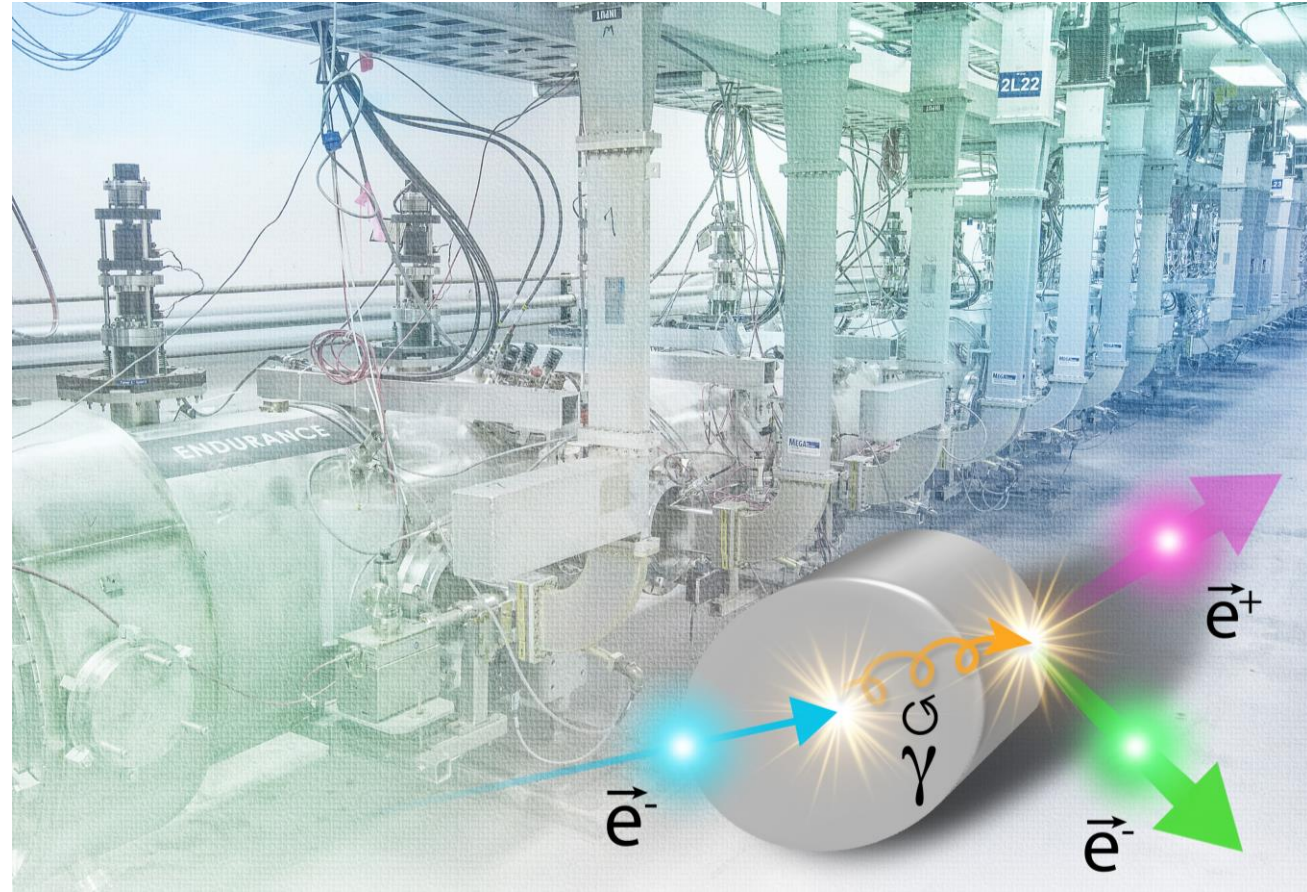


Jefferson Lab Positron Program

New 12 GeV science experiments enabled by adding a positron source to the CEBAF accelerator.



Polarized Electrons for Polarized Positrons (PEPPo)

<https://doi.org/10.1103/PhysRevLett.116.214801>

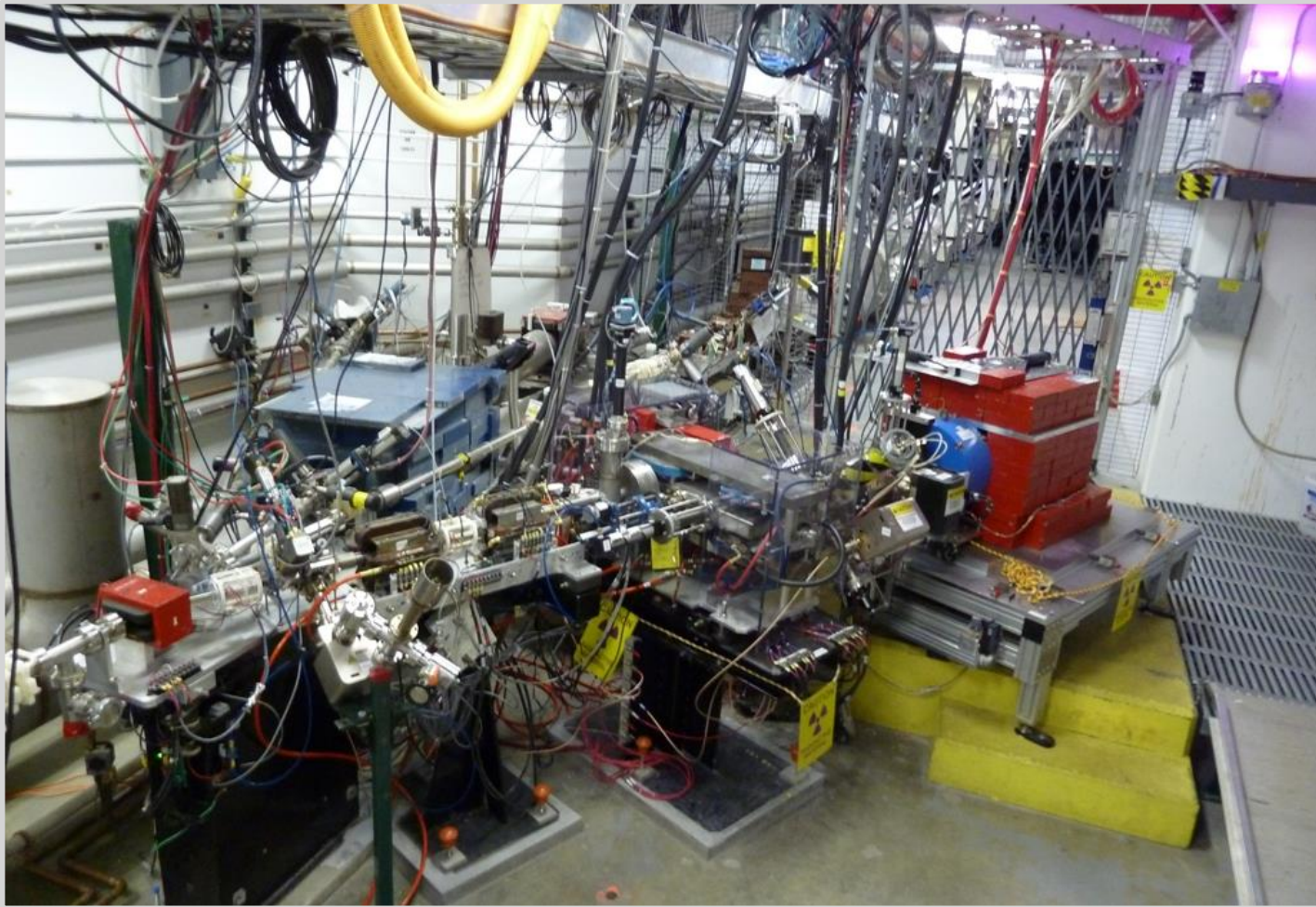


Photo of the PEPPo setup in the injector area of CEABF.

INTERNATIONAL WORKSHOP ON
POSITRONS
AT JEFFERSON LAB

March 25-27, 2009
JEFFERSON LAB

TOPICS:

- Positron-proton elastic scattering
- Deeply virtual Compton scattering
- New 12 GeV experiments with positrons
- Technology of positron sources
- Polarized positrons
- Electron/photon drivers
- Positron & electron polarimetry
- Applied physics with positrons

International Advisory Committee:

- X. Artru (IPN Lyon)
- L. Cardman (JLab)
- P. Cole (Idaho State U.)
- A. Freyberger (JLab)
- P. Guichon (CEA Saclay)
- R. Holt (ANL)
- A. Hunt (Idaho Accelerator Center)
- C. Hyde (LPC Clermont Ferrand)
- M. Klein (U. Liverpool)
- K. Kumar (U. Massachusetts)
- M. Poelker (JLab)
- J. Sheppard (SLAC)
- A. Variola (LAL Orsay)

Local organizing committee:

- L. Elouadrhiri (JLab)
- T. Forest (Idaho State U.)
- J. Grames (JLab)
- W. Melnitchouk (JLab)
- E. Voutier (LPSC, Grenoble)

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conferences.jlab.org/JPOS09

Jefferson Lab  

Positron Program White Paper Published 2022

Experiment		Measurement Configuration			Beam Parameters				Time (d)	PAC Grade
Label (EPJ A)	Short Name	Hall	Detector	Target	Polarity	p (GeV/c)	P (%)	I (μ A)		
<i>Two Photon Exchange Physics</i>										
57:144	$H(e, e'p)$	B	CLAS12 ⁺	H ₂	+/- _s	2.2/3.3/4.4/6.6	0	0.060	53	
57:188	$H(\bar{e}, e'\bar{p})$	A	ECAL/SBS	H ₂	+/- _p	2.2/4.4	60	0.200	121	
57:199	r_p	B	PRad-II	H ₂	+	0.7/1.4/2.1	0	0.070	40	
	r_d			D ₂		1.1/2.2		0.010		
57:213	$\vec{H}(e, e'p)$	A	BB/SBS	N \vec{H}_3	+/- _s	2.2/4.4/6.6	0	0.100	20	
57:290	$H(e, e'p)$	A	HRS/BB/SBS	H ₂	+/- _s	2.2/4.4	0	1.000	14	
57:319	SupRos	A	HRS	H ₂	+/- _p	0.6–11.0	0	2.000	35	
58:36	A(e, e')A	A	HRS	He	+/- _p	2.2	0	1.000	38	
<i>Nuclear Structure Physics</i>										
57:186	p-DVCS	B	CLAS12	H ₂	+/- _s	2.2/10.6	60	0.045	100	C2
57:226	n-DVCS	B	CLAS12	D ₂	+/- _s	11.0	60	0.060	80	
57:240	p-DDVCS	A	SoLID ^{μ}	H ₂	+/- _s	11.0	(30)	3.000	100	
57:273	He-DVCS	B	CLAS12/ALERT	⁴ He	+/- _s	11.0	60			
57:300	p-DVCS	C	SHMS/NPS	H ₂	+	6.6/8.8/11.0	0	5.000	77	C2
57:311	DIS	A/C	HRS/HMS/SHMS		+/- _s	11.0				
57:316	VCS	C	HMS/SHMS	H ₂	+/- _s		60			
<i>Beyond the Standard Model Physics</i>										
57:173	C _{3q}	A	SoLID	D ₂	+/- _s	6.6/11.0	(30)	3.000	104	D
57:253	LDM	B	ECAL/HCAL	PbWO ₄	+	11.0	0	0.100	180	
									120	
57:315	CLFV	A	SoLID ^{μ}	H ₂	+	11.0				
Total (d)									1121	

CLAS12⁺ \equiv CLAS12 implemented with an Electromagnetic Calorimeter in the Central Detector

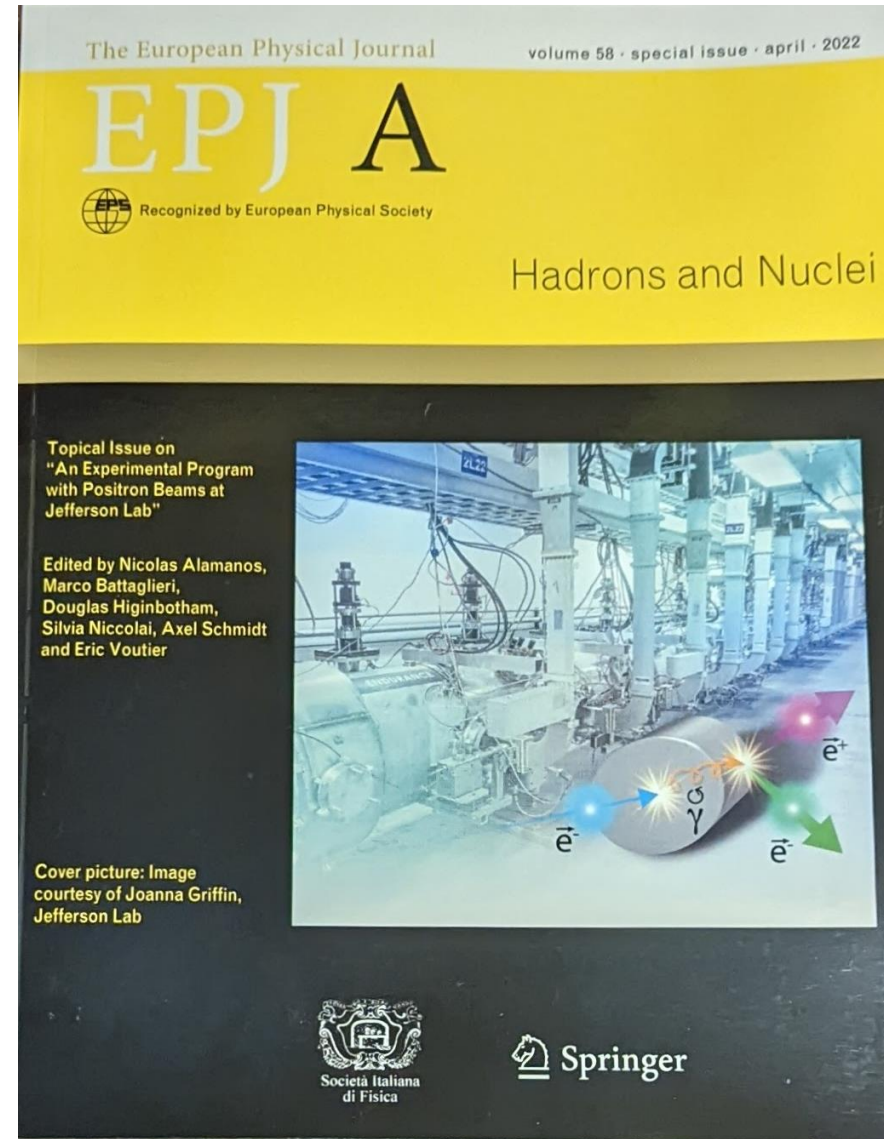
SoLID ^{μ} \equiv SoLID complemented with a muon detector

+ Secondary positron beam

-_s Secondary electron beam

-_p Primary electron beam

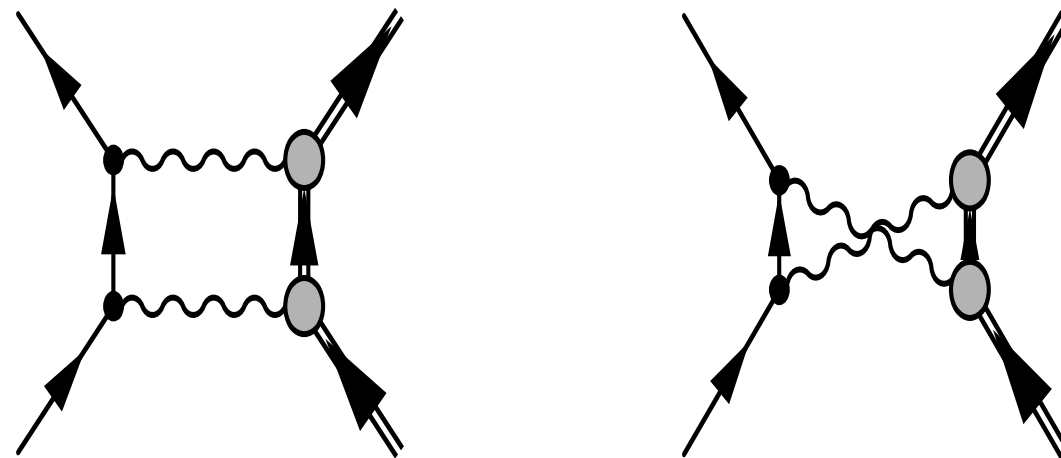
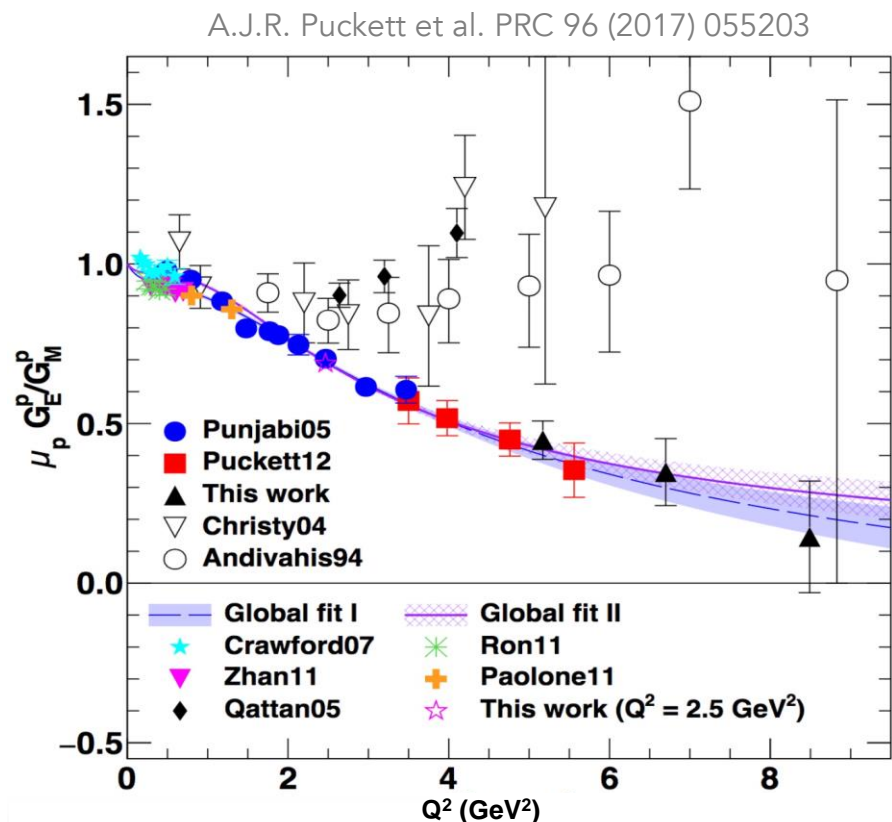
(30) Do not require polarization but would take advantage if available at the required beam intensity



One Detailed Example: Understanding Two Photo Exchange

P.A.M. Guichon, M. Vanderhaeghen, PRL 91 (2003) 142303 P.G. Blunden, W. Melnitchouk, J.A. Tjon, PRL 91 (2003) 142304

Measurements of polarization transfer observables in electron elastic scattering off protons question the validity of the 1γ exchange approximation of the electromagnetic interaction.



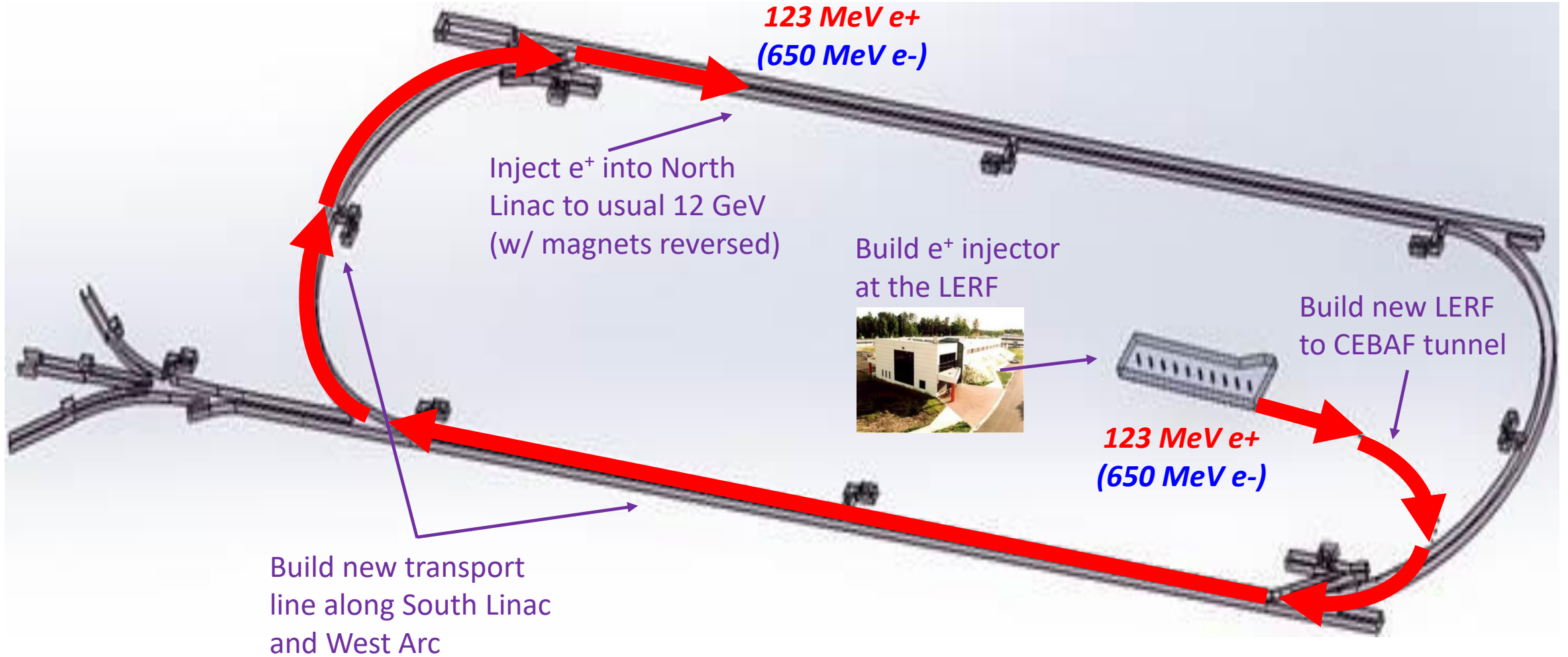
Two-photon exchange (TPE) is likely the cause of the form factor discrepancy at high Q^2 .

*e^+ @ JLab has a the unique opportunity to bring a **definitive answer** about TPE.*

12 GeV CEBAF vs. Ce⁺BAF

Machine Parameter	Electrons	Positrons
Hall Multiplicity	4	1 or more
Max. Energy (ABC/D)	11/12 GeV	11/12 GeV
Beam Repetition	249.5/499 MHz	249.5/499/1497 MHz
Duty Factor	100% cw	100% cw
Unpolarized Intensity	170 μ A	> 1 μ A
Polarized Intensity	170 μ A	> 50 nA
Beam Polarization	> 85%	> 60%
Fast/Slow Helicity Reversal	1920 Hz/Yes	1920 Hz/Yes

Low Energy Recirculator Facility (LEFRF) As The New Injector Facility for CEBAF

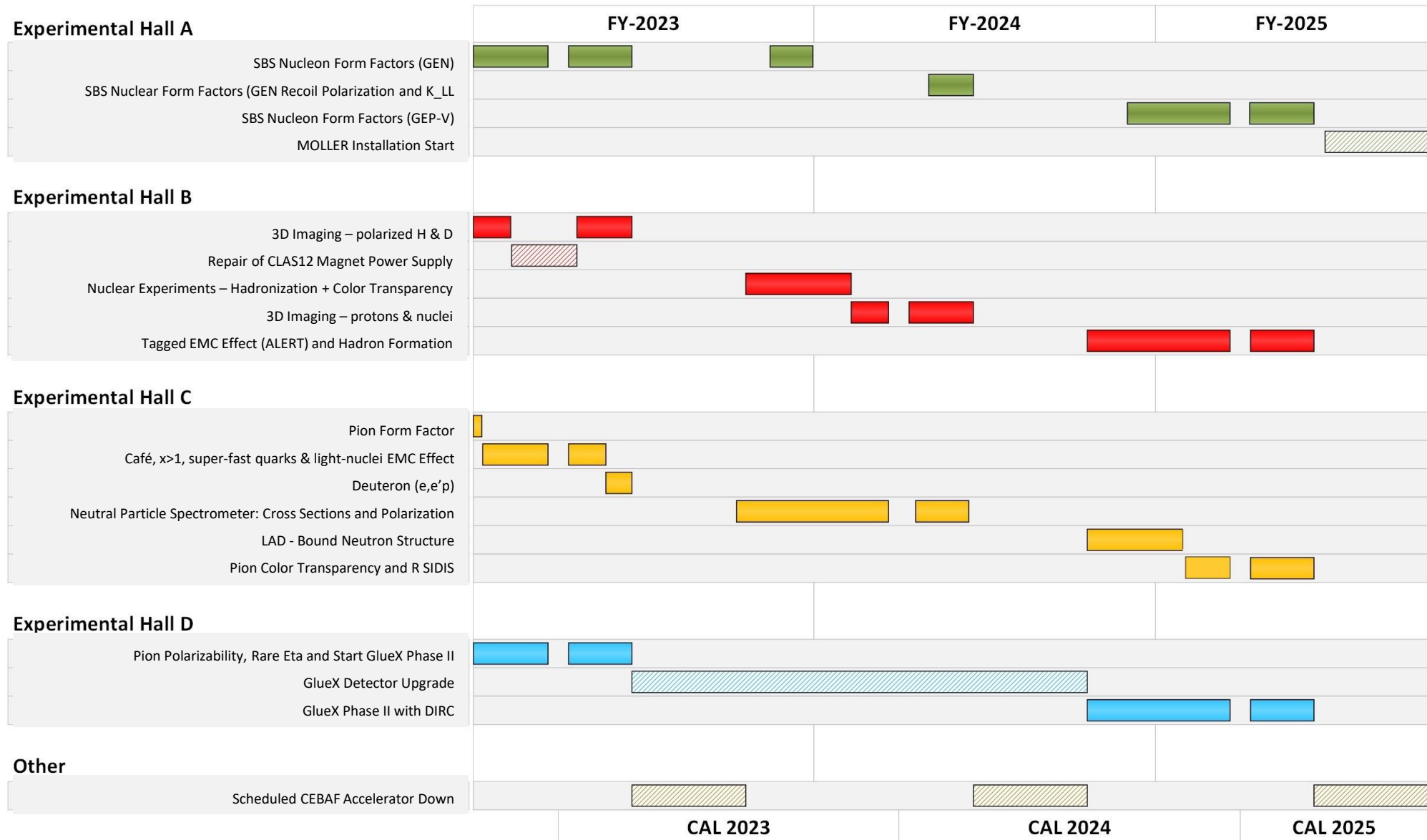


Likely Proposals and Letters of Intent In Preparation for the JLab PAC51

- Jefferson Lab has an annual Program Advisory Committee to review experimental proposals.
<https://www.jlab.org/physics/PAC>
- Likely Positron Proposals
 - p-DVCS @ NPS (point of contact Carlos Munoz Camacho [**CNRS/IN2P3**])
 - p-DVCS @ CLAS12 (point of contact Eric Voutier [**CNRS/IN2P3**])
 - TPE @ CLAS12 (point of contact Axel Schmidt [GWU])
 - Super Rosenbluth TPE (point of contact John Arrington [LBNL])
 - A1 search (Bogdan Wojtsekhowski [JLab])
 - Coulomb corrections in DIS (point of contact Dave Gaskell [JLab])
- Likely Letters of Intent
 - Axial Form Factor (point of contact Dipankar Dutta [MSU])
 - p-VCS (point of contact Nikos Sparveris [Temple])
- Ideas presented at March 2023 Positron Workshop: <https://indico.jlab.org/event/680/>

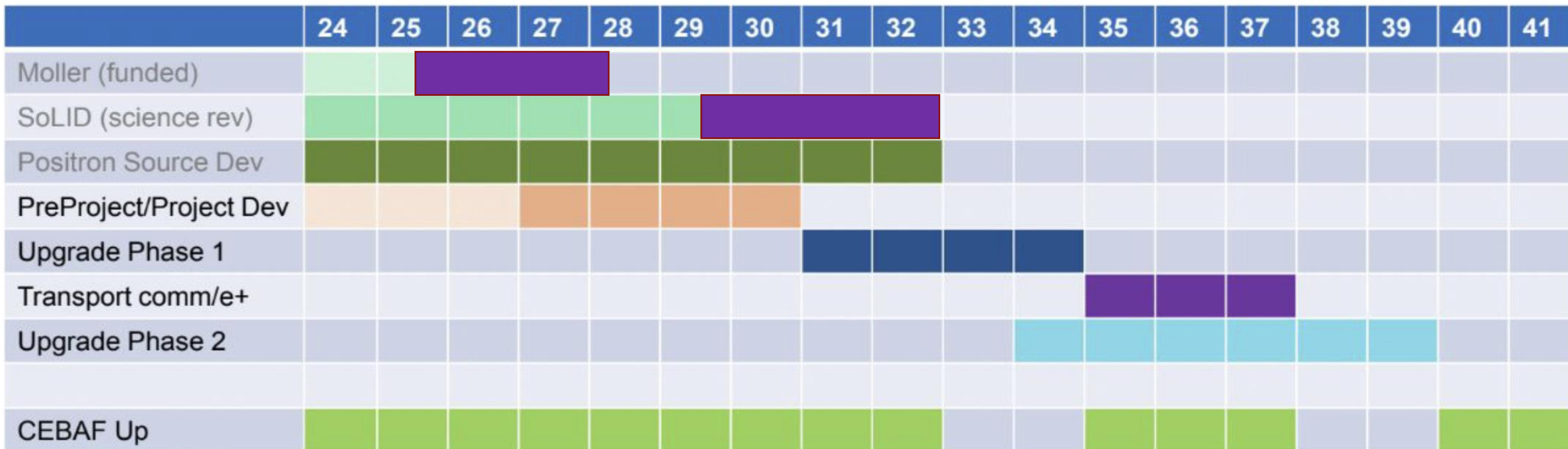
Current Jefferson Lab Two Year Schedule

Jefferson Lab's user community is ~1900 people strong, but made up of many collaborations doing lots of different nuclear physics.



VERY ROUGH Timeline for Positrons and the 22 GeV Upgrade

Gantt chart made by David Dean to give a rough idea when these project could become a reality.



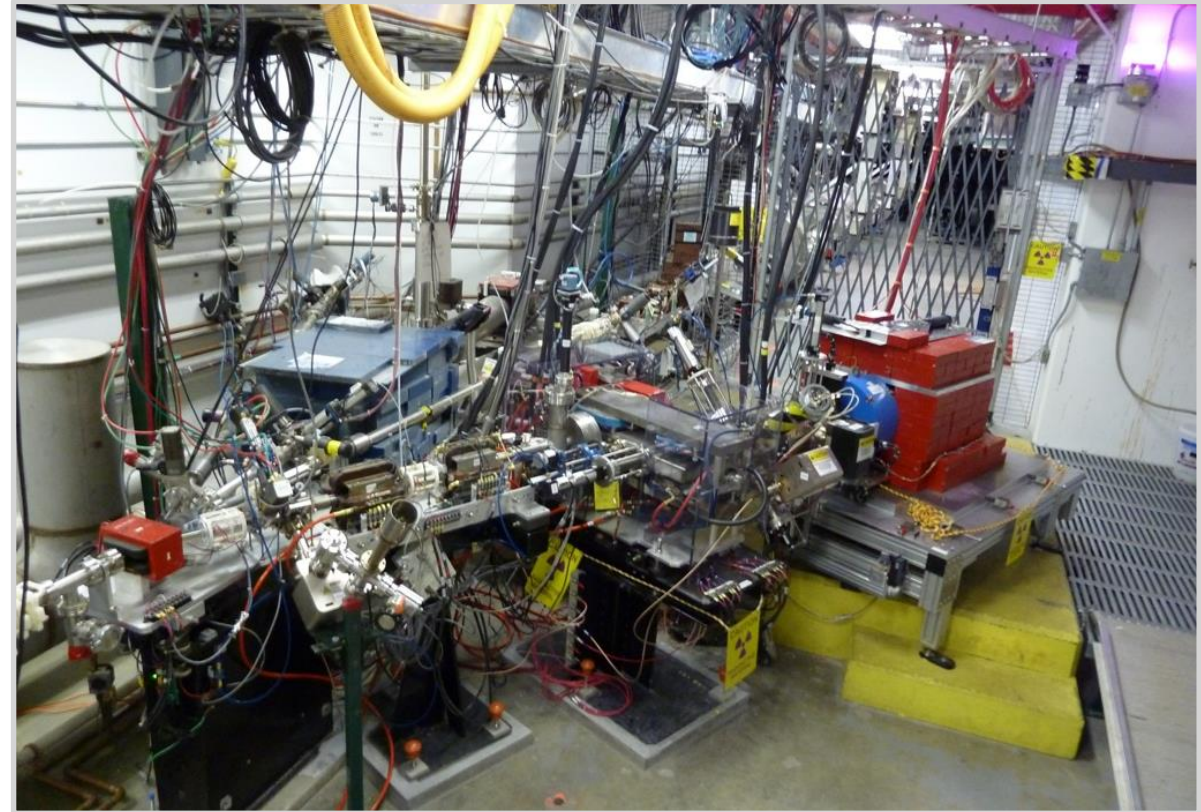
Phase 1 includes building the positron source and the tunnel & beamline connecting the source to main machine.

Phase 2 includes the new permanent magnets to allow 22 GeV within current CEBAF footprint.

NOTE: Plan was formulated so that these projects are ramping up as the EIC project cost is ramping down.

Summary

- Positrons are an exciting addition to the Jefferson Lab 12 GeV program
- Current plans look to make use of the FEL/LERF building and infrastructure to make the positron beam (including polarization)
- Will require the construction of a tunnel between the FEL/LERF and CEBAF.
- LERF and tunnel would also be used as the 22GeV electron injector.
- A full conceptual design and cost estimates are in preparation.
- Circa 2035-2038 for Ce^+BAF experiments.



Jefferson Lab Users Organization Meeting

April 16th 12:30 to 2pm

Symphony 1

Lunch Provided

Anyone interested in JLab Science is encouraged to attend!



JLUO
JEFFERSON LAB USERS ORGANIZATION

Our JLUO Satellite meeting will take place on Sunday, April 16 from 12:30-2 p.m. in Symphony 1 during the April APS meeting in Minnesota. Agenda is below and we hope to see you there!

Lunch will be provided!

12:30	Welcome	
12:40	JLUO news	Carlos Munoz Camacho (IJCLab)
12:47	News from the lab	Cynthia Keppel (JLab)
13:12	Hall A update	Sean Jeffas (UVa)
13:24	Hall B update	Richard Capobianco (UConn)
13:36	Hall C update	Iuliia Skorodumina (JLab)
13:48	Hall D update	Nathaniel Hoffman (CMU)

Anyone interested in JLab science is encouraged to attend!

This program is supported by the Initiatives Fund Program, a JSA commitment, to support programs, initiatives, and activities that further the scientific outreach, promote the science, education and technology of Jefferson Lab and benefit the Lab's extended user community in ways that complement the Lab's basic and applied research missions.