EICUG
Yellow Report Organization
Introduction

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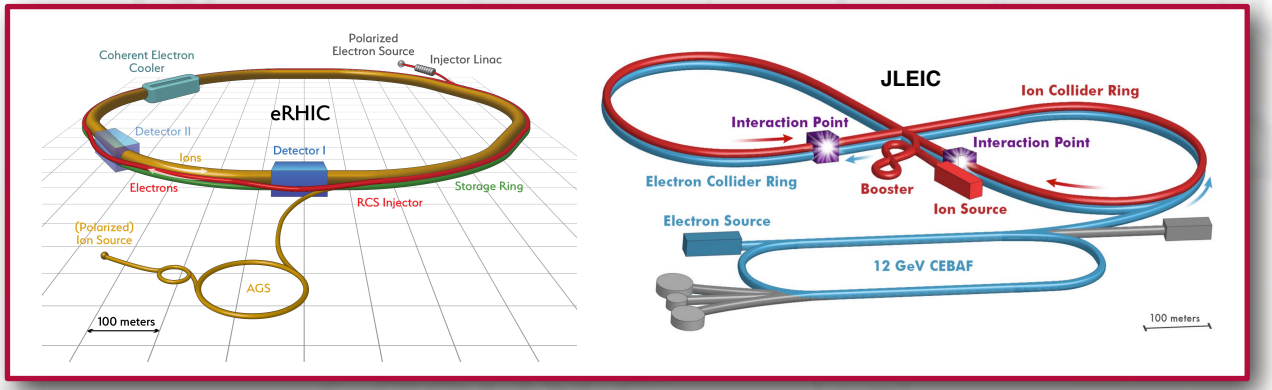
TEMPLE UNIVERSITY®

On behalf of the EICUG Steering Committee

Electron-Ion Collider facility concepts

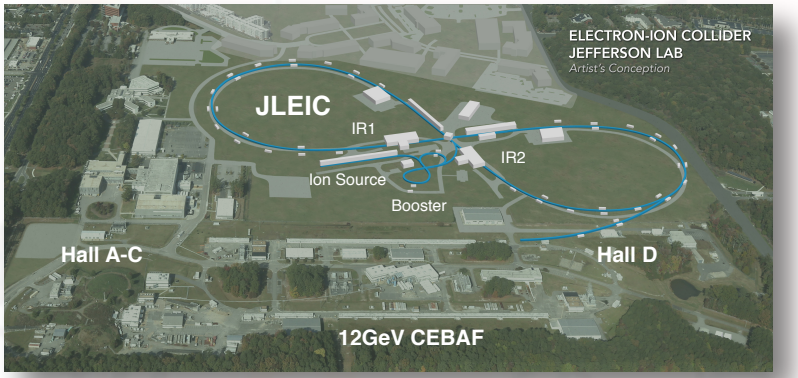


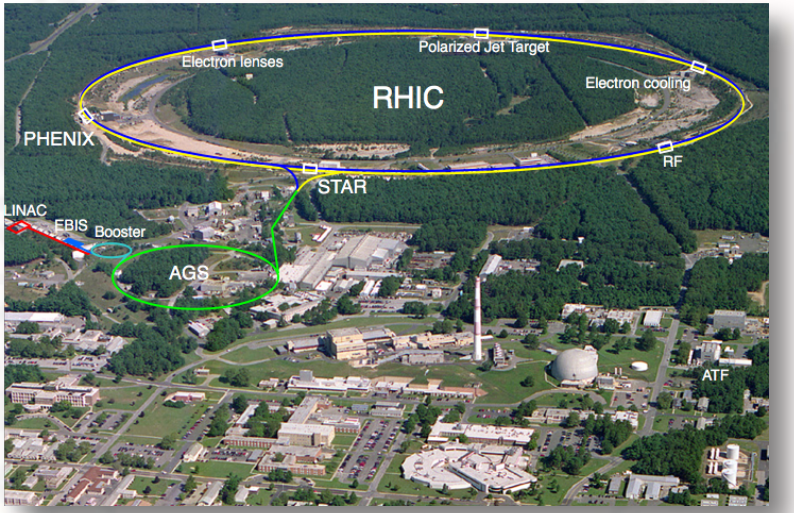
U.S. DEPARTMENT OF ENERGY | Office of Science

DOE NP contract: DE-SC0013405

Outline

- EIC development
- Vision for a Timeline - Paris EICUG Meeting
- Yellow Report:
  - Idea / Motivation
  - Strategy
  - Approach
  - Working groups - Introduction
  - Timeline for 2020/2021 - Workshop Series
- MIT Organizational Meeting and Next Steps
- Concluding Remarks





EIC development

- Critical steps over the last couple of years - 1
  - INT Workshop series / Documentation of Physics Case - Whitepaper: "Understanding the glue that binds us all!"
  - 2015 Long-range plan:

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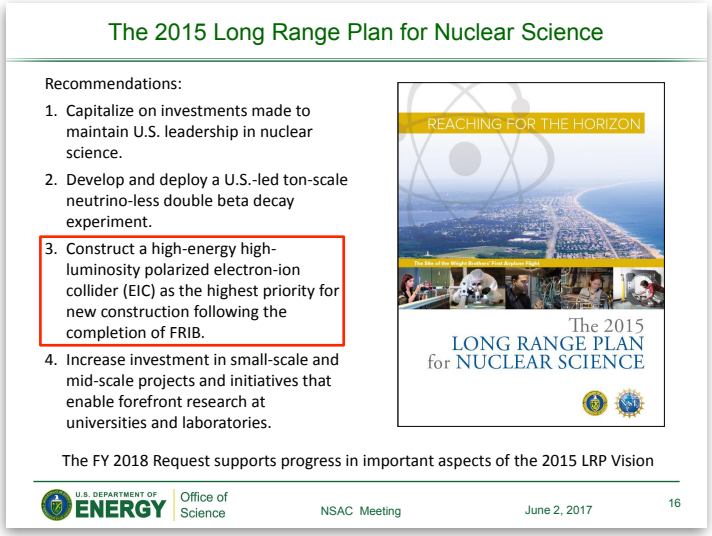
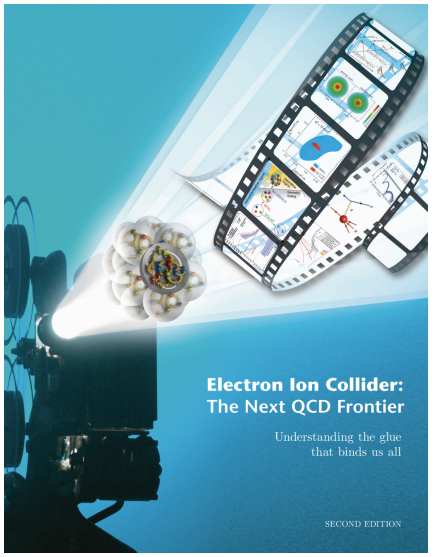


  - Request to review EIC Science Case by National Academy of Sciences, Engineering, and Medicine (NAS)

arXiv:1212.1701



Understanding the glue that binds as all!

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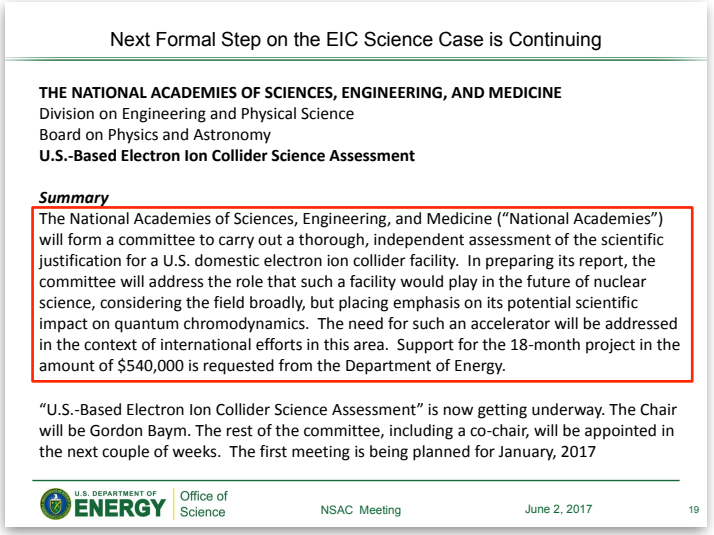

EIC development

- Critical steps over the last couple of years - 2
  - Release of NAS review report: July 24, 2018

"The committee finds that the science that can be addressed by an EIC is compelling, fundamental and timely."

  - Path towards realization of EIC:

T. Hallman

Current Status and Path forward for the EIC

The "wickets" are substantially aligned for a major step forward on the EIC

- A Mission Need Statement for an EIC has been approved by DOE
- An Independent Cost Review (ICR) Exercise mandated by DOE rules for projects of the projected scope of the EIC has been completed
- DOE is moving forward towards a request for CD-0 (approve "Mission Need")
- DOE convened a panel to assess options for siting between two proposed concepts.
- The Deputy Secretary is the Acquisition Executive for this level of DOE Investment
- The FY 2020 President's Request includes $ 1.5 million OPC. The FY 2020 House Mark identifies $ 10 million OPC and $ 1 million TEC. Senate Mark identifies $ 10 million OPC and $ 1 million TEC.

Other Project Cost (OPC) / Total Estimated Cost (TEC)

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July 24, 2018

FOR IMMEDIATE RELEASE

A Domestic Electron Ion Collider Would Unlock Scientific Mysteries of Atomic Nuclei, Maintain U.S. Leadership in Accelerator Science, New Report Says

WASHINGTON – The science questions that could be answered by an electron ion collider (EIC) – a very large-scale particle accelerator – are significant to advancing our understanding of the atomic nuclei that make up all visible matter in the universe, says a new report by the National Academies of Sciences, Engineering, and Medicine. Beyond its impact on nuclear science, the advances made possible by an EIC could have far-reaching benefits to the nation's science- and technology-driven economy as well as to maintaining U.S. leadership in nuclear physics and in collider and accelerator technologies.

The National Academies were asked by the U.S. Department of Energy (DOE) to examine the scientific importance of an EIC, as well as the international implications of building domestic EIC facility. The committee that conducted the study and wrote the report concluded that the science that could be addressed by an EIC is compelling and would provide long-elusive answers on the nature of matter. An EIC would allow scientists to investigate where quarks and gluons, the tiny particles that make up neutrons and protons, are located inside protons and neutrons, how they move, and how they interact together. While the famous Higgs mechanism explains the masses of the quarks, the most significant portion of the mass of a proton or neutron comes from its gluons and their interactions. Crucial questions that an EIC would answer include the origin of the mass of atomic nuclei, the origin of spin of neutrons and protons – a fundamental property that makes magnetic resonance imaging (MRI) possible, how gluons hold nuclei together, and whether emergent forms of matter made of dense gluons exist.

The report says a new EIC accelerator facility would have capabilities beyond all previous electron scattering machines in the U.S., Europe, and Asia. High energies and luminosities – the measure of the rate at which particle collisions occur – are required to achieve the fine resolution needed, and to reach such intensities and energy levels requires a collider where beams of electrons smash into beams of protons or heavier ions. Comparing all existing and proposed accelerator facilities around the world, the committee concluded that an EIC with high energy and luminosity, and highly polarized electron and ion beams, would be unique and in a position to greatly further our understanding of visible matter.

"An EIC would be the most sophisticated and challenging accelerator currently proposed for construction in the U.S. and would significantly advance accelerator science, and more specifically collider science and technologies, here and around the world," said committee co-chair Gordon Baym, Center for Advanced Study Professor Emeritus, George and Ann Fisher Distinguished Professor of Engineering Emeritus, and Research Professor at the University of Illinois at Urbana-Champaign. "The realization of an EIC is absolutely crucial to maintaining the health of the field of nuclear physics in the U.S. and would open up new areas of scientific investigation."

Currently, the Brookhaven National Laboratory (BNL) in Long Island, New York, has a heavy ion collider, and the Thomas Jefferson National Accelerator Laboratory (JLab) in Newport News, Virginia, has very energetic electron beams. Both labs have proposed design concepts for an EIC that would use their already available infrastructure, expertise, and experience. The report, without favoring one over the other, says that taking advantage of the existing facilities would make development of an EIC cost-effective and reduce associated risks that come with building a large accelerator facility. While both labs have well-developed designs for an EIC, both would require considerable R&D to fully deliver on the compelling science questions. The report states DOE R&D investment has been and would continue to be crucial to minimizing design risks in a timely fashion and to addressing outstanding accelerator challenges.

The committee added that along with advancing nuclear science, an EIC would also benefit other areas such as astrophysics, particle physics, accelerator physics, and theoretical and computational modeling. It would also play a valuable role in sustaining the U.S. nuclear physics workforce in the coming decades. Moreover, it would have a significant role in advancing more broadly the technologies that would result from the research and development undertaken in the implementation and construction of an EIC in the U.S. The report emphasizes that an EIC is the only high-energy collider being planned for construction in the U.S. currently, and building such a facility would maintain U.S. leadership in accelerator collider science while benefiting the physical sciences.

"The science that an EIC would achieve is simply unique and would ensure U.S. leadership in nuclear science as well as the accelerator science and technology of colliders around the world," said committee co-chair Ani Aprahamian, Freimann Professor of Experimental Nuclear Physics at the University of Notre Dame.

The study was sponsored by DOE. The National Academies of Sciences, Engineering, and Medicine are private, nonprofit institutions that provide independent, objective analysis and advice to the nation to solve complex problems and inform public policy decisions related to science, technology, and medicine. The National Academies operate under an 1863 congressional charter to the National Academy of Sciences, signed by President Lincoln. For more information, visit http://national-academies.org.

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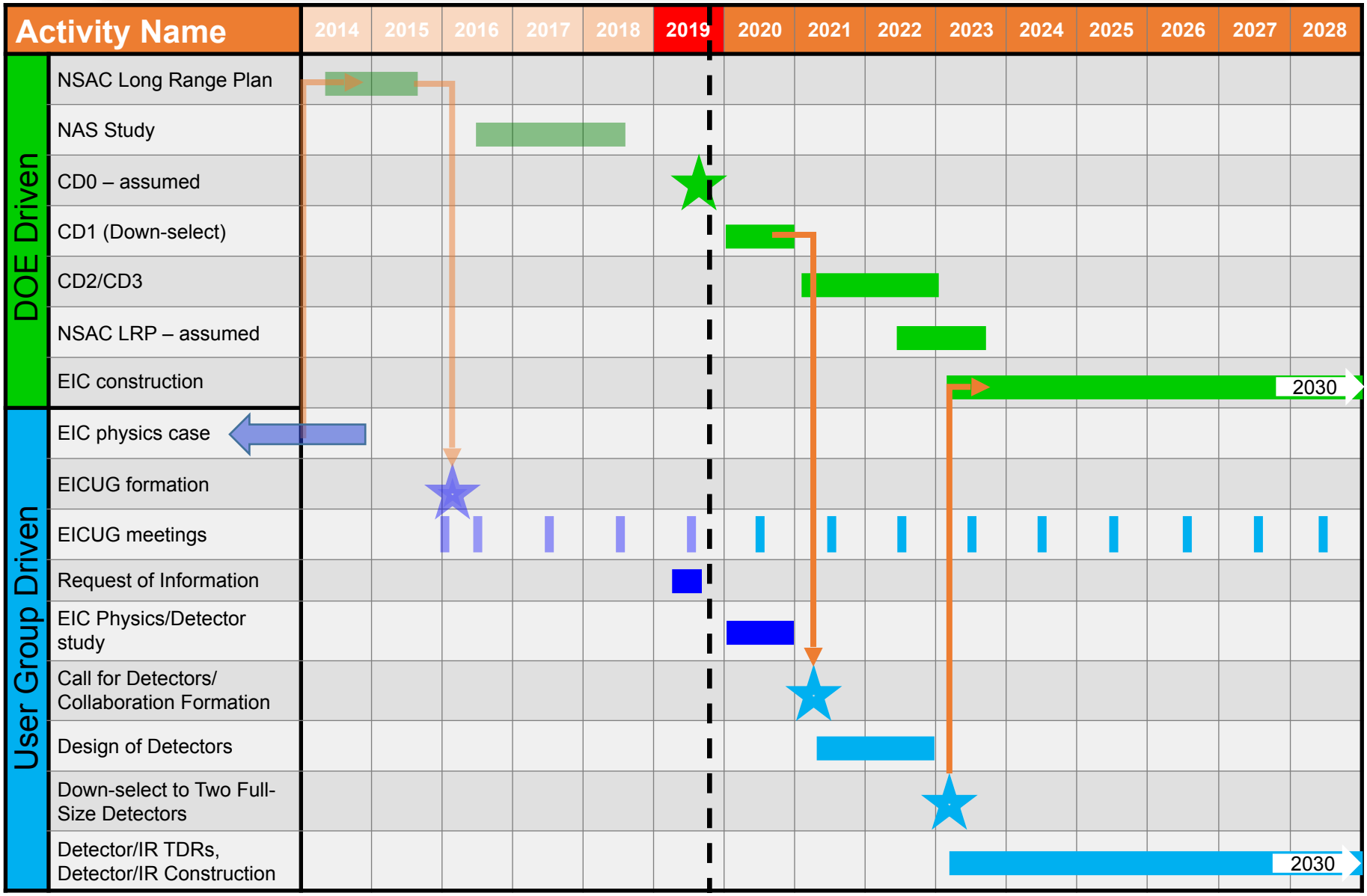
Vision for a Timeline - Paris EICUG Meeting



Yellow Report - Idea / Motivation

- Yellow Report Initiative:
  - The CERN Yellow Reports series provides a medium for communicating CERN-related work where publication in a journal is not appropriate. Reports include material having a large impact on the future of CERN, as well as reports on new activities which do not yet have a natural platform. The series includes reports on detectors and technical papers, criteria being that the audience should be large and the duration of interest long. The term Yellow Reports is now used frequently for documents with similar purpose in various physics communities unrelated to CERN.
- Our purpose:
  - Advance the state of documented (i) physics studies (White Paper, INT program proceedings) and (ii) detector concepts (Detector and R&D Handbook) in preparation for the EIC. This will provide both the basis for further development of concepts for experimental equipment best suited to the EIC science needs, including complementarity of the two detectors/interaction regions, and input towards future Technical Design Reports (TDRs) of the experimental equipment.

Yellow Report - Strategy

- Quantify physics measurements for existing or new physics topics and implications for detector design ("Physics WG")
  - Go beyond physics motivation to implication for detector requirements.
  - Physics considerations for two independent complementary detectors.
- Study detector concepts based on the requirements defined above, and quantify implications for the physics measurements ("Detector WG")
  - Balance detector concepts versus impact on physics measurements.
  - Document complementarity (+ reduction of systematics) of detectors.
  - Fold in ancillary detectors, measurements (polarimetry, luminosity, …).
  - Engage EIC-detector R&D consortia.
- Study opportunities for accelerator physics experiments at a future EIC ("Accelerator WG")
  - EIC, once built, will be unique facility to push frontiers of accelerator S&T.
  - Document ideas for experiments to study further push of EIC performance and/or generic accelerator R&D.
  - Likely smaller scale, 5-10 accelerator scientists.

Yellow Report - Approach

- Form Physics, Detector and Accelerator Working groups.
- First two will have 4 conveners (= editors of final Reports), the third group can have Ferdi Willeke and Andrei Seryi as convener, or their delegates.
- Each group has 1 Steering Committee (SC) observer that follows progress and reports the status of the effort to the SC.
- The two physics/detector and detector/physics groups should have regular meetings (preferably weekly) via video conference/phone. At regular intervals (preferably monthly) both groups should have a joint meeting.
- The accelerator physics working group should similarly reach out to have participants and solicit input from the wide EICUG accelerator community.
- Each group (physics and detector) will need to be divided in sub-groups, with sub-conveners. The third accelerator physics group likely can stay as a whole.
- Sub-groups will be defined following the analysis of the "Request of Information".
- The sub-conveners will be the people being requested to guide and document the contributions (10-15 pages each) to the conveners for the Yellow Report(s).

Yellow Report - Convener Tasks

- Rough outline of the tasks as foreseen for the physics/detector and detector/physics conveners as a group (i.e., it is understood not all may at all times be available)

1. Attend the kick-off meeting, lead the breakout sessions.
2. Structure and organize the sub-groups towards a complete Yellow Report.
3. Coordinate the efforts between the corresponding sub-groups.
4. Attend the series of workshops, and likely organize their breakout sessions.
5. Organize/lead frequent phone call meetings within their group.
6. Co-organize the (monthly?) phone call meetings with the other group to coordinate.
7. Ensure the sub-groups keep on track in their work and submissions.
8. Edit the Yellow Report from the submission of sub-groups.

- We estimate the commitment of each convener in terms of fraction of their time to be of order 10 hours per week.

Yellow Report

- Working Groups - Introduction / Physics
  - Adrian Dumitru (Baruch College / CUNY, New York, NY) (adrian.dumitru@baruch.cuny.edu)

    Theorist working on low-x physics / QGP aspects.

  - Olga Evdokimov (University of Illinois at Chicago, Chicago, IL) (evdolga@uic.edu)

    Experimentalist working on relativistic heavy-ion physics at STAR and CMS.

  - Andreas Metz (Temple University, Philadelphia, PA) (metza@temple.edu)

    Theorist working on parton structure of hadrons.

  - Carlos Munoz (IPN-Orsay, Orsay, France) (munoz@ipno.in2p3.fr)

    Experimentalist working on nucleon structure program at JLab (GPD's).

Yellow Report

- Working Groups - Introduction / Detector
  - Ken Barish (University of California at Riverside, Riverside, CA) (Kenneth.Barish@ucr.edu)

    Experimentalist on the spin physics program at RHIC.
  - Tanja Horn (Catholic University of America, Washington D.C.) (hornt@cua.edu)

    Experimentalist working on nucleon structure program at JLab.
  - Peter Jones (University of Birmingham, Birmingham, UK) (p.g.jones@bham.ac.uk)

    Experimentalist working on relativistic heavy-ion physics at ALICE.
  - Silvia Dalla Torre (University of Trieste and INFN Trieste, Trieste, Italy)

    (Silvia.dallatorre@ts.infn.it)

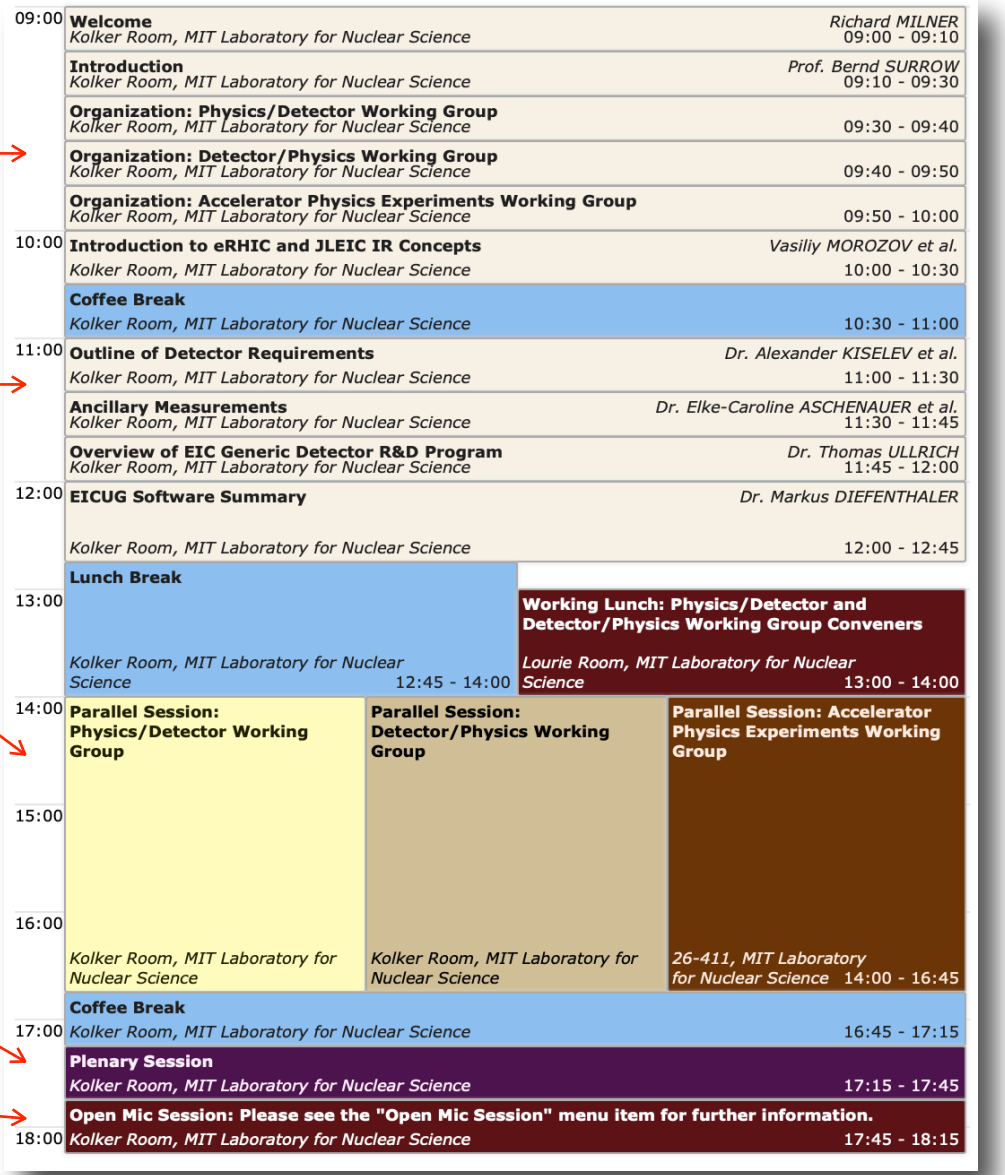
    Experimentalist working on nucleon spin structure program at CERN and MPGD detectors.

Yellow Report

- Timeline
  - Workshop series in 2020
    - 1st Workshop: March 19-21, 2020, Temple University, Philadelphia, PA
    - 2nd Workshop: May 22-24, 2020, University of Pavia, Pavia (Italy)
    - Status reports at Summer EICUG Meeting: August 3-7, 2020, FIU, Miami, FL
    - 3rd Workshop: September 17-19, 2020 CUA, Washington, DC
    - 4th Workshop: November 19-21, 2020, UC Berkeley, Berkeley, CA
    - Optional final meeting in January 2021
  - Review / Input to Yellow Report:
    - Period of web-based EICUG community input.
    - Independent reviewer read and provide comments.
    - Release of final report incl. input ~April 2021 or expedited in January 2021.

MIT Organization Meeting

- **Morning plenary session**:
  - Plans and organizational structure for WG's.
  - Presentations on status of key areas: Detector requirements, Ancillary Measurements, EIC Generic R&D program and EICUG Software summary.
- **Afternoon Parallel Sessions**:
  - BlueJeans connections for each parallel session / Approx. last hour not public.
  - Follow directions for location!
- **Afternoon plenary session**:
  - Brief summary of parallel sessions.
  - Open MIC session of brief 5min. contributions.

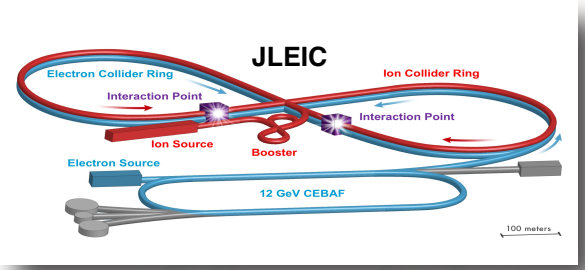


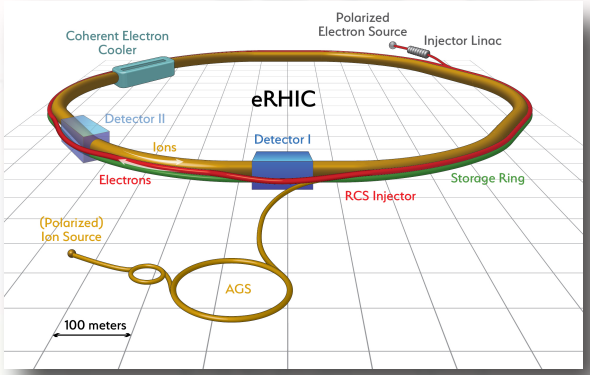
After MIT Organizational Meeting

- Anticipated next steps:
  - Finalize sub-convener appointments shortly after MIT meeting.
  - Send a finalized short "task list" to the sub-conveners for each sub-group, on what we want out of each WG, as a start/direction.
  - Offer one or two remote software tutorials around early - to mid-January, such that sub-groups can jumpstart activities.
  - Conveners start their regular meetings via video/conference.
  - Sub-conveners submit an outline of their foreseen (<15 page) contributions to the conveners.
  - The goal is to have by the end of January 2020 all activities well underway.
  - WORK!
  - Prepare for 1st Workshop, March 19-21, 2019.

Concluding Remarks

- Moving forward:
  - EIC community engagement may, based on common interest, naturally evolve into proto-collaboration formation, independent of hosting site.
  - It is vital for this effort that a large fraction of the active participants come from university groups: Aim to engage (at least!) 10% of the ~950 members of the EICUG in this effort.
  - This effort needs substantial participation from universities willing to invest some amount of their time in calendar year 2020 to this project. Yes, we are all busy, but the EIC time seems now! This is essential, EIC activities at DOE seem to proceed fast.
  - EICUG Steering Committee committed to intensify direct communication with JLab and BNL concerning timelines and to align overall planning!
  - We are all in this together to realize a future EIC facility - We are looking forward to an open and respectful discussion here at MIT!





Thanks to Richard and his group to host us here at MIT!