

Dosimetry and neutron fluxes for ePIC

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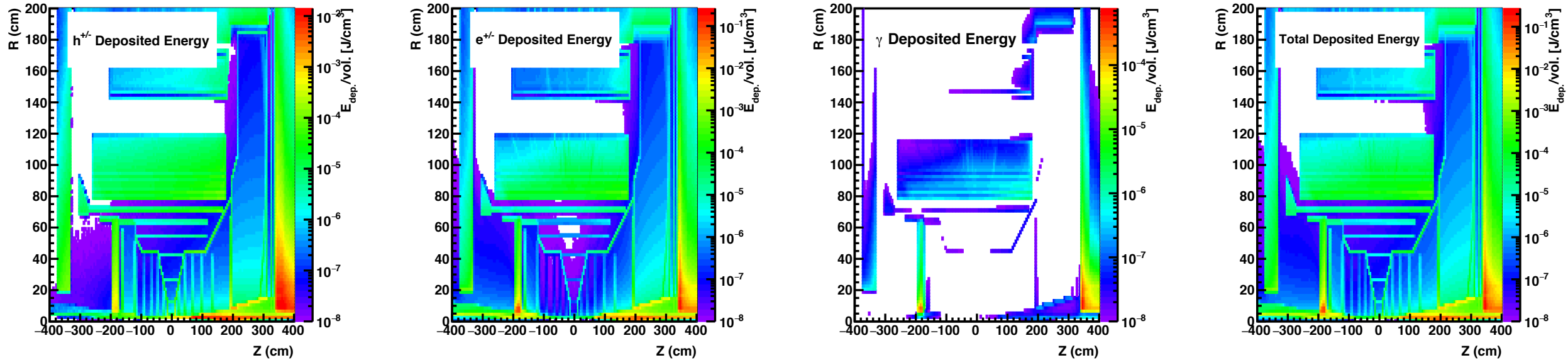
Preliminaries (PYTHIA)

- Using PYTHIA6 minBias sample from the Yellow Report (in eic-smear format).
 - e+p 18x275 GeV beam energy configuration.
 - $Q^2 < 1.0 \text{ GeV}^2$ (other samples are available and can be processed).
 - ~200M events used in GEANT simulation.
 - GEANT simulation performed using “starsim” (GEANT3) with Yuri’s settings
 - Studies now done for both “arches” and “bryceCanyon” – the latter shown here.
 - Using GCALOR for hadronic transport, very low threshold for neutrons.
 - Doses reported for gamma, electrons, and charged hadrons.
 - All results shown for ~1 run (6 months of active running) with top luminosity (amounting to 500kHz minBias rate).
 - Note: I am using the 500kHz with the “wrong” beam energy (500 kHz is for 10x275GeV).
 - The Wiki is updated, and more updates will follow.

Preliminaries (BeAGLE)

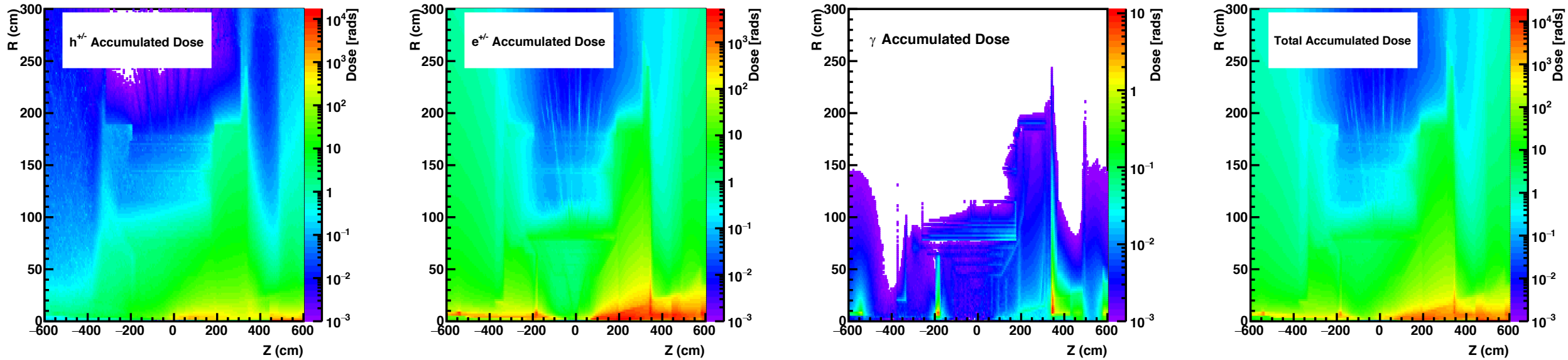
- Using BeAGLE minBias sample from the Yellow Report (in eic-smear format).
 - e+Au 18x110 GeV beam energy configuration.
 - Everything else is the same as above, and I assume 100 kHz rate for now.

Energy deposition (central detector)



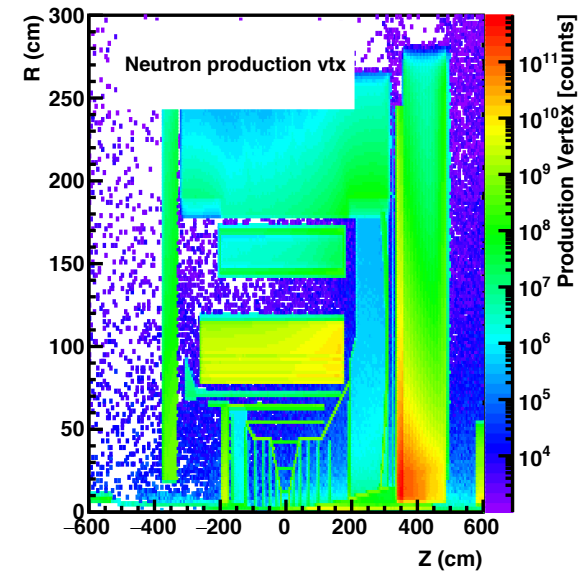
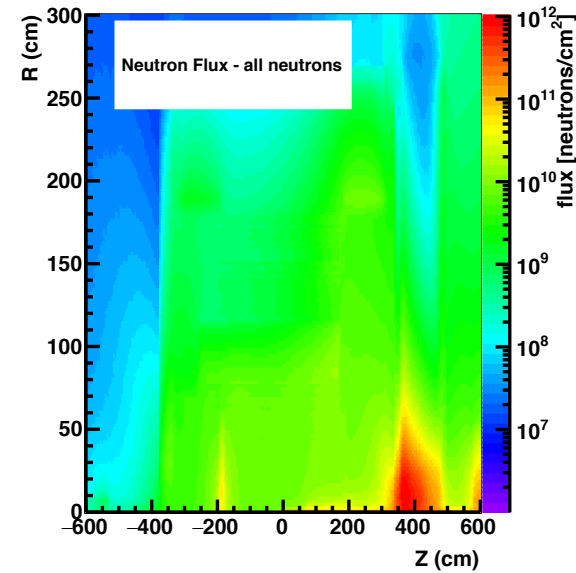
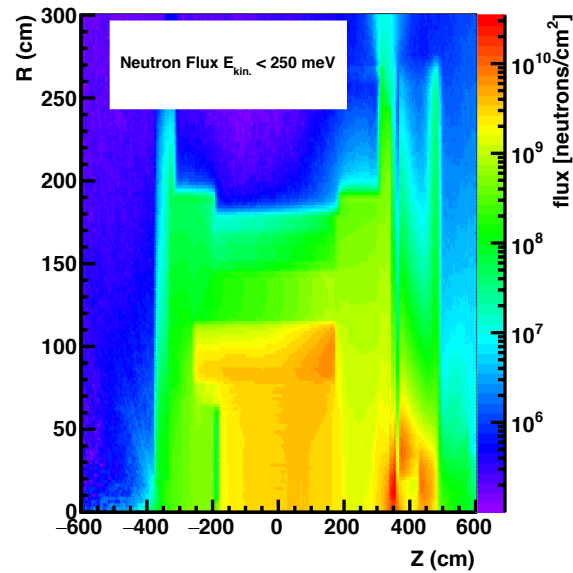
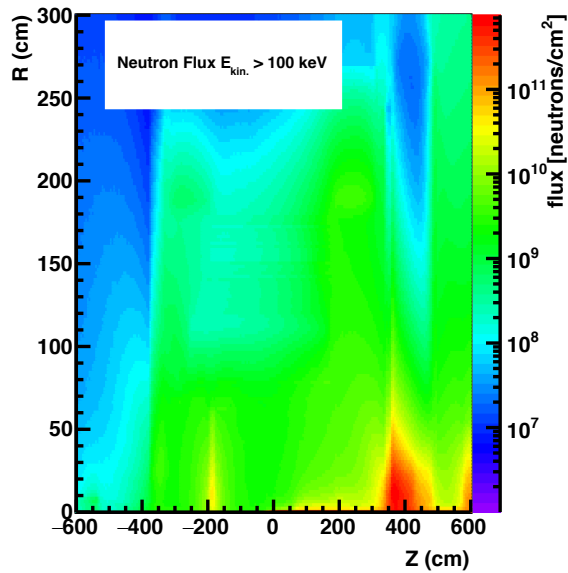
- Energy deposit from electrons and hadrons most significant.
- Hot spots:
 - hadron endcap near the beamline.
 - beamline components on the hadron-going and electron-going side.
 - Electron endcap near beampipe.

Accumulated Dose ($h^{+/-}$, $e^{+/-}$, γ) (central detector)



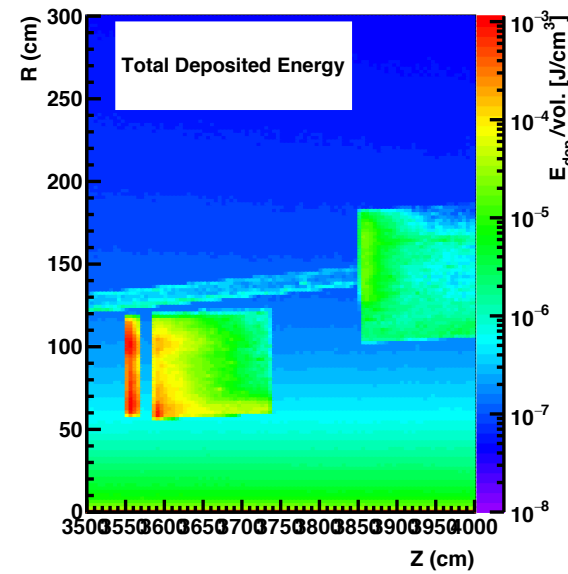
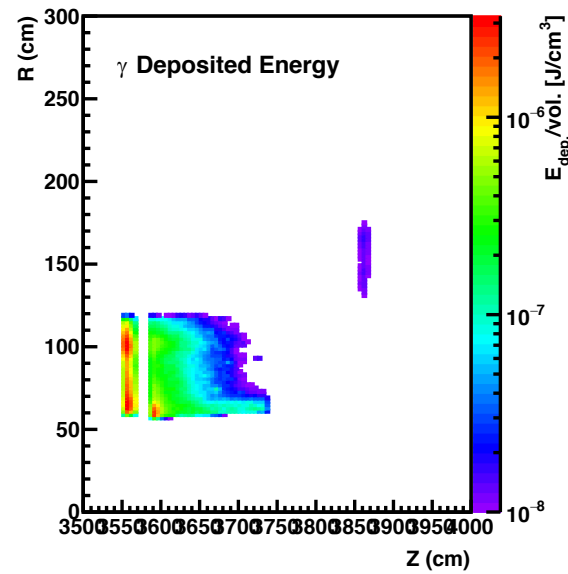
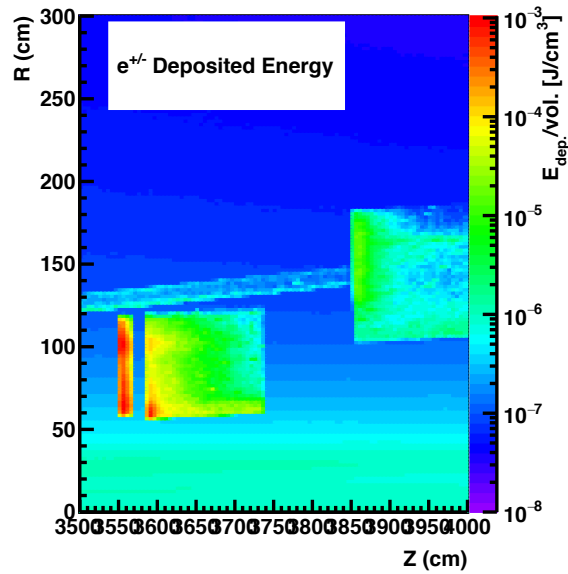
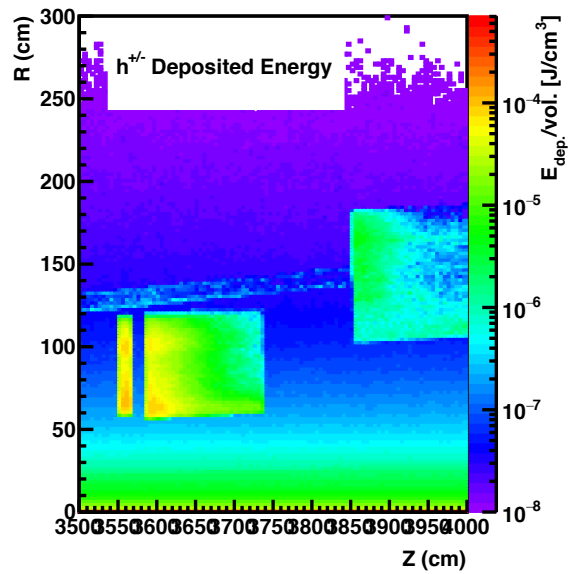
- Rates in most regions of ePIC < 10 krad for one run.
- Problem spots are near the beamline.
- Doses are overall quite manageable

Neutron Fluxes (central detector)



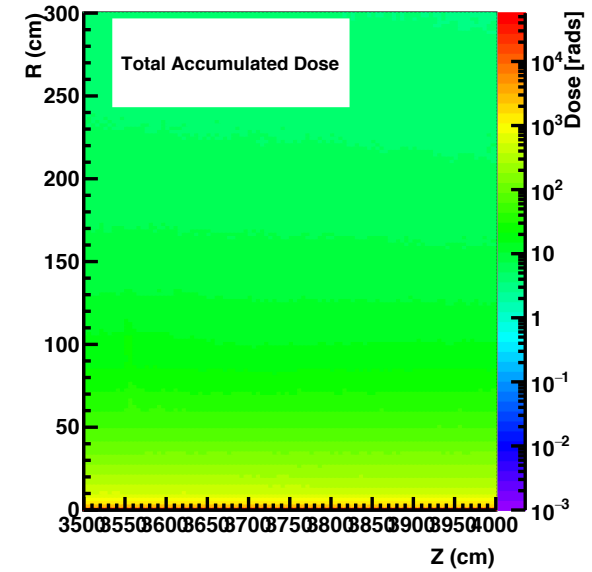
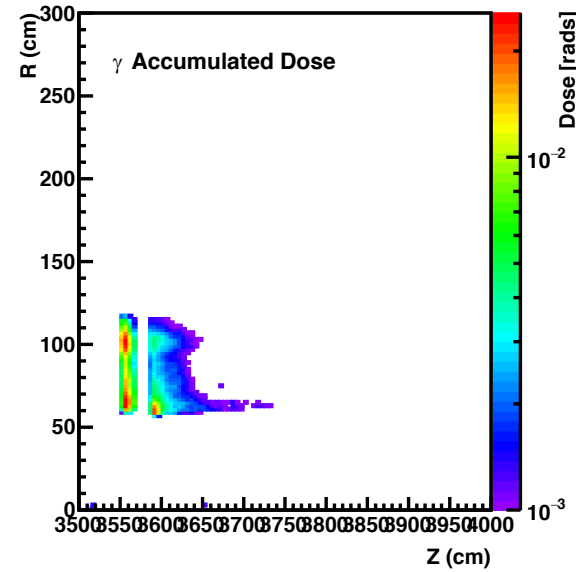
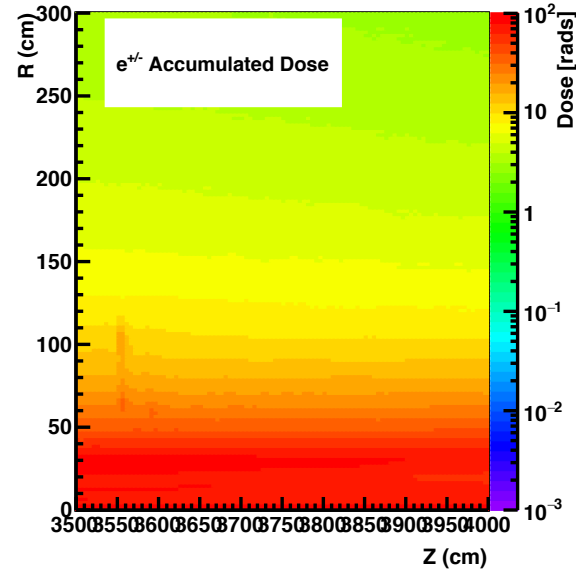
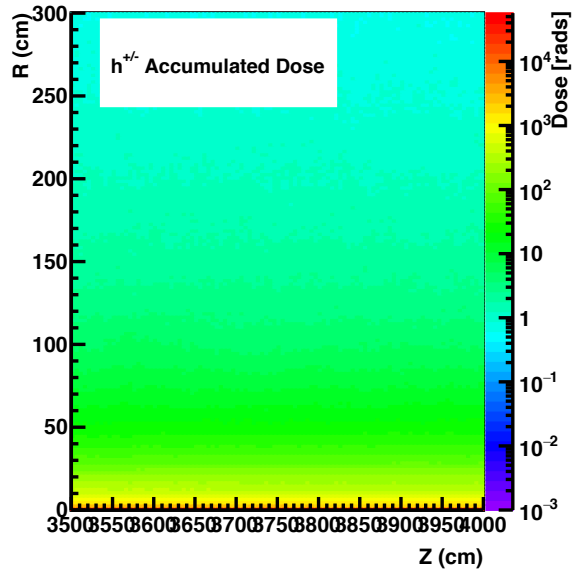
- Thermal neutrons mostly absorbed in the endcap and barrel*.
 - *Major difference between SciGlass and Imaging system.
- Fast neutrons mostly in endcap and in the B0pf magnet + detector area.
- Most neutrons produced within the endcap, close to the beampipe, and in the imaging EMCAL.

Energy deposition (ZDC)



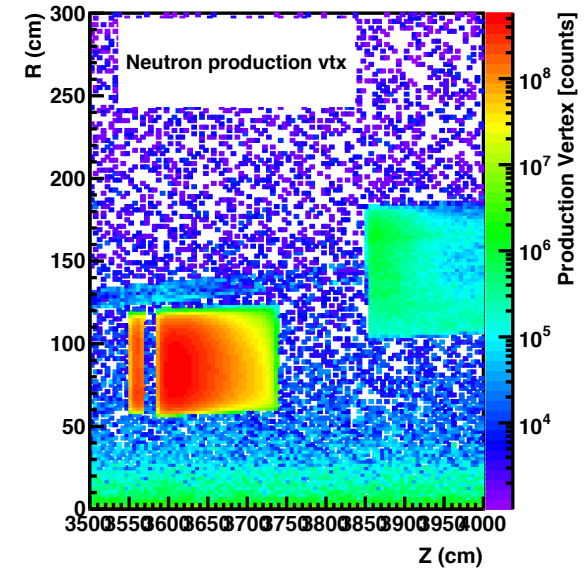
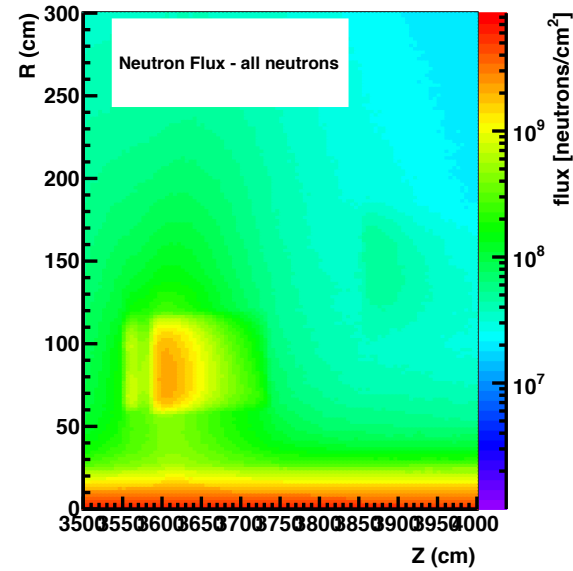
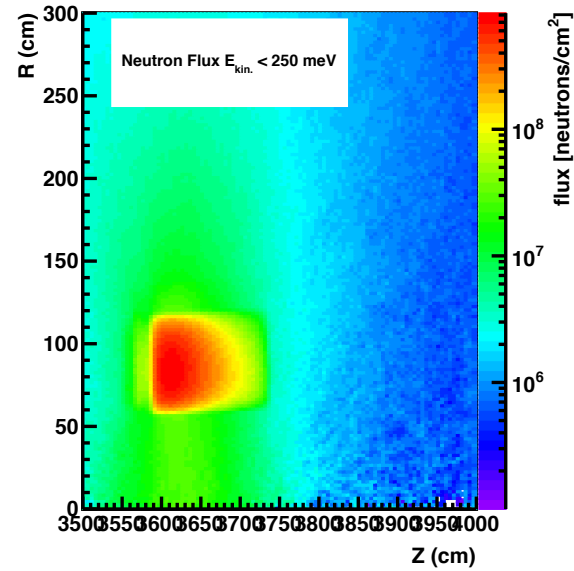
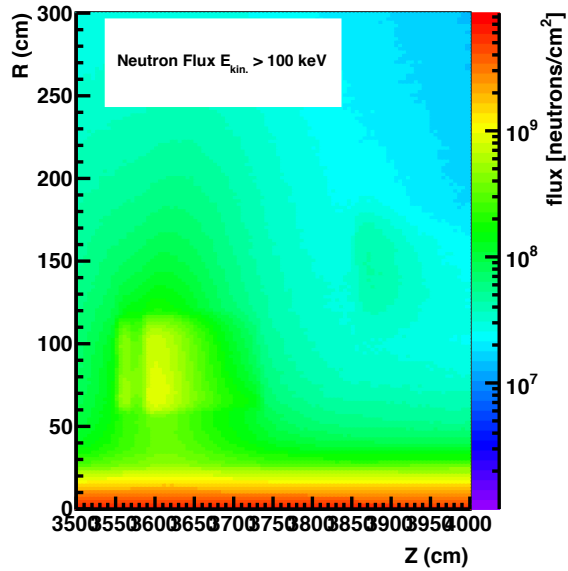
- Most of the energy deposited in the front of the ZDC.

Accumulated Dose ($h^{+/-}$, $e^{+/-}$, γ) (ZDC)



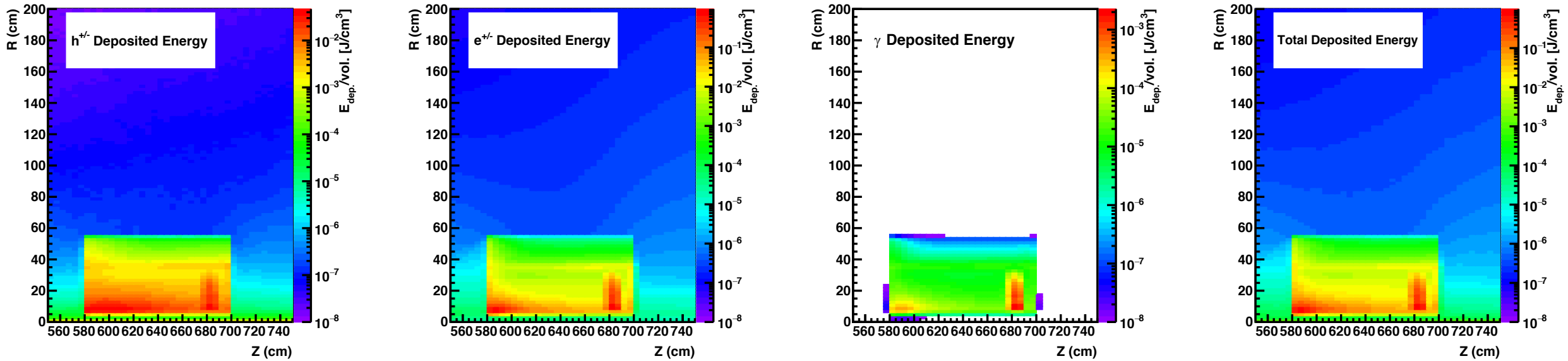
- Overall doses pretty small ~ 100 rads/run.

Neutron Fluxes (ZDC)



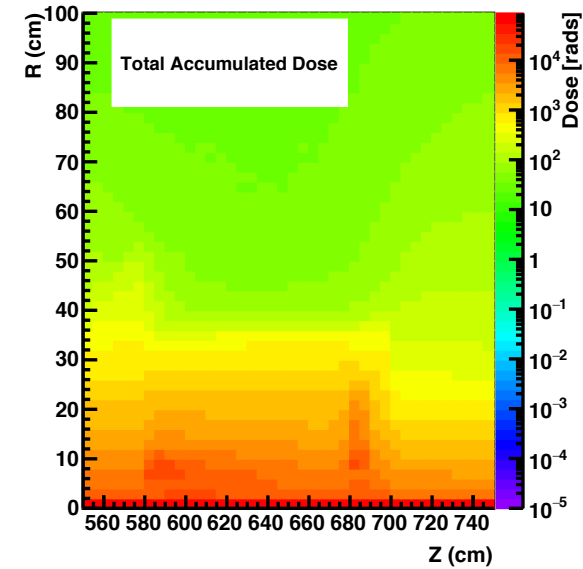
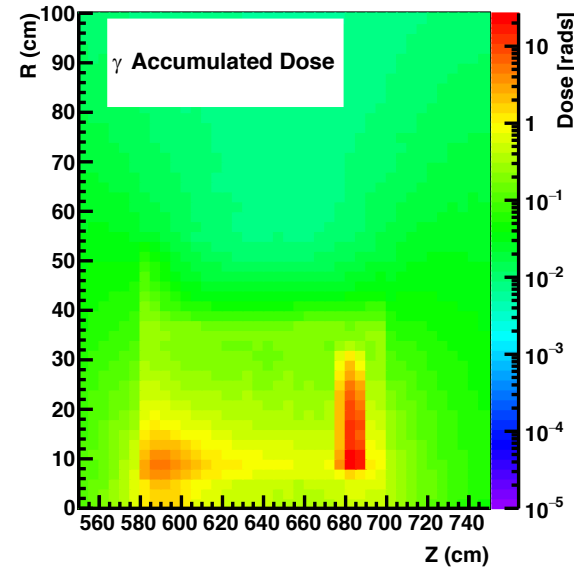
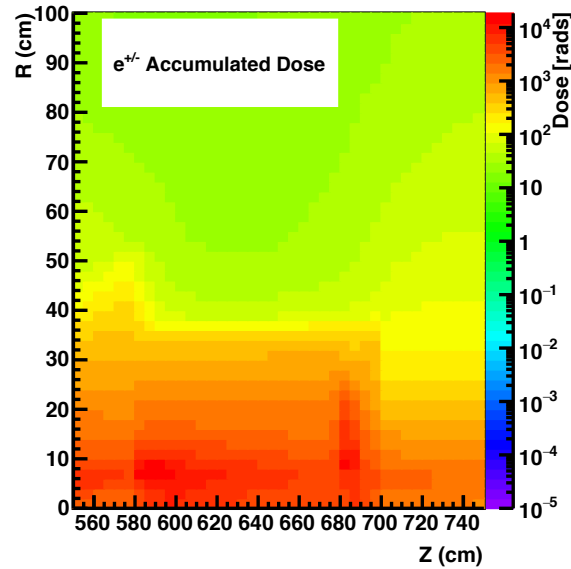
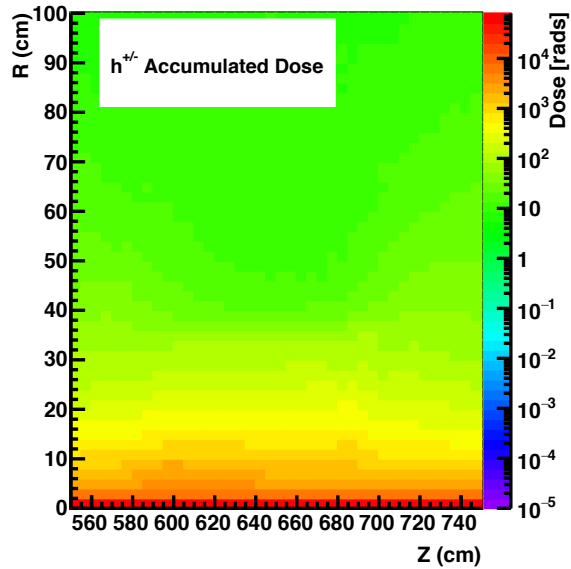
- Neutron fluxes $< 10^{10}$ cm⁻², overall.

Energy deposition (B0)



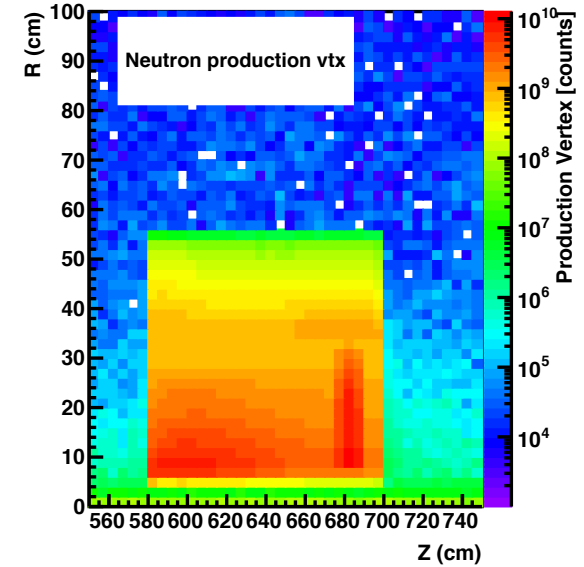
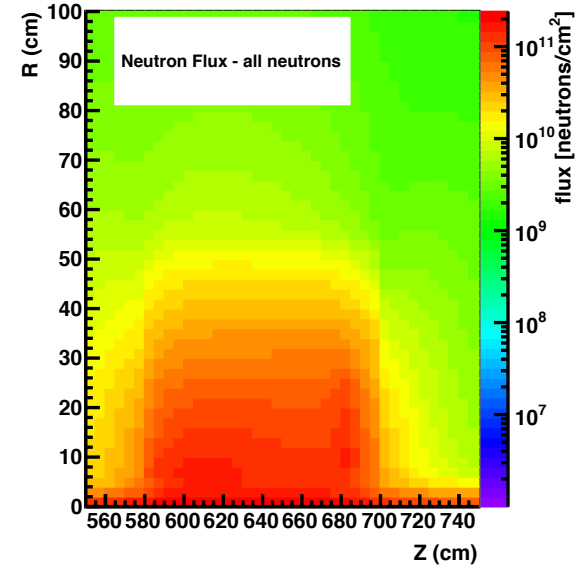
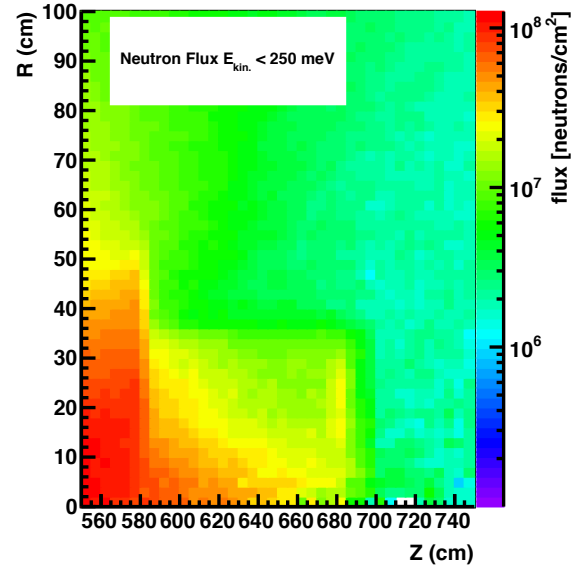
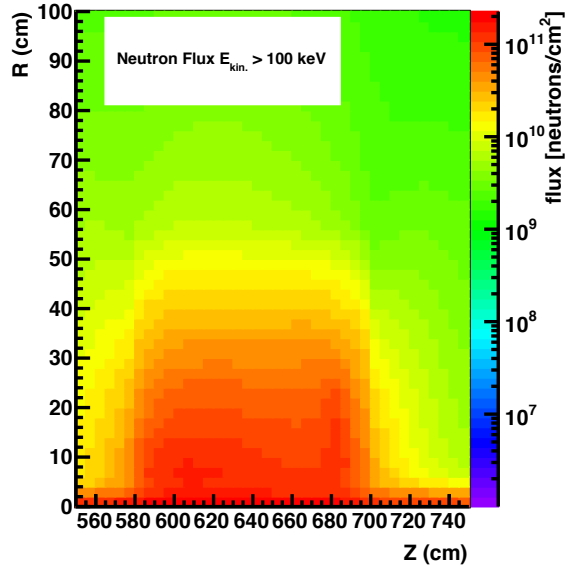
- High energy deposition from electrons in early tracking layers and of course in the EMCAL.
- Occupancies in the silicon need to be studied.

Accumulated Dose ($h^{+/-}$, $e^{+/-}$, γ) (B0)



- Fairly substantial doses, but manageable (< 100 krad total), around 10krad of dose across the entire B0 system from electrons.

Neutron Fluxes (B0)



- Neutron fluxes maximum $\sim 10^{11}$ cm⁻², overall.

Conclusions (so far)

- Doses from minBias, top energy + lumi are tolerable in most of ePIC.
- Doses in the B0pf area need to be carefully studied – they are rather high in comparison.
 - Need to do a comparison with and without the insert HCAL to assess any issues.
- Will look at PYTHIA 10x100 GeV energy config next, since it will put the focus more at mid-rapidity (similar to BeAGLE events).
- Will work on reproducing the results in DD4HEP.