Update on low-Q2 trackers

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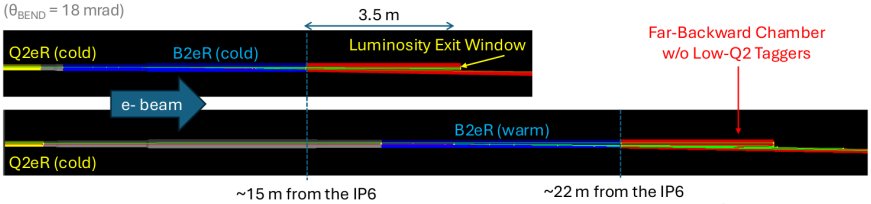
TIC Meeting

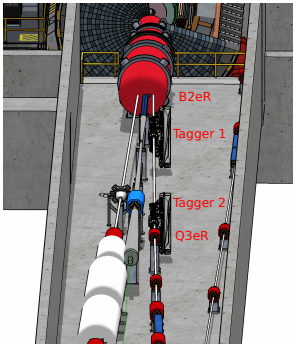
New lattice with warm B2eR magnet

Lattice file v6.2: Cold B2eR
(θ_{BEND} = 18 mrad)



Lattice file v6.3: Warm B2eR
(θ_{BEND} = 20 mrad)

Previous setup, cold B2eR in cryostat:



- B2eR dipole magnet had to move from cryostat (holding other electron and hadron magnets), implemented as normal-conducting warm magnet
- Big thanks to Andrii Natochii for invaluable help

New position further from IP, larger bending field (0.216 T instead of 0.198), change to FB area

Setup to test beam transport in Geant

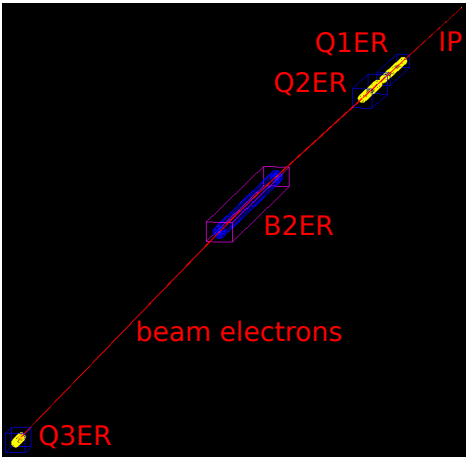
- Beam electrons are generated at nominal interaction point (IP) with positions and angular divergence taken from the latice
- The relevant GeneralParticleSource configuration:

```
/gps/ang/type beam2d
/gps/ang/sigma_x 0.0002017 rad
/gps/ang/sigma_y 0.0001873 rad
/gps/pos/type Beam
/gps/pos/sigma_x 0.119 mm
/gps/pos/sigma_y 0.0107 mm
/gps/energy 17846.263 MeV # by lattice gamma
/gps/particle e-
```

- Electron positions and angles are recorded at Q3eR

Beam spatial and angular distribution captured at Q3eR is compared with reference from lattice

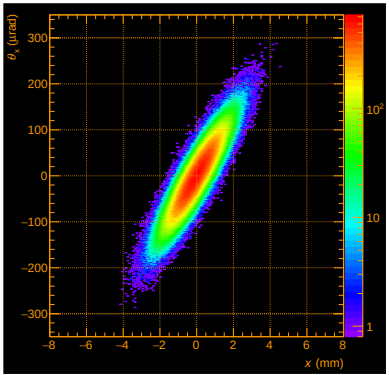
Magnet layout with warm B2eR



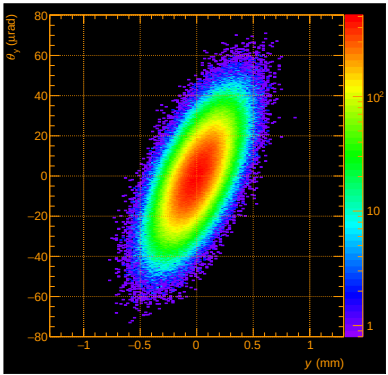
Results on test of beam transport in Geant

- Position x, y and angles $\theta_{x,y}$ at the front of Q3eR, $\sim$40 meters from the IP
- Spread in position gives beam size, spread in angles gives angular divergence
- In progress with adding a benchmark for the dd4hep simulation to compare lattice/geant4 phase space plots

Horizontal phase space



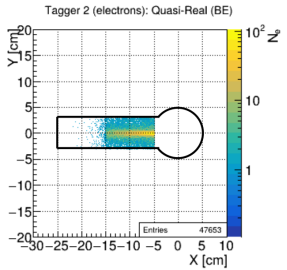
vertical phase space



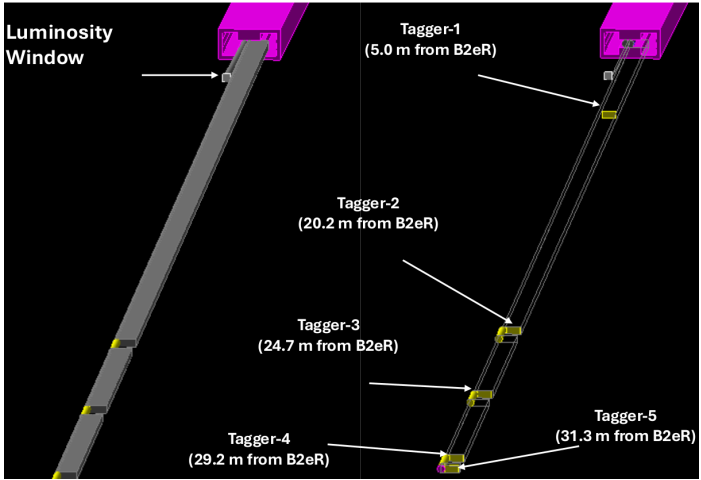
Two independent models show exact match of Geant to the reference from beam in lattice

Geant4 model with several tagger locations

- Simulation setup with potential detector locations, example photoproduction hits on tagger 2:



Circular beam pipe with rectangular ante-chamber holding the tagger detector is drawn as solid envelope



Evaluating performance and rates with bremsstrahlung background in new conditions

BACKUP

Beam energies by lattice gamma

- Exact energies are given by beam γ considered in lattice optics:
- 18 GeV: γ = 34924.26476, $E = \gamma m_e$ = 17.846263 GeV
- 10 GeV: γ = 22.19768139373845, $E = \gamma m_e$ = 9.781374116 GeV
- 5 GeV: γ = 11.5, $E = \gamma m_e$ = 5.067457287 GeV