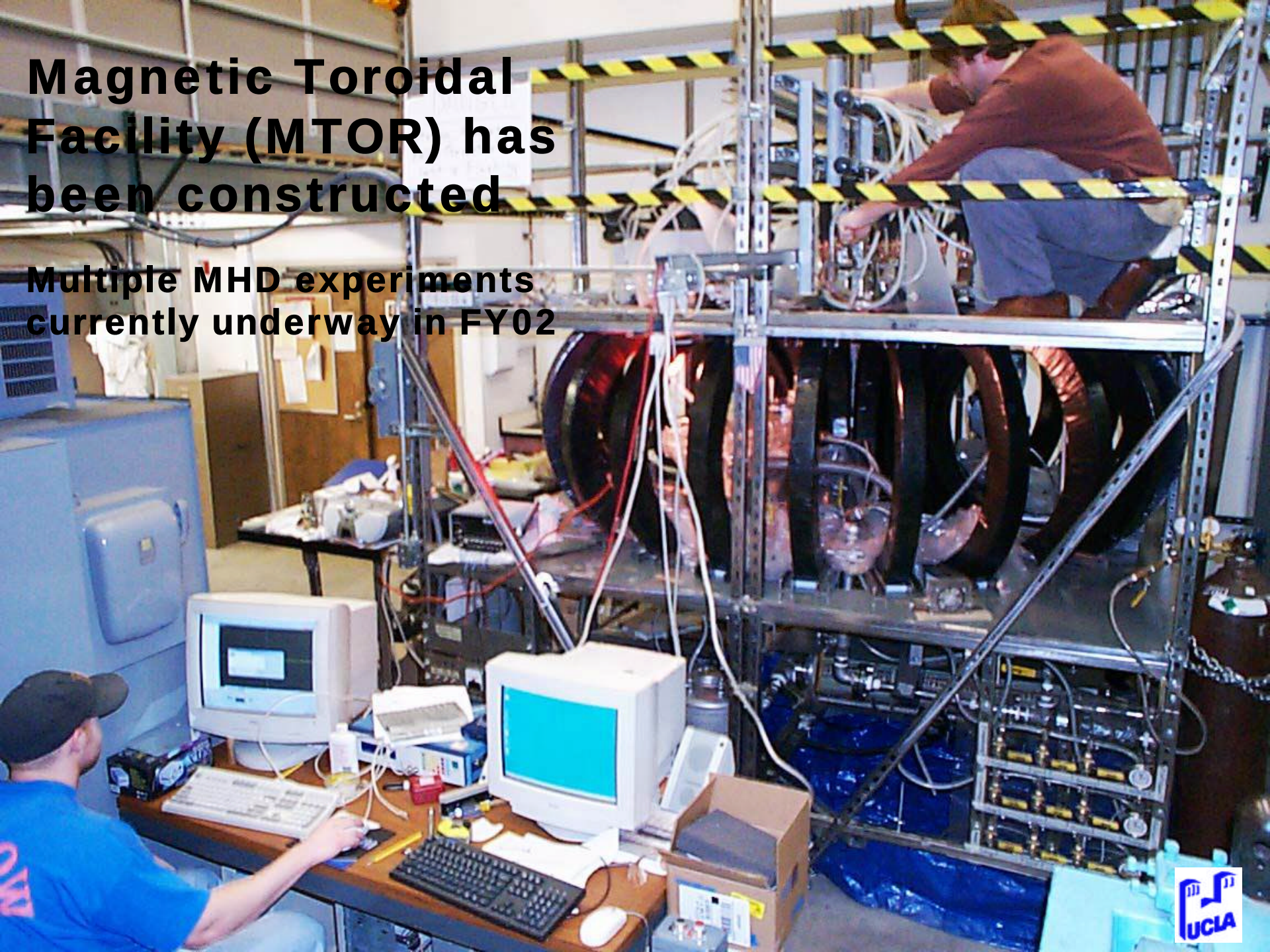


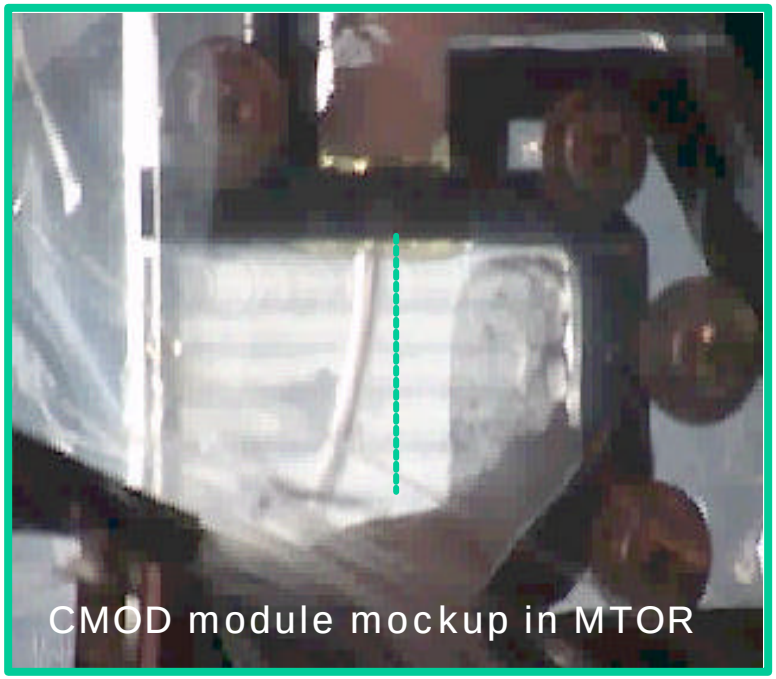
Magnetic Toroidal Facility (MTOR) has been constructed

Multiple MHD experiments currently underway in FY02

MHD effects on fluid flow and heat transfer are dominant issues for liquid metal walls

Extensive effort was initiated in FY02 and will be a major focus in APEX for FY03/04

1. Serious modeling of 3D MHD Flows with multiple component magnetic fields (no tools currently exist)
2. Intensive experiments on MTOR and LIMITS facilities to provide direct data for design and model validation



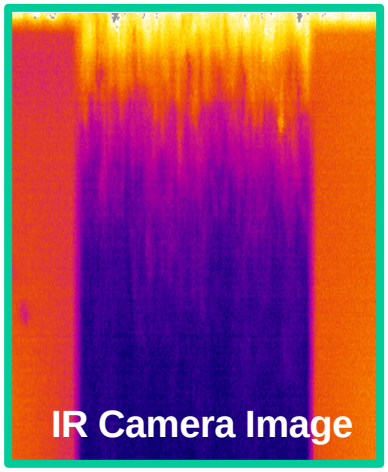
Ga-In-Sn Jet trajectory deviated from vertical strong magnetic field

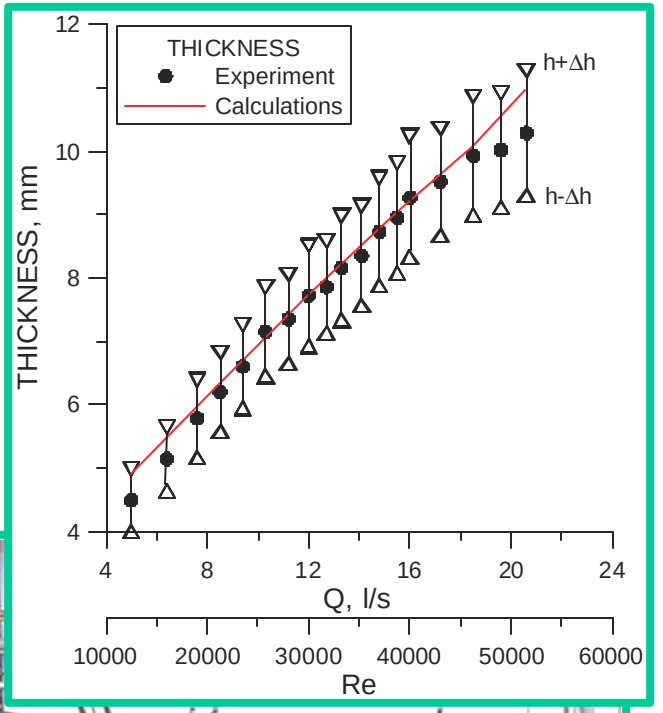
FLIHY Facility

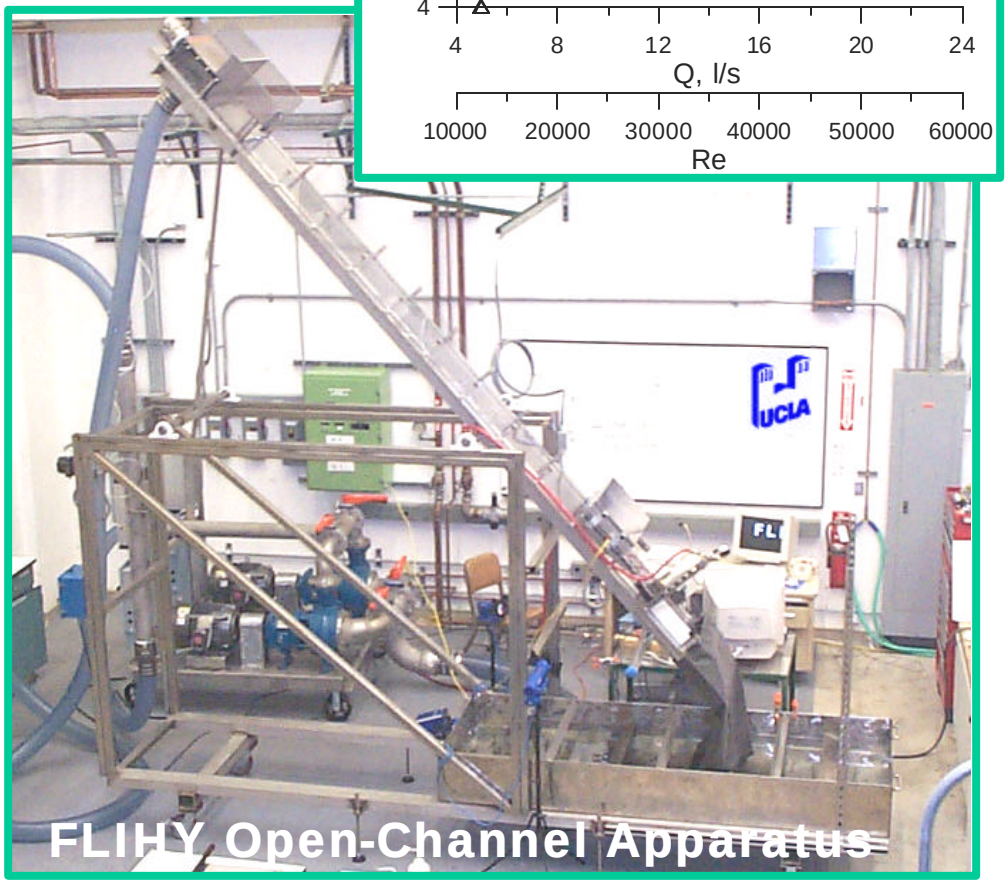
Free Surface Heat Transfer Experiments with Flibe Simulant

FY02 Accomplishments

- Completed construction of FLIHY Facility, initiated free-surface turbulent hydro-dynamics and heat transfer experiments
- The new experimental data used to validate k-e model for turbulent friction factor and flow depth
- Turbulent free surface experiments demonstrated enhancement of heat transfer in highly wavy flow regimes

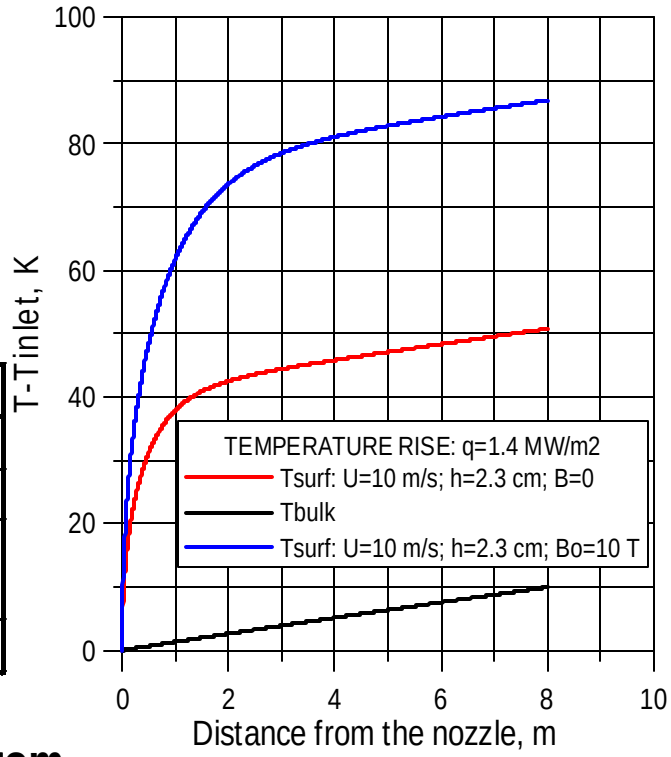






Low Conductivity Fluids Appear Promising for LW (Innovative spirit plus patience produce results)

- Flibe design was found to be severely constrained with high melting point (460C) and relatively low allowable temperature (from plasma interaction)
- **Flinabe was discovered.** Relatively low melting point (240-310C). Appears very promising with comfortable design window.

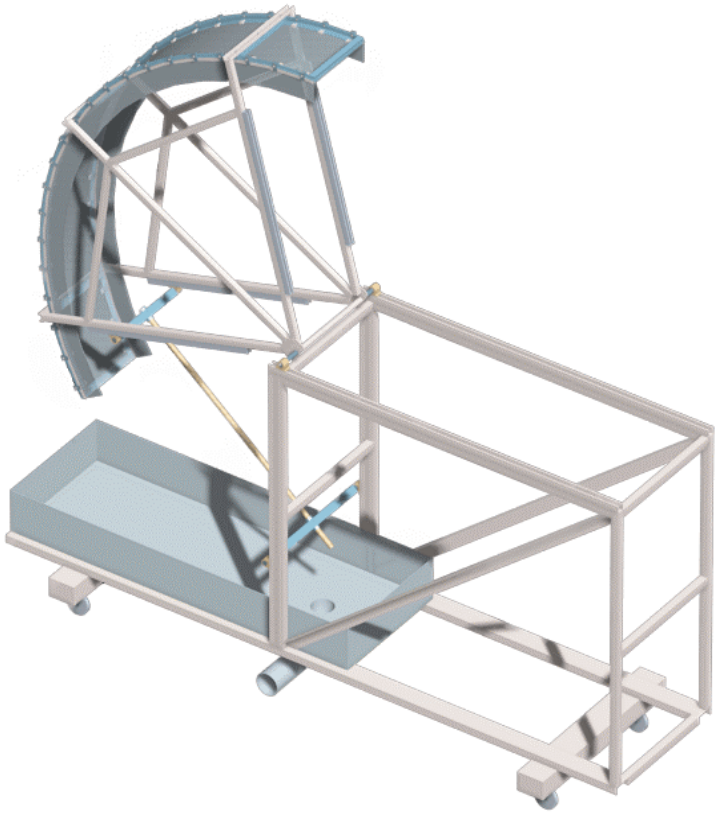


Flinabe ($LiF-NaF-BeF_2$)	
Melting temperature (°C)	240- 310
Inlet temperature (°C)	350
Maximum temperature rise (°C) (for surface heat load of 1.4 MW/m²)	60 –90
Maximum surface temperature at outlet (°C)	440 (< 480 allowable)

Wall surface temperature limits for high-recycling tokamak from Plasma Edge Modeling

Material	lithium	Tin-lithium	Flibe/Flinable	Tin
Teff (°C)	390	600	450	810
Tout (°C)	420	630	480	840

Liquid Wall scientific feasibility demonstration experiment is planned in FY03/04 (for low-k fluids)



FY03 Milestones

•Initiation of curved wall experiments using water as Flibe simulant

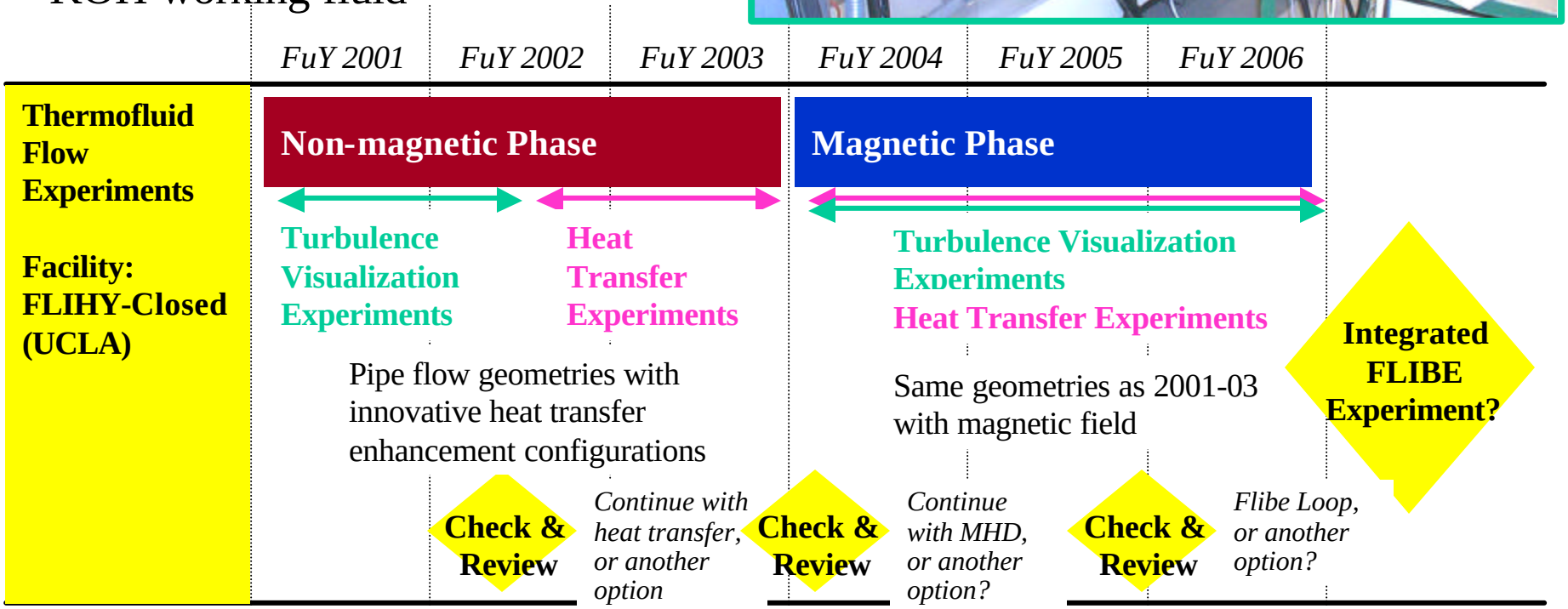
FY04 Milestones

•Initiation of penetration experiments on curved liquid wall test section

JUPITER-II Flibe Thermofluid Simulation

FY02 Accomplishments

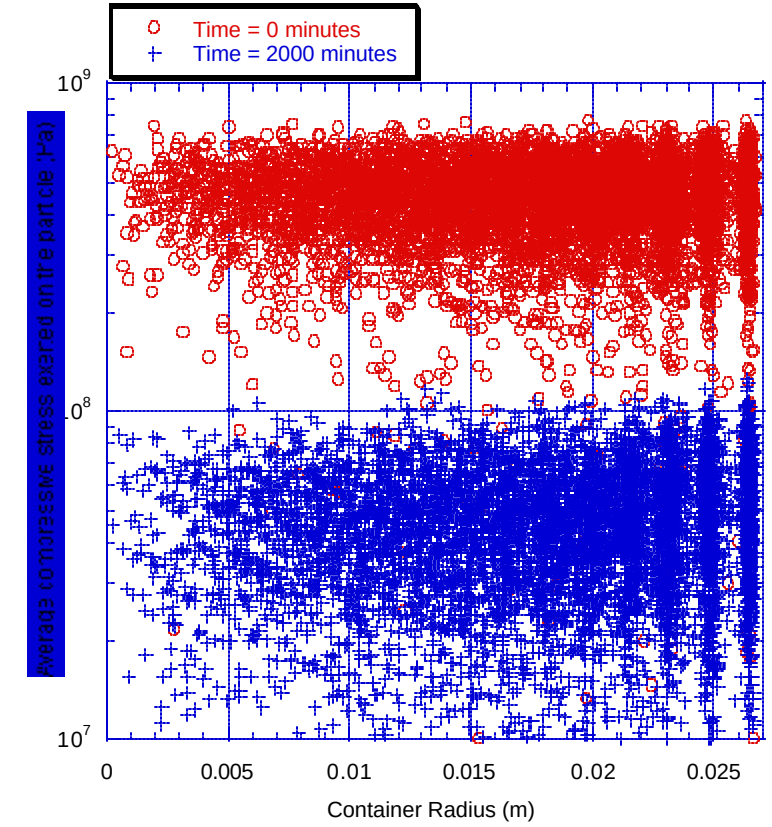
- Design/fabrication of first closed-channel test section and diagnostics
- Initiate operation of FLIHY-C facility and initial turbulence experiments
- Finalize safety hardware/procedures for initiation of experiments with KOH working fluid



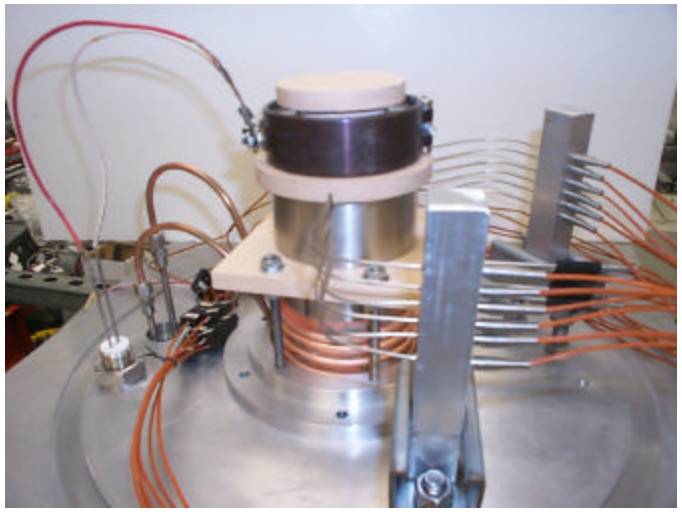
JUPITER-II SiC/Pebble Bed Thermomechanics Study

- **Phenomenological and numerical modeling**
- **Small scale experiments**

  (Obtain thermophysical data and technological experience with SiC systems)
- **International collaboration**



Average stress exerted on the particles at initial time and at time 2000 minutes. The average stress drops about one order of magnitude for most of the particles (Li_4SiO_4/SS)



Be/SiC/He interface conductance (to be conducted in Be-enclosure)