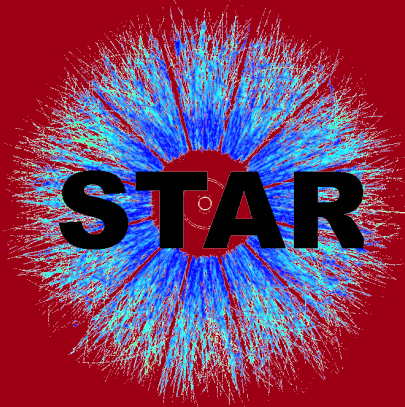


Construction of the STAR Event Plane Detector

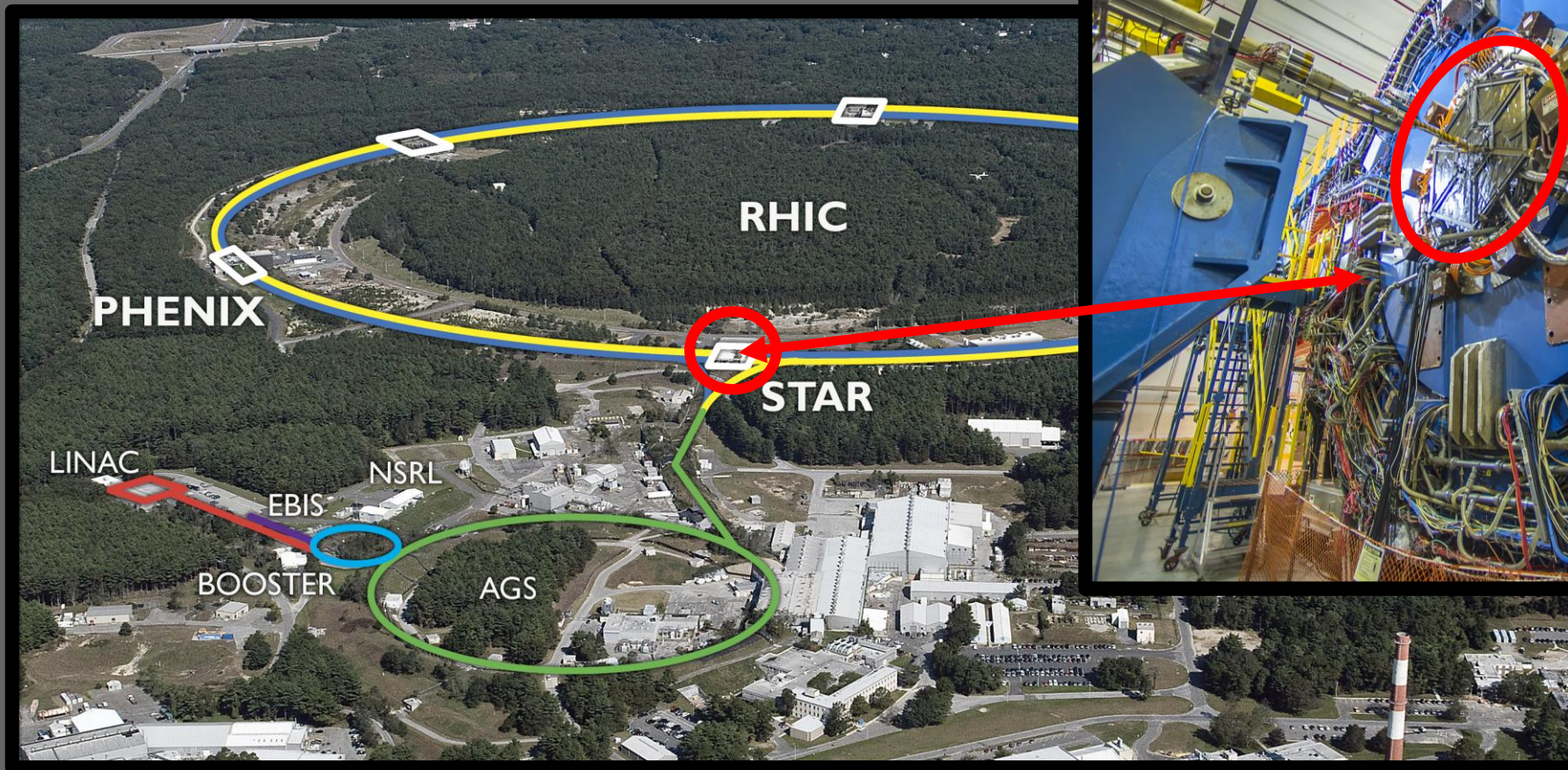
Joseph Adams



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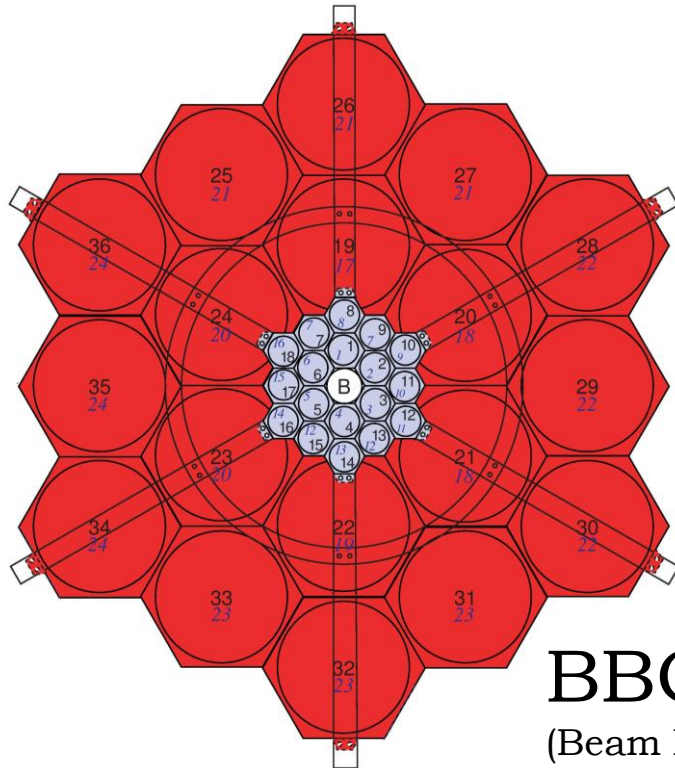
DEPARTMENT OF
PHYSICS

The EPD: a STAR upgrade



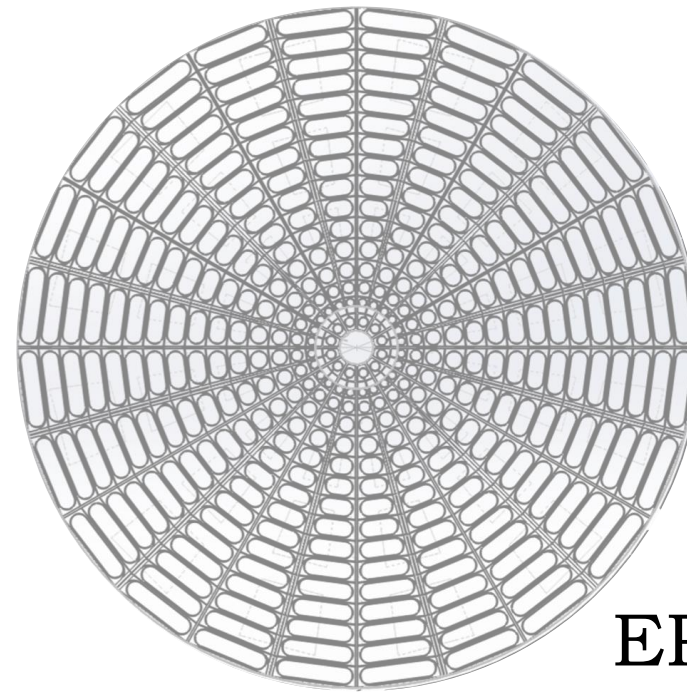
The EPD: a STAR upgrade

Out with the old...



BBC
(Beam Beam Counter)

in with the new.



EPD
(Event Plane Detector)

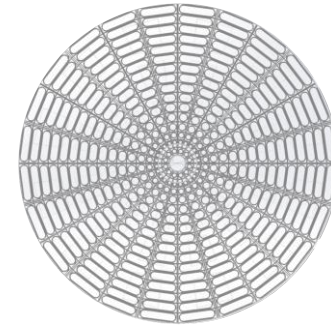
The EPD – a STAR upgrade

BBC



- 18 (x2) tiles but only 16(x2) photomultiplier tubes
- $|\eta_{\text{BBC}}| = 3.3 - 5.0$

EPD



- 372 (x2) tiles and 372(x2) Silicon photomultipliers
- $|\eta_{\text{EPD}}| = 2.1 - 5.1$

$$R_{1,\text{EPD}} \geq 1.5R_{1,\text{BBC}}$$

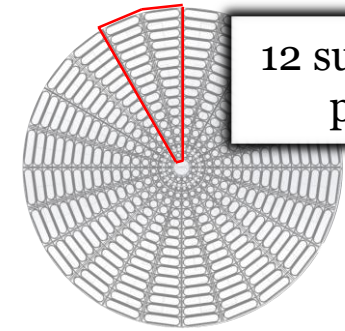
The EPD – a STAR upgrade

BBC



- 18 (x2) tiles but only 16(x2) photomultiplier tubes
- $|\eta_{\text{BBC}}| = 3.3 - 5.0$

EPD



12 supersectors
per disk

- 372 (x2) tiles and 372(x2) Silicon photomultipliers
- $|\eta_{\text{EPD}}| = 2.1 - 5.1$

$$R_{1,\text{EPD}} \geq 1.5R_{1,\text{BBC}}$$

Construction: from slab to supersector



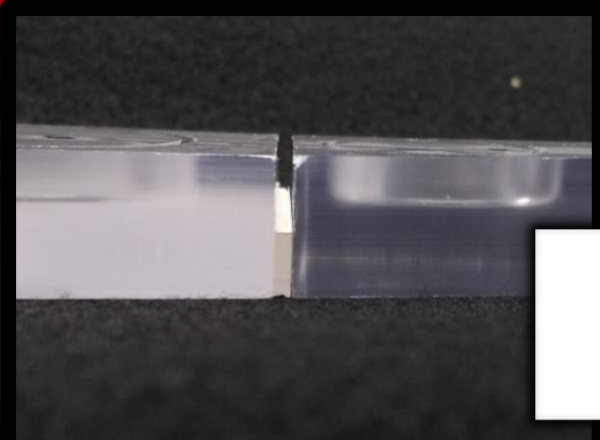
Scintillator
slab

Construction: from slab to supersector



Tile separation
grooves milled
halfway and filled
with white epoxy

Construction: from slab to supersector

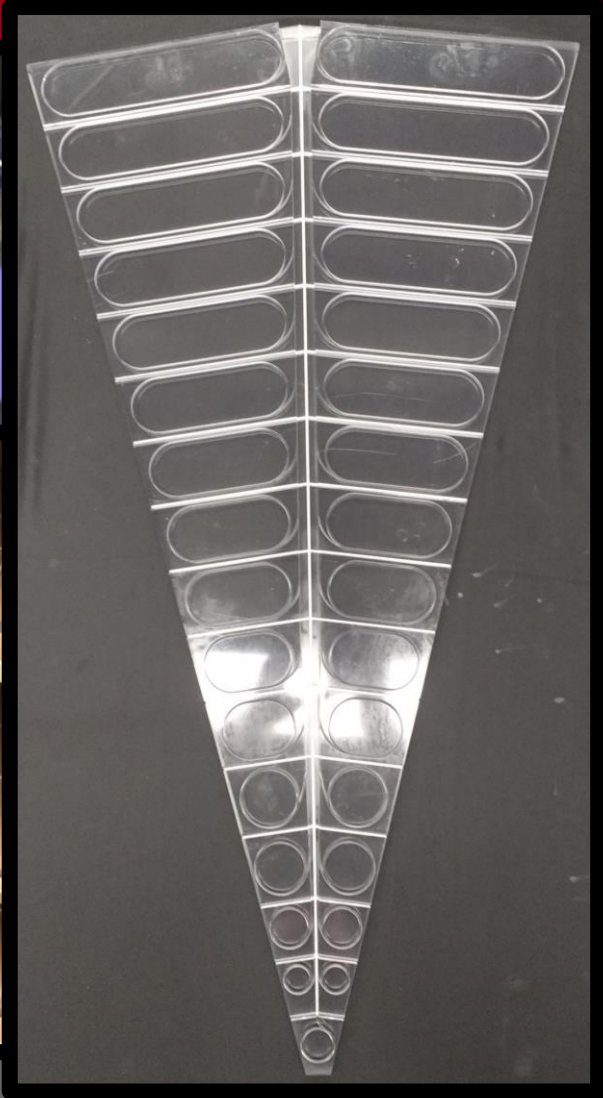


Tile separation
grooves milled
completely...



... as well as sigma
grooves for fiber
optics

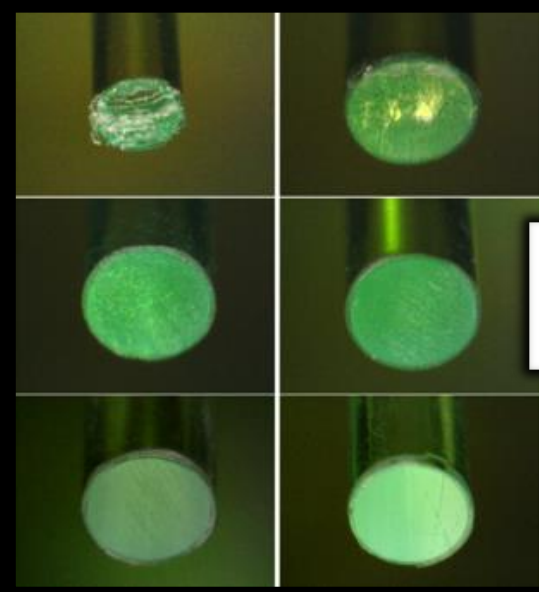
Construction: from slab to supersector



Construction: from slab to supersector

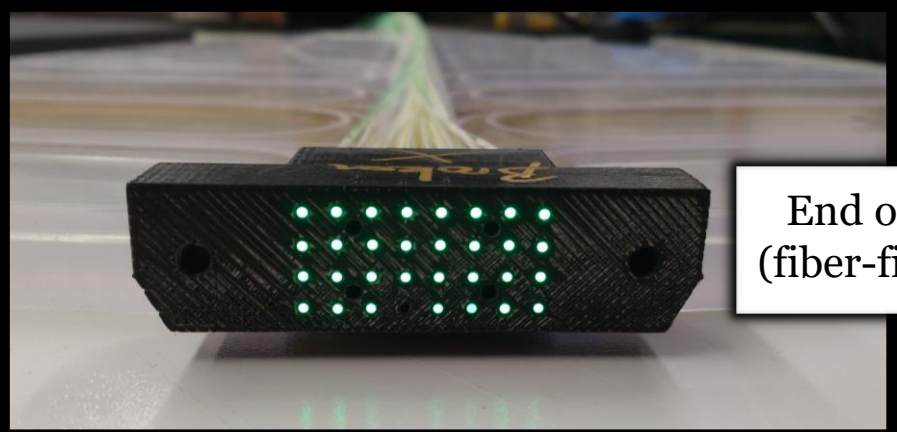
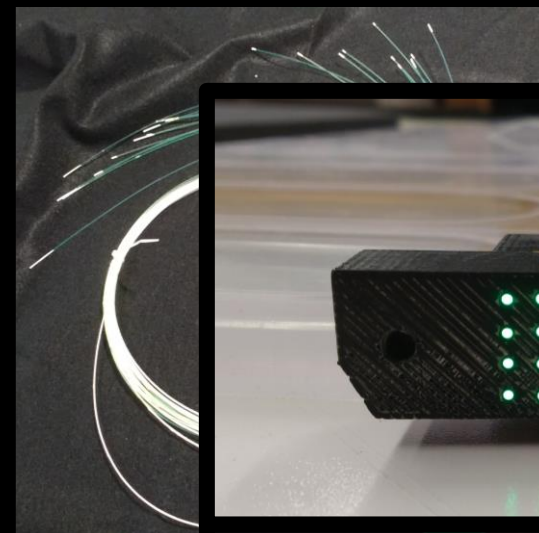
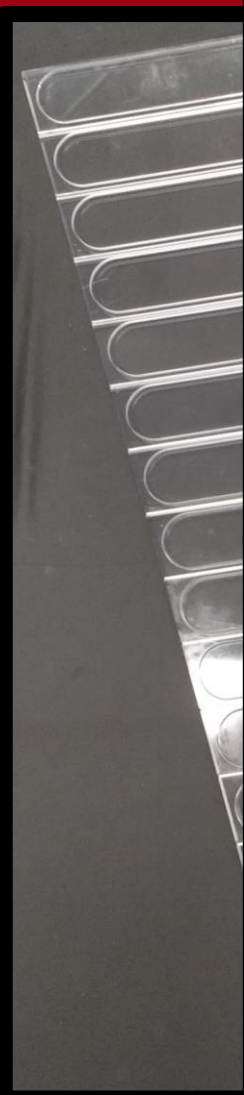


Fiber bundle containing 31 wavelength-shifting fibers

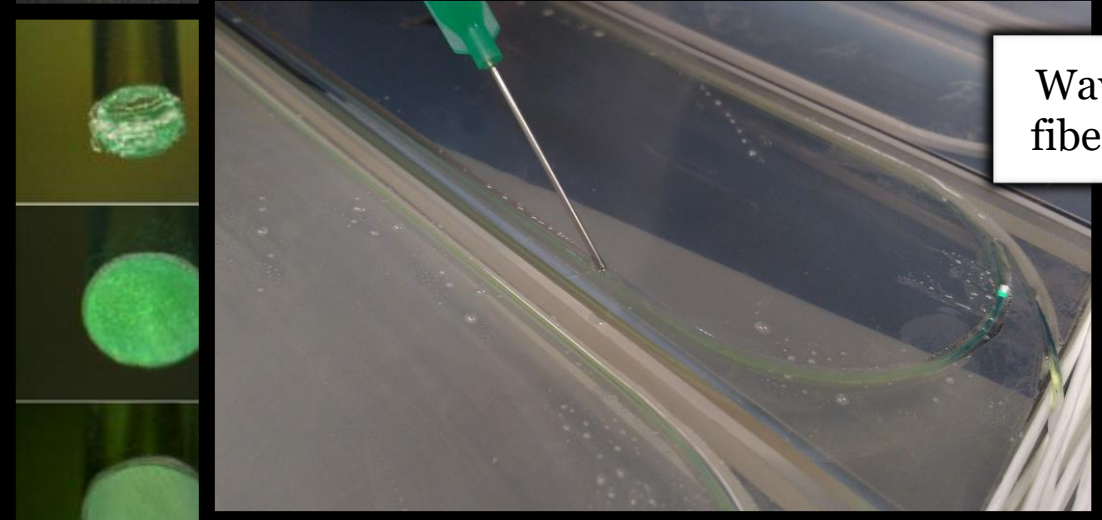


Different stages of fiber polishing

Construction: from slab to supersector

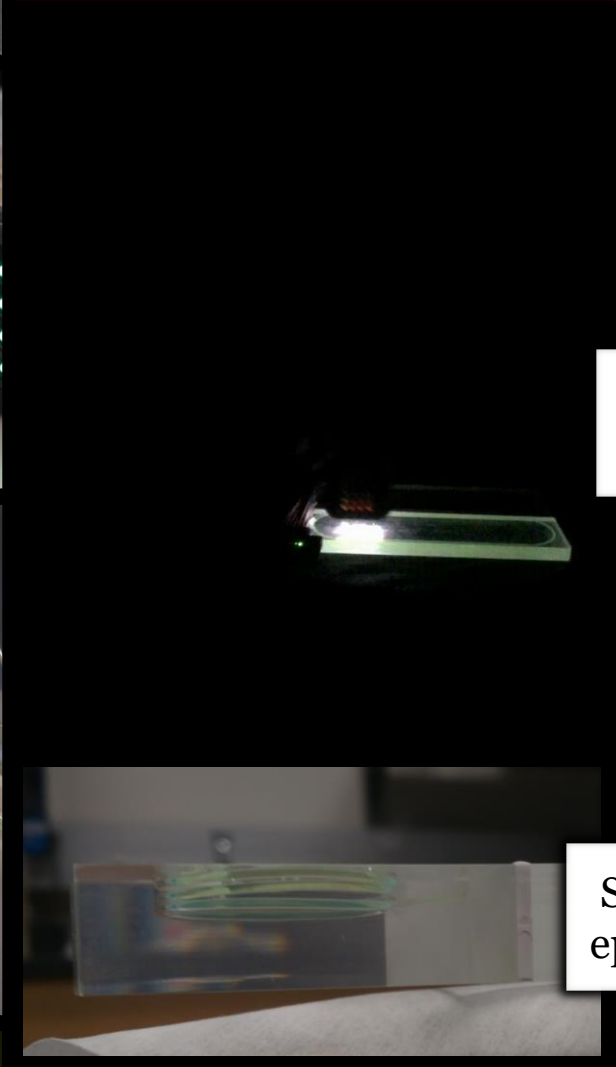
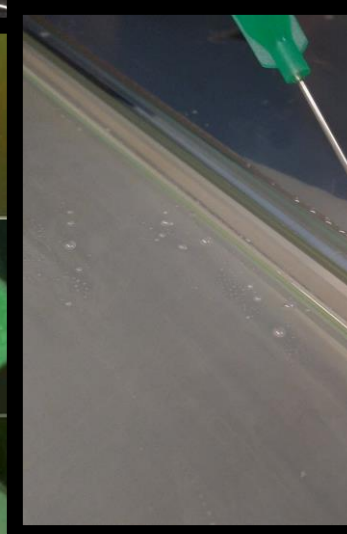
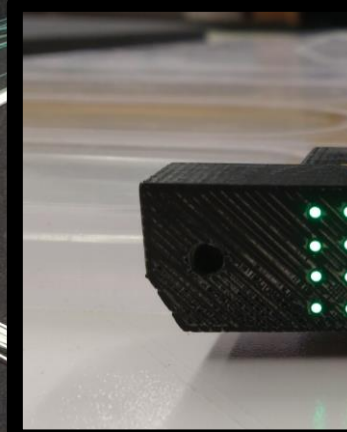
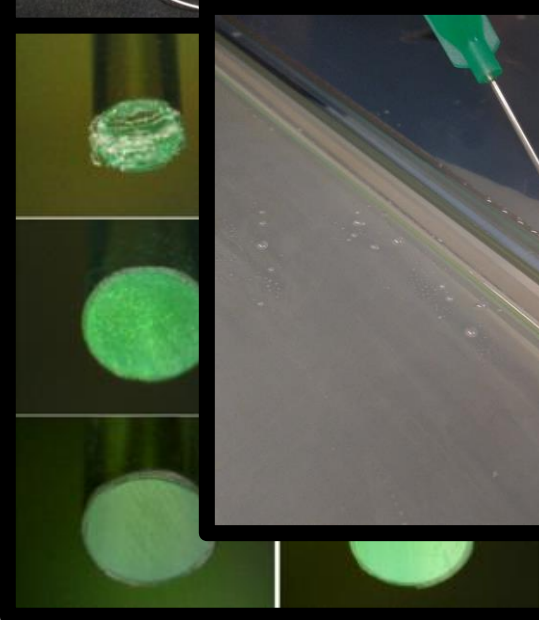
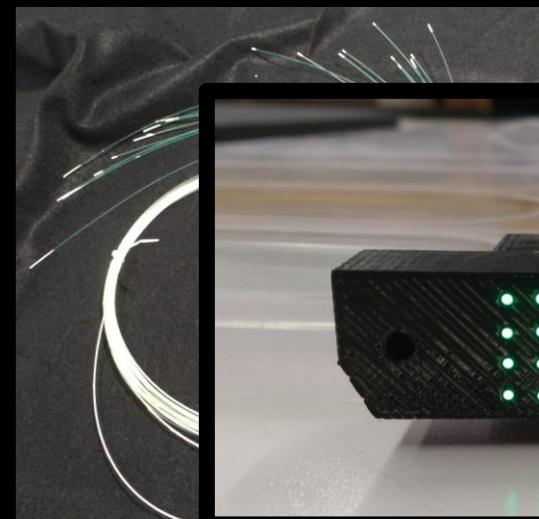
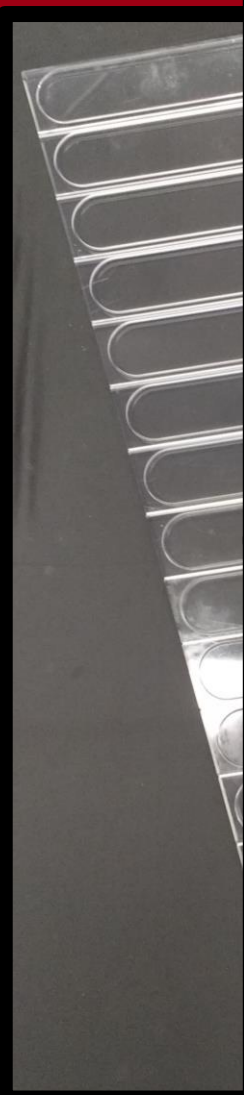


End of fiber bundle
(fiber-fiber connector)



Wavelength-shifting
fibers optically glued

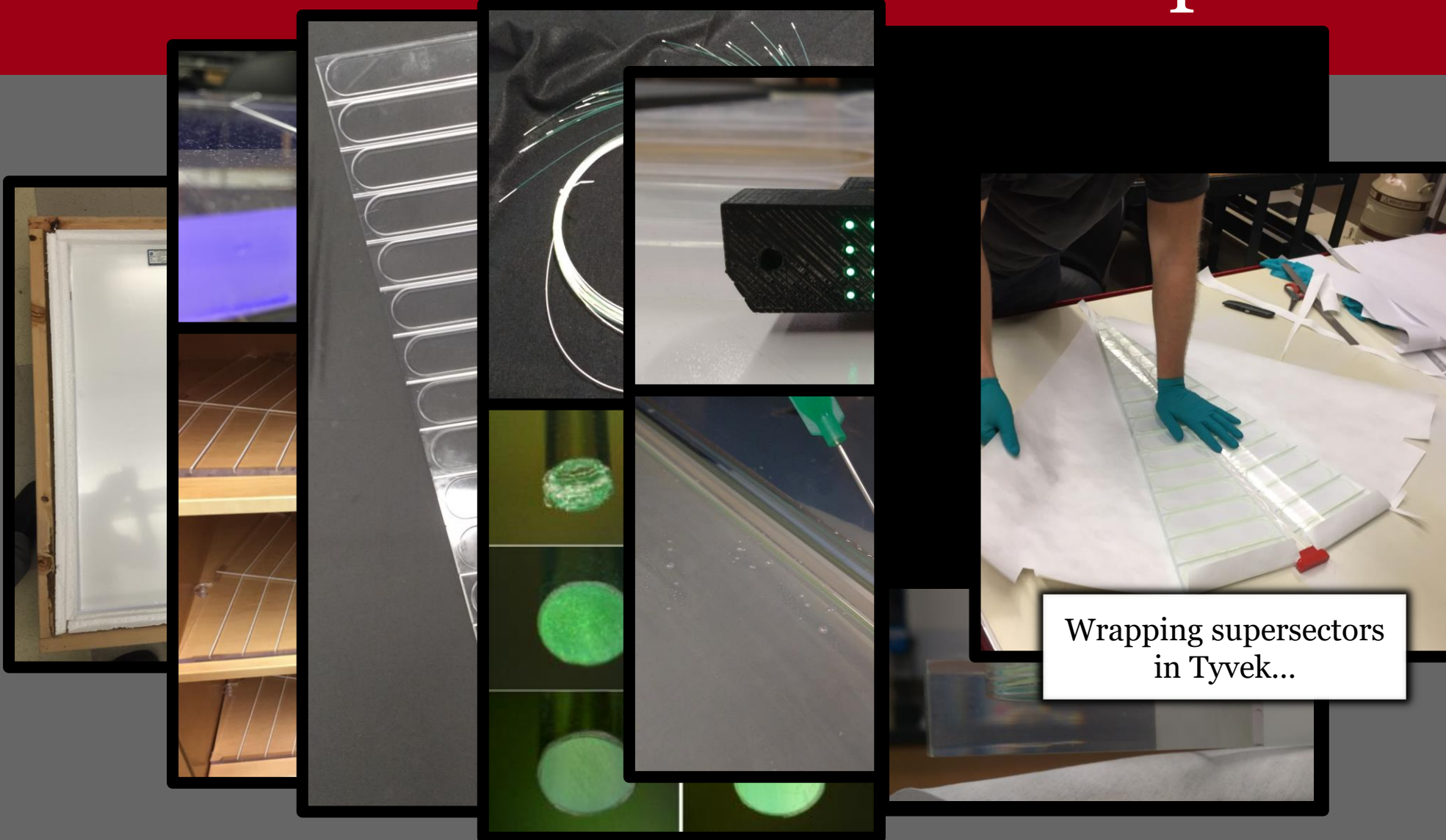
Construction: from slab to supersector



Optically isolated tiles

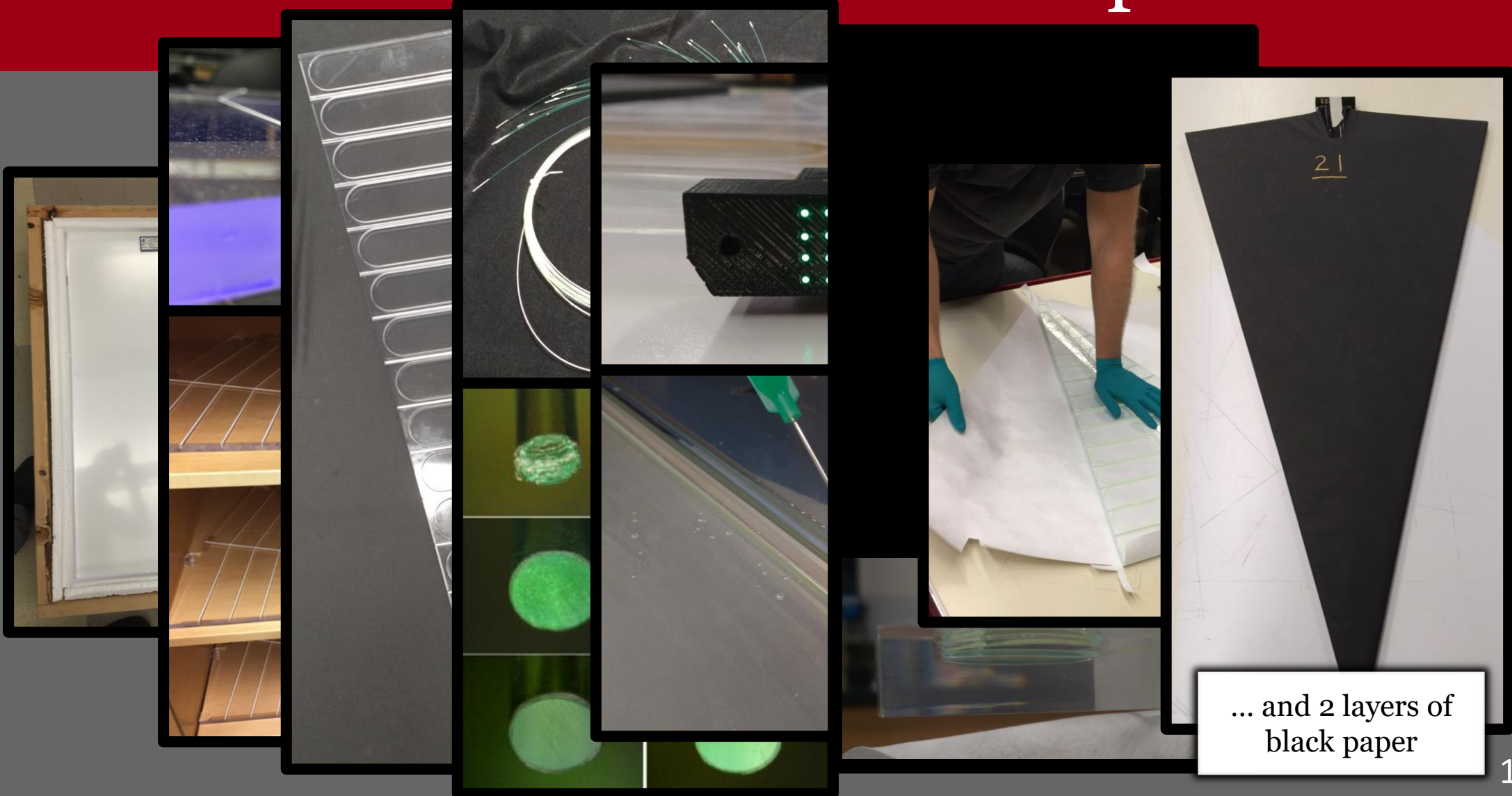
Solid wall of white epoxy between tiles

Construction: from slab to supersector



Wrapping supersectors in Tyvek...

Construction: from slab to supersector



Readout: from MIP to Q

End of supersector



Clear-fiber bundle
splits into two fiber-
fiber connectors

Readout: from MIP to Q

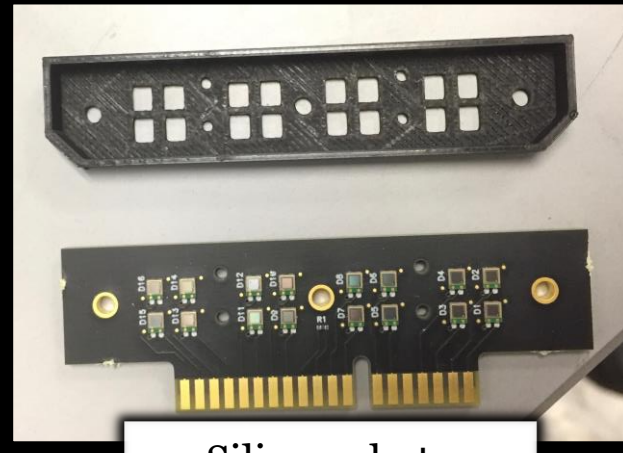
End of supersector



Two ends of a single clear fiber bundle



Clear-fiber bundle splits into two fiber connectors



Silicon photo-multiplier card

Readout: from MIP to Q

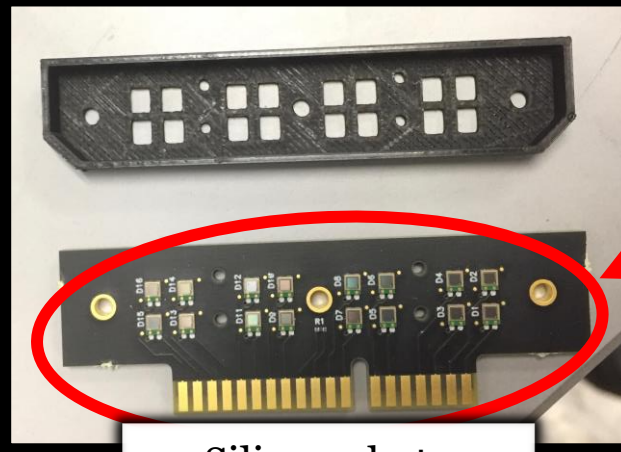
End of supersector



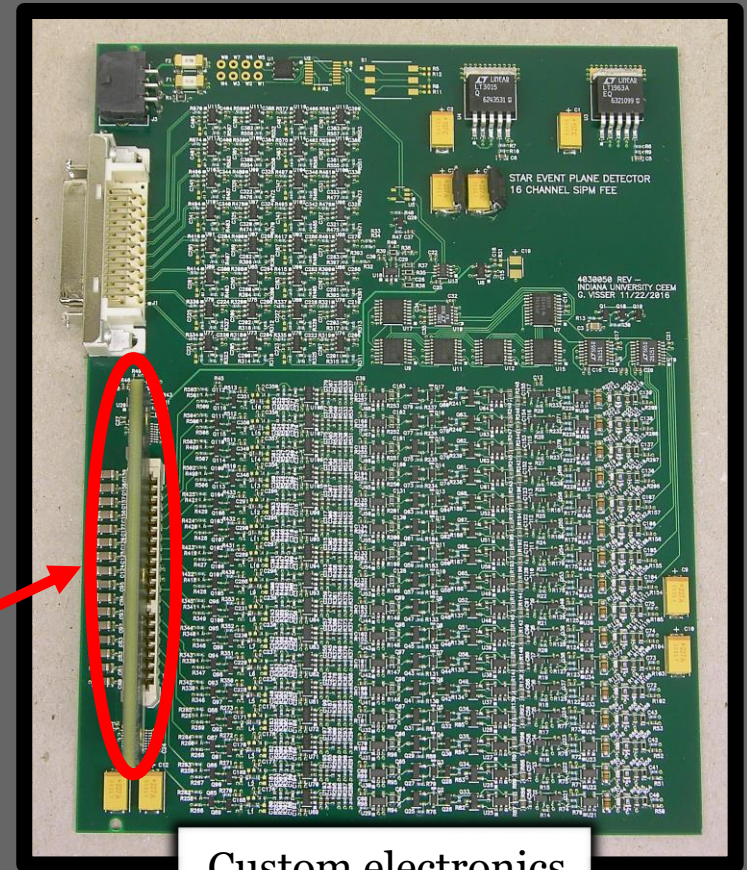
Two ends of a single clear fiber bundle



Clear-fiber bundle splits into two fiber connectors

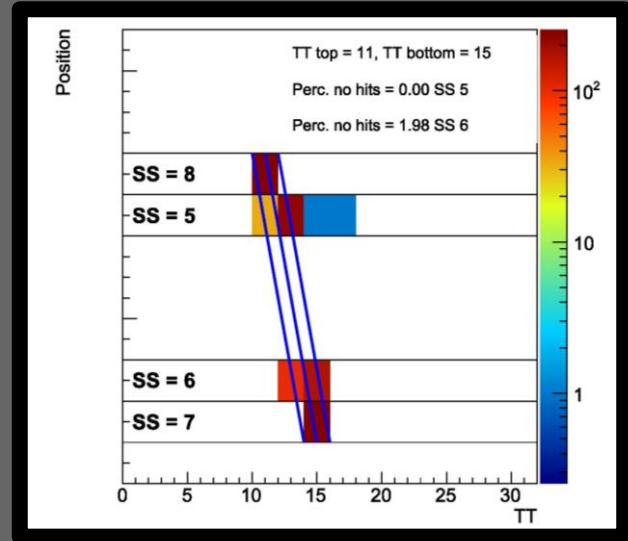
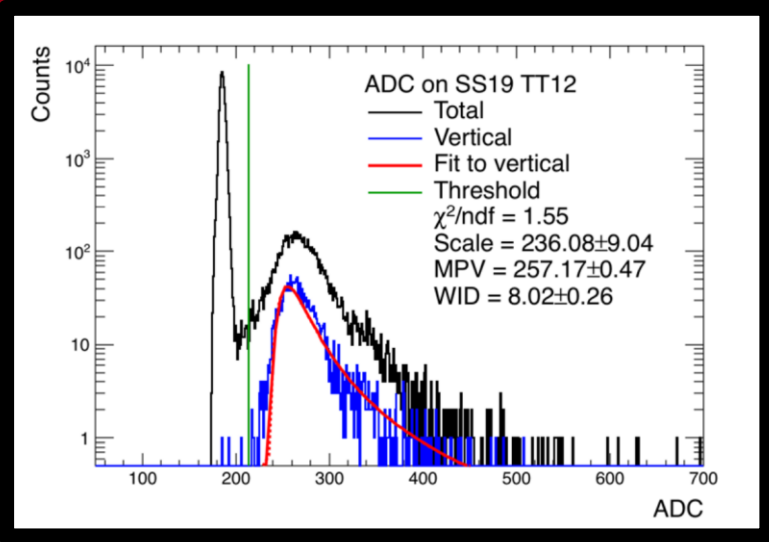
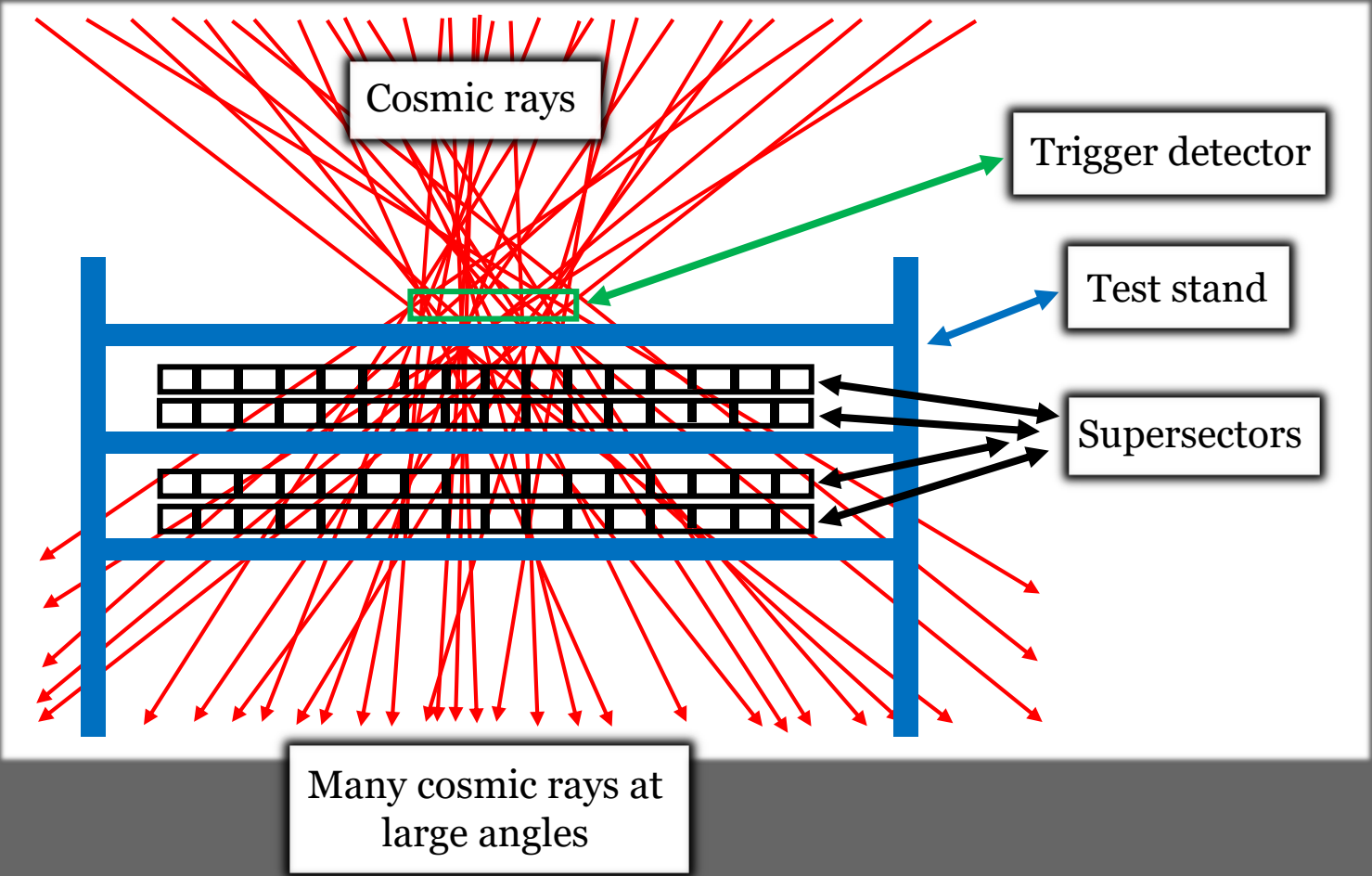


Silicon photo-multiplier card

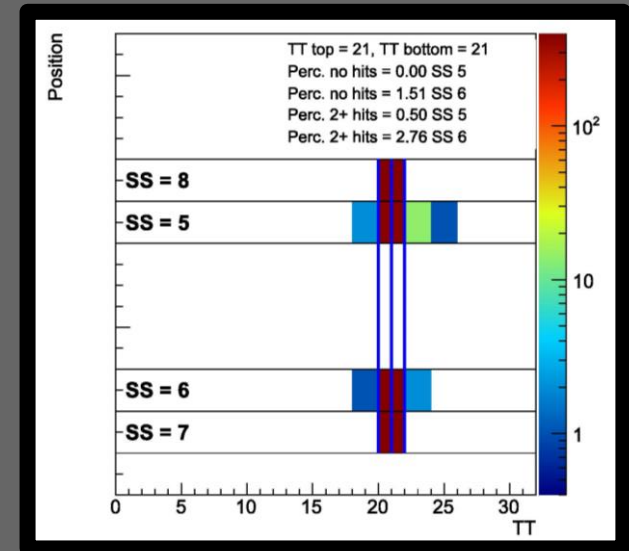
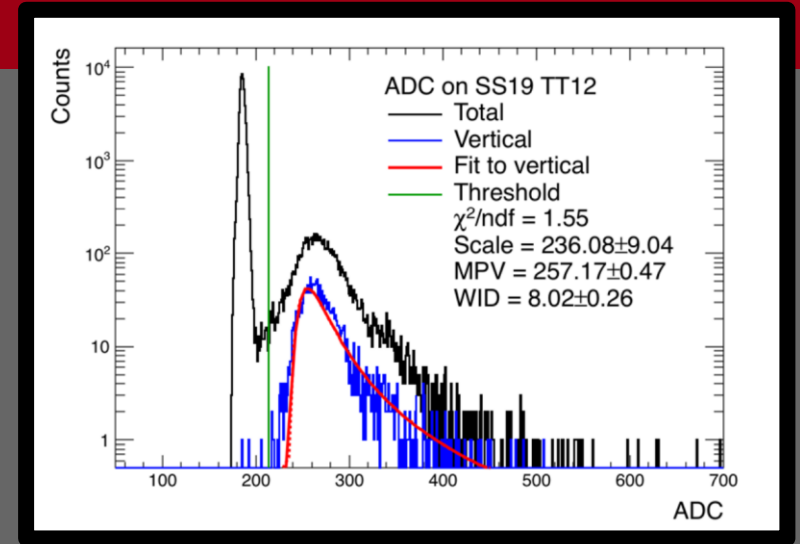
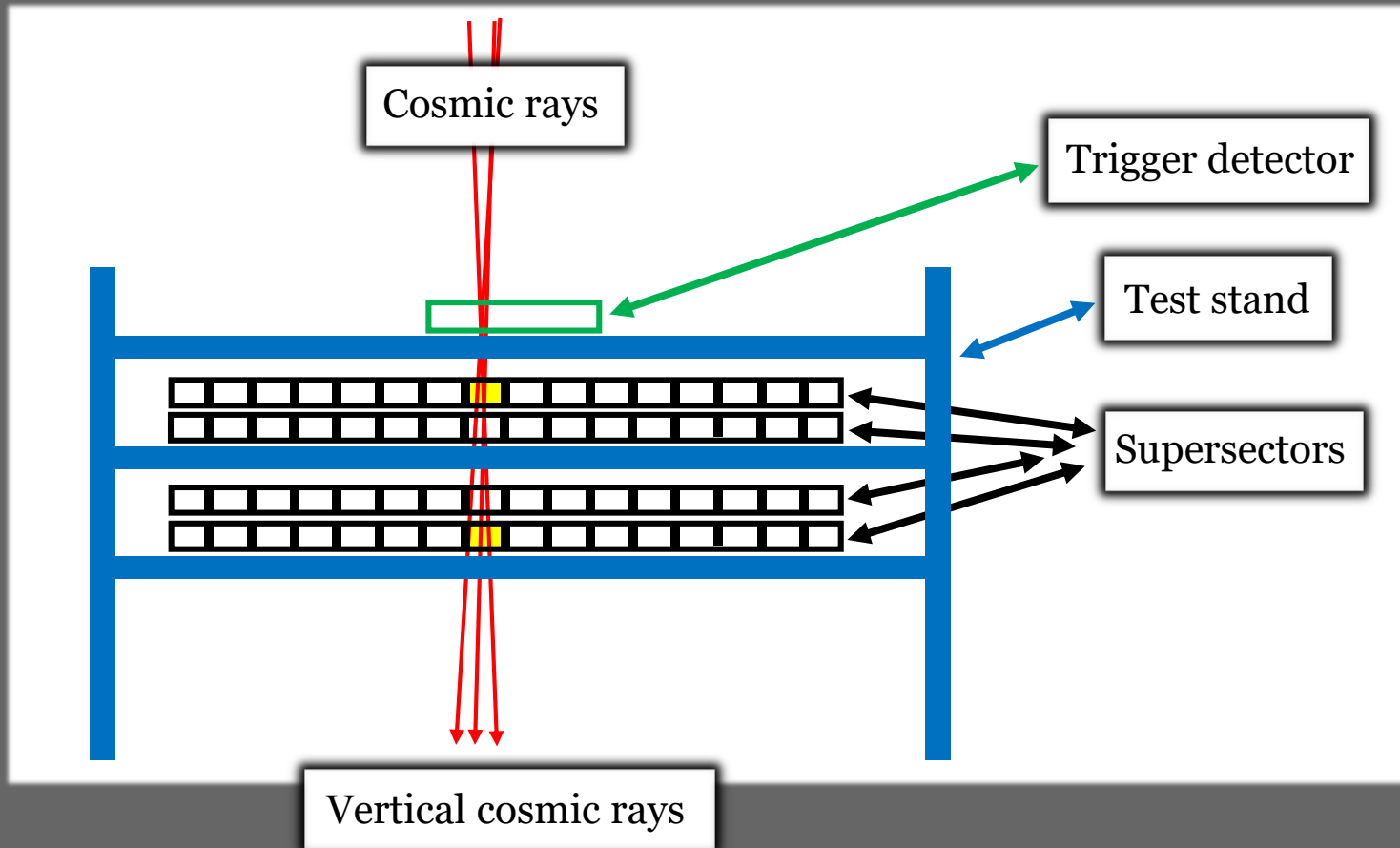


Custom electronics

Testing: cosmic ray test stand



Testing: cosmic ray test stand



Testing: Heat Map with Sr Source

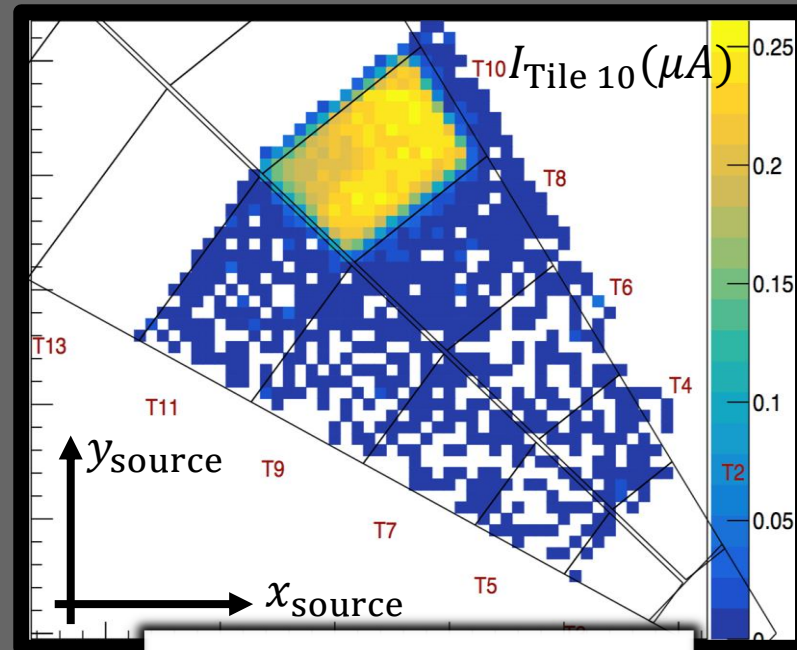


Sr source

Testing: Heat Map with Sr Source



Sr source

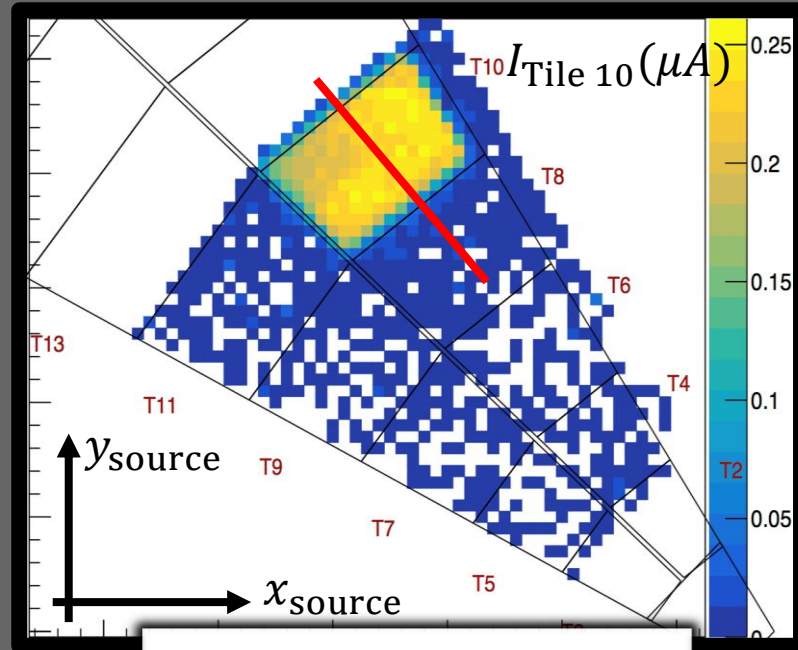


Current in tile as a function of source position

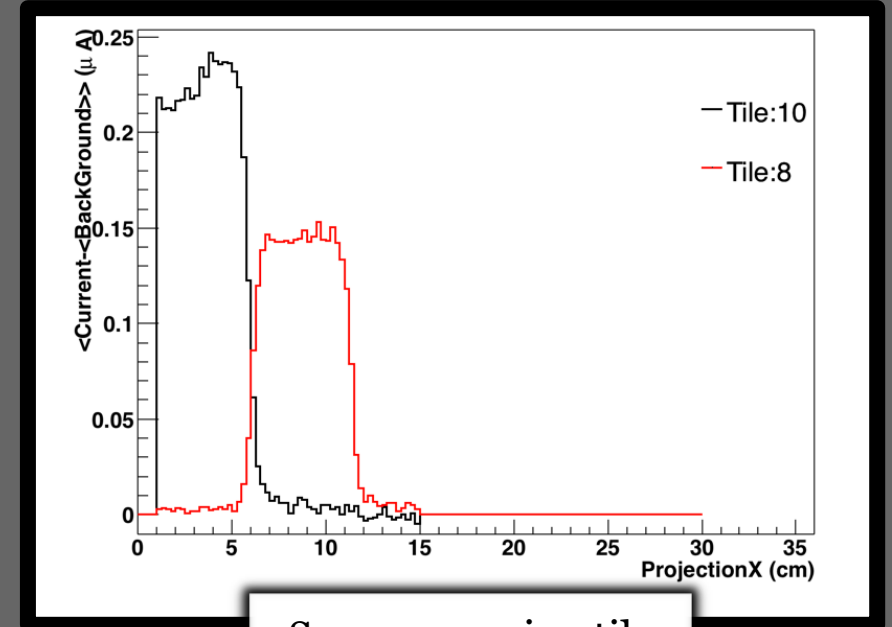
Testing: Heat Map with Sr Source



Sr source



Current in tile as a function of source position

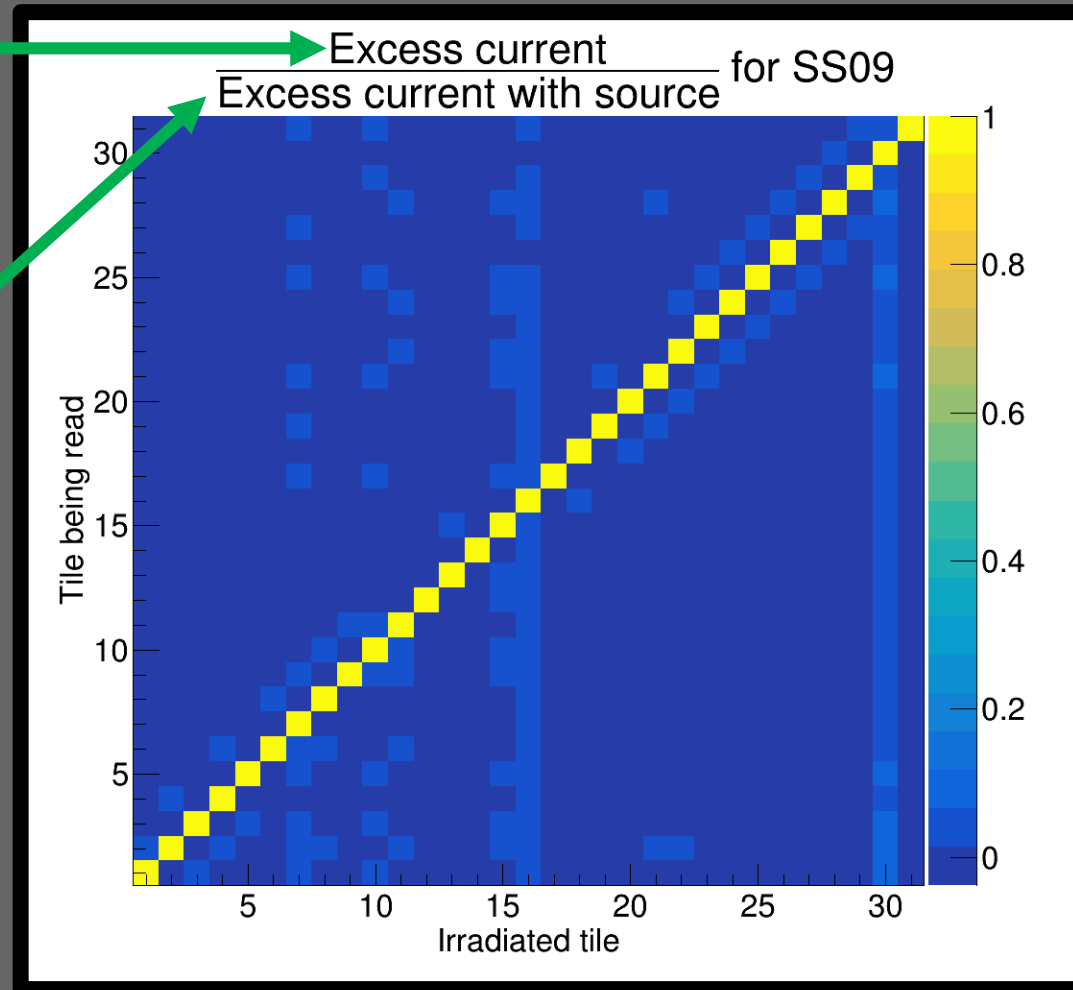


Source crossing tile separation groove

Testing: Checking for Crosstalk

(Current with source
under irradiated tile)
– (Current with source
at origin)

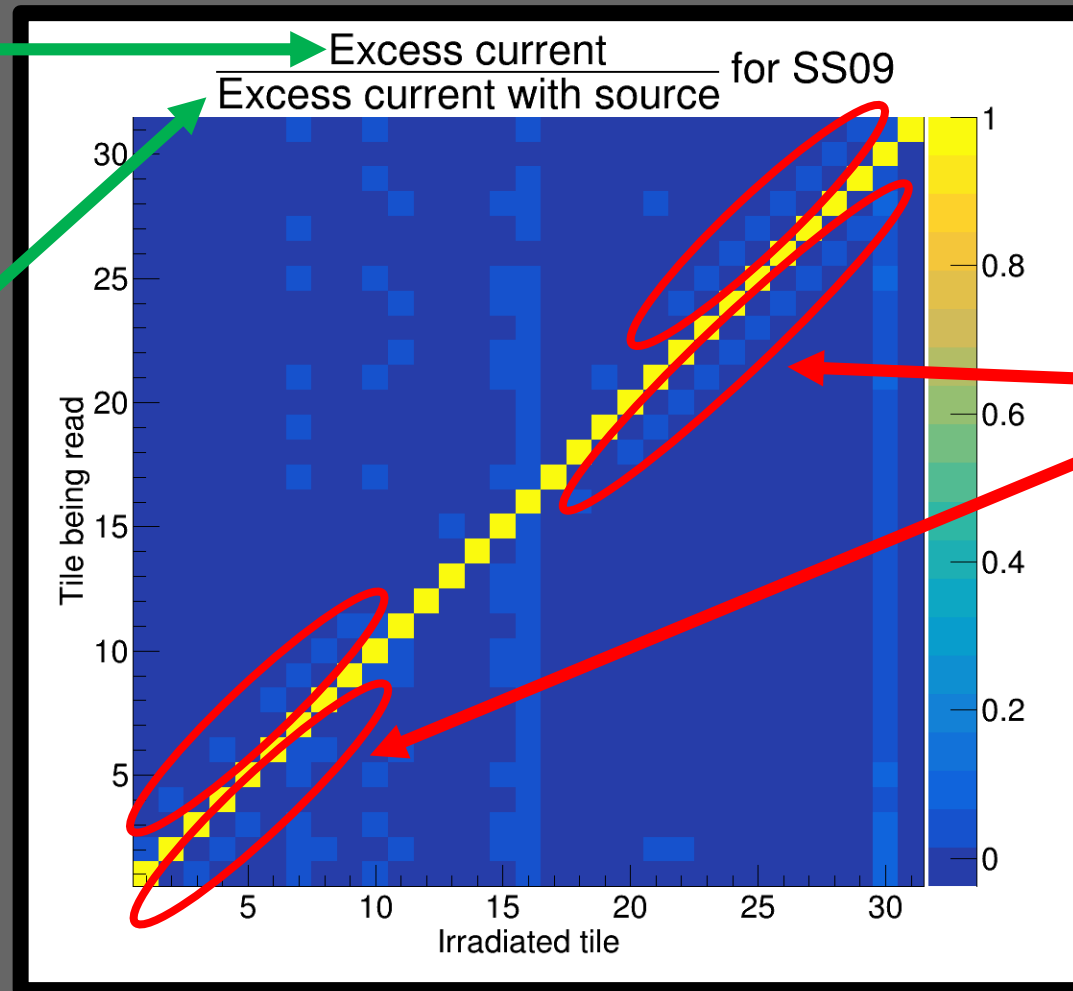
Excess current that tile
reads when the source
is underneath it



Testing: Checking for Crosstalk

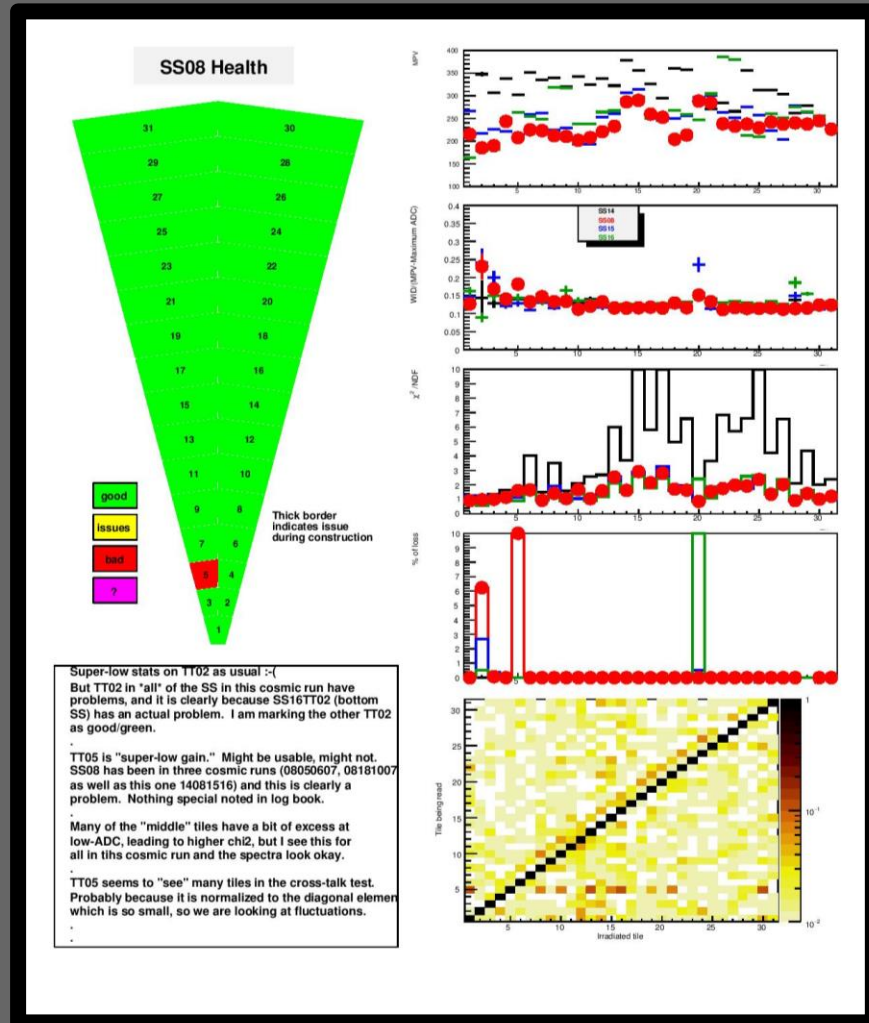
(Current with source under irradiated tile)
– (Current with source at origin)

Excess current that tile reads when the source is underneath it



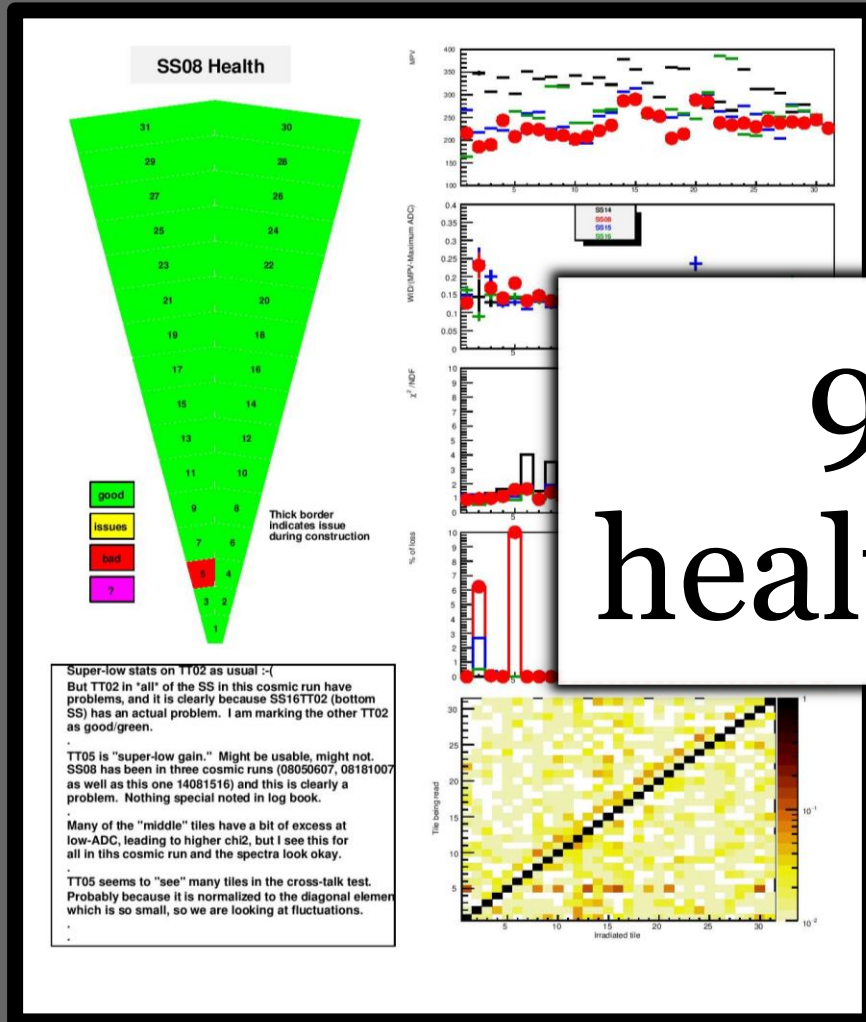
$\leq 2\%$ cross talk

Summarizing test results



- Each health sheet shows (for each tile):
- MPV (most probable value) of Landau distribution
 - Width of Landau distribution divided by its MPV
 - χ^2 /NDF
 - % of loss
 - Cross-talk testing results

Summarizing test results



99.5%
healthy tiles!

It shows (for each tile):
probable value) of
distribution
dau distribution divided
ting results

Summary

- The EPD is a BBC replacement
 - Many more tiles, each with distinct channels
 - Larger η coverage
 - Better event plane resolution
- On schedule (construction complete)
- Testing shows good results

Team STAR EPD



THE OHIO STATE
UNIVERSITY



BROOKHAVEN
NATIONAL LABORATORY

