

Expression of Interest (EOI) Questionnaire

For Stony Brook University

October 30, 2020

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

Abhay Deshpande

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

Stony Brook University

Please indicate the items of interest for potential equipment cooperation:

PID: contact person: Klaus Dehmelt

Top Priorities:

1. High momentum reach RICH - forward RICH with INFN/Italy, From India: BHU, NISER-Bhubaneswar, IoP-Bhubaneswar, RMRC-Kolkata
Presently SBU and INFN have formulated concrete plans for cooperative RICH test beam efforts at FTBF. SBU and INFN additionally co-authored a submission regarding high momentum PID to Snowmass. We plan to jointly pursue PID in the forward region through to its realization at EIC. A few Indian institutions will also collaborate with us on those projects and tasks.
2. Time Projection Chamber – dE/dx extension for sPHENIX TPC
SBU has taken a leading effort in the design and construction of the sPHENIX TPC and championed design aspects appropriate for EIC. Test beam efforts included a measurement emphasizing dE/dx performance of the device. Further optimization of the sPHENIX TPC for EIC will be pursued if that device is reused at EIC.

Available for Expertise and Support (if needed):

3. Hadron Blind Detector for eID if needed
4. DIRC with Catholic University of America (CUA), GSI/Germany
5. LAPPD with BNL

Polarimetry

Top Priority: Contact person: Ciprian Gal

1. Compton polarimetry – with UVa, UMass Amherst, JLab
SBU has initiated a collaborative effort (together with JLab and UVa eRD26) towards development of a polarimeter laser system that will meet the lepton polarimetry requirements at the EIC. In addition, we are interested in the overall design, operation (and eventual analysis of data) of the polarimeter and detectors to ensure the needed precision can be reached.

Available for Expertise and Support (if needed):

2. Hadron polarimetry with BNL

Data acquisition: Contact person: Jan Bernauer

Streaming readout with Jlab, MIT, BNL, INFN (see EOI from JLAB-BNL-SBU, Software Working Group, IP8, INFN)

The SBU group has been leading the efforts for streaming readout as a general EIC R&D project (eRD23). The group, in close cooperation with BNL is deeply involved in driving the hybrid DAQ design for sPHENIX. The SBU group has extensive expertise in electronics design. With the experience at sPHENIX and other experiments, the SBU group is in an excellent position to play a major role in the design and realize a high-performance streaming readout solution for EIC.

Software contributions:

Software support for the above activities will be given independently and where appropriate through collaboration with the SWG. See details below in the FTE table and NOTE, SWG EOI.

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

All contributions from SBU will be in-kind labor contributions and facilities available in Stony Brook's underground nuclear physics facility. All in-kind labor contributions will be towards design, construction, commissioning, and maintenance of the equipment under consideration. Software support will be provided when applicable.

In addition, there exist avenues, (and we will approach them) for additional non-DOE support for some of these projects from the University, State and other sources.

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

We assume design and engineering support from the EIC project. Material and supply costs to be provided by the EIC project.

Please indicate the labor contribution for the EIC experimental equipment activities:

Senior staff: 5 faculty, 6 research faculty, ~10 post-docs, ~10 graduate students, ~20 undergraduate students

Machine shop staff: 4 full time technicians

Electronics shop staff: 1 full time technicians, 1 electronics engineer.

The time commitment of members of the SBU group in the EIC efforts described in this EoI is listed in the Table 1 below. Contributions from other institutions are documented elsewhere.

Detector Under Investigation	Prof	Res. Prof	Postdoc	Grad	Under-grad	Total
High momentum reach RICH	0.5	0.7	2.5	1.8	1.4	6.9
Time Projection Chamber – dE/dx	0.0	1.0	1.5	1.3	1.2	5.0
Hadron Blind Detector for eID	0.0	0.1	0.0	0.0	0.0	0.1
DIRC	0.0	0.2	1.0	0.0	0.0	1.2
LAPPD	0.0	0.5	2.5	1.0	0.6	4.6
Compton polarimetry	0.1	0.5	0.7	0.3	0.4	2.0
Hadron polarimetry	0.0	0.0	0.3	0.2	0.4	0.9
Streaming readout	0.2	0.0	1.4	1.6	0.8	4.0
Total	0.8	3.0	9.9	6.2	4.8	24.7

Table 1: Summary of Stony Brook FTE contributions.

NOTE 1: FTE listings in grey text indicate the effort distribution if the secondary properties are additionally pursued. In the default scenario, this effort would be folded into the top priority efforts.

NOTE 2: We assume that approximately 15%, as an average of the total of the FTEs listed above will be software related and have been included as such in the SWG EOI. Individual components will have different percentages.

It is anticipated that annually SBU will contribute to the EIC Project: 0.8 full-time equivalent FTEs of a professor, 3.0 FTE of a research professor, 9.9 FTE of a postdoctoral researcher, 6.2 FTEs of graduate students, and 4.8 FTEs of undergraduate students: a total of **24.7 FTEs**. We anticipate the duration of this collaborative effort to cooperate on the EIC Project to start at the design phase (2021) and continue until the detector is operating.

Please indicate if there are timing constraints to your submission:

The commitment of the CFNS (from the Simons foundation) contributions, which accounts for about ~5 FTEs (in terms of post docs) is confirmed to be until 2027 and we have been encouraged to consider extensions beyond 2027. We fully anticipate that four faculty and their research groups funded by DOE or/and NSF will continue to support the EIC activity at the above-mentioned level.

Please indicate any other information you feel will be helpful:

Infrastructure available for the EIC project to use:

1. Large laboratory space (Underground van de Graaf NP Lab reoriented to using for EIC)
 - a. Total square footage: ~10k sq. Ft.
 - b. Cleanroom (class 1000): currently ~1k sq. ft (15k cu ft), plan to double it.
2. Well-equipped machine shop (Machine shop work to be funded by EIC funds)

Past and current experience in building large detector components:

SBU has and had leading contributions to sPHENIX, SoLID, MOLLER, RHIC and JLab polarimetry, various EIC detector R&D program groups, PHENIX.

1. sPHENIX: We are building the sPHENIX TPC
2. SoLID: Heavy Gas Cherenkov/Light Gas Cherenkov
3. MOLLER: GEM tracker and the infrastructure that are needed to create
4. Major contributions to eRD2/6/14/23/26
5. PHENIX: SBU had leading detector design, test & construction responsibilities on:
 - a. RICH
 - b. Drift Chamber
 - c. HBD
 - d. SiVTX
6. JLab: involved in e-polarimetry: Compton, MOLLER simulations, studies and operation in Hall-A
7. The Streaming DAQ interest has strong overlap with the standalone Streaming Readout EoI (representing people from JLab, BNL and SBU), the ECCE EoI and the EoIs of INFN and of the Software Working Group.