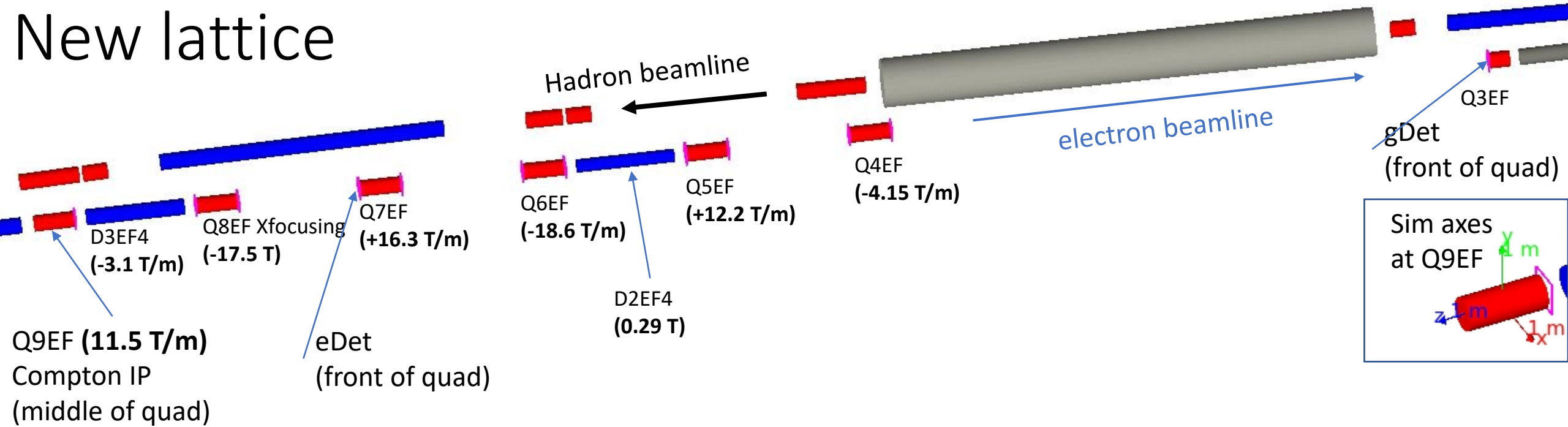


Compton IP location (V3)

Ciprian Gal



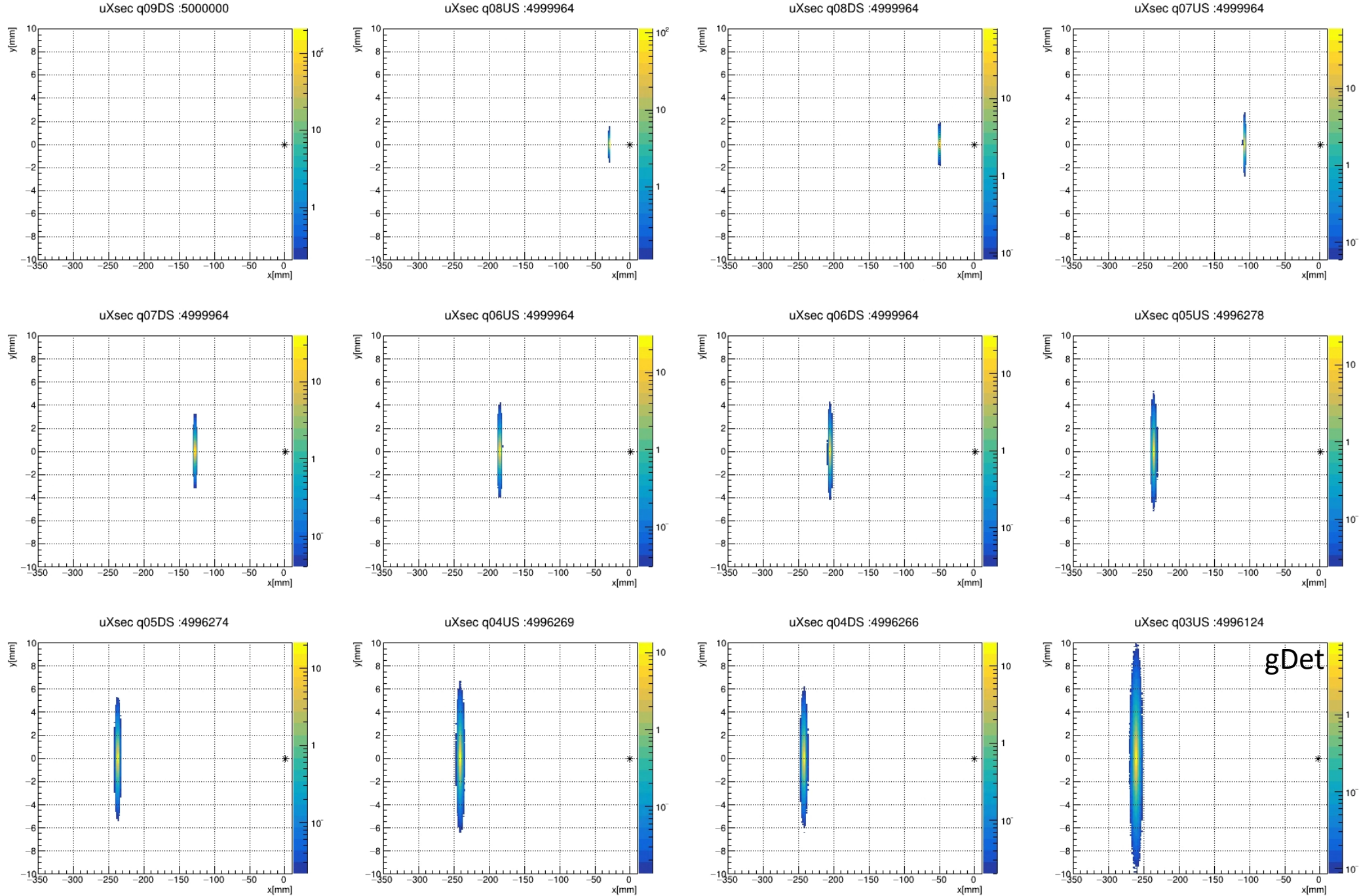
New lattice



- The current configuration that Zhengqiao suggested has the IP in the middle of Q9EF, the electron detector in front of Q7EF ($\sim 9.3\text{m}$ DS from IP) and the photon detector in front of Q3EF ($\sim 44\text{m}$ DS from IP)
- This configuration has the Q8EF magnet (after the dipole) being focusing for electrons which significantly reduces the horizontal width at the electron detector location
- Simulation ran with ~ 45 degree angle for spin direction (in the xz plane)

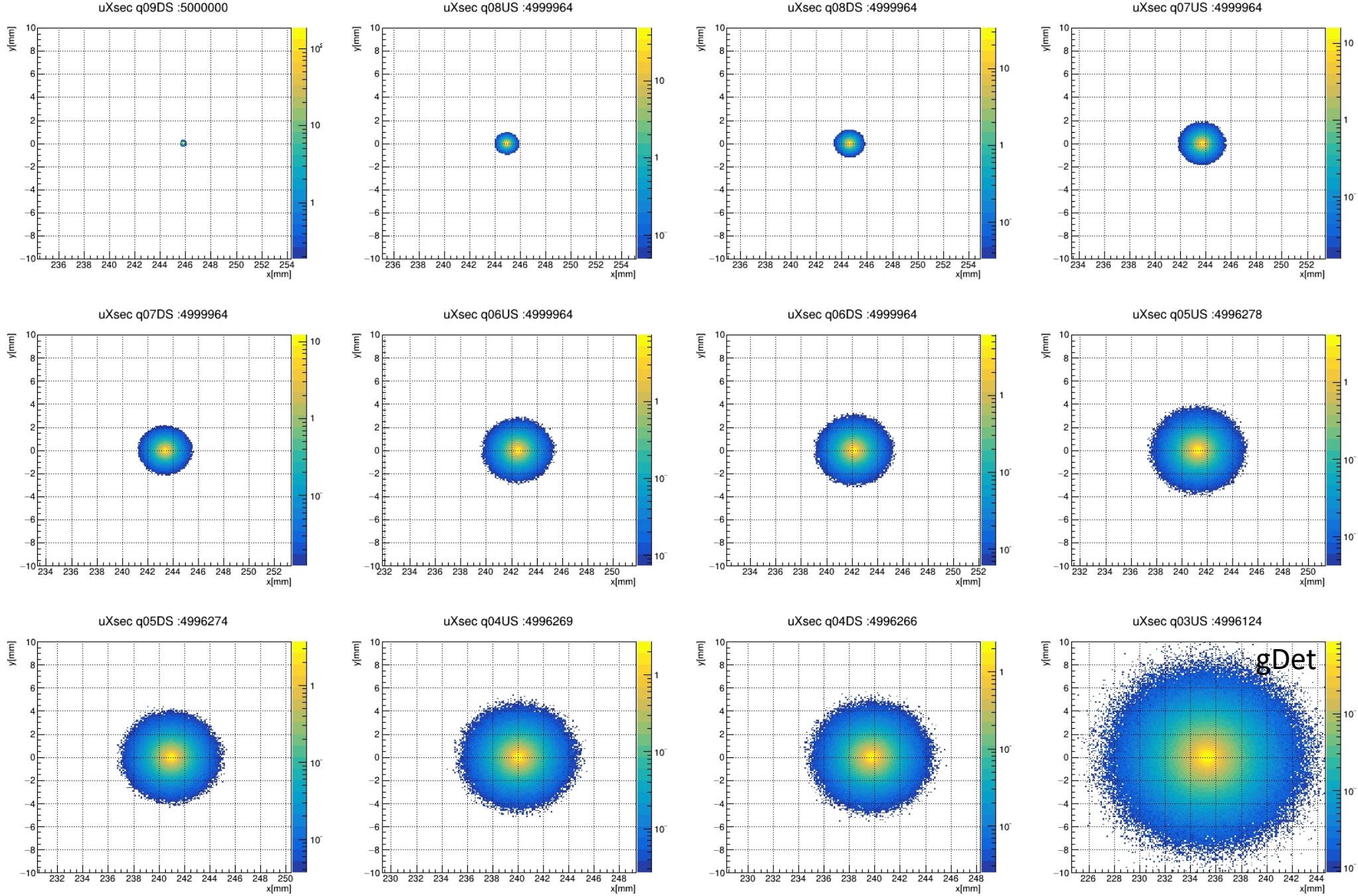
gamma

- The magnets are coded as having a IR of 60mm and an OR of 250mm
- By these sizes everything beyond Q7 would need to have a horizontal hole to allow the photon envelope to reach the detector



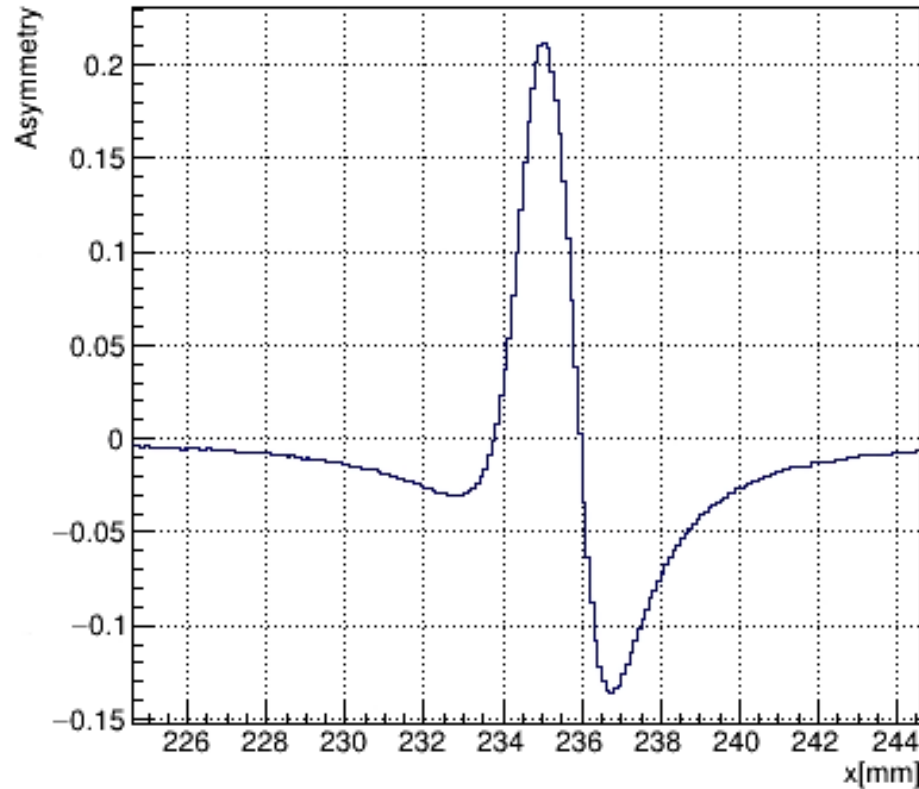
gamma

- The transverse size at the photon detector would be on the level of 8mm

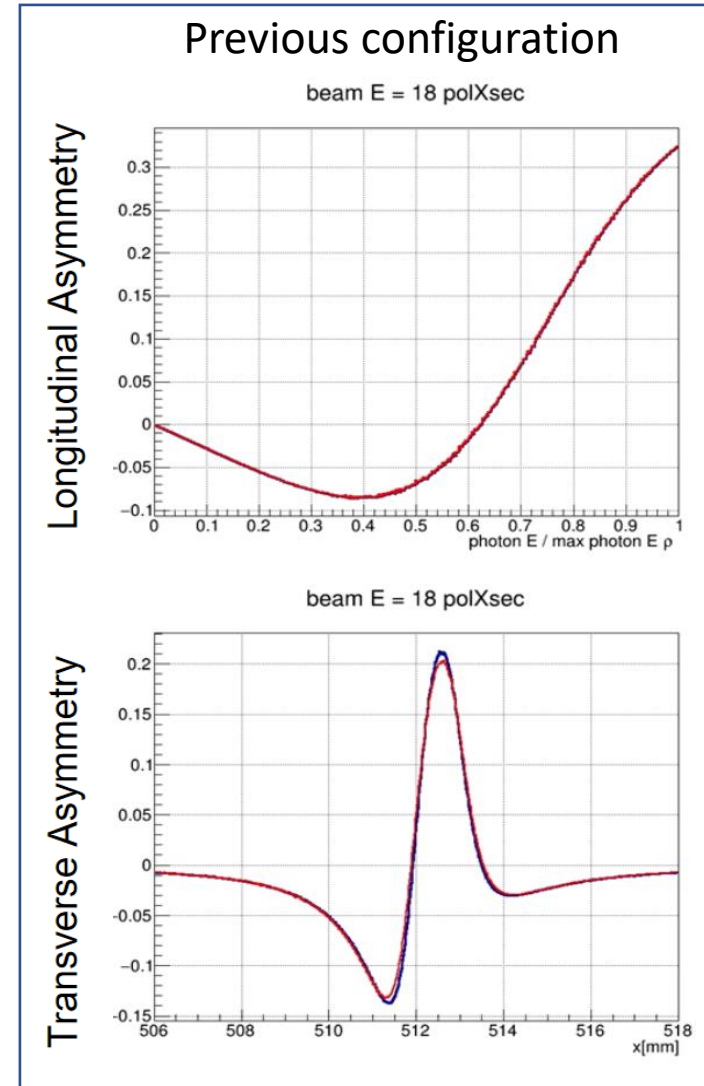


Compton photons at the detector location

pXsec q03US :499618

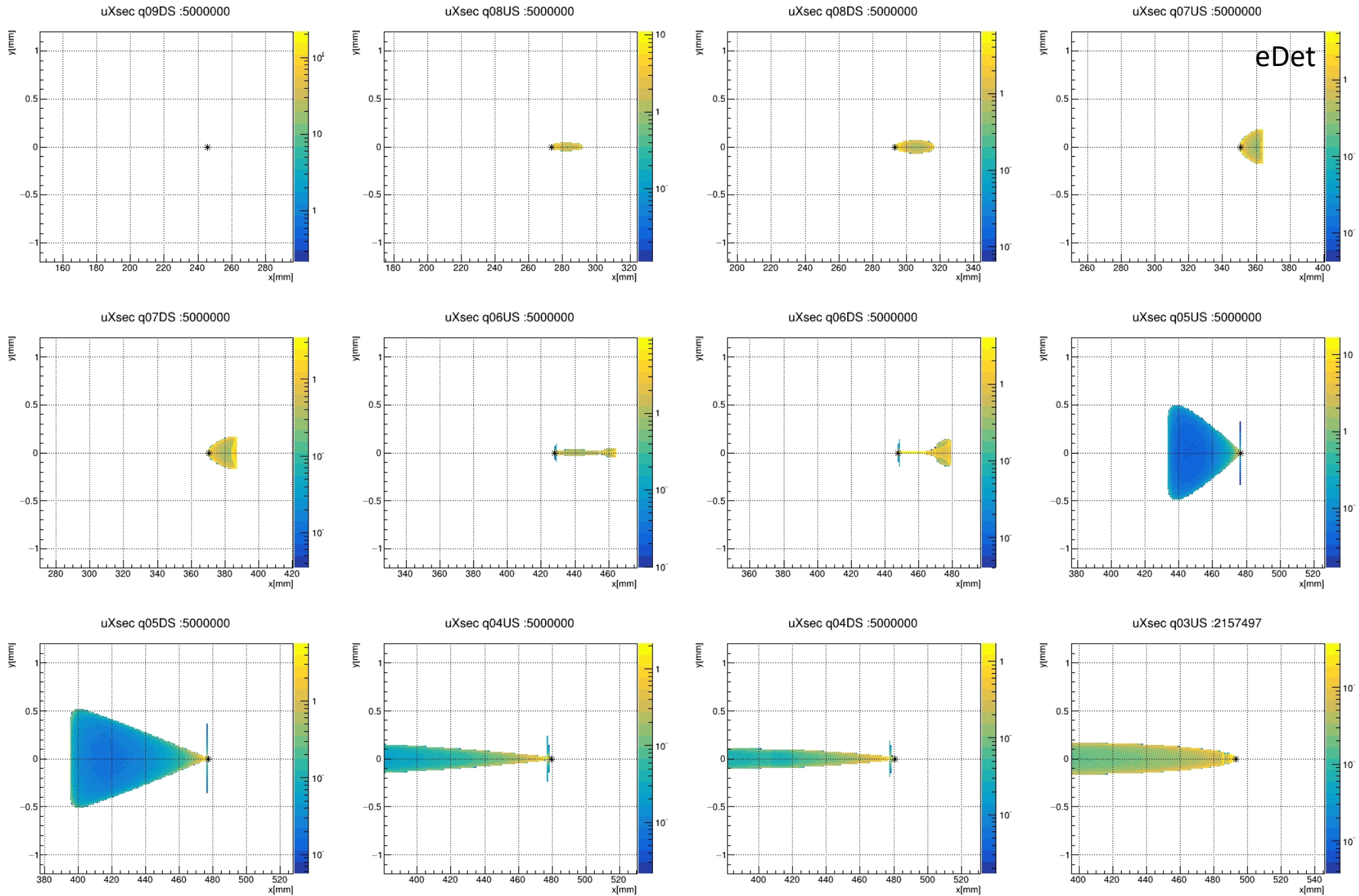


- The sensitivity to the transverse component would be increased in this configuration
 - The distance between the “peaks” is 2mm compared to the previous ~ 1.2 mm



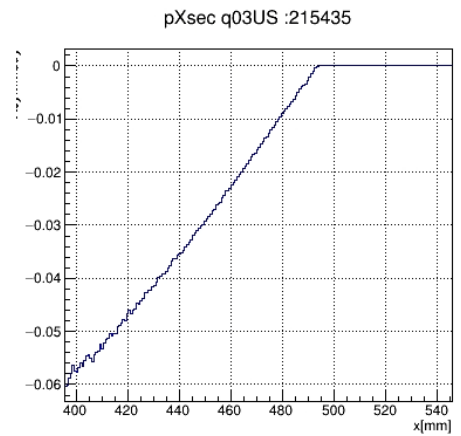
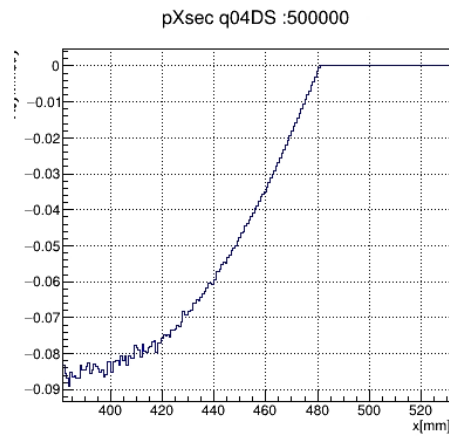
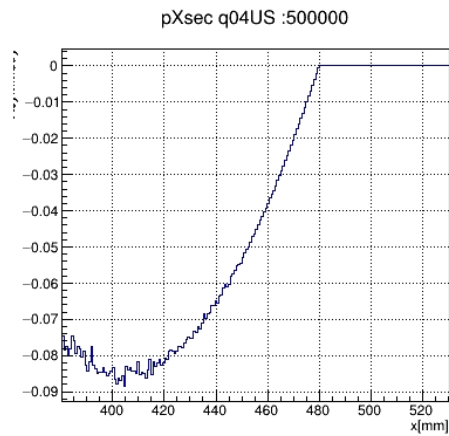
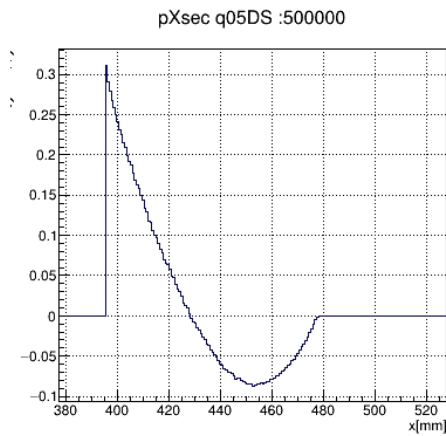
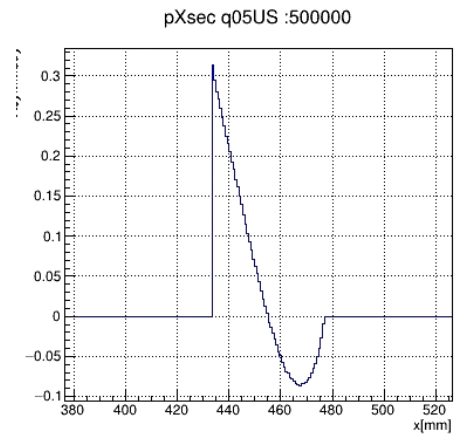
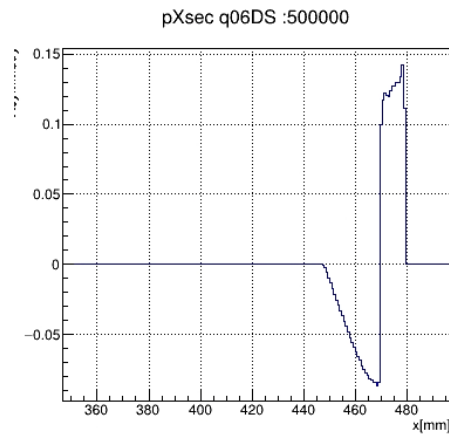
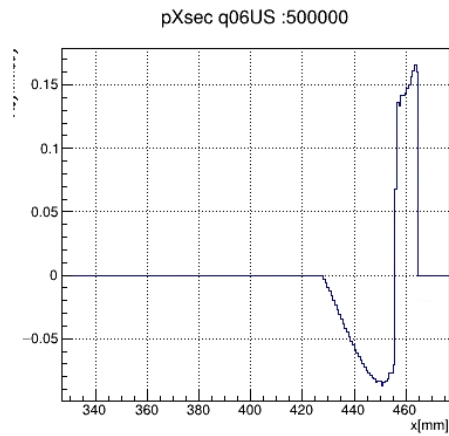
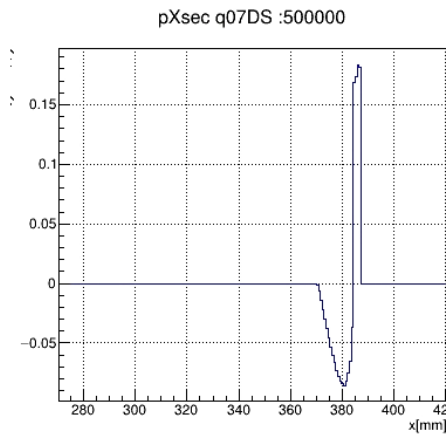
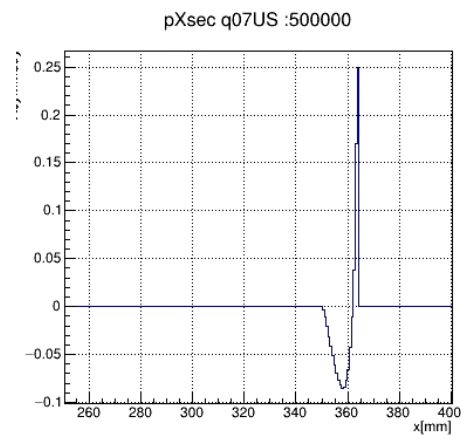
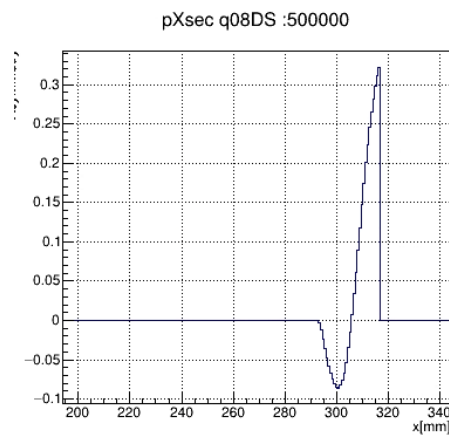
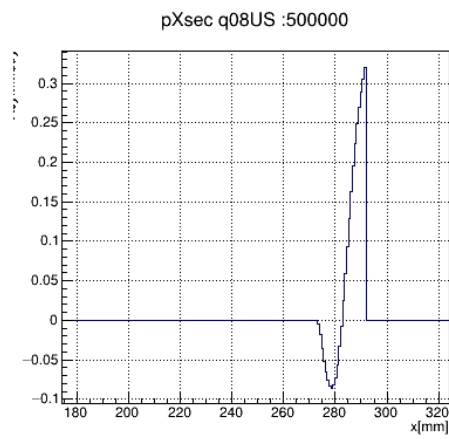
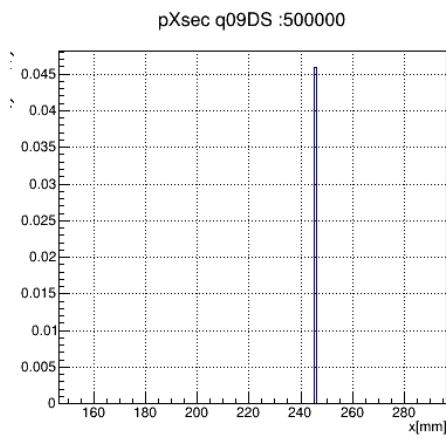
electrons

- Compton scattered electron envelope (5e6 events) weighted by unpolarized cross sections at all locations downstream of the IP
- The "*" (stars) are the locations where a 18GeV electron starting in the middle of the Q9EF quad interacts with each detector



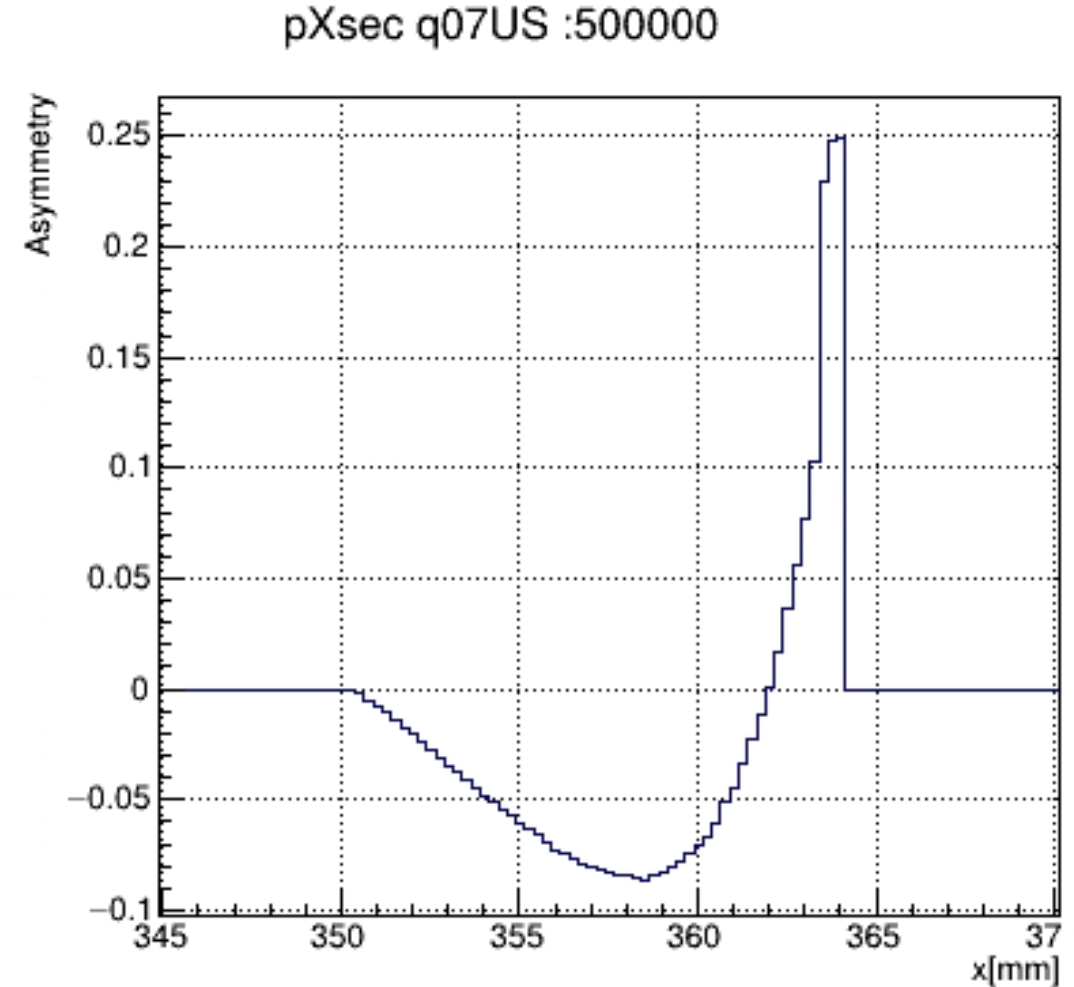
electrons

- Asymmetry as a function of position for Compton electron at each detector location

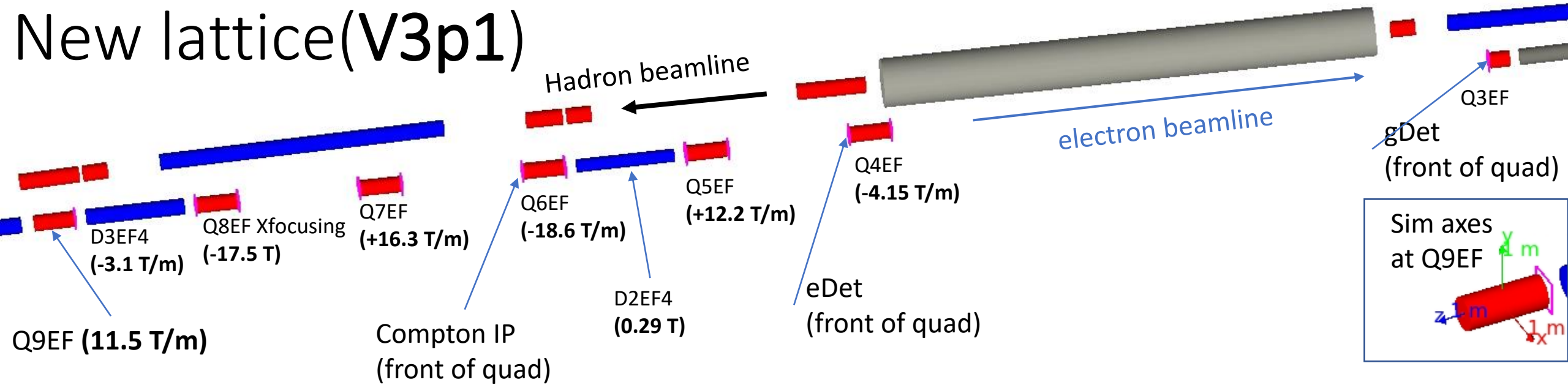


Compton electrons at detector location

- Because the low energy (high positive analyzing power) electrons are more affected by the focusing quad we can see we have about 7mm of clearance from the main beam to be able to catch the 0-crossing
 - If we assume similar divergences as before (500 μ m) then 10sigma is already at 5mm
 - We can expect that this would be worse at 5GeV
- The distortion could potentially add to our systematic budget

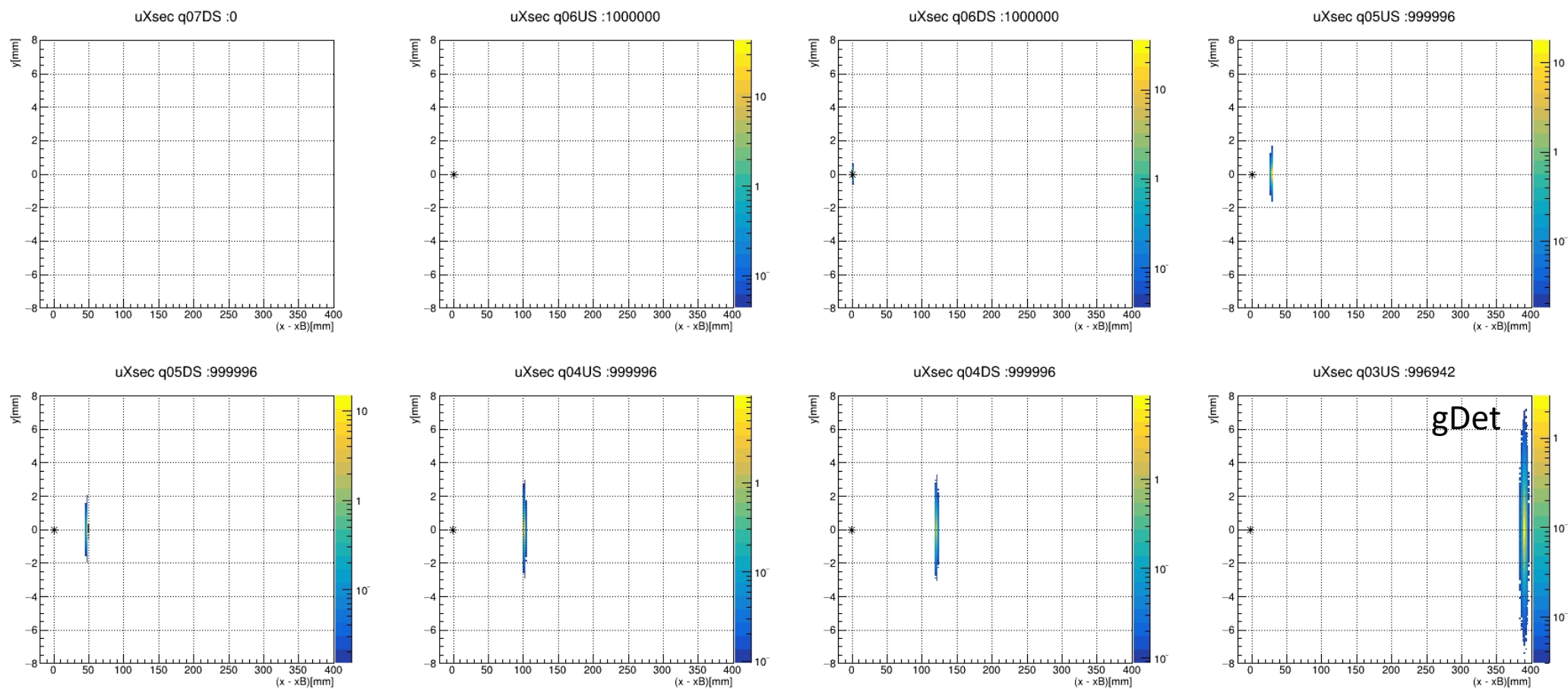


New lattice(V3p1)



- I would like to suggest a different configuration where the IP would be upstream of the Q6 quad
- The electron detector would be in front of Q4 (about the same distance from IP) but behind a **defocusing** quad
- The photon detector would remain in front of Q3 with a distance for about 29m from the IP
- The IP would be on the beamline and NOT in a quad which should simplify the engineering and construction

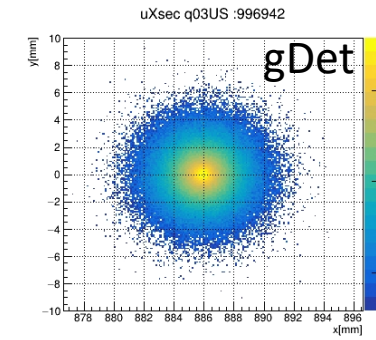
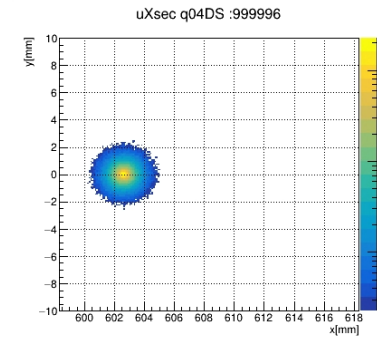
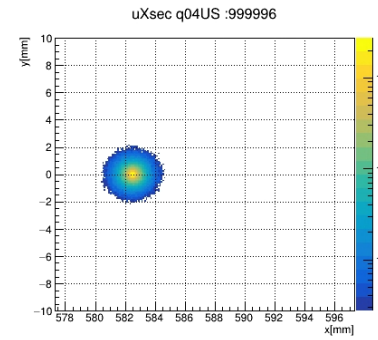
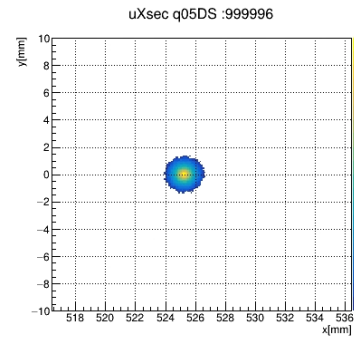
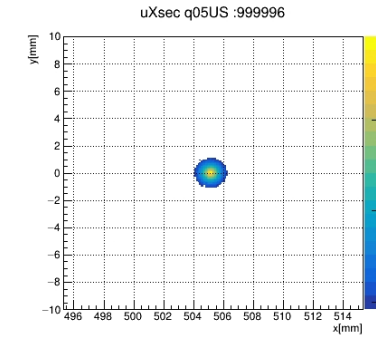
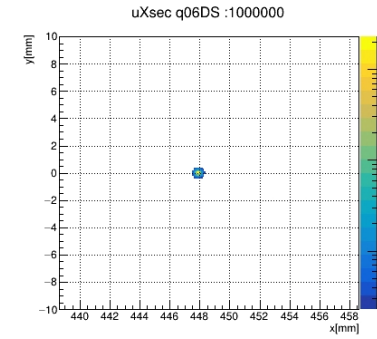
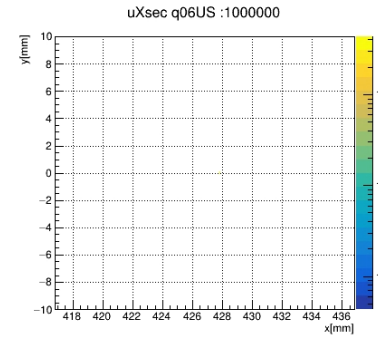
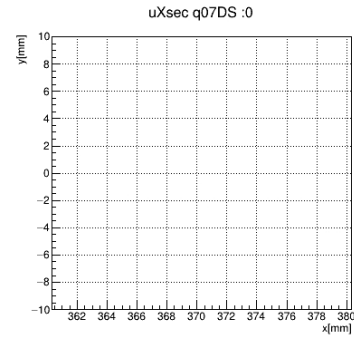
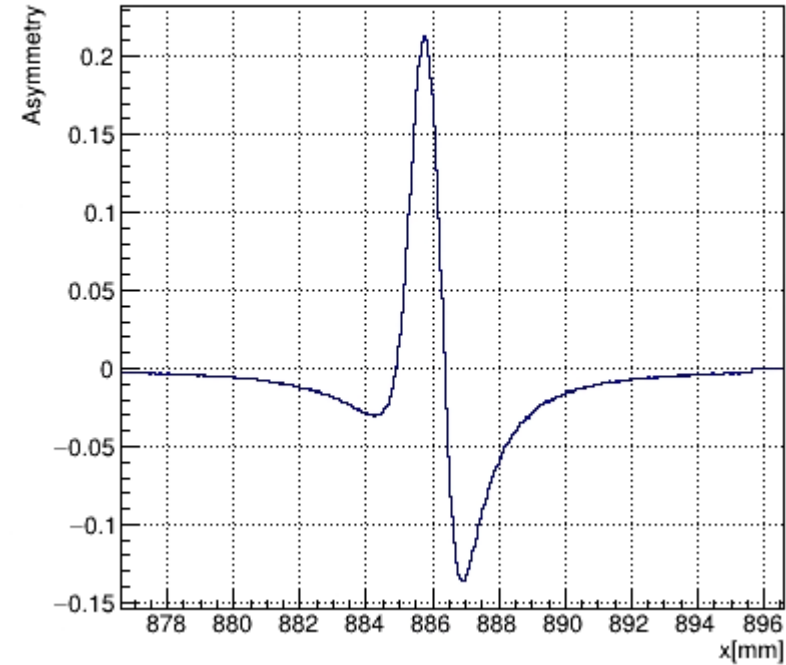
gamma



- In this configuration we would need to “holes” in Q4 only

gamma

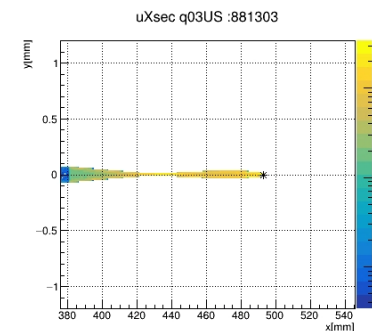
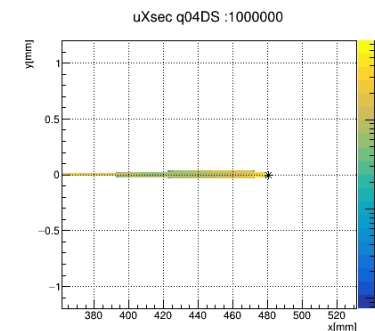
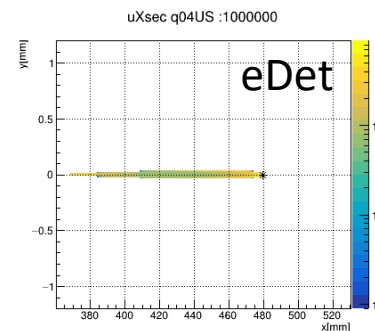
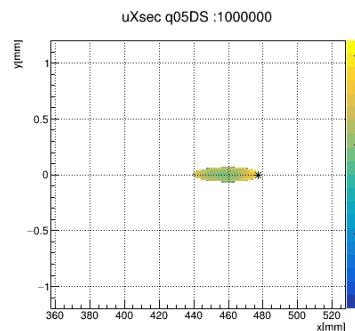
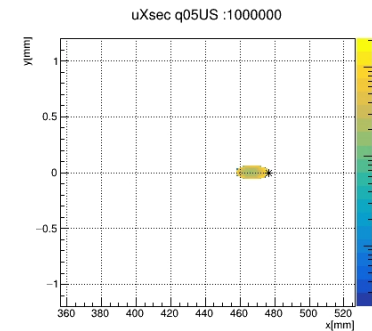
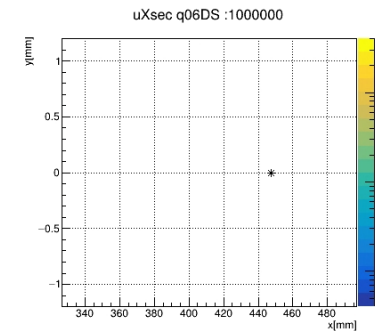
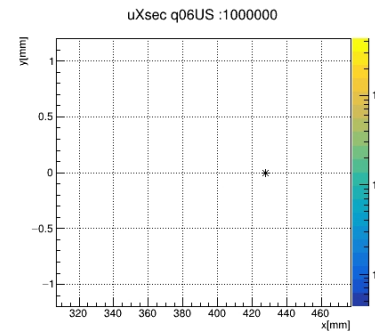
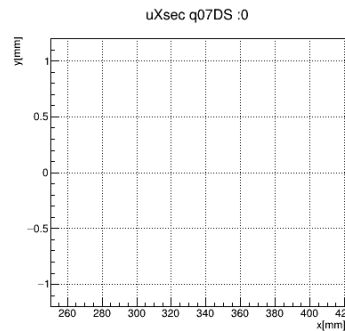
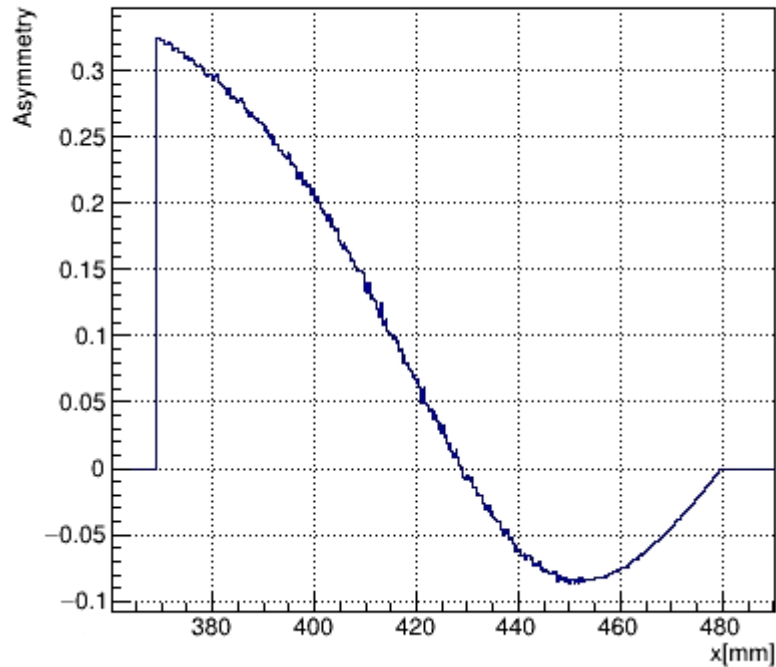
pXsec q03US :996942



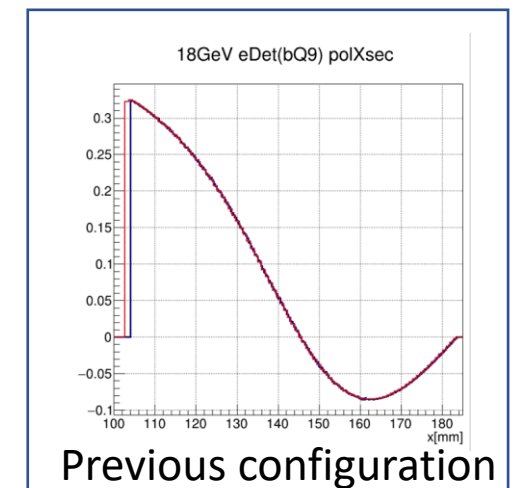
- The transverse size of the photons would be about 5mm (at 18GeV)
- The distance between the peaks would be 1.2mm (comparable to the previous setup)

Compton scattered electrons

pXsec q04US :1000000



- We can see that the spread at the electron detector is roughly 100 mm
 - The defocusing quad helps a lot
- We would need to get as close as 30mm to the beam which would give us plenty of room
 - The previous configuration had to get as close as 22mm

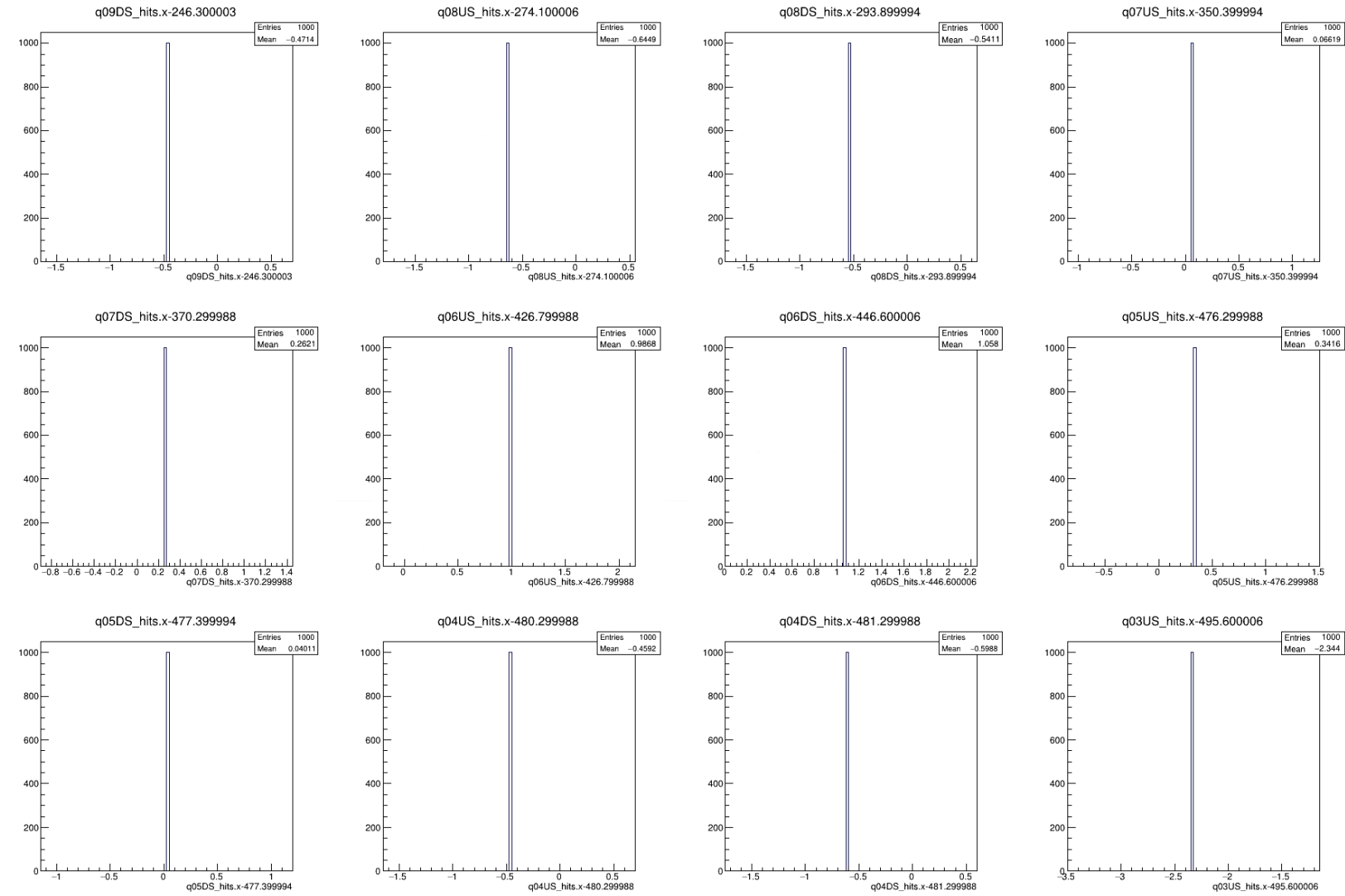


Conclusions

- Having the IP in the middle of Q9 would basically mean abandoning an electron measurement
 - A high precision longitudinal measurement with the photon detector alone would be rather challenging
- In contrast putting the IP before the last Q6 seem to preserve about the same FOM as we have studied in detail in the previous lattice, with some important additional advantages
 - Studies should be done at 5GeV to see how things stand up, but I am hopeful
 - We should get the spin direction at the different IP locations to extract the appropriate analyzing power
 - This configuration puts the electron detector in front of the sync spray from the US dipoles, but we should be able to shield that effectively if it is proven to be an issue

Backup

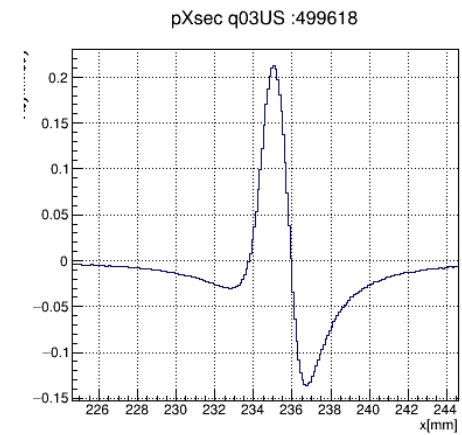
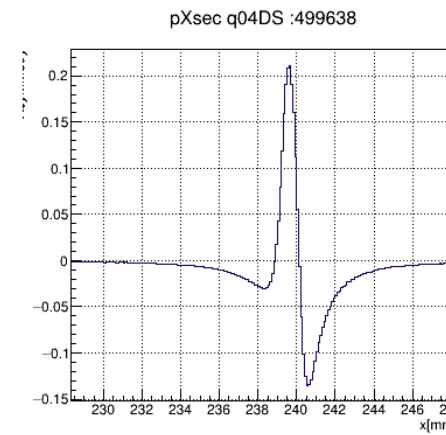
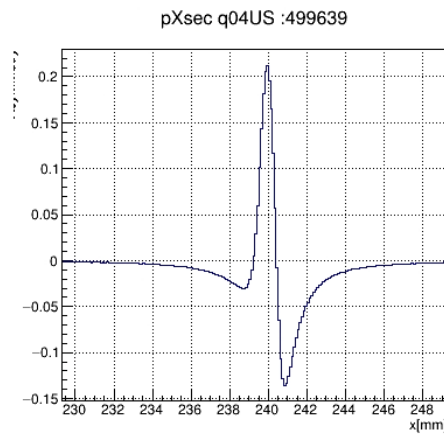
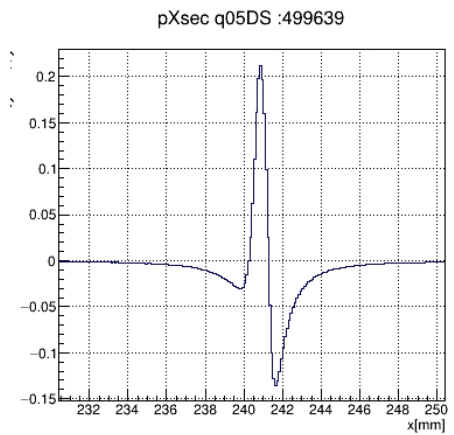
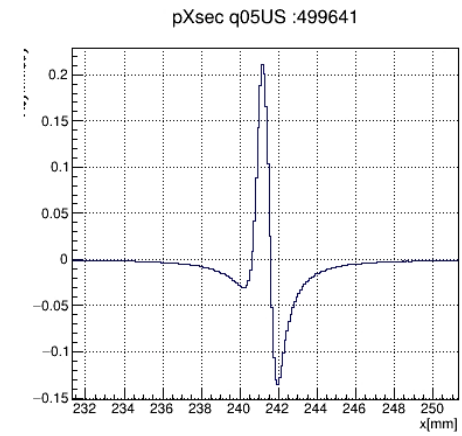
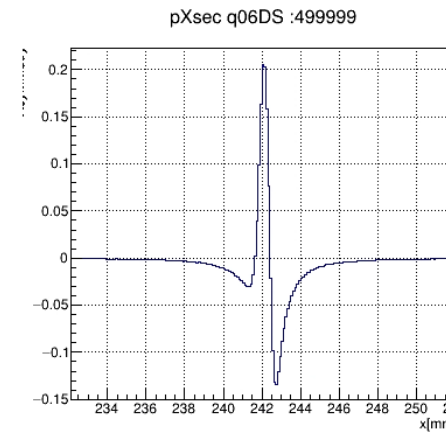
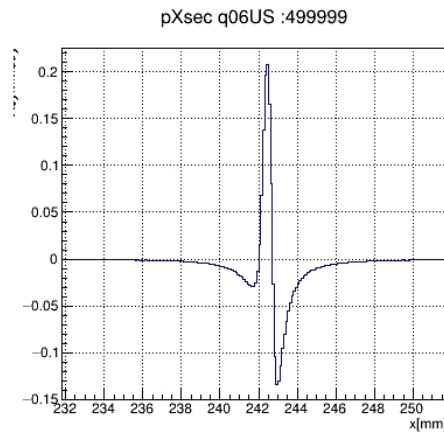
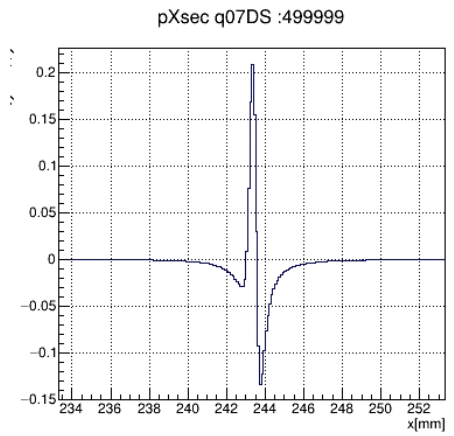
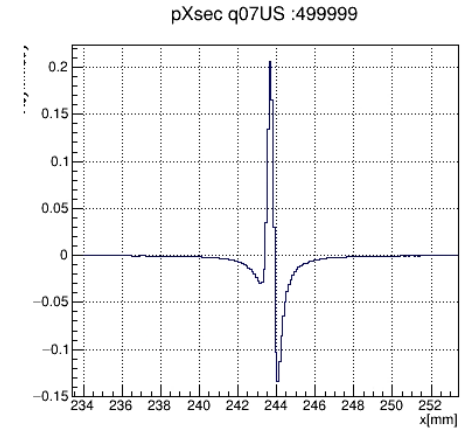
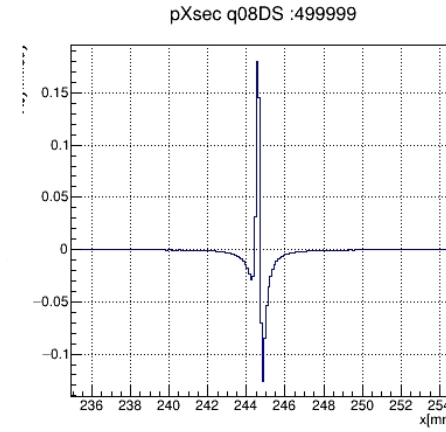
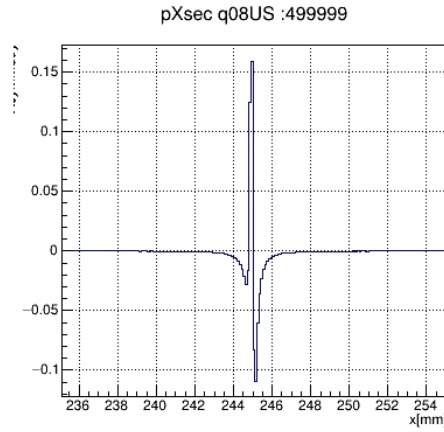
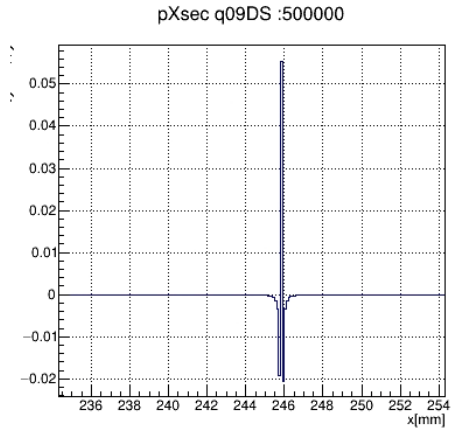
X-check beam simulation (V3)



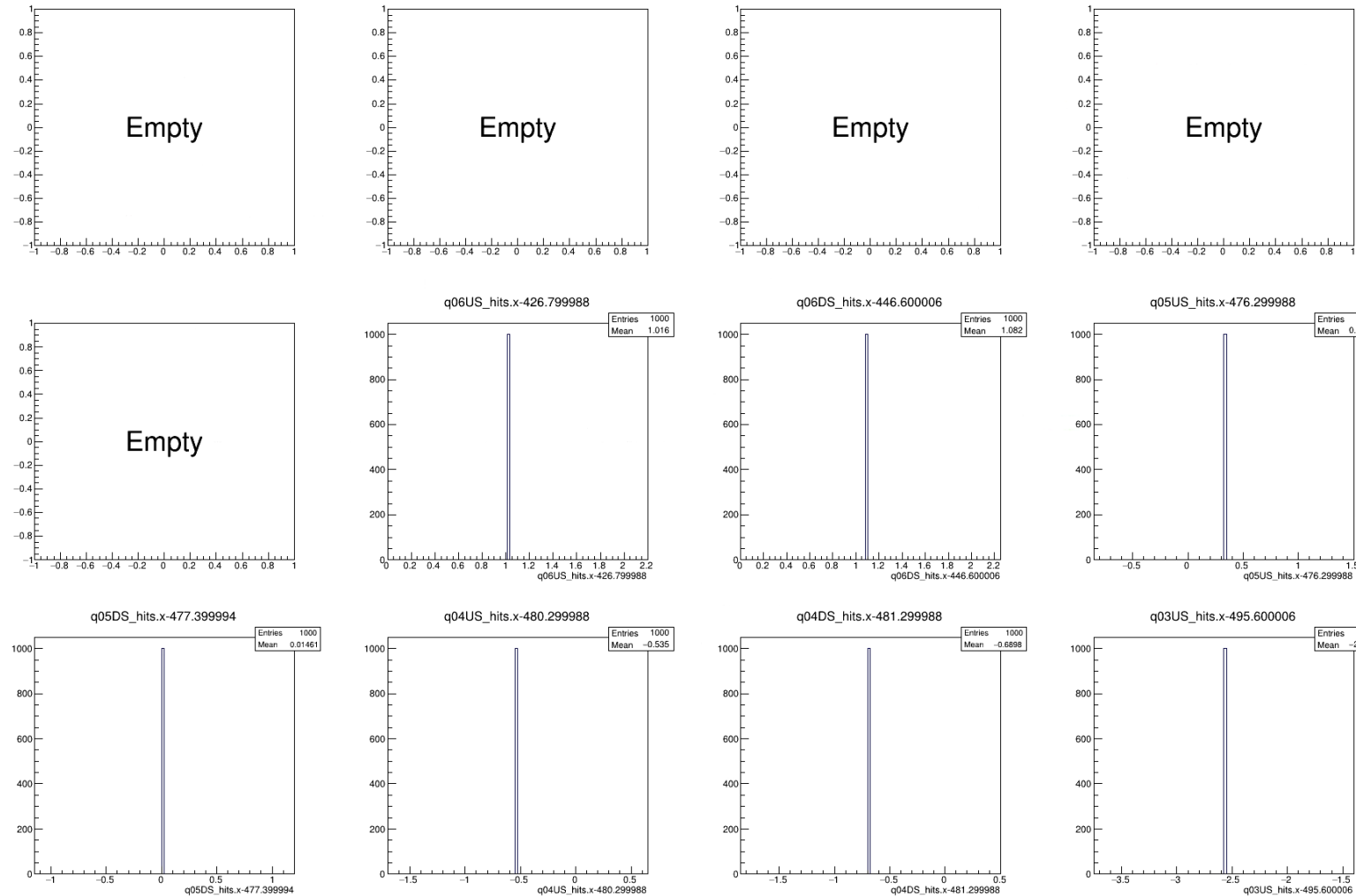
- Beam started at middle of Q09 (0.246,0,85.8796) with angle of -0.00024298 rad (same as quad angle)
- Deviations from calculated center at each detector plane are under mostly under 1mm

photons

- V3
- The sensitivity to the transverse component would be increased in this configuration



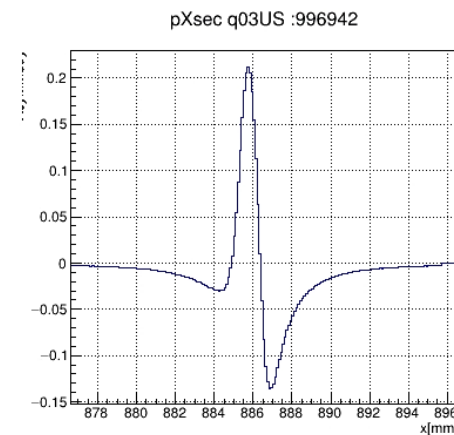
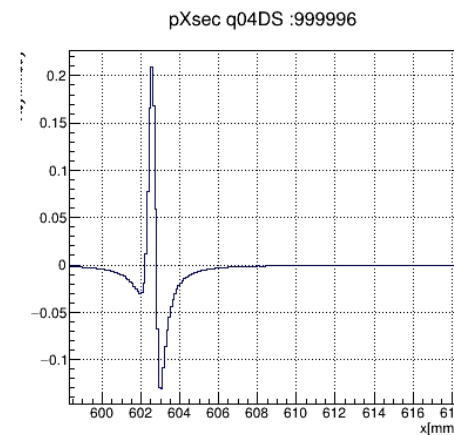
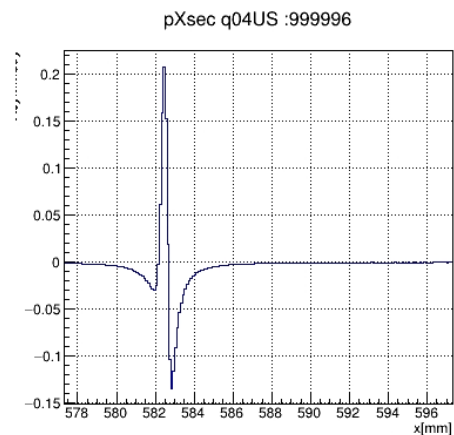
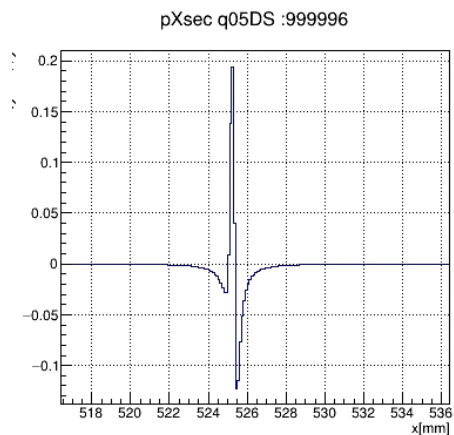
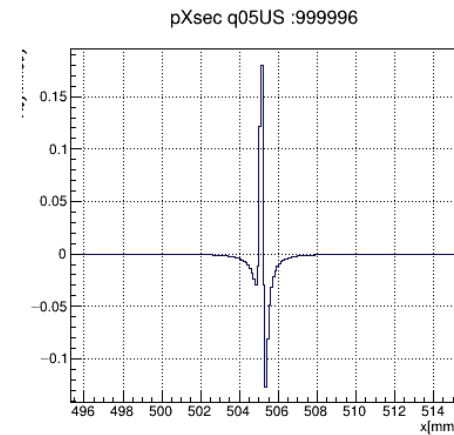
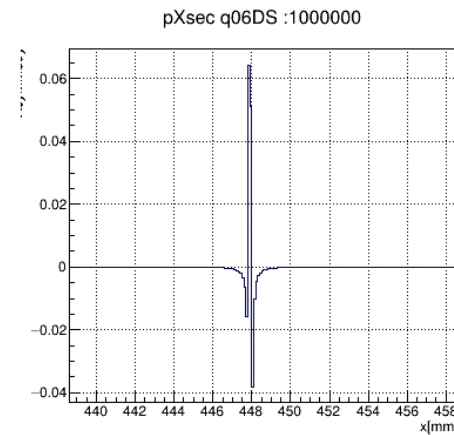
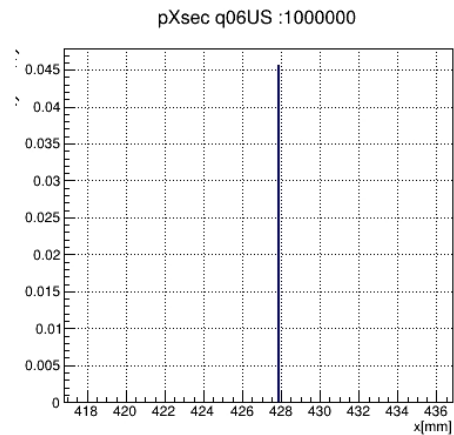
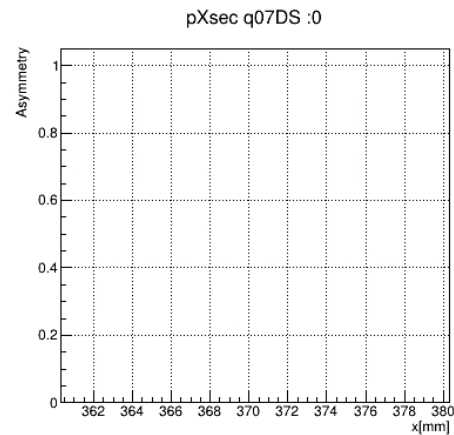
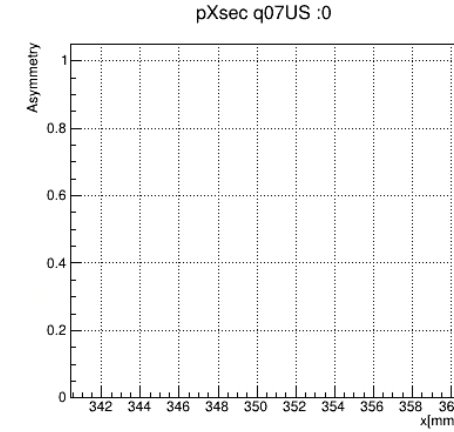
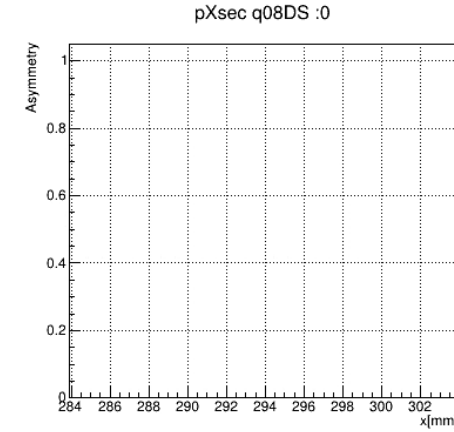
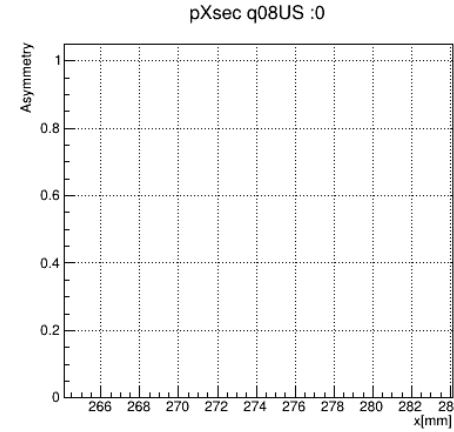
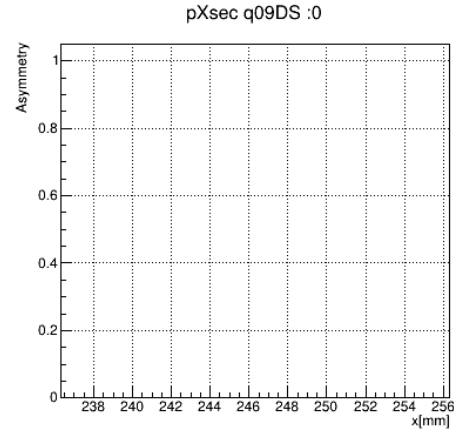
X-check beam simulation (V3p1)



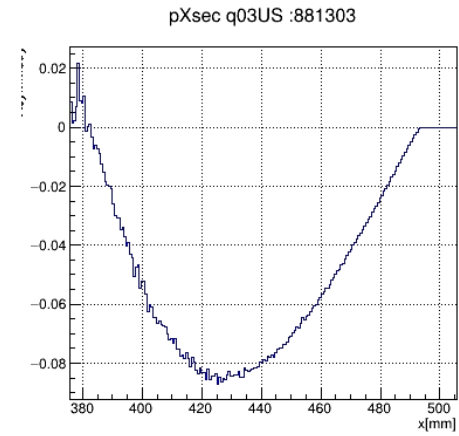
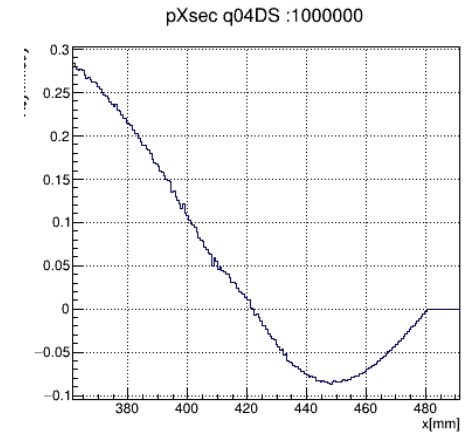
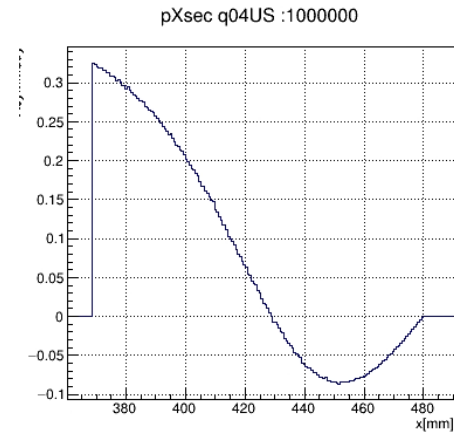
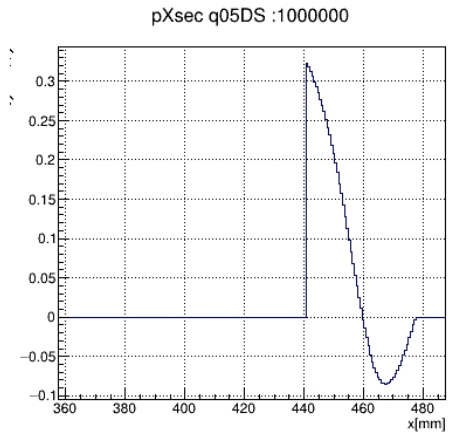
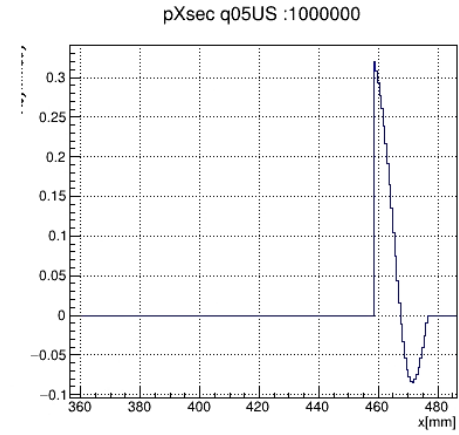
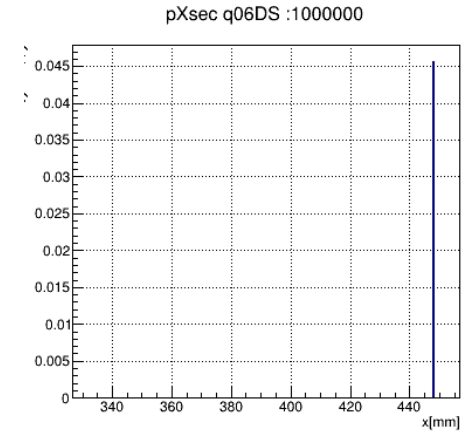
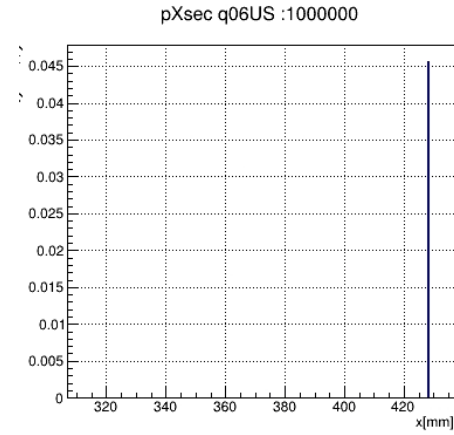
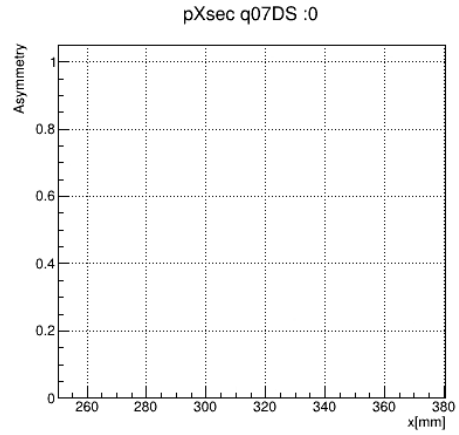
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photons

- V3p1



electrons



- V3p1