sPHENIX Hcal
Beam2016 – Goals & HowTo

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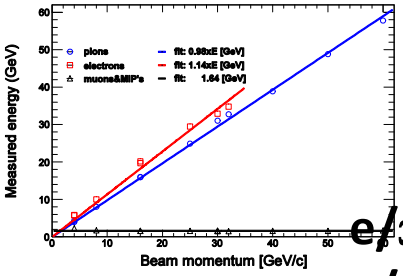
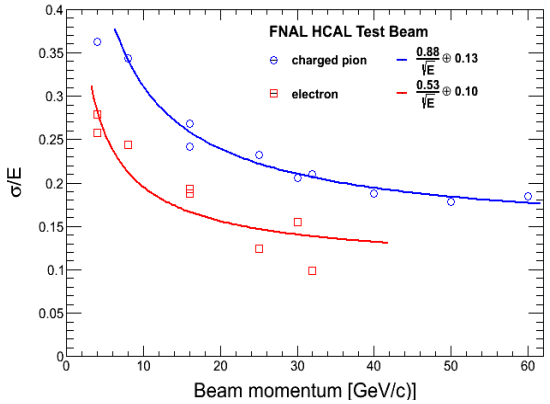
Test Beam: 2013

2013



e/π = 1.17

e/μ = 0.77



Published and unpublished results:

- linearity;
- Single particle energy resolution;
- Too large constant term – **bad or no calibration, too low light yield**;
- Tails - **“thin calorimeter (4Labs)”, “varying sampling fraction”**;

Conclusions:

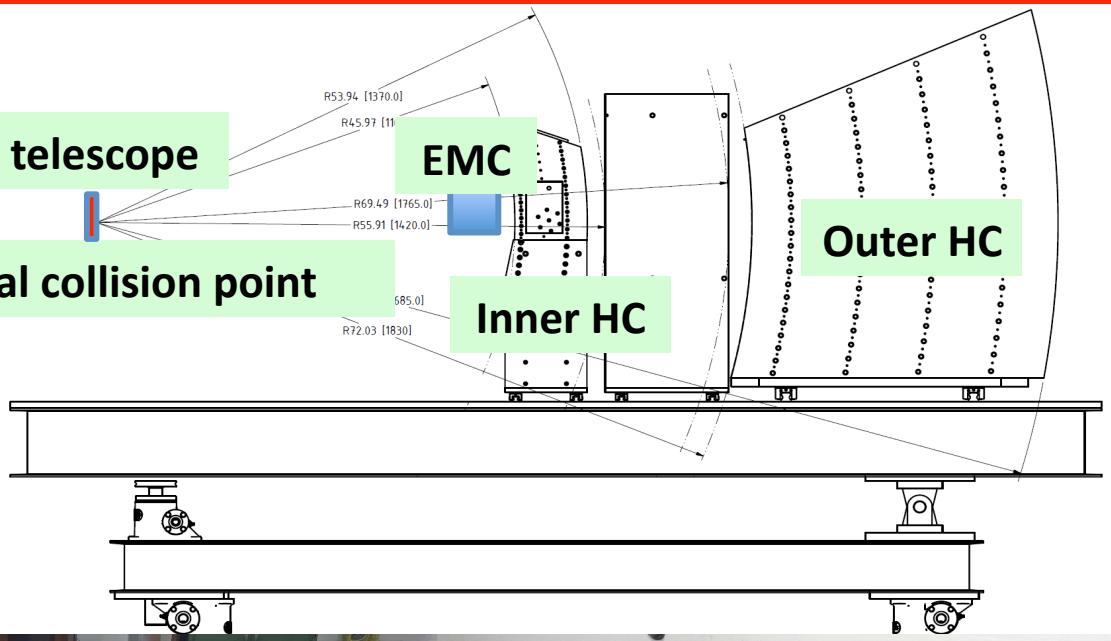
- Include EMC and increase total depth to 6Labs;
- Keep at least three longitudinal segments (almost killed, saved by BaBar magnet);
- Introduce software compensation to sampling fraction variations - make tilt one tower big to effectively create two extra longitudinal segments (tile patterning now probably obsolete);
- Hide the fibers – don’t let Carter neither to see nor to touch them

Test Beam: 2013 -> 2016

2016

XY Si strip beam telescope

Virtual collision point



Es

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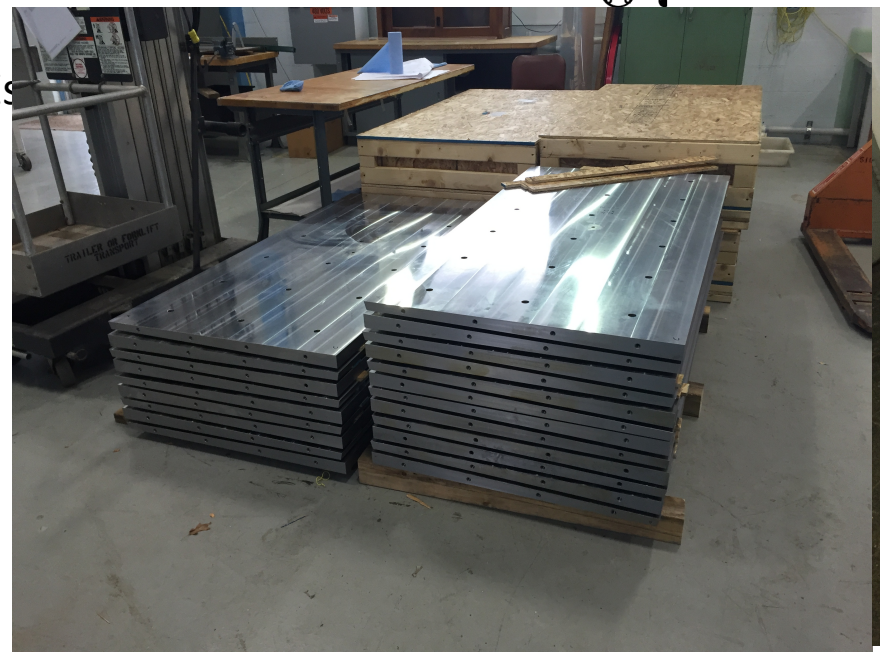
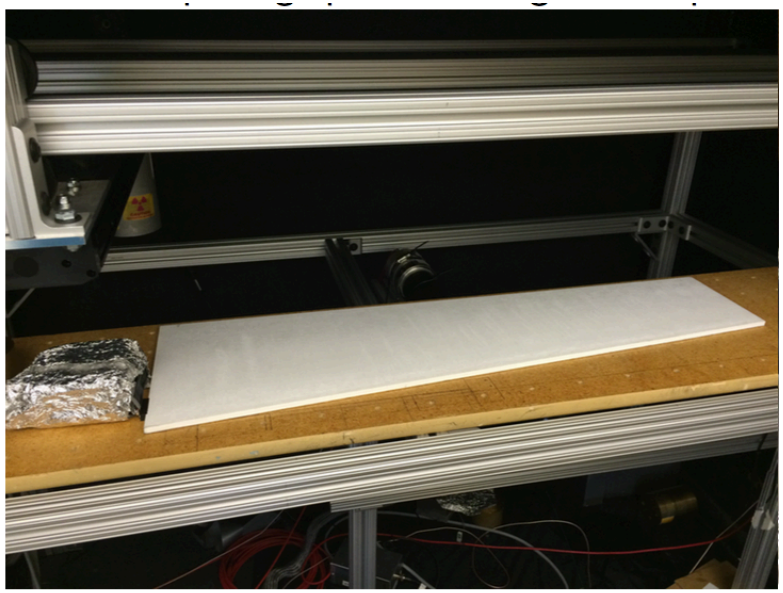
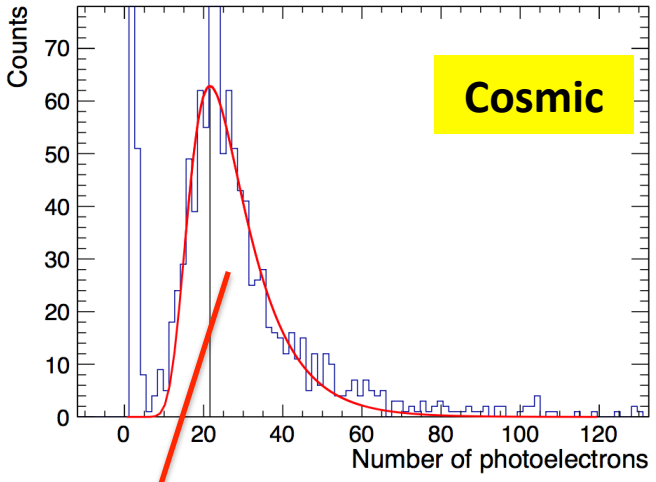
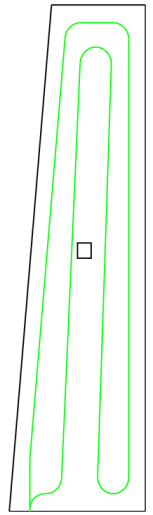


But this time we are much better prepared

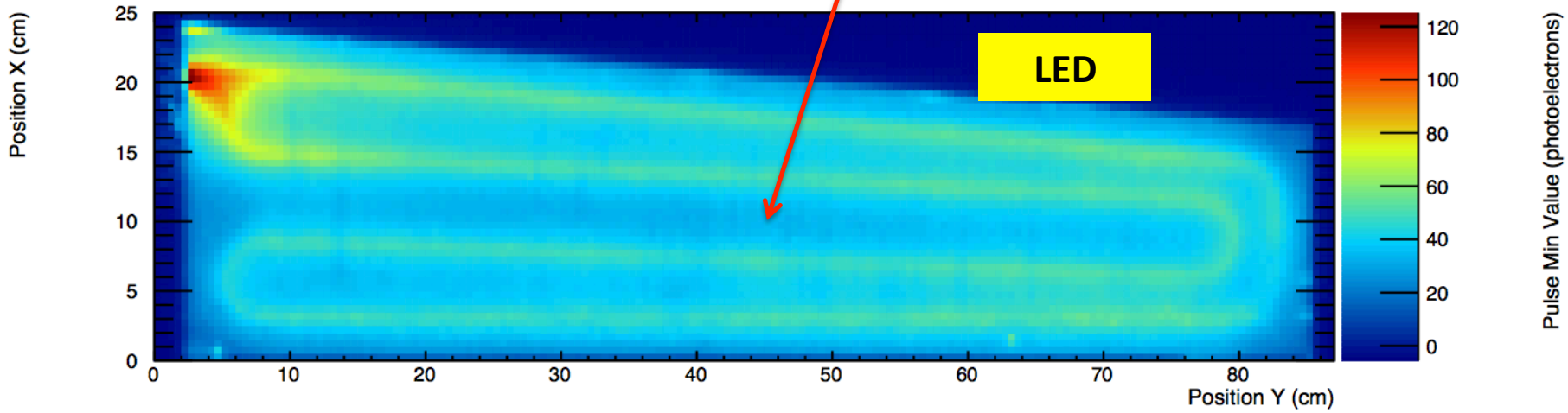




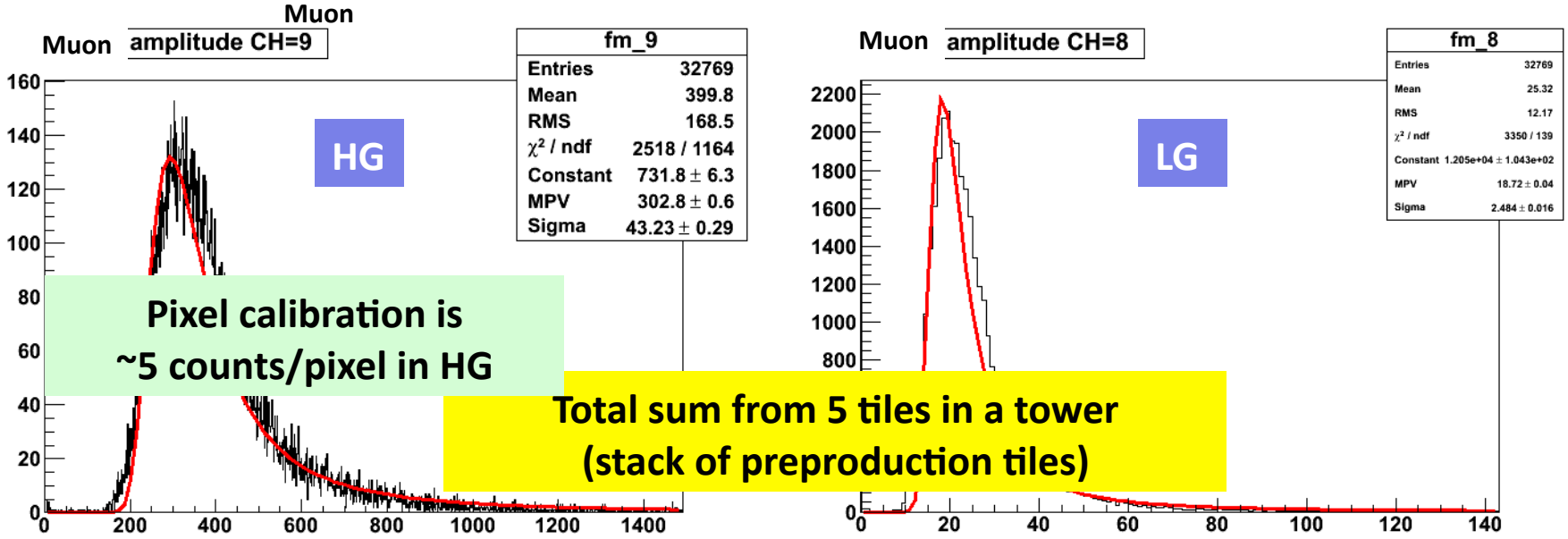


$[\Delta E]_{MPV} = 21.6 \pm 0.5$ photoelectrons and $\xi = 5.0 \pm 0.3$ photoelectrons

: Colorado



Test Beam 2016: Running Conditions



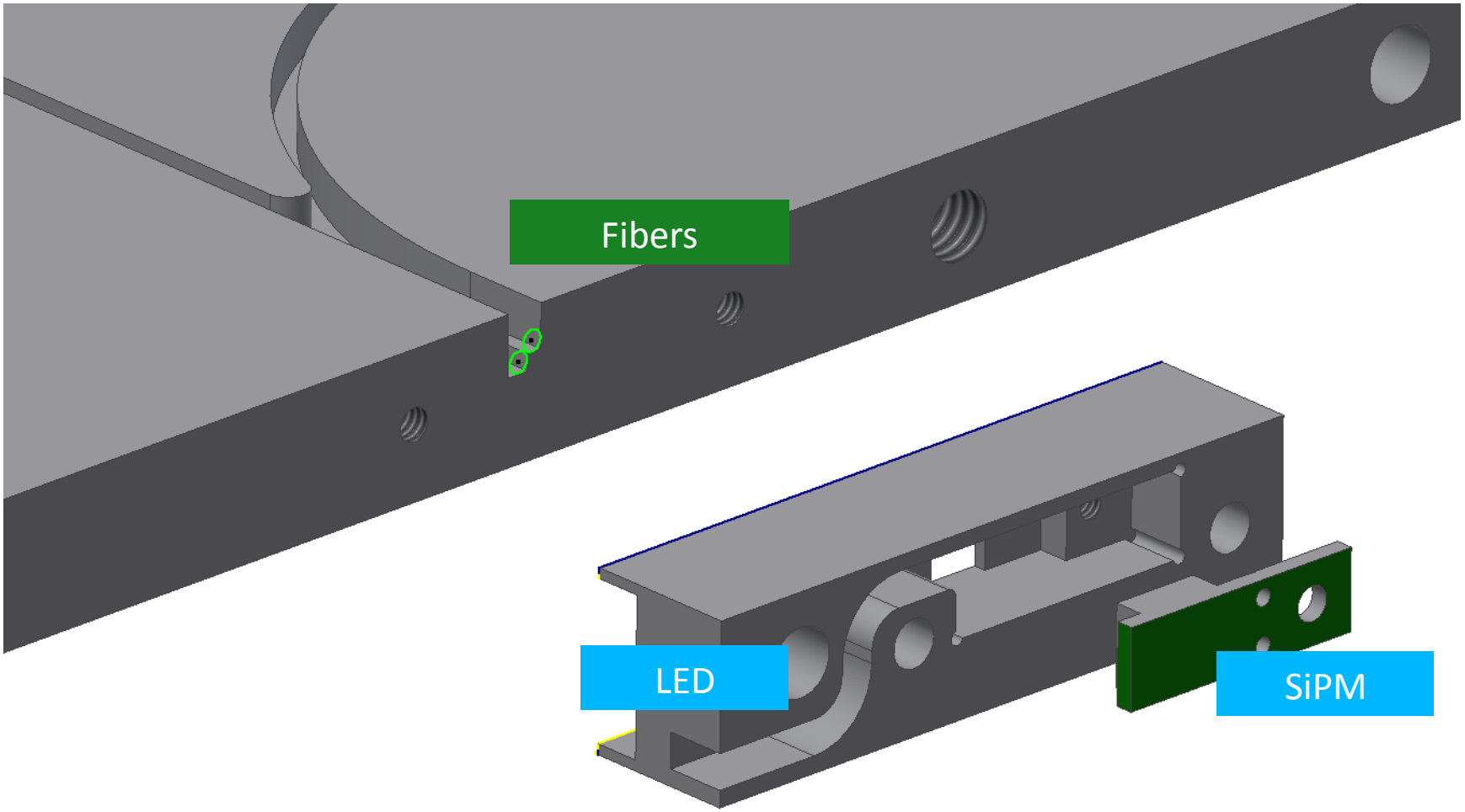
Pixel calibration is ~5 counts/pixel in HG

Total sum from 5 tiles in a tower (stack of preproduction tiles)

Muon crossing tower at 90deg	7 MeV
Sampling Fraction	3%
Visible energy	~230 MeV
Test Bench Least Count (High/Low Gains)	0.8/12.3 MeV/ADC count
Dynamic Range (1V unipolar pulse)	1.6GeV / 26GeV

Test Bench Measurements with Cosmic muons in Psudo-tower of 5 tiles with SiPM's ganged to the common sPHENIX preamplifier

Collecting Light and Monitoring



Goals for next few month

- ✓ **Accept and document scintillating tiles;**
- ✓ **Make tiles ready for installation;**
- ✓ **Install tiles and cable the detector;**
- ✓ **Collect data with existing HBD electronics (noise, LED, Cosmic);**

- ✓ **Finish with noise and SiPM calibration studies on fake tower;**

- ✓ **Develop missing control software (Bias, Temperature, SiPM in situ noise calibration, SiPM LED calibration;**
- ✓ **Develop Cosmic self-triggering algorithms (using built–in trigger capabilities of existing HBD electronics);**

- ✓ **Calibrate Hcal.**

Hcal MUST come to FNAL fully assembled and calibrated

Fibers

LED

SiPM

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But before everything else

Decide on labeling and numbering schemes:

- **Tile labeling (use drawing number or rapidity location, sequential box number, tile number from the top, whatever but tile must be easily traced back to UNIPLAST0;**
- **Tower labeling – label them left-to-right, bottom-to-top – easy to locate working with hardware;**

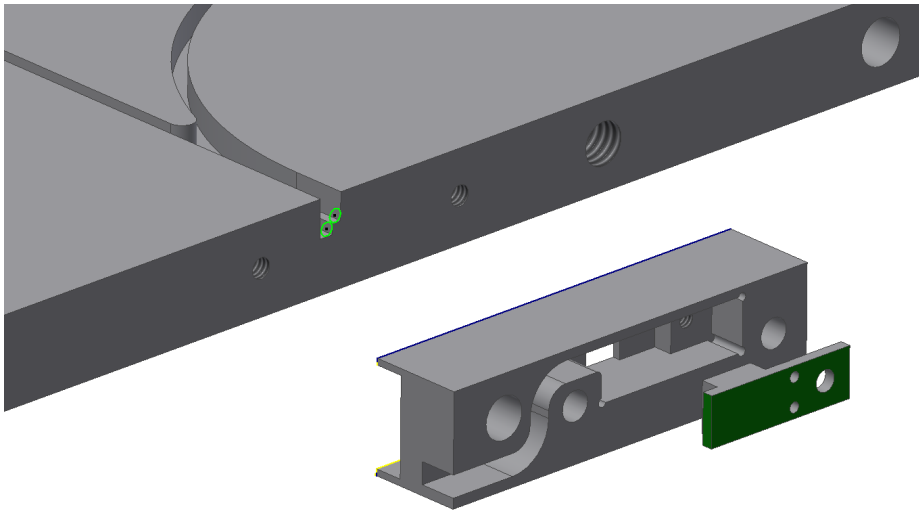
Build data bases:

- **tiles;**
  - **Make template dimensional control;**
  - **Include pictures of fiber exit area for each tile;**
- **Towers;**
  - **List of associated tiles**
  - **Refernces to calibration and control data;**
- **SiPM's;**
  - **Hamamatsu spec data;**
  - **Group identifier (5-SiPM grouping – closest Vbd/Gain);**
  - **Tower and tile cross identifiers –**
- **Locating tools for technicians**

Accepting and documenting tiles

Locate space and make sure we have enough shelving space;
Open the boxes, transfer box #-label to individual tiles, number the tiles in the box;
Identify tiles (Inner/Outer, rapidity);
Visually inspect the tiles, make fictures of fiber exit areas (comparable format);
Write comments into Data Base;
Store tiles of a same kind (32+ tiles of each kind) separately

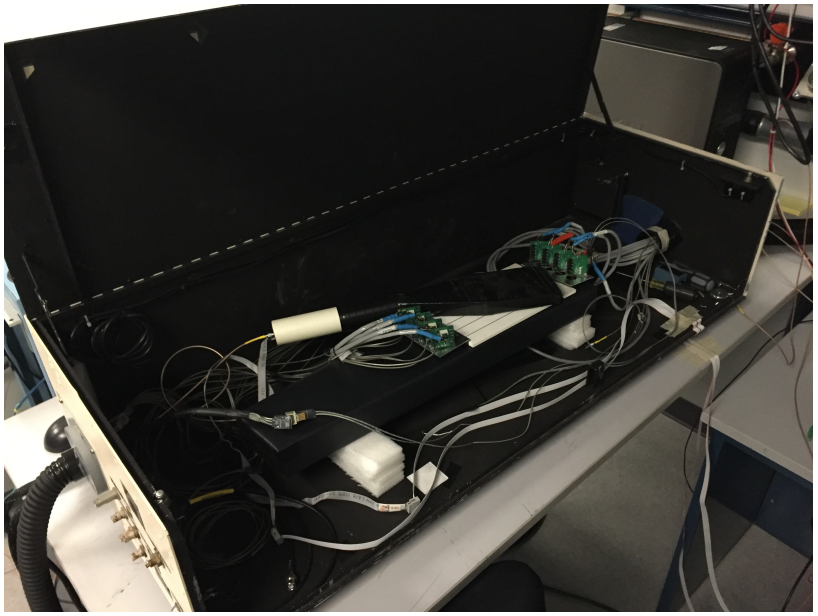
Preparing tiles for installation



Fix the edges (polyimid tape all over);
Clean the coupler installation area (currently the opening is +-1cm from fiber exits);
Install coupler. It is unclear if predrilled holes are usable. Probably the best solution is epoxy;
Visually confirm that fibers are still correctly centered in the coupler opening;
Using scotch tape light insulate the outsides of coupler;
Install preselected SiPM (silicon) and make sure that all related comments and data are in the DB;
Light test the tile:

external light->tile->PA->Scope->noise.

Unfinished Noise & SiPM Calibration work

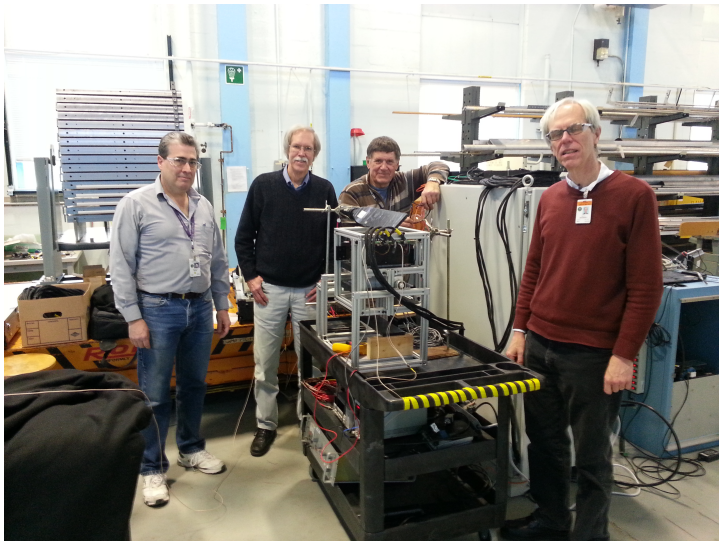


SiPM single pixel calibration in 5->1 configuration;

Baseline noise measurements: single vs 5->1 configurations;

5->1 configuration: short vs long leads

When tiles are assembled , light tested, installed and cabled



- ✓ **Take data and make sure bosses are happy;**
- ✓ **Do the actual work**
  - **Build selftriggering working for Cosmic (algorithm is simple);**
  - **Test selftriggering comparing selftriggered data with those due to external trigger (large counters are in the lab)**
  - **Calibrate HCal towers with Cosmic muons. Vary the orientation of detector.**