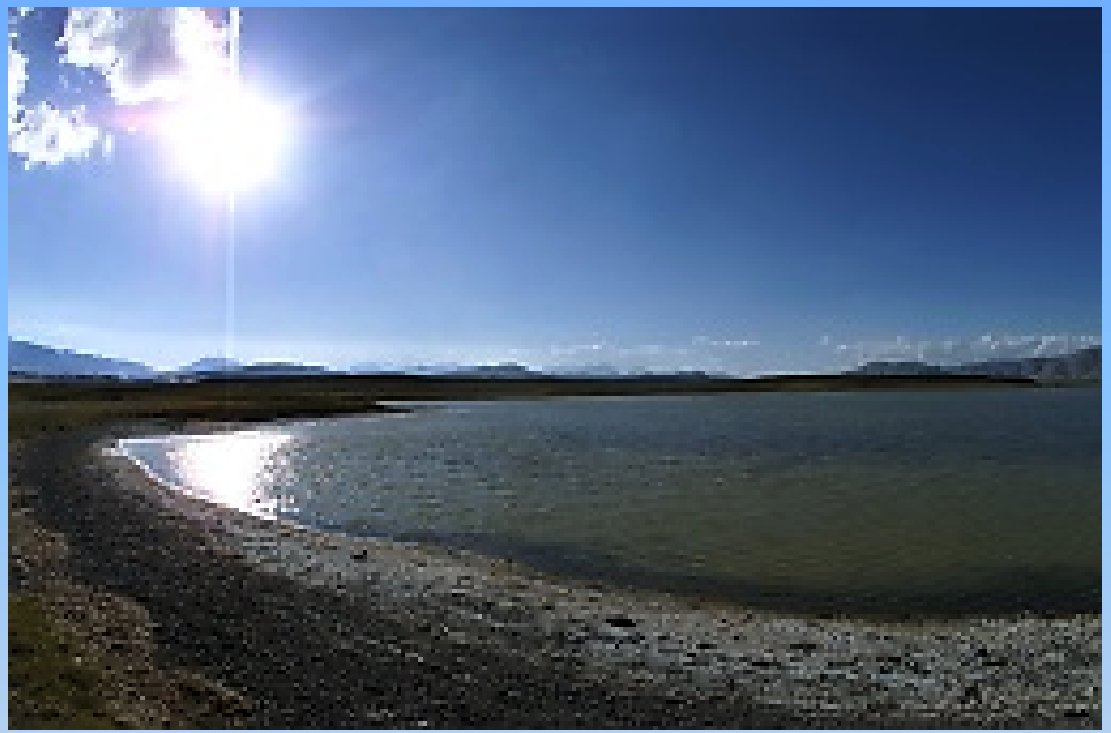
# Looking to the Horizon
## — Divisional Plans



*Swapan Chattopadhyay*

**Director's Review of AFRD**
**Lawrence Berkeley National Laboratory**
**May 16 & 17, 2000**

# How do we choose future directions?

## Develop the case:

- Grass-roots interest @ our laboratory & in the community
- Strategic Planning Retreats
  - → AFRD Retreat chaired by S. Chattopadhyay, November, 1999 @ UCB Faculty Club
- Supporting Workshops
  - → e.g. Neutron Tube Workshop

## Develop consensus:

- Discussions with Program Heads
- Discussion with General Sciences Directors
- Community alignment
- Development of project scope / plan
- Presentation to Lab Director and/or DOE

# Considerations in choosing new directions

- Quality of the science
  - → Break new scientific ground
- Institutional alignment
  - → Match of technical challenge & niche excellence in AFRD
  - → Synergism with other scientific programs @ LBNL
  - → Match of task with LBNL infrastructure
  - → Interest of experimental science programs @ LBNL
- Business opportunity
  - → Timing
  - → Opportunity
  - → Cost

# Strategic planning at the AFRD retreat

## PROGRAM AREA

**National Needs** →

**Beam Physics**

**Fusion**

**Ion Beam Technology**

**Radiation Sources**
With ALS

**Nuclear Physics**
With NSD

**High Energy Physics**
With PD

→ **Program plan**

→ **Venture Funds** → **Strategic Product**

**Venture Funds** → **LDRD requests**

**Strategic Product** → **Project involvement** → **New program @ LBNL**

# Market-pull driven planning

| | NATIONAL NEED | LDRD | STRATEGIC PRODUCT |
|---|---|---|---|
| **Radiation Sources** (with ALS) | New Light Source Damping Rings) | PM Synchrotron<br>Pixel Detectors<br>Fs beam-slicing | IR ring @ ALS<br>Ring Research Facility<br>NLC Damping Rings<br>B-factory upgrade<br>Optical Manipulators in Rings |
| **Nuclear Physics** (w/NSD) | NSAC Roadmap | RIA optimization, RIA physics | RIA@LBNL<br>RIA@anywhere |
| **High Energy Physics,** (w/ PD, NERSC) **(Fusion)** | Next Collider per<br>Community and HEPAP recommendation | End-to-end Accelerator Simulation | Neutrino Factory<br>(IRE@LBNL NLC) |

# AFRD retreat results, continued

| | NATIONAL NEED | LDRD | STRATEGIC PRODUCT |
|---|---|---|---|
| **Beam Physics** | New Physics | High Energy Density (HED) Physics<br>Laser-Plasma Accelerator | Sub- fs Physics<br>HED Experiments |
| **Fusion**<br>(Technology / Beam Physics) | Fusion Roadmap | Multi-beam Ion Source<br>VNL Formation | IRE --> ETF<br>HED Expts |
| **Ion Beam Technology** | SNS physics<br>Neutron Technology<br>Semi-conductor Roadmap | Neutron Tubes<br>Neutron Applications<br>Workshops I & II | Neutron science @LBL<br>(BNCT, Si technology, material analysis, non-proliferation)<br>SNS support |

# Partnerships for the future

Potential major construction projects:

Inertial Fusion IRE (LLNL, PPPL)

→ Design team home laboratory

Rare Isotope Accelerator (ANL, MSU, TJNAF)

→ Compete for site at LBNL

→ Front end systems, high field magnets, detector

Next Linear Collider (SLAC, KEK, LLNL,FNAL)

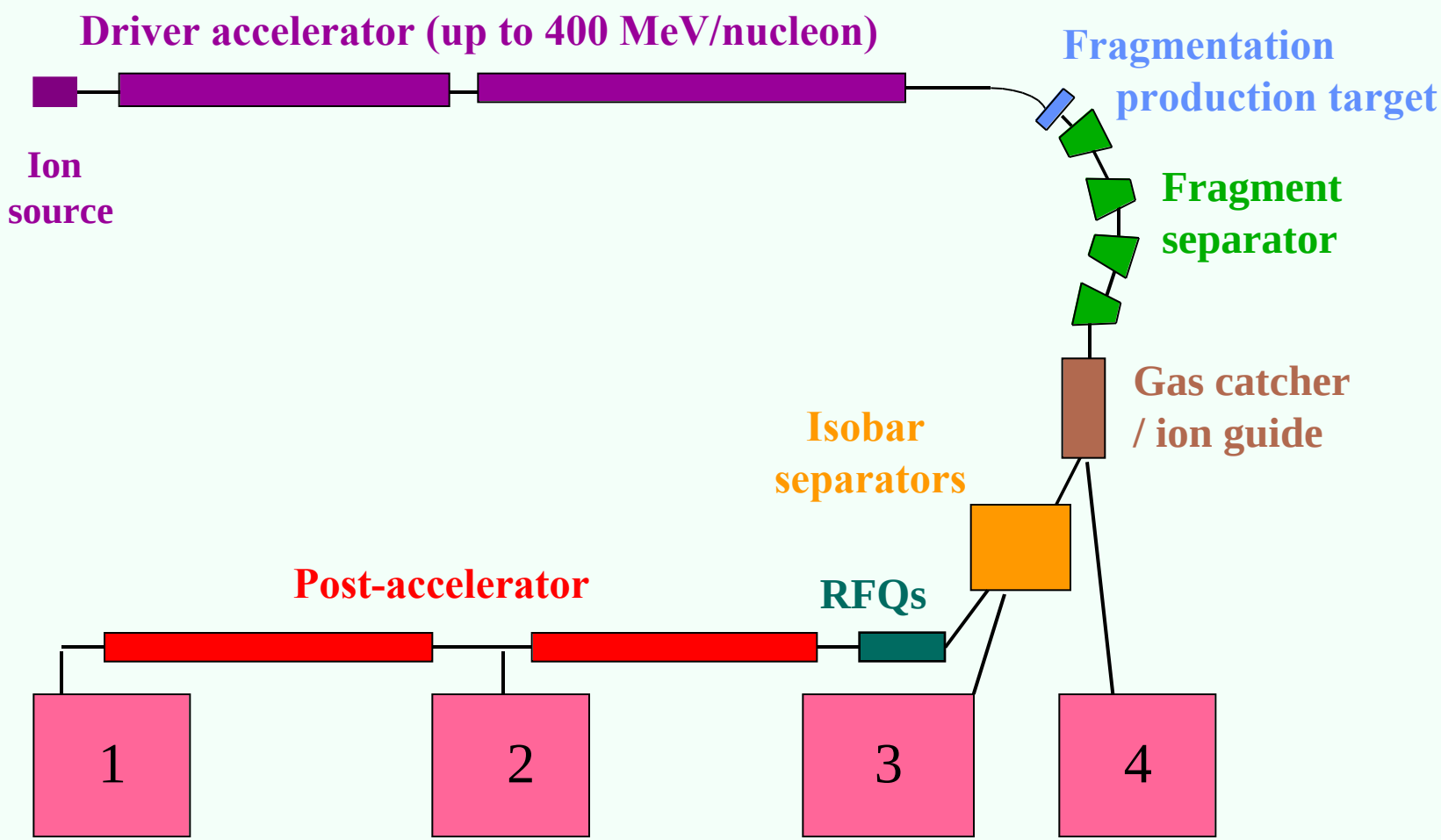
→ Damping ring complex

Muon collider / Neutrino factory (FNAL & BNL)

→ Collaboration management, lead in beam simulation

→ Phase rotator, RF components, superconductings, muon cooling

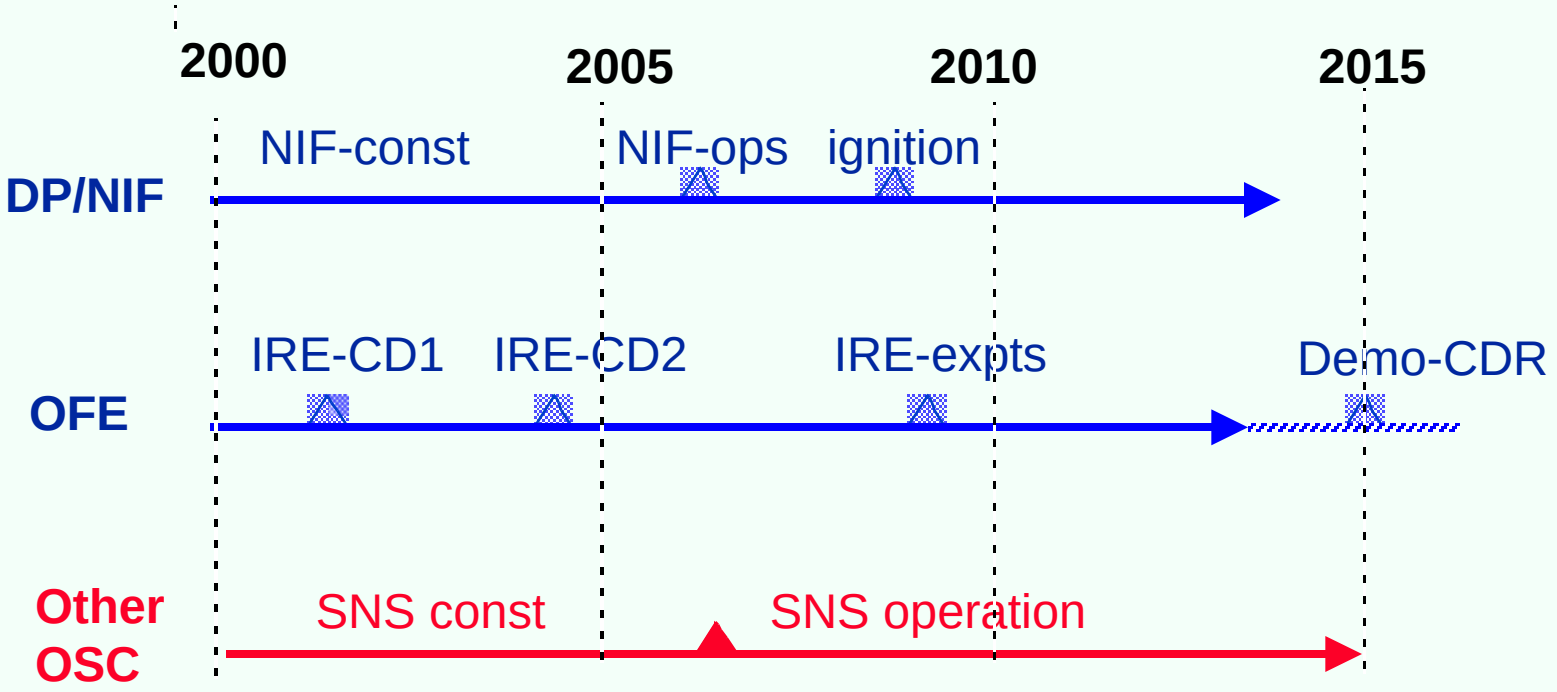
# Schematic of RIA @ LBNL (w/o ISOL)




**Experimental areas:**
**1) <12 MeV/u; 2) <1.5 MeV/u; 3) Non-accelerated; 4) In-flight fragments**

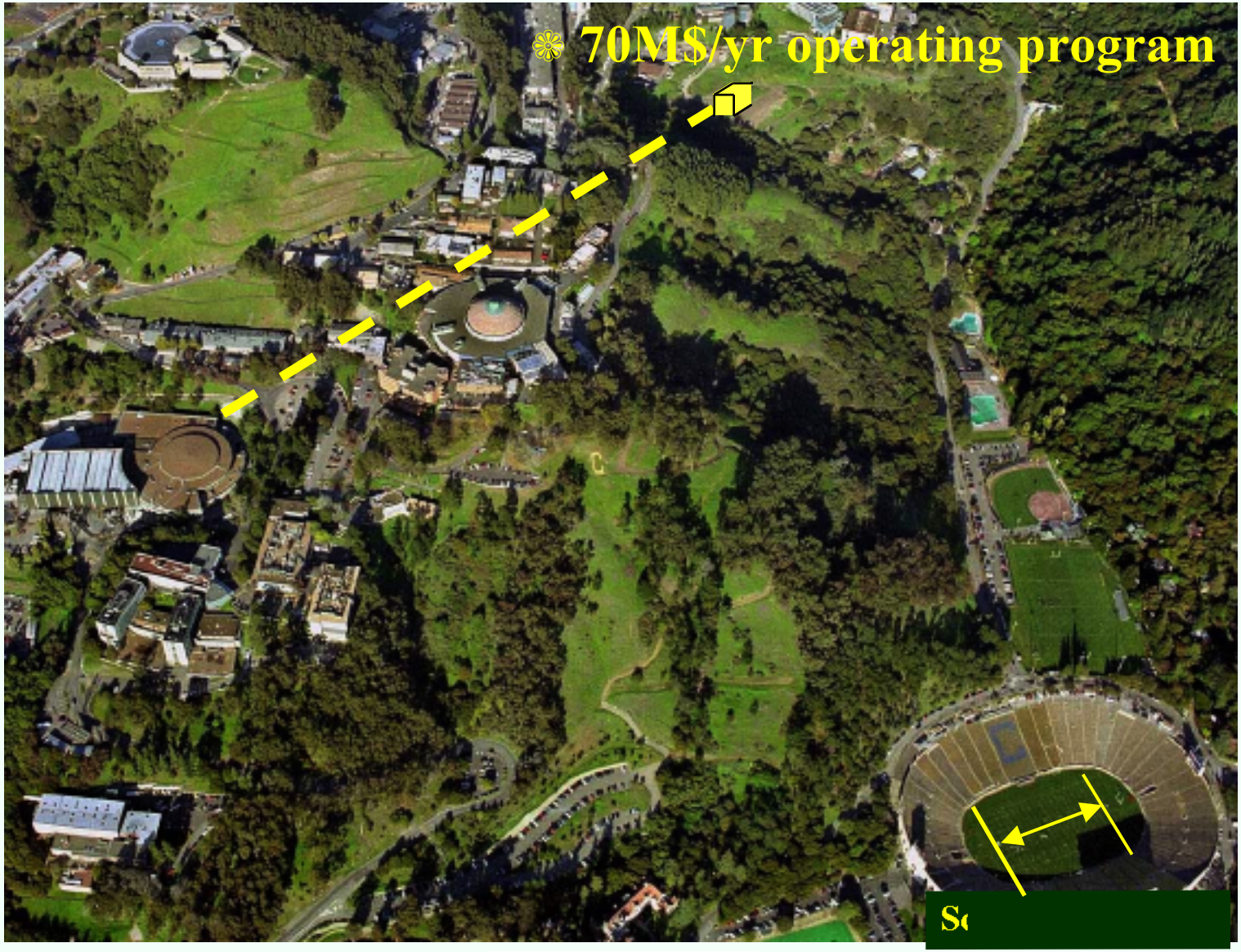
# Fusion: CD-1 in FY01 is crucial to IRE

Many projects will vie for the FY04 "window of opportunity"



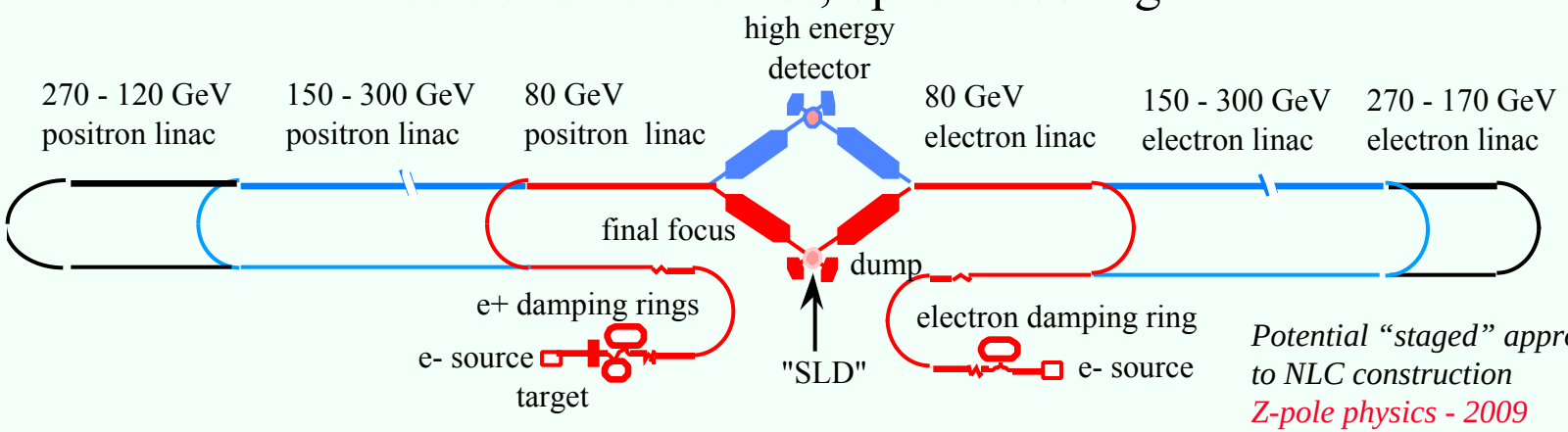

*UGT, Nova, and Omega fully establish the scientific basis for IRE*

# RIA and IRE@LBNL would assure a vibrant nuclear, fusion & high energy density physics program at Berkeley for the next 30 years



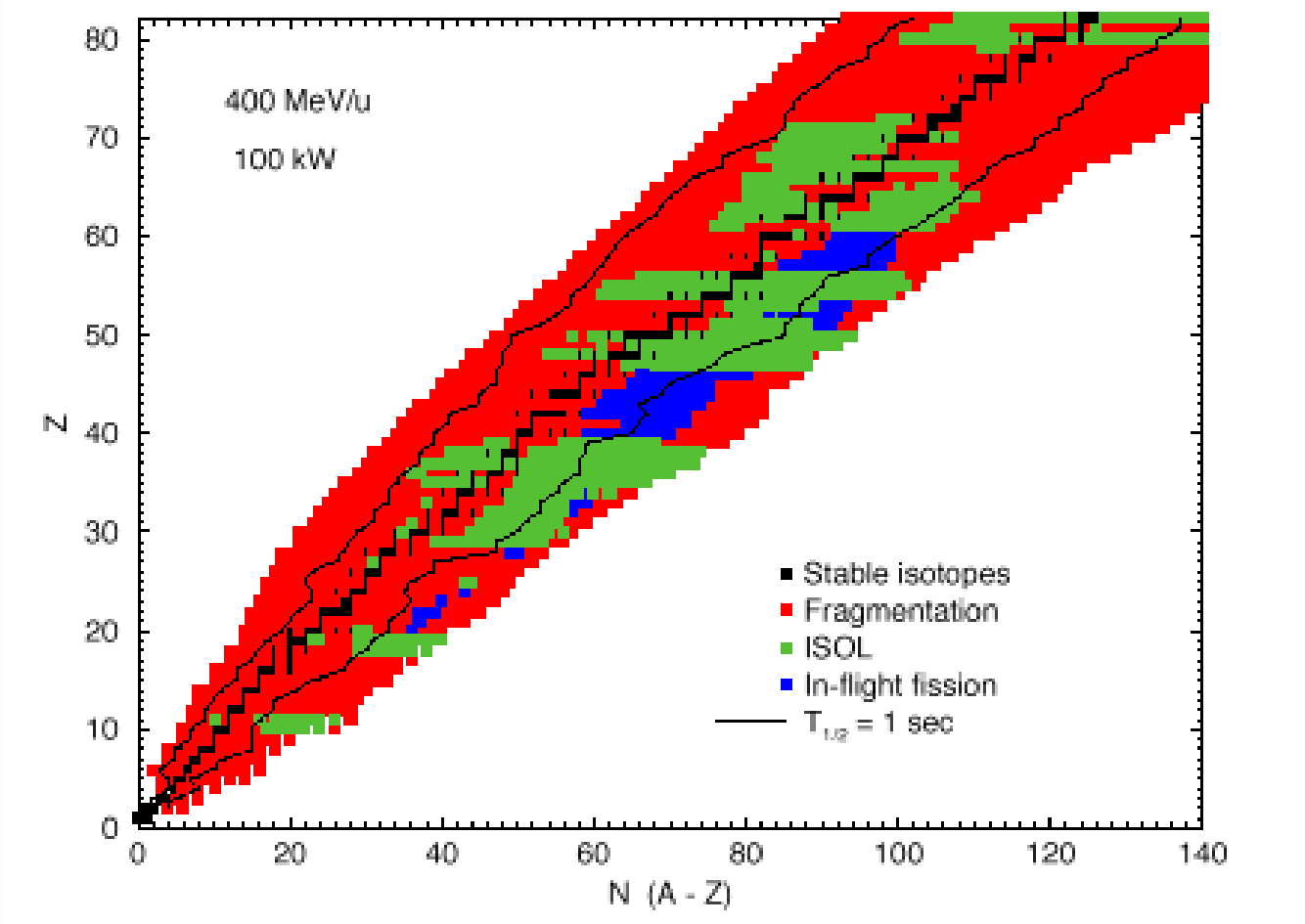
# NLC opportunity has direct local payoff

- Berkeley is responsible for the damping ring complex
- Early work focussed on rf-cavities
- NLC R&D develops new light source technology
  - New design features novel, tunable permanent magnets
  - Dedicated IR-ring @ ALS (w PMs?)
- Opens door to small research ring as 1st payoff
  - Tests of crab cavities, optical cooling

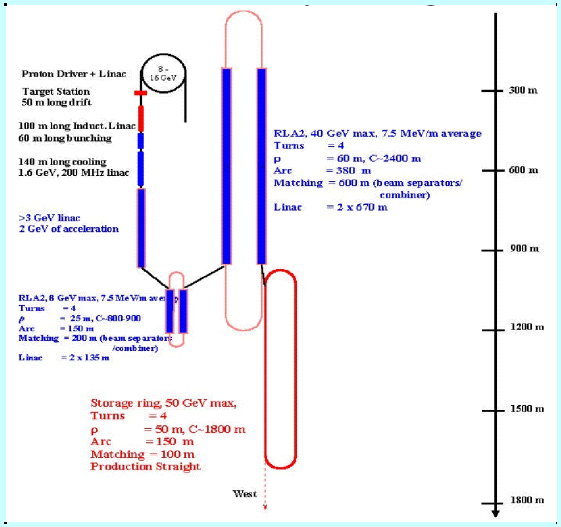



*Potential "staged" approach to NLC construction*
*Z-pole physics - 2009*
*Higgs physics - 2010*
*1 TeV physics - 2012*

# ISOL vs. Fragmentation



# Muon collaboration offers an important leadership role in HEP for LBNL

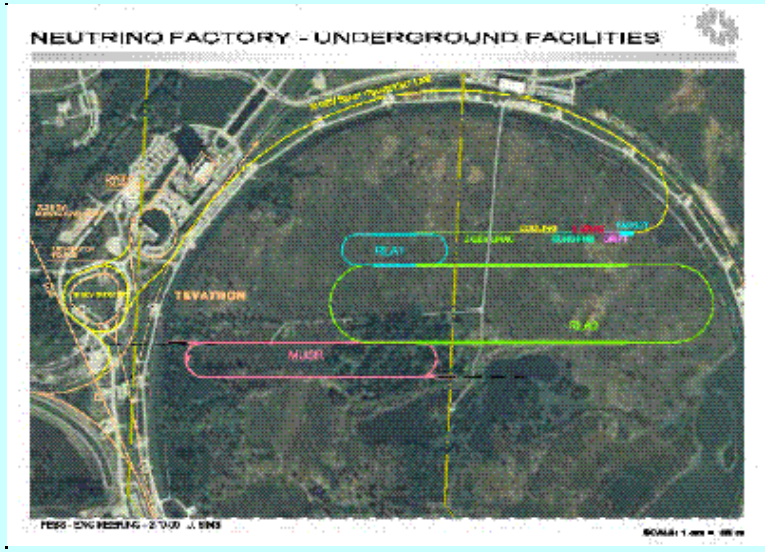



## Structure of collaboration:

MUCOG: S. Holmes, T. Kirk, P. Oddone (LBNL)
Spokesman: A. Sessler (LBNL)
Project manager : M. Zisman (LBNL)
Executive committee: J. Wurtele (LBNL/UCB)

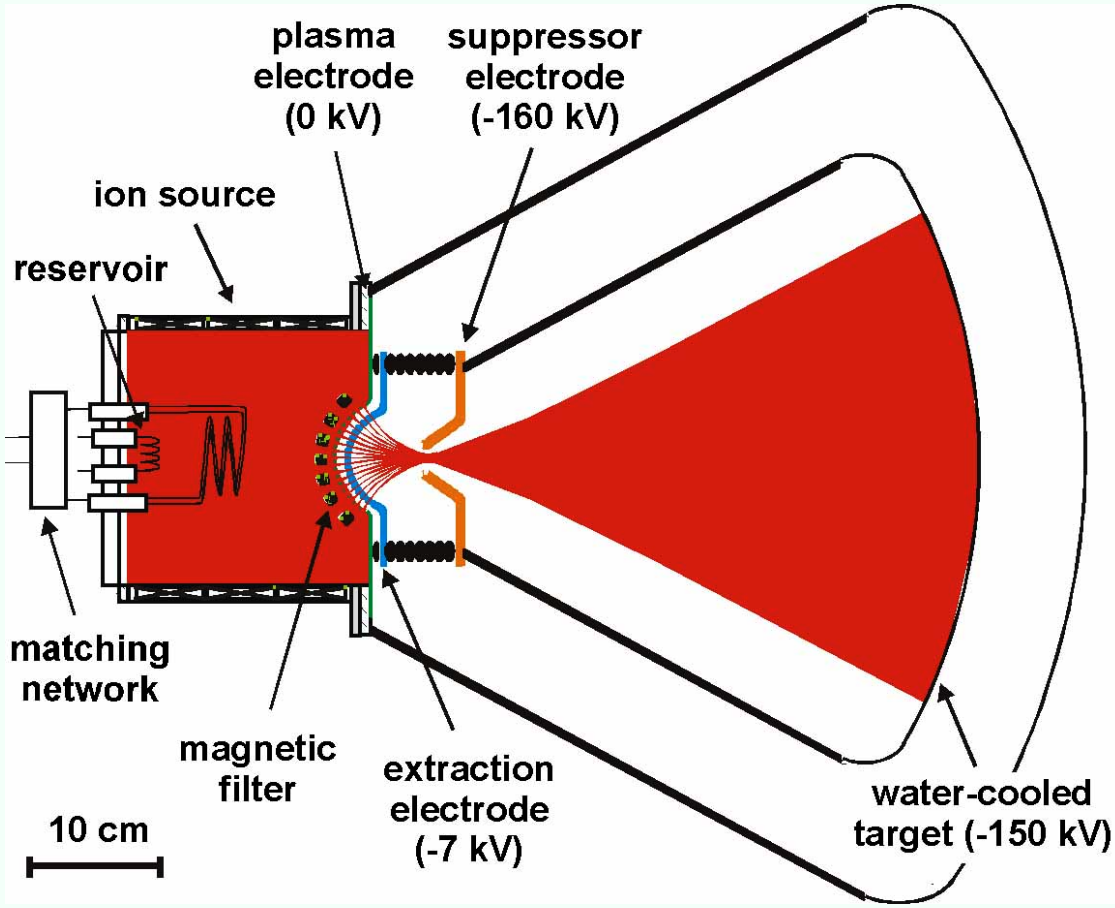
## Berkeley opportunity (lead roles):

End-to-end simulation
Front-end systems
→ Ion source, RFQ
→ Large aperture capture solenoids
→ Induction linac phase rotator
→ RF cavities, magnets in muon cooler



# Neutron sources: growth potential for ion beam technology

- Compact, D-T neutron tubes can provide a low cost source for SNS moderator development



# Laser accelerators will provide unprecedented probes of matter

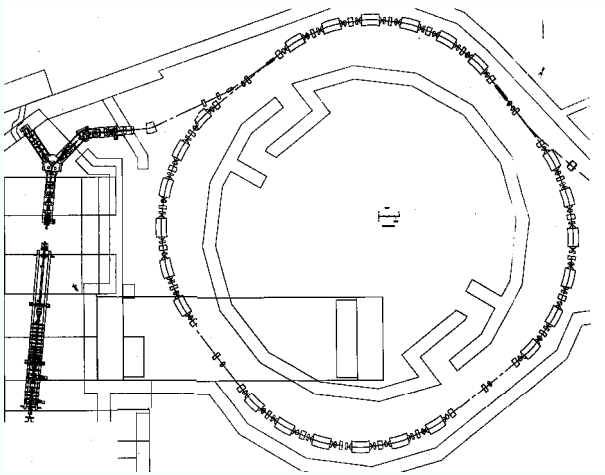
- Ultra-high gradient compact accelerators
  - 1 - 10 GeV/m possible
- Sub-fs probes of matter
  - Direct electron excitation of atoms
  - Conversion to x-rays
- Table-top high energy density experiments
  - Combined e-beam / laser experiments

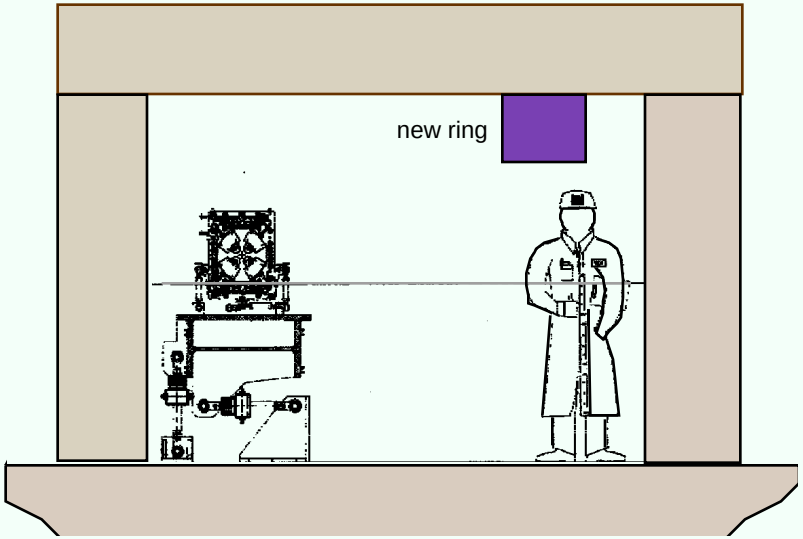
*Exciting, forefront physics in its own right*

# Radiation sources: extensions of the ALS

- IR microscopy using SR is growing
- ALS spectrum is limited to near & mid-IR due to vacuum chamber acceptance
- Ambient vibrations & photon beam loading make "parasitic" IR beamline operation difficult

*Why not an optimized IR light source?*






Potential location in the ALS booster tunnel

- Large tunnel area. (8'x10')
- Existing injector, shielding, utilities, etc.
- Unoccupied cast concrete roof for hutches
- Low RF power requirements.
  - ➔ With SC RF, potential for coherent SR

# Conclusion

***Expanding circles of scientific influence***

# Summary

- **We are world-class leaders in our niche competencies**
- **We make essential contributions to each of our partnership projects**
- **We have a market driven research plan for the future**
- **We have a strong Division management team**

***AFRD is a vital leadership force in U.S. accelerator-based physics***