29	0.885	ea	10		10					12			32	3.9	12	3.0	6.9	25.7	28.7	32.6	3.9	12.0	36.5
1.6.1.1.2.1.7.2.7	IFA Type 7	48	10	58	1.575	ea	10		10					24			44	3.9	4	6.1	10.0	91.4	97.4	101.3	12.2	12.0	113.5
1.6.1.1.2.1.7.3	Taper Pin	156240	15624	171864	0.000	ea	5		10				10				25	6.2	8	0.0	6.2	68.7	68.7	74.9	9.0	12.0	83.9
1.6.1.1.2.1.7.4	Wire Eyelet	156240	15624	171864	0.000	ea	5		10				10				25	6.2	26	0.0	6.2	17.2	17.2	23.4	3.3	14.0	26.6
1.6.1.1.2.1.7.5	Gas Fittings (Ultem)	1920	192	2112	0.002	ea	5		10				10				25	6.2	62	0.0	6.2	3.7	3.7	9.9	1.4	14.0	11.3
1.6.1.1.2.1.8	Glue/Epoxy for constructing modules	1	1	2	9.000	ea											0	0.0	0	0.0	0.0	18.0	18.0	18.0	0.7	4.0	18.7
1.6.1.1.2.1.9	HV Cables and connectors	1562	10	1572	0.050	ea											0	0.0	0	0.0	0.0	78.6	78.6	78.6	11.8	15.0	90.4
1.6.1.1.2.1.10	Signal Cables and connectors	3701	370	4071	0.010	ea											0	0.0	0	0.0	0.0	40.7	40.7	40.7	6.1	15.0	46.8
1.6.1.1.2.2	Production Tooling			0													0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	564.8
1.6.1.1.2.2.1	Optical-grade assembly tables	9	1	10	4.000	ea							5	5			10	1.2	3	1.3	2.4	40.0	41.3	42.4	2.5	6.0	45.0
1.6.1.1.2.2.2	Straw Testing			0																							108.1
1.6.1.1.2.2.1.1	Leak Test	3	1	4	5.000	ea	10		15					5			30	5.8	21	1.3	7.1	20.0	21.3	27.1	3.8	14.0	30.8
1.6.1.1.2.2.1.2	Straightness Test	3	1	4	6.000	ea	10		15					5			30	5.8	19	1.3	7.1	24.0	25.3	31.1	6.2	20.0	37.3
1.6.1.1.2.2.1.3	Straw Cutting Machine	3	1	4	7.000	ea	10		15					5			30	5.8	17	1.3	7.1	28.0	29.3	35.1	4.9	14.0	40.0
1.6.1.1.2.2.3	End plug gluing machine	3	1	4	15.000	ea	10		15					5			30	5.8	9	1.3	7.1	60.0	61.3	67.1	13.4	20.0	80.5
1.6.1.1.2.2.4	Sense Wire Fixtures	3	1	4	19.000	ea	10		15					5			30	5.8	7	1.3	7.1	76.0	77.3	83.1	16.6	20.0	99.7
1.6.1.1.2.2.5	HV Tester	3	1	4	12.000	ea	10		5					5			20	1.9	4	1.3	3.2	48.0	49.3	51.2	8.2	16.0	59.4
1.6.1.1.2.2.6	Wire Tension Tester	3	1	4	2.000	ea	10		5					5			20	1.9	17	1.3	3.2	8.0	9.3	11.2	1.8	16.0	13.0
1.6.1.1.2.2.7	Straw End Inspection	3	1	4	27.000	ea	10		5					5			20	1.9	2	1.3	3.2	108.0	109.3	111.2	22.2	20.0	133.4
1.6.1.1.2.2.8	Leak Tester	3	1	4	2.000	ea	10		5					5			20	1.9	17	1.3	3.2	8.0	9.3	11.2	1.8	16.0	13.0
1.6.1.1.2.2.9	Module Straightness Tester	3	1	4	2.000	ea	10		5					5			20	1.9	17	1.3	3.2	8.0	9.3	11.2	1.6	14.0	12.8
1.6.1.1.2.3	Component Assembly			0																							2,164.1
1.6.1.1.2.3.1	Component Preparation			0																							506.7
1.6.1.1.2.3.1.1	Wire guide: Internal Wire guides	152010				ea								76			76	0.0	0	19.3	19.3	0.0	19.3	19.3	2.7	14.0	22.0
1.6.1.1.2.3.1.2	Wire guide:End Wire guide	231840				ea								116			116	0.0	0	29.4	29.4	0.0	29.4	29.4	4.1	14.0	33.6
1.6.1.1.2.3.1.3	Wire guide:Parts cleaning	96				batches								12			12	0.0	0	3.0	3.0	0.0	3.0	3.0	0.4	14.0	3.5
1.6.1.1.2.3.1.4	Straws: receiving/unpacking	39				shipment								10			10	0.0	0	2.5	2.5	0.0	2.5	2.5	0.3	14.0	2.8
1.6.1.1.2.3.1.5	Straws: rough cut	78120				ea								98			98	0.0	0	25.0	25.0	0.0	25.0	25.0	3.5	14.0	28.5
1.6.1.1.2.3.1.6	Straws: twister-sleeve insertion	152010				ea								380			380	0.0	0	96.5	96.5	0.0	96.5	96.5	13.5	14.0	110.0
1.6.1.1.2.3.1.7	Straws: wire support glue test	152010				ea								125			125	0.0	0	31.7	31.7	0.0	31.7	31.7	4.4	14.0	36.1
1.6.1.1.2.3.1.8	Straws: leak check	78120				ea								487			487	0.0	0	123.8	123.8	0.0	123.8	123.8	17.3	14.0	141.2
1.6.1.1.2.3.1.9	Straws: straightness	78120				ea								66			66	0.0	0	16.7	16.7	0.0	16.7	16.7	2.3	14.0	19.0
1.6.1.1.2.3.1.10	Straws: resistance	78120				ea								66			66	0.0	0	16.7	16.7	0.0	16.7	16.7	2.3	14.0	19.0
1.6.1.1.2.3.1.11	Straws: final cut	78120				ea								66			66	0.0	0	16.7	16.7	0.0	16.7	16.7	2.3	14.0	19.0
1.6.1.1.2.3.1.12	Straws: length check	78120				ea								33			33	0.0	0	8.3	8.3	0.0	8.3	8.3	1.2	14.0	9.5
1.6.1.1.2.3.1.13	HV plate testing	192				ea								192			192	0.0	0	48.8	48.8	0.0	48.8	48.8	6.8	14.0	55.6
1.6.1.1.2.3.1.14	Tension plate inspection	192				ea								24			24	0.0	0	6.1	6.1	0.0	6.1	6.1	0.9	14.0	6.9
1.6.1.1.2.3.2	Module Production			0																							1,657.4
1.6.1.1.2.3.2.1	Install frame in assembly jig	96			1.000	hrs/module								12			12	0.0	0	3.0	3.0	0.0	3.0	3.0	0.4	14.0	3.5
1.6.1.1.2.3.2.2	Install end plates	96			4.000	hrs/module								48			48	0.0	0	12.2	12.2	0.0	12.2	12.2	1.7	14.0	13.9
1.6.1.1.2.3.2.3	QA length, perpendicularity	96			2.000	hrs/module								24			24	0.0	0	6.1	6.1	0.0	6.1	6.1	0.9	14.0	6.9
1.6.1.1.2.3.2.4	Rework end plates if necessary	96			0.500	hrs/module								6			6	0.0	0	1.5	1.5	0.0	1.5	1.5	0.2	14.0	1.7
1.6.1.1.2.3.2.5	Install straws	96			14.840	hrs/module								178			178	0.0	0	45.2	45.2	0.0	45.2	45.2	6.3	14.0	51.6
1.6.1.1.2.3.2.6	QA clamp and measure straightness	96			2.000	hrs/module								24			24	0.0	0	6.1	6.1	0.0	6.1	6.1	0.9	14.0	6.9
1.6.1.1.2.3.2.7	Rework Assembly Jig as necessary	96			1.000	hrs/module								12			12	0.0	0	3.0	3.0	0.0	3.0	3.0	0.4	14.0	3.5
1.6.1.1.2.3.2.9	QA straw end (visual inspection, front)	96			4.947	hrs/module								59			59	0.0	0	15.1	15.1	0.0	15.1	15.1	2.1	14.0	17.2
1.6.1.1.2.3.2.10	Rework Straws as necessary	96			0.742	hrs/module								9			9	0.0	0	2.3	2.3	0.0	2.3	2.3	0.3	14.0	2.6
1.6.1.1.2.3.2.11	QA straw end (visual inspection, back)	96			4.947	hrs/module								59			59	0.0	0	15.1	15.1	0.0	15.1	15.1	2.1	14.0	17.2
1.6.1.1.2.3.2.12	Rework Straws as necessary	96			0.742	hrs/module								9			9	0.0	0	2.3	2.3	0.0	2.3	2.3	0.3	14.0	2.6
1.6.1.1.2.3.2.13	1st glue end plugs - front	96			18.551	hrs/module								223			223	0.0	0	56.5	56.5	0.0	56.5	56.5	11.3	20.0	67.9
1.6.1.1.2.3.2.14	QA 1st resistance test after 24 hours	96			7.420	hrs/module								89			89	0.0	0	22.6	22.6	0.0	22.6	22.6	3.2	14.0	25.8
1.6.1.1.2.3.2.15	Rework End plugs as necessary	96			0.495	hrs/module								6			6	0.0	0	1.5	1.5	0.0	1.5	1.5	0.2	14.0	1.7
1.6.1.1.2.3.2.16	2nd glue end plugs - back	96			18.551	hrs/module								223			223	0.0	0	56.5	56.5	0.0	56.5	56.5	11.3	20.0	67.9
1.6.1.1.2.3.2.17	QA 2nd resistance test	96			7.420	hrs/module								89			89	0.0	0	22.6	22.6	0.0	22.6	22.6	3.2	14.0	25.8
1.6.1.1.2.3.2.18	Rework End plugs as necessary	96			0.742	hrs/module								9			9	0.0	0	2.3	2.3	0.0	2.3	2.3	0.3	14.0	2.6
1.6.1.1.2.3.2.19	QA Assembly Jig	96			0.500	hrs/module								6			6	0.0	0	1.5	1.5	0.0	1.5	1.5	0.2	14.0	1.7
1.6.1.1.2.3.2.20	Rework Assembly jif if necessary	96			0.200	hrs/module								2			2	0.0	0	0.6	0.6	0.0	0.6	0.6	0.1	14.0	0.7
1.6.1.1.2.3.2.21	QA straw straightness	96			9.894	hrs/module								119			119	0.0	0	30.2	30.2	0.0	30.2	30.2	8.4	28.0	38.6
1.6.1.1.2.3.2.22	Rework Assembly Jig as necessary	96			0.500	hrs/module								6			6	0.0	0	1.5	1.5	0.0	1.5	1.5	0.2	14.0	1.7
1.6.1.1.2.3.2.23	Glue straws	96			40.688	hrs/module								488			488	0.0	0	124.0	124.0	0.0	124.0	124.0	34.7	28.0	158.7
1.6.1.1.2.3.2.25	Final alignment test	96			9.894	hrs/module								119			119	0.0	0	30.2	30.2	0.0	30.2	30.2	4.8	16.0	35.0
1.6.1.1.2.3.2.25	Auto seal end plugs - front	96			9.894	hrs/module								119			119	0.0	0	30.2	30.2	0.0	30.2	30.2	4.2	14.0	34.4
1.6.1.1.2.3.2.26	Auto seal end plugs - back	96			9.894	hrs/module								119			119	0.0	0	30.2	30.2	0.0	30.2	30.2	4.2	14.0	34.4
1.6.1.1.2.3.2.27	Final seal endplates & endplates- front	96			2.473	hrs/module								30			30	0.0	0	7.5	7.5	0.0	7.5	7.5	1.1	14.0	8.6
1.6.1.1.2.3.2.28	Final seal endplates & endplates - back	96			2.473	hrs/module								30			30	0.0	0	7.5	7.5	0.0	7.5	7.5	1.1	14.0	8.6
1.6.1.1.2.3.2.29	1st leak test	96			3.000	hrs/module								36			36	0.0	0	9.1	9.1	0.0	9.1	9.1	1.3	14.0	10.4
1.6.1.1.2.3.2.30	Rework seals as necessary	96			2.000	hrs/module								24			24	0.0	0	6.1	6.1	0.0	6.1	6.1	0.9	14.0	6.9
1.6.1.1.2.3.2.31	QA final leak test	96			8.000	hrs/module								96			96	0.0	0	24.4	24.4	0.0	24.4	24.4	3.4	14.0	27.8
1.6.1.1.2.3.2.32	Rework glue joints as necessary	96			2.000	hrs/module								24			24	0.0	0	6.1	6.1	0.0	6.1	6.1	0.9	14.0	6.9
1.6.1.1.2.3.2.33	Remove module from module from assembly jig	96			1.000	hrs/module								12			12	0.0	0	3.0	3.0	0.0	3.0	3.0	0.4	14.0	3.5
1.6.1.1.2.3.2.34	Mount module in stringing jig	96			1.000	hrs/module								12			12	0.0	0	3.0	3.0	0.0	3.0	3.0	0.4	14.0	3.5
1.6.1.1.2.3.2.35	Install tension plates	96			2.000	hrs/module								24			24	0.0	0	6.1	6.1	0.0	6.1	6.1	0.9	14.0	6.9
1.6.1.1.2.3.2.36	QA high voltage test	96			4.947	hrs/module								59			59	0.0	0	15.1	15.1	0.0	15.1	15.1	2.1	14.0	17.2
1.6.1.1.2.3.2.37	Rework HV connects as necessary	96			1.237	hrs/module								15			15	0.0	0	3.8	3.8	0.0	3.8	3.8	0.5	14.0	4.3
1.6.1.1.2.3.2.38	QA gas flow	96			2.000	hrs/module								24			24	0.0	0	6.1	6.1	0.0	6.1	6.1	0.9	14.0	6.9
1.6.1.1.2.3.2.39	Rework gas fittings if necessary	96			0.500	hrs/module								6			6	0.0	0	1.5	1.5	0.0	1.5	1.5	0.2	14.0	1.7
1.6.1.1.2.3.2.40	String module	96			237.447	hrs/module								2849			2849	0.0	0	723.7	723.7	0.0	723.7	723.7	101.3	14.0	825.1
1.6.1.1.2.3.2.41	QA high voltage test	96			4.947	hrs/module								59			59	0.0	0	15.1	15.1	0.0	15.1	15.1	2.1	14.0	17.2

WBS Number	WBS Name or Description	Base Quantity	Spares Quantity	Total Quantity	Base Unit (K$)	Units	PH.D (days)	PH.M (days)	EN.D (days)	EN.M (days)	SW.D (days)	SW.M (days)	TE.D (days)	TE.M (days)	LA.D (days)	LA.M (days)	Labor (days)	Dev Labor (K$)	Dev Labor (%)	Mfg Labor (K$)	Tot Labor (K$)	Tot Mtrl (K$)	Mtrl+Mfg (K$)	Base Cost (K$)	Contingency (K$)	Contingency (%)	Total Cost (K$)
1.6.1.1.2.3.2.42	Rework wire string if necessary	96			2.473	hrs/module								30			30	0.0	0	7.5	7.5	0.0	7.5	7.5	1.1	14.0	8.6
1.6.1.1.2.3.2.43	QA tension test	96			12.367	hrs/module								148			148	0.0	0	37.7	37.7	0.0	37.7	37.7	5.3	14.0	43.0
1.6.1.1.2.3.2.44	Rework wire tension if necessary	96			2.473	hrs/module								30			30	0.0	0	7.5	7.5	0.0	7.5	7.5	1.1	14.0	8.6
1.6.1.1.2.3.2.45	Seal tension plate and taper pins	96			4.947	hrs/module								59			59	0.0	0	15.1	15.1	0.0	15.1	15.1	2.1	14.0	17.2
1.6.1.1.2.3.2.46	QA final leak test	96			8.000	hrs/module		96									96	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	14.0	0.0
1.6.1.1.2.3.2.47	Rework leaks if necessary	96			9.894	hrs/module		119									119	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	14.0	0.0
1.6.1.1.2.3.2.48	QA final HV test	96			4.947	hrs/module		59									59	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	14.0	0.0
1.6.1.1.2.3.2.49	Rework if necessary	96			2.473	hrs/module		30									30	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	14.0	0.0
1.6.1.1.2.3.2.50	QA signal test	96			19.787	hrs/module		237									237	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	14.0	0.0
1.6.1.1.2.3.2.51	Rework if necessary	96			19.787	hrs/module		237									237	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	14.0	0.0
1.6.1.1.2.4	Module Testing			0																							353.6
1.6.1.1.2.4.1	PC, LabView,DAQ Cards	9	1	10	6.000	ea	10		10				10	10			40	6.2	9	2.5	8.7	60.0	62.5	68.7	3.4	5.0	72.2
1.6.1.1.2.4.2	Gas (Production Testing at 3 sites)	3	1	4	9.000	ea											0	0.0	0	0.0	0.0	36.0	36.0	36.0	1.4	4.0	37.4
1.6.1.1.2.4.3	Common expenses at production sites	3	1	4	50.000	ea											0	0.0	0	0.0	0.0	200.0	200.0	200.0	44.0	22.0	244.0
1.6.1.2	Chambers			0																							154.6
1.6.1.2.1	Space Frame	14	0	14	3.000	ea	5	5	30	10			20	100			170	16.2	18	29.6	45.8	42.0	71.6	87.8	8.8	10.0	96.6
1.6.1.2.2	Mouting Parts	14	2	16	1.000	ea	5	5	30	30			20	20			110	16.2	32	17.7	34.0	16.0	33.7	50.0	8.0	16.0	58.0
1.6.2	**Front-End Electronics**					man yrs >	1.56	1.66	2.50	1.28	0.00	0.00	1.22	1.42	0.24	1.12	11.00	318.3	11	257.1	575.4	2,230.1	2,487.3	2,805.5	631.0	22.5	3,436.6
1.6.2.1	ASDQ ICs																										704.7
1.6.2.1.1	Development and Prototypes	60	0	60	0.032	each											0	0.0	0	0.0	0.0	1.9	1.9	1.9	0.5	24.0	2.4
1.6.2.1.2	Production	14808	2962	17770	0.032	each											0	0.0	0	0.0	0.0	566.4	566.4	566.4	135.9	24.0	702.4
1.6.2.2	TDC ICs																										515.1
1.6.2.2.1	Development and Prototypes																										276.7
1.6.2.2.1.1	Prototype Run 1	25		25	0.520	each	50		120				20				190	51.0	80	0.0	51.0	13.0	13.0	64.0	28.1	44.0	92.1
1.6.2.2.1.2	Prototype Run 2	25		25	0.520	each	50		120				20				190	51.0	80	0.0	51.0	13.0	13.0	64.0	17.9	28.0	81.9
1.6.2.2.1.3	Prototype Run 3	25		25	0.520	each	50		120				20				190	51.0	80	0.0	51.0	13.0	13.0	64.0	20.5	32.0	84.4
1.6.2.2.1.4	Test Fixtures	3		3	2.000	each	50		10				20				80	8.5	59	0.0	8.5	6.0	6.0	14.5	3.8	26.0	18.3
1.6.2.2.2	Production																										238.4
1.6.2.2.2.1	Production TDC ICs	3703	741	4444	0.027	each		100		50				25			175	0.0	0	27.5	27.5	120.0	147.4	147.4	35.4	24.0	182.8
1.6.2.2.2.2	Testing, Automated and Field	1		1	10.000	total		100		50				60			210	0.0	0	36.3	36.3	10.0	46.3	46.3	9.3	20.0	55.6
1.6.2.3	Control/Monitoring & Timing and Data Readout Electronics																										1,491.0
1.6.2.3.1	BTeV-Standard Control/Monitoring & Timing and Data Readout (TMC2) FPGA																										290.2
1.6.2.3.1.1	Development and Prototypes																										109.7
1.6.2.3.1.1.1	Firmware Specific To The Straw Tracker Detector	0		0			10		60				30				100	30.1	100	0.0	30.1	0.0	0.0	30.1	17.3	57.5	47.4
1.6.2.3.1.1.2	Design and Simulations Reviews	0		0			10		30								40	11.6	100	0.0	11.6	0.0	0.0	11.6	6.7	57.5	18.2
1.6.2.3.1.1.3	Prototype Straw Tracker (TMC2) FPGAs	10	0	10	0.286				10				5				15	5.0	64	0.0	5.0	2.9	2.9	7.9	2.0	25.0	9.9
1.6.2.3.1.1.4	Prototype Testing			0			60		50				15				125	22.8	100	0.0	22.8	0.0	0.0	22.8	11.4	50.0	34.2
1.6.2.3.1.2	Production																										180.5
1.6.2.3.1.2.1	Production Reviews	0		0				10		30				10			50	0.0	0	15.2	15.2	0.0	15.2	15.2	2.3	15.0	17.5
1.6.2.3.1.2.2	Production Straw Tracker (TMC2) FPGAs	463	93	556	0.147												0	0.0	0	0.0	0.0	81.7	81.7	81.7	20.4	25.0	102.2
1.6.2.3.1.2.3	Production Testing	0		0				60		60				60			180	0.0	0	40.6	40.6	0.0	40.6	40.6	20.3	50.0	60.8
1.6.2.3.2	Auxiliary Front End Board Electronic Components																										1,200.8
1.6.2.3.2.1	Development and Prototypes	30		30	0.295		10		40				20				70	20.1	69	0.0	20.1	8.9	8.9	28.9	4.3	15.0	33.3
1.6.2.3.2.2	Production	3702	370	4072	0.246	each				20				20			40	0.0	0	13.5	13.5	1,001.8	1,015.3	1,015.3	152.3	15.0	1,167.6
1.6.2.4	Data Serializer/Transmitter and C/M&T and Data Opto-Electronics																										147.4
1.6.2.4.1	Development & Prototypes																										27.1
1.6.2.4.1.1	Prototype Data Serializer/Transmitter ICs	4		4	0.050				5				5				10	3.1	94	0.0	3.1	0.2	0.2	3.3	0.8	24.0	4.1
1.6.2.4.1.2	Design Reviews and Prototype Testing						10		30				30				70	18.5	100	0.0	18.5	0.0	0.0	18.5	4.4	24.0	23.0
1.6.2.4.2	Production																										120.3
1.6.2.4.2.1	Testing: Automated and Field	1		1	5.000	total		20		30				30			80	0.0	0	20.3	20.3	5.0	25.3	25.3	5.1	20.0	30.3
1.6.2.4.2.2	Production C/M&T and Data Readout Opto-Electronics	463	70	533	0.030	each		30		30				30			90	0.0	0	20.3	20.3	16.0	36.3	36.3	8.7	24.0	45.0
1.6.2.4.2.3	Production Data Serializer/Transmitter ICs	463	70	533	0.030	each		30		30				30			90	0.0	0	20.3	20.3	16.0	36.3	36.3	8.7	24.0	45.0
1.6.2.5	32-Channel Front End Boards																										293.7
1.6.2.5.1	Development and Prototypes																										44.5
1.6.2.5.1.1	Fabrication & Assembly																										44.5
1.6.2.5.1.1.1	Set-up Charges (Fabrication)	3		3	0.700	each											0	0.0	0	0.0	0.0	2.1	2.1	2.1	0.2	10.0	2.3
1.6.2.5.1.1.2	Set-up Charges (Assembly)	3		3	0.500	each											0	0.0	0	0.0	0.0	1.5	1.5	1.5	0.2	10.0	1.7
1.6.2.5.1.1.3	Testing Jigs	3		3	2.500	each											0	0.0	0	0.0	0.0	7.5	7.5	7.5	0.8	10.0	8.3
1.6.2.5.1.1.4	Prototype ASDQ/TDC Front End Boards	30		30	0.170	each	60						60		60		180	20.2	80	0.0	20.2	5.1	5.1	25.3	7.1	28.0	32.3
1.6.2.5.2	Production																										249.1
1.6.2.5.2.1	Fabrication & Assembly																										249.1
1.6.2.5.2.1.1	Set-up Charges (Fabrication)	1		1	0.700	each											0	0.0	0	0.0	0.0	0.7	0.7	0.7	0.1	10.0	0.8
1.6.2.5.2.1.2	Set-up Charges (Assembly)	1		1	0.500	each											0	0.0	0	0.0	0.0	0.5	0.5	0.5	0.1	10.0	0.6
1.6.2.5.2.1.3	Testing Jigs	1		1	2.500	each											0	0.0	0	0.0	0.0	2.5	2.5	2.5	0.3	10.0	2.8
1.6.2.5.2.1.4	Production ASDQ/TDC Front End Boards	3702	370	4072	0.038	each		25						20		280	325	0.0	0	37.0	37.0	154.5	191.5	191.5	53.6	28.0	245.1
1.6.2.6	256-Channel Data Combiner Boards																0										284.7
1.6.2.6.1	Development and Prototypes	4	2	6	2.000	each	30		30				60				120	25.5	68	0.0	25.5	12.0	12.0	37.5	10.1	27.0	47.6
1.6.2.6.2	Production	463	46	509	0.330	each		40		20				70			130	0.0	0	26.2	26.2	168.1	194.3	194.3	42.7	22.0	237.0
1.6.3	**Power, Monitoring and Protection**					man yrs >	0.28	0.22	0.48	0.52	0.00	0.00	0.40	0.68	0.00	0.00	2.58	69.5	11	98.0	167.6	451.0	549.0	618.6	141.1	22.8	759.6
1.6.3.1	On-Detector Low-Voltage DC Power			0																							76.1
1.6.3.1.1	Development and Prototypes	500	50	550	0.003	$/watt	10		40				20				70	20.1	92	0.0	20.1	1.7	1.7	21.7	4.3	20.0	26.1
1.6.3.1.2	Production	2500	250	2750	0.003	$/watt		5		40				60			105	0.0	0	32.1	32.1	8.3	40.4	40.4	9.7	24.0	50.1
1.6.3.2	High Voltage Supply			0																							544.3
1.6.3.2.1	Development and Prototypes	4	1	5	38.000	each	10		40				20				70	20.1	10	0.0	20.1	190.0	190.0	210.1	58.8	28.0	268.9
1.6.3.2.2	Production	5	0	5	38.000	each		10		40				60			110	0.0	0	32.1	32.1	190.0	222.1	222.1	53.3	24.0	275.4
1.6.3.3	Controler for High Voltage Supply			0																							42.7
1.6.3.3.1	Development and Prototypes	1		1	9.200	each	5		10				10				25	6.2	40	0.0	6.2	9.2	9.2	15.4	1.8	12.0	17.2
1.6.3.3.2	Production	1	0	1	9.200	each		5		20				20			45	0.0	0	13.5	13.5	9.2	22.7	22.7	2.7	12.0	25.4
1.6.3.4	Gas Purity and Gas Gain Measurement Station			0																							73.4
1.6.3.4.1	Development and Prototypes	1		1	5.000	each	40		20				40				100	17.0	77	0.0	17.0	5.0	5.0	22.0	2.6	12.0	24.6
1.6.3.4.2	Production	1	1	2	15.000	each		30		20				20			70	0.0	0	13.5	13.5	30.0	43.5	43.5	5.2	12.0	48.7
1.6.3.5	Temperature Montoring System	14	1	15	0.500	each	5	5	10	10			10	10			50	6.2	30	6.8	12.9	7.7	14.5	20.6	2.5	12.0	23.1
1.6.4	**Mechanical and Other Systems**					man yrs >	0.19	0.12	0.36	0.36	0.00	0.00	0.16	0.17	0.00	0.00	1.36	44.0	16	48.6	92.7	175.0	223.6	267.7	50.9	19.0	318.6
1.6.4.1	Gas Supply and Distribution Systems																										108.3
1.6.4.1.1	Gas Mixing System																										16.6
1.6.4.1.1.1	MKS Flow Controllers	4	4	8	1.000	each								2			2	0.0	0	0.5	0.5	8.0	8.5	8.5	0.7	8.0	9.2
1.6.4.1.1.2	MKS Readout Module	1	1	2	1.500	each											0	0.0	0	0.0	0.0	3.0	3.0	3.0	0.2	8.0	3.2

WBS Number	WBS Name or Description	Base Quantity	Spares Quantity	Total Quantity	Base Unit (K$)	Units	PH.D (days)	PH.M (days)	EN.D (days)	EN.M (days)	SW.D (days)	SW.M (days)	TE.D (days)	TE.M (days)	LA.D (days)	LA.M (days)	Labor (days)	Dev Labor (K$)	Dev Labor (%)	Mfg Labor (K$)	Tot Labor (K$)	Tot Mtrl (K$)	Mtrl+Mfg (K$)	Base Cost (K$)	Contingency (K$)	Contingency (%)	Total Cost (K$)
1.6.4.1.1.3	Miscellaneous Parts			0	5.000									5			5	0.0	0	1.3	1.3	0.0	1.3	1.3	0.2	14.0	1.4
1.6.4.1.1.4	Assembly			0			5	5					5	5			20	1.2	48	1.3	2.4	0.0	1.3	2.4	0.3	12.0	2.7
1.6.4.1.2	Gas Distribution System																									0.0	78.6
1.6.4.1.2.1	Flow Monitors	96	4	100	0.500												0	0.0	0	0.0	0.0	50.0	50.0	50.0	4.0	8.0	54.0
1.6.4.1.2.2	Tubing, Parts	1		1	15.000												0	0.0	0	0.0	0.0	15.0	15.0	15.0	2.1	14.0	17.1
1.6.4.1.2.3	Distribution Manifold	1	1	2	2.000												0	0.0	0	0.0	0.0	4.0	4.0	4.0	0.6	14.0	4.6
1.6.4.1.2.4	Assembly			0				5						10			15	0.0	0	2.5	2.5	0.0	2.5	2.5	0.4	14.0	2.9
1.6.4.1.3	Gas Monitoring System	1	1	2	5.000		3						5				8	1.2	10	0.0	1.2	10.0	10.0	11.2	2.0	18.0	13.2
1.6.4.2	Precision Alignment System			0																							210.3
1.6.4.2.1	Development and Prototypes	1		1	5.000	ea	30	10	60	60			10	10			180	25.5	44	27.9	53.3	5.0	32.9	58.3	9.3	16.0	67.7
1.6.4.2.2	Alignment System	14	2	16	5.000	ea	10	10	30	30			20	10			110	16.2	15	15.2	31.4	80.0	95.2	111.4	31.2	28.0	142.6
1.6.5	**Test Beam Studies**					man yrs >	0.30	0.00	0.04	0.00	0.00	0.00	0.04	0.04	0.00	0.00	0.42	6.2	12	2.5	8.7	42.5	45.0	51.2	24.7	48.2	75.9
1.6.5.1	Portable Test Beam DA Computers and Interface	1		1	10.000	ea	30										30	0.0	0	0.0	0.0	10.0	10.0	10.0	6.0	60.0	16.0
1.6.5.2	Portable Electronics System	1		1	10.000	ea	30										30	0.0	0	0.0	0.0	10.0	10.0	10.0	6.0	60.0	16.0
1.6.5.3	Portable Gas System	1		1	1.000	ea	5						5	5			15	1.2	34	1.3	2.4	1.0	2.3	3.4	1.0	30.0	4.5
1.6.5.4	Gas	5		5	2.000	ea											0	0.0	0	0.0	0.0	10.0	10.0	10.0	3.0	30.0	13.0
1.6.5.4	Mechanical Supports	1		1	0.500	ea							5	5			10	1.2	40	1.3	2.4	0.5	1.8	2.9	2.3	80.0	5.3
1.6.5.5	Travel	10		10	1.000	ea											0	0.0	0	0.0	0.0	10.0	10.0	10.0	6.0	60.0	16.0
1.6.5.6	ES&H	1		1	1.000	ea	10		10								20	3.9	79	0.0	3.9	1.0	1.0	4.9	0.3	6.0	5.2
1.6.6	**Hardware & Software Specific To Straw Development & Testing**					man yrs >	0.48	0.20	0.68	0.04	0.28	0.16	1.32	0.04	0.00	0.00	3.20	167.7	86	22.7	190.3	5.6	28.3	195.9	19.4	9.9	215.3
1.6.6.1	Hardware			0																							150.1
1.6.6.1.1	TDC IC Probe Station Adapter	1	1	2	1.000	each			50				100				150	42.5	96	0.0	42.5	2.0	2.0	44.5	2.7	6.0	47.2
1.6.6.1.2	Straw Tracker-Specific Adapters to BTeV Standard Test Stands	4	2	6	0.600	each			100				200				300	85.0	96	0.0	85.0	3.6	3.6	88.6	5.3	6.0	93.9
1.6.6.1.3	Other Test Stands			0			20		10				20				50	8.5	100	0.0	8.5	0.0	0.0	8.5	0.5	6.0	9.0
1.6.6.2	Software			0																							65.2
1.6.6.2.1	Straw Tracker Monitoring Software						100	50			30	20					200	10.9	58	8.0	18.9	0.0	8.0	18.9	3.8	20.0	22.7
1.6.6.2.2	Straw FEB and DCB Testing Software								10	10	40	20	10	10			100	20.7	58	14.7	35.5	0.0	14.7	35.5	7.1	20.0	42.6
1.6.7	**ES&H**					man yrs >	0.80	0.28	0.76	0.48	0.00	0.00	0.42	0.28	0.00	0.00	3.02	97.7	49	68.4	166.1	35.0	103.4	201.1	40.2	20.0	241.3
1.6.7.1	Sensors, Mechanical, Gas and Cryogenics	1		1	5.000	material	30	10	30	20			15	10			115	15.1	49	11.0	26.0	5.0	16.0	31.0	6.2	20.0	37.2
1.6.7.2	Electrical and Electronics			0																							111.7
1.6.7.2.1	High Voltage Power	1		1	5.000	material	30	10	30	20			15	10			115	15.1	49	11.0	26.0	5.0	16.0	31.0	6.2	20.0	37.2
1.6.7.2.2	Low Voltage Power	1		1	5.000	material	30	10	30	20			15	10			115	15.1	49	11.0	26.0	5.0	16.0	31.0	6.2	20.0	37.2
1.6.7.2.3	Front-End Electronics	1		1	5.000	material	30	10	30	20			15	10			115	15.1	49	11.0	26.0	5.0	16.0	31.0	6.2	20.0	37.2
1.6.7.3	Environmental	1		1	5.000	material	30	10	30	20			15	10			115	15.1	49	11.0	26.0	5.0	16.0	31.0	6.2	20.0	37.2
1.6.7.4	Radiation Safety	1		1	5.000	material	30	10	20	10			15	10			95	11.2	49	6.8	18.0	5.0	11.8	23.0	4.6	20.0	27.6
1.6.7.5	Training	1		1	5.000	material	20	10	20	10			15	10			85	11.2	49	6.8	18.0	5.0	11.8	23.0	4.6	20.0	27.6
1.6.8	**Transportation to and Installation and Testing at C0**					man yrs >	0.72	0.00	0.72	0.00	0.00	0.00	0.72	0.00	0.00	0.00	2.16	111.2	74	0.0	111.2	40.0	40.0	151.2	52.5	34.7	203.7
1.6.8.1	Mount Modules into Plane Assemblies (on frame)	3	1	4	10.000	each	40		40				40				120	24.7	38	0.0	24.7	40.0	40.0	64.7	23.3	36.0	88.0
1.6.8.2	Surveying			0			20		20				20				60	12.4	100	0.0	12.4	0.0	0.0	12.4	4.0	32.0	16.3
1.6.8.3	Install Cables			0			30		30				30				90	18.5	100	0.0	18.5	0.0	0.0	18.5	5.2	28.0	23.7
1.6.8.4	Testing after Transport and Installation			0			90		90				90				270	55.6	100	0.0	55.6	0.0	0.0	55.6	20.0	36.0	75.6
1.6.9	**Forward Tracker Straw Detector Project Management**					man yrs >	1.60	0.48	1.04	1.34	0.00	0.00	0.00	0.04	0.00	0.00	4.50	100.4	33	143.9	244.3	60.0	203.9	304.3	60.9	20.0	365.1
1.6.9.1	Project Coordination			0		400	400		60	60							520	23.2	48	25.3	48.5	0.0	25.3	48.5	9.7	20.0	58.2
1.6.9.2	Project Engineering								200	200							400	77.2	48	84.4	161.6	0.0	84.4	161.6	32.3	20.0	193.9
1.6.9.3	Project Reviews	3		3	5.000			30		30							60	0.0	0	12.7	12.7	15.0	27.7	27.7	5.5	20.0	33.2
1.6.9.4	ES&H Reviews	3		3	5.000			30		30							60	0.0	0	12.7	12.7	15.0	27.7	27.7	5.5	20.0	33.2
1.6.9.5	Travel	30		30	1.000	each	0	60	0	15			0	10			85	0.0	0	8.9	8.9	30.0	38.9	38.9	7.8	20.0	46.6
1.7	**Forward Tracker Silicon Microstrip Detector**					man yrs >	4.5	3.7	8.0	4.3	2.4	0.4	2.8	5.5	0.1	0.0	31.7	1,160.6	27	830.9	1,991.4	2,250.9	3,081.8	4,242.3	856.9	20.2	5,099.2
1.7.1	**Sensors and Interconections to Front-End Electronics**					man yrs >	0.17	0.00	0.50	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.84	48.6	5	17.7	66.4	877.4	895.1	943.8	185.8	19.7	1,129.5
1.7.1.1	Silicon Microstrip Detectors																										930.1
1.7.1.1.1	Development and Prototypes - Photomask NRE	2	0	2	25.000	each	42		63								105	24.3	33	0.0	24.3	50.0	50.0	74.3	35.7	48.0	110.0
1.7.1.1.2	Prototypes	550	0	550	0.030	cm^2			42								42	16.2	50	0.0	16.2	16.5	16.5	32.7	5.9	18.0	38.6
1.7.1.1.3	Production	19800	1980	21780	0.030	cm^2				21							21	0.0	0	8.9	8.9	653.4	662.3	662.3	119.2	18.0	781.5
1.7.1.2	Interconnection to Front-End Electronics																										199.5
1.7.1.2.1	Development and Prototypes	1	0	1	1.500	each	0		21	0							21	8.1	84	0.0	8.1	1.5	1.5	9.6	1.9	20.0	11.5
1.7.1.2.2	Production	216	24	240	0.650	each	0		0	21							21	0.0	0	8.9	8.9	156.0	164.9	164.9	23.1	14.0	187.9
1.7.2	**Front End Electronics**					man yrs >	2.54	2.40	3.14	1.48	0.00	0.00	1.26	2.32	0.00	0.00	13.14	376.1	32	303.7	679.8	508.7	812.4	1,188.5	340.8	28.7	1,529.3
1.7.2.1	Silicon Preamplifier and Programmable Discriminator ICs																										604.9
1.7.2.1.1	Development and Prototypes																										325.1
1.7.2.1.1.1	Prototype Run 1	25		25	1.000	each	50		120				20				190	51.0	67	0.0	51.0	25.0	25.0	76.0	33.4	44.0	109.4
1.7.2.1.1.2	Prototype Run 2	25		25	1.000	each	50		120				20				190	51.0	67	0.0	51.0	25.0	25.0	76.0	21.3	28.0	97.2
1.7.2.1.1.3	Prototype Run 3	25		25	1.000	each	50		120				20				190	51.0	67	0.0	51.0	25.0	25.0	76.0	24.3	32.0	100.3
1.7.2.1.1.4	Test Fixtures	3		3	2.000	each			10				20				30	8.5	59	0.0	8.5	6.0	6.0	14.5	3.8	26.0	18.3
1.7.2.1.2	Production																										279.7
1.7.2.1.2.1	Production BTeV Silicon ICs	1688	422	2109	0.077	each		50		40				25			115	0.0	0	23.2	23.2	162.4	185.7	185.7	44.6	24.0	230.2
1.7.2.1.2.2	Testing, Automated and Field	1		1	10.000	total		100		50				40			190	0.0	0	31.3	31.3	10.0	41.3	41.3	8.3	20.0	49.5
1.7.2.2	Rad-Hard Serializer/Transmitter ICs (Developed in WBS 1.10)																										92.4
1.7.2.2.1	Design Reviews and Prototype Testing						100		30								130	11.6	100	0.0	11.6	0.0	0.0	11.6	2.8	24.0	14.4
1.7.2.2.2	Production																										78.0
1.7.2.2.2.1	Testing: Automated and Field	2		2	5.000	total		50		25				20			95	0.0	0	15.6	15.6	10.0	25.6	25.6	5.1	20.0	30.8
1.7.2.2.2.2	Production Serializer/Transmitter ICs	422	106	527.5	0.050	each	0	25	0	20			0	13			58	0.0	0	11.7	11.7	26.4	38.1	38.1	9.1	24.0	47.3
1.7.2.3	Microstrip C/M&T and Data Opto-Electronics (Developed in WBS 1.10)																										100.9
1.7.2.3.1	Design Reviews and Prototype Testing						30		30				30				90	18.5	100	0.0	18.5	0.0	0.0	18.5	4.4	24.0	23.0
1.7.2.3.2	Production																										78.0
1.7.2.3.2.1	Testing: Automated and Field	2		2	5.000	total		20		30				30			80	0.0	0	20.3	20.3	10.0	30.3	30.3	6.1	20.0	36.3
1.7.2.3.2.2	Production C/M&T and Data Opto-Electronics	422	106	527.5	0.030	each		30		30				20			80	0.0	0	17.7	17.7	15.8	33.6	33.6	8.1	24.0	41.6
1.7.2.4	Rad-Hard Microstrip Control/Monitoring & Timing ICs (Developed in WBS 1.13)																										112.0
1.7.2.4.1	Design Reviews and Prototype Testing						100		30								130	11.6	100	0.0	11.6	0.0	0.0	11.6	2.8	24.0	14.4
1.7.2.4.2	Production																										97.6
1.7.2.4.2.1	Testing, Automated and Field	2		2	5.000	total		50		25				20			95	0.0	0	15.6	15.6	10.0	25.6	25.6	5.1	20.0	30.8
1.7.2.4.2.2	Production Rad-Hard C/M & T ICs	422	106	528	0.080	each		25		20				13			58	0.0	0	11.7	11.7	42.2	53.9	53.9	12.9	24.0	66.9
1.7.2.5	Microstrip Multi-Chip Modules			0													0										619.1
1.7.2.5.1	Development and Prototypes			0													0										304.5
1.7.2.5.1.1	Prototype Run 1	2		2	7.000	each	50		100				50				200	50.2	78	0.0	50.2	14.0	14.0	64.2	38.5	60.0	102.7
1.7.2.5.1.2	Prototype Run 2	4		4	4.000	each	50		100				50				200	50.2	76	0.0	50.2	16.0	16.0	66.2	27.8	42.0	94.0

WBS Number	WBS Name or Description	Base Quantity	Spares Quantity	Total Quantity	Base Unit (K$)	Units	PH.D (days)	PH.M (days)	EN.D (days)	EN.M (days)	SW.D (days)	SW.M (days)	TE.D (days)	TE.M (days)	LA.D (days)	LA.M (days)	Labor (days)	Dev Labor (K$)	Dev Labor (%)	Mfg Labor (K$)	Tot Labor (K$)	Tot Mtrl (K$)	Mtrl+Mfg (K$)	Base Cost (K$)	Contingency (K$)	Contingency (%)	Total Cost (K$)
1.7.2.5.1.3	Prototype Run 4, 3% System	13		13	0.550	each	50		100				50				200	50.2	88	0.0	50.2	7.2	7.2	57.4	14.9	26.0	72.3
1.7.2.5.1.4	Radiation Studies	1		1	2.000	each	25		15				30				70	12.8	86	0.0	12.8	2.0	2.0	14.8	3.0	20.0	17.7
1.7.2.5.1.5	Testing Fixtures and Setup	3		3	1.500	each	80		10				25				115	9.7	68	0.0	9.7	4.5	4.5	14.2	3.7	26.0	17.8
1.7.2.5.2	Production	422	64	486	0.200	each		250		130				400			780	0.0	0	156.5	156.5	97.2	253.7	253.7	60.9	24.0	314.5
1.7.3	**Power, Cooling and Electronics Protection**					man yrs >	0.00	0.00	0.86	0.42	0.00	0.00	0.04	0.73	0.00	0.00	2.06	85.3	14	91.2	176.5	417.0	508.2	593.5	81.8	13.8	675.4
1.7.3.1	Silicon Detector Bias High Voltage Power Supplies																										120.6
1.7.3.1.1	Development and Prototypes	2	0	2	8.580	each	0		20								20	7.7	31	0.0	7.7	17.2	17.2	24.9	3.5	14.0	28.4
1.7.3.1.2	Production	13	2	15	5.110	each				10							10	0.0	0	4.2	4.2	76.7	80.9	80.9	11.3	14.0	92.2
1.7.3.2	Front End Electronics Power Supplies																										270.8
1.7.3.2.1	Development and Prototypes	50		50	0.050	K$/watt			50								50	19.3	89	0.0	19.3	2.5	2.5	21.8	3.1	14.0	24.9
1.7.3.2.2	Production	3500	350	3850	0.050	K$/watt				25				50			75	0.0	0	23.3	23.3	192.5	215.8	215.8	30.2	14.0	246.0
1.7.3.3	Silicon Detector Cooling and Protection																										53.5
1.7.3.3.1	Development and Prototypes	12	2	14	0.300	each			21								21	8.1	66	0.0	8.1	4.2	4.2	12.3	1.7	14.0	14.0
1.7.3.3.2	Production	2	1	3	6.810	each				21				21			42	0.0	0	14.2	14.2	20.4	34.6	34.6	4.8	14.0	39.5
1.7.3.4	Electronics Cooling and Protection																										118.4
1.7.3.4.1	Development and Prototypes	1		1	5.000				25								25	9.7	66	0.0	9.7	5.0	5.0	14.7	2.1	14.0	16.7
1.7.3.4.2	Production	1	1	2	33.000	unit				25				50			75	0.0	0	23.3	23.3	66.0	89.3	89.3	12.5	14.0	101.7
1.7.3.5	Temperature Monitoring System																										27.8
1.7.3.5.1	Development and Prototypes	10	0	10	0.020	each			15					10			25	5.8	68	2.5	8.3	0.2	2.7	8.5	0.9	10.0	9.4
1.7.3.5.2	Production	144	20	164	0.020	each			21					21			42	8.1	48	5.3	13.4	3.3	8.6	16.7	1.7	10.0	18.4
1.7.3.6	Nitrogen Flow Monitoring System																										23.6
1.7.3.6.1	Development and Prototypes	1	0	1	0.300	each			21								21	8.1	96	0.0	8.1	0.3	0.3	8.4	0.8	10.0	9.2
1.7.3.6.2	Production	12	2	14	0.250	each				10				21			31	0.0	0	9.6	9.6	3.5	13.1	13.1	1.3	10.0	14.4
1.7.3.7	Silicon Microstrips and Electronics Radiation Monitoring System																										60.7
1.7.3.7.1	Power Supplies	2	0	2	5.110	each			21								21	8.1	44	0.0	8.1	10.2	10.2	18.3	1.8	10.0	20.2
1.7.3.7.2	Development and Prototypes	1	0	1	0.500	each			21				10				31	10.4	95	0.0	10.4	0.5	0.5	10.9	2.4	22.0	13.3
1.7.3.7.3	Production	48	5	53	0.275	each				15				10			25	0.0	0	8.9	8.9	14.6	23.4	23.4	3.8	16.0	27.2
1.7.4	**Mechanical and Other Systems**					man yrs >	0.00	0.00	0.71	0.43	0.00	0.00	0.26	1.32	0.00	0.00	2.72	83.4	24	129.0	212.4	131.9	260.9	344.3	81.4	23.6	425.7
1.7.4.1	Carbon Fiber Ladders																										155.9
1.7.4.1.1	Development and Prototypes Type A	2	0	2	2.000	each			21				15				18	11.6	74	0.0	11.6	4.0	4.0	15.6	5.6	36.0	21.2
1.7.4.1.2	Development and Prototypes Type B	2	0	2	2.000	each			21				15				18	11.6	74	0.0	11.6	4.0	4.0	15.6	5.6	36.0	21.2
1.7.4.1.3	Production Type A	144	15	159	0.300	each				15				15			30	0.0	0	10.1	10.1	47.7	57.8	57.8	16.8	29.0	74.6
1.7.4.1.4	Production Type B	72	8	80	0.250	each				15				15			30	0.0	0	10.1	10.1	20.0	30.1	30.1	8.7	29.0	38.9
1.7.4.2	Plane Frames Containing the Ladders, FEBs and Cooling Systems																										71.1
1.7.4.2.1	Development and Prototypes	1	0	1	1.200	each			21				10	5			36	10.4	81	1.3	11.7	1.2	2.5	12.9	12.7	28.0	25.6
1.7.4.2.2	Production	36	4	40	0.650	each				10				60			70	0.0	0	19.5	19.5	26.0	45.5	45.5	0.0	18.0	45.5
1.7.4.3	Silicon Wafer Mounting and Alignment on Ladders																										47.1
1.7.4.3.1	Development and Prototypes	1	0	1	0.200	each			21				10				31	10.4	98	0.0	10.4	0.2	0.2	10.6	2.9	27.0	13.5
1.7.4.3.2	Production	1	0	1	0.600	each				21				72			93	0.0	0	27.2	27.2	0.6	27.8	27.8	5.8	21.0	33.6
1.7.4.4	Intrastrip Bonding			0																							47.2
1.7.4.4.1	Development and Prototypes	1	0	1	0.200	each			21				10				31	10.4	98	0.0	10.4	0.2	0.2	10.6	2.9	27.0	13.5
1.7.4.4.2	Production	1	0	1	0.700	each				21				72			93	0.0	0	27.2	27.2	0.7	27.9	27.9	5.8	21.0	33.7
1.7.4.5	Station Supports																										35.1
1.7.4.5.1	Development and Prototypes	2	0	2	0.500	each			21				5				26	9.3	90	0.0	9.3	1.0	1.0	10.3	1.6	16.0	11.9
1.7.4.5.2	Production	12	2	14	0.500	each				10				36			46	0.0	0	13.4	13.4	7.0	20.4	20.4	2.9	14.0	23.2
1.7.4.6	Cabling - Power and Fiber Optics (I/O)																										26.6
1.7.4.6.1	Development and Prototypes	3	1	4	0.200	each			21								21	8.1	91	0.0	8.1	0.8	0.8	8.9	2.0	22.0	10.9
1.7.4.6.2	Production	36	5	41	0.150	each				5				20			25	0.0	0	7.2	7.2	6.2	13.3	13.3	2.4	18.0	15.7
1.7.4.7	Nitrogen Gas System																										22.1
1.7.4.7.1	Development and Prototypes	1	0	1	0.100	each			15								15	5.8	98	0.0	5.8	0.1	0.1	5.9	1.2	20.0	7.1
1.7.4.7.2	Production	12	2	14	0.500	each				5				15			20	0.0	0	5.9	5.9	7.0	12.9	12.9	2.1	16.0	15.0
1.7.4.8	Silicon Detector and Electronics Calibration System																										20.7
1.7.4.8.1	Development and Prototypes	1	0	1	0.250	each			15								15	5.8	96	0.0	5.8	0.3	0.3	6.0	1.2	20.0	7.2
1.7.4.8.2	Production	36	4	40	0.125	each				5				20			25	0.0	0	7.2	7.2	5.0	12.2	12.2	1.2	10.0	13.4
1.7.5	**Test Beam Studies**					man yrs >	0.18	0.10	0.18	0.20	0.00	0.00	0.00	0.20	0.00	0.00	0.87	17.4	20	34.5	51.8	33.6	68.0	85.4	13.9	16.3	99.3
1.7.5.1	Test Beam Detectors	483	0	483	0.030	cm^2	20		20	10				10			60	7.7	27	6.8	14.5	14.5	21.3	29.0	5.8	20.0	34.8
1.7.5.2	Test Beam Electronics	1	1	2	2.000	each	10		10	10				10			40	3.9	26	6.8	10.6	4.0	10.8	14.6	2.9	20.0	17.5
1.7.5.3	Test Beam Mechanics	1	1	2	2.500	each	10		10	10				10			40	3.9	25	6.8	10.6	5.0	11.8	15.6	3.1	20.0	18.7
1.7.5.4	Travel	63	21	84	0.120	per diem		21		21				21			63	0.0	0	14.2	14.2	10.1	24.3	24.3	1.9	8.0	26.2
1.7.5.5	ES&H			0			5	5	5								15	1.9	100	0.0	1.9	0.0	0.0	1.9	0.1	6.0	2.0
1.7.6	**Hardware and Software Specific to Microstrip Development and Testing**					man yrs >	0.20	0.08	0.76	0.08	0.56	0.36	1.28	0.08	0.00	0.00	3.40	198.5	77	49.3	247.9	9.6	58.9	257.5	46.0	17.9	303.5
1.7.6.1	Hardware																										159.0
1.7.6.1.1	Silicon IC Probe Station Adapter	4	2	6	1.000	each			50				100				150	42.5	88	0.0	42.5	6.0	6.0	48.5	7.8	16.0	56.3
1.7.6.1.2	Silicon Microstrip Specific Adapters to BTeV Standard Test Stand	4	2	6	0.600	each			100				200				300	85.0	96	0.0	85.0	3.6	3.6	88.6	14.2	16.0	102.8
1.7.6.2	Software			0																							144.5
1.7.6.2.1	Monitoring Software						30		30	10	100	70	10	10			260	50.3	59	34.6	84.9	0.0	34.6	84.9	17.0	20.0	101.9
1.7.6.2.2	FEB Testing Software						20	20	10	10	40	20	10	10			140	20.7	58	14.7	35.5	0.0	14.7	35.5	7.1	20.0	42.6
1.7.7	**ES&H**					man yrs >	0.50	0.32	0.18	0.46	0.48	0.00	0.00	0.16	0.14	0.00	2.25	64.8	52	58.7	123.5	0.0	58.7	123.5	12.3	10.0	135.8
1.7.7.1	Mechanical			0			7	10	5	15	15			4	2		58	7.6	51	7.3	14.9	0.0	7.3	14.9	1.5	10.0	16.4
1.7.7.2	Gas Systems			0			7	10	5	15	15			3	2		57	7.6	52	7.1	14.7	0.0	7.1	14.7	1.5	10.0	16.2
1.7.7.3	Cyrogenic Systems			0			7	10	5	15	15			3	2		57	7.6	52	7.1	14.7	0.0	7.1	14.7	1.5	10.0	16.2
1.7.7.4	Electrical and Electronics																										51.2
1.7.7.4.1	High Voltage Power			0			20	10	5	15	15			5	5		75	7.9	51	7.6	15.5	0.0	7.6	15.5	1.6	10.0	17.1
1.7.7.4.2	Low Voltage Power			0			20	10	5	15	15			5	5		75	7.9	51	7.6	15.5	0.0	7.6	15.5	1.6	10.0	17.1
1.7.7.4.3	Front End Electronics			0			20	10	5	15	15			5	5		75	7.9	51	7.6	15.5	0.0	7.6	15.5	1.6	10.0	17.1
1.7.7.5	Environmental			0			20	10	5	15	15			5	5		75	7.9	51	7.6	15.5	0.0	7.6	15.5	1.6	10.0	17.1
1.7.7.6	Radiation Safety			0			20	10	5	10	10			5	5		65	6.1	53	5.5	11.6	0.0	5.5	11.6	1.2	10.0	12.7
1.7.7.7	Training			0			5		5		5			5	5		25	4.3	77	1.3	5.5	0.0	1.3	5.5	0.6	10.0	6.1
1.7.8	**Transportation to and Installation and Testing at C0**					man yrs >	0.12	0.04	0.68	0.04	0.64	0.00	0.00	0.64	0.00	0.00	2.15	123.1	52	44.6	167.7	67.5	112.1	235.3	43.7	18.6	279.0
1.7.8.1	Transportation of detector components and equipment to Fermilab	1		1	0.500	Truck Rental			5		5			5			15	3.8	68	1.3	5.0	0.5	1.8	5.5	0.9	16.0	6.4
1.7.8.2	Mount Ladders and FEBs into Plane Frames			0					20		20			20			60	15.0	75	5.1	20.1	0.0	5.1	20.1	3.6	18.0	23.7
1.7.8.3	Mount Planes Frames into Station Supports			0					5		5			5			15	3.8	75	1.3	5.0	0.0	1.3	5.0	0.9	18.0	5.9
1.7.8.4	Mount Nitrogen Gas System Components			0					5		5			5			15	3.8	75	1.3	5.0	0.0	1.3	5.0	0.9	18.0	5.9
1.7.8.5	Mount Silicon Detector Cooling System Components			0					5		5			5			15	3.8	75	1.3	5.0	0.0	1.3	5.0	0.9	18.0	5.9
1.7.8.6	Mount Electroinics Cooling System Components			0					5		5			5			15	3.8	75	1.3	5.0	0.0	1.3	5.0	0.9	18.0	5.9
1.7.8.7	Surveying	1	0	1	5.000	total	30	10	10	10							60	3.9	30	4.2	8.1	5.0	9.2	13.1	2.4	18.0	15.4
1.7.8.8	Install Cables			0					5		5			5			15	3.8	75	1.3	5.0	0.0	1.3	5.0	0.8	16.0	5.8

WBS Number	WBS Name or Description	Base Quantity	Spares Quantity	Total Quantity	Base Unit (K$)	Units	PH.D (days)	PH.M (days)	EN.D (days)	EN.M (days)	SW.D (days)	SW.M (days)	TE.D (days)	TE.M (days)	LA.D (days)	LA.M (days)	Labor (days)	Dev Labor (K$)	Dev Labor (%)	Mfg Labor (K$)	Tot Labor (K$)	Tot Mtrl (K$)	Mtrl+Mfg (K$)	Base Cost (K$)	Contingency (K$)	Contingency (%)	Total Cost (K$)
1.7.8.9	Testing After Transport and Installation																										135.7
1.7.8.9.1	Plane testing			0					15		15			15			45	11.3	75	3.8	15.1	0.0	3.8	15.1	3.6	24.0	18.7
1.7.8.9.2	Full Channel Verification			0					20		20			20			60	15.0	75	5.1	20.1	0.0	5.1	20.1	4.8	24.0	24.9
1.7.8.9.3	System Calibration			0					14		14			14			42	10.5	75	3.6	14.1	0.0	3.6	14.1	3.4	24.0	17.4
1.7.8.9.4	Cosmic Run			0					60		60			60			180	45.0	75	15.2	60.2	0.0	15.2	60.2	14.5	24.0	74.7
1.7.8.10	Travel	517		517	0.120	per diem											0	0.0	0	0.0	0.0	62.0	62.0	62.0	6.2	10.0	68.2
1.7.9	**Forward Tracker Microstrip Detector Project Management**					man yrs >	0.82	0.77	0.97	0.97	0.77	0.00	0.00	0.00	0.00	0.00	4.29	163.3	35	102.1	265.4	205.2	307.3	470.6	51.1	10.9	521.7
1.7.9.1	Project Coordination			0			144	144	144	144	144						720	108.0	64	60.8	168.8	0.0	60.8	168.8	16.9	10.0	185.6
1.7.9.2	Project Engineering			0					50	50							100	19.3	48	21.1	40.4	0.0	21.1	40.4	8.1	20.0	48.5
1.7.9.3	Project Reviews			0			60	36	36	36	36						204	27.0	64	15.2	42.2	0.0	15.2	42.2	4.2	10.0	46.4
1.7.9.4	ES&H Reviews			0				12	12	12	12						48	9.0	64	5.1	14.1	0.0	5.1	14.1	1.4	10.0	15.5
1.7.9.5	Travel	6		6	34.200	year											0	0.0	0	0.0	0.0	205.2	205.2	205.2	20.5	10.0	225.7
1.8	**(Unassigned)**					man yrs >																					0.0
1.9	**Level 1 and Global Triggers**					man yrs >	2.1	1.6	7.6	3.5	6.3	2.9	3.6	4.0	0.0	0.0	31.6	1,510.3	29	918.2	2,428.5	2,786.1	3,704.2	5,214.6	985.5	18.9	6,200.0
1.9.1	**Pixel Trigger System**					man yrs >	1.02	1.10	4.96	2.12	2.66	2.12	3.02	3.62	0.00	0.00	20.62	895.5	22	664.5	1,559.9	2,467.6	3,132.1	4,027.6	792.8	19.7	4,820.4
1.9.1.1	Pixel Trigger Prototype																										106.6
1.9.1.1.1	SQ Box prototype	1		1	44.000												0	0.0	0	0.0	0.0	44.0	44.0	44.0	21.1	48.0	65.1
1.9.1.1.2	Processor Farm prototype	1		1	28.000												0	0.0	0	0.0	0.0	28.0	28.0	28.0	13.4	48.0	41.4
1.9.1.2	Pixel Trigger Production																										3,658.0
1.9.1.2.1	FPGA Tracker Subsystem																										1,563.1
1.9.1.2.1.1	SQ_Processor: Station-Quadrant Processor Board																										1,357.0
1.9.1.2.1.1.1	Pixel Processor	248	49	297	0.750				125								125	48.3	18	0.0	48.3	222.8	222.8	271.0	59.6	22.0	330.6
1.9.1.2.1.1.2	Tracker FPGA(s)	372	74	446	0.700				250								250	96.5	24	0.0	96.5	312.2	312.2	408.7	89.9	22.0	498.6
1.9.1.2.1.1.3	L1_Buffer: Level 1 Buffer (see 1.10.1.2)	124	24	148	0.000				64								64	24.7	100	0.0	24.7	0.0	0.0	24.7	5.4	22.0	30.1
1.9.1.2.1.1.4	Board and Connectors (SQ board)	124	24	148	0.750				5	50			100	50			205	25.1	15	33.8	58.9	111.0	144.8	169.9	37.4	22.0	207.3
1.9.1.2.1.1.5	Links from pixel detector	992	198	1190	0.200												0	0.0	0	0.0	0.0	238.0	238.0	238.0	52.4	22.0	290.4
1.9.1.2.1.2	SQ_Backplane: dual 4x4 Switched Backplane																										102.5
1.9.1.2.1.2.1	Switch FPGAs (4x4)	32	6	38	0.300				10								10	3.9	25	0.0	3.9	11.4	11.4	15.3	3.4	22.0	18.6
1.9.1.2.1.2.2	Monitor and Control Node	32	6	38	0.300				15								15	5.8	34	0.0	5.8	11.4	11.4	17.2	3.8	22.0	21.0
1.9.1.2.1.2.3	Board and Connectors (SQ Backplane)	16	3	19	0.075				15	20			100	50			185	29.0	56	21.1	50.1	1.4	22.6	51.6	11.3	22.0	62.9
1.9.1.2.1.3	Quad_Link Card																										80.1
1.9.1.2.1.3.1	Links to Farms	128	25	153	0.150												0	0.0	0	0.0	0.0	23.0	23.0	23.0	5.0	22.0	28.0
1.9.1.2.1.3.2	Board and Connectors (Link Card)	32	6	38	0.500				10	10			40	25			85	13.1	31	10.6	23.7	19.0	29.6	42.7	9.4	22.0	52.1
1.9.1.2.1.4	Power and Enclosure (FPGA tracker subsystem)	16	3	19	0.500				10				20	10			40	8.5	41	2.5	11.0	9.5	12.0	20.5	2.9	14.0	23.4
1.9.1.2.2	Track Farm	16																									2,094.9
1.9.1.2.2.1	Farm Processor Box	23																									2,094.9
1.9.1.2.2.1.1	Farm_Backplane: 8x8 Switched Backplane																										217.4
1.9.1.2.2.1.1.1	Switch FPGA (Dual 4x4 switch per chip)	46	9	55	0.700				65								65	25.1	39	0.0	25.1	38.5	38.5	63.6	14.0	22.0	77.6
1.9.1.2.2.1.1.2	Monitor and Control Node	23	4	27	0.300				0								0	0.0	0	0.0	0.0	8.1	8.1	8.1	1.8	22.0	9.9
1.9.1.2.2.1.1.3	Merge FPGA	46	9	55	0.300				65								65	25.1	60	0.0	25.1	16.5	16.5	41.6	9.1	22.0	50.7
1.9.1.2.2.1.1.4	Board and Connectors (Backplane)	23	4	27	0.750				5	50			100	50			205	25.1	32	33.8	58.9	20.3	54.1	79.2	0.0	0.0	79.2
1.9.1.2.2.1.2	Link Card: 4 in 1 out																										173.2
1.9.1.2.2.1.2.1	Link Receivers	184	36	220	0.150				45								45	17.4	34	0.0	17.4	33.0	33.0	50.4	11.1	22.0	61.5
1.9.1.2.2.1.2.2	Link Transmitters and cables	46	9	55	0.150				0								0	0.0	0	0.0	0.0	8.3	8.3	8.3	1.8	22.0	10.1
1.9.1.2.2.1.2.3	Control/Buffer FPGA	46	9	55	0.300				30								30	11.6	41	0.0	11.6	16.5	16.5	28.1	6.2	22.0	34.3
1.9.1.2.2.1.2.4	L1_Buffer: Level 1 Buffer (see 1.10.1.2)	46	9	55	0.000				10								10	3.9	100	0.0	3.9	0.0	0.0	3.9	0.8	22.0	4.7
1.9.1.2.2.1.2.5	Board and Connectors (Link Card)	46	9	55	0.500				5	15			40	25			85	11.2	22	12.7	23.9	27.5	40.2	51.4	11.3	22.0	62.7
1.9.1.2.2.1.3	Processor Card: 16 Processors																										338.2
1.9.1.2.2.1.3.1	Buffer_Manager FPGA	184	20	204	0.300				65								65	25.1	29	0.0	25.1	61.2	61.2	86.3	19.0	22.0	105.3
1.9.1.2.2.1.3.2	Monitor and Control Node	184	20	204	0.300												0	0.0	0	0.0	0.0	61.2	61.2	61.2	13.5	22.0	74.7
1.9.1.2.2.1.3.3	Board and Connectors (Processor Card)	184	20	204	0.500				5	10			60	30			105	15.9	12	11.8	27.7	102.0	113.8	129.7	28.5	22.0	158.2
1.9.1.2.2.1.4	DSP Daughter Card																										1,335.9
1.9.1.2.2.1.4.1	DSP Processor IC	2944	20	2964	0.200												0	0.0	0	0.0	0.0	592.8	592.8	592.8	106.7	18.0	699.5
1.9.1.2.2.1.4.2	Interface FPGA	2944	20	2964	0.075				85								85	32.8	13	0.0	32.8	222.3	222.3	255.1	45.9	18.0	301.0
1.9.1.2.2.1.4.3	Board and Connector (DSP Daughter Card)	2944	20	2964	0.050				5	20			60	440			525	15.9	6	120.2	136.1	148.2	268.4	284.3	51.2	18.0	335.4
1.9.1.2.2.1.5	Power and Enclosure (Farm processor box)	23	8	31	0.500				10				20	10			40	8.5	32	2.5	11.0	15.5	18.0	26.5	3.7	14.0	30.3
1.9.1.2.3	Vertex Farm																										0.0
1.9.1.2.3.1	Farm Processor Box (see 1.9.1.2.2)	0		0													0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	16.0	0.0
1.9.1.3	Hardware and Software for Pixel Trigger Development and Testing																										611.1
1.9.1.3.1	Hardware																										10.3
1.9.1.3.1.1	Control and Monitoring Host	1		1	5.000		0	0	5				5	5			15	3.1	33	1.3	4.4	5.0	6.3	9.4	0.9	10.0	10.3
1.9.1.3.2	Software																										600.8
1.9.1.3.2.1	Operating System Software	2		2	10.000						625	500					1125	227.5	51	199.0	426.5	20.0	219.0	446.5	111.6	25.0	558.1
1.9.1.3.2.2	Pixel Trigger Testing Software			0			60	80	20	20	40	30					250	22.3	52	20.4	42.7	0.0	20.4	42.7	0.0	0.0	42.7
1.9.1.4	ES&H																										70.3
1.9.1.4.1	Electrical and Electronics	8	2	10	2.000					20			20	20			60	4.6	12	13.5	18.2	19.2	32.7	37.4	1.1	3.0	38.5
1.9.1.4.2	Training	100	0	100	0.050	classes	20	20	20	20			20	20			120	12.4	40	13.5	25.9	5.0	18.5	30.9	0.9	3.0	31.8
1.9.1.5	Transportation to and Installation and Testing at C0			0			30	30	60	60			60	60			300	37.1	48	40.6	77.6	0.0	40.6	77.6	2.3	3.0	80.0
1.9.1.6	Pixel Trigger System Project Management																										294.5
1.9.1.6.1	Project Coordination			0			120	120	120	120							480	46.3	48	50.6	97.0	0.0	50.6	97.0	13.6	14.0	110.5
1.9.1.6.2	Project Reviews			0			25	25	25	25			20	20			140	14.3	48	15.6	29.9	0.0	15.6	29.9	4.2	14.0	34.1
1.9.1.6.3	ES&H Reviews			0					90	90			90	90			360	55.6	48	60.8	116.5	0.0	60.8	116.5	16.3	14.0	132.8
1.9.1.6.4	Travel	10		10	1.500												0	0.0	0	0.0	0.0	15.0	15.0	15.0	2.1	14.0	17.1
1.9.2	**Muon Trigger System**					man yrs >	1.05	0.48	2.24	1.00	2.00	0.40	0.56	0.42	0.00	0.00	8.15	430.6	47	171.7	602.4	318.4	490.1	920.8	192.7	20.9	1,113.4
1.9.2.1	Muon Trigger Simulation						83										83	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	0.0
1.9.2.2	Muon Trigger Prototype																0										44.4
1.9.2.2.1	SQ Box prototype	1		1	15.000												0	0.0	0	0.0	0.0	15.0	15.0	15.0	7.2	48.0	22.2
1.9.2.2.2	Farm Box prototype	1		1	15.000												0	0.0	0	0.0	0.0	15.0	15.0	15.0	7.2	48.0	22.2
1.9.2.3	MuonTrigger Production																0										574.4
1.9.2.3.1	FPGA Tracker Subsystem																0										574.4
1.9.2.3.1.1	SQ_Processor: Station-Quadrant Processor Board	48															0										536.3
1.9.2.3.1.1.1	Muon Processor	96	19	115	0.750				125	50							175	48.3	31	21.1	69.4	86.3	107.4	155.6	34.2	22.0	189.8
1.9.2.3.1.1.2	Tracker FPGA(s)	96	19	115	0.700				125	50							175	48.3	32	21.1	69.4	80.5	101.6	149.9	33.0	22.0	182.8
1.9.2.3.1.1.3	L1_Buffer: Level 1 Buffer (Costed under 1.10.1.2)	48	9	57	0.000												0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	22.0	0.0
1.9.2.3.1.1.4	Board and Connectors (SQ board)	48	9	57	0.750					50			50	50			150	11.6	13	33.8	45.4	42.8	76.6	88.2	19.4	22.0	107.5

WBS Number	WBS Name or Description	Base Quantity	Spares Quantity	Total Quantity	Base Unit (K$)	Units	PH.D (days)	PH.M (days)	EN.D (days)	EN.M (days)	SW.D (days)	SW.M (days)	TE.D (days)	TE.M (days)	LA.D (days)	LA.M (days)	Labor (days)	Dev Labor (K$)	Dev Labor (%)	Mfg Labor (K$)	Tot Labor (K$)	Tot Mtrl (K$)	Mtrl+Mfg (K$)	Base Cost (K$)	Contingency (K$)	Contingency (%)	Total Cost (K$)
1.9.2.3.1.1.5	Links from Muon detector	192	38	230	0.200												0	0.0	0	0.0	0.0	46.0	46.0	46.0	10.1	22.0	56.1
1.9.2.3.1.2	SQ_Backplane: dual 4x4 Switched Backplane (Only 1 switch us	8																									22.9
1.9.2.3.1.2.1	Switch FPGAs (4x4)	8	1	9	0.300												0	0.0	0	0.0	0.0	2.7	2.7	2.7	0.6	22.0	3.3
1.9.2.3.1.2.2	Monitor and Control Node	8	1	9	0.300												0	0.0	0	0.0	0.0	2.7	2.7	2.7	0.6	22.0	3.3
1.9.2.3.1.2.3	Board and Connectors (SQ Backplane)	8	1	9	0.075									50			50	0.0	0	12.7	12.7	0.7	13.4	13.4	2.9	22.0	16.3
1.9.2.3.1.3	Quad_Link Card (Populated with only 2 links/card)	8	1	9																						0.0	10.2
1.9.2.3.1.3.1	Links to Farms	16	3	19	0.150												0	0.0	0	0.0	0.0	2.9	2.9	2.9	0.6	22.0	3.5
1.9.2.3.1.3.2	Board and Connectors (Link Card)	8	1	9	0.500									4			4	0.0	0	1.0	1.0	4.5	5.5	5.5	1.2	22.0	6.7
1.9.2.3.1.4	Power and Enclosure	8	1	9	0.500												0	0.0	0	0.0	0.0	4.5	4.5	4.5	0.5	10.0	5.0
1.9.2.3.2	Farm Processor Box	2	0	2													0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0
1.9.2.4	Muon Trigger System Testing and Development																									10.0	348.4
1.9.2.4.1	Hardware			0					120								120	46.3	100	0.0	46.3	0.0	0.0	46.3	4.6	10.0	51.0
1.9.2.4.2	Software			0					20	20	500	100					640	189.7	80	48.2	238.0	0.0	48.2	238.0	59.5	25.0	297.5
1.9.2.5	ES&H																										64.5
1.9.2.5.1	Electrical and Electronics			0					50				50				100	30.9	100	0.0	30.9	0.0	0.0	30.9	4.9	16.0	35.8
1.9.2.5.2	Environmental			0					20				20				40	12.4	100	0.0	12.4	0.0	0.0	12.4	2.0	16.0	14.3
1.9.2.5.3	Training			0					20				20				40	12.4	100	0.0	12.4	0.0	0.0	12.4	2.0	16.0	14.3
1.9.2.6	Transportation to and Installation and Testing at C0			0													0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.9.2.7	Muon Trigger System Project Management						180	120	80	80							460	30.9	48	33.8	64.6	0.0	33.8	64.6	0.0	0.0	81.7
1.9.2.7.1	Project Coordination			0													0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	14.0	0.0
1.9.2.7.2	Project Reviews			0													0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	14.0	0.0
1.9.2.7.3	ES&H Reviews			0													0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	14.0	0.0
1.9.2.7.4	Travel	10		10	1.500												0	0.0	0	0.0	0.0	15.0	15.0	15.0	2.1	14.0	17.1
1.9.3	**Global Trigger**					man yrs >	0.00	0.00	0.40	0.40	1.60	0.40	0.00	0.00	0.00	0.00	2.80	184.2	69	82.0	266.2	0.0	82.0	266.2	0.0	0.0	266.2
1.9.3.1	Farm Processor Box	1		1													0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.9.3.2	Hardware and Software for Global Trigger Development and Testing																										266.2
1.9.3.2.1	Hardware			0					100	100							200	38.6	48	42.2	80.8	0.0	42.2	80.8	0.0	0.0	80.8
1.9.3.2.2	Software			0							400	100					500	145.6	79	39.8	185.4	0.0	39.8	185.4	0.0	0.0	185.4
1.9.3.3	ES&H			0																							0.0
1.9.3.3.1	Electrical and Electronics			0													0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.9.3.3.2	Environmental			0													0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.9.3.3.3	Training			0													0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.9.3.4	Transportation to and Installation and Testing at C0			0													0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.9.3.5	Global Trigger System Project Management			0																							0.0
1.9.3.5.1	Project Coordination			0													0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.9.3.5.2	Project Reviews			0													0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.9.3.5.3	ES&H Reviews			0													0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.9.3.5.4	Travel			0													0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.10	**Data Acquisition Electronics and Links**					man yrs >	3.2	0.0	9.3	2.5	0.0	0.0	7.0	5.6	0.0	0.0	27.6	1,307.7	33	614.7	1,922.4	2,082.1	2,696.8	4,004.5	812.0	20.3	4,816.5
1.10.1	**Data Acquisition Electronics**					man yrs >	2.72	0.00	6.36	1.32	0.00	0.00	3.84	2.40	0.00	0.00	16.64	836.5	31	291.7	1,128.1	1,535.3	1,826.9	2,663.4	562.0	21.1	3,225.4
1.10.1.1	Data Concentrators and Translators (merged with WBS 1.10.1.2)																										0.0
1.10.1.1.1	Development and Prototypes																										0.0
1.10.1.1.1.1	FPGA ICs			0	0.000												0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	16.0	0.0
1.10.1.1.1.2	Receivers and Transmitters			0	0.000												0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	16.0	0.0
1.10.1.1.1.3	PC Board/Assembly			0	0.000												0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	16.0	0.0
1.10.1.1.1.4	Design and Simulation			0													0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	16.0	0.0
1.10.1.1.1.5	Prototype Test			0													0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	16.0	0.0
1.10.1.1.2	Production																										0.0
1.10.1.1.2.1	FPGA ICs			0	0.000												0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	16.0	0.0
1.10.1.1.2.2	Receivers and Transmitters			0	0.000												0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	16.0	0.0
1.10.1.1.2.3	PC Board/Assembly			0	0.000												0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	16.0	0.0
1.10.1.1.2.4	Production Test			0													0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	16.0	0.0
1.10.1.2	Level 1 (Switch Input) Buffers																										2,028.6
1.10.1.2.1	Development and Prototypes																										442.3
1.10.1.2.1.1	FPGA ICs	32		32	1.800												0	0.0	0	0.0	0.0	57.6	57.6	57.6	9.2	16.0	66.8
1.10.1.2.1.2	Receivers and Transmitters	32		32	0.500												0	0.0	0	0.0	0.0	16.0	16.0	16.0	2.6	16.0	18.6
1.10.1.2.1.3	Memory ICs	32		32	0.400												0	0.0	0	0.0	0.0	12.8	12.8	12.8	2.0	16.0	14.8
1.10.1.2.1.4	Microcontroller	32		32	0.080												0	0.0	0	0.0	0.0	2.6	2.6	2.6	0.4	16.0	3.0
1.10.1.2.1.5	Control Link Interface	32		32	0.030												0	0.0	0	0.0	0.0	1.0	1.0	1.0	0.2	16.0	1.1
1.10.1.2.1.6	PC Board/Assembly	32		32	0.900												0	0.0	0	0.0	0.0	28.8	28.8	28.8	4.6	16.0	33.4
1.10.1.2.1.7	Design and Simulation						150		400				200				750	200.8	100	0.0	200.8	0.0	0.0	200.8	32.1	16.0	232.9
1.10.1.2.1.8	Prototype Test						50		100				100				250	61.8	100	0.0	61.8	0.0	0.0	61.8	9.9	16.0	71.7
1.10.1.2.2	Production																										1,586.3
1.10.1.2.2.1	FPGA ICs	380	40	420	1.300												0	0.0	0	0.0	0.0	546.0	546.0	546.0	152.9	28.0	698.9
1.10.1.2.2.2	Receivers and Transmitters	380	40	420	0.450												0	0.0	0	0.0	0.0	189.0	189.0	189.0	52.9	28.0	241.9
1.10.1.2.2.3	Memory ICs	380	40	420	0.300												0	0.0	0	0.0	0.0	126.0	126.0	126.0	35.3	28.0	161.3
1.10.1.2.2.4	Microcontroller	380	40	420	0.080												0	0.0	0	0.0	0.0	33.6	33.6	33.6	5.4	16.0	39.0
1.10.1.2.2.5	Control Link Interface	380	40	420	0.020												0	0.0	0	0.0	0.0	8.4	8.4	8.4	1.3	16.0	9.7
1.10.1.2.2.6	PC Board/Assembly	380	40	420	0.650												0	0.0	0	0.0	0.0	273.0	273.0	273.0	54.6	20.0	327.6
1.10.1.2.2.7	Production Test									100				200			300	0.0	0	93.0	93.0	0.0	93.0	93.0	14.9	16.0	107.9
1.10.1.3	Event Building Switch																										199.2
1.10.1.3.1	Development and Prototypes																										129.2
1.10.1.3.1.1	FPGA ICs	4	0	4	1.000												0	0.0	0	0.0	0.0	4.0	4.0	4.0	0.6	16.0	4.6
1.10.1.3.1.2	Fiber Receivers and Transmitters	4	0	4	2.100												0	0.0	0	0.0	0.0	8.4	8.4	8.4	1.3	16.0	9.7
1.10.1.3.1.3	Microcontroller	4	0	4	0.080												0	0.0	0	0.0	0.0	0.3	0.3	0.3	0.1	16.0	0.4
1.10.1.3.1.4	PC Board/Assembly	4	0	4	1.500												0	0.0	0	0.0	0.0	6.0	6.0	6.0	1.0	16.0	7.0
1.10.1.3.1.5	Design and Simulation						30		100				50				180	50.2	100	0.0	50.2	0.0	0.0	50.2	8.0	16.0	58.2
1.10.1.3.1.6	Prototype Test						20		80				50				150	42.5	100	0.0	42.5	0.0	0.0	42.5	6.8	16.0	49.3
1.10.1.3.2	Production																										70.0
1.10.1.3.2.1	FPGA ICs	8	2	10	0.800												0	0.0	0	0.0	0.0	8.0	8.0	8.0	1.3	16.0	9.3
1.10.1.3.2.2	Fiber Receivers and Transmitters	8	2	10	2.100												0	0.0	0	0.0	0.0	21.0	21.0	21.0	3.4	16.0	24.4
1.10.1.3.2.3	Microcontroller	8	2	10	0.080												0	0.0	0	0.0	0.0	0.8	0.8	0.8	0.1	16.0	0.9
1.10.1.3.2.4	PC Board/Assembly	8	2	10	0.500												0	0.0	0	0.0	0.0	5.0	5.0	5.0	1.0	20.0	6.0
1.10.1.3.2.5	Production Test									30				50			80	0.0	0	25.4	25.4		25.4	25.4	4.1	16.0	29.4
1.10.1.4	Event Data Flow Controller																										253.9
1.10.1.4.1	Development and Prototypes																										198.7

WBS Number	WBS Name or Description	Base Quantity	Spares Quantity	Total Quantity	Base Unit (K$)	Units	PH.D (days)	PH.M (days)	EN.D (days)	EN.M (days)	SW.D (days)	SW.M (days)	TE.D (days)	TE.M (days)	LA.D (days)	LA.M (days)	Labor (days)	Dev Labor (K$)	Dev Labor (%)	Mfg Labor (K$)	Tot Labor (K$)	Tot Mtrl (K$)	Mtrl+Mfg (K$)	Base Cost (K$)	Contingency (K$)	Contingency (%)	Total Cost (K$)
1.10.1.4.1.1	FPGA ICs	2	0	2	2.000												0	0.0	0	0.0	0.0	4.0	4.0	4.0	0.6	16.0	4.6
1.10.1.4.1.2	Fiber Receivers and Transmitters	2	0	2	0.120												0	0.0	0	0.0	0.0	0.2	0.2	0.2	0.0	16.0	0.3
1.10.1.4.1.3	Memory ICs	2	0	2	0.300												0	0.0	0	0.0	0.0	0.6	0.6	0.6	0.1	16.0	0.7
1.10.1.4.1.4	Microcontroller	2	0	2	0.080												0	0.0	0	0.0	0.0	0.2	0.2	0.2	0.0	16.0	0.2
1.10.1.4.1.5	Control Link Interface	2	0	2	0.030												0	0.0	0	0.0	0.0	0.1	0.1	0.1	0.0	16.0	0.1
1.10.1.4.1.6	PC Board/Assembly	2	0	2	2.000												0	0.0	0	0.0	0.0	4.0	4.0	4.0	0.6	16.0	4.6
1.10.1.4.1.7	Design and Simulation						150		250				100				500	119.7	100	0.0	119.7	0.0	0.0	119.7	19.2	16.0	138.9
1.10.1.4.1.8	Prototype Test						30		50				100				180	42.5	100	0.0	42.5	0.0	0.0	42.5	6.8	16.0	49.3
1.10.1.4.2	Production																										55.3
1.10.1.4.2.1	FPGA ICs	1	2	3	2.000												0	0.0	0	0.0	0.0	6.0	6.0	6.0	1.0	16.0	7.0
1.10.1.4.2.2	Fiber Receivers and Transmitters	1	2	3	0.120												0	0.0	0	0.0	0.0	0.4	0.4	0.4	0.1	16.0	0.4
1.10.1.4.2.3	Memory ICs	1	2	3	0.300												0	0.0	0	0.0	0.0	0.9	0.9	0.9	0.3	28.0	1.2
1.10.1.4.2.4	Microcontroller	1	2	3	0.080												0	0.0	0	0.0	0.0	0.2	0.2	0.2	0.0	16.0	0.3
1.10.1.4.2.5	Control Link Interface	1	2	3	0.020												0	0.0	0	0.0	0.0	0.1	0.1	0.1	0.0	16.0	0.1
1.10.1.4.2.6	PC Board/Assembly	1	2	3	2.000												0	0.0	0	0.0	0.0	6.0	6.0	6.0	1.2	20.0	7.2
1.10.1.4.2.7	Production Test									50				50			100	0.0	0	33.8	33.8	0.0	33.8	33.8	5.4	16.0	39.2
1.10.1.5	Level 2/3 (Switch Output) Buffers																										376.4
1.10.1.5.1	Development and Prototypes																										191.7
1.10.1.5.1.1	FPGA ICs	8	0	8	0.800												0	0.0	0	0.0	0.0	6.4	6.4	6.4	1.0	16.0	7.4
1.10.1.5.1.2	Receivers and Transmitters	8	0	8	0.120												0	0.0	0	0.0	0.0	1.0	1.0	1.0	0.2	16.0	1.1
1.10.1.5.1.3	Memory ICs	8	0	8	0.200												0	0.0	0	0.0	0.0	1.6	1.6	1.6	0.3	16.0	1.9
1.10.1.5.1.4	Microcontroller	8	0	8	0.080												0	0.0	0	0.0	0.0	0.6	0.6	0.6	0.1	16.0	0.7
1.10.1.5.1.5	Output Link Interface	8	0	8	0.600												0	0.0	0	0.0	0.0	4.8	4.8	4.8	0.8	16.0	5.6
1.10.1.5.1.6	PC Board/Assembly	8	0	8	1.000												0	0.0	0	0.0	0.0	8.0	8.0	8.0	1.3	16.0	9.3
1.10.1.5.1.7	Design and Simulation						100		200				100				400	100.4	100	0.0	100.4	0.0	0.0	100.4	16.1	16.0	116.5
1.10.1.5.1.8	Prototype Test						30		50				100				180	42.5	100	0.0	42.5	0.0	0.0	42.5	6.8	16.0	49.3
1.10.1.5.2	Production																										184.7
1.10.1.5.2.1	FPGA ICs	64	8	72	0.400												0	0.0	0	0.0	0.0	28.8	28.8	28.8	8.1	28.0	36.9
1.10.1.5.2.2	Receivers and Transmitters	64	8	72	0.120												0	0.0	0	0.0	0.0	8.6	8.6	8.6	1.4	16.0	10.0
1.10.1.5.2.3	Memory ICs	64	8	72	0.100												0	0.0	0	0.0	0.0	7.2	7.2	7.2	2.0	28.0	9.2
1.10.1.5.2.4	Microcontroller	64	8	72	0.080												0	0.0	0	0.0	0.0	5.8	5.8	5.8	0.9	16.0	6.7
1.10.1.5.2.5	Output Link Interface	64	8	72	0.400												0	0.0	0	0.0	0.0	28.8	28.8	28.8	4.6	16.0	33.4
1.10.1.5.2.6	PC Board/Assembly	64	8	72	0.400												0	0.0	0	0.0	0.0	28.8	28.8	28.8	5.8	20.0	34.6
1.10.1.5.2.7	Production Test									50				100			150	0.0	0	46.5	46.5	0.0	46.5	46.5	7.4	16.0	53.9
1.10.1.6	Control/Monitor and Readout Data Combiner																										199.8
1.10.1.6.1	Development and Prototypes																										145.8
1.10.1.6.1.1	FPGA ICs	20	0	20	0.300												0	0.0	0	0.0	0.0	6.0	6.0	6.0	1.0	16.0	7.0
1.10.1.6.1.2	Design and Simulation						50		200				50				300	88.8	100	0.0	88.8	0.0	0.0	88.8	14.2	16.0	103.0
1.10.1.6.1.3	Prototype Test						20		50				50				120	30.9	100	0.0	30.9	0.0	0.0	30.9	4.9	16.0	35.8
1.10.1.6.2	Production																										53.9
1.10.1.6.2.1	Production Test									50				100			150	0.0	0	46.5	46.5	0.0	46.5	46.5	7.4	16.0	53.9
1.10.1.7	Rad-Hard Serializer/Transmitter ICs for Pixel and Microstrip Systems																										167.4
1.10.1.7.1	Development and Prototypes																										113.5
1.10.1.7.1.1	Prototype Run 1	6		6	2.000	total	20		50				20				90	23.9	67	0.0	23.9	12.0	12.0	35.9	15.8	44.0	51.8
1.10.1.7.1.2	Prototype Run 2	6		6	2.000	total	20		50				20				90	23.9	67	0.0	23.9	12.0	12.0	35.9	10.1	28.0	46.0
1.10.1.7.1.3	Test Fixtures	4		4	1.000	each			10				20				30	8.5	68	0.0	8.5	4.0	4.0	12.5	3.3	26.0	15.8
1.10.1.7.2	Production Ordering and Testing						10			50				100			160	0.0	0	46.5	46.5	0.0	46.5	46.5	7.4	16.0	53.9
1.10.2	**Data and Other Links**					man yrs >	0.06	0.04	1.60	0.40	0.00	0.00	1.92	1.36	0.00	0.00	5.38	265.8	32	128.6	394.3	441.8	570.4	836.2	167.0	20.0	1,003.1
1.10.2.1	Data Link Research and Development																										128.4
1.10.2.1.1	Data Link Components	40		40	0.100												0	0.0	0	0.0	0.0	4.0	4.0	4.0	0.6	16.0	4.6
1.10.2.1.2	Data Link Test Boards	8		8	0.500												0	0.0	0	0.0	0.0	4.0	4.0	4.0	0.6	16.0	4.6
1.10.2.1.3	Optical Link Test Equipment	2		2	5.000												0	0.0	0	0.0	0.0	10.0	10.0	10.0	1.6	16.0	11.6
1.10.2.1.4	Design and Simulation								100				50				150	50.2	100	0.0	50.2	0.0	0.0	50.2	8.0	16.0	58.2
1.10.2.1.5	Prototype Test								50				100				150	42.5	100	0.0	42.5	0.0	0.0	42.5	6.8	16.0	49.3
1.10.2.2	Front-End Electronics to Level 1 Buffers Data Links																										325.2
1.10.2.2.1	Development and Prototypes																										41.7
1.10.2.2.1.1	Fiber Optic Cables	10		10	0.430												0	0.0	0	0.0	0.0	4.3	4.3	4.3	0.7	16.0	5.0
1.10.2.2.1.2	Design								20				20				40	12.4	100	0.0	12.4	0.0	0.0	12.4	2.0	16.0	14.3
1.10.2.2.1.3	Prototype Test								20				50				70	19.3	100	0.0	19.3	0.0	0.0	19.3	3.1	16.0	22.4
1.10.2.2.2	Production																										283.4
1.10.2.2.2.1	Fiber Optic Cables	380	30	410	0.400												0	0.0	0	0.0	0.0	164.0	164.0	164.0	26.2	16.0	190.2
1.10.2.2.2.2	Innerduct	200	10	210	0.150												0	0.0	0	0.0	0.0	31.5	31.5	31.5	5.0	16.0	36.5
1.10.2.2.2.3	Cable Support System	1		1	15.000												0	0.0	0	0.0	0.0	15.0	15.0	15.0	2.4	16.0	17.4
1.10.2.2.2.4	Production Test									20				100			120	0.0	0	33.8	33.8	0.0	33.8	33.8	5.4	16.0	39.3
1.10.2.3	Data Acquisition Network Links																										67.0
1.10.2.3.1	Development and Prototypes																										35.1
1.10.2.3.1.1	Fiber Optic Cables	40		40	0.023												0	0.0	0	0.0	0.0	0.9	0.9	0.9	0.1	16.0	1.1
1.10.2.3.1.2	Design and Simulation			0					20				20				40	12.4	100	0.0	12.4	0.0	0.0	12.4	2.0	16.0	14.3
1.10.2.3.1.3	Prototype Test			0					20				40				60	17.0	100	0.0	17.0	0.0	0.0	17.0	2.7	16.0	19.7
1.10.2.3.2	Production																										31.9
1.10.2.3.2.1	Fiber Optic Cables	125	20	145	0.023												0	0.0	0	0.0	0.0	3.3	3.3	3.3	0.5	16.0	3.9
1.10.2.3.2.2	Copper Cables	250	50	300	0.010												0	0.0	0	0.0	0.0	3.0	3.0	3.0	0.5	16.0	3.5
1.10.2.3.2.2	Production Test			0						20				50			70	0.0	0	21.1	21.1	0.0	21.1	21.1	3.4	16.0	24.5
1.10.2.4	Level 2/3 Buffer to Level 2/3 Online Processor Array Data Links																										47.7
1.10.2.4.1	Development and Prototypes																										23.1
1.10.2.4.1.1	Link Cables (Copper)	4		4	0.140												0	0.0	0	0.0	0.0	0.6	0.6	0.6	0.1	16.0	0.6
1.10.2.4.1.2	Design and Simulation			0					10				30				40	10.8	100	0.0	10.8	0.0	0.0	10.8	1.7	16.0	12.6
1.10.2.4.1.3	Prototype Test			0					10				20				30	8.5	100	0.0	8.5	0.0	0.0	8.5	1.4	16.0	9.9
1.10.2.4.2	Production																										24.6
1.10.2.4.2.1	Link Cables (Copper)	64	3	67	0.140												0	0.0	0	0.0	0.0	9.4	9.4	9.4	1.5	16.0	10.9
1.10.2.4.2.2	Production Test			0						10				30			40	0.0	0	11.8	11.8	0.0	11.8	11.8	1.9	16.0	13.7
1.10.2.5	Data Acquisition to Level 1 Trigger System Links																										37.1
1.10.2.5.1	Development and Prototypes																										14.7
1.10.2.5.1.1	Gigabit per second Copper Link cables	10		10	0.030												0	0.0	0	0.0	0.0	0.3	0.3	0.3	0.0	16.0	0.3
1.10.2.5.1.2	Design and Simulation			0					10				10				20	6.2	100	0.0	6.2	0.0	0.0	6.2	1.0	16.0	7.2
1.10.2.5.1.3	Prototype Test			0					10				10				20	6.2	100	0.0	6.2	0.0	0.0	6.2	1.0	16.0	7.2

WBS Number	WBS Name or Description	Base Quantity	Spares Quantity	Total Quantity	Base Unit (K$)	Units	PH.D (days)	PH.M (days)	EN.D (days)	EN.M (days)	SW.D (days)	SW.M (days)	TE.D (days)	TE.M (days)	LA.D (days)	LA.M (days)	Labor (days)	Dev Labor (K$)	Dev Labor (%)	Mfg Labor (K$)	Tot Labor (K$)	Tot Mtrl (K$)	Mtrl+Mfg (K$)	Base Cost (K$)	Contingency (K$)	Contingency (%)	Total Cost (K$)
1.10.2.5.2	Production																										22.4
1.10.2.5.2.1	Gigabit per second Copper Link cables	200		200	0.050												0	0.0	0	0.0	0.0	10.0	10.0	10.0	1.6	16.0	11.6
1.10.2.5.2.2	Production Test			0						10				20			30	0.0	0	9.3	9.3	0.0	9.3	9.3	1.5	16.0	10.8
1.10.2.6	C/M&T and Data Opto-Electronics																										180.0
1.10.2.6.1	Development and Prototypes																										135.9
1.10.2.6.1.1	Prototype Run 1	50		50	0.200	each	10		60				20				90	27.8	74	0.0	27.8	10.0	10.0	37.8	24.2	64.0	62.0
1.10.2.6.1.2	Prototype Run 2	50		50	0.200	each	5		30				20				55	16.2	62	0.0	16.2	10.0	10.0	26.2	16.8	64.0	43.0
1.10.2.6.1.3	Test Fixtures	8		8	2.000	each			10				20				30	8.5	35	0.0	8.5	16.0	16.0	24.5	6.4	26.0	30.9
1.10.2.6.2	Production Ordering and Testing							10		30				100			140	0.0	0	38.1	38.1	0.0	38.1	38.1	6.1	16.0	44.1
1.10.2.7	Optical Distribution Box																										159.8
1.10.2.7.1	Development and Prototype																										35.9
1.10.2.7.1.1	Fiber Distribution Boxes (Fusion Splice)	1		1	0.750												0	0.0	0	0.0	0.0	0.8	0.8	0.8	0.1	16.0	0.9
1.10.2.7.1.2	Fiber Distribution Boxes (Breakout Connectors)	1		1	2.400												0	0.0	0	0.0	0.0	2.4	2.4	2.4	0.4	16.0	2.8
1.10.2.7.1.3	Design and Simulation			0					20				40				60	17.0	100	0.0	17.0	0.0	0.0	17.0	2.7	16.0	19.7
1.10.2.7.1.4	Prototype Test			0					10				30				40	10.8	100	0.0	10.8	0.0	0.0	10.8	1.7	16.0	12.6
1.10.2.7.2	Production																										123.9
1.10.2.7.2.1	Splice Boxes	20		20	0.100												0	0.0	0	0.0	0.0	2.0	2.0	2.0	0.3	16.0	2.3
1.10.2.7.2.2	Distribution Boxes (Breakout Connectors)	30	4	34	2.600												0	0.0	0	0.0	0.0	88.4	88.4	88.4	14.1	16.0	102.5
1.10.2.7.2.3	Field Splices	20		20	0.100												0	0.0	0	0.0	0.0	2.0	2.0	2.0	0.3	16.0	2.3
1.10.2.7.2.4	Production Test			0						10				40			50	0.0	0	14.4	14.4	0.0	14.4	14.4	2.3	16.0	16.7
1.10.2.8	Optical Link Infrastucture																										58.0
1.10.2.8.1	Ribbon Optical Fiber Splicer and Fuser	1		1	28.000												0	0.0	0	0.0	0.0	28.0	28.0	28.0	4.5	16.0	32.5
1.10.2.8.2	Single Optical Fiber Splicer and Fuser	1		1	22.000												0	0.0	0	0.0	0.0	22.0	22.0	22.0	3.5	16.0	25.5
1.10.3	**Packaging, Power, Cooling, and Protection**					man yrs >	0.00	0.00	0.48	0.08	0.00	0.00	0.60	0.40	0.00	0.00	1.56	81.1	45	33.8	115.0	65.0	98.8	180.0	31.0	17.2	211.0
1.10.3.1	Development and Prototypes																										105.7
1.10.3.1.1	Prototype Packaging Components	20		20	0.500												0	0.0	0	0.0	0.0	10.0	10.0	10.0	1.6	16.0	11.6
1.10.3.1.2	Design and Simulation			0					100				100				200	61.8	100	0.0	61.8	0.0	0.0	61.8	9.9	16.0	71.7
1.10.3.1.3	Prototype Test			0					20				50				70	19.3	100	0.0	19.3	0.0	0.0	19.3	3.1	16.0	22.4
1.10.3.2	Production																										105.3
1.10.3.2.1	Packaging, Power, Cooling Components	200	20	220	0.250												0	0.0	0	0.0	0.0	55.0	55.0	55.0	11.0	20.0	66.0
1.10.3.2.2	Production Test			0						20				100			120	0.0	0	33.8	33.8	0.0	33.8	33.8	5.4	16.0	39.3
1.10.4	**Hardware and Software for Testing and Development**					man yrs >	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.0	0	0.0	0.0	32.0	32.0	32.0	5.1	16.0	37.1
1.10.4.1	Hardware																										18.6
1.10.4.1.1	Test adapter modules	8		8	2.000												0	0.0	0	0.0	0.0	16.0	16.0	16.0	2.6	16.0	18.6
1.10.4.2	Software																										18.6
1.10.4.2.1	Embedded Monitor and Compilers	4		4	2.000		50										50	0.0	0	0.0	0.0	8.0	8.0	8.0	1.3	16.0	9.3
1.10.4.2.2	Embedded Test Software	4		4	2.000		50										50	0.0	0	0.0	0.0	8.0	8.0	8.0	1.3	16.0	9.3
1.10.5	**ES&H**					man yrs >	0.00	0.00	0.36	0.00	0.00	0.00	0.36	0.00	0.00	0.00	0.72	55.6	100	0.0	55.6	0.0	0.0	55.6	8.9	16.0	64.5
1.10.5.1	Electrical and Electronics			0					50				50				100	30.9	100	0.0	30.9	0.0	0.0	30.9	4.9	16.0	35.8
1.10.5.2	Environmental			0					20				20				40	12.4	100	0.0	12.4	0.0	0.0	12.4	2.0	16.0	14.3
1.10.5.3	Training			0					20				20				40	12.4	100	0.0	12.4	0.0	0.0	12.4	2.0	16.0	14.3
1.10.6	**Installation and Testing at C0**					man yrs >	0.00	0.00	0.00	0.56	0.00	0.00	0.00	1.40	0.00	0.00	1.96	0.0	0	148.0	148.0	0.0	148.0	148.0	23.7	16.0	171.7
1.10.6.1	Module Installation			0						30				100			130	0.0	0	38.1	38.1	0.0	38.1	38.1	6.1	16.0	44.1
1.10.6.2	Cable Installation and Termination			0						10				150			160	0.0	0	42.3	42.3	0.0	42.3	42.3	6.8	16.0	49.1
1.10.6.3	In-situ System Operational Tests			0						100				100			200	0.0	0	67.6	67.6	0.0	67.6	67.6	10.8	16.0	78.4
1.10.7	**DAQ Electronics & Links Project Management**					man yrs >	0.00	0.00	0.52	0.12	0.00	0.00	0.32	0.00	0.00	0.00	0.96	68.7	77	12.7	81.4	8.0	20.7	89.4	14.3	16.0	103.7
1.10.7.1	Project Coordination			0					50				30				80	26.3	100	0.0	26.3	0.0	0.0	26.3	4.2	16.0	30.5
1.10.7.2	Project Reviews			0					50				50				100	30.9	100	0.0	30.9	0.0	0.0	30.9	4.9	16.0	35.8
1.10.7.3	ES&H Reviews			0					30	30							60	11.6	48	12.7	24.2	0.0	12.7	24.2	3.9	16.0	28.1
1.10.7.4	Travel	8		8	1.000												0	0.0	0	0.0	0.0	8.0	8.0	8.0	1.3	16.0	9.3
1.11	**Level 2/3 Processor Array**					man yrs >	1.5	0.0	0.4	0.2	0.2	0.2	0.0	1.6	0.0	0.0	4.1	54.8	3	144.2	198.9	1,615.0	1,759.2	1,813.9	1,135.9	62.6	2,949.8
1.11.1	**Processors**					man yrs >	0.40	0.00	0.04	0.02	0.02	0.02	0.00	0.80	0.00	0.00	1.30	5.7	1	54.9	60.6	1,000.0	1,054.9	1,060.6	1,060.6	100.0	2,121.2
1.11.1.1	People and/or Material	2500		2500	0.400		100		10	5	5	5		200			325	5.7	1	54.9	60.6	1,000.0	1,054.9	1,060.6	1,060.6	100.0	2,121.2
1.11.2	**Infrastructure**					man yrs >	0.08	0.00	0.04	0.02	0.02	0.02	0.00	0.20	0.00	0.00	0.38	5.7	8	16.8	22.5	50.0	66.8	72.5	7.2	10.0	79.7
1.11.2.1	People and/or Material	1		1	50.000		20		10	5	5	5		50			95	5.7	8	16.8	22.5	50.0	66.8	72.5	7.2	10.0	79.7
1.11.3	**Disk System (25 Terabytes)**					man yrs >	0.08	0.00	0.04	0.02	0.02	0.02	0.00	0.08	0.00	0.00	0.26	5.7	5	9.2	14.9	100.0	109.2	114.9	11.5	10.0	126.3
1.11.3.1	People and/or Material	1		1	100.000		20		10	5	5	5		20			65	5.7	5	9.2	14.9	100.0	109.2	114.9	11.5	10.0	126.3
1.11.4	**Network Connections**					man yrs >	0.08	0.00	0.04	0.02	0.02	0.02	0.00	0.12	0.00	0.00	0.30	5.7	3	11.7	17.4	150.0	161.7	167.4	16.7	10.0	184.1
1.11.4.1	People and/or Material	1		1	150.000		20		10	5	5	5		30			75	5.7	3	11.7	17.4	150.0	161.7	167.4	16.7	10.0	184.1
1.11.5	**Tape Drives**					man yrs >	0.08	0.00	0.04	0.02	0.02	0.02	0.00	0.08	0.00	0.00	0.26	5.7	5	9.2	14.9	100.0	109.2	114.9	11.5	10.0	126.3
1.11.5.1	People and/or Material	1		1	100.000		20		10	5	5	5		20			65	5.7	5	9.2	14.9	100.0	109.2	114.9	11.5	10.0	126.3
1.11.6	**Connections to FCC**					man yrs >	0.08	0.00	0.04	0.02	0.02	0.02	0.00	0.20	0.00	0.00	0.38	5.7	3	16.8	22.5	200.0	216.8	222.5	22.2	10.0	244.7
1.11.6.1	People and/or Material	1		1	200.000		20		10	5	5	5		50			95	5.7	3	16.8	22.5	200.0	216.8	222.5	22.2	10.0	244.7
1.11.7	**Transportation to and Installation and Testing at C0**					man yrs >	0.24	0.00	0.04	0.02	0.08	0.08	0.00	0.08	0.00	0.00	0.54	11.1	42	15.2	26.3	0.0	15.2	26.3	2.6	10.0	28.9
1.11.7.1	People and/or Material			0			60		10	5	20	20		20			135	11.1	42	15.2	26.3	0.0	15.2	26.3	2.6	10.0	28.9
1.11.8	**ES&H**					man yrs >	0.12	0.00	0.06	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.24	5.8	48	6.3	12.1	0.0	6.3	12.1	1.2	10.0	13.3
1.11.8.1	People and/or Material			0			30		15	15							60	5.8	48	6.3	12.1	0.0	6.3	12.1	1.2	10.0	13.3
1.11.9	**Level 2/3 Processor Array Project Management**					man yrs >	0.32	0.00	0.02	0.02	0.02	0.02	0.00	0.00	0.00	0.00	0.40	3.8	16	4.1	7.9	15.0	19.1	22.9	2.3	10.0	25.1
1.11.9.1	People, Travel and/or Material	10		10	1.500		80		5	5	5	5					100	3.8	16	4.1	7.9	15.0	19.1	22.9	2.3	10.0	25.1
1.13	**Controls/Monitoring & Timing**					man yrs >	1.7	0.1	5.3	1.4	0.2	0.0	3.2	2.5	0.0	0.0	14.5	722.6	45	307.7	1,030.3	565.5	873.2	1,595.8	372.8	23.4	1,968.6
1.13.1	**Accelerator Timing Generator**					man yrs >	0.00	0.00	1.52	0.28	0.00	0.00	1.52	0.52	0.00	0.00	3.84	234.8	70	62.6	297.4	39.3	101.9	336.7	45.5	13.5	382.2
1.13.1.1	Timing R&D																										156.0
1.13.1.1.1	Phase Lock Loop	2	0	2	2.500				80	10			80				170	49.4	84	4.2	53.7	5.0	9.2	58.7	8.2	14.0	66.9
1.13.1.1.2	Fiber Optic Link Accuracy & Jitter	2	0	2	1.000				60				60				120	37.1	95	0.0	37.1	2.0	2.0	39.1	5.5	14.0	44.6
1.13.1.1.3	Copper Link Accuracy & Jitter	2	0	2	1.000				60				60				120	37.1	95	0.0	37.1	2.0	2.0	39.1	5.5	14.0	44.6
1.13.1.2	Accelerator Timing System Interface																									0.0	226.2
1.13.1.2.1	Cables From/To Accelerator Timing Interface	1	2	3	0.100					30				30			60	0.0	0	20.3	20.3	0.3	20.6	20.6	1.2	6.0	21.8
1.13.1.2.2	Circuit Board																										204.4
1.13.1.2.2.1	Development & Prototypes	6	0	6	2.000				180				180				360	111.2	90	0.0	111.2	12.0	12.0	123.2	17.3	14.0	140.5
1.13.1.2.2.2	Production	3	6	9	2.000					30				100			130	0.0	0	38.1	38.1	18.0	56.1	56.1	7.8	14.0	63.9
1.13.2	**Controls/Monitoring Host & Timing Interface**					man yrs >	0.20	0.00	0.46	0.16	0.00	0.00	0.20	0.16	0.00	0.00	1.18	56.0	49	27.0	83.0	31.0	58.0	114.0	21.3	18.6	135.3
1.13.2.1	Host Computer (Windows PC)	1	1	2	7.500				10	10				10			30	3.9	15	6.8	10.6	15.0	21.8	25.6	1.3	5.0	26.9
1.13.2.2	Host Controller Control/Monitoring & Timing Fanout																										108.4
1.13.2.2.1	Development & Prototypes																										71.7
1.13.2.2.1.1	Control/Monitoring Circuitry	8		8	0.400				30				15				45	15.1	82	0.0	15.1	3.2	3.2	18.3	3.7	20.0	21.9

WBS Number	WBS Name or Description	Base Quantity	Spares Quantity	Total Quantity	Base Unit (K$)	Units	PH.D (days)	PH.M (days)	EN.D (days)	EN.M (days)	SW.D (days)	SW.M (days)	TE.D (days)	TE.M (days)	LA.D (days)	LA.M (days)	Labor (days)	Dev Labor (K$)	Dev Labor (%)	Mfg Labor (K$)	Tot Labor (K$)	Tot Mtrl (K$)	Mtrl+Mfg (K$)	Base Cost (K$)	Contingency (K$)	Contingency (%)	Total Cost (K$)
1.13.2.2.1.2	Timing Circuitry	8		8	0.200		30		30				15				75	15.1	90	0.0	15.1	1.6	1.6	16.7	3.3	20.0	20.0
1.12.2.2.1.3	Interface To Fermilab's Fire Alarm System	8		8	0.150				20				10				30	10.0	89	0.0	10.0	1.2	1.2	11.2	2.2	20.0	13.5
1.12.2.2.1.4	Link Interfaces	8		8	0.200		20		25				10				55	12.0	88	0.0	12.0	1.6	1.6	13.6	2.7	20.0	16.3
1.13.2.2.2	Production	10	2	12	0.700					30				30			60	0.0	0	20.3	20.3	8.4	28.7	28.7	8.0	28.0	36.7
1.13.3	**Control/Monitoring & Timing Hub**					man yrs >	0.24	0.00	0.58	0.16	0.00	0.00	0.24	0.48	0.00	0.00	1.70	69.9	19	47.4	117.3	247.2	294.6	364.5	94.7	26.0	459.1
1.13.3.1	Development & Prototypes																										102.8
1.13.3.1.1	Control/Monitoring Circuitry	12		12	0.400		30		40				15				85	18.9	80	0.0	18.9	4.8	4.8	23.7	4.7	20.0	28.5
1.13.3.1.2	Timing Circuitry	12		12	0.200		30		40				15				85	18.9	89	0.0	18.9	2.4	2.4	21.3	4.3	20.0	25.6
1.13.3.1.3	Alarms & Limits Circuitry & Cabling	12		12	0.150				20				10				30	10.0	85	0.0	10.0	1.8	1.8	11.8	2.1	18.0	14.0
1.13.3.1.4	Alarms & Limits Interface To Fermilab's Fire Alarm System	12		12	0.100				20				10				30	10.0	89	0.0	10.0	1.2	1.2	11.2	2.0	18.0	13.3
1.13.3.1.5	Link Interfaces	12		12	0.500				25				10				35	12.0	67	0.0	12.0	6.0	6.0	18.0	3.6	20.0	21.6
1.13.3.2	Production	190	20	210	1.100					40				120			160	0.0	0	47.4	47.4	231.0	278.4	278.4	77.9	28.0	356.3
1.13.4	**Control/Monitoring & Timing Links and Monitoring Interface**					man yrs >	0.32	0.00	0.32	0.24	0.00	0.00	0.20	0.36	0.00	0.00	1.44	42.5	21	48.2	90.7	112.9	161.1	203.5	37.7	18.5	241.3
1.13.4.1	Control/Monitoring & Timing Links																										199.4
1.13.4.1.1	Development & Prototypes	20	0	20	0.500		60		60				30				150	30.1	75	0.0	30.1	10.0	10.0	40.1	8.0	20.0	48.1
1.13.4.1.2	Production	3101	310	3411	0.030					20				60			80	0.0	0	23.7	23.7	102.3	126.0	126.0	25.2	20.0	151.2
1.13.4.2	Monitoring Interface from DAQ System Data Flow Controller																0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0		41.9
1.13.4.2.1	Development & Prototypes	1		1	0.500		20		20				20				60	12.4	96	0.0	12.4	0.5	0.5	12.9	1.5	12.0	14.4
1.13.4.2.2	Production	1		1	0.050					40				30			70	0.0	0	24.5	24.5	0.1	24.6	24.6	2.9	12.0	27.5
1.13.5	**Packaging, Power Cooling & Protection**					man yrs >	0.00	0.00	0.08	0.08	0.00	0.00	0.12	0.08	0.00	0.00	0.36	14.7	26	13.5	28.2	28.2	41.7	56.4	3.9	7.0	60.3
1.13.5.1	Development & Prototypes	12		12	0.600				20				30				50	14.7	67	0.0	14.7	7.2	7.2	21.9	1.5	7.0	23.4
1.13.5.2	Production	190	20	210	0.100					20				20			40	0.0	0	13.5	13.5	21.0	34.5	34.5	2.4	7.0	36.9
1.13.6	**Rad-Hard C/M&T ICs for Pixel and Microstrip Systems**					man yrs >	0.04	0.00	1.60	0.20	0.00	0.00	0.44	0.40	0.00	0.00	2.68	179.9	66	46.5	226.4	47.9	94.4	274.3	134.4	49.0	408.7
1.13.6.1	Development and Prototypes																										354.7
1.13.6.1.1	Prototype Run 1	26		26	0.460	each			130				30				160	57.1	83	0.0	57.1	12.0	12.0	69.1	44.2	64.0	113.3
1.13.6.1.2	Prototype Run 2	26		26	0.460	each			130				30				160	57.1	83	0.0	57.1	12.0	12.0	69.1	44.2	64.0	113.3
1.13.6.1.3	Prototype Run 3	26		26	0.460	each			130				30				160	57.1	83	0.0	57.1	12.0	12.0	69.1	33.2	48.0	102.3
1.13.6.1.4	Test Fixtures	6		6	2.000	each			10				20				30	8.5	41	0.0	8.5	12.0	12.0	20.5	5.3	26.0	25.8
1.13.6.2	Production Ordering and Testing						10			50				100			160	0.0	0	46.5	46.5	0.0	46.5	46.5	7.4	16.0	53.9
1.13.7	**Hardware and Software Specific to C/M & T Development & Testing**					man yrs >	0.32	0.00	0.20	0.00	0.24	0.00	0.16	0.00	0.00	0.00	0.92	50.4	67	0.0	50.4	25.0	25.0	75.4	7.1	9.4	82.5
1.13.7.1	Development & Test Hardware																										47.5
1.13.7.1.1	Rad-Hard Control/Monitoring & Timing IC Probe Station Adapter	1	1	2	5.000		40		40				20				100	20.1	67	0.0	20.1	10.0	10.0	30.1	1.5	5.0	31.6
1.13.7.1.2	Adapters To BteV-Standard Test Stands	6		6	1.500		10		10				10				30	6.2	41	0.0	6.2	9.0	9.0	15.2	0.8	5.0	15.9
1.13.7.2	Development & Test Software	2															0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	16.0	35.0
1.13.7.2.1	Control/Monitoring Software	1		3	2.000		30				60		10				100	24.2	80	0.0	24.2	6.0	6.0	30.2	4.8	16.0	35.0
1.13.8	**ES&H**					man yrs >	0.04	0.04	0.06	0.05	0.00	0.00	0.04	0.00	0.00	0.00	0.23	8.0	36	5.1	13.0	9.0	14.1	22.0	0.2	0.9	22.2
1.13.8.1	Electrical & Electronics	1		1	5.000		5	5	5	5			5				25	3.1	30	2.1	5.2	5.0	7.1	10.2	0.1	1.0	10.3
1.13.8.2	Environmental	1		1	2.000		2	2	5	5			2				16	2.4	37	2.1	4.5	2.0	4.1	6.5	0.1	1.0	6.6
1.13.8.3	Radiation Safety	1		1	2.000		2	2	2	2			2				10	1.2	30	0.8	2.1	2.0	2.8	4.1	0.0	1.0	4.1
1.13.8.4	Training			0			2		2				2				6	1.2	100	0.0	1.2	0.0	0.0	1.2	0.0	1.0	1.2
1.13.9	**Transportation to and Installation & Testing at C0**					man yrs >	0.16	0.00	0.00	0.16	0.00	0.00	0.00	0.48	0.00	0.00	0.80	0.0	0	47.4	47.4	5.0	52.4	52.4	12.6	24.0	64.9
1.13.9.1	People and/or Material	1		1	5.000		40			40				120			200	0.0	0	47.4	47.4	5.0	52.4	52.4	12.6	24.0	64.9
1.13.10	**Controls/Monitoring & Timing Project Management**					man yrs >	0.40	0.06	0.52	0.06	0.00	0.00	0.28	0.06	0.00	0.00	1.38	66.4	69	10.1	76.6	20.0	30.1	96.6	15.4	16.0	112.0
1.13.10.1	Project Coordination			0			60	10	90	10			30	10			210	41.7	86	6.8	48.5	0.0	6.8	48.5	7.8	16.0	56.2
1.13.10.2	Project Reviews			0					10				10				20	6.2	100	0.0	6.2	0.0	0.0	6.2	1.0	16.0	7.2
1.13.10.3	ES&H Reviews			0					10				10				20	6.2	100	0.0	6.2	0.0	0.0	6.2	1.0	16.0	7.2
1.13.10.4	Travel	10		10	2.000		40	5	20	5			20	5			95	12.4	35	3.4	15.7	20.0	23.4	35.7	5.7	16.0	41.5
1.14	**Control Room Electronics & Equipment Infrastructure**					man yrs	0.3	0.3	0.7	0.5	0.0	0.0	0.4	1.1	0.0	0.0	3.3	89.3	8	120.3	209.6	844.8	965.1	1,054.4	106.9	10.1	1,161.3
1.14.1	**Control Room Electronics**					man yrs >	0.12	0.11	0.26	0.14	0.00	0.00	0.10	0.39	0.00	0.00	1.12	30.7	7	40.1	70.7	354.9	395.0	425.6	42.6	10.0	468.2
1.14.1.1	Accelerator Monitoring Interface																										151.8
1.14.1.1.1	Accelerator I/O Crate + Power supply	2	1	3	5.000	each	2	2		2				2			8	0.0	0	1.4	1.4	15.0	16.4	16.4	1.6	10.0	18.0
1.14.1.1.2	Accelerator I/O Modules	4	2	6	4.000	each	2	2	14	5			14	14			51	8.7	23	5.7	14.3	24.0	29.7	38.3	3.8	10.0	42.1
1.14.1.1.3	Accelerator Timing Signals	4	2	6	10.000	each	2	5	21	7			7	21			63	9.7	12	8.3	18.0	60.0	68.3	78.0	7.8	10.0	85.8
1.14.1.1.4	TV Monitors	9	1	10	0.200	each		2	2	2			2	5			13	1.2	23	2.1	3.4	2.0	4.1	5.4	0.5	10.0	5.9
1.14.1.2	Experiment Control Computing																										219.1
1.14.1.2.1	Data Acquisition Control Main Computer	1	1	2	20.000	each	5	5	5	5				2			22	1.9	42	2.6	4.5	0.0	2.6	4.5	0.5	10.0	5.0
1.14.1.2.2	Experimenter Interface Consoles Computers	5	1	6	3.000	each	10	2	10	0				7			29	3.9	16	1.8	5.6	18.0	19.8	23.6	2.4	10.0	26.0
1.14.1.2.3	Software and Licenses	7	0	7	20.000	each	5		5	5				5			20	1.9	1	3.4	5.3	140.0	143.4	145.3	14.5	10.0	159.8
1.14.1.2.4	Backup Media and Storage Systems	5	1	6	4.000	each			1					5			6	0.4	2	1.3	1.7	24.0	25.3	25.7	2.6	10.0	28.2
1.14.1.3	Networks And Consoles																										97.3
1.14.1.3.1	Interface To Network Backbone																										54.0
1.14.1.3.1.1	Router/Firewall and fiber completion	1	0	1	30.000	each	2	2	4	4				7			19	1.5	4	3.5	5.0	30.0	33.5	35.0	3.5	10.0	38.5
1.14.1.3.1.2	Hubs, counting room and offices.	2	1	3	4.000	each		2		2				5			9	0.0	0	2.1	2.1	12.0	14.1	14.1	1.4	10.0	15.5
1.14.1.3.2	LAN (Ethernet)																										17.5
1.14.1.3.2.1	Network Cabling	50	5	55	0.100	each	2	2	2	2				7			15	0.8	9	2.6	3.4	5.5	8.1	8.9	0.9	10.0	9.8
1.14.1.3.2.2	Mini-Hubs	10	0	10	0.100	each		2		2				5			9	0.0	0	2.1	2.1	1.0	3.1	3.1	0.3	10.0	3.4
1.14.1.3.2.3	Miscellaneous	1	0	1	3.000	each	1	1	1				1	1			5	0.6	16	0.3	0.9	3.0	3.3	3.9	0.4	10.0	4.3
1.14.1.3.3	Operator Consoles and Infrastructure																										25.8
1.14.1.3.3.1	Console Racks	6	0	6	0.700	each								4			4	0.0	0	1.0	1.0	4.2	5.2	5.2	0.5	10.0	5.7
1.14.1.3.3.2	PC-Driven Monitors	15	0	15	1.000	each								4			4	0.0	0	1.0	1.0	15.0	16.0	16.0	1.6	10.0	17.6
1.14.1.3.3.3	Extra Keyboards, Mice, Switches and Cabling	5	1	6	0.200	each								4			4	0.0	0	1.0	1.0	1.2	2.2	2.2	0.2	10.0	2.4
1.14.2	**Control Room Infrastructure**					man yrs >	0.08	0.02	0.16	0.06	0.00	0.00	0.23	0.60	0.00	0.00	1.15	28.9	6	44.6	73.5	447.9	492.5	521.4	52.1	10.0	573.5
1.14.2.1	Raised Computer Room Floor Modifications	1	0	1	2.000	each	5		5	2			2	7			21	2.4	34	2.6	5.0	2.0	4.6	7.0	0.7	10.0	7.7
1.14.2.2	Overhead Cable Trays	3	0	3	1.000	each	2		2	2			2	7			15	1.2	18	2.6	3.9	3.0	5.6	6.9	0.7	10.0	7.5
1.14.2.3	Relay Racks, Rack Cooling and Protection																										264.9
1.14.2.3.1	Relay Racks	19	6	25	0.700	each			1				2	4			7	0.9	4	1.0	1.9	17.5	18.5	19.4	1.9	10.0	21.3
1.14.2.3.2	Rack Cooling System	19	6	25	2.000	each			2				2	5			9	1.2	2	1.3	2.5	50.0	51.3	52.5	5.3	10.0	57.8
1.14.2.3.3	Power Monitors, Rack and Consoles	12	2	14	3.000	each	2		4	2			2	7			17	2.0	4	2.6	4.6	42.0	44.6	46.6	4.7	10.0	51.3
1.14.2.3.4	Safety Monitors, Rack and Consoles	19	6	25	3.000	each	2		4	2			2	7			17	2.0	3	2.6	4.6	75.0	77.6	79.6	8.0	10.0	87.6
1.14.2.3.5	Operator Status/Alarm Notification System	1	1	2	15.000	each	5	3	14	5			7	14			48	7.0	16	5.7	12.7	30.0	35.7	42.7	4.3	10.0	47.0
1.14.2.4	AC Power Distribution Modifications																										40.9
1.14.2.4.1	240V 3 Phase Power Distribution	1		1	5.000	each								7			7	0.0	0	1.8	1.8	5.0	6.8	6.8	0.7	10.0	7.5
1.14.2.4.2	Additional Circuit Breaker Boxes	2		2	0.500	each								7			7	0.0	0	1.8	1.8	1.0	2.8	2.8	0.3	10.0	3.1
1.14.2.4.3	110V Power Distribution Inside The Control Room	1		1	5.000	each								7			7	0.0	0	1.8	1.8	5.0	6.8	6.8	0.7	10.0	7.5
1.14.2.4.4	AC Power Line Monitors and Indicators	3	1	4	0.600	each							2	2			4	0.5	14	0.5	1.0	2.4	2.9	3.4	0.3	10.0	3.7
1.14.2.4.5	UPS Systems	3		3	5.000	each	1		2				2	5			10	1.2	7	1.3	2.5	15.0	16.3	17.5	1.8	10.0	19.3

WBS Number	WBS Name or Description	Base Quantity	Spares Quantity	Total Quantity	Base Unit (K$)	Units	PH.D (days)	PH.M (days)	EN.D (days)	EN.M (days)	SW.D (days)	SW.M (days)	TE.D (days)	TE.M (days)	LA.D (days)	LA.M (days)	Labor (days)	Dev Labor (K$)	Dev Labor (%)	Mfg Labor (K$)	Tot Labor (K$)	Tot Mtrl (K$)	Mtrl+Mfg (K$)	Base Cost (K$)	Contingency (K$)	Contingency (%)	Total Cost (K$)
1.14.2.5	MiscellaneousInfrastructure																										252.4
1.14.2.5.1	Miscellaneous Items (including CPU shelving)	1	0	1	20.000	each	2	1	2	1			5	10			21	1.9	8	3.0	4.9	20.0	23.0	24.9	2.5	10.0	27.4
1.14.2.5.2	Repair Equipment and Miscellaneous Spare Boards	1		1	120.000	each			2	2			5	10			19	1.9	2	3.4	5.3	120.0	123.4	125.3	12.5	10.0	137.8
1.14.2.5.3	Furniture	1		1	60.000	each	2		2				25	50			79	6.6	8	12.7	19.3	60.0	72.7	79.3	7.9	10.0	87.2
1.14.3	**ES&H**					man yrs >	0.03	0.08	0.03	0.08	0.00	0.00	0.05	0.12	0.00	0.00	0.40	6.1	14	16.1	22.2	20.0	36.1	42.2	4.2	10.0	46.4
1.14.3.1	Electrical and Electronics (all material for WBS 1.14.3 in this row)	1		1	20.000	total	2	5	2	5			2	5			21	1.2	5	3.4	4.6	20.0	23.4	24.6	2.5	10.0	27.1
1.14.3.2	Environmental					each	2	5	2	5			2	5			21	1.2	27	3.4	4.6	0.0	3.4	4.6	0.5	10.0	5.1
1.14.3.3	Radiation Safety					each	2	5	2	5			2	5			21	1.2	27	3.4	4.6	0.0	3.4	4.6	0.5	10.0	5.1
1.14.3.4	Training					each	2	5	2	5			2	5			21	1.2	27	3.4	4.6	0.0	3.4	4.6	0.5	10.0	5.1
1.14.3.5	ES&H Items for Infrastructure			0		each							5	10			15	1.2	31	2.5	3.7	0.0	2.5	3.7	0.4	10.0	4.1
1.14.4	**Transportation, Installation and Testing at C0**					man yrs >	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.02	0.00	0.00	0.05	0.9	11	1.9	2.7	5.0	6.9	7.7	0.8	10.0	8.5
1.14.4.1	People and/or Material	1		1	5.000	each	1	2	1	2			2	4			12	0.9	11	1.9	2.7	5.0	6.9	7.7	0.8	10.0	8.5
1.14.5	**Control Room Electronics Project Management**					man yrs >	0.10	0.05	0.22	0.17	0.00	0.00	0.02	0.00	0.00	0.00	0.56	22.8	40	17.7	40.5	17.0	34.7	57.5	7.2	12.5	64.7
1.14.5.1	Project Coordination	1		1	5.000	each	7	7	7	7							28	2.7	25	3.0	5.7	5.0	8.0	10.7	1.1	10.0	11.7
1.14.5.2	Project Reviews			0			14		14				5				33	6.6	100	0.0	6.6	0.0	0.0	6.6	0.7	10.0	7.2
1.14.5.3	ES&H Reviews			0					30	30							60	11.6	48	12.7	24.2	0.0	12.7	24.2	3.9	16.0	28.1
1.14.5.4	Travel	4	2	6	2.000	each	5	5	5	5							20	1.9	12	2.1	4.0	12.0	14.1	16.0	1.6	10.0	17.6
1.15	**Control, Monitoring and Event Readout (DAQ) Software**					man yrs >	9.4	1.0	0.0	0.0	17.6	3.4	1.6	0.0	0.0	0.0	33.1	1,694.4	68	340.3	2,034.7	440.5	780.8	2,475.2	393.3	15.9	2,868.5
1.15.1	**Run and Data Acquisition System Software**					man yrs >	0.52	0.00	0.00	0.00	10.90	0.00	0.36	0.00	0.00	0.00	11.78	1,012.8	78	0.0	1,012.8	290.0	290.0	1,302.8	151.3	11.6	1,454.1
1.15.1.1	Host Computers and Peripherals																										374.8
1.15.1.1.1	Run Control Host Computers and Peripherals	10	0	10	4.000												0	0.0	0	0.0	0.0	40.0	40.0	40.0	2.8	7.0	42.8
1.15.1.1.2	Online Database Machines and Peripherals	2	0	2	75.000												0	0.0	0	0.0	0.0	150.0	150.0	150.0	0.0	0.0	150.0
1.15.1.1.3	Online System Manager	1	0	1							500						500	182.0	100	0.0	182.0	0.0	0.0	182.0	0.0	0.0	182.0
1.15.1.2	Run Control			0							375						375	136.5	100	0.0	136.5	0.0	0.0	136.5	21.8	16.0	158.3
1.15.1.3	Data Flow Monitoring			0							250						250	91.0	100	0.0	91.0	0.0	0.0	91.0	14.6	16.0	105.6
1.15.1.4	Error Logging			0			10				170						180	61.9	100	0.0	61.9	0.0	0.0	61.9	9.9	16.0	71.8
1.15.1.5	Configuration Databases			0			120				750		90				960	293.9	100	0.0	293.9	0.0	0.0	293.9	47.0	16.0	340.9
1.15.1.6	Information Services	1		1	100.000						60						60	21.8	18	0.0	21.8	100.0	100.0	121.8	19.5	16.0	141.3
1.15.1.7	Process Management			0							170						170	61.9	100	0.0	61.9	0.0	0.0	61.9	9.9	16.0	71.8
1.15.1.8	Resource Manager			0							60						60	21.8	100	0.0	21.8	0.0	0.0	21.8	3.1	14.0	24.9
1.15.1.9	Partition Manager			0							40						40	14.6	100	0.0	14.6	0.0	0.0	14.6	2.3	16.0	16.9
1.15.1.10	Test Manager			0													0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.15.1.11	Diagnostics			0							170						170	61.9	100	0.0	61.9	0.0	0.0	61.9	9.9	16.0	71.8
1.15.1.12	Integrated Graphical User Interface			0							120						120	43.7	100	0.0	43.7	0.0	0.0	43.7	7.0	16.0	50.7
1.15.1.13	Online Bookkeeper			0							60						60	21.8	100	0.0	21.8	0.0	0.0	21.8	3.5	16.0	25.3
1.15.2	**Test Stand Software**					man yrs >	0.00	0.00	0.00	0.00	2.96	0.00	0.00	0.00	0.00	0.00	2.96	269.4	96	0.0	269.4	10.0	10.0	279.4	43.4	15.5	322.8
1.15.2.1	Frameworks			0							620						620	225.7	100	0.0	225.7	0.0	0.0	225.7	36.1	16.0	261.8
1.15.2.2	Operating Systems Licenses	20	5	25	0.400												0	0.0	0	0.0	0.0	10.0	10.0	10.0	0.3	3.0	10.3
1.15.2.3	Training and User Support			0							120						120	43.7	100	0.0	43.7	0.0	0.0	43.7	7.0	16.0	50.7
1.15.3	**Slow Controls**					man yrs >	6.48	0.00	0.00	0.00	1.72	0.00	1.24	0.00	0.00	0.00	9.44	228.4	67	0.0	228.4	113.0	113.0	341.4	54.6	16.0	396.1
1.15.3.1	Specification			0			500				120		60				680	57.6	100	0.0	57.6	0.0	0.0	57.6	9.2	16.0	66.8
1.15.3.2	Hardware - Computers and Networks	10	1	11	3.000												0	0.0	0	0.0	0.0	33.0	33.0	33.0	5.3	16.0	38.3
1.15.3.3	Licenses	10		10	8.000												0	0.0	0	0.0	0.0	80.0	80.0	80.0	12.8	16.0	92.8
1.15.3.4	Evaluation and Selection			0			120				30						150	10.9	100	0.0	10.9	0.0	0.0	10.9	1.7	16.0	12.7
1.15.3.5	Installation			0			500				40		250				790	72.6	100	0.0	72.6	0.0	0.0	72.6	11.6	16.0	84.2
1.15.3.6	BTeV interfaces and experiment specific applications			0			500				120						620	43.7	100	0.0	43.7	0.0	0.0	43.7	7.0	16.0	50.7
1.15.3.7	Training and User Support			0							120						120	43.7	100	0.0	43.7	0.0	0.0	43.7	7.0	16.0	50.7
1.15.4	**ES&H**					man yrs >	0.20	0.00	0.00	0.00	0.08	0.08	0.00	0.00	0.00	0.00	0.36	7.3	48	8.0	15.2	0.0	8.0	15.2	2.4	16.0	17.7
1.15.4.1	Environmental			0			30				10	10					50	3.6	48	4.0	7.6	0.0	4.0	7.6	1.2	16.0	8.8
1.15.4.2	Training			0			20				10	10					40	3.6	48	4.0	7.6	0.0	4.0	7.6	1.2	16.0	8.8
1.15.5	**Testing at C0**					man yrs >	0.00	1.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	3.00	0.0	0	199.0	199.0	0.0	199.0	199.0	87.6	44.0	286.6
1.15.5.1	People and/or Material							250				500					750	0.0	0	199.0	199.0	0.0	199.0	199.0	87.6	44.0	286.6
1.15.6	**Control, Monitoring & DAQ Software Project Management**					man yrs >	2.24	0.00	0.00	0.00	1.94	1.34	0.00	0.00	0.00	0.00	5.52	176.5	52	133.3	309.9	27.5	160.8	337.4	54.0	16.0	391.3
1.15.6.1	Project Coordination	1		1	5.000		400				300	300					1000	109.2	47	119.4	228.6	5.0	124.4	233.6	37.4	16.0	271.0
1.15.6.2	Project Reviews			0			100				125	25					250	45.5	82	10.0	55.5	0.0	10.0	55.5	8.9	16.0	64.3
1.15.6.3	ES&H Reviews			0			10				10	10					30	3.6	48	4.0	7.6	0.0	4.0	7.6	1.2	16.0	8.8
1.15.6.4	Travel	15		15	1.500		50				50	0					100	18.2	45	0.0	18.2	22.5	22.5	40.7	6.5	16.0	47.2
1.17	**Test Stands and Test Equipment**					man yrs >	0.7	1.1	1.2	1.3	0.4	0.3	0.7	3.4	0.0	0.0	9.1	190.5	13	387.4	577.9	934.4	1,321.8	1,512.3	112.3	7.4	1,624.6
1.17.1	**BTeV-Standard Test Stand Hardware**					man yrs >	0.08	1.00	0.59	1.12	0.00	0.00	0.40	3.25	0.00	0.00	6.44	79.9	9	325.1	405.0	468.7	793.8	873.8	77.6	8.9	951.4
1.17.1.1	Computers																										377.7
1.17.1.1.1	Standard PCs	50	5	55	3.800	each			5					55			60	1.9	1	14.0	15.9	209.0	223.0	224.9	15.7	7.0	240.6
1.17.1.1.2	Industrial PCs	5	1	6	5.179	each			5					9			14	1.9	5	2.3	4.2	31.1	33.4	35.3	2.5	7.0	37.8
1.17.1.1.3	Other Workstations	10	0	10	6.786	each	20	250	10	50							330	3.9	4	21.1	25.0	67.9	89.0	92.8	6.5	7.0	99.3
1.17.1.2	Test Adapter Cards																										310.9
1.17.1.2.1	PCI-Based Interface Cards	77	11	88	0.860	each			80	30			60	96			266	44.8	28	37.0	81.8	75.7	112.7	157.5	44.1	28.0	201.6
1.17.1.2.2	Expansion Chassis and Interface Cards	5	1	6	1.436	each			5					6			11	1.9	16	1.5	3.5	8.6	10.1	12.1	0.8	7.0	12.9
1.17.1.2.3	Wafer Probe Cards	5	2	7	10.000	each			20	20			20	20			80	12.4	13	13.5	25.9	70.0	83.5	95.9	0.0	0.0	95.9
1.17.1.2.4	GPIB Catd (NI AT/TNT) and Cable	5		5	0.100	each											0	0.0	0	0.0	0.0	0.5	0.5	0.5	0.0	0.0	0.5
1.17.1.3	Cables	264	52	316	0.019	each			2					2			4	0.8	11	0.5	1.3	6.0	6.5	7.3	0.5	7.0	7.8
1.17.1.4	Test Stand Setup, Testing and Distribution			0					20	181			20	625			846	12.4	5	235.1	247.5	0.0	235.1	247.5	7.4	3.0	254.9
1.17.2	**Test Equipment**					man yrs >	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.07	0.00	0.00	0.12	0.0	0	9.4	9.4	440.7	450.1	450.1	4.5	1.0	454.6
1.17.2.1	Logic Analyzers																										124.9
1.17.2.1.1	Logic Analyzer Mainframe	3	0	3	10.700	each				1				3			4	0.0	0	1.2	1.2	32.1	33.3	33.3	0.3	1.0	33.6
1.17.2.1.2	102 Channel Logic Analyzer	3	0	3	9.000	each											0	0.0	0	0.0	0.0	27.0	27.0	27.0	0.3	1.0	27.3
1.17.2.1.3	Termination Adapters and Accessories	12	2	14	0.345	each											0	0.0	0	0.0	0.0	4.8	4.8	4.8	0.0	1.0	4.9
1.17.2.1.4	Two Channel Digital Oscilloscopes	3	0	3	8.600	each											0	0.0	0	0.0	0.0	25.8	25.8	25.8	0.3	1.0	26.1
1.17.2.1.5	Pattern Generators	4	0	4	6.100	each											0	0.0	0	0.0	0.0	24.4	24.4	24.4	0.2	1.0	24.6
1.17.2.1.6	Stimulus and Response Pods and Accessories	6	0	6	0.150	each											0	0.0	0	0.0	0.0	0.9	0.9	0.9	0.0	1.0	0.9
1.17.2.1.7	Monitors	3	0	3	1.300	each											0	0.0	0	0.0	0.0	3.9	3.9	3.9	0.0	1.0	3.9
1.17.2.1.8	Color Printers	3	0	3	0.250	each											0	0.0	0	0.0	0.0	0.8	0.8	0.8	0.0	1.0	0.8
1.17.2.1.9	Instrument Carts	3	0	3	0.930	each											0	0.0	0	0.0	0.0	2.8	2.8	2.8	0.0	1.0	2.8
1.17.2.2	Oscilloscopes																										94.7
1.17.2.2.1	Four Channel Digital Oscilloscopes	2	0	2	37.000	each				1				2			3	0.0	0	0.9	0.9	74.0	74.9	74.9	0.7	1.0	75.7
1.17.2.2.2	Active Probes and Accessories	4	0	4	2.400	each											0	0.0	0	0.0	0.0	9.6	9.6	9.6	0.1	1.0	9.7
1.17.2.2.3	Optical-to-Electrical Converters	2	0	2	3.700	each											0	0.0	0	0.0	0.0	7.4	7.4	7.4	0.1	1.0	7.5

WBS Number	WBS Name or Description	Base Quantity	Spares Quantity	Total Quantity	Base Unit (K$)	Units	PH.D (days)	PH.M (days)	EN.D (days)	EN.M (days)	SW.D (days)	SW.M (days)	TE.D (days)	TE.M (days)	LA.D (days)	LA.M (days)	Labor (days)	Dev Labor (K$)	Dev Labor (%)	Mfg Labor (K$)	Tot Labor (K$)	Tot Mtrl (K$)	Mtrl+Mfg (K$)	Base Cost (K$)	Contingency (K$)	Contingency (%)	Total Cost (K$)
1.17.2.2.4	Instrument Carts	2	0	2	0.660	each											0	0.0	0	0.0	0.0	1.3	1.3	1.3	0.0	1.0	1.3
1.17.2.2.5	Color Printers	2	0	2	0.250	each											0	0.0	0	0.0	0.0	0.5	0.5	0.5	0.0	1.0	0.5
1.17.2.3	Spectrum Analyzer	1	0	1	43.900	each				1				1			2	0.0	0	0.7	0.7	43.9	44.6	44.6	0.4	1.0	45.0
1.17.2.4	Noise & Common Mode Voltage Generator	1	0	1	15.000	each				1				1			2	0.0	0	0.7	0.7	15.0	15.7	15.7	0.2	1.0	15.8
1.17.2.5	Protocol Checker	1	0	1	20.000	each				1				1			2	0.0	0	0.7	0.7	20.0	20.7	20.7	0.2	1.0	20.9
1.17.2.6	Optical Cable Test Equipment																										3.4
1.17.2.6.1	Optical Source	1	0	1	0.995	each				1				1			2	0.0	0	0.7	0.7	1.0	1.7	1.7	0.0	1.0	1.7
1.17.2.6.2	Optical Power Meter	1	0	1	1.000	each				1				1			2	0.0	0	0.7	0.7	1.0	1.7	1.7	0.0	1.0	1.7
1.17.2.7	Signal Generator	3	0	3	33.300	each				1				3			4	0.0	0	1.2	1.2	99.9	101.1	101.1	1.0	1.0	102.1
1.17.2.8	Digital Multimeter	2	0	2	0.400	each											0	0.0	0	0.0	0.0	0.8	0.8	0.8	0.0	1.0	0.8
1.17.2.9	Bench Power Supplies																										15.3
1.17.2.9.1	High Voltage Supply	2	0	2	1.500	each				1				1			2	0.0	0	0.7	0.7	3.0	3.7	3.7	0.0	1.0	3.7
1.17.2.9.2	Low Voltage Supply	8	1	9	1.200	each				1				1			2	0.0	0	0.7	0.7	10.8	11.5	11.5	0.1	1.0	11.6
1.17.2.10	JTAG Circuit Test Software	1	0	1	30.000	each				2				2			4	0.0	0	1.4	1.4	30.0	31.4	31.4	0.3	1.0	31.7
1.17.3	**Test Stand Software**					man yrs >	0.00	0.00	0.08	0.08	0.32	0.24	0.00	0.04	0.00	0.00	0.76	36.8	42	34.9	71.7	15.0	49.9	86.7	17.3	20.0	104.0
1.17.3.1	LabView	1		1	10.000	each			10	10	40	30		5			95	18.4	40	17.4	35.9	10.0	27.4	45.9	9.2	20.0	55.0
1.17.3.2	Other Test and Analysis Software	1		1	5.000	each			10	10	40	30		5			95	18.4	45	17.4	35.9	5.0	22.4	40.9	8.2	20.0	49.0
1.17.4	**ES&H**					man yrs >	0.20	0.00	0.00	0.00	0.08	0.08	0.00	0.00	0.00	0.00	0.36	7.3	48	8.0	15.2	0.0	8.0	15.2	2.4	16.0	17.7
1.17.4.1	Environmental			0			30				10	10					50	3.6	48	4.0	7.6	0.0	4.0	7.6	1.2	16.0	8.8
1.17.4.2	Training			0			20				10	10					40	3.6	48	4.0	7.6	0.0	4.0	7.6	1.2	16.0	8.8
1.17.5	**Test Stands and Test Equipment Project Management**					man yrs >	0.40	0.06	0.52	0.06	0.00	0.00	0.28	0.06	0.00	0.00	1.38	66.4	77	10.1	76.6	10.0	20.1	86.6	10.4	12.0	97.0
1.17.5.1	Project Coordination			0			60	10	90	10			30	10			210	41.7	86	6.8	48.5	0.0	6.8	48.5	7.3	15.0	55.7
1.17.5.2	Project Reviews			0					10				10				20	6.2	100	0.0	6.2	0.0	0.0	6.2	0.9	15.0	7.1
1.17.5.3	ES&H Reviews			0					10				10				20	6.2	100	0.0	6.2	0.0	0.0	6.2	0.9	15.0	7.1
1.17.5.4	Travel	5		5	2.000	each	40	5	20	5			20	5			95	12.4	48	3.4	15.7	10.0	13.4	25.7	1.3	5.0	27.0
1.18	**(Unassigned)**					man yrs >																					0.0
1.19	**System Installation, Integration & Commissioning**					man yrs >	3.3	14.0	0.8	3.0	0.0	0.0	3.1	9.2	0.0	0.4	33.8	253.9	0	911.7	1,165.6	32.5	944.2	1,198.1	253.4	21.1	1,451.5
1.19.1	**System Installation**					man yrs >	0.00	0.00	0.00	0.36	0.00	0.00	3.00	7.48	0.00	0.00	10.84	174.0	25	513.0	687.0	10.0	523.0	697.0	156.0	22.4	853.0
1.19.1.1	Site Installation Crew (3 Technicians)												750	1500			2250	174.0	31	381.0	555.0	0.0	381.0	555.0	127.7	23.0	682.7
1.19.1.2	Detector and Counting Room Cable Trays	30	0	30	0.200	each								120			120	0.0	0	30.5	30.5	6.0	36.5	36.5	7.3	20.0	43.8
1.19.1.3	Cable Installation																										84.0
1.19.1.3.1	On and Near-Detector	20	0	20	0.050	each				20				80			100	0.0	0	28.8	28.8	1.0	29.8	29.8	6.0	20.0	35.7
1.19.1.3.2	Detector to Counting Room	20	0	20	0.100	each				20				20			40	0.0	0	13.5	13.5	2.0	15.5	15.5	3.1	20.0	18.6
1.19.1.3.3	Counting Room	20	0	20	0.050	each				20				60			80	0.0	0	23.7	23.7	1.0	24.7	24.7	4.9	20.0	29.6
1.19.1.4	Relay Rack and Subrack Installation, Powering & Cooling	4	0	4	0.000	each				30				90			120	0.0	0	35.5	35.5	0.0	35.5	35.5	7.1	20.0	42.6
1.19.2	**Procedure Specification**					man yrs >	0.48	0.20	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.80	0.0	0	12.7	12.7	0.0	12.7	12.7	2.5	20.0	15.2
1.19.2.1	Run Startup & Stop & Partitioning						60	30		10							100	0.0	0	4.2	4.2	0.0	4.2	4.2	0.8	20.0	5.1
1.19.2.2	Halt/Reset/Run & Error Recovery						60	20		20							100	0.0	0	8.4	8.4	0.0	8.4	8.4	1.7	20.0	10.1
1.19.3	**Commission Control, Timing, and Monitoring System**					man yrs >	0.00	0.16	0.00	0.12	0.00	0.00	0.00	0.12	0.00	0.00	0.40	0.0	0	20.3	20.3	0.0	20.3	20.3	4.1	20.0	24.3
1.19.3.1	People and/or Material							40		30				30			100	0.0	0	20.3	20.3	0.0	20.3	20.3	4.1	20.0	24.3
1.19.4	**Establish Simplest Data Readout Path**					man yrs >	0.00	0.08	0.00	0.06	0.00	0.00	0.00	0.04	0.00	0.00	0.18	0.0	0	8.9	8.9	0.0	8.9	8.9	1.8	20.0	10.6
1.19.4.1	People and/or Material							20		15				10			45	0.0	0	8.9	8.9	0.0	8.9	8.9	1.8	20.0	10.6
1.19.5	**Integrate Accelerator Clock with BTeV C/M & T System**					man yrs >	0.00	0.12	0.00	0.04	0.00	0.00	0.00	0.04	0.00	0.00	0.20	0.0	0	6.8	6.8	0.0	6.8	6.8	1.4	20.0	8.1
1.19.5.1	People and/or Material							30		10				10			50	0.0	0	6.8	6.8	0.0	6.8	6.8	1.4	20.0	8.1
1.19.6	**Establish Front-End Timing**					man yrs >	0.20	0.72	0.00	0.24	0.00	0.00	0.00	0.04	0.00	0.00	1.20	0.0	0	27.9	27.9	0.0	27.9	27.9	5.6	20.0	33.4
1.19.6.1	Pixel						10	40		10				10			70	0.0	0	6.8	6.8	0.0	6.8	6.8	1.4	20.0	8.1
1.19.6.2	RICH						10	40		10							60	0.0	0	4.2	4.2	0.0	4.2	4.2	0.8	20.0	5.1
1.19.6.3	EM Calorimeter						10	40		10							60	0.0	0	4.2	4.2	0.0	4.2	4.2	0.8	20.0	5.1
1.19.6.4	Muon						5	20		10							35	0.0	0	4.2	4.2	0.0	4.2	4.2	0.8	20.0	5.1
1.19.6.5	Straws						5	20		10							35	0.0	0	4.2	4.2	0.0	4.2	4.2	0.8	20.0	5.1
1.19.6.6	Silicon Strip Detectors						10	20		10							40	0.0	0	4.2	4.2	0.0	4.2	4.2	0.8	20.0	5.1
1.19.7	**System Integration without Triggers and Event Builder**					man yrs >	0.08	0.24	0.00	0.12	0.00	0.00	0.00	0.08	0.00	0.00	0.52	0.0	0	17.7	17.7	0.0	17.7	17.7	3.5	20.0	21.3
1.19.7.1	People and/or Material						20	60		30				20			130	0.0	0	17.7	17.7	0.0	17.7	17.7	3.5	20.0	21.3
1.19.8	**Level 1 Trigger Testing**					man yrs >	0.20	0.64	0.00	0.30	0.00	0.00	0.00	0.08	0.00	0.00	1.22	0.0	0	36.7	36.7	0.0	36.7	36.7	7.3	20.0	44.1
1.19.8.1	Pixel Trigger						40	80		30				15			165	0.0	0	16.5	16.5	0.0	16.5	16.5	3.3	20.0	19.8
1.19.8.2	Muon Trigger						10	20		15							45	0.0	0	6.3	6.3	0.0	6.3	6.3	1.3	20.0	7.6
1.19.8.3	Integration and Testing of Pixel Trigger with Global Trigger							40		15				5			60	0.0	0	7.6	7.6	0.0	7.6	7.6	1.5	20.0	9.1
1.19.8.4	Integration and Testing of Muon Trigger with Global Trigger							20		15							35	0.0	0	6.3	6.3	0.0	6.3	6.3	1.3	20.0	7.6
1.19.9	**Partial Data Acquisition System Testing**					man yrs >	0.00	0.16	0.00	0.12	0.00	0.00	0.00	0.06	0.00	0.00	0.34	0.0	0	16.5	16.5	0.0	16.5	16.5	3.3	20.0	19.8
1.19.9.1	People and/or Material							40		30				15			85	0.0	0	16.5	16.5	0.0	16.5	16.5	3.3	20.0	19.8
1.19.10	**Integration Of Front-End Systems and Their Triggers**					man yrs >	0.00	0.16	0.00	0.08	0.00	0.00	0.00	0.02	0.00	0.00	0.26	0.0	0	9.7	9.7	0.0	9.7	9.7	1.9	20.0	11.7
1.19.10.1	People and/or Material							40		20				5			65	0.0	0	9.7	9.7	0.0	9.7	9.7	1.9	20.0	11.7
1.19.11	**System Integration Testing and Commissioning**					man yrs >	0.00	0.36	0.00	0.16	0.00	0.00	0.00	0.08	0.00	0.00	0.60	0.0	0	22.0	22.0	0.0	22.0	22.0	4.4	20.0	26.4
1.19.11.1	People and/or Material							90		40				20			150	0.0	0	22.0	22.0	0.0	22.0	22.0	4.4	20.0	26.4
1.19.12	**Establish and Test DAQ Procedures**					man yrs >	0.48	0.72	0.00	0.20	0.00	0.00	0.00	0.12	0.00	0.00	1.52	0.0	0	28.7	28.7	0.0	28.7	28.7	5.7	20.0	34.5
1.19.12.1	Induced Errors and System Recovery Testing																										34.5
1.19.12.1.1	System by System						60	60		30				20			170	0.0	0	17.7	17.7	0.0	17.7	17.7	3.5	20.0	21.3
1.19.12.1.2	Total System						60	120		20				10			210	0.0	0	11.0	11.0	0.0	11.0	11.0	2.2	20.0	13.2
1.19.13	**Establish Detector Alignment Procedures**					man yrs >	0.28	1.00	0.04	0.10	0.00	0.00	0.08	0.40	0.00	0.00	1.90	8.5	19	36.0	44.5	0.0	36.0	44.5	8.9	20.0	53.3
1.19.13.1	Pixel																										32.7
1.19.13.1.1	Precision Movement Subsystem						20	20	5	25			20	40			130	6.6	24	20.7	27.3	0.0	20.7	27.3	5.5	20.0	32.7
1.19.13.1.2	Alignment With Tracks						40	80									120	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	0.0
1.19.13.2	RICH						10	20	5					20			55	1.9	28	5.1	7.0	0.0	5.1	7.0	1.4	20.0	8.4
1.19.13.3	EM Calorimeter							30						10			40	0.0	0	2.5	2.5	0.0	2.5	2.5	0.5	20.0	3.0
1.19.13.4	Muon							20						10			30	0.0	0	2.5	2.5	0.0	2.5	2.5	0.5	20.0	3.0
1.19.13.5	Straws							40						10			50	0.0	0	2.5	2.5	0.0	2.5	2.5	0.5	20.0	3.0
1.19.13.6	Silicon Strip Detectors							40						10			50	0.0	0	2.5	2.5	0.0	2.5	2.5	0.5	20.0	3.0
1.19.14	**Establish Detector Calibration Procedures**					man yrs >	1.60	1.60	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.24	3.9	100	0.0	3.9	0.0	0.0	3.9	0.8	20.0	4.6
1.19.14.1	Pixel						80	80	10								170	3.9	100	0.0	3.9	0.0	0.0	3.9	0.8	20.0	4.6
1.19.14.2	RICH						80	80									160	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	0.0
1.19.14.3	EM Calorimeter						80	80									160	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	0.0
1.19.14.4	Muon						40	40									80	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	0.0
1.19.14.5	Straws						40	40									80	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	0.0
1.19.14.6	Silicon Strip Detectors						80	80									160	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	0.0
1.19.15	**ES&H**					man yrs >	0.00	1.40	0.30	0.26	0.00	0.00	0.00	0.40	0.00	0.00	2.36	29.0	35	52.8	81.8	0.0	52.8	81.8	16.4	20.0	98.1

WBS Number	WBS Name or Description	Base Quantity	Spares Quantity	Total Quantity	Base Unit (K$)	Units	PH.D (days)	PH.M (days)	EN.D (days)	EN.M (days)	SW.D (days)	SW.M (days)	TE.D (days)	TE.M (days)	LA.D (days)	LA.M (days)	Labor (days)	Dev Labor (K$)	Dev Labor (%)	Mfg Labor (K$)	Tot Labor (K$)	Tot Mtrl (K$)	Mtrl+Mfg (K$)	Base Cost (K$)	Contingency (K$)	Contingency (%)	Total Cost (K$)
1.19.15.1	Compliance-Testing and Verification																										98.1
1.19.15.1.1	Electrical and Electronics																										98.1
1.19.15.1.1.1	Low-Voltage Interlocks							10	15	20				20			65	5.8	30	13.5	19.3	0.0	13.5	19.3	3.9	20.0	23.2
1.19.15.1.1.2	High-Voltage Interlocks							10	15	10				20			55	5.8	38	9.3	15.1	0.0	9.3	15.1	3.0	20.0	18.1
1.19.15.1.1.3	Cooling Interlocks							10	15	15				20			60	5.8	34	11.4	17.2	0.0	11.4	17.2	3.4	20.0	20.6
1.19.15.1.1.4	Level 2 System ES&H Compliance-Testing and Verification							10	15	10				20			55	5.8	38	9.3	15.1	0.0	9.3	15.1	3.0	20.0	18.1
1.19.15.1.1.5	Other Systems							10	15	10				20			55	5.8	38	9.3	15.1	0.0	9.3	15.1	3.0	20.0	18.1
1.19.15.1.2	Conventional Safety																0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	0.0
1.19.15.1.3	Radiation Safety																0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	0.0
1.19.15.2	Training							300									300	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	0.0
1.19.16	**System Installation, Integration & Commissioning Project Management**					man yrs >	0.00	6.44	0.40	0.74	0.00	0.00	0.00	0.20	0.00	0.40	8.18	38.6	24	102.2	140.8	22.5	124.7	163.3	29.8	18.2	193.0
1.19.16.1	Project Coordination							250	100	125							475	38.6	42	52.8	91.4	0.0	52.8	91.4	18.3	20.0	109.6
1.19.16.2	Project Reviews							800									800	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	0.0
1.19.16.3	ES&H Reviews							360									360	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	0.0
1.19.16.4	Travel	15		15	1.500			200		60				50		100	410	0.0	0	49.4	49.4	22.5	71.9	71.9	11.5	16.0	83.4
1.20	**BTeV Project Management**					man yrs >	3.0	2.0	9.1	7.8	0.0	0.0	4.1	3.8	0.0	0.0	30	1,119.8	32	1,055.8	2,175.6	1,370.0	2,425.8	3,545.6	312.4	8.8	3,857.9
1.20.1	**BTeV Project Office**					man yrs >	3.00	2.00	9.13	7.75	0.00	0.00	4.13	3.75	0.00	0.00	29.75	1,119.8	41	1,055.8	2,175.6	545.0	1,600.8	2,720.6	174.1	6.4	2,894.7
1.20.1.1	Preparation and Equipping of Office Space																										133.9
1.20.1.1.1	Furniture	10	0	10	2.000	suites											0	0.0	0	0.0	0.0	20.0	20.0	20.0	0.6	3.0	20.6
1.20.1.1.2	Office Equipment (copiers, faxes, phones, etc.)	1	0	1	20.000	total											0	0.0	0	0.0	0.0	20.0	20.0	20.0	0.6	3.0	20.6
1.20.1.1.3	Desktop PCs and Laptops	50	0	50	1.500	ppl-yrs											0	0.0	0	0.0	0.0	75.0	75.0	75.0	2.3	3.0	77.3
1.20.1.1.4	Videoconferencing Equipment	1	0	1	15.000	total											0	0.0	0	0.0	0.0	15.0	15.0	15.0	0.5	3.0	15.5
1.20.1.2	Salaries for BTeV Project Office Staff																										2,333.3
1.20.1.2.1	L1 Project Manager						750	500									1250	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	9.0	0.0
1.20.1.2.2	Deputy Project Manager								625	500							1125	241.3	53	211.0	452.3	0.0	211.0	452.3	40.7	9.0	493.0
1.20.1.2.3	Project Mechanical Engineer								625	500							1125	241.3	53	211.0	452.3	0.0	211.0	452.3	40.7	9.0	493.0
1.20.1.2.4	Project Electronics Engineer								625	500							1125	241.3	53	211.0	452.3	0.0	211.0	452.3	40.7	9.0	493.0
1.20.1.2.5	Project Safety Oficer								94	188			94	188			563	57.9	31	126.8	184.7	0.0	126.8	184.7	16.6	9.0	201.3
1.20.1.2.6	Administrative Assistant/Budget Officer								313	250			313	250			1125	193.1	53	169.0	362.1	0.0	169.0	362.1	10.9	3.0	373.0
1.20.1.2.7	Secretarial Support												625	500			1125	145.0	53	127.0	272.0	0.0	127.0	272.0	8.2	3.0	280.2
1.20.1.3	Support for Project Office																0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	427.5
1.20.1.3.1	Travel	1	0	1	250.000	total travel											0	0.0	0	0.0	0.0	250.0	250.0	250.0	7.5	3.0	257.5
1.20.1.3.2	Supplies and Services	1	0	1	110.000	total											0	0.0	0	0.0	0.0	110.0	110.0	110.0	3.3	3.0	113.3
1.20.1.3.3	Communications	1	0	1	30.000	total											0	0.0	0	0.0	0.0	30.0	30.0	30.0	0.9	3.0	30.9
1.20.1.3.4	Software Licenses for Staff PCs and Laptops	1	0	1	25.000	total											0	0.0	0	0.0	0.0	25.0	25.0	25.0	0.8	3.0	25.8
1.20.2	**Support for Project Management Activities of BTeV Physicists**					man yrs >	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0	0.0	0.0	200.0	200.0	200.0	88.0	44.0	288.0
1.20.2.1	People and/or Material	1	0	1	200.000	total											0	0.0	0	0.0	0.0	200.0	200.0	200.0	88.0	44.0	288.0
1.20.3	**Support for External Reviews and Consultants**					man yrs >	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0	0.0	0.0	475.0	475.0	475.0	19.3	4.1	494.3
1.20.3.1	Travel and Related for Reviews	7	0	7	25.000	reviews											0	0.0	0	0.0	0.0	175.0	175.0	175.0	19.3	11.0	194.3
1.20.3.2	Support for Management Consultants	1	0	1	100.000	total											0	0.0	0	0.0	0.0	100.0	100.0	100.0	0.0	0.0	100.0
1.20.3.3	Support for Technical Consultants	1	0	1	200.000	total											0	0.0	0	0.0	0.0	200.0	200.0	200.0	0.0	0.0	200.0
1.20.4	**Support for Documentation, Report Preparation and Distribution**					man yrs >	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0	0.0	0.0	50.0	50.0	50.0	22.0	44.0	72.0
1.20.4.1	People and/or Material	1	0	1	50.000	total											0	0.0	0	0.0	0.0	50.0	50.0	50.0	22.0	44.0	72.0
1.20.5	**Project Managemnet Software Tools**					man yrs >	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0	0.0	0.0	100.0	100.0	100.0	9.0	9.0	109.0
1.20.5.1	Software Tool Licenses	10		10	3.000	each											0	0.0	0	0.0	0.0	30.0	30.0	30.0	2.7	9.0	32.7
1.20.5.2	Consultants to Adapt or Develop Software	1		1	50.000	total											0	0.0	0	0.0	0.0	50.0	50.0	50.0	4.5	9.0	54.5
1.20.5.3	Training in Project Management Tools	10		10	2.000	each											0	0.0	0	0.0	0.0	20.0	20.0	20.0	1.8	9.0	21.8
1.20.6	**Oversight of BTeV ES&H** (included in 1.20.1.2)					man yrs >	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.20.6.1	Radiation Safety																0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.20.6.2	Environmental Safety																0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.20.6.3	Electrical and Electronics Systems Safety																0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.20.6.4	Mechanical and Gas Systems Safety																0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.20.6.5	ES&H Training																0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0