

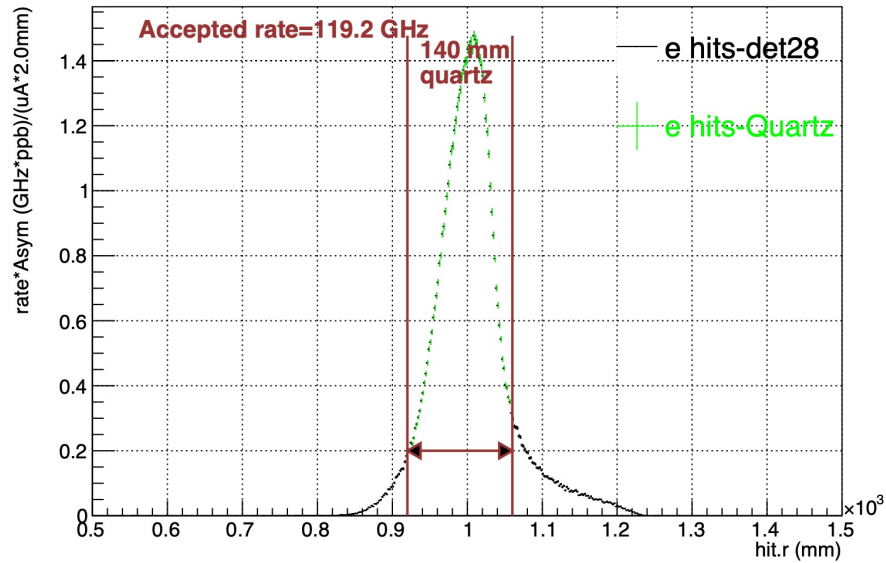
# Remoll Dose simulations for Shower-max

Sep 16, 2021

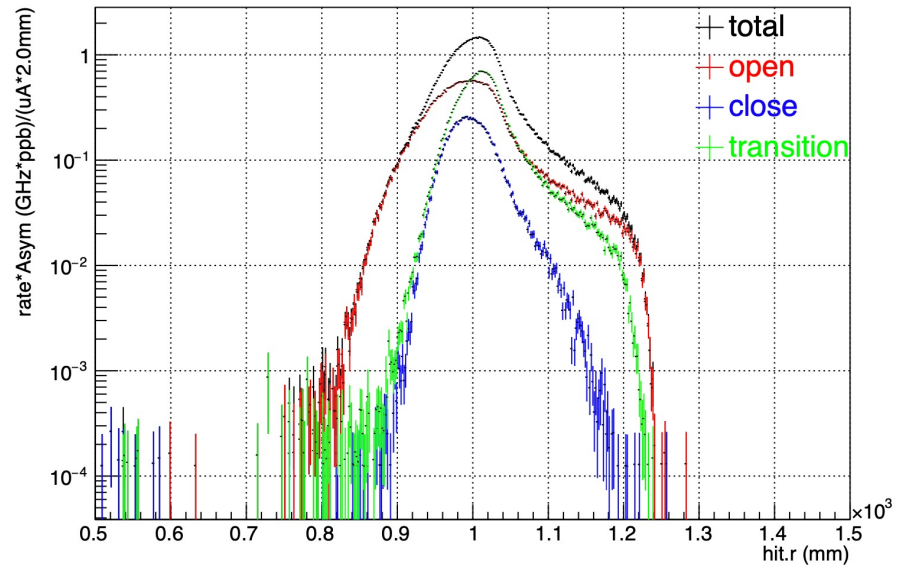
Dustin McNulty

(Idaho State University)

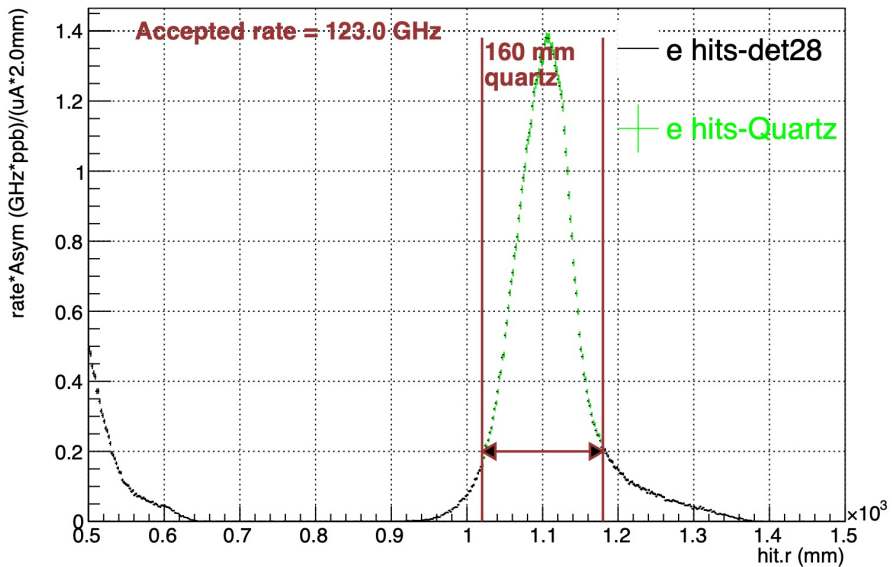
ee distribution on ring 5 (rate\*Asym weighted)



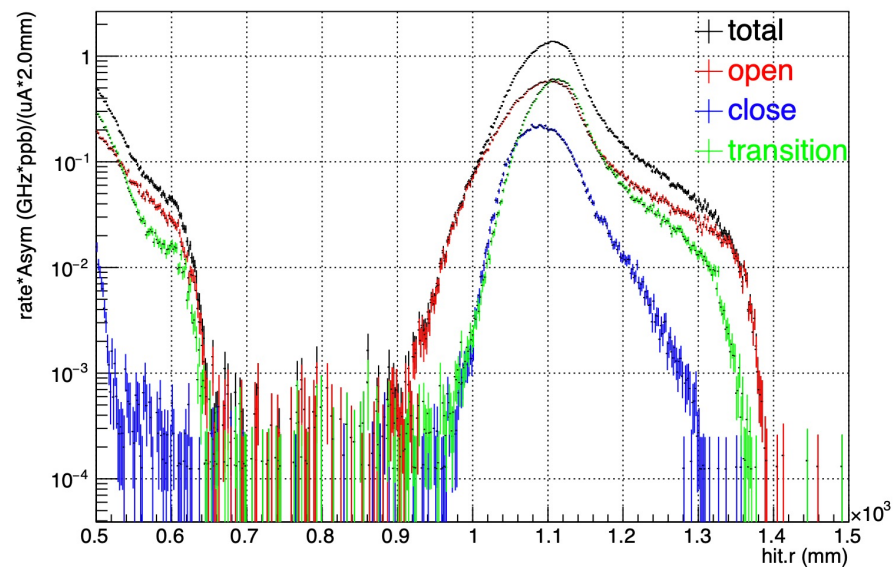
ee distribution on ring 5 (rate\*Asym weighted)



ee distribution on sm det (rate\*Asym weighted)



ee distribution on sm det (rate\*Asym weighted)



Generated 1M events from each generator: Moller, ep, inep

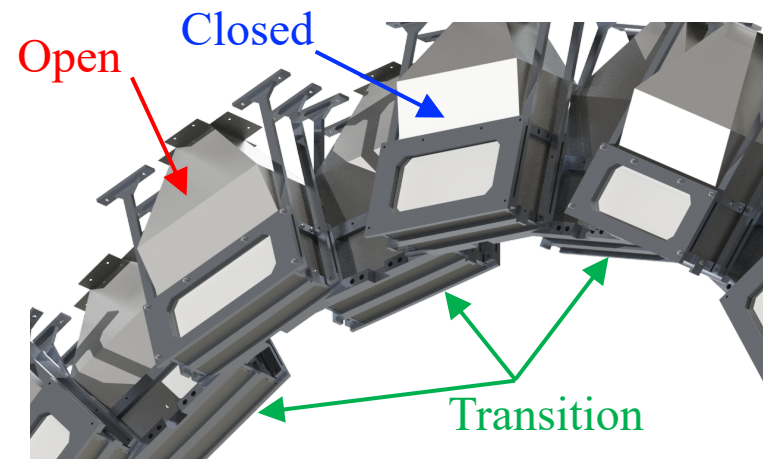
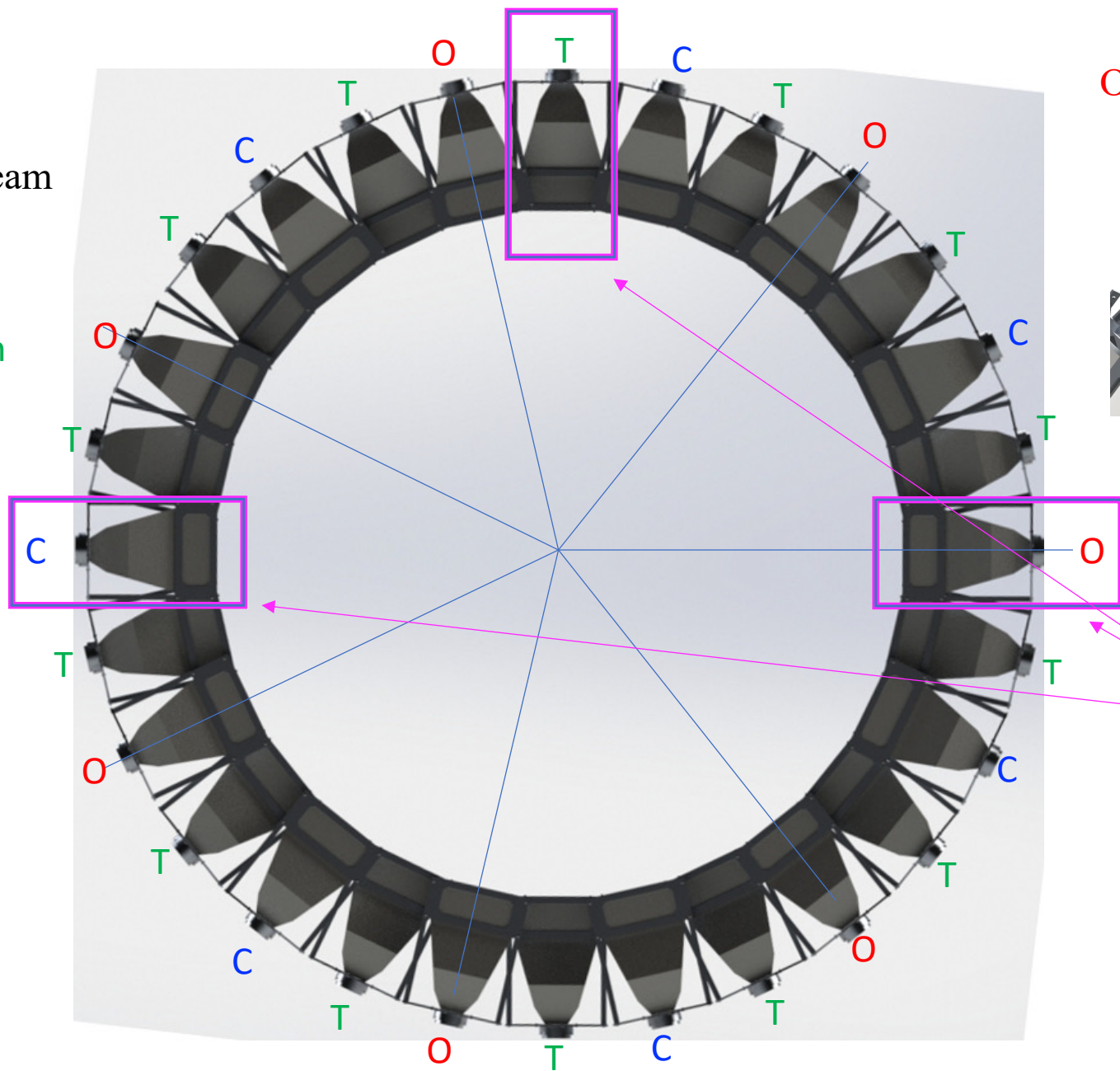
Radial ee distributions shown for plane 28 (ring 5) and plane 70 (SM).

Only electrons with  $E \geq 1$  GeV are shown; used Chandan's geometry from recent envelop study

# SM Dose Study using remoll

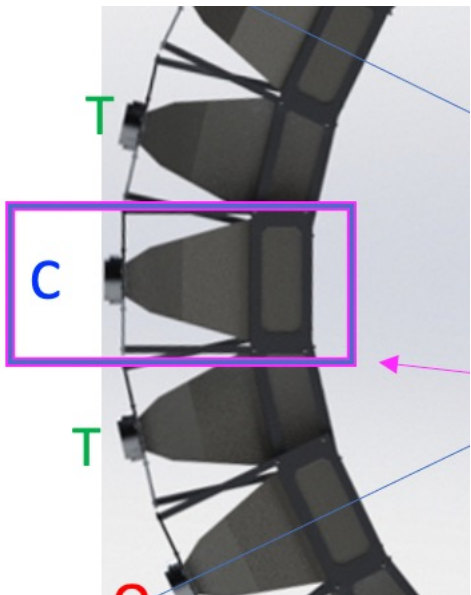
Shower-max ring:  
Looking downstream

C – Closed  
O – Open  
T – Transition



Made each quartz layer sensitive for individual Open, Closed, and Transition detectors located at these specific positions

# SM Closed region Dose over entire experiment



hits in close SM quartz1 -ee,ep gen

```
double mipF = 2.4; // MeV/(g/cm2)
double PACdays = 235 + 95 + 14;
double h2s = 3600;
double hIn1day = 24;
double area = 0.5*0.5; //cm2
double MeV2rad = 100/6.24e9; //100rad = 1 Gy = 6.24 10^12 MeV/kg
double doseScale = mipF * PACdays * hIn1day * h2s / area * MeV2rad / 1e6; // [Mrad]
```

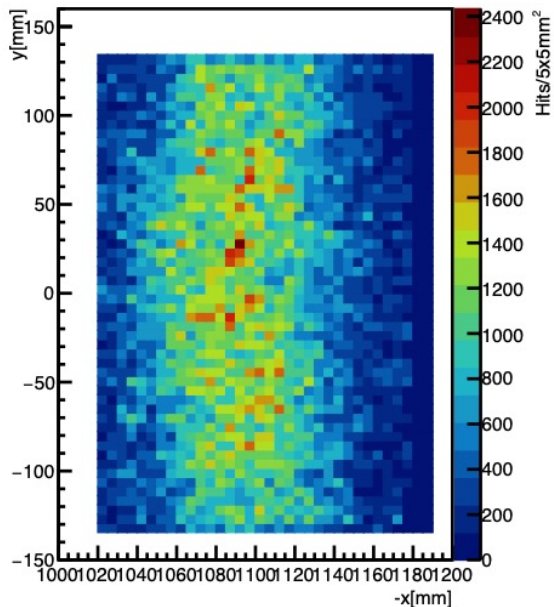
<https://github.com/Jeffe/shield-design/analysis/n>

- Use same above calculation numbers, except mipF is replaced with actual edep
- Also, no particle type or energy cuts of any kind for this analysis.

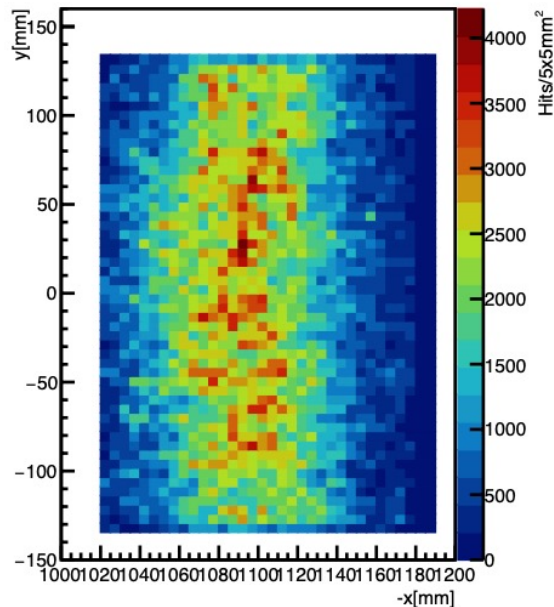
hits in close SM quartz2 -ee,ep gen

hits in close SM quartz3 -ee,ep gen

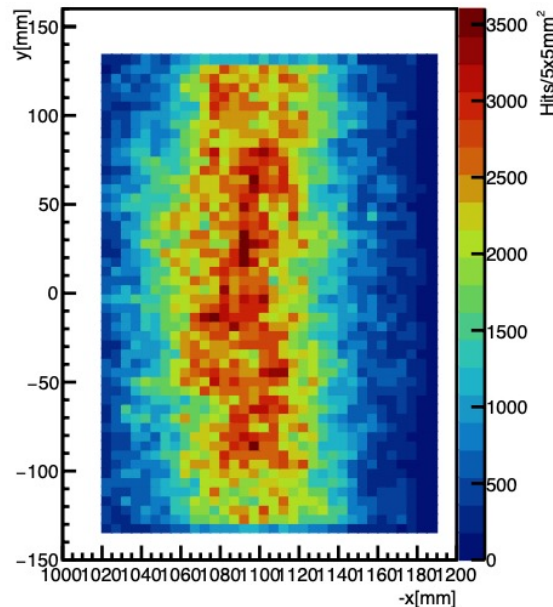
hits in close SM quartz4 -ee,ep gen



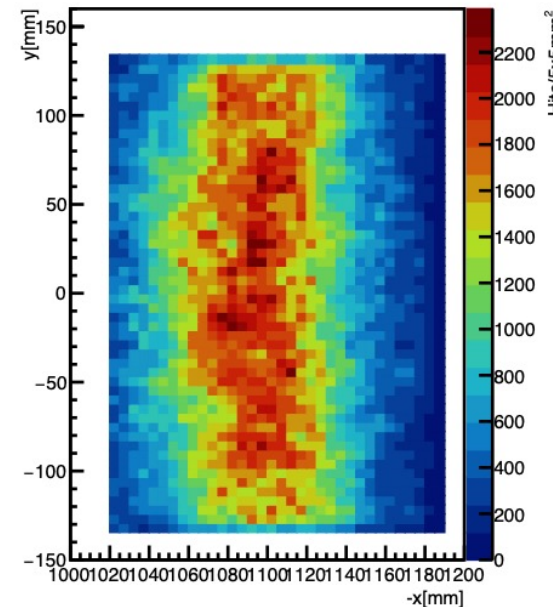
Layer 1



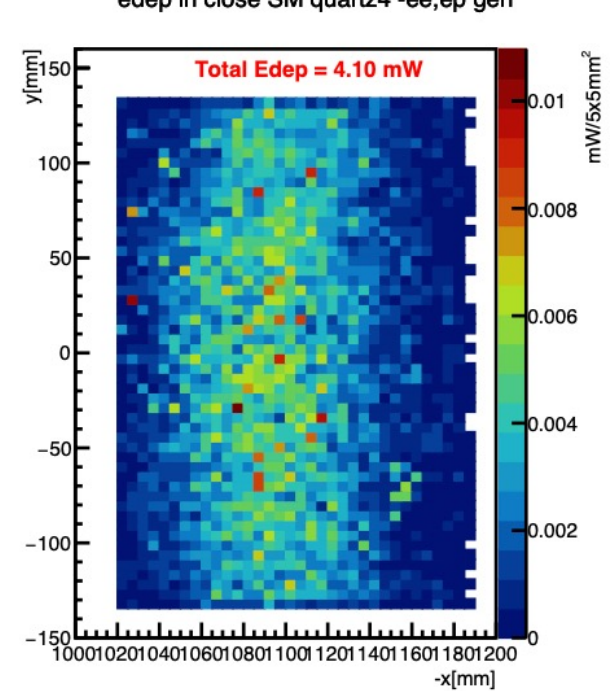
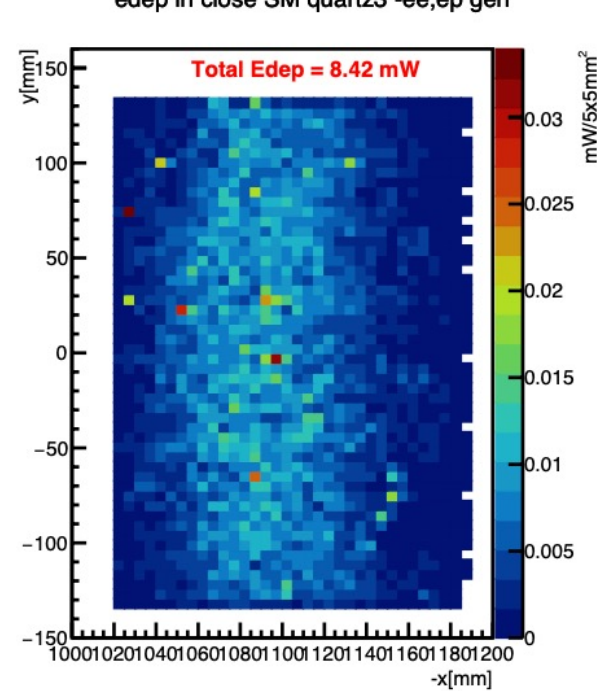
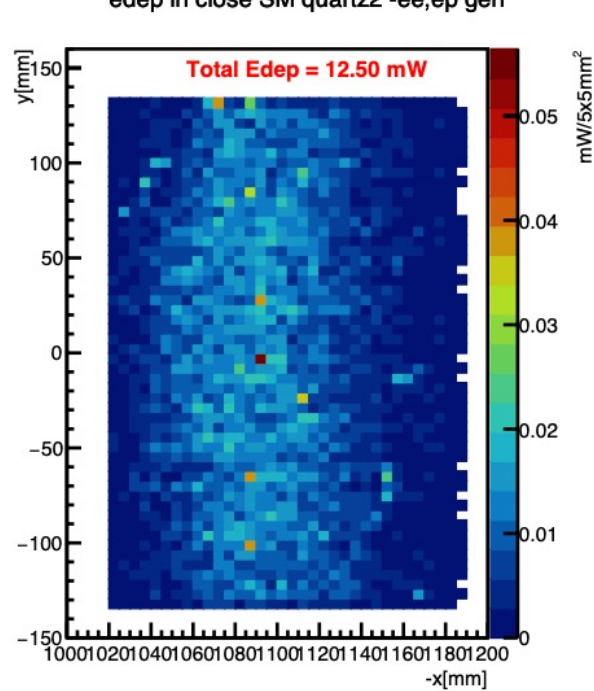
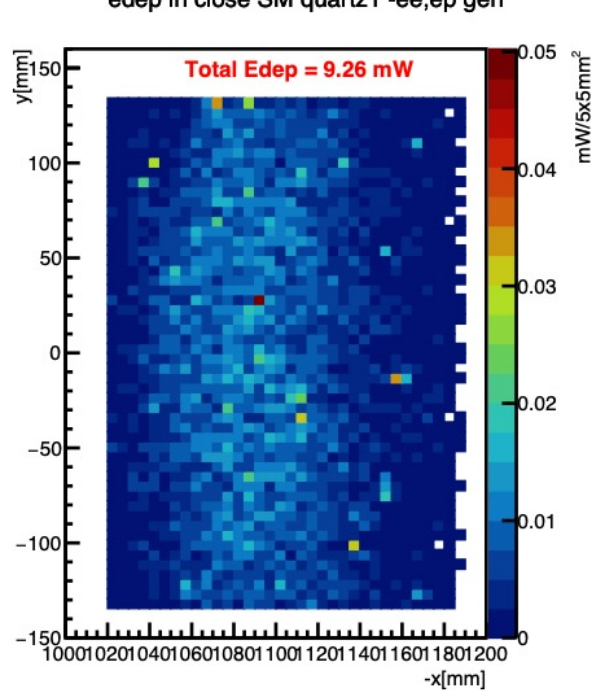
Layer 2



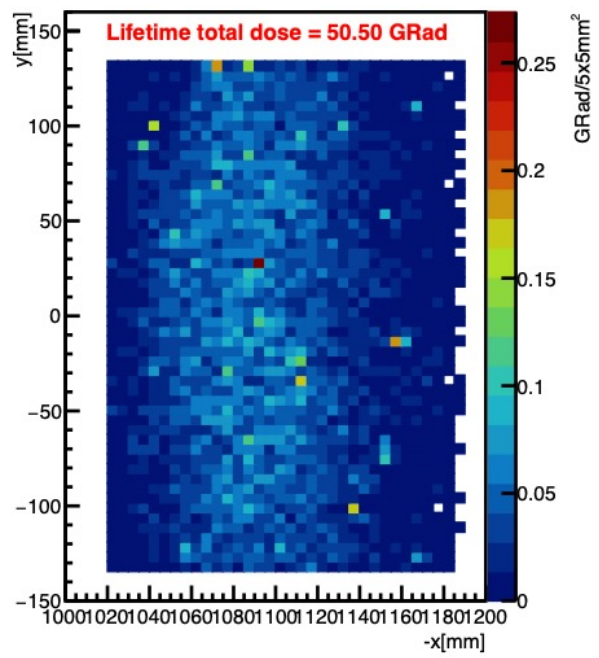
Layer 3



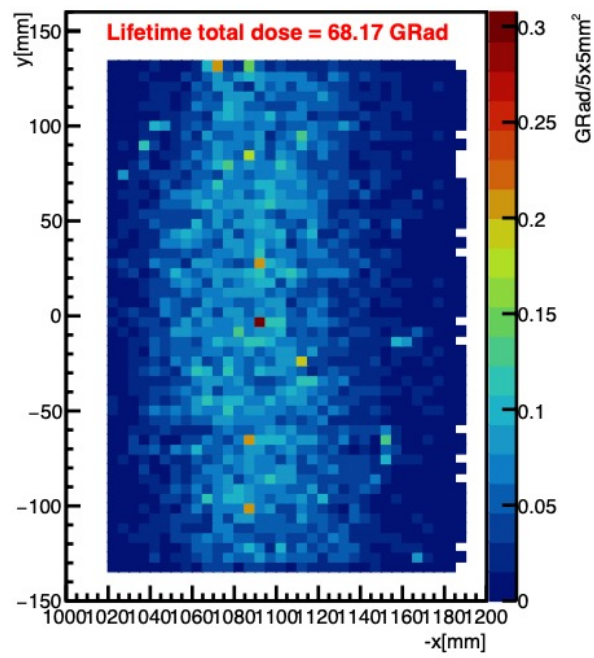
Layer 4



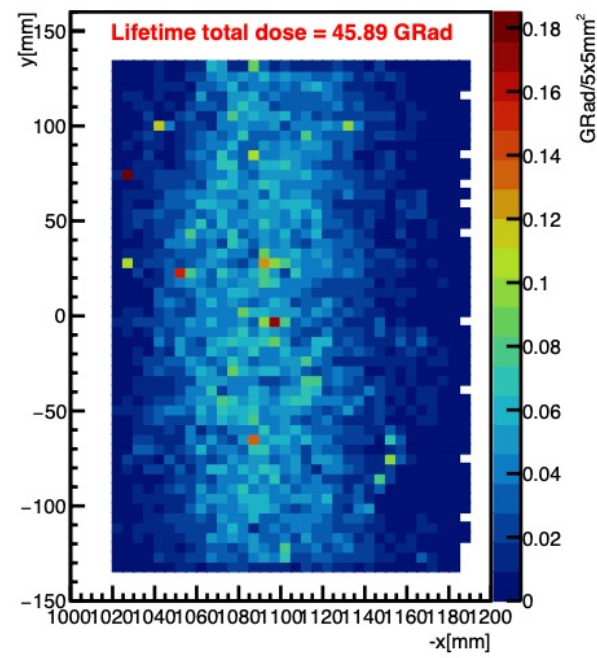
dose in close SM quartz1 -ee,ep gen



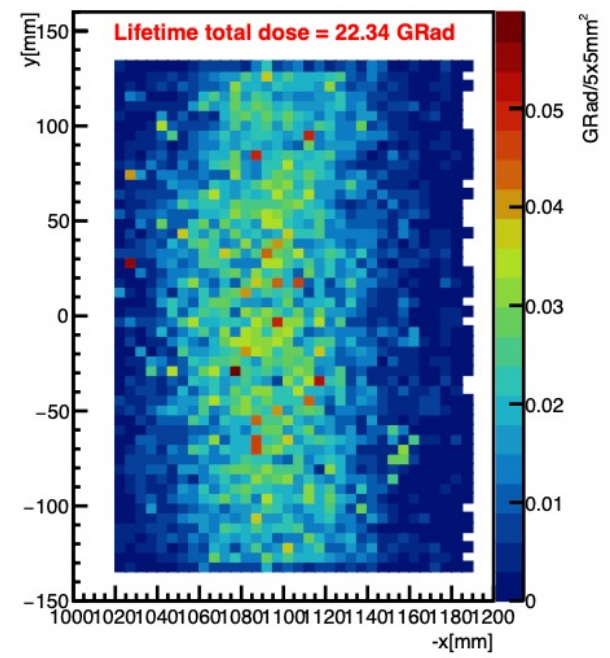
dose in close SM quartz2 -ee,ep gen



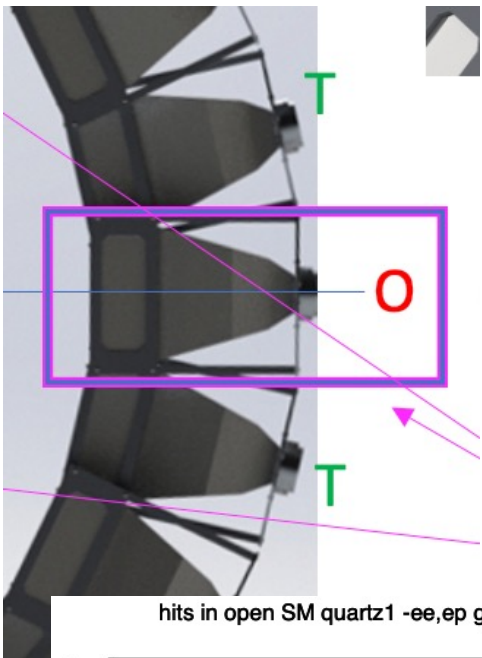
dose in close SM quartz3 -ee,ep gen



dose in close SM quartz4 -ee,ep gen



# SM Open region Dose over entire experiment

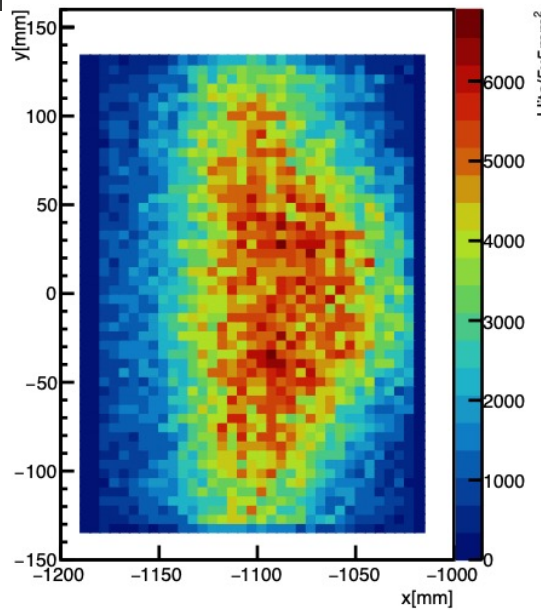


hits in open SM quartz1 -ee,ep gen

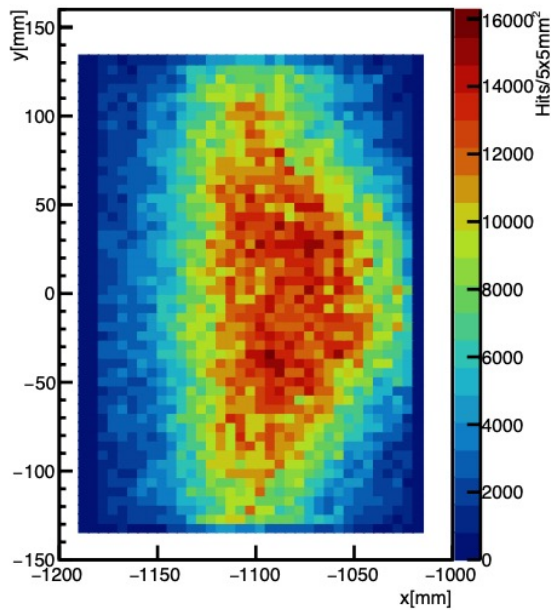
hits in open SM quartz2 -ee,ep gen

hits in open SM quartz3 -ee,ep gen

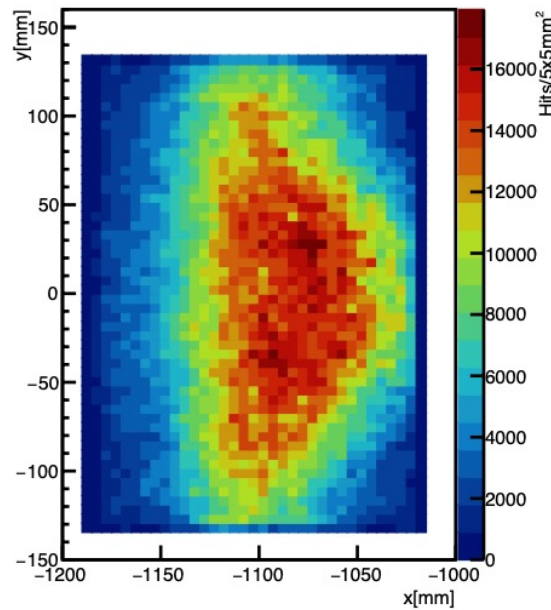
hits in open SM quartz4 -ee,ep gen



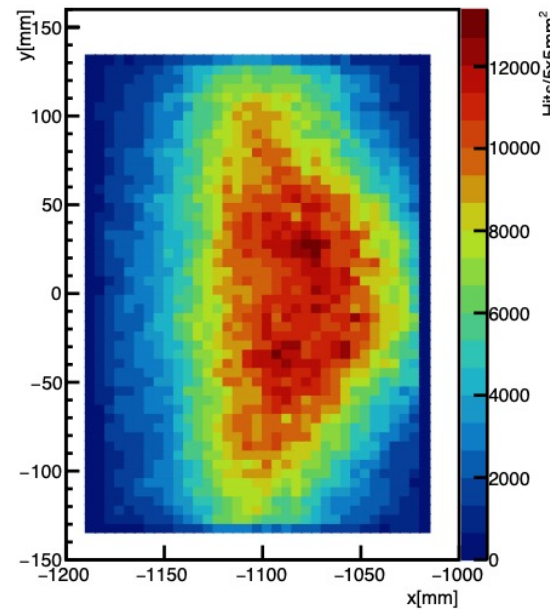
Layer 1



Layer 2

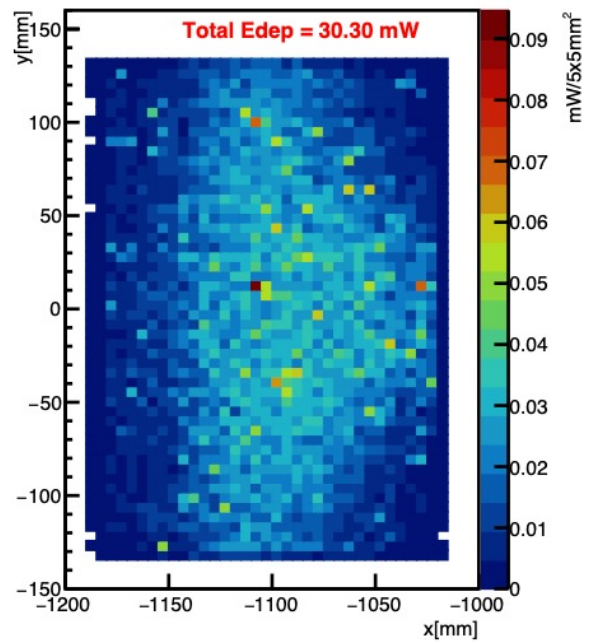


Layer 3

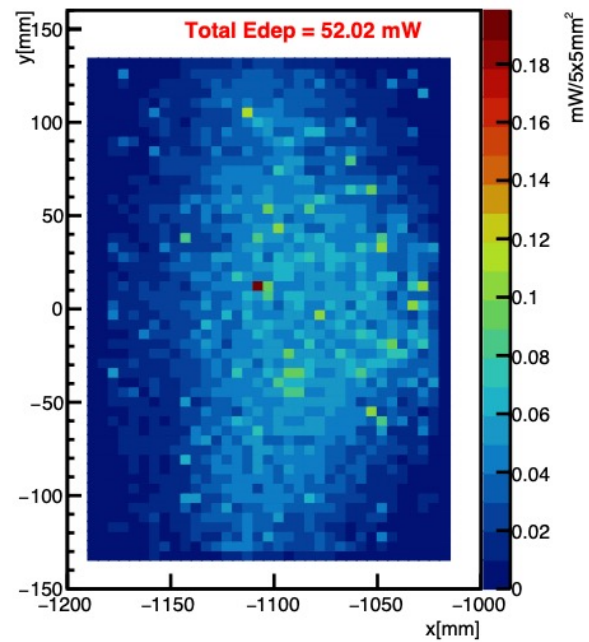


Layer 4

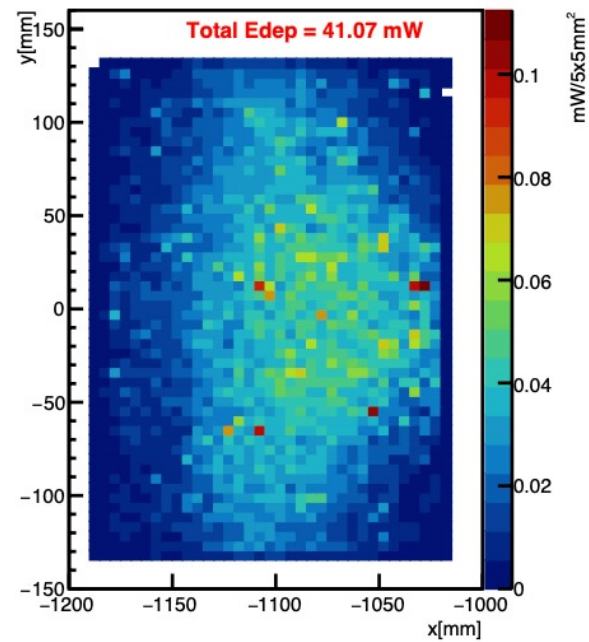
edep in open SM quartz1 -ee,ep gen



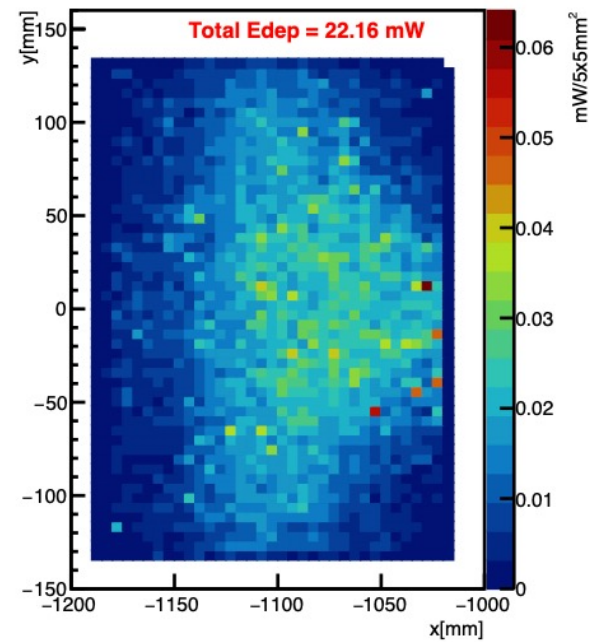
edep in open SM quartz2 -ee,ep gen



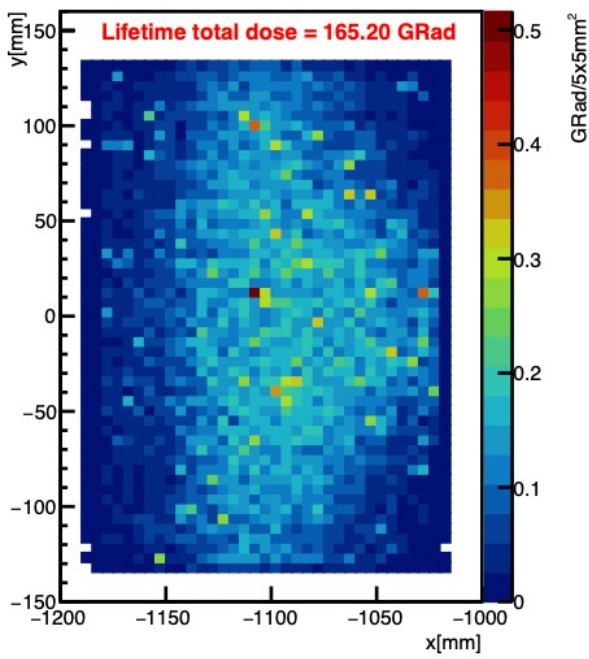
edep in open SM quartz3 -ee,ep gen



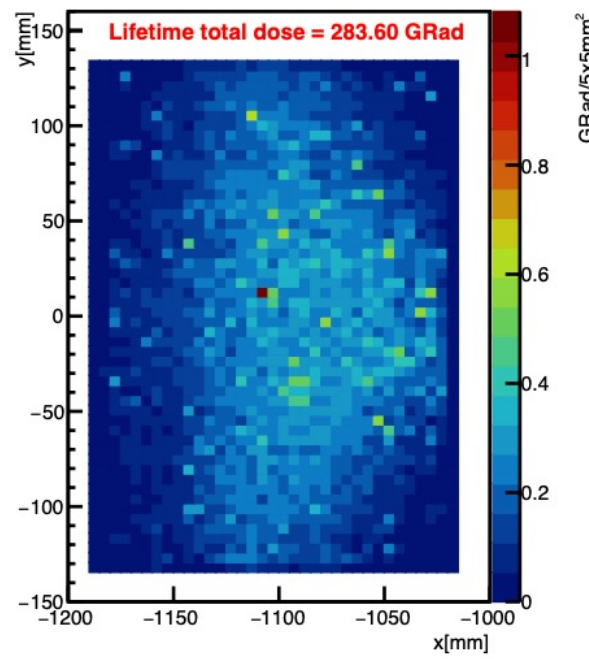
edep in open SM quartz4 -ee,ep gen



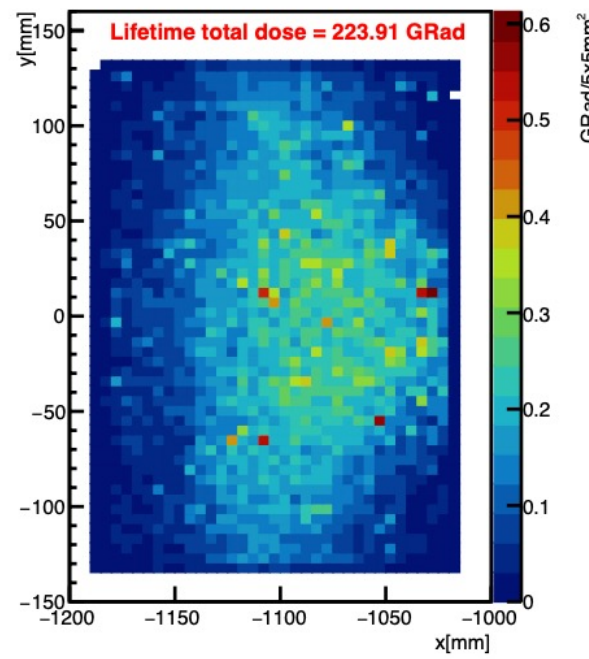
dose in open SM quartz1 -ee,ep gen



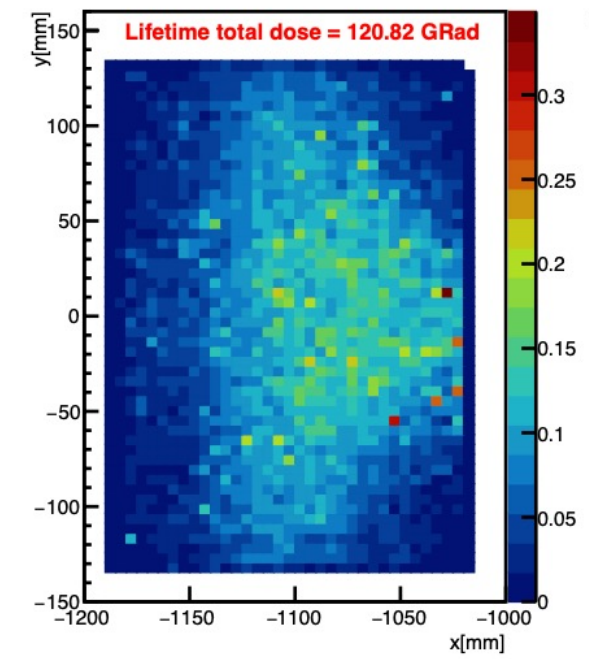
dose in open SM quartz2 -ee,ep gen



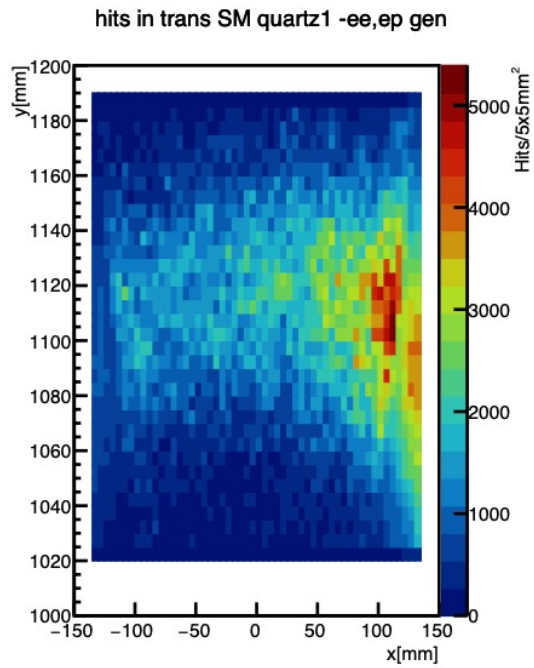
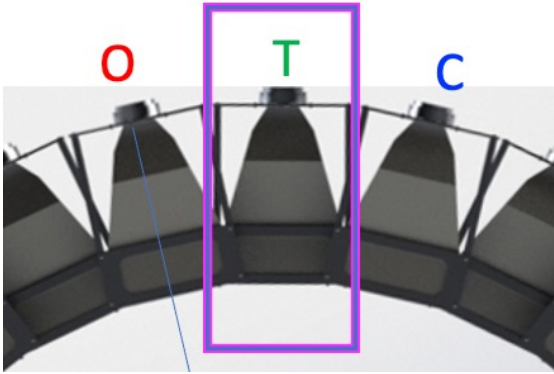
dose in open SM quartz3 -ee,ep gen



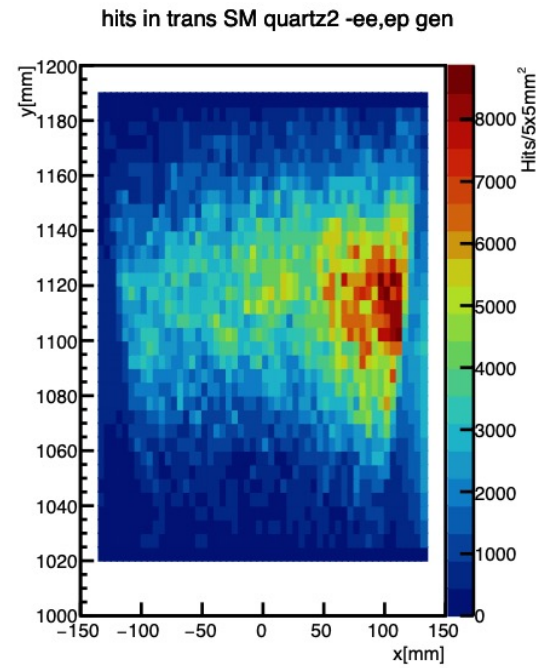
dose in open SM quartz4 -ee,ep gen



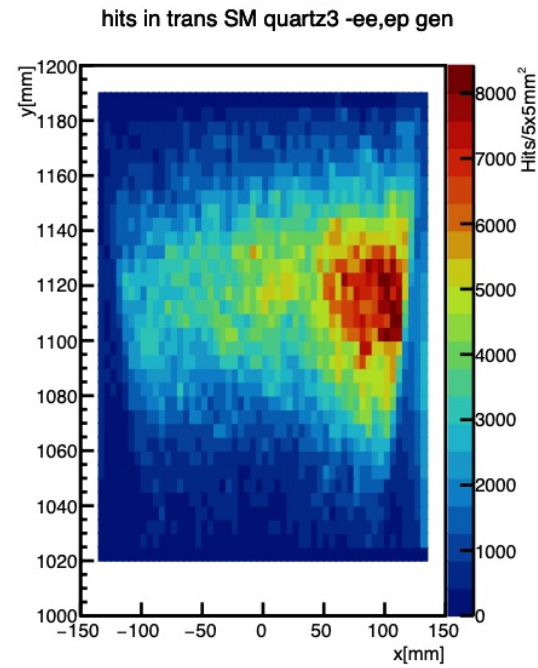
# SM Transition region Dose over entire experiment



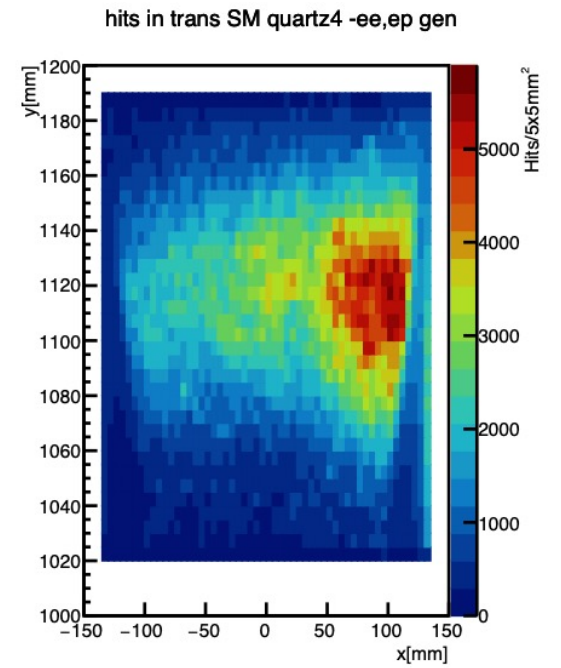
Layer 1



Layer 2

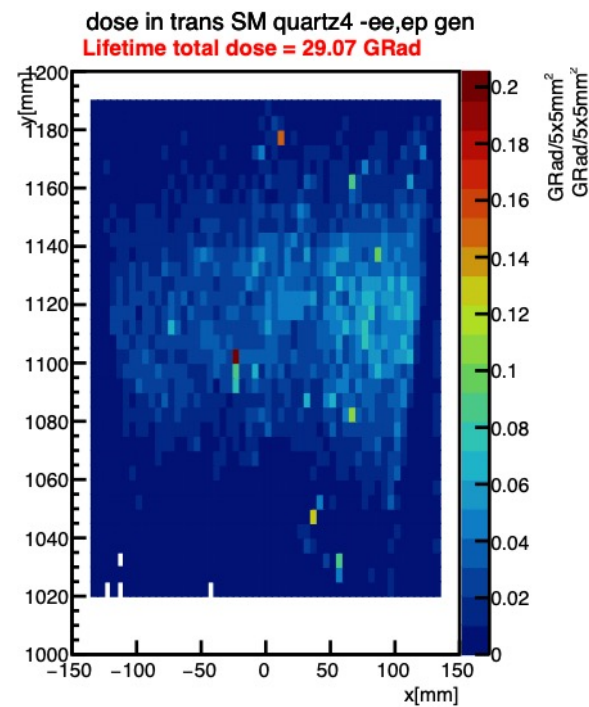
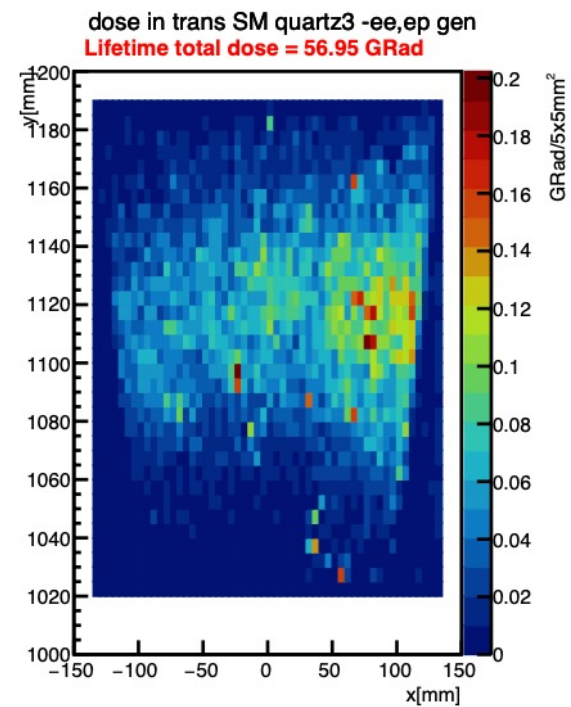
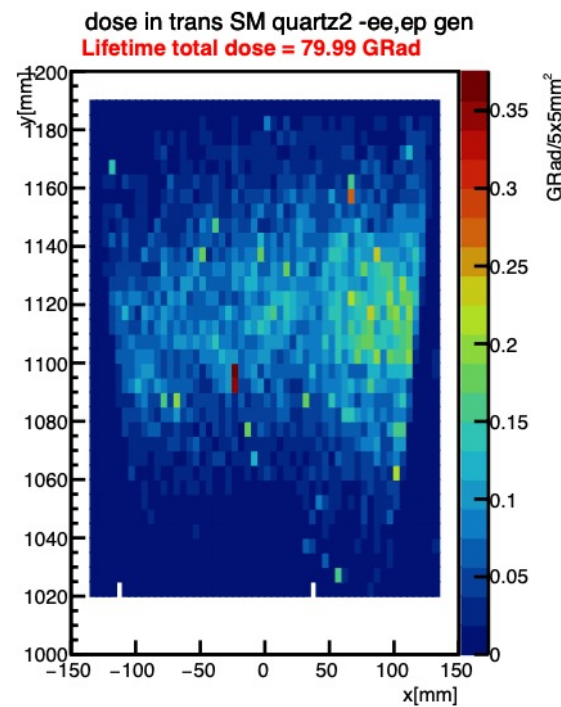
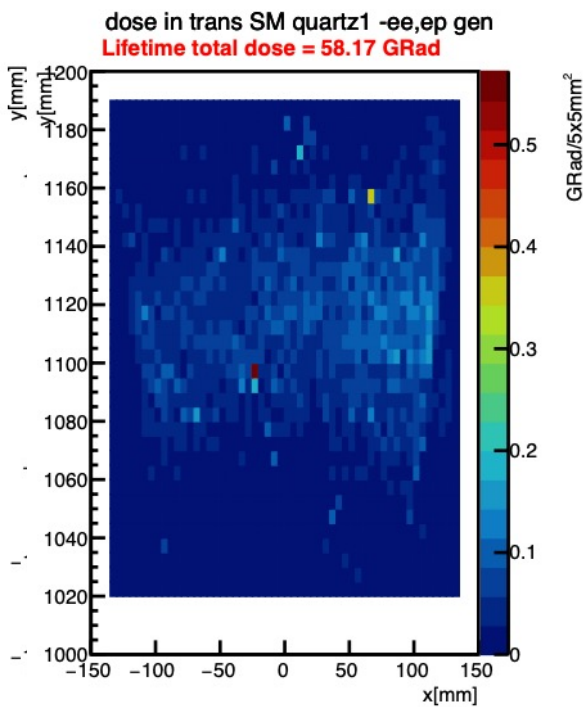
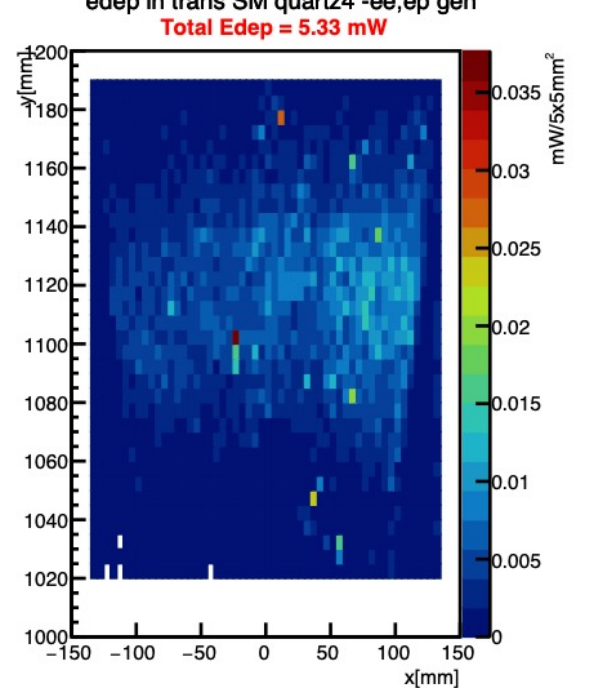
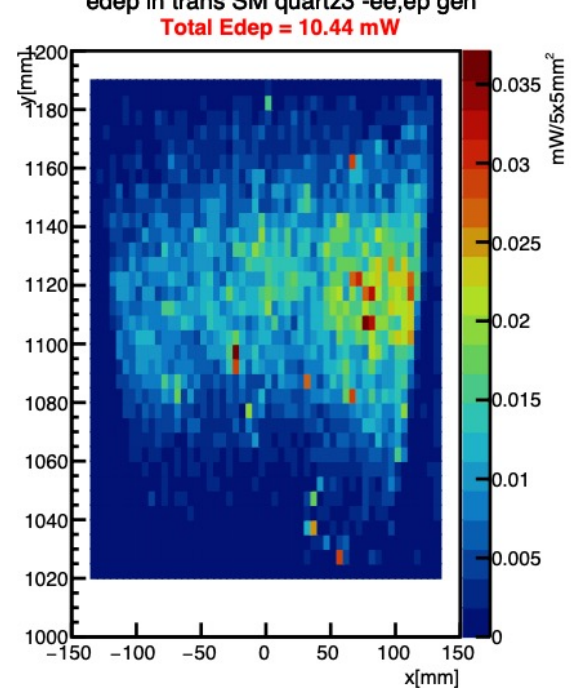
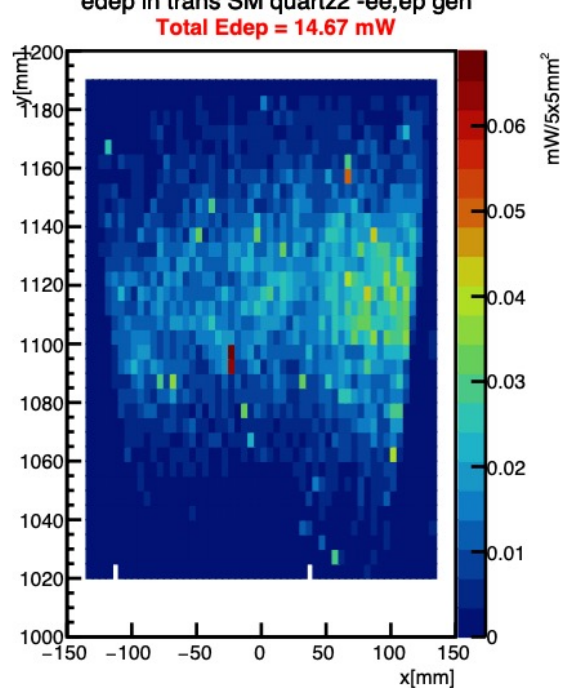
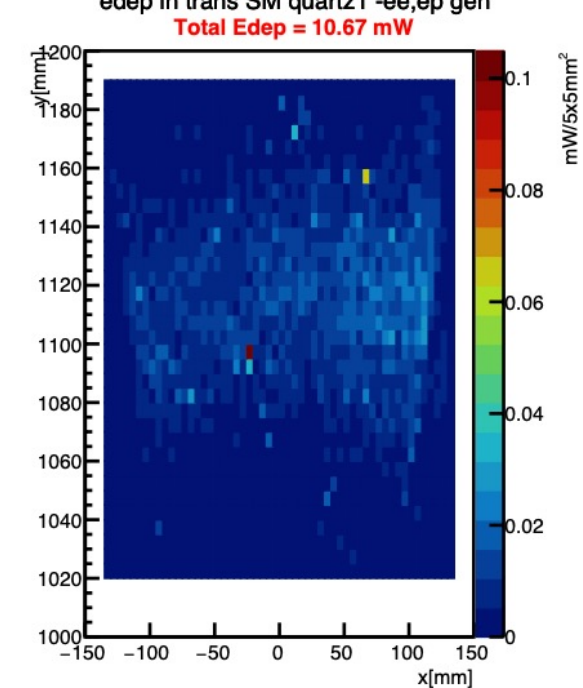


Layer 3



Layer 4 8





# Summary

- 2<sup>nd</sup> tile has greatest dose; 4<sup>th</sup> tile has lowest dose.
- Peak dose per 5x5 mm<sup>2</sup> is in Open tile#2 and is at least ~500 Mrad
- Runs with greater statistics for the backgrounds are underway—to remove any possible large stat fluctuations in our results.
- We irradiated one of our Heraeus samples to > 500 Mrad (per 5x5 mm<sup>2</sup>) and it still transmitted light well for 400nm and up. We're working to quantify it.