Radiation levels from BIB

Camilla Curatolo, Francesco Collamati, Alessio Mereghetti, Paola Sala
Aim: evaluate annual dose rates and other quantities of interest for radiation damage from BIB

Starting point: geometry used for FLUKA BIB studies, 1.5 TeV, half ring

Added: materials and mag field inside the detector hall

Scored:
- dose on the vertex Silicon detector layers
- 1 MeV neutron equivalent flux in the detector hall and specifically at the Silicon layer next to the IP

Trick: having only one half of the ring, results have been obtained for one beam, then reflected around the IP and summed.
Geometry

- All Si layers, with active and passive parts (from Nazar’s detailed description)
Geometry

- **Calorimeters:**
  - no detailed layering, only average composition and density
  - Shape simplified from polyhedron to cylinder

- **Magnet + Yoke:**
  - Average composition and density
  - Uniform B field (3.5 T inside)
Scoring

- Dose: from energy deposited in the Si active layers
- 1 MeV n equivalent: run-time convolution of particle fluxes with conversion tables, particle and energy-dependent. In the space internal to the yoke
- Normalization:
  - $2 \times 10^{12}$ muons/beam/bunch
  - 200 days/y
  - 100kHz bunch crossing
Results: 1 MeV n-eq

\[ \approx \text{few } 10^{15} \text{ /cm}^2 \text{ /y} \]

\[ \approx \text{few } 10^{12} \text{ /cm}^2 \text{ /y} \]
Results: 1 MeV n-eq, zoom

\[ \approx \text{few } 10^{15} /\text{cm}^2 /\text{y} \]

From direct scoring on 1st Vertex Si (R=3 cm):

\[ 1.4 \times 10^{15} /\text{cm}^2 /\text{y} \]
Results: dose

- In the most affected Si: 1st vertex barrel and 1st vertex endcap:
  \[ \approx 10^6 \text{ Gy/y or } 100\text{ Mrad/y} \]

NOT included: beam-beam interactions
All numbers to be taken with care!!