

Software Working Group



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



UNIVERSITÀ
DEGLI STUDI DI TRIESTE

EICUG Software Working Group



Electron-Ion Collider User Group

The world's most powerful microscope for studying the "glue" that binds the building blocks of visible matter.

HOME	JOIN EICUG	SCIENCE	ORGANIZATION	CALENDAR	SOFTWARE	DOCUMENTS	YELLOW REPORT	MEDIA	ADMIN
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EIC Software

Software Working Group

The Software Working Group (SWG) is open to all members of the EICUG to work on EICUG related software tasks. It communicates via its [mailing list](#) and organizes regular [online and in-person meetings](#) that enable broad and active participation from within the EICUG as a whole.

The SWG has participated in the call for Expressions of Interest (EoI) and intends to carry its [EoI for Software](#) forward as a living document that will evolve towards a work plan for the SWG, setting priorities for the next years and goals for the next decade.

In addition to that, it will support the work on the simulation efforts for the [collaboration proposals for detectors at the EIC](#).

For questions about the Software Working Group, please [contact the conveners](#) (Andrea Bressan (Trieste), Markus Diefenthaler (JLab), and Torre Wenaus (BNL)).

Important links

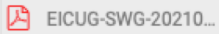
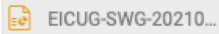
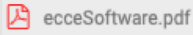

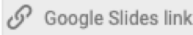

Mailing list	eicug-software@eicug.org (subscribe via Google Group)
EIC organization on GitHub	https://github.com/eic
Website	https://eic.github.io

Working Together

EICUG Software Working Group Meeting

Wednesday 21 Apr 2021, 11:00 → 12:00 US/Eastern

Description We will use BlueJeans for the meeting: <https://bluejeans.com/920347364>

11:00 → 11:10	SWG: Announcements and News Speakers: Andrea Bressan (University of Trieste and INFN), Dr Markus Diefenthaler (Jefferson Lab), Torre Wenaus (BNL)  	10m
11:10 → 11:20	Report from ECCE Speaker: Joe Osborn (Oak Ridge National Laboratory) 	10m
11:20 → 11:30	Report from EIC@IP6 Speaker: Andrea Bressan (University of Trieste and INFN)	10m
11:30 → 11:40	Report from EICUG Steering Committee Speaker: Wouter Deconinck  	10m
11:40 → 11:50	Report from Project eAST Speaker: Makoto Asai (SLAC) 	10m
11:50 → 12:00	Discussion on common efforts, in particular next tutorials Speakers: Andrea Bressan (University of Trieste and INFN), Dr Markus Diefenthaler (Jefferson Lab), Torre Wenaus (BNL)	10m

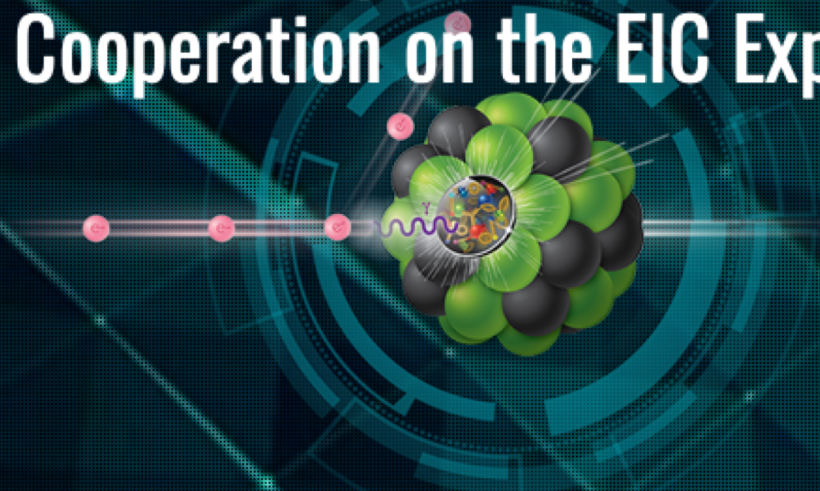
Since EIC User Group meeting in July 2020

- **55+ Meetings**
 - 29 SWG Meetings
 - 20+ Validation Meetings with EIC-India
 - 6 Meetings on Project eAST
- **4 Tutorials** with 1600 views on YouTube
- **1 Software Town Hall**

Highlights since EICUG Remote Meeting in May 2021

- Preparations for EIC Software & Computing meeting
- Reproducibility with computer scientists from OTH Regensburg and University of Passau

Call for Expressions of Interest for Potential Cooperation on the EIC Experimental Program



Brookhaven National Laboratory (BNL), in association with Thomas Jefferson National Accelerator Facility (TJNAF), calls for an Expression of Interest (EOI) for potential cooperation on the experimental equipment as required for a successful science program at the Electron-Ion Collider (EIC). This call emphasizes all detector components to facilitate the full EIC science program including those integrated in the interaction regions.

Common Projects: Expression of Interest for Software

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

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:

ANL	Argonne National Laboratory	29 institutions
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/>

- **Software Tools for Simulations and Reconstruction**
 - Monte Carlo Event Generators see validation
 - Detector Simulations Project eAST **Update from Wouter**
 - Reconstruction ACTS
 - Validation **Update from EIC-India**, test-beam data
- **Middleware and Preservation**
 - Workflows Job submission, simple examples provided to proto-collaborations
 - Data and Analysis Preservation REANA
- **Interaction with the Software Tools**
 - Explore User-Centered Design **Slides 8 – 11**
 - Discoverable Software cvmfs/spack
 - Data Model Common data format
- **Future Technologies**
 - Artificial Intelligence
 - Heterogeneous computing
 - New languages and tools
 - Collaborative software

Accelerator and Beam Conditions Critical for EIC Simulations

Simulations

<https://eic.github.io/resources/simulations.html>

Accelerator and Beam Conditions Critical for EIC Simulations

A note summarizes how measurements at the Electron-Ion Collider will be influenced by accelerator and beam effects, including the:

- Beam crossing angle.
- Crabbing rotation.
- Beam energy spread.
- Angular beam divergence.
- Beam vertex spread.

The accelerator and beam effects may have profound consequences on the measurement capabilities of the EIC, as well as the design and layout of the detectors. The effects studied in the note should be included in physics and detector simulations for the EIC. The supplementary material gives example implementations on the generator level as well as for a generator-agnostic approach on how to integrate these effects in physics and detector simulations for the EIC.

[Accelerator and Beam Conditions Critical for Physics and Detector Simulations for the Electron-ion Collider](#) (J. Adam, E.-C.Aschenauer, M. Diefenthaler, Y. Furletova, J. Huang, A. Jentsch, B. Page)

It also includes a movie illustrating the electron and proton bunch movement during their interaction. The visualization is for an electron-proton collision at 18x275 GeV and based on the transport model described in the note.

[Visualization of the electron and proton bunch movement during their interaction \(18x275 GeV\)](#) (J. Adam)

Project eAST: Unify the Simulation Effort with the Community



Detector
Simulation

Requirements

Project Leader

Common effort on next-generation simulations:

- building on the work done in the existing simulations,
 - a requirement for the common toolkit is that it integrates existing detector simulations in a modular way.
- **comprehensive, centrally maintained application**
 - **based on Geant4 10.7 / 11**
 - **for fast and full simulations**
 - **with library of potential detector options**
- ability to **reuse existing simulation work** ✓
 - ease of **switching detector options** ✓
 - ease of switching between **detailed and coarse** detector descriptions (work in progress)
 - ease of **leveraging new and rapidly evolving** technologies:
 - AI/ML (to be tested)
 - heterogeneous architectures (work in progress)
 - Makoto Asai (SLAC), Geant4 project leader and deep technical expert for >20yrs.

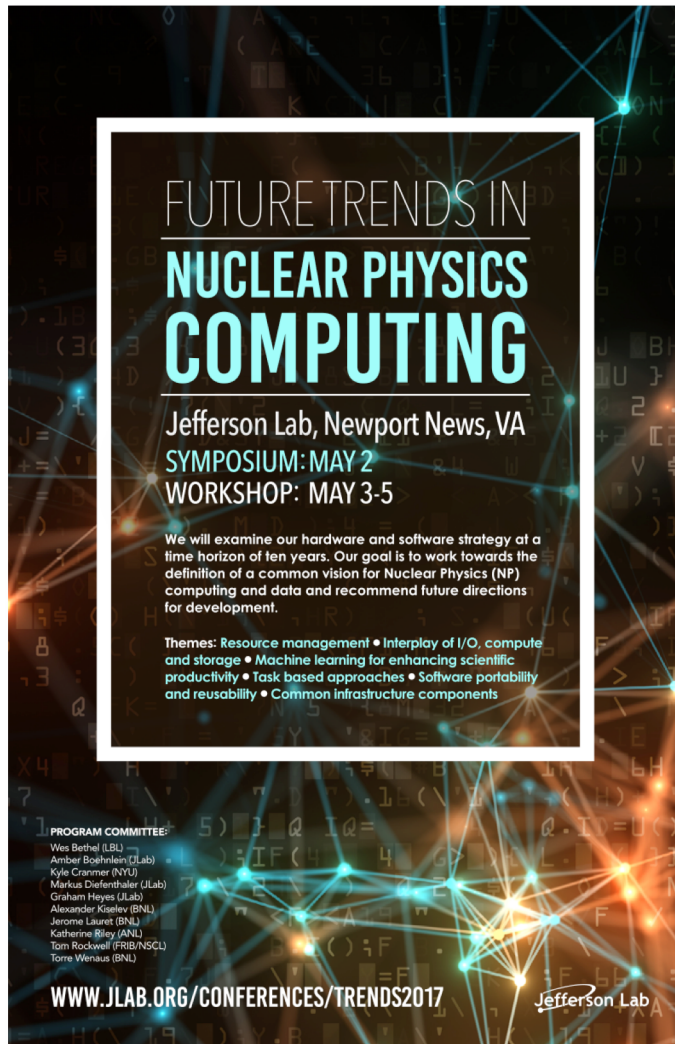


Explore User-Centered Design

- **Software and computing are an integral part of our research**



- **Goal** All scientists of all levels worldwide should be enabled to participate in EIC simulations and analyses actively.
- **User-Centered Design** To achieve this goal, we must develop simulation and analysis software using modern and advanced technologies while *hiding* that complexity.



FUTURE TRENDS IN NUCLEAR PHYSICS COMPUTING

Jefferson Lab, Newport News, VA
SYMPOSIUM: MAY 2
WORKSHOP: MAY 3-5

We will examine our hardware and software strategy at a time horizon of ten years. Our goal is to work towards the definition of a common vision for Nuclear Physics (NP) computing and data and recommend future directions for development.

Themes: Resource management • Interplay of I/O, compute and storage • Machine learning for enhancing scientific productivity • Task based approaches • Software portability and reusability • Common infrastructure components

PROGRAM COMMITTEE:
Wes Bethel (JLab)
Amber Boehnlein (JLab)
Kyle Cranmer (NYU)
Markus Diefenthaler (JLab)
Graham Hayes (JLab)
Alexander Kiselev (BNL)
Jerome Laney (BNL)
Katherine Riley (ANL)
Tom Rockwell (FRIB/NSCL)
Torre Wenaus (BNL)

WWW.JLAB.ORG/CONFERENCES/TRENDS2017

Jefferson Lab



BROOKHAVEN NATIONAL LABORATORY & Jefferson Lab

FUTURE TRENDS IN NUCLEAR PHYSICS COMPUTING

SEPT. 29 - OCT. 1, 2020

The workshop focuses on the Nuclear Physics Software & Computing community. We will identify what is unique about our community and we will discuss how we can strengthen common efforts and chart a path for Software & Computing in Nuclear Physics for the next ten years.

TOPICS:
• Common Scientific Software
• The Role of Data Centers in Scientific Discovery
• Unique Software Challenges for Nuclear Physics

PROGRAM COMMITTEE:
Alexander Kiselev (BNL)
Amber Boehnlein (JLab)
Graham Hayes (JLab)
Mark Ito (JLab)
Markus Diefenthaler (JLab)
Ofer Rind (BNL)
Paul Laycock (BNL)
Torre Wenaus (BNL)

<https://indico.bnl.gov/event/9023/>

Initial Step: State of Software Survey



ELECTRON ION COLLIDER USER GROUP **STATE OF SOFTWARE SURVEY**

Survey from February 16 – 23, 2021. Full questions and answers are listed in the appendix.

The Software Working Group collected information on the community's specific software tools and practices during the Yellow Report Initiative. This *software census* will be essential to better understand and quantify software usage throughout the EIC community.

Survey results summarized by Wouter Deconinck (Manitoba), Markus Diefenthaler (JLab), Rebecca Duckett (JLab), Sylvester Joosten (ANL), and Kolja Kauder (BNL).

[Download Report](#)

Developing User Stories

Project with BNL and JLab Communication Offices and
User Experience Consultant T. Wiggins

Focus Group Discussions

Focus Group: Students

Focus Group: Junior Postdocs

Focus Group: Senior Postdocs

Focus Group: Professors

Focus Group: Industry

Extremely valuable
feedback, including many
suggestions and ideas.

User Stories

Input to software developers as to which users they are writing software for.



DREW – Software as Part of My Research

#Independent, #Invested, #StatusQuo, #LateAdopter

"You cannot participate in research in our field without spending a significant amount of time on software. That's just how it is. I feel comfortable using the software and modifying it for my needs. I sometimes share my modifications but software development is not my priority."

CHARACTERISTICS



Independent as
long as things work.



Invested in status quo. Won't
push for new approaches but
rather for maintaining old ones.



Late adopter will change
from status quo only when
others already have.

ATTRIBUTE METRICS – All sliders are ranging from low to high.



SOFTWARE EXPERIENCE



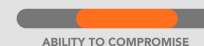
SOFTWARE EXPERTISE



EMOTIONAL INVESTMENT



OPENNESS TO NEW EXPERIENCES



ABILITY TO COMPROMISE



INFLUENCE

More detailed user profiles with a (partial) focus on software

- "Important outreach to put a human face on the exciting science we work so hard to do!" (John Lajoie)
- [Rachel Montgomery \(University of Glasgow\)](#)
- [Vaibhavi Gawas \(IIT Madras\)](#)
- [Prabhakar Palni \(Goa University\)](#)
- [Alex Jentsch \(BNL\)](#)

Software Town Hall

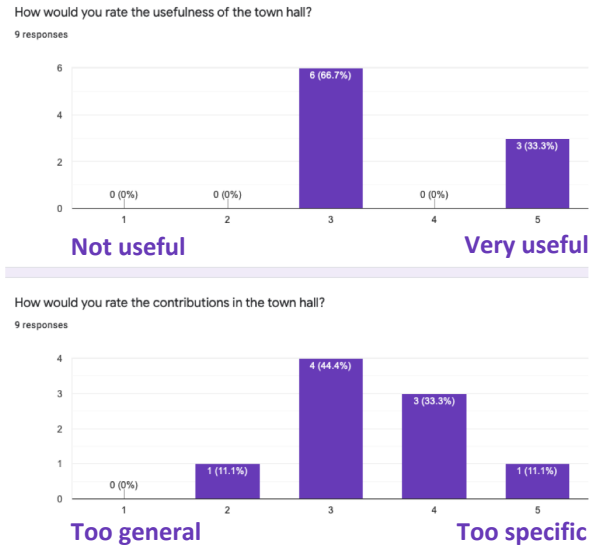
<https://indico.bnl.gov/event/11868/>

OPERATOR CLASSES

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Operator):
    mirror to the select
    select_mirror_mirror_x"
    mirror_x"
```

SOFTWARE TOWN HALL

Thursday, June 3
11 a.m. - 1 p.m. EDT



<https://indico.bnl.gov/event/12645/>

```
use_x = True
mod.use_x = True
mod.use_y = False
mod.use_z = True
mod.use_x = False
mod.use_y = True
mod.use_z = False
mod.use_x = False
mod.use_y = False
mod.use_z = True
```

selection at the end -add back
select-1
select-1
select-1
scene.objects.active

SOFTWARE TOWN HALL

Thursday, December 16
11 a.m. - 1 p.m. EDT

EIC Science and Software

All scientists of all levels worldwide should be enabled to participate actively in the science of the Electron-Ion Collider (EIC). To achieve this goal, we need to understand the requirements of the community on the data analysis software and workflows first and foremost.

Software Town Hall

The idea of the event is to allow anyone in the EIC community a chance to share past experiences or suggest requirements for EIC Software in an open environment.

Organizers

W. Deconinck, A. Deshpande, M. Diefenthaler, O. Evdokimov, T. Hemmick, D. Higinbotham, and K. Kauder.

Teaching Together



The 2021 CFNS Summer School on the
Physics of the Electron-Ion Collider,
August 9 - 20, 2021

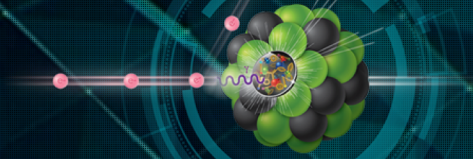
9-20 August 2021
CFNS
US/Eastern timezone

Software Tutorials on August 19 and 20

- by W. Deconinck, M. Diefenthaler, S. Joosten, J. Osborn.
- **Teach students**
 - how to do an EIC analysis for both ATHENA and ECCE, and by doing so
 - how to contribute to the ongoing physics and detector studies.

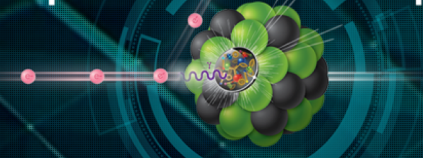
Summary

Call for Collaboration Proposals for Detectors at the Electron-Ion Collider



Brookhaven National Laboratory (BNL) and the Thomas Jefferson National Accelerator Facility (JLab) are pleased to announce the Call for Collaboration Proposals for Detectors to be located at the Electron-Ion Collider (EIC). The EIC will have the capacity to host two interaction regions, each with a corresponding detector. It is expected that each of these two detectors would be represented by a Collaboration.

Call for Expressions of Interest for Potential Cooperation on the EIC Experimental Program



Brookhaven National Laboratory (BNL), in association with Thomas Jefferson National Accelerator Facility (TJNAF), calls for an Expression of Interest (EOI) for potential cooperation on the experimental equipment as required for a successful science program at the Electron-Ion Collider (EIC). This call emphasizes all detector components to facilitate the full EIC science program including those integrated in the interaction regions.

Support of Collaboration Proposals

get work done in the short term

Weekly Meetings <https://indico.bnl.gov/category/301/>

Mailing List eicug-software@eicug.org

Realize Software Eoi

sustainable effort

Get involved