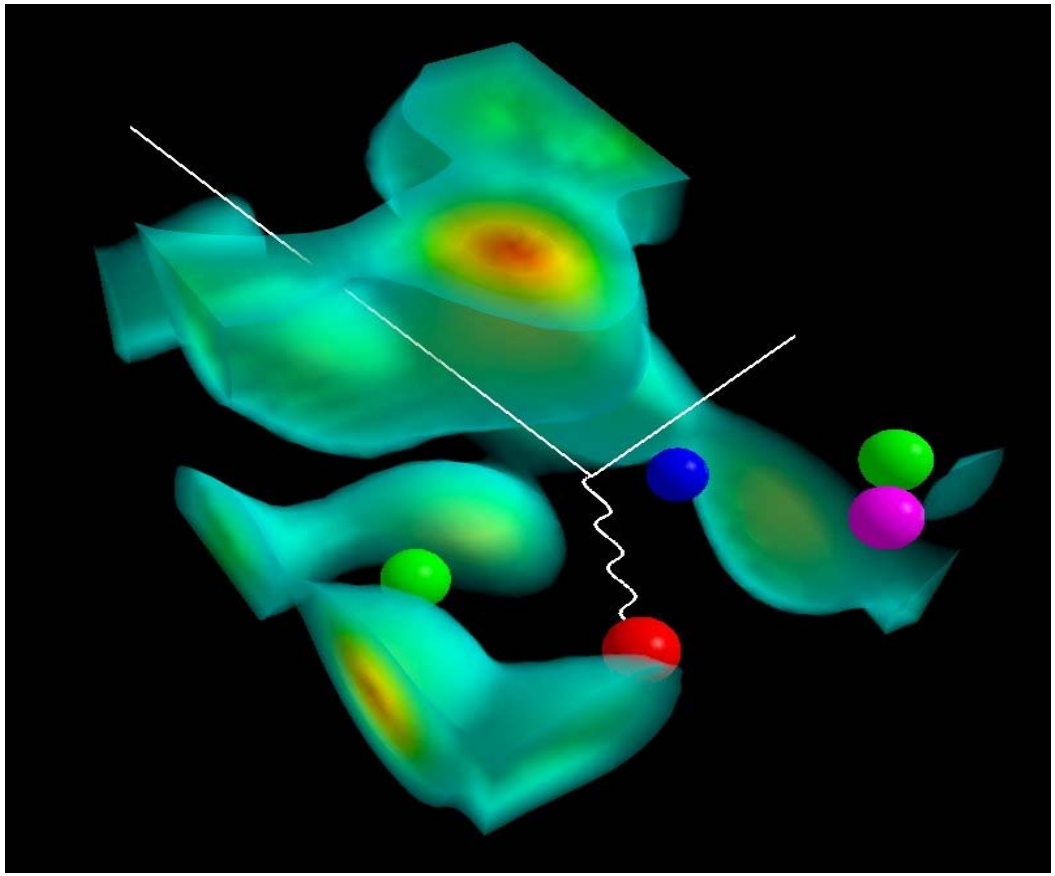
FEL User Meeting



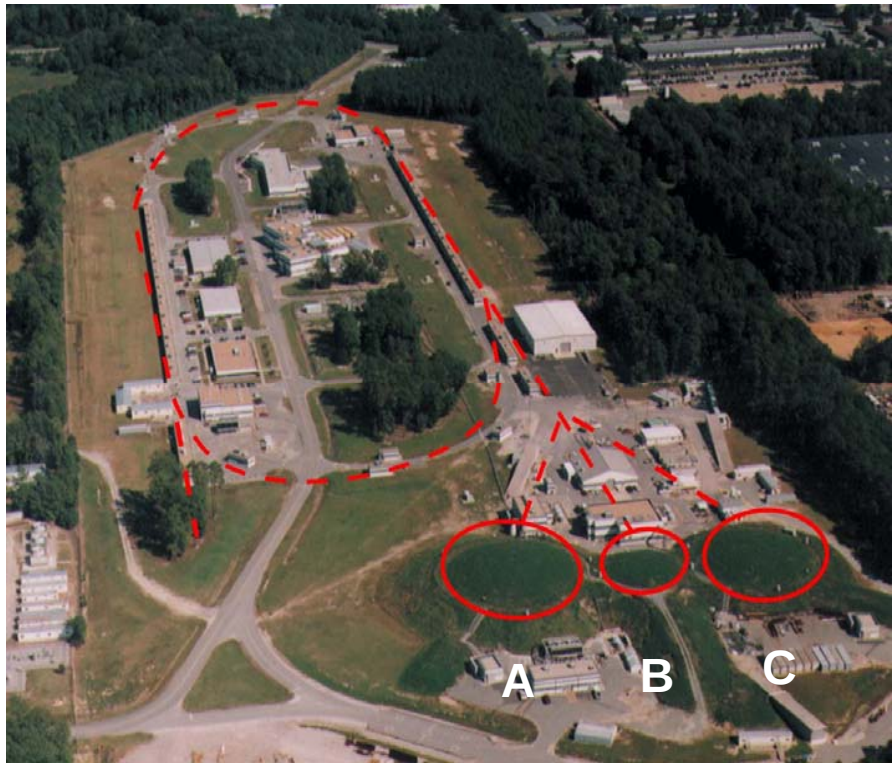
Anthony W. Thomas

Jefferson Lab : May 16th 2007

Jefferson Lab Today

2000 member international user community engaged in exploring quark-gluon structure of matter

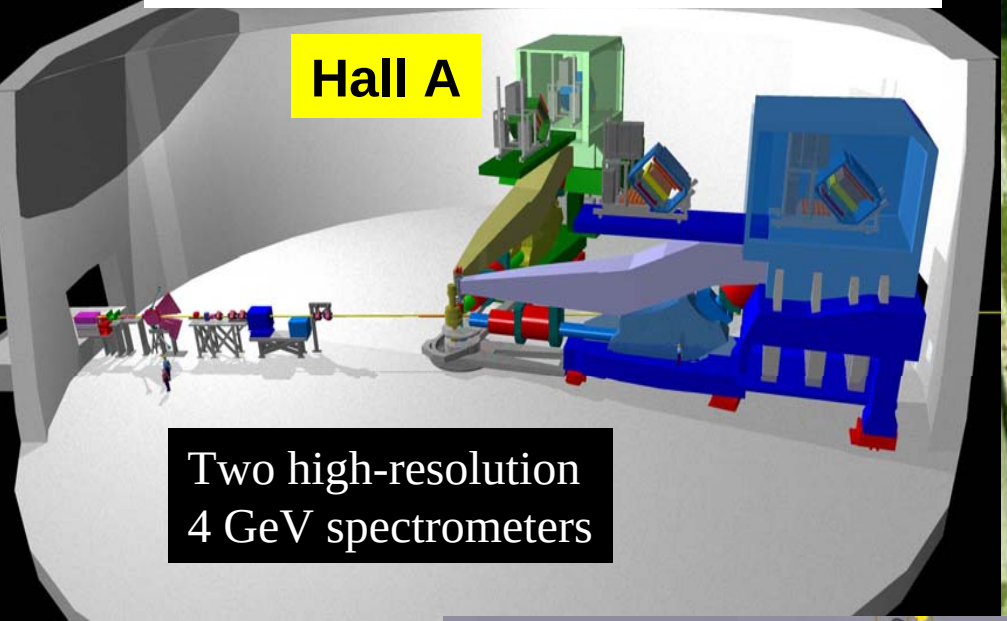
Superconducting accelerator provides 100% duty factor beams of unprecedented quality, with energies to 6 GeV



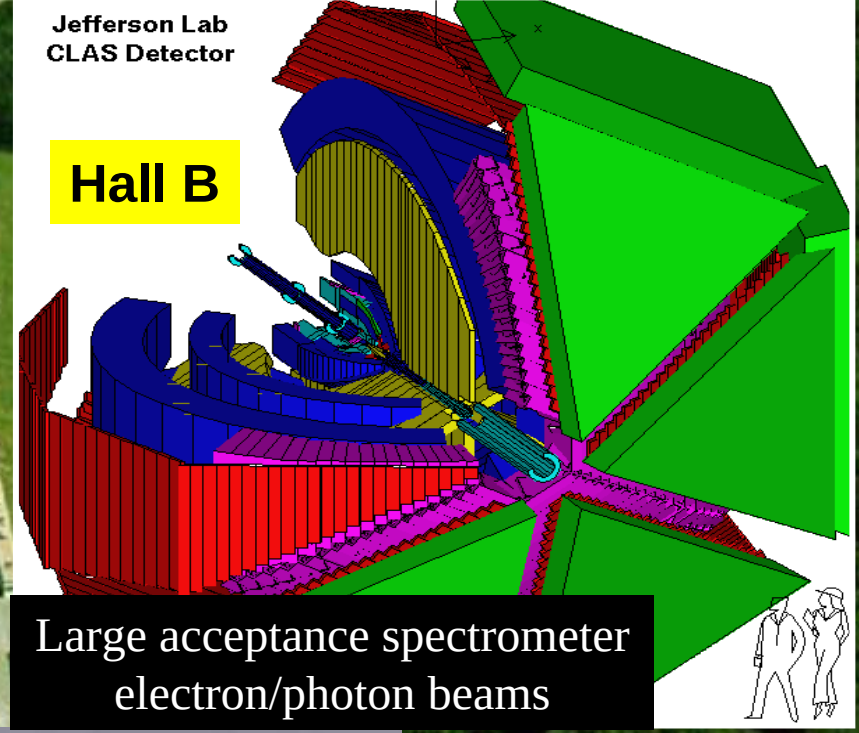
CEBAF's innovative design allows delivery of beam with unique properties to three experimental halls simultaneously

Each of the three halls offers complementary experimental capabilities

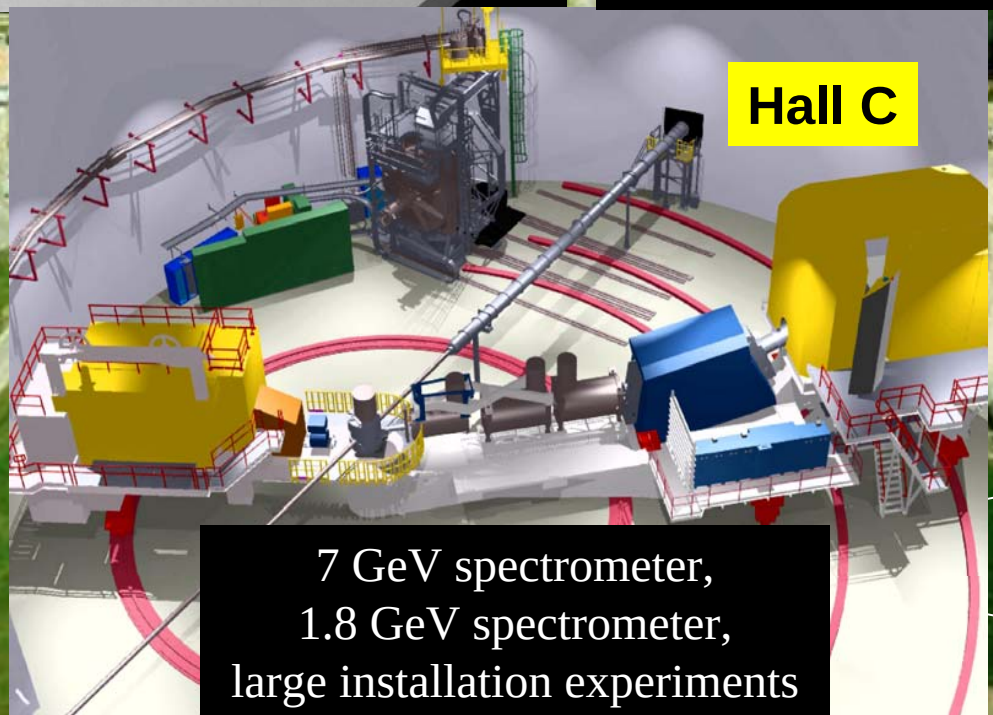
Jefferson Lab Today



Two high-resolution
4 GeV spectrometers



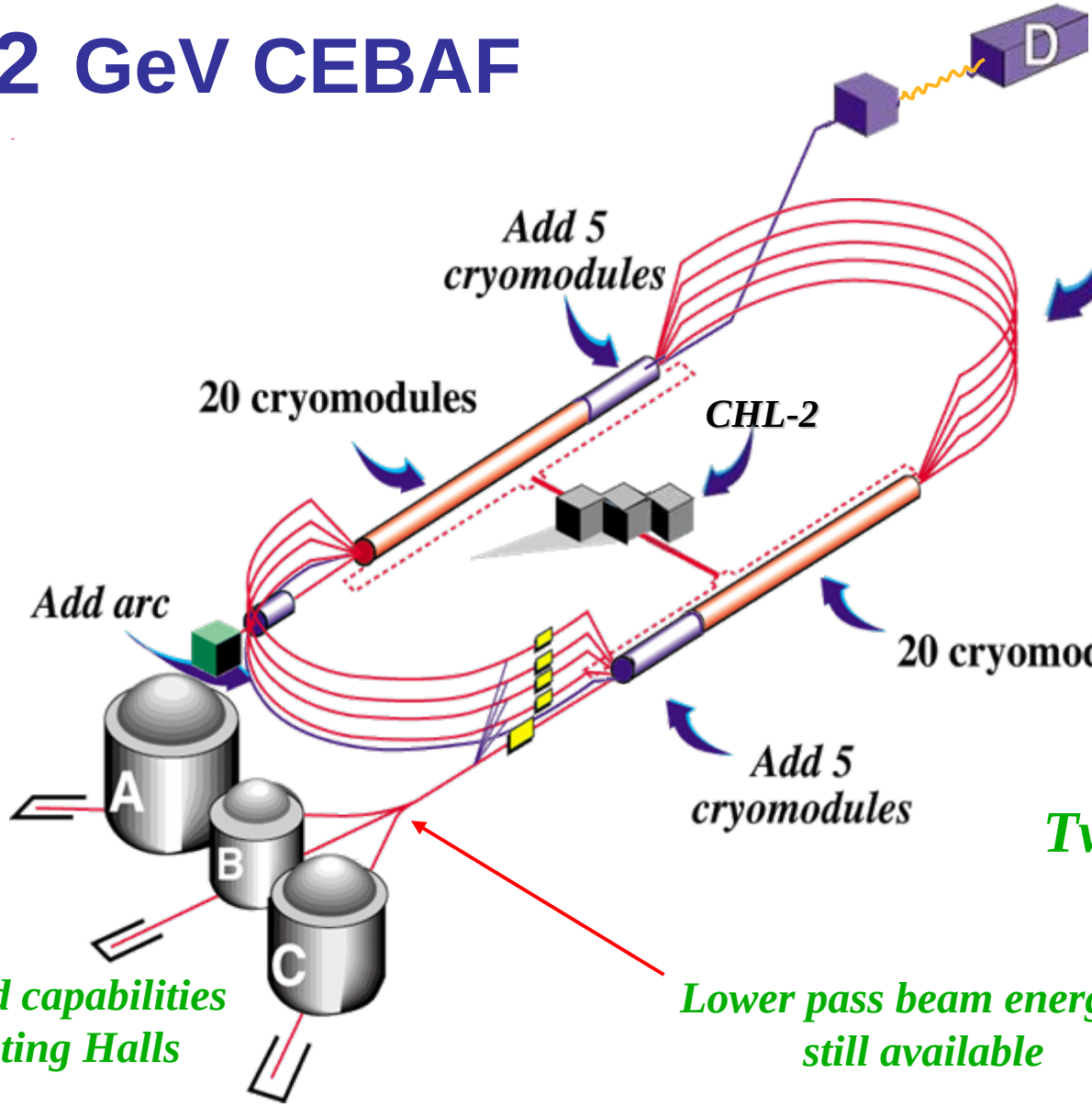
Large acceptance spectrometer
electron/photon beams



7 GeV spectrometer,
1.8 GeV spectrometer,
large installation experiments

C

12 GeV CEBAF



Two 1.1 GV linacs

Enhanced capabilities in existing Halls

Lower pass beam energies still available

Recommendations (NSAC Resolution Cttee)

- **We recommend the completion of the 12 GeV Upgrade at Jefferson Lab. The Upgrade will enable new insights into the structure of the nucleon, the transition between the hadronic and quark/gluon descriptions of nuclei, and the nature of confinement.**
- We recommend the construction of the Facility for Rare Isotope Beams, FRIB, a world-leading facility for the study of nuclear structure, reactions and astrophysics. Experiments with the new isotopes produced at FRIB will lead to a comprehensive description of nuclei, elucidate the origin of the elements in the cosmos, provide an understanding of matter in the crust of neutron stars, and establish the scientific foundation for innovative applications of nuclear science to society.
- We recommend a targeted program of experiments to investigate neutrino properties and fundamental symmetries. These experiments aim to discover the nature of the neutrino, yet unseen violations of time-reversal symmetry, and other key ingredients of the new standard model of fundamental interactions. Construction of a Deep Underground Science and Engineering Laboratory is vital to US leadership in core aspects of this initiative.
- The experiments at the Relativistic Heavy Ion Collider have discovered a new state of matter at extreme temperature and density—a quark-gluon plasma that exhibits unexpected, almost perfect liquid dynamical behavior. We recommend implementation of the RHIC II luminosity upgrade, together with detector improvements, to determine the properties of this new state of matter.

Recommendation 1

We recommend the completion of the 12 GeV Upgrade at Jefferson Lab. The Upgrade will enable new insights into the structure of the nucleon, the transition between the hadronic and quark/gluon descriptions of nuclei, and the nature of confinement.

A fundamental challenge for modern nuclear physics is to understand the structure and interactions of nucleons and nuclei in terms of quantum chromodynamics. Jefferson Lab's unique electron microscope has given the US leadership in addressing this challenge. Its first decade of research has already provided key insights into the structure of nucleons and the dynamics of finite nuclei.

Doubling the energy of this microscope will enable three-dimensional imaging of the nucleon, revealing hidden aspects of its internal dynamics. It will complete our understanding of the transition between the hadronic and quark/gluon descriptions of nuclei, and test definitively the existence of exotic hadrons, long-predicted by QCD as arising from quark confinement. Through the use of parity violation, it will provide low-energy probes of physics beyond the Standard Model complementing anticipated measurements at the highest accessible energy scales.

FEL

- **The FEL Program has made significant progress in power generation over the past year: world record 14.3 kW at 1.6 μm !**

- **FEL program continues to deliver broad benefits to the technical capability of accelerator based light sources worldwide:**
  Cornell, 4GLS, Aladdin, FSU, ANL LBNL, BNL…

- **Fred Dylla has moved on to become head of the AIP. George Neil is Acting Associate Director for the FEL with Gwyn Williams his Deputy (in charge of the Science Program as before)**

The Challenge

- **Finding funding for User operations continues to be a challenge**
  - **Most of the FEL funding has been from DoD with some funding from commercial interests, the Commonwealth, SURA and DOE/NP.**
  - **Congressional plus-ups have recently provided half of DoD support**
  - **ONR financial support has been and will continue to be goal oriented toward next generation FEL (capital funding not operations)**
  - **As a result the User Program has been inadequately funded**

FY08 and Beyond

- **FY08 DoD/ONR funding is projected to be significantly below requirements to operate current program and plus ups are uncertain. Most of staff will be focused on injector test stand efforts**

- **This should be a temporary setback:**
  FY09 and beyond look good for support with ONR plans to launch an FEL Innovative Naval Prototype.

- **Availability of beam time in FY08 is uncertain**

- **The development of a strategic plan for stable funding for FEL operations is underway and has support of the Lab Leadership Council**

Summary

- **This is a time of transition for the FEL, offering challenges and opportunities.**

- **FEL remains an incredible tool with unique capabilities and great potential for new and exciting basic and applied science.**
  - **Experiments we have been able to run have yielded significant results**

- **Lab management is committed to seeing that the FEL reaches its full potential as a scientific tool.**

- **We need User involvement in a serious way if this potential is to be realized!**