

Charting a course to the 2nd Detector and Interaction Region at the EIC

May 17, 2023

A stylized, dark blue road with white dashed lines, winding across a bright yellow background. The road starts at the top center, curves to the left, then to the right, and finally curves back to the left, ending at the bottom right corner. It has a slight 3D effect with a grey shadow on the left side.

EICUG Det II Milestones

EICUG-SC expanded and codified the arguments, producing a glossy brochure that was distributed to same international funding agencies that received copies of the yellow report.

Spring 2022

Richard Milner and Rolf Ent lead a discussion about the role of a 2nd IR and Detector at the EIC.

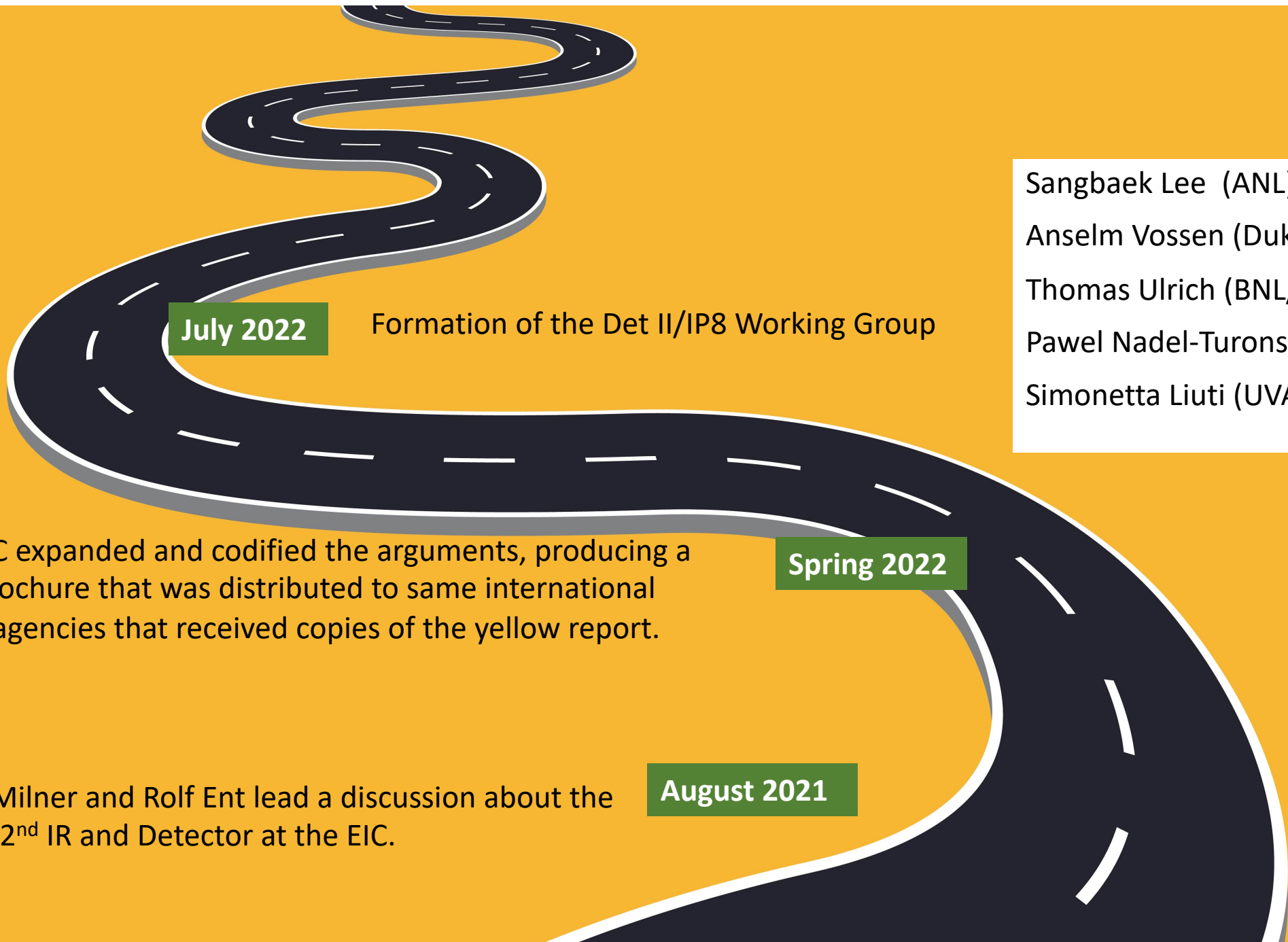
August 2021



THE ELECTRON-ION COLLIDER

The Benefits of Two Detectors

The Electron-Ion Collider (EIC) is a transformational and unique accelerator that will enable studies of nuclear matter with unprecedented precision. The EIC is required to address fundamental open questions in physics, such as the origin of mass and spin of protons and neutrons, the details of the "glue" that binds them, and the nature of very dense gluon systems in nuclei. This ambitious collider could not deliver physics results without powerful "cameras" capable of taking the most detailed snapshots of the collisions produced at the EIC. Novel particle detectors must be designed and constructed to capitalize on the investment made on the accelerator side, so that the deepest secrets of the building blocks of matter in our visible universe may be unlocked.



July 2022

Formation of the Det II/IP8 Working Group

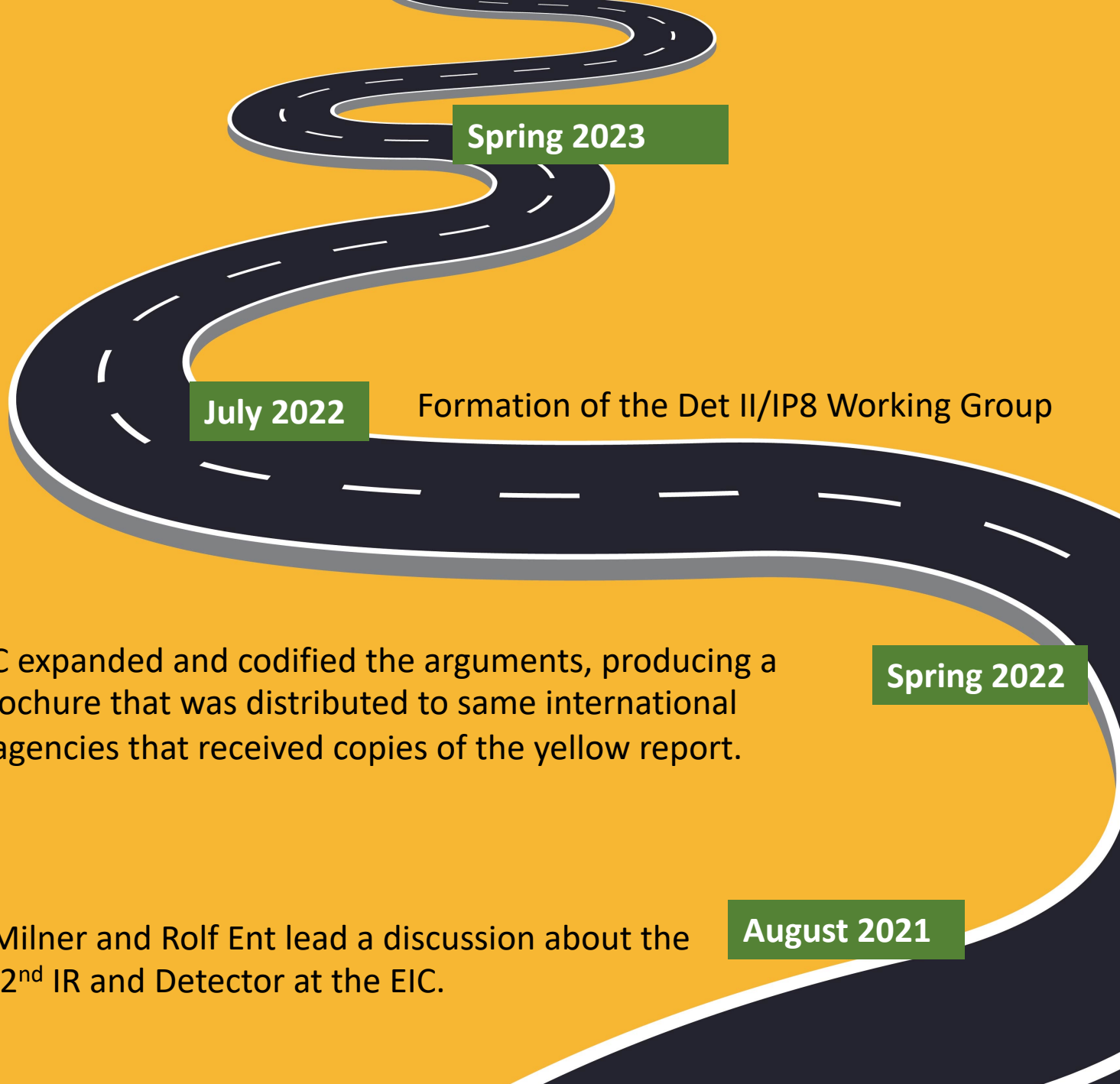
- Sangbaek Lee (ANL)
- Anselm Vossen (Duke/JLAB)
- Thomas Ulrich (BNL/Yale)
- Pawel Nadel-Turonski (CFNS/SBU)
- Simonetta Liuti (UVA)

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Detector WG

- Klaus Dehmelt (CFNS/SBU)
- Ernst Sichtermann (LBNL)

Physics WG

- Charles Hyde (ODU)
- Bjoern Schenke (BNL)

Det II/IP8
Incubator
Workshop

December 2022

CNFS Workshop

1. Cross checks of key measurements & potential discoveries
2. New opportunities enabled by unique features of a 2nd detector such as the 2nd focus in IR8.

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Unique opportunities for Det II @ IP8

- A. **MAGNETIC FIELD** - Solenoid field up to 3T, allowing for high resolution momentum reconstruction for charged particles.
- B. **EXTENDED COVERAGE** for precision electromagnetic calorimetry - important for DVCS on nuclei
- C. **MUONS** – enhanced muon ID in backward and barrel region.
- D. **BACKWARD HADRONIC CALO** - Low-x physics, reconstruction of current jets in the approach to saturation
- E. **SECONDARY FOCUS** - tagging for nearly all ion fragments and extended acceptance for low pT/ low x protons. Enables detection of short-lived rare isotopes.

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1st International Workshop on Detector II

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**1ST INTERNATIONAL WORKSHOP
ON A 2ND DETECTOR FOR THE
ELECTRON-ION COLLIDER**

Temple University
Philadelphia, PA
May 17-19, 2023

Scientific Topics
> Science Opportunities with a 2nd Detector
> Detector Technologies
> R&D Needs & Perspectives
> Opportunities for AI/ML
> International Perspectives and Community Broadening

Organizing Committee:
Klaus Dehmel (CFNS/SBU)
Abhay Deshpande (BNL/CFNS/SBU)
Renee Fatemi (UKY)
Charles Hyde (ODU)
Sangbaek Lee (ANL)
Simonetta Liuti (JVA)
Pawel Nadol-Turoski (CFNS/SBU)
Marco Radici (INFN/Pavia)
Byern Schenke (BNL)
Ernst Sichtermann (LENL)
Bernd Surrow (Temple)
Thomas Ullrich (BNL/Yale)
Anselm Vossen (Duke/Lab)

Organized by the EIC User Group,
CFNS, and Temple University
<https://indico.bnl.gov/event/18414>



Where to from here?

I. Develop concrete physics projections for selected channels

- Leverage ePIC software & simulation structure
- Start with magnetic field
- Study effect of field + tracking choices on tracks in backward region
- Explore complementarity with ePIC technologies – mRICH, SciGlass etc.

II. Recruit new institutions

- Identify international ambassadors (physics contacts – not funding agencies) that can help navigate the nuclear physics landscape in their country.
- Goal is to engage institutions that are interested in EIC, but on an extended timeline, after the day 1 commissioning of ePIC.
- Maintain close communication with project so as to avoid mixed or confusing messages to potential international partner.

1st International Workshop on Detector II

- Thank you for joining us this week!

- Your job is two-fold:



Bring new ideas to the table



Highlight measurements that should be high priority for a 2nd detector.

- This is another opportunity to help shape the future physics scope at the EIC.

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- Next Det II workshop is July 30-31 in Warsaw!

Electron-Ion Collider User Group Meeting

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

• Early Career

EICUG 2023

International Advisory Committee:

- E. C. Aschenauer (BNL)
- S. Dalla Torre (INFN Trieste)
- A. Deshpande (CFNS, Stony Brook U. & BNL)
- R. Ent (JLab)
- T. Altinoluk (NCBJ)
- B. Badelek (U. Warsaw, chair)
- D. Kikoła (WUT)
- M. Suster (Candela F., U. Warsaw)
- P. Nadel-Turonski (CFNS, Stony Brook U.)
- M. Radici (INFN Pavia)
- J. Rittenhouse West (BNL)
- E. Sichtermann (BNL)
- P. Sznajder (NCBJ)
- J. Wagner (NCBJ)

Local Organising Committee:

JULY 23 - 31 2023

Warsaw

<https://indico.cern.ch/e/EICUG2023>

Indico logo and QR code at the bottom right.

Backup

Charge for Detector II/IP8 Working Group

1. Engage the broader community, **including theorists, accelerator physicists and ePIC experimentalists**, to fully develop projections for the portfolio of measurements that are complementary to the ePIC physics program, including those that capitalize on the implementation of the secondary focus.
2. Work with the EICUG Steering Committee and Project to **recruit new institutions** and establish a diverse and vibrant 2nd Detector working group.
3. Utilize the extended design period for Detector 2 to identify groups that will focus on **R&D for emerging technologies** that could provide another aspect of complementarity to ePIC.
4. Facilitate the development of a **unified concept** for a general-purpose detector at IR8. In particular, the 2nd detector should be complementary to the project detector at IR6 and may capitalize on the possibility of a secondary focus at IR8.