



# LERF

Operation of a High Current,  
Low–Energy Research Facility for  
Nuclear and Accelerator Research

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Staytreat, July 17, 2015

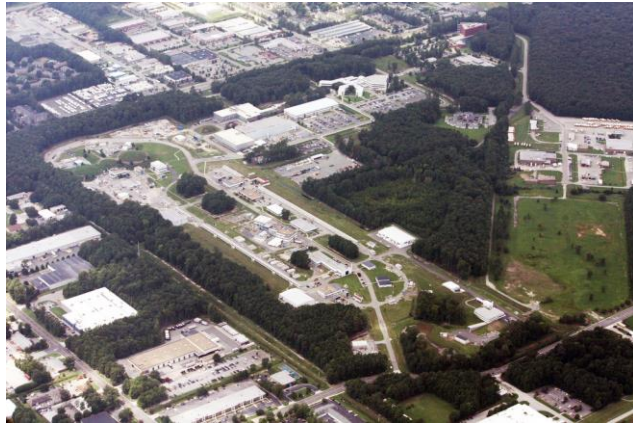
# LERF

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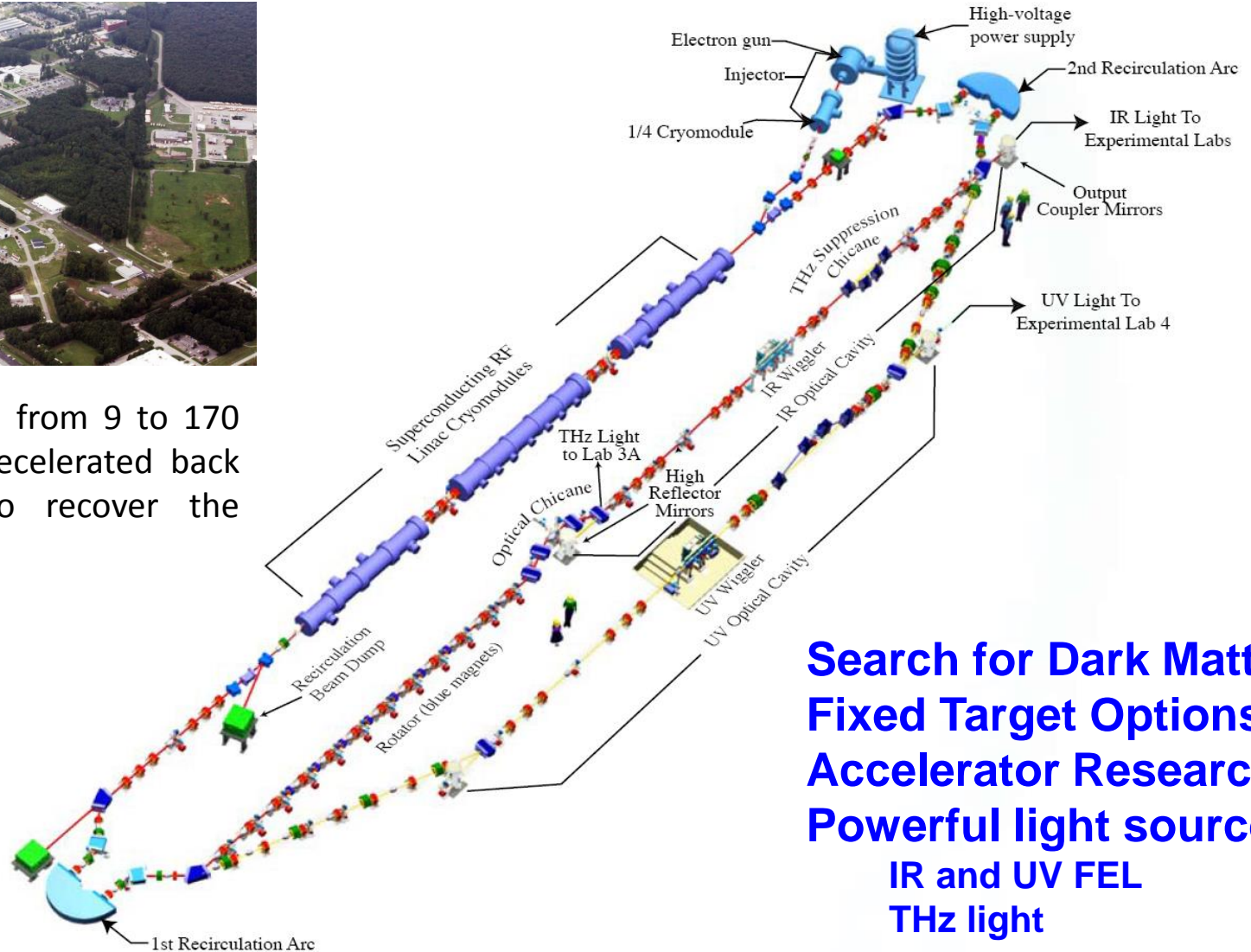
Ongoing activities include:

- **Darklight**
  - Beam-time request submitted
  - Resuscitation activities ongoing
  - Starting detailed beamline design and halo study
  - Internal readiness review being planned
- **Project E (EUVFEL design)**
  - Continuing design review activities under AES CRADA
  - Waiting for DOE approval of CRADA
- **Update on Isotopes**
  - Waiting for SBIR approval
  - Discussing with ONP on Isotope production
- **Other activities**
  - Diagnostic studies
  - Positron production
  - MEIC studies (LDRD)

# JLAB ERL: Low Energy Research Facility (LERF)



Beam accelerated from 9 to 170 MeV and then decelerated back to  $\sim 10$  MeV, to recover the energy



**Search for Dark Matter**  
**Fixed Target Options**  
**Accelerator Research**  
**Powerful light source**  
**IR and UV FEL**  
**THz light**

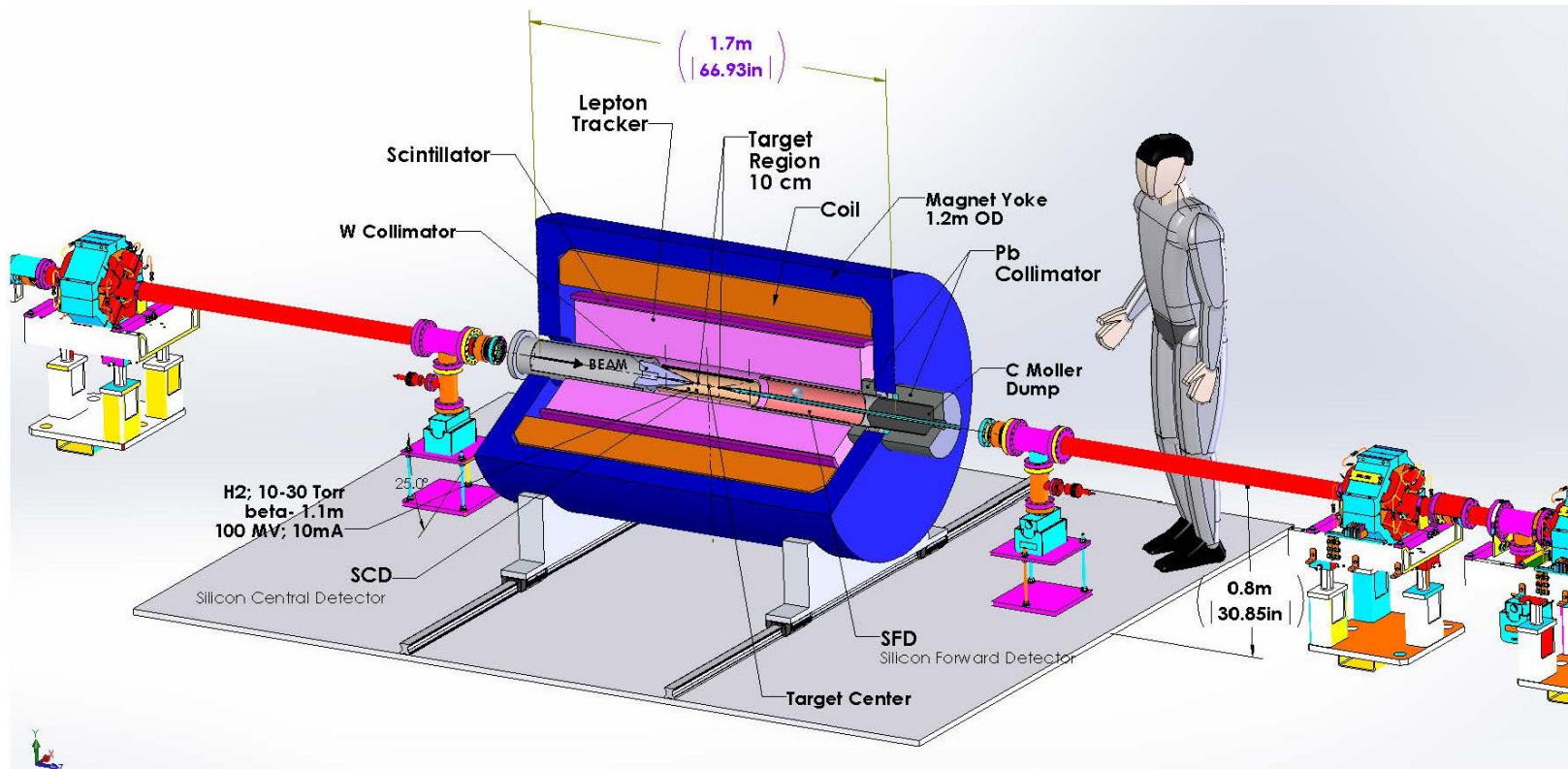
# LERF Capabilities

The ERL in the LERF is available for:

- Fixed target experiments at medium current (With new RSAD)
- Internal target experiments at high current
- Offline accelerator research and development
- Diagnostic development
- FEL studies in the IR and UV
- THz production,

Parameter	Maximum value
Current (ERL)	8 mA
Energy	170 MeV
Charge	150 pC
Frequency	75 (750) MHz
Current (fixed target)	0.5 mA

# Internal Targets - Dark Light

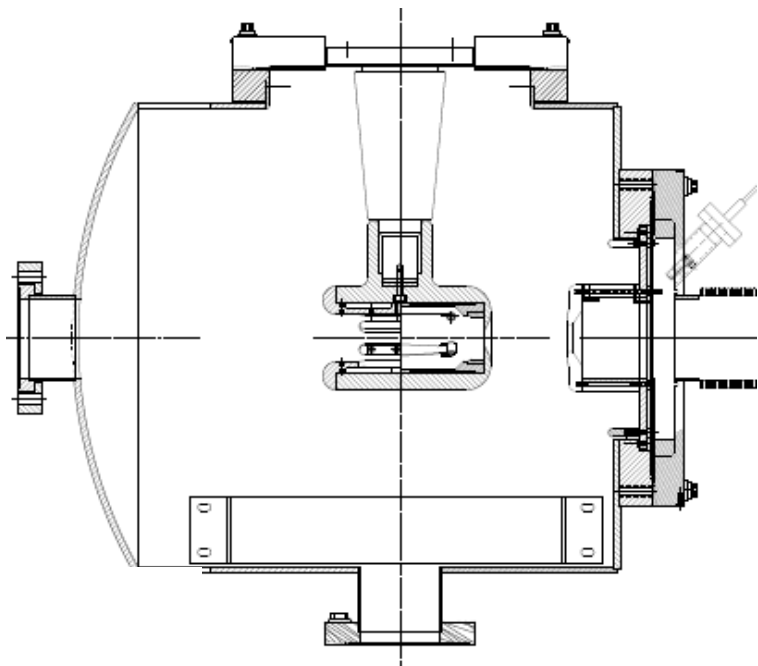


- 10 mA at 100 MeV : 1 MW beam power!!
- ERL + internal target makes this experiment possible



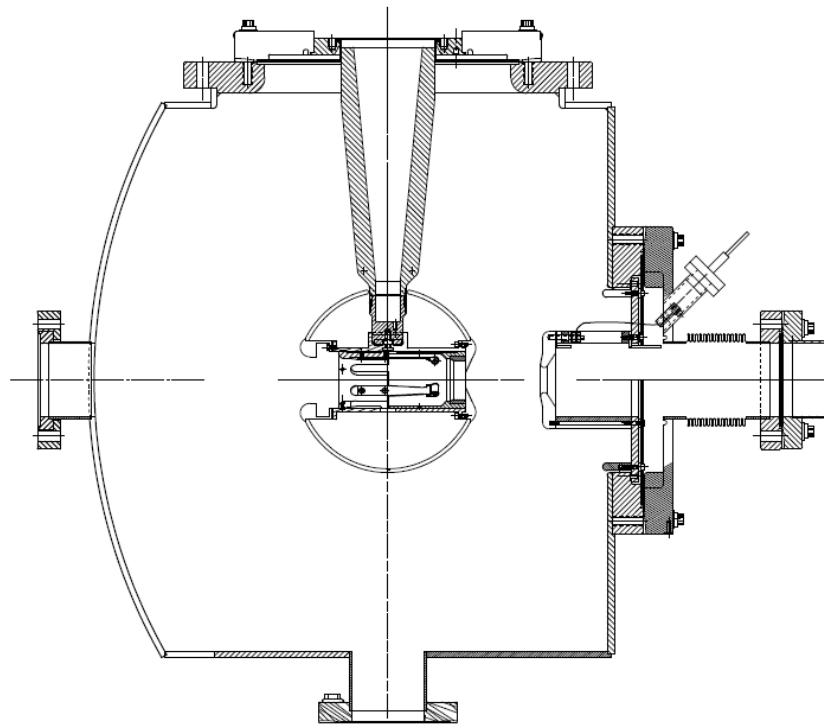
# Physics at JLAB Requires a 350 kV Photogun

CEBAF Inverted 200 kV DC  
Load Lock Inverted Photogun



Building **two** 350 kV DC  
Load Lock Inverted Photoguns

Incorporates CsK<sub>2</sub>Sb and GaAs/GaAsP SLL



- Longer "R30" insulator
- Spherical electrode
- Thin NEG sheet moves ground further away
  - **Maximum Field strength ~ 10 MV/m**

# Dark Light Schedule

- Summer 2015 Resuscitate ERL
- Fall 2015 Recommission with beam, measure solenoid
- Late Fall 2015 Install magnets and re-arrange quads
- Winter 2015-16 Commission with solenoid on
- Early Summer 2016 Run with internal target
- Late summer 2016 Run low current through DLC Möller target
- Summer 2017 Statistics run

## Parameter

Current (ERL)

Energy

Charge

Frequency

Energy spread

## Value

8 mA (10  $\mu$ A for Möller run)

100 MeV

120 (12) pC

75 (750) MHz

<0.1% rms



# Diagnostic Studies

The LERF provides a very flexible test-bed for testing out diagnostics that might be used on CEBAF or other machines. Examples include:

- High Dynamic Range viewer systems to see very low current halo
- Electro-optic sampling system can measure sub-picosecond bunches with no phase ambiguity
- New THz interferometers can measure very short bunches over a wide range of beam parameters.
- New scanning slits can be used to map out the phase space at locations with high space charge forces.



# LERF Operations Directives (LOD)

## Draft to Date - Safety

- All work is carried using standard work management tools (ATLis, OSPs, TOSPs, LOSPs, etc.). All ISM techniques are to be utilized.
- Two types of experiments:
  - PAC approved experiments that go through the usual Safety Review and scheduling (ESAD, TAC, scheduling committee, COO, etc.).
  - Outside WFO experiments that are reviewed for safety and then scheduled by the run coordinator.
- Laser Safety coordinated by the Laser System Supervisor (LSS) with the Jlab Laser Safety Officer. Use LOSPs and LPSS to manage the laser use.
- Overall operations is subject to the FSAD and ASE for the facility. Some experiments required an RSAD. Readiness reviews might be required depending on the uniqueness of the task.
- PSS, Radcon, ARMs, and ODH setup is similar to CEBAF. Have Rapid Access system for most of the machine.

# LOD to Date (Personnel)

- The basic philosophy is to treat the LERF as a fifth hall. There are therefore:
  - LERF Hall leader
  - Experiment lead scientist
  - LERF Operations coordinator
  - LERF Run coordinator (2 week appt.)
  - LERF Accelerator-Physics Experiment Liaison (APEL)
  - LERF Work coordinator
  - LERF Geographic Integrator
  - LERF Operator
  - FEL Laser Operator
  - LERF Scientist on Shift (LSOS)
  - System owners
- Most these are the same as for any other Hall. It is possible to have one person handle more than one job here.
- Meet at 8:30 in LERF break room

# LOD to Date (Configuration)

Note: All this will require significant work before it is available. Remember, patience is a virtue.

- Hope to have a LERF-specific Hot Checkout system
- Will have a LERF Element Database (LED).
- Modifications and updates to LED same as for CED.
- Presently have Monticello type control interface. We hope to move to a Jtabs type interface in the long run.
- Use OPS-PR and ATLis for trouble accounting and work control.

# LOD to Date (Operations)

Operations may be conducted from the MCC or from the LERF control room (crew chief's choice). Some details:

- Need FEL Laser Operator in LERF to operate the FELs
- May have Hot Standby Operator during some periods. Can be CEBAF Operator concurrently.
- Need separate LERF operator during LERF operations. Cannot act as CEBAF operator concurrently.
- When CEBAF is not running, we still must have a crew chief.
- Schedule is on LERF whiteboard.
- All this implies increased staffing if LERF runs in parallel with CEBAF.

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