Expression of Interest (EOI)
Questionnaire

Please indicate the name of the contact person for this submission:
Kent Paschke

Please indicate all institutions collectively involved in this submission of interest:
This EOI summarizes intended activities at the University of Virginia.
Tracking: Kondo Gnanvo and Nilanga Liyanage (in the MPGD_TRD consortium EOI)

Lepton Polarimetry: Kent Paschke (in the Lepton Polarimetry consortium EOI)

(even if institutions can submit on their own, it is highly encouraged to form groups to work together within their country, their geographical region, or as a general consortium)

Please indicate the items of interest for potential equipment cooperation:

- Central and forward/backward endcap tracking detectors based on Micro-Pattern Gas Detector (MPGD) technologies, in particular Gas Electron Multipliers (GEMs) and micro Resistive Well (μRWELL).
- Lepton Compton polarimeter, laser system and simulation.

(indicate experimental equipment components, including those integrated in the interaction regions, each separately)

Please indicate what the level of potential contributions are for each item of interest:
Tracking: person power, expertise and infrastructure for construction, and testing of detector components.
Lepton polarization: person power and expertise.

Please indicate what, if any, assumptions you made as coming from the EIC Project or the labs for your items of interest:
Tracking: Our efforts will focus on detector design activities. We are assuming that material costs and some engineering support will be provided by the EIC project.

Polarimetry: We anticipate that funding for the postdoc contribution will be made with support of CFNS under a Joint Postdoctoral position. Future activities are assumed to be funded from continuing grant research funding. UVa laboratory space could be used for laser development or the work could be performed at other institutions. Materials and engineering for laser development would be expected to come from the EIC project or other external sources.

(e.g., indicate if you include engineering and design activities or assume those to come from the EIC Project, if you assume certain material costs to be covered by the EIC Project, if you rely on existing capabilities at the labs, etc. Try to be as inclusive as you can be.).

Please indicate the labor contribution for the EIC experimental equipment activities:
(e.g., for each cooperation and/or institution list the number of senior staff, the number of postdocs, and the number of graduate and undergraduate students that you plan to dedicate to the EIC experimental equipment activities. Similarly, please list the number of engineers, designers and technicians included in your potential cooperation).

The time commitment of members of the University of Virginia group in the EIC efforts described in this EoI is anticipated to be as follows:

Institution Name	Professor	Research Professor	Staff Scientist	Postdoc	Graduate Student	Undergrad. student	Engineer	Designer	Technician	Total Sum
UVa, Tracking	0.1	0.3		0.5	1.0	0.4				**2.3**
UVa Polarimetry	0.1			0.25	0.5					0.85

NOTE: FTE in the above table represents the annual fractional full time equivalent (FTE).
NOTE: for a professor, full-time equivalent research time may be limited to 25% max, for a research professor (or a sabbatical) or a staff scientist limited to 50% max, for a postdoc maybe 100%, and for a grad. student perhaps 50% (on average). For an undergraduate student research time (on average) is limited to 20% max.

Tracking: at an annual basis, 0.1 full-time equivalent FTEs of a professor, 0.3 FTEs of a Research Professor, 0.5 FTEs of a postdoctoral researcher, 1.0 FTEs of PH.D. students, and 0.4 FTEs of undergraduate students.

Polarimetry: 0.25 FTE postdoc effort starting in 2021 toward this effort, along with a fraction of PI effort. In 2022 and beyond, up to 0.5 FTE of a graduate student for several years of development and implementation.

Please indicate if there are timing constraints to your submission:
(e.g., indicate any known or anticipated timing profile assumed in your EOI. This can include anticipated time frames folding in constraints due to ongoing commitments, due to ongoing R&D and its anticipated completion date, etc.)

Please indicate any other information you feel will be helpful:

UVa has been developing large-area triple-GEM trackers for several experiments at Jefferson Lab, including PRad and Super BigBite, as well as future experiments MOLLER and SoLID and

also served as the detector production site. UVa has been a participant EIC R&D program, working with collaborating instituations to explore GEM and μRWELL technologies as part of the eRD6 and eRD22 projects.

UVa has significant experience with high precision Compton polarimetry in Jefferson Lab in Halls A and C, including laser development, operation, analysis and studies of potential systematic errors.

Gaseous-Detector Development Laboratory: 1600 sq. ft. with gas system infrastructure which includes:

- Small cosmic ray stand with four 10 cm x 10 cm CERN "standard GEMs" for R&D
- Large cosmic ray stand for large MPGD detector (1000 cm x 50 cm) tests and characterization. The stand consists of plastic scintillation detectors with PMTs with associated digital DAQ cards for providing cosmic ray coincident triggers.
- Several readout electronics systems for MPGDs:
    - APV25-SRS (10k Ch): APV25-based Scalable Readout System with both RD51 DAQ (DATE and amoreSRS for monitoring) and Jefferson Lab DAQ (CODA and GEMView for monitoring).
    - APV25-MPD (2k Ch): Multi-Purpose Digitized with Jefferson Lab DAQ (CODA)
    - VMM3-SRS: VMM3-based Scalable Readout System with RD51 DAQ
- Pico-ammeters for HV testing and leakage current measurements of large GEMs under nitrogen flow.
- Lead-shielding x-ray box and x-ray gun for high particle rate exposure of large area MPGDs.
- Variety of scintillation detectors (Nal and plastic scintillators with PMTs) with associated HV power supplies.
- SoLIDWorks and Inventor design software suites.
- NIM crates and modules for trigger logic, CAEN HV PS modules, MPOD Wiener PS (> 8 channels).

GEM Production and Quality Control for Jefferson Lab Experiments (PRad, SBS, SoLID, Moller)

- Two fully equipped clean rooms for assembly of large triple GEM (150 cm x 55 cm) including
    - Large mechanical stretcher
    - 175 cm x 55 cm Nitrogen plexiglass box for HV tests and leakage current measurements.
    - Ultrasonic bath (60 cm x 50 cm x 40 cm) for cleaning of GEM components.
    - High resolution optical microscope for GEM foil and GEM readout inspection.

University Machine Shop: Mechanical machining jobs can be done at the University machine shop for reasonable hourly fees ($35) or for free for a student project. Students can get trained

by machinists on the use of standard machines in a dedicated 3-week training course before beginning work. Several students in our lab have completed this course in the past.

University Electronics Shop

The UVa Physics department electronics shop has a full time electronics engineer with particle and nuclear physics instrumentation expertise and an electronics technician skilled in laboratory instrument construction and repair. The shop provides in-house electronics development, prototyping, fabrication, and optimization services.