

User Program Development

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Topics

- THz
- HELIOS
- User Program



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THz Program

- High power* THz light is critical for communications, imaging and remote sensing.
- Generating high power THz light means relatively simple applications based on an understanding of fundamental physics.
- Implementation of the above has become possible only recently with advances in the laboratory, particularly combining modern ultra-fast lasers with superconductivity and relativity.
- We have established a user facility which is equipped for spectroscopy and imaging proof of principle experiments in this new arena.

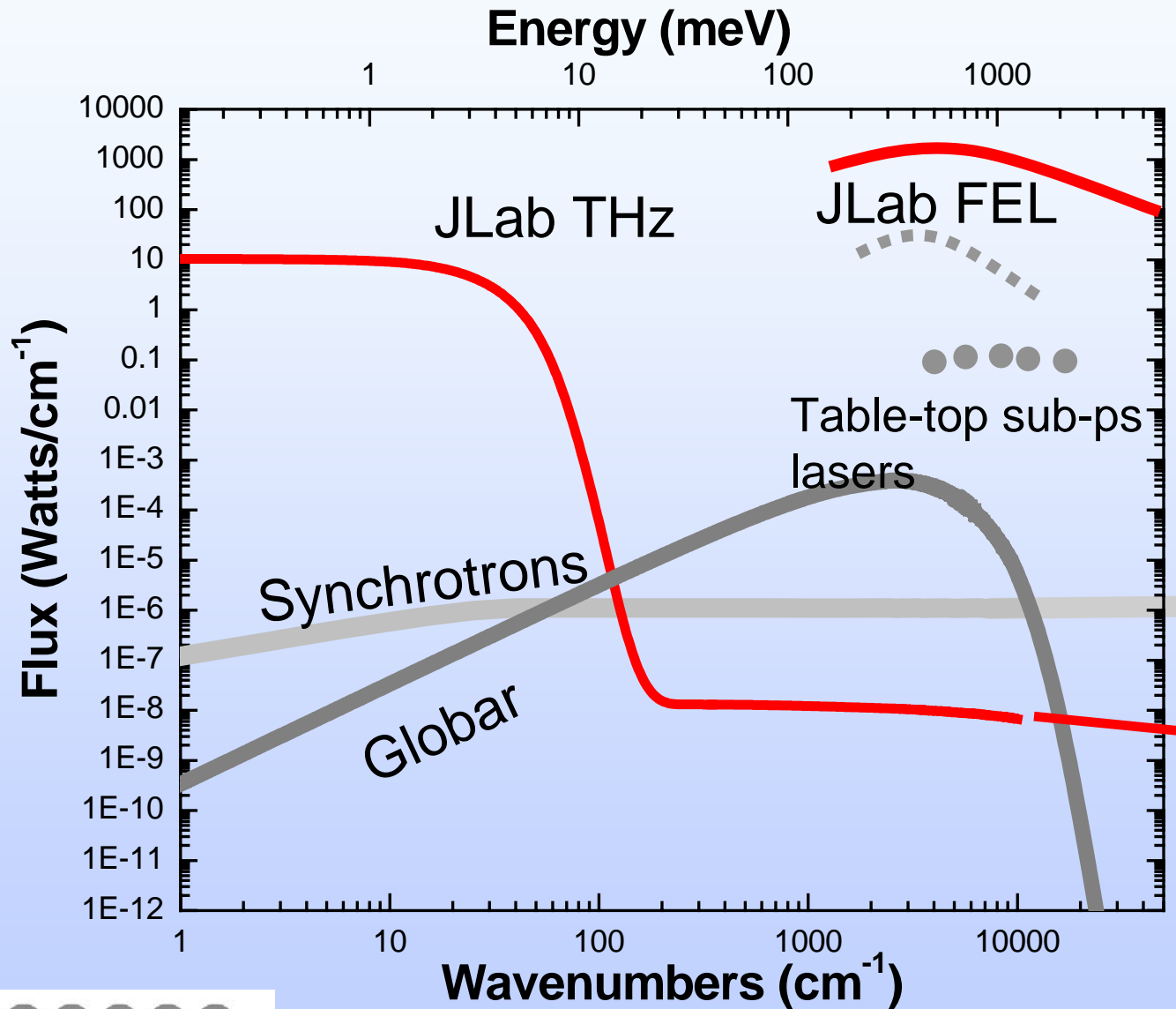
* > 100 W average power, > 1 MW peak power



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High power THz with sub-picosecond pulses is produced parasitically from electron beam



FEL proof of principle:
Neil et al. Phys. Rev. Letts 84, 662 (2000)

THz proof of principle:
Carr, Martin, McKinney, Neil, Jordan & Williams
Nature 420, 153 (2002)



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JLab Terahertz Beam Extraction and Transport

M2

diamond
window

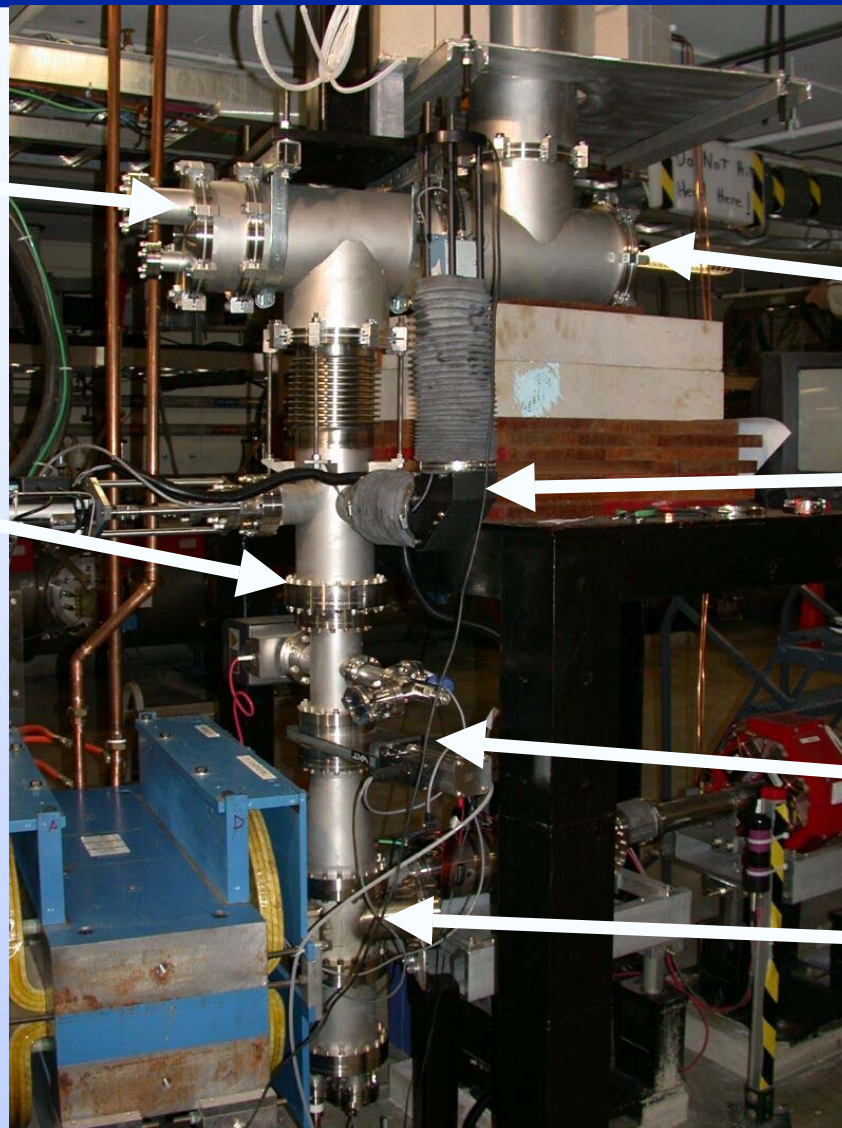
M3

Shutter/viewer &
camera

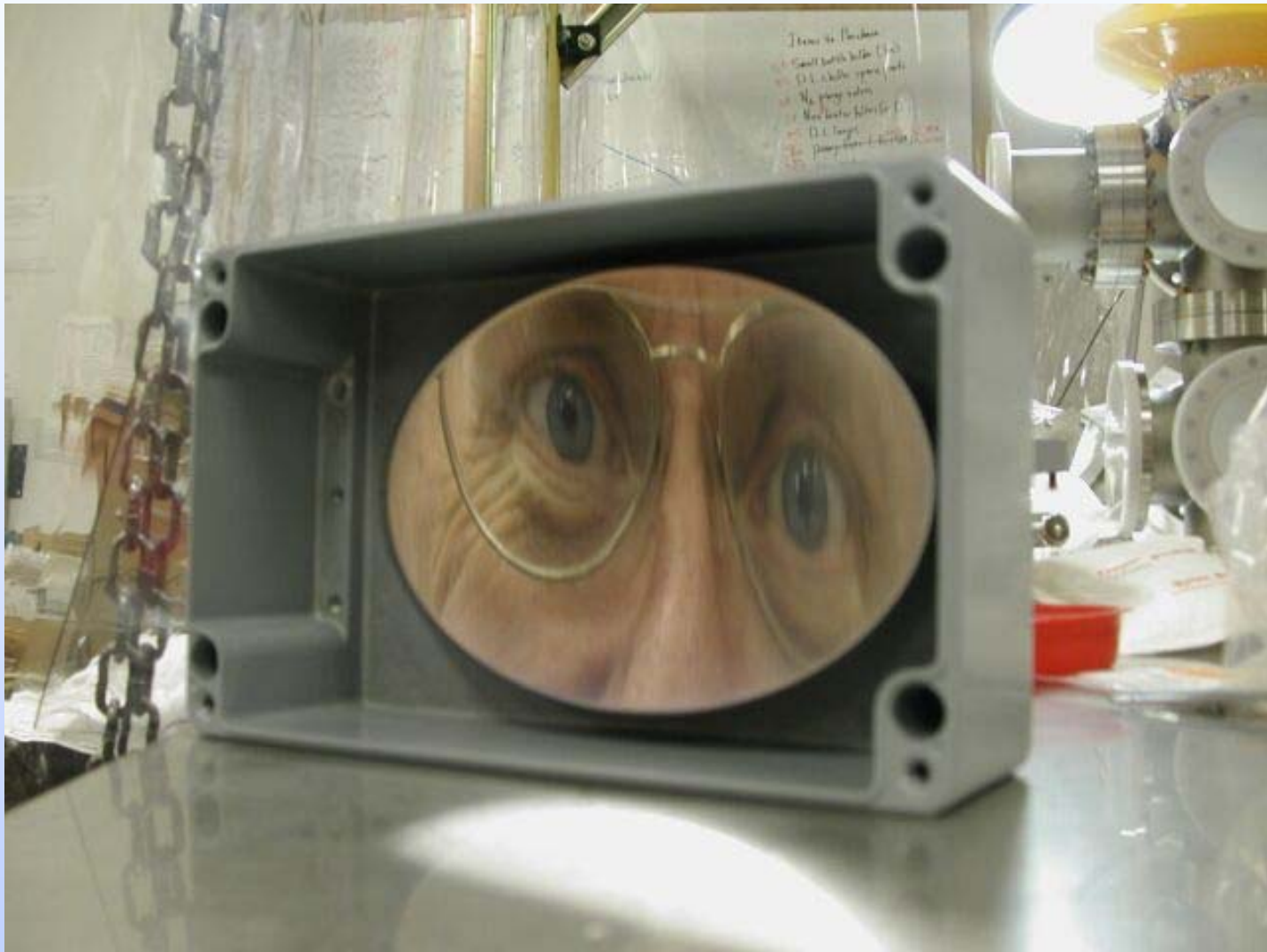
V1

M1

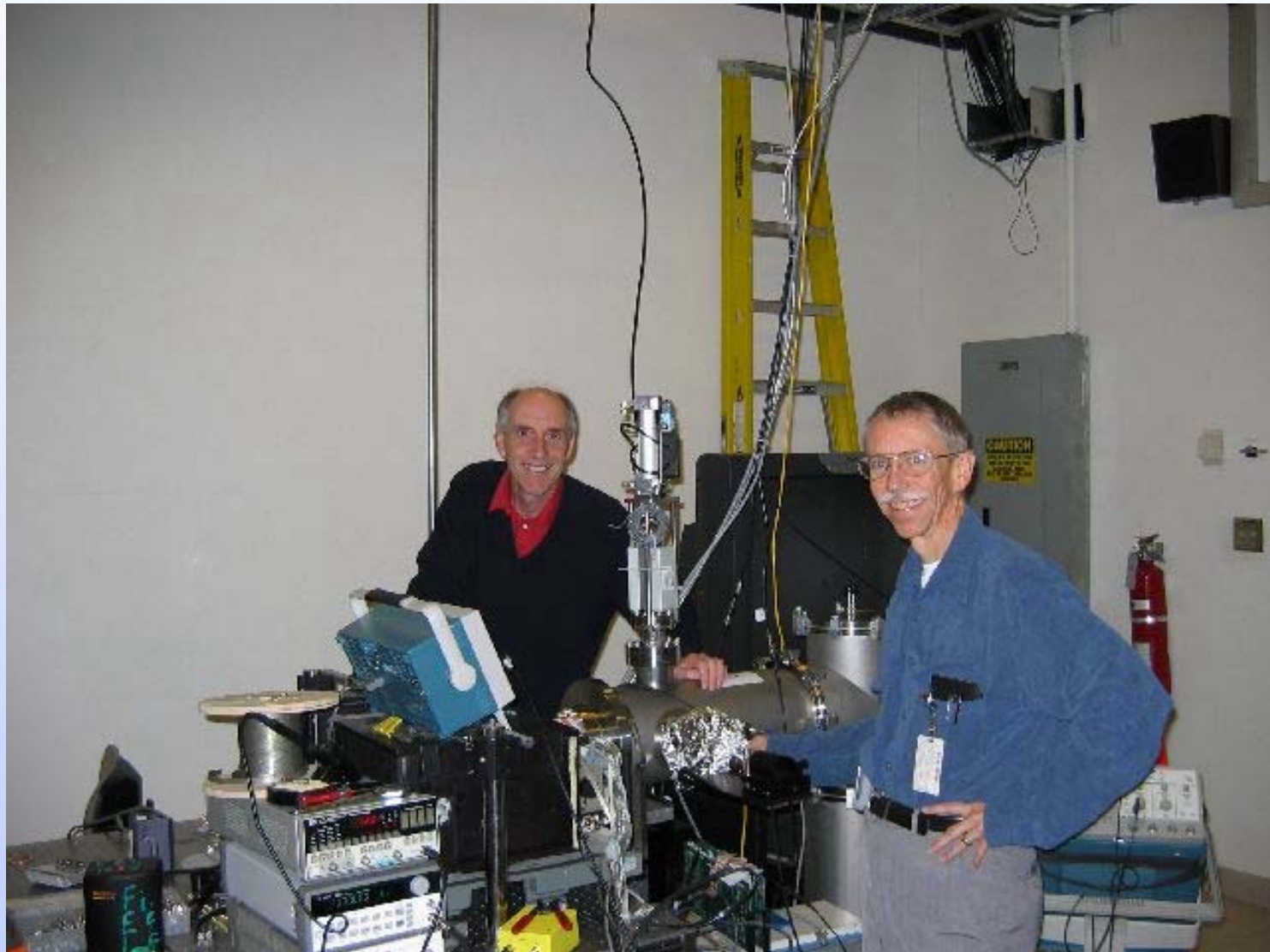
M1



Mirror 1 - courtesy of Richard Wylde, (Thomas Keating)



High Power THz User Lab 3



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THz Program update

- DOE-BES workshop held 1 year ago, report came out in 9/2004.
- Army Night Vision Lab awarded \$2M in FY 05-06, in conjunction with AES.
- National THz network formed 2/2005:

Mark Sherwin (UCSB)	President
Gwyn Williams (JLab)	VP
Charlie Schmuttenmaer (Yale)	Treasurer
Mike Martin (LBNL)	Secretary

Meetings scheduled for Optical Society of America, Orlando, 3/15-16, 2005
American Physical Society, LA, 3/23, 2005



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Applications of Jefferson Lab High Power THz facility

1. Basic research

(a) Imaging

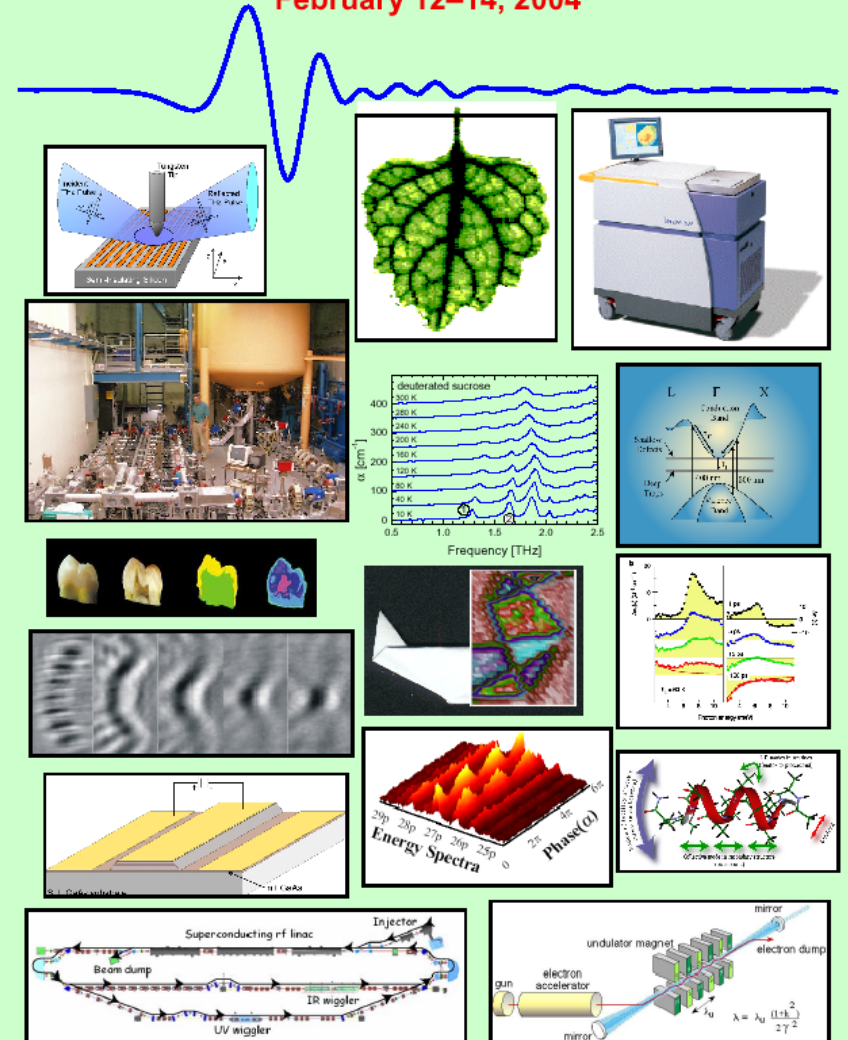
(b) Non-linear dynamics

<http://www.er.doe.gov/production/bes/reports/list.html>



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DOE-NSF-NIH Workshop on Opportunities in THz Science
February 12–14, 2004



Jefferson Lab User Facility

- First meeting for potential users held on Sept. 20, 2004
<http://www.jlab.org/FEL/THz/wkshp0904.html>
- Identified 2 important niche areas for the high power source– dynamical spectroscopy and imaging.
- Initial proposals and lab equipment requirements defined.
- Proposals presented for work in magnetism, superconductivity, non-linear processes, biology, medicine, materials science.
- Invitation for proposals here:www.jlab.org/FEL



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Jefferson Lab User Facility

- **Major initial players:**
 - Sievers, Cornell
 - Luepke, William & Mary
 - Zhang/Wilke, RPI
 - Schmittenmaer, Yale
 - Globus, UVa
 - Carr, Martin BNL/LBNL
 - Tanner, U. Florida
 - Chamberlain, Weightman, UK
 - Mittleman, Rice
- **Major equipment needed:**
 - Spectrometer/detectors
 - Array detectors/cameras
 - Optics
 - Electronics
 - Cryostat
 - Magnet
 - Total ~ \$1M



JLab Synchrotron Radiation Source - HELIOS-1



Synchrotron Specifications

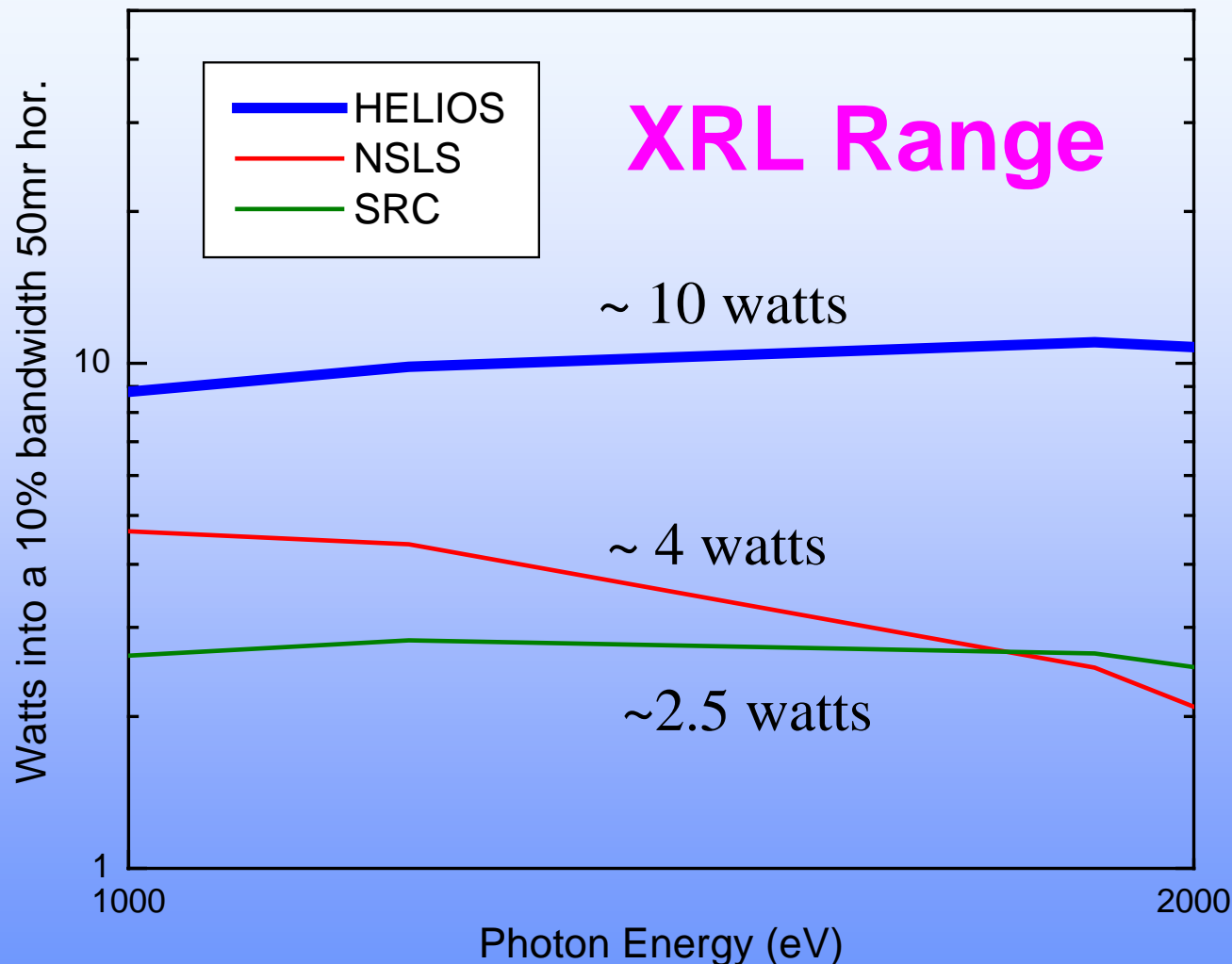
- Superconducting ring, 4.5T max. field
- 700 MeV Electron Energy
- 500 MHz rf with 16 bunches
- synchronized with FEL at 125 MHz
- 10Å critical wavelength
- 800 milliamps of stored current



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XRL – Synchrotron Power



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X-Ray Lithography status, March 2004/March 2005

- BAE Systems ready to propose project with JLab.
 - ready and waiting
- Need at least one more partner.
 - JMAR-SAL visited 2/2005
- DARPA re-directs money for production of CRAM to entice industry.
 - not complete, possibly 7/2005.
- Helios would be available for basic research if recommissioned somewhere in the US.



User Program

1. Experiment proposal submitted (Gwyn Williams)

- Submit any time
- Approved by Program Advisory Committee
- Ranking based on science
- Good for 2 years

2. Also need Laser Operational Plan & Experimental Safety Form

3. Training is important and required

- Eye exam
- EH&S
- General Employee Radiological Training (GERT)
- Oxygen Deficiency Hazard (ODH)
- Laser safety training

See: www.jlab.org/FEL



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