

Expression of Interest (EOI) Questionnaire for the University of Hawai'i

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

Thomas E Browder (teb@phys.hawaii.edu). Other University of Hawai'i (UH) faculty involved in this EOI are the following: Prof. Philip von Doetinchem, Prof. Peter Gorham, Prof. Kurtis Nishimura, Prof. Sven Vahsen, Prof. Gary Varner. Dr Kevin Flood, Nalu Scientific LLC Senior Scientist and UH Affiliate Graduate Faculty, is also a key participant.

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

University of Hawai'i at Manoa, Nalu Scientific LLC.

Please indicate the items of interest for potential equipment cooperation:

We are actively seeking opportunities to contribute consistent with our expertise and interests. In particular, UH is prepared to contribute to readout systems of the EIC particle identification detectors (see below).

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

Given UH's strengths in HEP instrumentation and past experience on other detectors (most recently Belle II), we anticipate extensive participation of UH graduate students and postdocs in the development and beam tests of readout systems and new detector technologies for the EIC. As other opportunities become clearer, other UH professors may engage in R&D on photosensors, calorimetry, gas detectors etc. The students and postdocs will be closely supervised by UH faculty.

To date, Varner has received funding from ERD14 project for several years. He is participating in the design of readout systems of the hpDIRC, the modular RICH, the KLM option, the dual RICH option and triggerless DAQ. Varner has signed the EOI for the hpDIRC and an EOI with Dr. Pawel Nadel-Turnoski and Belle II/Nuclear Physics colleagues from Duke and Indiana for an EIC Klong-Muon detector system.

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

We will assume that the EIC project will cover the costs of the detectors and their associated readout systems.

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

We briefly summarize the potential faculty contributions below:

Professor von Doetinchem is a founder of the GAPS cosmic ray balloon experiment and a member of the AMS experiment and would have a research program in anti-particle production

(especially anti-deuterons) at the EIC. Philip von Doetinchem and a graduate student have extensive experience in the CERN nuclear physics program (NA61/SHINE).

Professor Gorham is the founder and spokesperson of the ANITA high energy neutrino and cosmic ray balloon experiment and is doing R&D on detection of Askaryan radiation from electron beams. Gorham has developed a novel 5-D calorimeter based on Askaryan radiation, which could be applicable to the EIC.

Professors Nishimura and Varner have a long record of participation in design of advanced Cerenkov detectors (including the focusing DIRC and the Belle II iTOP detector) and will participate in R&D for the DIRC planned for the EIC. Both also have interest in Belle II-like Klong-muon detectors. Varner is already a member of eRD14 (EIC particle identification).

Nishimura is one of the leading experts on firmware for such detectors in the US as well as an expert on the new emerging LAPPD detector technologies. Applications of LAPPDs to the EIC and tests of these technologies are a major interest.

Professor Vahsen is an expert on TPCs readout by gas-pattern microstrip detectors (MGPD). He has implemented these detectors in a Belle II background monitor and is the chief proponent of CYGNUS, a directional dark matter project. Vahsen is working with EIC members to promote MGPD R&D in the US.

Professor Browder was Belle II spokesperson 2013-2019 and is interested in synergies between Belle II and EIC physics, especially those connected with heavy quarks, fragmentation function measurements at Belle and e- beam polarization

Through Nalu Scientific, Dr Flood is participating with Prof. Varner in the hpDIRC detector effort. Like Prof. Browder, he is interested in SIDIS topics where Belle II can possibly complement and supplement the EIC SIDIS effort. Belle II's possible contributions in this area are briefly described in a Letter of Interest recently submitted to the HEP Snowmass study. Such contributions will be greatly enhanced when Belle II begins operations with a polarized electron beam in several years. Approximately half of Flood's research effort will be dedicated to EIC and other synergistic NP experiments, dependent on funding.

(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 Hawaii 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
University of Hawaii	0.1			TBD	TBD		TBD			
	0.1									
	0.1									
	0.1									
	0.1									
	0.1									
	0.5 (Nalu)									
	0.5 (new UH faculty hire)									
	1.6									

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.

We are bootstrapping the process and will need some time to explore and find places where we can effectively contribute beyond the PID and MGPD instrumentation efforts mentioned above. Past experience indicates great potential for participation of young scientists in beam tests of EIC detectors and readout. We hope to make a UH EIC faculty hire in the future, who would be presumed to have at least one graduate student and postdoc working full-time on the EIC. If the faculty hire is a joint hire with JLAB, for example, the level of research engagement could be higher.

Please indicate if there are timing constraints to your submission:

The possible timing of the bootstrap process of establishing a new group among faculty with different but loosely aligned current research interests is one aspect here; the second aspect is possible timing for a new hire. Both are highly uncertain because of the pandemic.

Please indicate any other information you feel will be helpful:

The University of Hawai'i has a state of the art instrument development lab (electronics laboratory) with extensive experience in ASIC and firmware design for high energy physics and

astroparticle experiments. Subcontracts and dedicated EIC project funding would be required for effective use of these facilities and the accompanying technical expertise.

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