

SHMS Quartz Plane – Update



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(Jefferson Lab)

Invaluable contribution from one of the F_2 (E12-10-002) students: **Abel Sun (CMU)**

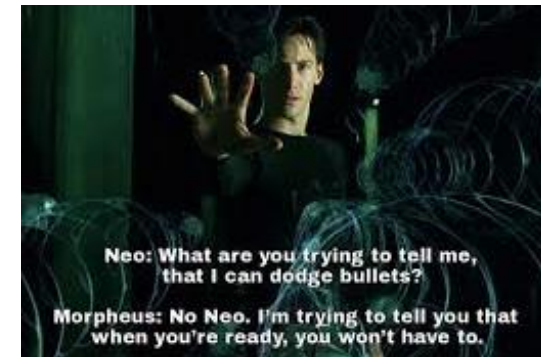
What Were We trying to Fix?

1. All PMTs (18 ET9814QB and 24 XP2020QB) in the SHMS quartz plane had to be replaced: so gassy that would go in discharge and shut off. No useful steady gain could come out of them.
2. Those PMTs that could be used somewhat during the KPP (the ET type) revealed that there might also be a problem with the optical coupling (RTV615) between the quartz bars and PMTs

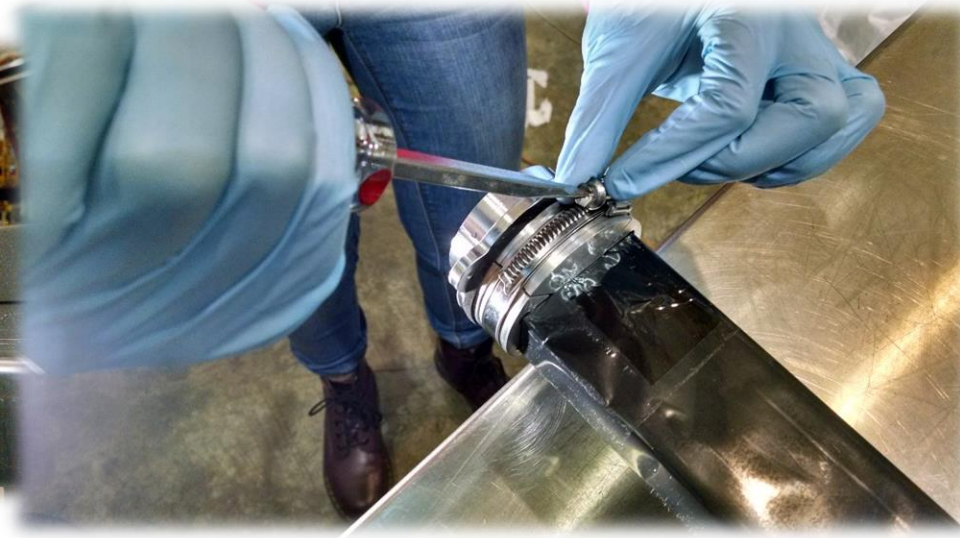
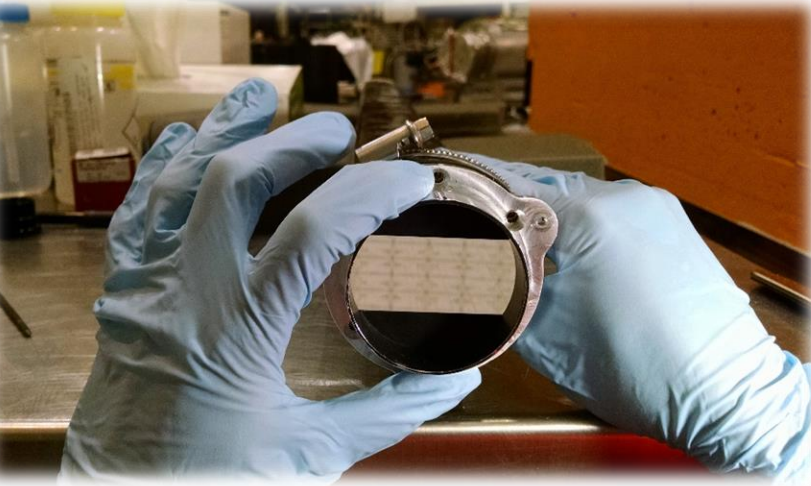
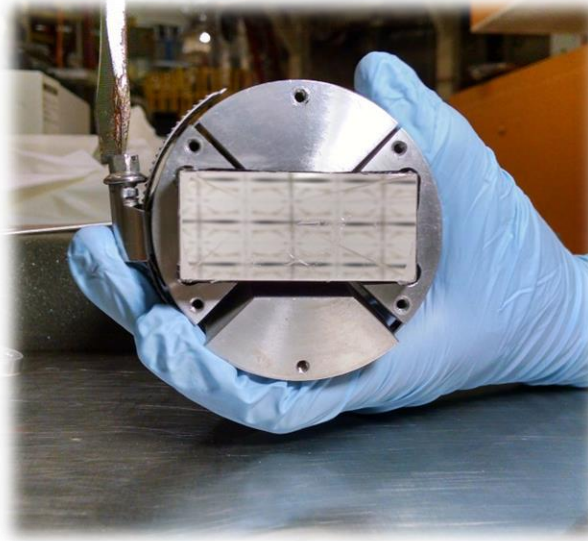
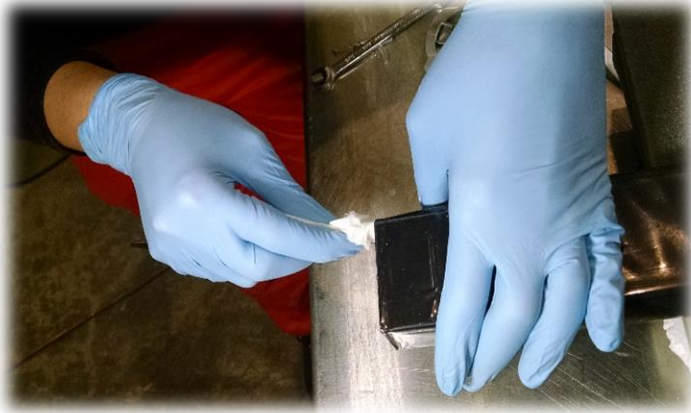
⇒ To address 1. Jefferson Lab bought 32 new ET9814W (UV glass) PMTs – we figured that quartz window is more a liability than help (more permeable to He + the RTV615 would cut around 200 nm even when thin, clean and mixed in the right proportion)

⇒ To address 2. Abel and I worked from beginning of August until mid November around the clock to be ready for the Fall 2017 running

- We pulled the old PMTs from the bars
- We cleaned the bars
- We made very many RTV couplings to make sure we can get down to 50 microns thickness
- We put together bench tests to check the bars with cosmics
- We tested the new PMTs to get the gain vs voltage curve
- We did the final assembly of the new PMT on the bars
- We tested all the bars with cosmics on the bench (and in the SHMS stack)
- Tested the plane with beam in December



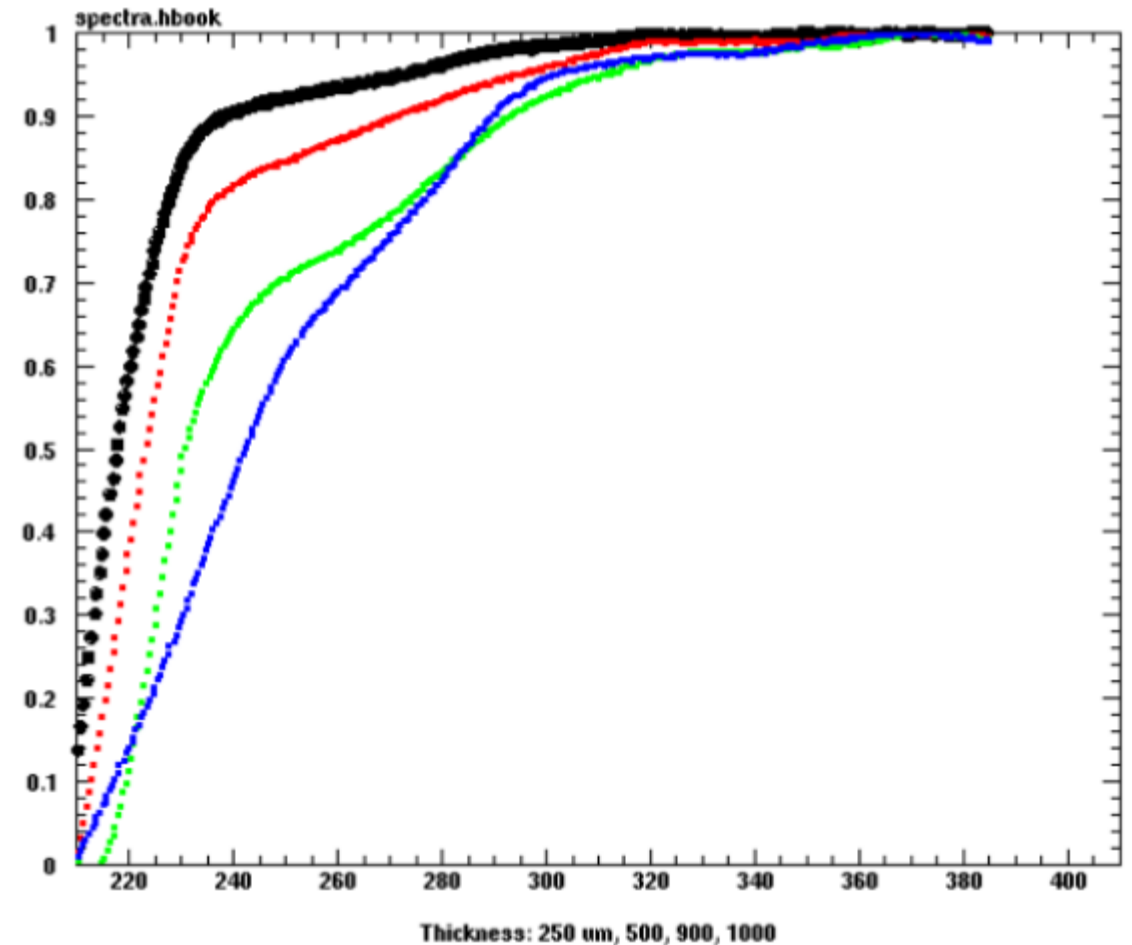
The Story in Pictures: Cleaning and Assembling Bars



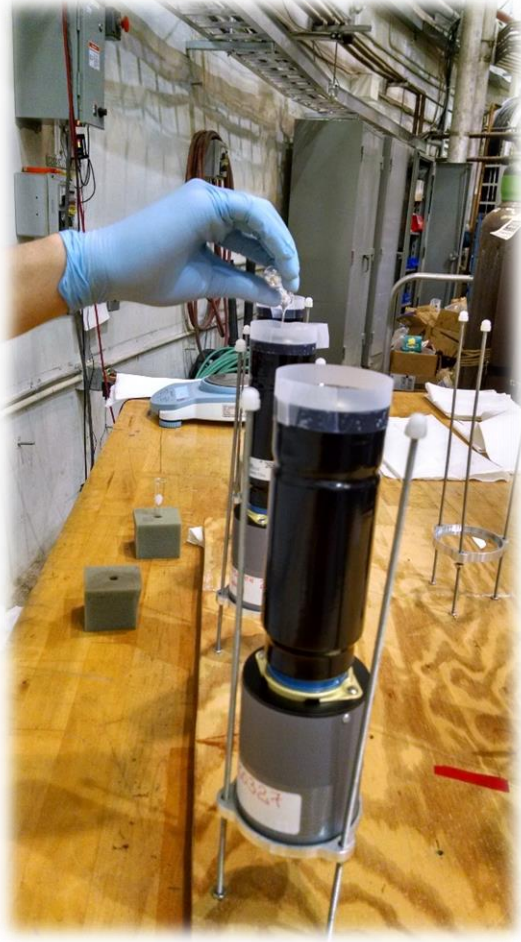
The Story in Pictures: Preparing the RTV

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- Needs to be thin to allow UV photons to go through
- By the end we could easily achieve 50 microns thickness (just a matter of choosing the right quantity per PMT and judge the proper curing time before installing it on the bar)
- RTV615 is mixed by weight 10:1 ratio RTV to crosslinking agent; we were very careful with keeping all glass jars and stainless steel spatulas very clean; we were also very careful with obtaining a near perfect 10:1 ratio (for example, if we pour 12.00 g of RTV 615 we add 1.20 g of the crosslinking agent); we also mixed carefully for 15 minutes scraping periodically the walls of the glass jars; we used Sam Danagouliau's centrifuge to eliminate air bubbles



The Story in Pictures: Preparing the RTV and Installing PMTs



Pouring the freshly mixed RTV on the face of a very level PMT



RTV is curing for few hours in the "doll house"...

→ PMTs are carefully removed from under the doll house, the mu-metal is put on and

→ I would very carefully place the PMT with mu-metal on while holding it from the base in the PMT cup

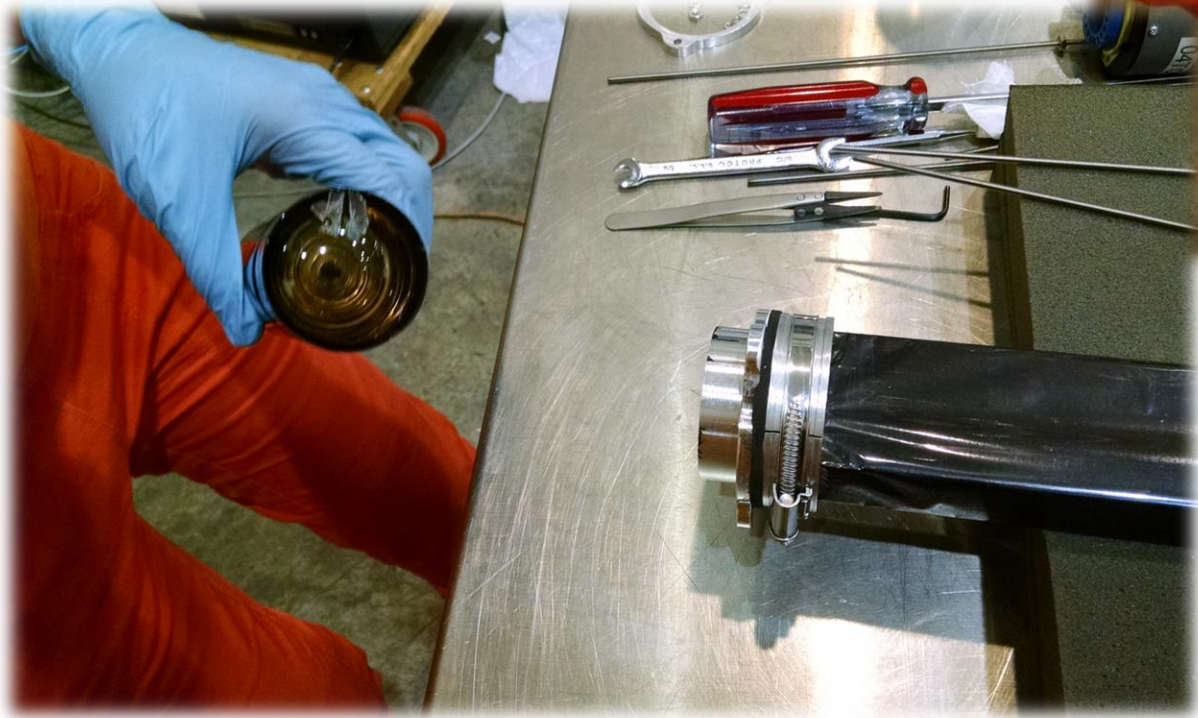


Sam and Abdellah's boxes

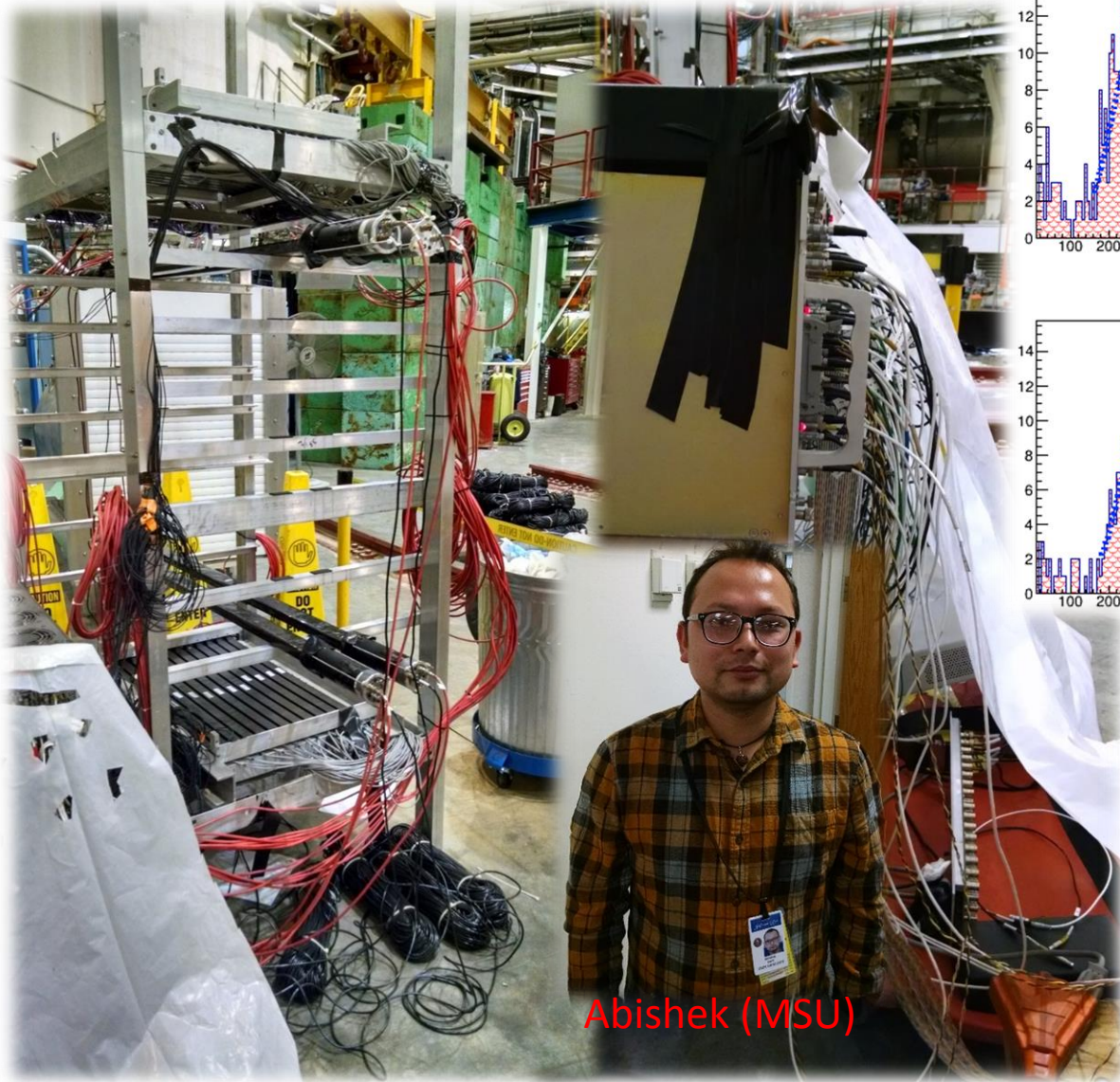
Curing time for per side... 7 days

The Story in Pictures: Preparing the Bar for PMT Installation

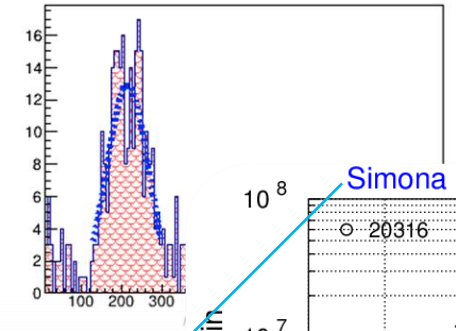
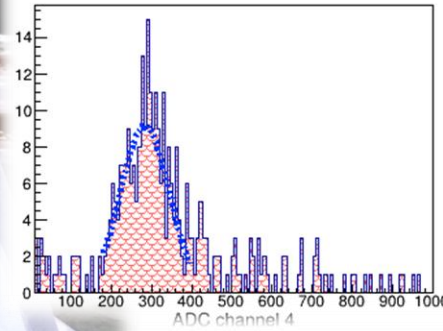
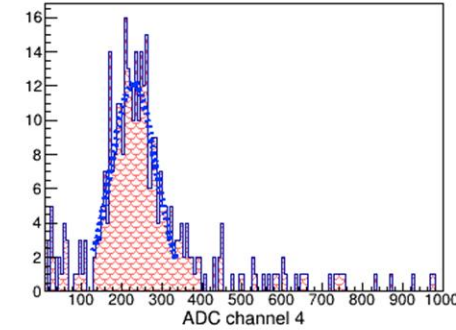
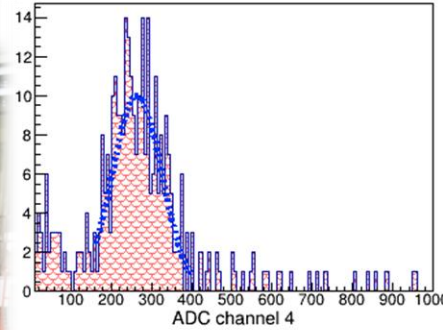
→ We practiced zillion of times until we could make really thin but strong RTV couplings



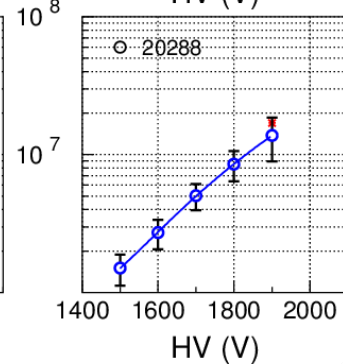
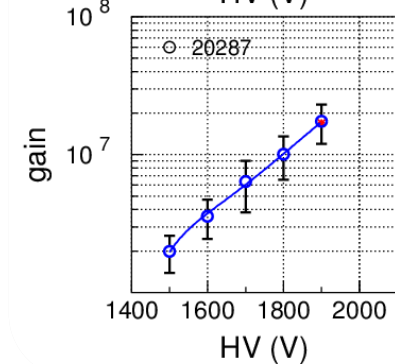
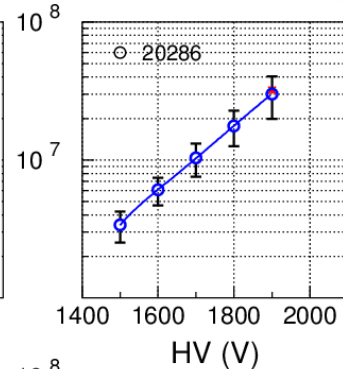
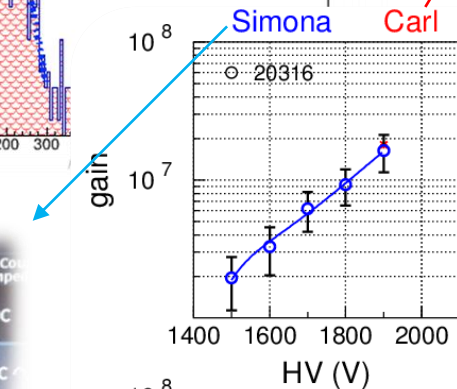
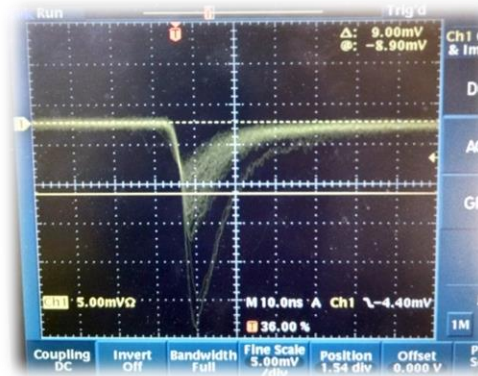
The Story in Pictures: Bench Tests



Abishek (MSU)

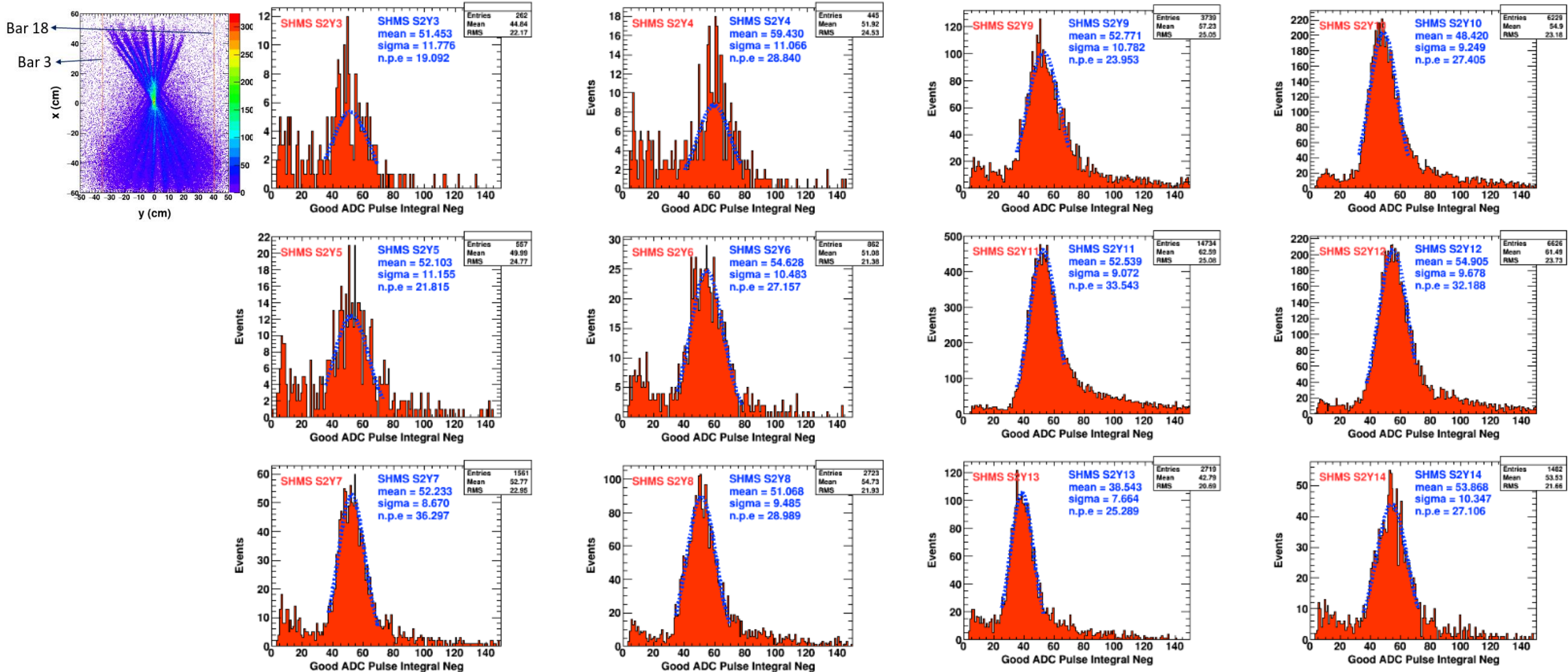


QE measurements to identify the crappy PMTs to be placed at the edge of acceptance – there weren't any!



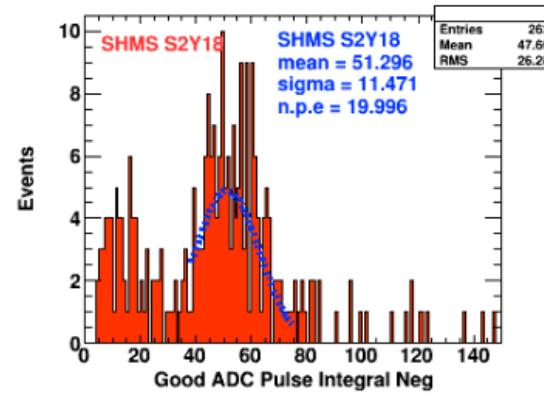
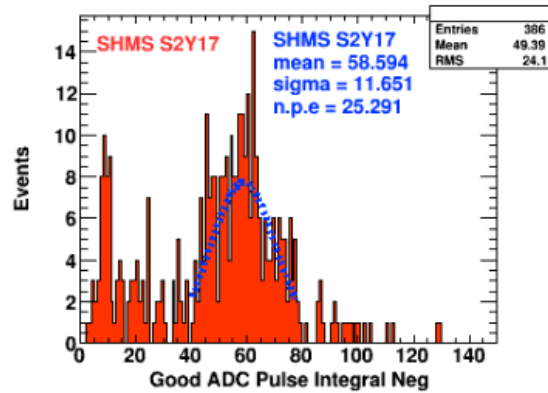
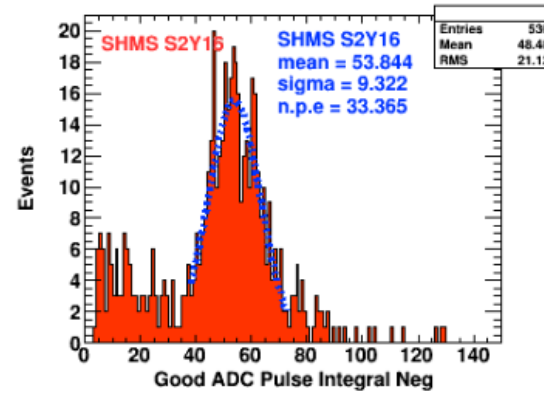
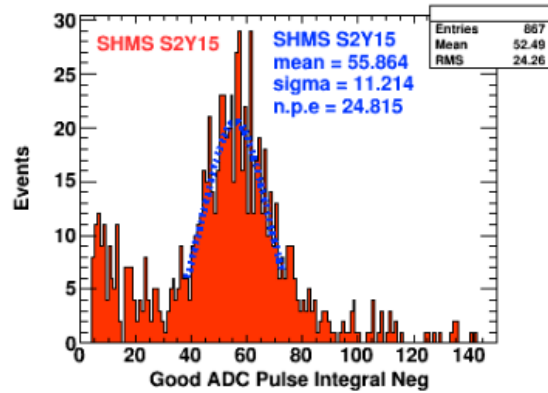
The Story in Pictures: **Response of the Quartz Plane to Beam, Dec. 2017**

The SHMS Quartz Plane – **NPEs Top (Neg)**, Events with 1 Track Only and Tight Cut on the Angle in XZ Plane



The Story in Pictures: **Response of the Quartz Plane to Beam, Dec. 2017**

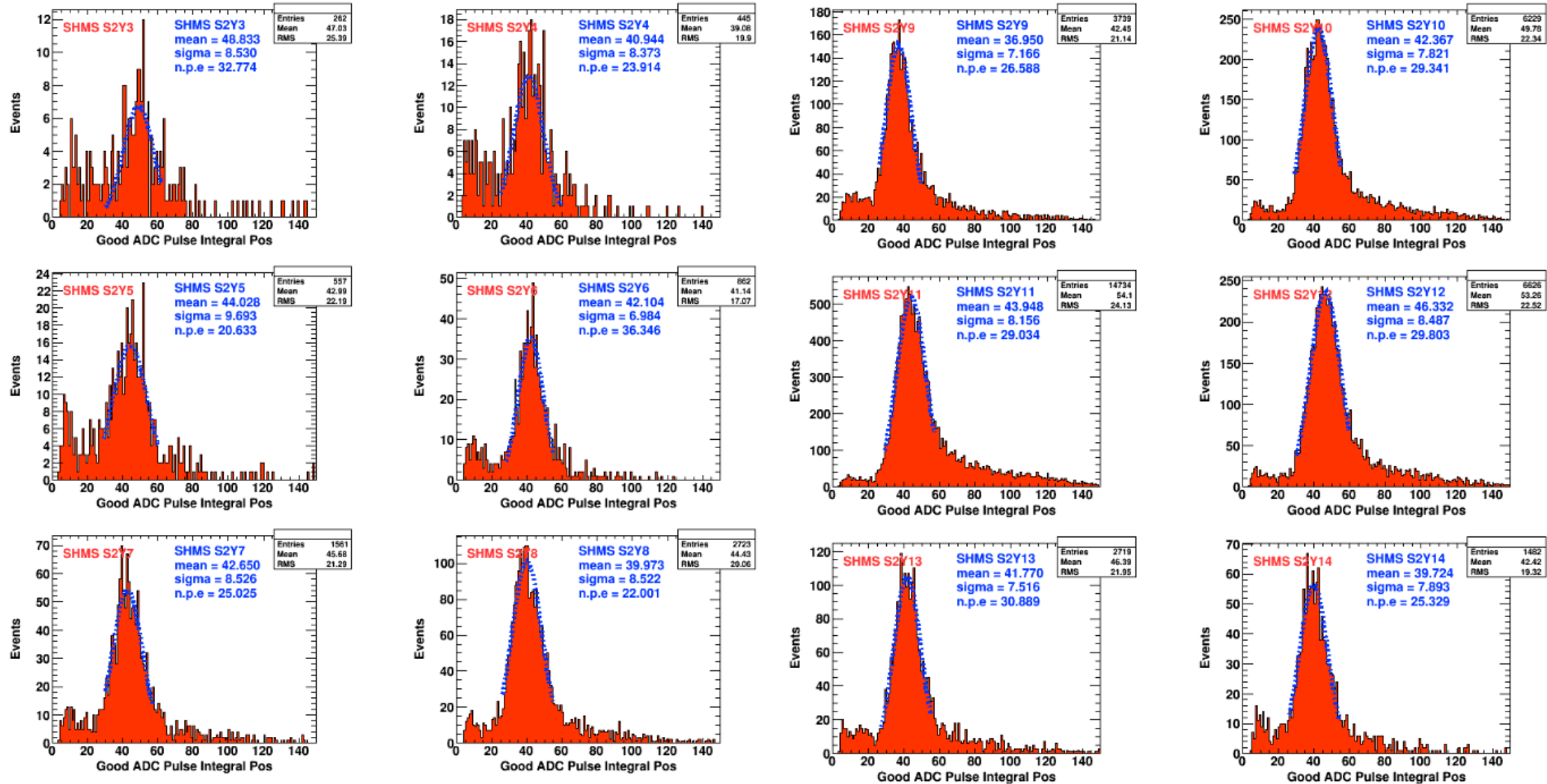
The SHMS Quartz Plane – **NPEs Top (Neg)**, Events with 1 Track Only and Tight Cut on the Angle in XZ Plane



The response from All Top (Neg) PMTs looks good

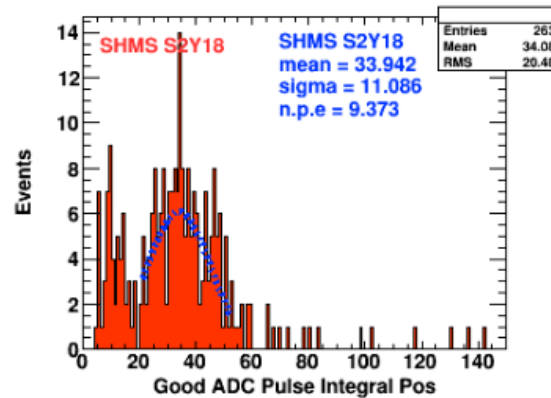
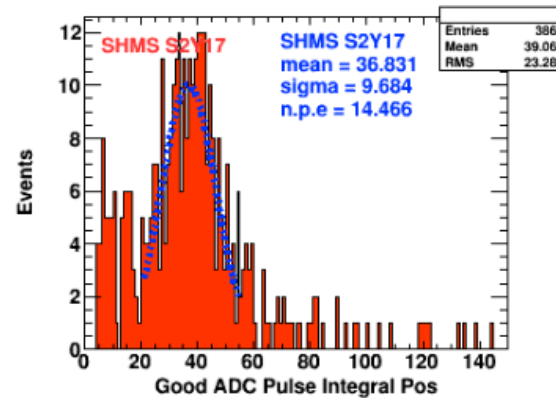
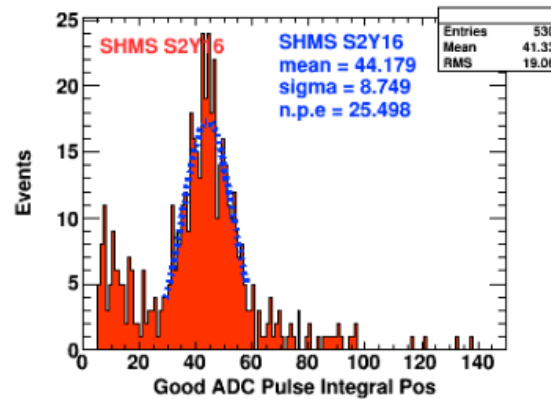
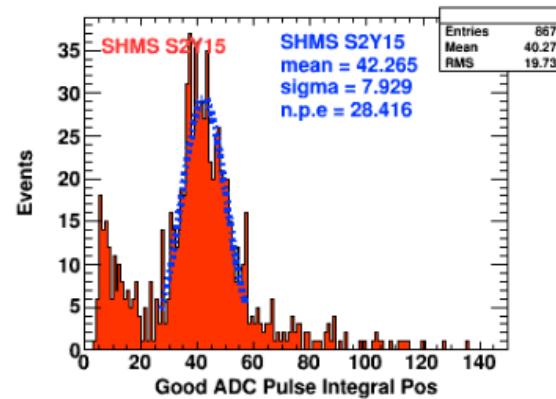
The Story in Pictures: Response of the Quartz Plane to Beam, Dec. 2017

The SHMS Quartz Plane – NPEs Bot (Pos), Events with 1 Track Only and Tight Cut on the Angle in XZ Plane

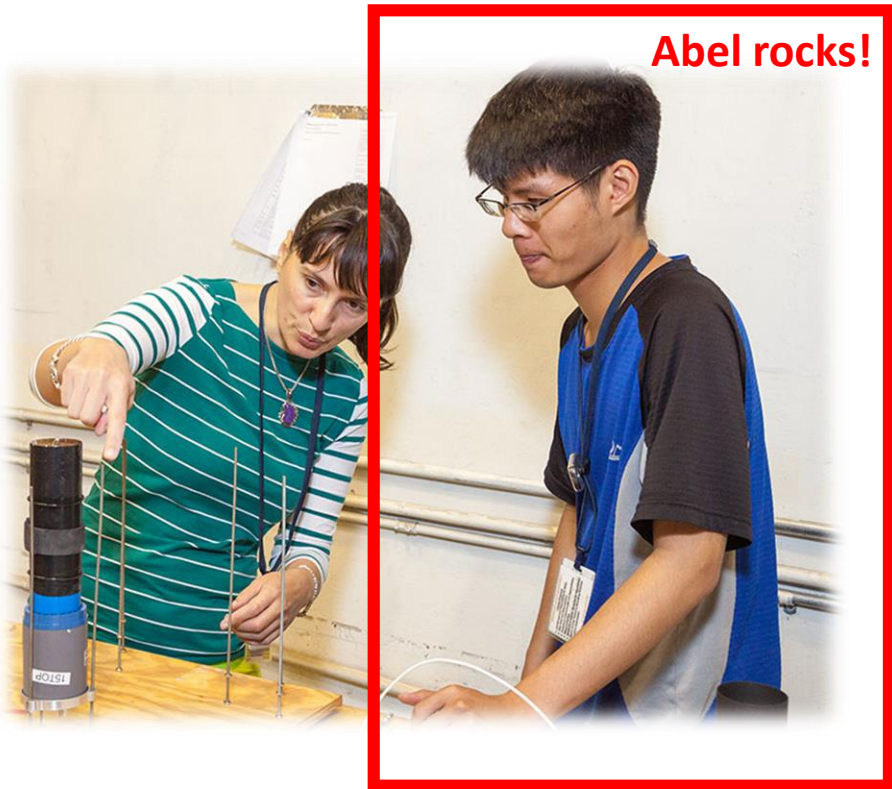


The Story in Pictures: **Response of the Quartz Plane to Beam, Dec. 2017**

The SHMS Quartz Plane – **NPEs Bot (Pos)**, Events with 1 Track Only and Tight Cut on the Angle in XZ Plane



The response from All Bot (Pos) PMTs looks O.K.



Abel rocks!



Hem (MSU)



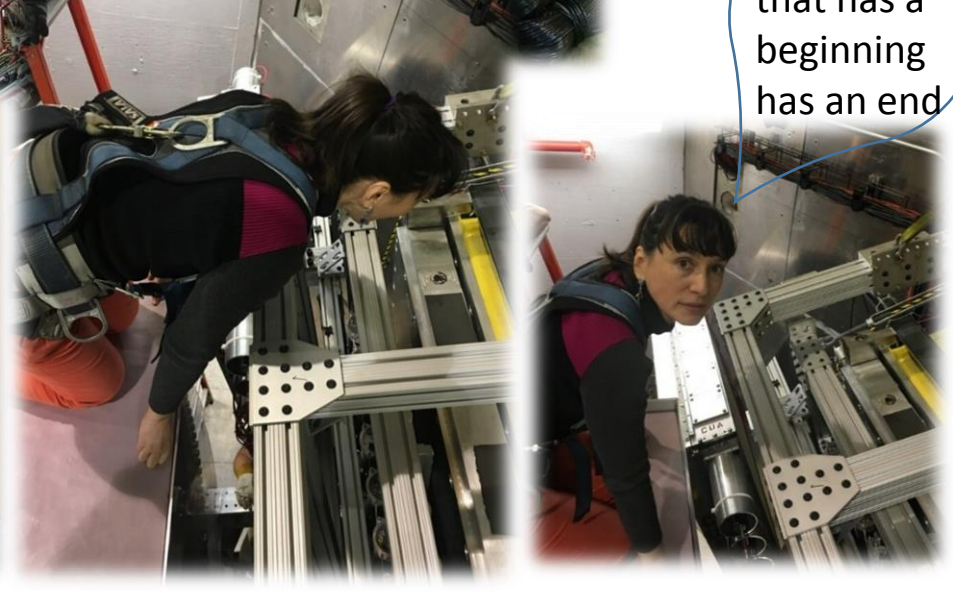
Jerry

Stan

Larry



Abishek (MSU)



Everything that has a beginning has an end