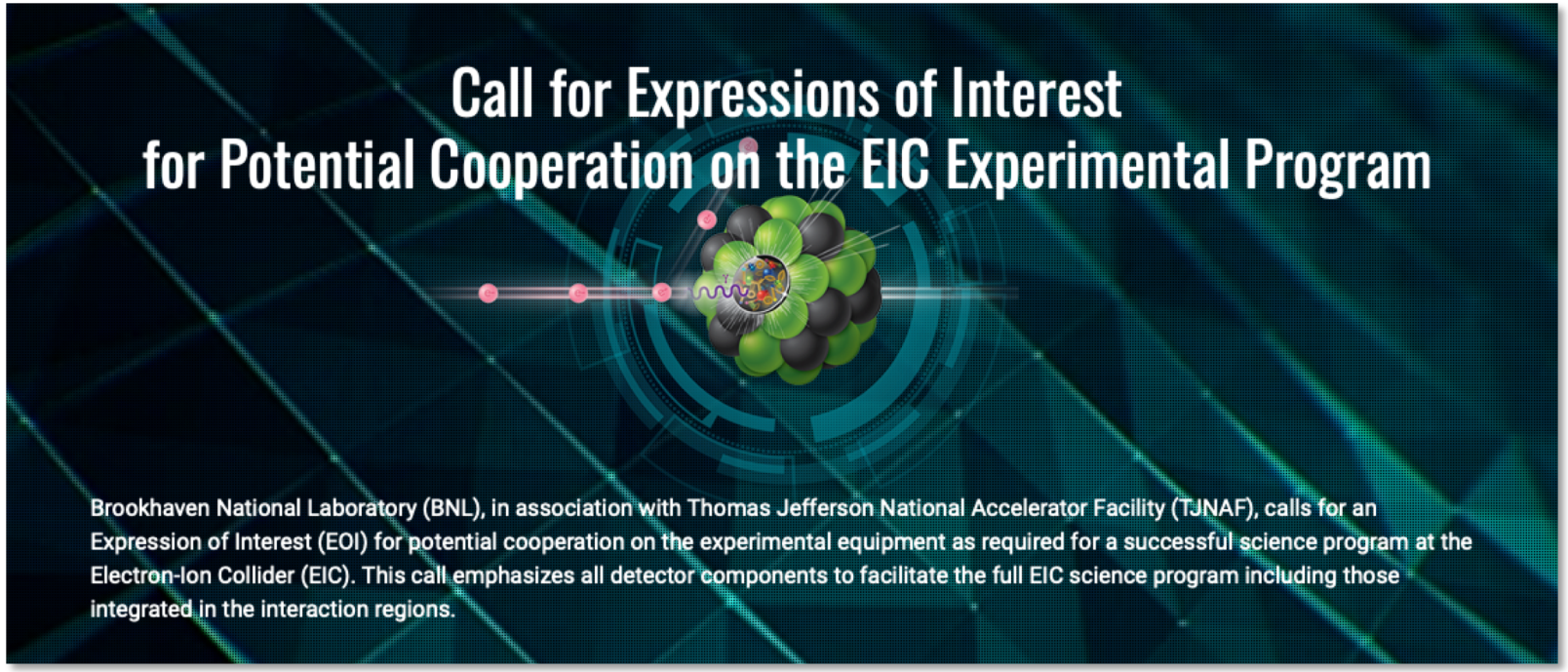
Expression of Interest for Software



Andrea Bressan (Trieste), Markus Diefenthaler (JLAB), Torre Wenaus (BNL)

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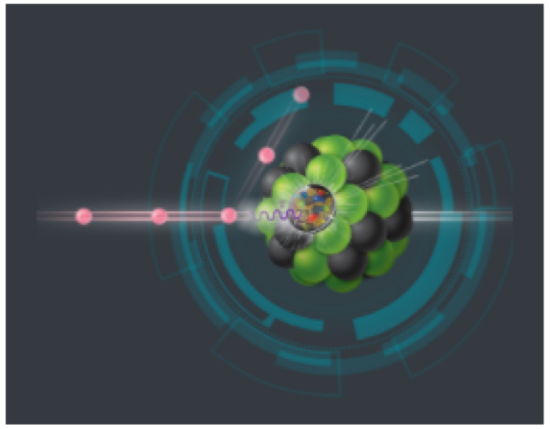
EICUG Software Working Group (https://eic.github.io)

Software | Resources | Activities | Organization | About



Purpose of this site

This is the main portal to the EIC software, repositories, documentation and resources. It is developed and maintained by the EIC Software Group.

Questions? Contact the EICUG Software Working Group Conveners:
eicug-software-conveners@eicug.org

News

Software News July	2020-07-31
Software News June	2020-06-24
Software News April	2020-04-07

Site built at 2020-11-30 16:23:42 -0500

Science problem space in Nuclear Physics

- Focus on non-perturbative QCD phenomena

- MC event generators for spin-dependent measurement, including novel QCD phenomena (GPDs, TMDs)

- **Analyses considering large number of signal events simultaneously** (or multiple times)
  - **Contrary** to separating a few events from a large number of background events
  - **Example** complexity of multi-dimensional, strongly correlated relationships among data opposed to search of rare events with novel topologies
  - **Example** high-precision results which require complex analyses to control systematic uncertainties
  - Require unique software and computing strategies

Community input for Expression of Interest

Software Needs

Requirements What software needs for EIC Software would you like to highlight now, in a few years, and for the completion of the EIC project?

Technologies & Techniques What software technologies and techniques should be considered for the EIC?

Meeting Software Needs

What resources can your group contribute?

Expression of Interest for Software

Expression of Interest (EOI) for Software

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

Conveners of the Software Working Group:
- A. Bressan, M. Diefenthaler, and T. Wenaus
- eicug-software-conveners@eicug.org

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

29 institutions

ANL	Argonne National Laboratory
BNL	Brookhaven National Laboratory
CEA/Irfu	IRFU at CEA /Saclay institute
EIC-India	Akal University, Central University of Karnataka, DAV College Chandigarh, Goa University, Indian Institute of Technology Bombay, Indian Institute of Technology Delhi, Indian Institute of Technology Indore, Indian Institute of Technology Patna, Indian Institute of Technology Madras, Malaviya National Institute of Technology Jaipur, Panjab University, Ramkrishna Mission Residential College Kolkata
IMP-CAS	Institute of Modern Physics - Chinese Academy of Sciences
INFN	Istituto Nazionale di Fisica Nucleare
JLab	Thomas Jefferson National Accelerator Facility
LANL	Los Alamos National Laboratory
LBNL and UC Berkeley	Lawrence Berkeley National Laboratory and University of California, Berkeley
NCBJ	National Centre for Nuclear Research
OhioU	Ohio University
ORNL	Oak Ridge National Laboratory
SBU	Stony Brook University
SLAC	SLAC National Accelerator Laboratory
SU	Shandong University

https://indico.bnl.gov/event/8552/contributions/43221/

Common Projects

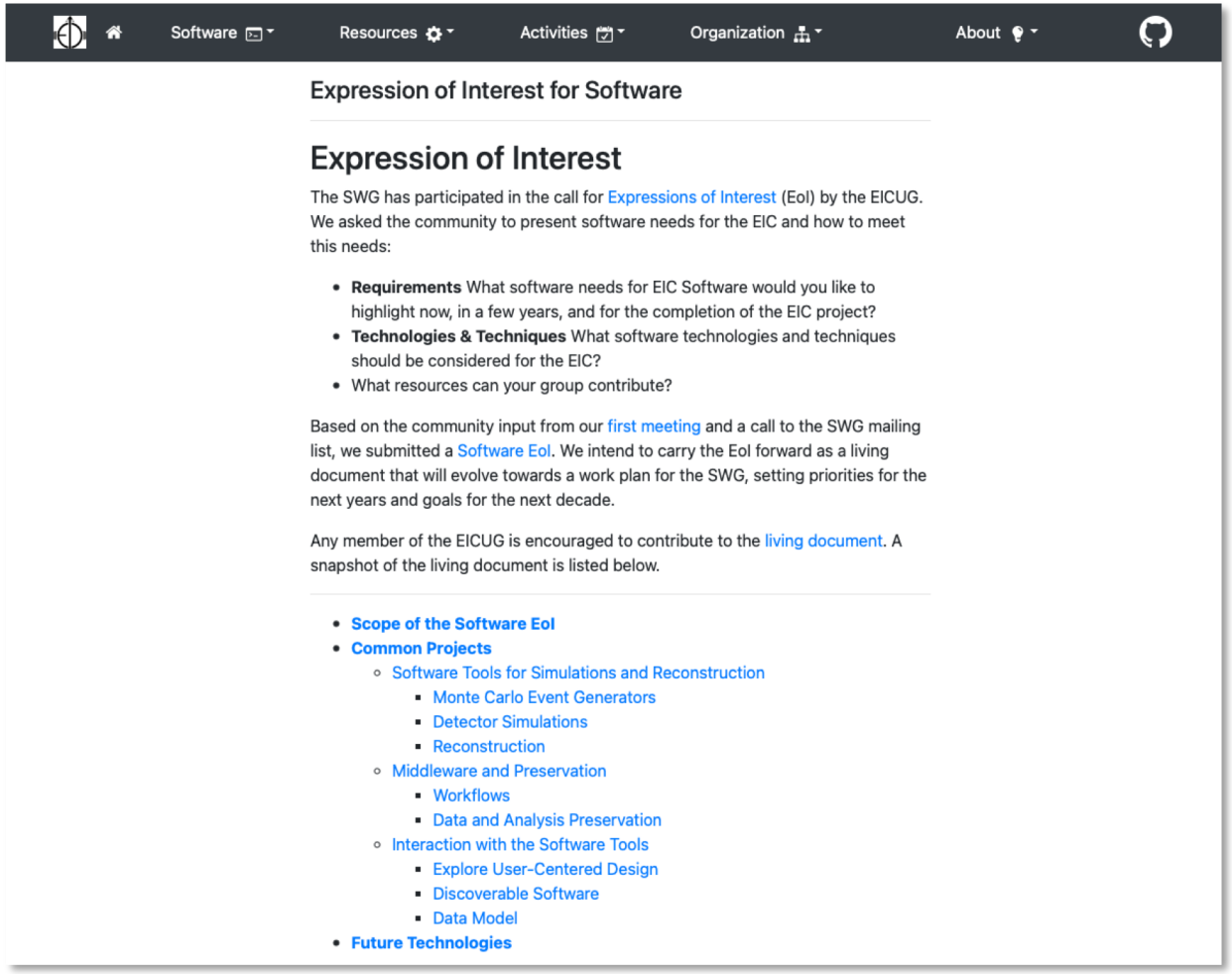
- **Software Tools for Simulations and Reconstruction**
  - Monte Carlo Event Generators
  - **Detector Simulations**
  - Reconstruction
- **Middleware and Preservation**
  - Workflows
  - Data and Analysis Preservation
- **Interaction with the Software Tools**
  - Explore User-Centered Design
  - Discoverable Software
  - Data Model

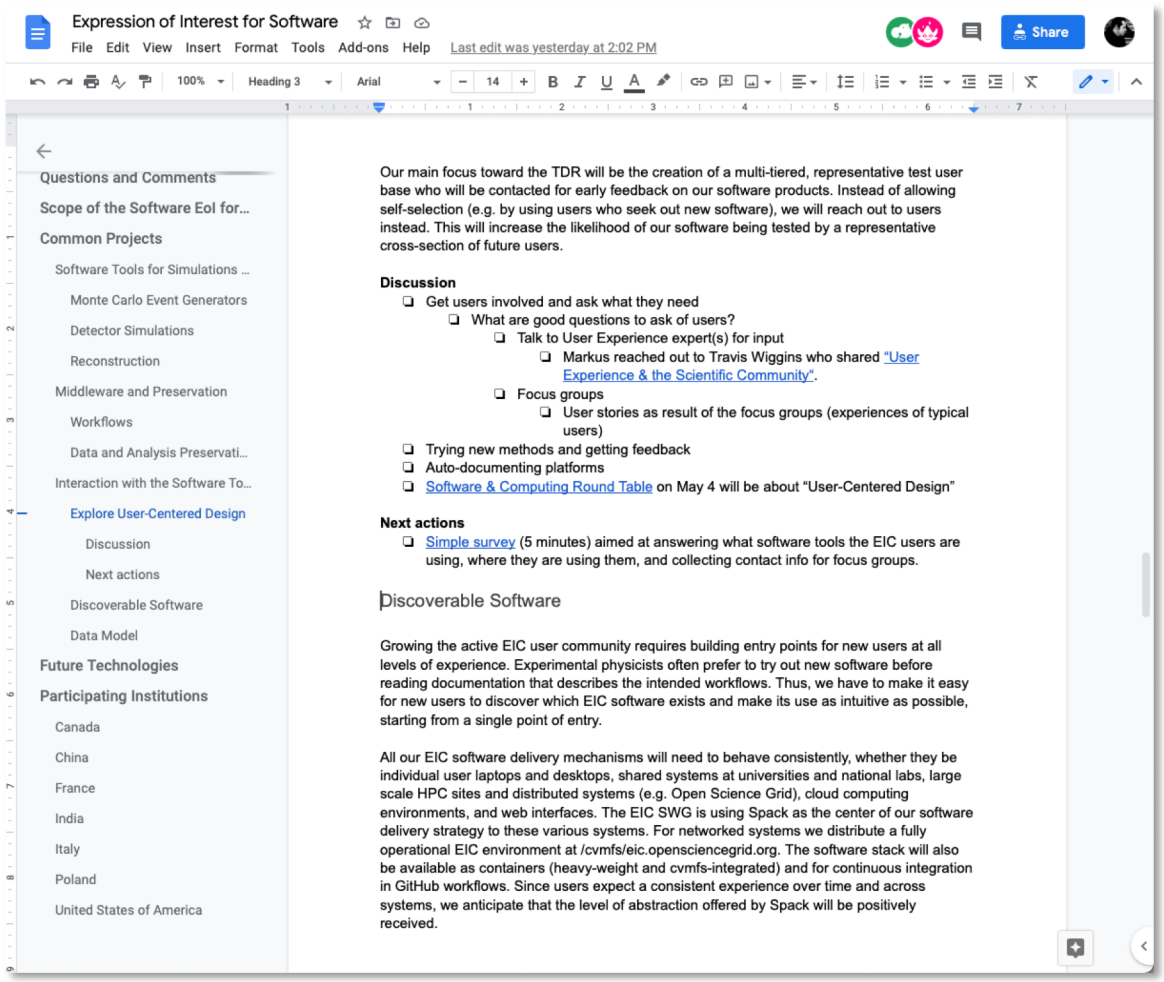
Future Technologies

- Artificial Intelligence
- Heterogeneous computing
- New languages and tools
- Collaborative software

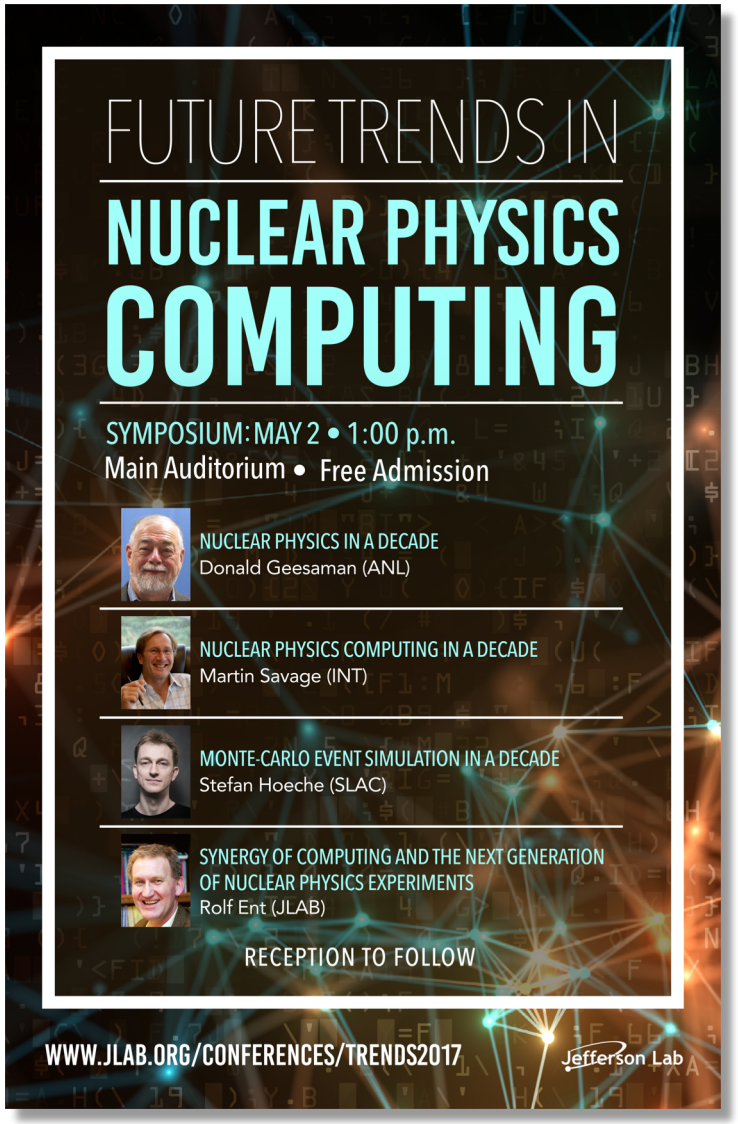
Evolving the EoI towards a work plan for the SWG

https://eic.github.io/activities/eoi.html





Towards the next-generation Nuclear Physics research model



Donald Geesaman (ANL, former NSAC Chair) "*It will be **joint progress of theory and experiment** that moves us forward, not in one side alone"*

- All scientists of all levels, worldwide, should be enabled to actively participate in the NP data analysis.
- To achieve this goal, we must develop analysis toolkits using modern and advanced technologies while hiding that complexity (**Explore User-Centered Design**).
- We must emphasize **data** as much as **analysis**. Experimental data must be open access, **readily accessible** and in self-describing formats.

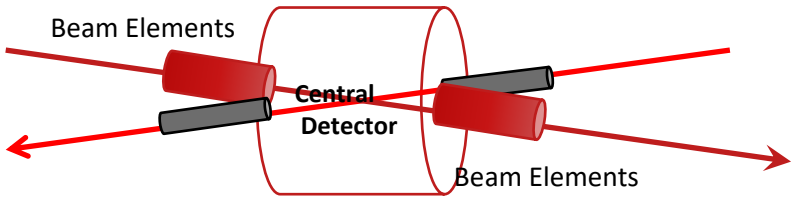
Compute-detector integration to deliver **analysis-ready data from the DAQ system**:

- responsive alignment and calibrations in *real time / online*
- *real-time / online* event reconstruction and filtering
- *real time / online* physics analysis

Machine-Detector interface (MDI)

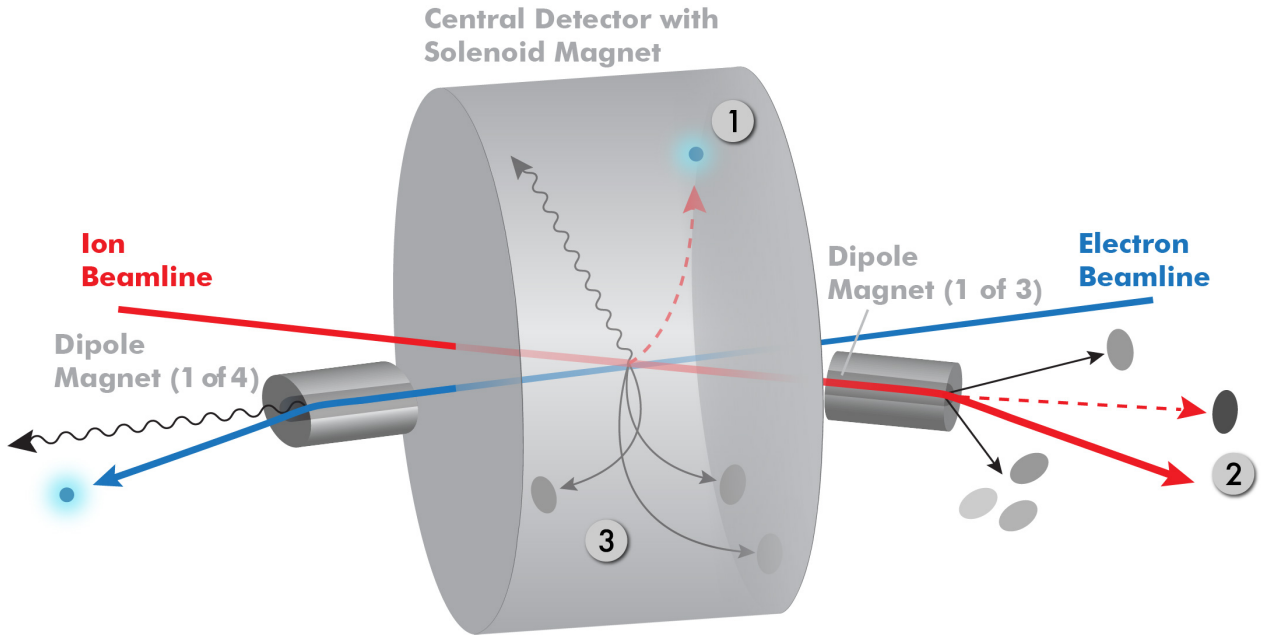
Integrated interaction region and detector design to optimize physics reach

The aim is to get **~100% acceptance** for all final state particles, and measure them with good resolution.



Experimental challenges:

- beam elements limit forward acceptance
- central Solenoid not effective for forward



Possible to get ~100% acceptance for the whole event.

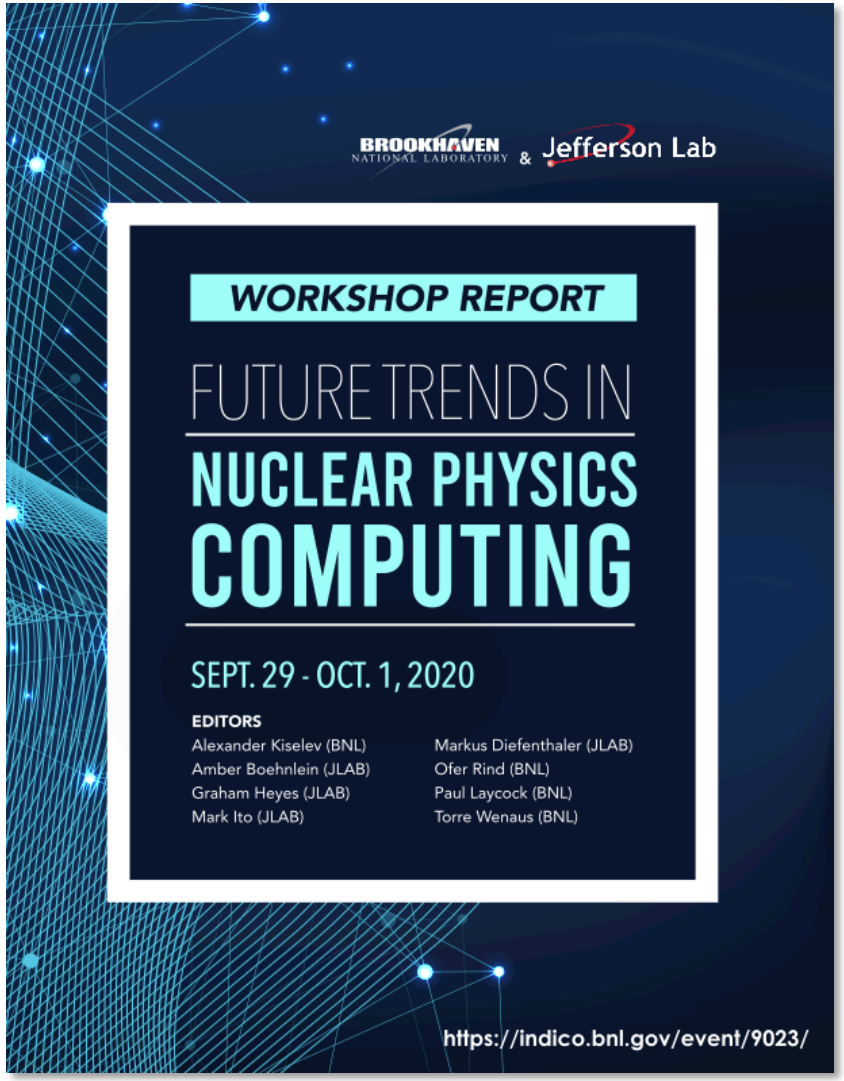
Beyond Machine-Detector Interface

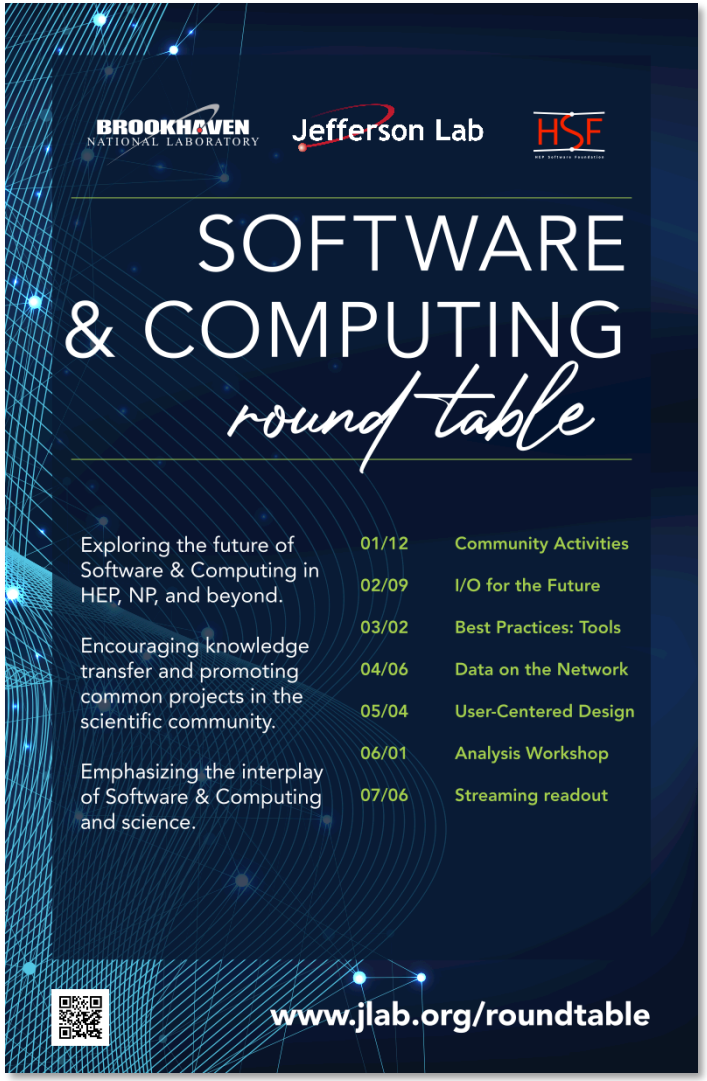
Integration of DAQ, analysis and theory to optimize physics reach

research model with seamless data processing from DAQ to data analysis

- not about building the best detector
- but the best detector that fully supports streaming readout, fast alignment and calibration, and reconstruction algorithms for near real-time analysis

Community building





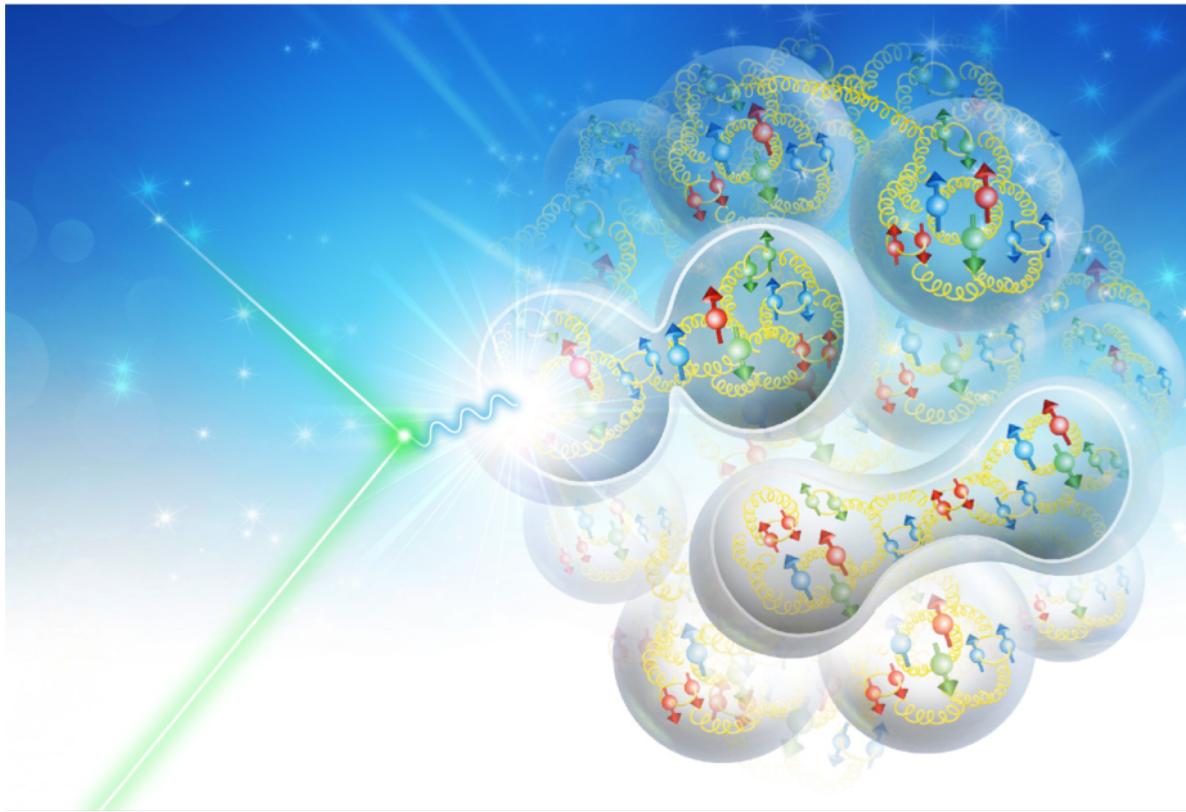
Report Draft (28 pages and growing)

Software EoI

SWG conveners

eicug-software-conveners@eicug.org

- **All aspects of software**
  - From physics and detector simulations to online and offline analysis,
  - but not computing infrastructure.
- Based on the input from the EICUG at large and with contributions from 29 member institutions.
- The SWG carries the EoI forward as a living document that is evolving towards a work plan for the SWG, setting priorities for the next years and goals for the next decade.



- **Many opportunities to get involved!**

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