HD PDS Performance in NP04

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HD Technical Board Meeting
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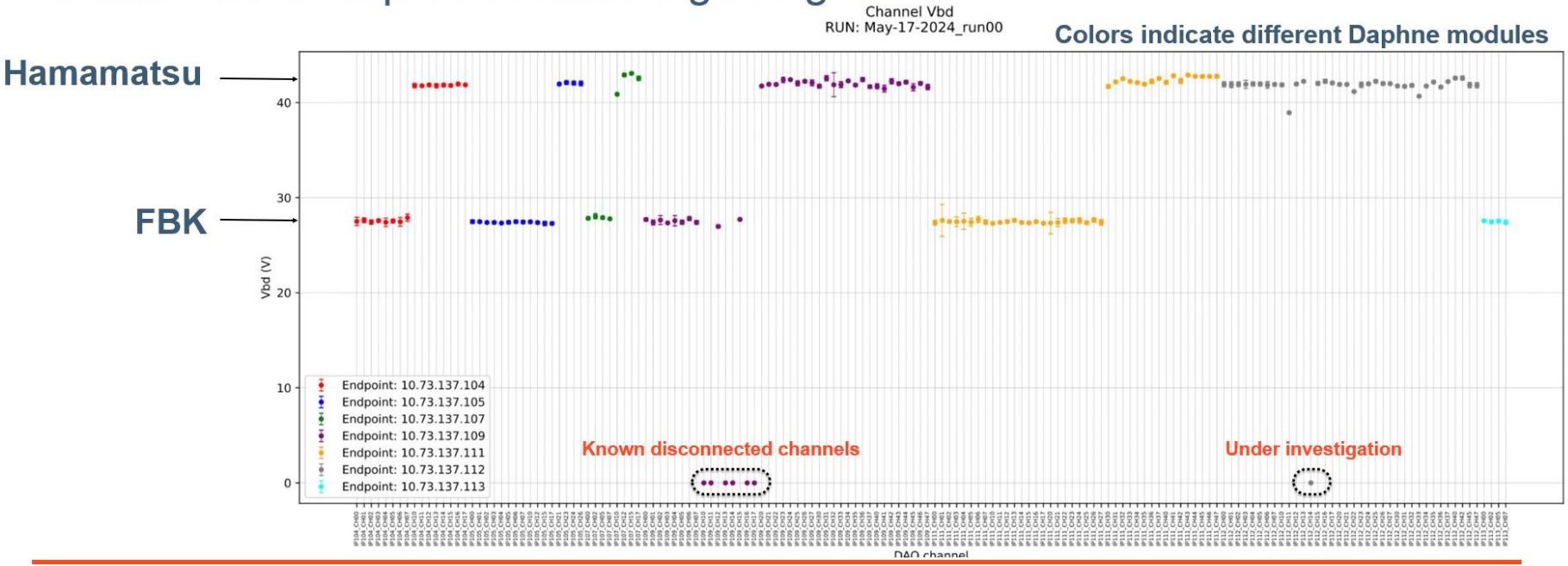
Status summary:

- We are able to operate the PDS in all APAs, with proper bias for all modules.
  - 6 (out of 160) channels disconnected prior to filling .
  - All other channels operational (some still being tuned).
- We have tools for quickly analysing the data, resolve bugs and optimise DAPHNE parameters.
- PDS configuration and operation is fully integrated within the DAQ.
- LED calibration system has been commissioned.

160 channels

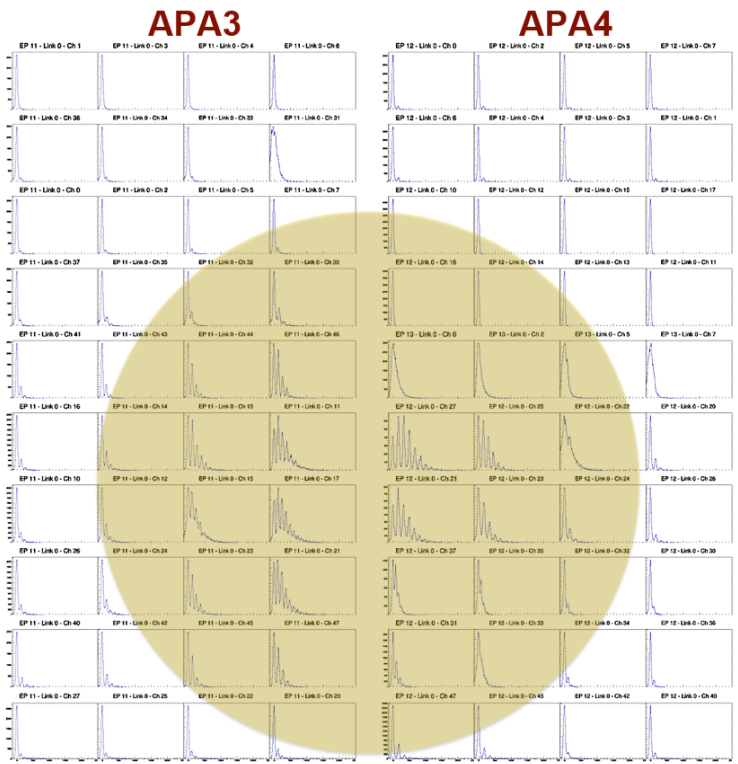
- 4% dead channels (known since installation). Few other channels under investigation
- All channels alive provide meaningful signals



LED calibration

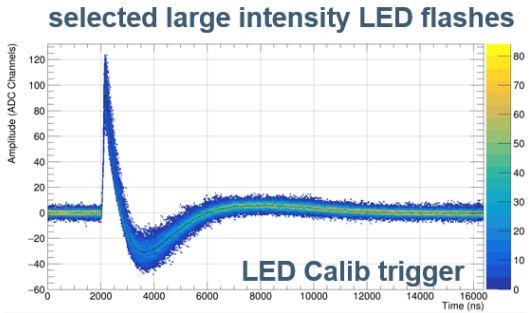
- LED calibration system with 5 independent diffusers in each side of the cathode
- Applications:
  - Characterise single photo electron (spe) response for all channels
  - Self-trigger efficiency studies
- Tune intensity to obtain suitable spe spectrum in all channels: **DONE** except for APA1
- Ongoing systematic calibrations

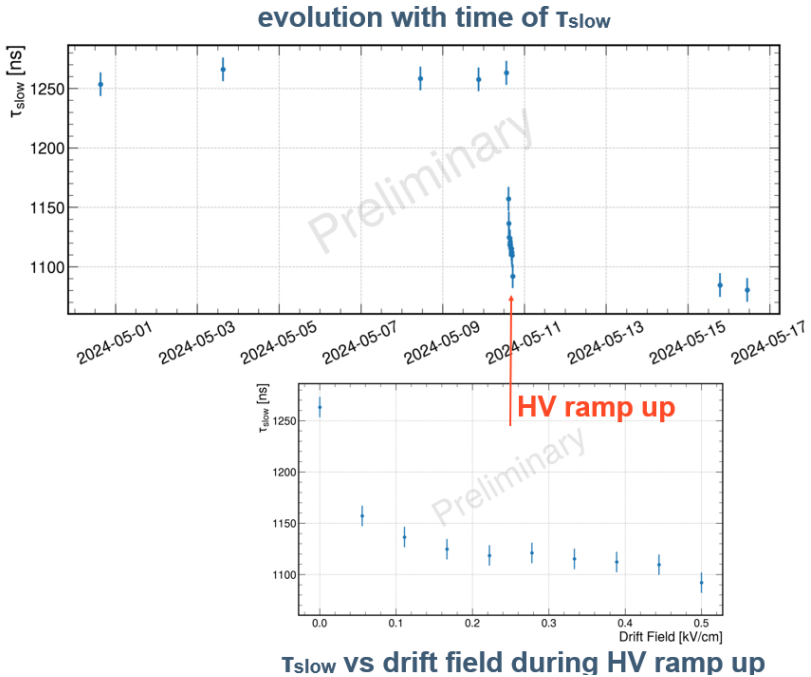
Example with only central diffuser ON



First *physics* result

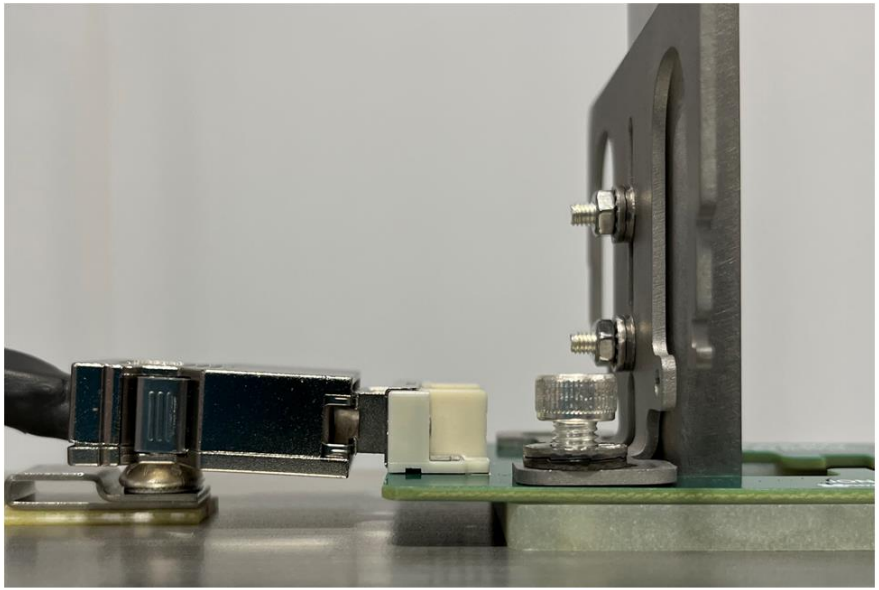
- Measurement of the slow component of the liquid argon scintillation light
- Use LED pulses for deconvolution of detector effects and cosmic muons for the actual analysis





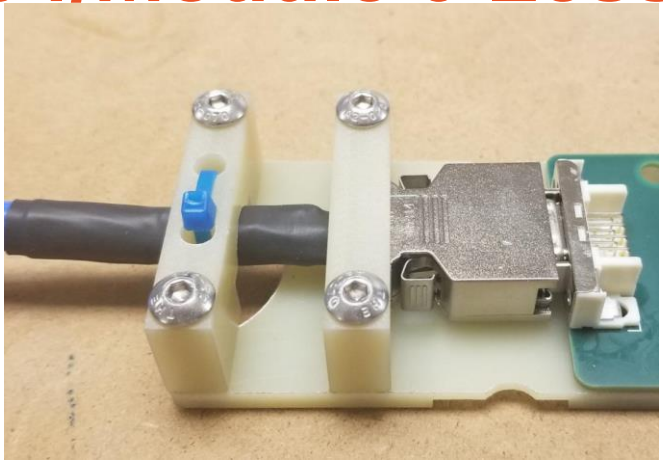
NP-04/Module 0 Lessons Learned - i

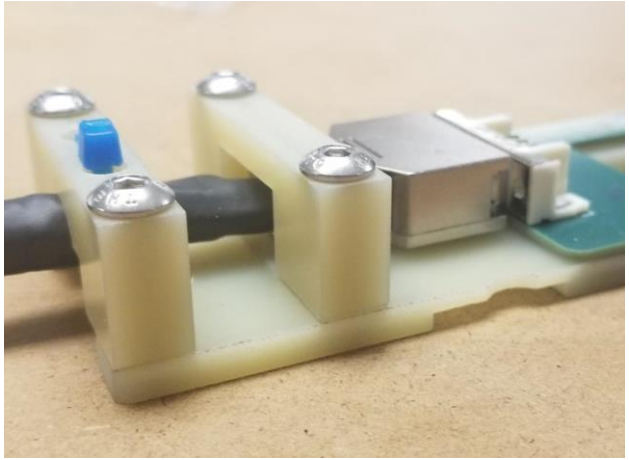
Significant (~2mm) PD cable interference with temperature sensor and cable tie clip (Upper APA only)

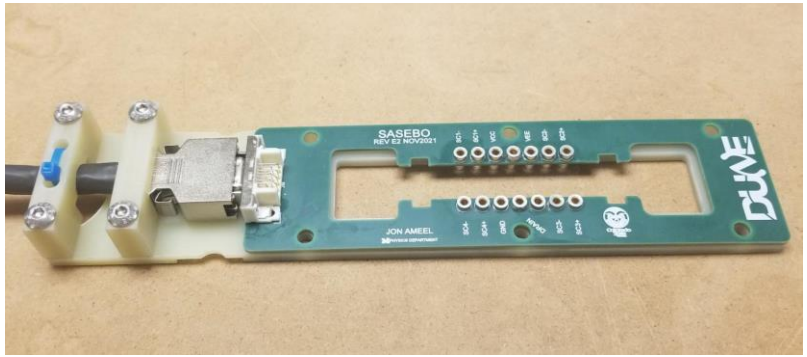


Resulted to short to ground requiring disconnecting readout channels.

NP-04/Module 0 Lessons Learned - ii







Modified cable connection structure approved in PRR October 2022.

Other PDS Lessons Learned

- Module testing at MiB developed simple mechanical enhancements improving detection efficiency.
  - Diagonal slice across WLS plate re-directs photons to SiPMs along module side.
  - Raised reflective surfaces between SiPMs avoid losses at edges of module.
- Nearly doubles photon collection efficiency to ~5% in testing.
- Testing will be duplicated and confirmed at CIEMAT in summer 2024.
- Full-scale prototype will be tested in CERN cold box in fall 2024.

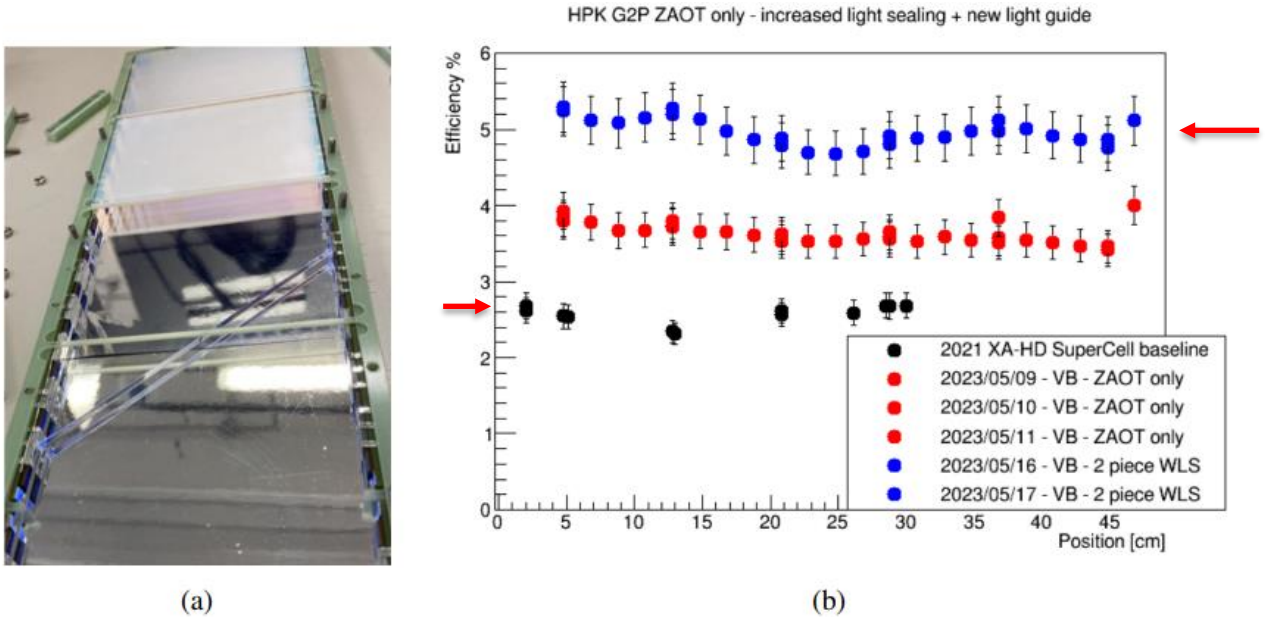


Figure 5. (a) The X-Arapuca embedding a WLS-LG with a 40° cut and the reflector lined blocks between the SiPMs; (b) The PDE values measured with the MiB method described in section 3 as a function of the source position along the device, including the geometrical acceptance correction.

https://iopscience.iop.org/article/10.1088/1748-0221/19/06/C06007/pdf

HD PDS HWDB

- The primary point of contact for the HD PDS HWDB interface is Gustavo Valdiviesso (gustavo.valdiviesso@unifal-mg.edu.br)
- A secondary point of contact is Mike Eads (meads@niu.edu)
- We have been beginning to incorporate our extensive database of SiPM data into the HWDB. We have encountered issues, but are working with the HWDB team to resolve them.

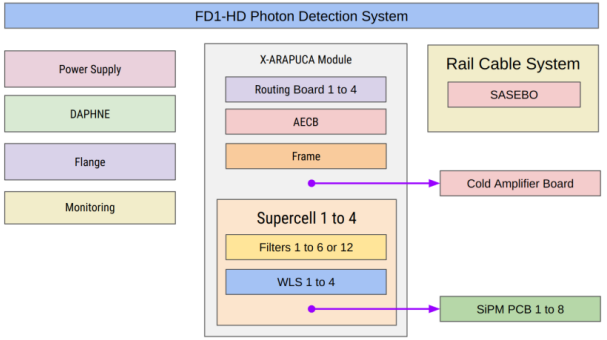


Figure 11.1: The PDS database schema illustrated. Each box shows a component within the PDS subsystem. Nested boxes correspond to parts without an exclusive database component (PID) associated to it. The SiPM and Cold Amplifier boards have their own components, but individual entries are related to entries in the X-ARAPUCA component.

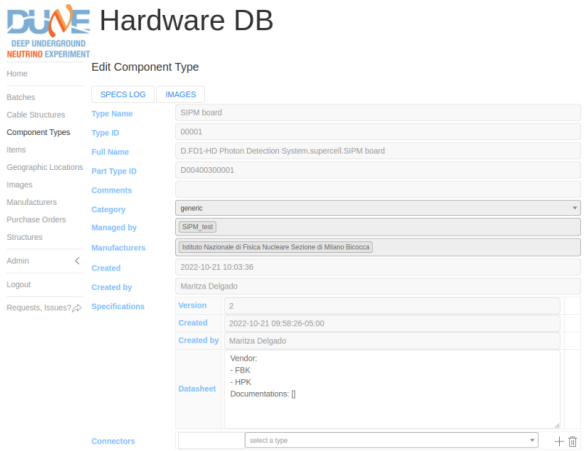


Figure 11.2: Snapshot of the HWDB web interface, showing the component description for the SiPM boards.