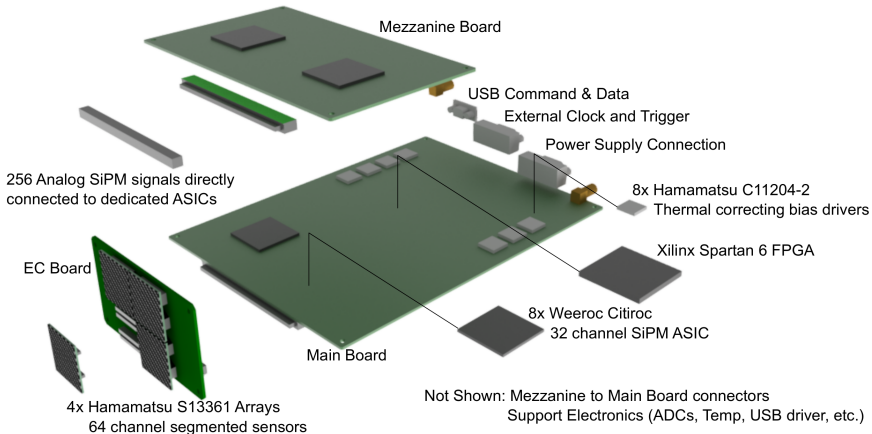


SiECA

W. Painter | KIT-ETP



Silicon photomultiplier Elementary Cell Add-on camera



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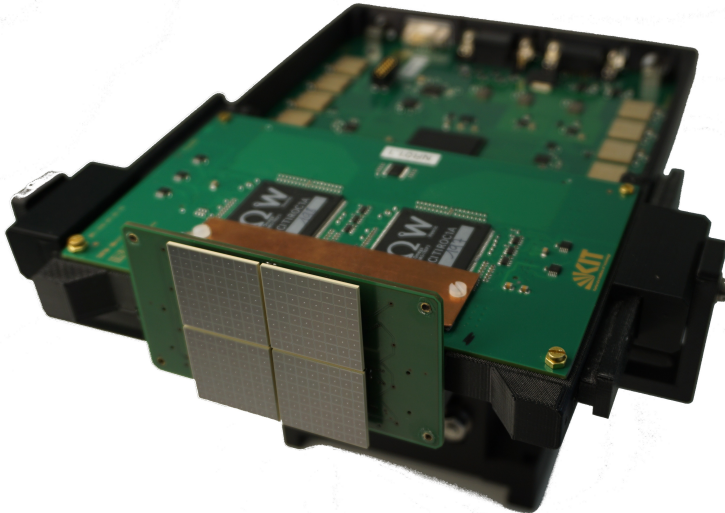
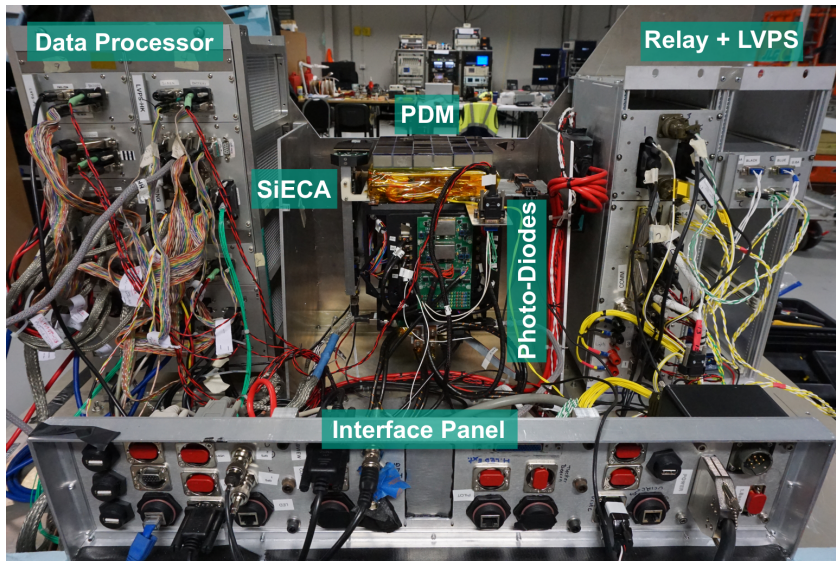


Photo-Detection Module(s)



An Affront to the Gods

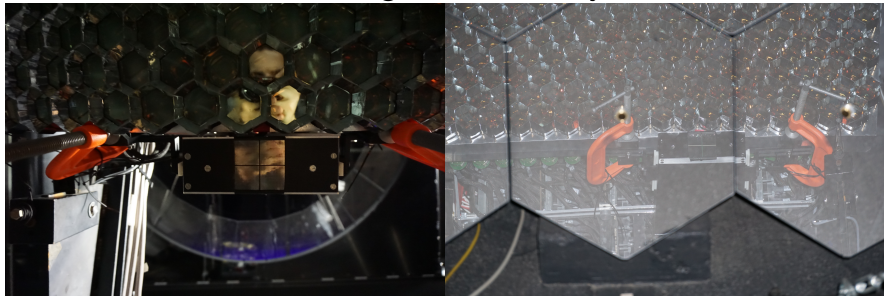
SiECA_V2.0 -> Pacific Ocean

SiECA_V2.1 -> Pierre Auger Observatory, HEAT 1

An Affront to the Gods

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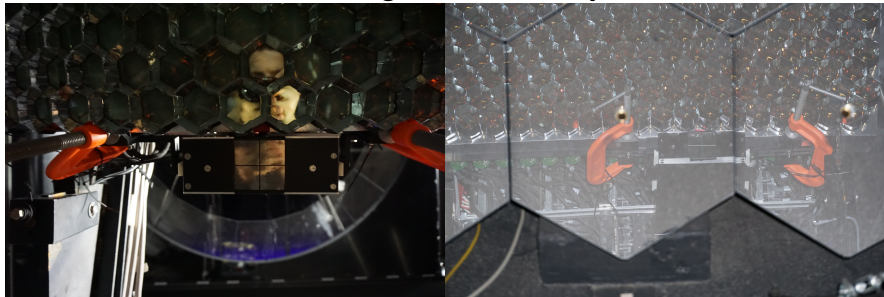
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An Affront to the Gods

SiECA_V2.0 -> Pacific Ocean

SiECA_V2.1 -> Pierre Auger Observatory, HEAT 1



Integrated with new power supply and establishing working trigger routine.
Operated on self trigger for background measurement for one night.

An Affront to the Gods

Calibration A of HEAT 1: Direct illumination of PMTs

- SiECA on but not active one night, active second night
 - Communication fault between CDAS and Coihueco
- Elevated variance in HEAT 1 PMTs in Calib A
- Centered near SiECA but sparse over 10% of camera

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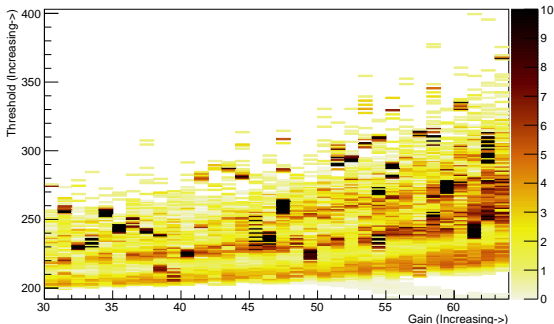
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High winds damaged shutter and replaced UPC was unstable for remainder of shift. → SiECA-cancer strikes again.

Laboratory Testing

Study of single discriminator measurement effects is ongoing.
Paper draft on flat-fielding processes and logic planned by
end of May.

SNR at Vbias 55 with 3photon Pulses



Dark bands indicate threshold near photoelectron(s) signal amplitude

Remaining Work

Verification of Flat-Fielding:

- Characterization of Hamamatsu 64-channel TSV SiPMs
- Test flat field from individual channel measurement
- Evaluate effect of Gain flat field on PDE flat field

Channel by channel measurement is tedious but effective.
Plan for first draft by end of May.

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Secondary technical paper on SiECA specific issues:

- Evaluate the total PDE of SiECA (discriminator signal)
- Internal noise assessment
- SiECA to PMT noise connection TBD (relevant)

From SiECA to POEMMA

- SiECA is not a good model for POEMMA

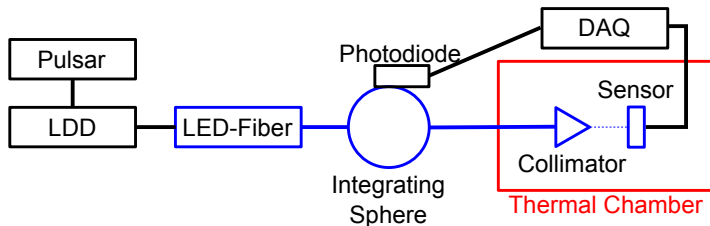
From SiECA to POEMMA

- SiECA is not a good model for POEMMA
- New ASIC is required with faster sampling/digitizing
- Avoid complex routing with BGA SiPM mounting
- Modular sensors, kapton to HV and ASIC boards
 - Non-monolithic design separates digital-analog
 - Allows replacement of faulty SiPM, ASIC or HV board

Cold SPOCK

Thermal chamber with calibrated light source

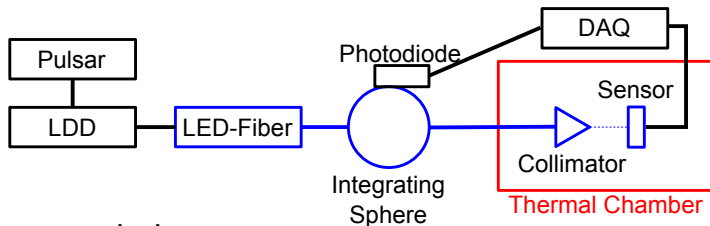
- Collimated, Pulsed or constant light
- Thermal control -70°C to 120°C



Cold SPOCK

Thermal chamber with calibrated light source

- Collimated, Pulsed or constant light
- Thermal control -70°C to 120°C



Many uncertainties:

- $d\text{Collimator}/d^{\circ}\text{C}$, $d\text{Fiber}/d^{\circ}\text{C}$, $d\text{Photodiode}/d^{\circ}\text{C}$
- Study started at KIT (Bachelor B. Mitic, maybe others)
- Smaller volume than SPOCK, 1 PDM possible

Conclusions

- POEMMA is very different from SiECA
- Lessons from SiECA can be useful
- Thermal controlled low light testing under development
- Flat Fielding paper draft expected end of May
- SiECA hardware paper draft end of June to mid July