THE EIC-SPHENIX PROJECT

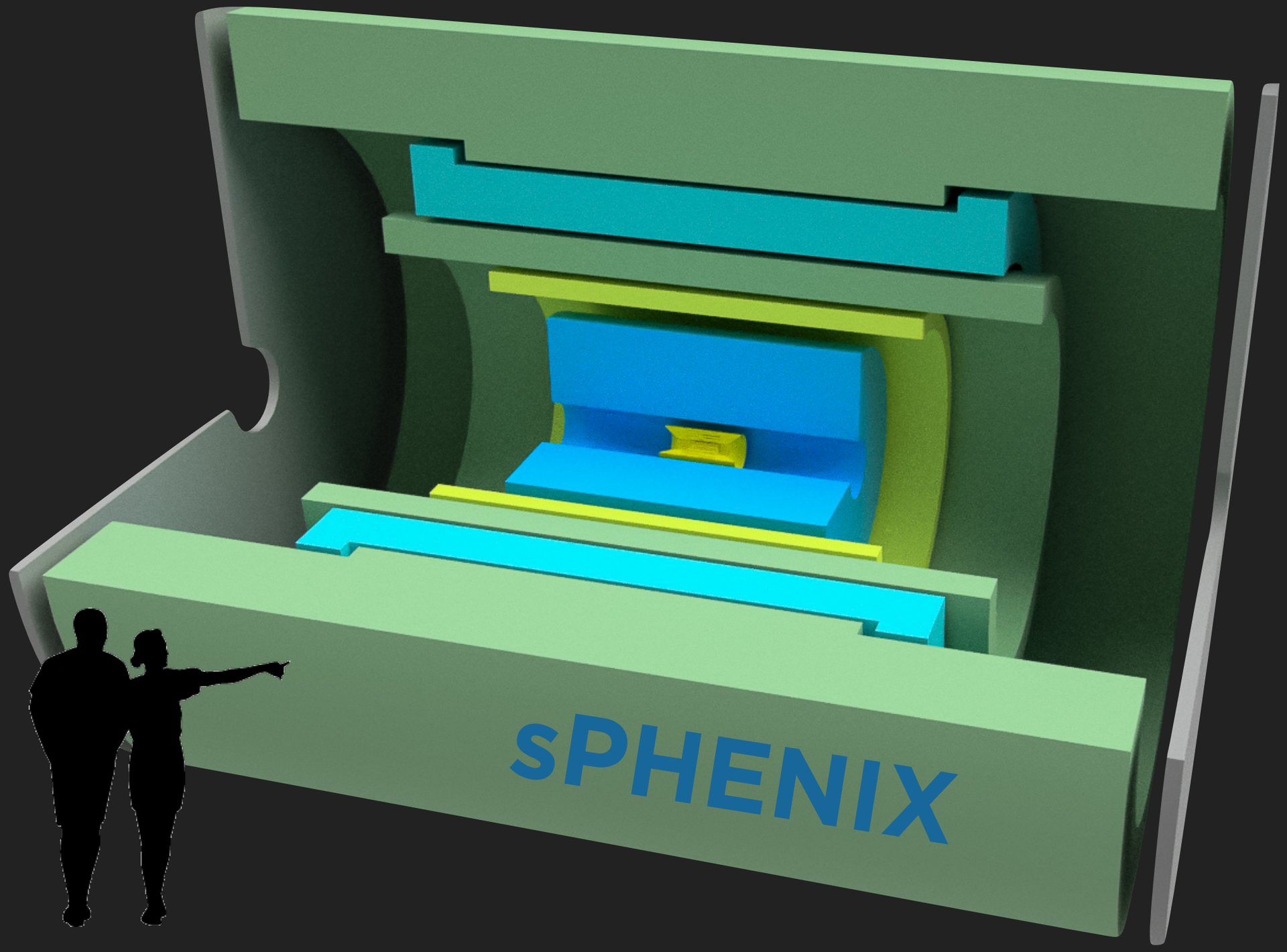
NILS FEEGE

Next-generation GPD studies with exclusive meson production at EIC

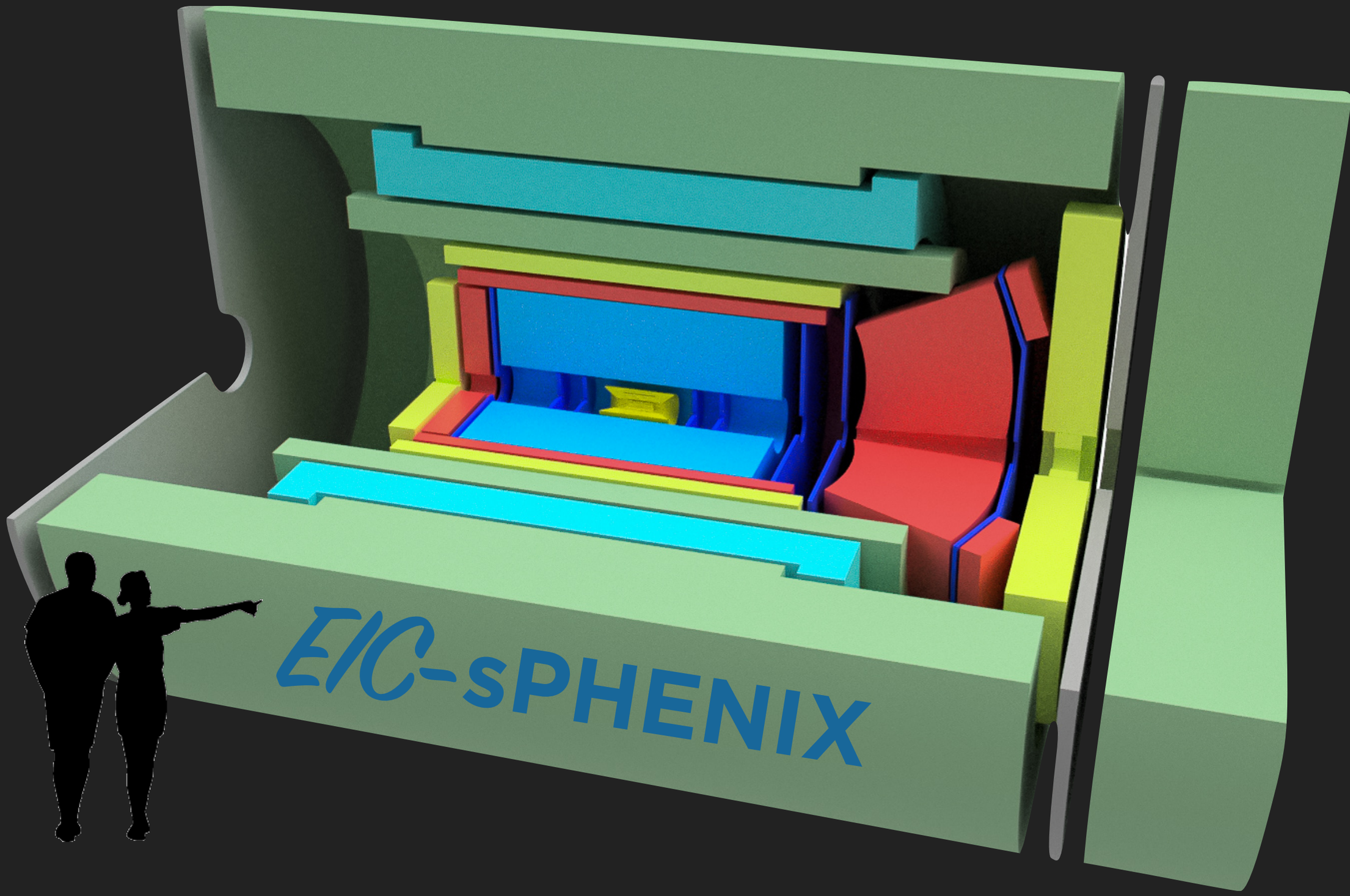
Stony Brook, New York, June 6, 2018

Center for Frontiers in Nuclear Science

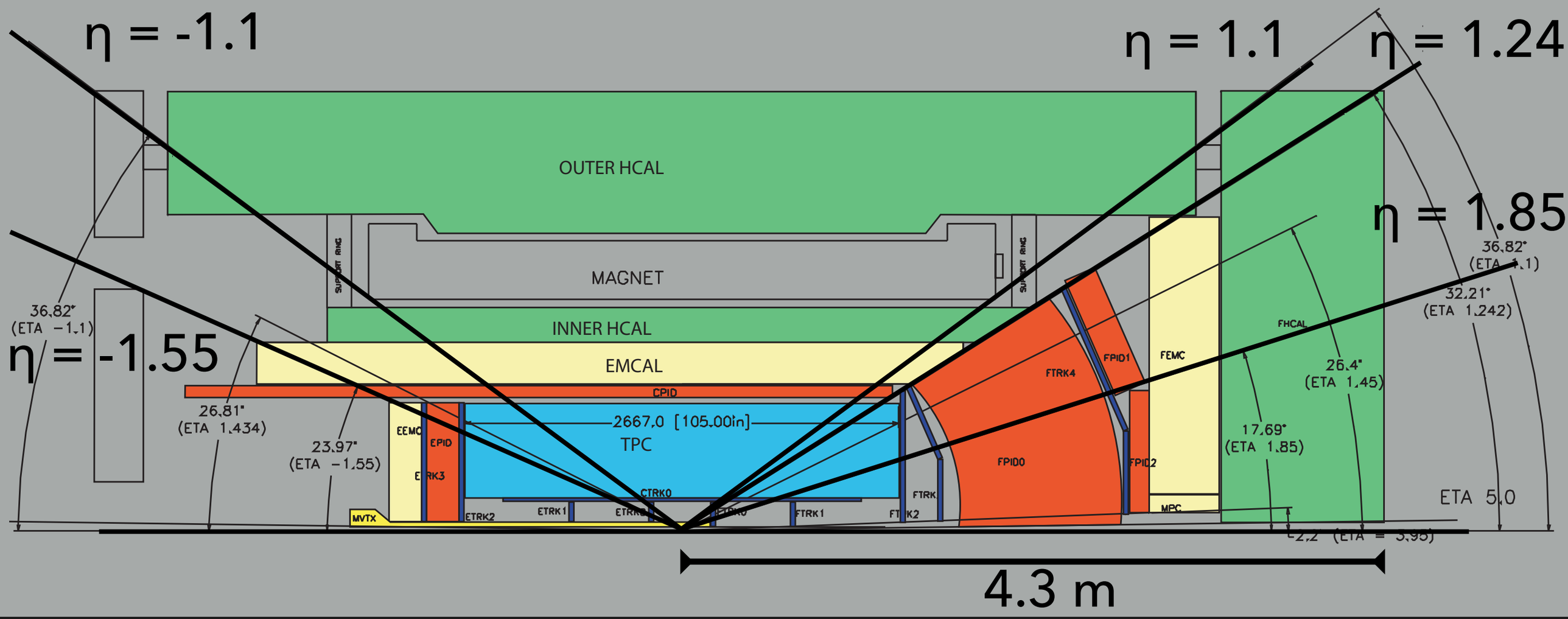
Stony Brook University



Solenoid
Flux return
Central tracking
Electromagnetic calorimeter
Hadron calorimeter



Solenoid
Flux return
Central tracking
Electromagnetic calorimeter
Forward tracking
Hadron calorimeter
Particle ID

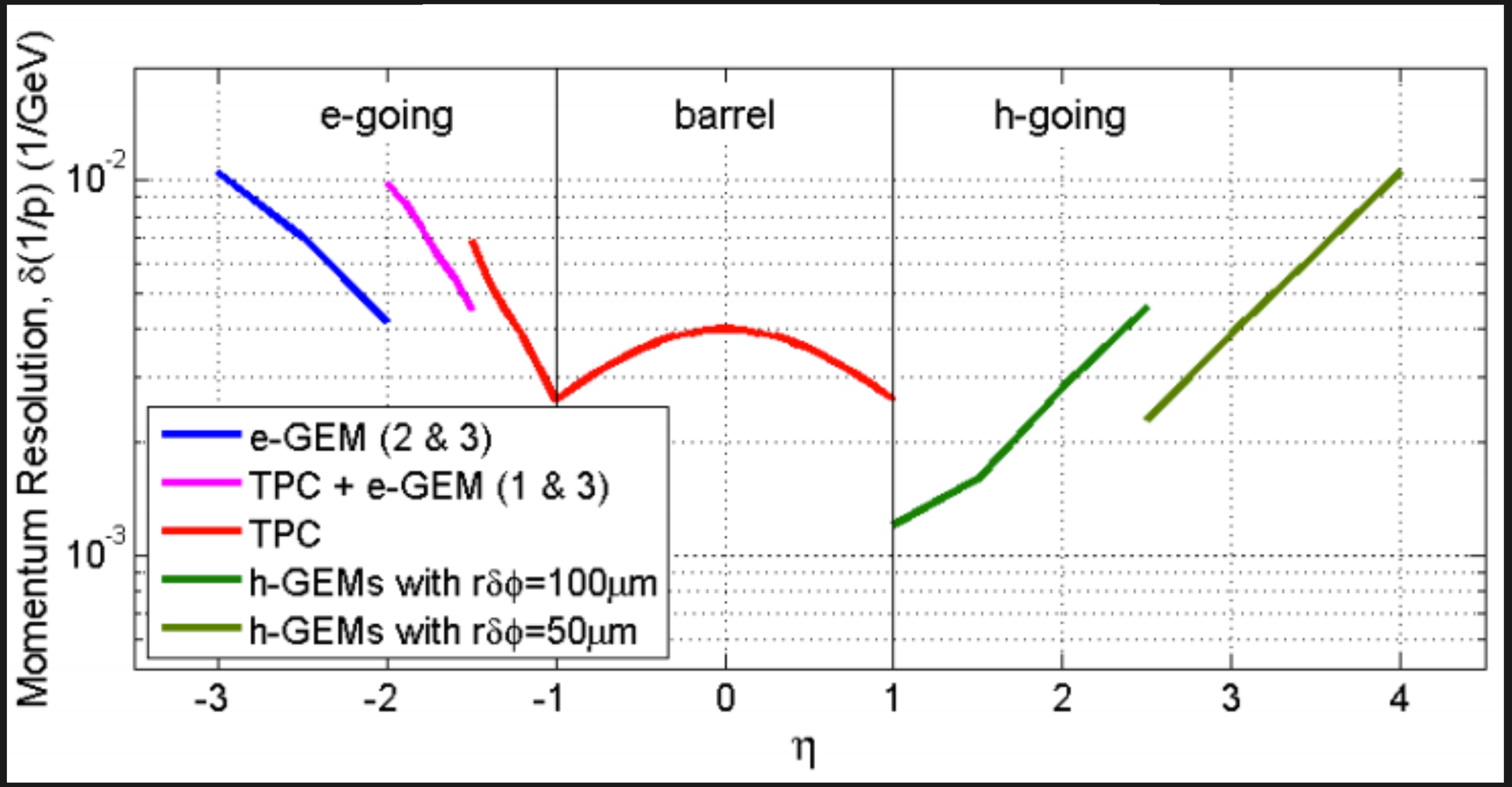

η = -1.1
η = 1.1
η = 1.24
η = 1.85
OUTER HCAL
MAGNET
INNER HCAL
EMCAL
CPID
2667.0 [105.00in]
TPC
FTRK4
FPID1
FEMC
FHCAL
FPID0
FPID2
MPC
CTRK0
FTRK
ETRK1
ETRK2
MVTX
EEMC
EPID
36.82°
(ETA −1.1)
η = -1.55
26.81°
(ETA 1.434)
23.97°
(ETA −1.55)
32.21°
(ETA 1.242)
26.4°
(ETA 1.45)
17.69°
(ETA 1.85)
ETA 5.0
4.3 m

EIC-SPHENIX ELECTROMAGNETIC CALORIMETER COVER -4 < ETA < 4.

-4 < η < -1.55	$PbWO_4$	2 cm x 2 cm	$\frac{2.5\%}{\sqrt{E}} \oplus 1\%$
-1.55 < η < 1.24	W-SciFi	0.025 x 0.025	$\frac{16\%}{\sqrt{E}} \oplus 5\%$
1.24 < η < 3.3	PbScint	5.5 cm x 5.5 cm	$\frac{8\%}{\sqrt{E}} \oplus 2\%$
3.3 < η < 4	$PbWO_4$	2.2 cm x 2.2 cm	$\frac{12\%}{\sqrt{E}}$
-1.1 < η < 1.1	Fe Scint + Steel Scint	0.1 x 0.1	$\frac{81\%}{\sqrt{E}} \oplus 12\%$
-1.24 < η < 5	Fe Scint	10 cm x 10 cm	$\frac{70\%}{\sqrt{E}}$

EIC-SPHENIX TRACKING COVERAGE EXTENDED TO -4 < ETA < 4.

Status 2014 Letter of Intent:

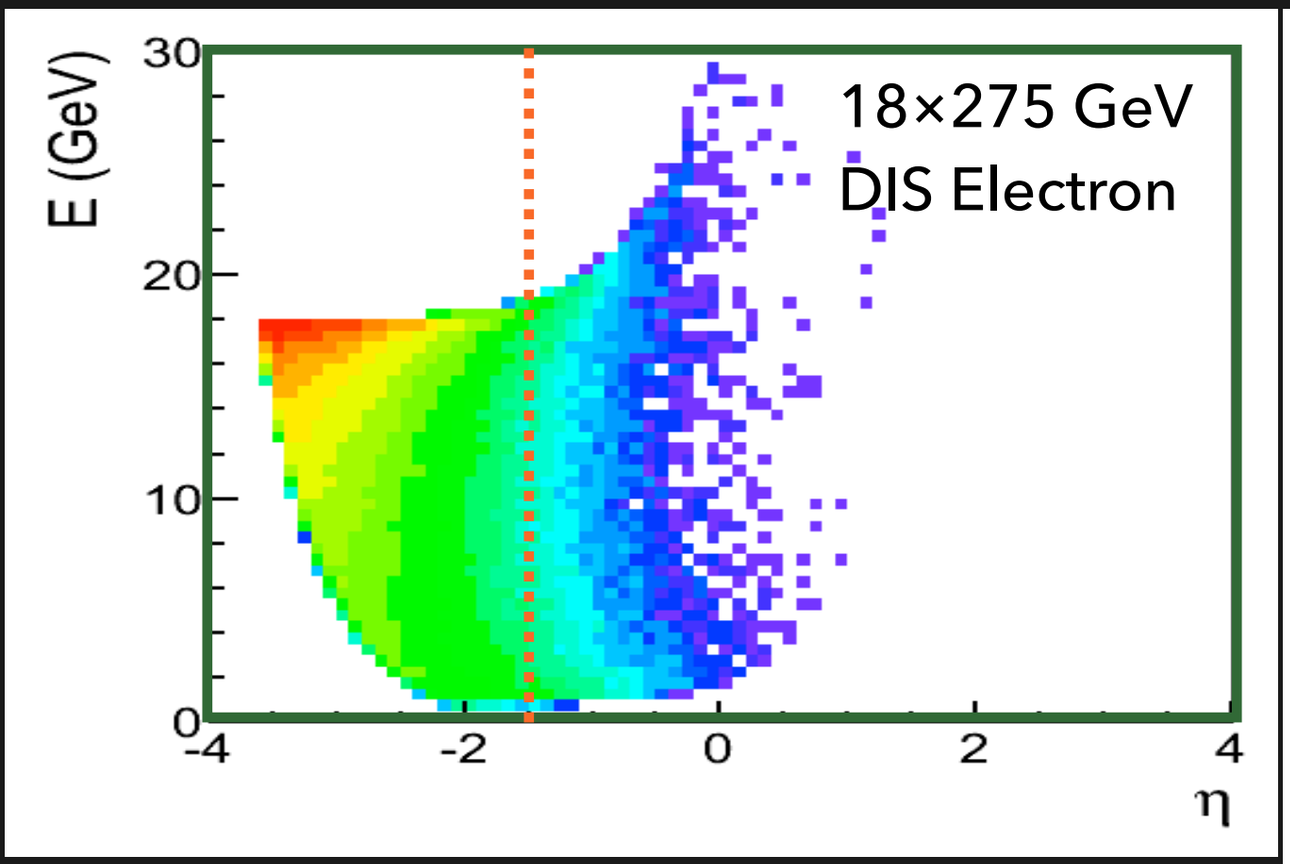


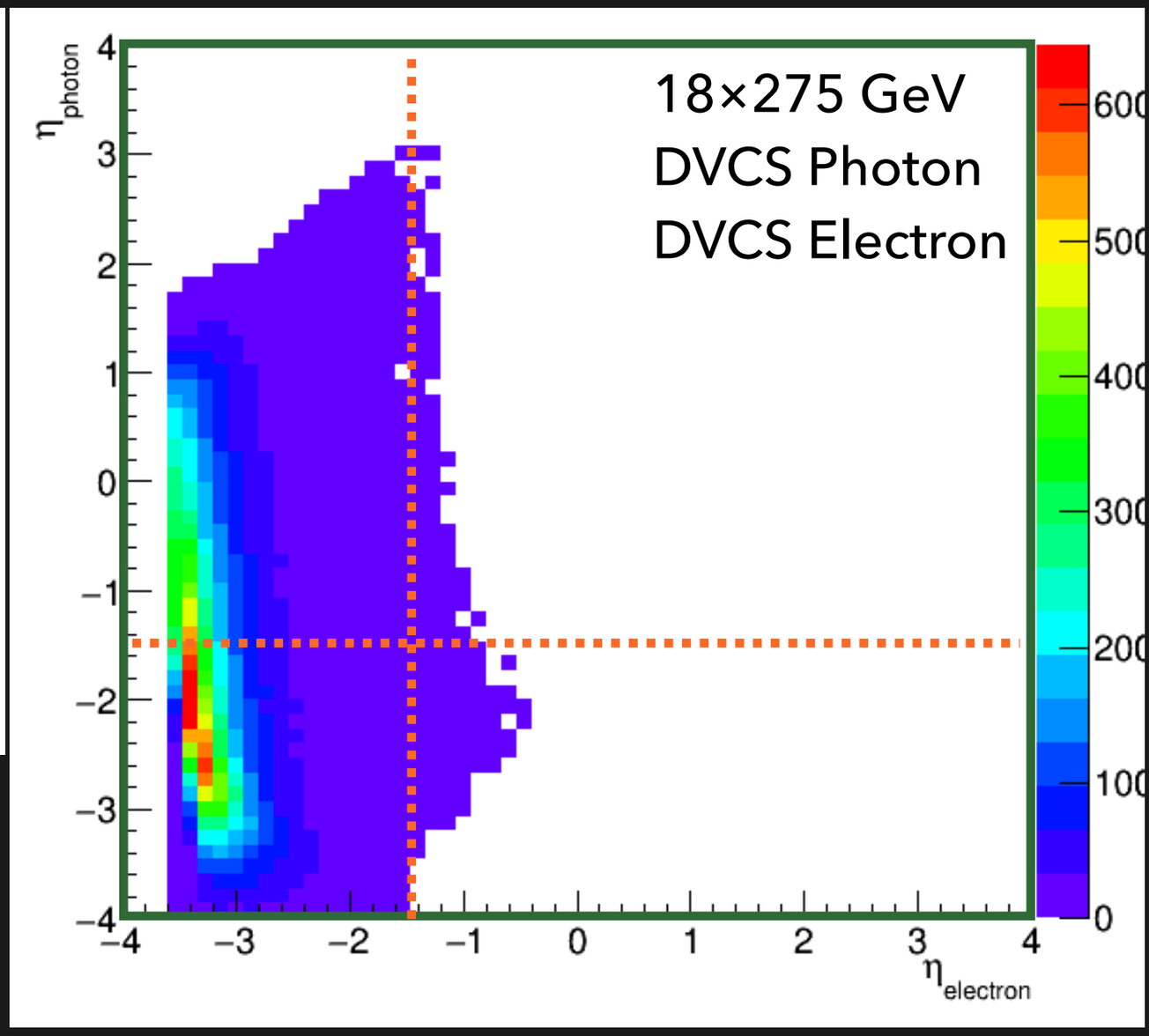
arXiv:1402.1209v1

Updated plot coming soon!

EIC-SPHENIX COVERS CRITICAL ACCEPTANCES.

Electromagnetic Calorimeter + Tracking.



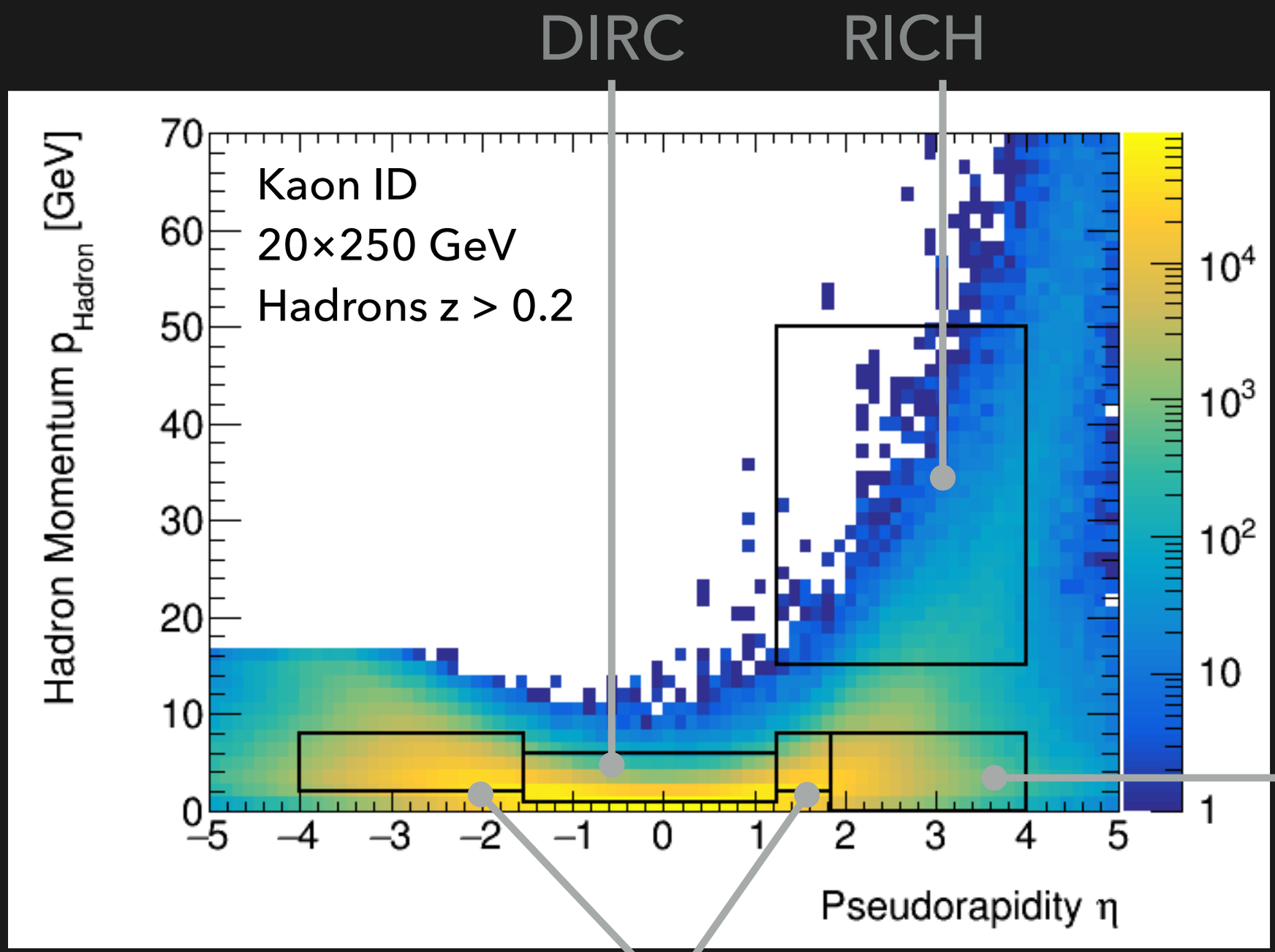


$PbWO_4$ Calorimeter:

$-4 < \eta < -1.55$

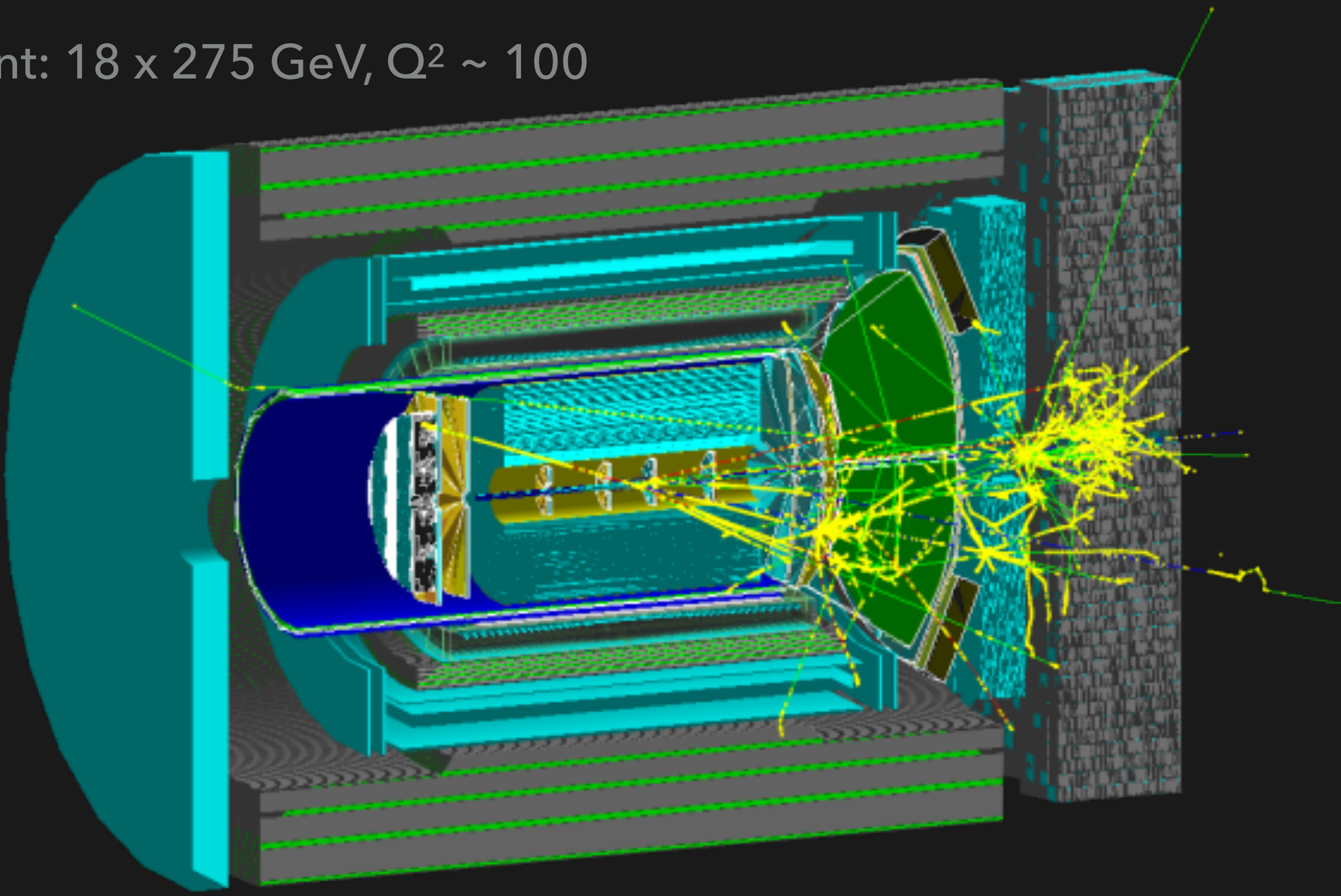
EIC-SPHENIX COVERS CRITICAL ACCEPTANCES.

Kaon Identification.

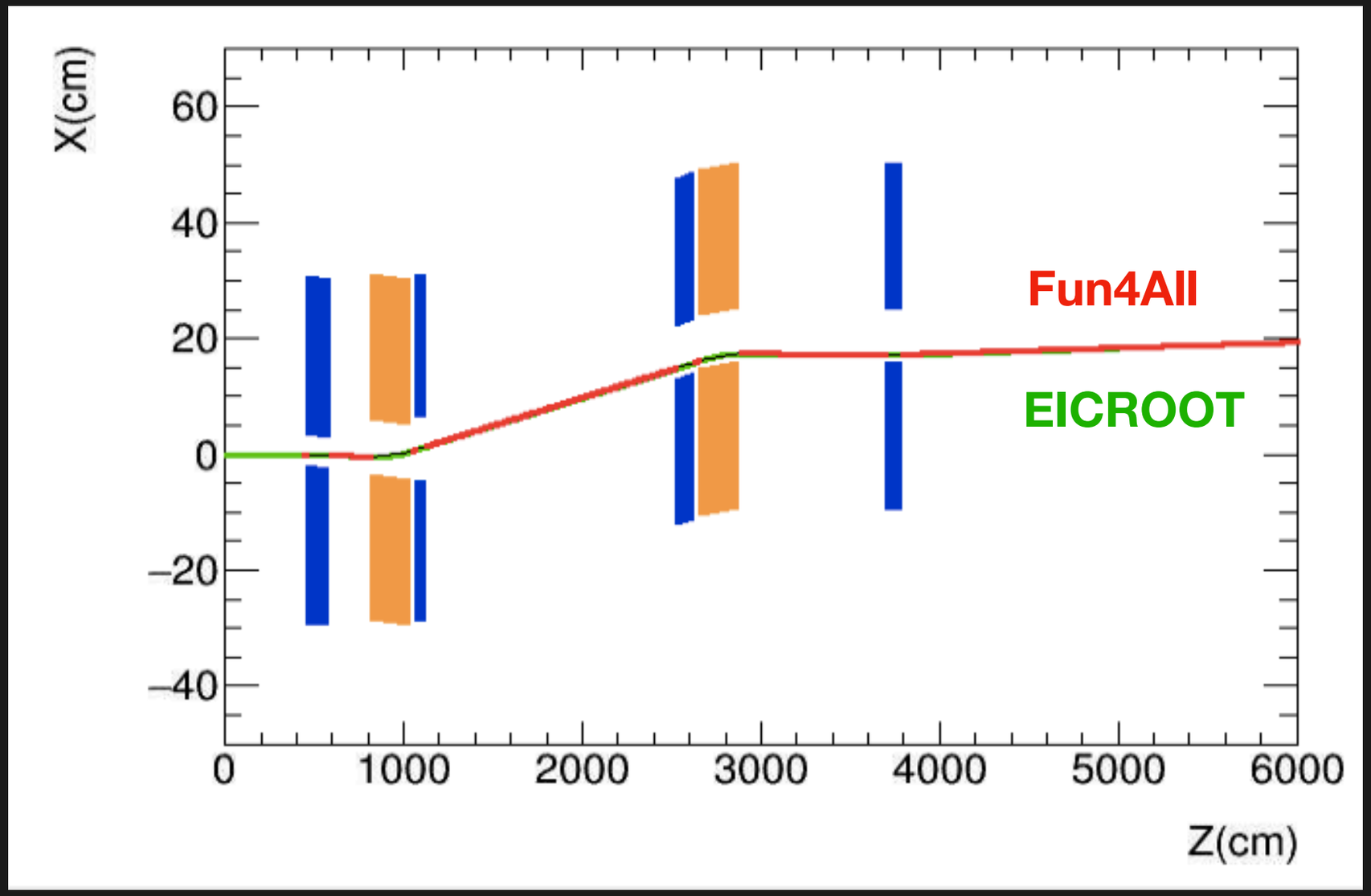


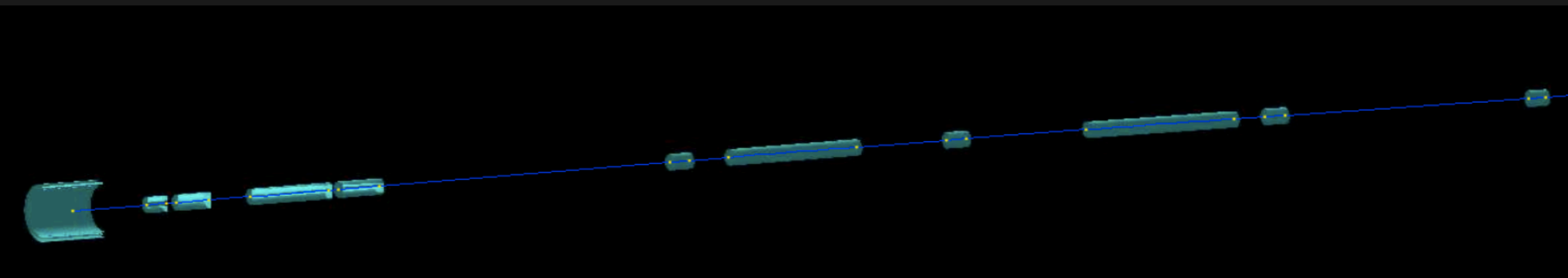
A FULL GEANT4 SIMULATION OF EIC-SPHENIX IS AVAILABLE FOR USERS.

Event: 18 x 275 GeV, $Q^2 \sim 100$

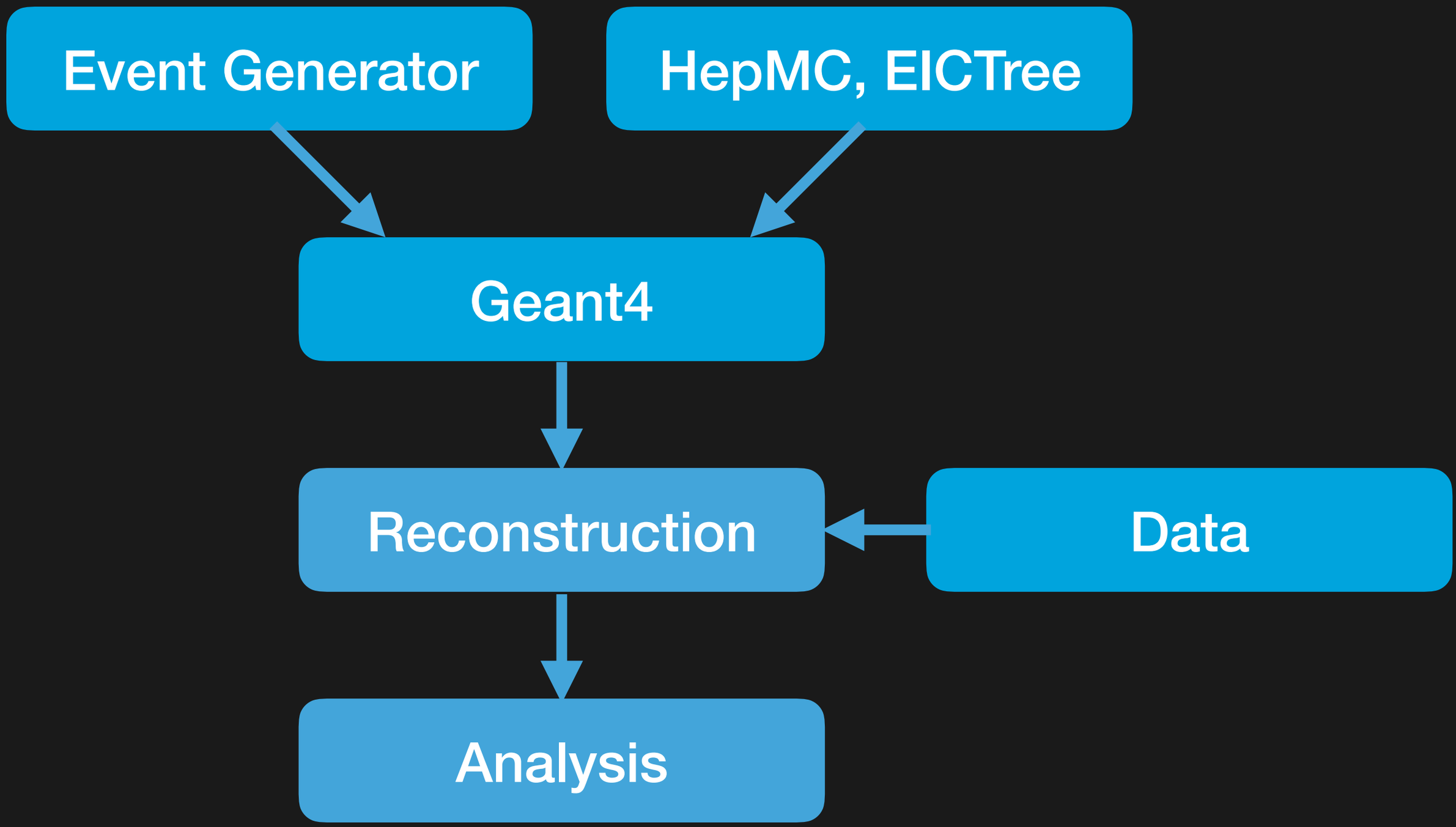


THE GEANT4 SIMULATION INCLUDES BEAM LINE DIPOLES AND QUADRUPOLES.





MODULAR FUN4ALL FRAMEWORK PROVIDES COMPLETE ANALYSIS CHAIN.

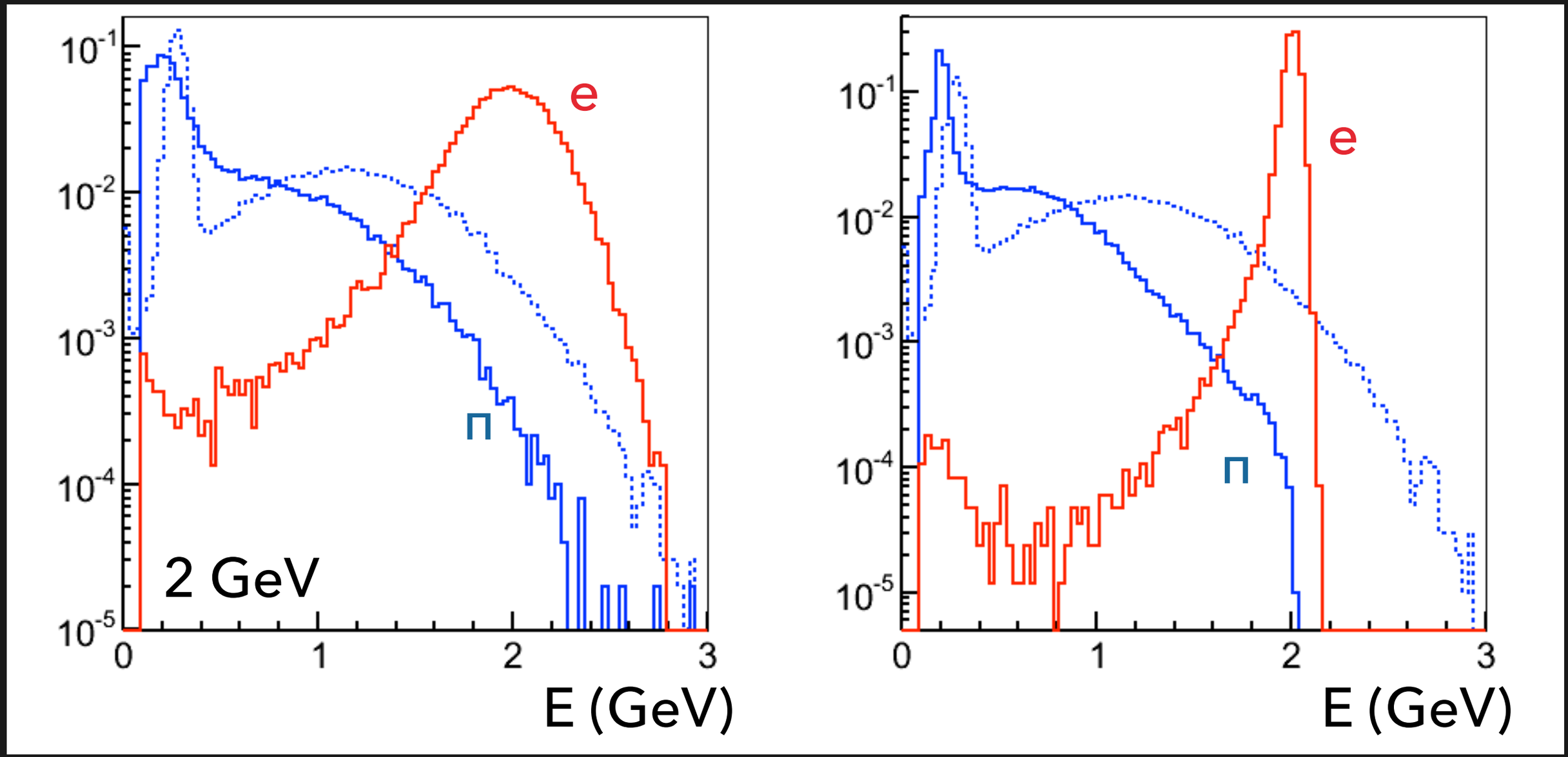


https://github.com/sPHENIX-Collaboration

GEANT4 STUDY: ELECTRON-PION SEPARATION IN EMCAL.

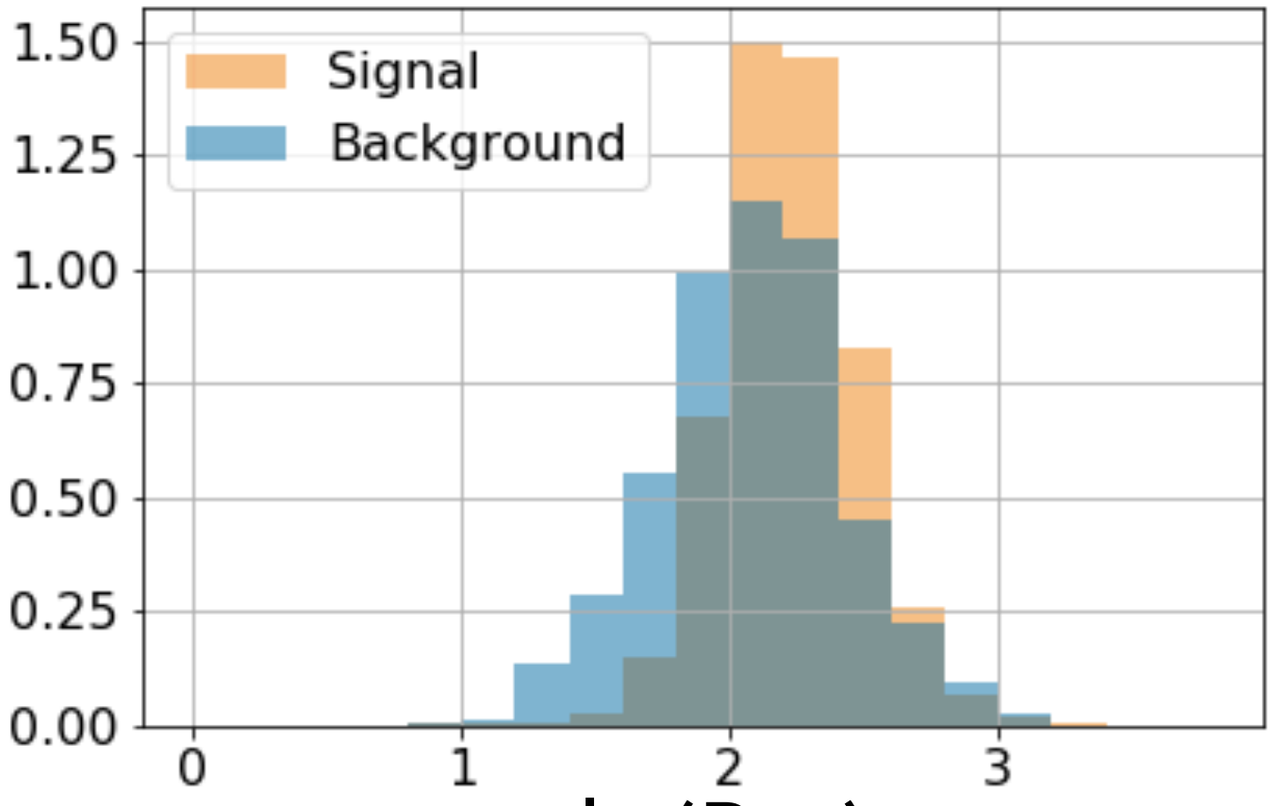
CEMC

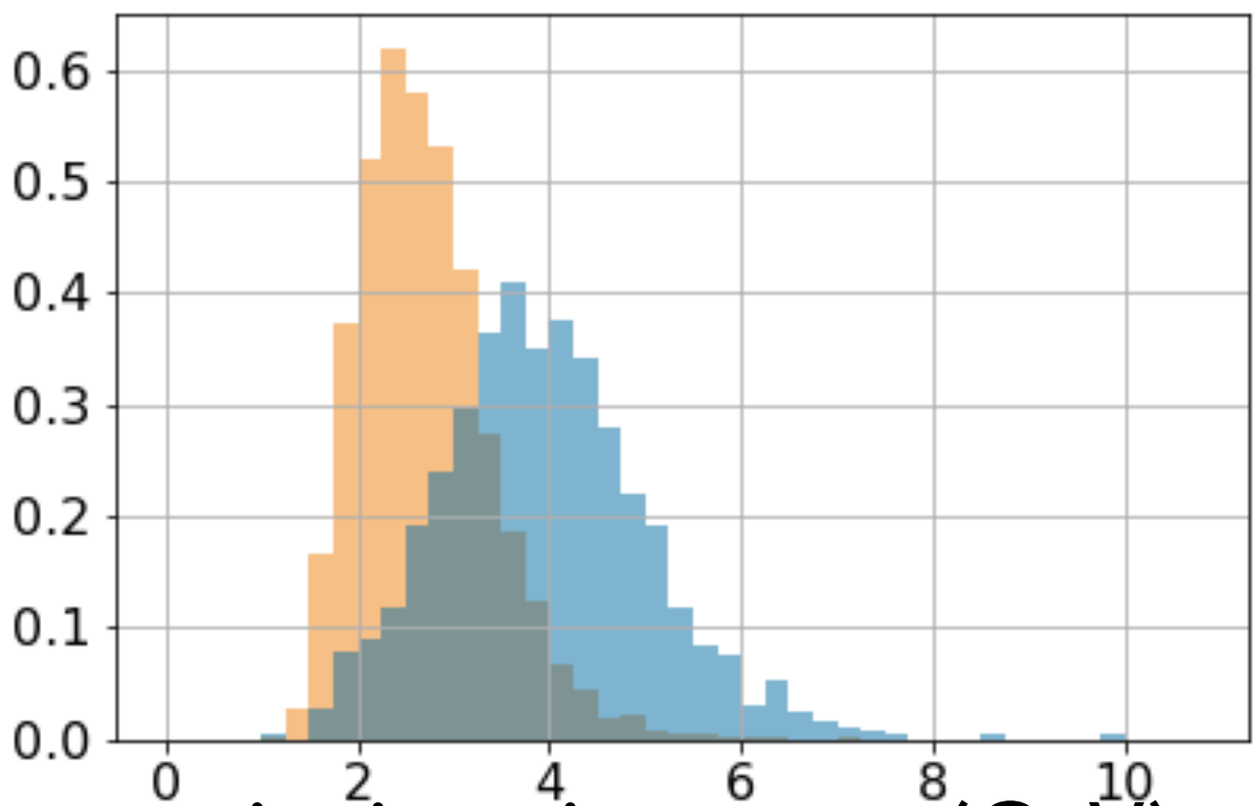
EEMC

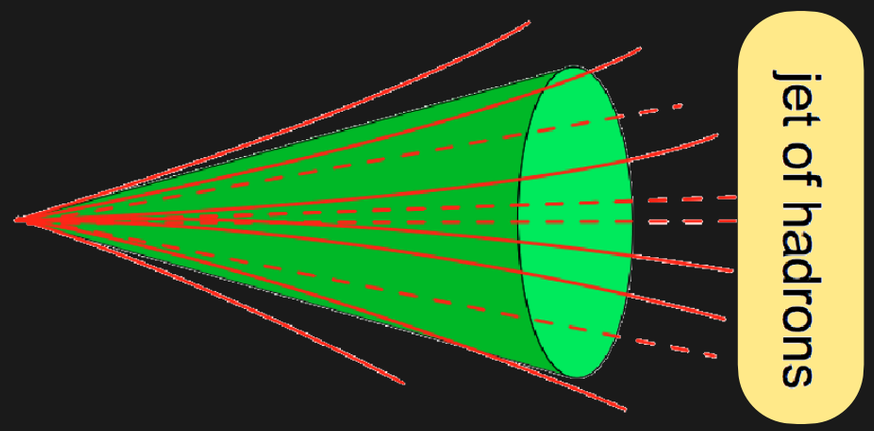


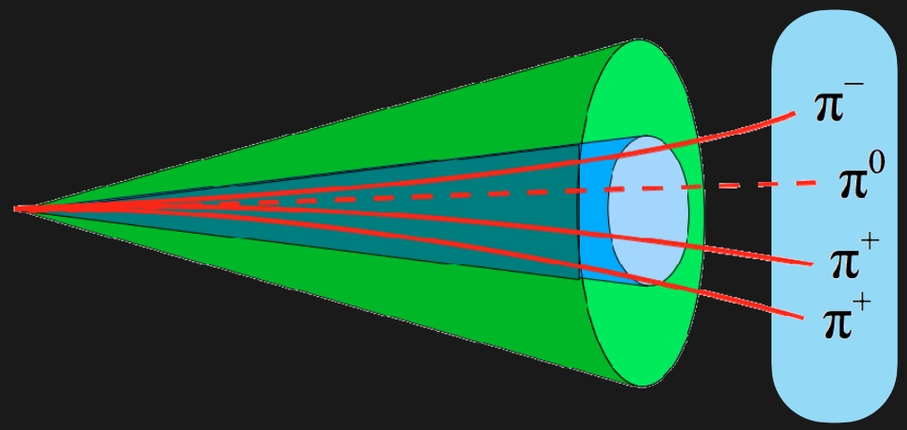
e π PHENIX PbSc Parametrization

GEANT4 STUDY: JET STRUCTURE AND TAU JET IDENTIFICATION.

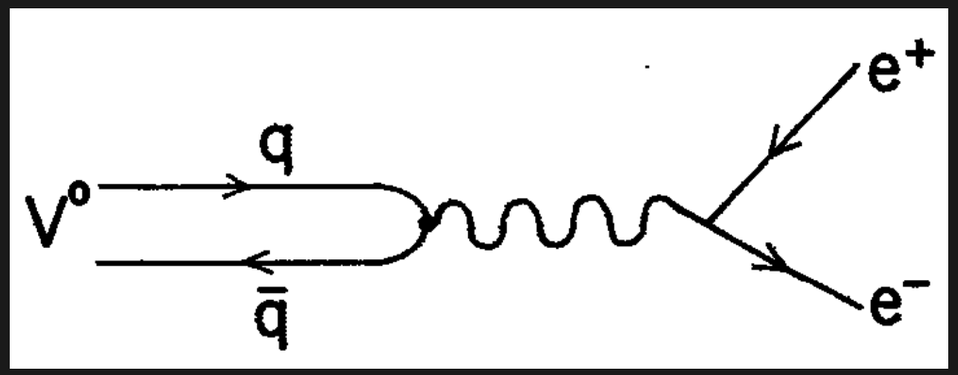




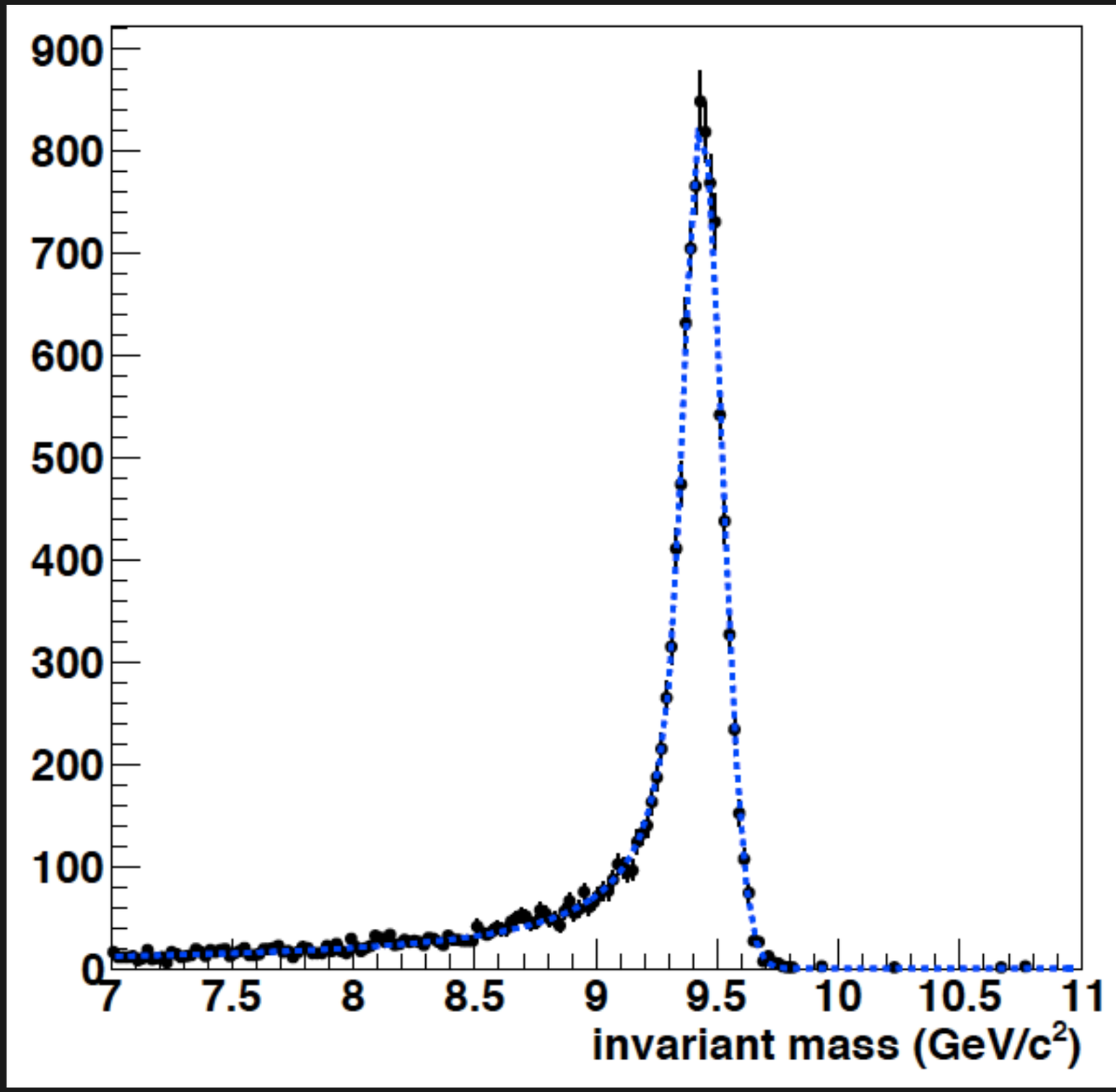




GEANT4 STUDY: VECTOR MESON RECONSTRUCTION.



Y(1S)
$-1.1 < \eta < 1.1$
$\sigma \sim 85$ MeV



sPHENIX CDR (2018)

EIC-SPHENIX GOES FAR BEYOND SPHENIX. COME JOIN US!

sPHENIX

Cold QCG TG

EIC Collaborators

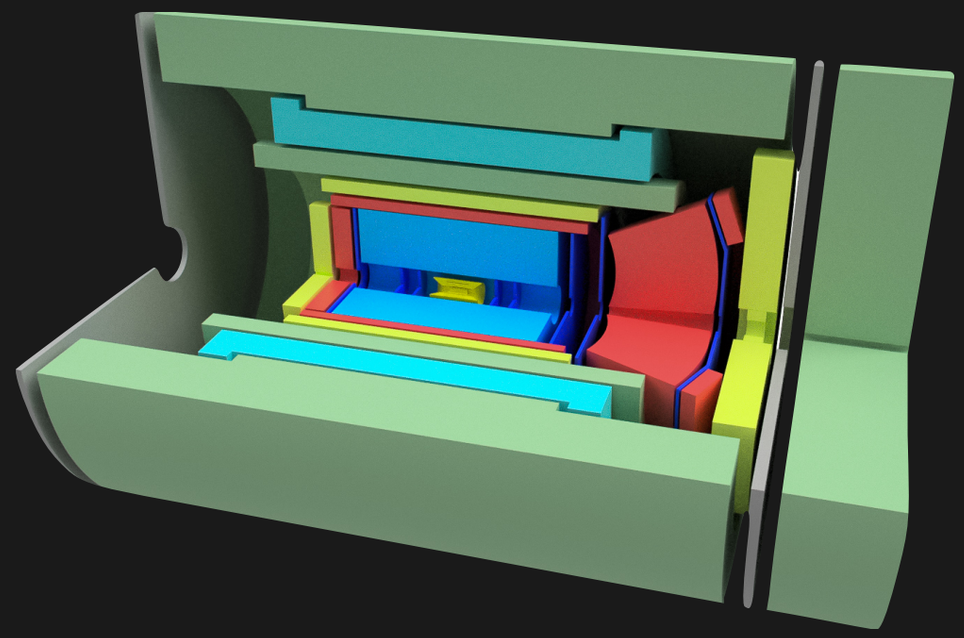
EIC Detector Study Group

eic-dsg-l@lists.bnl.gov

Mondays 8:30pm ET (bi-weekly):

https://bluejeans.com/345777492

Current focus: Letter of Intent (due September 30th).



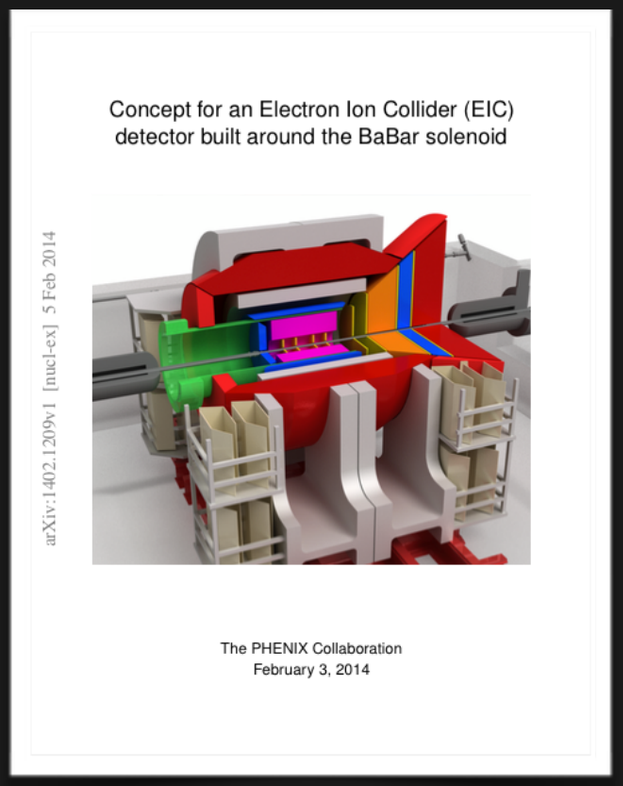
- The latest EIC-sPHENIX design covers all critical acceptances.

- The modular Fun4All framework provides a complete reconstruction and analysis chain for the GEANT4 model of this detector and is free to use for everyone.

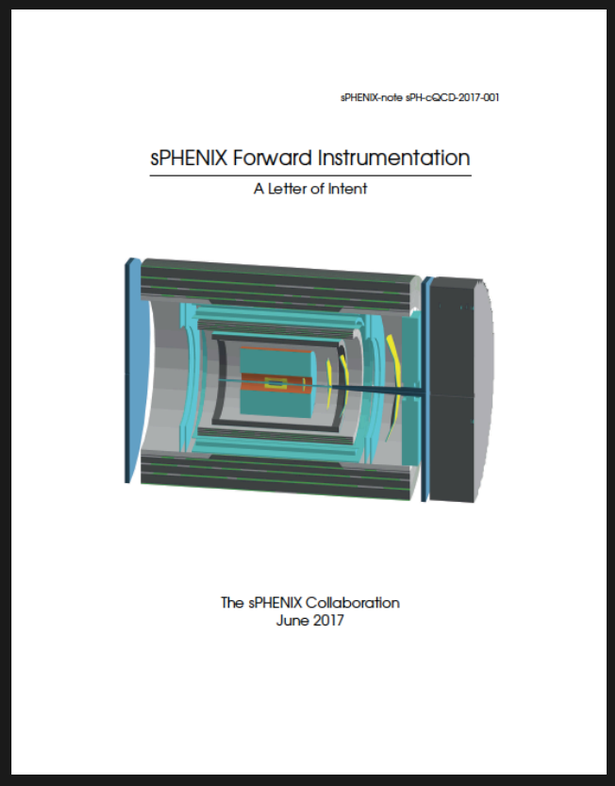
- The current LOI charge lead to increased activity and a newly established Detector Study Group investigating EIC physics topics with this detector. Come join us!

ADDITIONAL SLIDES

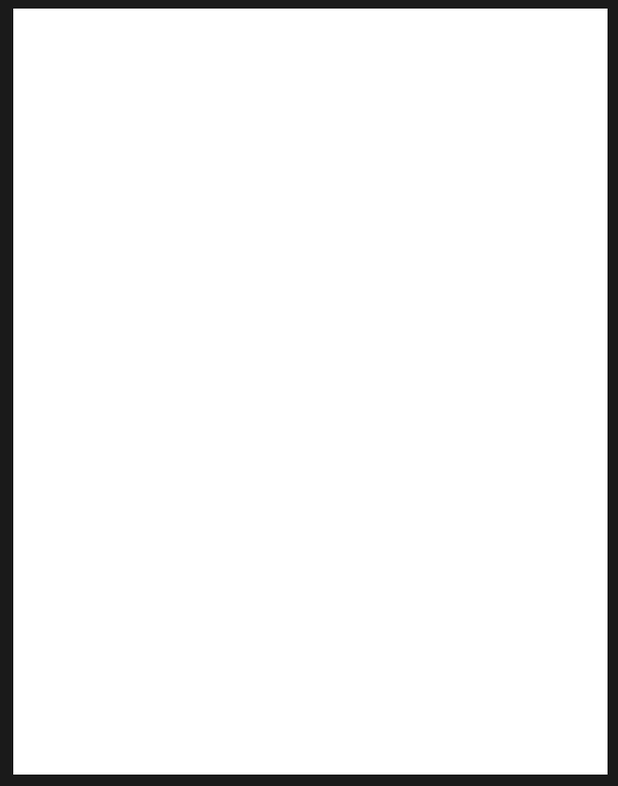
Learn more about EIC-sPHENIX and get involved:



2014 Letter of Intent
[arXiv:1402.1209v1]



2017 Letter of Intent
for sPHENIX Forward Instrumentation
[https://www.sphenix.bnl.gov/web/system/files/sPH-cQCD-2017-001_draft_2017_06_02.pdf]

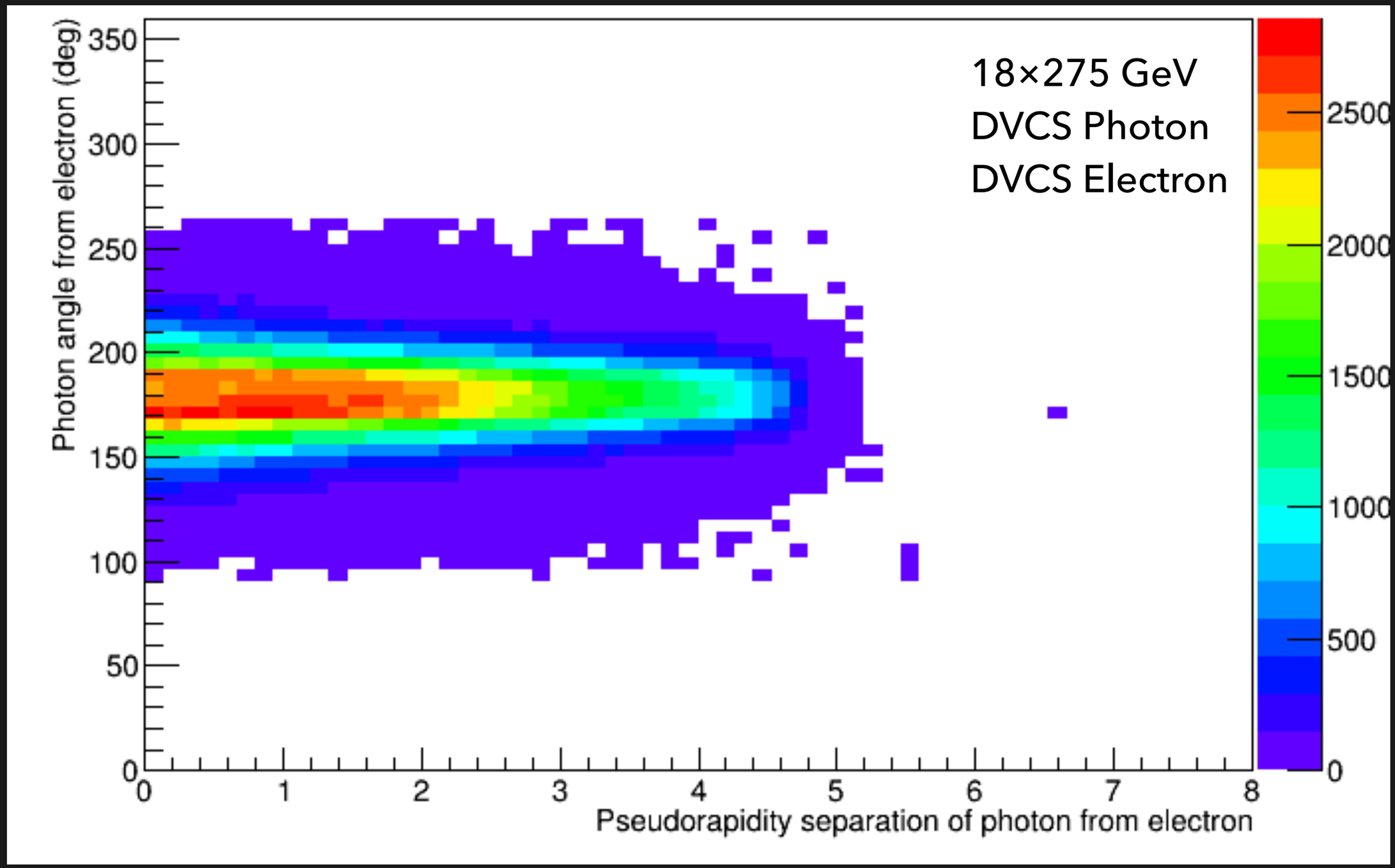


2018 Letter of Intent
Coming soon…

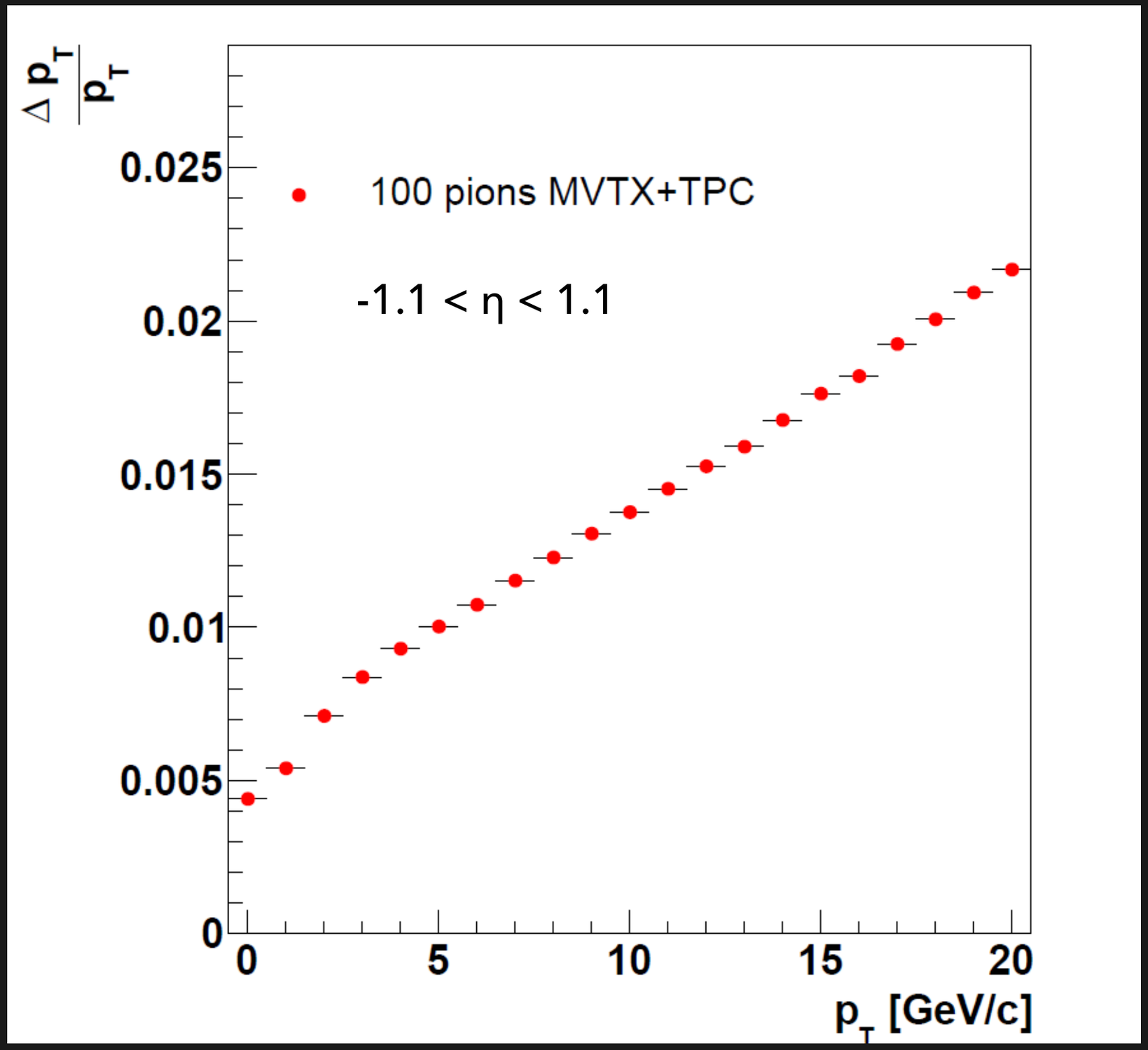
EIC Detector Study Group eic-dsg-l@lists.bnl.gov

Mondays 8:30pm ET (bi-weekly):
https://bluejeans.com/345777492

DVCS ELECTRON-PHOTON SEPARATION.

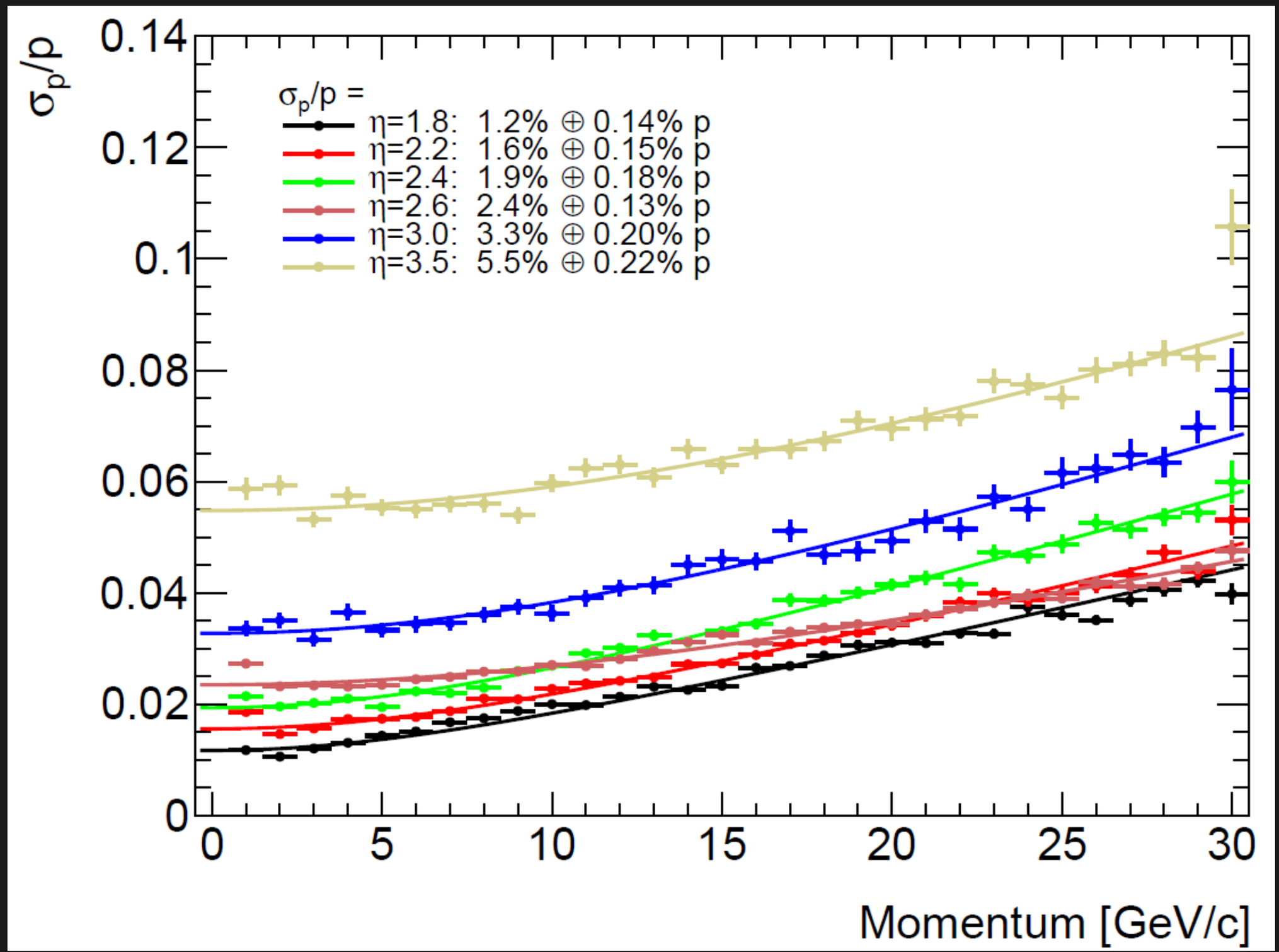


BARREL TRACKING RESOLUTION (GEANT4).

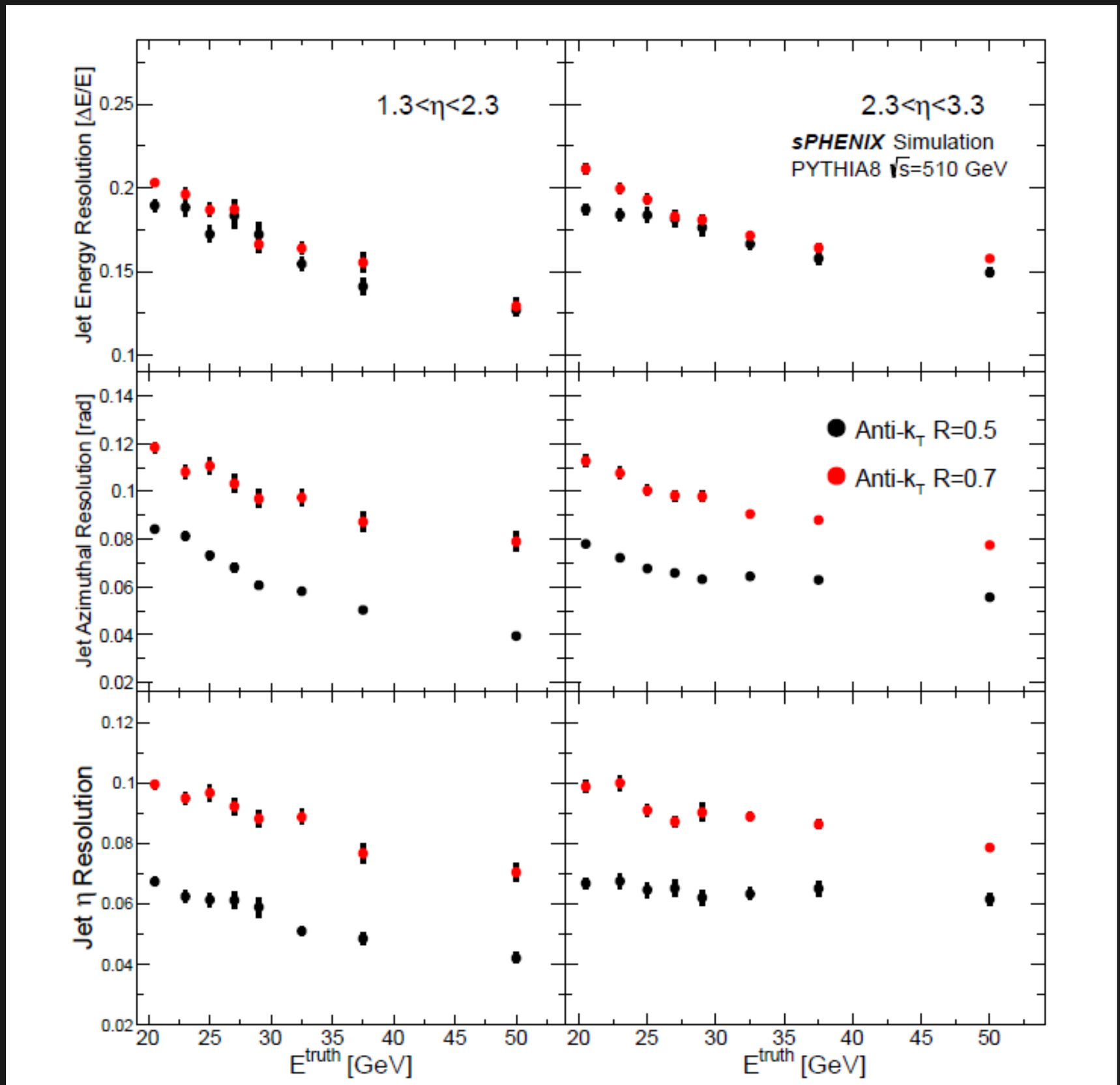


HADRON-DIRECTION TRACKING RESOLUTION (GEANT4).

sPHENIX 2017 Forward Instrumentation LOI



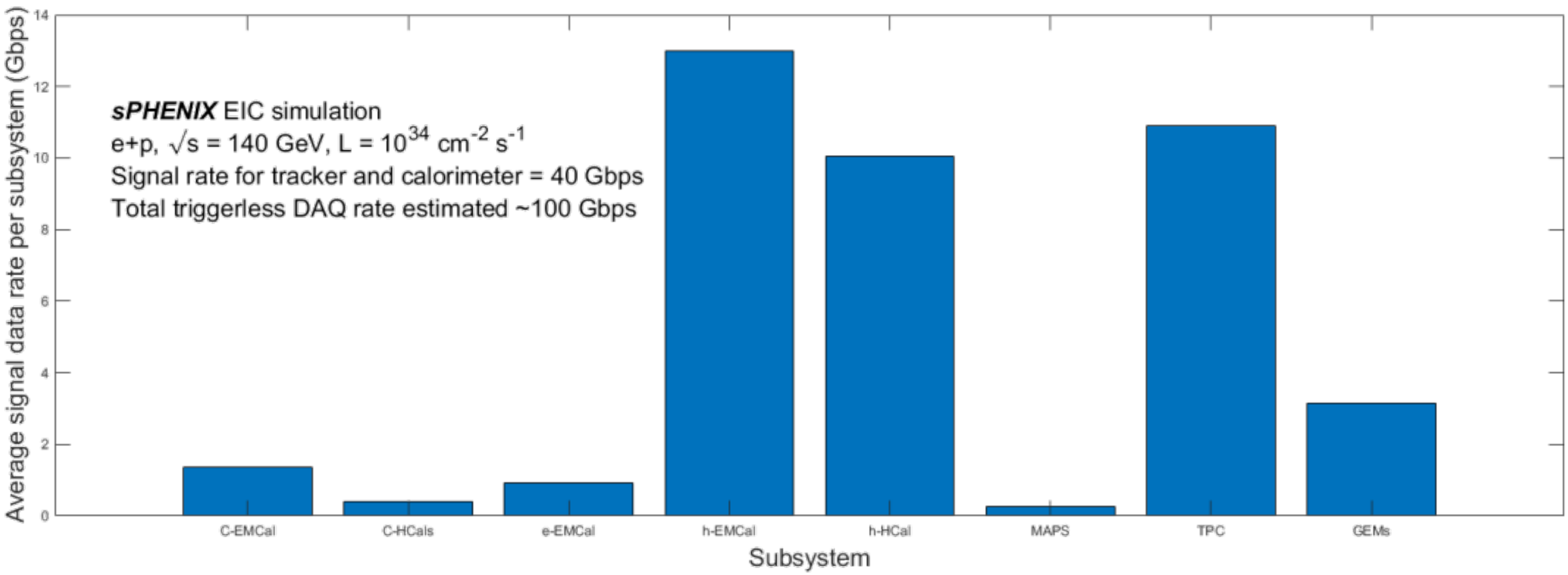
FORWARD JET RESOLUTION.



2017 Forward Instrumentation Letter Of Intent

USING COMPONENTS OF THE SPHENIX DAQ.

- Versatility of EIC event topology calls for triggerless DAQ
  - 0.5 MHz interaction rate at top luminosity
- Start using sPHENIX-EIC full detector simulation to estimate triggerless DAQ
  - Total data rate on order of 100 Gbps
  - Matches well with sPHENIX TPC/MVTX DAQ through-put rate
- sPHENIX TPC/MVTX DAQ may be expanded and reused to use for EIC detector
- Similar architecture with ATLAS/LHCb/ALICE DAQ upgrade in 2020+



Electrons
Protons
Deuterium, ^{3}He
Nuclei up to Uranium

} **Spin Polarized!**

$\sqrt{s}$ = 32 GeV … **141 GeV**

$L_{ep} = 10^{33}$ … **10^{34}** $cm^{-2}s^{-1}$