

AFCI Reactor-Accelerator Coupling Experiments (RACE) Project

Denis Beller

&

Frank Harmon

Idaho St. University

(e-mail: beller@egr.unlv.edu)



RACE-ECATs Meeting

April 20-21, 2005

RACE Project Collaborators



ISU: A. Hunt, J. Bennion, K. Sabourov, J. Chen, R. Spaulding, K. Folkman, and students V. Makarashvili, C. Maidana, J. Peterson, and others

Texas: W. Charlton, S. O’Kelly, and students T. Woddi, T. Greene, and D. Speaker

UNLV TRP: students E. Stankovskiy and T. Beller

U of Michigan: J. Lee and Ph.D. students Y. Chao and V. Kulik (graduated, post-doc at CEA Saclay)

Labs: G. Imel (ANL) and J. Sanders (INL)

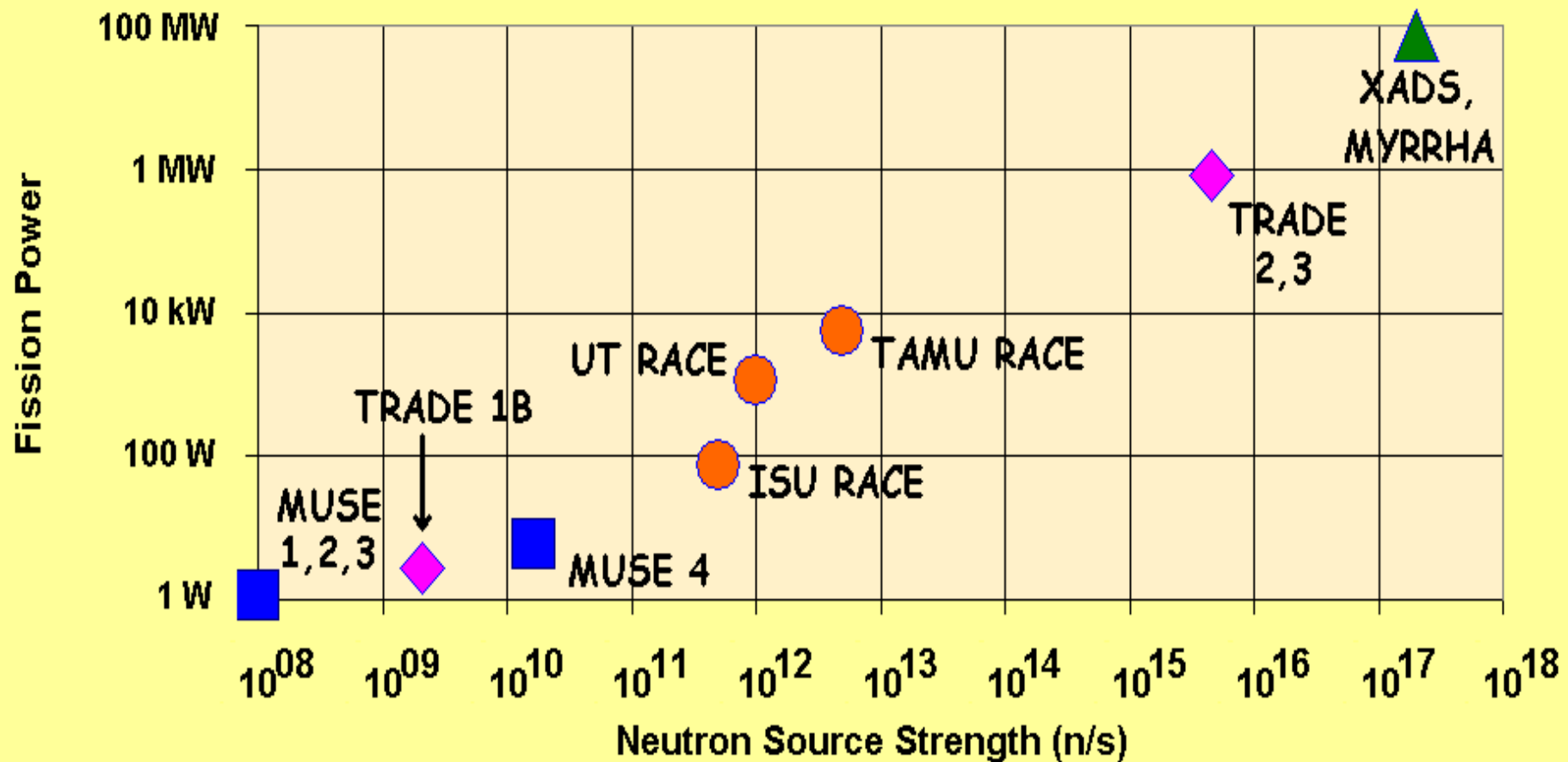


RACE is an academic project to

- Design, model, and conduct ADSS experiments
- Predict and analyze subcritical multiplication and source-driven transients
- Map source importance & flux in and around a **variety** of ADSS
- Complement international ADSS research (e.g. MUSE, TRADE, SAD, J-PARC, VENUS-1, and others)



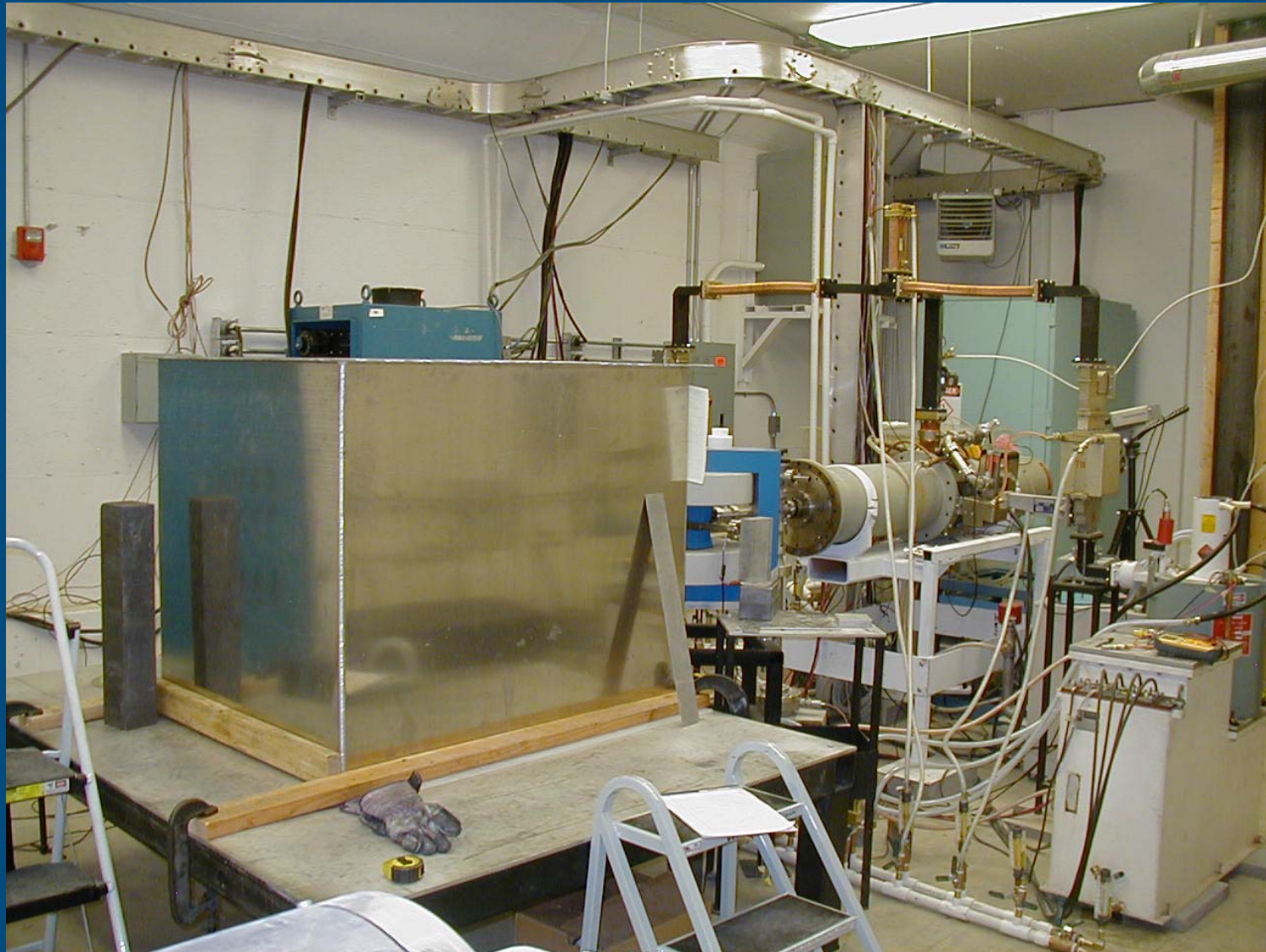
Source strength and reactor power comparisons



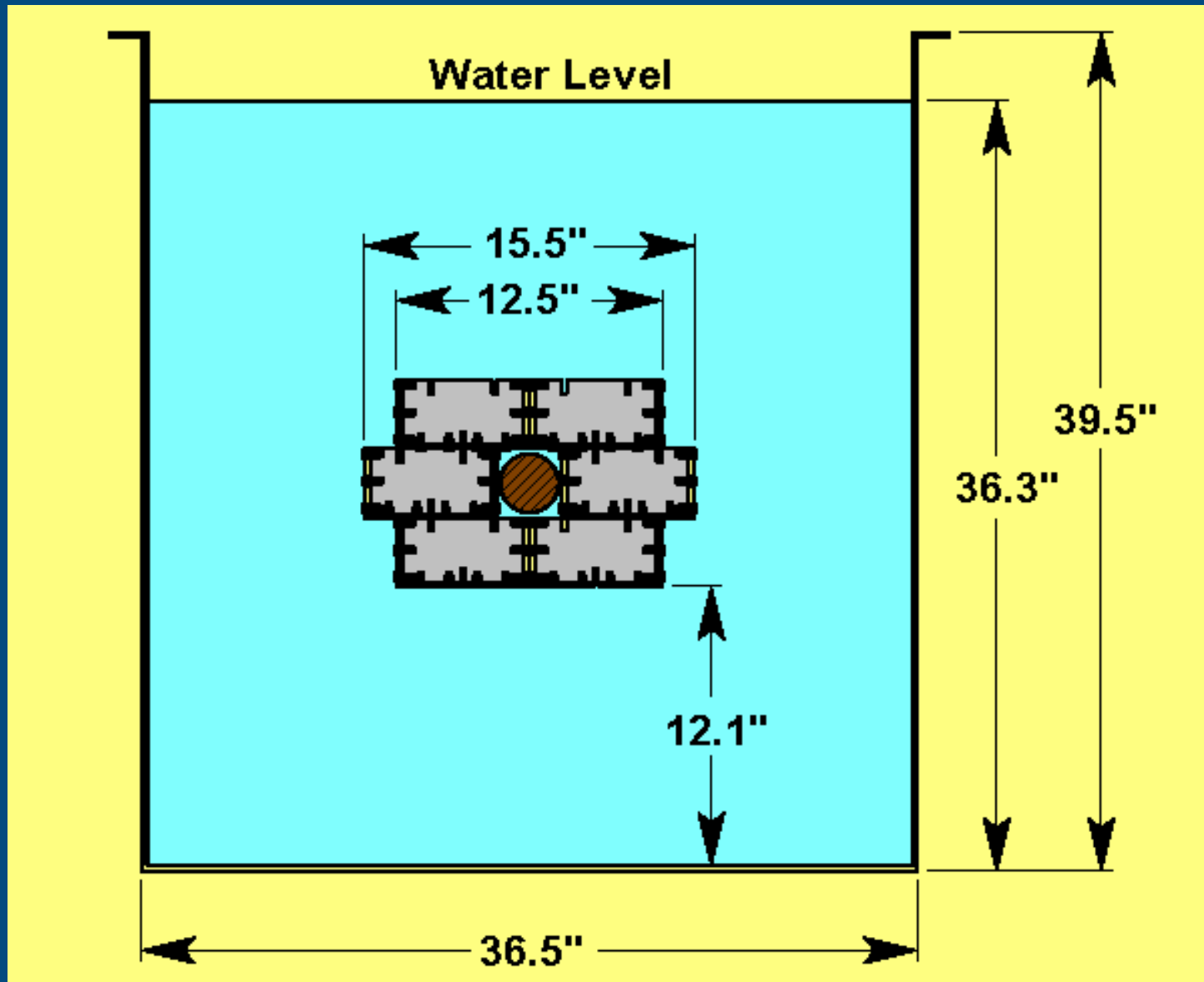
Reactor Characteristics

University	nominal power (kWth)	peak power (MWth)	target location	fuel type	fuel composition	fuel enrichment	keff
ISU	0	0	center	plates	U-Al Alloy, Al clad	<20%	0.7-0.95
UT-Austin	1	1000	edge	rods	U-ZrH	<20%	~0.92 to 1.0
Tx A&M 1	10	1000	edge, graphite column	rods	U-ZrH "FLIP" fuel	70%	up to 1.0
Tx A&M 2	10	1000	center	rods	U-ZrH	<20%	up to 1.0
Tx A&M 3 (LBE)	0	0	center	rods	U-ZrH	<20%	0.90 to 0.95?

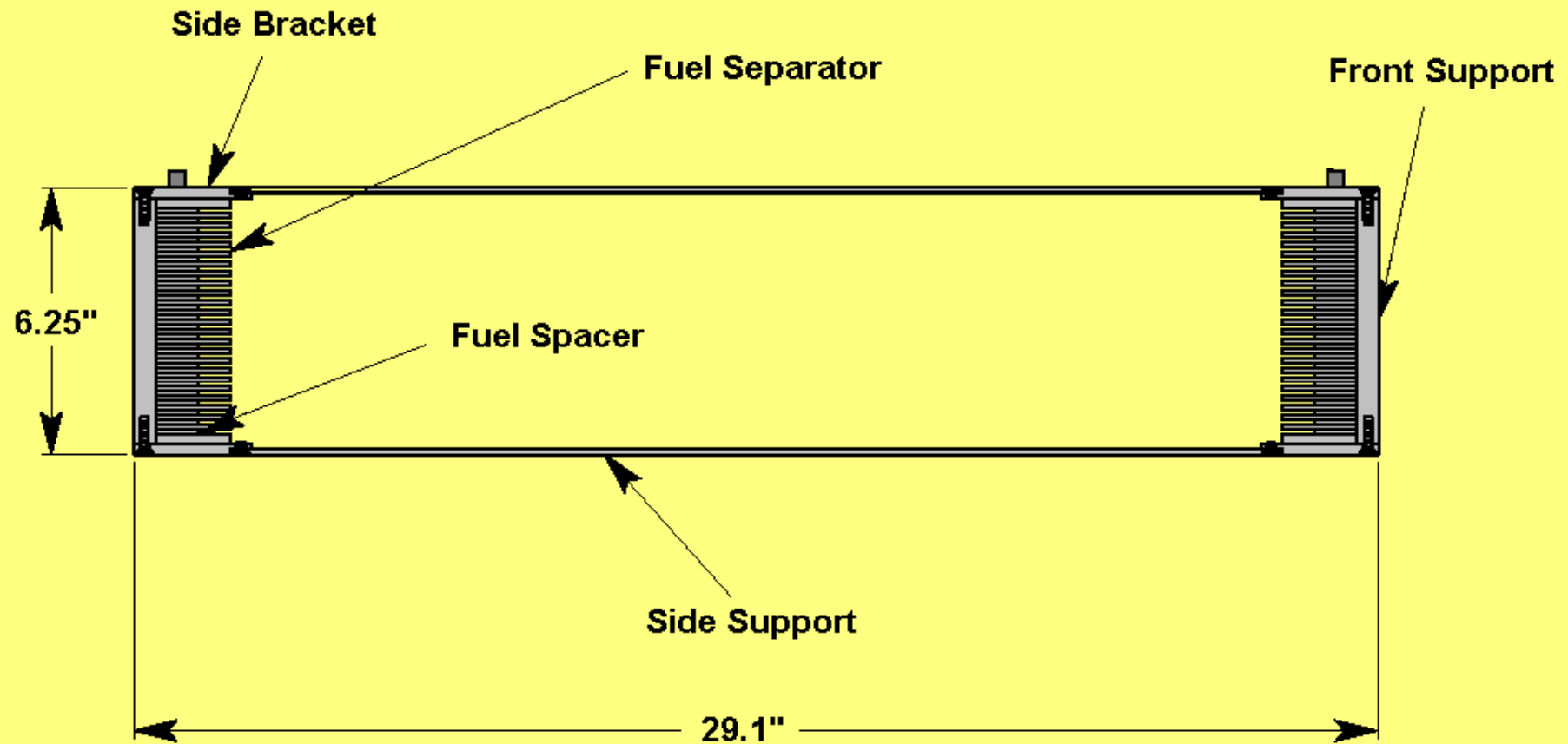
Accelerator and “large” vessel



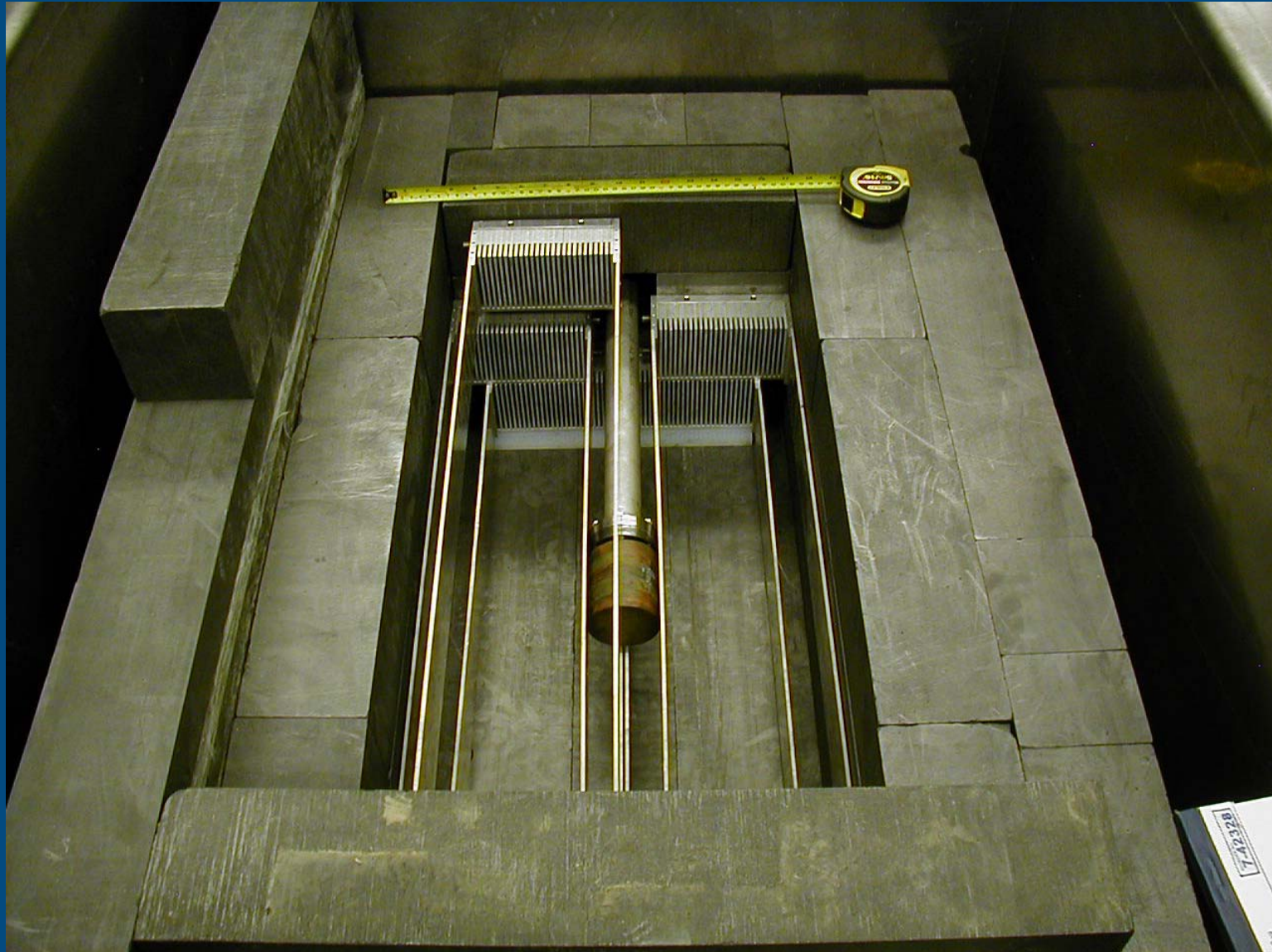
Vessel, target, and fuel trays



Components and dimensions of a modular RACE fuel tray (3.24" h) [Alan Hunt design]



RACE fuel trays and target inside the graphite reflector

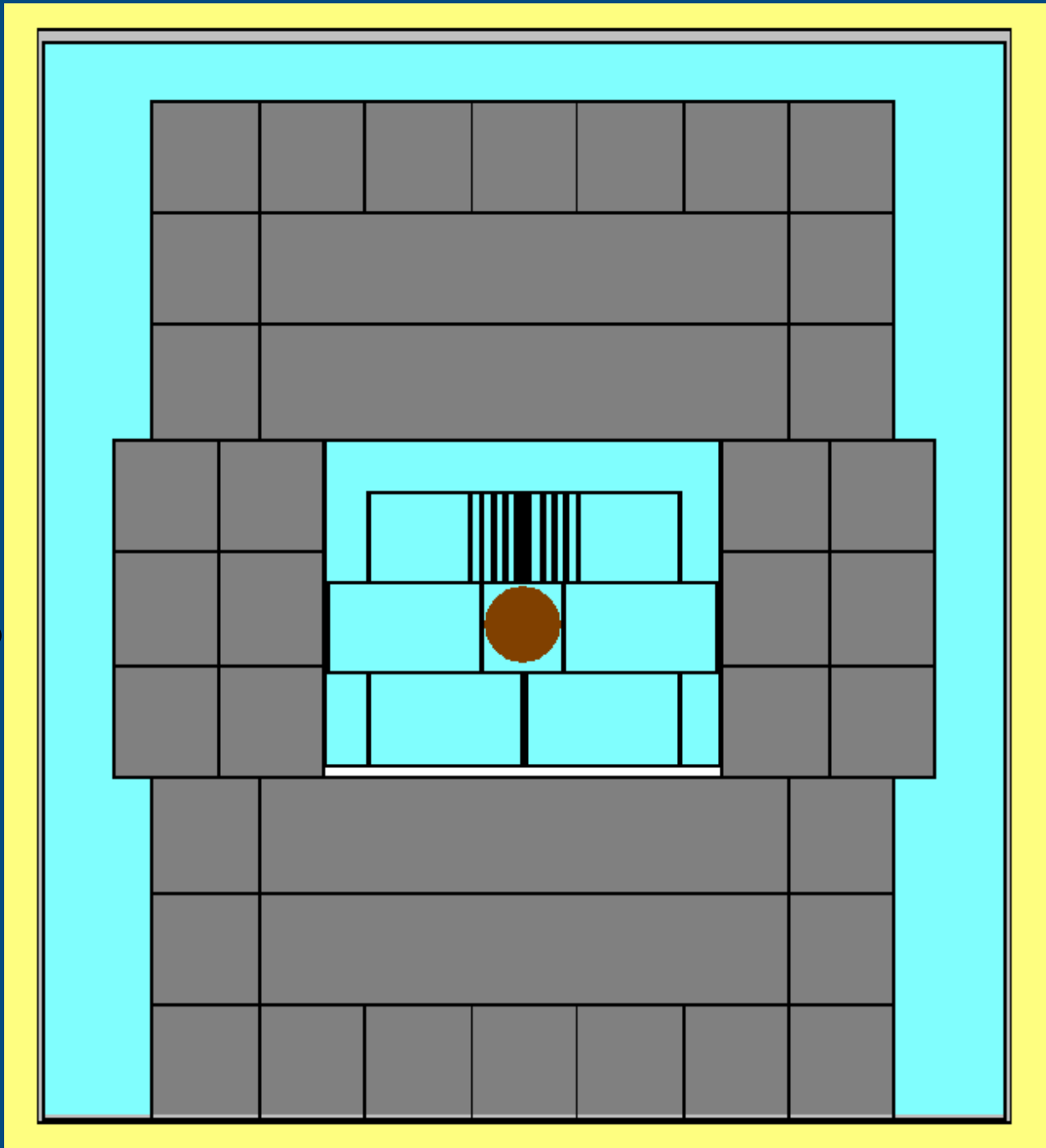


RACE Progress

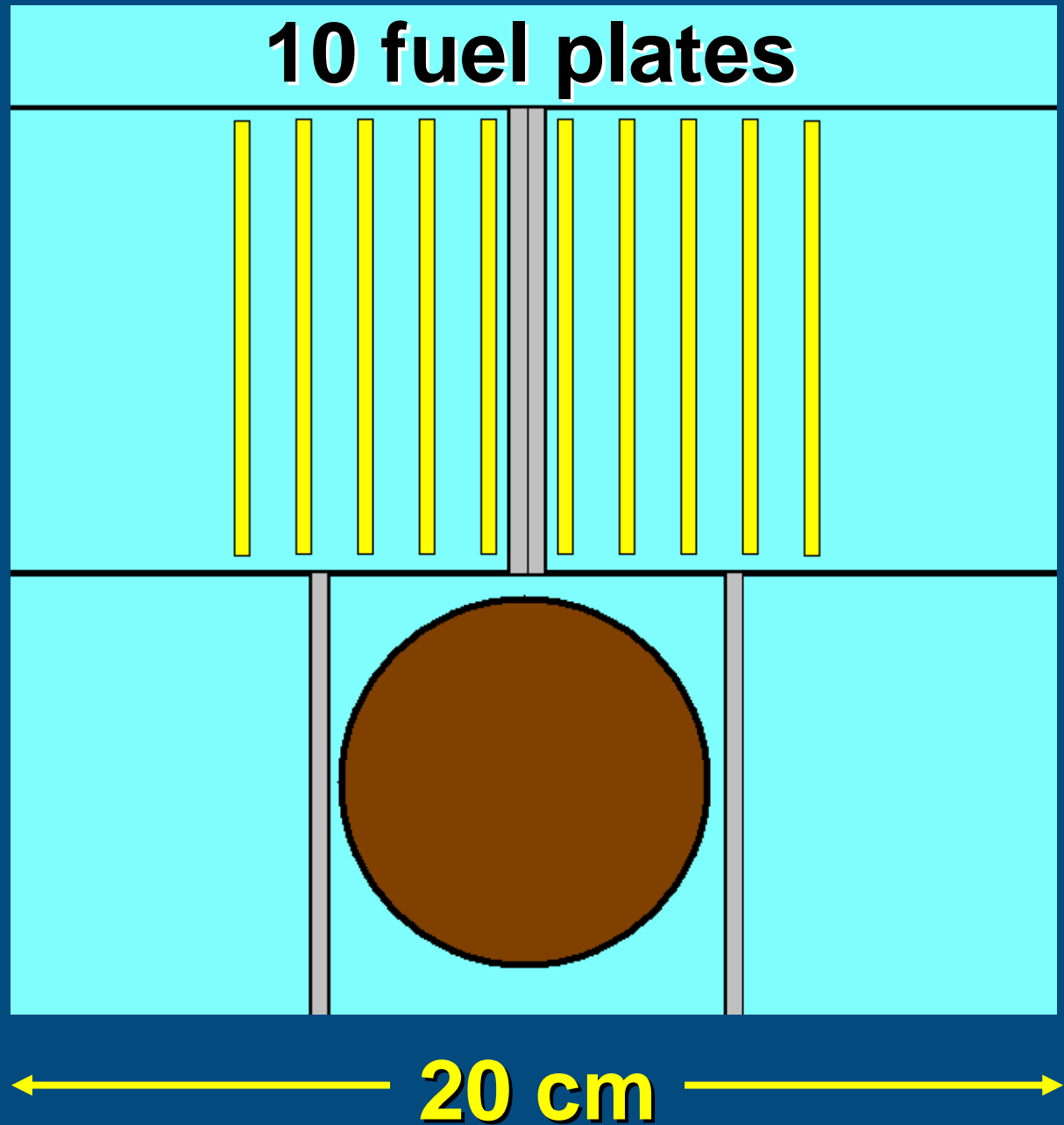
- **Static and transient analyses completed at U of Mich**
- **ISU Benchmark validation and criticality analyses with MCNPX**
- **NRC license amendment**
- **Design studies completed at Texas A&M**
- **Accelerator & instrumentation being developed for UT**
- **ADSS and other experiments completed at ISU-IAC**



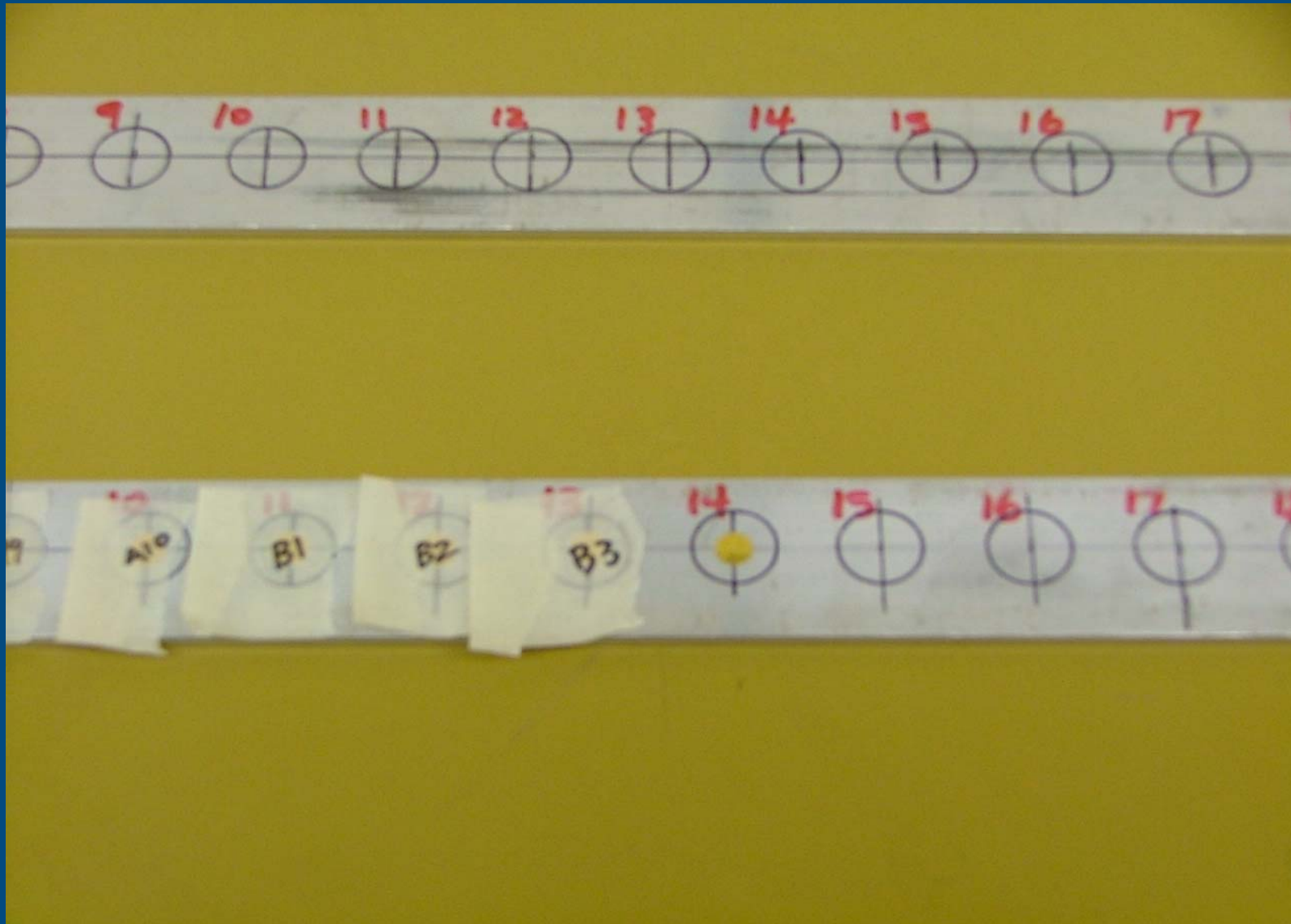
**Cross
section of
10-plate
experiments
from
MCNPX**



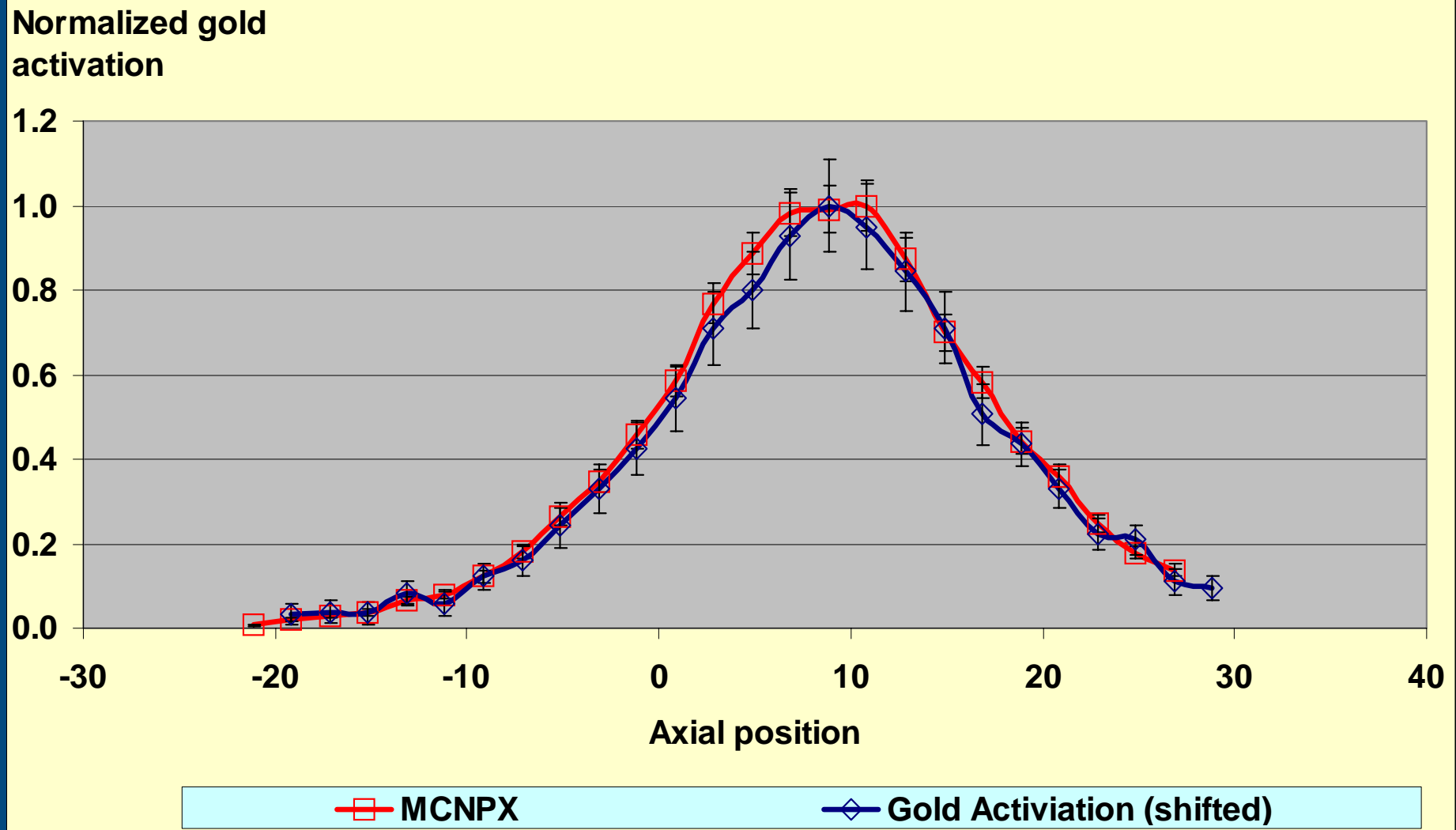
**Cross
section
of fueled
region**



Gold Foil Placement



RACE Results: Gold activation versus MCNPX



Detector development activities

- Challenging environment:
 - » EM noise and gamma-ray flash during each accelerator pulse
 - » activation background increases during test
- Team approach: ISU, UT, INL, and ANL
- ^3He detectors
- Fission Chambers
- Self-powered neutron detectors



Schedule

- Phase I: ISU-IAC
 - » Design & licensing **Aug '03-Mar '05**
 - » Full-core experiment **Spring '05**
- Phase II: UT-Austin **Summer '05+**
 - » TRIGA, fresh fuel, other
- Phase III: Texas A&M **Summer '06+**
 - » TRIGA '06, TTS '07, (LBE '08?)
- Phase IV: High power **2006+**



RACE is a multi-university academic project in collaboration with DOE labs

- Predict and measure subcritical multiplication, source-driven transients, and map source importance
- ADSS exp. at ISU, UT-Austin, and Texas A&M
- Students and post-docs design, model, and execute → education and training
- k_{eff} up to $1-\beta$ and thermal feedback
- Now thru 2007 or beyond

