LANL LDRD for EIC

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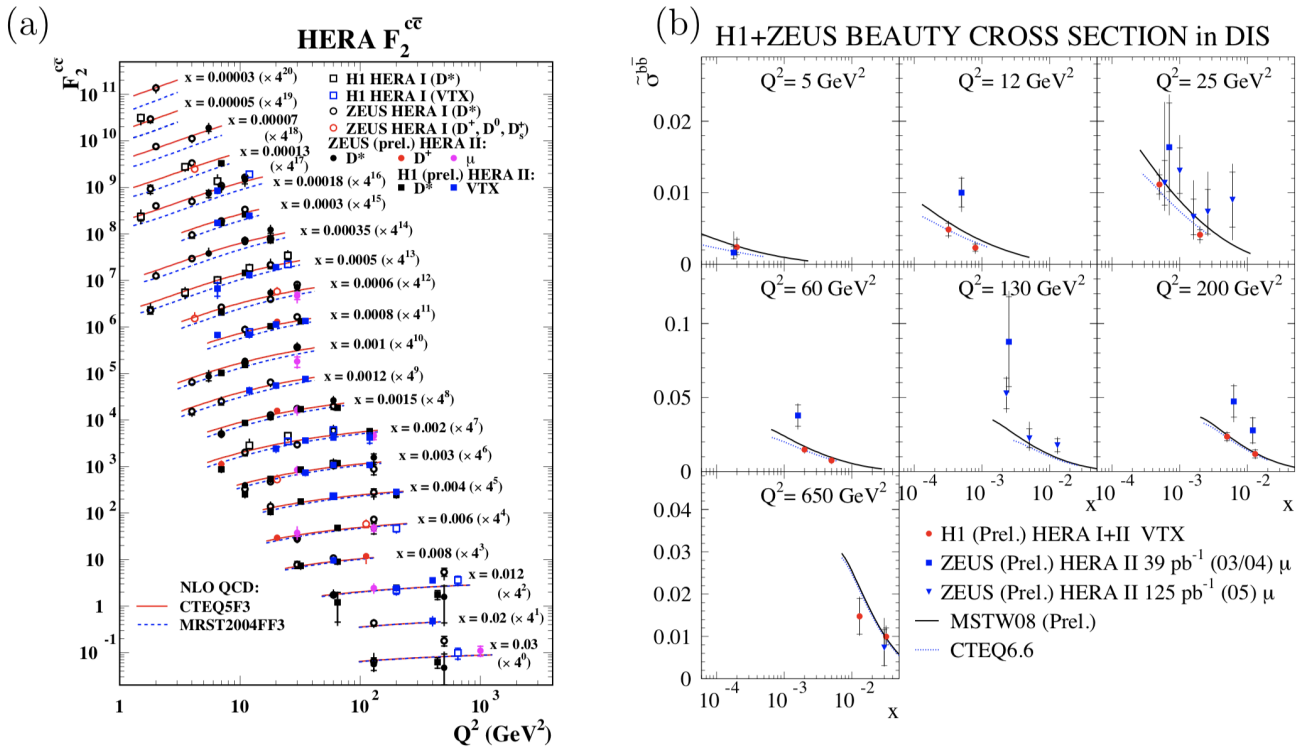


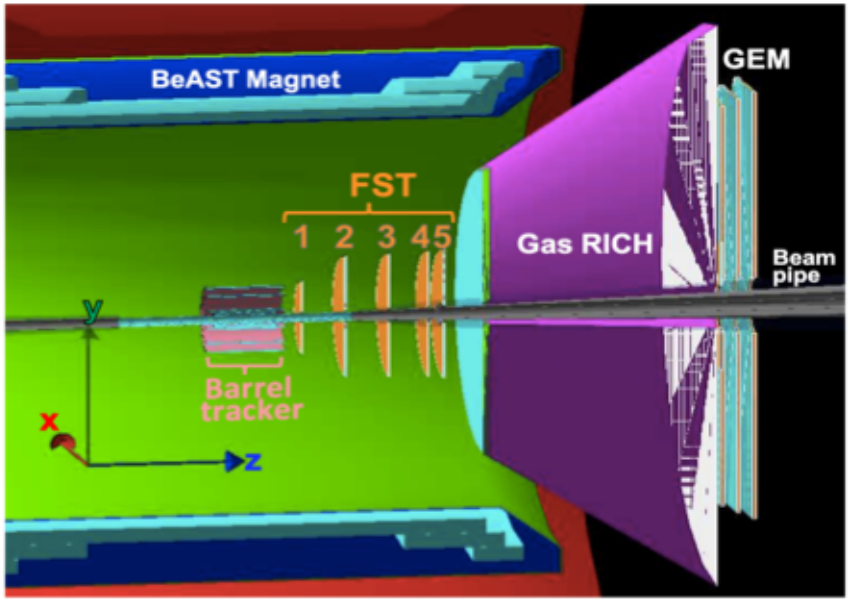
Figure 3: (a) The structure function $F_2^{c\bar{c}}$ as a function of Q^2 for various values of x. (b) The reduced cross section $\tilde{\sigma}_{b\bar{b}}$ as a function of x for different values of Q^2. The data are compared to QCD predictions.

- a heavy flavor program for eIC
- needs to build up from HERA results in ep and repeat the performance in eA

Conceptual design of the proposed Forward Silicon Tracking detector for the EIC(I)

- GEANT4 simulation within the Fun4All framework for silicon vertex/tracking detector:
  - The proposed Forward-rapidity silicon tracking detector (FST) with $1.0 < \eta < 3.5$: 3 planes of MAPS silicon detector and 2 forward planes of HV-MAPS silicon detector.

LANL FST integrated inside the EIC



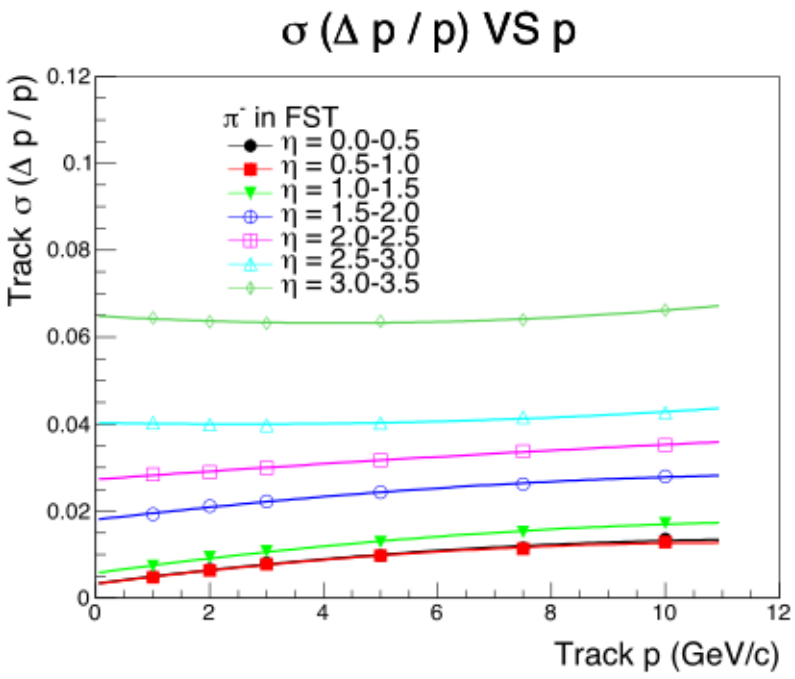
arXiv:2009.02888

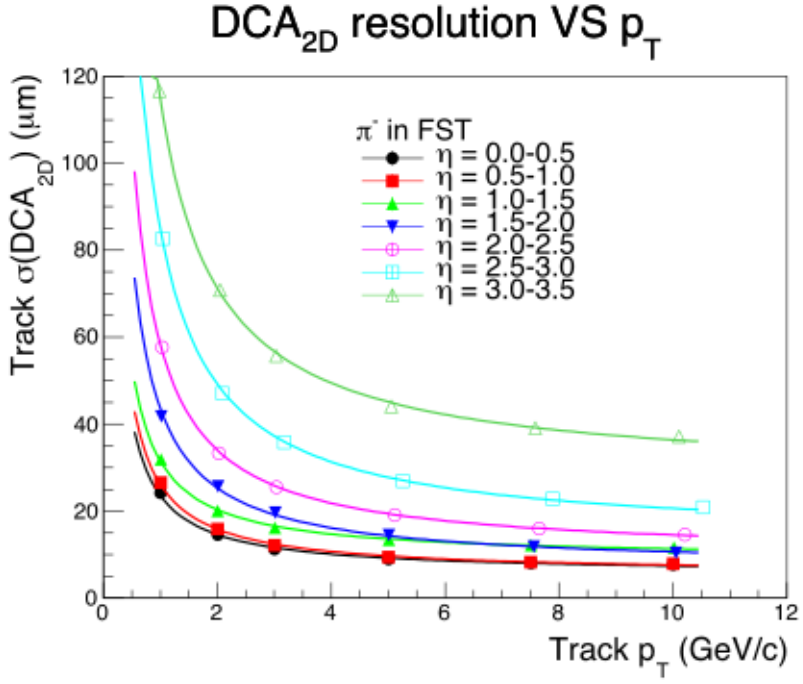
LANL FST geometry parameters

Plane index	z (cm)	r_{in} (cm)	r_{out} (cm)	Pixel pitch (um)	Silicon thickness (um)
1	35	4	25	20	50
2	62.3	4.5	42	20	50
3	90	5.2	43	20	50
4	115	6	44	36.4	100
5	125	6.5	45	36.4	100

Tracking performance of the proposed Forward Silicon Tracker (FST)

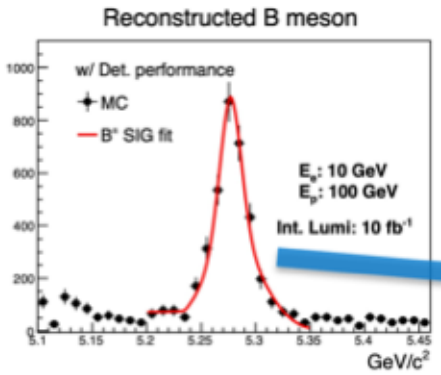
- Tracking performance of the proposed forward silicon tracker has been evaluated within the Fun4All framework.
- For example, TPC+FST+GEM inside the Beast magnet.

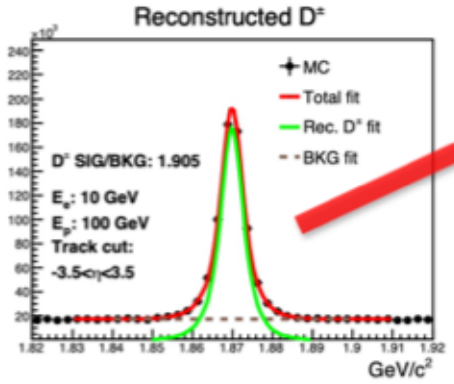


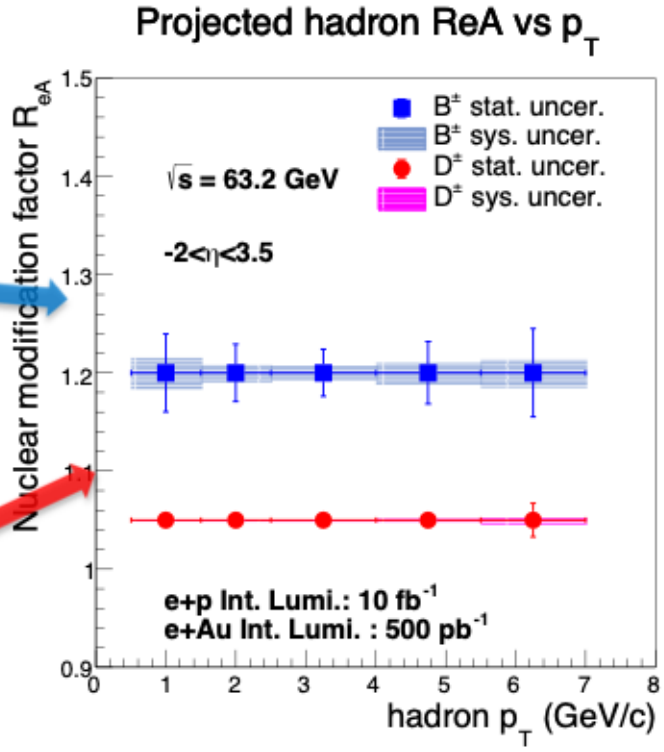


Flavor dependent nuclear modification factor projections for reconstructed hadrons

- Inclusive flavor dependent hadron nuclear modification factor R_{eA} projection in 10+100 GeV e+Au collisions.







Nuclear modification factor:

$$R_{eA} = \frac{\#_{e+A}}{\$\#_{e+p}}$$

Systematic uncertainty sources:

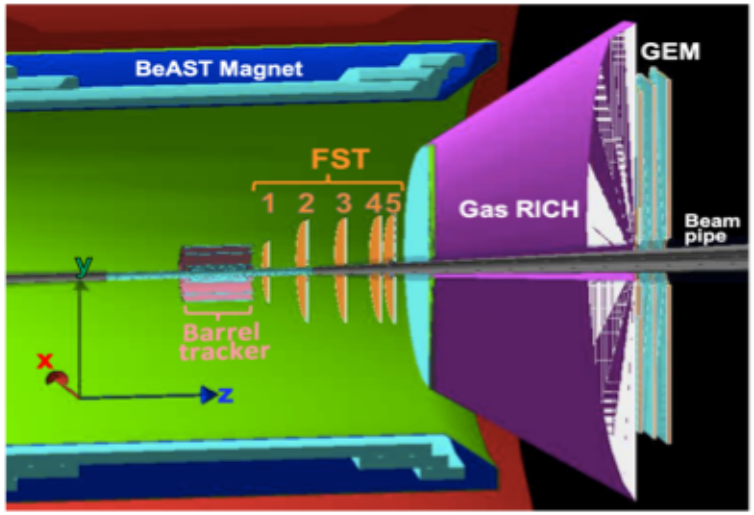
- Different detector design and performances.
- Different magnet options: Beast VS Babar.

arXiv: 2009.02888
Included in the EICYR

Ongoing EIC detector R&D at LANL (I)

- Potential hybrid design for the proposed forward silicon vertex/tracking detector and technology candidates:

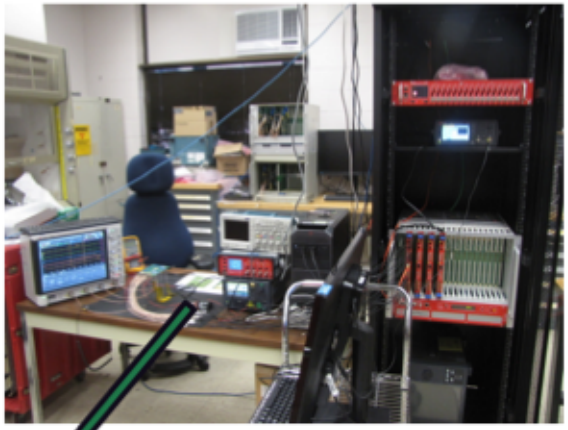
Different geometries have been explored, arXiv:2009.02888



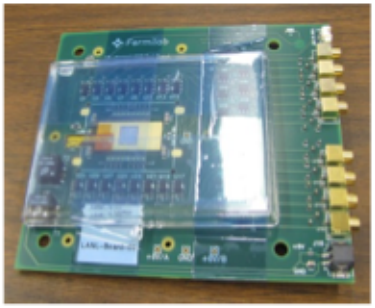
Name	Technique	Pixel Size	Integration Time	Thickness per layer
Monolithic Active Pixel Sensor (MAPS)	180 nm (future 65 nm) Tower Jazz	~20 X 20 ! " !	~100 ns	<0.3%X_0 per layer
Radiation hard MAPS (MALTA)	180 nm Tower Jazz	36.4 X 36.4 ! " !	<5 ns	<0.5%X_0 per layer
LGAD or AC-LGAD	Low Gain Avalanche Diode	100 X 100 ! " !	<100 ps	<1%X_0 per layer

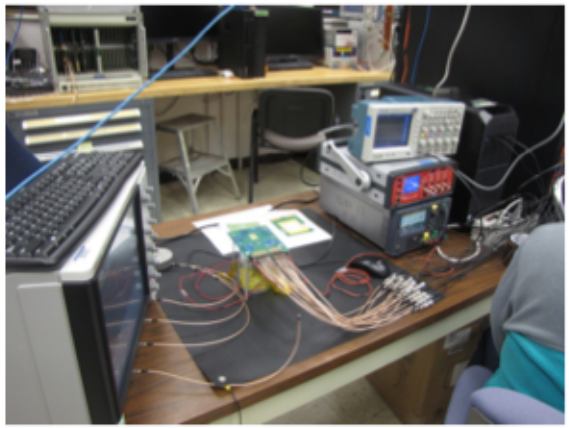
Ongoing EIC detector R&D at LANL (II)

- Snapshot of the silicon R&D lab and ongoing testing at LANL.



LGAD sensor

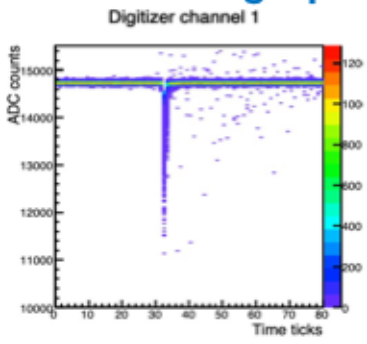


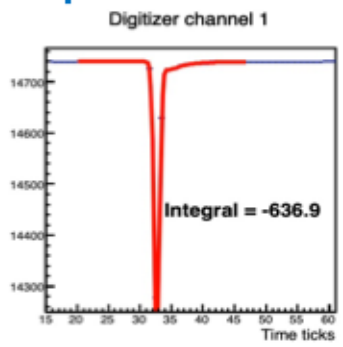


LGAD sensor test setup with a Sr^{90} source

MALTA test under setup

Single pixel output data





- Performance will be implemented in the simulation and considered in the conceptual design.

Final Remarks

- Ongoing LANL LDRD is working with available silicon technology (MALTA) for a forward tracker device to provide a final report in ~18 months
- LGAD technology is also under study for a potential one/two layer(s) TOF to cover PID of soft particles which may not be at reach of RICH detectors
- We are also paying a lot of attention to Synchrotron Radiation backgrounds which may be incorporated in our next simulations
- Several other ideas in the air, for example:
  - B0 spectrometer
  - Real time data processing
- We are hiring a new mechanical engineer, Eric Renner, to interact with Walt Sondheim for sPHENIX and EIC business. He will be the one who will be around during the detector design and construction.
- Important interaction with national and foreign Institutions to attract them to eIC