

# Hall D Status

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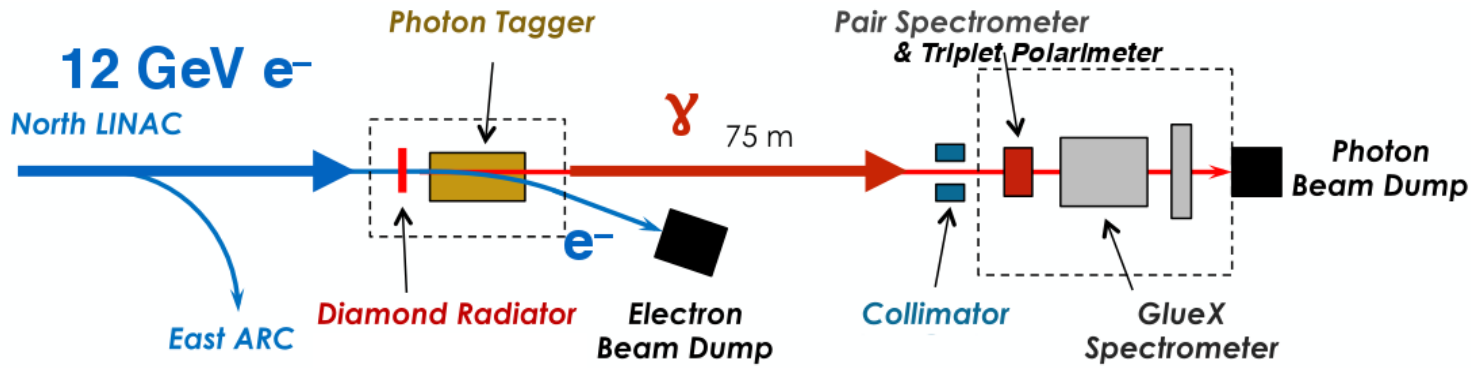
# Overview

- Brief JLAB Status
- Hall D facility
- Approved physics program
- Physics Division Readiness Review
- Budgeting and staff
- Schedule

# JLAB Status

- JLAB is in MEDCON2 (new definitions of the levels)
  - Masks are not required, except for working at <3 ft from other people
  - Daily self-certification is still required
  - Users are allowed on site
  - Vaccination status does not need to be reported in order to work on site
- Hybrid and remote work policy for staff, formalizing the “remote work” conditions and requirements. Four categories, with a number of requirements. Formal agreements with the supervisors required.
  - Dedicated 100% on-site
  - Flexible: > 60% on-site
  - Remote: < 60% on-site, within commuting distance, no permanent office
  - Virtual: anywhere
- Lab is involved in EIC construction
  - NP long range plan may include EIC project recommendation and EIC Detector-2 Initiative
  - \$33M to EIC from Inflation Reduction Act (IRA)
- Lab management as well as users are interested in energy upgrade
  - NP long range plan may include CEBAF Energy Upgrade Initiative
- Budget:
  - For current lab budget Continuing Resolution till mid December
  - MOLLER experiment is funded by IRA (\$31.2M)
  - CEBAF Renovation and Expansion project is funded by IRA (\$10M)
  - Laydown Yard Expansion will receive \$2.2M from IRA.

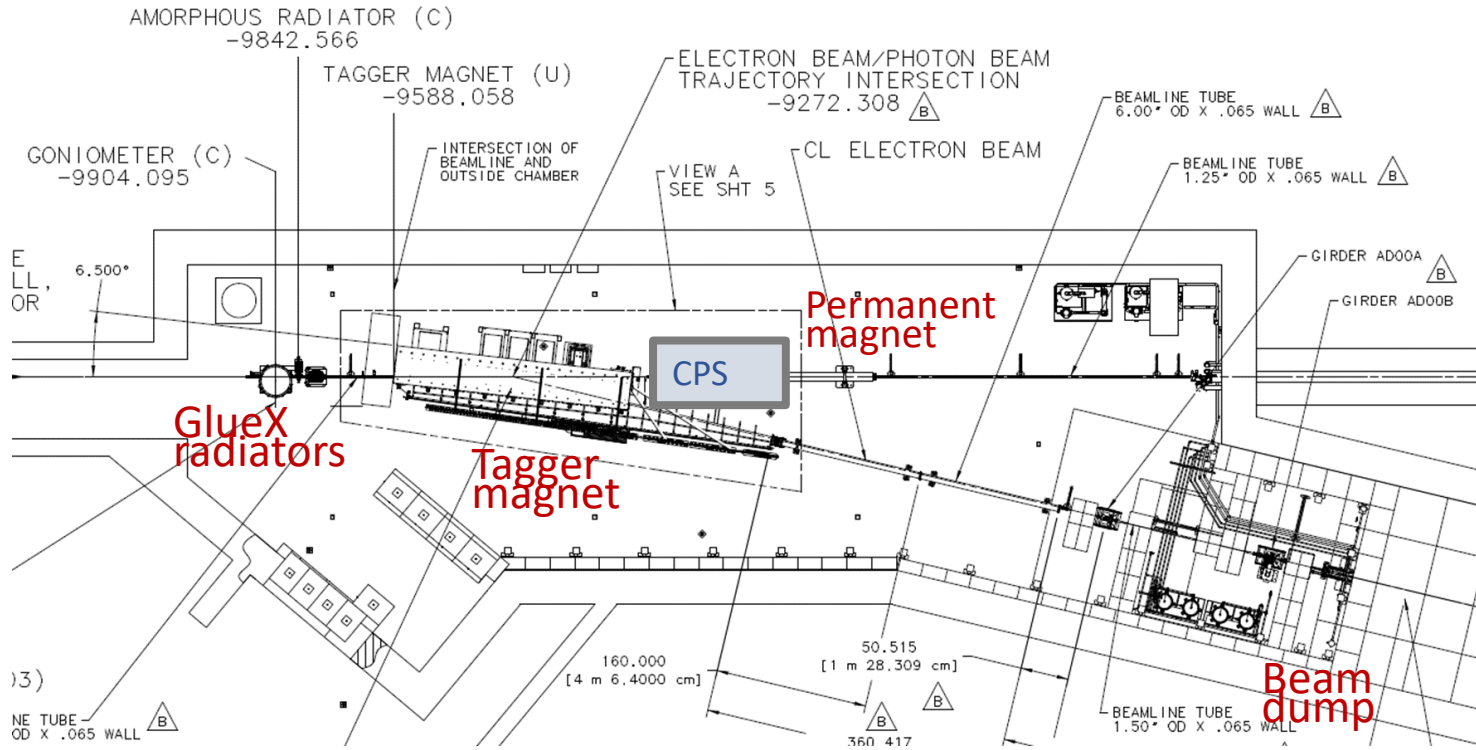
# Hall D Apparatus



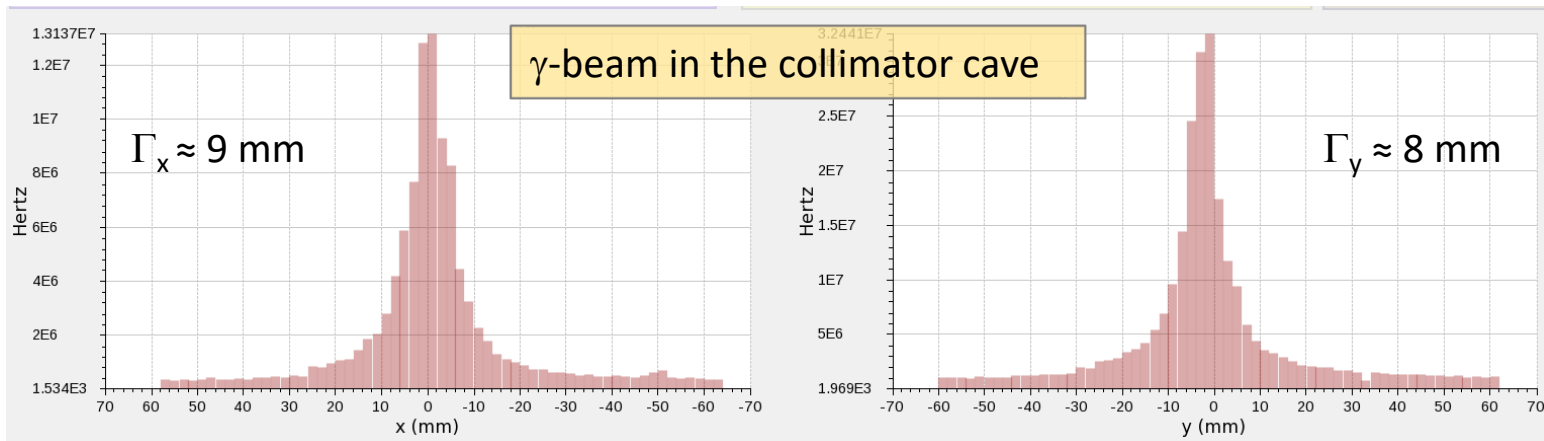
- Hall D complex consists of two halls:
  - Tagger Hall for photon beam creation
  - Hall D for particle and event detection
- Acceptance:  $1^\circ < \theta < 120^\circ$
- Resolutions for  $h^\pm$ :  $\sigma_p/p \approx 1 - 3\%$
- Resolutions for  $\gamma$ :  $\sigma_E/E \approx 6\%/\sqrt{E} + 2\%$
- Trigger: photoproduction at  $E_{\text{BEAM}} > 7 \text{ GeV}$
- In 2020: 85 kHz (signal + EM background)



# Hall D Beam



- Linearly polarized photon beam for GlueX produced 75m upstream of the main hall.
  - The beam could have circular polarization as well.
- Beam bunches normally are spaced 4ns apart
- There is a couple of nA bleedthrough from the other halls.
- 1mm x 0.5mm beam size in  $\sigma_x$  and  $\sigma_y$  at the GlueX radiator
- Beam also could be rastered upstream of the tagger hall using FFB magnets.
  - Rastering using 5C11B correctors is being developed for GlueX.
- Can run 5 $\mu$ A e-beam on the tagger dump.
- Photon beam monitor at the entrance to Hall D



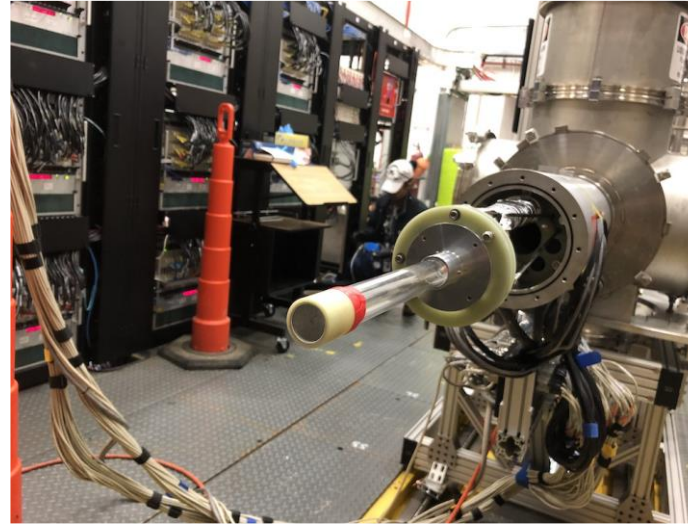
- Hall-C style CPS could be placed in the tagger hall where there is sufficient room for it.
- A larger design could probably be accommodated as well.
- Will need to optimize the length and the gap size for CPS.

# Hall D Targets

LH2, LD2, LHe  $\varnothing 15 \times 300 \text{ mm}$



Be  $\varnothing 25.4 \times 17.75 \text{ mm}$

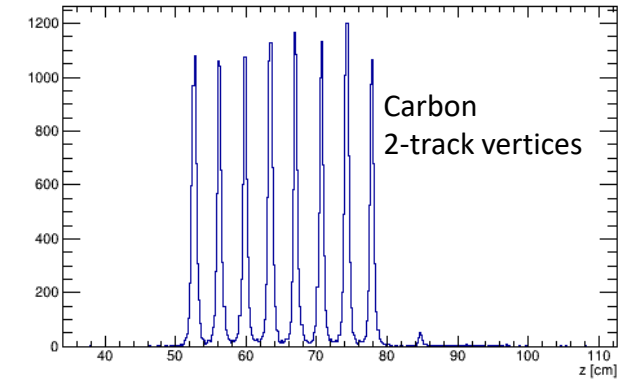


$^{12}\text{C}$   $8 \times \varnothing 20 \times 2.3 \text{ mm}$



| Target | Experiment            | Thickness |                        | Neutron<br>Radiation,<br>relative |
|--------|-----------------------|-----------|------------------------|-----------------------------------|
|        |                       | RL        | $\text{g}/\text{cm}^2$ |                                   |
| LH2    | GlueX, PrimeX- $\eta$ | 3.5%      | 2.1                    | 1                                 |
| LD2    | SRC                   | 4.1%      | 5.1                    | 2.4                               |
| LHe    | PrimeX- $\eta$ , SRC  | 3.7%      | 3.5                    | 1.7                               |
| Be     | PrimeX- $\eta$        | 5.0%      | 3.3                    | 1.6                               |
| Carbon | SRC                   | 7.9%      | 3.4                    | 1.6                               |
| Lead   | CPP/NPP               | 5.0%      | 3.2                    | 1.5                               |

z for  $r < 0.5 \text{ cm}$



$^{208}\text{Pb}$   $\varnothing 25.4 \times 0.3 \text{ mm}$



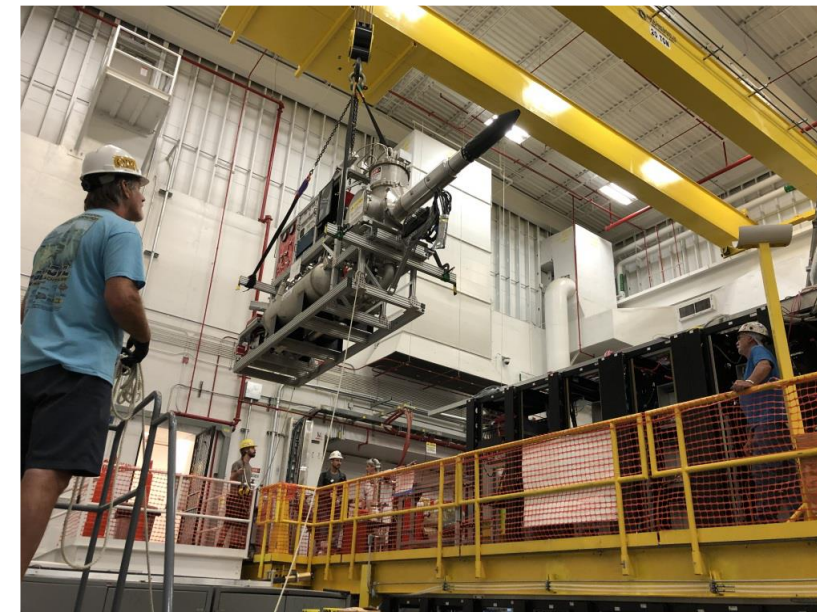
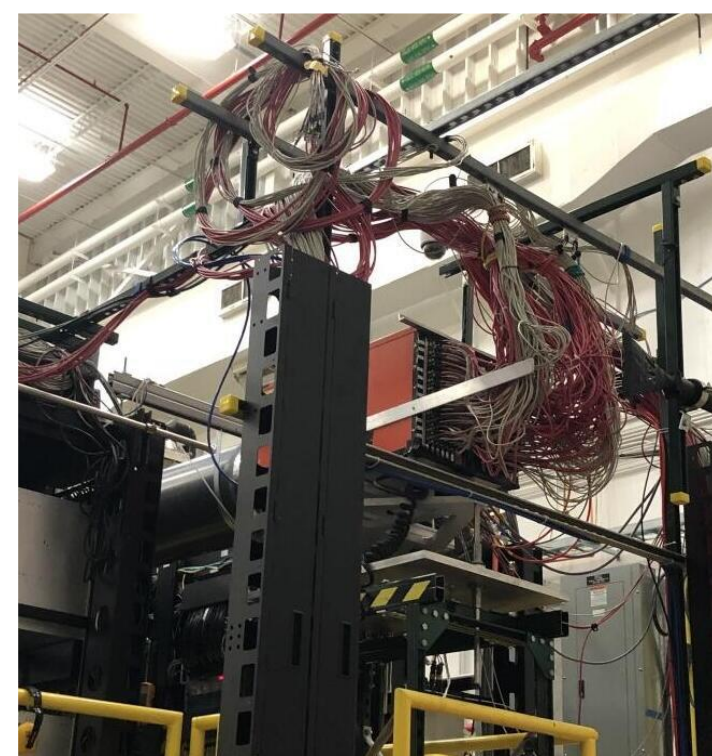
- Polarized target in the distant future (REGGE)

# Physics program

| Experiment   | Title  | PAC Rating | PAC days | PAC # | Data taken |
|--------------|--|------------|----------|-------|------------|
| E12-06-102   | Mapping the Spectrum of Light Quark Mesons and Gluonic Excitations with Linearly Polarized Photons | A          | 120      | 30    | 100%       |
| E12-12-002   | A study of meson and baryon decays to strange final states with GlueX in Hall D                    | A          | 220      | 42    | 33%        |
| E12-13-003   | An initial study of hadron decays to strange final states with GlueX in Hall D                     | Grp        | 200      | 40    | 0%         |
| E12-13-003 A | A Eta Decays with Emphasis on Rare Neutral Modes: The JLab Eta Factory (JEF) Experiment            | Grp        | 100      | 45    | 0%         |
| E12-10-011   | A Precision Measurement of the eta Radiative Decay Width via the Primakoff Effect                  | A-         | 79       | 35    | >80%       |
| E12-13-008   | Measuring the Charged Pion Polarizability in the $\gamma\gamma \rightarrow \pi^+ \pi^-$ Reaction   | A-         | 25       | 40    | 100%       |
| A            | Measuring the neutral pion polarizability  | Grp        |          | 48    | 100%       |
| E12-19-003   | Studying Short-Range Correlations with Real Photon Beams at GlueX                                  | B+         | 15       | 47    | 100%       |
| E12-19-001   | Strange Hadron Spectroscopy with Secondary KL Beam in Hall D                                       | A-         | 200      | 48    | 0%         |
| E12-20-011   | Measurement of the high-energy contribution to the Gerasimov-Drell-Hearn sum rule                  | A-         | 33       | 48    | 0%         |

# Upcoming Hall D running

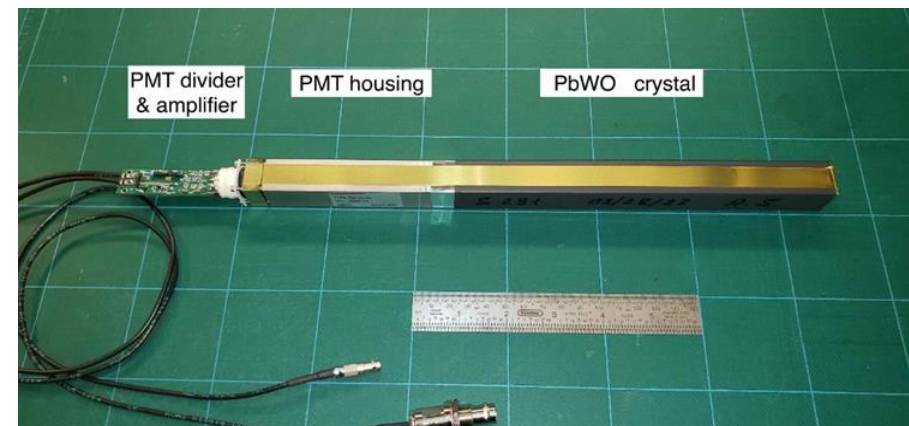
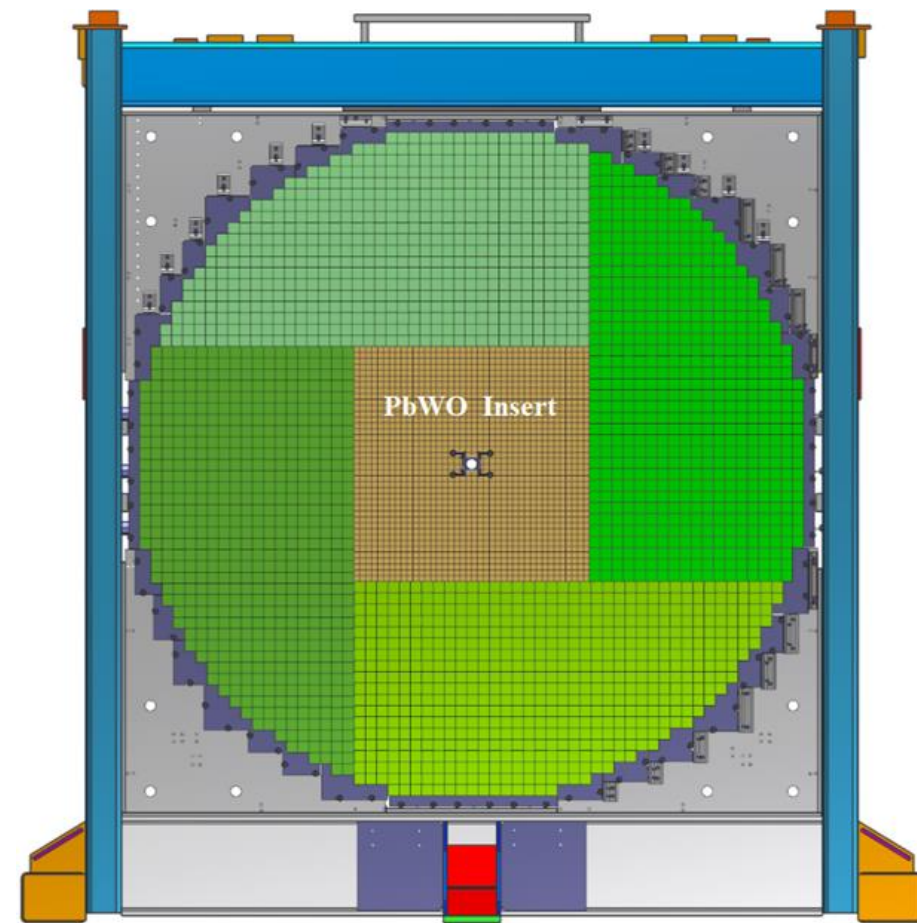
- Finish PrimEx- $\eta$  run (113 calendar days), currently running in Hall D
- Changeover to GlueX-II before and after holidays
  - TAGM full restoration
  - DIRC installation
  - COMCAL removal?
  - Target cell change?
- GlueX-II run lasting just 63 calendar days
- FCAL upgrade
- GlueX-II run conclusion with FCAL-2
- KLF installations and running
- Deinstall KLF, install and run REGGE





# FCAL-2 Upgrade

- Install an array of 40 x 40 PbWO<sub>4</sub> modules in the inner part of the FCAL (replace lead glass modules)
  - ✓ 2 cm x 2 cm x 20 cm PbWO<sub>4</sub>
  - ✓ 4 cm x 4 cm x 45 cm lead glass
- A factor of 4 better detector granularity
  - ✓ significantly improve shower separation
  - ✓ improves the energy and position resolutions by about a factor of 2
- Use COMCAL as a prototype for the design.
- Most of the procurements are complete.
- A lot of work to be done during next 18 months
  - ✓ FCAL will need to be disassembled and reassembled with a new frame end dark room.
  - ✓ Start installation in May of 2023 and end in May of 2024



# KLF and Hall D

- Capital construction budget for KLF - \$2M (expected but not certain)
  - JLab: capital funding - \$0.4-0.7M/FY, started in FY23: 2023-2026
  - The FY23 budget should provide KLF capital funding of \$400K, budgets not confirmed yet
  - External funding should be helpful.
  - Large spending contingent on Phase 1 ERR review
    - We are not allowed to spend significant amount before this review.
- Operations budget for KLF for items that may also be used for other experiments.
- Current JLAB efforts
  - KPT: one designer is working on the model of the Be target assembly and on the technical design the beamline in Hall D.
  - CPS: conceptual design needed before engineering design and procurements
    - Tim and Hovanes are helping with CPS conceptual design
  - Other elements: Lab will address the tasks depending on resources
- 2025: earliest finishing of the approved photon beam experiments
  - Includes a break for the FCAL2 installation
  - Often schedules gets delayed, it is not a guaranteed date

# Hall D budget and staffing

- FY23 capital budget
  - KLF Designer's work
  - Laser procurement for KLF
  - KLF equipment for the collimator cave
- Hall D Staff:
  - Scientific group:
    - 13 staff scientists and 1 postdocs
    - Mark Ito and Elton Smith retired
    - New staff scientists hired: Boris Grube, Malte Albrecht and Igal Jaeglé
    - One postdoc position opened and advertised in October
    - Supported: 3 university postdocs and one tech (all at a 50% level)
  - Technical group:
    - 1 mechanical engineer, 1 designer, and 6 techs
    - Mark Stevens is retiring next month

# NPD Reviews

- Physics division requires multiple reviews in certain cases.

- At the design phase

- Identify risks and mitigation measures.

- Construction phase

- Verify that the construction is on track and that the equipment will be ready for beam

- Before starting the experiment

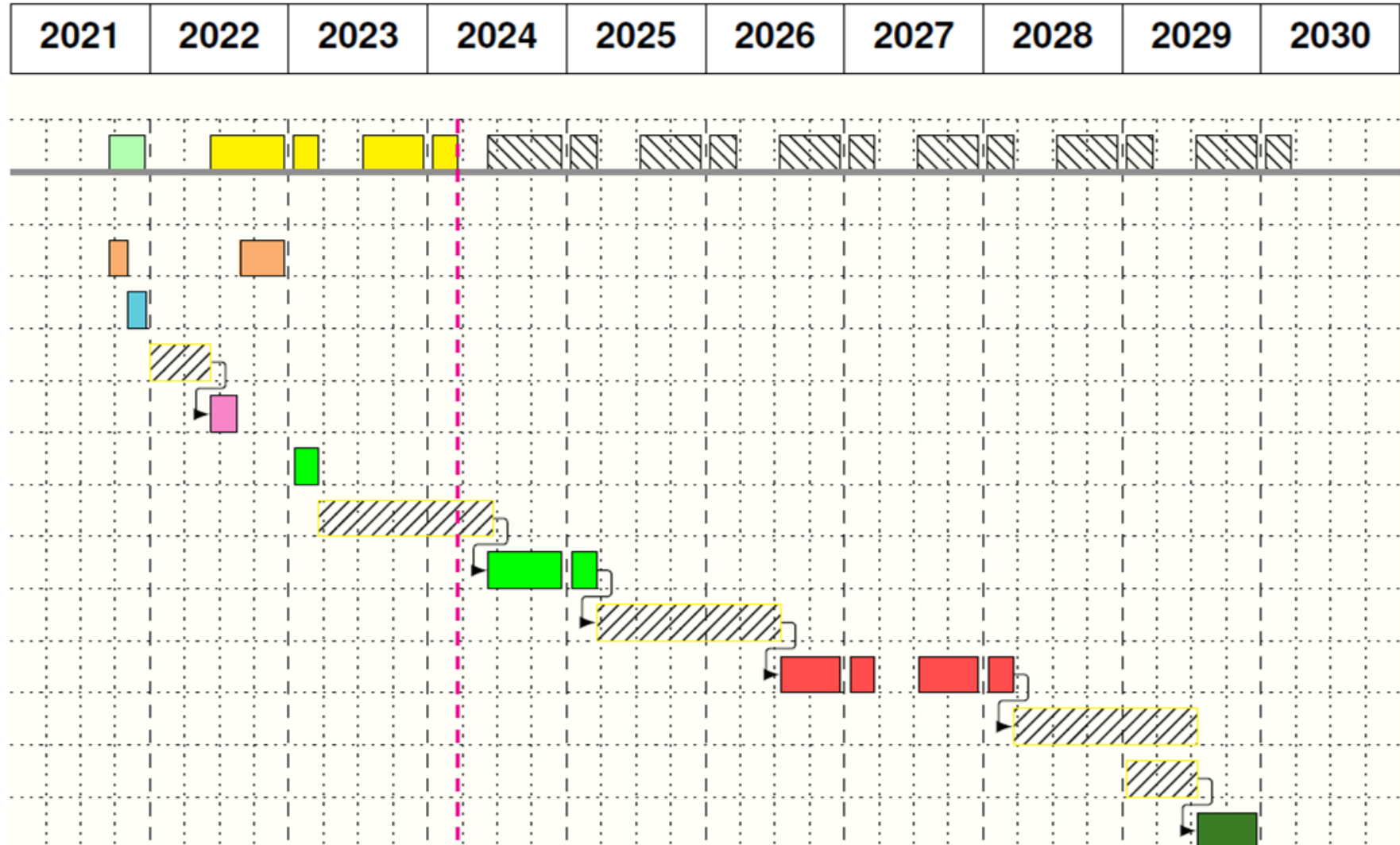
- All JLAB experiments undergo this review before Experiment Readiness Clearance is issued.
- All procedures need to be well defined and documentation need to be complete.

| Preliminary Planning Phase  |  | <ul style="list-style-type: none"> <li>Exp. Description and Requirements</li> <li>Exp. Readiness Review Calendar</li> </ul> |  |   |  |
|---|--|---|--|---|--|
|   |  | When is ERR?  | Need   | Requirements/Outcome  | What to do   |
|   |  | <b>N. 1:</b><br><br>Before construction phase starts <b>or</b> existing equipment with high risk                            | <ul style="list-style-type: none"> <li>If the experiment includes one-of-a-kind equipment with potential novel safety implications (examples: SC magnets, tritium or high-power cryogenic targets).</li> </ul> | <ul style="list-style-type: none"> <li>Fabrication of the equipment can start or it is deemed to be acceptable for use at the lab.</li> </ul> | <ul style="list-style-type: none"> <li>Provide the complete conceptual design of the full equipment. Decommissioning plans for target and activated components must also be developed as appropriate.</li> <li>Carry out a safety analysis of the proposed equipment design, identify safety issues and incorporate mitigating measures necessary to be operated in planned experiment.</li> <li>Provide manpower and resource requirements for equipment fabrication</li> </ul> |
| Design Phase  |  |   |  |   |  |
| From NPD web site:<br><a href="https://www.jlab.org/physics/experiment_process/np-pfx-chart">https://www.jlab.org/physics/experiment_process/np-pfx-chart</a> |  |   |  |   |  |

# Phase 1 ERR by Nuclear Physics Division

- Review is requested by NPD in January or February 2023
  - This is the Review in the designing/planning phase
    - Does not put KLF on the firm experiment schedule
  - Permission to spend significant amount of NPD money on KLF
  - Patrizia Rossi from NPD is organizing the review
- Conceptual designs of JLAB-built KLF components will be reviewed
  - The designs do not have to final, design modification are possible before Phase #2 ERR.
  - Beamline, CPS and KPT are to be build by JLAB
    - Risk factor and mitigation measures
  - Kaon Flux Monitor will be provided by UK
    - May not be a part of the review
  - Cost estimates
  - Not clear if the accelerator progress will be reviewed as well.
- Estimates of heat deposition, cooling and radiation environment will need to be presented.
  - Not clear if the radiation levels at the lab boundary and to what precision need to be evaluate by RadCon group for the review.
  - This meeting should help defining the charge for the review.
- It is highly desirable to have a document on the CPS conceptual design for the reviewers.
- The charge to the committee has not yet been finalized.

# Hall D plans



Approved schedule

- Assumed 35 weeks/year for Hall D running 2024/06-2025/03 and 30 weeks afterwards

- Assumed timely budgeting for KLF and REGGE

- Assumed timely construction of JEF,KLF,REGGE

# Summary

- Hall D experimental facility so far has been performing well.
- Most of the physics data for meson production/GlueX program has been collected
  - GlueX Collaboration is working on the publications
  - GlueX analysis effort underwent a successful review by JLab.
- Upgrade of the FCAL starts next year
  - FCAL2 procurements from capital budget are complete.
  - FCAL2 modules construction is almost complete.
- The NPD Phase 1 ERR of KLF is being organized, expected in January 2023
- KLF should be able to receive capital funding after successful review
  - Need a CPS conceptual design, preferably with a document, with cost estimates.
- Earliest start of KLF installation is in the middle of FY25.