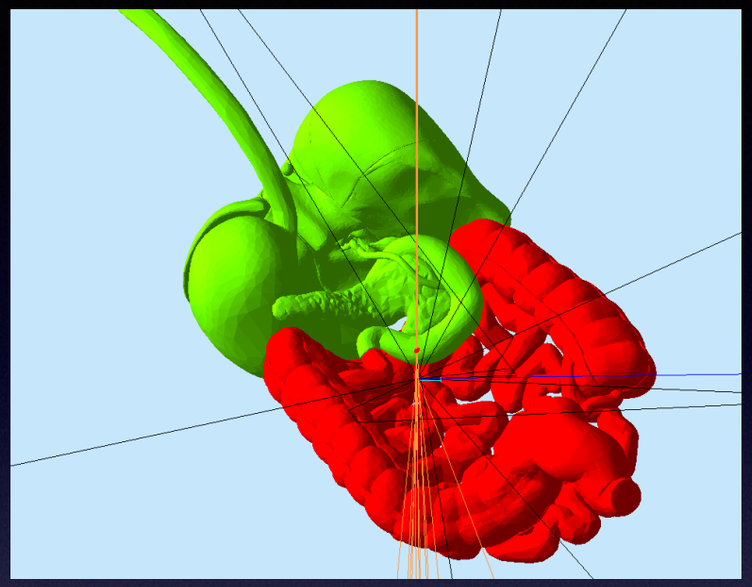
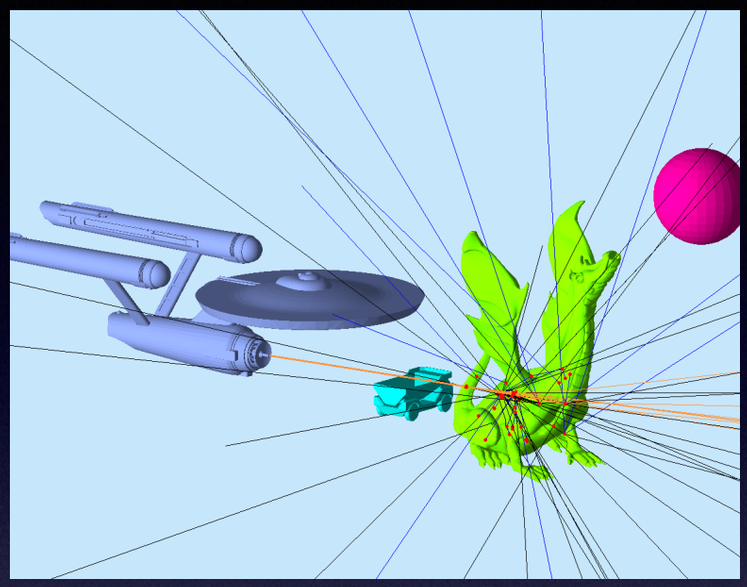
GEant4 Monte Carlo

Version 2.5

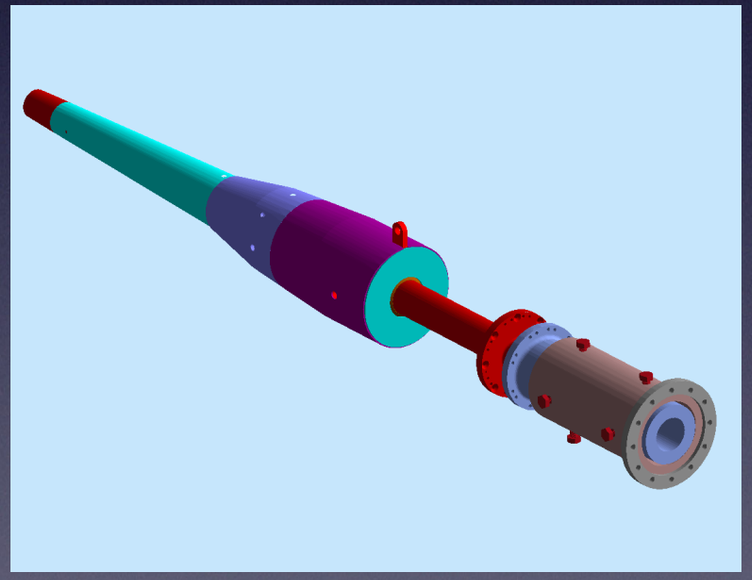
Geometry / Digitization status

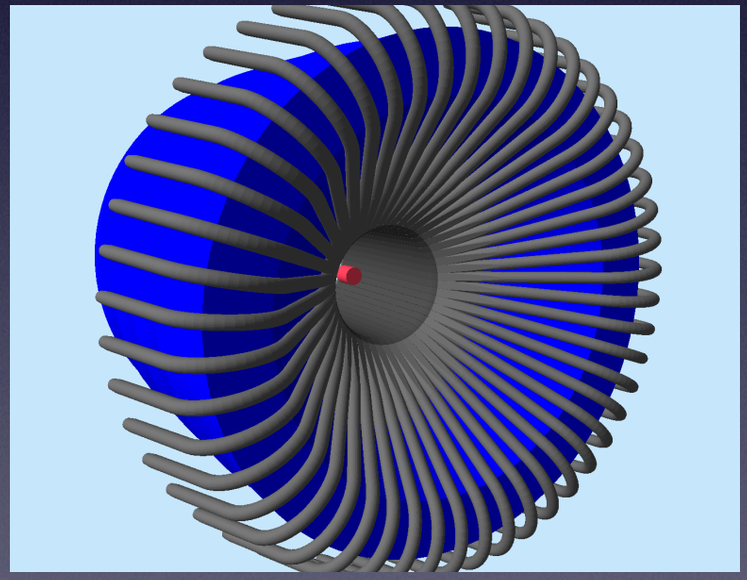
CAD/GDML import





CLAS12 Beamline: CAD engineering drawings





CLAS12 CTOF and light guides: CAD engineering drawings

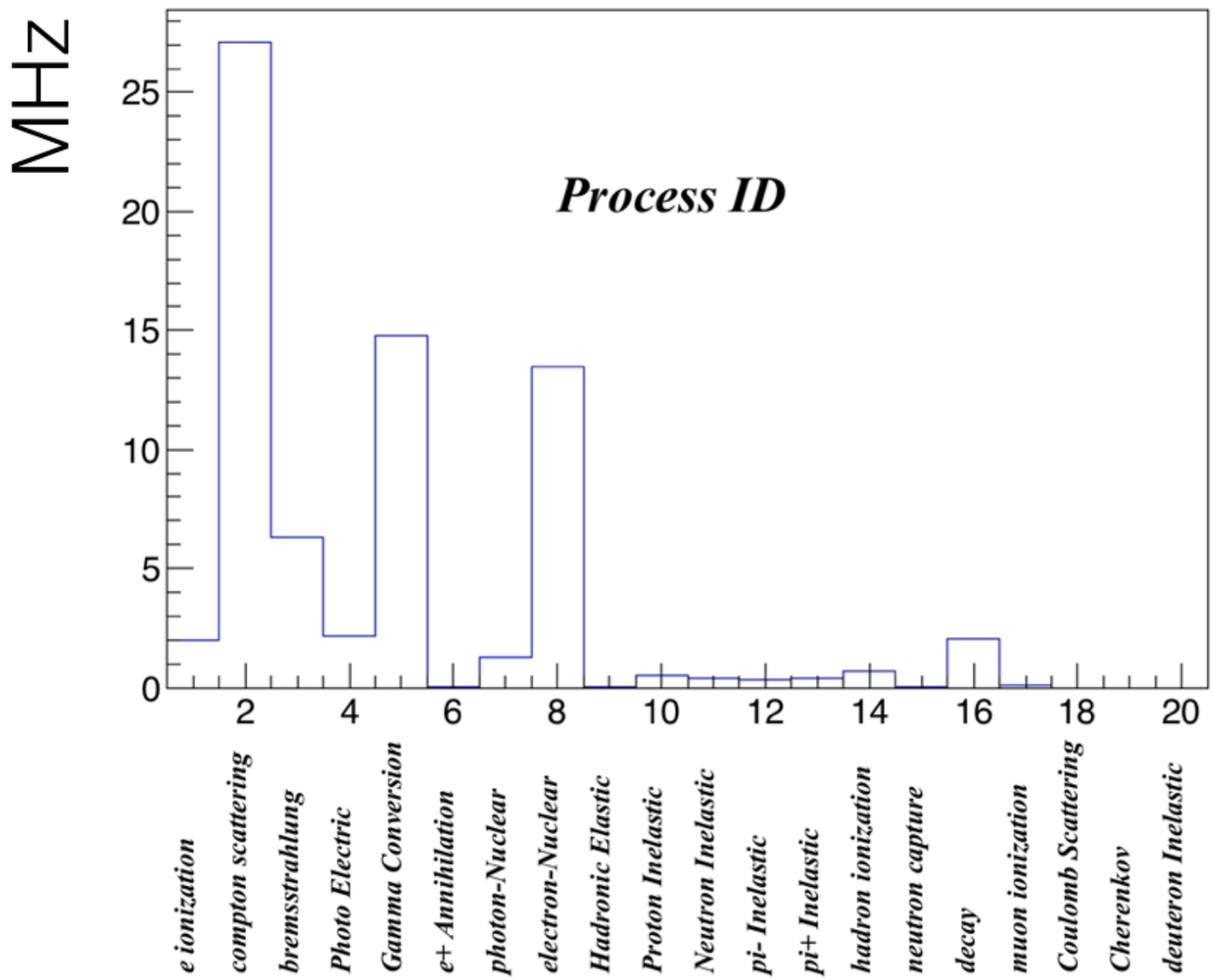
- CAD: objects can be made sensitive at run time.
- Attributes (material, mother volume, position, rotation, touchable ID) can be assigned at run time.
- Mix and match of several factories: TEXT, GDML, CAD

Expanded process catalogue

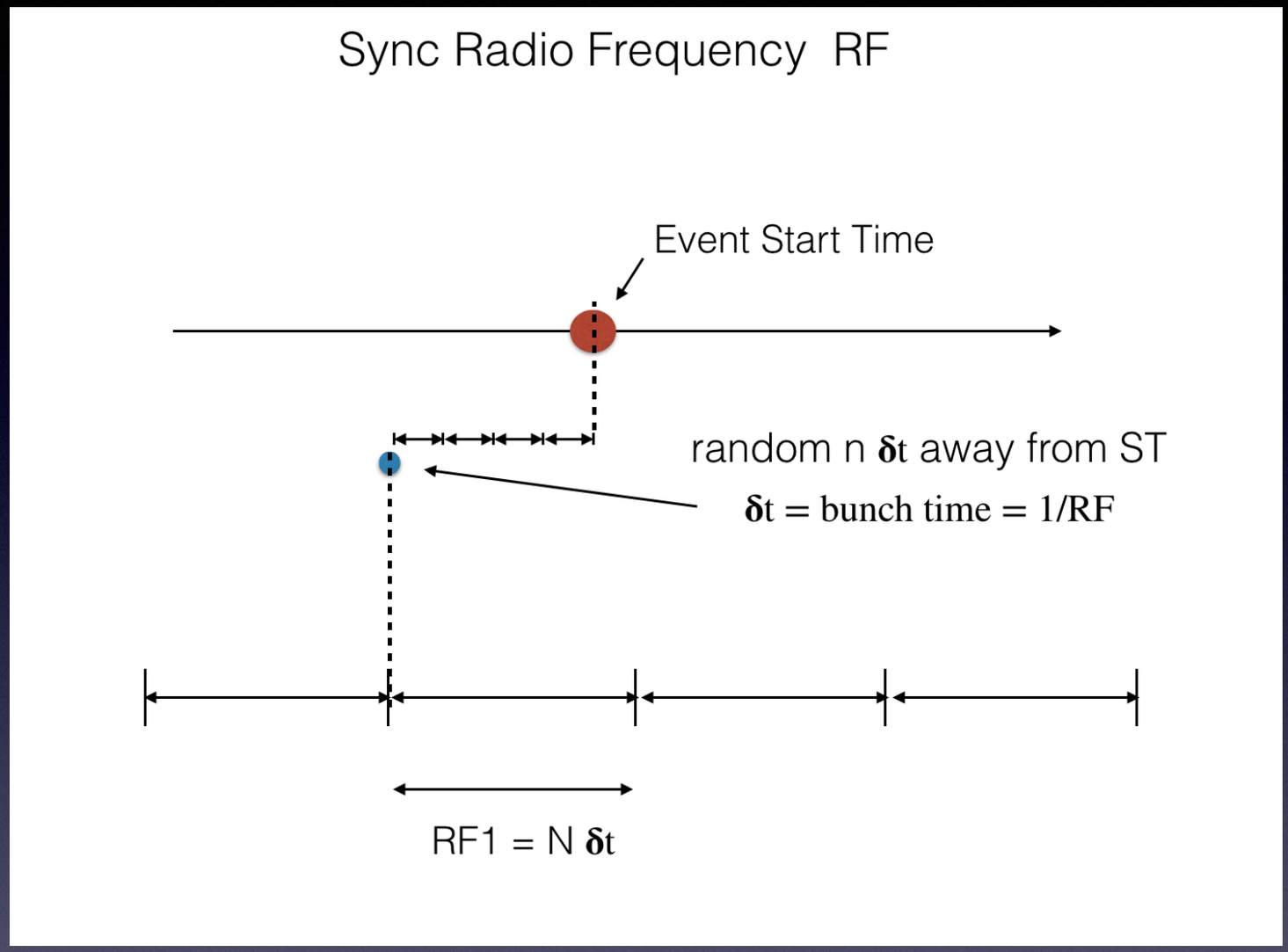
Process Name	ID (int)
e ionization	1
compton scattering	2
e bremsstrahlung	3
Photo Electric Effect	4
Gamma Conversion	5
e+ Annihilation	6
photon-Nuclear	7
electron-Nuclear	8
positron-Nuclear	9
Hadronic Elastic	10
Proton Inelastic	11
Neutron Inelastic	12
pi- Inelastic	13
pi+ Inelastic	14
hadron ionization	15
neutron capture	16
decay	17
muon ionization	18
Coulomb Scattering	19
Cherenkov	20
deuteron Inelastic	21
muPairProd	22
ion ionization	23
hadron pair production	24
triton Inelastic	25
kaon- Inelastic	26
kaon+ Inelastic	27
kaon0 Inelastic	28
kaon0L Inelastic	29
alpha Inelastic	30
lambda Inelastic	31
sigma- Inelastic	32
hadronic bremsstrahlung	33
muon decay With Spin	34
na	90

procID is in the true info output bank

example from beam on target background



RF signals in the output



The option **RFSETUP** is used to control the sync signal.

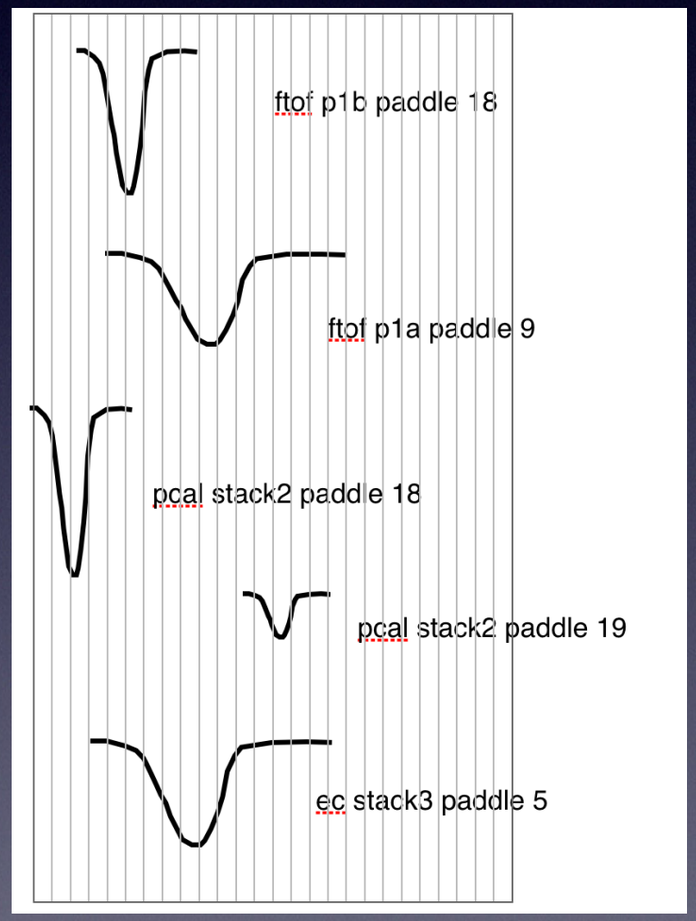
For example, to set the accelerator radio frequency to CEBAF 499MHz (0.499 GHz) and produce two RF signal, 40 ns away from each other, each every 80ns:

```
-RFSETUP="0.499, 80, 40"
```

translation tables, voltage sampling

FADC Output

Output organized by CRATE/SLOT/CHANNEL
Translation table SAME as real experiment



User defined voltage vs time function

Voltage Sampling mode 7

```
<composite data_type="0xf" tag="57602" padding="0" num="19" length="92" ndata="91">
  <comp>
     <format  data_type="0x3" tag="65" length="6" ndata="1">
        c,i,l,N(c,N(s,i,s,s))
     </format>
     <data  tag="66" num="67">
        <row num="1">
           <uint8 count="1"> 0x04  </uint8>
           <uint32 count="1"> 0x00000001  </uint32>
           <uint64 count="1"> 0x0000000000000001  </uint64>
           <repeat  n="4">
              <paren>
                 <uint8 count="1"> 0x03  </uint8>
                 <repeat  n="1">
                    <paren>
                       <uint16 count="1"> 0x0002  </uint16>
                       <uint32 count="1"> 0x00000003  </uint32>
                       <uint16 count="1"> 0x0004  </uint16>
                       <uint16 count="1"> 0x0005  </uint16>
                    </paren>
                 </repeat>
              </paren>
              <paren>
                 <uint8 count="1"> 0x04  </uint8>
                 <repeat  n="1">
                    <paren>
                       <uint16 count="1"> 0x0002  </uint16>
                       <uint32 count="1"> 0x00000003  </uint32>
                       <uint16 count="1"> 0x0004  </uint16>
                       <uint16 count="1"> 0x0005  </uint16>
                    </paren>
                 </repeat>
              </paren>
```

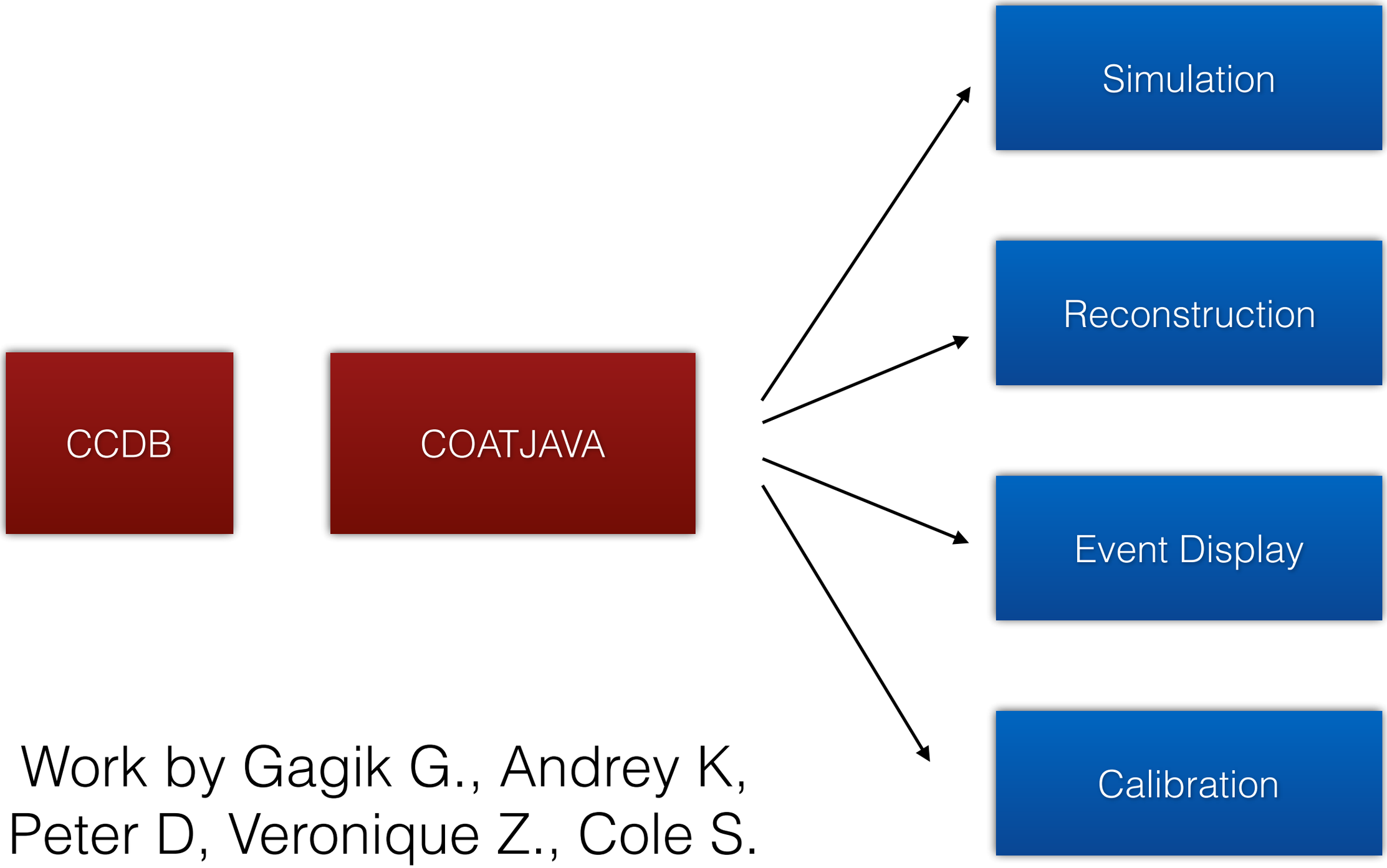
crate number

slot

channels

output indistinguishable from real data

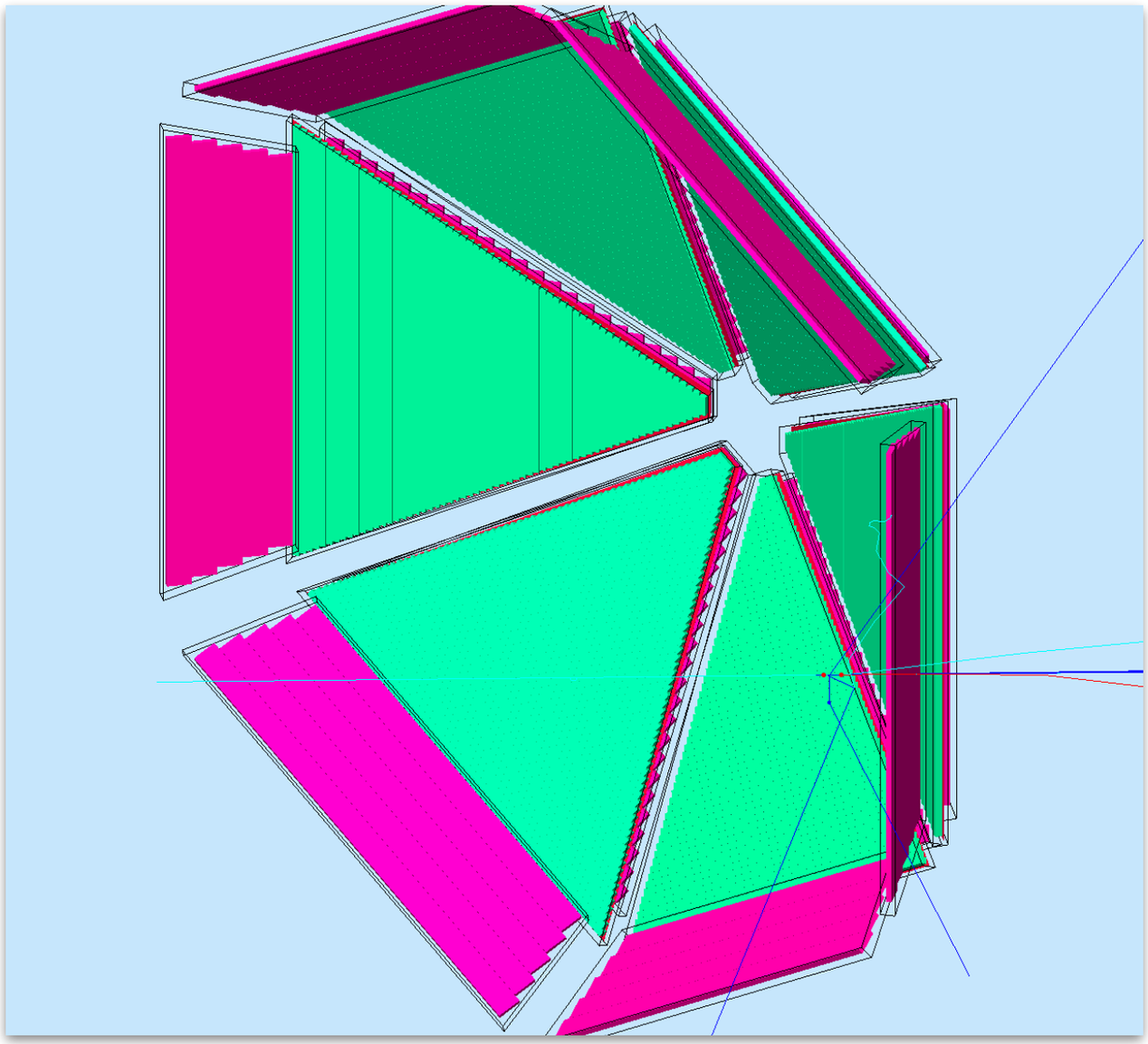
Coatjava/CCDB geometries



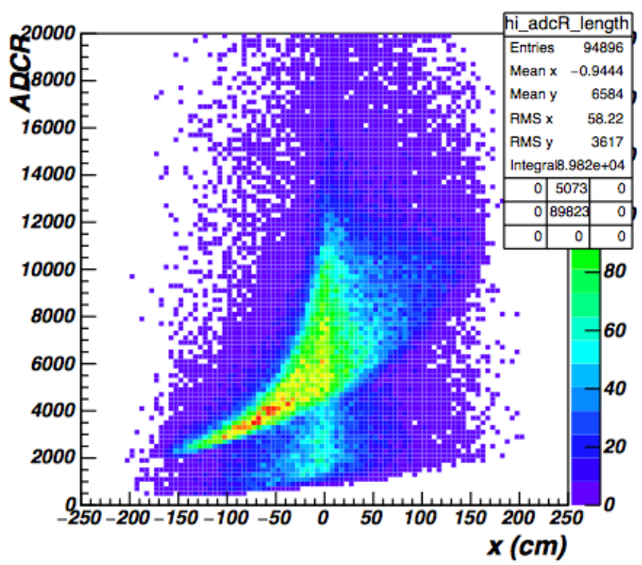
Work by Gagik G., Andrey K,
Peter D, Veronique Z., Cole S.

Coatjava geometries

	Geometry	Digitization
FTOF	Andrey/Dan	Dan/Raffa/Mauri

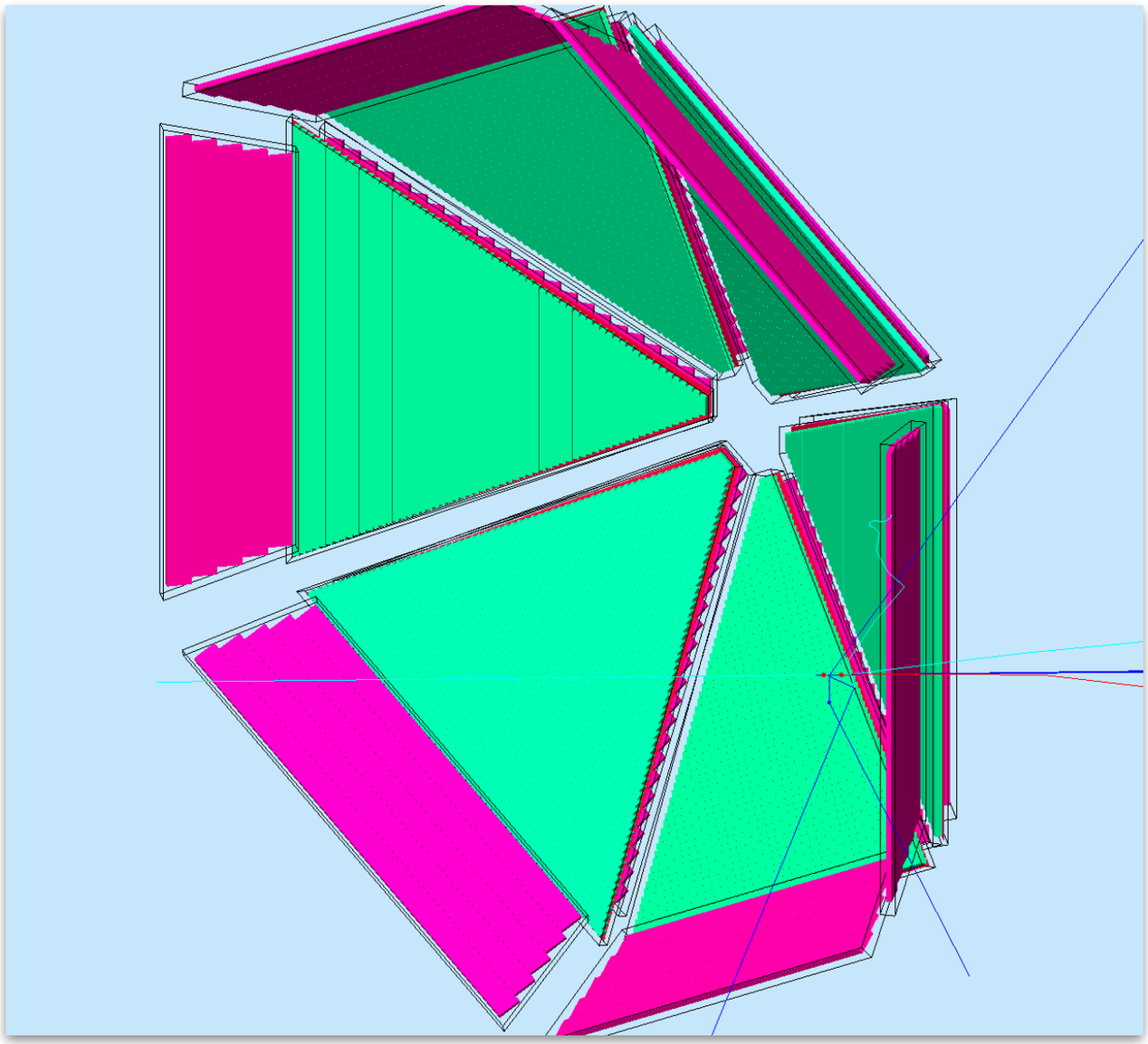


- CCDB Calibration Constants
- Attenuation length
- Effective Velocity
- Time Walk
- Smeared / Un-smeared output
- Status



Coatjava geometries

	Geometry	Digitization
FTOF	Andrey/Dan	Dan/Raffa/Mauri



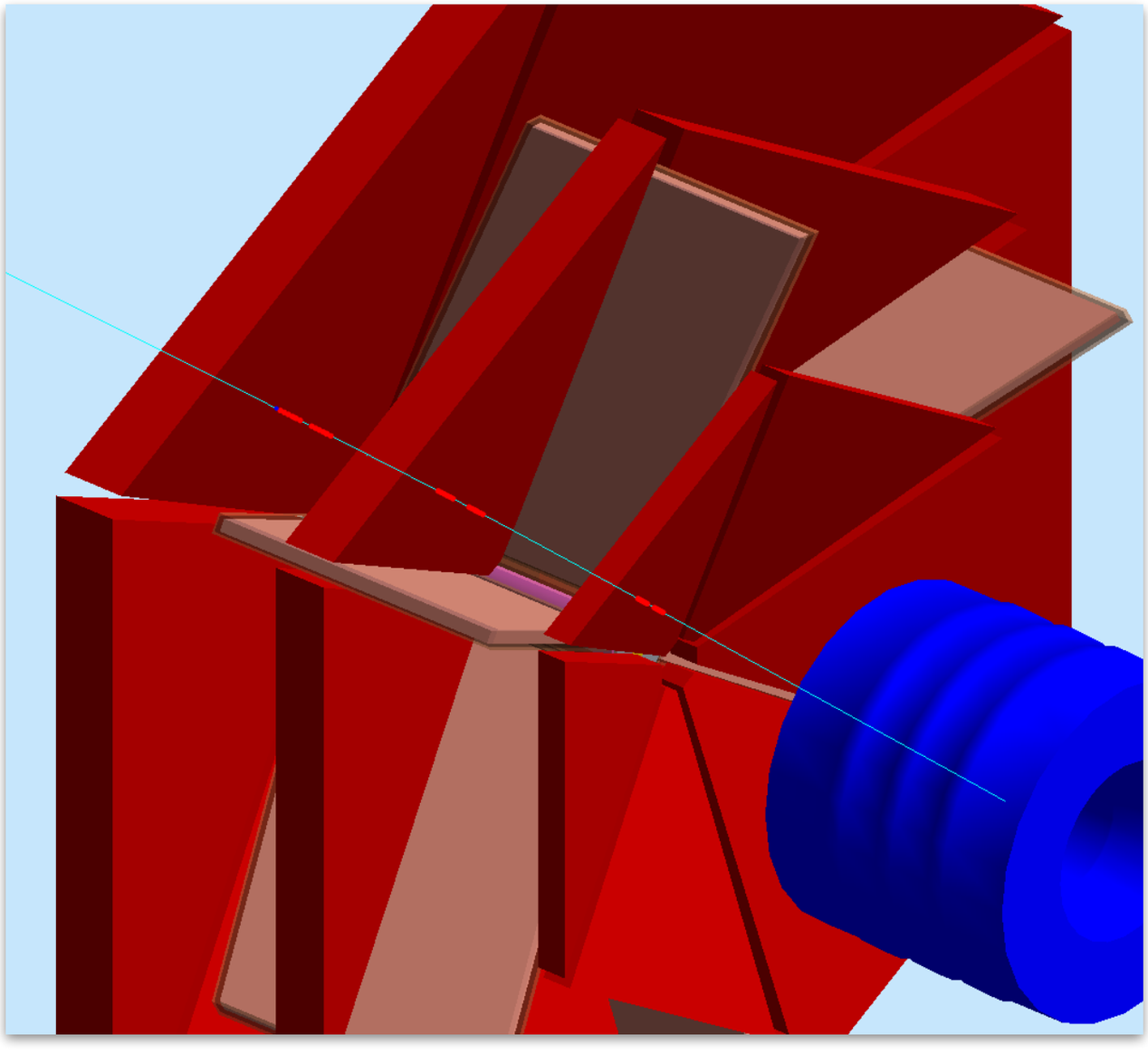
- CCDB Calibration Constants
- Attenuation length
- Effective Velocity
- Time Walk
- Smeared / Un-smeared output
- Status

TODO:

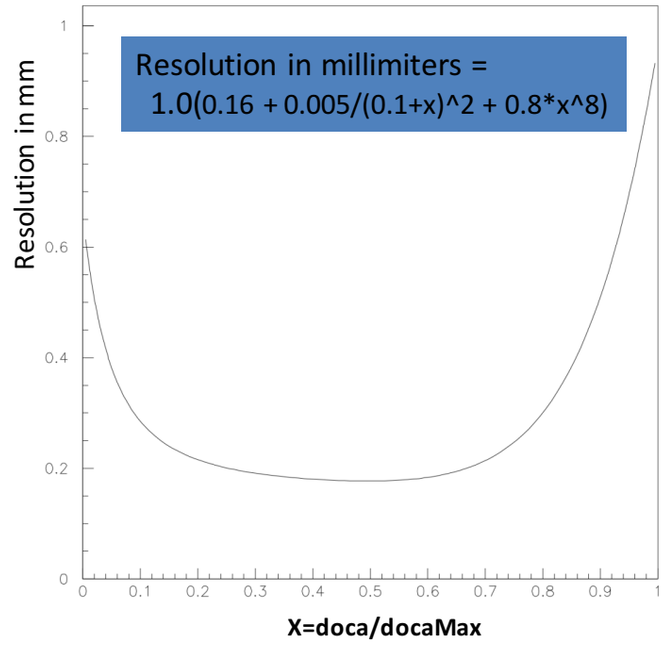
- smear quantities for calibration challenge (example: paddle to paddle timing)

Coatjava geometries

	Geometry	Digitization
DC	Andrey/Mac	Mac/Veronique/Krishna/ Mauri

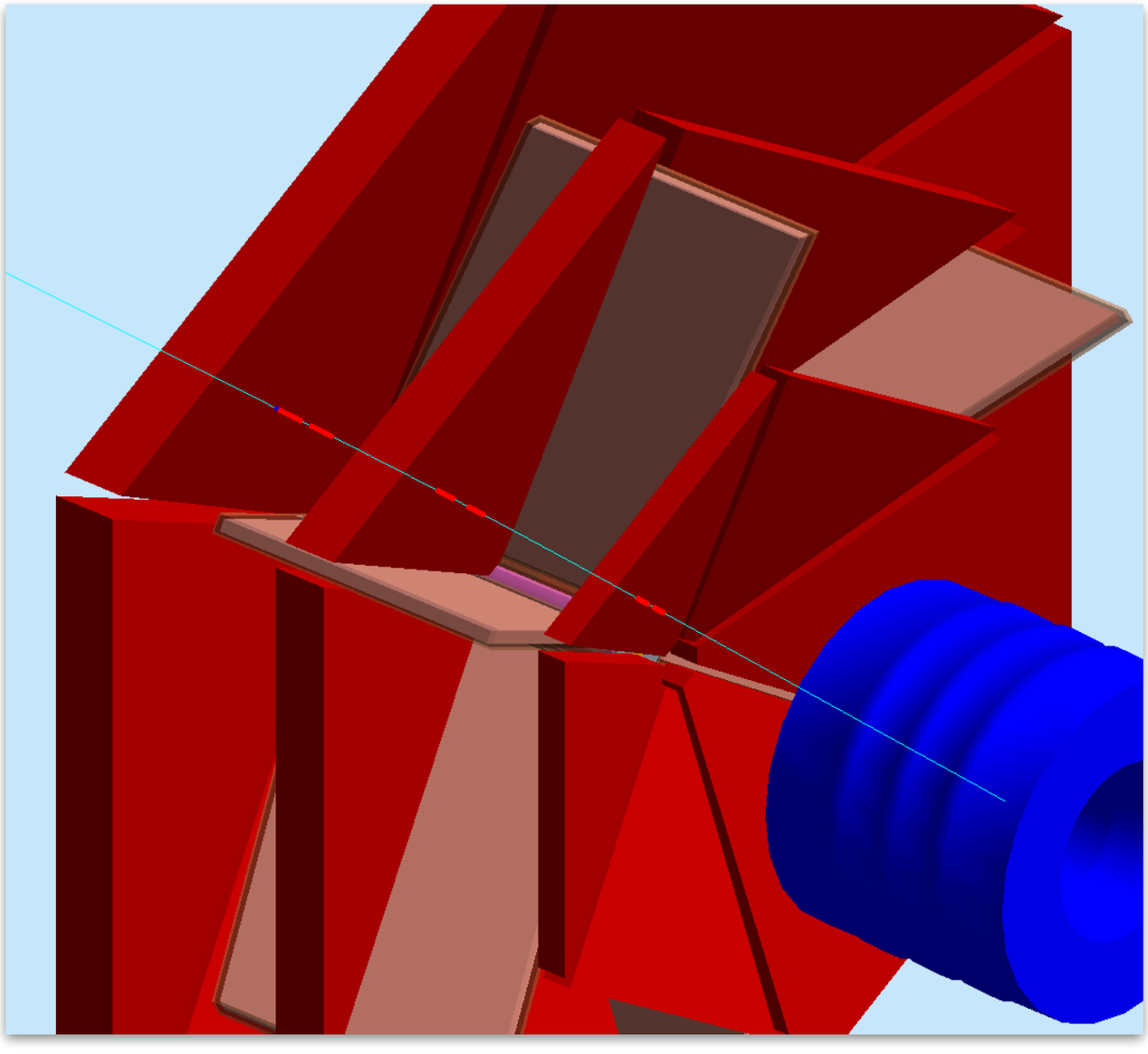


- CCDB Calibration Constants
- Intrinsic inefficiency
- Resolution
- Drift Velocity
- DOCA



Coatjava geometries

	Geometry	Digitization
DC	Andrey/Mac	Mac/Veronique/Krishna/ Mauri



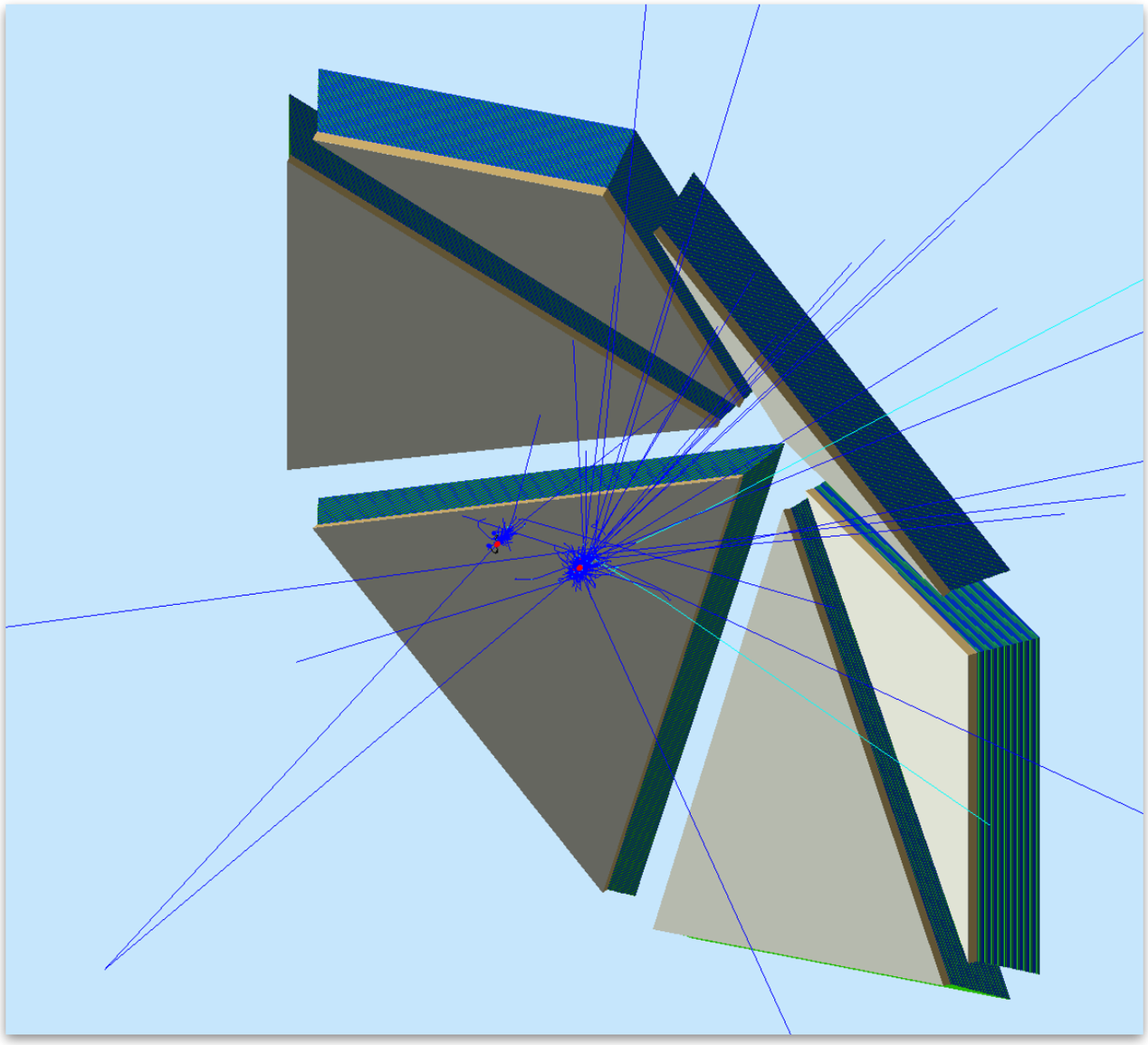
- CCDB Calibration Constants
- Intrinsic inefficiency
- Resolution
- Drift Velocity
- DOCA

TODO:

- smear quantities for calibration challenge (example: paddle to paddle timing)
- time to distance function(**θ, field**)

Coatjava geometries

	Geometry	Digitization
EC	Andrey/Cole	Jerry/Cole/Mauri

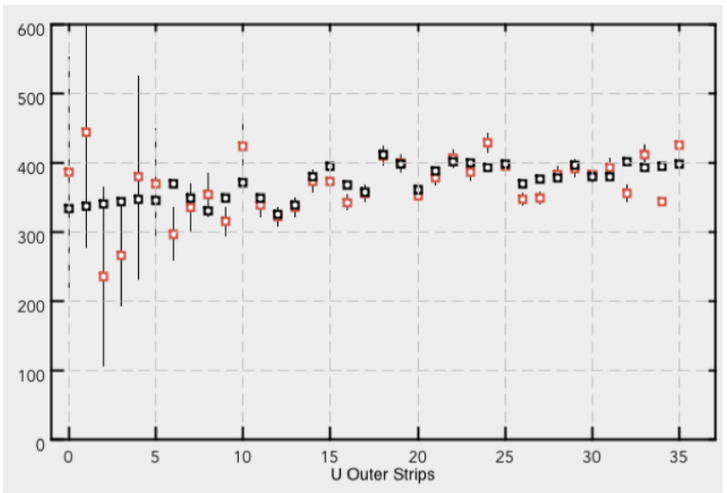


pi0 event in EC

- CCDB Calibration Constants
- Translation Table
- Effective Velocity
- Attenuation Length
- Voltage (time)
- All strips volumes

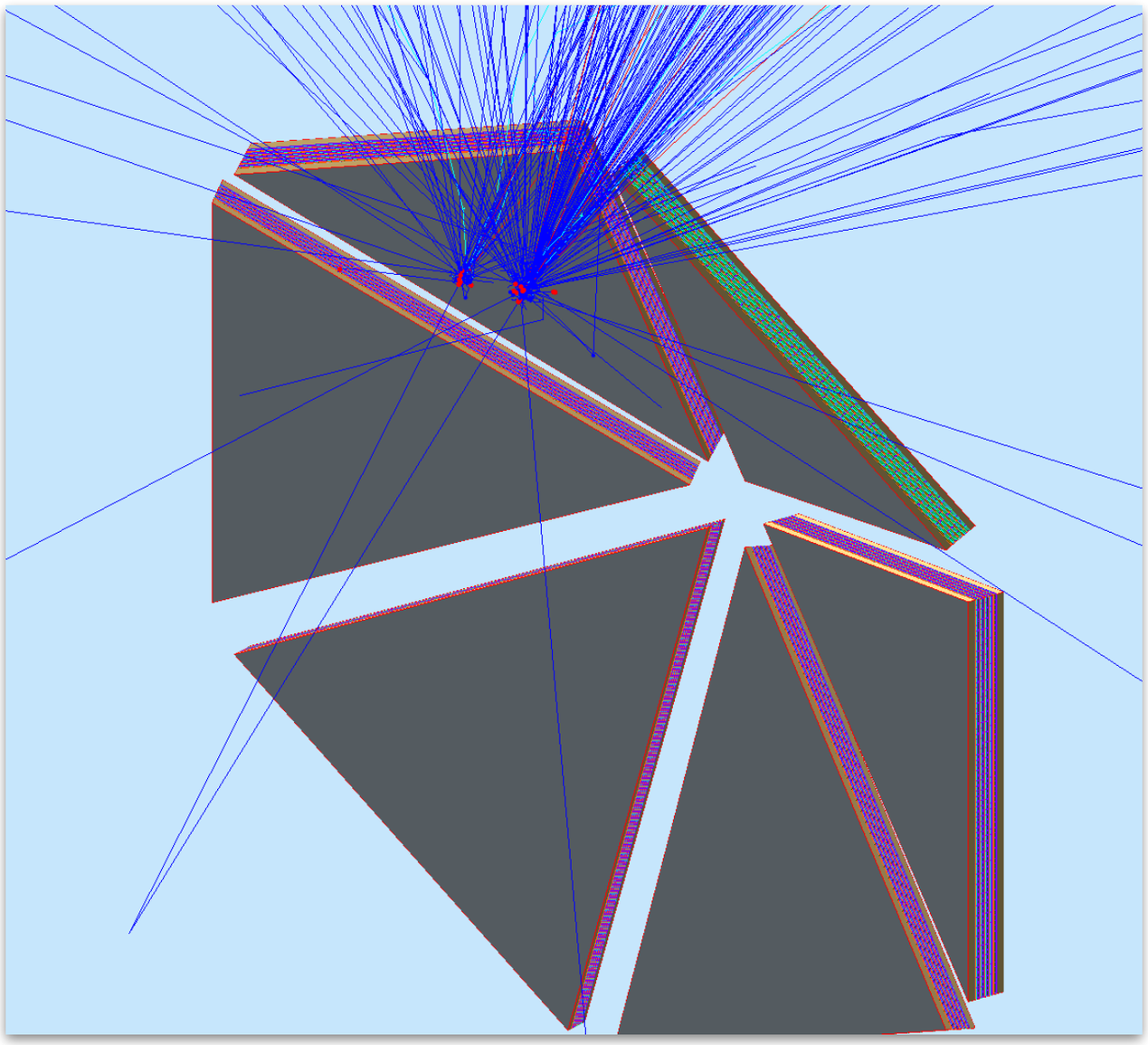
GEMC attenuation

ECMon fit to simulated data



Coatjava geometries

	Geometry	Digitization
PCAL	Andrey/Cole	Jerry/Cole/Mauri



pi0 event in PCAL

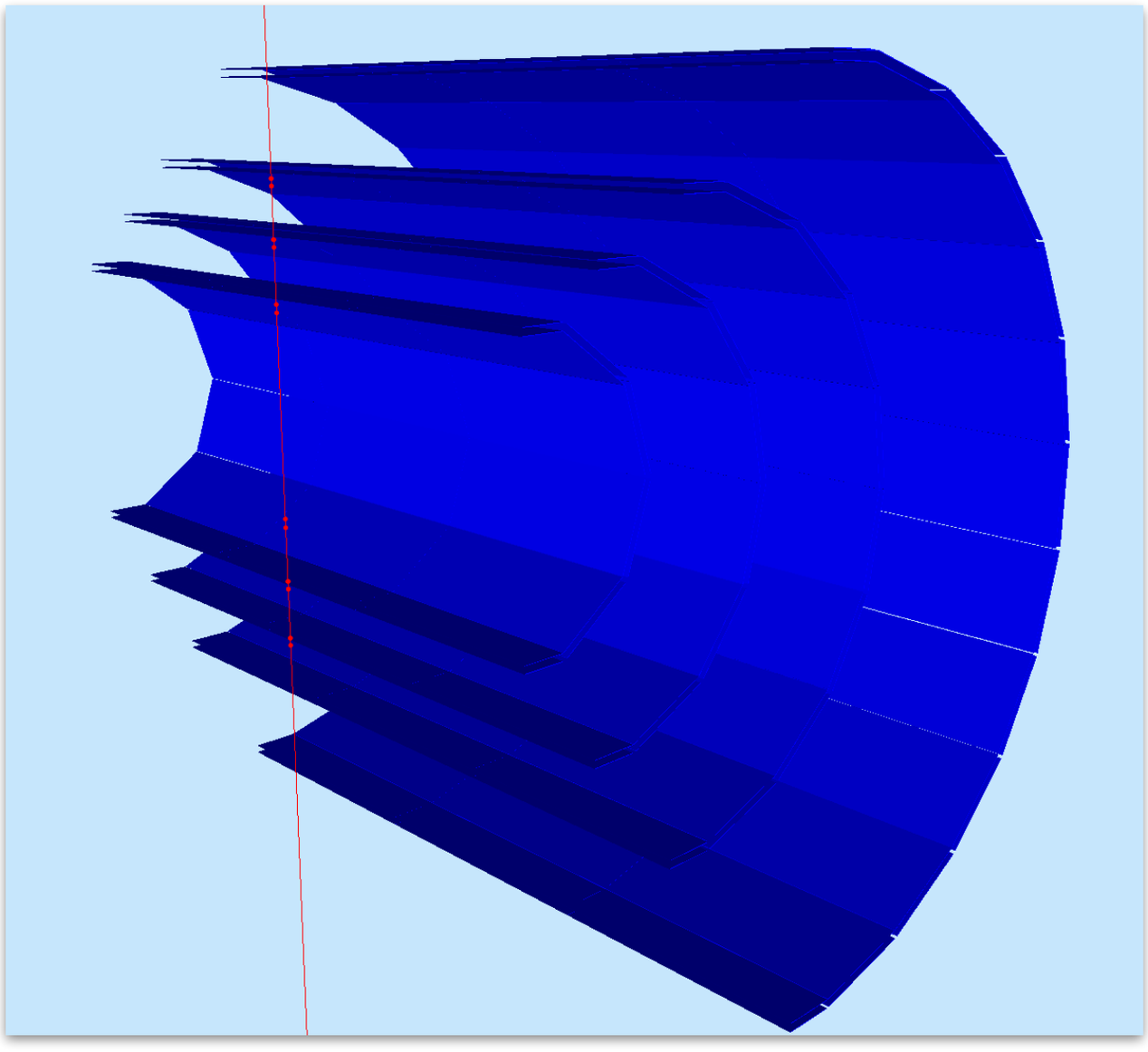
- CCDB Calibration Constants
- Translation Table
- Effective Velocity
- Attenuation Length
- Voltage (time)
- All strips volumes

TODO:

- finalize geometry details
- smear quantities for calibration challenge (example: charge to ADC constants)

Coatjava geometries

	Geometry	Digitization
BST	Peter	Veronique/Peter/Yuri/Mauri



- No CCDB yet
- Energy Sharing between strips
- 3 bit ADC

TODO:

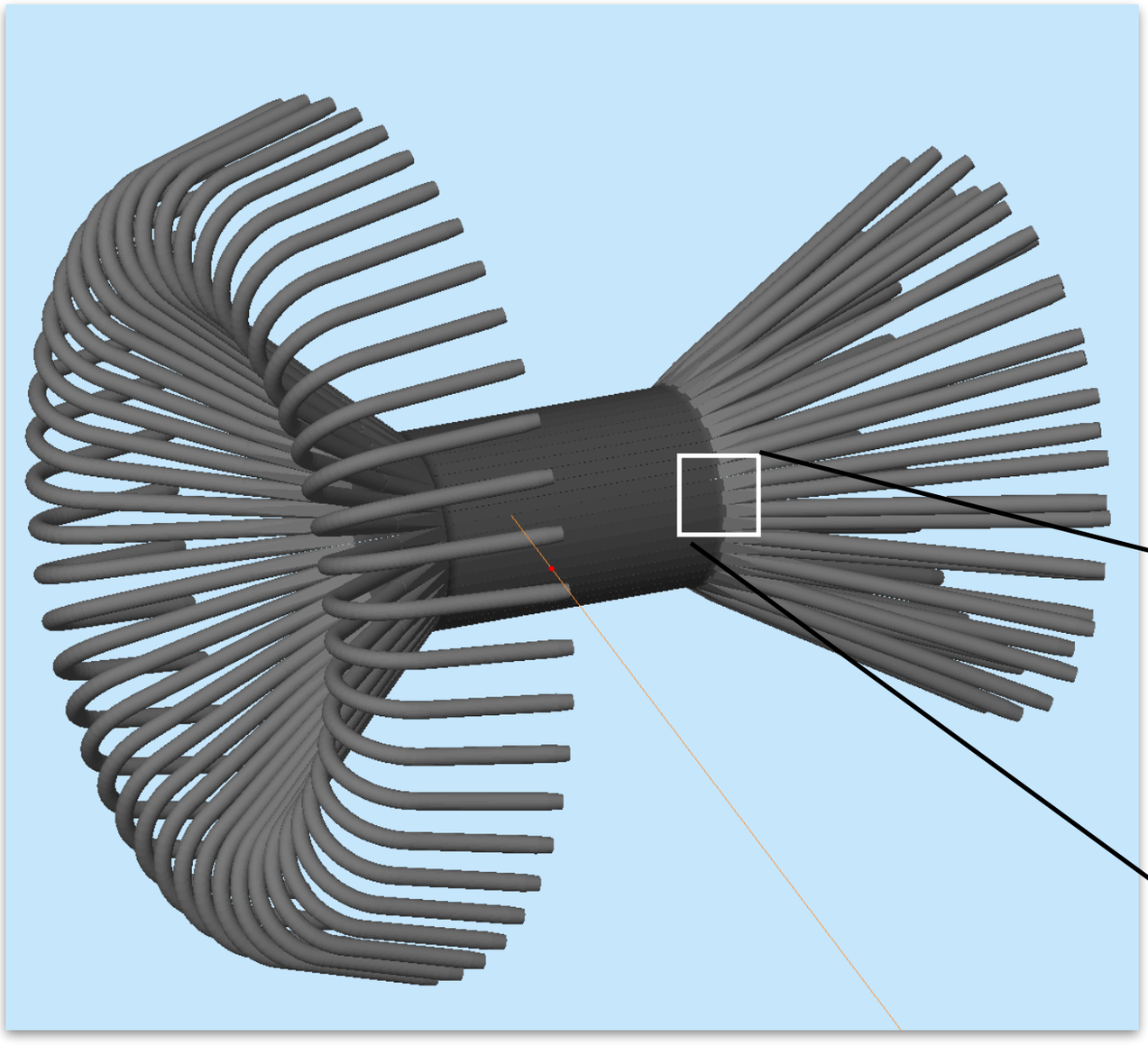
- CCDB constants
- finalize geometry (add passive materials)

CAD geometries

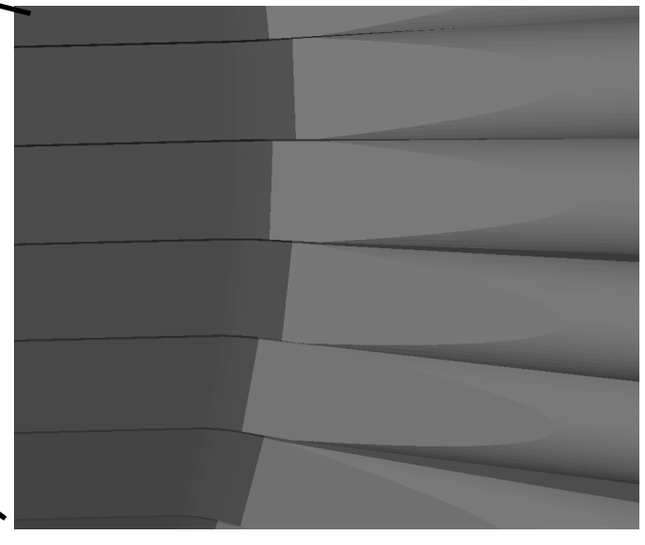
Work by Andrey Kim

CAD geometries

	Geometry	Digitization
CTOF	JLAB ENG	Dan/Raffa/Mauri

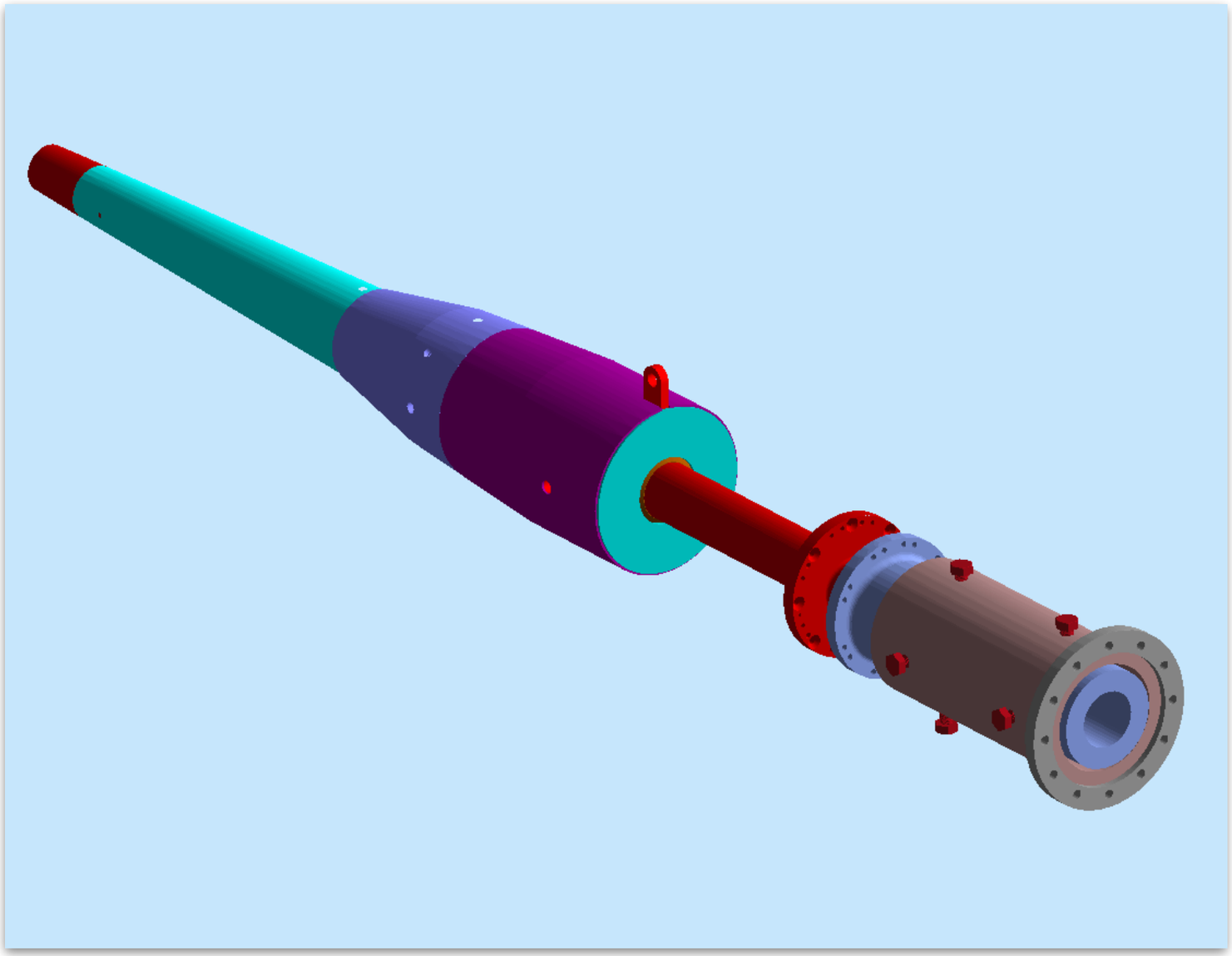


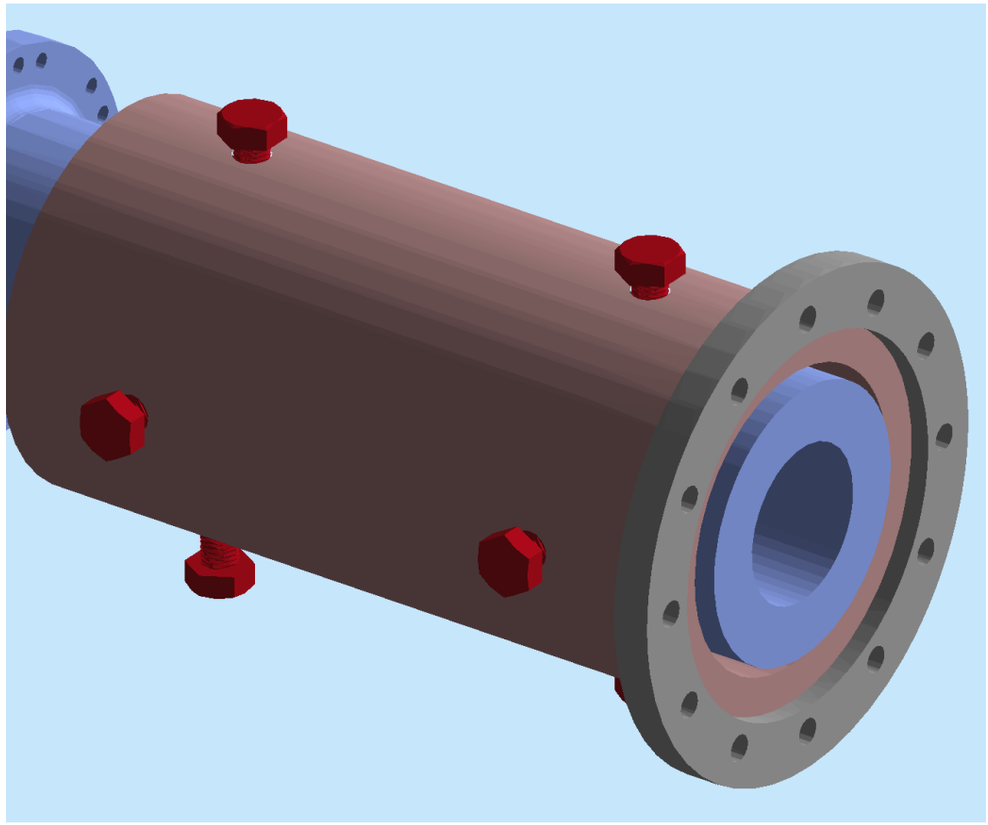
- CCDB Calibration Constants
- Attenuation length
- Effective Velocity
- Time Walk
- Smeared / Unsmeared output
- Gain Balance
- Paddles, light guides from CAD



CAD geometries

	Geometry	Digitization
Beam line	JLAB ENG	



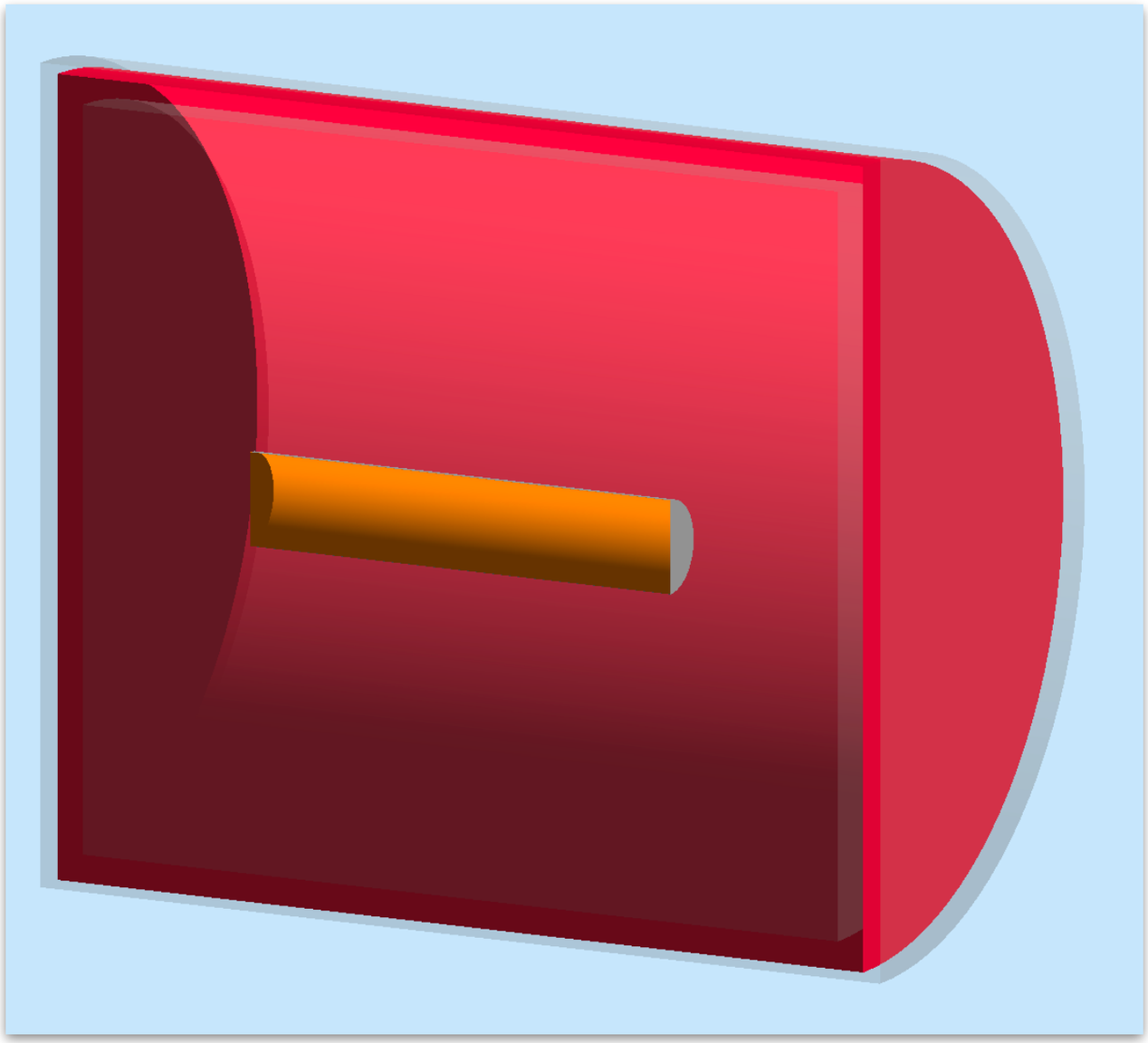


Coatjava / CAD geometries

	Geometry	**Digitization**
FTOF	Andrey/Dan	Dan/Raffa/Mauri
DC	Andrey/Mac	Mac/Veronique/Krishna/ Mauri
EC	Andrey/Cole	Jerry/Cole/Mauri
PCAL	Andrey/Cole	Jerry/Cole/Mauri
BST	Peter	Veronique/Peter/Yuri/Mauri
CTOF	JLAB ENG	Dan/Raffa/Mauri
Beam line	JLAB ENG	

TEXT geometries

	Geometry	Digitization
Targets	Mauri/Raffa/Angela	



- 3 variations: LH2, LD2, ND3

LH2:

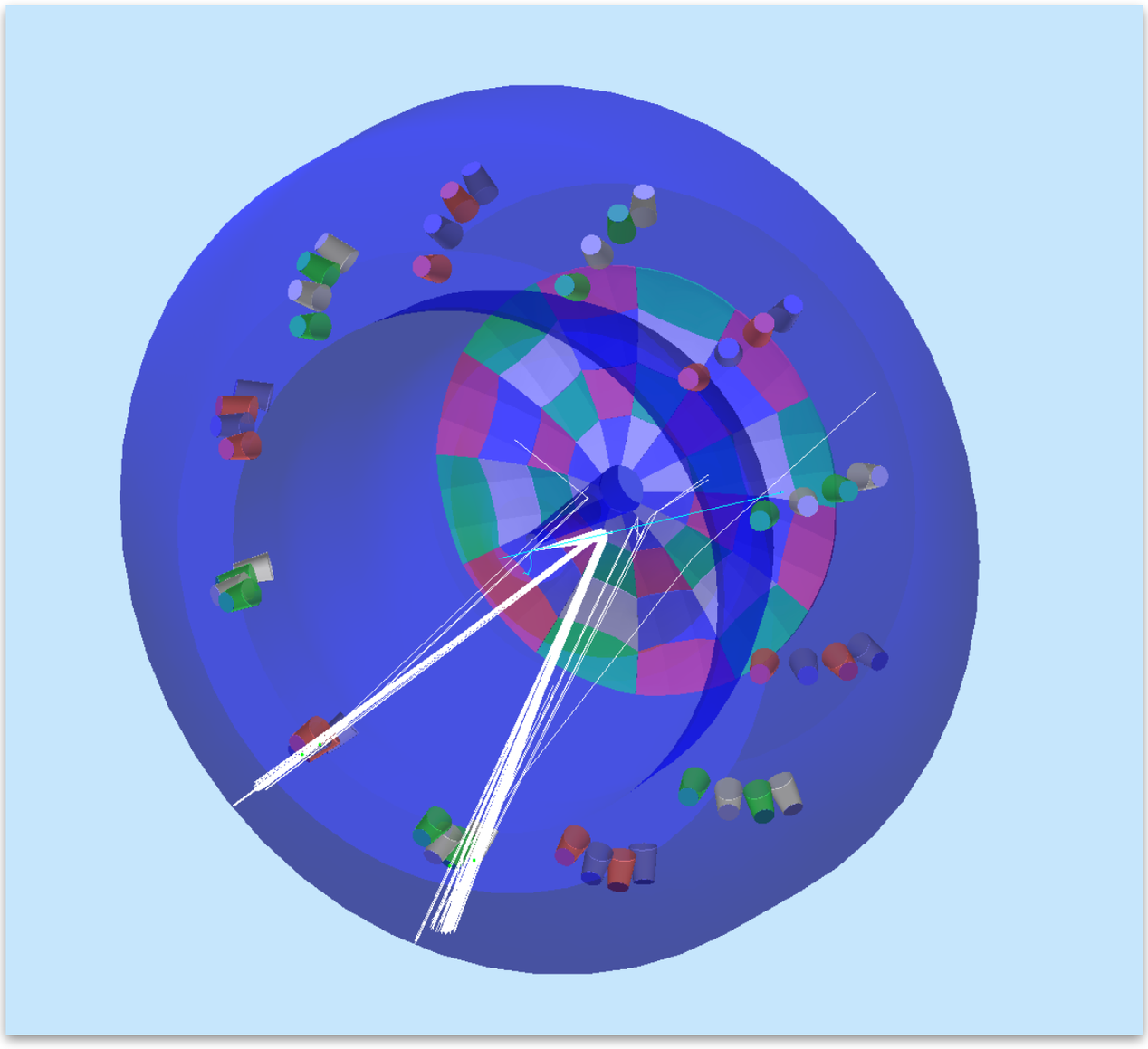
- 5cm long, 5mm radius LH2
- in aluminum cell, 30 microns thick
- vacuum + rohacell scattering chamber

TODO:

- realistic geometry (CAD?)

TEXT geometries

	Geometry	**Digitization**
HTCC	Nathan/Andrew/Nick/ Mauri	Nathan/Andrew/Nick/ Mauri



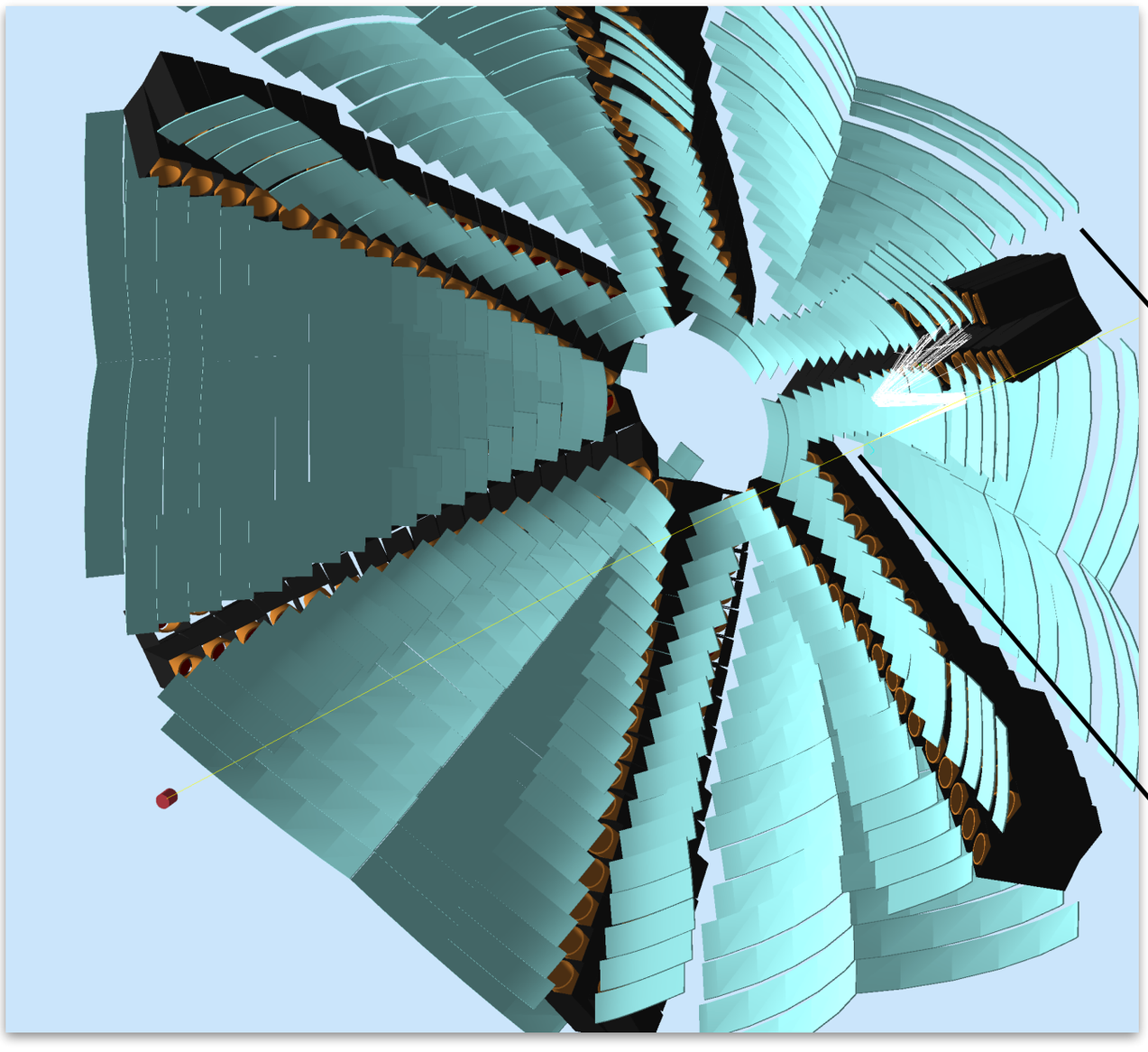
- CO2 Refractive index, transparency
- Mirrors, WC reflectivity comes from actual measurements
- PMT q.e. function
- Output: NPHE, time.

TODO:

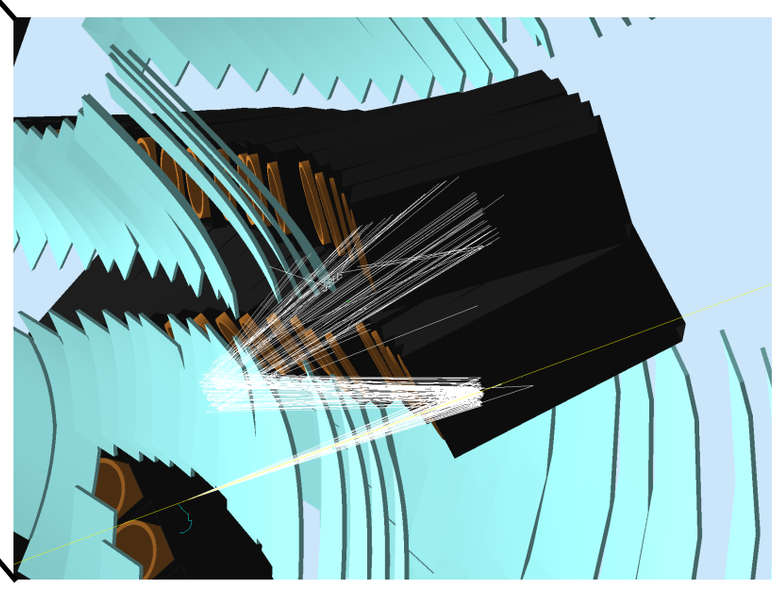
- geometry in COATJAVA (next on Andrey agenda)
- tweak response function
- BOX: from CAD?
- CCDB constants

TEXT geometries

	Geometry	Digitization
LTCC	Temple/Mauri/Vlassov	Temple/Mauri

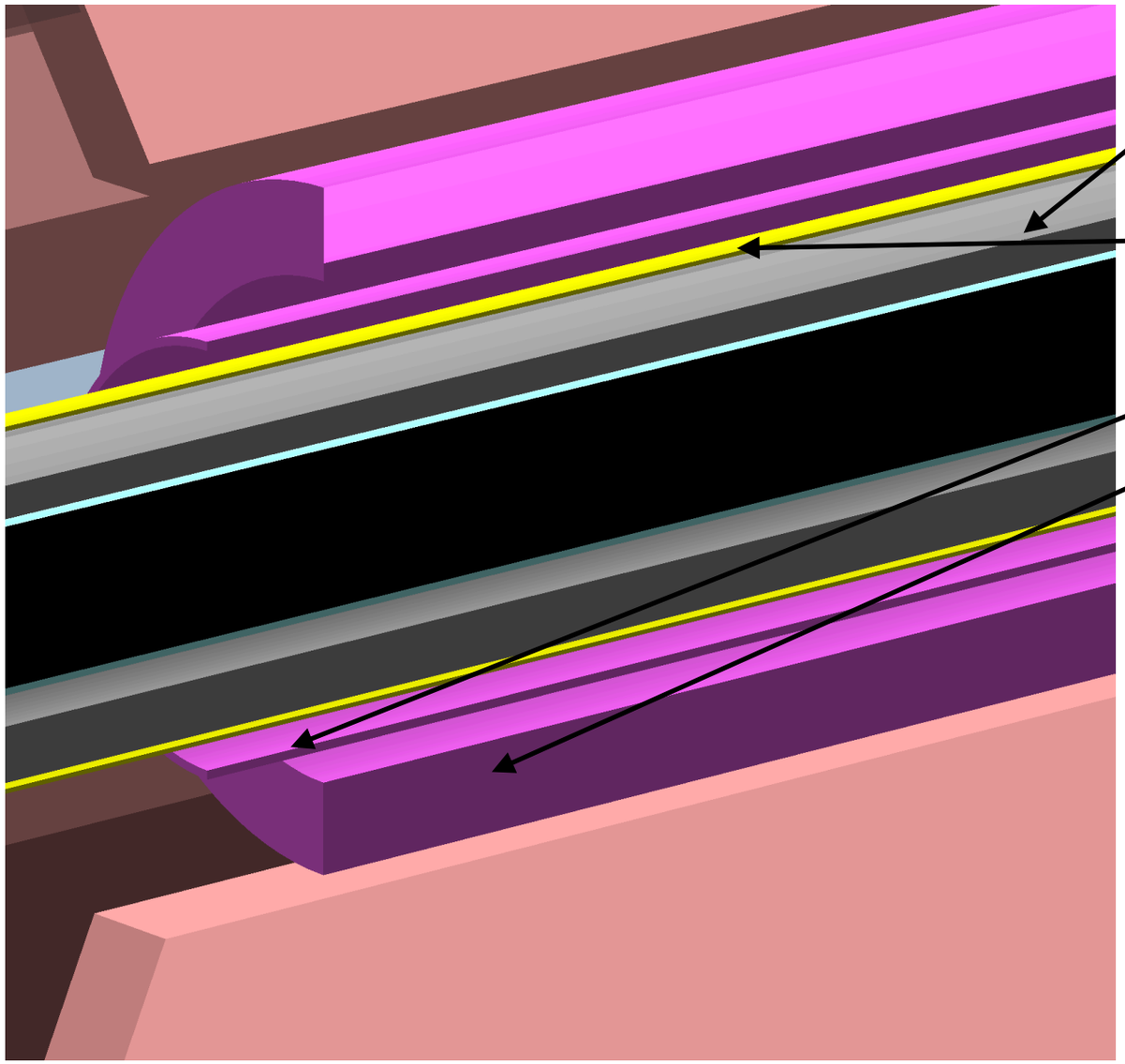


- C4F10 Refractive index, transparency
- Mirrors, WC reflectivity comes from actual measurements
- PMT q.e. function
- Output: NPHE, time.

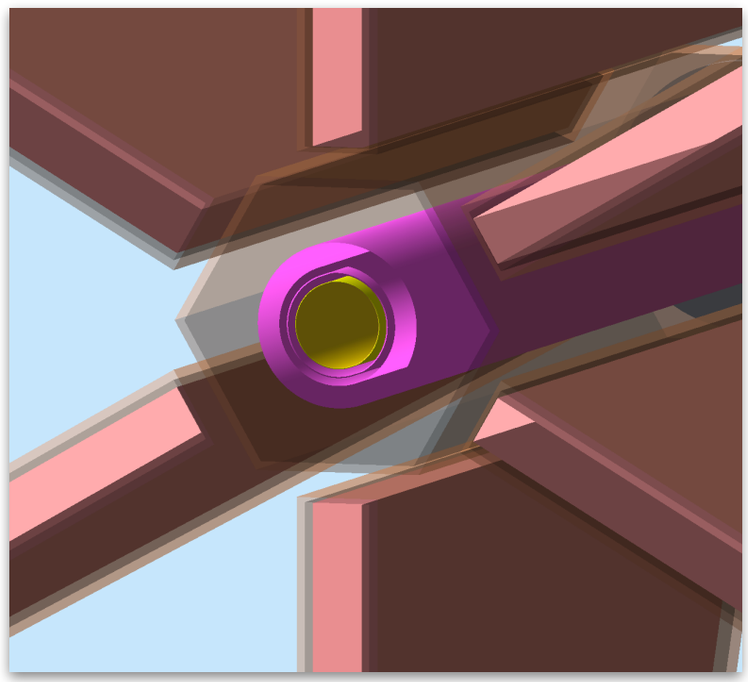


TEXT geometries

	Geometry	Digitization
Torus	Mauri/JLab Eng	

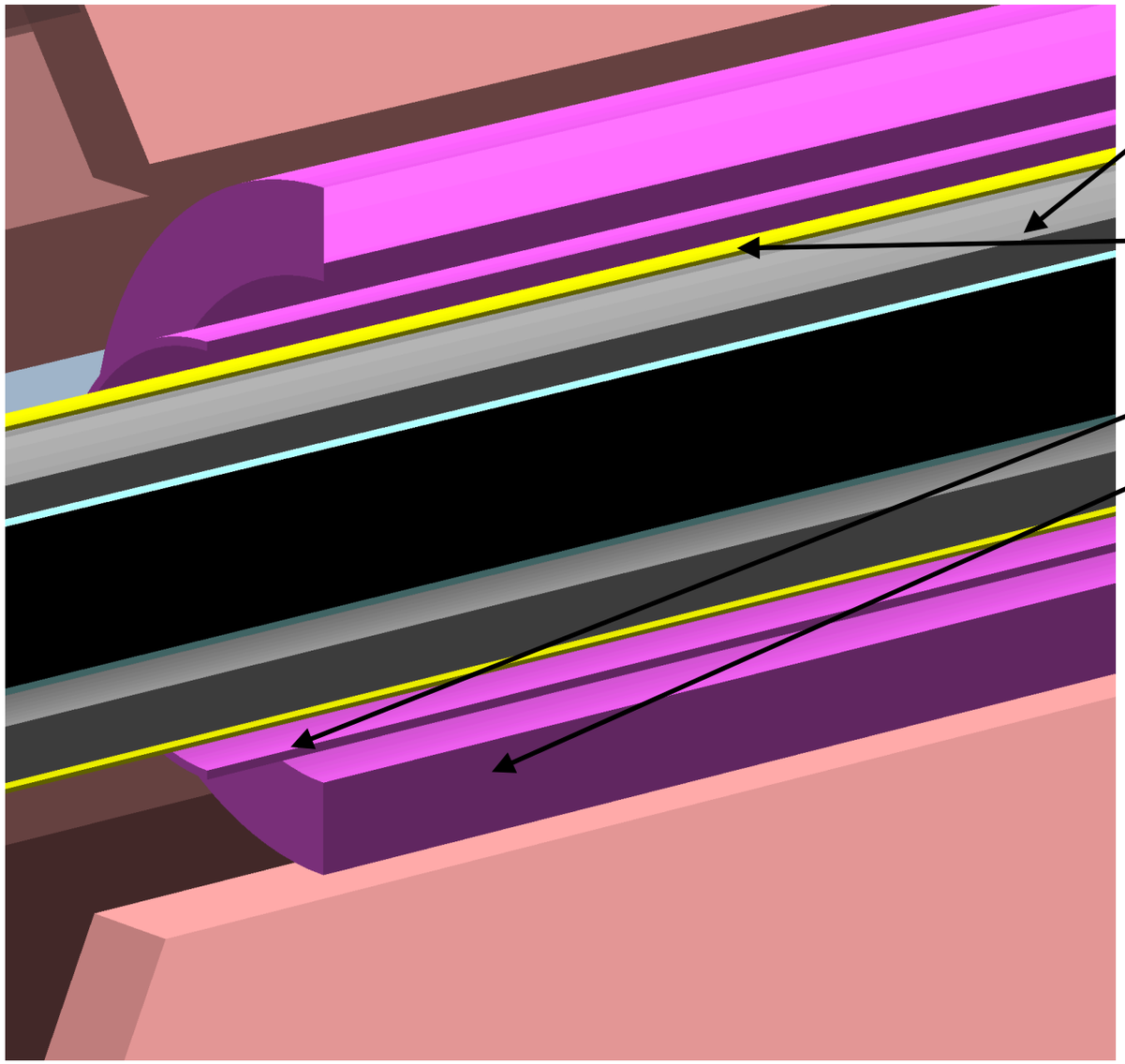


- W shield around AL beampipe inside torus, 2cm, 12 cm OD
- 2mm inner steel pipe, 3mm outer pipe to support W shield
- Torus Warm Bore
- Torus Warm Bore Shield
- Torus Cold Hub
- Steel frame around coils



TEXT geometries

	Geometry	Digitization
Torus	Mauri/JLab Eng	



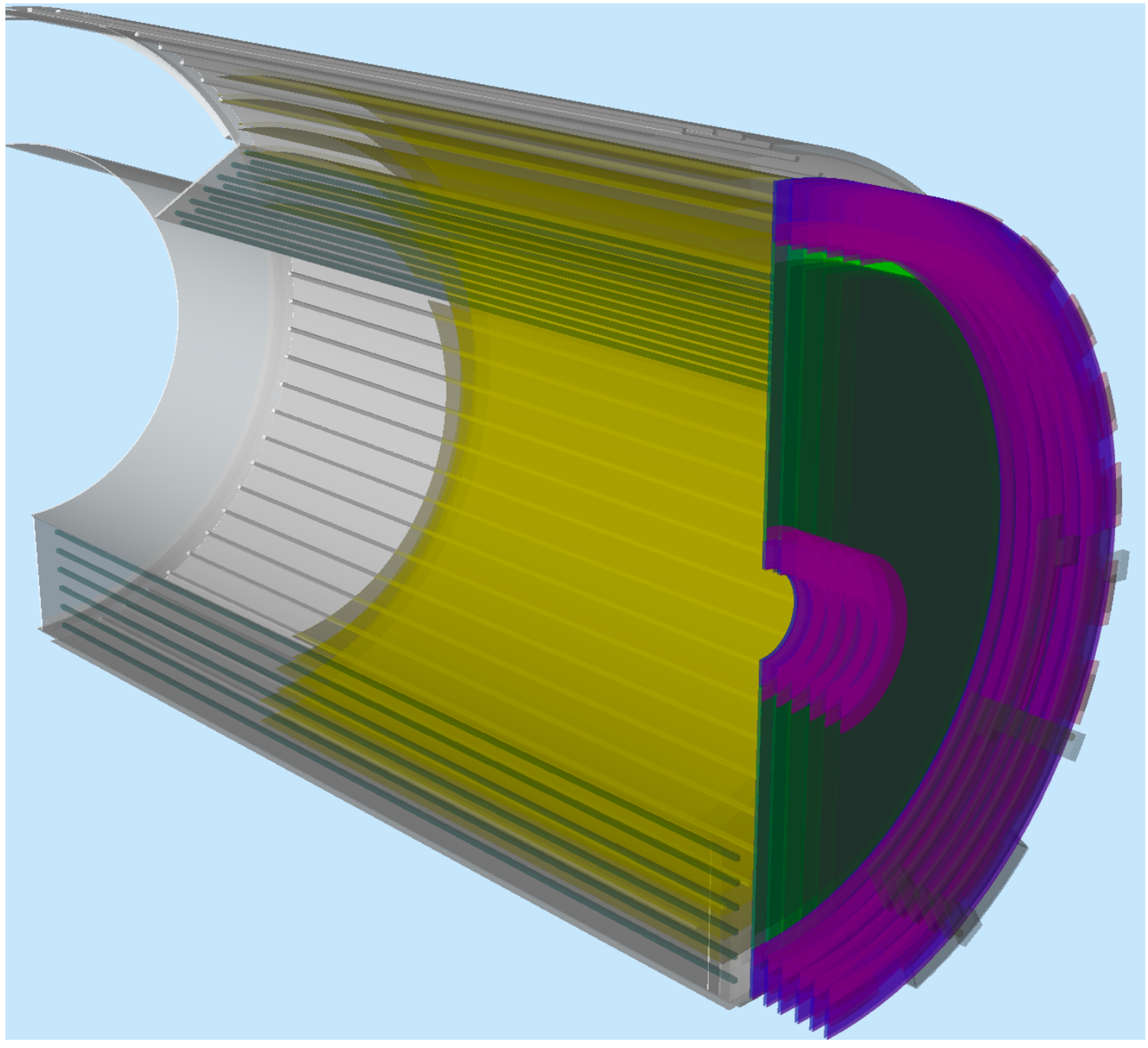
- W shield around AL beampipe inside torus, 2cm, 12 cm OD
- 2mm inner steel pipe, 3mm outer pipe to support W shield
- Torus Warm Bore
- Torus Warm Bore Shield
- Torus Cold Hub
- Steel frame around coils

TODO:

- torus, solenoid geometries from CAD engineering

TEXT geometries

	Geometry	**Digitization**
Micromegas	Michel/Sebastien/ Veronique/Mauri	Veronique/Mauri/Saclay



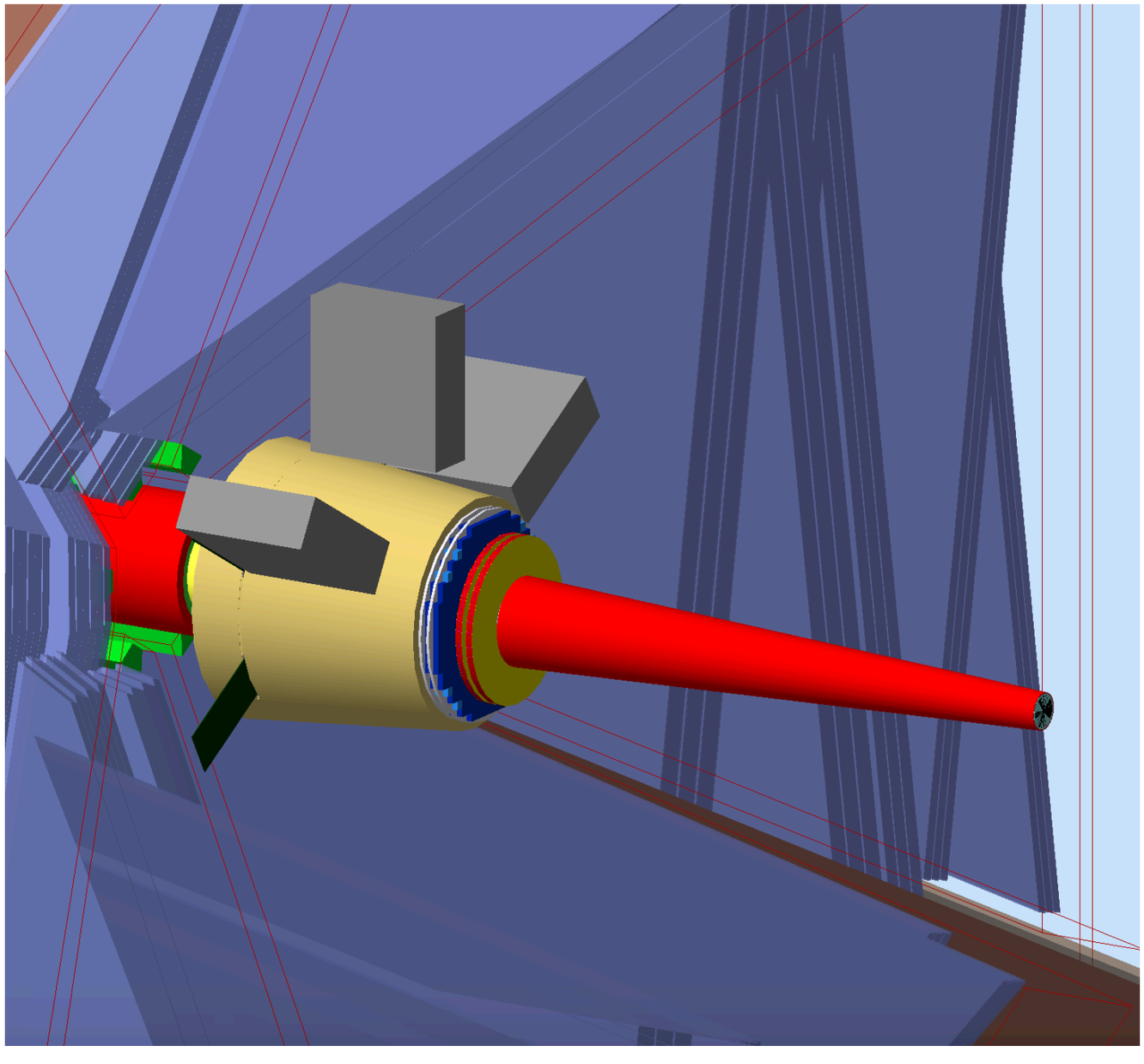
- "original" variation
- "michel" variation, much more realistic
- Lorentz angle from solenoid actual value.
- Energy sharing

TODO:

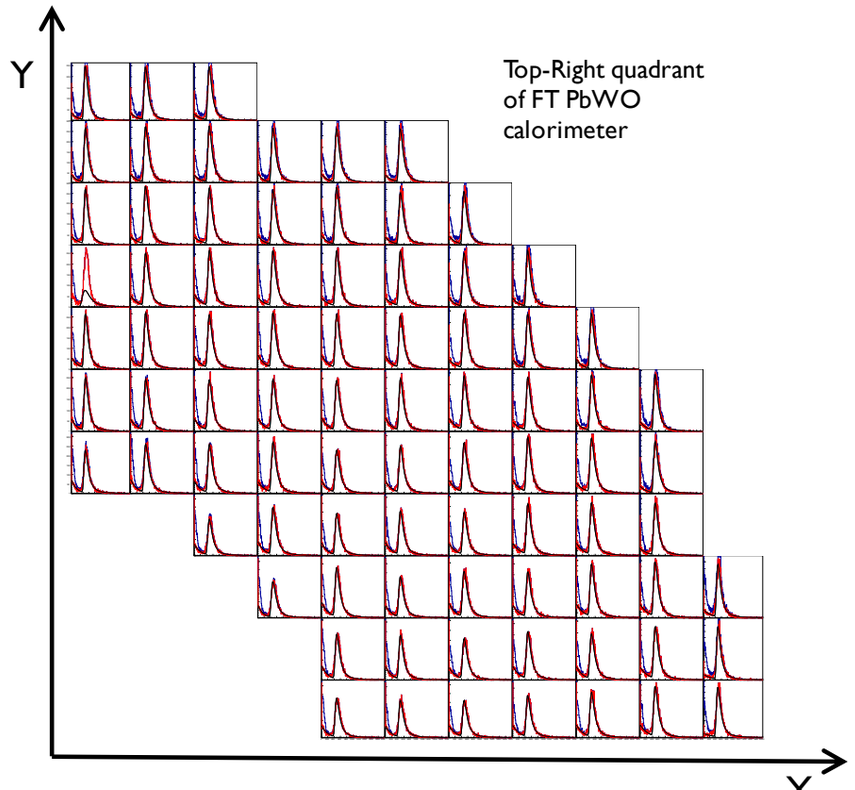
- improve digitization
- CCDB constants

TEXT geometries

	Geometry	Digitization
Forward Tagger	INFN Genoa (Raffa De Vita)	INFN Genoa (Raffa De Vita)



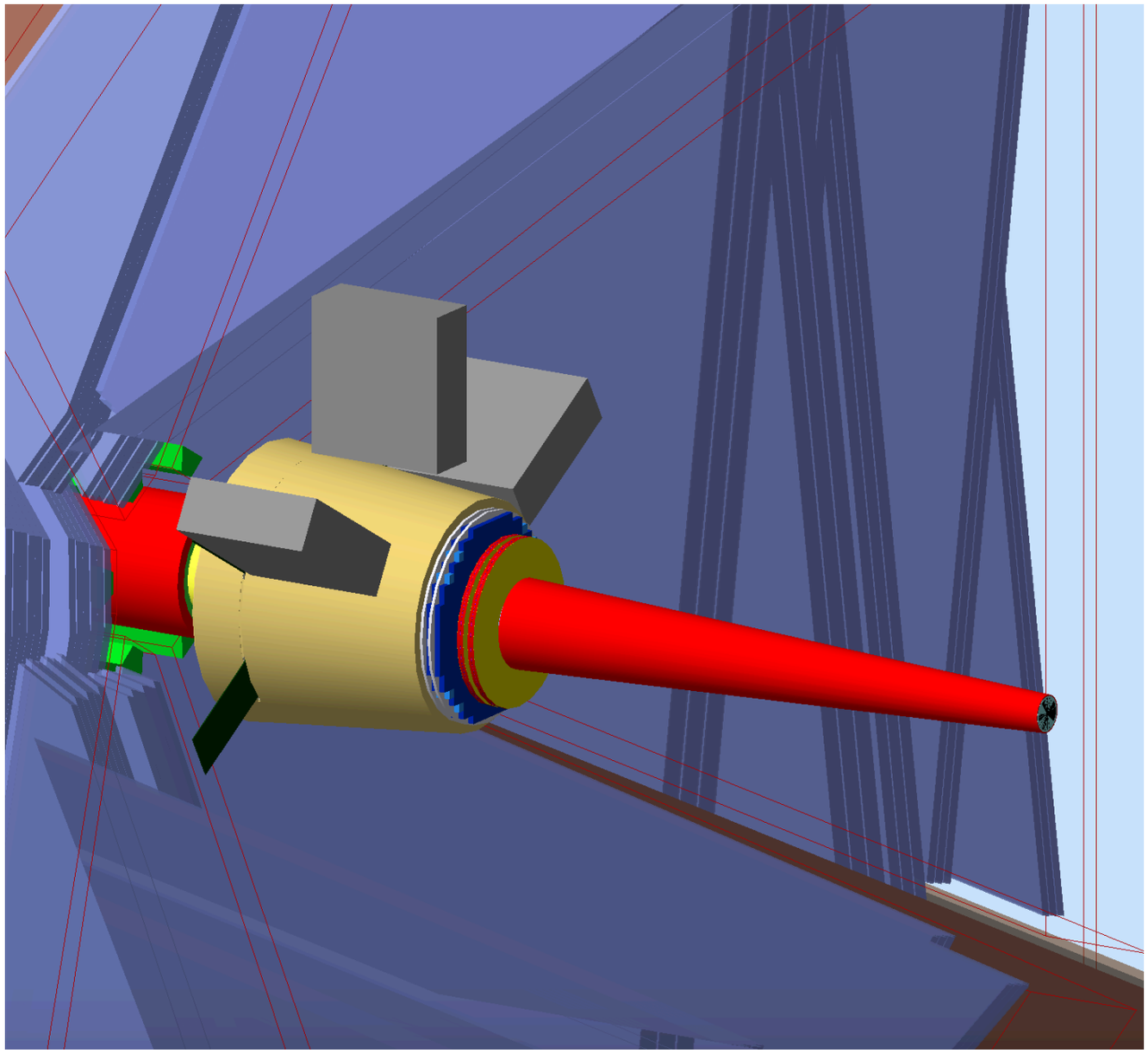
- Beam line components from CAD
- Calorimeter, Hodoscope, MM Tracker
- APD gains, noise, advanced digitization



FT Response to cosmic rays in GEMC

TEXT geometries

	Geometry	**Digitization**
Forward Tagger	INFN Genoa (Raffa De Vita)	INFN Genoa (Raffa De Vita)



- Beam line components from CAD
- Calorimeter, Hodoscope, MM Tracker

TODO:

- geometry in COATJAVA
- CCDB constants

Running gemc 2.0

On the JLAB Cue machines:

- **source /site/12gev_phys/production.csh 2.0**

On Mac: can **download DMG**

GCARD with all the defaults:

/group/clas12/clas12.gcard

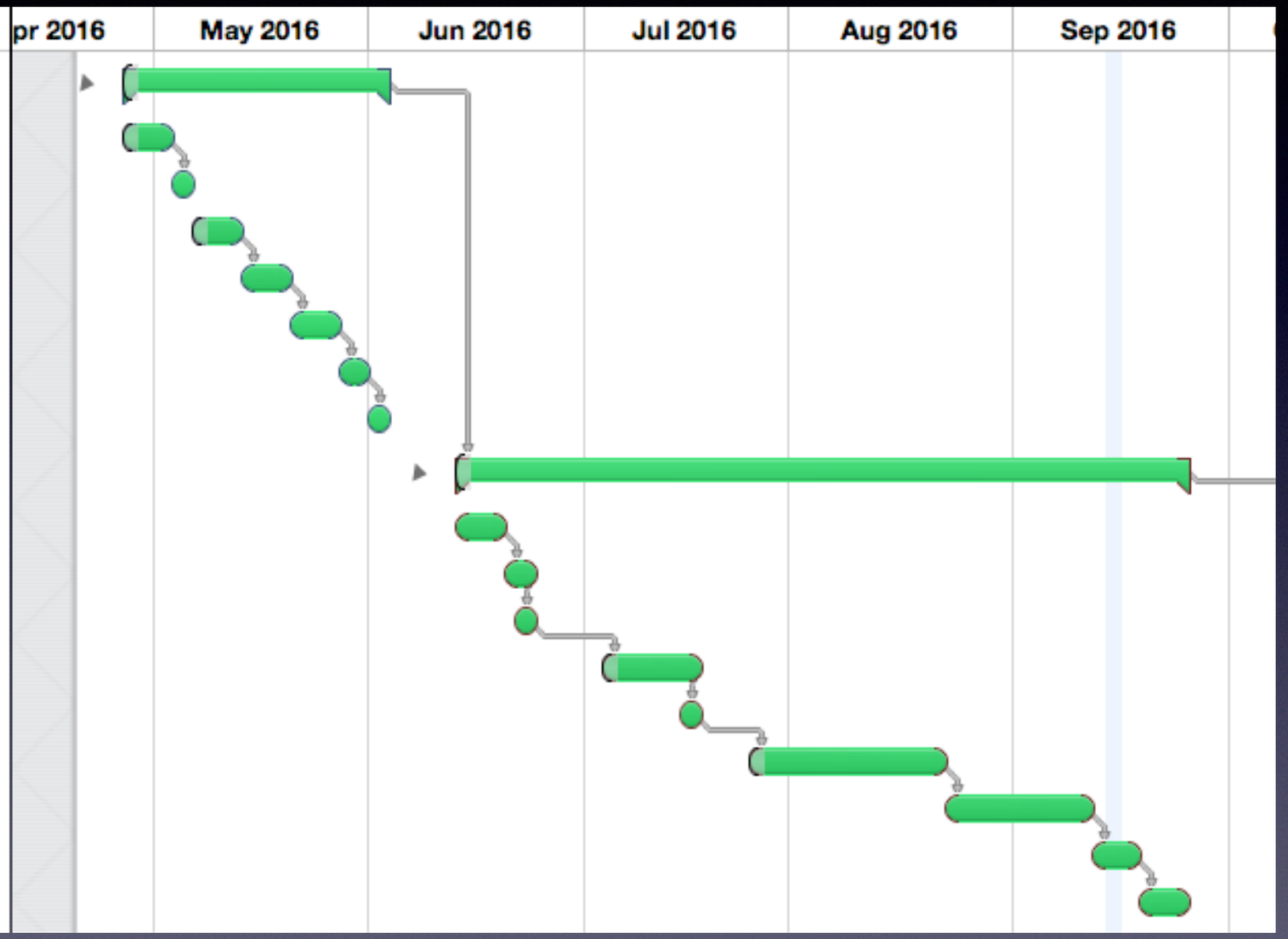
Geometry:

- from gemc.jlab.org
- in /group/clas12

gemc roadmap

full roadmap available at gemc.jlab.org

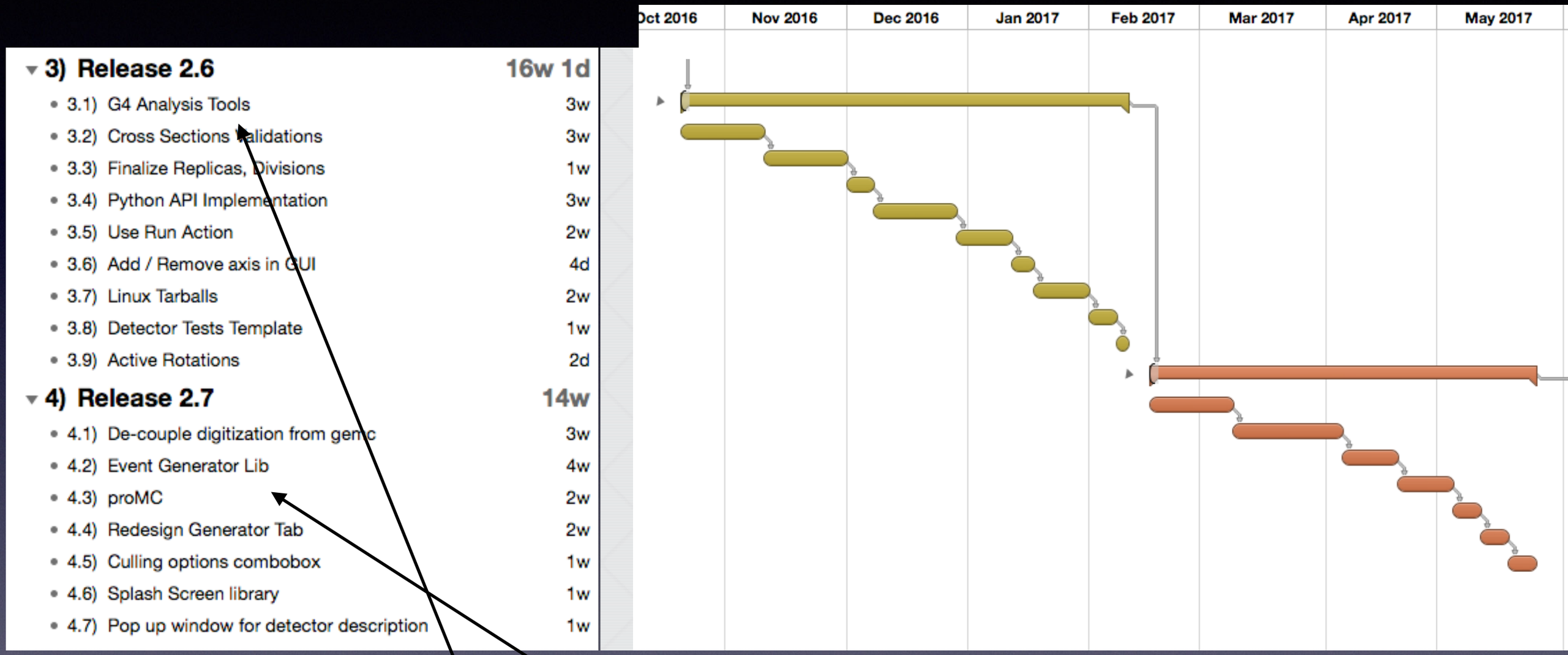
Title	Effort
1) Release 2.4	**5w 2d**
1.1) Field Interpolations	1w
1.2) Field Map Attributes	2d
1.3) Noise Generator	1w
1.4) Neutron Cosmics	1w
1.5) Options to Force Radiative decay for muons	1w
1.6) Material change options	3d
1.7) Sensitivity removal option	2d
2) Release 2.5	**13w 2d**
2.1) GEMC external libraries	1w
2.2) Remove CPP mats	3d
2.3) Accelerator Sync Bank	2d
2.4) Translation Tables	2w
2.5) gstring namespace mlibrary	2d
2.6) Custom V(t)	4w
2.7) Composite Banks	3w
2.8) GDML Factory	1w
2.9) CAD Factory	1w



green = completed

gemc roadmap

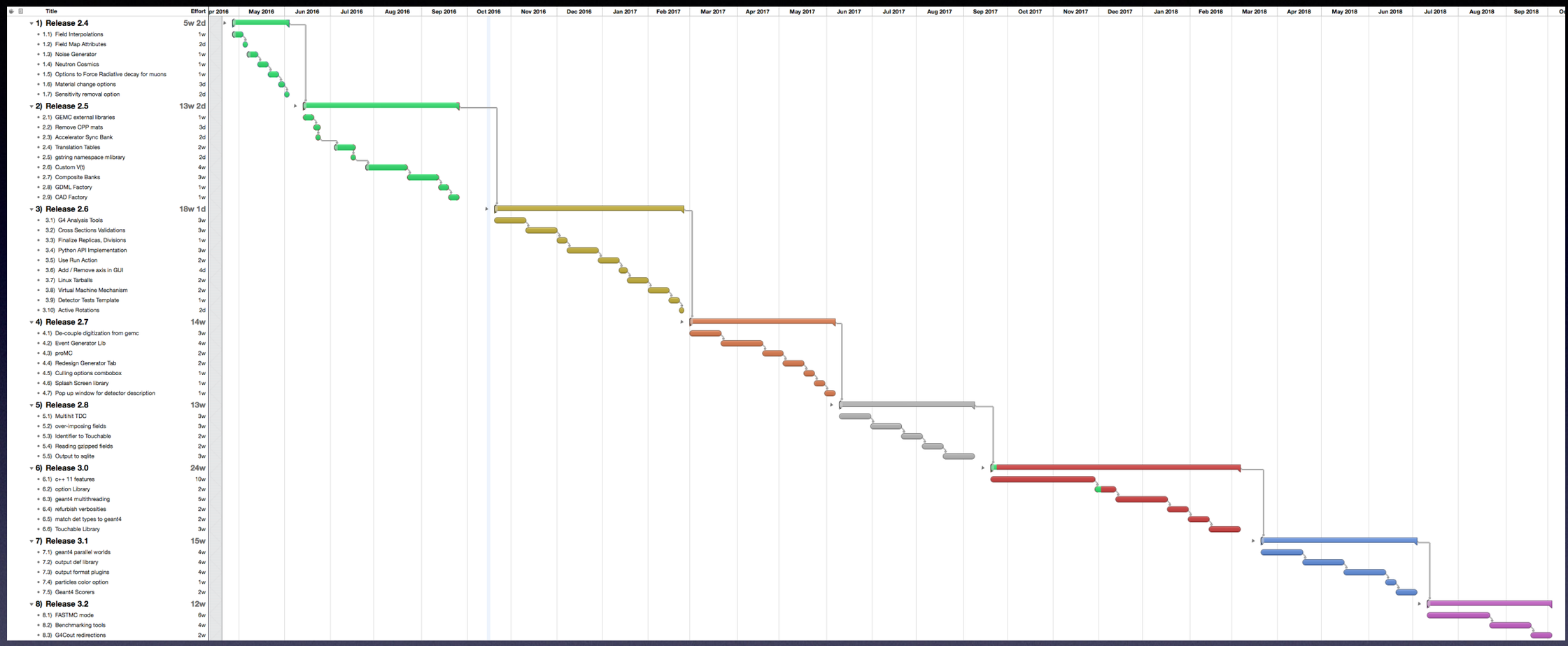
full roadmap available at gemc.jlab.org



G4 Analysis Tools. Finalize python API.
Event generator library (various inputs, pythia, proMC)

Outlook

full roadmap/release notes available at gemc.jlab.org



- coatjava / ccdb / cad interface working for many detectors, development in progress for the remaining
- advanced digitization working for many detectors, development in progress.
- **FADC** mechanism ready. Need detectors implementation.
- Final goal: **GEMC output indistinguishable from data**
- **Tune MC to commissioning data**