



Upcoming SRC-EMC Experiments at Jefferson Lab

Thomas Jefferson National Accelerator Facility



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United States Department of Energy National Lab (Primary Focus Nuclear Physics)

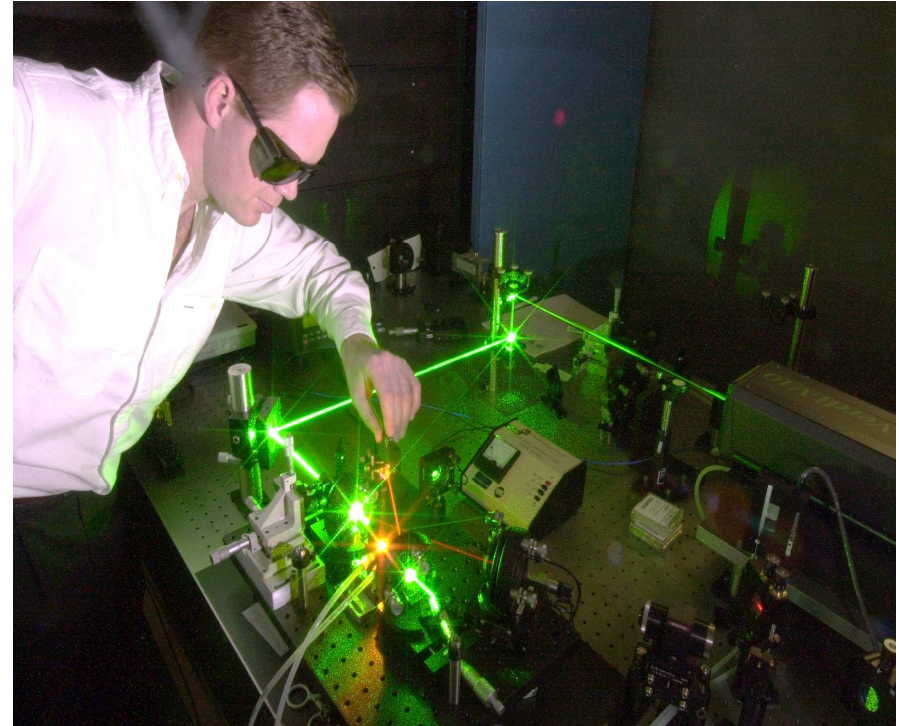
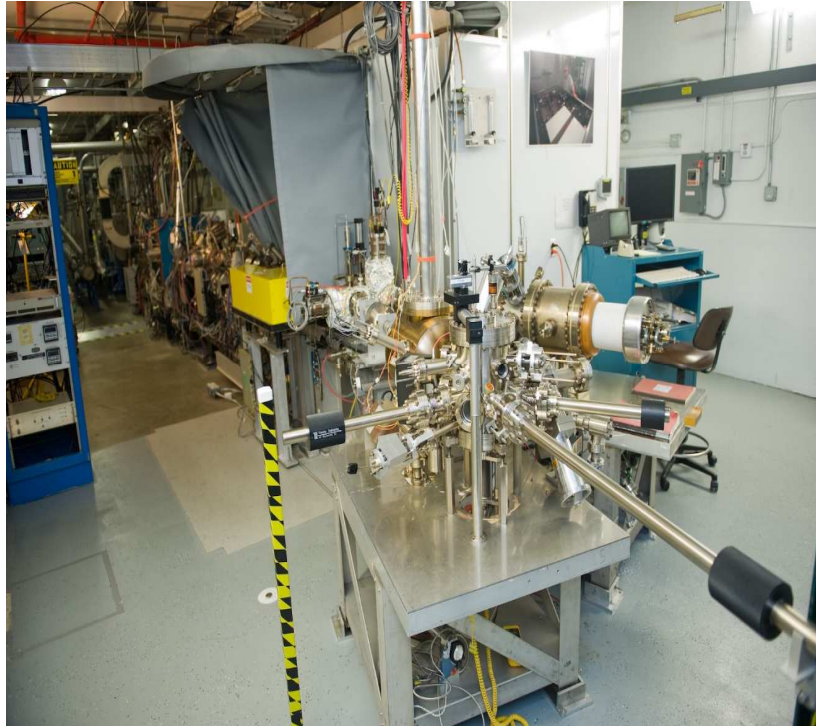
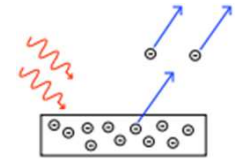
- 2000 Scientists
 - U.S. Universities
 - International
- Train Next Generation
 - 10 Ph.D.'s/Year
 - College Programs
 - High School Programs
- **Primary Mission of the lab is to understand the transition from hadronic to partonic degrees of freedom.**
- **SRC-EMC experiments naturally are part of this mission.**

Virtual Tour of Jefferson Lab's Accelerator

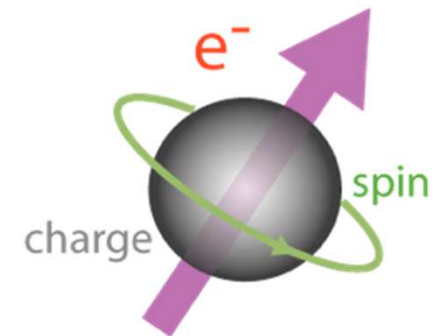


Higinbotham and Hen

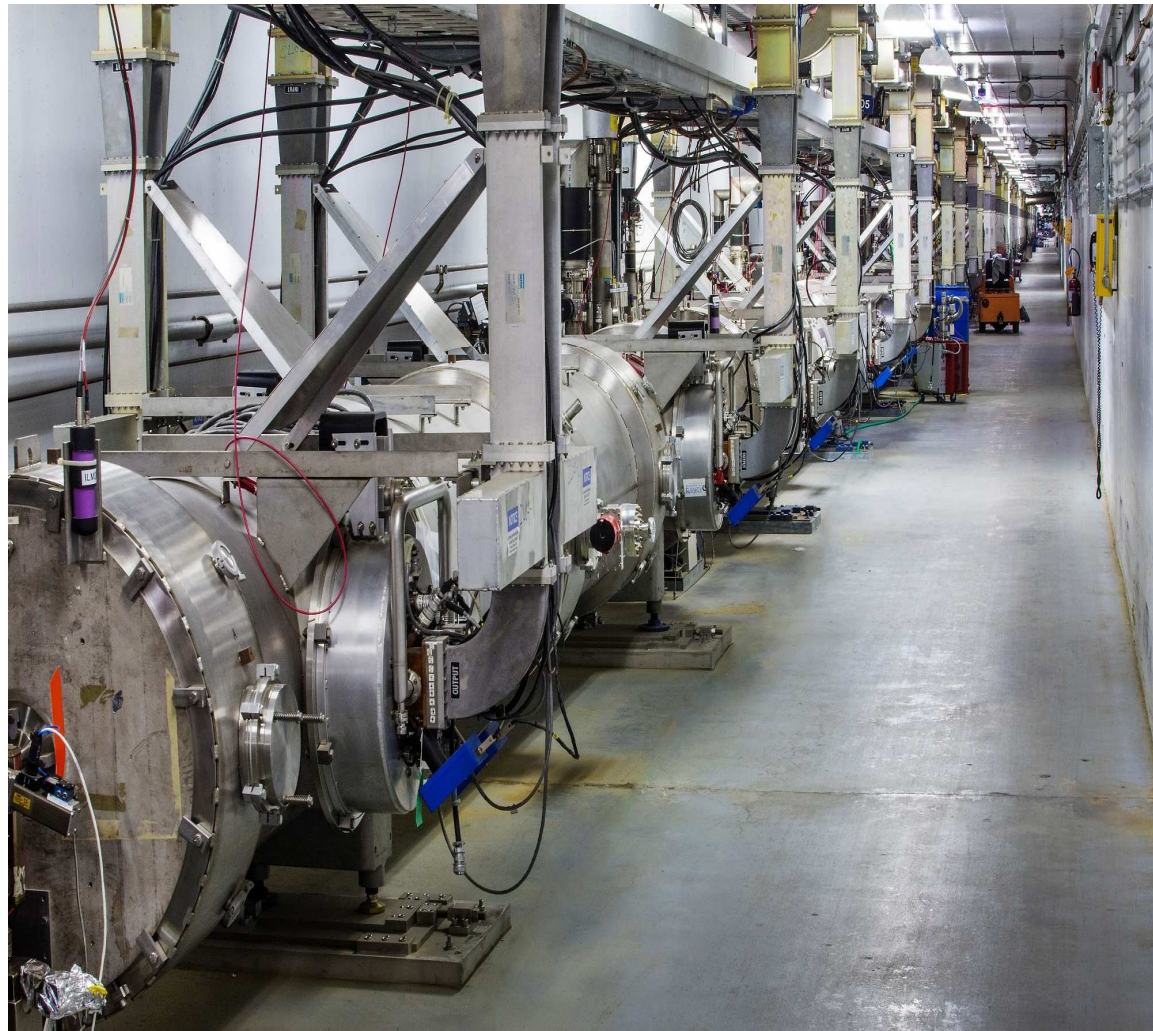
Injector: Photoelectric Effect



By using polarized laser light and strained GaAs, ~85% polarized has become absolutely standard.

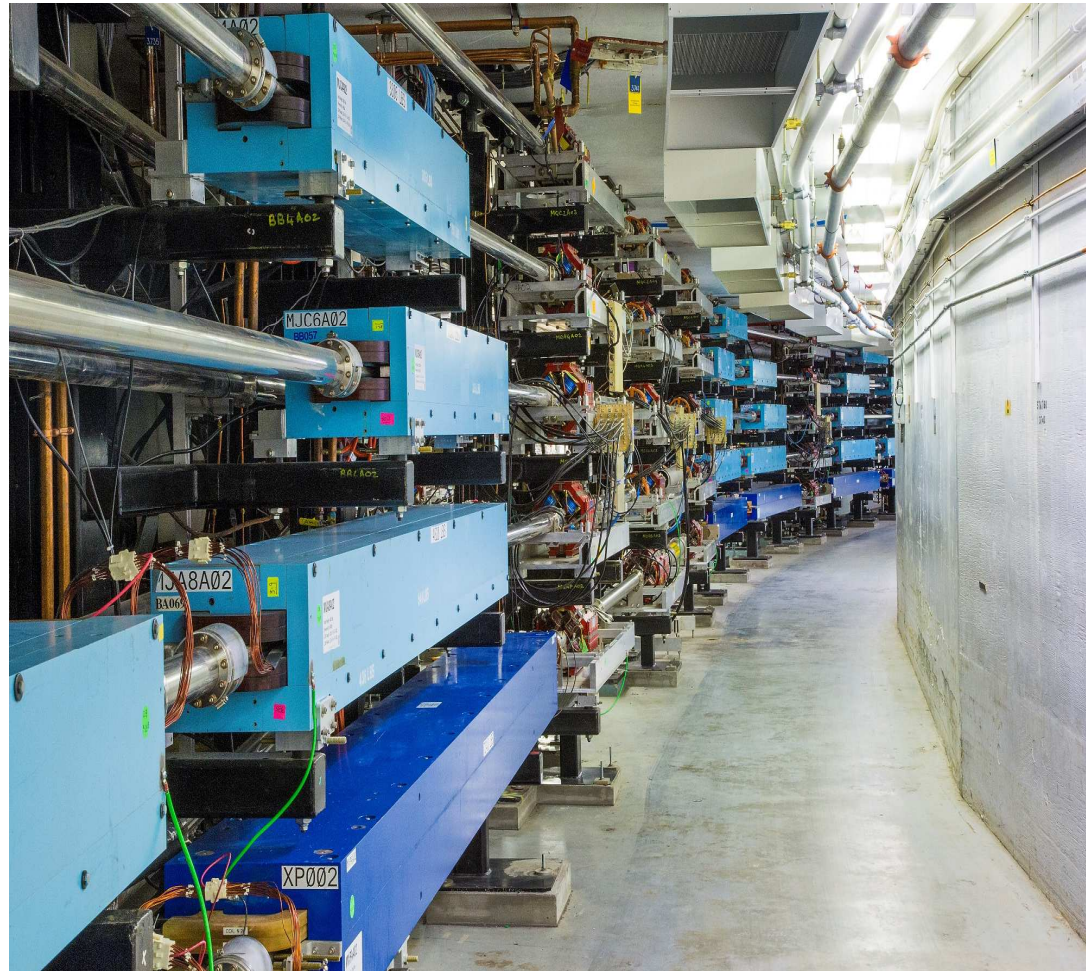


Linear Accelerator



Presently accelerating 2.1 GeV/pass around the machine.

Race Track Design



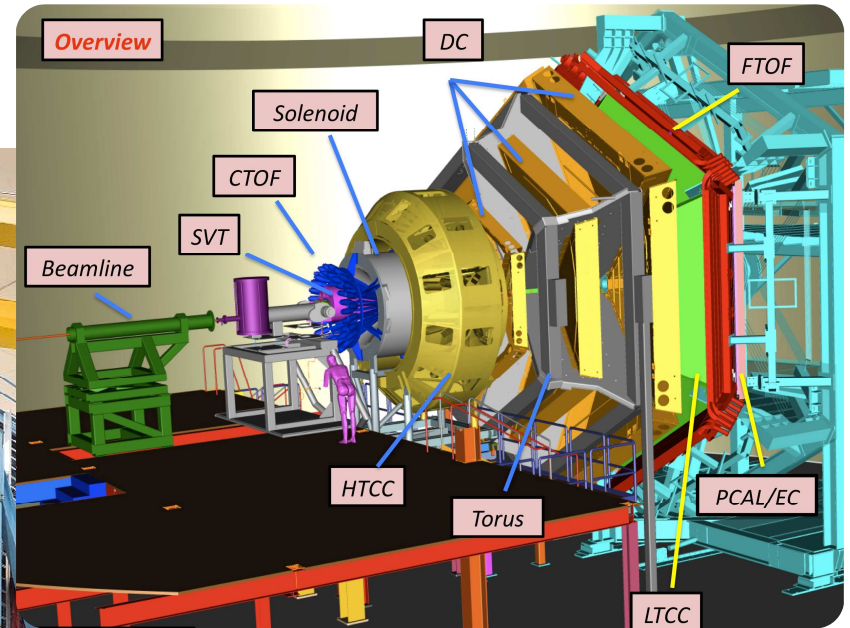
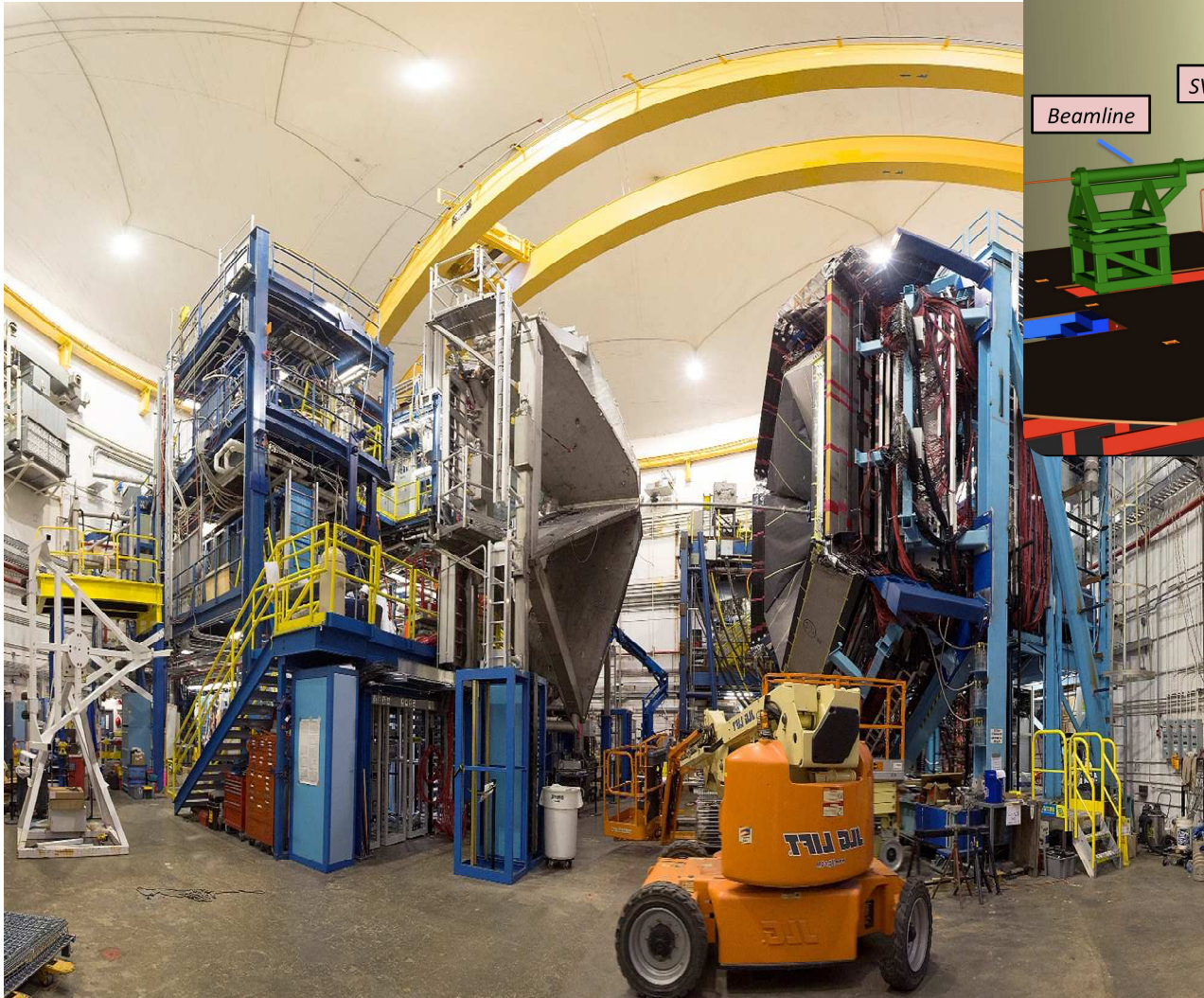
Accelerators are expensive (>100 million dollars) while bending magnets are cheap.

Jefferson Lab's Experimental Hall A



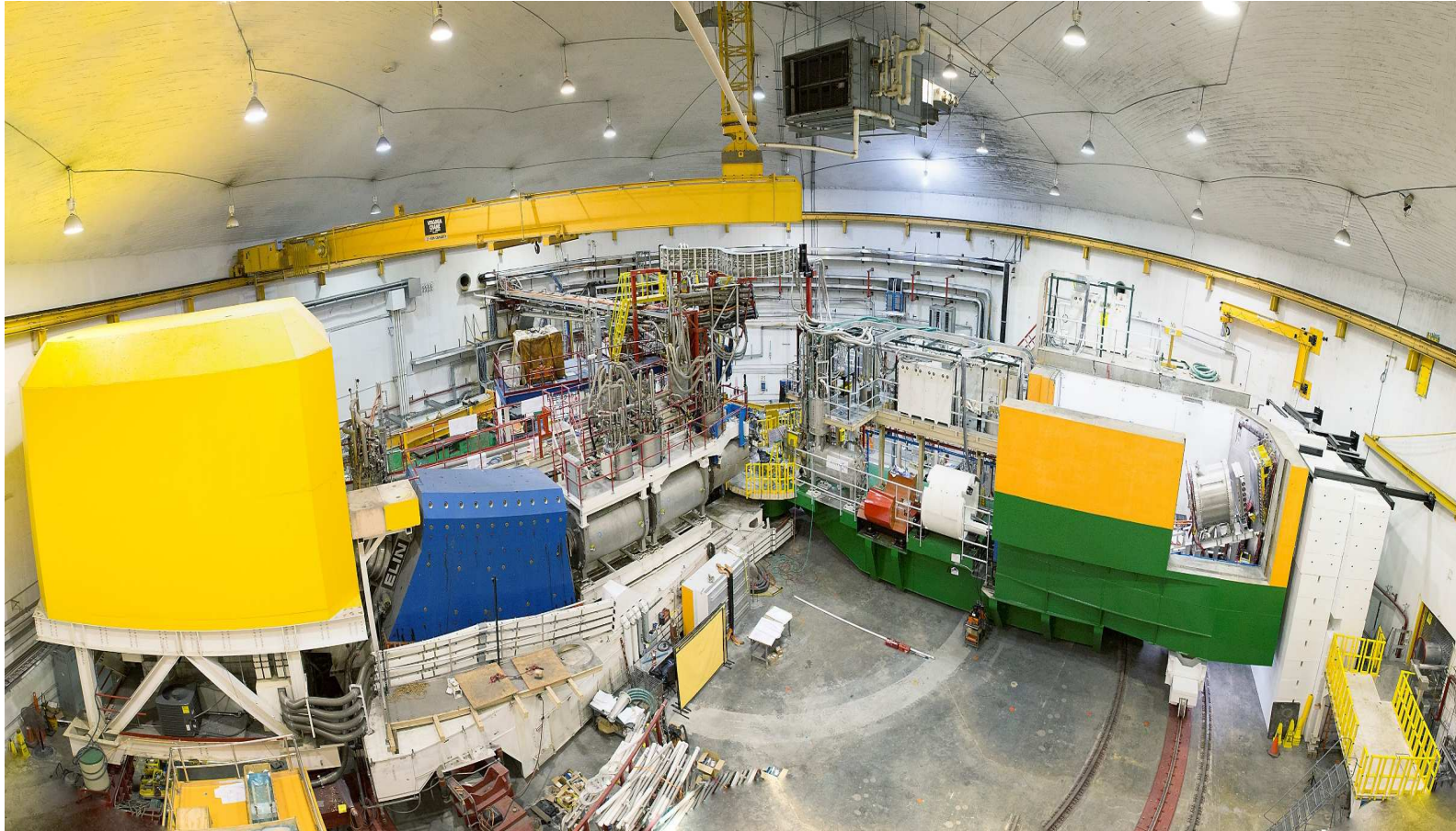
Now the home of the SBS / BB experiments and will be the home of MOLLER & SoLID

Jefferson Lab's Experimental Hall B

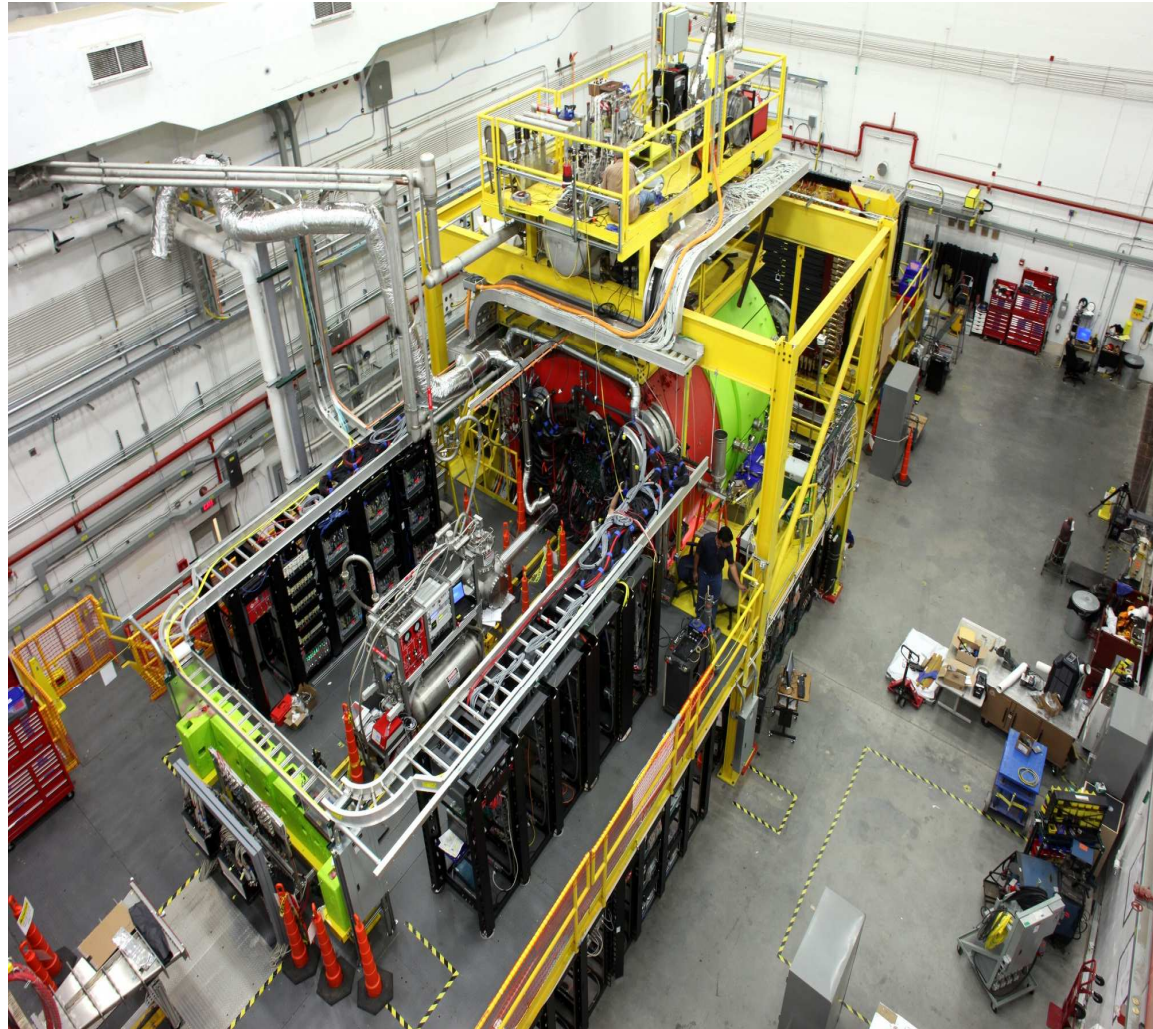


Higinbotham and Hen

Jefferson Lab's Experimental Hall C



Jefferson Lab's Experimental Hall D



Higinbotham and Hen

Some Key Parameters

- We can run four halls at one time! (1.5 GHz machine sending 250 MHz to the halls)
 - When running just A,B, C it is 500 MHz to the three halls.
- Highly polarized electron beams to Hall A, B, and C
 - Can always send full longitudinal polarization to one hall
 - Making carefully selection of the beam energy (making use of g-2) it is possible to get high polarization to two or even three halls at once
- Energies to Hall A, B, C up to ~ 11 GeV and to Hall D up to 12 GeV
 - ~ 0.5 to ~ 2 GeV/pass
 - Halls A, B,

12 GeV Era JLab SRC-EMC Experiments: General

Quasielastic Scattering:

(e,e') QE High-Q ² , high-x _B	(e,e'p) QE High-Q ² , high-x _B , high-P _m	(e,e'2N) & (e,e'3N) High-Q ² , wide-x _B , high-P _m
Tensor Polarized d @ Hall C	d @ Hall C [Yero PRL + 2023]	d, ⁴ He, ¹² C, ⁴⁰ Ca, ⁴⁸ Ca, ¹²⁰ Sn @ Hall B [2021/22] *All final states possible, starting with charged particles and working towards neutrons
A=3 @ Hall A [Li Nature]	A=3 @ Hall A [Cruz Torres PRL + PLB] Hall B [2025+]	
D, ⁴ He, ⁶ Li, ⁷ Li, ⁹ Be, ¹⁰ B, ¹¹ B, ¹² C; ⁴⁰ Ca, ⁴⁸ Ca, Fe, Ni, Cu, Ag, Au, Th Hall C [2022/23]	⁹ Be- ¹⁰ B- ¹¹ B- ¹² C; ⁴⁰ Ca- ⁴⁸ Ca- ⁵⁴ Fe; Au Hall C [2022 (23)]	

Nuclear DIS:

Hall C – (e,e') on ⁹Be-¹⁰B-¹¹B-¹²C; ⁴⁰Ca-⁴⁸Ca-⁵⁴Fe; Au ...

Hall B – (e,e'π) on nuclei from deuterium to Lead

Tagged DIS / SIDIS – (e,e'N_{recoil}) / (e,e'πN_{recoil})

BAND (d): CLAS12 + recoil neutron

ALERT (d, He, ..): CLAS12 + recoil proton + light nuclei

LAD (d): Hall C + recoil proton

Photonuclear:

d, ⁴He, ¹²C @ Hall D
[2021/22] [Jackson's
talk]

SRC-EMC Experiments Running Early 2023

Experimental Hall C

E12-06-105: Inclusive Scattering from Nuclei at $x_B > 1$ in the QE and DIS regimes

E12-10-008: Detailed studies of the nuclear dependence of F2 in light nuclei.

Running right now as a pair and unfortunately the key members couldn't come here.

Burcu Duran, Casey Morean, Nadia Fomin, Dave Gaskell, John Arrington, and many others

I EXPECT TO SEE SOME GREAT PRELIMINARY RESULTS AT THE 5th SRC-EMC Workshop

E12-10-003: Deuteron Electro-Disintegration at Very High Missing Momentum

Scheduled to start late next month and run until March 20th

Chat with Werner Boeglin and/or Carlos Yeros for more details.

Upcoming Jefferson Lab Experiment Schedule

WARNING: FURTHER OUT IN TIME GETS FUZZIER AND FUZZIER

- 2023 Scheduled accelerator down starts on March 20th
 - Adding two C100 modules (i.e. 100 MeV of gradient each)
 - Upgrading the injector of the machine getting ready for the MOLLER experiment
- 2023 Resumption of Physics Planned for July 21st
 - Same energy as 2022, but mostly two hall running and now plenty of overhead from the two new C100's.
 - Hall D is doing detector upgrades for their 2024 GlueX 2
 - Hall C NPS experiments: E12-06-114, E13-010, and E12-22-006
 - Hall B Run Groups D, K, and E ([discription experiments in the run groups](#))
 - **D = Color Transparency & Nuclear TMD's**
 - E = Quark formation and hadron formation (nucleus as the laboratory)
 - K = DVCS, Nuclear Resonances
 - Hall A SBS experiments E12-17-004 (GEN-PR) and E12-20-008 (K_{LL})
- 2024 SAD tentatively starts March 17th
 - After two new C75's, CEBAF should be back to a true 2.2 GeV / pass machine (i.e. 12 GeV)
- 2024 Resumption of Physics Late July / Early August
 - Hall A: GEP-V once finished and start Moller detector installation
 - Hall B: **RG-L (ALERT: Tagged EMC)** & RG-K
 - Hall C: **E12-11-107 (LAD)** & E12-06-104, **E12-06-107 (Color Transparency / Hadronization)**
 - Hall D: GLUE-X 2
- **Fall 2025 is a possible time for non-standard beam energy experiments**

Late 2025 / Early 2026 Moller Starts Physics (effects what can be scheduled in the other halls)

Some Upcoming Nuclear Highlights

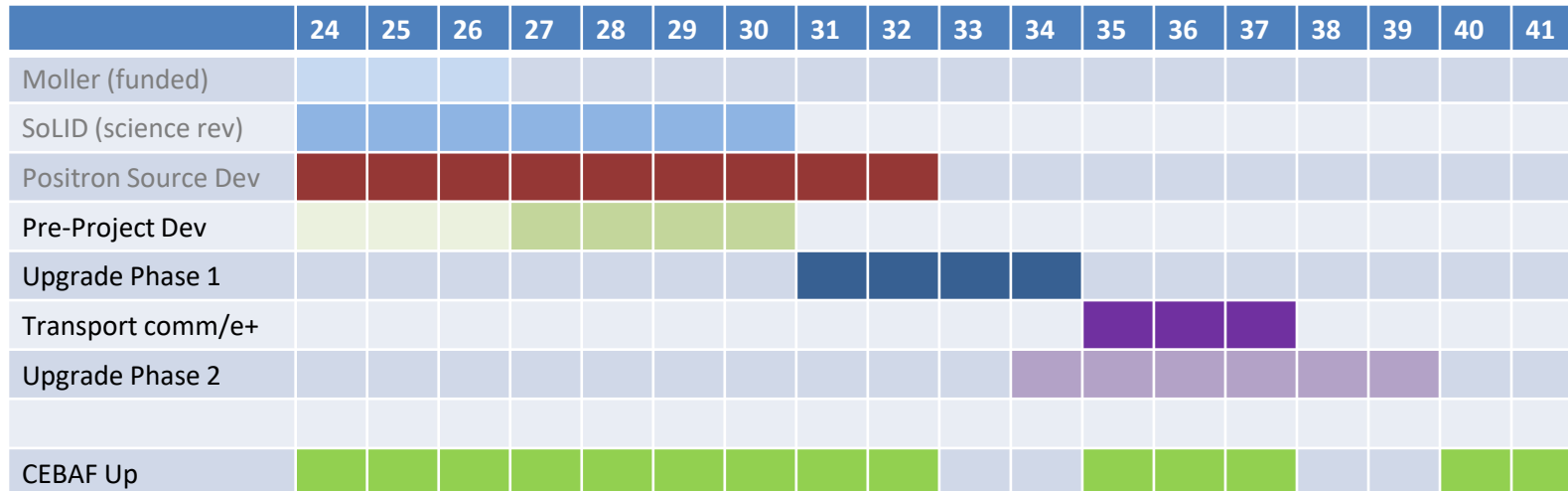
Beyond what is on the two-year published schedule.

- Tensor Polarized Deuteron in Hall C
 - Inclusive QE approved
 - Nathaly Santiesteban (UNH) looking into $(e, e'p)$
- Tritium and ^3He in Hall B
 - Getting the next JLab tritium target will take some years
 - We have discussed adding ^3He to ALERT
 - Also could be a run group experiment
- Polarized EMC Effect in Hall B (Lithium target)

And I think it would be great to see another nuclear run in Hall D (see Jackson talks)

Notional CEBAF Long Range Schedule

timeline from David Dean



- FY23 \$\$
- Phase 1: tie LERF to CEBAF & injector for e+ \$101M (\$78M – \$152M)
- Phase 2: High Energy Upgrade (includes FFAs) \$244M (\$188M – \$366M)
- Total cost (Class 4 estimate) \$345M (\$265M – \$517M)

Schedule assumptions based on a notional timing of when funds might be available (i.e. EIC construction cost ramp down)

Discussion: what else should we measure?

Quasielastic Scattering:

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