

HV for Ecal PMTs

- 23,000 6-stage PMT's will be used.
- 100 PMT bases are ganged together(?) to save HV power supply cost
- Requirement document: <http://www-ese.fnal.gov/BTeV/ElectronicsProjects/Systems/EMCalormetry/WorkReqs/WorkrequestEMCalPMT engr022201.doc>

More fundamentals

- **Some of PMT's draw 50 μ A.** Many others draw only 50 nA.
 - 1 GeV every crossing: $10,000e's/10^{-7}s =$
 $10,000 \times 3,000$ (PMT gain) $\times 1.6 \times 10^{-19}/10^{-7}s =$
 $5 \times 10^{-5}A = 50 \mu A.$
- Conventional bases will need **2.5mA of standing current** in the voltage divider!

With FNAL transistorized base

- Still $50 \mu\text{A}$ (?) of standing current operating at 1,000 V
 - 50 mW of power dissipation/PMT.
- If we use separate HV's for each dynode, this will go down to 10 mW (200 V) for the worst case and $10 \mu\text{W}$ for many others.

Advantages/disadvantages

- Cut down heat dissipation by a factor of 5(?).
 - Crystals are very sensitive to temperature and gradient
- More (external) connections to make.
 - effect cost, labor, reliability.

Proposal

- Provide 4 separate HV supplies:
 - Anode - DY6 (220 V)
 - Anode - DY5 (430 V)
 - Anode - DY4 (570 V)
 - Anode - DY3, DY2, DY1, cathode (1000 V)
(conventional voltage divider)

Variations?

- Do up to 7 supplies make sense?
- Fewer?

Other major issues

- What **HV stability** is required for each HV supply if the gains are to be stable to a **few $\times 10^{-3}$** .
 - If 1000-V supply is stable to 10^{-4} , can others be less so?

Other major issues – 2

- Cheap and reliable HV (inter) connections
 - Even though we want to “gang” 100 or so PMT bases together to save on HV PS,
 - For accessibility, each PMT base needs to be mechanically separate from each other!
- How are we connecting PMT’s to bases?
 - Using sockets?
 - Wire-version of PMT to solder directly to PCB?

Other major issues – 3

- Is electrostatic shield needed? (assuming that we use $-HV$)
- Can we **control gains** by a factor of 2 or so?
- Given that 100 channels are ganged together, would a **failure** of one base/PMT **affect the others** in the same group?
- Magnetic field effect?