

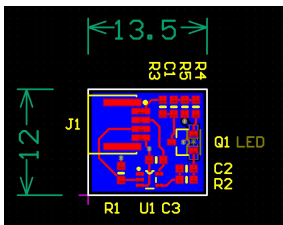
# Barrel Imaging Calorimeter

- Built-in calibration systems/tools

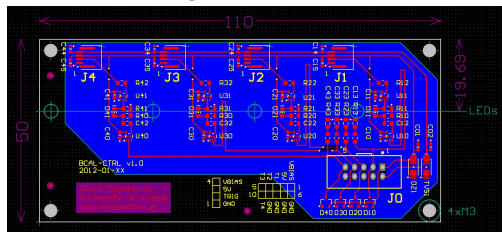
# LMS – modelled after GlueX-BCAL LMS



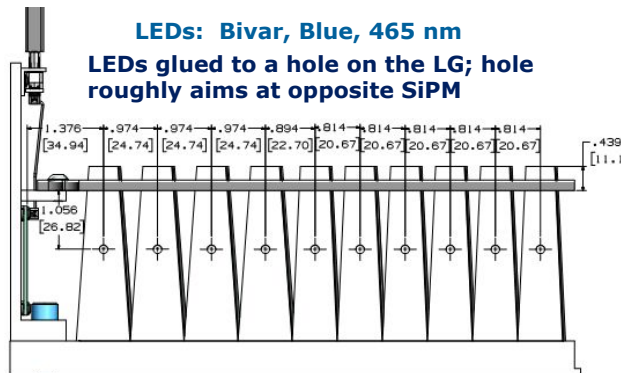
BCAL miniboard layout  
("components" side,  
LED on the other  
side, shining parallel  
to the board towards  
the right)



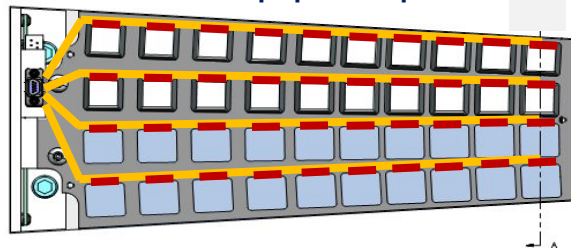
**BCAL Controller layout**



innermost LG 21x21 mm<sup>2</sup>, outermost 27x25 mm<sup>2</sup>;  
output faces are 13x13 mm<sup>2</sup> to match SiPM window



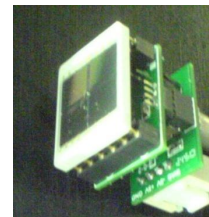
**4 flexible strips per side per module**



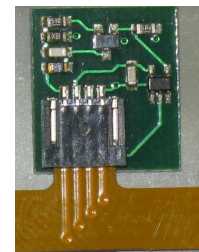
- 1 flex cable per row, connecting 10 mini boards; 384 flex cables
- 4 flex cables connected to 1 BCAL controller; **96 BCAL controllers**
- **1 BCAL controller per half module**; light each row independently
- System typically pulsed at 50-100 Hz

BCAL has 3840 SiPMs, and 3840 LEDs: pulsing both ends decouples SiPM from LED failure

**Hamamatsu S12045X**



**BCAL miniboard on flex cable**



NIMA 738 (2014) 41-49

# Barrel Imaging Calorimeter

- Update on Irradiation Studies

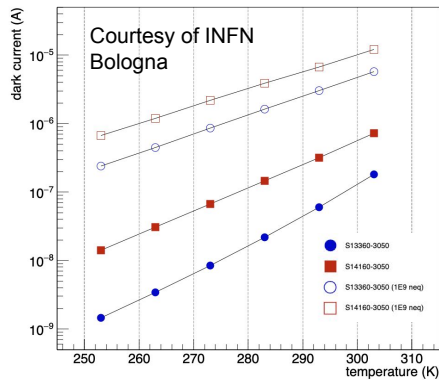
Initial Strategy Presented at TIC on Dec 11, 2023

M. Zurek, <https://indico.bnl.gov/event/21106/>

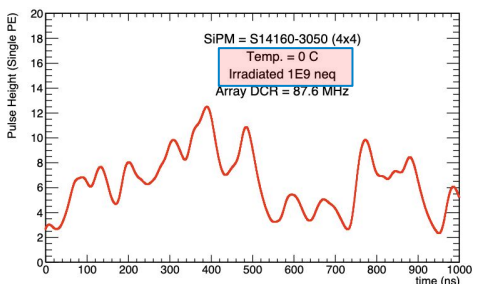
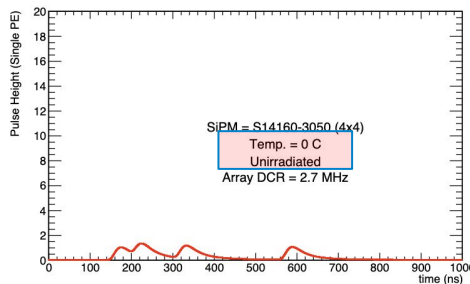
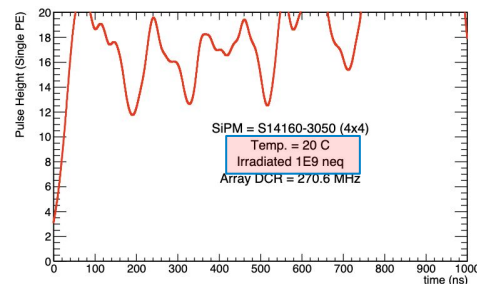
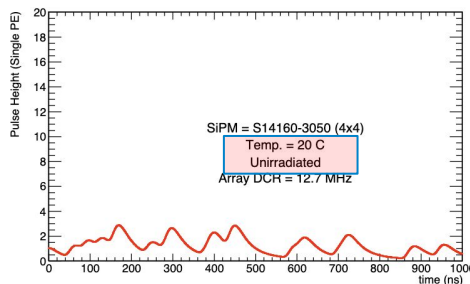
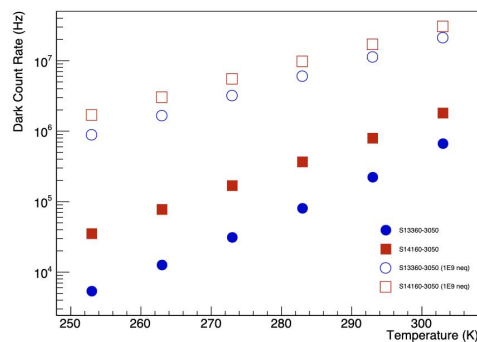
# Rad Damage

## Update on SiPMs

- INFN Bologna measurements available for S14 and S13 Hamamatsu SiPMs
- Indicate factor 20 increase in dark current is possible during a year of EIC running ( $10^9$  neq)
- **Caveat: worse case scenario!: Naively scale dark current to dark counts (upper limit estimate)**
- If not mitigated, thresholds will need to be increased significantly beyond desired level after irradiation
  - Factor  $\sim 5$  increase in threshold during the first year of running
  - Loss of MIP & few hundred MeV photons
- Mitigation options
  - Use S13360 SiPM
  - Splitting of readout channels to increase S/N for MIPs
  - Lower  $V_{op}$
  - Further cooling of SiPM
  - SiPM annealing
  - Swap SiPMs (+z and -z)
  - Left-Right Coincidence



Scale by gain,  $q_e$



See more here: H. Klest, BIC Simulation Meeting:  
<https://indico.bnl.gov/event/21335/>