ePIC Collaboration: Status, Plans, Responsibilities, Capabilities

Silvia Dalla Torre, John Lajoie

INFN TRIESTE

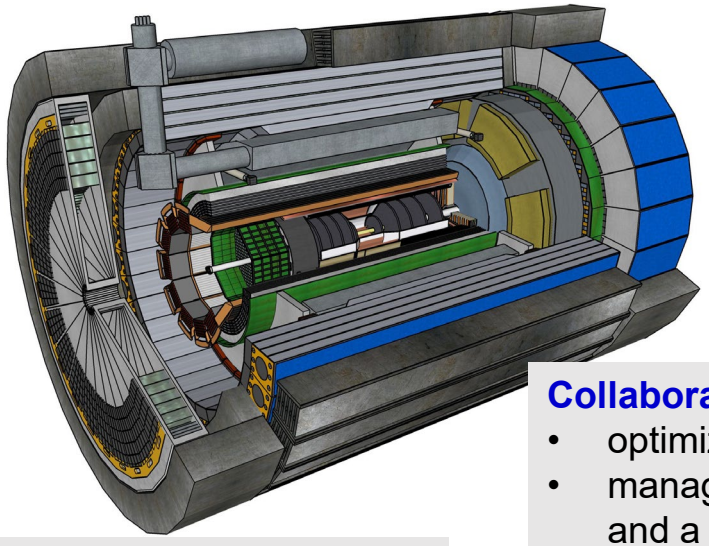
OAK RIDGE National Laboratory

10th EIC DAC Meeting, June 11-13, 2025

The ePIC DETECTOR:

the combined EIC PROJECT and ePIC COLLABORATION efforts

ePIC (designed for IP6 at EIC) is the **Project Detector**



ePIC is the detector to which the **ePIC Collaboration** is dedicated

Project mission for the ePIC detector

- ensure that all aspects related to the EIC project realization and completion are satisfied

Project support to the ePIC detector

- Administrative structure
- Engineer team
- Financial support
  - Past : mainly via R&D program
  - Present: mainly via PED (Project Engineering & Design)
  - After CD3: construction

Collaboration mission for the ePIC detector

- optimize the physics reach of the detector
- manage the Collaboration to make it functional, effectively operative and a professionally sound environment

Collaboration support to the ePIC detector

- Scientific workforce
  - For hardware, software and dedicated physics studies
- Support
  - Staff members
  - Past and present: international cofinancing R&D, PED
  - international in-kind contribution to constructions

Beyond these specificities, **Project and Collaboration are synergistically cooperating** across the two missions towards the common goal:
a detector matching the overall EIC physics scope.

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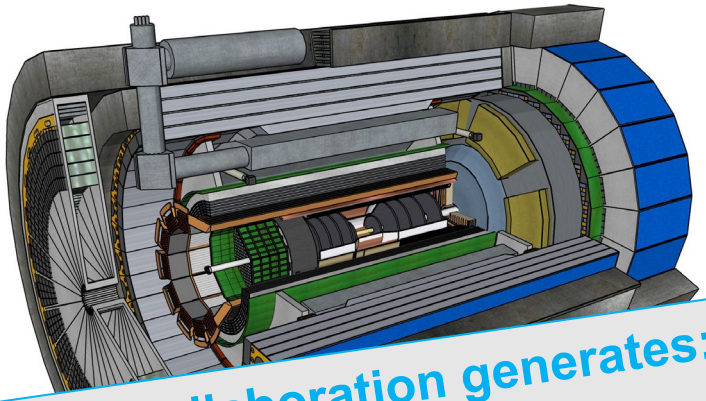

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  - After CD

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&D, PED
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Membership in the ePIC Collaboration generates:

- The large majority of **detector-dedicated scientific workforce;**
- The whole **complementary scientific workforce for simulation and physics studies** (these two ingredients are key for the optimization of the detector physics reach and for the detector R&D and engineering details);
- The motivation for the **in-kind** (they are agreed upon by Institutions and Agencies; they typically arise from the bottom-up pressure by scientists in the collaboration).

specificities, **Project and Collaboration are synergistically cooperating** across the two missions towards the common goal:
a detector matching the overall EIC physics scope.

The ePIC Collaboration

The community dedicated to the EIC science mission
by the realization of the ePIC detector

JLab, Jan. 2023

Warsaw, July 2023

Lehigh, July 2024

The ePIC Collaboration

ePIC initiated in July 2022

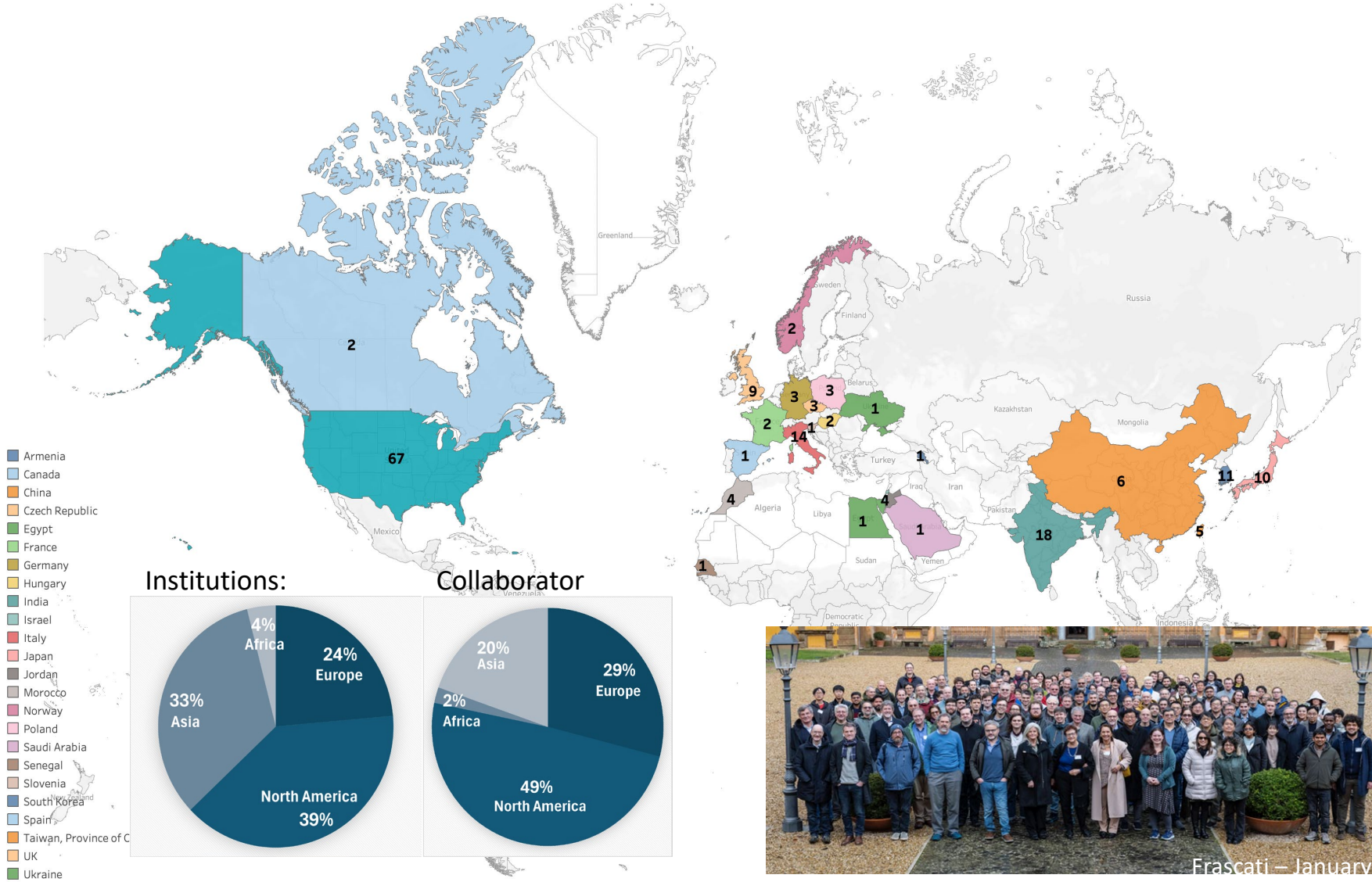
Currently:

> 1000 collaborators

ePIC Institutions
180

ePIC Countries
25

ePIC World Region
4



Institutions:

Collaborator

Frascati – January

The ePIC Collaboration

17 New Institutions Joining ePIC in 2024 and 2025:

- Univ. of Texas at Austin
- Univ. Mohammed V in Rabat
- Univ. Ibn Tofail in Kénitra
- Univ. Mohammed Premier in Oujda
- Tohoku University
- Univ. Mohammed VI in Bengurir
- University of Hawai‘i at Mānoa
- Texas Southern University
- Seoul National University
- Kent State Univ.
- Laboratoire Leprince-Ringuet (LLR)
- American University in Cairo
- Central University of Haryana
- Indian Institute of Technology Mandi
- UPES
- Johannes Gutenberg University Mainz
- Mount Allison University

The ePIC Collaboration, organization aspects

Second ePIC Spokesperson Election

- Spokesperson election in February 2025
  - Open call for nominations went out Oct. 25th , 2024
  - Candidate presentation at Jan. 2025 collaboration meeting
- John Lajoie elected to a second (final) term as Spokesperson
- Silvia Dalla Torre continues as Deputy Spokesperson

Formation of ePIC Policies

The Membership Policy was endorsed by the Collaboration Council August 2024.

The Conference and Talks Policy was endorsed by the Collaboration Council November 2024.

The *Code of Conduct* was endorsed by the Collaboration Council December 2024.

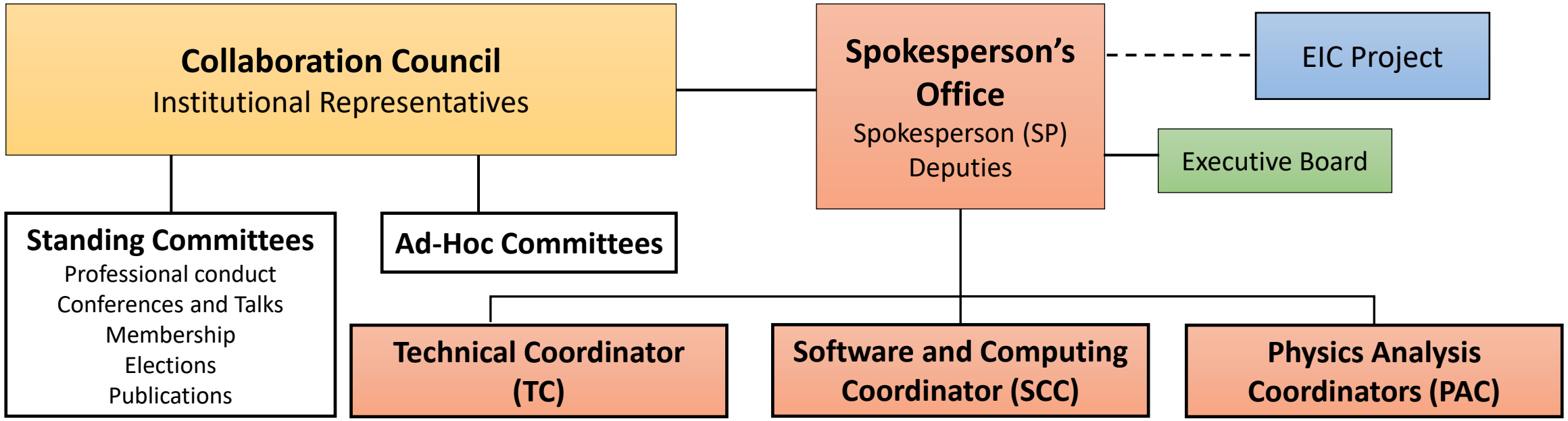
The *Results Release Policy* was endorsed by the Collaboration Council May 2025.

The *Publication Policy* is in an advanced draft, discussed in CC meetings in January and April 2025.

On-going election procedure for renewing the chair-lines:

- Collaboration Council
- Conference & Talks Committee
- Membership Committee

Reminder: ePIC Collaboration Structure



Reminder: ePIC Collaboration Structure

Collaboration Council
Institutional Representatives

Spokesperson's Office
Spokesperson (SP)
Deputies

EIC Project

Executive Board

Standing Committees
Professional conduct
Conferences and Talks
Membership
Elections
Publications

Ad-Hoc Committees

Tech  **inator**

Software and Computing Coordinator (SCC)

Physics Analysis Coordinators (PAC)

TECHNICAL COORDINATION OFFICE
Silvia Dalla Torre (INFN, acting)
Prakhar Garg (Yale), Deputy
John Haggerty (BNL), Deputy
Oskar Hartbrich (ORNL), Deputy
Matt Posik (Temple), Deputy

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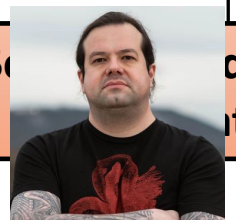

Physics Analysis Coordinators (PAC)

TECHNICAL COORDINATION OFFICE
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John Haggerty (BNL), Deputy
Oskar Hartbrich (ORNL), Deputy
Matt Posik (Temple), Deputy

SOFTWARE AND COMPUTING COORDINATOR
Markus Diefenthaler (JLab), Coordinator
Wouter Deconinck (Manitoba), Deputy
Dmitry Kalinkin (Kentucky), Deputy
Torre Wenaus (BNL), Deputy

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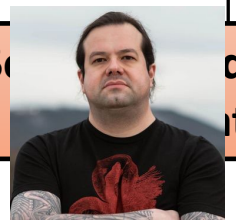
S  **d Computing tor (SCC)**

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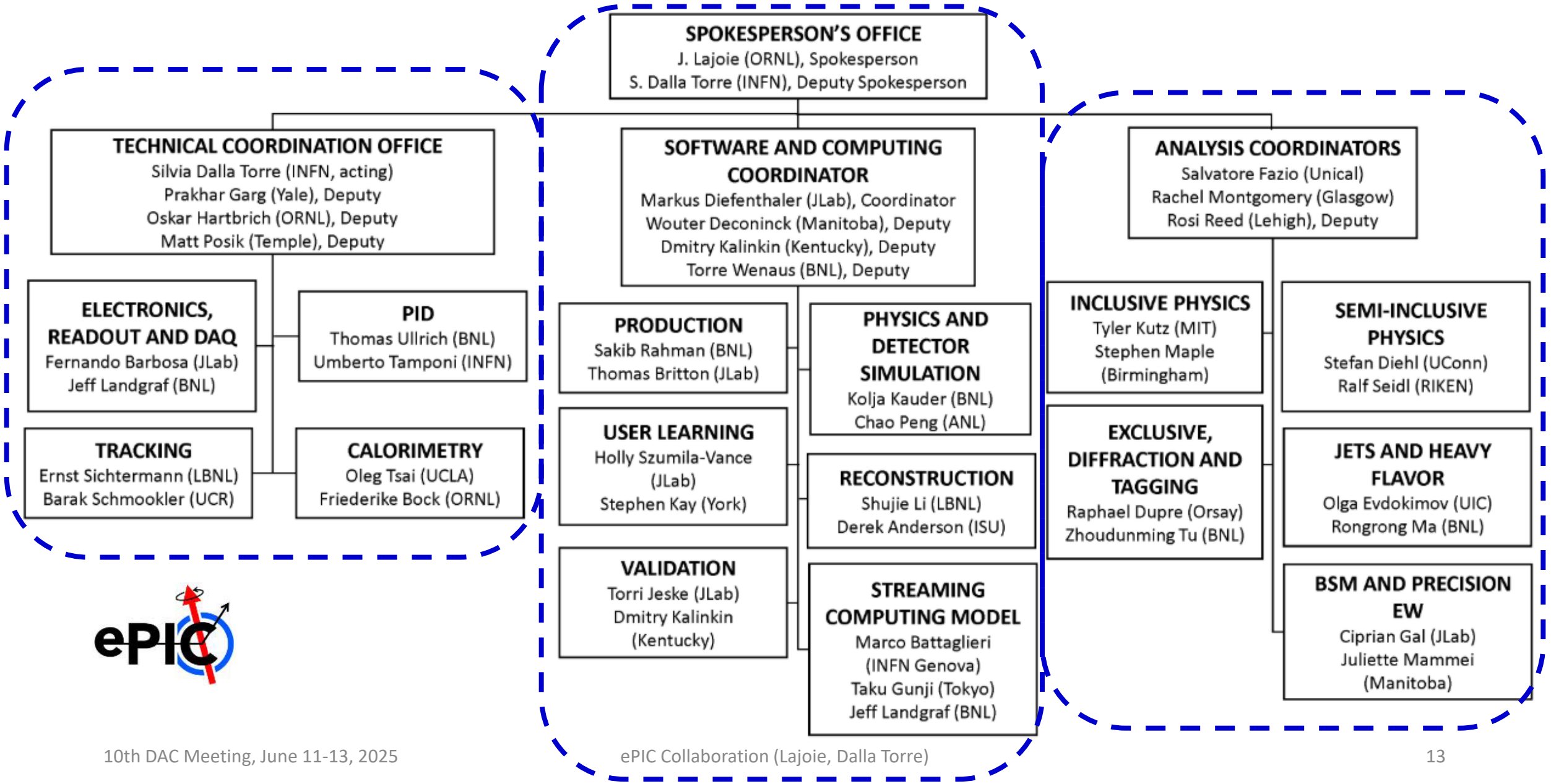
Dmitry Kalinkin (Kentucky), Deputy
Torre Wenaus (BNL), Deputy

PHYSICS ANALISYS COORDINATORS
Salvatore Fazio (Unical)
Rachel Montgomery (Glasgow)
Rosi Reed (Lehigh), Deputy

ePIC Collaboration Structure : new faces in the leadership

- The Spokesperson's Office nominated Rachel Montgomery as a new Physics Analysis Co-Coordinator:
  - Lecturer in Nuclear and Hadron Physics at University of Glasgow
  - Former ePIC Diffractive and Exclusive Physics WG Convener
- The Spokesperson's Office nominated Taku Gunji as a new Streaming Computing Model WG convener
  - Associate Professor at the University of Tokyo, CNS
  - SPADI Alliance member
- The Spokesperson's Office appointed John Haggerty as a new Deputy Technical Coordinator
  - sPHENIX CDR/TDR editor

The ePIC Working Groups



The ePIC Structure for the DETECTOR

New personnel since last RRB

SPOKESPERSON'S OFFICE
J. Lajoie (ORNL), Spokesperson
S. Dalla Torre (INFN), Deputy Spokesperson

TECHNICAL COORDINATION OFFICE
Silvia Dalla Torre (INFN, acting)
Prakhar Garg (Yale), Deputy
John Haggerty (BNL), Deputy
Oskar Hartbrich (ORNL), Deputy
Matt Posik (Temple), Deputy

Detector Subsystem Collaborations
revised: 5/28/2025

Particle Identification

dRICH
DSL/DSTC: Marco Contalbrigo (INFN)

hpDIRC
DSL/DSTC: Greg Kalicy (CUA)

BACKWARD RICH
DSL/DSTC: Alexander Kiselev (BNL)
Deputy DSL: Brian Page (BNL)

AC-LGAD TOF
DSL: Zhangbu Xu (Kent State)
Deputy DSL: Satoshi Yano (Hiroshima)
DSTC (barrel): Simone Mazza (UCSC)
DSTC (forward): Mathieu Benoit (ORNL)

Calorimetry

BARREL ECAL
Co-DSL: Sylvester Joosten (ANL)
Co-DSL: Hwidong Yoo (Yonsei)
Deputy DSL: Maria Zurek (ANL)
DSTC: Jessica Metcalfe (ANL)

BACKWARDS HCAL
DSL: Leszek Kosarzewski (OSU)
DSTC: Caroline Riedl (UIUC)

FORWARD HCAL
DSL/DSTC: Friederike Bock (ORNL)
Deputy DSL/DSTC: Miguel Arratia (UCR)

BARREL HCAL
Co-DSL: Stefan Bathe (Baruch)
Co-DSL: Murad Sarsour (GSU)

FORWARD ECAL
Co-DSL/DSTC: Oleg Tsai (UCLA)
Co-DSL: Huan Huang (UCLA)

BACKWARDS ECAL
DSL: Tanja Horn (CUA)
DSTC: Carlos Munhoz Camacho (JLab)

Far-Forward Far-Backward

FAR FORWARD
DSL: Alex Jentsch (BNL)
DSTC (B0): Zvi Citron (Ben-Gurion)
DSTC (Roman Pots/OMD): Alex Jentsch (BNL)
Co-DSTC (ZDC): Yuji Goto (RIKEN)
Co-DSTC (ZDC): Miguel Arratia (UCR)

FAR BACKWARD HIGH RATE TRACKER
DSL: Jaroslav Adam (CTU)
DSTC: Simon Gardner (Glasgow)

LUMINOSITY
Co-DSL: Nick Zachariou (York)
Co-DSL: Krzysztof Piotrzkowski (AGH Krakow)
DSTC (Pair Spectr.): Stephen Kay (York)

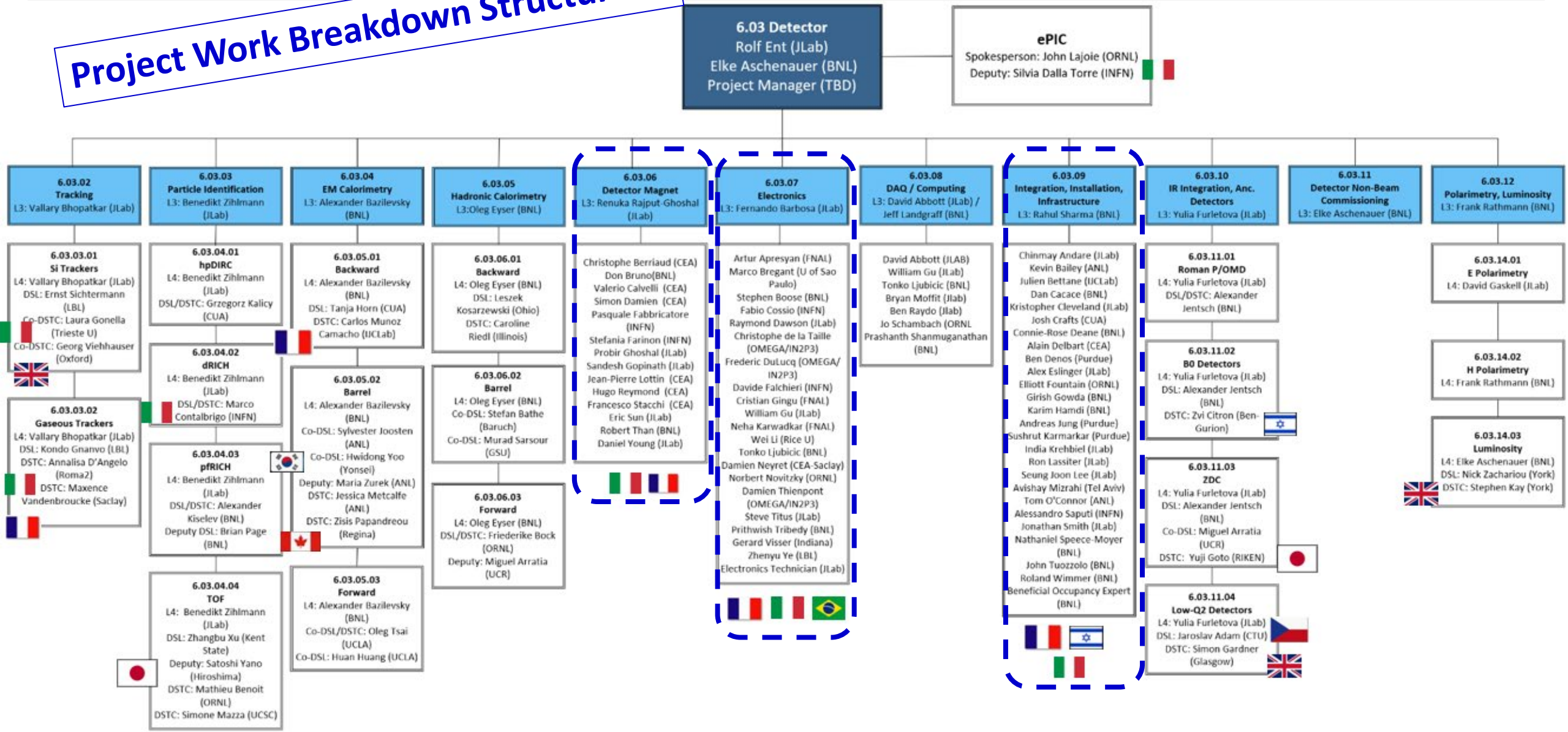
Tracking

Si TRACKERS
DSL: Ernst Sichtermann (LBL)
Co-DSTC: Laura Gonella (Trieste)
Co-DSTC: Georg Viehhauser (Oxford)

GASEOUS TRACKERS
DSL: Kondo Gnanvo (JLab)
DSTC: Maxence Vandenbroucke (Saclay)
DSTC: Annalisa D'Angelo (INFN Roma II)

The combined EIC PROJECT and ePIC COLLABORATION efforts: HOW?

Project Work Breakdown Structure



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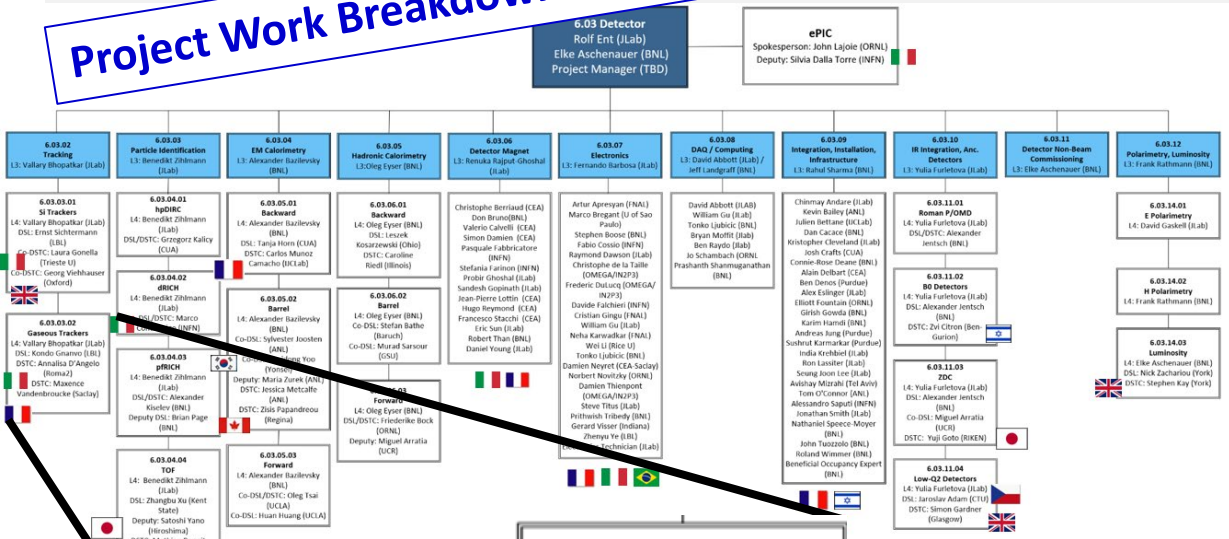
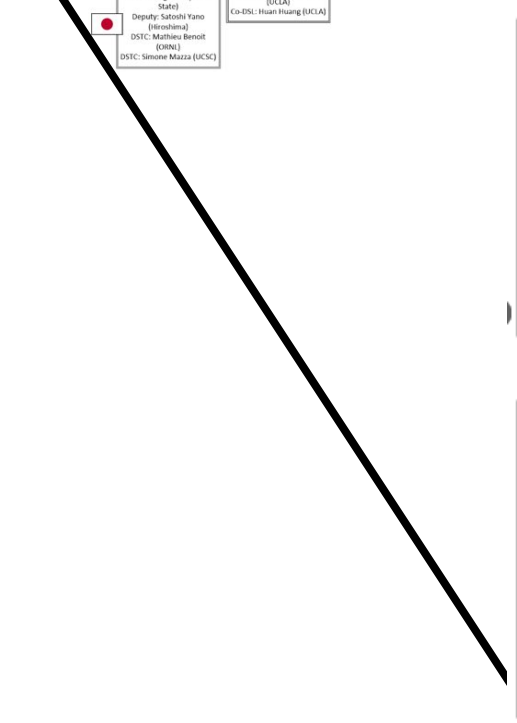
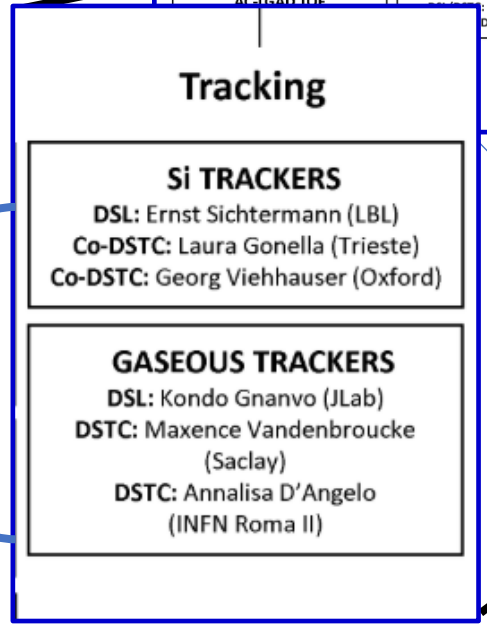
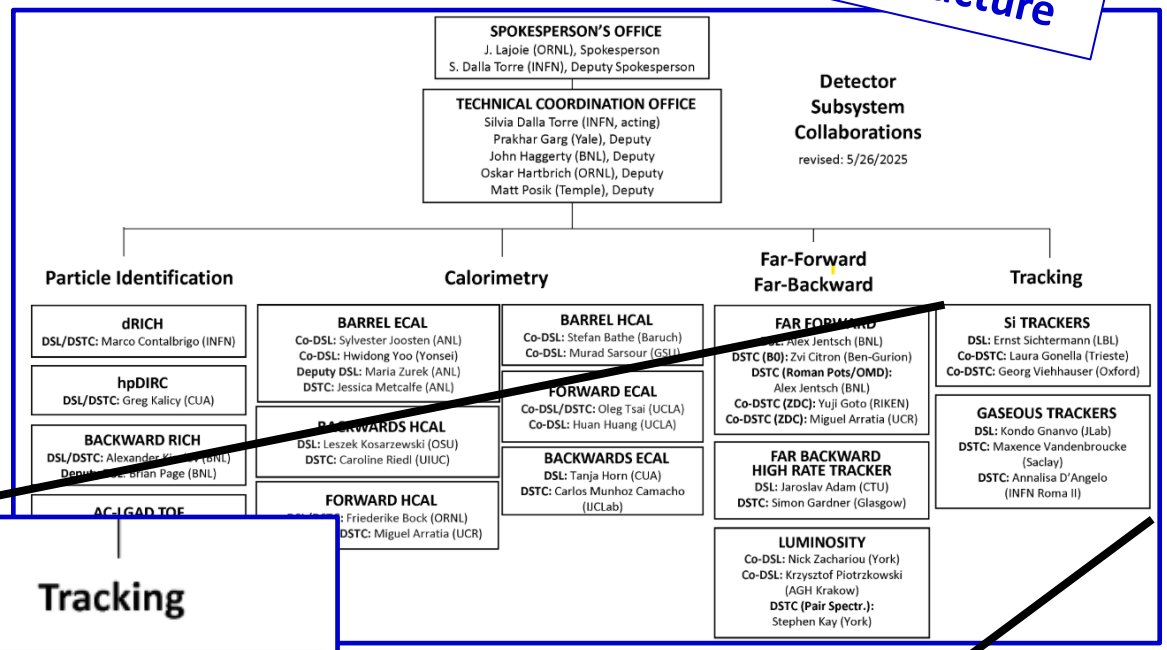




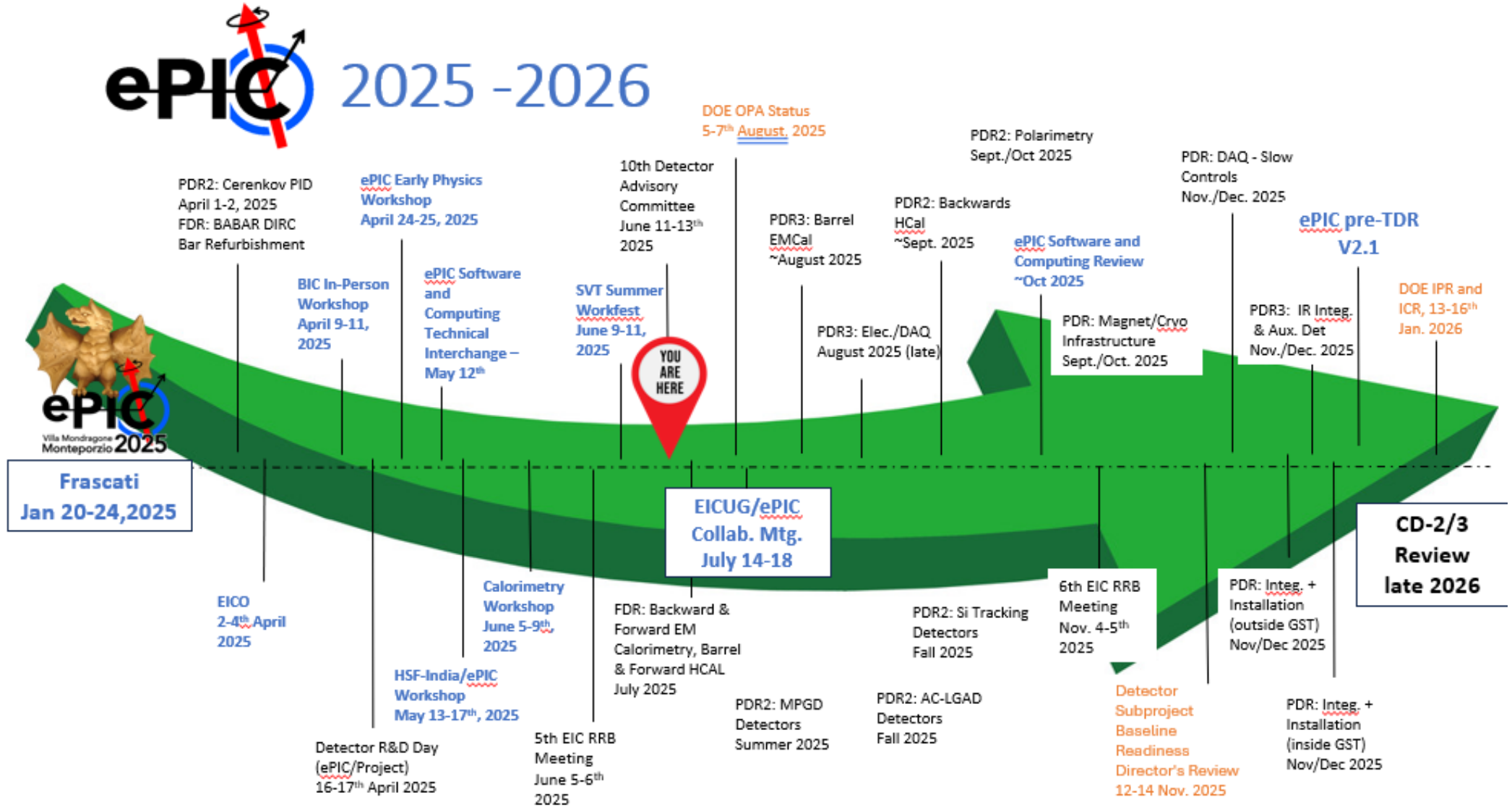
DSLs/DSTCs integrated in the Project



ePIC Detector Structure



ePIC Activity plans



People and activities in ePIC: the 2024 Collaboration Survey (1st year)

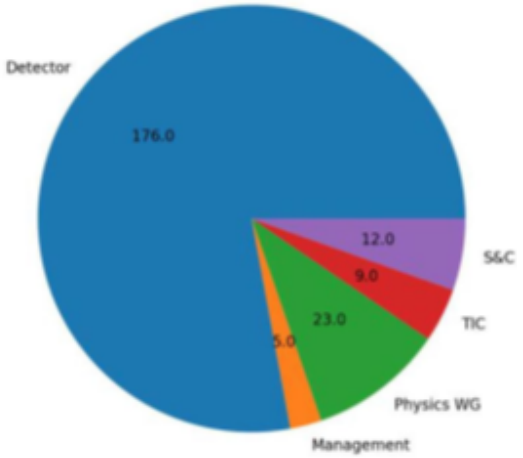
From the ePIC Membership Policy:

> Continued authorship in the ePIC Collaboration requires membership in a signing institution and inclusion in an annual institutional “statement of service”.
>
> The annual statement of service is intended to reflect institutional commitments for the coming year, and document contributions to ePIC carried out during the previous year. It is expected that the majority of institutions will maintain signing status, once obtained, while they are active members of ePIC.

The survey collects the information about:

- Up-to-date Census of the Institutional Groups
- **Statement of Work, also related to the Statement of Service (ePIC membership Policy)**
- Workforce projection for the next 10 y
- First exercise at the end of 2024

- 67% of collaborators intend to qualify for authorship in 2025
  - 176.4 FTE on detector, 23.1 FTE on Physics Analysis
- Survey data made available to DSC’s, WG’s to improve engagement



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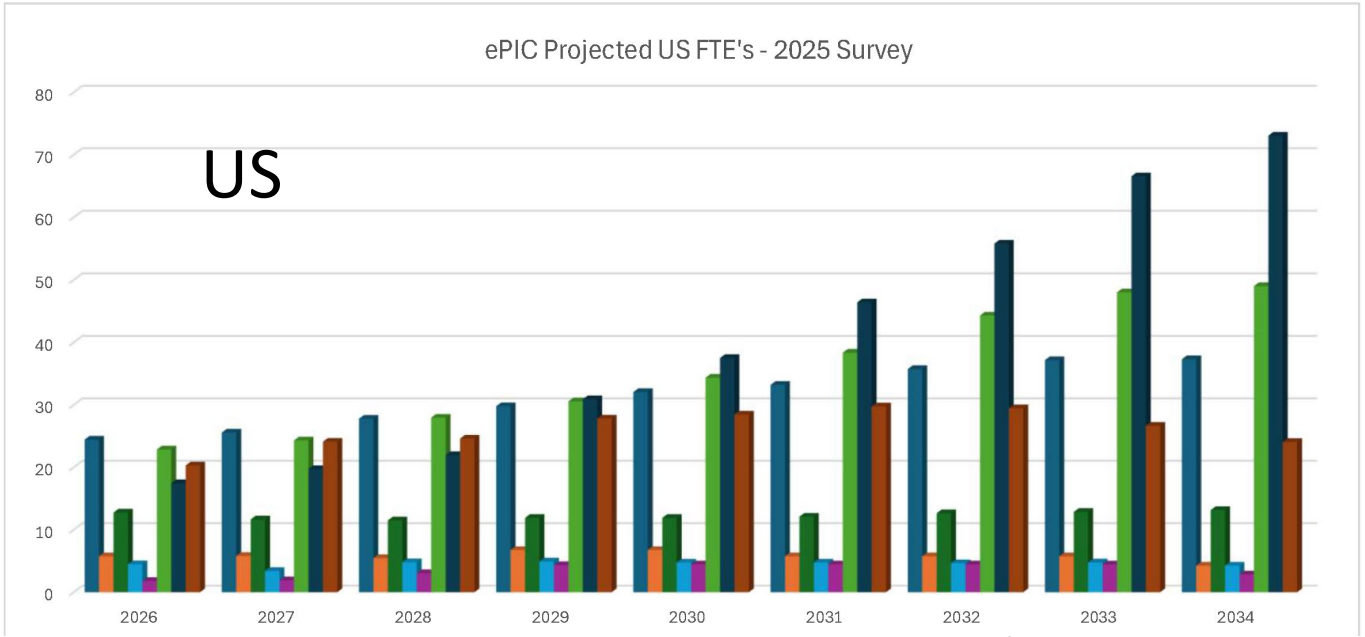
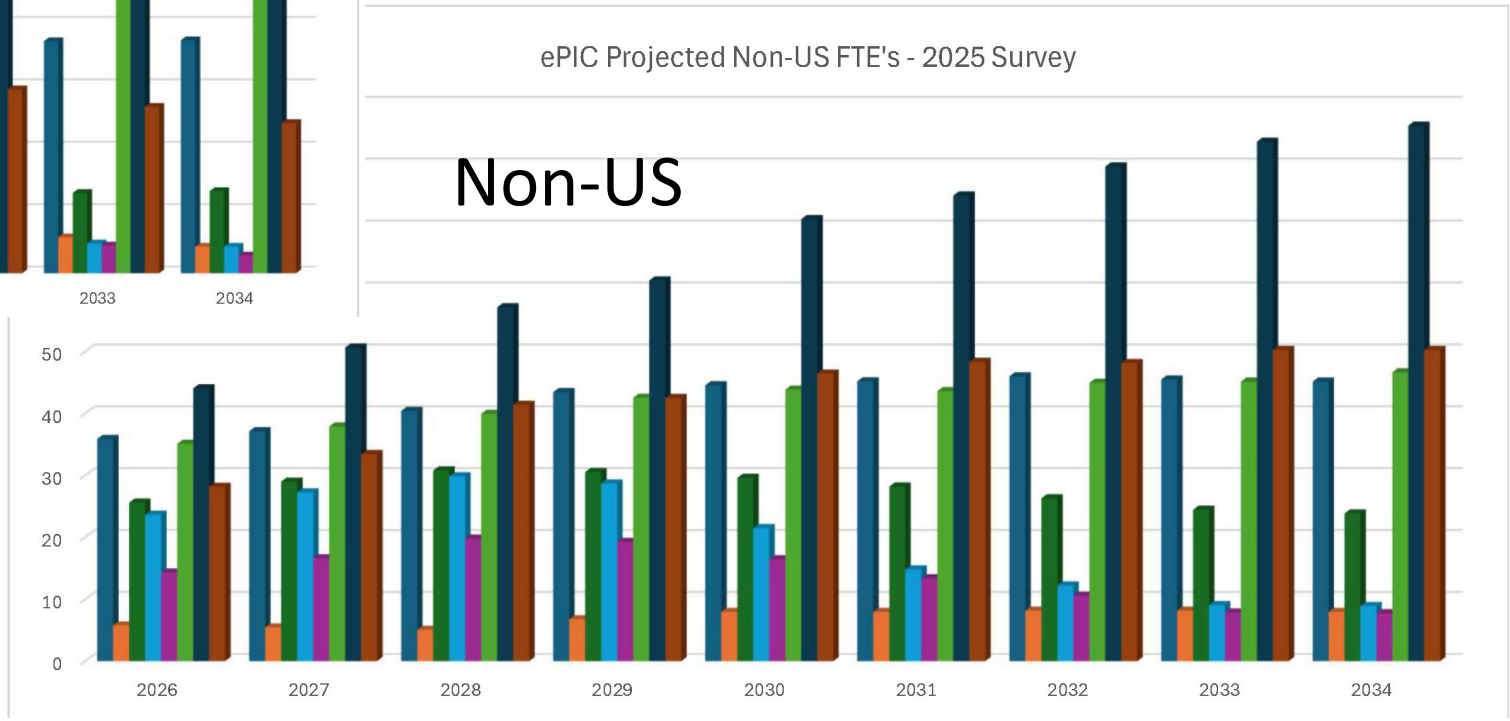


Workforce Projections

- ~70% of institutions responded
  - Same fraction US/international



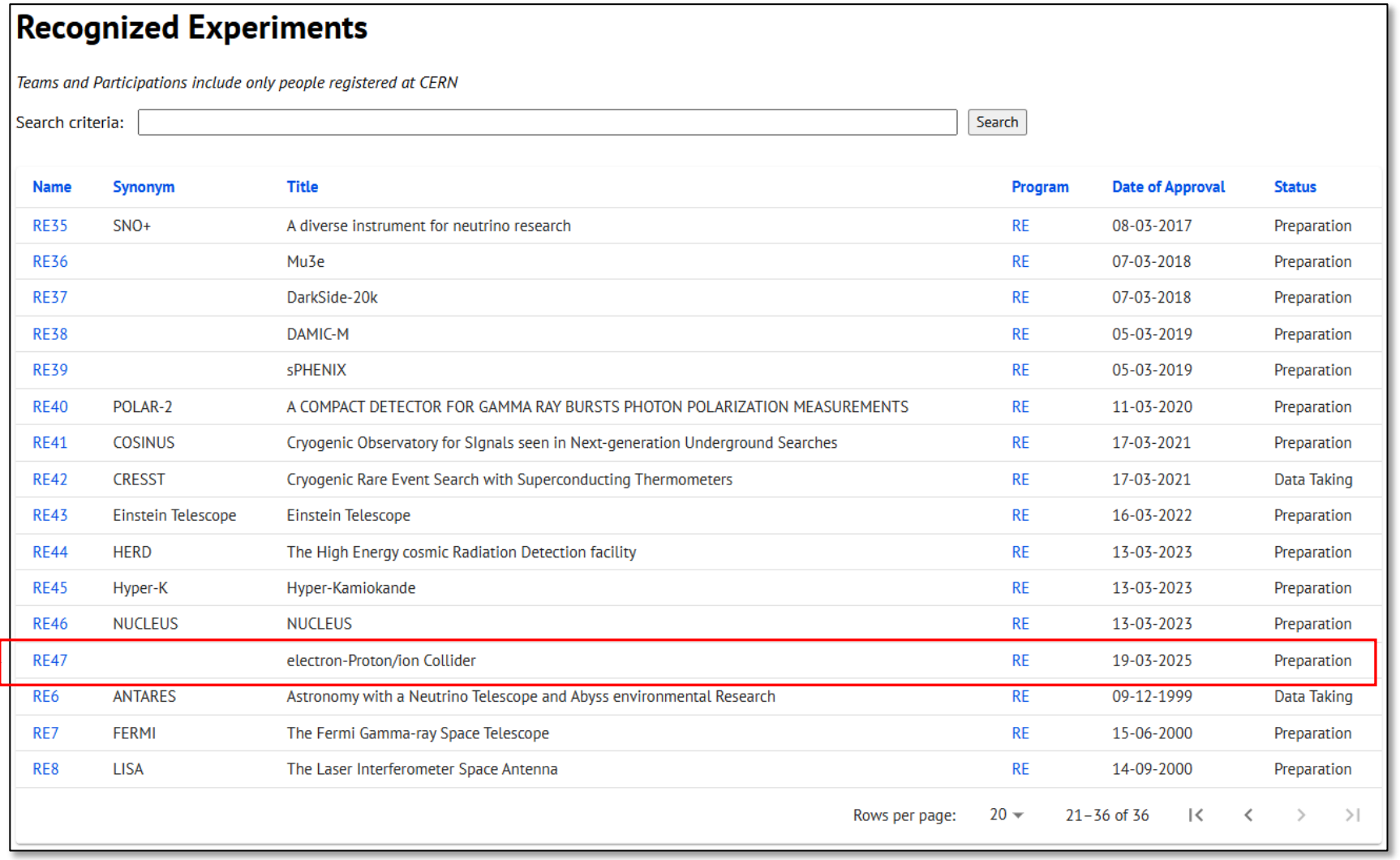
ePIC as CERN recognized experiment

ePIC now appears in the CERN Grey Book database as RE47: https://greybook.cern.ch/experiment/recognized

Two steps to get ePIC Collaborators registered at CERN:

- CC Representative needs to register as team leader with CERN Users Office:
  - https://usersoffice.web.cern.ch/
  - https://usersoffice.web.cern.ch/team-leaders-corner
  - Users.Office@cern.ch
- CC member can then certify registrations of team members

Several ePIC groups successfully registered



Recognized Experiments

Teams and Participations include only people registered at CERN

Search criteria: Search

Name	Synonym	Title	Program	Date of Approval	Status
RE35	SNO+	A diverse instrument for neutrino research	RE	08-03-2017	Preparation
RE36		Mu3e	RE	07-03-2018	Preparation
RE37		DarkSide-20k	RE	07-03-2018	Preparation
RE38		DAMIC-M	RE	05-03-2019	Preparation
RE39		sPHENIX	RE	05-03-2019	Preparation
RE40	POLAR-2	A COMPACT DETECTOR FOR GAMMA RAY BURSTS PHOTON POLARIZATION MEASUREMENTS	RE	11-03-2020	Preparation
RE41	COSINUS	Cryogenic Observatory for SIgnals seen in Next-generation Underground Searches	RE	17-03-2021	Preparation
RE42	CRESST	Cryogenic Rare Event Search with Superconducting Thermometers	RE	17-03-2021	Data Taking
RE43	Einstein Telescope	Einstein Telescope	RE	16-03-2022	Preparation
RE44	HERD	The High Energy cosmic Radiation Detection facility	RE	13-03-2023	Preparation
RE45	Hyper-K	Hyper-Kamiokande	RE	13-03-2023	Preparation
RE46	NUCLEUS	NUCLEUS	RE	13-03-2023	Preparation
RE47		electron-Proton/ion Collider	RE	19-03-2025	Preparation
RE6	ANTARES	Astronomy with a Neutrino Telescope and Abyss environmental Research	RE	09-12-1999	Data Taking
RE7	FERMI	The Fermi Gamma-ray Space Telescope	RE	15-06-2000	Preparation
RE8	LISA	The Laser Interferometer Space Antenna	RE	14-09-2000	Preparation

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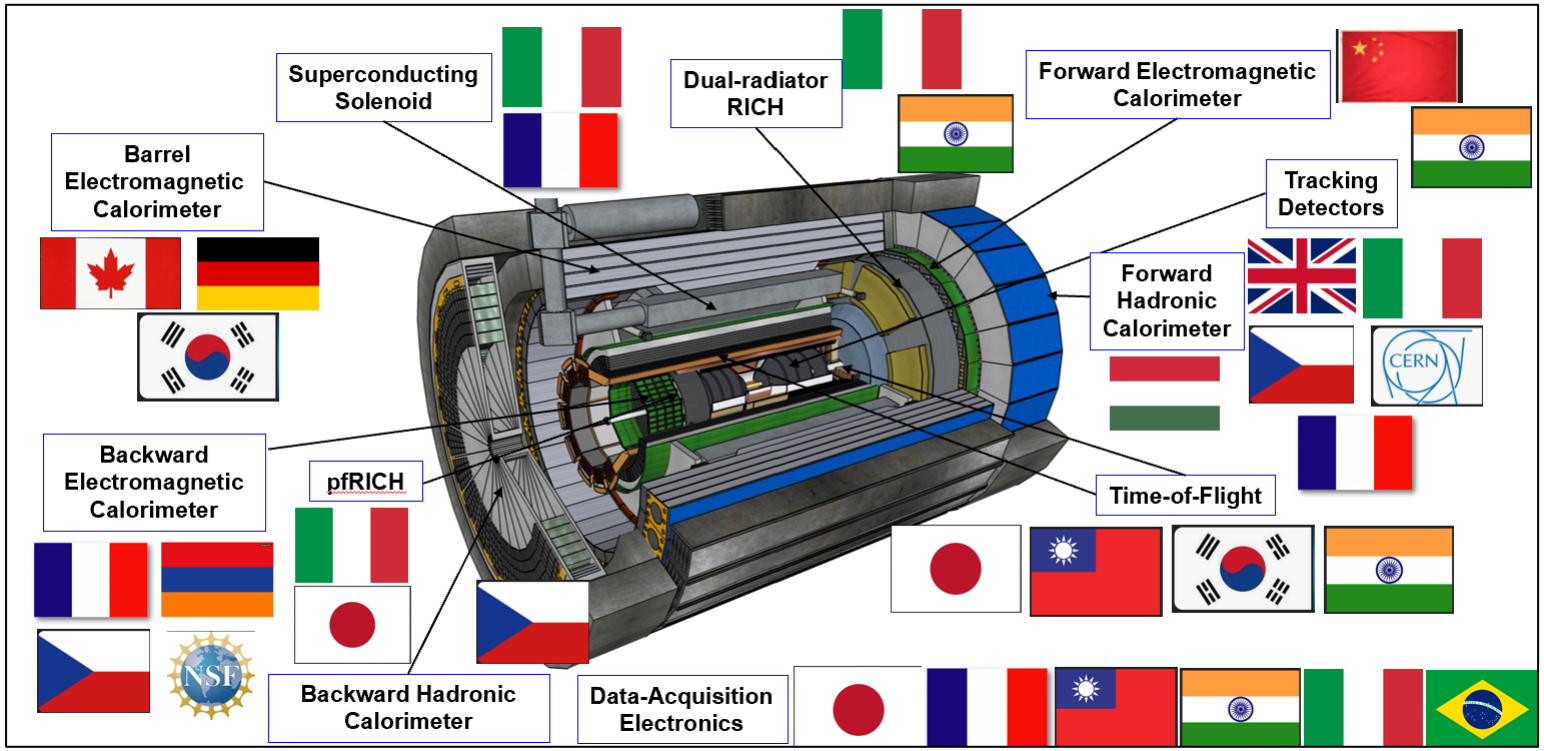
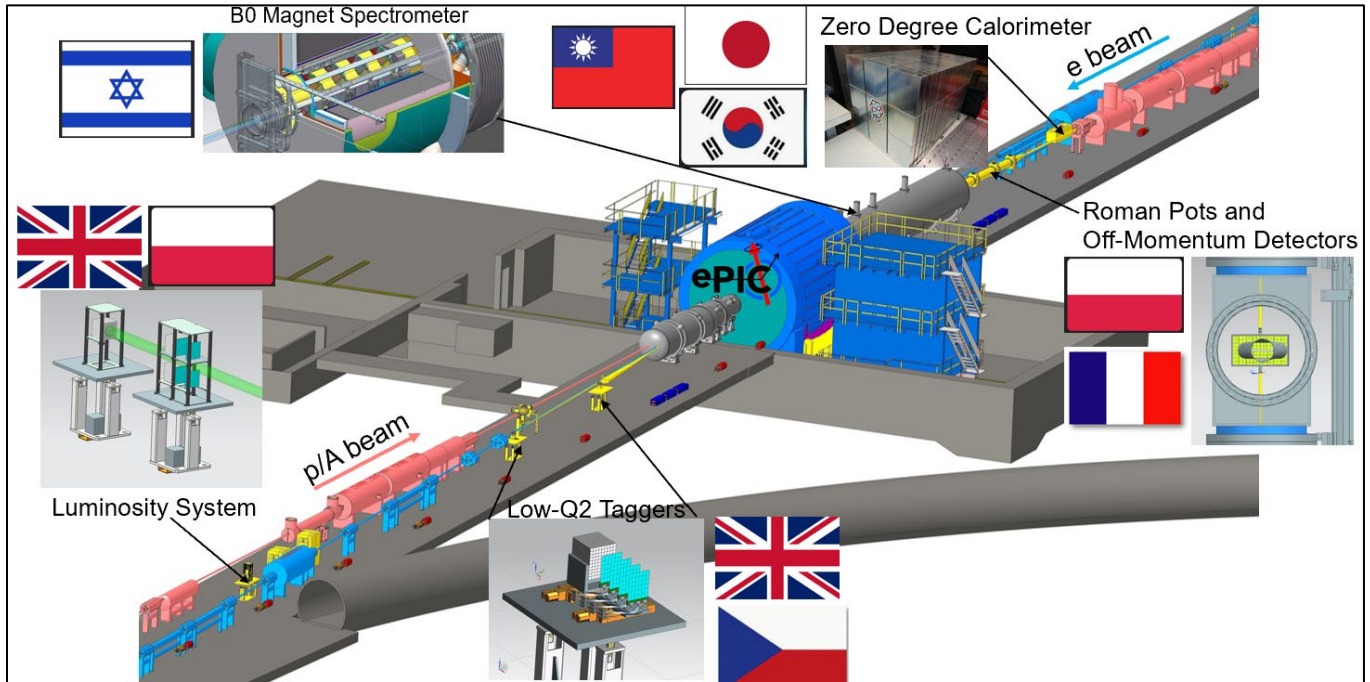
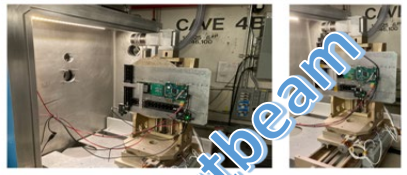
International contribution via the ePIC Collaboration

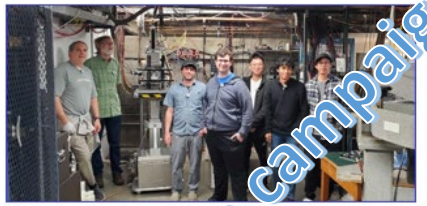




Intense detector activity, illustrated by prototyping and testbeams

Testbeam at BASE (Berkley), May 2024



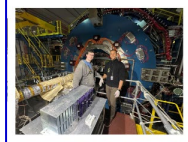


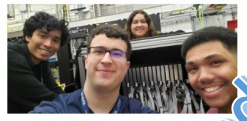
Test beam at FNAL, June-July 2024

BabyMoss testbeam

SiPM irradiation campaign

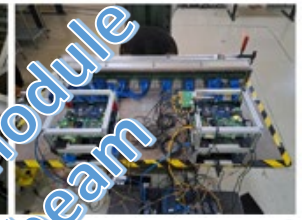
2024-2025 Brookhaven National Laboratory | 2025 Jefferson Lab | 2025 Brookhaven National Laboratory





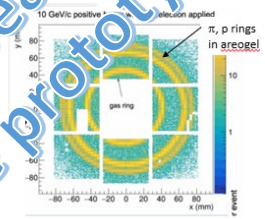
ZDC module testbeams

First module at test beam (Sept/Oct 2024)



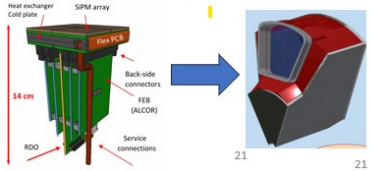
LFCal module testbeam

dRICH testbeam and fullscale prototype



Engineered photon detector unit already used in 2024 testbeam

Building a full-scale prototype in 2025 to be validated in a testbeam in 2025



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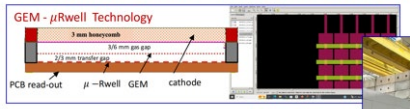
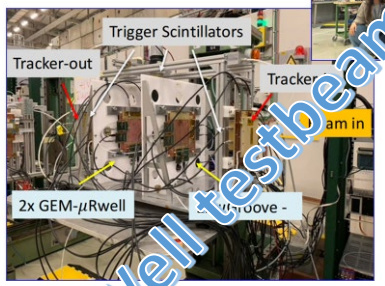
November 11 – 28 Test beam @ PS-T10 - CERN





μRWell testbeam

Further effort in 2025 in cross-cutting mode: all ePIC MPGD technologies

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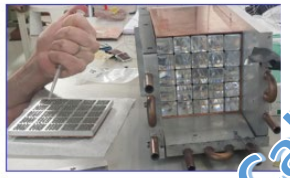
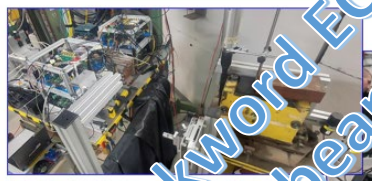


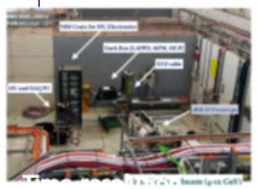


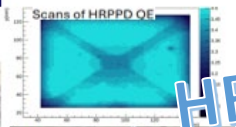
Backword ECal testbeam

Baby BCal commissioned with proton, pion, and electron beams during a June 2024 FBTF test

BabyBcal testbeam

HRPPD characterization





HRPPD testbeam and magnetic field studies

ePIC and the worldwide detector panorama:
ePIC detector technology document for **EPPSU2026** submitted (ID=17)

Enabling future detector technology within ePIC at the EIC

Contact persons: S. Dalla Torre*, D. Elia†, P.G. Jones‡, J. Lajoie§ and C. Munoz Camacho¶

On behalf of **the ePIC Collaboration**

Input to the European Strategy for Particle Physics - 2026 update

March 22, 2025

Abstract

The ePIC experiment at the EIC incorporates a wide variety of detector technologies. The different technological approaches are imposed by the broad EIC physics scope and by the nature of the collider, which is asymmetric in energy and beam particles, and by the wide variety of ion species that will collide with electrons. Major parts of the experiment use novel technologies, developed for application in ePIC and with applications at major coming experiments and facilities, worldwide. The ePIC detector is, therefore, both a stimulus toward innovative detector approaches and a testbench for the implementation of novel technologies in collider experiments.

This document is to underline the value of the ePIC detector in terms of technological developments and the options for collaborative efforts that can be beneficial to fundamental studies at high energies.

Novel detector technologies and implementations, techniques and methods in ePIC:

- ePIC solenoid
- A lightweight, MAPS based, Silicon Vertex Tracker
- Hybrid MPGD: µRWELL with GEM preamplification
- Innovative applications of SiPMs in calorimetry
  - SiPMs as sensors for a crystal electromagnetic calorimeter
  - W/SciFi electromagnetic calorimeter
  - SiPM-on-tile hadronic calorimeter
- Hybrid Si/PbSciFi electromagnetic calorimeter
- AC-LGADs
- Photosensors for Cherenkov imaging counters
  - High Rate Picosecond Photodetectors (HRPPD)
  - SiPMs
- New frontend ASICs with triggerless architecture
  - EICROC, CALOROC, FCFD, SALSA, ALCOR
- Innovative Compute-Detector Integration Using Streaming Readout
- Novel approaches to synchrotron radiation simulation

Context

- *One of the several submitted documents related to ePIC*
  - *EIC-LHC synergies (EICUG & ePIC effort), ID # 114*
  - *EIC accelerator (EIC accelerator collaboration)*
  - *DIS Physics*
  - *ePIC endorsing a document related to the relevance of computing in strategic terms*

The Collaboration at work beyond the detector: Physics Interest

A series of three **Early Science workshops**:

- September 13, 2024 (https://indico.bnl.gov/event/24432/)
  - Great participation! – peaked at 79 participants on Zoom, 105 unique participants overall
  - Scenario of the collider ramping up, option of measurements during ramping up

- With the January 2025 ePIC Collaboration in Frascati, January 22, 2025 (https://agenda.infn.it/event/43344/)
  - Deeper in opportunities for physics with the support of theorists

- April 24-25, 2025 (https://indico.cfnssbu.physics.sunysb.edu/event/410/)
  - At Stony Brook, with Hybrid attendance
  - In total, 82 registered participants
  - Physics opportunities from the point of view of theorists and the ePIC physics Working Groups

The Collaboration at work beyond the detector: SOFTWARE and COMPUTING

Two main scope directions :

- Preparing for the data reconstruction and analysis in the ePIC streaming read-out model
- Producing and reconstructing simulated data for the needs of the detector optimization and the physics studies
- Activity marked by an intense cross-checks via the review mechanism:
  - Software and Computer review on September 23-24, 2024 at the Catholic University of America
  - Technical Interchange Meeting with the EIC Computing and Software Advisory Committee (ECSAC) on May 12, 2025
  - Next review in October 2025

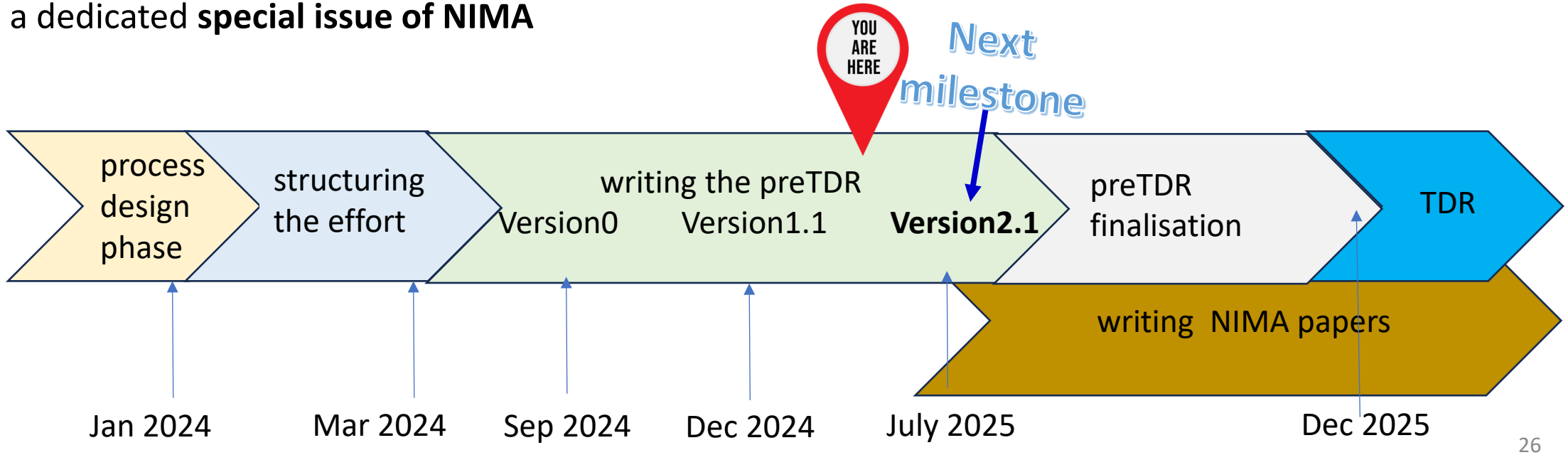
The whole ePIC Collaboration at work for the preTDR

preTDR: Project document needed for CD2 and requiring 60% readiness level

The ePIC collaboration has taken responsibility for

- Chapter 2 - **Physics Goals and Requirements**
- Chapter 8 - **Experimental Systems**

- ePIC planning: with **priority to preTDR**, prepare the **publication** of the detailed scientific material in a dedicated **special issue of NIMA**



The whole ePIC Collaboration at work for the preTDR

preTDR Version1, Dec. 1, 2024

266 pages, 198 figures

Take-away messages

- The ePIC Collaboration is strong, active and growing!
- International participation is key to the success of ePIC
- Solid Collaboration organization (policies, regular election process)
- New leaders are emerging from within the collaboration
- There has been good progress on the preTDR and plans for publications
- The 2025 collaboration survey has provided important data about the composition and plans on collaborating institutions
- Remarkable effort in physics, software/computing and detector activities
- The ePIC experiment is exercising its status as a
  CERN Recognized Experiment

Thank you