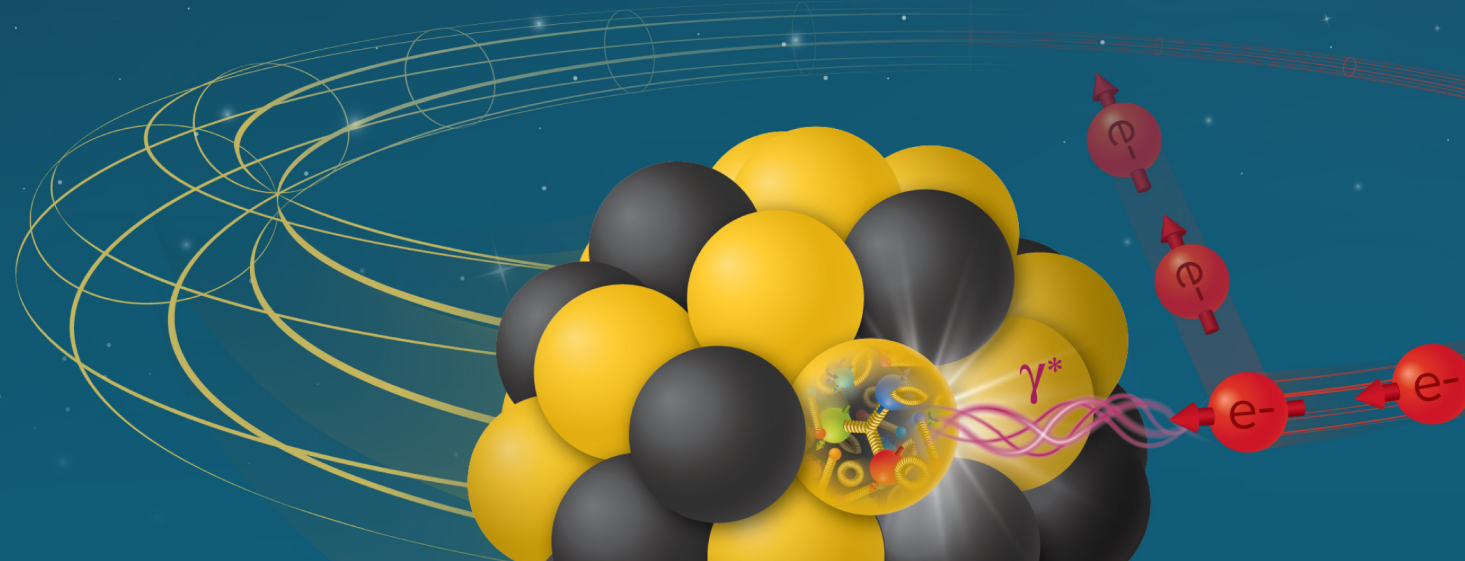


Detector R&D Status

Thomas Ullrich

TIC Meeting
November 20, 2023

Electron-Ion Collider



Project R&D



imgflip.com

JAKE-CLARK.TUMBLR

Ongoing FY23 Program

- ePIC baseline defined - still open questions on some technologies
- Still somewhat out-of-sync with FY boundaries but catching up
- Timeline 2022
 - July: **Request to submit proposals** and status reports, **deadline October 1, 2022** in time for DAC meeting
 - **DAC Meeting** October 19-21, 2022
 - November: **Discussion with groups** and updates to proposals
 - December 2022: **Final decisions** and response letters to participating groups
- Remarks
 - First time funded: eRD106/107 (Fwd Cal), eRD109 (ASICs), eRD113 (MAPS)
 - Si sensors (eRD113) moved from an assumed generic detector R&D to a project R&D and took some time to sort out
 - In several proposal substantial mix of PED and R&D that needed to be separated
 - In practice, it still takes several months to get contracts in place

FY23 Program












ID	R&D Subject	Funding (requested)	Funding (actual)
eRD101	mRICH	\$113,500	██████████
eRD102	dRICH	\$190,000	██████████
eRD103	hpDIRC	\$230,000	██████████
eRD104	Service reduction (Si)	\$87,300	██████████
eRD105	SciGlass	\$60,000	██████████
eRD106	Forward EMCAL	\$99,100	██████████
eRD107	Forward HCAL	\$150,500	██████████
eRD108	MPGDs	\$189,785	██████████
eRD109	ASICs	\$569,700	██████████
eRD110	Photosensors	\$314,500	██████████
eRD111	Si-Tracker (no sensors)	\$628,300	██████████
eRD112	AC-LGAD (incl. ASIC)	\$462,000	██████████
eRD113	MAPS/ITS3	\$1,416,000	██████████
		\$4,510,685	\$2,999,805

- eRD110 more emphasis on LAPPD/HRPPD less on SiPM
- Awarded ██████████ to eRD111 as PED, and ██████████ for eRD110 awarded separately as PED (for the SiPMs mechanical design for in situ annealing).

Remarks

- Be aware: Items funded by PED cannot be subject to R&D later
- NCE - FY22/FY23
 - Put in No-Cost-Extensions to all relevant FY22/FY23 contracts
 - End date 9/30/24
 - Funds will be there until contract funds exhausted or 9/30/2024 is reached
 - Not sure further NCE will be made for FY22/23 - spend the money!
- Contract office at BNL is increasingly complaining about insufficient documentation of invoices cost. Please provide more details of your invoices.
 - Nervousness about audits
- What is not in the SoW cannot be paid
 - If no travel in approved proposal and SoW, any travel cannot be paid

FY24 Program

ID	R&D Subject	Funding
eRD101	mRICH	<i>not baseline</i>
eRD102	dRICH	
eRD103	hpDIRC	
eRD104	Service reduction (Si)	
eRD105	SciGlass	<i>not baseline</i>
eRD106	Forward EMCAL	<i>no funds requested</i>
eRD107	Forward HCAL	
eRD108	MPGDs	
eRD109	ASICs	
eRD110	Photosensors	
eRD111	Si-Tracker (no sensors)	
eRD112	AC-LGAD (incl. ASIC)	
eRD113	MAPS/ITS3	
eRD114	pfRICH	<i>PED only</i>
eRD115	Imaging Cal	

- DAC review August 28 & 31, 2023
- Switch two baseline technologies
 - mRICH → pfRICH
 - SciGlass EM Cal → Imaging Cal
- We have ~\$3M funding available for FY24, with the original requests surpassing this.
- Some requests again did not qualify as project R&D.
- Decisions sent out Oct 20, 2023

FY24 Some Details

- **eRD102 dRICH**

- Requests from Duke had to be taken out. Simulations == Research cannot be covered by project R&D. For the mirror testing protocol join with pfRICH; PED will pay experienced expert to develop this.

- **eRD103 hpDIRC**

- Cosmic Ray Telescope might better go to Jlab to avoid excessive travel of bars. Replace support of senior phys & grad student with 50k support for technician/senior PD & travel to finalize CRT and test of prototype up to 50k.

- **eRD104 Service Reduction**

- full funding

- **eRD107 Fwd Heal**

- full funding

- **eRD108 MPGD**

- Cut down to support for Saclay (inner cyl. MMG). All other systems (cylindric and disks) → PED

- **eRD109 ASICs**

- full funding

FY24 Some Details

- **eRD110 Photosensors**
 - parts moved to PED
- **eRD111 Si Tracker**
 - full funding
- **eRD112 AC-LGAD**
 - No FBK production (HPK only). R&D on novel cooling → generic R&D
- **eRD113 ITS3 MAPS**
 - Complex, lots of discussion with PIs, large fraction moved to PED
- **eRD114 pfRICH**
 - All PED
- **eRD115 Imaging Cal**
 - full funding

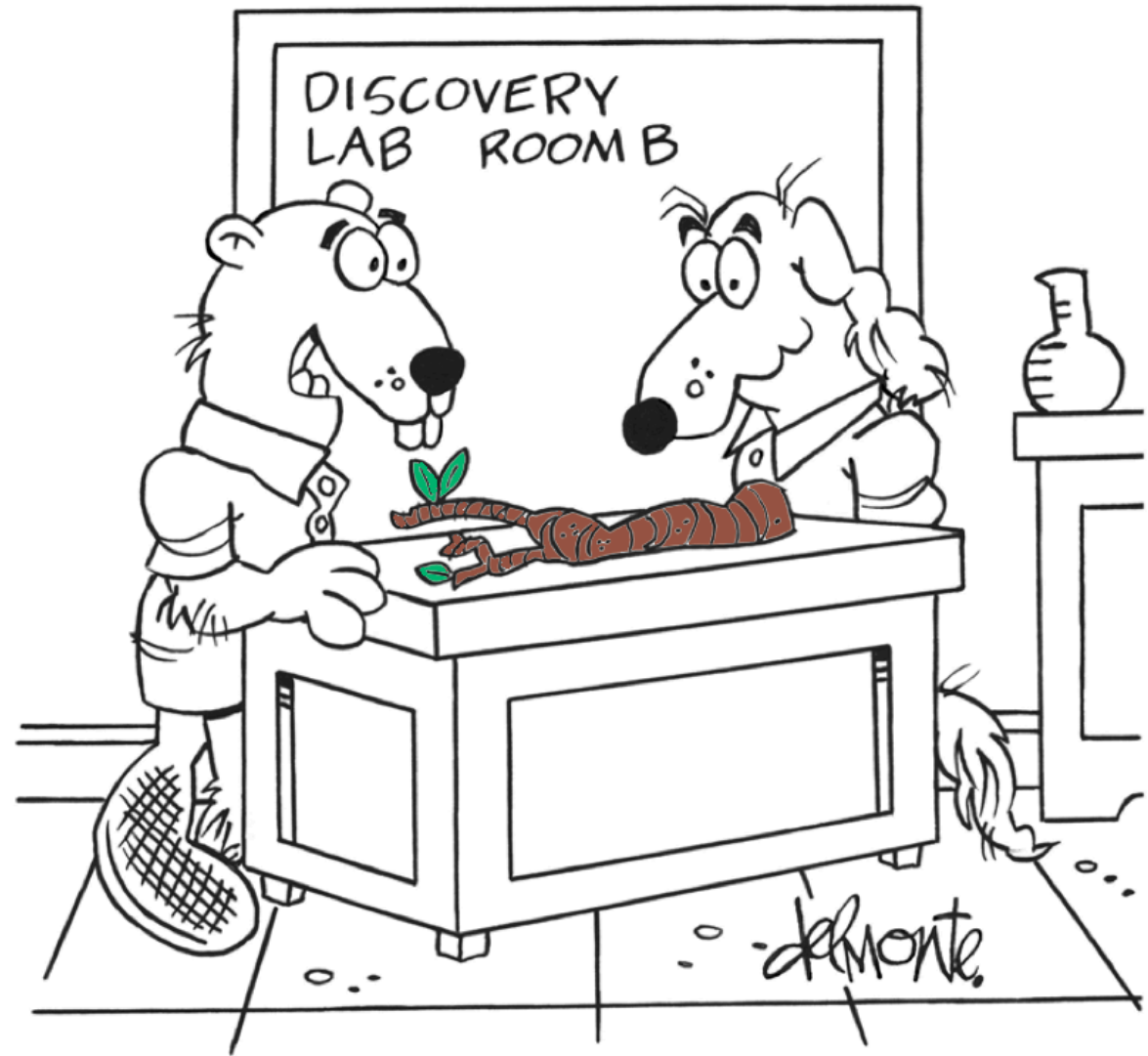
Completion of R&D Dates as Listed in P6

Layout: EIC - Full Detail Schedule (w)		Filter All: L4 Milestone, WBS: 6.10.XX		Original Duration	Start	Finish	Budgeted Labor Units	Budgeted Nonlabor Units	Budgeted Total Cost	Total Float	2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035													
Activity ID	Activity Name										FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31	FY32	FY33	FY34	FY35	
6	EIC	1060	30-Sep-2022	04-Jan-2027	0	0	\$0.00	375																
6.10	EIC Detector	1060	30-Sep-2022	04-Jan-2027	0	0	\$0.00	375																
6.10.02	Detector R&D and Physics Design	1060	30-Sep-2022	04-Jan-2027	0	0	\$0.00	375																
E1002_10360	Detector R&D - Particle ID - eRD110 (Photosensors, SiPM) Milestone Complete	0		30-Sep-2022*	0	0	\$0.00	1435																
E1002_10610	Detector R&D - Calorimetry - eRD105 (Sciglass) Milestone Complete	0		18-Jul-2023	0	0	\$0.00	670																
E1002_10660	Detector R&D - Tracking - eRD108 (mRWELL) Milestone Complete	0		29-Sep-2023*	0	0	\$0.00	1063																
E1002_10690	Detector R&D - Tracking - eRD104 (Service Reduction, Develop Powering Scheme) complete	0		02-Jan-2024*	0	0	\$0.00	1006																
E1002_10700	Detector R&D - Tracking - eRD111 (Si Tracker, Report completed on barrel and disc cooling opti	0		02-Jan-2024*	0	0	\$0.00	1006																
E1002_10810	Detector R&D - Particle ID - eRD110 (Photosensors, LAPPD/HRPPD) complete	0		30-Sep-2024*	0	0	\$0.00	924																
E1002_10820	Detector R&D - Calorimetry - eRD105 (Sciglass Beam Test Results) complete	0		30-Sep-2024*	0	0	\$0.00	369																
E1002_10830	Detector R&D - Tracking - eRD111 (Si Tracker, stitching of sensors) complete	0		30-Sep-2024*	0	0	\$0.00	816																
E1002_10900	Detector R&D - Tracking - eRD108 (Micromegas) complete	0		02-Jan-2025*	0	0	\$0.00	759																
E1002_10910	Detector R&D - Tracking - eRD104 (Service Reduction, FPGAs) complete	0		02-Jan-2025*	0	0	\$0.00	759																
E1002_10920	Detector R&D - Particle ID - eRD101 (mRICH) complete	0		31-Mar-2025*	0	0	\$0.00	697																
E1002_10930	Detector R&D - Particle ID - eRD102 (dRICH) complete	0		31-Mar-2025*	0	0	\$0.00	704																
E1002_10970	Detector R&D - Particle ID - eRD103 (hpDIRC) complete	0		30-Jun-2025*	0	0	\$0.00	502																
E1002_10980	Detector R&D - Calorimetry - eRD106 (fwd ECal optimizing uniformity and efficiency) complete	0		30-Jun-2025*	0	0	\$0.00	508																
E1002_10990	Detector R&D - Calorimetry - eRD107 (fwd HCal Prototyping) complete	0		30-Jun-2025*	0	0	\$0.00	747																
E1002_11030	Detector R&D - Electronics - eRD109 (ASICs/FEEs, Calorimeters) complete	0		30-Sep-2025*	0	0	\$0.00	562																
E1002_11040	Detector R&D - Electronics - eRD109 (ASICs/FEEs, AC-LGAD) complete	0		30-Sep-2025*	0	0	\$0.00	562																
E1002_11100	Detector R&D - Electronics - eRD109 (ASICs/FEEs, RICH) complete	0		02-Jan-2026*	0	0	\$0.00	504																
E1002_11110	Detector R&D - Electronics - eRD109 (ASICs/FEEs, MPGD) complete	0		31-Mar-2026*	0	0	\$0.00	442																
E1002_11120	Detector R&D - Particle ID - eRD112 (AC-LGAD/ToF) complete	0		30-Sep-2026*	0	0	\$0.00	315																
E1002_11130	Detector R&D - Tracking - eRD113 (Si Sensors/ITS3) complete	0		30-Sep-2026*	0	0	\$0.00	431																
E1002_11180	Detector R&D - Electronics - eRD109 (ASICs/FEEs, PID LAPPDs and or MCPMTs) complete	0		04-Jan-2027*	0	0	\$0.00	373																
E1002_11190	Detector R&D and Physics Design - Complete	0		04-Jan-2027	0	0	\$0.00	373																

Recall: CD-2/3 April 2025

only Si sensors and ASICs/Electronics after CD-2

Generic R&D



"The applications are limitless!"

Generic EIC R&D

- Home Page: https://www.jlab.org/research/eic_rd_prgm
- Coordinated by Dave Mack (JLab)
- Aim at ePIC upgrades and D2 technologies
- TU and others are watching for potential overlap with project R&D (DOE pays attention, Question during CD-3A review)
- 1st Round (2022)
 - Substantial delays due to contract difficulties (similar or worse than for project R&D)
- 2nd Round:
 - Detector advisory meeting reviewed proposals Oct 30-31, final report pending although funding decisions are made
 - as always requests exceeded available fund by factor 2 (\$2.8M vs. \$1.3M)

Generic R&D: Calorimetry

Title	PI(s)	PI Institution(s)	Committee Fractional Funding Factor
Towards a Few-Degree Calorimeter: bridging the Q^2 gap to support the quest for gluon saturation	M. Arratia	UC Riverside	0.50
Generic glass scintillators for EIC Calorimeters (ScintCalEIC) R&D	T. Horn	CUA	0.40
Feasibility of Organic Glass Scintillators for EIC ZDC	G. Carini, E. Aschenauer, A. Bolotnik	BNL Instr. Div., BNL Physics Div.	0.20
Continuation of EIC KLM R&D Proposal	A. Vossen, W. W. Jacobs	Duke U., Indiana U. CEEM	0.80

Generic R&D: PID

Title	PI(s)	PI Institution(s)	Committee Fractional Funding Factor
Pressurized RICH	M. Contalbrigo	INFN Ferrara and U. Ferrara	1.00
Z-Tagging Mini DIRC	C.E. Hyde, Wenliang Li	ODU, SBU and CFNS	0.50
Performance of GridPIX Detector in Magnetic Field with low mass and high efficiency CO2 cooling	T. K. Hemmick, P. Garg	SBU and CFNS, Yale U.	0.50
Development of a Novel Readout Concept for an EIC DIRC	G. Kalicy, J. Schwiening	CUA, GSI	0.80

Generic R&D: MPGDs, Timing, FEE

Title	PI(s)	PI Institution(s)	Committee Fractional Funding Factor
Gaseous Precision Timing and/or Tracking:			
Development of High Precision and Eco-friendly MRPC TOF Detector for EIC	Zhenyu Ye, Zhihong Ye	UI at Chicago, Tsinghua U.	0.60
Development of Double-sided Thin-Gap GEM- μ RWELL for Tracking at the EIC	K. Gnanvo	Jlab	0.50
Front End Electronics:			
Design, Fabrication and testing of a multi-channel System on a chip for Low-Power High-Density High Timing Precision Readout ASIC for AC-LGADs (HPSoCv3)	L. Macchiarulo, B. Schumm	Nalu Scientific, UC Santa Cruz	0.80

Generic R&D: Silicon Detectors

Title	PI(s)	PI Institution(s)	Committee Fractional Funding Factor
A Fast Timing MAPS Detector for the EIC	X. Li	LANL	0.40
Slim Edge for LGADs	G. Giacomini	BNL Instr. Div.	1.00
Photonics-Based Readout and Power Delivery by Light for Large-Area Monolithic Active Pixel Sensors	S. Mandal, S. Rescia	BNL Instr. Div.	0.80
Large-Area Monolithic Active Pixel Sensors Combining High Spatial and Temporal Resolution	D. Gorni	BNL Instr. Div.	0.00
R&D of 4D Detectors with EICROC and AC-LGAD at EIC consolidating a US-Japan Consortium	P. Tribedy, K. Shigaki	BNL Instr. Div., Hiroshima U.	0.00
Fabrication and characterisation of the Trench Isolated Low Gain Avalanche Detectors for 4D tracking	S. Gardner	U. Glasgow	0.00

Generic R&D: Others

Title	PI(s)	PI Institution(s)	Committee Fractional Funding Factor
Other New Detectors:			
Scintillator Fiber Trackers for the ZDC and off-momentum detectors	C. Ayerbe Gayoso	College of William and Mary	0.59
Superconducting Nanowire Detectors for the EIC	Sangbaek Lee, W. Armstrong	ANL	1.00
Other R&D to Support or Expand the Physics Program:			
R&D for a new concept EIC nucleon polarimeter based on chemical hyperpolarisation	D. P. Watts	U. of York	0.00

Last Slide

- EIC Community is in lucky situation having two R&D programs
 - Project R&D \Rightarrow ePIC
 - Generic R&D \Rightarrow D2 and ePIC upgrades
- Project detector R&D expected to dwindle down at CD-2, generic program is there to stay
-