Spallation Target Development at Los Alamos National Laboratory

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The LANSCE beam:

800 MeV, ~100 μA proton beam

- Beam produced in 620 μs “macropulses”
- Macropulse composed of micropulses of ~8×10^{10} protons

Beam delivered to experimental areas can be adjusted to intermittent delivery with from 1 micropulse to full macropulse in beam

Proton Storage Ring (Lujan center and also possibly Target 2, the “blue room”) creates single 250 ns pulses with 4×10^{13} protons, delivered at up to 120 Hz

LANSCE Facilities: What can be done?

- **Lujan Center: neutron scattering studies**
  - Reflectometer is used to evaluate reflectivity of guide materials

- **Target 2 (Blue Room): general spallation target development at low power**
  - Direct measurements of performance of moderator materials and geometries

- **Area B: ultracold neutron (UCN) source and technology development**
  - Explore properties of solid deuterium UCN/VCN source
  - Develop UCN/VCN technologies (guides and detectors)

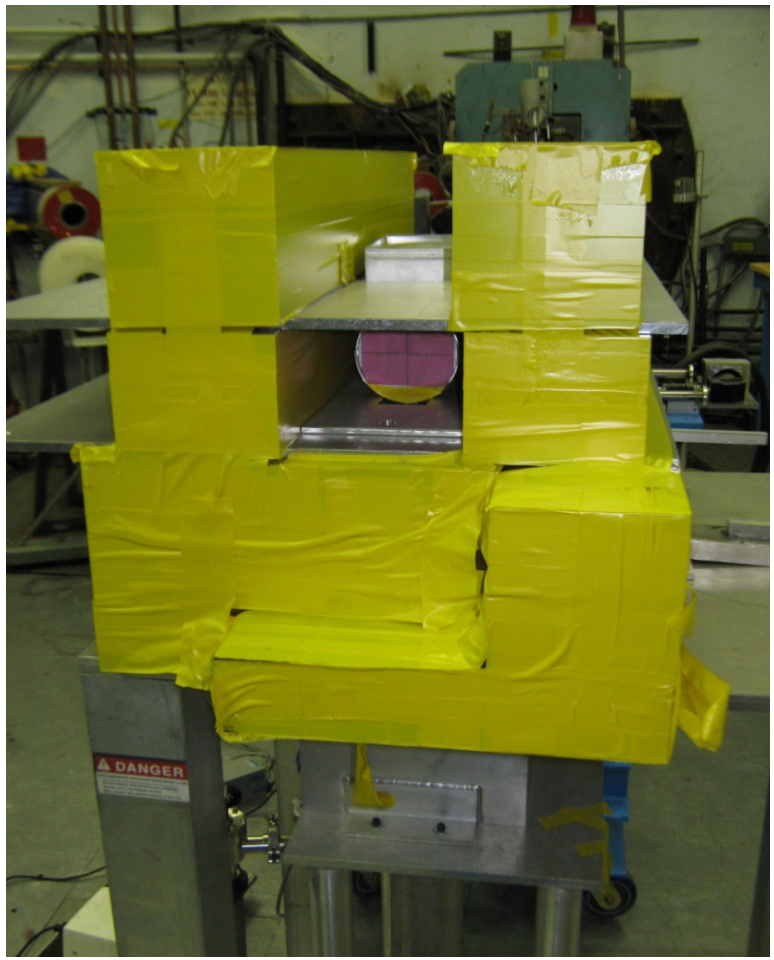
Target 2 (Blue Room)

- Maximum parameters: 100 Hz, 80 nA (~65 W)
- Energy adjustable from 200 MeV to 800 MeV
- PSR pulses also can be used

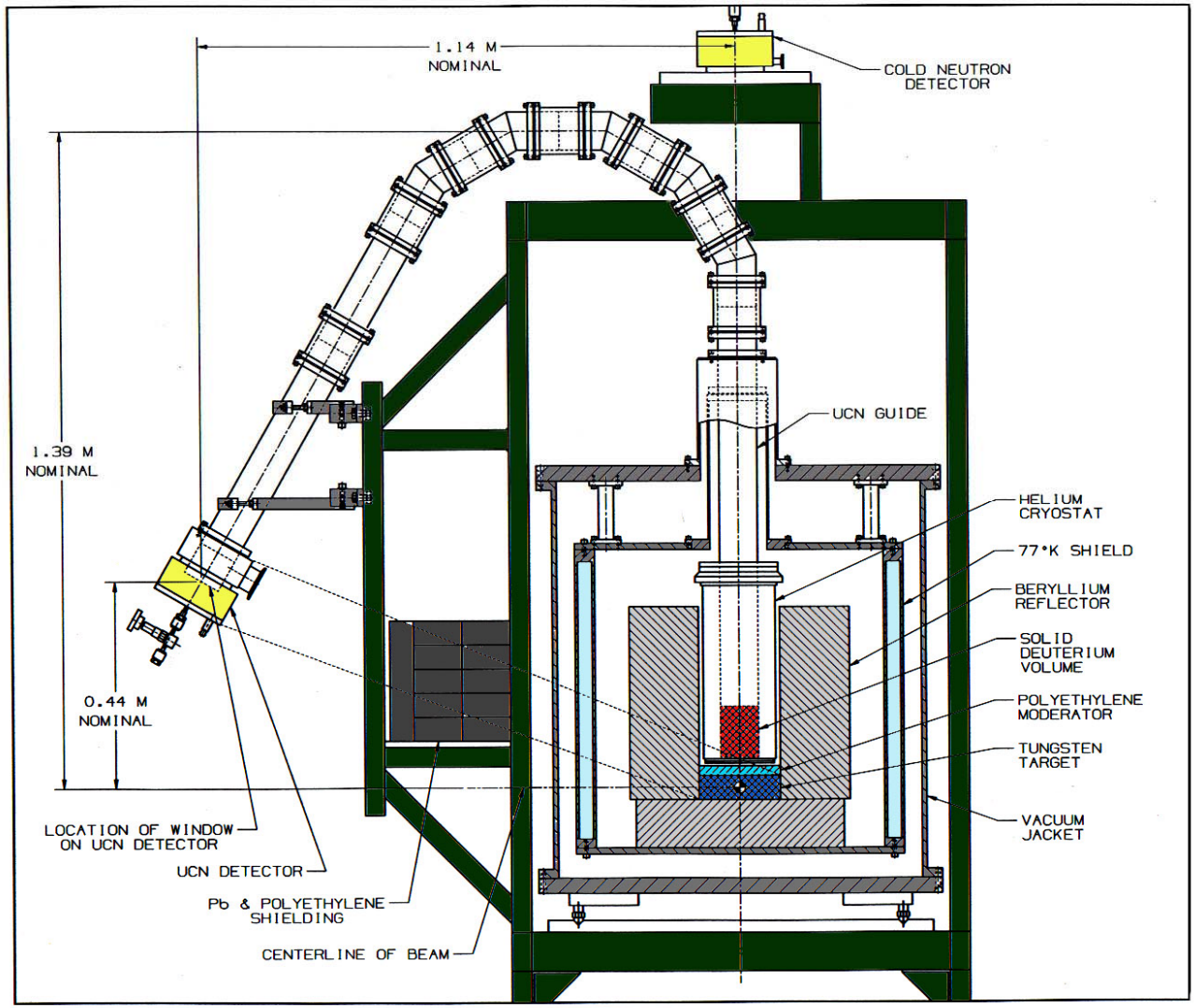
Useful characteristics:

- Space: 40 ft diameter dome
- Al floor raised 20 ft above concrete “basement” to reduce particle “return” signals
- proton beam focusing elements available to adjust spatial profile of beam
- timing substructure available

What has been done: Mark III development (Guenter's talk)



TOF studies of cold and ultracold neutron production from solid deuterium



What Can Be Done?

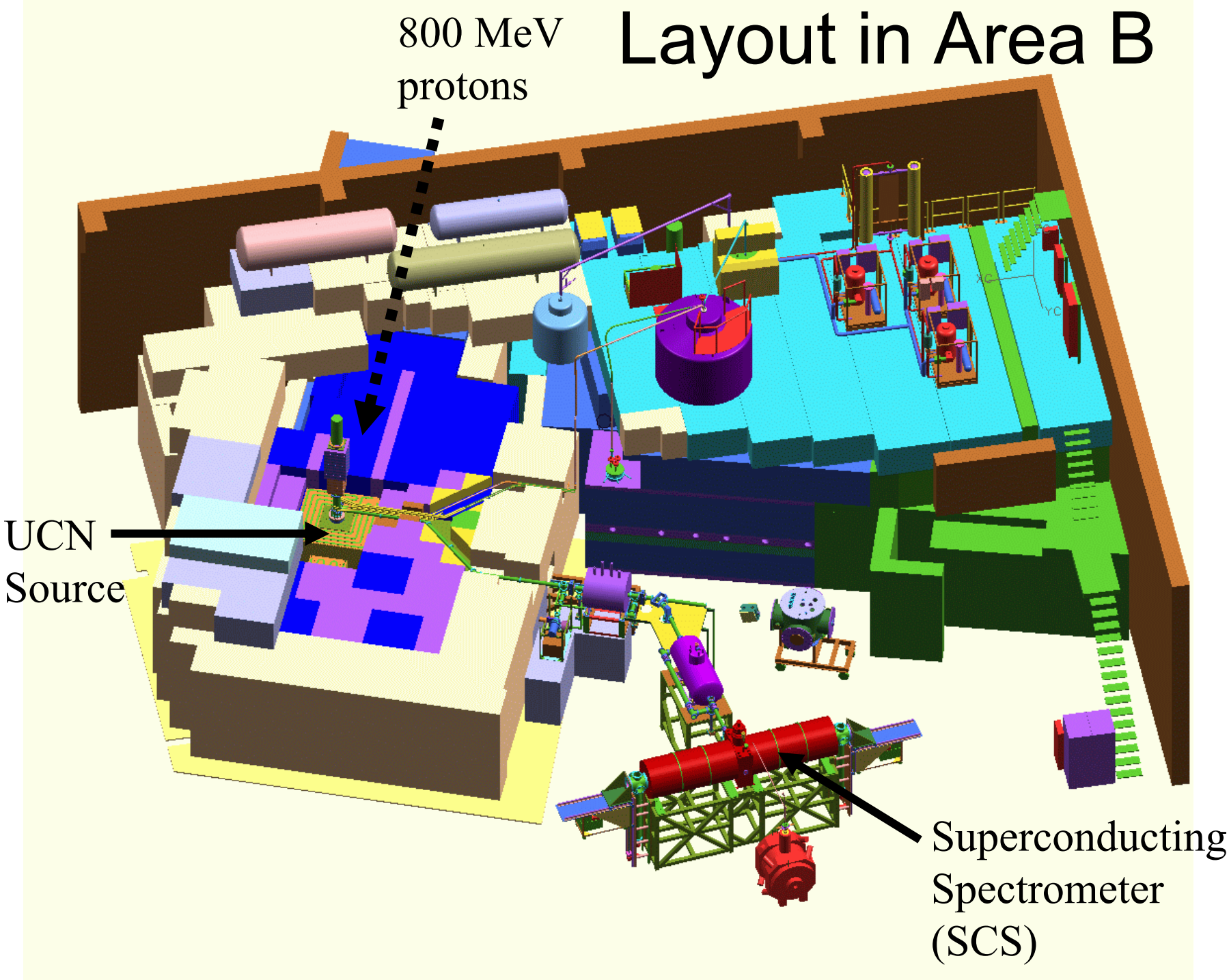
- Direct evaluation of neutron moderation performance (neutron flux) of “inverted source” geometry or other target geometries

- Direct evaluation of heating effects for model geometries

Examples:
Blue room and related tests uncovered critical materials issues for Mark III source

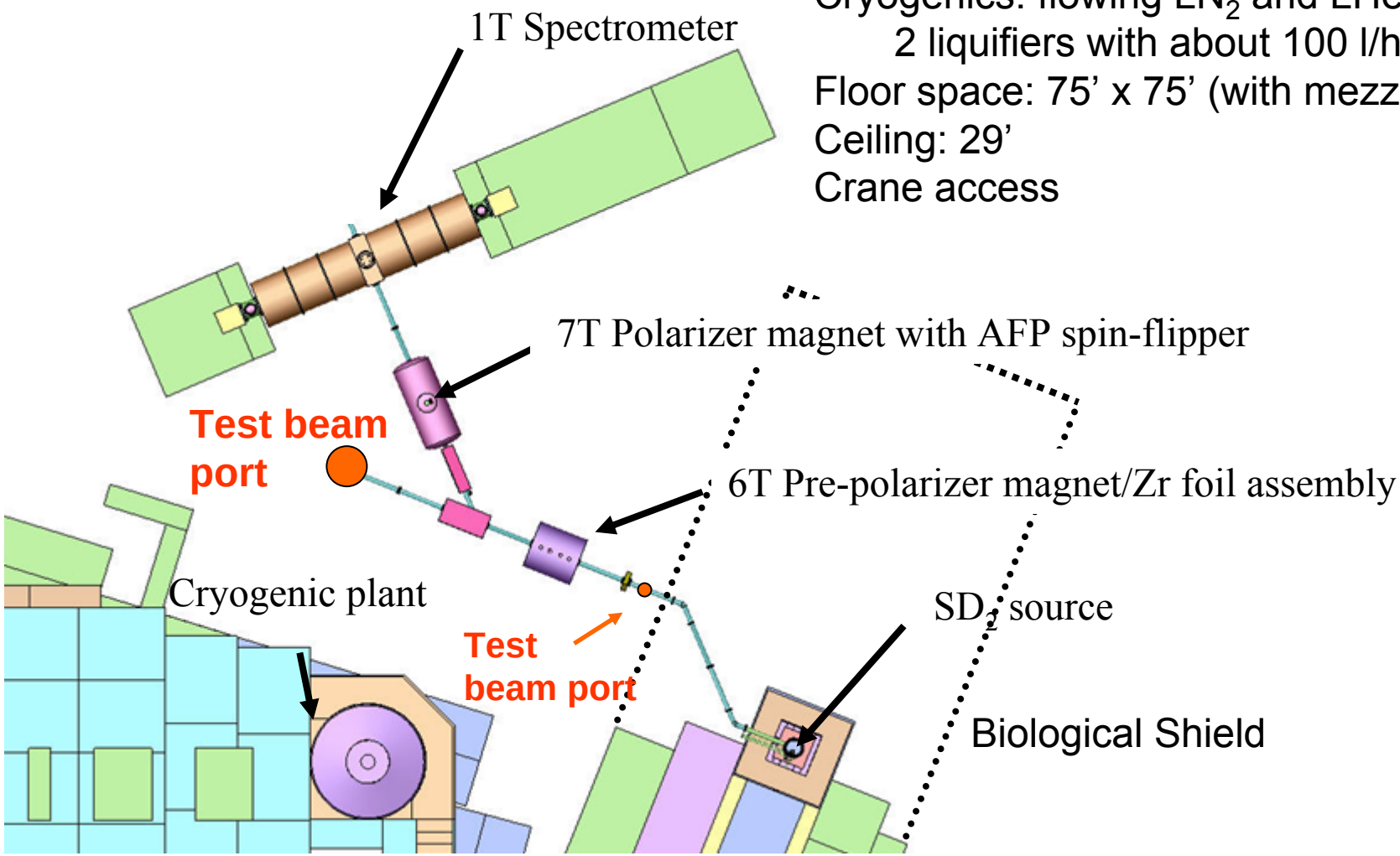
Blue room and related tests uncovered serious issues for UCNA source:
- Beam-generated heading and vapor production in source material
- UCN losses due to use of cold windows in transport system
- Losses due to para-deuterium

Layout in Area B



UCNA Experimental Layout in Area B of LANSCE

2 UCN Test beam ports
Polarized or unpolarized UCN
Cryogenics: flowing LN_2 and LHe
2 liquifiers with about 100 l/hr capability
Floor space: 75' x 75' (with mezzanine)
Ceiling: 29'
Crane access



Loading the Decay Volume: SD_2 source facility

4 kW spallation power (about 5 μA)

- 2005: no decays

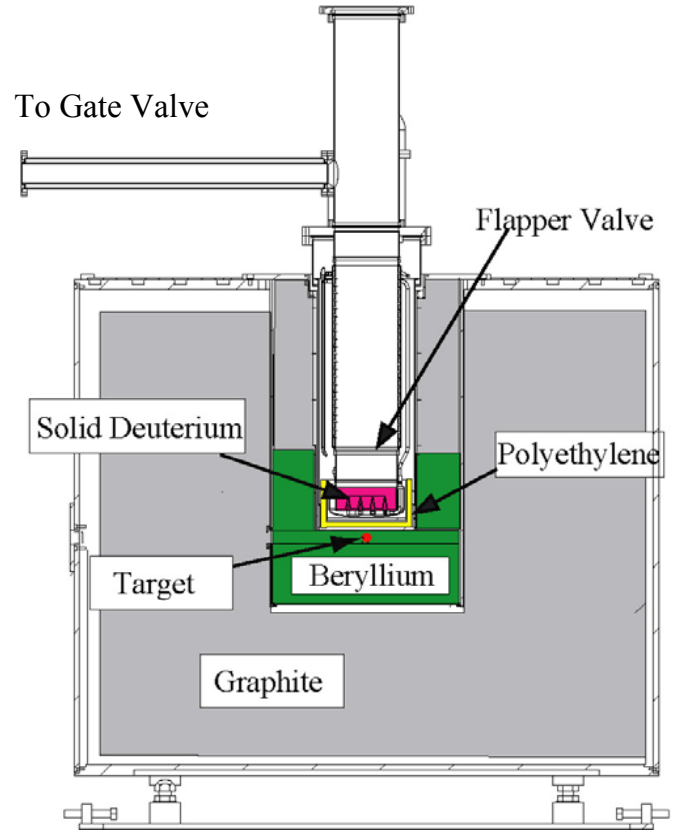
  replaced horizontal guides w/ SS
- 2006: 2 s^{-1} (raw rate)

  current: <1μA →2μA, improved flapper
- 2007: 6 s^{-1}

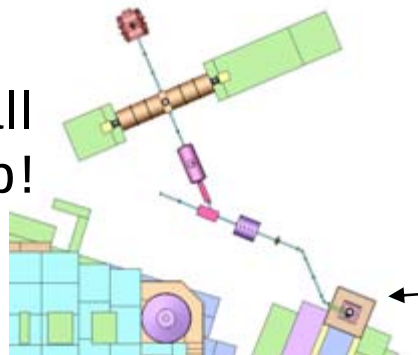
  current: →4μA, source volume 2l
- 2008: 15 s^{-1}

  guides changed to DLC-coated EP Cu, geom C
- 2009: 30 s^{-1}

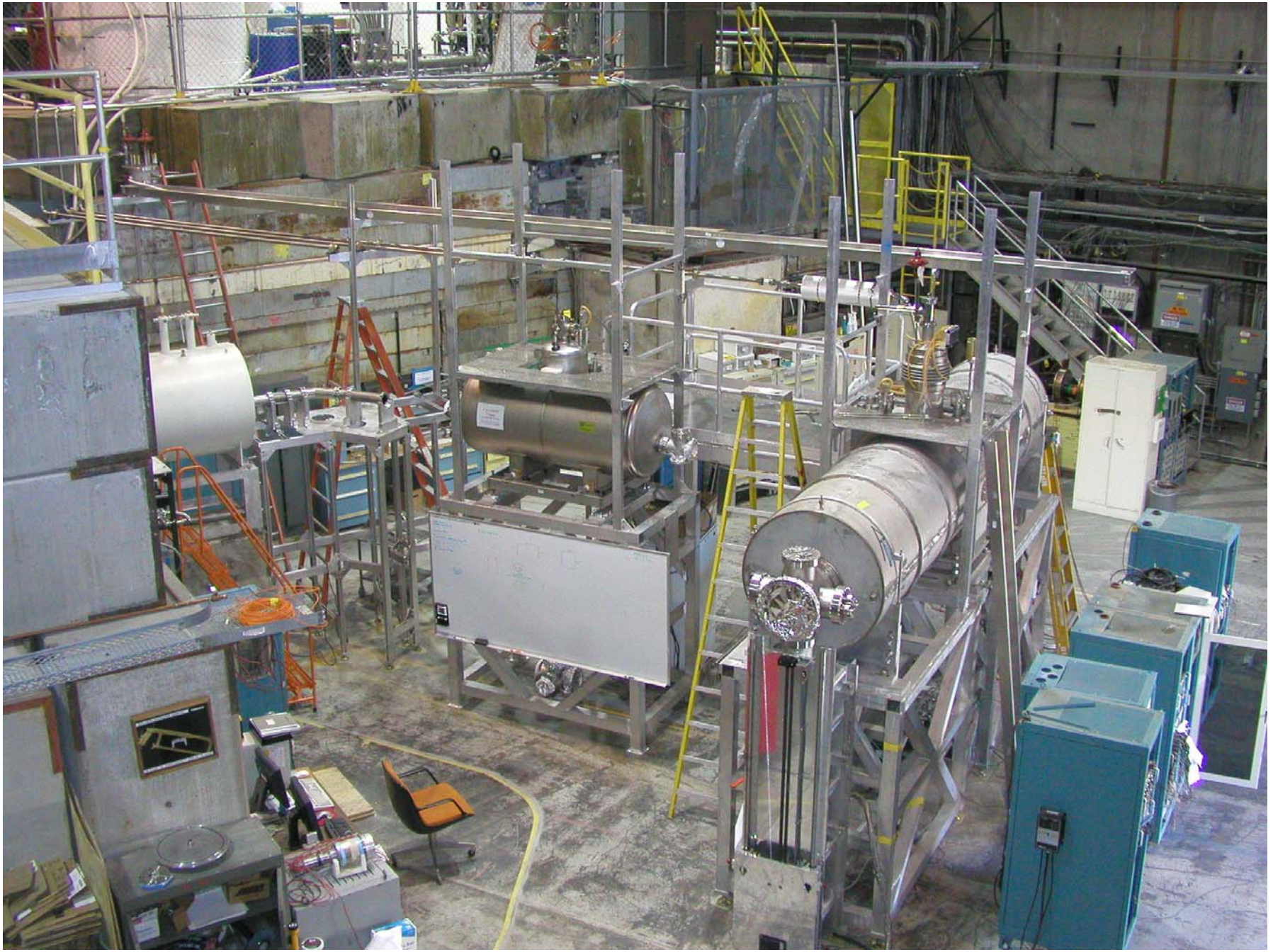
  new target and improved guides before AFP
- 2010: 55 s^{-1} (Nov)



≈ 80 UCN/cm^3 at guide wall
2 UCN/cm^3 in decay trap!



Solid deuterium source



What Can Be Done?

- Direct evaluation of UCN and VCN production in solid and liquid deuterium sources (UCNA source can serve as benchmark and test of methods)

- Development and evaluation of neutron detection and neutron optics

Examples:

1) Multichambered 3He detectors developed for TOF studies of VCN production in UCNA source
2) Low noise MWPCs developed for UCN detection
3) DLC-coated UCN guide developed for polarization-preserving neutron transport

Higher Power Operation

- Specific areas may be available for higher power operation
  - UCNA utilized Line B for this purpose during development work
  - Other sites appropriate for high power testing exist, but may require more beamline development
- A dedicated high power target test station (HPTTS) with cryogenic capability is also under consideration for a future facility, which would provide an ideal development platform for next generation neutron sources…