MinBias Particle Rates and Dosimetry for ePIC

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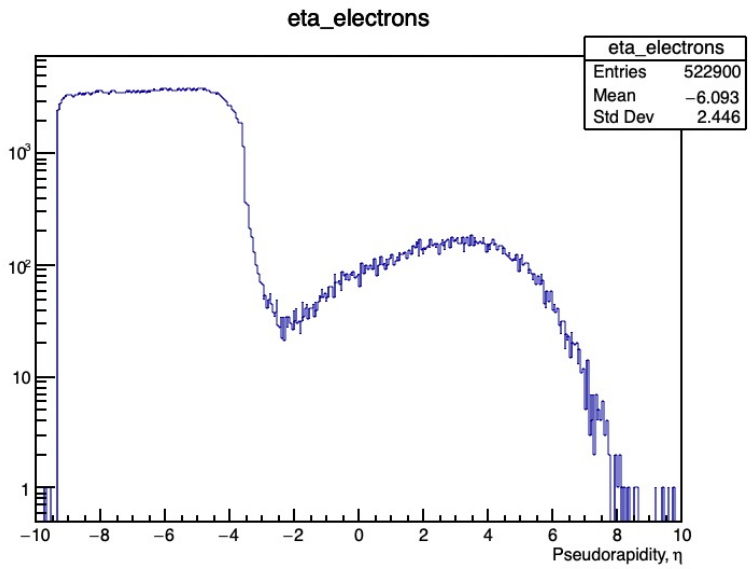
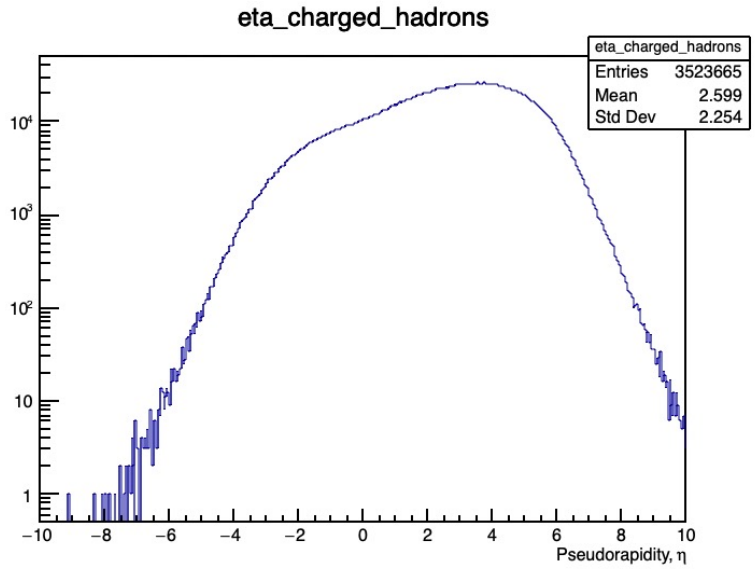
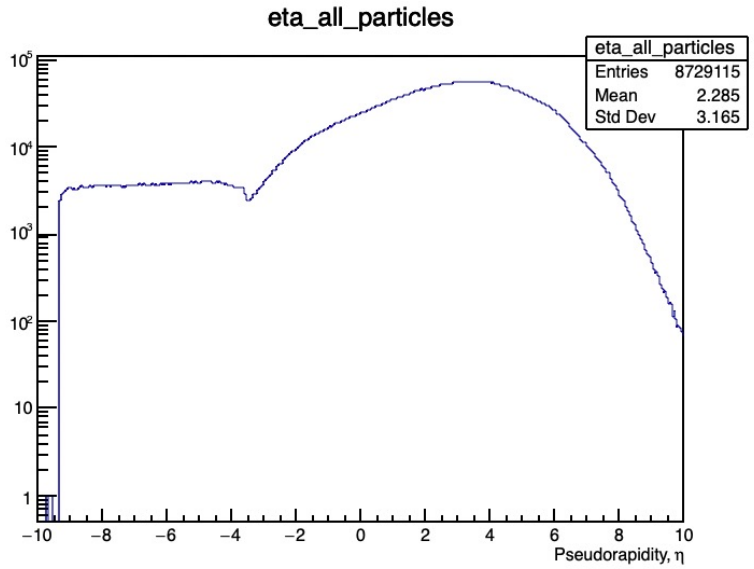
Preliminaries

- Using PYTHIA6 minBias sample from the Yellow Report (in eic-smear format).
  - e+p 18x275 GeV beam energy configuration.
  - $Q^2 < 1.0\ GeV^2$ (other samples are available and can be processed).
  - ~200M events used in GEANT simulation.
  - GEANT simulation performed using “starsim” (GEANT3) with Yuri’s settings, with ePIC “arches” geometry (using the SciGlass EMCAL).
    - 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).
  - Will be re-processed with DD4HEP soon.

MC Sample (small event selection)

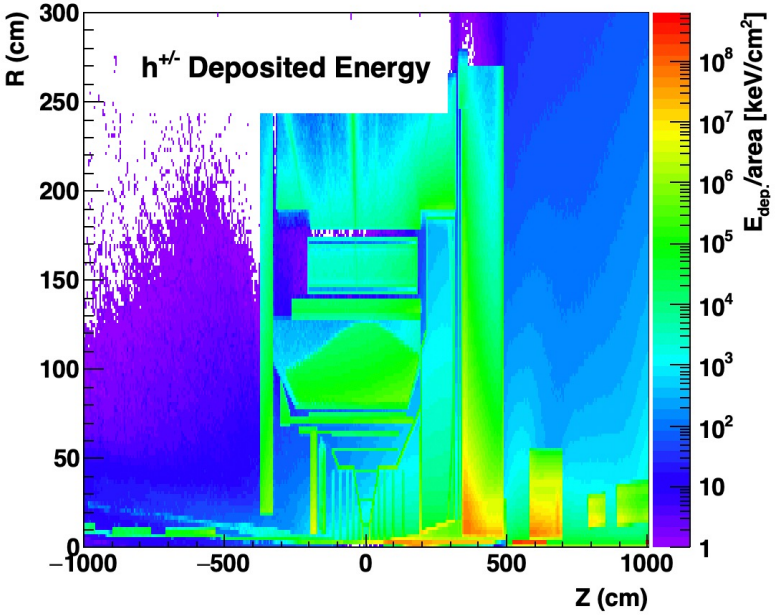


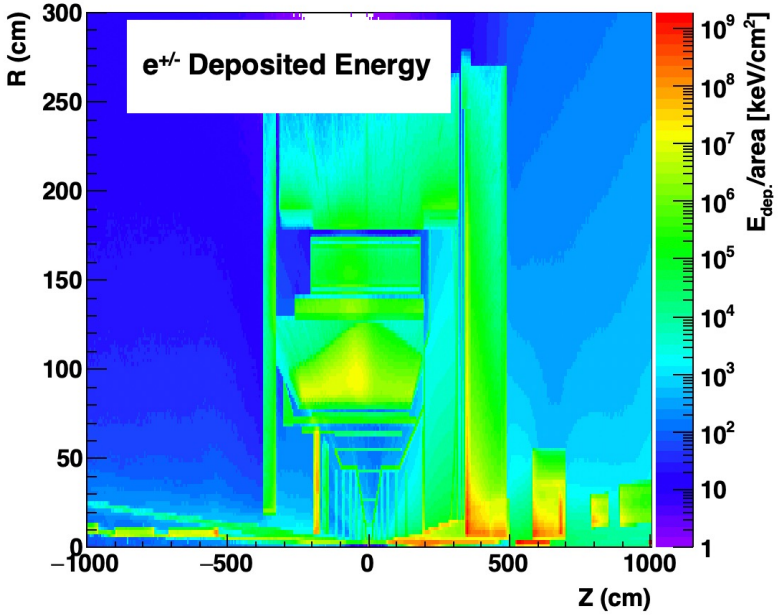


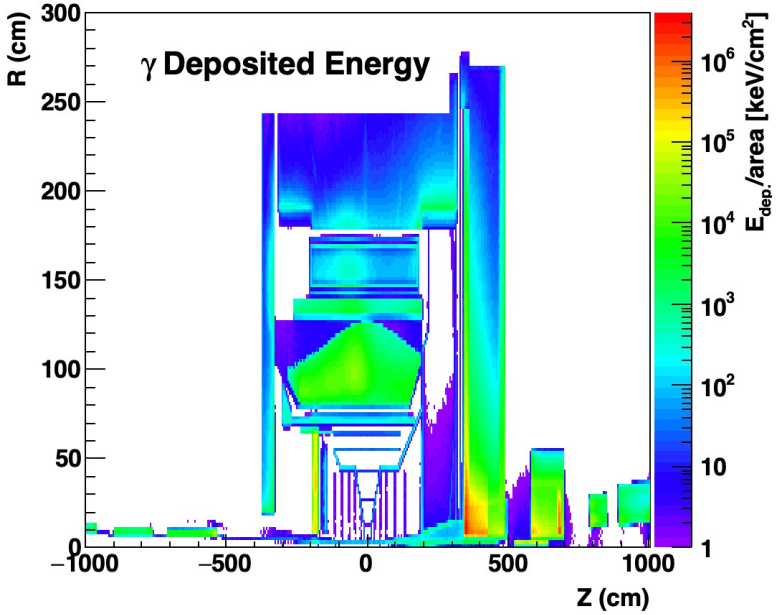


- Lower Q^2 puts many scattered electrons at very backward eta.
- Charged hadrons produced mostly forward, as expected.

Energy deposition

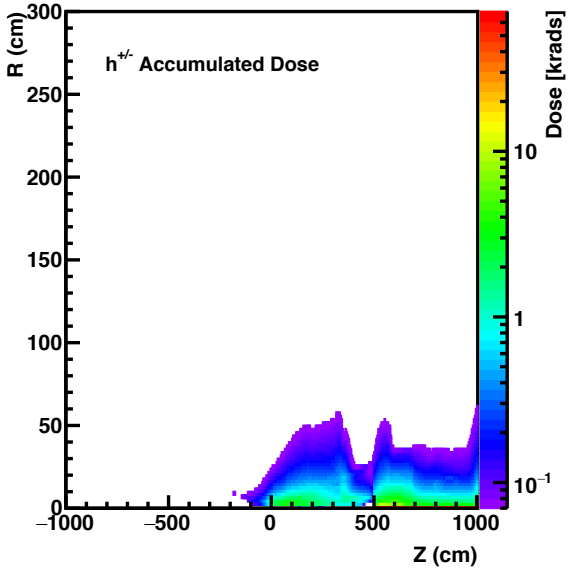


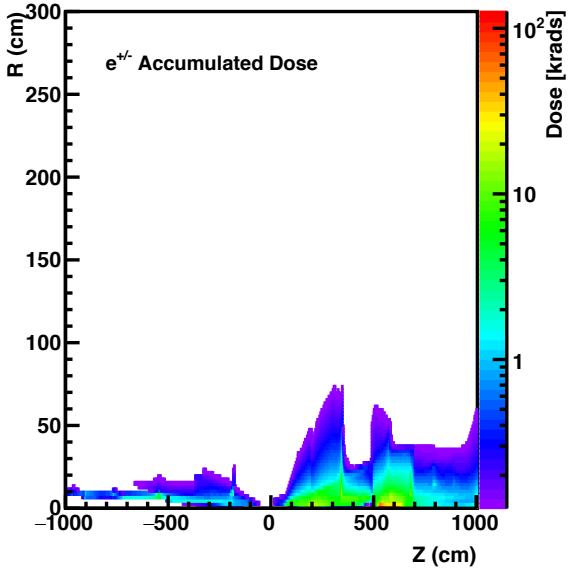


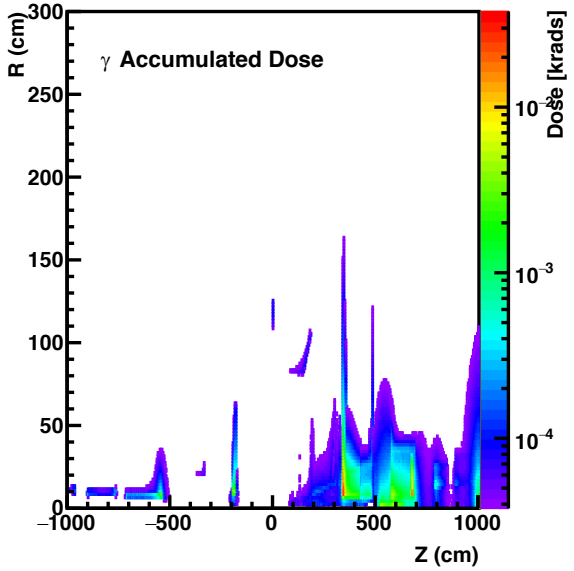


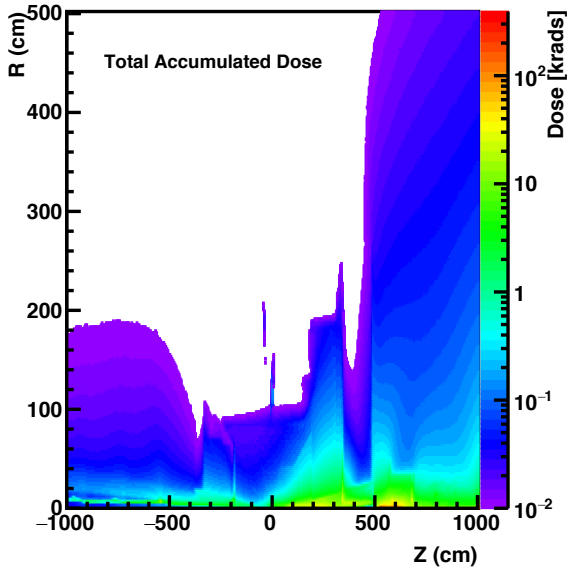
- Energy deposit from electrons and hadrons most significant.
- Hot spots are in the hadron endcap near the beamline, and in the beamline components on the hadron-going side.

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



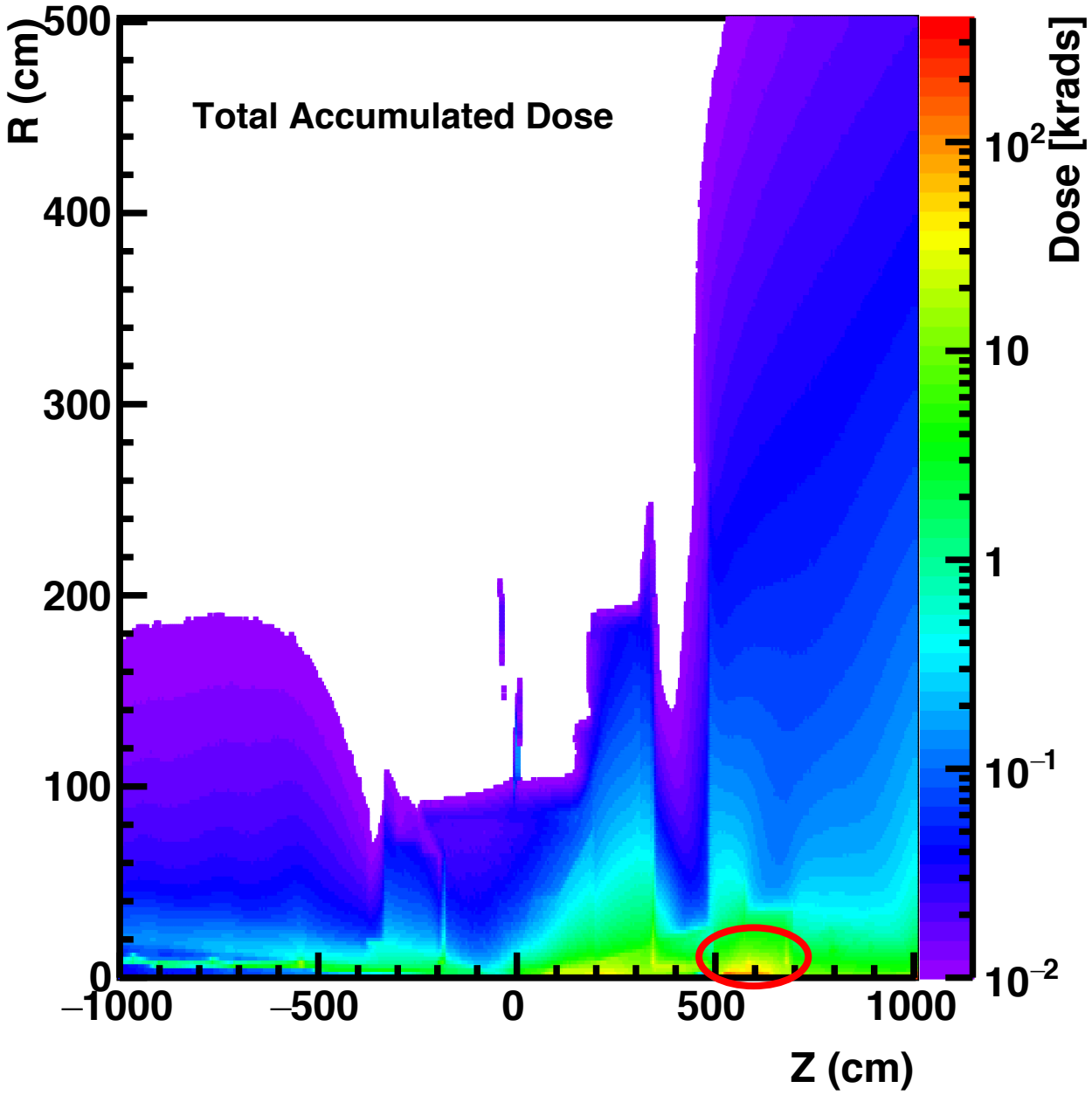






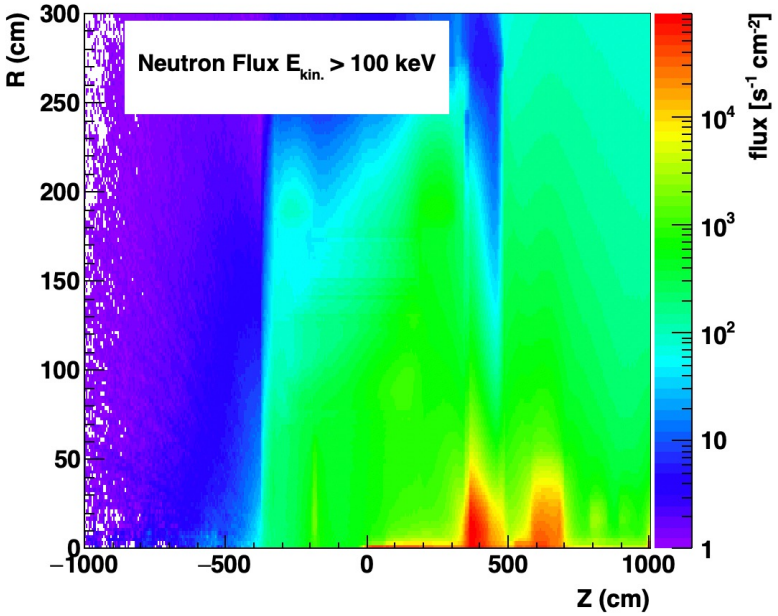
- Rates in most regions of ePIC < 5 krad for one run.
- Problem spots are near the beamline.

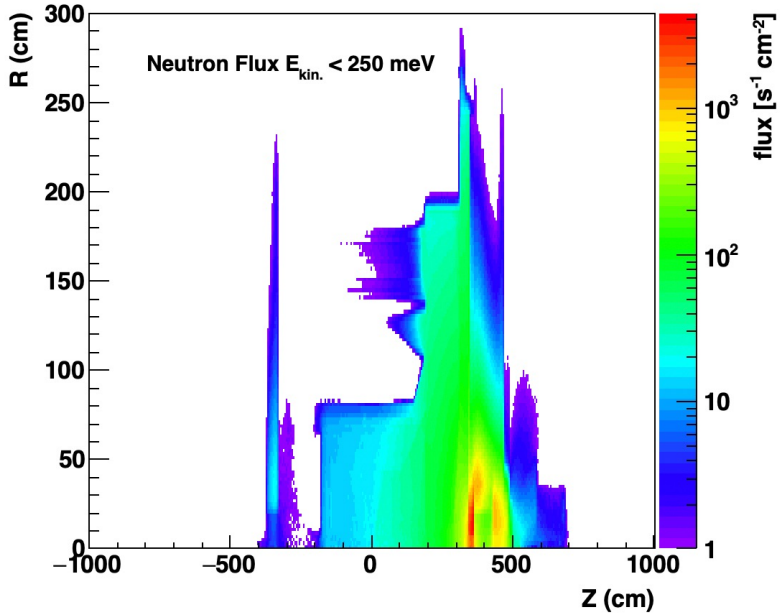
Accumulated Dose ($h^{+/-}$, $e^{+/-}$, γ)

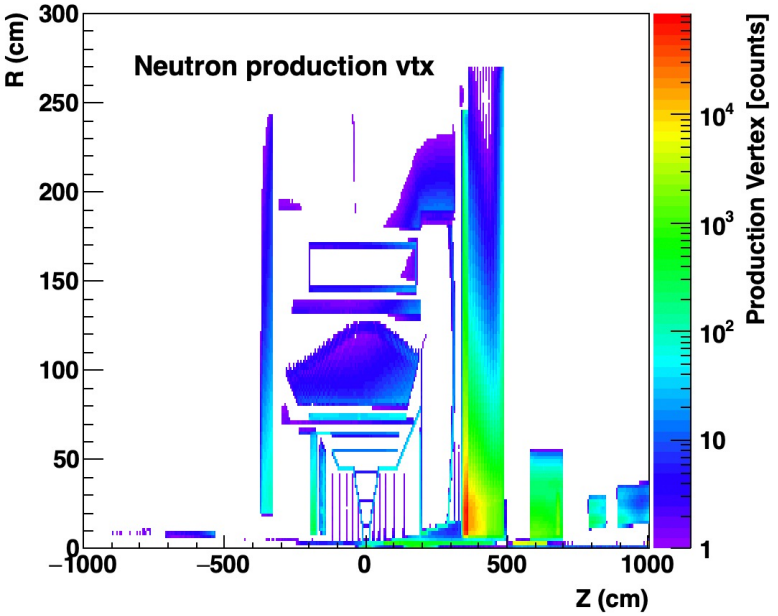


- B0pf magnet + associated components see ~100 krad, or more, during a single run.

Neutron Fluxes







- Thermal neutrons mostly absorbed in the endcap.
- Fast neutrons mostly in endcap and in the B0pf magnet + detector area.
- Most neutrons produced within the endcap, close to the beampipe.

Conclusions (so far)

- Doses from minBias, top energy + lumi are tolerable in most of ePIC.
- Doses in the B0pf area need to carefully studied – they are rather high in comparison.
- Need to look at some other beam energies to see how this conclusion might change.
- Will work on reproducing the results in DD4HEP.