

**Fermi National Accelerator Laboratory**

## **PIXEL DETECTOR PROJECT**

### **MITEL VCSEL ARRAY TESTS**

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**-PRELIMINARY-**

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## Tests Results on the single VCSEL from Mitel

VCSEL Current i (mA)	VCSEL-1		VCSEL-2	
	Voltage V (Volt)	Intensity I (uW)	Voltage V (Volt)	Intensity I (uW)
0.167	1.39	0.018	1.39	0.017
0.672	1.48	0.165	1.48	0.153
1.5	1.55	0.495	1.55	0.456
2	1.59	0.728	1.60	0.714
4	1.70	2.196	1.72	2.265
6	1.80	132.000	1.83	205.000
8	1.88	397.000	1.91	611.000
10	1.96	629.000	2.00	1,190.000
12	2.04	917.000	2.09	1,650.000
14	2.10	1,202.000	2.16	2,119.000
16	2.17	1,475.000	2.24	2,519.000
18	2.23	1,635.000	2.30	3,000.000
20	2.30	1,846.000	2.37	3,288.000
22	2.36	2,044.000	2.44	3,759.000
24	2.42	2,164.000	2.50	4,170.000
26	2.48	2,334.000	2.57	4,528.000
28	2.52	2,517.000	2.62	4,870.000

Table 1: Intensity, Voltage and current measurements of the two single VCSELs (Mitel, 1A444 ST-2A), the test was done, using a fiber optic (50um/125um, fiber-1) with an ST connector. First test.

VCSEL Current i (mA)	VCSEL-1		VCSEL-2	
	Voltage V (Volt)	Intensity I (uW)	Voltage V (Volt)	Intensity I (uW)
0.166	1.39	0.008	1.39	0.005
0.678	1.48	0.155	1.48	0.120
1.513	1.55	0.488	1.55	0.370
2	1.59	0.722	1.60	0.584
4	1.70	2.190	1.72	1.891
6	1.80	132.000	1.82	205.000
8	1.88	398.000	1.91	546.000
10	1.96	627.000	1.99	946.000
12	2.04	909.000	2.08	1,250.000
14	2.10	1,187.000	2.15	1,600.000
16	2.17	1,443.000	2.23	1,966.000
18	2.23	1,593.000	2.30	2,314.000
20	2.30	1,826.000	2.37	2,630.000
22	2.37	2,051.000	2.44	2,910.000
24	2.42	2,150.000	2.50	3,250.000
26	2.48	2,297.000	2.57	3,634.000
28	2.53	2,477.000	2.62	3,817.000

Table 2: Intensity, Voltage and current measurements of the two single VCSELs (Mitel, 1A444 ST-2A), the test was done, using a fiber optic (50um/125um, fiber-1) with an ST connector. Second test.

VCSEL Current i (mA)	VCSEL-1		VCSEL-2	
	Voltage V (Volt)	Intensity I (uW)	Voltage V (Volt)	Intensity I (uW)
0.160	1.39	0.018	1.39	0.007
0.665	1.48	0.172	1.48	0.111
1.495	1.55	0.518	1.55	0.330
2	1.59	0.699	1.60	0.670
4	1.70	2.145	1.72	2.170
6	1.80	137.000	1.82	190.000
8	1.88	405.000	1.90	617.000
10	1.96	640.000	1.99	1,104.000
12	2.04	907.000	2.08	1,525.000
14	2.10	1,187.000	2.15	1,923.000
16	2.17	1,427.000	2.23	2,367.000
18	2.23	1,575.000	2.29	2,717.000
20	2.30	1,778.000	2.37	3,095.000
22	2.36	1,978.000	2.44	3,494.000
24	2.42	2,096.000	2.50	3,832.000
26	2.48	2,206.000	2.56	4,230.000
28	2.53	2,350.000	2.62	4,555.000

Table 3: Intensity, Voltage and current measurements of the two single VCSELs (Mitel, 1A444 ST-2A), the test was done, using a fiber optic (50um/125um, fiber-2) with an ST connector. First test.

VCSEL Current i (mA)	VCSEL-1		VCSEL-2	
	Voltage V (Volt)	Intensity I (uW)	Voltage V (Volt)	Intensity I (uW)
0.160	1.39	0.006	1.39	0.007
0.667	1.48	0.156	1.48	0.144
1.5	1.55	0.487	1.55	0.437
2	1.59	0.719	1.60	0.687
4	1.70	2.170	1.71	2.111
6	1.80	132.000	1.82	200.000
8	1.88	506.000	1.90	612.000
10	1.96	641.000	1.99	1,089.000
12	2.04	932.000	2.08	1,478.000
14	2.10	1,227.000	2.15	1,811.000
16	2.18	1,503.000	2.23	2,240.000
18	2.23	1,653.000	2.29	2,600.000
20	2.30	1,868.000	2.36	2,885.000
22	2.36	2,056.000	2.44	3,303.000
24	2.42	2,194.000	2.50	3,755.000
26	2.48	2,319.000	2.56	4,050.000
28	2.53	2,464.000	2.62	4,390.000

Table 4: Intensity, Voltage and current measurements of the two single VCSELs (Mitel, 1A444 ST-2A), the test was done, using a fiber optic (50um/125um, fiber-2) with an ST connector. Second test.

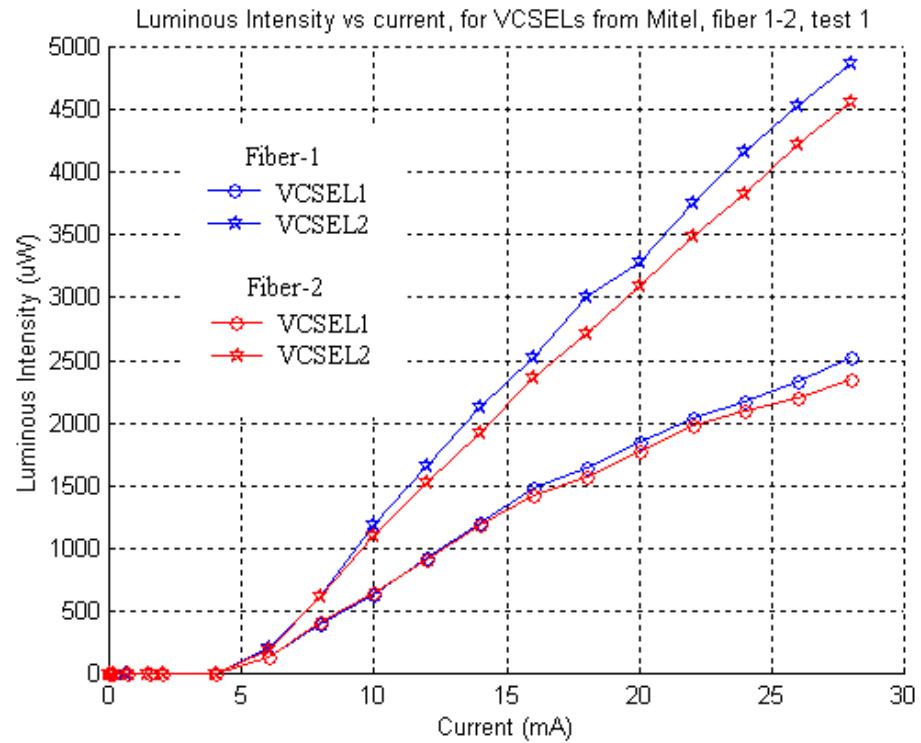


Figure 1: Graphic of Luminous Intensity versus Current for each single VCSEL (Mitel, 1A444 ST-2A). Using optical fiber 1 and 2 in the first test.

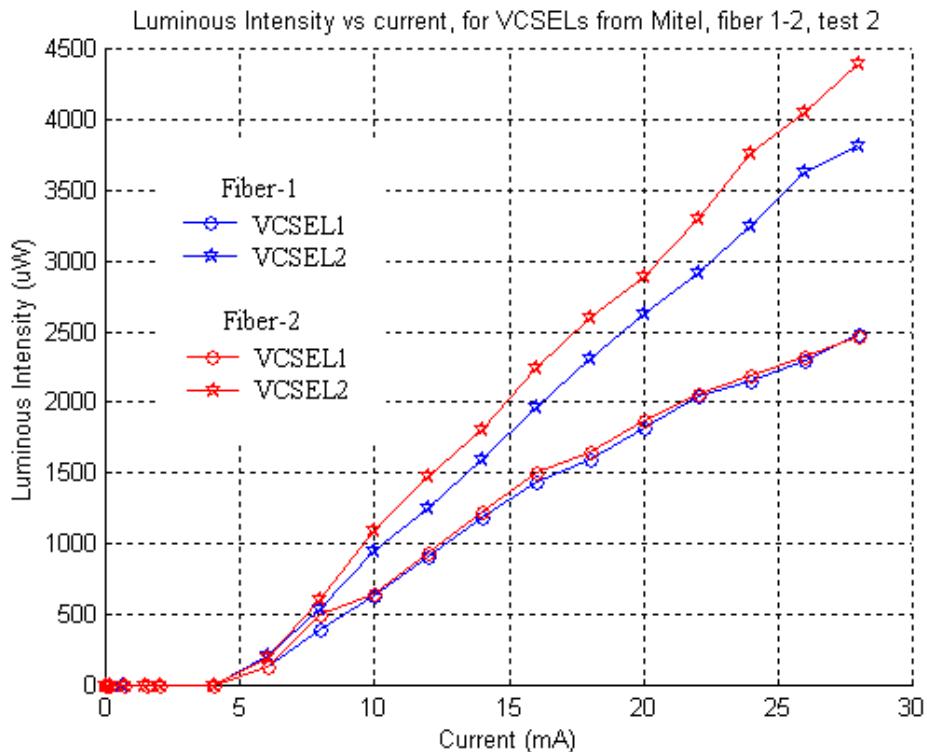


Figure 2: Graphic of Luminous Intensity versus Current for each single VCSEL (Mitel, 1A444 ST-2A). Using optical fiber 1 and 2 in the second test.

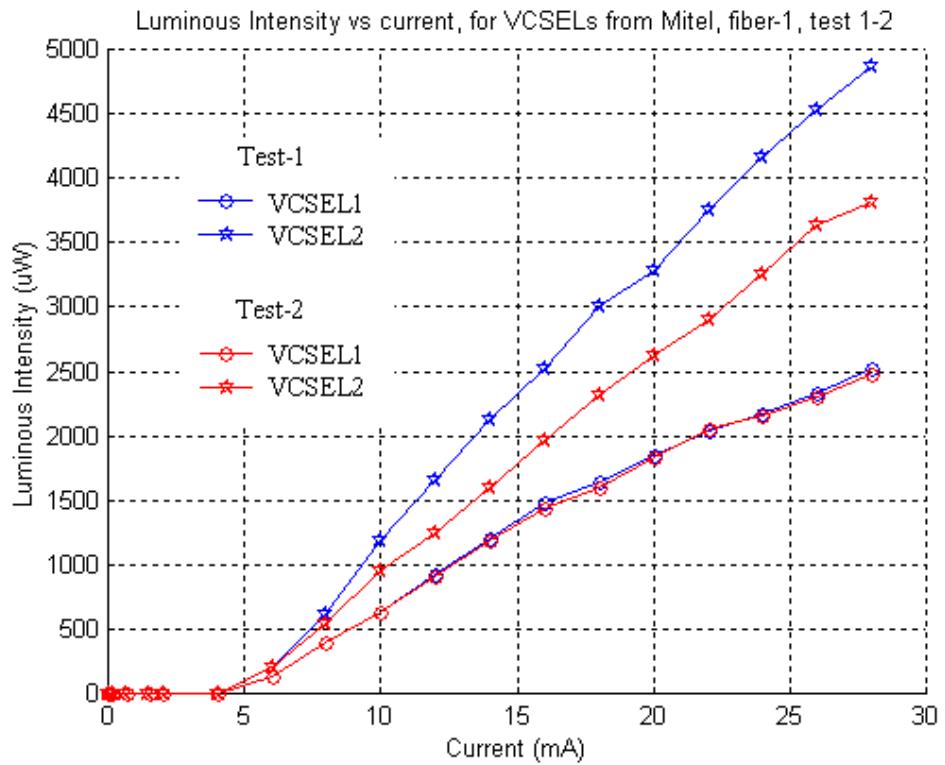


Figure 3: Graphic of Luminous Intensity versus Current for each single VCSEL (Mitel, 1A444 ST-2A). Using optical fiber 1 in the first and second test.

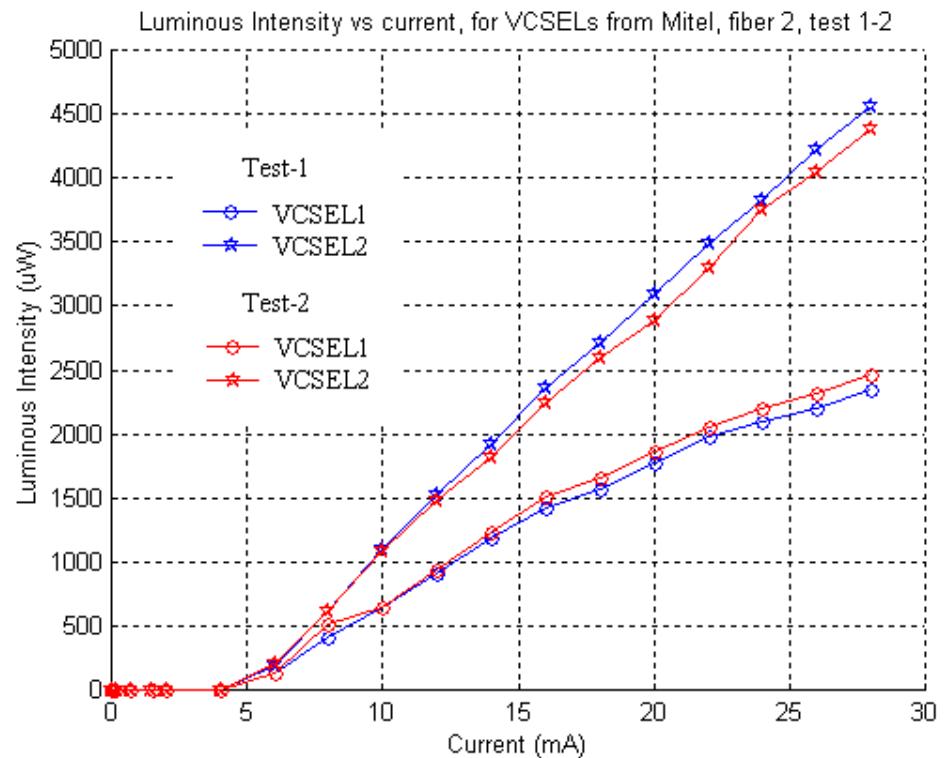


Figure 4: Graphic of Luminous Intensity versus Current for each single VCSEL (Mitel, 1A444 ST-2A). Using optical fiber 2 in the first and second test.

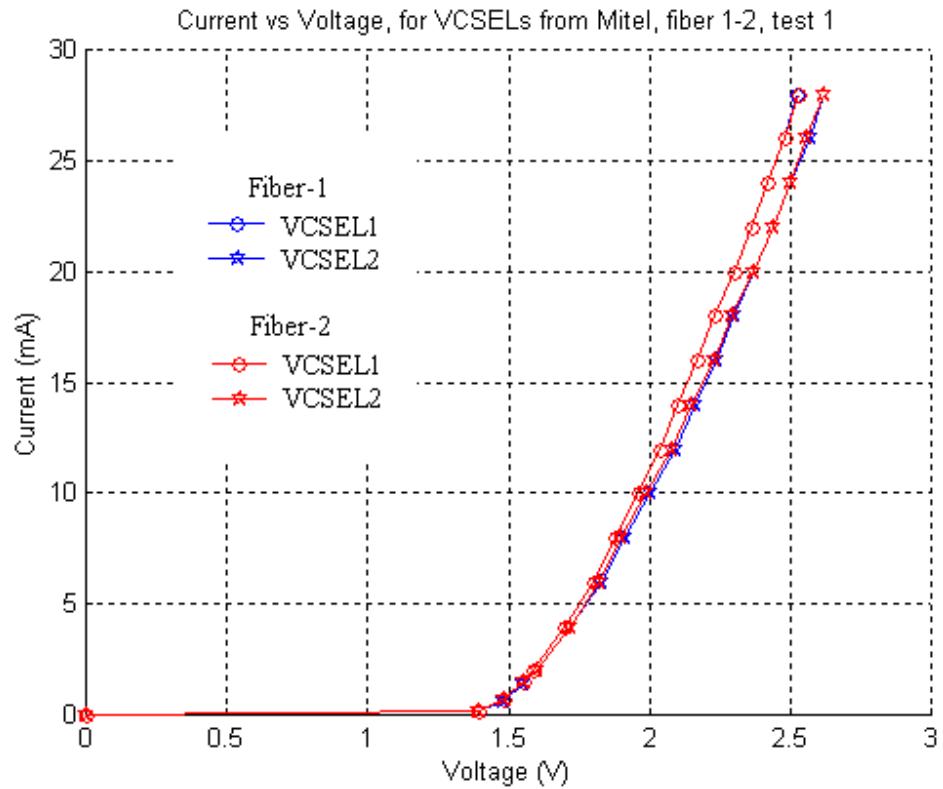


Figure 5: Graphic of the Current versus Voltage for each single VCSEL (Mitel, 1A444 ST-2A). Using optical fiber 1 and 2 in the first test.

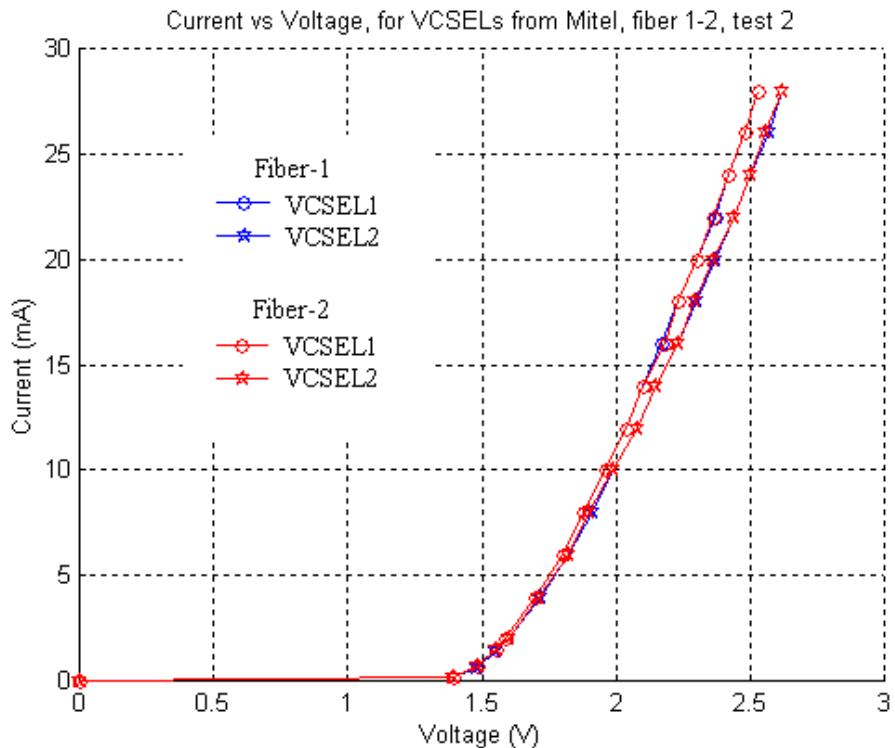


Figure 6: Graphic of the Current versus Voltage for each single VCSEL (Mitel, 1A444 ST-2A). Using optical fiber 1 and 2 in the second test.

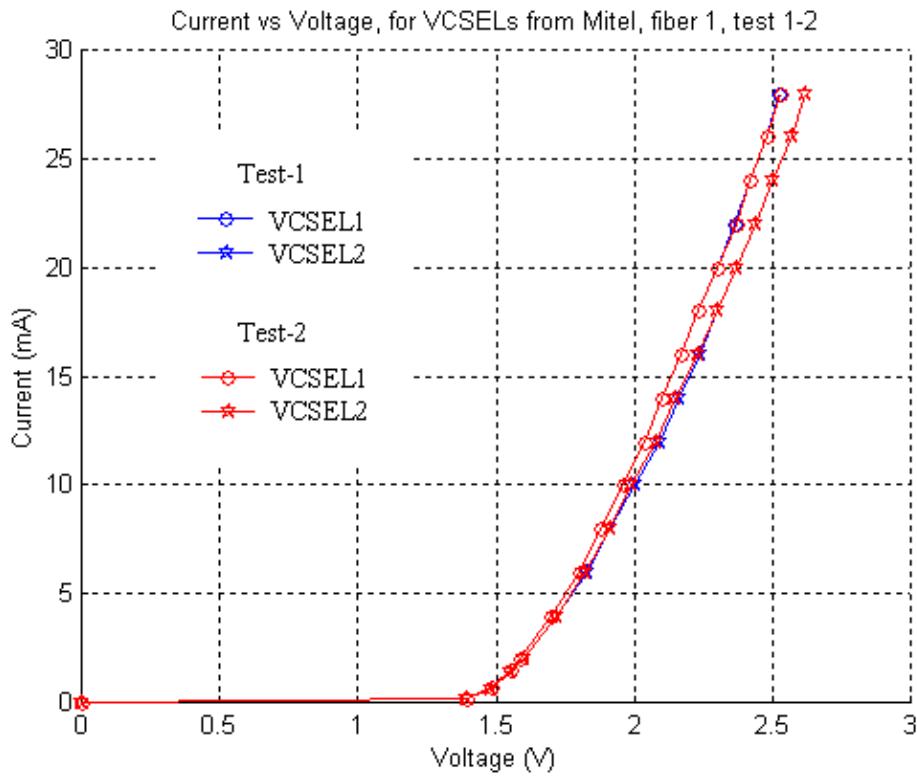


Figure 7: Graphic of the Current versus Voltage for each single VCSEL (Mitel, 1A444 ST-2A). Using optical fiber 1 in the first and second test.

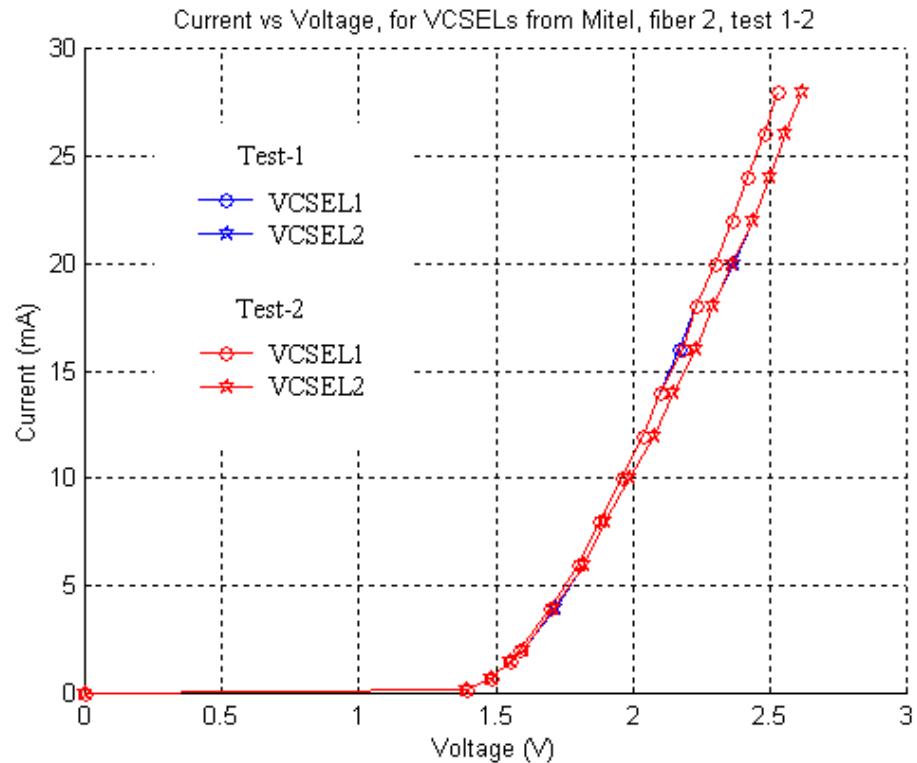


Figure 8: Graphic of the Current versus Voltage for each single VCSEL (Mitel, 1A444 ST-2A). Using optical fiber 2 in the first and second test.

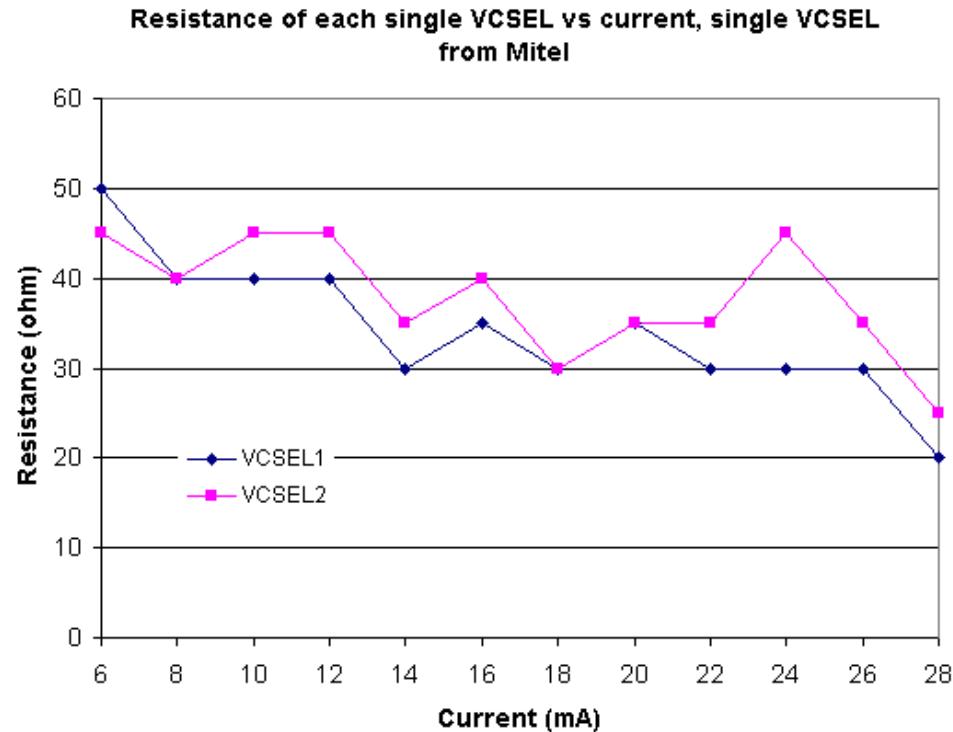


Figure 9: Relationship between the resistance in each single VCSEL of Mitel and its current.

## Conclusions

- Each single VCSEL from Mitel shows a very stable current-voltage relationship.
- The resistance in the single Mitel VCSELs working with a current below 12mA is about  $45\Omega$  and for currents between 12mA and 28mA the resistance goes down to  $20\Omega$ .
- The relationship between the optical power delivered for the VCSEL and its current is stable but the optical power delivered into the fiber optic depends strongly on the quality of the connectors.