

# Target Shielding Redesign

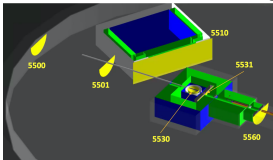
Ciprian Gal, Tao Ye, Zhongling Ji, Zuhail Seyma Demiroglu

04 Mar, 2021

# The updated geometry

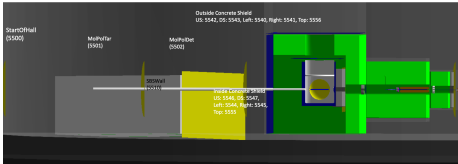
## Reminder slides from Ciprian Gal et al.

### Modifications made around target



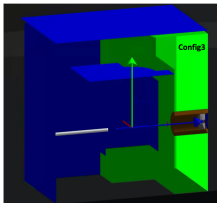
- Left all previous detectors alone
  - The hope is to remove them at some point later
- Added:
  - sphere detector around target
  - Plane DS of the target lead wall
  - Plane DS of US toroid (should be made kryptonite)
  - Plane US of the sbs bunker
  - Plane around moller and entrance of the hall (named Compton)
  - Plane detector at the moller polarimeter detector location
  - Use US outside shielding detector to evaluate harp/BPM radiation

### Updated geometry: Config2



- Geometry updated by Sakib with replacement of the material of the Pb wall to concrete and increase from 40cm to 65cm (maximum)
- Remove upstream wall
- 2m hole on the room

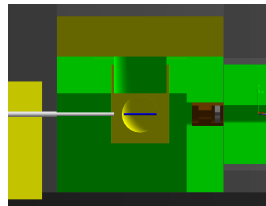
### Extended change (Config3)



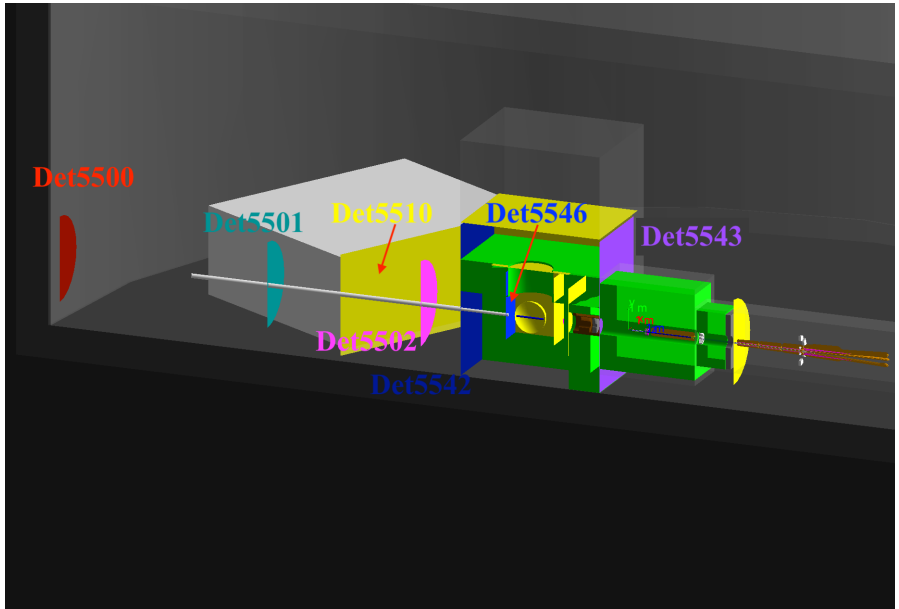
- Decided to take a look at a configuration that doesn't have any shielding US of the center of the target
- The (brown) inner bore of the DS concrete is barite (36-50.5 cm)
- While this may turn out unrealistic I figured it would be instructive
  - SBS bunker analysis pending

### Config4

- Lowered the above wall by 1524mm and the side and DS wall are also lowered in height accordingly.
- Added an inner barite portion.

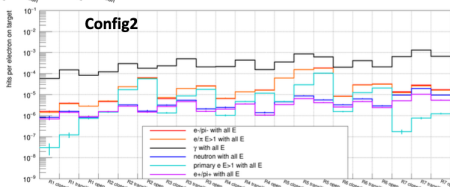
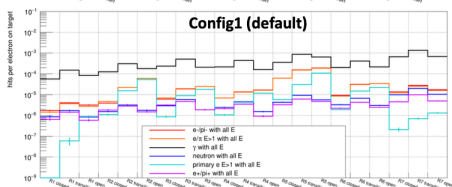
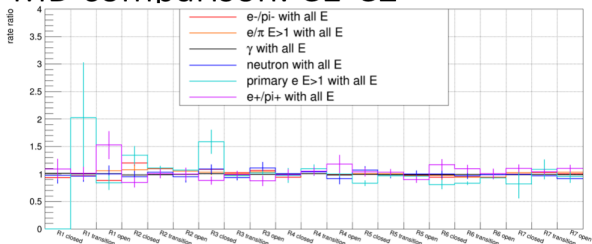


# The updated geometry



# Main Detector output from V1-V2 configurations

## MD comparison: C1-C2

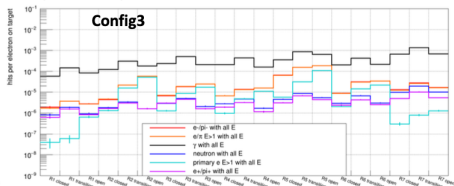
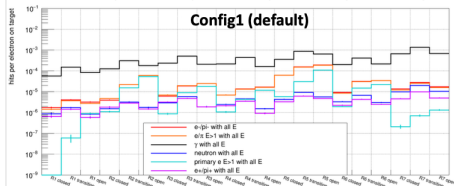
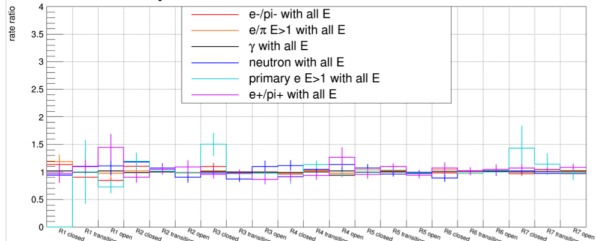


- The ratio of rates at the MD doesn't show any significant discrepancies.



# Main Detector output from V1-V3 configurations

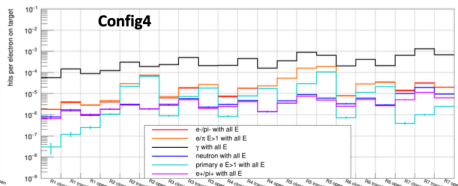
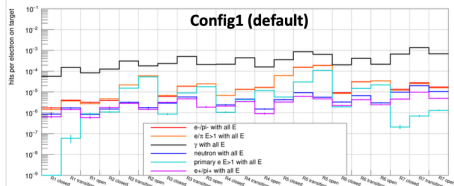
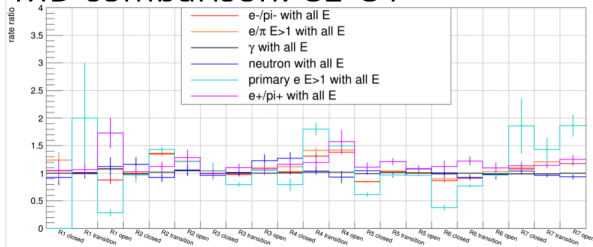
## MD comparison: C1-C3



- The ratio of rates at the MD doesn't show any significant discrepancies.

# Main Detector output from V1-V4 configurations

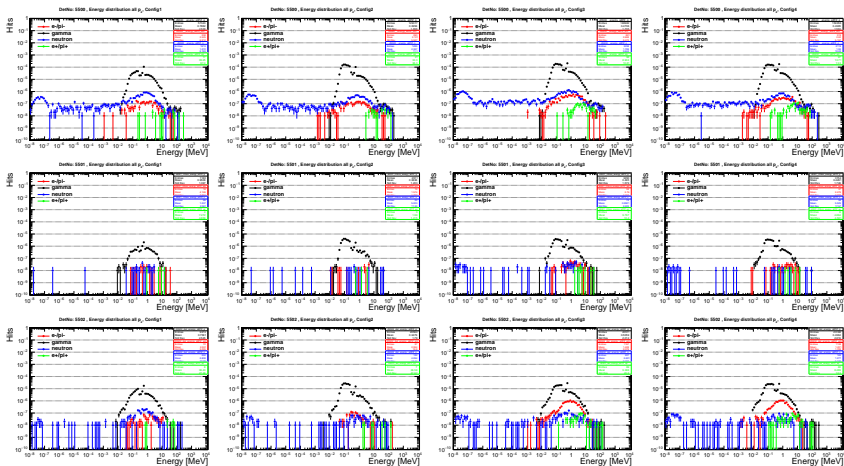
## MD comparison: C1-C4



- Adding the US inner barite plug makes a difference for the secondaries.
  - Probably scattering from the inner bore of that component and a taper would be needed if we have to have it in.

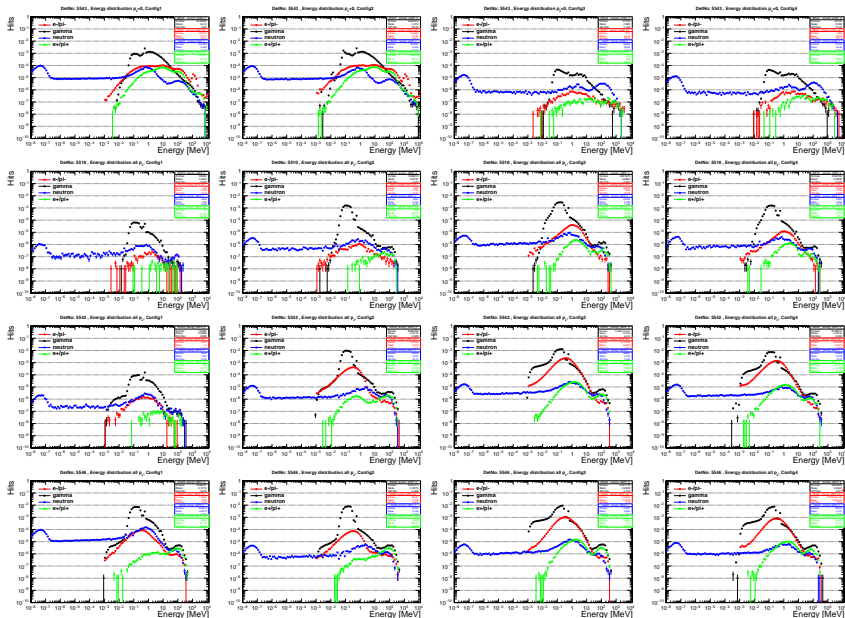
# Energy Distributions for det5500, 5501 and 5502

- US electronics definitions
  - Compton: entire 1.9m disk at entrance to hall ( $z=-26\text{m}$ )
  - Moller polarimeter tgt:  $R<20\text{cm}$  at  $z=-16.5\text{m}$
  - Moller polarimeter det:  $(X,Y)=(0,0)-(10,20)\text{cm}$ ; 20cm wide 30cm tall; at  $z=-9.5\text{m}$



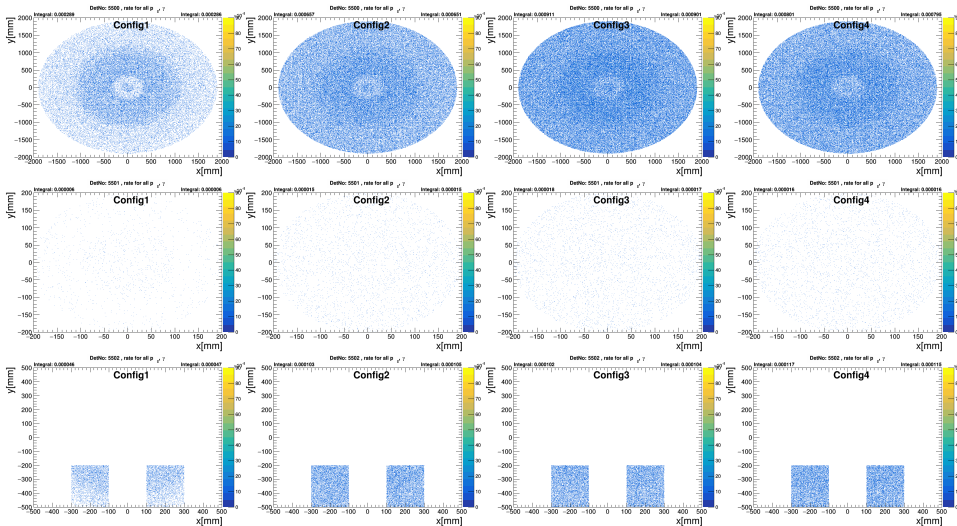
- The rates are still very small even without the US wall (increase by about factor 2)

# Energy Distributions for det5510, 5542, 5543 and 5546



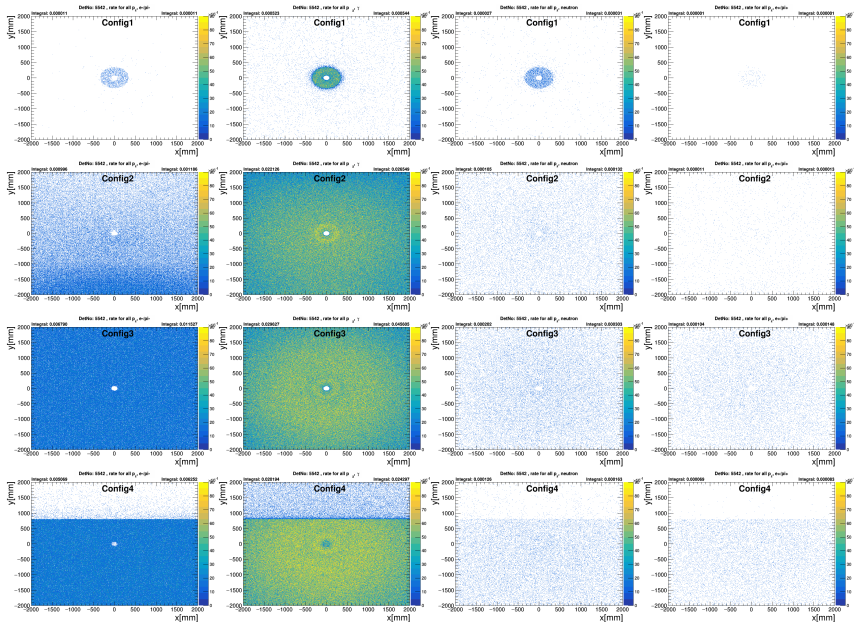
# 2D Hit Distributions weighted by rate for all $p_z$ , config1/2/3/4

(Det5500 & Det5501 & Det5502)

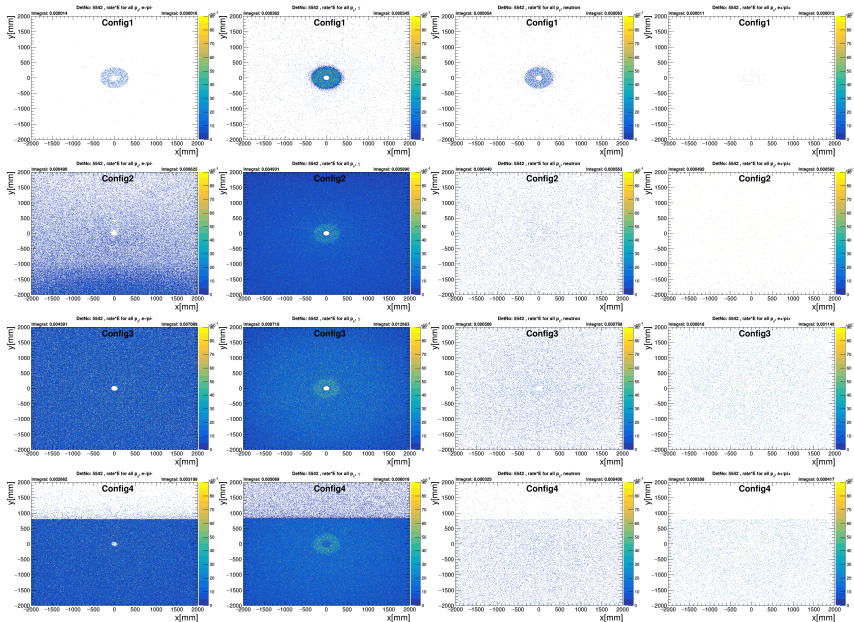


- Removing the US wall produced an increase in radiation at the entrance of the hall.
- The increase is  $\sim 3$  for the entrance of the hall if we look at the integral values.

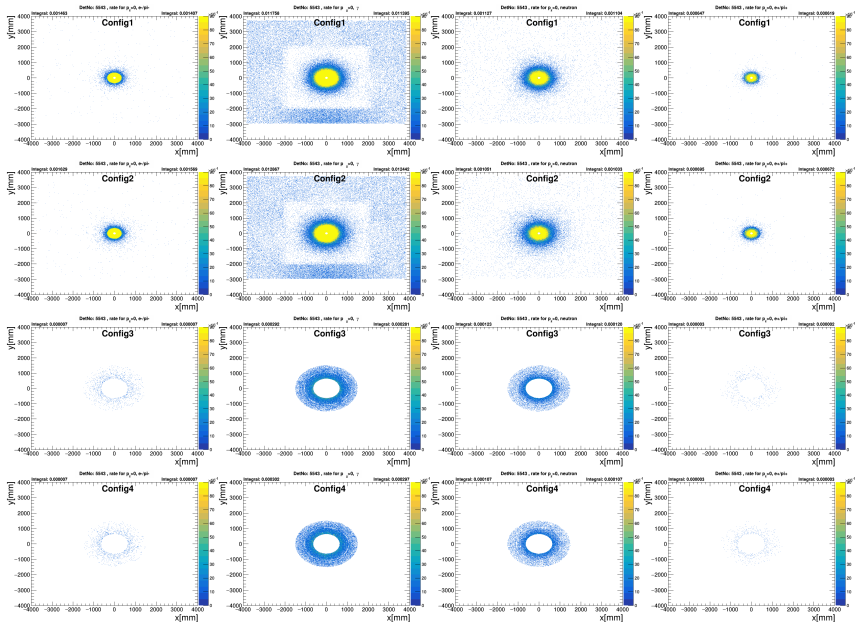
# 2D Hit Distributions weighted by rate for all $p_z$ , config1/2/3/4 (Det5542)



# 2D Hit Distributions weighted by rate\*E for all $p_z$ , config1/2/3/4 (Det5542)

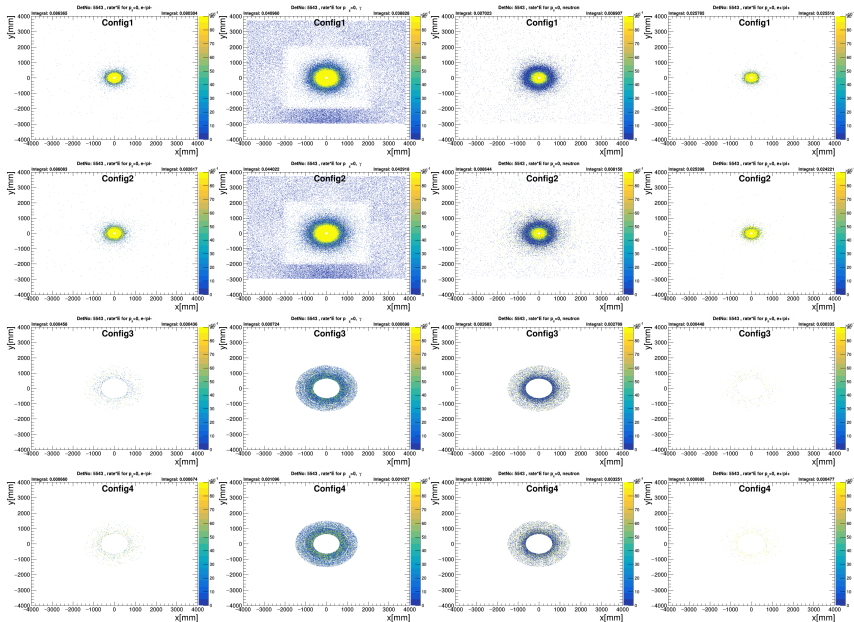


# 2D Hit Distributions weighted by rate for $p_z > 0$ , config1/2/3/4 (Det5543)

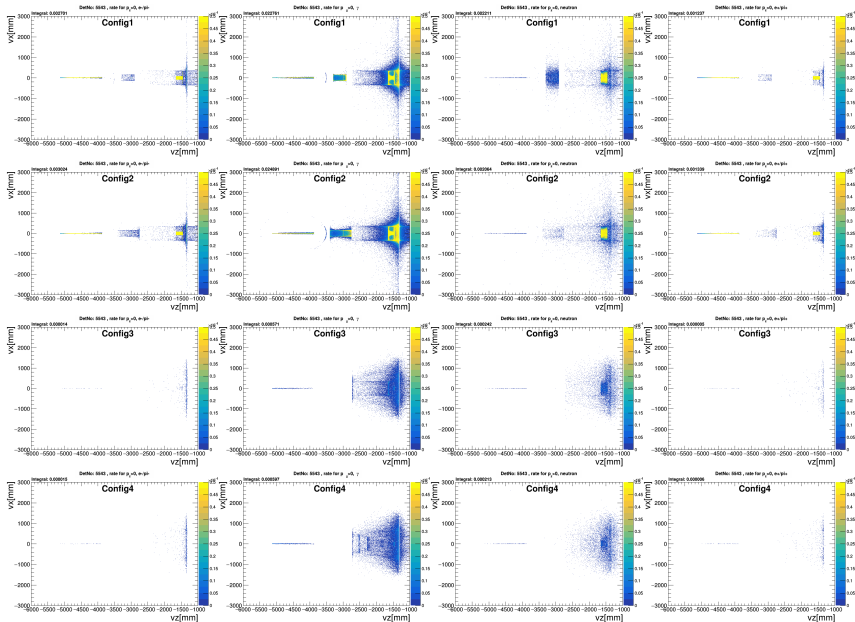




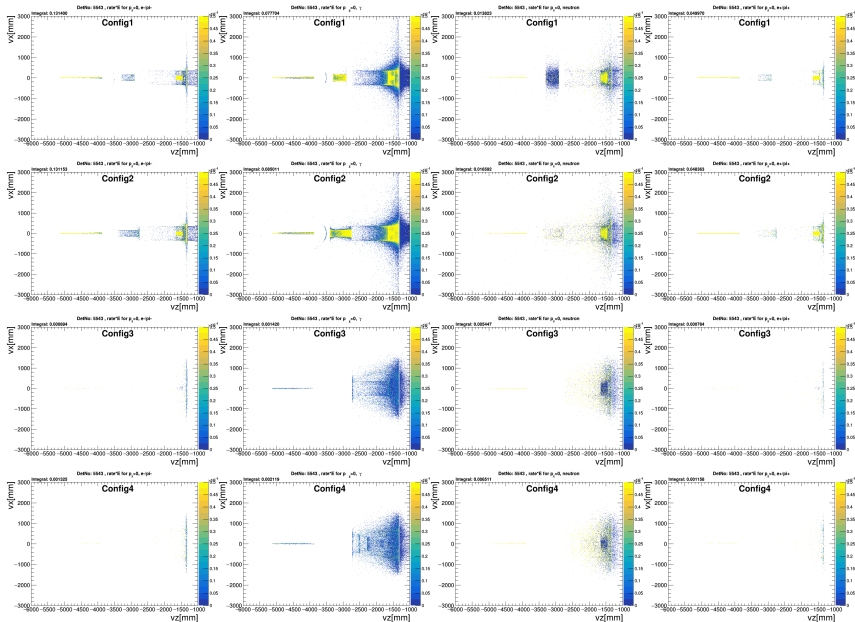
# 2D Hit Distributions weighted by rate\*E for $p_z > 0$ , config1/2/3/4 (Det5543)



# Vertex positions $v_x$ vs $v_z$ weighted by rate for $p_z > 0$ , config1/2/3/4 (Det5543)



# Vertex positions $v_x$ vs $v_z$ weighted by rate\*E for $p_z > 0$ , config1/2/3/4 (Det5543)



# Summary

- The ratio of the different configurations at the main detector does not show any significant discrepancy.
- Removing the Pb-wall improves things in the DS.
- Removing the US wall produced an increase in radiation at the entrance of the hall for photons and neutrons.
- For Det5543: We don't understand the 'hole' in config3/4 yet and we are investigating.
  - The positrons from the target are significantly reduced with config3/4.

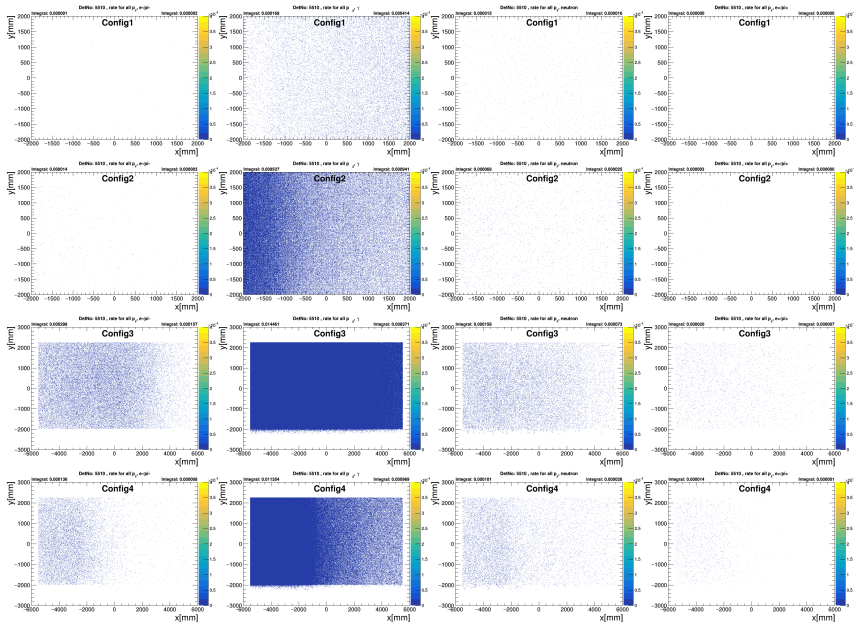
## To do list

- Look at "stopping power" for the roof, SBS bunker, and DS wall with a look towards optimizing the thickness.
- Update geometry from the engineering team.
- Start looking collimator 1/2 region.
  - It may be worth someone taking another look at the collimator 1/2 power deposition, US torus power deposition with this configuration.

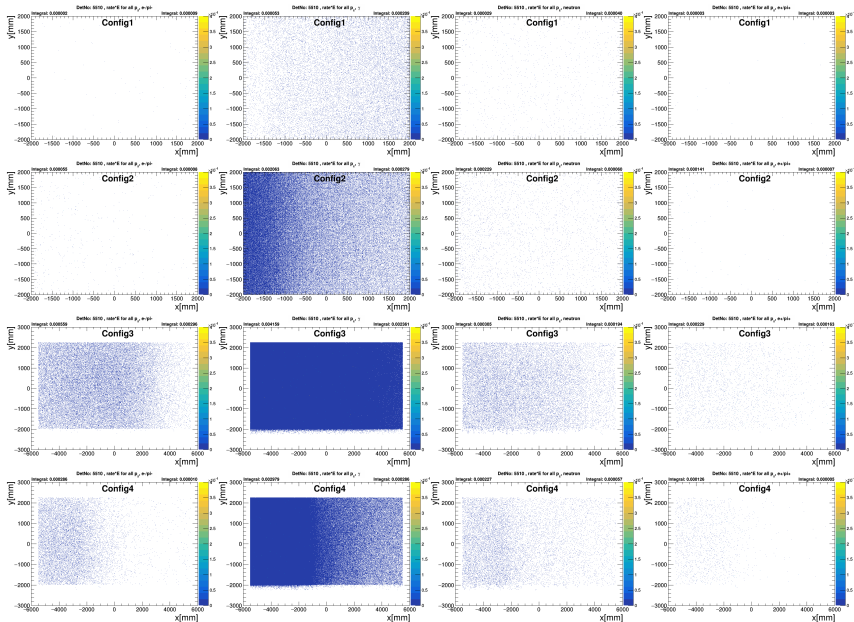
Thank you!

# Backup

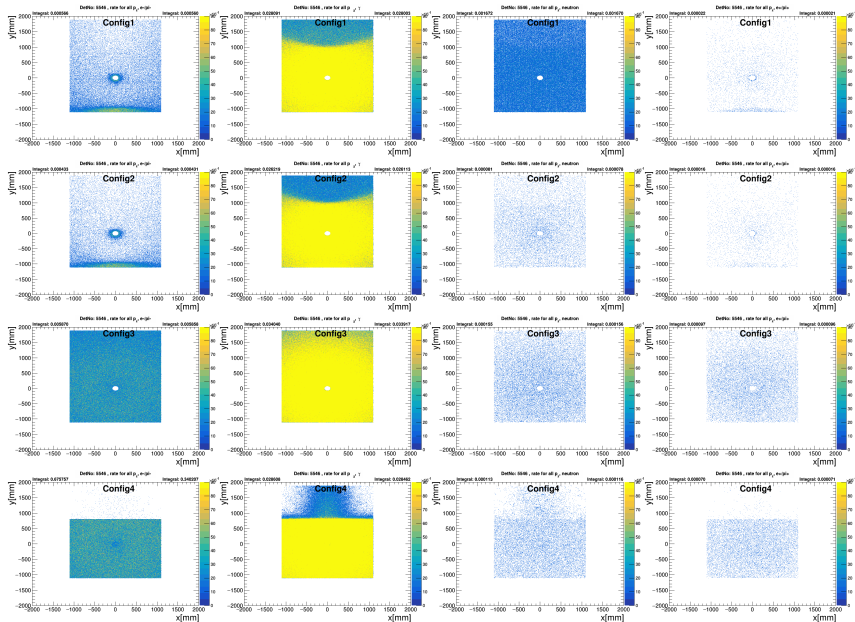
# 2D Hit Distributions weighted by rate for all $p_z$ , config1/2/3/4 (Det5510)



# 2D Hit Distributions weighted by rate\*E for all $p_z$ , config1/2/3/4 (Det5510)

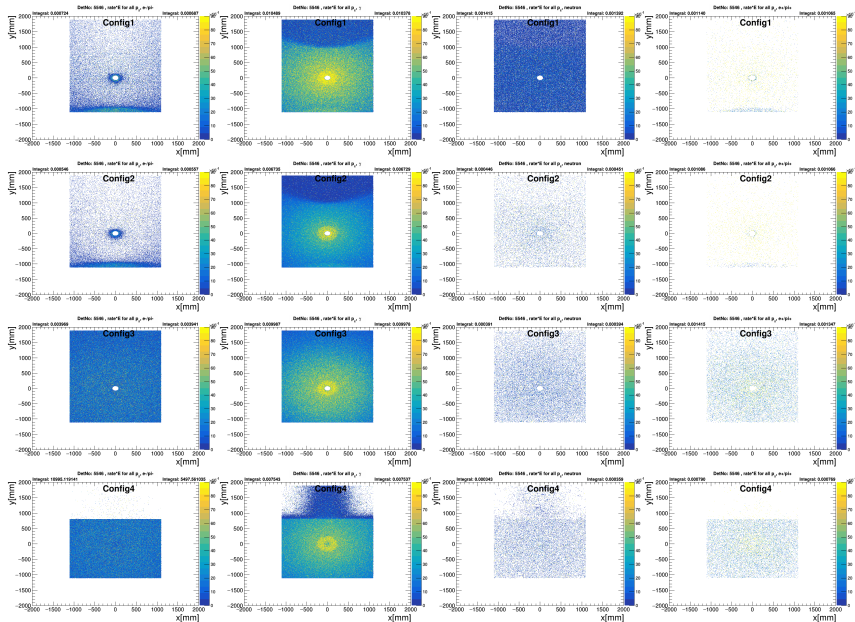


# 2D Hit Distributions weighted by rate for all $p_z$ , config1/2/3/4 (Det5546)

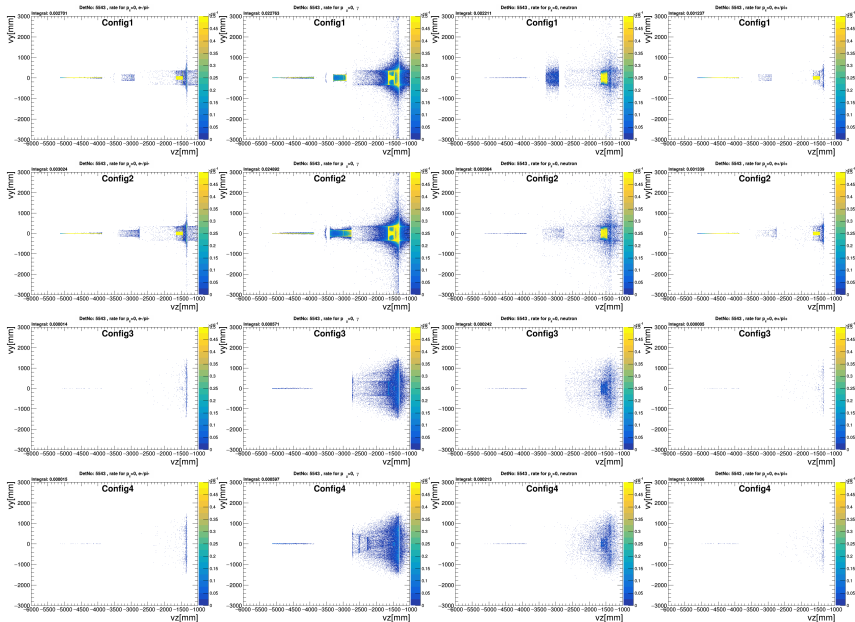




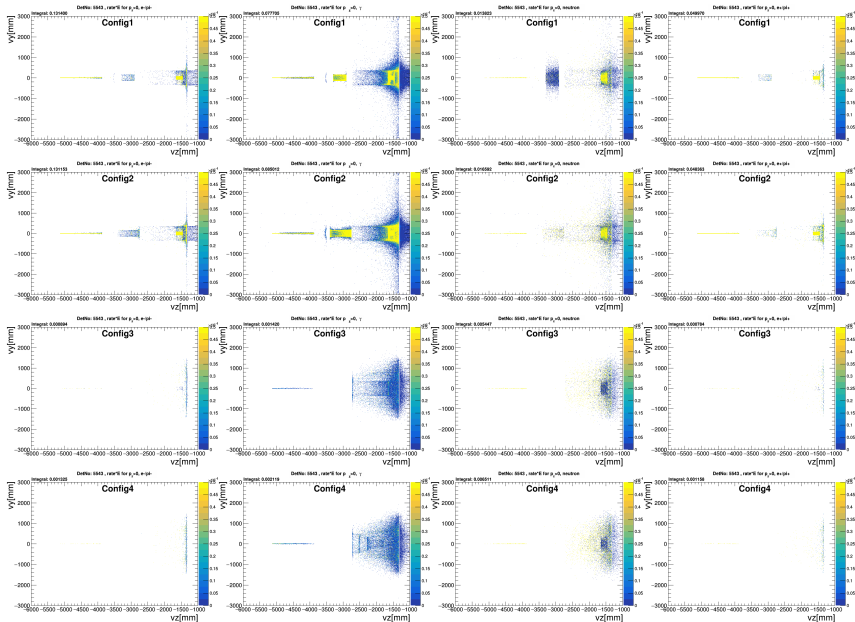
# 2D Hit Distributions weighted by rate\*E for all $p_z$ , config1/2/3/4 (Det5546)



# Vertex positions $v_y$ vs $v_z$ weighted by rate for $p_z > 0$ , config1/2/3/4 (Det5543)

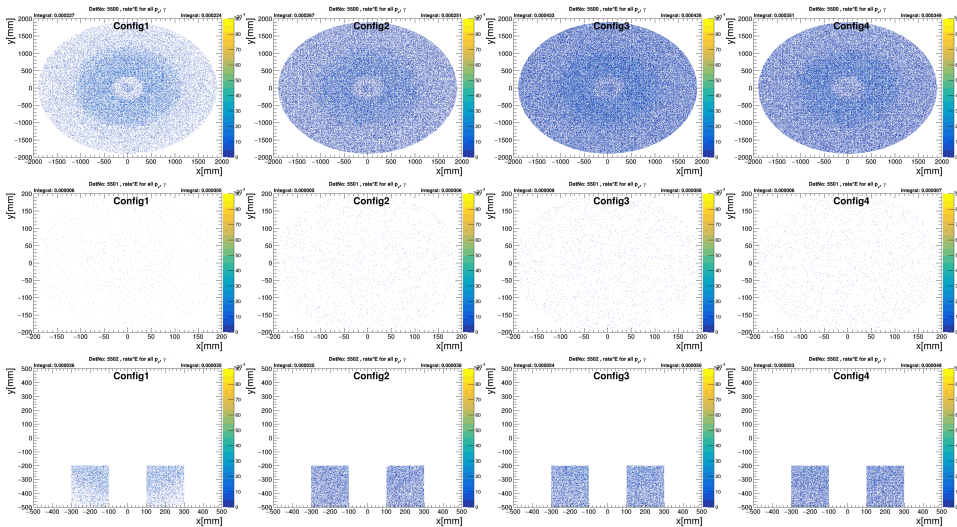


# Vertex positions $v_y$ vs $v_z$ weighted by rate\*E for $p_z > 0$ , config1/2/3/4 (Det5543)



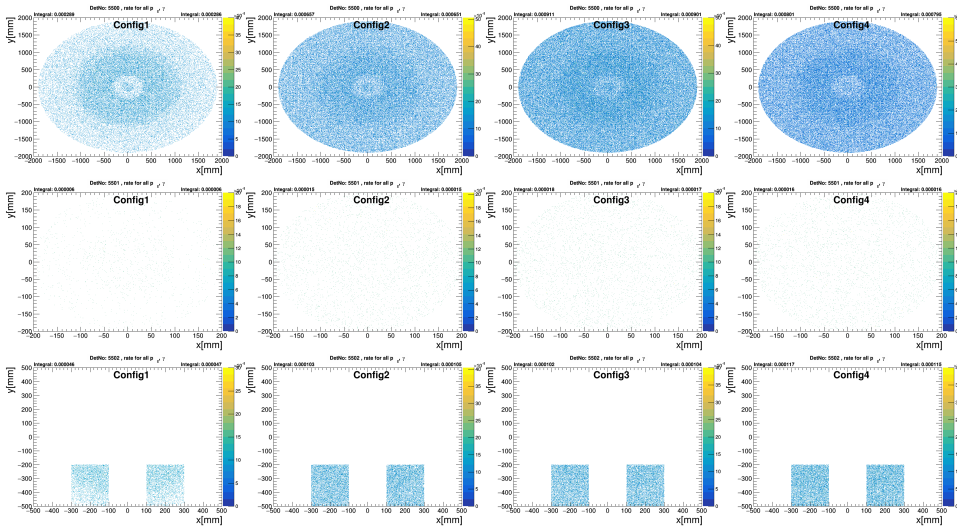
2D Hit Distributions weighted by rate\*E for all  $p_z$ , config1/2/3/4

(Det5500 , rate\*E for all  $p_z$   $\tau$  & Det5501 & Det5502)

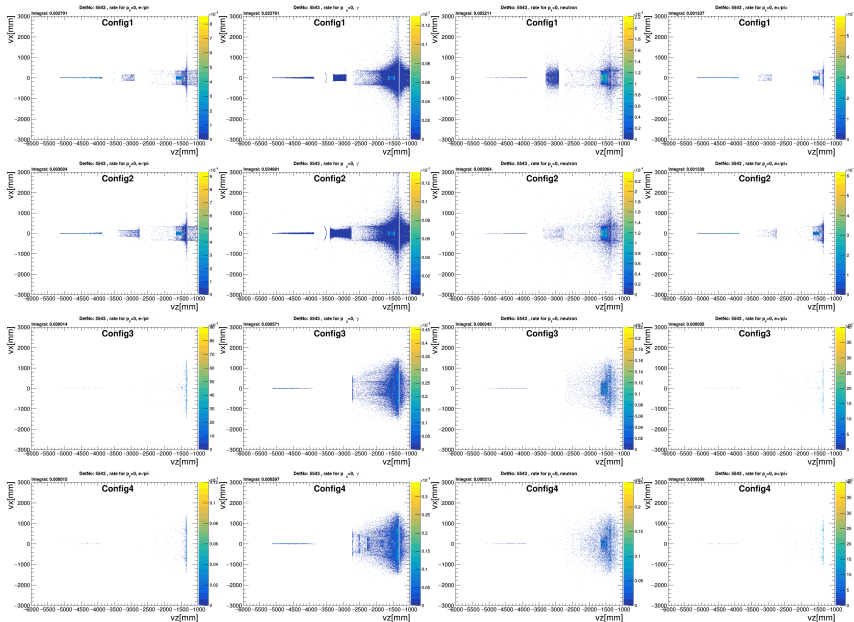


# 2D Hit Distributions weighted by rate for all $p_z$ , config1/2/3/4

(Det5500 & Det5501 & Det5502)



# Vertex positions $v_x$ vs $v_z$ weighted by rate for $p_z > 0$ , config1/2/3/4 (Det5543)



# Vertex positions $v_x$ vs $v_z$ weighted by rate\*E for $p_z > 0$ , config1/2/3/4 (Det5543)

