**Expression of Interest (EOI)**

**Questionnaire**

*(Use this template for your document. The document can be at most 10 pages long, in this style, font and font size, but you can have appendices and do not have to include the tables in the page count. There is no prescribed format of the document, but you are asked to address the questions below. It is understood that maybe not all questions can be answered precisely, everybody is asked to fill the questions as good as currently possible. All submitted public Questionnaires will be viewable here (https://indico.bnl.gov/event/8552/). You can also submit a separate document with certain information you would only like to be viewable by the EIC Project. DEADLINE FOR SUBMISSION: NOVEMBER 1.)*

**Please indicate the name of the contact person for this submission:**

*(we ask for one main contact person per submission. You can as needed provide further contacts, but there should be one primary contact)*

**Charles E. Hyde:** chyde@odu.edu

**Please indicate all institutions collectively involved in this submission of interest:**

*(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)*

**Old Dominion University**

Norfolk VA 23529

**Please indicate the items of interest for potential equipment cooperation:**

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

* DIRC for Particle I.D.
* Ion side Zero Degree Calorimeter including both hadronic calorimetry and electromagnetic calorimetry.
* Luminosity measurements.
* Detectors for ion polarimetry via Coulomb-Nuclear interference.

**Please indicate what the level of potential contributions are for each item of interest:**

*(e.g. indicate if contributions are for full in-kind experimental equipment components – we have provided a rough direct cost estimate for many components in an appendix, if contributions are for partial in-kind experimental equipment components, if contributions are for in-kind labor contributions, etc.).*

Listed items are expected to be multi-institutional collaborations.

We anticipate participation in a DIRC consortium, and could provide the clean-room space for assembly of DIRC boxes, if the EIC project provides appropriate labor and equipment costs. We currently have a facility for testing the optical quality of DIRC lenses at ODU, and can sustain this for production testing of lenses. We are also equipped to characterize DIRC photosensors.

Elements of the zero-degree detectors (both ion-side and electron-side) are within the scope of our experience, interests, and available labor.

**Please indicate what, if any, assumptions you made as coming from the EIC Project or the labs for your items of interest:**

*(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.).*

* Engineering and advanced design must come from the EIC Project or labs.
* We will submit supplemental funding requests to either DOE or NSF for material and equipment costs specific to our contribution to the EIC project. Our participation in significant construction projects will be contingent on receiving this supplemental funding either from such grants, or directly from the EIC project

**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 **Old Dominion University** 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 |
| ODU | 0.15 |  |  | 0.5 | 0.5 | 0.1 |  |  | 0.5 |  |
| 0.15 |  |  | 0.5 | 0.5 | 0.1 |  |  |  |  |
| 0.1 |  |  |  | 0.5 |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  | **3.6** |
|  |  |  |  |  |  |  |  |  |  |  |

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.

*(Repeat this table for each institution, or include the information for the whole group/consortium together in one table as shown above.* ***This reflects an annual average FTE estimate.*** *Please state below for how many years you estimate this average cooperation level to be valid.)*

It is anticipated that the collaborative effort of OLD DOMINION UNIVERSITY to cooperate on the EIC Project will include (at an annual basis) 0.4 full-time equivalent FTEs of a professor, 1.0 FTE of a postdoctoral researcher, and 1.5 FTEs of Ph.D. students. The technical collaborative effort will include at least 0.5 FTE of a technician.

**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.)*

In the current year, the ODU EIC effort is already 0.15 FTE professor, 1.0 FTE Post-Doc, 0.25 FTE graduate student and 0.25 FTE technician. We anticipate the full complement detailed in the table above will be available starting in calendar year 2022, and will last for the duration of the EIC Project.

The full experimental nuclear physics research group at ODU includes 6 regular faculty, one research faculty member, 3 post-docs, and 8 graduate students. The group is strongly engaged in leadership roles of the research program at Jefferson Lab with important commitments that span the next 5 years. The EIC effort outlined above is the current and expected commitment specifically to the EIC. However, our EIC effort will benefit from the strengths and experience of the entire ODU group.

**Please indicate any other information you feel will be helpful:**

*(e.g., this could be things like assembly and storage space at your institute, clean rooms and class, special skills or machine shops, or perhaps some pointers to past accomplishments – you can expand on those in an appendix. If you could make existing engineering, design or technician labor available to the EIC experimental equipment but would rely on funds coming from the EIC Project you can also list those here).*

Our facilities at ODU include:

* 4840 sq ft of lab space, including
  + Two class-10,000 clean rooms: 800 sq ft and 280 sq ft,   
    plus a 150 sq ft common ante-chamber.   
    The larger clean room has a ceiling height of 20 ft.
* A modest inventory of VME and CAMAC electronics, high voltage power supplies, plastic scintillator, photo-multiplier tubes, and optical equipment.

Major projects we have built in our lab, or collaborated on, include:

* The complete Region-2 Drift Chambers for both CLAS6 and CLAS12 at Jefferson Lab.
* A set of cathode planes for a COMPASS tracker
* Three generations of radial Time Projection Chambers (rTPC) based on GEM foils
* Two generations of a PbF4 calorimeters for gamma and π0 detection in deep virtual exclusive reactions in Hall A at Jefferson Lab.
* The Dynamic Nuclear Polarization NH3 and ND3 target for CLAS12.
* Commissioning, operating, and analyzing the Roman-Pot silicon trackers of the RHIC pp2pp experiment (later incorporated into STAR).

Ongoing EIC work includes

* EIC detector background studies from (ion) beam-gas interactions and synchrotron radiation. The beam-gas interactions include a full neutron cascade to obtain 1 MeV neutron equivalent fluence in all regions of the detector. This work is conducted with the eRD21 project
* Optical characterization of prototype lenses for DIRC focusing. This is conducted at ODU in collaboration with CUA, as part of the eRD14 PID consortium.
* Simulation and design of a ZDC (eRD27, in collaboration with University of Kansas).