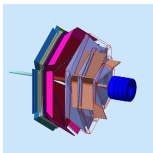


CLAS12 Background Studies with GEMC

David Riser

University of Connecticut

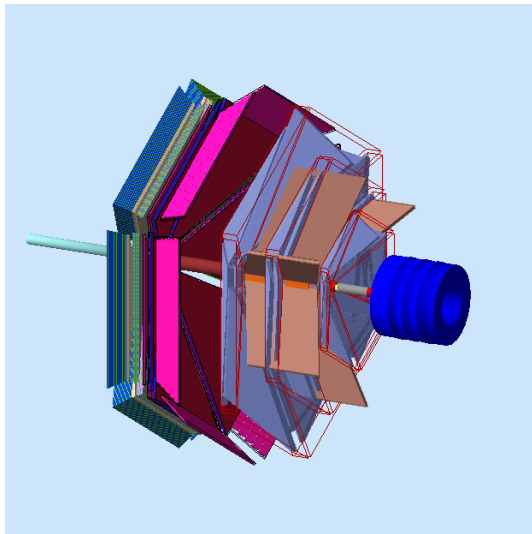
February 25, 2016



CLAS12 Geometry and Beamline

Background
Studies
(GEMC)

David Riser



Motivation

Background
Studies
(GEMC)

David Riser

- Operating luminosity CLAS12 $\rightarrow 10^{35} \text{cm}^{-2} \text{s}^{-1}$

Motivation

Background
Studies
(GEMC)

David Riser

- Operating luminosity CLAS12 $\rightarrow 10^{35} \text{cm}^{-2} \text{s}^{-1}$
- Can be extended further **if background can be contained**

Motivation

Background
Studies
(GEMC)

David Riser

- Operating luminosity CLAS12 $\rightarrow 10^{35} \text{cm}^{-2} \text{s}^{-1}$
- Can be extended further **if background can be contained**
- More physics/less beam time

Motivation

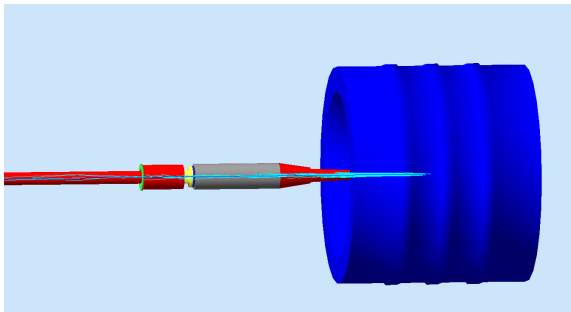
- Operating luminosity CLAS12 $\rightarrow 10^{35} \text{cm}^{-2} \text{s}^{-1}$
- Can be extended further **if background can be contained**
- More physics/less beam time
- Two sources of background identified by previous studies
 - Møller Electrons near target
 - Downstream beamline components

Motivation

Existing Shielding

Background
Studies
(GEMC)

David Riser



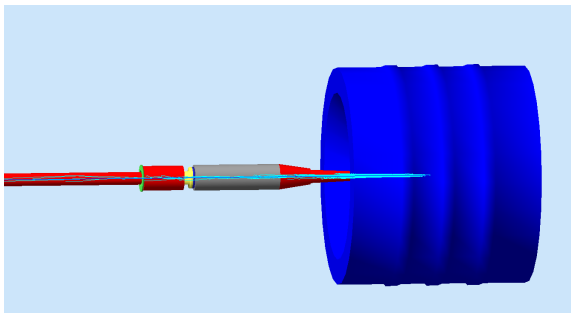
- Solenoid creates 5T field in z-direction (beam direction)

Motivation

Existing Shielding

Background
Studies
(GEMC)

David Riser



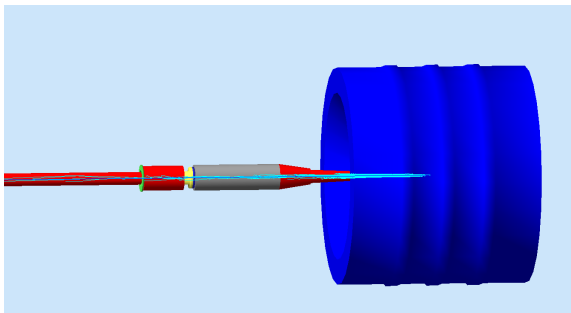
- Solenoid creates 5T field in z-direction (beam direction)
- Helical trajectory \rightarrow focuses e^- into Møller Cone

Motivation

Existing Shielding

Background
Studies
(GEMC)

David Riser



- Solenoid creates 5T field in z-direction (beam direction)
- Helical trajectory \rightarrow focuses e^- into Møller Cone
- Beam pipe in torus has tungsten lining

GEant Monte Carlo (GEMC)

- geometries / materials defined in database
 - xml “gcard” specifies included detectors, options
 - can accept generated events
 - propagation and physics handled by GEANT4
 - outputs .evio format
-
- Simulate with GEMC → GEANT4
 - Use built-in luminosity generator (simulates 10^{35})
 - STD → Electromagnetic processes
 - FTFP_BERT → Hadronic processes below 20GeV

Background Analysis Techniques

- Drift Chamber Occupancy
 - How much background?
- Vertex Positions
 - Where is the background coming from?

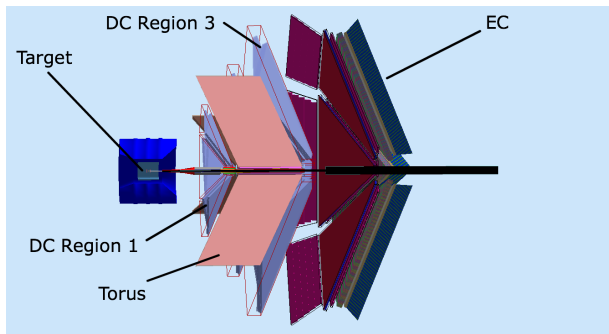
Background Analysis Techniques

- Drift Chamber Occupancy
 - How much background?
- Vertex Positions
 - Where is the background coming from?
 - Where do we put shields?

Results

Base Beamline Configuration

Base Beamline configuration → simplified geometry



- Target/Solenoid
- DC, Torus frame, EC, PCal, FTOF

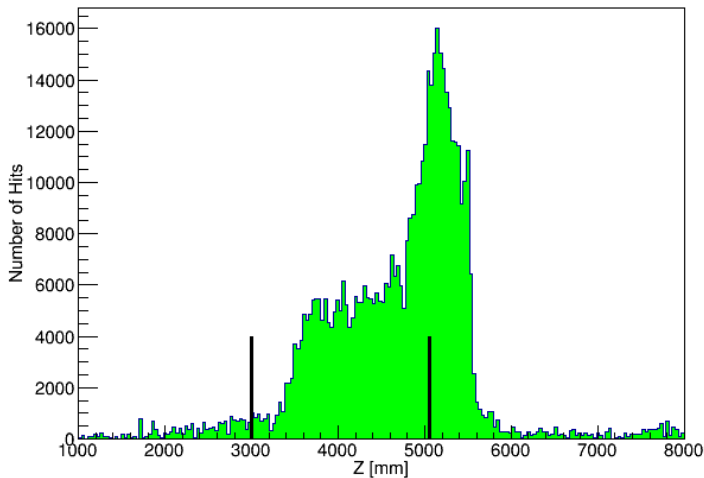
Results

Baseline Configuration

Background
Studies
(GEMC)

David Riser

Z-Vertex Position For Region 3 Hits



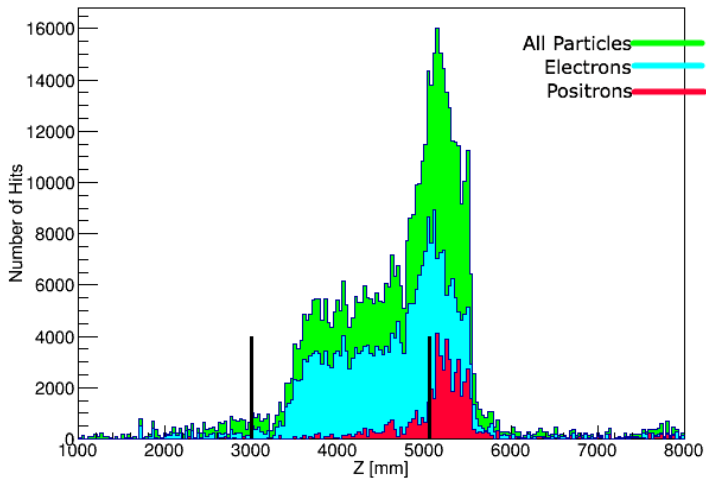
Results

Baseline Configuration

Background
Studies
(GEMC)

David Riser

Z-Vertex Position For Region 3 Hits



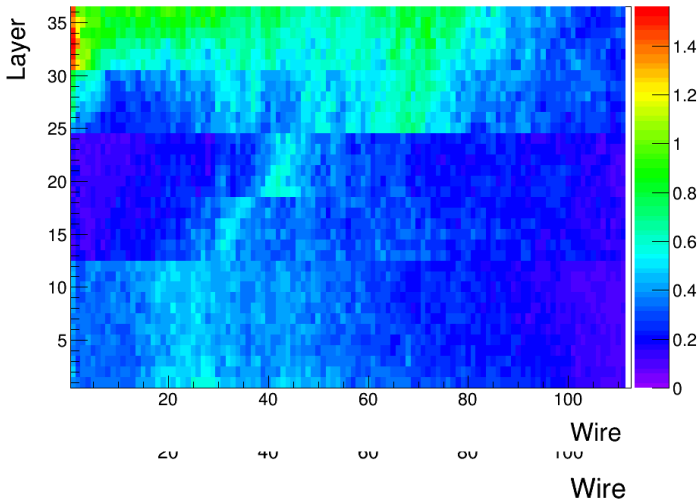
Results

Baseline Configuration

Background
Studies
(GEMC)

David Riser

Hit Probability for Sector 1 for baseline



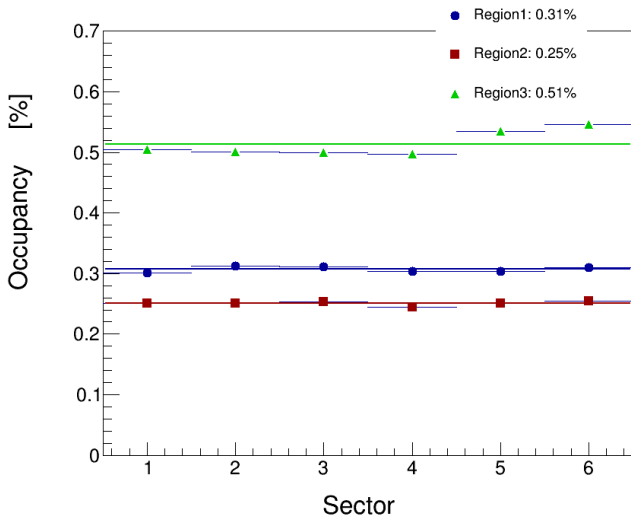
Results

Baseline Configuration

Background
Studies
(GEMC)

David Riser

Drift Chamber Occupancy for baseline

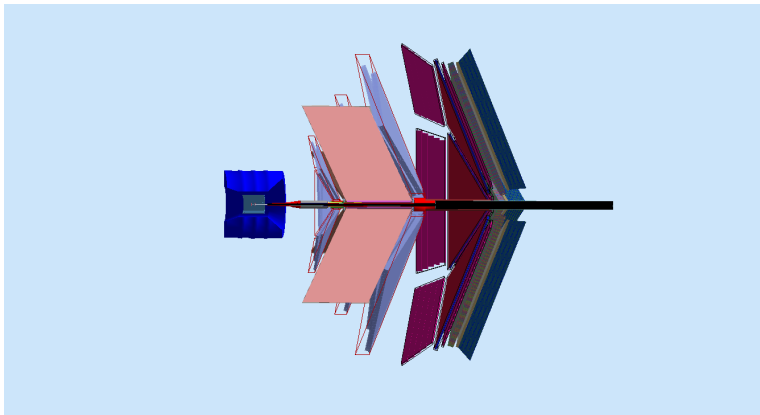


Results

Modified Configuration

Background
Studies
(GEMC)

David Riser

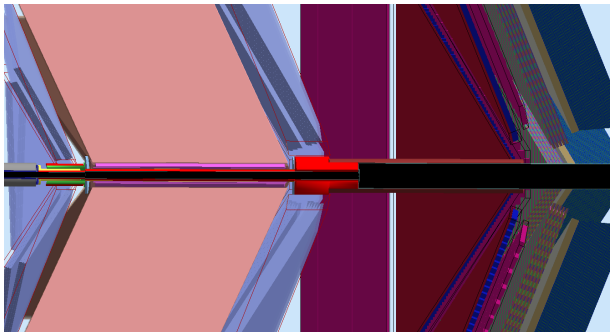


Results

Modified Configuration

Background
Studies
(GEMC)

David Riser



- Added tungsten nose downstream of torus (shown in center - red)

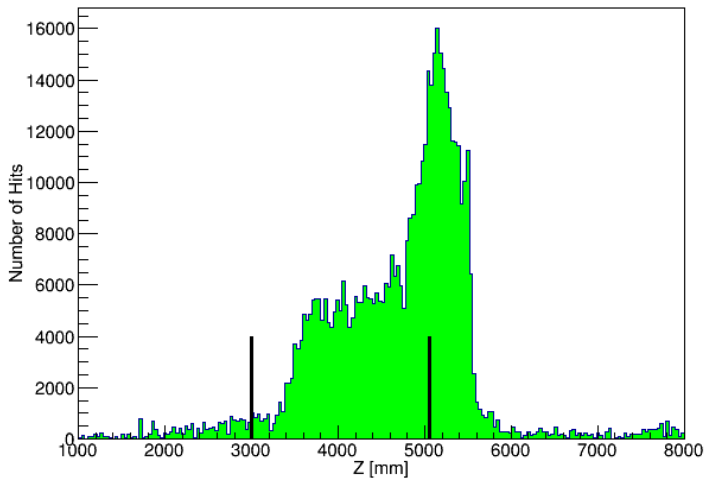
Results

Baseline Configuration

Background
Studies
(GEMC)

David Riser

Z-Vertex Position For Region 3 Hits



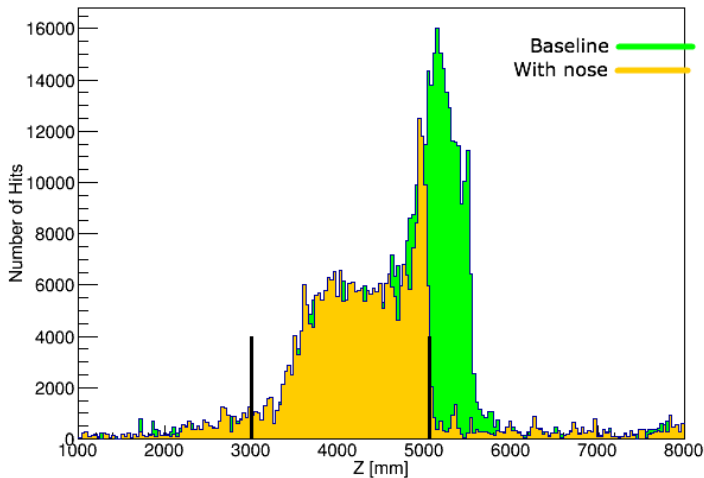
Results

Modified Configuration

Background
Studies
(GEMC)

David Riser

Z-Vertex Position For Region 3 Hits



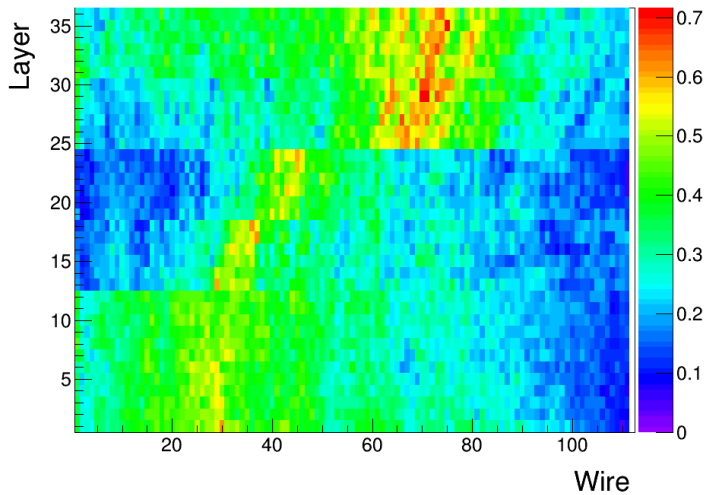
Results

Modified Configuration

Background
Studies
(GEMC)

David Riser

Hit Probability for Sector 1 for noft-I254-r195.4



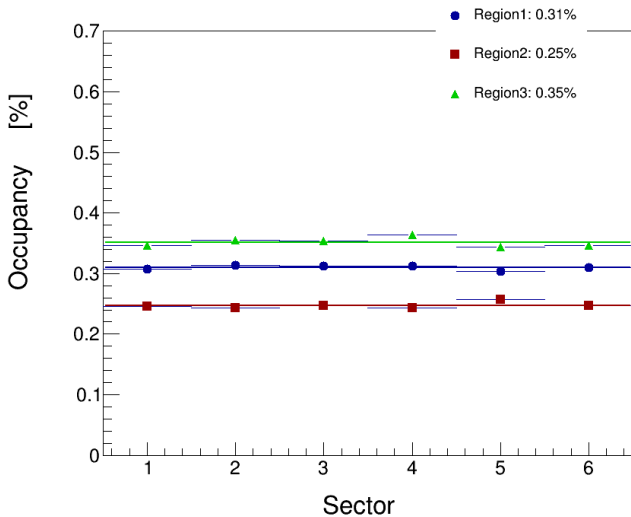
Results

Modified Configuration

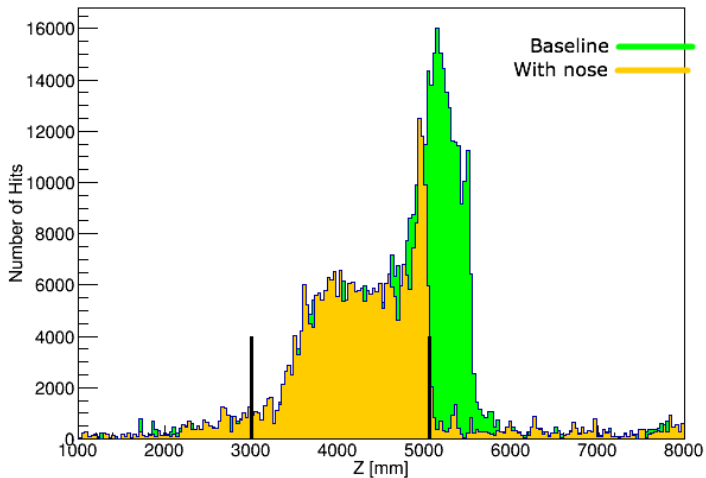
Background
Studies
(GEMC)

David Riser

Drift Chamber Occupancy for noft-l254-r195.4



Z-Vertex Position For Region 3 Hits

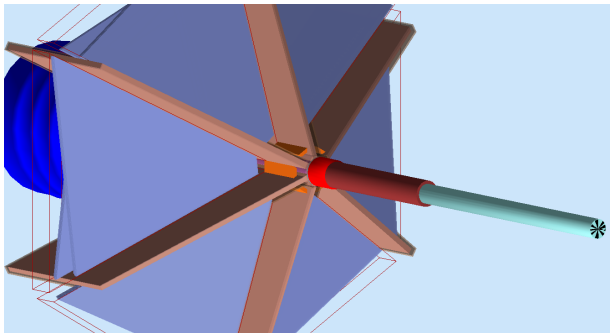


Future

Torus shielding blocks

Background
Studies
(GEMC)

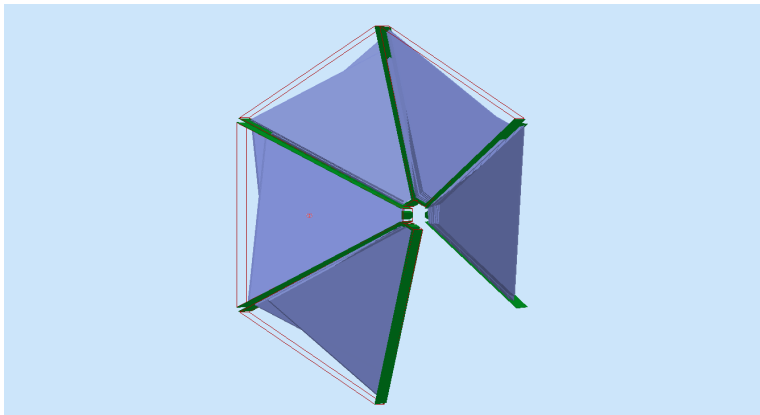
David Riser



Future

Background
Studies
(GEMC)

David Riser



Future

Background
Studies
(GEMC)

David Riser

- Study the effect of torus blocks

Future

Background
Studies
(GEMC)

David Riser

- Study the effect of torus blocks
- Iteratively improve GEMC geometry → check for consistency

Future

Background
Studies
(GEMC)

David Riser

- Study the effect of torus blocks
- Iteratively improve GEMC geometry → check for consistency
- Continue talks with Hall-B engineering → fabricate shielding

Summary

Background
Studies
(GEMC)

David Riser

- Our group has simulated with/without additional beamline shielding

Summary

Background
Studies
(GEMC)

David Riser

- Our group has simulated with/without additional beamline shielding
- Beamline shielding lowers region 3 occupancy by 30%

Summary

- Our group has simulated with/without additional beamline shielding
- Beamline shielding lowers region 3 occupancy by 30%
- With shielding in place it may be possible to run at several times the designed luminosity, while staying below 1% occupancy

Acknowledgements

Background
Studies
(GEMC)

David Riser

Thanks to the people who have contributed to this work

- Maurizio Ungaro, Latifa Elouadrhiri, Francois-Xavier Girard
- Kyungseon Joo, Nick Markov

End of Slides

Thank you.