

GEMC Updates

- gemc/geant4 and physics
- latest CLAS12 geometries
- torus from CAD
- web interface
- gemc 3.0

gemc/geant4 and physics

GEMC does not alter in any way, form or fashion the geant4 physics: transportation, secondaries production and energy losses are “pure” geant4 mechanisms. We select physics packages (see documentation for details).

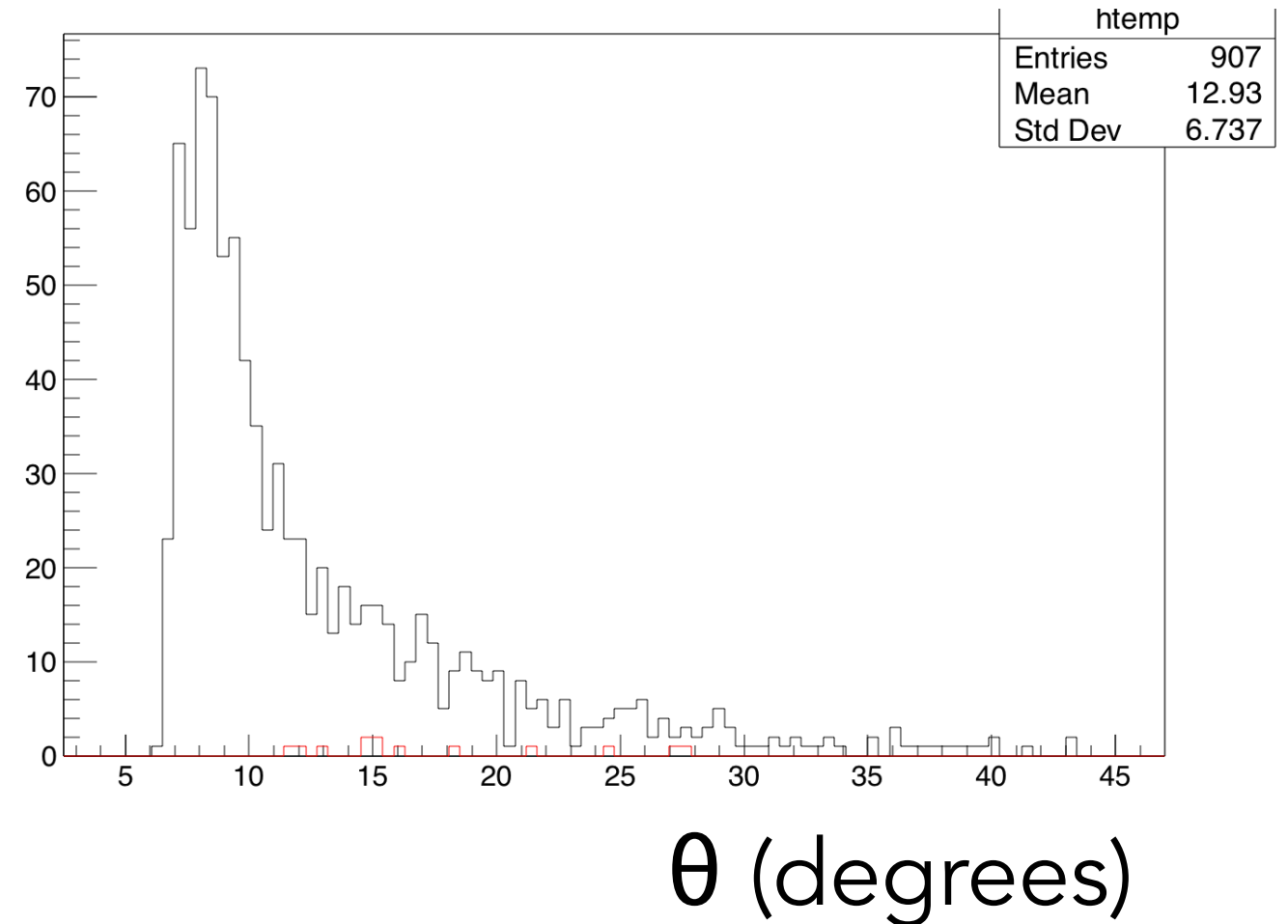
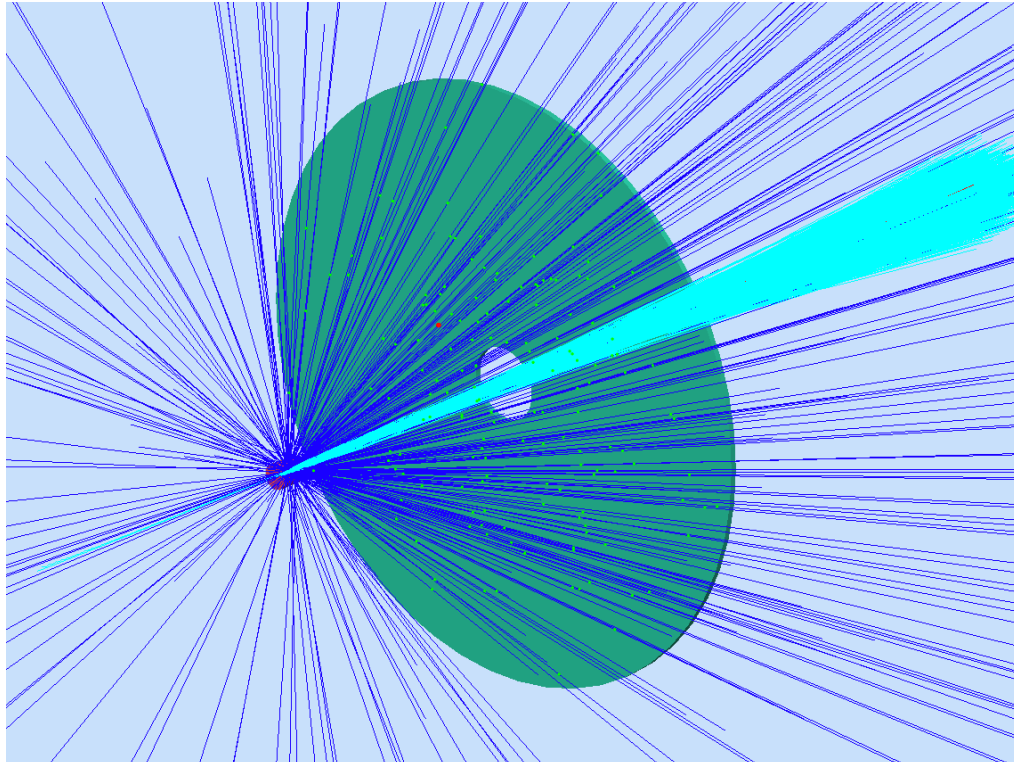
Exceptions:

- “kryptonite” kills all particle entering it
- fast mc mode 1 disable all secondaries
- fast mc mode 2 disable all physics
- can control magnetic field max step, production threshold
- FORCE_MUON_RADIATIVE_DECAY flag (cosmic rays)

gemc/geant4 and physics

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inclusive electroproduction “background” rates

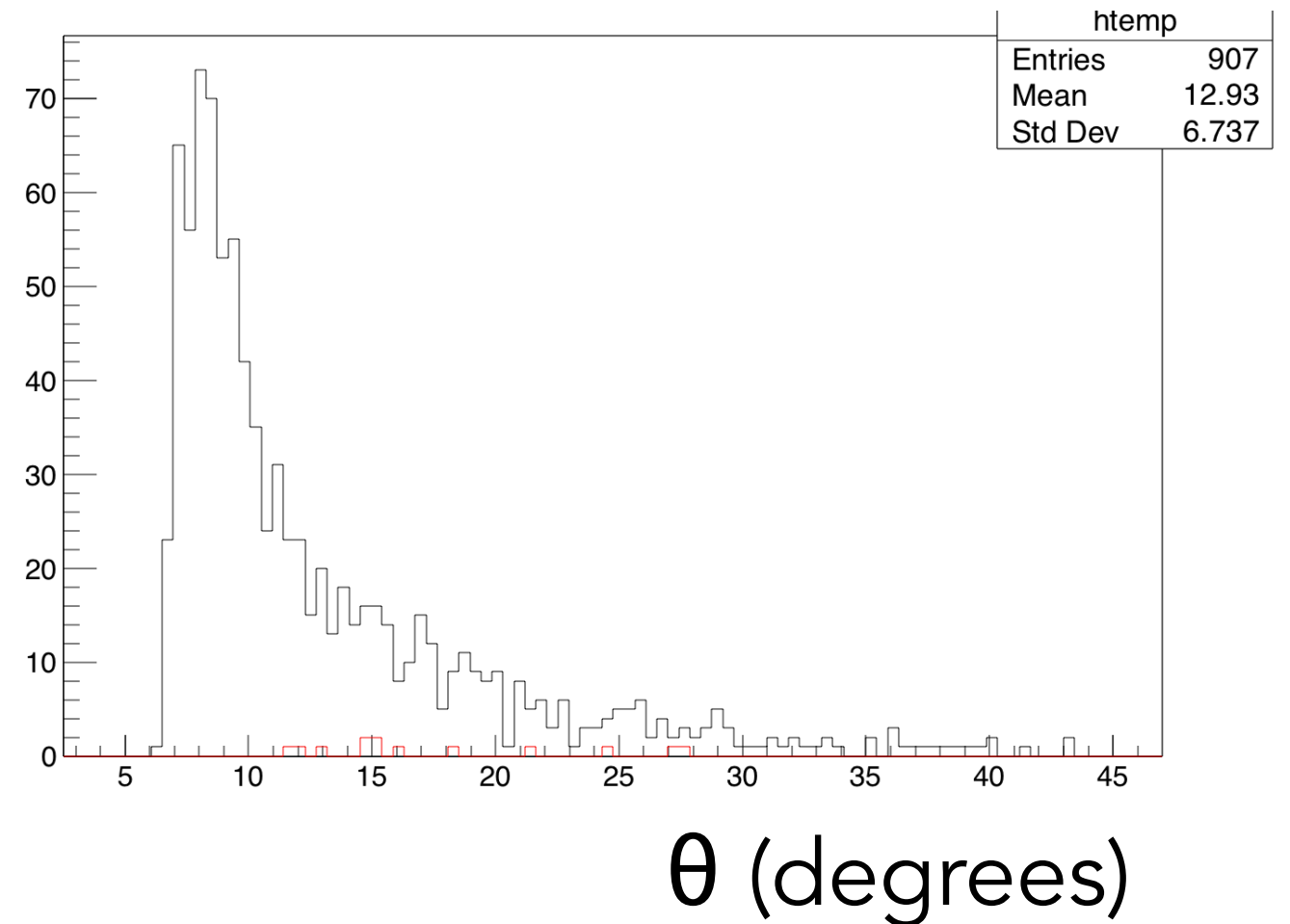
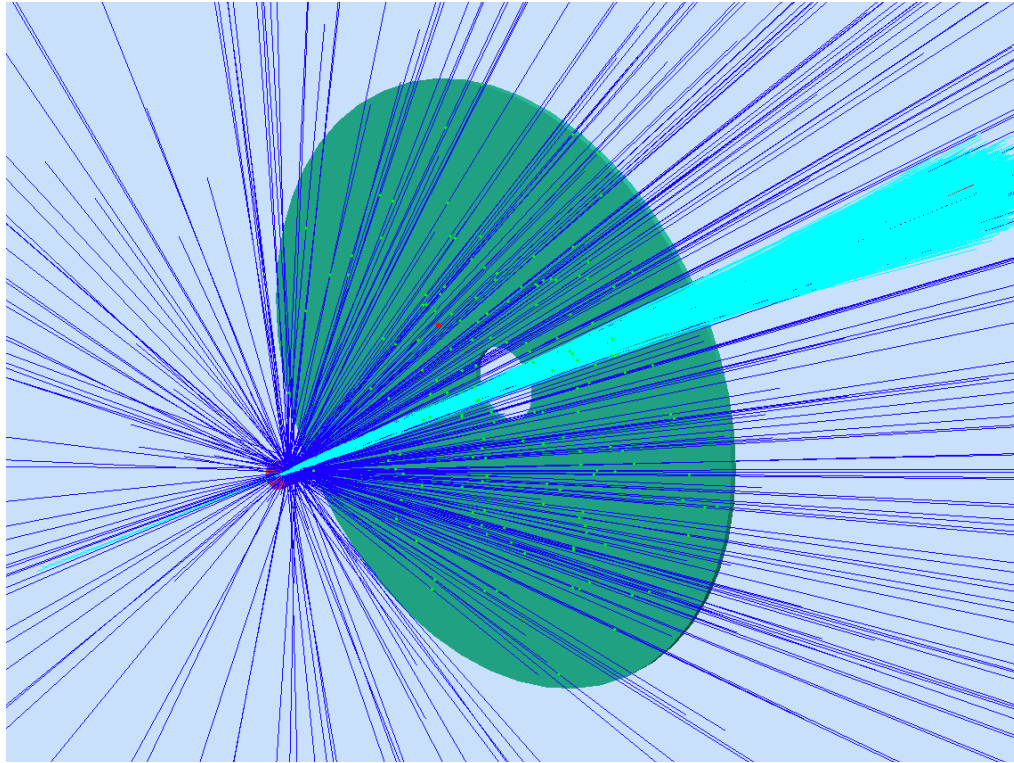


907 in 33.1K events, or
0.008275 seconds:

110KHz electrons.

**Verified on all hadronic and
all e.m. physics lists.**

inclusive electroproduction “background” rates



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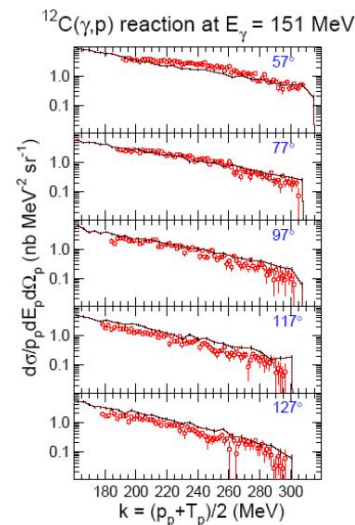
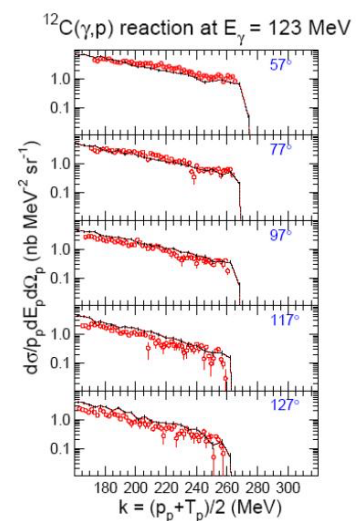
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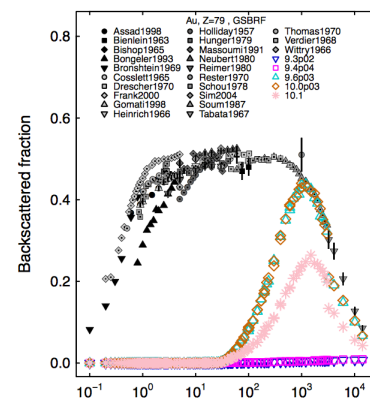


what happened?

1. 110KHz does not affect occupancy. It is 2.5 e- every 100 events = 0.05% occupancy
2. No validation for electroproduction at our energy in geant4. One validation for photo production on Carbon at $E_\gamma = 150$ MeV



3. Different versions of geant4 can differ by factors of ~ 2 in electron scattering.



Validation Test of Geant4 Simulation of Electron Backscattering

[arXiv:1502.01507](https://arxiv.org/abs/1502.01507) [physics.comp-ph]

Investigation of Geant4 Simulation of Electron Backscattering

[arXiv:1506.01531](https://arxiv.org/abs/1506.01531) [physics.comp-ph]

4. Still investigating. Eventually may report to geant4 developers.

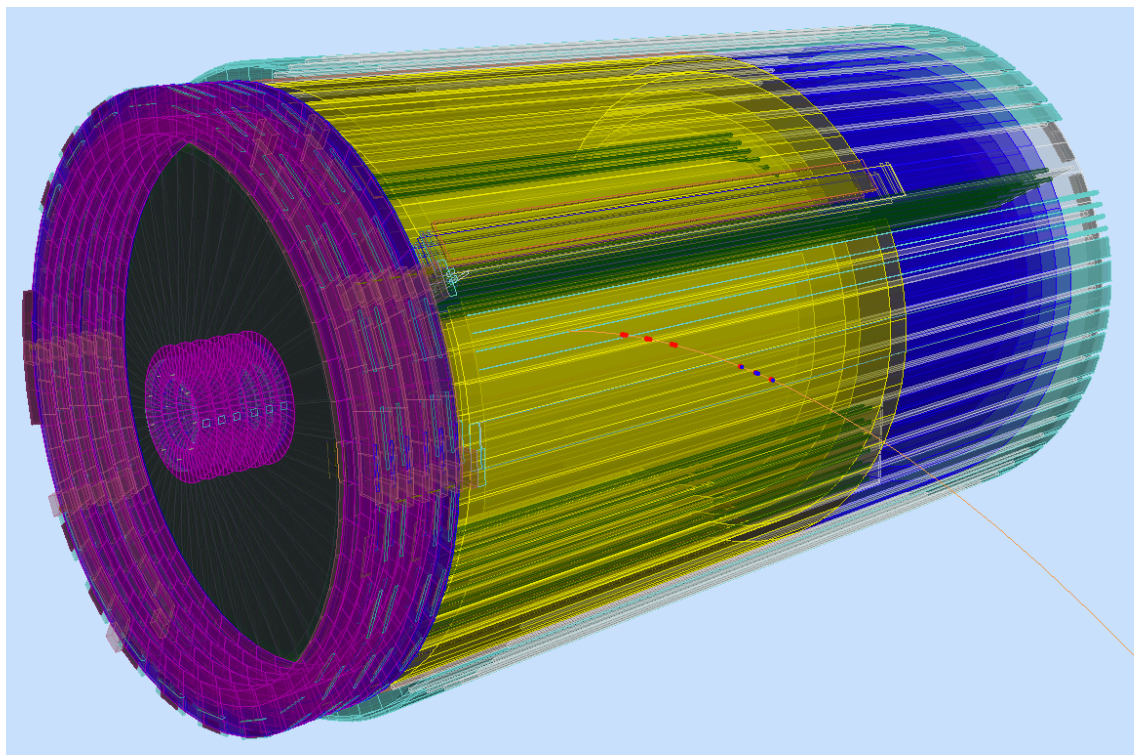
CLAS12 Drift Chambers

- Non linear distance to time reading calibration database
- Intrinsic efficiency
- Time walk correction
- Smearing

Krishna Adhikari
Daniel Lersch
Mac Mestayer
Veronique Ziegler

Status: Ready for next clas12 tag.

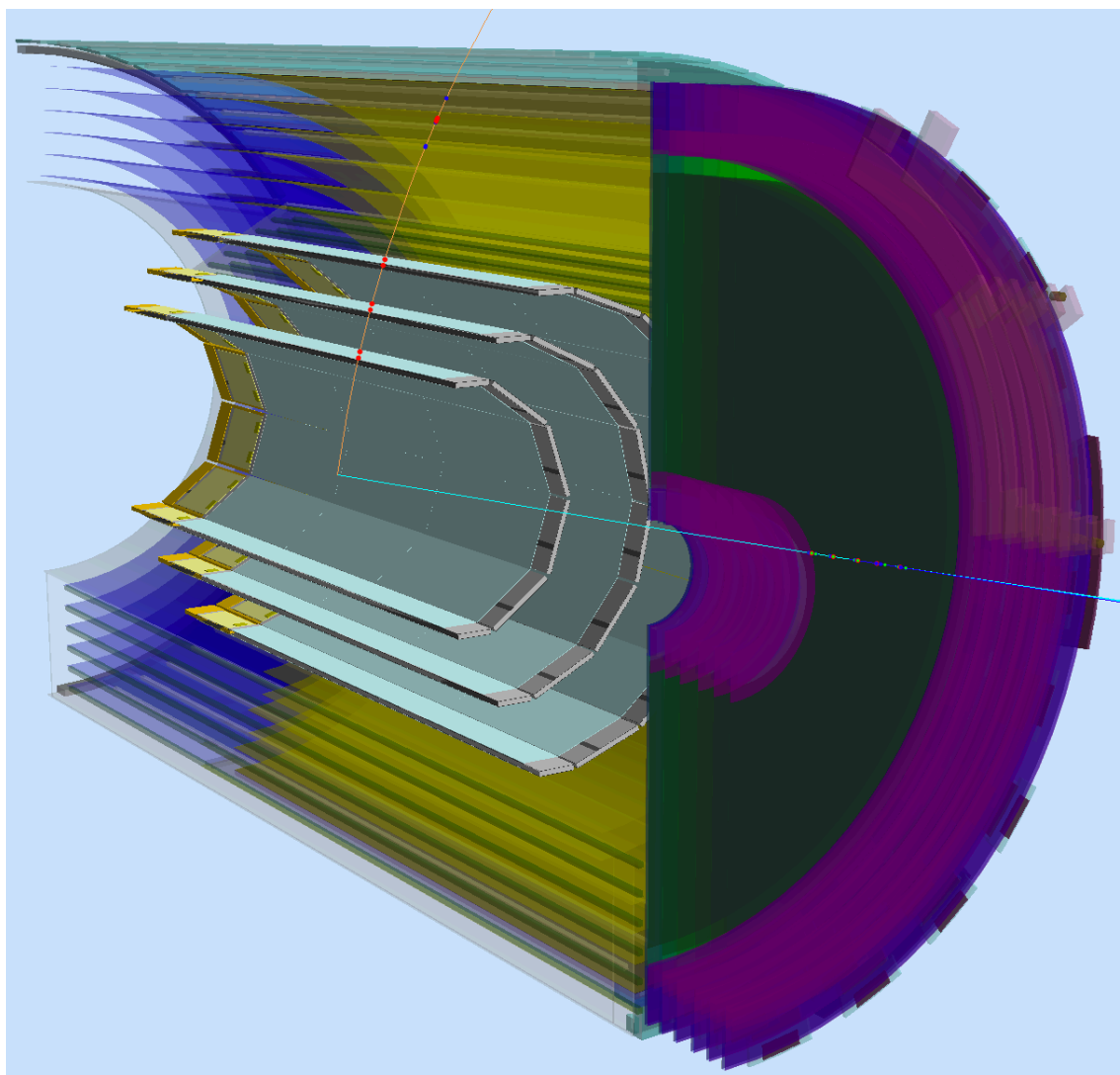
CLAS12 Micromegas



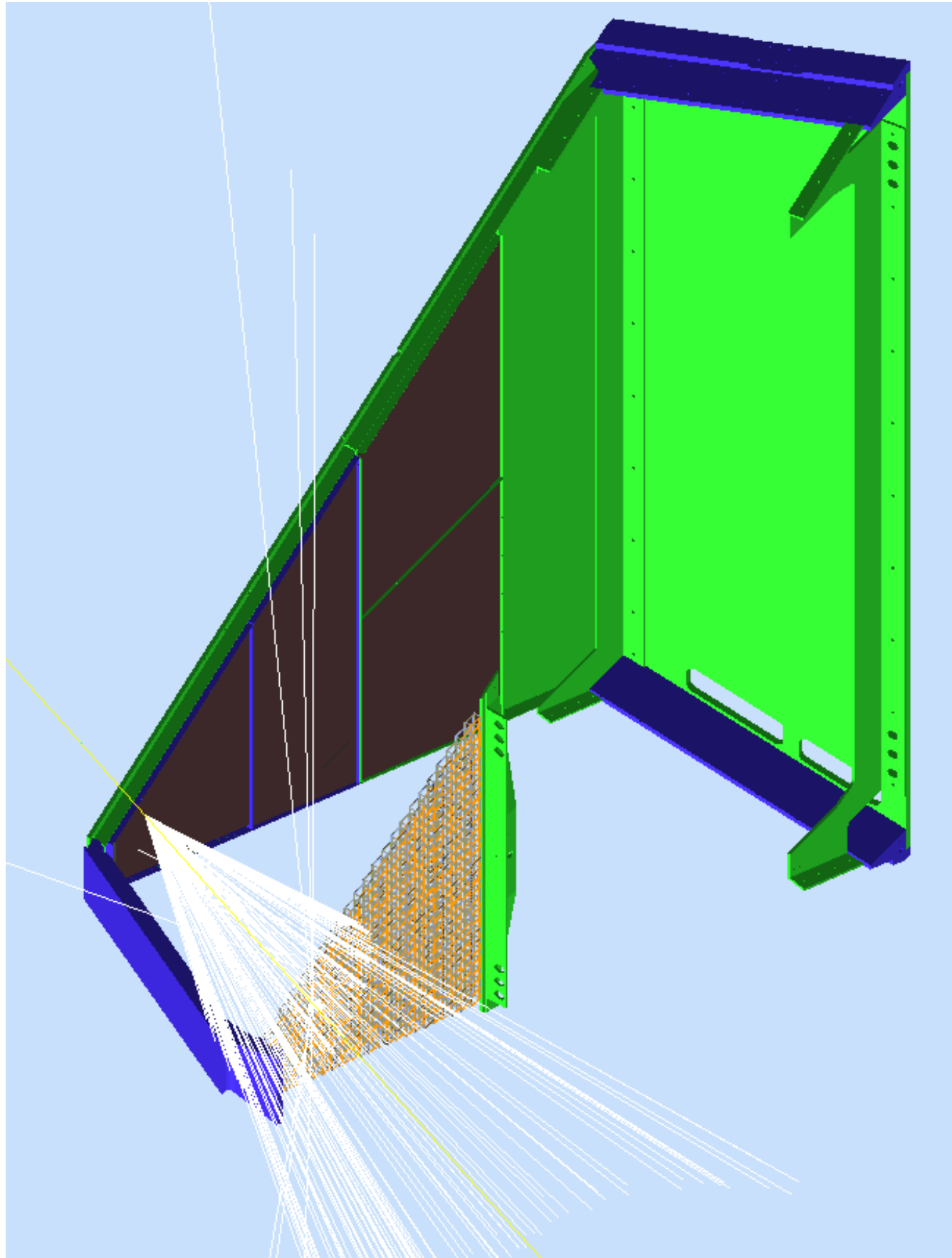
Michel Garcon
Maxime Defurne

Barrel and forward
tracker MM

*Status: Ready for next
clas12 tag. Maybe
some optimization
needed.*



CLAS12 Rich

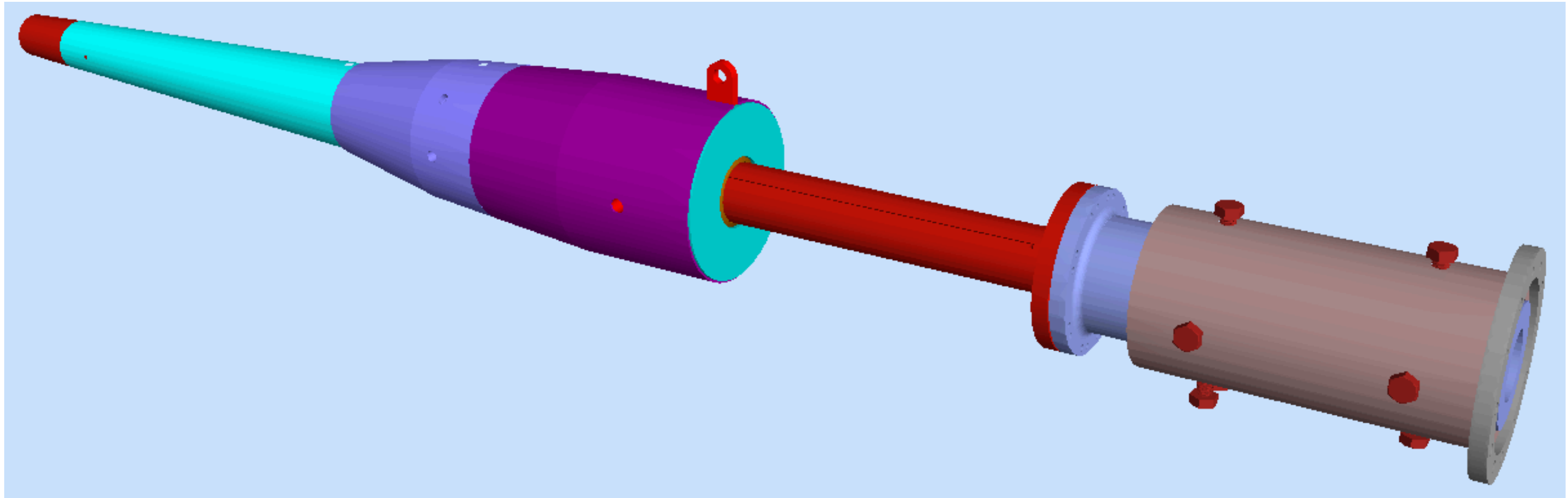


Giovanni Angelini
Andrey Kim
Marco Mirazita
Marco Contalbrigo

Combination of CAD
volumes and native geant4

*TODO (gemc side): allow
cross hierarchy between
CAD/native factories.*

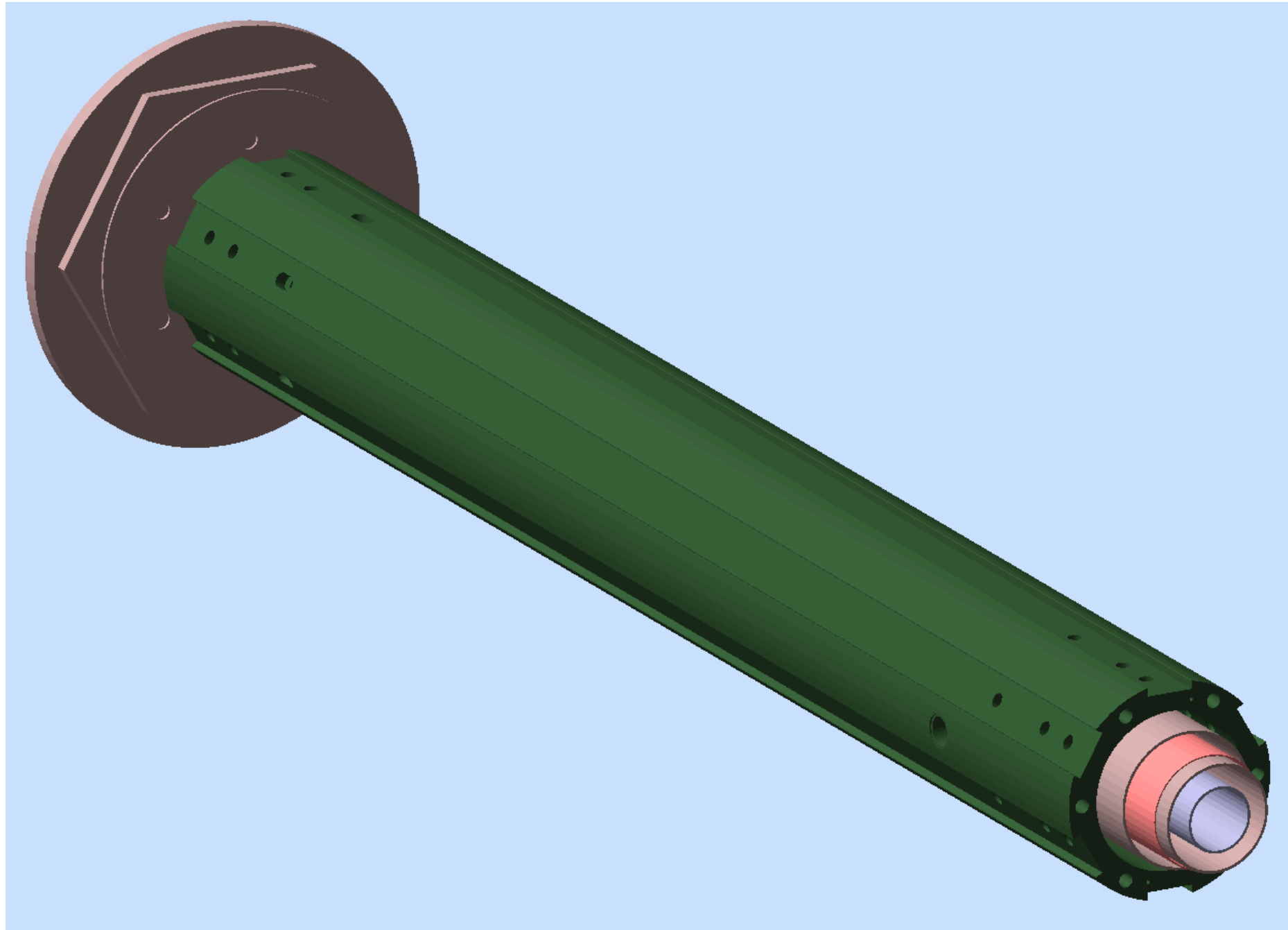
CLAS12 Beamline



Tungsten shield
Support
FT shield
Mounts to Torus

Status: Ready for next clas12 tag.

CLAS12 Torus

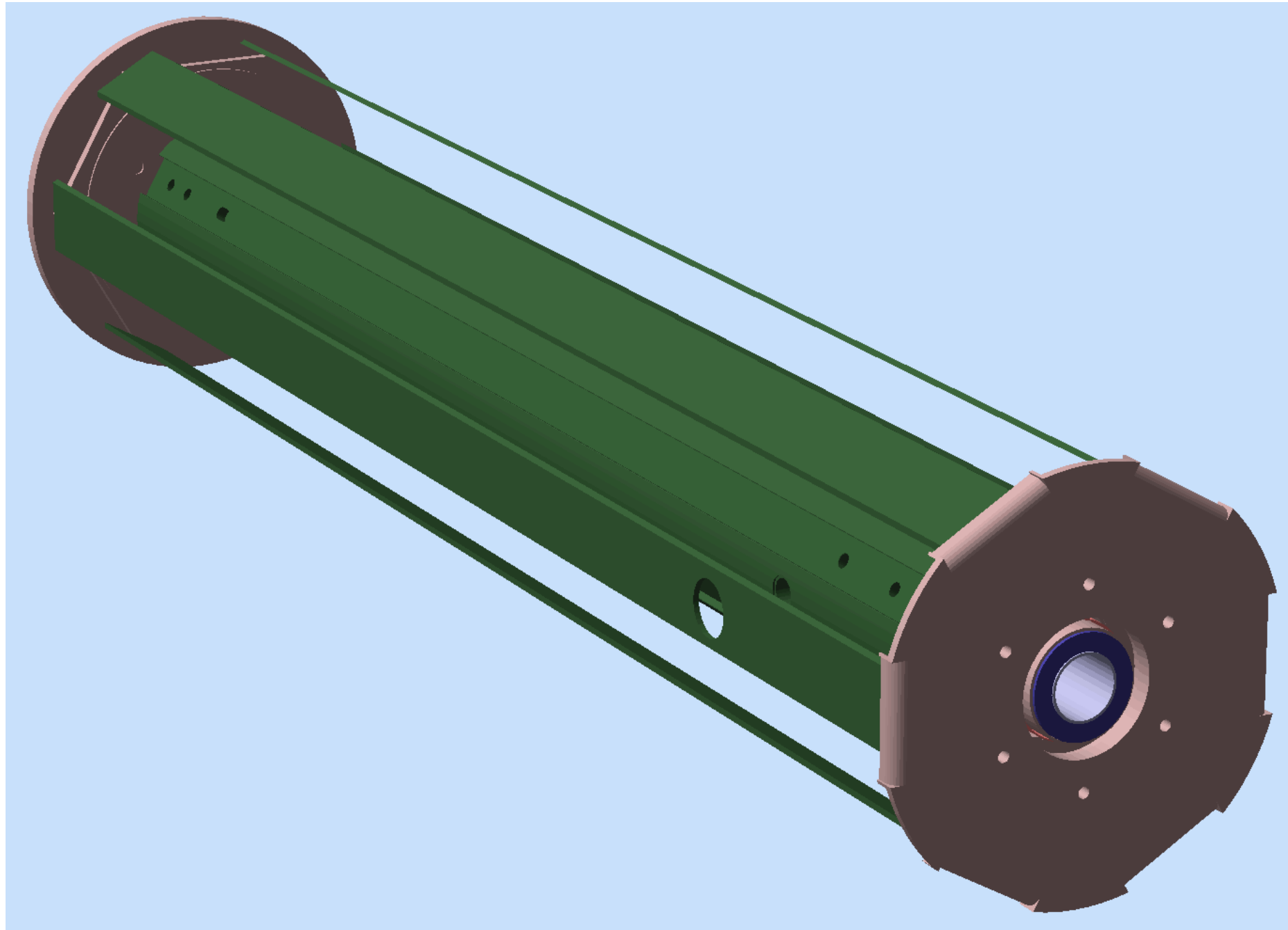


beam line
beamline shields
Center tube
Hub
Warm Bore
us/ds shield plates
us/ds vacuum jackets

do we need all this?

YES

CLAS12 Torus

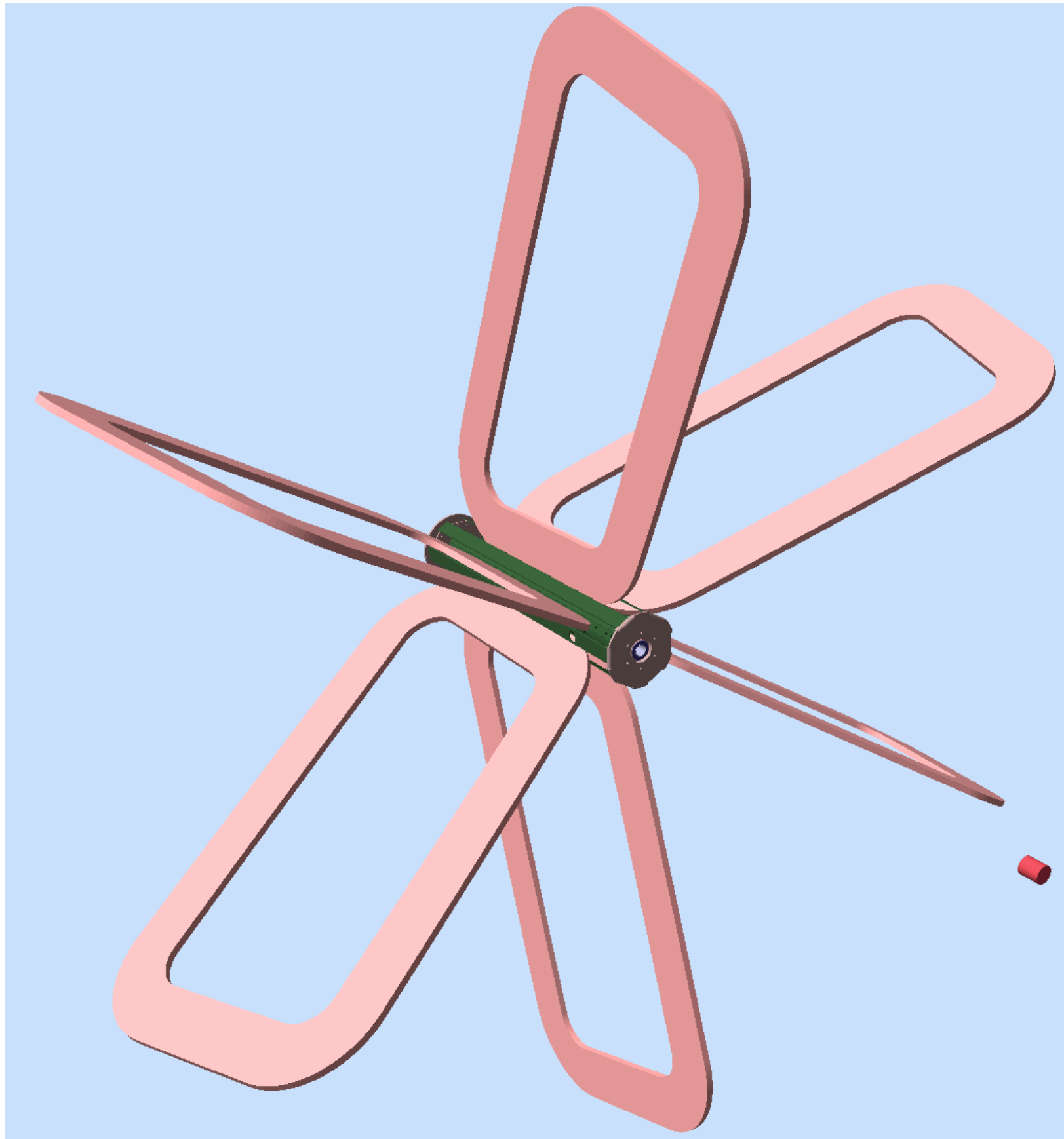


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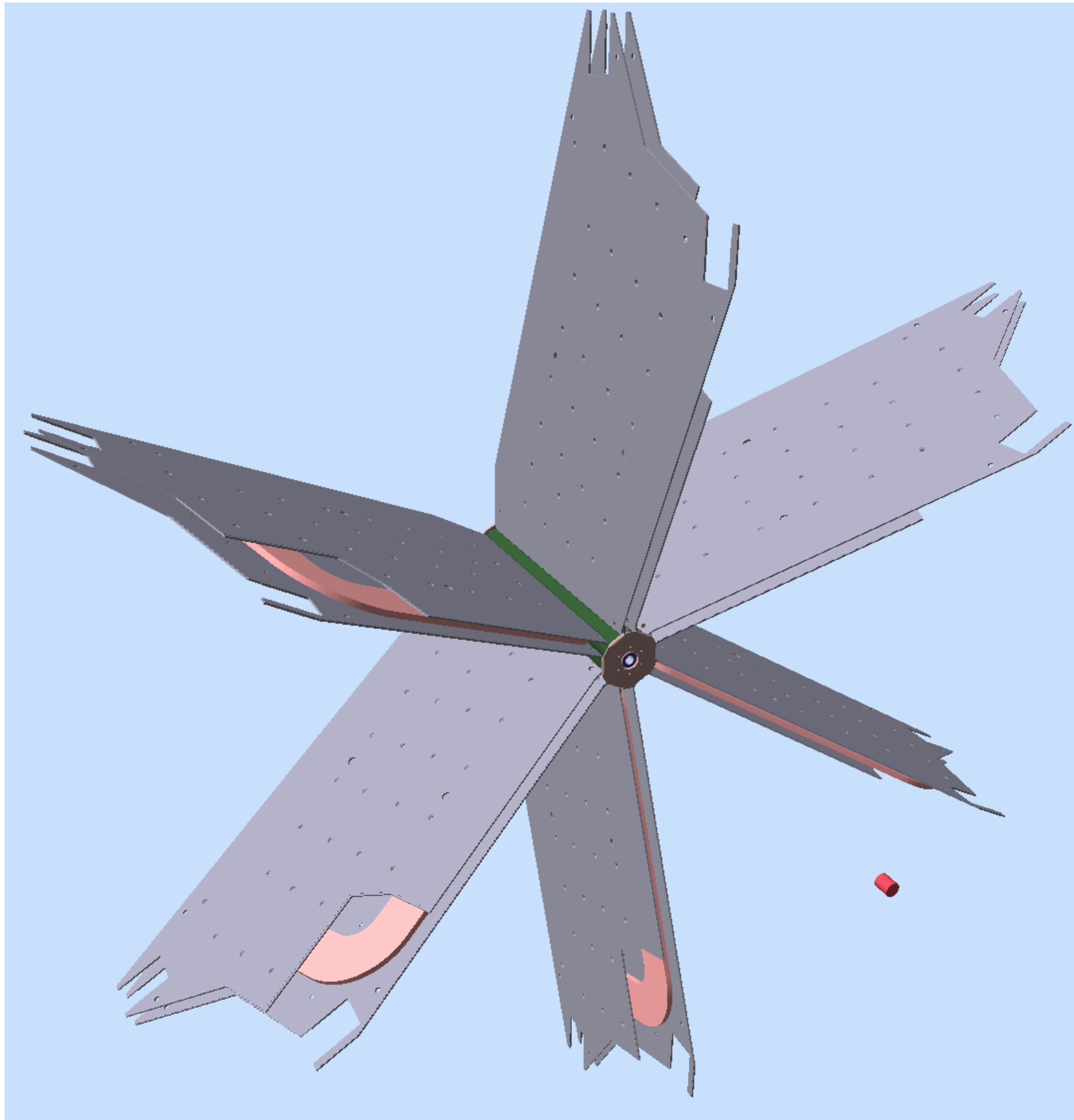
torus coils

steel frames

DC r1 mounts

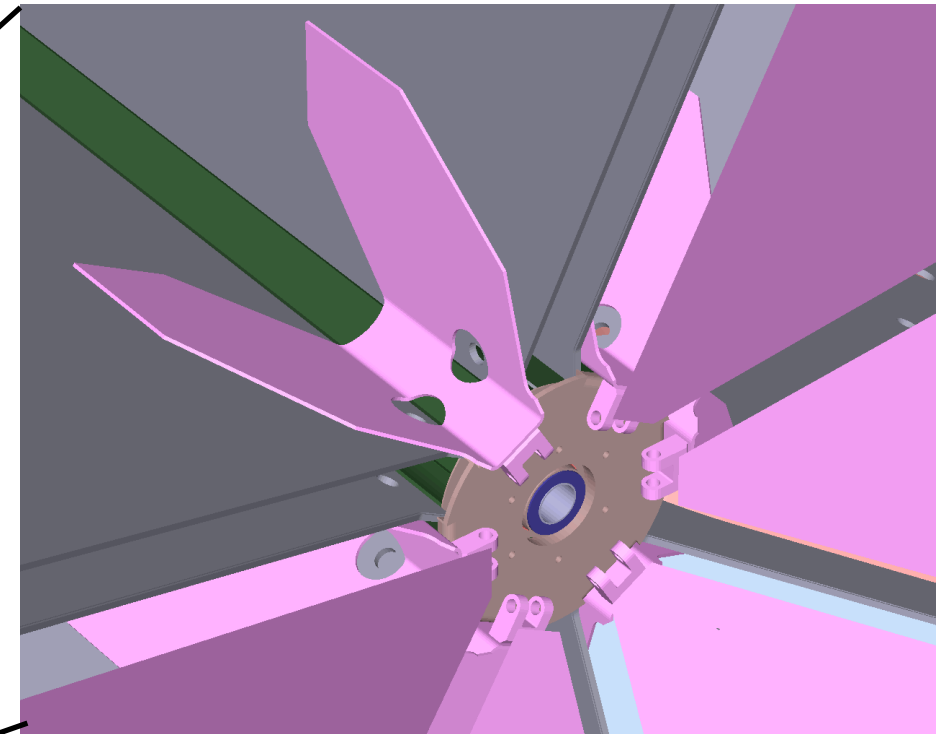
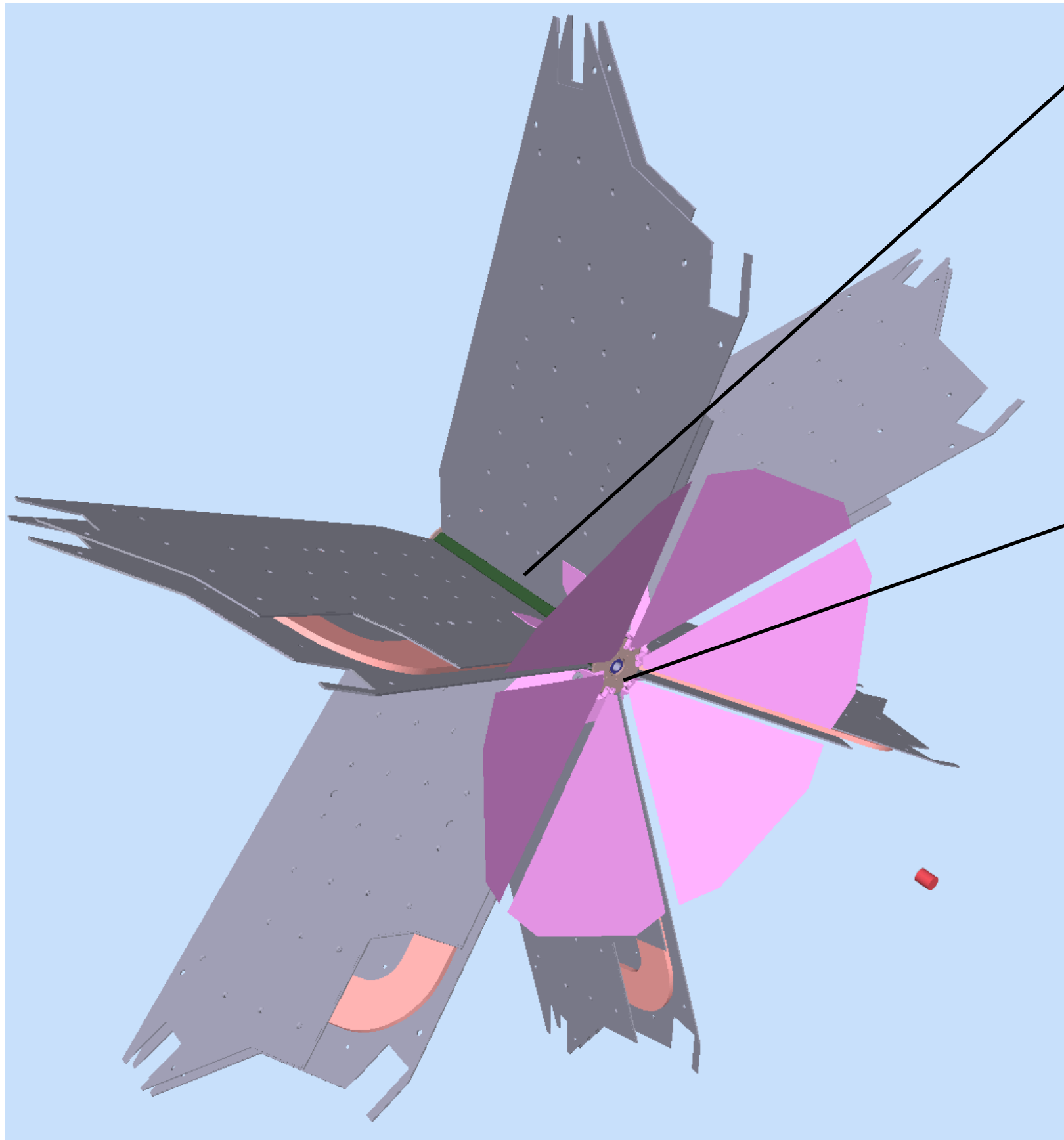
DC r1 back wall

CLAS12 Torus



torus coils
steel frames
DC r1 mounts
DC r1 back wall

CLAS12 Torus



detectors mount
hardware crucial to
check consistency
between model
and simulation/
reconstruction

*Staus: Ready for next
clas12 tag.*

web interface

EIC Summer Project: Markus Diefenthaler,
Sam Markelon

Develop a web interface to run gemc on a
server and/or on the JLAB farm

- select detectors / run conditions
- select/upload generator
- select gemc / geant4 version
- submit jobs on farm
- download results

gemc 3.0

geant4 improvements:

- Run/Event streamline and API for user actions
- Analysis tools
- Parallel worlds
- **Multithreading**

game changer. Need transition 2.x > 3.0

Also needed:

- better memory management
- code modularization
- code optimization.

Multithreading: at the event level

Now thread local:

- physics list
- Sensitive detector mechanism.
Process ID, Energy sharing, Noise.
- Hit definition
- Magnetic field
- Generator and input from files
- Digitization
- Event log
- Random numbers mechanism

Non thread local:

- merge events info
- write to file

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gemc 3.0.beta1
development underway.
Transition will be (mostly)
transparent to users.

Summary

- problem in geant4 inclusive electroproduction.
Investigating, may report.
- new geometries / digitization for:
 - ✓ dc
 - ✓ micromegas
 - ✓ rich
 - ✓ beam line
 - ✓ torus
- cad mechanism working awesome
- gemc 3.0 will:
 - take advantage of geant4 event multithreading
 - have better memory management
 - be optimized
 - ready for new geant4 goodies