**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. This document will be viewable by password to all who submit. 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:**

*Murad Sarsour (msar@gsu.edu)*

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

*Georgia State University*

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

* *Modular Ring Imaging CHerenkov (mRICH) detector. It is modular and compact RICH detector that provides hadron PID capability from 3 to 10 GeV/c for* π*/K separation and electron PID for e/*π *separation below 2 GeV/c. It uses Aerogel as radiator and Fresnel lens for focusing which forms sharper and smaller ring image than a proximity focusing RICH detector and shifts the ring image by the lens to the central region of the lens focal plane [C. Wong, et al., NIM A* ***871****, 13 (2017)].*
* *Hadronic Calorimeter (HCal) for an EIC detector (GSU is one of the leading institutions building the sPHENIX HCal) [C. Aidala et al., IEEE Transactions on Nuclear Science* ***65****, 2901 (2018)]*

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

* *mRICH: construct the individual modules. GSU already built several prototype modules and carried out two beam tests. We look forward to collaborate with other institutions on sensor development and the readout electronics. We are currently collaborating with an INFN group in Italy and a group from Hawaii University on developing electronics. In addition, we are working with collaborators from ANL and BNL on testing the viability of using Gen-II LAPPDs with an external pixelated readout board for mRICH at FNAL.*
* *HCal: if the sPHENIX HCal meets the EIC requirements GSU, being one of the institutions building HCal, will contribute with maintenance, calibrations and commissioning; however, GSU developed the knowledge and experience to build or work with other collaborators on building HCal up to EIC specs.*

**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.).*

*Sensor development and electronics (engineering & design).*

**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).*

*Currently, the GSU nuclear physics group consists of three professors (Megan Connors, Xiaochun He and Murad Sarsour), one technician, one postdoc and one graduate student. We also have several undergraduate students working in the group on both HCal and mRICH projects. We expect the group to grow especially with more students and postdocs as the project moves forward and with more funds for the project.*

The time commitment of members of the Georgia State 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 |
| Georgia State University | 0.2 |  |  | 0.5 | 0.5 | 1.0 |  |  | 1.0 |  |
| 0.2 |  |  |  |  |  |  |  |  |  |
| 0.1 |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  | 3.5 |

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 Georgia State University to cooperate on the EIC Project is to include (at an annual basis) 0.5 full-time equivalent FTEs of a professor, 0.5 FTE of a postdoctoral researcher, and 0.5 FTEs of Ph.D. students. The technical collaborative effort contributed is to include 1.0 FTE of a technician. We anticipate the duration of this collaborative effort to cooperate on the EIC Project to finalize the <DESIGN> phase for a period of <ONE> year, followed by the <CONSTRUCTION> phase for a period of <THREE> years.

**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.)*

*Two more beam tests are planned to demonstrate mRICH performance, i.e. the e/π and π/K separation. One is planned to be carried out in Hall D at JLab using secondary electron beam (1 to 6 GeV/c) with tracking, while the other is a joint beam test at FNAL with the LAPPD group. The main objective of the second activity is to test the viability of using Gen-II LAPPDs with an external pixelated readout board for EIC RICH detectors.*

*We are currently heavily involved with the sPHENIX detector, building the HCal (inner & outer) and devoting significant manpower and resources, and expect to be completed by the end of 2021.*

**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).*

*Depending on available funds, we have a machine shop at GSU that is capable of all the machining related to mRICH but would require funds from the EIC project if efforts to seek support from other sources don’t succeed.*