ADS Experiments Summary and MTS Status

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Several ADS Coupling Experiments are in Progress

- MUSE 1, 2 and 3 completed
- MUSE 4, complete
- TRADE 1B, analysis in progress
- RACE in progress
- SAD planned thru the ISTC

MUSE 1,2,3

MUSE 1 and 2

- Cf-252 source
- Neutron source strength 1e8 n/s
- Core Fuel: MOX (UO2PuO2, Pu around 25% enrichment): Fast Neutron Spectrum
- Core power (500 watts from intrinsic source)
- Test completed in 1995 and 1996 (few weeks each)
- Experiment provided first measurement of the source importance
- Demonstrated the ability to measure the source importance

MUSE 3

- DT commercial tube (SODERN GENIE26)
- Neutron source strength 1e8 n/s
- Core Fuel: Same as in MUSE 1, 2
- Core power (500 watts from intrinsic source)
- Tests completed in February thru April, 1998
- Experiment demonstrated the difficulties of measuring reactivity by PNS (in absolute sense)

Muse 4

- Completed August 2004, Analysis continuing
- DT and DD generator built by CNRS Grenoble (Deuterium accelerator coupled to D or T target)
- Source Strength, DD approximately 1e08 n/s, DT approximately 1e10 n/s
- Same core fuel as MUSE 1, 2, 3 (Fast Spectrum)
- Core power from zero to 1-2 kw. (Core is slightly air cooled)
- November 27, 2001 was first coupling of neutron generator to core.
- Extensive multinational effort to demonstrate methods of reactivity monitoring (variations of PNS, Feynman and Rossi-alpha, and noise techniques).
- Eight PhD's (Muse 3 & 4)

TRADE-1B Tests

- Underway since July, 2004, DD and DT neutron source
- DT around 1e09 n/s
- TRIGA fuel (20 % enriched U235, 8 w/o Uranium, UZrH matrix): Thermal Spectrum
- Core power from zero to a few hundred watts, Keff from 0.95 to 0.995
- Experiment is providing confirmation of MUSE reactivity measurement methods
- Experiment will demonstrate the independence of reactor spectrum (TRADE is a thermal spectrum, while MUSE is fast)
- Complete by December, 2005

TRADE-II and III Goals

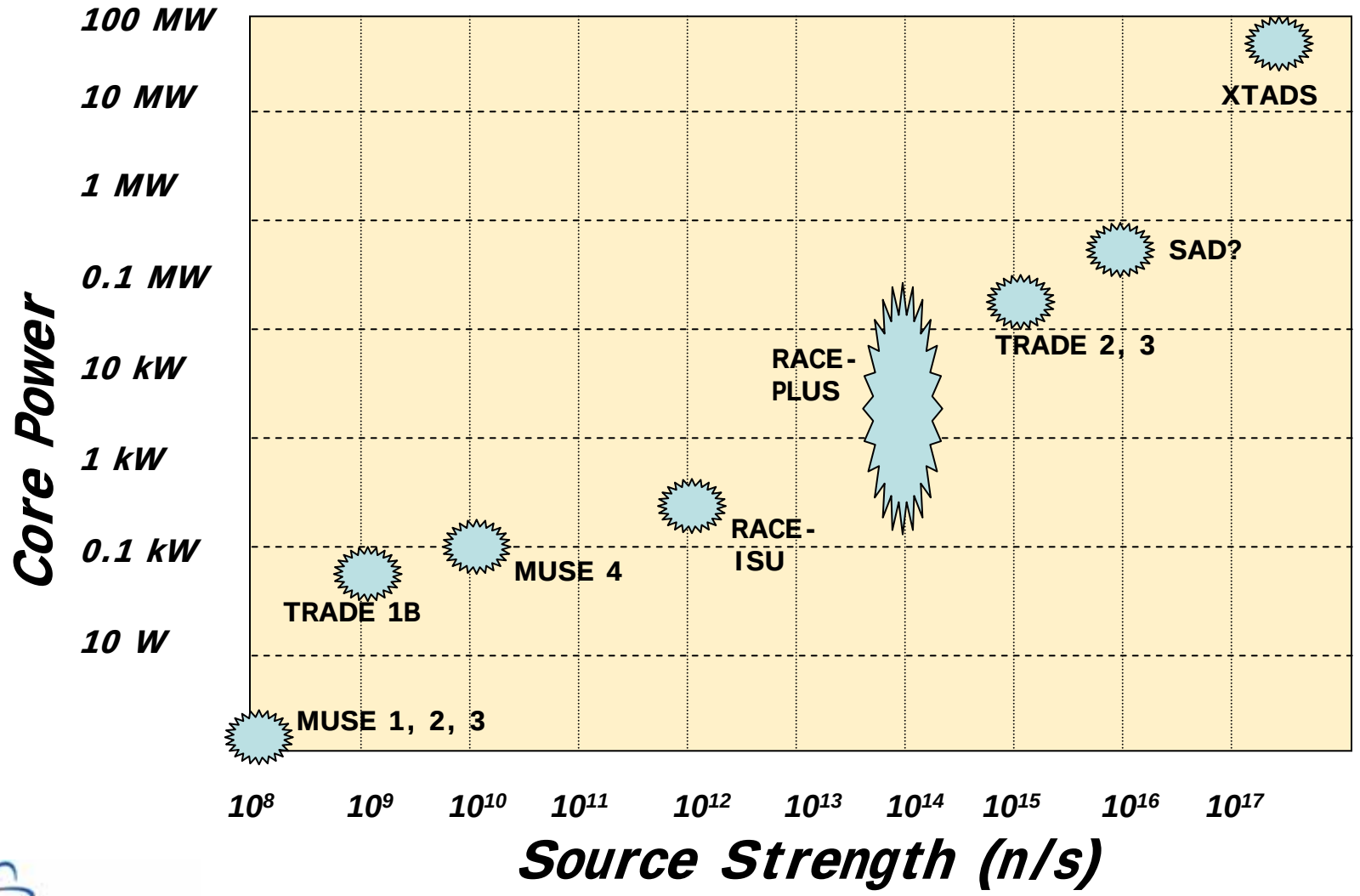
- **Neutron Source: 140 MeV protons from cyclotron at 300 micro-amps impinging on a Water-cooled Tantalum Target. (30-40 kW target power)**
- **Source strength of 1e15 n/s**
- **TRIGA fuel with central elements removed for the tantalum target.**
- **Up to 200 kW core power.**
- **Planned to provide operational testing of beam current, reactivity, and source importance interactions at a power level where feedback is important.**
- **Demonstration of controlling an ADS power level w/o control rods.**
- **Will provide final reactivity monitoring techniques to XTADS**

RACE

- **RACE-ISU**
  - 1kW electron on tungsten copper
  - 1e12 n/s source strength,
  - 0.9 - 0.94 keff subcritical assembly of uranium plates:
- **RACE-Plus**
  - 30 kW electron linac (30 MeV) on DU target
  - up to 1e14 n/s source strength
  - Drive the UT TRIGA and TAMU TRIGA, up to 100 kW core power

- **Can hopefully meet the original TRADE goals:**
  - provide operational testing of beam current, reactivity, and source importance interactions at a power level where feedback is important.
  - Demonstration of controlling an ADS power level w/o control rods.
  - provide final reactivity monitoring techniques to XTADS

Coupling Experiment Comparison



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ADS Experiments Summary

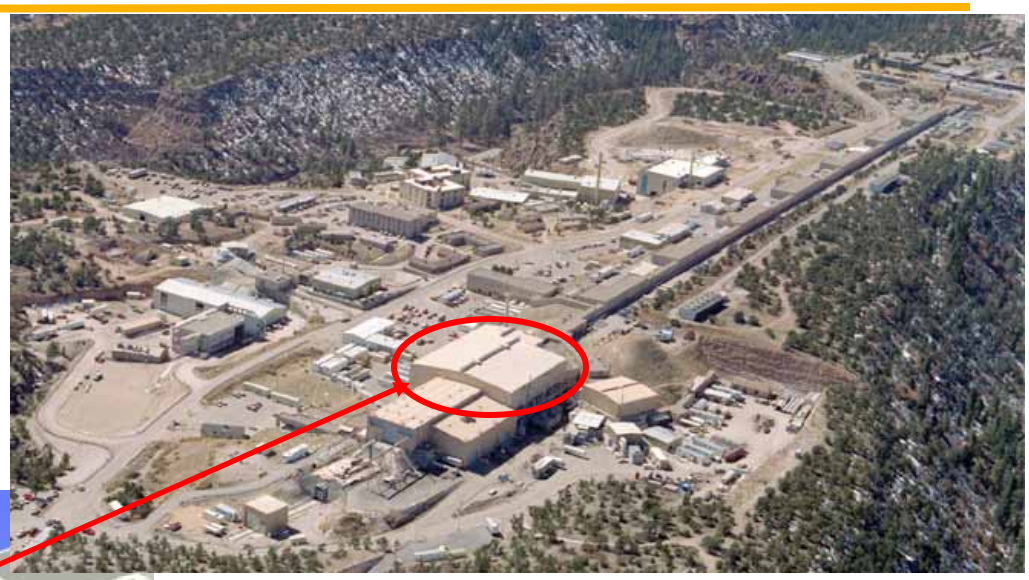
- **MUSE experiments at zero power provided the basis for reactivity monitoring and control.**
- **TRADE experiments originally planned to provide demonstration of control and operation at sufficient power level to measure feedback effects. RACE may be able to support these goals if ~100 kW can be achieved.**
- **XTADS will provide a 100 MW demonstration.**

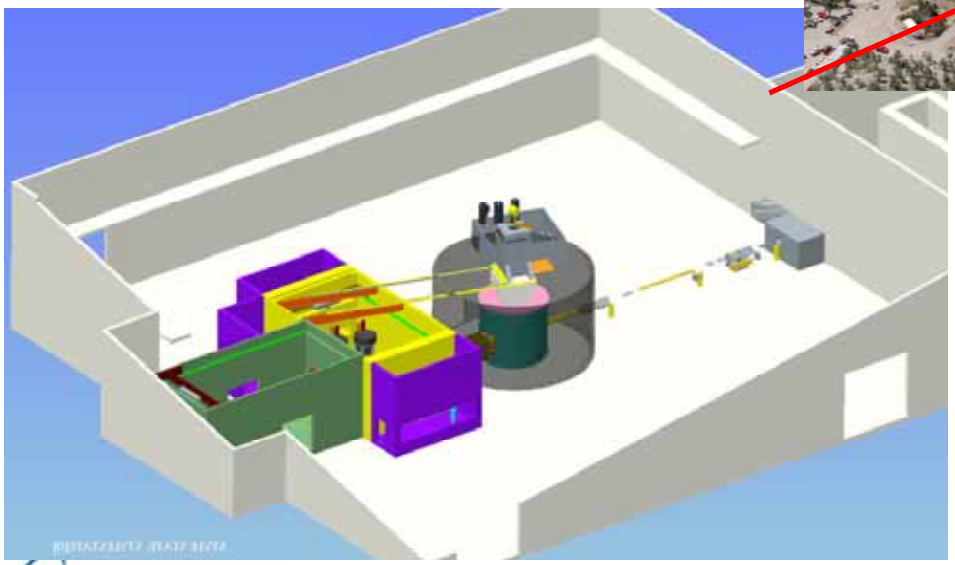
Status of the LANSCE Materials Test Station

- ***What:*** Replace unused experimental target in Area-A at LANSCE with a new test station that provides an intense source of fast neutrons for the irradiation of samples of structural materials and fuels.
- ***Mission Need:*** Provide domestic fast-neutron irradiation capability to meet the programmatic demands of the Advanced Fuel Cycle Initiative and Generation-IV programs.
- ***And:*** Provide user facility for researchers and collaborators (University and International), and meet the needs of other programs such as space reactors, fusion energy and isotope production.
- **Status:**
  - $7 M received in January
  - Need 3 years and 36 - 50$M to complete
  - Pre-Conceptual Design Complete

MTS will Replace an Existing Target in LANSCE Area-A Experimental Hall

LANL Assets include: Existing high-current, high-energy proton linac, an existing experiment hall with the right size and proportions, utilities and operating 30-T crane.





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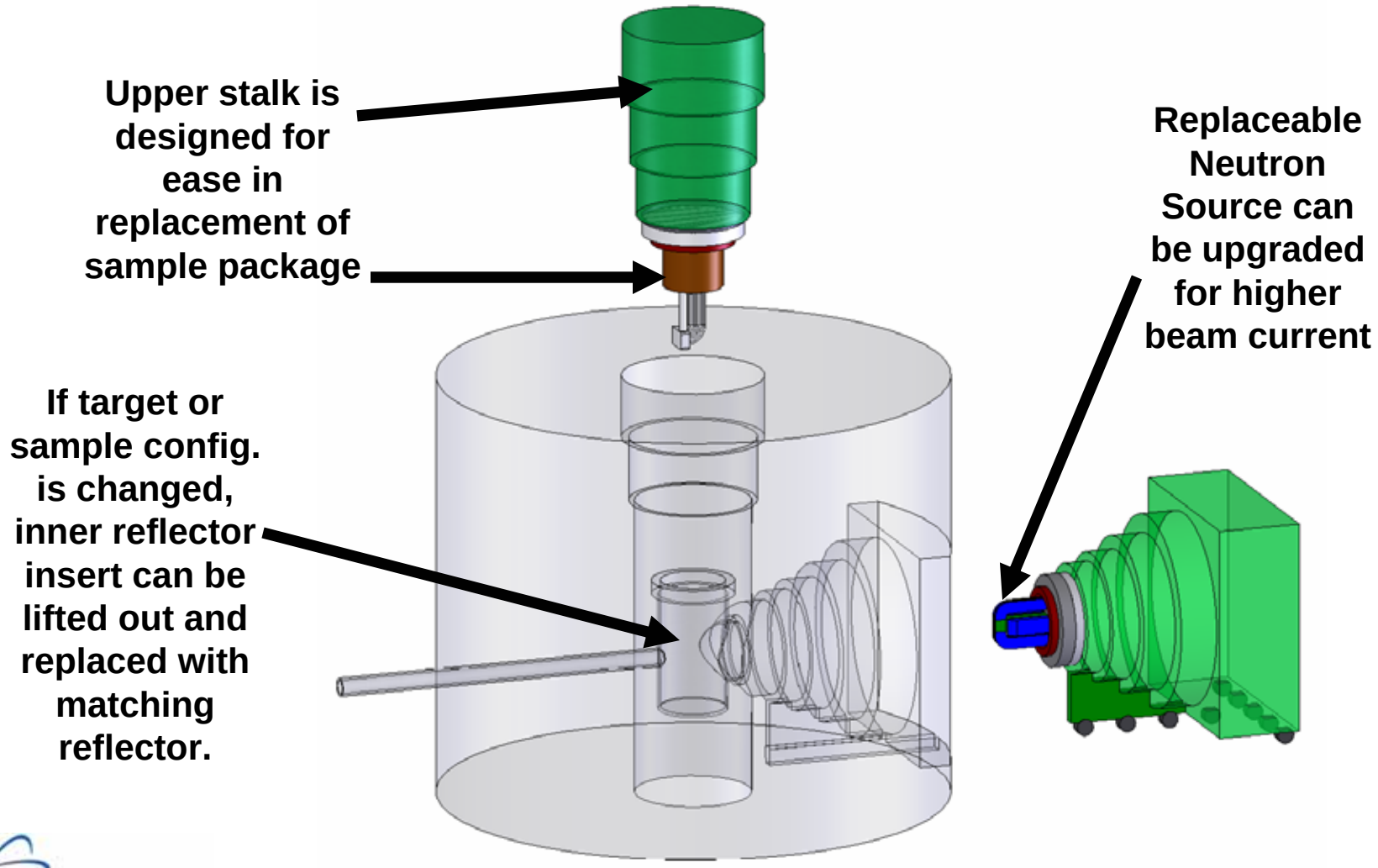
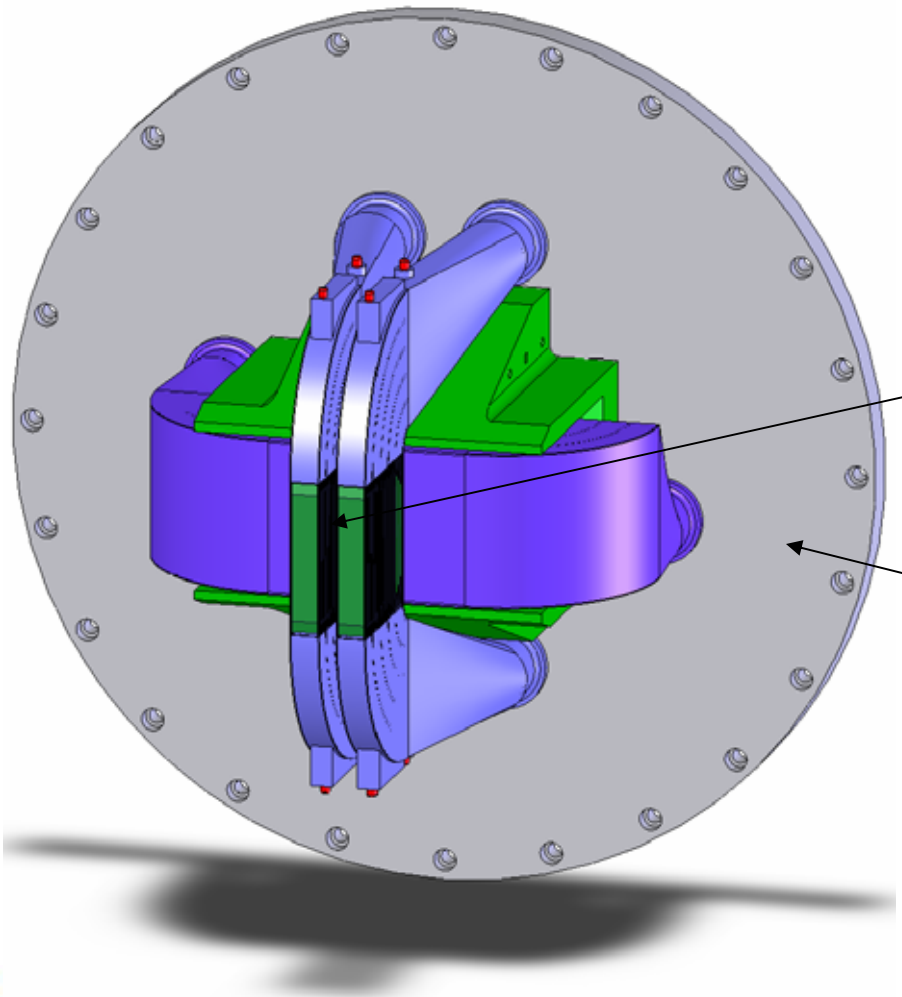
The Neutron Source and Sample Modules Provide a Versatile System to Accommodate User Needs



MTS is Designed to Accommodate a Doubling of Beam Current

Parameter	*Initial*	*Upgrade*
Proton Beam Current	*1mA*	*2mA*
Proton Beam Power	*800 kW*	*1600kW*
Target Power	*600 kW*	*1200kW*
Target Decay Power	*6 kW*	*12kW*
Sample Insert Design Power	*50 kW*	*Same*
Sample Design Decay Power	*12 kW*	*Same*
Peak Total Neutron Flux	*1e15 n/cm2/s*	*~2e15*
Peak fuel power density	*1000 W/cc*	*2000*
He/dpa range	*1 - 10*	*Same*
Number of Experiment positions	*24 - 36*	*Same*

Tungsten Neutron Source is Based on Existing Technology



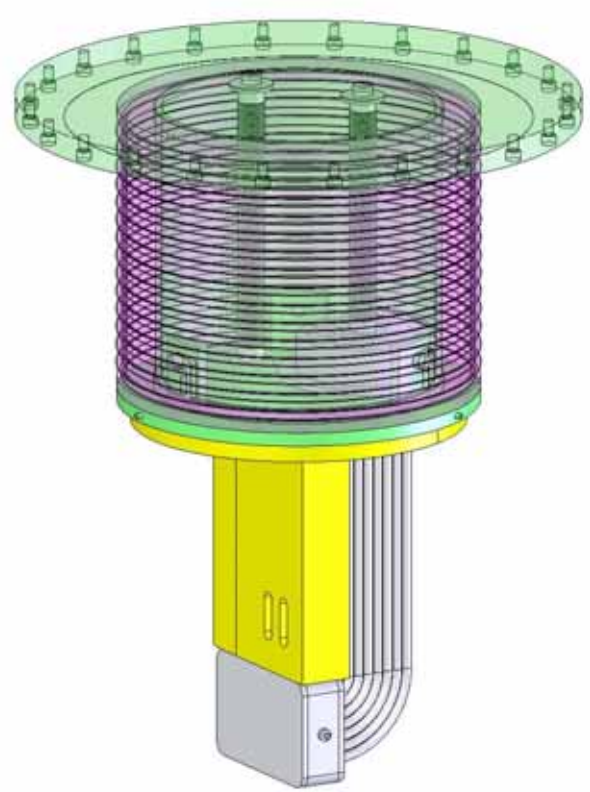
Based on experience from LANSCE, ISIS, and KENS

- Tungsten plates clad in Ta or SS
- Heavy water cooled
- Easily replaceable target assembly.

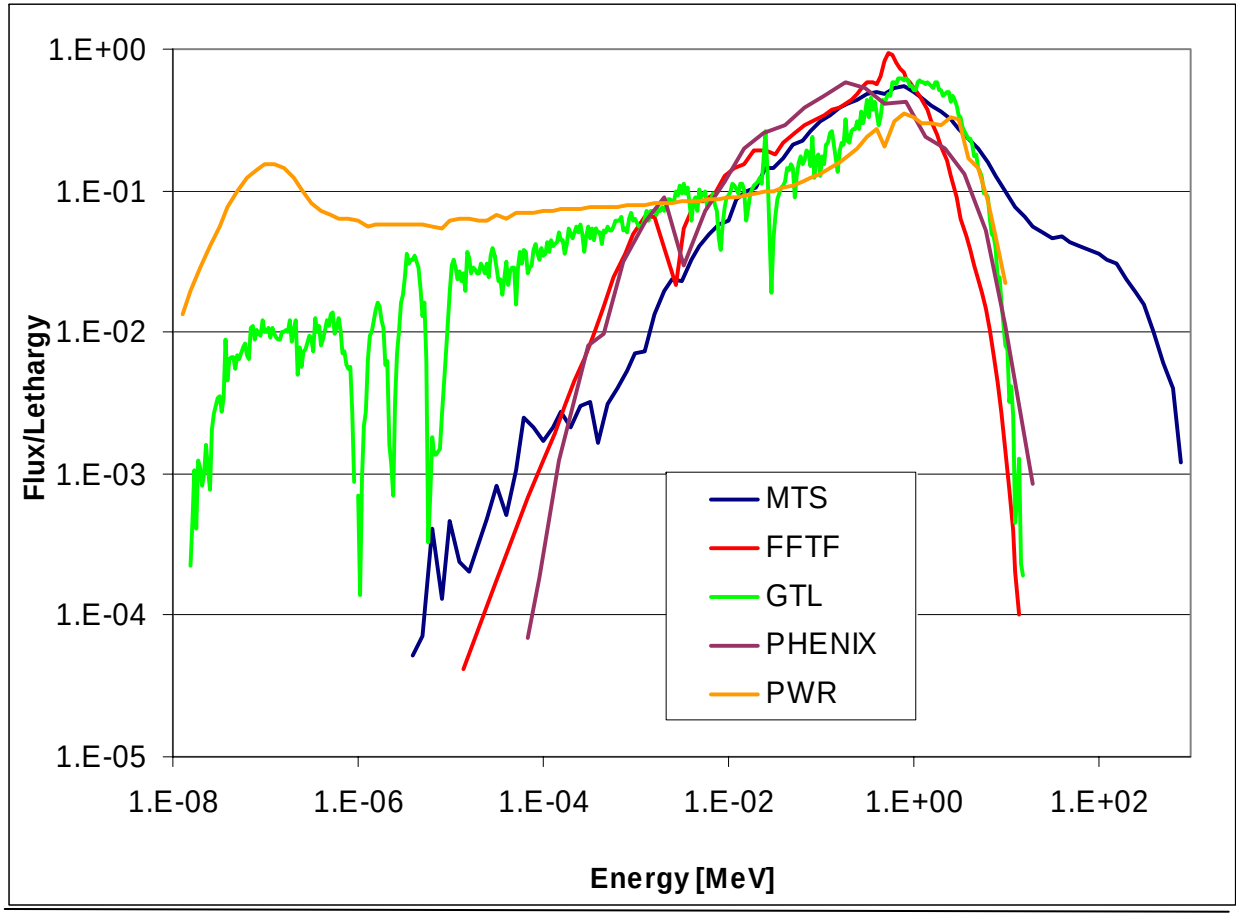
Sample Module Provides Controlled Environment for Irradiations

- Lower sample assembly is a single application test article
- Features
  - Sized to accommodate various sample packages and layouts
  - Light or heavy water cooling*
  - Flexible enclosure and guide features for precision alignment
  - Helium/vacuum seal
  - Head gasket seal for coolant penetration into upper stalk
  - Gas/electrical cable routing and connections into upper stalk
  - LBE coolant loop upgrade path

***Liquid Metal Closed Loop may be nested within coolant tubes as needed for experiment.**



Neutron Spectra is Prototypic of Fast Reactors



MTS neutron spectrum is similar to fast reactors, with the addition of high energy "tail"

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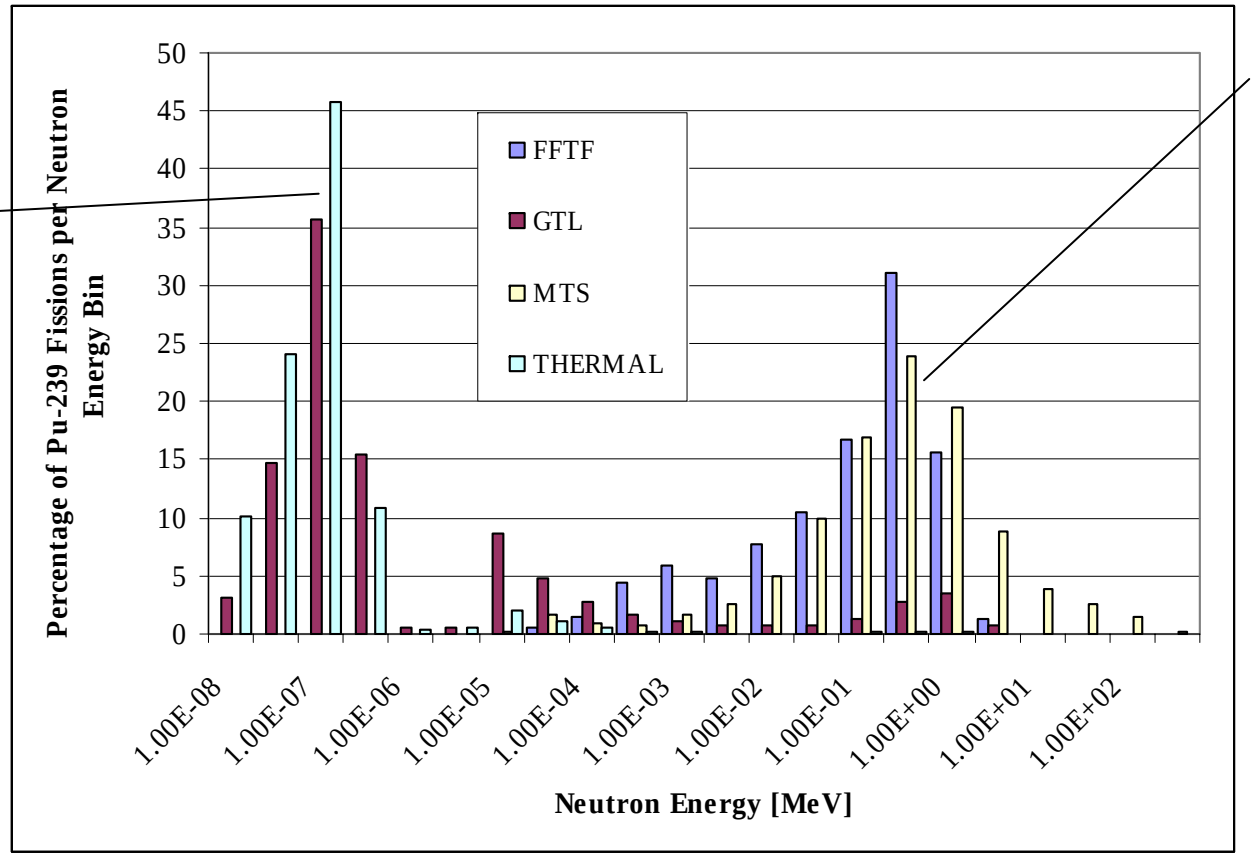
MTS Provides the Correct Fluence to Burn up Ratio Needed to Test Fast Reactor Fuels

In thermal neutron systems virtually all fissions are induced by low energy neutrons



MTS simulates fast reactor conditions with the correct neutron fission spectra

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MTS Status Summary

- The Materials Test Station project is moving forward towards completion in FY09.
- LANSCE Accelerator is being refurbished to provide reliable beam.
- MTS provides a versatile fast spectrum irradiation capability for the AFCI and Gen-IV programs.