Simulation latest news

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Mu2e-ITA meeting
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Simulation: an effort shared between groups

ECAL

TRACKER

CRV

STM

EXTM

COMPUTING

Trigger+ DAQ

Simulation

Detector geometry
Digitization
Reconstruction
Performances
Calibration
Database

Beam description
Database interface
Data handling
Offline reconstruction
Dataset production

Data flow
Event building
Trigger algorithms
Online reconstruction
Trigger efficiency

Physics models
Experiment description
(Pre-)Analysis
Data-MC validation

Simulation group: examples of applications

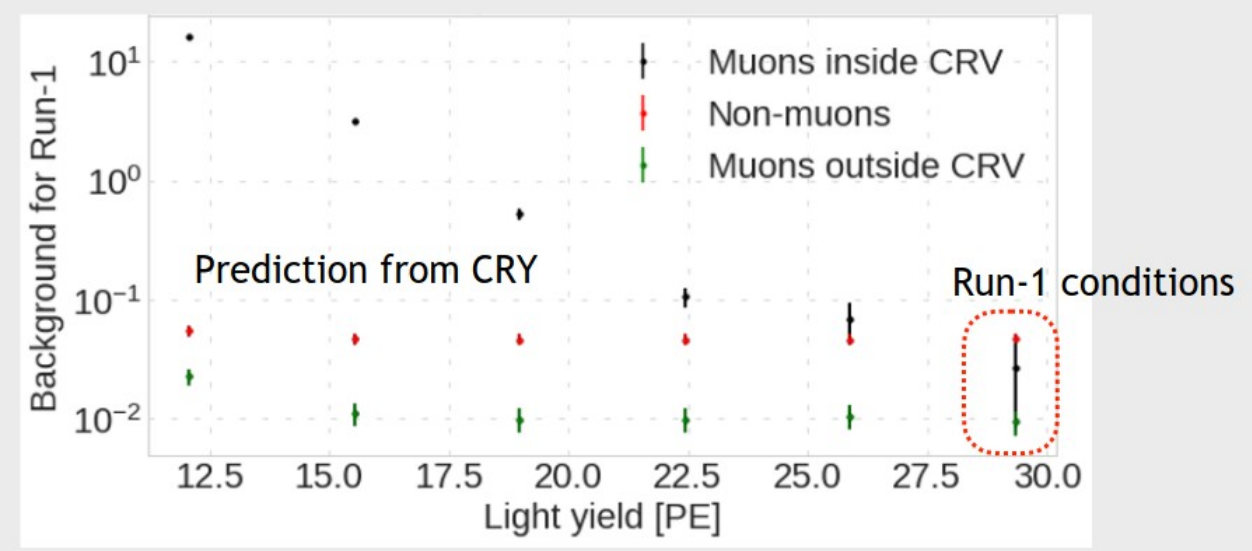
1) Physics models implementation: existing measurements and theories
Past: radiative corrections, antiproton production (SU2020)
Present: cosmic fluxes, neutron absorption, neutron damage
Next: in situ measurements (cosmics, DIO, RMC, RPC, pbar)

2) Detector response: from energy deposit to digitization
Present: condition database, calibration (MDC2020)
Next: validation with VSLT, ECAL energy scale (LRU), noise

3) Feasibility studies: prepare analysis
Present: dedicated triggers
Next: 2 tracks, cosmic neutron rejection, RMC tail, momentum scale

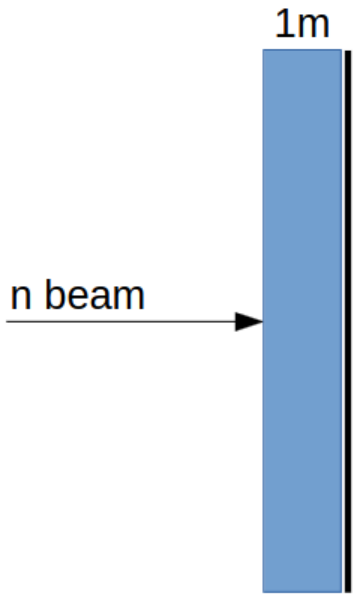
4) Publication: data-MC comparison
Next: evaluate efficiency, background estimate, systematic error

Physics models: cosmics neutrons absorption

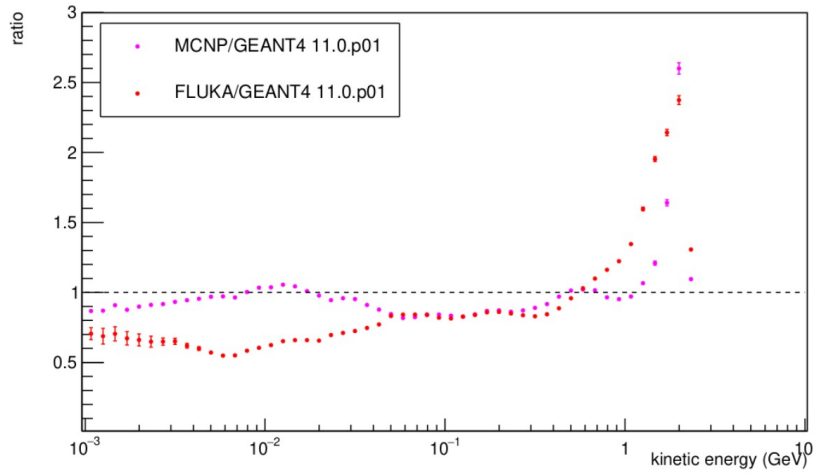


Differently from SU2020 findings, cosmic neutrons are now considered the **largest background source** for CE

Background rejection to be revisited!



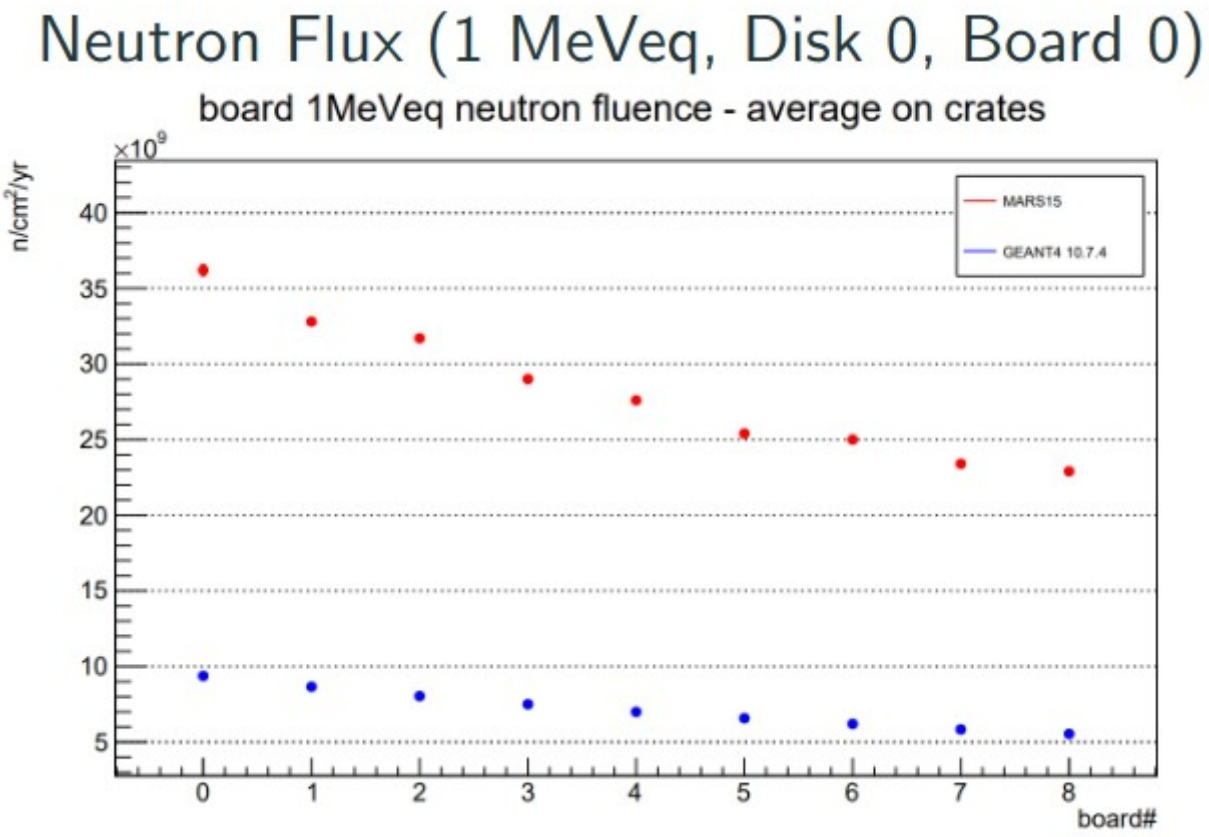
Neutrons after 1m of concrete (2.5 GeV n beam): ratio to G4



Doc-db 41646

Neutron absorption by the concrete shielding may be worse than what predicted by Geant4!

Physics models: neutron flux on electronics



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MARS fluence x3 worse than Geant4!

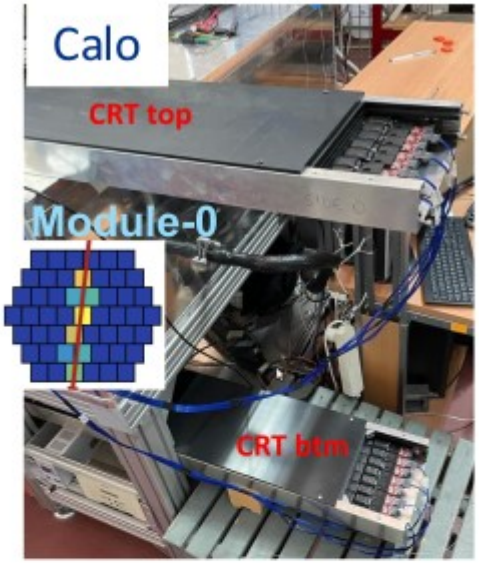
Situation even worse for the tracker

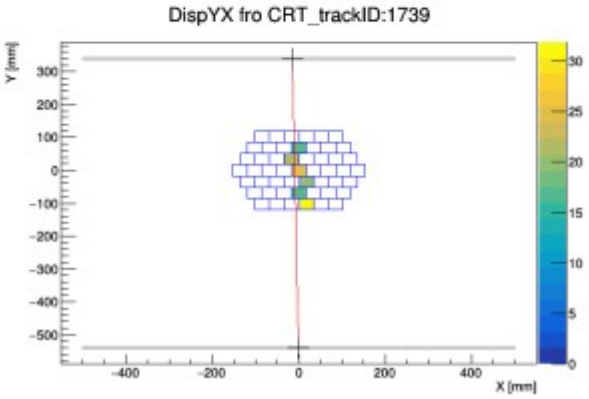
The main source of neutrons is the muon capture on the ST: **to be checked!**

Contacts with Krzystof to get the best from Geant4 (also for **thermal neutrons**)

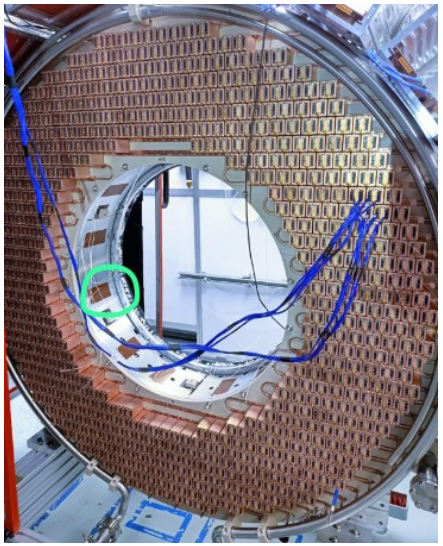
In situ measurements: cosmics

Module 0 + CRT

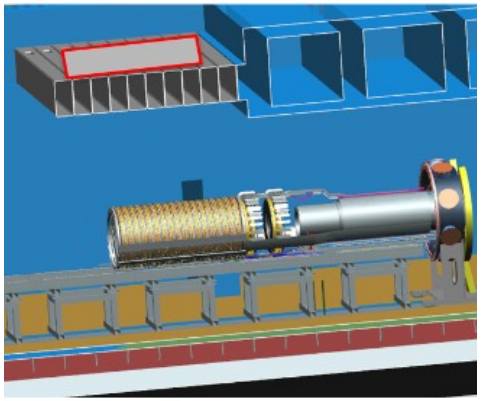




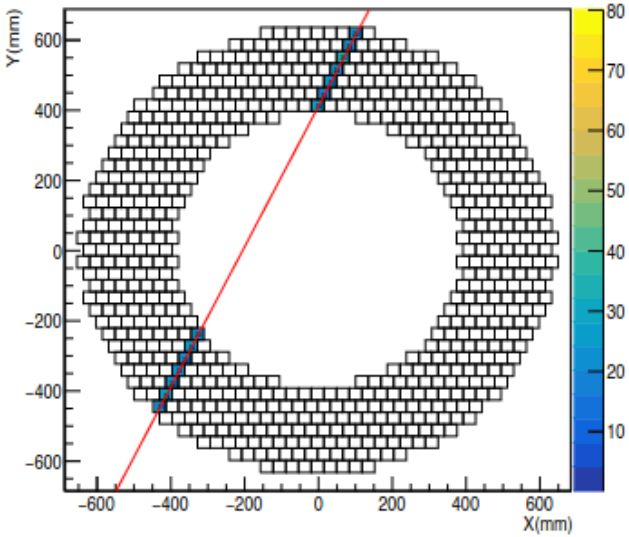
SIDET
(+ test beam?)



Extracted position



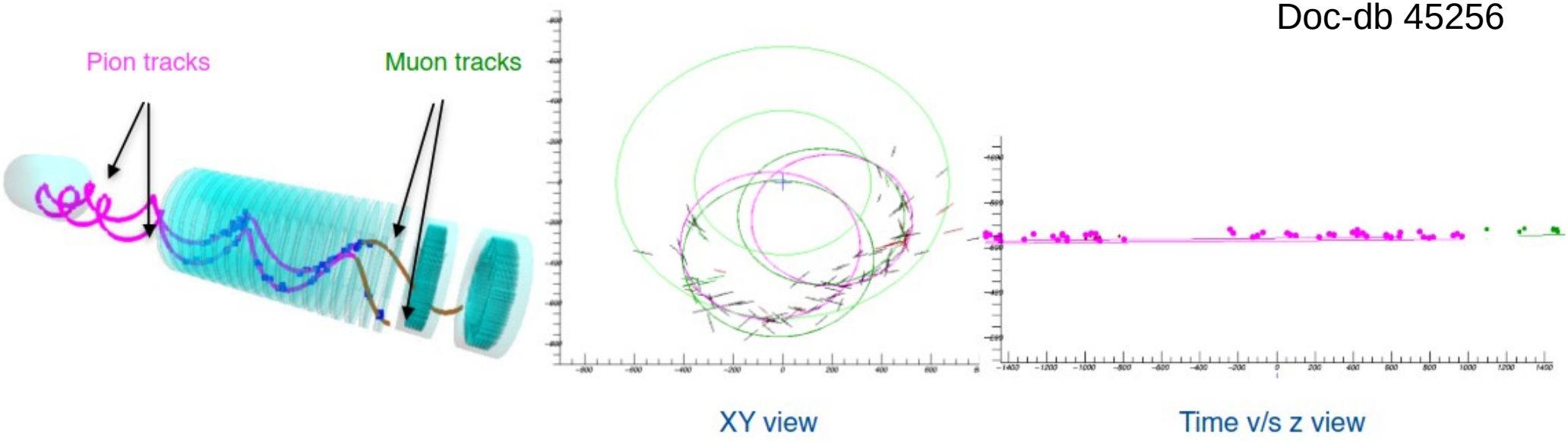
With B field
(**horizontal cosmics?**)



Goals: **time alignment and energy calibration** (doc-db 45424)**, flux measurement?**

In situ measurements: antiprotons

Doc-db 45256



Goal: Identify and reconstruct the multi-track final state events with good efficiency and estimate the $\overline{p}$ background by comparison.

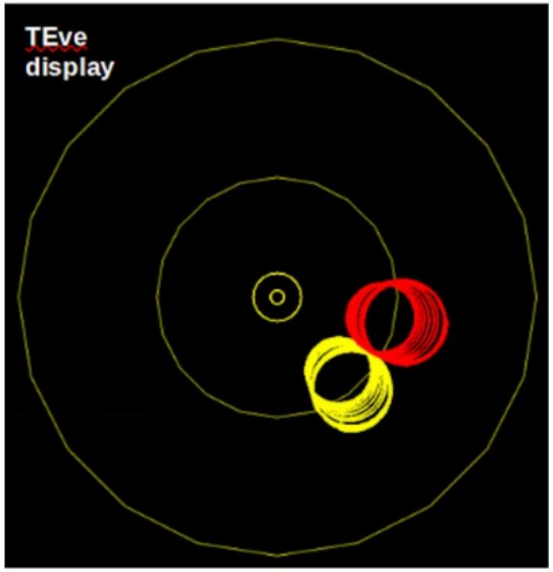
About 1 event expected on RUN 1: will confirm that pbar background is O(0.01) event
Background contamination still under study

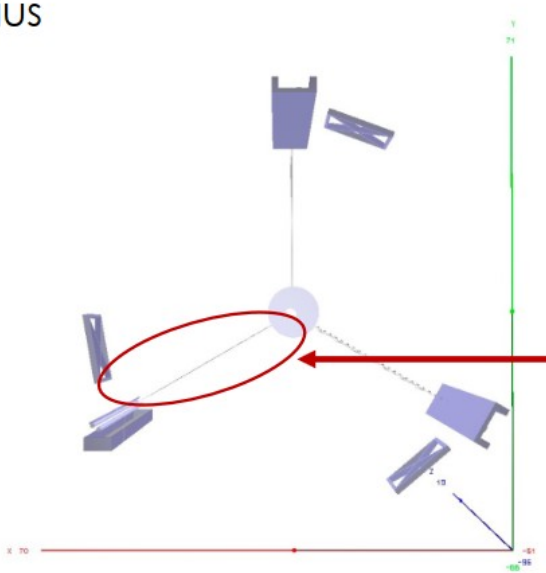
Interesting work for **2 tracks recontruction**, can be extended to other physics cases…
Similar work on going from Yale's group

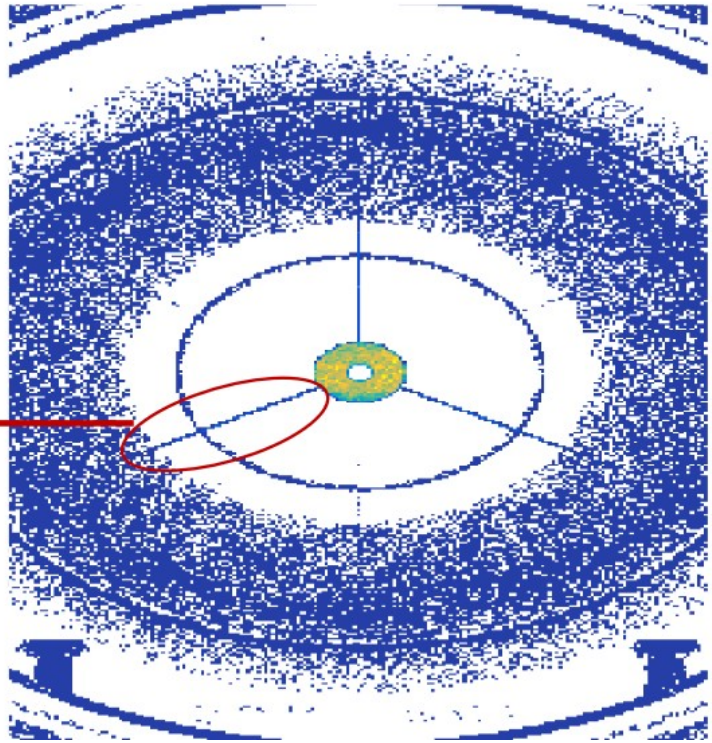
In situ measurements: RMC

Doc-db 45550

- ST supporting wires made of W/Au
- Pairs tracks are centred at larger radius







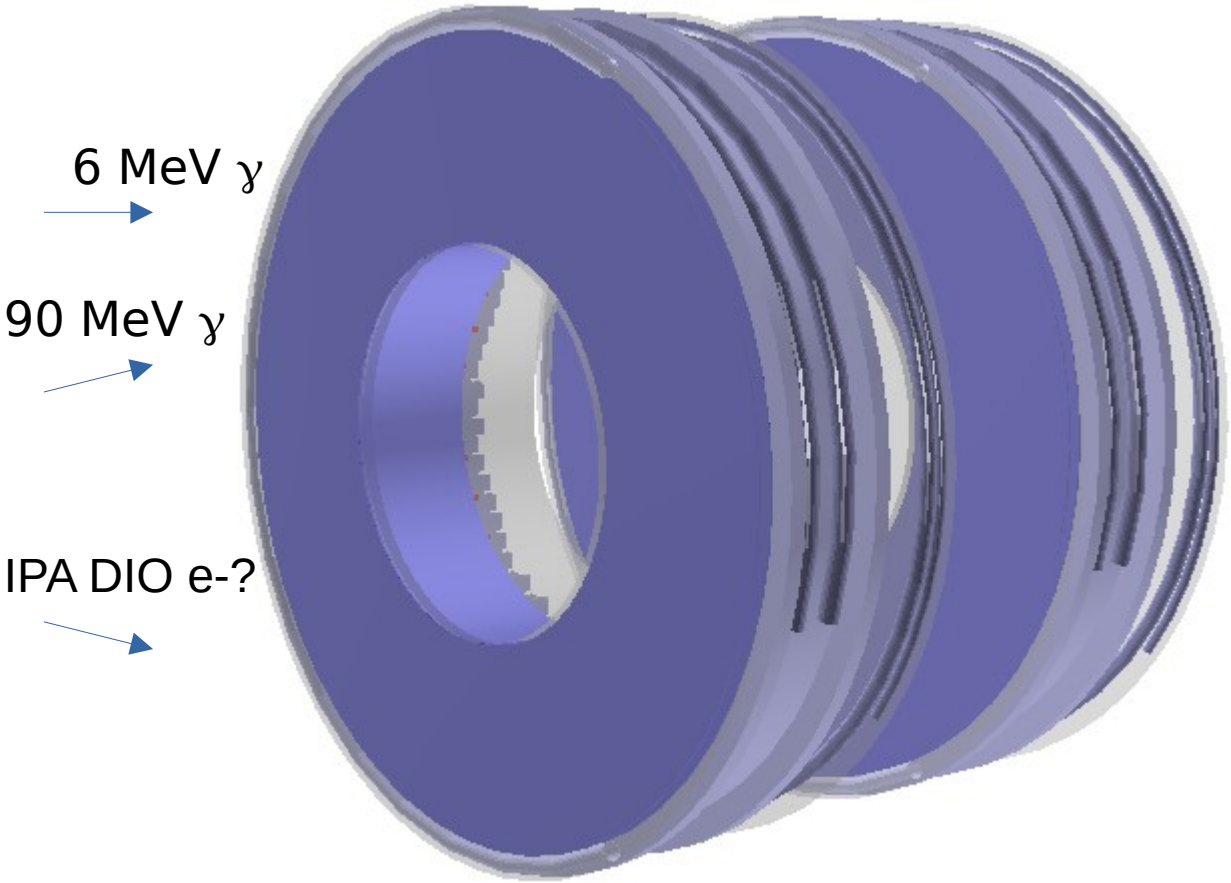
Radiated photons can convert in the W/Au wires supporting ST
Sensitivity to the **end point of the photon spectrum** (main background for $\mu^- \rightarrow e^+$) looks promising!

Needs **2 tracks recontruction** efficiency and **vertex reconstruction** to evaluate the real feasibility

Collaboration/competition with Caltech group :-)… **Learn to use POMS!**

W wires may offers other in situ measurement opportunities: μ^+ stops without changing B field?

Detector response: ECAL energy scale



How can we calibrate the **energy scale**?
Can the photon/electron differences be evaluated by MC?
A standalone simulation of the ECAL disk as built could be useful also for test beam analysis

Summary

Many interesting field of application for simulations, and many to come… (bent crystals, lumonisity monitors, ...)

Training needed (also for me!) to get experienced on computing/simulation tools and have relevant roles in future analysis groups

Intense work foreseen to understand Mu2e apparatus as soon as data taking will start