

Accelerator-Driven Subcritical Systems Experiments

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Within the ISU AFCI Project we will conduct ADSS Experiments:

- **Idaho State University**
 - » **IAC + “transportable” reactor**
 - » **Prof. John Bennion**
- **UT-Austin**
 - » **UT NETL TRIGA**
 - » **Prof. Sean O’Kelly**
- **Texas A&M University**
 - » **TAMU NSC TRIGA + others**
 - » **Prof. William Charlton**

Why? Demonstrate the ability in the U.S. to:

- **Design, model, and conduct ADSS experiments**
- **Predict and measure subcriticality and subcritical multiplication**
- **Predict and analyze subcritical source-driven transients**

Other purposes

- **Create steady state and transient benchmarks**
- **Test new computational codes and methods**
- **Recruit, educate, & train students**
- **Transmute higher actinides or problem fission fragments in ADSS**

ISU Electron Linac & Target

- 20 MeV Linacs
- Two Linacs coupled
 - » 20 to 40 MeV
- $\sim 10^{12}$ neutrons/ μA
 - » UNLV student developed targets
- 4 kW beam (100 μA @ 40 MeV)

ADSS Experiments Participants at ISU:

- **Prof. John Bennion, ISU Nuclear Engineering, ISU experiments, licensing**
- **Dr. Alan Hunt, ISU-IAC, Accelerators and experiments**
- **Dr. Mohamed Reda, ISU-IAC, Reactor physics, target design, experiments**
- **Undergrad and graduate students**

Texas ADSS Experiments

Participants:

- Prof. William Charlton, UT-Austin and Tx A&M, Texas experiments, licensing
- Prof. Dan Reece, Texas A&M, Reactor supervisor
- Prof. Sean O'Kelly, UT-Austin, Reactor supervisor
- students

Reactor Characteristics

University	nominal power (MWth)	peak power (MWth)	target location	fuel type	fuel composition	fuel enrichment	keff
ISU	0	0	center	plates	U-Al Alloy, Al clad	<20%	0.92
UT-Austin	1	1500	edge	rods	U-ZrH	<20%	~0.92 to 1.0
Tx A&M 1	1	1000	edge, graphite column	rods	U-ZrH "FLIP" fuel	70%	? to 1.0
Tx A&M 2	1	1000	center	rods	U-ZrH	<20%	? to 1.0
Tx A&M 3	0	?	center	rods	U-ZrH	<20%	0.90 to 0.95?





**Inside the
shielded beam-
port bay for the
UT-Austin
ADSS
Experiment**



Other ADSS Experiments

Participants (TBD):

- **Prof. William Culbreth, UNLV, Calculations, supervise students, analysis**
- **Dr. Carter Hull, UNLV, Instrumentation, neutron multiplication**
- **TBD Technical Advisors:**
 - » **LANL**
 - » **Dr. Waclaw Gudowski, RIT**
 - » **Dr. Massimo Salvatores, ANL**
- **Students from/at UNLV**

Tentative Experiment Schedule

- **ISU-IAC**
 - » Design & licensing Fall '03
 - » Construction Dec '03
 - » Experiments Jan-Feb '04
- **UT-Austin Experiments** Fall '04
- **Texas A&M Experiments**
 - » TRIGA Fall '05
 - » Used fuel core Spring '06
 - » LBE Fall '06

Issues

- **Fuel arrangement to minimize leakage, increase multiplication/coupling**
- **Fission product generation in fuel**
- **Pulsed electron-neutron source**
- **Target cooling/structure**
- **Gamma-ray fluence/radiation detection**

Conclusion

- **ADSS Exp at ISU, UT, and Tx A&M**
- **Now thru 2006 or beyond**
- **Design, modeling, and execution**
- **Predict and measure subcriticality, subcritical multiplication, and subcritical source-driven transients**
- **Recruit, educate and train students**
- **Transmutation**