Update 09/19/2016

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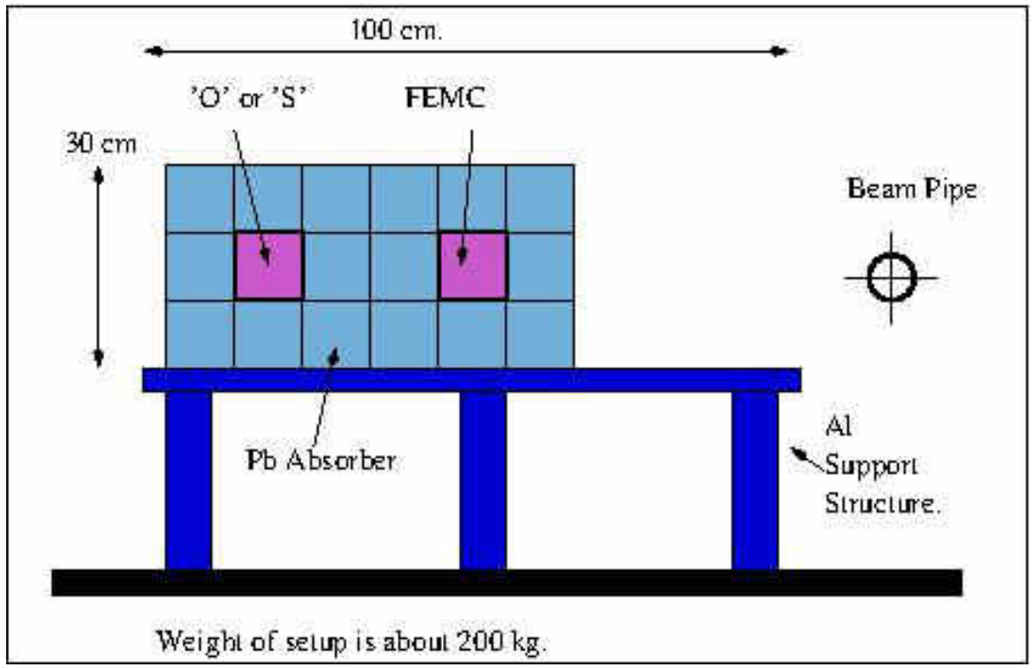
EIC Calor Sep 19, 2016

Priorities for R&D, sampling calorimeters FY17 (budget cut 50%):

- Systematic study of behavior of Si sensors in realistic conditions.



Modify FEMC (light guide for PMT, two sets of SiPM readouts, one being blind to scintillation light.)

Modify 'O' or 'S' similar to FEMC, keep SiPMs downstrem.

- Optimization of compact light collection for FEMC. (Goal to have final version).

Future planning (~2018/2019). Sampling calorimeters (with current budget projections this is out of reach, unless we'll find funds outside eic R&D).

- Build full scale FEMC (256 ch EM + 16 ch. HAD)
- Use it as a permanently running test stand to optimize FEEs, digitizers, DAQ, trigger, monitoring, slow control systems.
- Operate all these systems during RHIC running.

Update since ANL meeting (Prototypes for Tests at STAR, Run 17).

- Both Forward Emcal and 'O' version of HR EMCal were modified for test at STAR during RUN 17. (Added light guides for SiPMs in 'O' and light guide for PMT in FEMC.
- Additional FEEs for SiPMs were produced at UCLA electronics shop.
- First version of SiPM boards had incorrect sensors placement pads, now being reworked.
- Platform at STAR East side were cleaned up from FPD supports.
- Waiting results of STAR review for installations at the East side for Run17 (FHCal, EIC Setup). Result of review is due by end of Oct.
- Tested SiPMs exposed during run 16 (~ 2-5 10^9 n/cm2) no degradation in resolution or gain compare to un-exposed boards, as expected.

In general, no problem with preparation of two prototypes to be placed at STAR for Run 17.

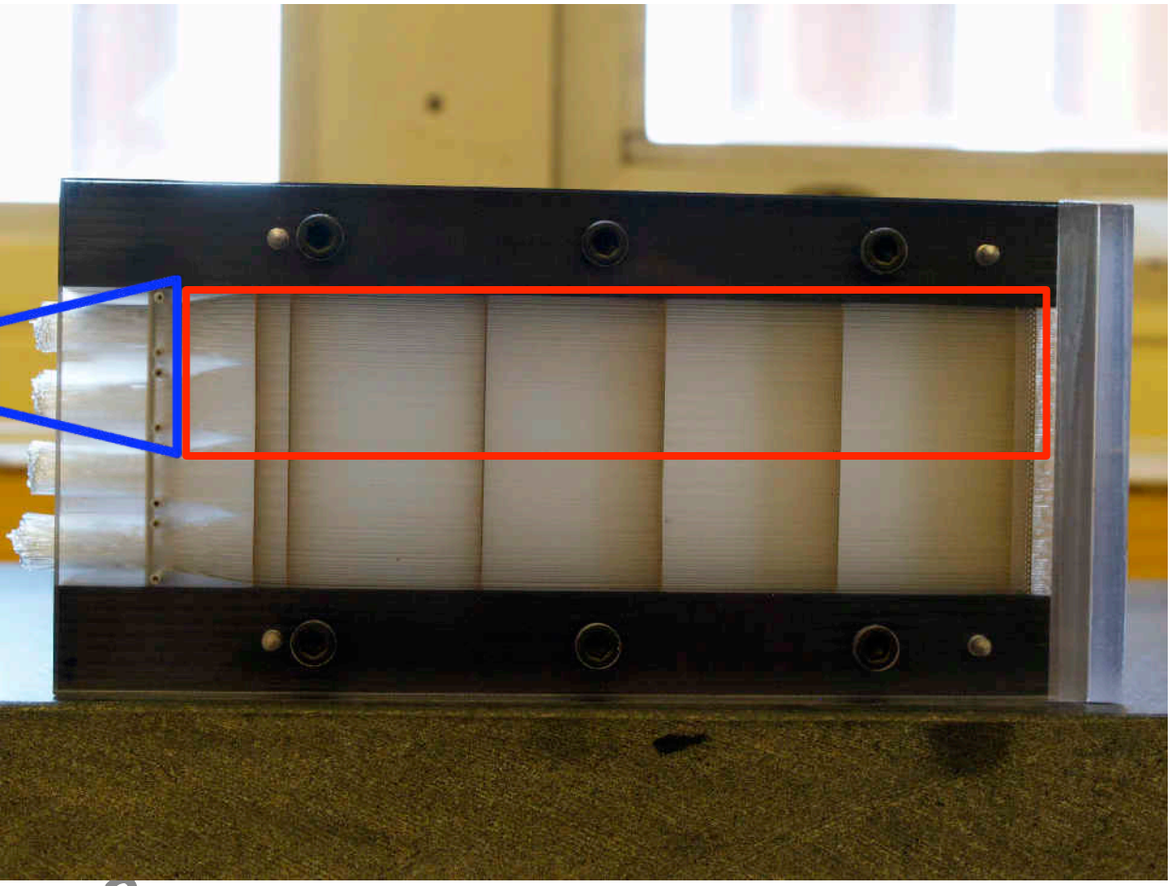
Update since ANL meeting (Optimization of light collection).

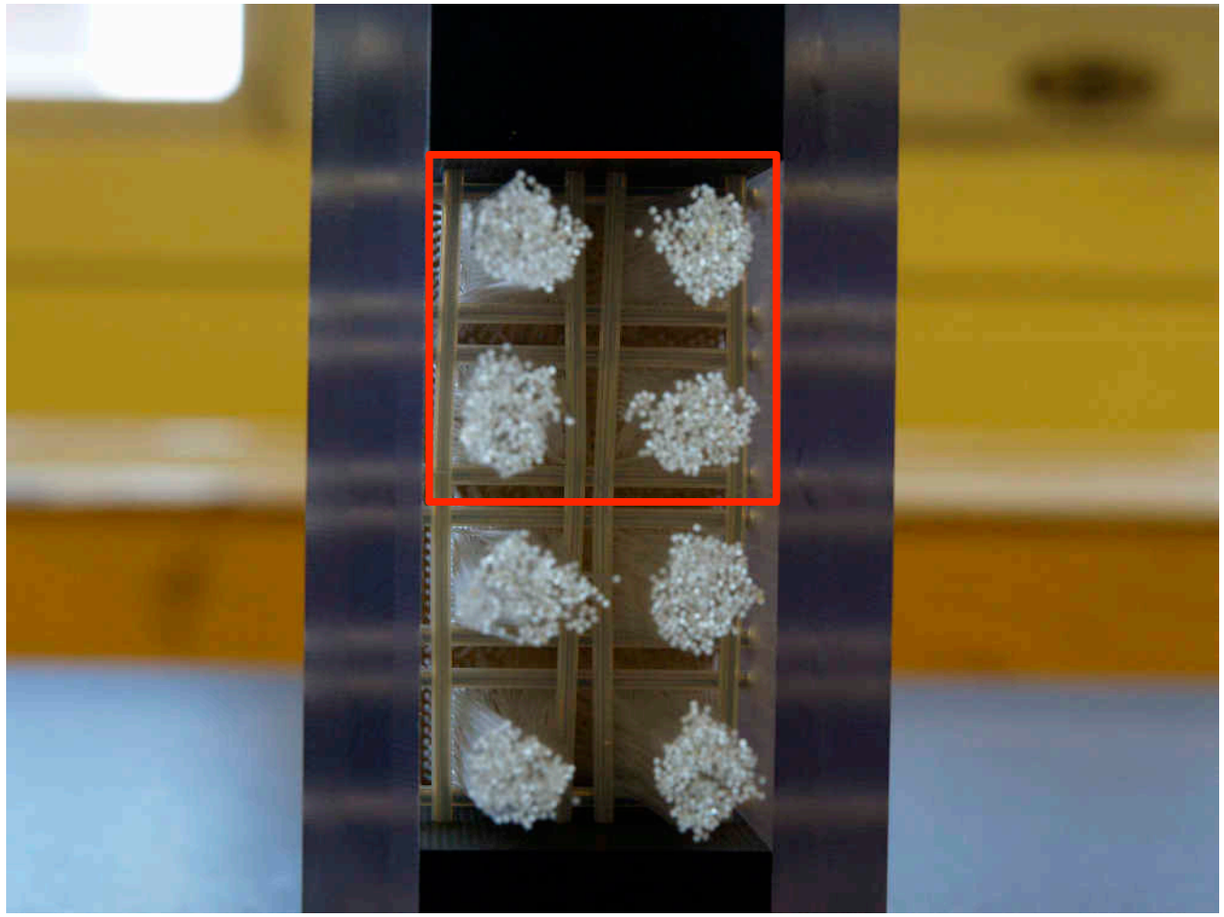
Goal is to have it uniform without compensation filter between fibers and light guides.

ND filter cut about 30% of light_(FNAL test runs 2014/2015)

- Different methods of optimizations of light collection scheme for FEMC discussed in the proposal is out of reach with current budget, thus we'll try the one we think is easiest.

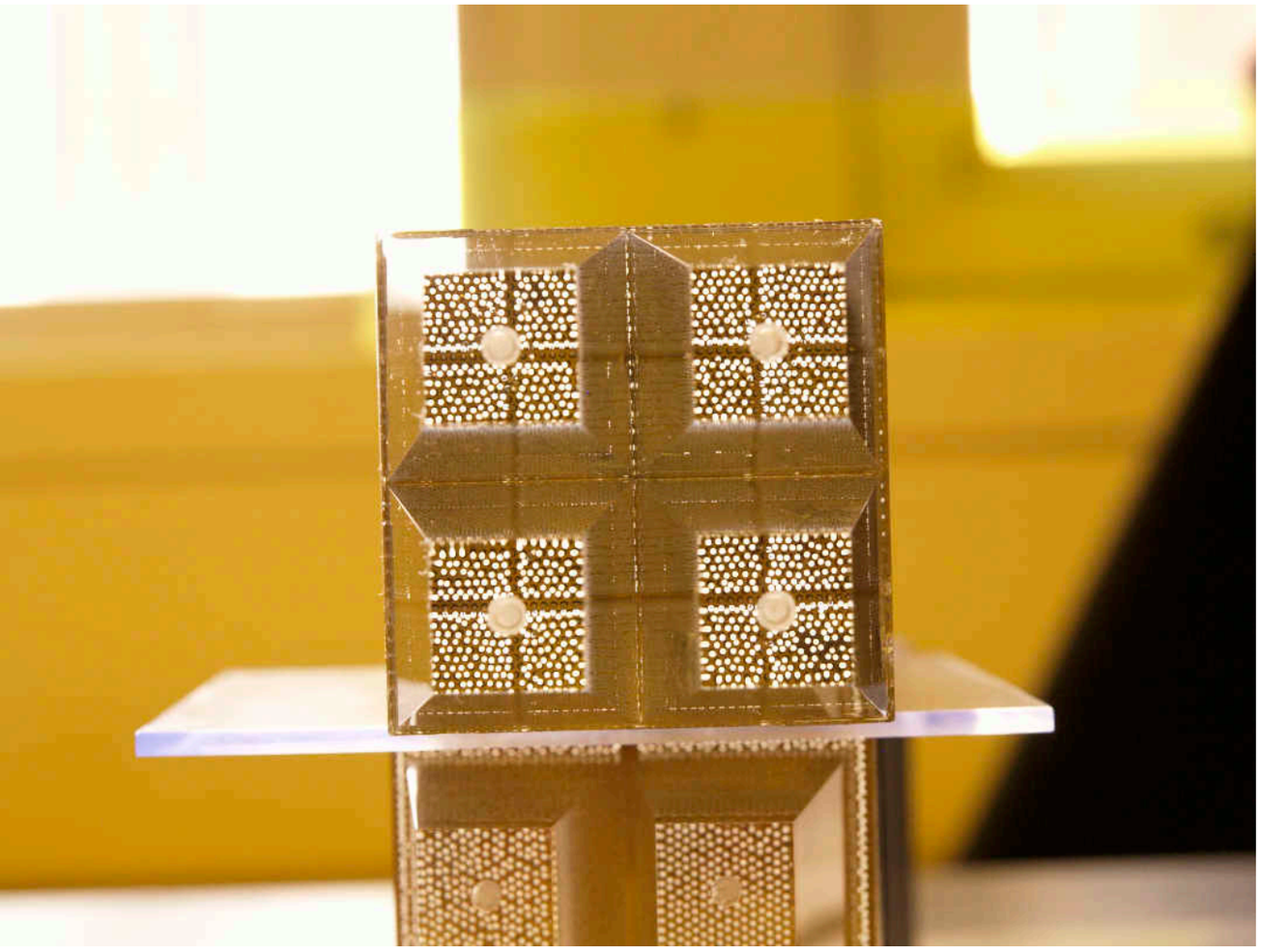
- Introduce 'controlled angular irregularities' in fibers within tower, so that fibers in the corners and in the center will provide same LY.

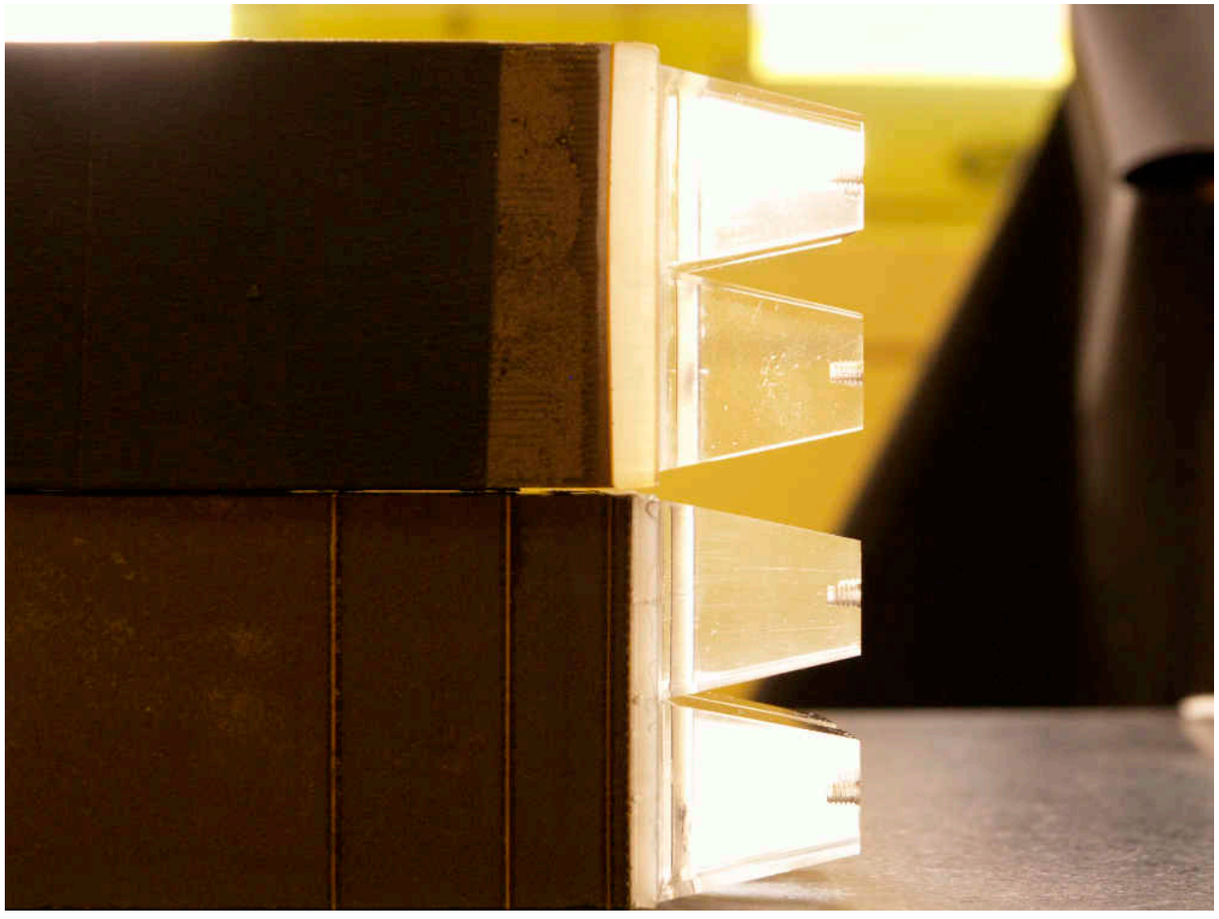


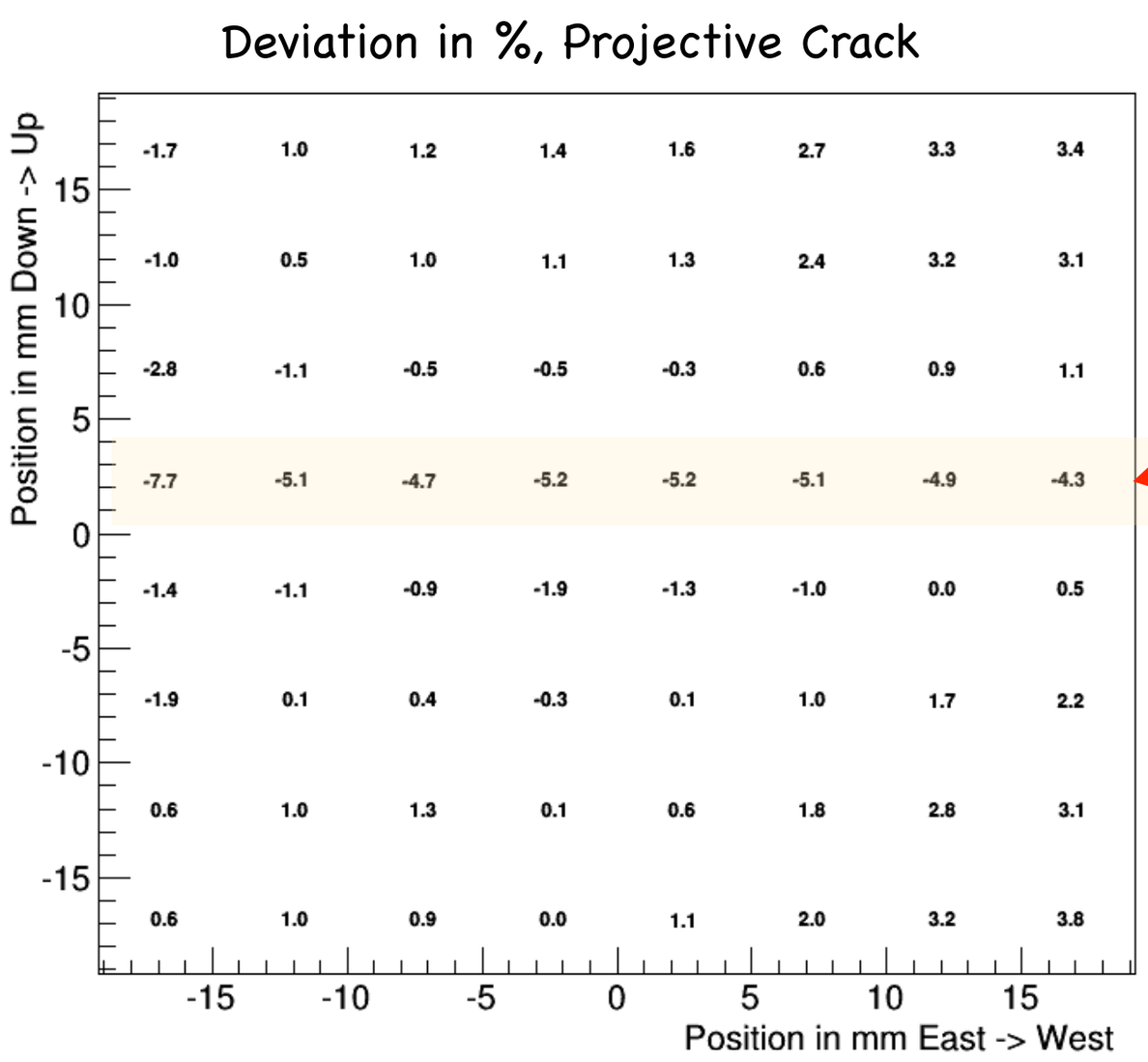


Update since ANL meeting (Optimization of light collection, cont.).

- Made Short version of FEMC 2 x 2 block (2/3 of lengths, due to luck of fibers).
- Meshes at the end (close to light guides) have larger holes to allow bending of fibers.

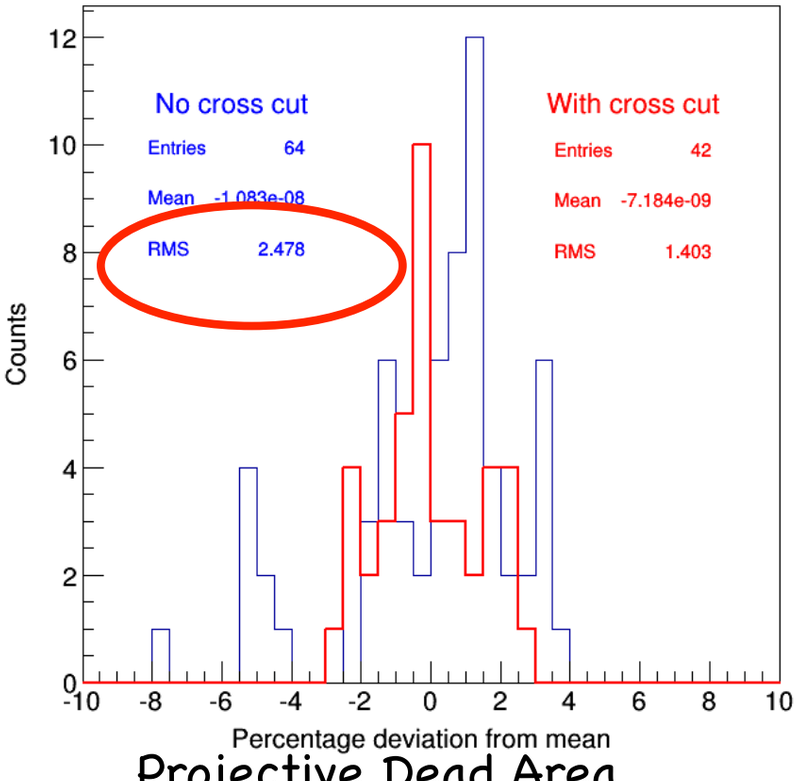




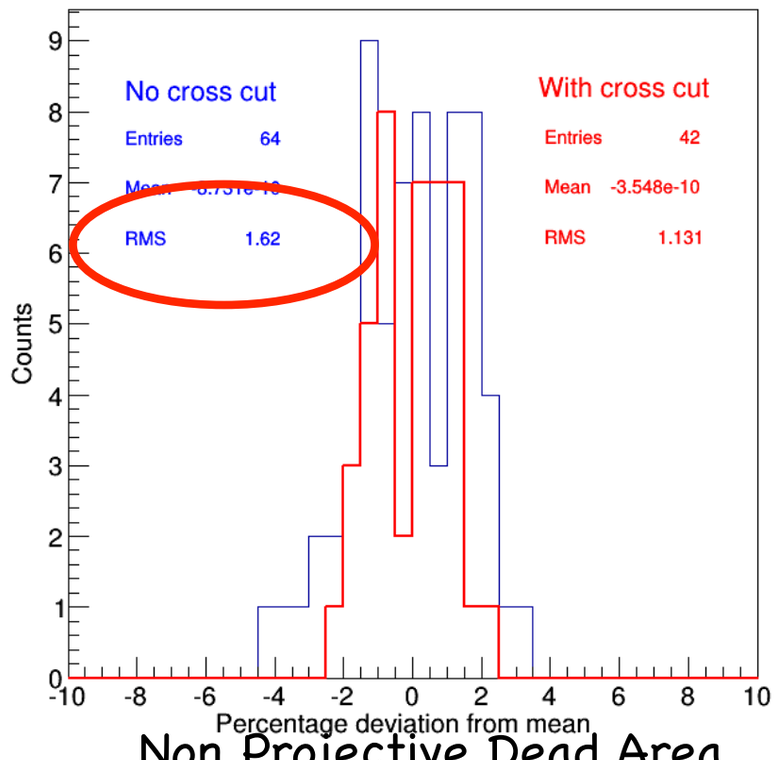


Uniformity Studies:

- Data sample 4 GeV electrons, 1k e- evt. in pixel 5mm x 5mm
- 'Cracks' clearly seen for hits within +- 2.5 mm to the crack
- Projective dead areas (horizontal orientation of the 'crack') increases constant term by ~ 50%.
- Projective dead areas increases dip near the 'crack' by ~ 100%.



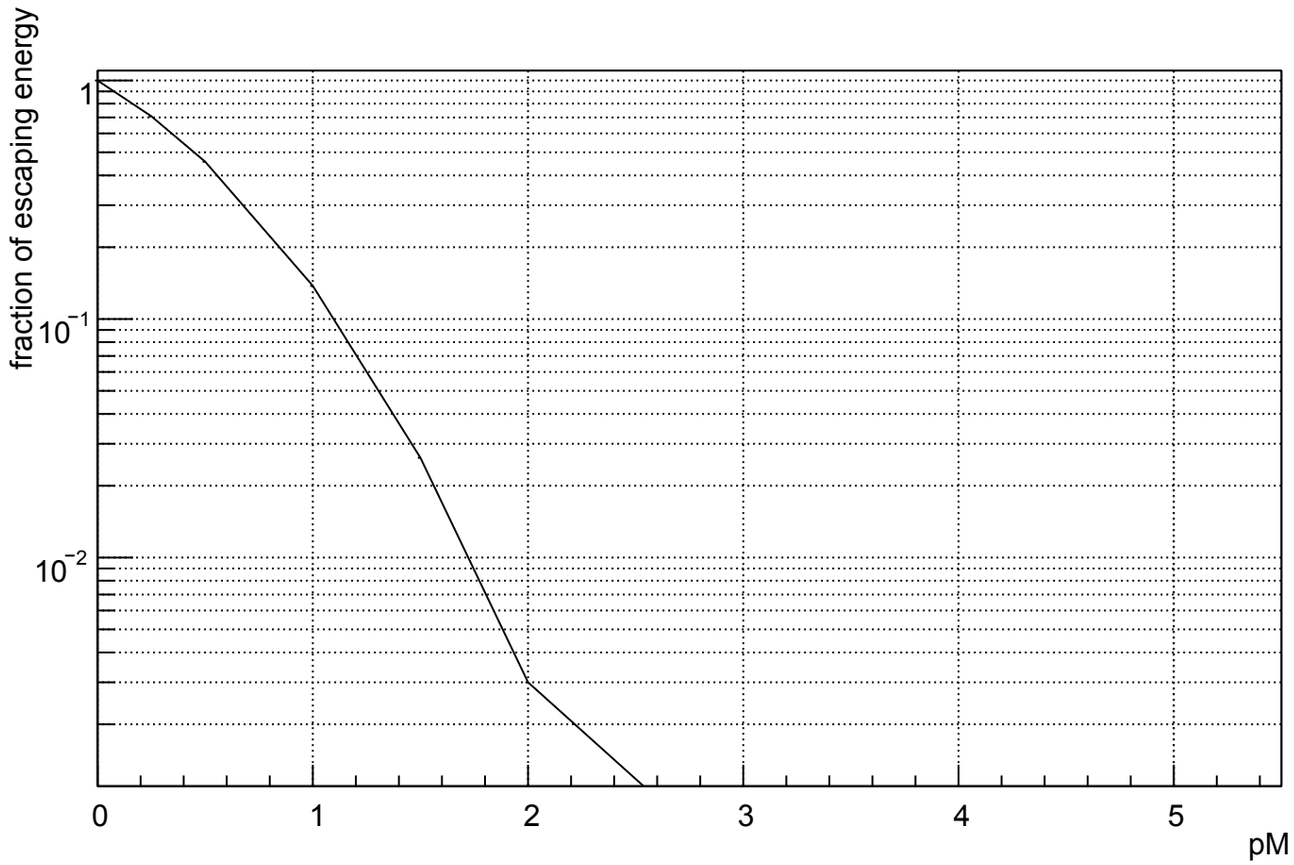
Projective Dead Area



Non Projective Dead Area

Update since ANL meeting (Optimization of light collection, cont.).

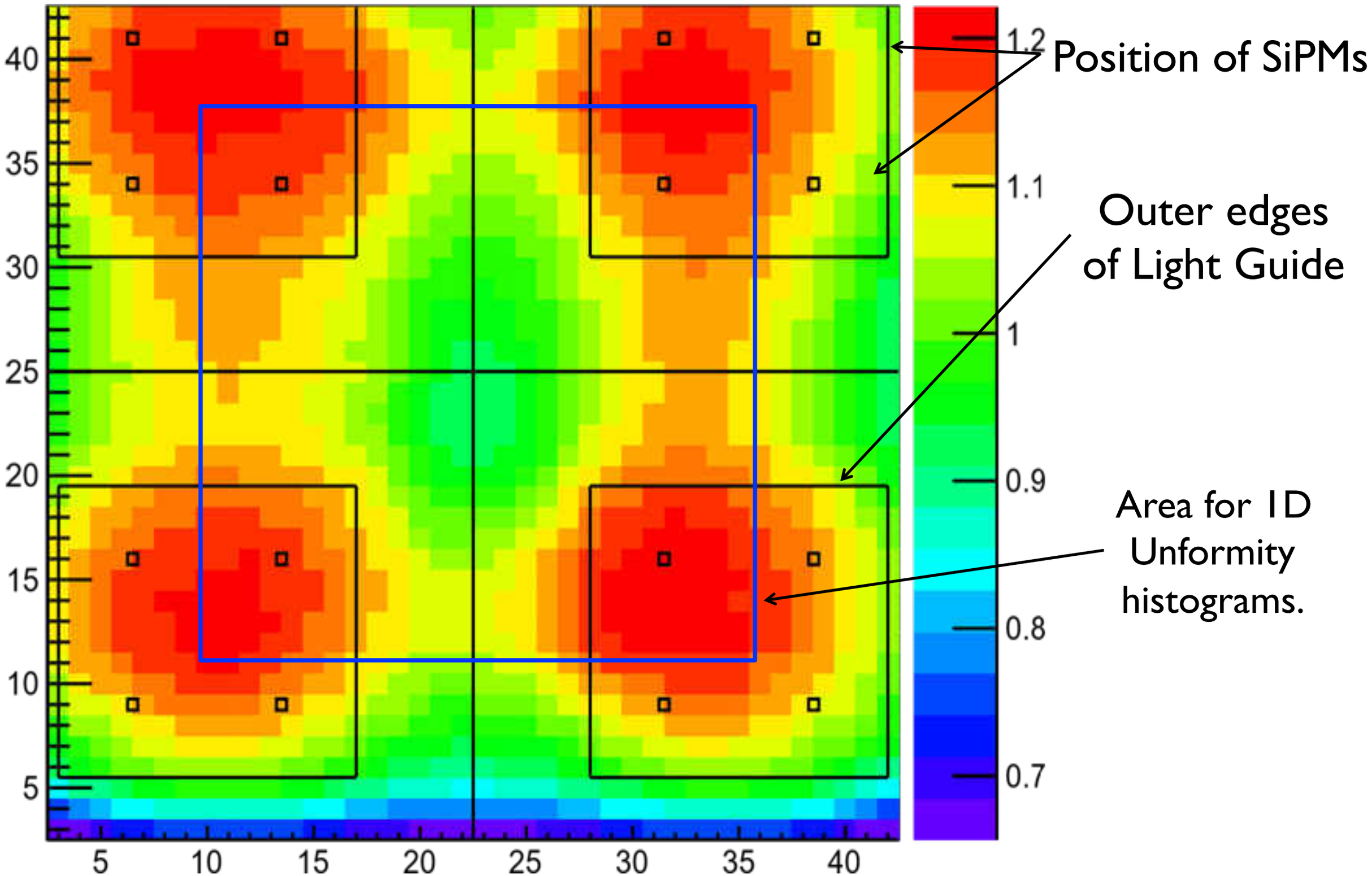
- Mark Warner, new UCLA undergraduate studied different things related to light collection.
- Light source (375 nm LED), Intensity profile mimic em shower, calibrated with PMT/Sc plate.
- Coupling between SiPMs and light guides turned out to be quite important.



Update since ANL meeting (Optimization of light collection, cont. M. Warner).

Current FEMC Light Collection Map, corrected with ND Filter.

Amplitude is Sum of signals from four towers (16 SiPMs).



Update since ANL meeting (Optimization of light collection, cont. M. Warner).

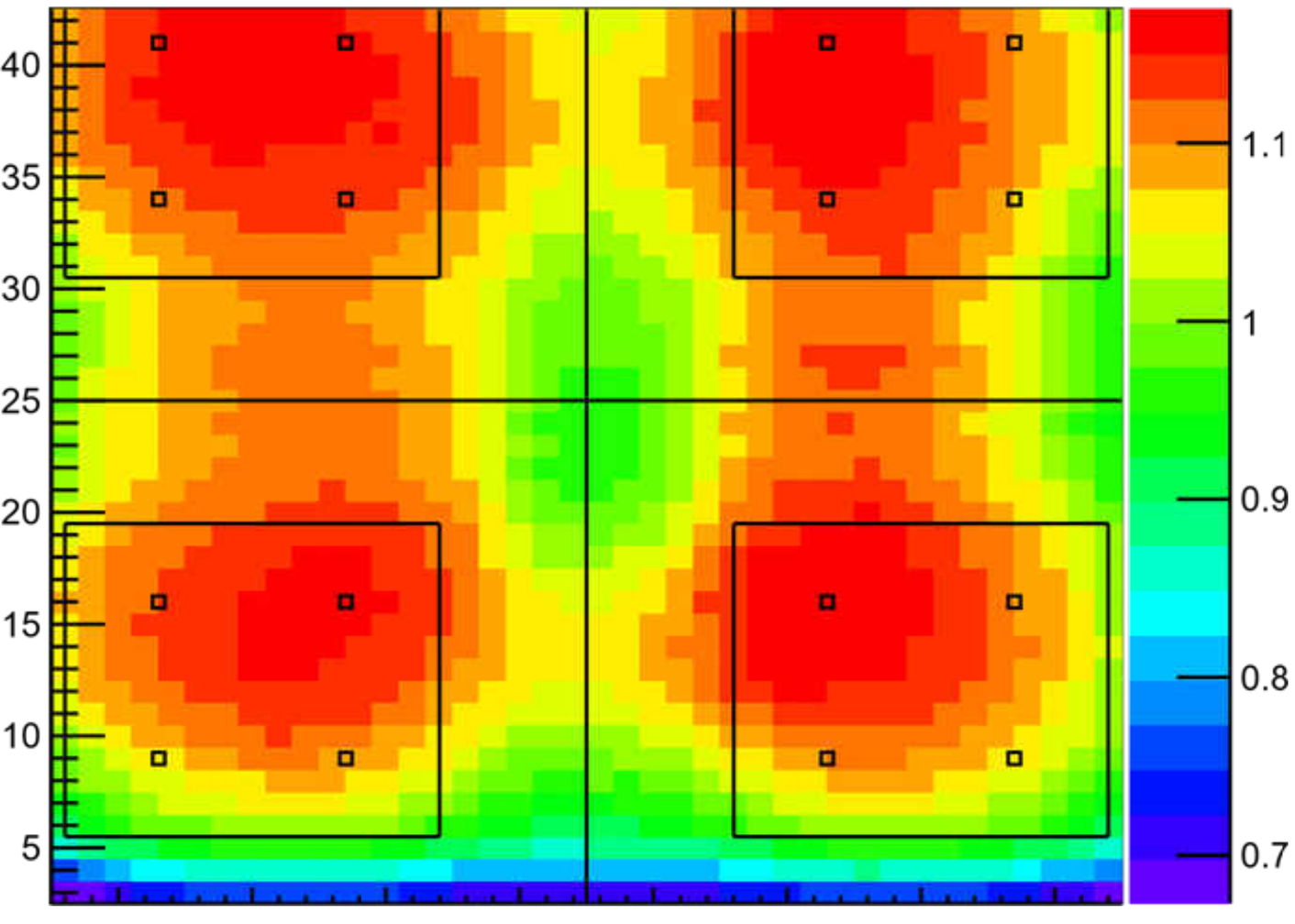
Tests with old FEMC block (no ND filter between light guides and fibers)

Replacing Sylgard 184 used in FEMC SiPM board for coupling SiPMs with light guides by Bicron BC-630 improved light collection (LC) by 10% and also improved uniformity.

Improved LC can be explained (1mm thick Sylgard 184 has 90% transmittance).

Improved uniformity may be due to higher refraction index of BC-630 compare Sylgard 184.

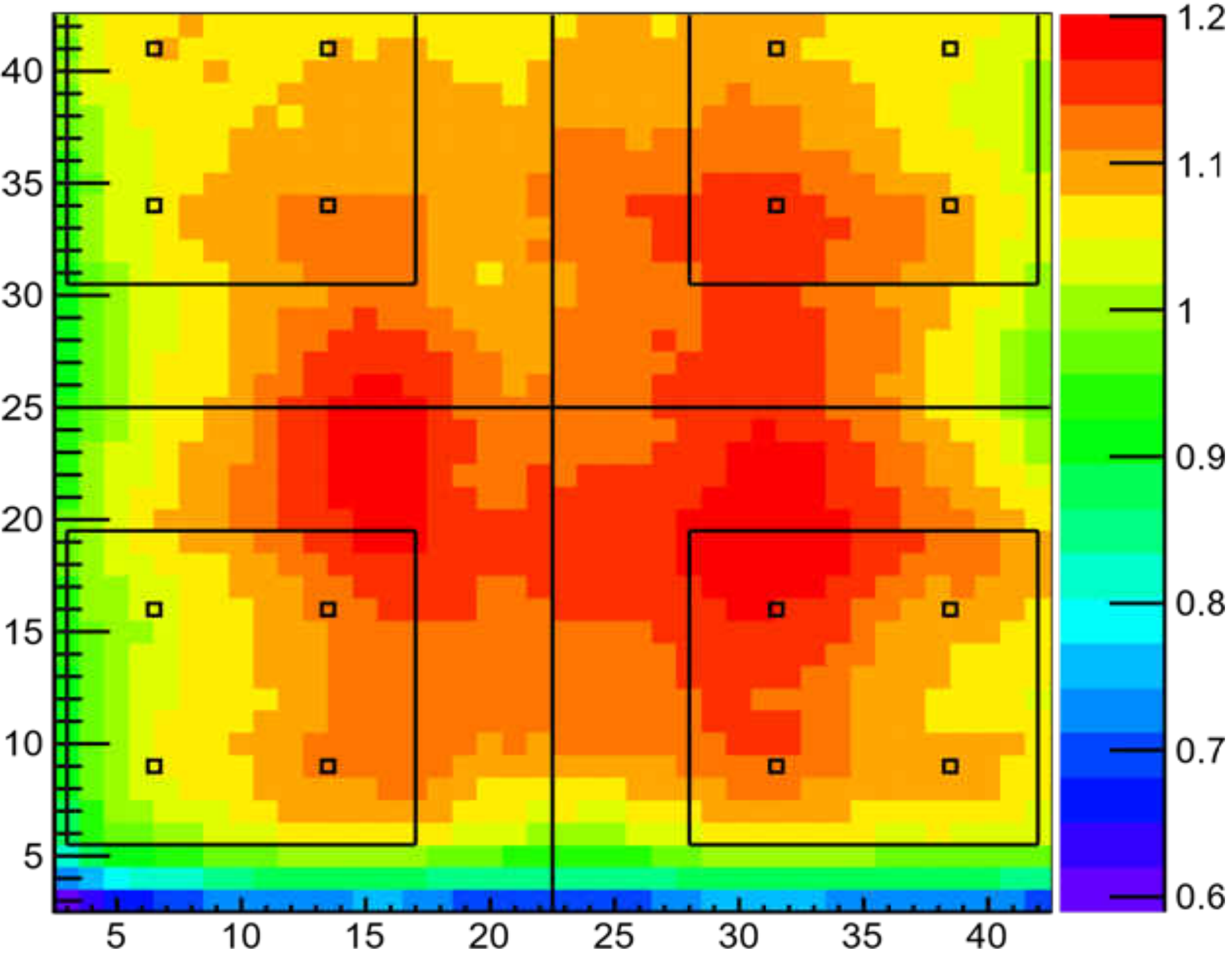
RTV 3145 (CMS, STAR/EIC HCAL, STAR FPS) similar results to Sylgard 184.



Update since ANL meeting (Optimization of light collection, cont. M. Warner).

Tests with new short version of FEMC block (bunched fibers)

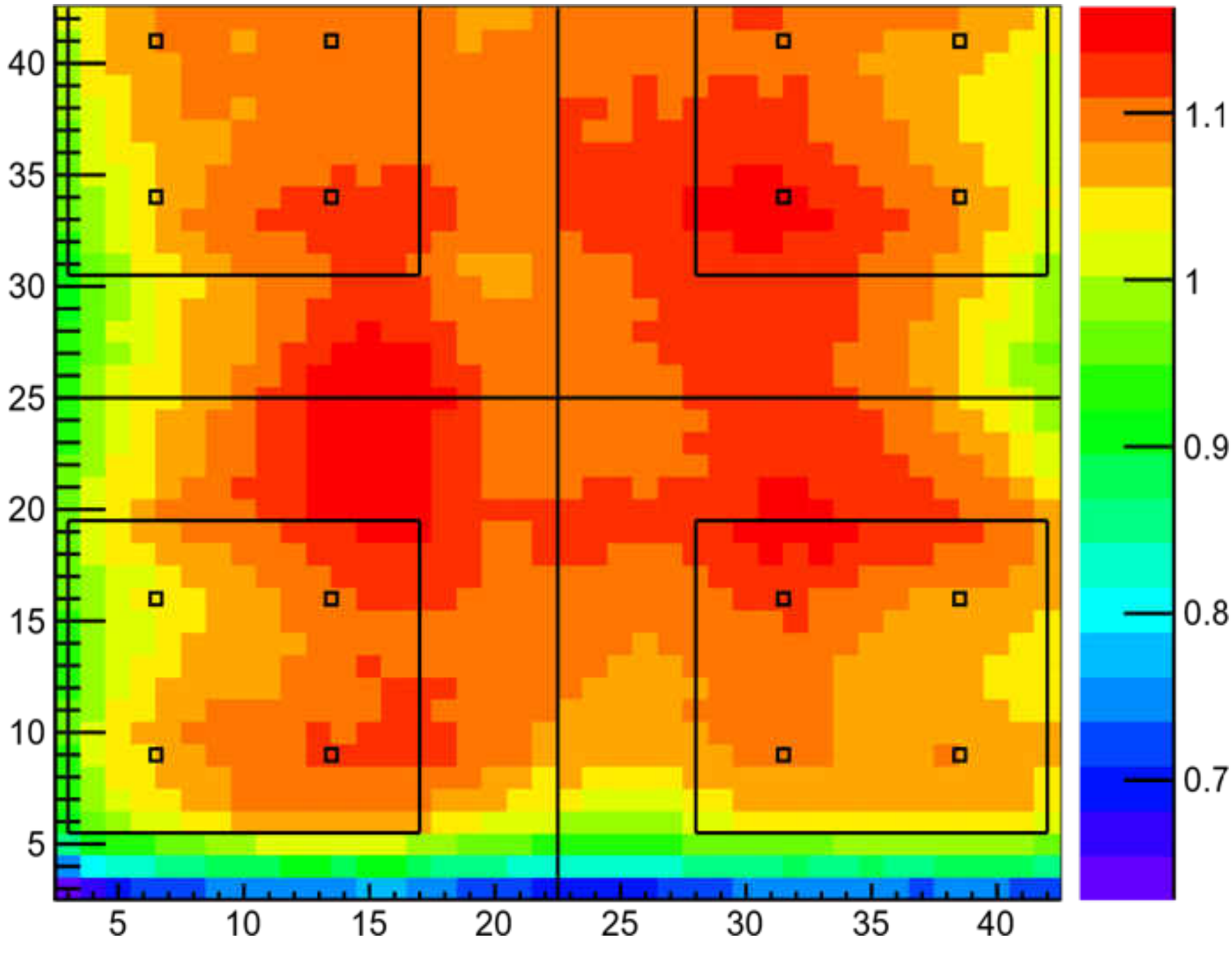
Map with Bicron BC-630. Much better uniformity.

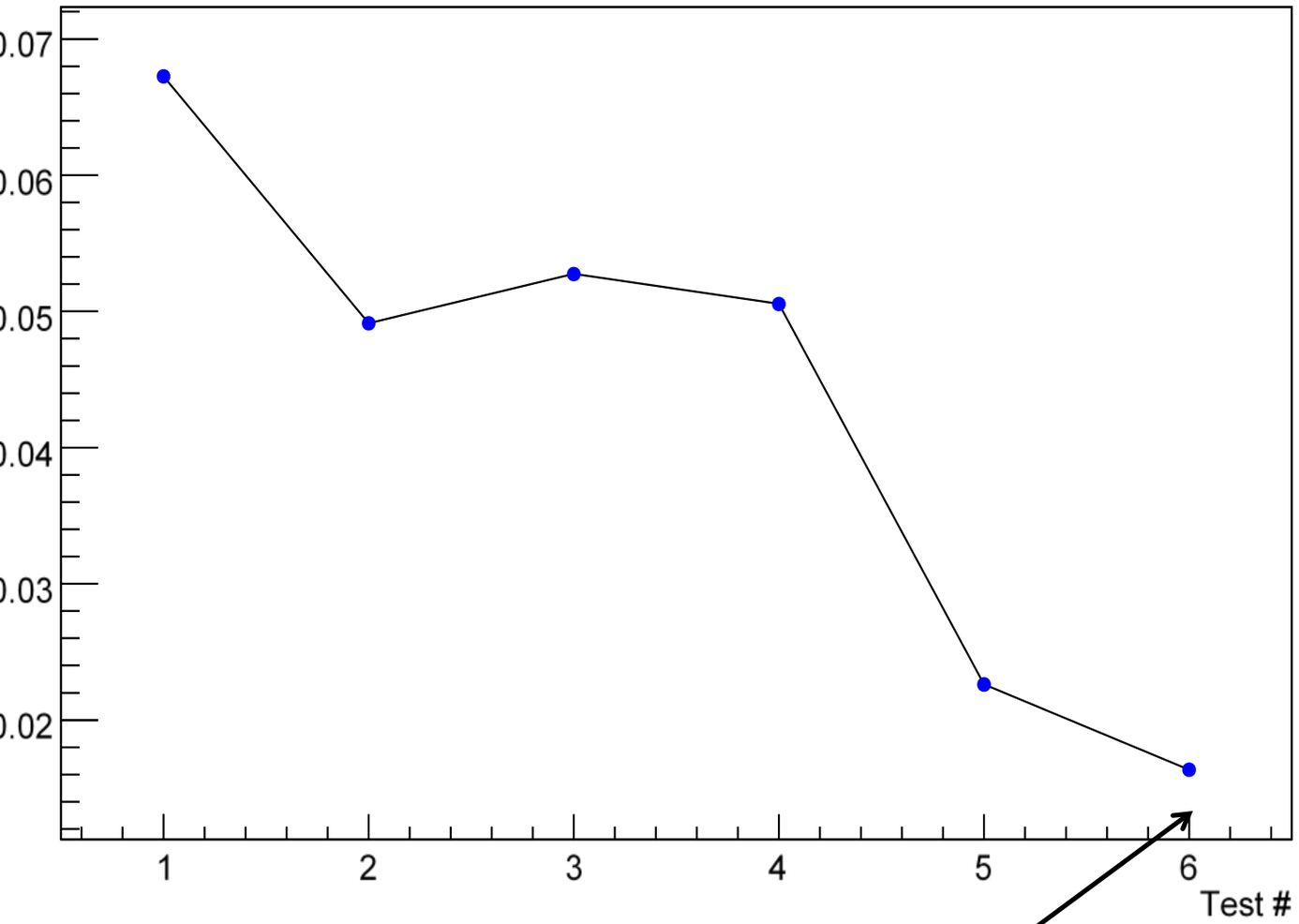


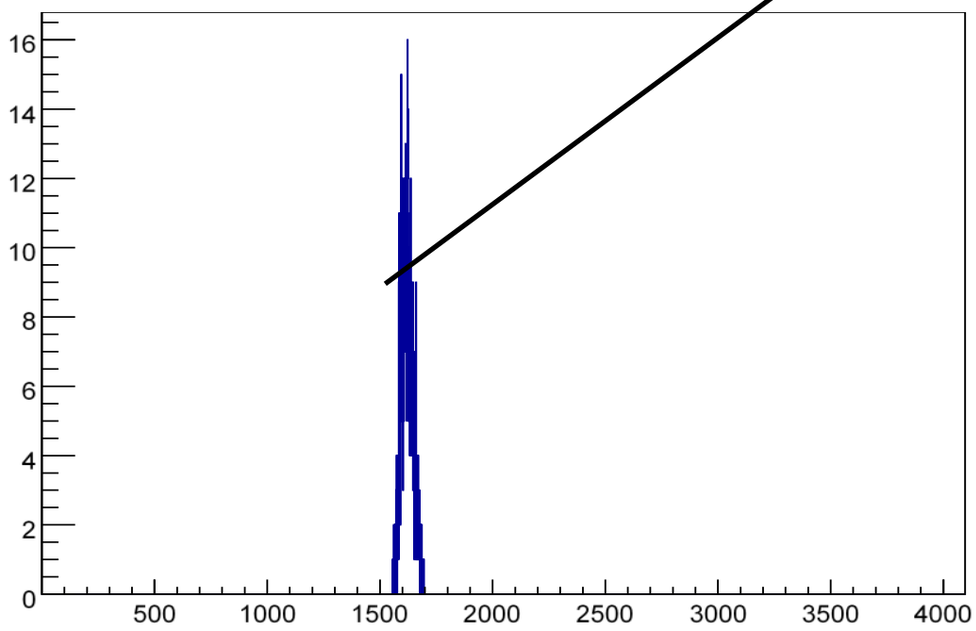
Update since ANL meeting (Optimization of light collection, cont. M. Warner).

Tests with new short version of FEMC block (bunched fibers)

Map with Lumisil 591 (n = 1.53, Waker Silicones, 2016). Best result so far.







Update since ANL meeting (Optimization of light collection, cont. M. Warner).

Best achieved uniformity (rms/mean) ~ 1.6% (bunched fibers/lumisil) is close to what was measured at FNAL for High Reso Emcal with PMT.

Missing is control test with Lumisil and old FEMC (this week).

Once fibers, etc. will arrived we'll make Normal length FEMC modules (bunched fibers / straight fibers) and repeat these tests. (~ 3 months form now).