

Expression of Interest (EOI) Questionnaire

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

Jakub Wagner (jakub.wagner@ncbj.gov.pl) (main contact)
Ewa Rondio (ewa.rondio@ncbj.gov.pl) (NCBJ management)
Paweł Sznajder (pawel.sznajder@ncbj.gov.pl)
Tolga Altinoluk (tolga.altinoluk@ncbj.gov.pl)

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

National Centre for Nuclear Research (NCBJ)
Andrzej Sołtana 7, 05-400 Otwock, Poland

Please indicate the items of interest for potential cooperation:

- Świerk Computing Center resources

The Centre provides resources and services for scientific and technological research. Data of no key national importance, for example academic research, are carried out on infrastructure integrated into a worldwide grid.

The Center ensures security and continuity of processes related to data processing due to high quality of the services provided and the use of optimum technical and technological infrastructure of data communications resources as well as collaboration with international competence centres.

It operates a cluster of High Performance Computing (HPC) consisting of more than 1,400 servers equipped with more than 66,000 physical cores (CPU) and 200 TB of memory (RAM) in total. The theoretical performance of this configuration is approx. 1,320 TFLOPS. The disk and tape resources allow to store over 18,000 TB (18 PB) of data.

The Center participates in European Grid Infrastructure (EGI) and collaborates with Worldwide LHC Computing Grid (WLCG). It provides Tier 2 EGI GRID siteservices for two LHC experiments: LHCb and CMS. The Center is involved in European XFEL and many less resource consuming projects.

References:

- <https://www.cis.gov.pl>
- PARTONS software project

PARTONS is a state-of-the-art software framework dedicated to the phenomenology of 3D hadron structure, in particular Generalized Parton Distributions (GPDs). Its development is mostly driven in Europe by CEA/IRFU in France and NCBJ in Poland.

PARTONS provides a necessary bridge between models of 3D hadron structure and experimental data measured in various channels, like for example Deeply Virtual Compton Scattering (DVCS). It is characterised by a modern architecture flexible enough to aggregate knowledge and know-how of the hadron structure community; a multi-channel analysis capability for computations in collider and fixed-target settings; an engine for fits to experimental data; architectural choices independent of any family of models to allow full generality; good coding practices to install the framework as a long-term and robust product.

PARTONS is useful to theorists to develop new models, phenomenologists to interpret existing measurements and to experimentalists to design new experiments. The source code of PARTONS is released as a public GitLab project under the GPLv3 and Apache licenses (depending on the subproject).

References:

- <http://partons.cea.fr>
- B. Berthou *et al.*, Eur. Phys. J. C78 (2018), 478, [DOI](#)

Cross-references to other EoIs:

- CEA/IRFU EoI
- Software group EoI

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

- Šwierk Computing Center resources

We propose to include the Center in the computing network system dedicated to EIC. It may be used for instance as a facility to perform high-performance Monte Carlo simulations of EIC experimental setup, in particular those exhausting currently available resources in the US. In the latter stage of EIC the Center may serve as a computing farm to perform demanding calculations for the purpose of physical analyses by EIC users. The proposed input will strengthen the international aspect of EIC.

The details on the Center's resources dedicated to EIC are to be fixed, depending on the needs.

- PARTONS software project

The PARTONS framework is a key element in the preparation of the physics case for EIC. It is used in particular to perform impact studies. After the completion of EIC it will be used to make phenomenological interpretations of collected data, in particular to

extract the physics quantities of interest for 3D nucleon structure, like the nucleon tomography.

The PARTONS developers have already started blueprinting the bases of a new event generator that will benefit from the full stack of the framework. Such an event generator will give access to the EIC users to the latest parameterizations and theoretical developments, including radiative corrections. Thus it will be extremely important for the EIC community in the beginning for the detector design and then for the physics analyses. The PARTONS developers will work closely with the EIC software group to best integrate this event generator with the EIC software stack.

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

No such assumptions made.

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

The time commitment of members of NCBJ group in the EIC efforts described in this EoI is anticipated to be as follows:

Institution Name	Professor	Researcher	Staff Scientist	Post doc	Graduate Student	Undergrad. student	Engineer	Designer	Technician	Total Sum
NCBJ Poland			0.2	0.2	0.2				0.2	
			0.2							
										1.0

It is anticipated that the collaborative effort of NCBJ to cooperate on the EIC Project is to include (at an annual basis) 0.4 full-time equivalent FTEs of a staff scientist, 0.2 FTE of a postdoctoral researcher, and 0.2 FTEs of Ph.D. student. The technical collaborative effort contributed is to include up to 0.2 FTE of a technician. We anticipate the duration of this collaborative effort to cooperate on the EIC Project to start at both design and construction phases and to be for a period of five years.

Please indicate if there are timing constraints to your submission:

No timing constraints related to this EoI.

Please indicate any other information you feel will be helpful:

NCBJ is one of the largest research institutes in Poland, operating the MARIA nuclear research reactor. Research activities developed at the institute cover elementary particle physics, nuclear physics, hot plasma physics, nuclear reactor studies, astrophysics, detector and electronics systems for the industry and large scale experiments. NCBJ collaborates with the largest laboratories in the world, in particular CERN, DESY, Grenoble, JParc, FAIR, Julich, ESS, JINR and T2K. Recent activities and experiences of NCBJ groups involved in the high energy experiments include (in the parentheses we indicate developed hardware):

- CMS (the first stage (L1) muon trigger)
- LHCb (straw chambers for Outer Tracker)
- ALICE (calibration of the PHOS photon detector)
- T2K (Side Muon Range Detector - a part of the Near Detector, ND280)

In addition, NCBJ Division of Nuclear Equipment was involved in building Linac4 for LHC (buncher and twelve PI-mode structures) and GBAR experiment at CERN (e accelerator).

NCBJ Radiation Detectors and Plasma Diagnostics Division has a recent experience in the construction and laboratory characterization of a demonstrator of COsmic Ray Detector for MPD @NICA (MCORD). This includes designing of the full MCORD detector, based on long and thin plastic scintillators with WLS fibers and silicon photomultiplier photodetectors (SiPM) for muon detection.