EIC-related Generic Detector R&D Program

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TJNAF

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Overview

I’m here to:

- give an update on the generic R&D program,
- learn more about the needs for Detector 2,
- answer any questions regarding the generic R&D program either here, or in the hallways.

Scope of the Generic Detector R&D Program

This program will support advanced R&D on innovative, cost-effective detector concepts which reduce risk and that either the one detector in the project scope or a second detector could incorporate. (The term "generic" conveys this duality.) The program is supported through R&D funds provided to Jefferson Lab by the DOE Office of Nuclear Physics, and is open to all segments of the EIC community. It is expected to be funded at an annual level of $2M, subject to availability of funds from DOE NP.

In a nut-shell:

- EIC-related R&D
- Aimed at Detector 2, or upgrades of Detector 1
- Proposals accepted from across the world from universities, laboratories, and companies
- Features of a proposal that add value: increase physics scope, reduce risk, cost effective, innovative etc

(Also: we need to stay orthogonal to other sources of federal funding such as EIC project R&D, the SBIR program, etc.)

2022 Submissions: The Whole Elephant

EICGENR&D Proposal Number	Title	PI(s)	Institution(s) (abbreviated and only includes PI's at this time)	# of pages	Budget Request $US
1	CSGlass for hadron calorimetry at the EIC	T. Horn	Catholic University of America, Washington, DC, USA	8	97,240
2	A proposal for MPGD-based transition radiation detector/tracker	Y. Furletova, J. Velkovska	Jlab, and Vanderbilt U., USA	12	174,999
3	Precise Timing with a Micro Pattern Gaseous Detector	K. Dehmelt	Stony Brook U., USA	15	94,694
4	BeAGLE, a tool to refine IR and detector requirements for the EIC	M.D. Baker	MDBPADS LLC, Miller Place, NY	10	105,400
5	Continued Development and Evaluation of a Low-Power High-Density High Timing Precision Readout ASIC for AC-LGADs (HPSoC)	B. Schumm, L. Macchiarulo,	UCSC, and Nalu Scientific LLC	17	150,000
6	A new radiation tolerant low power Phase-Locked Loop IP block in a 65 nm technology for precision clocking in the EIC frontend electronics	D. Neyret, W. van Noije	IRFU, CEA Saclay, France, and Instituto de Física da U. de São Paulo (USP), São Paulo, Brasil	11	54,000
7	Refined Methods for Transfer Matrix Reconstruction Using Beamline Silicon Detectors for Exclusive Processes at the EIC	A. Jentsch, B. M. Murray	BNL, Upton, NY, USA, and U. of Kansas, Lawrence, KS, USA	5	127,000
8	TOMATO (end-TO-end siMulation fAst deTectOrs): An end-to-end simulation framework for fast detectors at the EIC	D. Tapia Takaki	The University of Kansas Center for Research, Inc., Lawrence, KS, USA	9	46,423
9	Z-Tagging Mini DIRC	C. E. Hyde	Old Dominion University, Norfolk, VA, USA	13	114,000
10	Implementation of a gain layer in Monolithic Active Pixel Sensor (MAPS) for high resolution timing application	P. Schwemling	CEA IRFU Saclay, France	7	355,000
11	Development of a Generic, Low-power and Multi-channel Frontend Readout ASIC for Precision Timing Measurements at EIC	Z. Ye, A. Apresyan	U. of Illinois at Chicago, Chicago, IL, USA, and Fermilab	10	210,000
12	Development of a Novel Readout Concept for an EIC DIRC	G. Kalicy (the submitter)	Catholic University of America, Washington, DC, USA	9	95,000
13	Simulations of the physics impact of a solenoid-based compensation scheme for the field of the main detector solenoid in IR8	Pawel Nadel-Turonski, Wenliang Li, and V. Morozov	Department of Physics, Stony Brook U., Stony Brook, NY, USA, and ORNL, Oak Ridge, TN, USA	18	128,000
14	Tracking and PID with a GridPIX Detector	P. Garg	Department of Physics and Astronomy, Stony Brook University, USA	17	74,555
15	Particle identification and tracking in real time using Machine Learning on FPGA	S. Furletov D. Romanov	Jlab, Newport News, VA, USA	7	101,044
16	Development of High Precision and Eco-friendly MRPC TOF Detector for EIC	Zhihong Ye, and Zhenyu Ye	Department of Physics, Tsinghua U., Beijing, China, and Department of Physics, U. of Illinois at Chicago, Chicago, IL, USA	18	118,000
17	Machine Learning for Detection of Low-Energy Photons in the EIC ZDC	L. Wood	PNNL	10	226,000
18	Superconducting Nanowire Detectors for the EIC	W. Armstrong	ANL	26	138,000
19	EIC KLM R&D Proposal	A. Vossen	Duke U., Durham, North Carolina, USA	24	245,100
20	High Quantum Efficiency III-nitrides photocathodes and hybrid photon detectors for EIC	L. Cultrera	BNL, Upton, NY, USA	20	275,000
21	Exclusive and Semi-inclusive reactions in the muonic channel, and development of muon detectors in the far forward region	M. Boer	Virginia Tech, Blacksburg, VA, USA	10	75,000
22	Injection Molding of Large Plastic Scintillator Tiles at Optical Quality	O. Hartbrich	ORNL, Oak Ridge, USA	10	128,000
23	Development of Thin Gap MPGDs for EIC Trackers	K. Gnanvo	Jlab	12	161,354.50
24	Simplified LGAD structure with fine pixelation	G. Giacomini	BNL, Upton, NY, USA	14	215,000
25	Imaging Calorimetry for the Electron-Ion Collider	M. Zurek, and Z. Papandreou	ANL, and U. Regina, Regina, Saskatchewan, Canada	20	97,000
26	Silicon Tracking and Vertexing Consortium	N. Apadula (the submitter)	LBNL, USA	18	574,200
27	Combined design of a projective tracker and PID system for the EIC Detector-1 with the assistance of Artificial Intelligence	C. Fanelli	College of William and Mary, VA, USA	19	110,000
EICGENR&D Proposal Number	Title	PI(s)	Institution(s) (abbreviated and only includes PI's at this time)	# of pages	Budget Request $US

2022 Submissions: Topical Breakdown

We received the equivalent of 30 proposals. (One of the silicon detector submissions unpacked into what I treated as 4 separate proposals.)
Twice as many as expected. Twice as much work. (369 pages) But it means twice as much world-wide interest in EIC generic detector R&D.

Organizing proposals by topic helped make the pile less over-whelming, and helped shepherd us toward a balanced program.
Most of the topics below will be perennials, but we may add/drop a few topics from year to year. In 2022 the topics were:

Topic	# of proposals submitted
Calorimetry	5
PID (non-TOF)	3
Gaseous Precision Timing and/or Tracking	3
Front End Electronics	3
Silicon Detectors	6
Software Supporting Electronics/Detector Design or Physics Program	4
“Other New Detectors”	3
Studies to Support or Expand the Physics Program	3

Budget request was $4.3M for about $1.3M in disbursable funds, a factor of 3.3 over-subscribed.

The proposals can be found at https://www.jlab.org/research/eic_rd_prgm/receivedproposals .

FY22 Review Committee

Reviewing proposals is an imperfect but necessary process.

Most of the proposals are sound, and written by experts.

It is a challenge to form a committee which can evaluate the wide range of topics we might receive, and do so at a level which respects the effort and expertise of the PI's.

Nevertheless, this is a very talented committee.

	Name	Institution
1	Nicolo Cartiglia	INFN
2	Gabriel Charles	IJCLab/IN2P3/CNRS, University Paris-Saclay
3	Oleg Eyser	BNL
4	Jin Huang	BNL
5	Samo Korpar	U. of Maribor and Institute Jozef Stefan
6	Ron Lipton	FNAL (retired)
7	Clara Matteuzzi	INFN (retired)
8	Ben Nachman	LBNL
9	Daniel Pitzl	DESY
10	Fabrice Retiere	TRIUMF
11	Petra Riedler	CERN
12	Stefan Ritt	PSI
13	Bjoern Seitz	U. Glasgow
14	Justin Stevens	College of W&M
15	Maxim Titov	CEA
16	Glenn Young	BNL

The committee had to be large to keep the workload down, but the size proved to be an advantage. We have:

- deep subject matter experts on most topics, as well as what I call "Swiss-army knife" people,
- experience from many labs across the world, but also people familiar with EIC and BNL
- Retired people who have time to quickly answer my emails, as well as mid-career people whose hair is always on fire
- Heavy sprinklings of enthusiasm thru-out
- keystones of continuity from the previous generic R&D program (Glenn Young, with Thomas Ullrich ex officio)

The Committee Reading Process

- A standard proposal gets 2 readers.
- Complex or cross-disciplinary proposals get 3 readers assigned.
- Each reader ended up with 4 assignments.
- Working groups later split off to discuss groups of proposals on related topics (silicon, gaseous detectors).
- Readers sent me their comments. If they recommend that a proposal give a presentation, they also send me questions that need to be addressed in the presentation.
- I sent notification that a presentation was requested 1 month in advance of the presentation meeting.
- I sent questions to PI’s 2 weeks in advance of the presentation meeting.

Light-handed Filtering Before the Presentation Meeting

We had to reduce the number of presentations so the remainder could fit into a final, grueling 2 day presentation/review meeting.
After a lot of work and discussion by the readers and subject matter experts, only 5 proposals were not offered presentations:

resubmission not encouraged - Hardware won't work (1),
Software organization plan won't work (1), and
ratio of cost/benefit too high (1)

resubmission encouraged - needs basic simulation to establish basic feasibility (1),
needs to target a specific technical issue (1)

Topic	# of proposals before filtering	# of proposals after filtering
Calorimetry	5	5
PID (non-TOF)	3	3
Gaseous Precision Timing and/or Tracking	3	3
Front End Electronics	3	3
Silicon Detectors	6	5
Software Supporting Electronics/Detector Design or Physics Program	4	4
"Other New Detectors"	3	1
Studies to Support or Expand the Physics Program	3	1

That left us with 25 presentations.

The average over-subscription factor dropped to ~2.7.

The presentation/review meeting slides are at https://indico.jlab.org/event/658/ and https://indico.jlab.org/event/659/ .

Divvying up Funds to Achieve a Balanced Program

We'd like achieve a broad spectrum of R&D, while taking into account higher demand and higher costs in some areas.

In 1st approximation, funds were divided across all topics. (all weights = 1)
Then, topics with higher demand (ie, more proposals and/or higher average cost) were given increased weight. (up to weight = 2)

Tension: silicon R&D proposals tend to be relatively expensive due to salary charges for engineers and some physicists at national labs (and one company). I felt it was essential to support some silicon R&D, but could not let it destroy our balance.

Topic	# of proposals before filtering	# of proposals after filtering	Assigned Weight
Calorimetry	5	5	2
PID (non-TOF)	3	3	1
Gaseous Precision Timing and/or Tracking	3	3	1
Front End Electronics	3	3	1.25
Silicon Detectors	6	5	2
Software Supporting Electronics/Detector Design or Physics Program	4	4	2
"Other New Detectors"	3	1	1
Studies to Support or Expand the Physics Program	3	1	1

FY22 Awards
(next 11 slides)

Calorimetry

Green means "funded at some level"

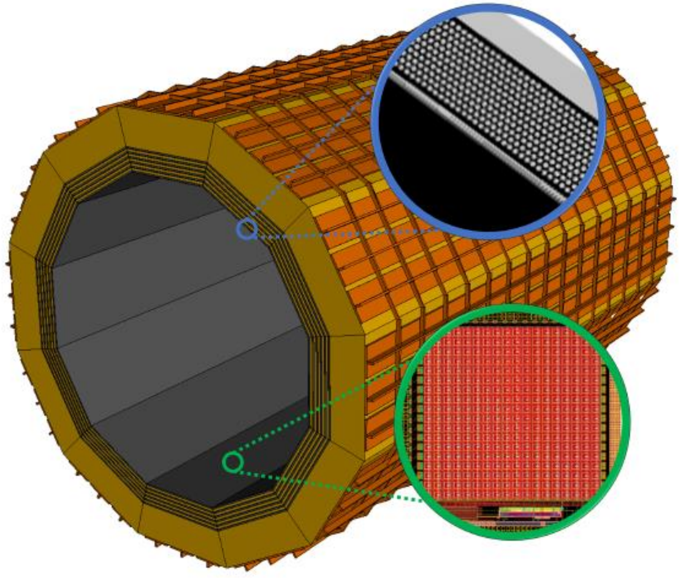
	Calorimetry:			
1	CSGlass for hadron calorimetry at the EIC	T. Horn	Catholic University of America, Washington, DC, USA	$ 97,240
17	Machine Learning for Detection of Low-Energy Photons in the EIC ZDC	L. Wood	PNNL	$ 226,000
19	EIC KLM R&D Proposal	A. Vossen, M. Arratia, W.W. Jacobs	Duke U., Durham, North Carolina, USA, UC Riverside, IU Bloomington	$ 245,100
22	Injection Molding of Large Plastic Scintillator Tiles at Optical Quality	O. Hartbrich	ORNL, Oak Ridge, USA	$ 128,000
25	Imaging Calorimetry for the Electron-Ion Collider	M. Zurek, and Z. Papandreou	ANL, and U. Regina, Regina, Saskatchewan, Canada	$ 97,000

Dollar amounts are the request.

Most proposals that were funded received only 60-80% of the request.
One expensive proposal was funded at the 50% level, and only a few proposals were funded at the 100% level.

Imaging Calorimetry for the Electron-Ion Collider

Maria Zurek (zurek@anl.gov), Zisis Papandreou (Zisis.Papandreou@uregina.ca)



How could one improve on the lead sci-fi barrel calorimeter concept, as exemplified by BCAL in the GlueX detector?

Much better resolution of shower development :

i. longitudinally, for better discrimination between deeper pi+- showers and shallower e+- showers (generally speaking)

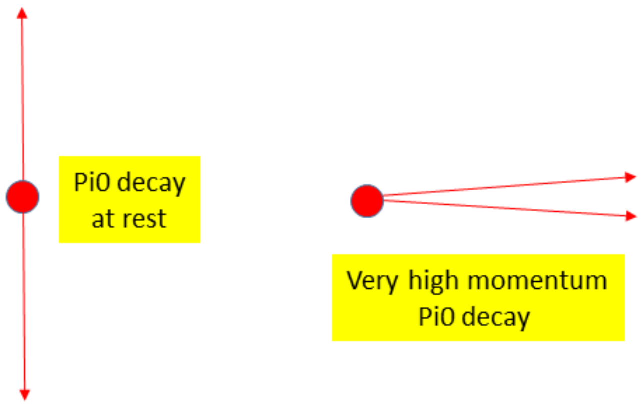
ii. transversely, to better separate the two showers from pi0→gamma + gamma decays (which can otherwise "fuse" in the data analysis and mimic a high energy photon, which is obviously a horrible background in interesting measurements looking for rare events with single, high energy photons)

The PIs' collaboration intends to do this via:

i. finer pixelization of the photosensors (2x2cm^2), and

ii. sandwiching Astropix silicon tracking between the innermost layers

Simulated pi/e discrimination and pi0 shower separation are excellent.



The collaboration has been funded to measure the energy resolution at high beam energy, and compare SiPM and MCP-PMT photosensor readout.

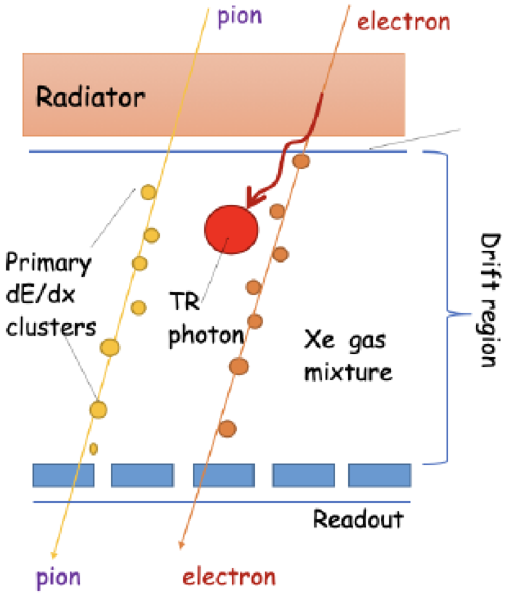
For more information including references, see the 2022 proposal #22 at
https://www.jlab.org/research/eic_rd_prgm/receivedproposals

PID-non TOF

	PID (non-TOF):			
2	A proposal for MPGD-based transition radiation detector/tracker	Y. Furletova, J. Velkovska	Jlab, and Vanderbilt U., USA	$ 174,999
12	Development of a Novel Readout Concept for an EIC DIRC	G. Kalicy, J. Schwiening	Catholic University of America, Washington, DC, USA	$ 95,000
14	Tracking and PID with a GridPIX Detector	T. Hemmick, (P. Garg, contact person)	Department of Physics and Astronomy, Stony Brook University, USA	$ 74,555

A proposal for Micro Pattern Gaseous Detector-based transition radiation detector/tracker

Y. Furletova (yulia@jlab.org), and J. Velkovska (julia.velkovska@vanderbilt.edu)

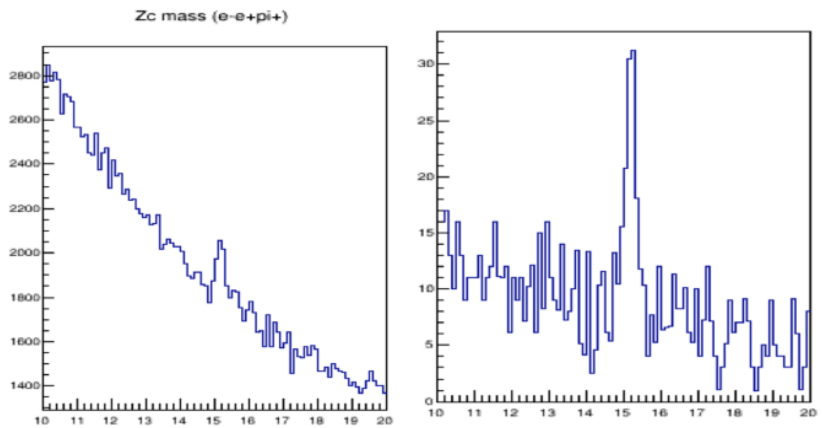


Transition radiation in the x-ray spectrum is emitted when a charged particle sees sudden changes in the index of refraction, such when passing thru a polymer in the form of sheets, foam, or "wool". The intensity is proportional to Energy/mass, so provides some discrimination between a relativistic pi- and an ultra-relativistic e-.

Figure upper right: the x-rays are absorbed in a Xe rich gas mixture, the electrons drift in a an electric field to a structure with gas gain such as a GEM, and the signal is read out.

The PIs' collaboration is testing alternative gas gain structures which are potentially cheaper, simpler to fabricate, and easier to operate than GEMs. They will also continue to optimize the radiator, and try to mitigate cost and supply chain issues with Xe.

Figure lower right: a simulated spectrum for Zc → e+e- at EIC, without and with an additional factor of ~10 rejection of pi+- using a TRD.



For more information including references, see the 2022 proposal #2 at https://www.jlab.org/research/eic_rd_prgm/receivedproposals

Gaseous Precision Timing and/or Tracking

	Gaseous Precision Timing and/or Tracking:			
3	Precise Timing with a Micro Pattern Gaseous Detector	K. Dehmelt	Stony Brook U., USA	$ 94,694
16	Development of High Precision and Eco-friendly MRPC TOF Detector for EIC	Zhihong Ye, and Zhenyu Ye	Department of Physics, Tsinghua U., Beijing, China, and Department of Physics, U. of Illinois at Chicago, Chicago, IL, USA	$ 118,000
23	Development of Thin Gap MPGDs for EIC Trackers	K. Gnanvo	Jlab	$ 161,355

Front End Electronics

	Front End Electronics:			
5	Continued Development and Evaluation of a Low-Power High-Density High Timing Precision Readout ASIC for AC-LGADs (HPSoC)	B. Schumm, L. Macchiarulo	UCSC, and Nalu Scientific LLC	$ 150,000
6	A new radiation tolerant low power Phase-Locked Loop IP block in a 65 nm technology for precision clocking in the EIC frontend electronics	D. Neyret, W. van Noije	IRFU, CEA Saclay, France, and Instituto de Física da U. de São Paulo (USP), São Paulo, Brasil	$ 54,000
11	Development of a Generic, Low-power and Multi-channel Frontend Readout ASIC for Precision Timing Measurements at EIC	Z. Ye, A. Apresyan	U. of Illinois at Chicago, Chicago, IL, USA, and Fermilab	$ 210,000

Note: FEE is tricky. The committee was concerned about developing FEE that may never be adopted by experimental collaborations. The approved proposals are sensitive to this:

- In proposal #5, the ASIC will digitize the signal and attempt to demonstrate on-board feature extraction such as timing and pulse integrals. The committee believes this is the future, and a demonstration of feasibility is important.
- In proposal #6, a precision clock block is developed for the EIC 100 MHz bunch crossing rate. (CERN clocks didn't have enough frequency range to be used.) It will attempt to demonstrate the use of digital feedback to reduce jitter to exceptionally low levels. If developed quickly, it could be become a standard block to incorporate into EIC ASICs.

Silicon Detectors

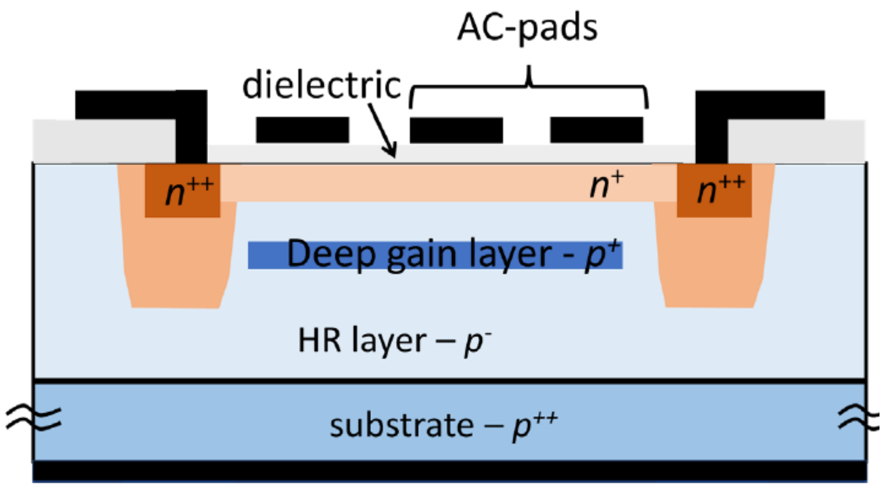
	Silicon Detectors			
~~10~~	~~Implementation of a gain layer in Monolithic Active Pixel Sensor (MAPS) for high resolution timing application~~	~~P. Schwemling, A. Camsonne, H.S. Jo~~	~~CEA IRFU Saclay, France; Jlab; Kyungpook National U., Korea~~	~~$ 355,000~~
24	Simplified LGAD structure with fine pixelation	G. Giacomini	BNL, Upton, NY, USA	$ 215,000
26	Silicon Tracking and Vertexing Consortium, Section 1: Embedded Monolithic Active Pixel Sensor R&D	Nicole Apadula, Giacomo Contin, Nicolas Schmidt	LBNL, Trieste/INFN, ORNL	$ 268,700
26	Silicon Tracking and Vertexing Consortium, Section 2: Aluminum Flexible Circuit Manufacturing Capability	Yuan Mei	LBNL	$ 15,000
26	Silicon Tracking and Vertexing Consortium, Section 3: Functional Verification Model of EIC Tracking and Vertexing Detectors R&D	Grzegorz Deptuch	BNL	$ 108,000
26	Silicon Tracking and Vertexing Consortium, Section 4: Ultra-fast Timing Monolithic Active Pixel Sensors	Yuan Mei	LBNL	$ 182,500

Simplified LGAD structure with fine pixelation

G. Giacomini (giacomini@bnl.gov), B. Schumm (baschumm@ucsc.edu)

The existing AC-LGAD detector has several highly desired properties:

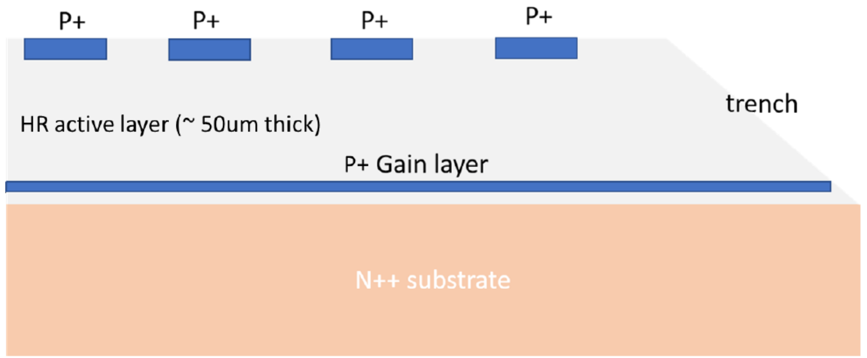
- ~100% fill factor,
- superb timing resolution (30 ps),
- superb position resolution (few microns).



But the AC-LGAD structure and hence fabrication is somewhat complex. (See figure at right.) Also, performance is somewhat compromised by cross-talk (a limitation at high rates) and relatively large capacitance (a limitation when increasing strip sizes to the cm scale).

The PI's intend to fabricate a new device they call, "a novel LGAD structure". It would

- retain the good properties of the AC-LGAD,
- reduce cross-talk and capacitance due to its DC-coupled nature,
- be easier to fabricate resulting in higher yields and lower costs.



The perfect 4D detector (ie, precise in both position and time) is arguably the Holy Grail. But even if the "novel LGAD structure" is successful and finds important applications, the search for the Holy Grail will probably continue to reduce multiple scattering, power consumption, etc.

For more information including references, see the 2022 proposal #24 at https://www.jlab.org/research/eic_rd_prgm/receivedproposals

Software Supporting Electronics/Detector Design or Physics Program

	Software Supporting Electronics/Detector Design or Physics Program:			
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Other New Detectors

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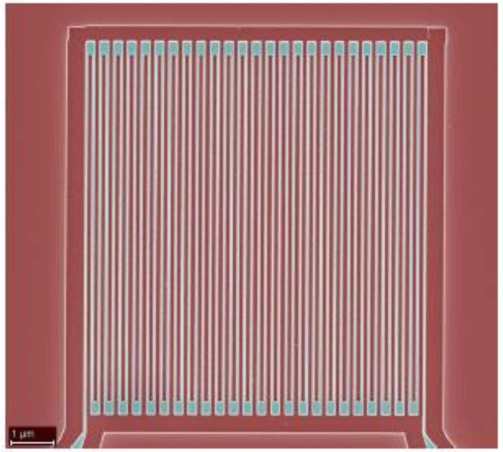
Superconducting Nanowire Detectors for the EIC

Whitney Armstrong (warmstrong@anl.gov)



Potential application of a relatively new technology to particle physics:

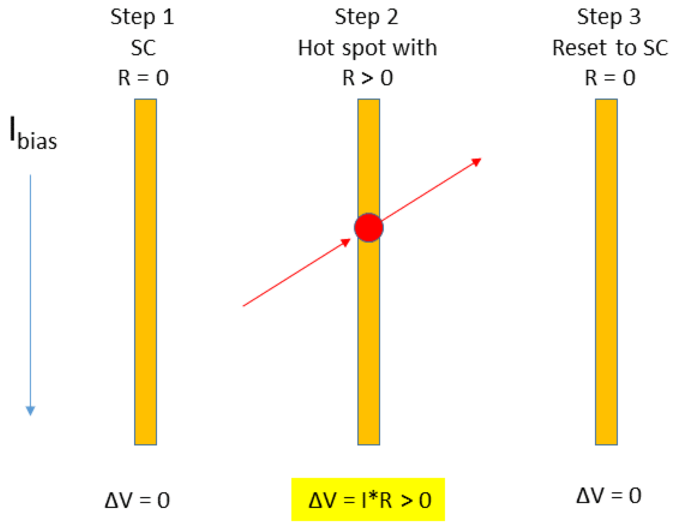
Superconducting nanowire single photon detectors (SNSPDs) have high quantum efficiency, rapid time response, and ability to operate in multi-Tesla magnetic fields.

Stages in detection (see figure at lower right):

- Wire is superconducting with a bias current flowing thru it. $\Delta V = 0$
- Absorption of particle energy induces a local transition to resistive. $\Delta V > 0$
- The hot spot cools and the wire is ready for another hit. $\Delta V = 0$

The PI's collaboration is testing whether this technology can work for the detection of charged particles in a high radiation environment very close to the EIC hadron beamline. It will also be interesting to see how long the reset times are for charged particles depositing keV-scale energies.

For more information including references, see the 2022 proposal #18 at https://www.jlab.org/research/eic_rd_prgm/receivedproposals



Studies to Support or Expand the Physics Program

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~~13~~	~~Simulations of the physics impact of a solenoid-based compensation scheme for the field of the main detector solenoid in IR8~~	~~P. Nadel-Turonski, Wenliang Li, and V. Morozov~~	~~Department of Physics, Stony Brook U., Stony Brook, NY, USA, and ORNL, Oak Ridge, TN, USA~~	~~$ 128,000~~
15	Particle identification and tracking in real time using Machine Learning on FPGA	S. Furletov D. Romanov	Jlab, Newport News, VA, USA	$ 101,044
~~21~~	~~Exclusive and Semi-inclusive reactions in the muonic channel, and development of muon detectors in the far forward region~~	~~M. Boer~~	~~Virginia Tech, Blacksburg, VA, USA~~	~~$ 75,000~~

The Contracting Phase

30 proposals

25 invited for presentations (after filtering 5)

15 proposals were funded

But a typical proposal usually involves multiple institutions, so ….

<u>38 separate funding efforts: </u>contracts for the universities and businesses, IEWO’s for the national labs, etc

Contracting went slowly due to the large number of PRs I submitted, and because Jlab had not previously made contracts with most of these institutions.

It’s going to go much faster next year. Seriously!

Example Actual Procurement Notes

The physicist's view of the contracting process:

Jlab says, "Take this free money to do brilliant R&D that your employee proposed!".

The university says, "Yes!", opens an account, and the PI's soon start spending.

Example Actual Procurement Notes

The physicist's view of the contracting process:
Jlab says, "Take this free money to do brilliant R&D that your employee proposed!".
The university says, "Yes!", opens an account, and the PI's soon start spending.

In the real world:
Jlab says, "Take this money to do R&D that your employee proposed, subject to these Terms and Conditions!".
The university says, "Our lawyer shall read and propose changes to your T&C … when they have time!"
And so begins lawyer ping- (when they have time) and –pong (when they have time), with plenty of 1-2 week delays on both sides.

XYZ Univ – RFQ sent on 1/25 – response due 2/6 –

2/14/22 XYZ sent Proposal back with changes to the Ts&Cs.

2/23/23 - Working with legal and University on changes to Ts&Cs.

2/28/23 - sent revised Ts&Cs to University waiting on response.

4/15/23 - No change.

4/26/23 - All terms and conditions accepted just waiting on Univ to sign document.

5/3/23 - No Change

	Amount in $	Percentage of total (Out of $1.412M total.)	Comments
Funds available to PIs:			
Contracts awarded	0.6821M	48.3%	After a lot of work by procurement officers, and multiple iterations on Terms and Conditions by legal, many contracts finally converged. Even if it's for only a few $k in travel funds, the work is the same. 22 contracts so far!
IEWO's fully approved	0.4230M	30.0%	7 Inter-entity Work Orders so far!
Accounts opened for Jlab PIs	0.1475M	10.4%	3 of these
	----------------	----------------	
Total funds in PI hands	**1.2526M**	**88.7%**	Was 72.2% on April 20.
Ongoing:			
Making contracts	0.1105M	7.8%	UC Santa Cruz (x2), Stony Brook U, Yale U (these are drawing to a close)
Remaining IEWO's under review by national labs	0.020M	1.4%	Inter-entity Work Orders are all complete except for one for FNAL (which has never responded)
	----------------	----------------	
Total ongoing	**0.1305M**	**9.2%**	
Other:	**0.029M**	**2.1%**	Most of "Other" is due to one tardy Statement of Work.

Time to Do It All Over Again

- DOE sent us FY23 funds in the second half of April.
- The arduous FY22 contracting process is winding down.
- Last nite I sent a draft FY22 report to the committee to edit.
- The committee's font of irrepressible enthusiasm, Maxim Titov, has let me know that he's ready for Year 2.

So it's time to do it all over again!

- The next call for proposals will go out in 1-2 days, with a deadline of 5pm, July 14, 2023.

Summary

- Funds from the late launch in FY22 are now mostly accessible to PIs.

  (The choice was to start late, or lose the FY22 funds and restart the program in FY23.)

- The majority of the FY22 proposals were sound, and the proposed R&D would likely benefit Detector 2 or an upgrade of Detector 1.

- If a proposal makes a presentation and is not awarded funds, this should not be thought of as a rejection in most cases. It’s often more a question of the committee assigning priorities within topical categories, and running out of money. Most unfunded proposals are welcome to resubmit (after updating as appropriate).

- We’re looking forward to your proposals. (But hopefully you’ll send us fewer than 30.)

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