**[[1]](#footnote-1)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:**

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

Primary contact: Oh, Yongseok (Kyungpook National University), yohphy@knu.ac.kr

Deputy contacts:

* Kim, Yongsun (Sejong University), yongsun@sejong.ac.kr
* Lim, Sanghoon (Pusan National University), shlim@pusan.ac.kr
* Jo, Hyon-Suk (Kyungpook National University), hyonsuk@knu.ac.kr

All institutions are located in South Korea.

**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)*

|  |  |  |  |
| --- | --- | --- | --- |
| Group | Devoted to | Institutions | Faculties |
| A | Forward Calorimeter | Korea University | Byungsik Hong  Jung Keun Ahn |
| Sejong University | Yongsun Kim |
| Chonnam National University | Dongho Moon |
| B | Pixel Tracker | Jeonbuk National University | Eun-Joo Kim |
| Pusan National University | Sanghoon Lim |
| Yonsei University | Youngil Kwon |
| Inha University | Minjung Kweon |
| C | Dual-Readout Calorimeter | Kyungpook National University | Hyon-Suk Jo  Sehwook Lee |
| University of Seoul | Jason Lee |
| Yonsei University | Hwidong Yoo |

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

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

|  |  |
| --- | --- |
| Group A  (Forward Cal) | R&D of forward calorimeters, including neutron detectors at the very forward region. |
| Group B  (Pixel Tracker) | Development, test, and production of silicon pixel detector |
| Group C  (Dual-Readout) | single component calorimeter technique including entire functionalities of both electromagnetic and hadronic calorimeters |

**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.).*

|  |  |
| --- | --- |
| Group A  (Forward Cal) | Provision of manpower and testbed.  Cooperation with RIKEN for the calorimeter development |
| Group B  (Pixel Tracker) | Contribution to develop and test silicon sensors by utilizing facilities for the ALICE ITS2 upgrade and providing manpower.  Cooperation with local companies to handle silicon sensors for thinning and dicing. |
| Group C  (Dual-Readout) | Full in-kind experimental equipment and labors to develop new components |

**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.).*

1. Group A: Forward Calorimeter

- Goal: We plan to contribute our manpower and lab facilities to the development of prototypes and electronics for the forward calorimeters, including the very forward neutron detector.

- Expectation from the EIC project: the coordination of the taskforce with other institutions which are interested in the similar studies, e.g., RIKEN, Iowa State University and University of Kansas.

2. Group B: Pixel Tracker

- Goal: we plan to contribute to R&D of silicon sensor and production

- We expect the support of some components for building the complete silicon detector, such as support structure, read-out, power supply from other institutions in the EIC project.

- Synergy: Institutions in this group have also been participating in sPHENIX and ALICE where silicon pixel detectors with the ALPIDE chip will be used. Therefore, we expect that experiences on sPHENIX and ALICE will be beneficial to the EIC activities.

3. Group C: Dual-Readout Calorimeter

- Goal: we consider both central and forward calorimeter using the dual-readout calorimeter

- Direction: we will study the detector design and engineering aspects based on the knowledge of the dual-readout calorimeter and fit to the physics goal and detector requirements of the EIC project

- Cost: we expect to be competitive to the estimation of current ECAL+HCAL designs

- Synergy: we expect a synergy with the R&D and preparation with CEPC and FCC-ee projects which have a similar timeline in HEP particle physics community. This study has already been started since 2017 and the single component of the calorimeter detector using the dual-readout calorimeter was included in the conceptual design reports of both CEPC and FCC-ee published in 2018.

**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).*

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Institution Name | | Professor | Research Professor | Staff Scientist | Postdoc | Graduate Student | Undergrad. student | Engineer | Designer | Technician |
| Group A | Korea Univ. | B. Hong |  |  | 1 | 1 |  |  |  |  |
| J. Ahn |  |  | 1 | 2 | 2 |  |  |  |
| Sejong Univ. | Y. Kim | 1 |  | 1 | 2 | 2 |  |  |  |
| New prof. |  |  | 1 | 2 | 2 |  |  |  |
| Chonnam Nat. Univ. | D. Moon |  |  |  | 1 | 1 |  |  |  |
| Group B | Inha University | M. Kweon |  |  | 1 | 2 | 2 |  |  |  |
| Jeonbuk  Nat. Univ. | E. Kim |  |  |  | 1 |  |  |  |  |
| Pusan  Nat. Univ. | S. Lim | 1 |  | 1 | 2 | 2 |  |  |  |
| Yonsei Univ. | Y. Kwon |  |  | 1 | 1 | 1 |  |  |  |
| Group C | Kyungpook Nat. Univ. | H.S. Jo |  |  |  | 1 | 2 |  |  |  |
| S.W. Lee |  |  |  | 2 |  |  |  |  |
| Univ.  of Seoul | J. Lee | 1 |  |  | 2 |  | 1 |  |  |
| Yonsei Univ. | H.D. Yoo |  |  | 1 | 3 | 5 |  |  |  |

The time commitment of members of the <INSTITUTION NAME> group in the EIC efforts

described in this EoI is anticipated to be as follows:

NOTE: FTE in the above table represents the annual fractional full time equivalent (FTE).

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Institution Name | | Professor | Research Professor | Staff Scientist | Postdoc | Graduate Student | Undergrad. student | Engineer | Designer | Technician | Total Sum |
| Group A | Korea Univ. | 0.2  x2 |  |  | 0.3  x2 | 0.5  x3 | 0.2  x2 |  |  |  | 2.9 |
| Sejong Univ. | 0.2  x2 | 0.5 |  | 0.3  x2 | 0.5  x4 | 0.2  x4 |  |  |  | 4.3 |
| Chonnam Nat. Univ. | 0.2 |  |  |  | 0.5 | 0.2 |  |  |  | 0.9 |
| Group B | Inha Univ. | 0.2 |  |  | 0.3 | 0.5  x2 | 0.2  x2 |  |  |  | 1.9 |
| Jeonbuk  Nat. Univ. | 0.1 |  |  |  | 0.1 |  |  |  |  | 0.2 |
| Pusan  Nat.Univ. | 0.2 | 0.3 |  | 0.3 | 0.5  x2 | 0.3  x2 |  |  |  | 2.4 |
| Yonsei Univ. | 0.2 |  |  | 0.3 | 0.5 | 0.2 |  |  |  | 1.2 |
| Group C | Kyungpook Nat. Univ. | 0.2  x2 |  |  |  | 0.4  x3 | 0.2  X2 |  |  |  | 2.0 |
| Univ.  of Seoul | 0.2 | 0.3 |  |  | 0.3 x2 |  | 0.2 |  |  | 1.4 |
| Yonsei Univ. | 0.2 |  |  | 0.5 | 0.3 x3 | 0.2 x5 |  |  |  | 2.6 |

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 <INSTITUTION A> to cooperate on the EIC Project is to include (at an annual basis) 0.2 full-time equivalent FTEs of a professor, 0.3 FTE of a research professor, 1.0 FTE of a postdoctoral researcher, and 0.9 FTEs of Ph.D. students. The technical collaborative effort contributed is to include up to 0.8 FTE of a (mechanical or electronics) engineer, 0.5 FTE of a designer, and 1.0 FTE of a technician. We anticipate the duration of this collaborative effort to cooperate on the EIC Project to start at the <DESIGN/CONSTRUCTION> phase and to be for a period of <TWO/THREE/FOUR/FIVE> 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.)*

N/A

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

|  |  |
| --- | --- |
| Group A  (Forward Cal) | N/A |
| Group B  (Pixel Tracker) | - Basic R&D infrastructures for ALICE ITS2 and ITS3 upgrade projects in Korea can be utilized for the EIC project as well. - Korean ALICE group contributed to the outer barrel module production for the ALICE ITS2 upgrade |
| Group C  (Dual-Readout) | HEP detector facility (CHEP) at Kyungpook National University  - dual-readout detector R&D cent at Yonsei University  - Supercomputing centers at Kyungpook National University and University of Seoul for simulation study for detector design and performance  # past accomplishments  - Review and other papers from RD52 projects, CDRs  - prototype detector of dual-readout calorimeter  # funding  - funding for dual-readout R&D for 5 years (about $2M for 5 years) |

1. [↑](#footnote-ref-1)