ROUND TABLE #2
POSSIBLE HEP-NP SYNERGIES
A SUMMARY

- Klaus Dehmelt

- CPAD 2022 Workshop
- December 02, 2022

Stony Brook University | The State University of New York

DESCRIPTION OF THE ROUNDTABLE

- Identify specific applications and technologies that are of common interest. Identify specifications for EIC and e.g., future collider detectors. In which cases can EIC detector(s) be used as demonstrators for future collider detector needs? How can we improve collaboration and funding synergies (e.g., common FOAs or LDRDs?) between EIC and HEP communities?
- Please note: EIC is one application of Nuclear Physics
  - Others
    - CEBAF
    - FRIB
    - ALICE @ LHC
    - Fixed target experiments @ SPS …

EIC PROJECT DETECTOR

EPIC - Baseline Design

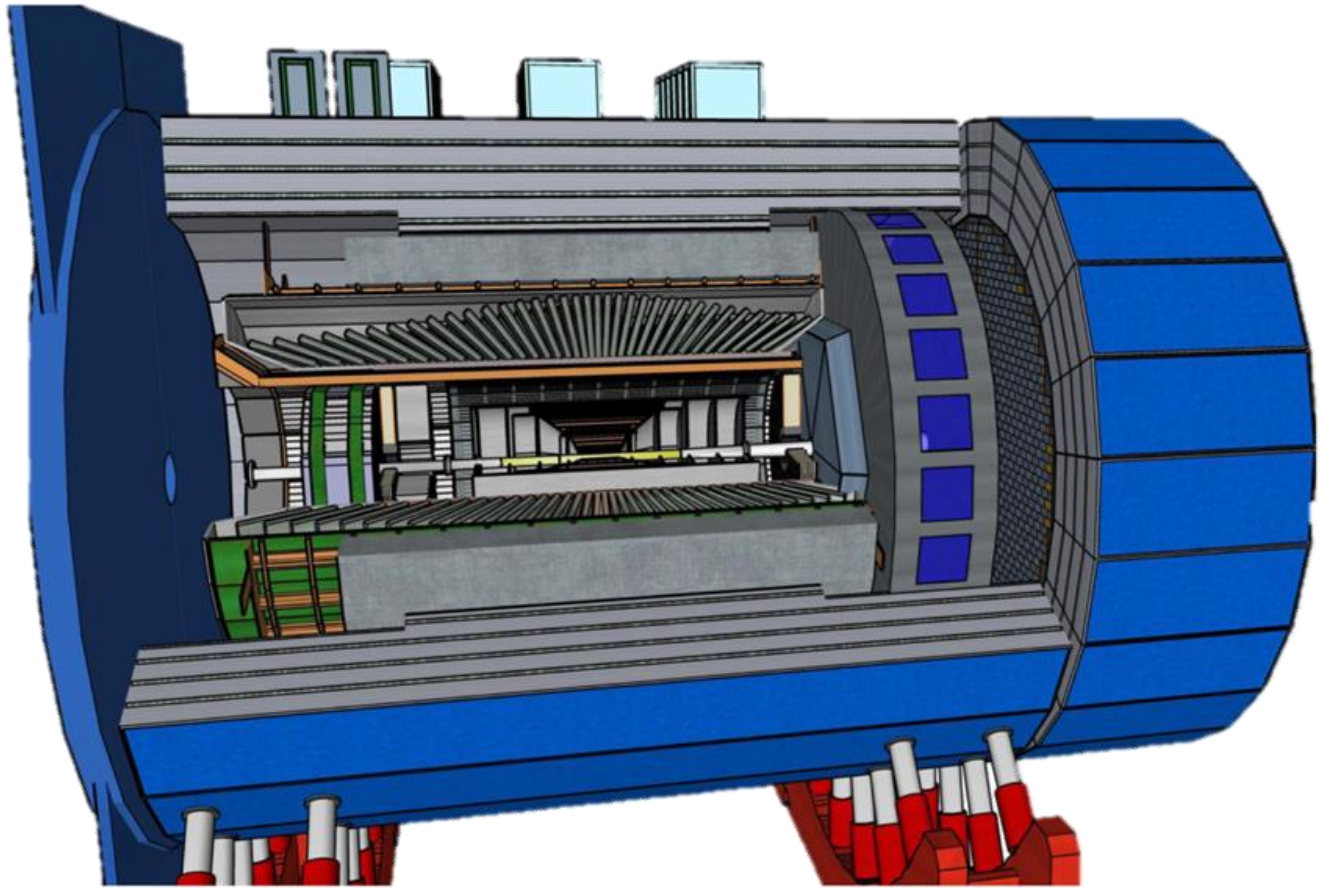
Magnet
- New 1.7 T SC solenoid

Tracking
- Si Vertex Tracker MAPS/ITS3 wafer-level stitched sensors
- Si Tracker MAPS/ITS3/EIC barrel and disks
- MPGDs (μRWELL/MMG) cylindrical and planar

PID
- high performance DIRC (hpDIRC)
- dual RICH (aerogel + gaseous)
- aerogel RICH/modular w/ Fresnel **or** proximity focussing RICH
- ToF using AC-LGAD

EM Calorimetry
- SciGlass **or** Imaging EMCal
- finely segmented W/SciFi EMCal
- $PbWO_4$ EMCal

Hadron Calorimeter
- re-used sPHENIX Fe/Sc
- long. separated Fe-W-Sc calorimeter w/ high-η insert



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EIC DETECTOR R&D EFFORTS

Generic R&D Projects 2014-2021

Project	Topic
eRD1	EIC Calorimeter Development
eRD2	A Compact Magnetic Field Cloaking Device
eRD3	Design and assembly of fast and lightweight forward tracking prototype systems
eRD6	Tracking and PID detector R&D towards an EIC detector
eRD10	(Sub) 10 Picosecond Timing Detectors at the EIC
eRD11	RICH detector for the EIC's forward region particle identification - Simulations
eRD12	Polarimeter, Luminosity Monitor and Low Q2-Tagger for Electron Beam
eRD14	An integrated program for particle identification (PID)
eRD15	R&D for a Compton Electron Detector
eRD16	Forward/Backward Tracking at EIC using MAPS Detectors
eRD17	BeAGLE: A Tool to Refine Detector Requirements for eA Collisions in the Nuclear Shadowing/Saturation Regime
eRD18	Precision Central Silicon Tracking & Vertexing
eRD19	Detailed Simulations of Machine Background Sources and the Impact to Detector Operations
eRD20	Developing Simulation and Analysis Tools for the EIC
eRD21	EIC Background Studies and the Impact on the IR and Detector design
eRD22	GEM based Transition Radiation Tracker R&D
eRD23	Streaming Readout for EIC Detectors
eRD24	Silicon Detectors with high Position and Timing Resolution as Roman Pots at EIC
eRD25	Si-Tracking
eRD26	Pulsed Laser System for Compton Polarimetry
eRD27	High Resolution ZDC
eRD28	Superconducting Nanowire Detectors
eRD29	Precision Timing Silicon Detectors for combined PID and Tracking System

Tracking | PID | Calorimetry | Software/Simulations | Other

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EIC DETECTOR R&D EFFORTS

Project R&D Projects 2022+

Project	Topic
eRD101	mRICH / aerogel RICH
eRD102	dRICH
eRD103	hpDIRC
eRD104	Service reduction
eRD105	SciGlass
eRD106	Forward EMCAL
eRD107	Forward HCAL
eRD108	Cylindrical & Planar MPGD
eRD109	ASICs/Electronics
eRD110	Photosensors
eRD111	Si-Tracker (no sensors)
eRD112	ToF with AC-LGAD
eRD113	ITS3/EIC MAPS development

Tracking PID Calorimetry Sensors Electronics

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EIC DETECTOR R&D EFFORTS

New Generic R&D Program 2022+

- After lots of efforts: Generic program reconstituted starting this year
  - funded by DOE, coordinated by JLab
  - `https://www.jlab.org/research/eic_rd_prgm`
  - total of 30 proposals were received on July 25, 2022

Topic
CSGlass for hadron calorimetry at the EIC
A proposal for MPGD-based transition radiation detector/tracker
Continued Development and Evaluation of a Low-Power High-Density High Timing Precision Readout ASIC for AC-LGADs (HPSoC)
A new radiation tolerant low power Phase-Locked Loop IP block in a 65 nm technology for precision clocking in the EIC frontend electronics
Refined Methods for Transfer Matrix Reconstruction Using Beamline Silicon Detectors for Exclusive Processes at the EIC
Development of a Novel Readout Concept for an EIC DIRC
Tracking and PID with a GridPIX Detector

Particle identification and tracking in real time using Machine Learning on FPGA
Superconducting Nanowire Detectors for the EIC
EIC KLM R&D Proposal
Development of Thin Gap MPGDs for EIC Trackers
Simplified LGAD structure with fine pixelation
Imaging Calorimetry for the Electron-Ion Collider
Silicon Tracking and Vertexing Consortium, Section 1: Embedded Monolithic Active Pixel Sensor R&D
Silicon Tracking and Vertexing Consortium, Section 2: Aluminum Flexible Circuit Manufacturing Capability

Tracking | PID | Calorimetry | Software/AI | ASICs/FEE

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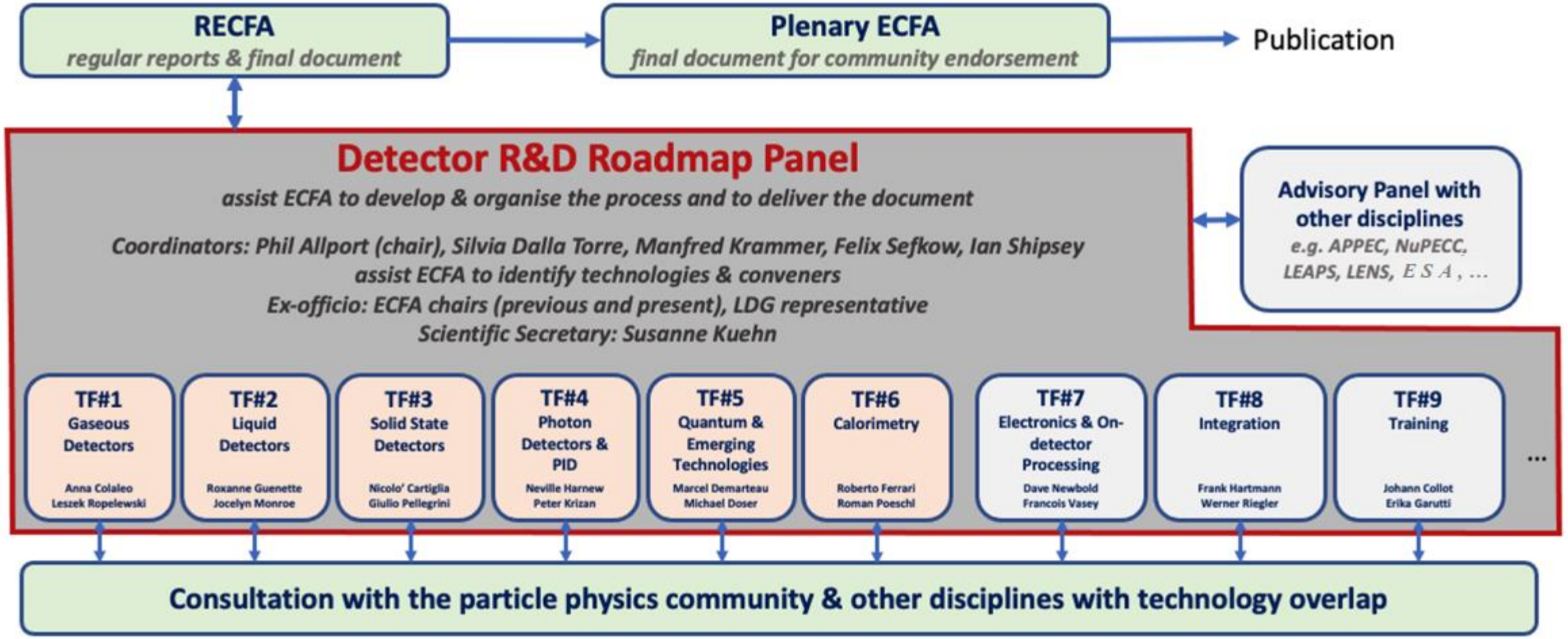
SNOWMASS – ECFA ROADMAP - AIDAINNOVA

Topical Group	Co-Conveners		
Quantum Sensors	Thomas Cecil (ANL)	Kent Irwin (SLAC)	Reina Maruyama (Yale) Matt Pyle (Berkeley)
Photon Detectors	Chris Rogan (KU)	Juan Estrada (FNAL)	Carlos Escobar (FNAL)
Solid State Detectors and Tracking	Tony Affolder (UCSC)	Artur Apresyan (FNAL)	Steve Worm (DESY/Humboldt)
Trigger and DAQ	Darin Acosta (Rice)	Wes Ketchum (FNAL)	Stephanie Majewski (Oregon)
Micro Pattern Gas Detectors	Bern Surrow (Temple)	Maxim Titov (Saclay)	Sven Vahsen (Hawaii)
Calorimetry	Andy White (UTA)	Minfang Yeh (BNL)	Rachel Yohay (FSU)
Electronics/ASICs	Gabriella Carini (BNL)	Mitch Newcomer (Penn)	John Parsons (Columbia)
Noble Elements	Eric Dahl (Northwestern/FNAL)	Roxanne Guenette (Harvard)	Jen Raaf (FNAL)
Cross Cutting and System Integration	Jim Fast (JLab)	Maurice Garcia-Sciveres (LBNL)	Ian Shipsey (Oxford)
Radio Detection	Amy Connolly (OSU)		Albrecht Karle (Wisconsin)

P. Merkel
S. Dalla Torre
P. Giacomelli

SNOWMASS – ECFA ROADMAP - AIDAinnova



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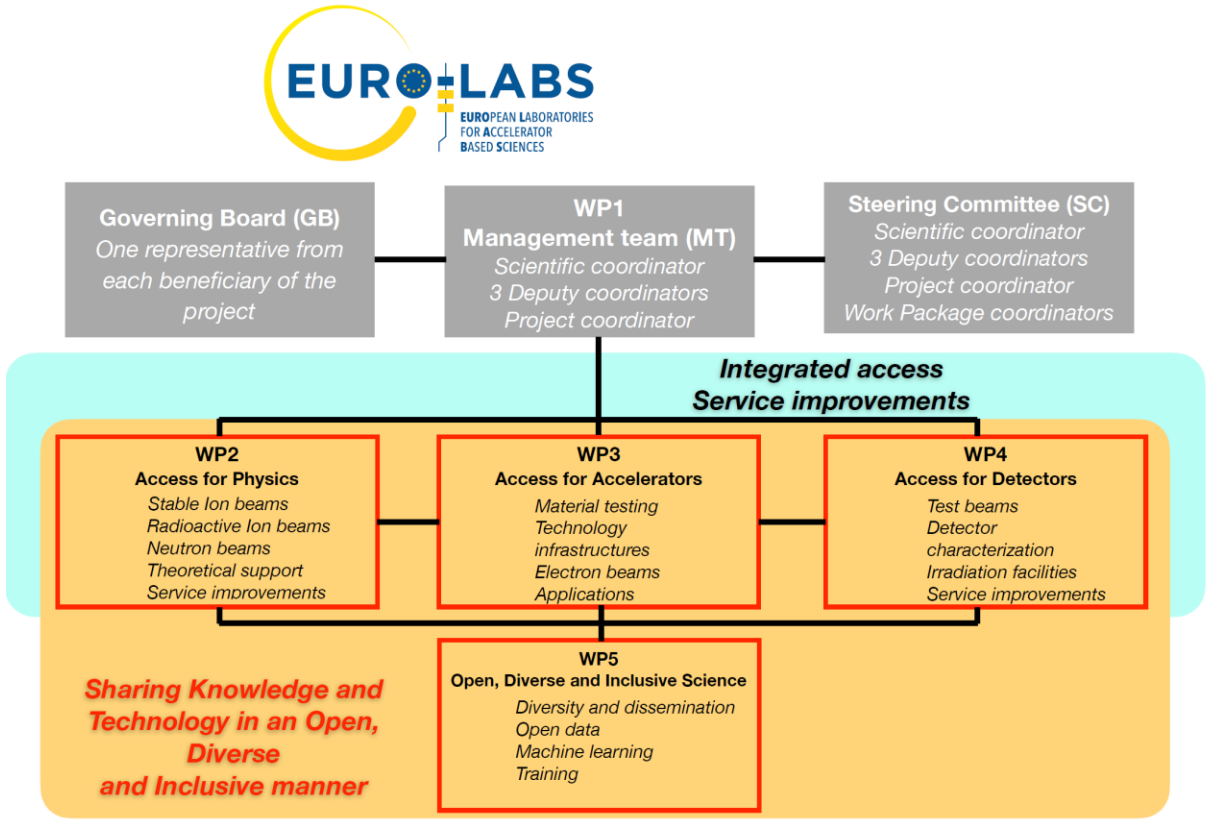
EURO-LABS project



EURO-LABS is a project that mostly provides funding for Transnational Access (TA) to Research Infrastructures (RI).
For us this means test beams and irradiation facilities.

Total EURO-LABS EU funding: **~15 M€**

- **Start of the Project: 01/09/2022**
- **Duration: 01/09/2022 - 31/08/2026**
- **Budget for WP4: ~3.2 M€**

First EU project that brings together Nuclear Physics, HEP Accelerators and HEP Detectors

EURO-LABS - Paolo Giacomelli 25

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SNOWMASS – ECFA ROADMAP - AIDAinnova

Summary

- EC-funded detector initiatives are a **unique forum** to exchange knowhow, unfold synergies and enhance coherence in European detector R&D
- AIDAinnova started on April 1, 2021: **10 M€** of EU contribution, total budget of **26 M€** (4 years)
- Targeted applications in line with **European Strategy** Update the ECFA DRD groups and the **Snowmass EF** report
  - Future large e^+e^- colliders (FCC-ee, CEPC, ILC), EIC, pre-TDR fixed target experiments
  - Pre-TDR LHC upgrades (ALICE LS3, LHCb LS4)
  - Accelerator-based neutrino experiments (DUNE)
- Increased focus on integration with **industrial partners**

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A KIND OF SUMMARY - ROUND TABLE #2

- Detector R&D is a program in DOE-HEP
- Detector R&D is project dependent in DOE-NP
- What are commonalities/differences of getting physics observables? For instance: trigger requirements? Collision species? Collision rates?
- Many common technologies
- Testbeam facility is already a synergistic effort → FTBF
- P5 → can it be extended to NP?
- Funding sources in general: is overlap allowed?
- Funding agencies cannot support specific experiments installations → restrict requests to detector R&D
- Explore "interdisciplinary" structure of funding agencies
- Users need to act → explore a request for an inclusive generic R&D program