The ORION Facility

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AAC04, BNL Session on User Facilities, June 25, 2004

ORION Facility for Advanced Accelerator and Beam Physics Research

Location: Next Linear Collider Test Accelerator, SLAC

SLAC CENTRAL RESEARCH YARD

ORION Overview

- User-oriented research facility for understanding the physics and developing the technology for future high-energy particle accelerators

- The facility has as its centerpiece the Next Linear Collider Test Accelerator (NLCTA) at the Stanford Linear Accelerator Center (SLAC).

- The first experiment, the laser acceleration experiment E-163, is under construction and anticipated to start running in 2005 in the 60 MeV hall.

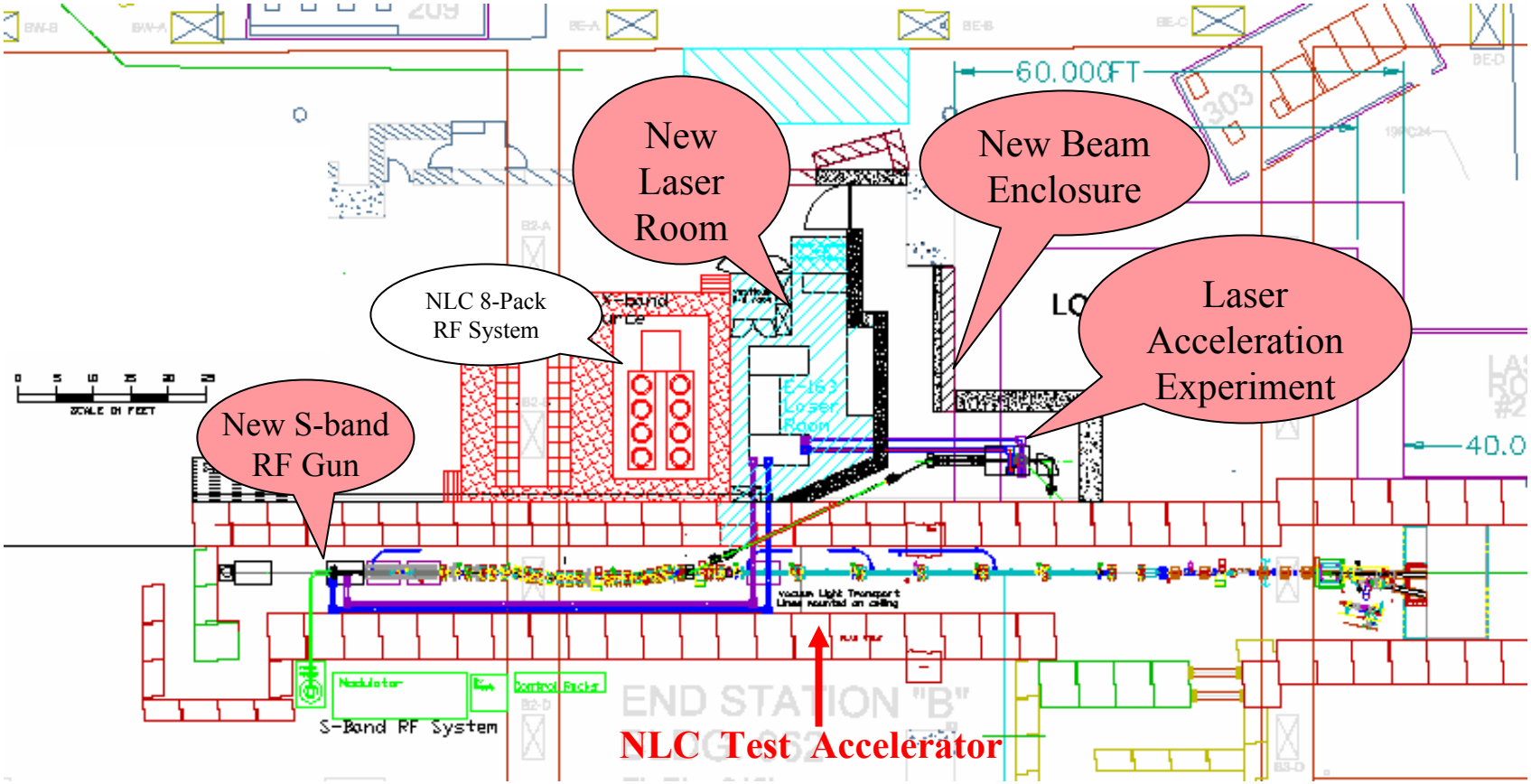
- Further development of ORION to include a 350 MeV experimental hall has been deferred by the Director due to funding priorities at SLAC.

General Design Parameters of the ORION Facility

http://www-project.slac.stanford.edu/orion/

Beam Energies	7 MeV (Source); 7-67 MeV (LE Hall); 67-350 MeV (HE Hall)
Charge per Bunch	0.25 nC optimum, adjustable up to a nominal maximum of 1 nC
Number of Bunches	1 or 2 (split charge)
Transverse Emittance	$< 2 \times 10^{-6}$ m , normalized rms (0.25 nC)
Bunch Length	1.8 psec, rms (0.25 nC)
Charge Stability	2.5% pulse-to-pulse
Bunch Timing Jitter	0.25 psec, rms
Repetition Rate	10 Hz
Average Beam Power	0.67 W at 67 MeV; 3.5 W at 350 MeV (1 nC bunches)
Electron Source	1.6 cell, S-band (2.856 GHz) Photoinjector , Mg cathode
Drive Laser	Commercial Ti:Sapphire, 266 nm wavelength, 1 mJ output
Source RF System	SLAC 5045 Klystron; Solid-State, NLC-type Modulator
Injector Linac	Two X-band (11.4 GHz), 0.9 m, 30 MV, NLC structures
High-Energy Linac	Four X-band, 1.8 m, 72 MV, NLC structures

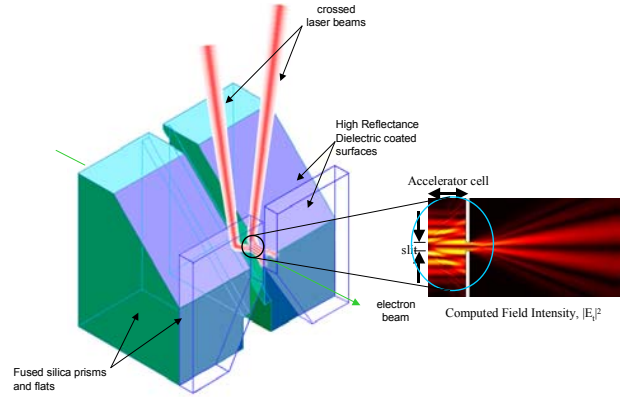
First ORION Experiment:
E-163, Laser Acceleration at the NLCTA

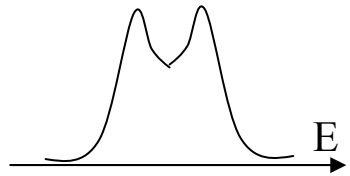


Several major E-163 components in place – anticipated start is mid-2005

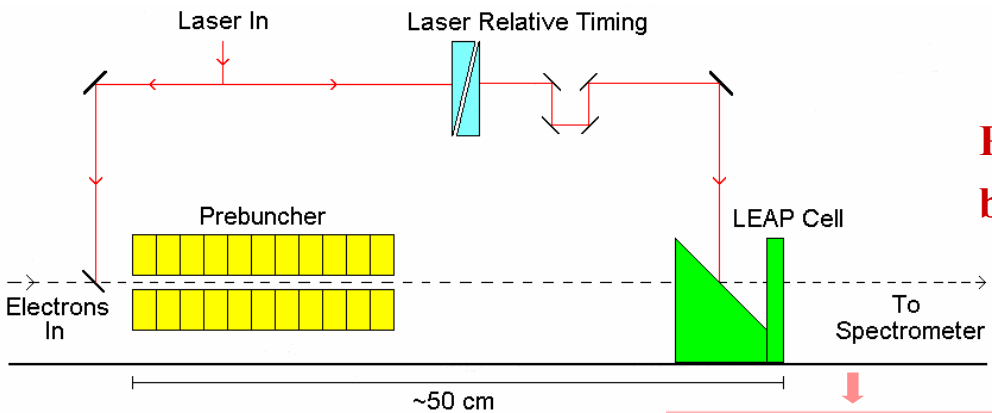
E-163

Laser Acceleration at the NLCTA

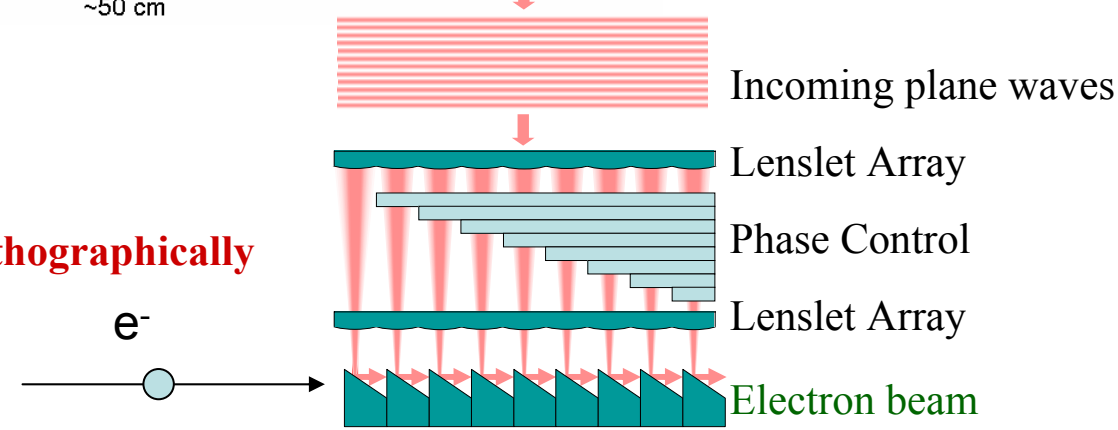




Phase I. Characterize laser/electron energy exchange in vacuum



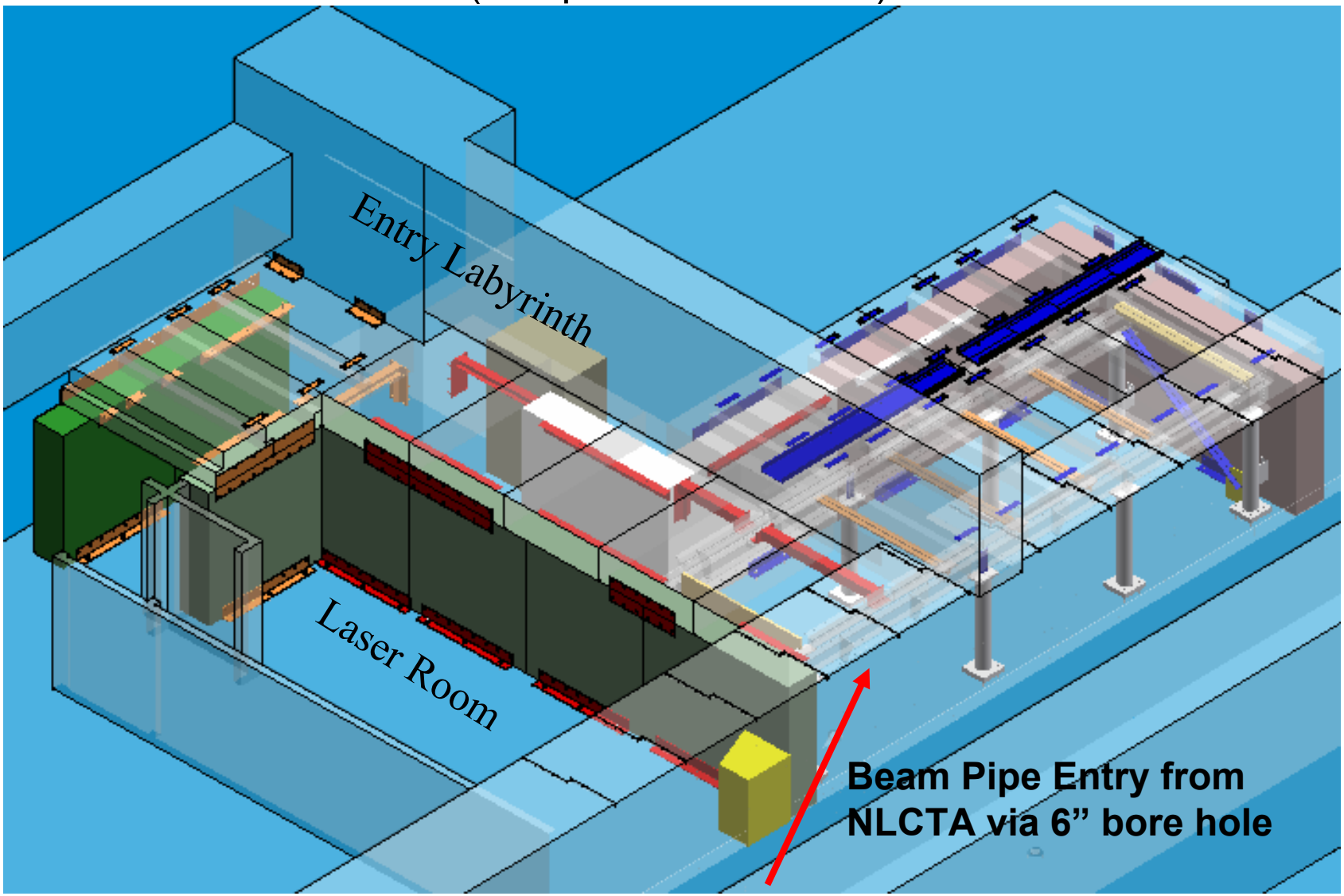
Phase II. Demonstrate optical bunching and acceleration



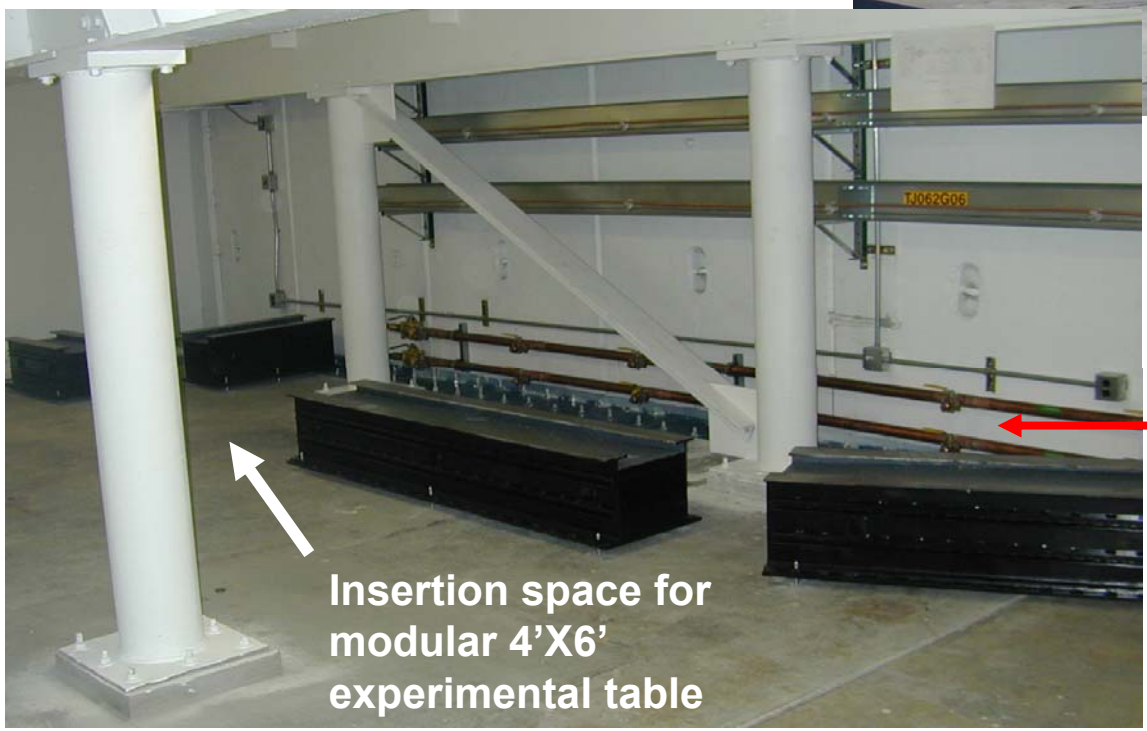
Phase III. Test multicell lithographically produced structures

E-163 Experimental Hall

(completed at NLCTA)

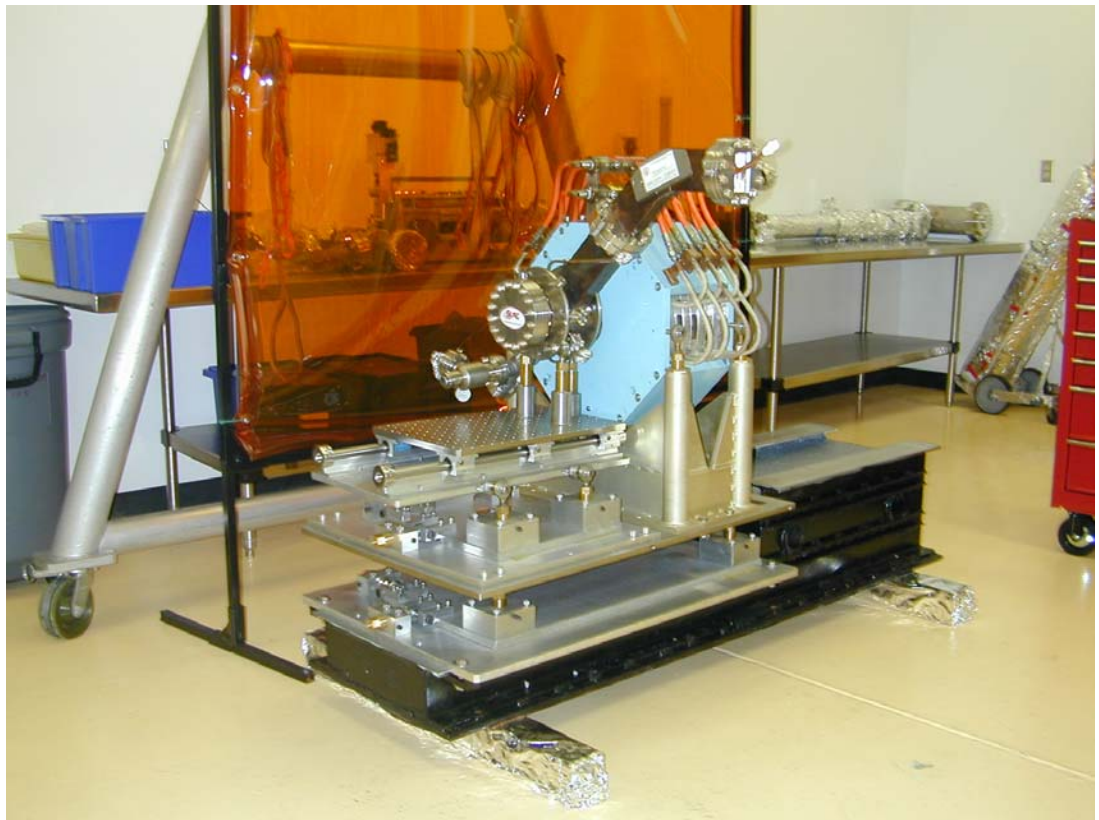


New 500 square-foot experimental hall for 60 MeV beam delivered from the adjacent NLCTA.



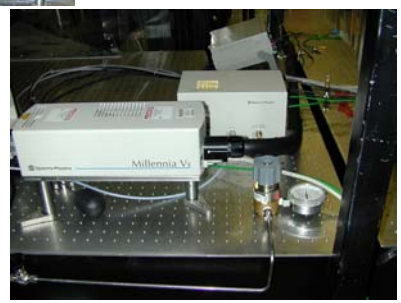
Beam entry direction from NLCTA

S-band rf gun and integrated system with focusing solenoid on girder



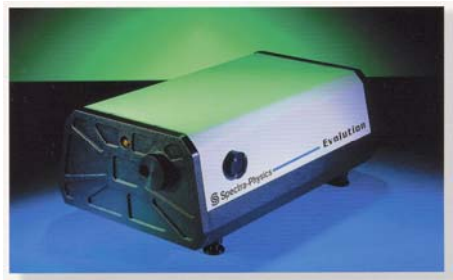
UV Drive Laser System Procured

Oscillator Subsystem



Amplifier Subsystem

Evolution X



Diode Pumped
Nd:YLF
10 mJ @ 527 nm 1KHz

Spitfire

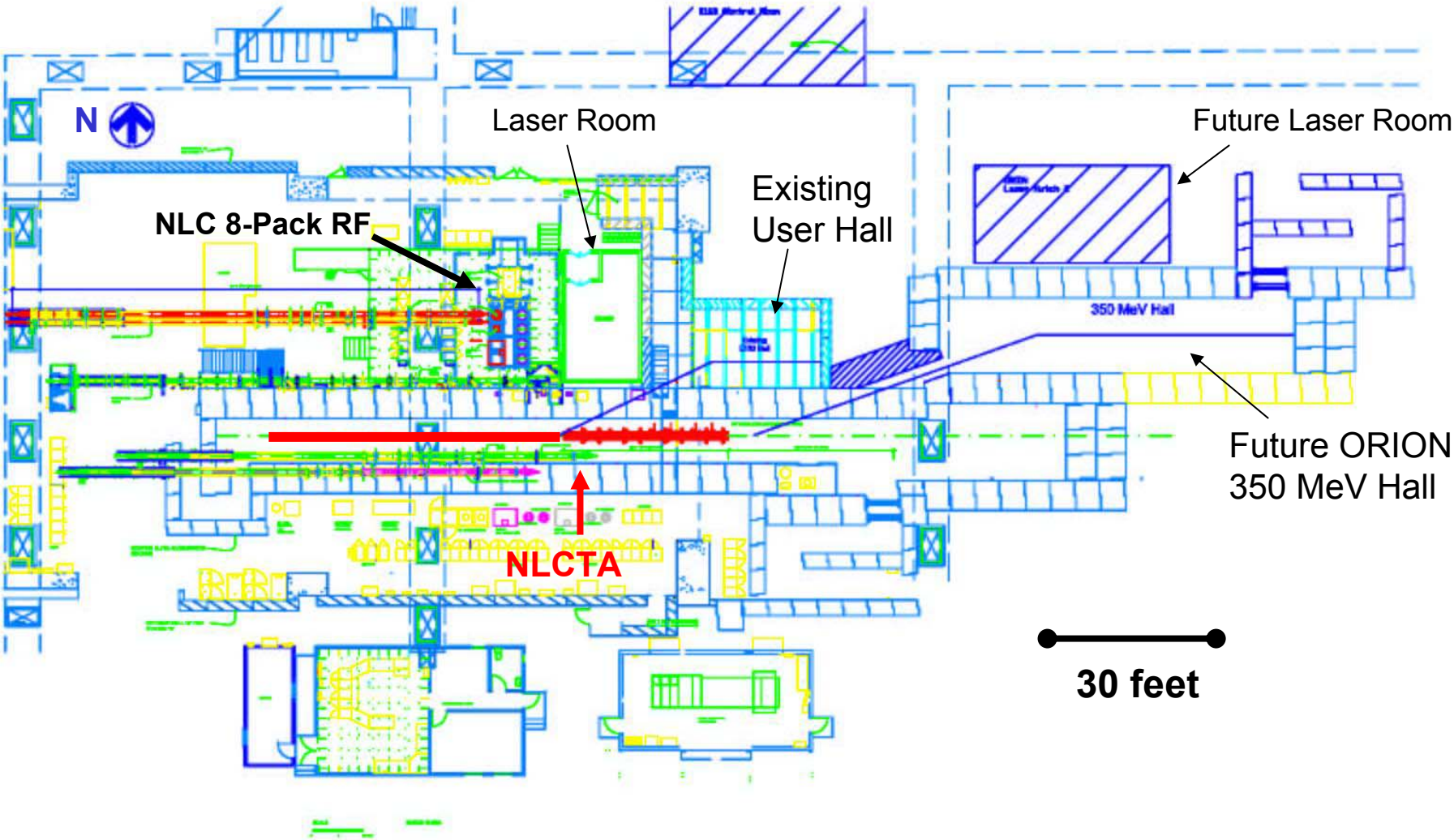
Regenerative Amp +
Multi-pass Stage +
future upgrades

Frequency Tripler

S-band RF System installed and ready to test

Ti:Sapphire Laser System to be transferred to new laser cleanroom, 2005

Concept for Future ORION Facility Expansion



Summary

1. **The lab's stated goal is to complete the E163 laser acceleration experimental setup at NLCTA and begin the measurement program:**

- Laser system complete; will be transferred to new clean room in early 2005
- RF gun power conditioned, and focusing solenoid complete
- S-band rf system and IGBT modulator installed and ready to test
- E163 experimental hall complete
- Beamline magnets in production; to be completed by fall 2004
- Laser cleanroom in procurement; to be installed by fall 2004
- Existing building being converted to E163 control room

2. **The ORION Low Energy Hall will be limited to the present 500 square-foot, 60 MeV experimental hall.**

- Available in summer 2005 for user experiments for about half the beam time. Experiments can be proposed to the SLAC Experimental Program Advisory Committee.

3. **Further development of the NLCTA/ORION Facility has been deferred by the Director due to funding priorities at SLAC.**