Fluka IBL simulations

1. Introduction
2. New 1MeV fluences in Pixel regions.
3. Dose and 20MeV hadron fluences
4. Summary and plans

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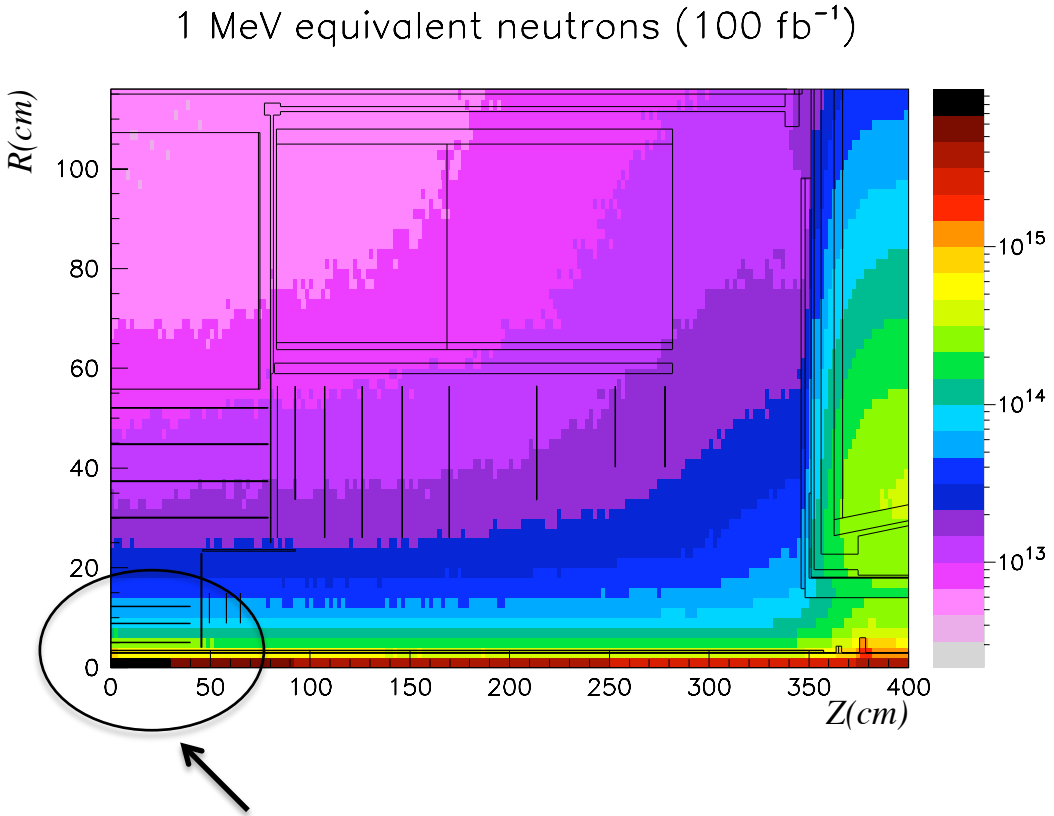
Introduction

- In the Radiation Task Force document (ATL-GEN-2005-001), ID fluences for LHC operation were obtained using 2cm radial binning (4cm in GCALOR studies). This is too coarse for B-layer studies.

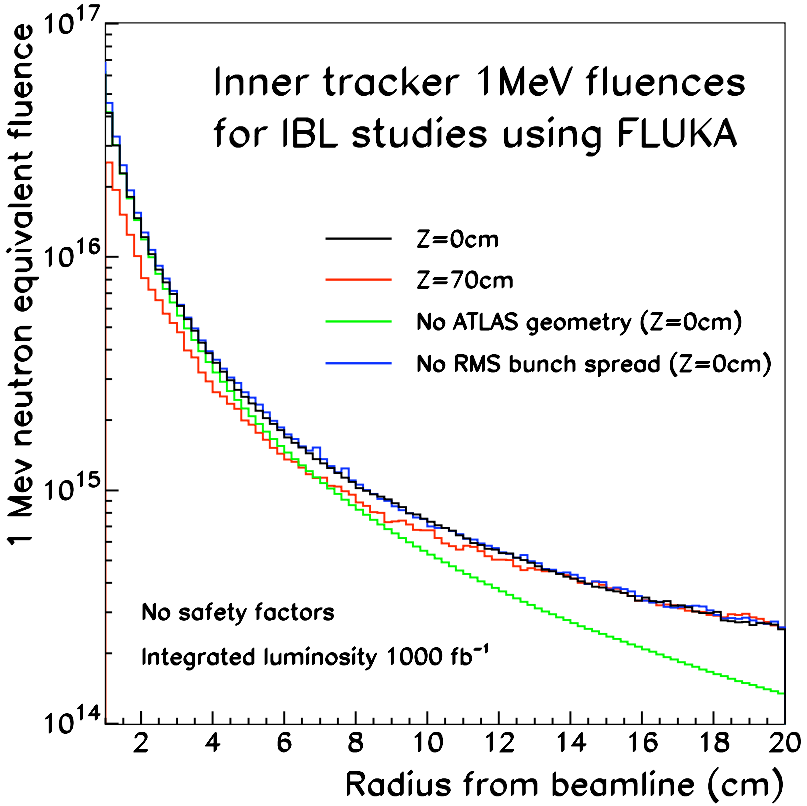
- Change to 2mm radial binning, and update Pixel layout. However, no physical implementation of an insertable B-layer.

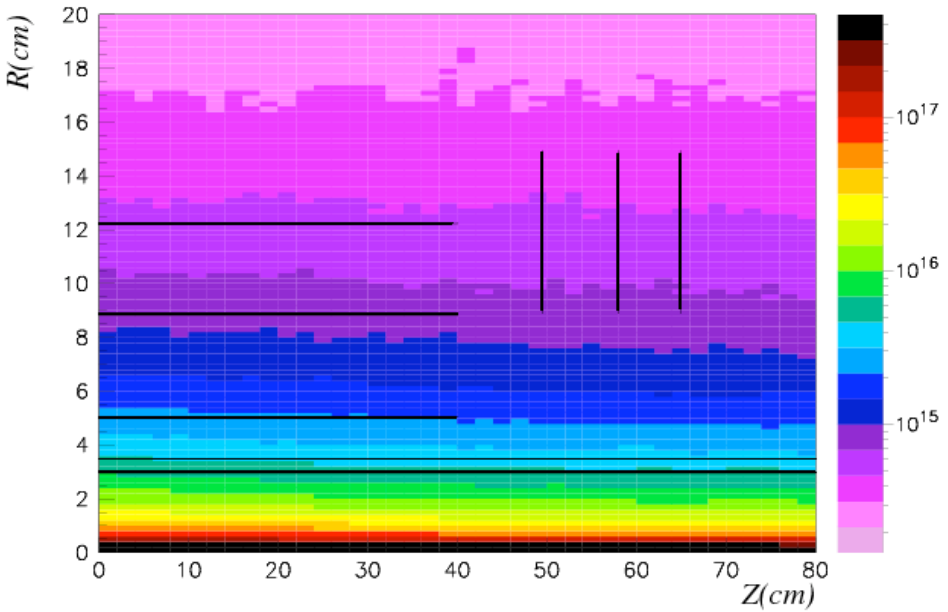
- Also look at:
  - Z dependence of fluences
  - Impact of ATLAS material on pixel fluences
  - Effect of gaussian beam profile



Explore this region in more detail

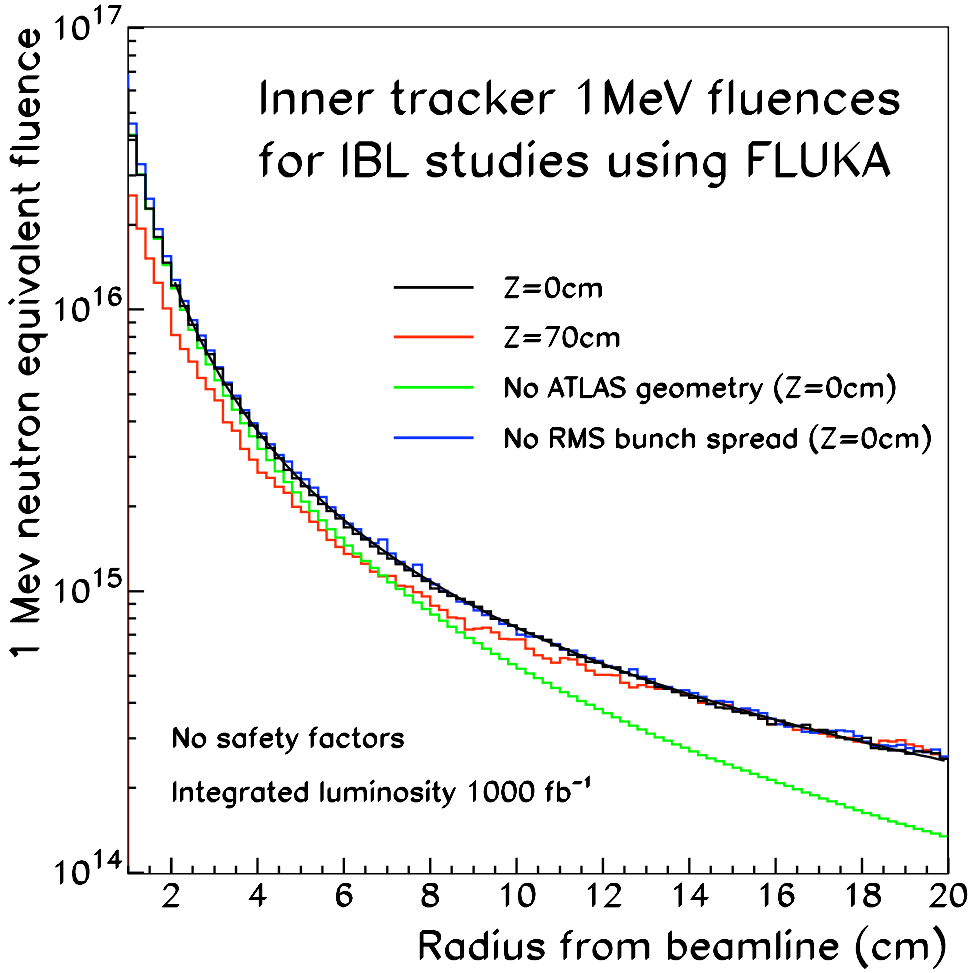
- 1 MeV neutron equivalent fluences, normalised to 1000 fb^{-1}.
  - → Use PHOJET pp event generator and FLUKA particle transport code.





- Little z dependence, so why not obtain a simple parameterization to cover full region.
- ATLAS material doesn't impact 1MeV fluences much for R < 8 cm, because fluences dominated by pions from IP.
- Proton bunch profile small effect.

- Parameterize the 1 MeV fluences for z = 0cm (worst case) ?



- Fit to data gives following form, which is shown on plot.

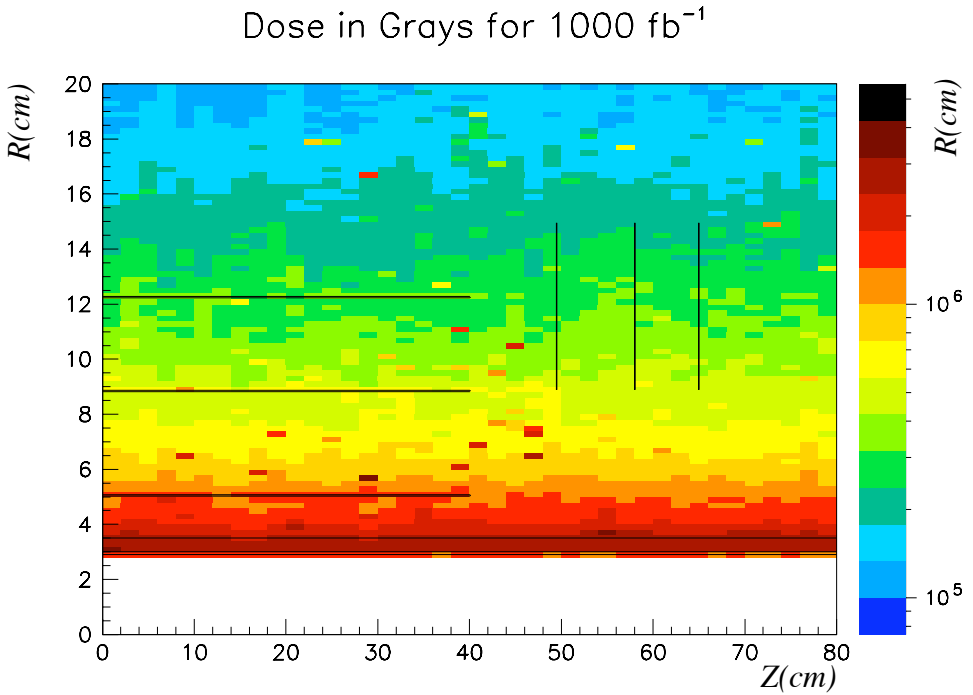
$$\Phi(r) = \left(\frac{493}{r^2} + \frac{25}{r}\right) \times 10^{14}$$

- Note:
  - → fit made for 2 < r < 20 cm
  - → simple parameterization for region close to interaction point
  - → Normalised to 1000fb^{-1}, to scale to LHC (730fb^{-1}) or IBL (550 fb^{-1}) multiply by 0.73 or 0.55 resp.

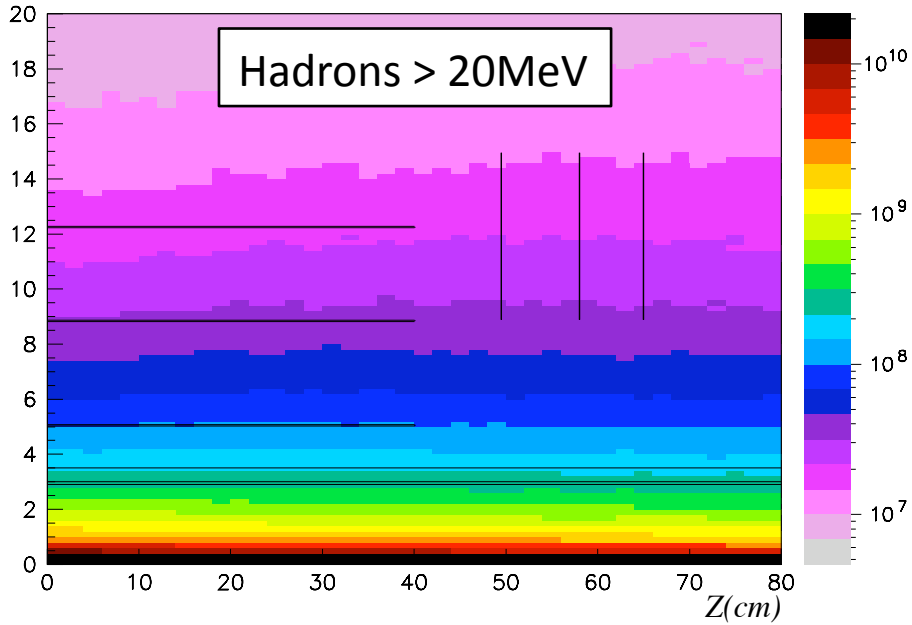
- For example, for r=3.7cm and 550fb^{-1}:

$$\Phi_{1MeV} = 2.4 \times 10^{15}$$

- Data also available for energy deposited and 20MeV hadron fluences?



Dose for estimating damage to electronic etc



20 MeV fluences for estimating SEU etc

IBL fluence uncertainties

1. pp event generator => 30%
2. For 1MeV fluences, damage factors => 50% (discussed in RTF)
3. Can assume uncertainties from geometry description and Fluka or G4 simulations small as fluences and dose in IBL region dominated by particles from interaction point.

Summary and plans

1. Updated fluences and doses available in finer detail than done previously.
2. Would like to put all information on the web (Twiki?) to allow others to play with data
3. Will write up everything, eventually, in Atlas note, along with phase II studies.
4. Big effort at present to update FLUKA geometry to be same as in Athena G4 start-up geometry.