

LANL 4-year overview

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Groups members: current and past

Engineers:

current: Walter Sondheim, Joellen Renck, Eric Renner

Students:

current: Julie Berkey, Bade Sayki

Postdocs:

current: Brandon Blankenship, Thomas Boettcher, Liliet Diaz, Jakub Kvapil, Zhiwan Xu, Jackson Pybus, Nicolas Schmidt, Yu-Dai Tsai

Scientists:

current: Matt Durham, Hugo Pereira Da Costa, Cesar da Silva, Ming Liu, Kun Liu, Xuan Li

List main accomplishments in past 4 years

- The LANL team has contributed to the ATHENA and ECCE proposal preparation.
- The LANL team has contributed to the EIC yellow report writing.
- The LANL team has contributed to the ePIC SVT mechanical design.
- The LANL team has contributed to the ePIC tracking evaluation in simulation.
- The LANL team has contributed to the EIC heavy flavor physics simulation studies.
- The LANL team has led DOE NP supported Fast-ML projects on real-time event tagging and control for sPHENIX and EIC experiments.

Detector construction plans at campus/lab

- The LANL team plans to get involved in the ePIC SVT hadron-endcap disk assembly and characterization.
- If there will be sufficient resources, the LANL team plan to contribute to the hadron-endcap AC-LGAD ToF assembly as well.

Key roles in ePIC

- Former ePIC tracking WG co-convenor: Xuan Li
- Former ePIC heavy flavor and jet WG co-convenor: Cheuk-Ping Wong
- Current ePIC Junior representative: Nicolas Schmidt

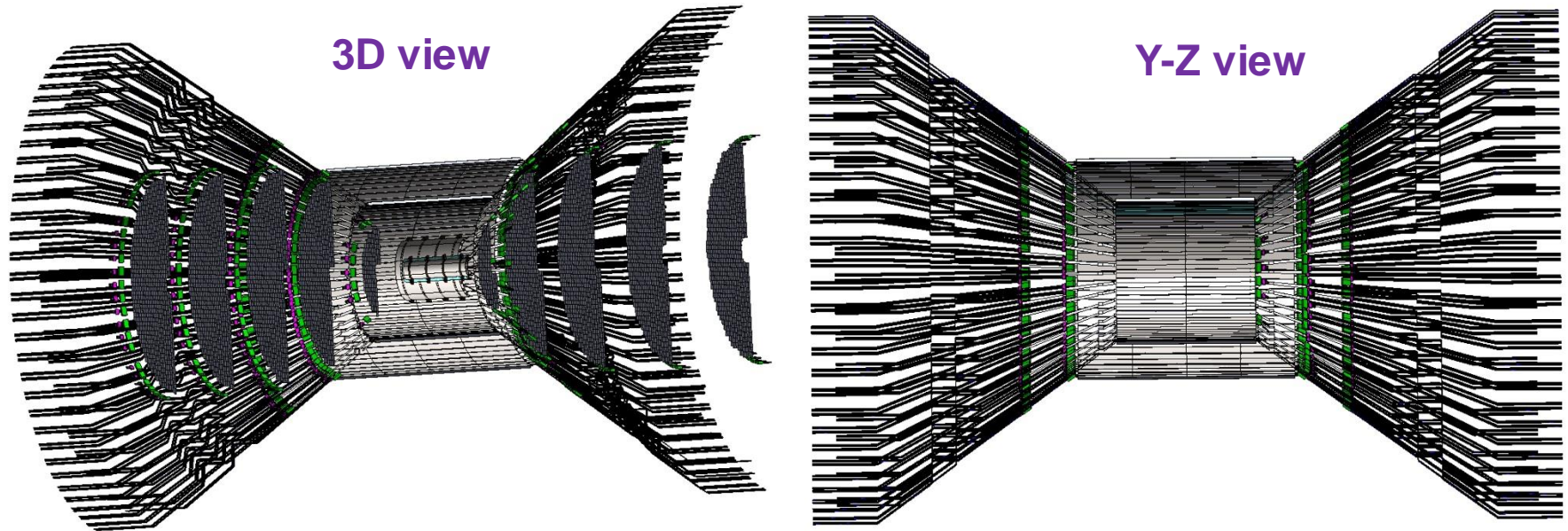
Key non-EIC accomplishments

- LHCb experiment operation and data analyses.
- PHENIX experiment data analyses.
- sPHENIX experiment operation and data analyses.
- sPHENIX MVTX and TPOT R&D, construction and operation.
- E1039 experiment operation and data analyses.
- E1039 polarized proton target R&D, construction and operation.
- AMBER experiment operation and data analyses.
- AMBER silicon detector upgrade and operation.

EIC highlight 1

- The original mechanical design of the ePIC SVT led by Walter Sondheim at LANL has implemented the mechanical structure of the barrel layers and the endcap disks following the previous design.

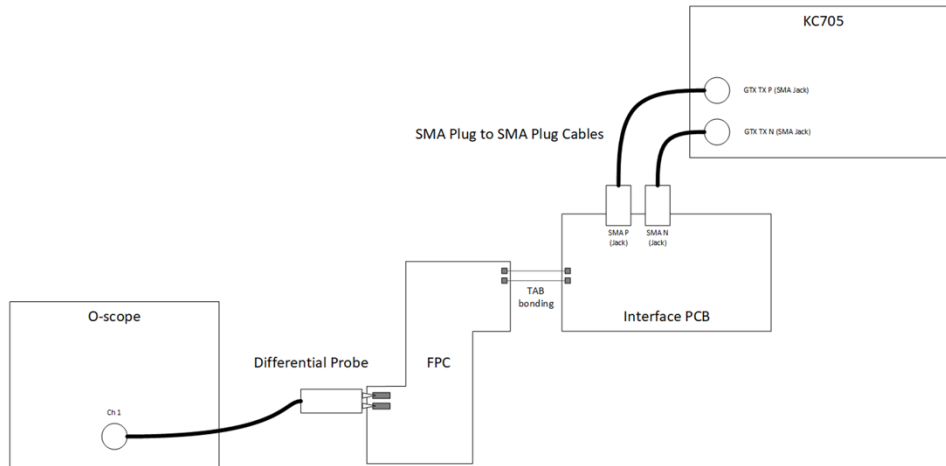
**Service cables from the 3 SVT vertex layers.
No service cables from the endcap disks**



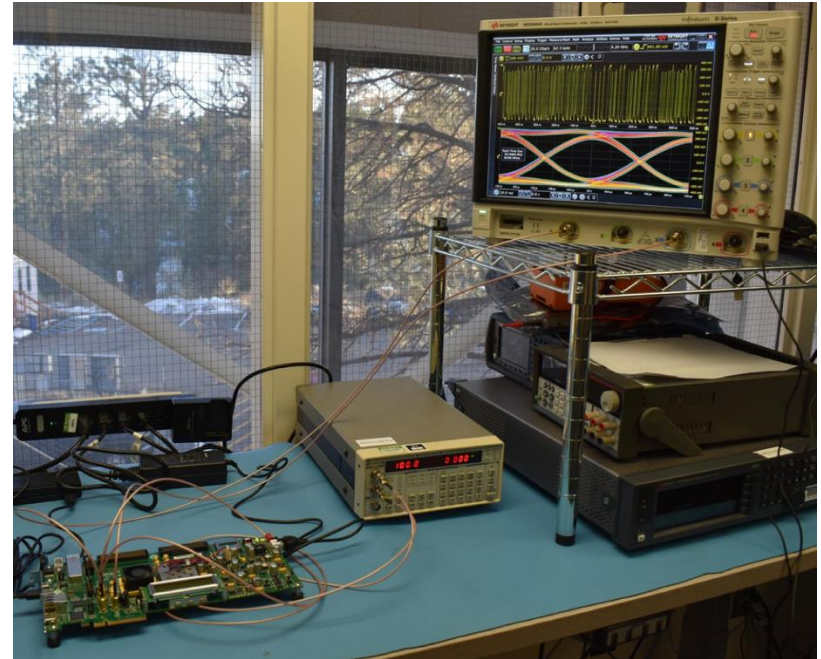
EIC highlight 2

- In collaboration with LBNL and UK SVT colleagues, we are setting up the test bench to perform the SVT FPC characterization studies. This work is led by Joellen Renck at LANL.

Planned test bench configuration



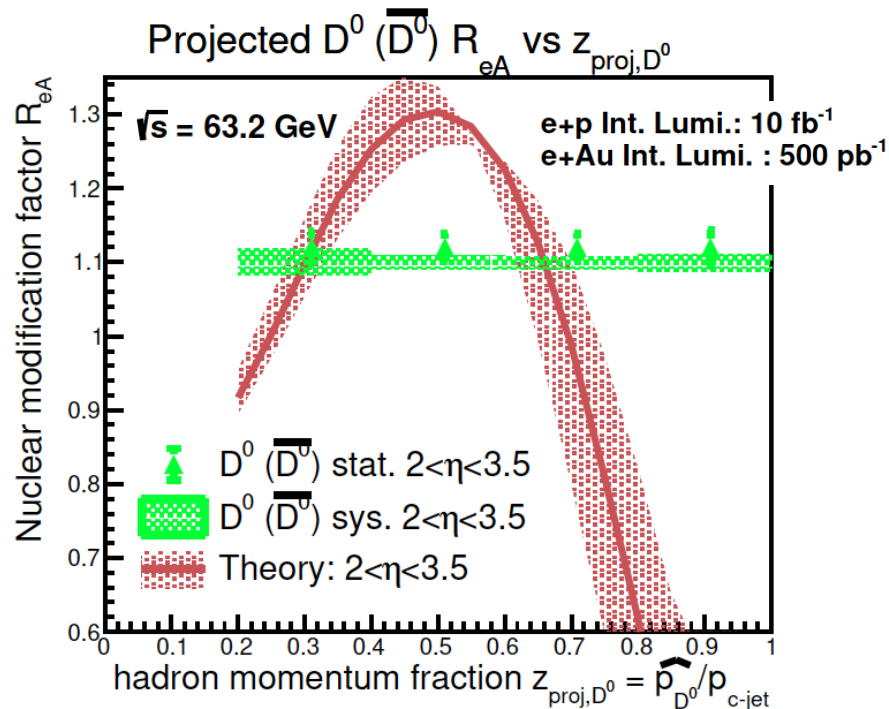
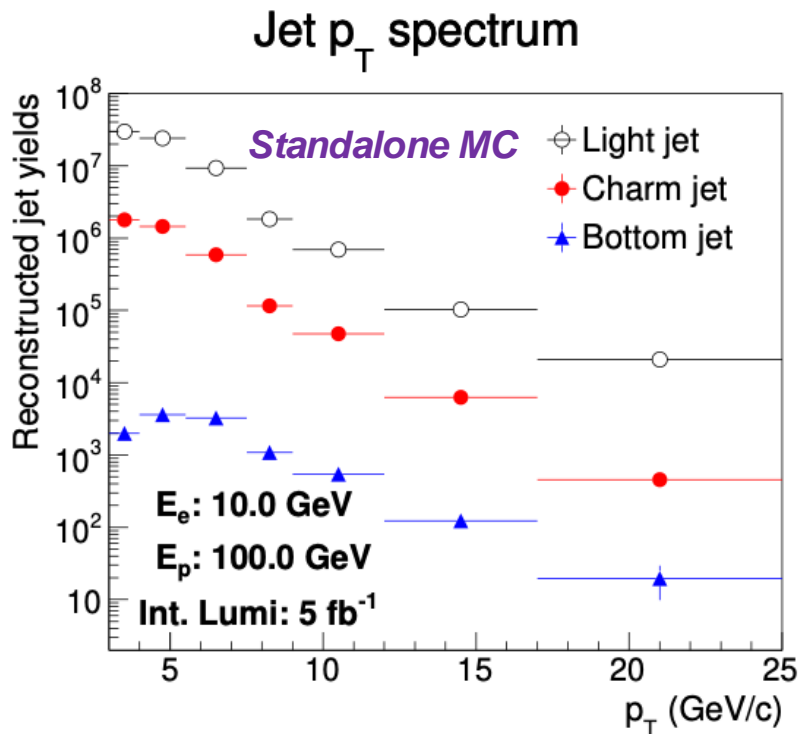
Test bench setup at LANL



EIC highlight 3

- The LANL EIC team is also working on heavy flavor studies using standalone simulation with parameterized EIC detector performance. We plan to continue this work with the ePIC default simulation framework.

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Leveraged funding (grants due to MRPI project)

- EIC project R&D program eRD111 project funding (~\$100k).
- EIC project R&D program eRD113 project funding (~\$155k).

Publications in past 4 years

- “Precision studies of QCD in the low energy domain of the EIC”, V. D. Burkett et al., Progress in Particle and Nuclear Physics 131 (2023) 104032, <https://doi.org/10.1016/j.pnnp.2023.104032>
- “Heavy Flavor Physics at the EIC with the ECCE detector”, X. Li, <https://doi.org/10.31349/SuplRevMexFis.3.040916>
- “Design of the ECCE Detector for the Electron Ion Collider”, J. K. Adkins et al., arXiv: 2209.02580.
- “ATHENA detector proposal — a totally hermetic electron nucleus apparatus proposed for IP6 at the Electron-Ion Collider”, J. Adam et al., 2022 JINST 17 P10019, DOI: 10.1088/1748-0221/17/10/P10019.
- “Science Requirements and Detector Concepts for the Electron-Ion Collider”, R. Abdul Khalek et al., Nucl. Phys. A 1026 (2022) 122447, DOI: 10.1016/j.nuclphysa.2022.122447.
- “Snowmass 2021 White Paper: Electron Ion Collider for High Energy Physics”, R. Abdul Khalek et al., arXiv: 2203.13199.

Future plans in the EIC program

- We plan to accomplish the R&D work for the eRD113 project in collaboration with the SVT working group and the UC EIC consortium colleagues.
- We plan to contribute to the ePIC SVT hadron-endcap disks assembly and operation.
- We are also interested in the following detector subsystems for the ePIC upgrade and/or detector II:
 - Fast MAPS mini-tracking detector.
 - Possible forward muon detectors for exclusive HF production.
 - A gaseous target to enable the fixed-target program at the EIC.

Future plans in the EIC program

- We will update the heavy flavor hadron and jet physics studies with the latest ePIC detector design and interested physics topics include:
 - Heavy flavor jet and heavy flavor hadron inside jet measurements in $e+p/A$ collisions to explore the final-state hadronization process.
 - Constraining the gluon TMD with open charm and heavy flavor jet production.
 - HF exclusive process to study gluon GPD with high luminosity $e+p/A$ collisions.
- We welcome UC students to visit us for EIC detector R&D and physics related work.

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