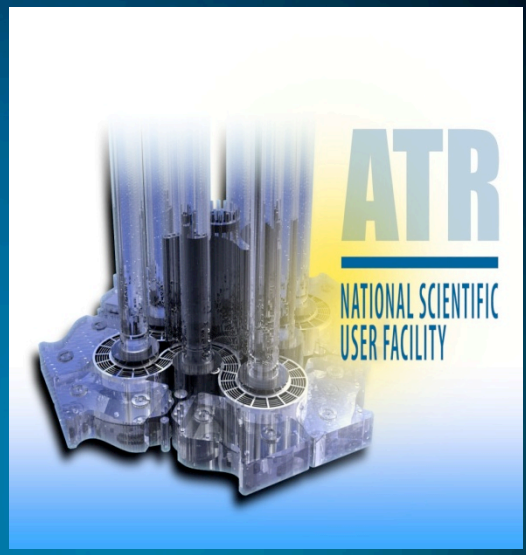
Irradiation Test Train Construction - Test Train Assembly Facility (TTAF)

Clifford J. Stanley
TTAF Laboratory Space Coordinator
ATR Experiment Engineering

Advanced Test Reactor Complex
Idaho National Laboratory



Joint Meeting:
National Organization of Test, Research, and Training Reactors (TRTR) and the
International Group on Research Reactors (IGORR)

September 20 - 23, 2010
Knoxville, TN

(INL/CON-10-19011)

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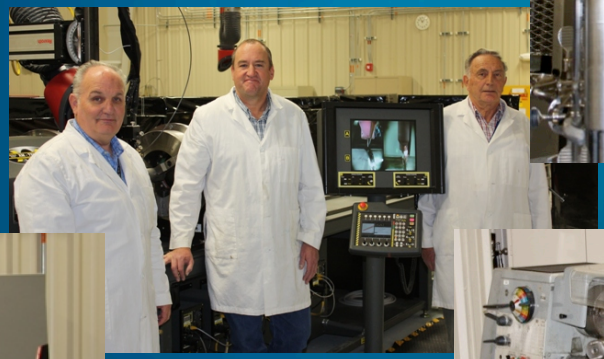
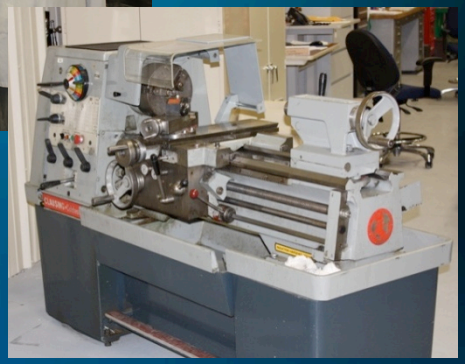
INL Test Train Assembly Facility (TTAF)

- Location:
  - Advanced Test Reactor (ATR) Complex
- Purpose:
  - Assemble Experiment Test Trains for Irradiation in the ATR
- 4300 sq ft Facility
  - High-bay Area
  - Office Area
  - Conference Room
- LTHC 3 Rad Facility

Test Train Assembly Facility (TTAF)

- TTAF High-boy
  - ~ 2500 sq. ft
  - Designed and furnished with equipment to support the final assembly of variety of test train configurations
  - Staffed with experienced technicians





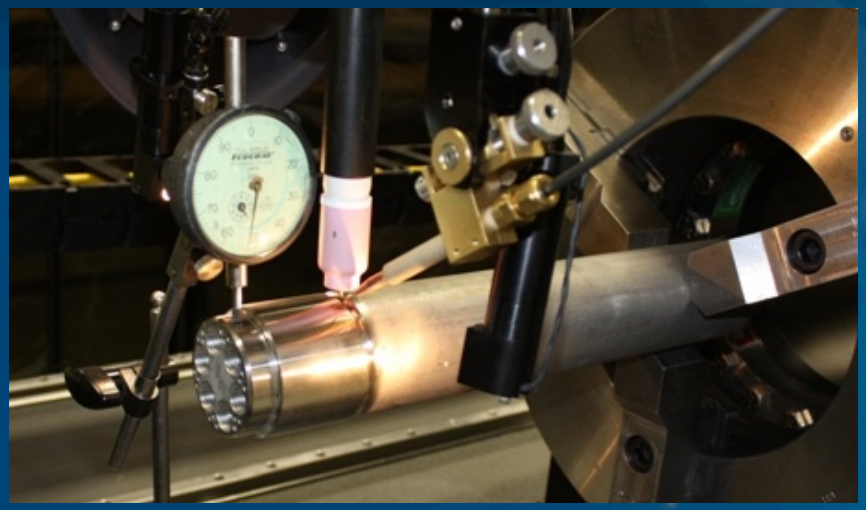
Test Train Assembly Welding Operation

- Automated Gas Tungsten Arc Weld (GTAW) System
- Tail Stock Driven Lath System (TDLS)
- Computer Controlled
- Typical Gas (Ar, He, or Mixture)

Detailed Machining Capabilities

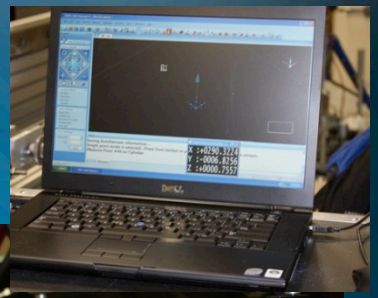
- Various Materials
  - Stainless Steel
  - Aluminum
  - Graphite
  - Inconel
  - Zirconium alloys
  - Niobium
  - Hafnium
  - Copper
  - Brass

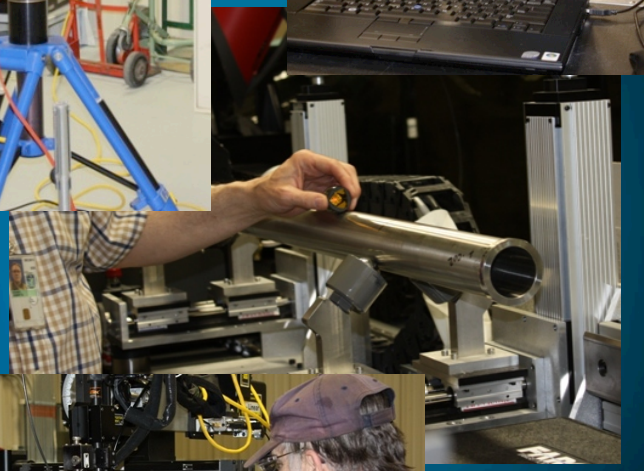
Measurement and Inspection



Assembly Quality Assurance Inspections

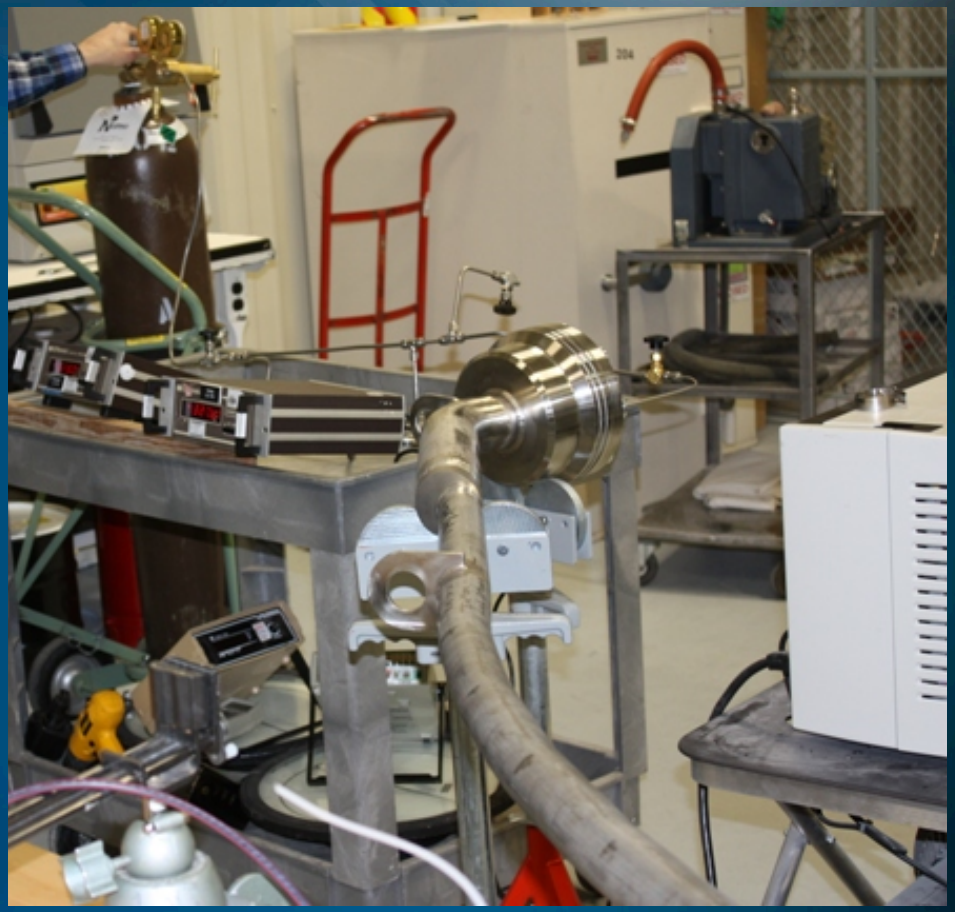
- Faro Laser Tracker
  - Computer based data acquisition system
  - Mirror/Tracking ball
  - 3 D location coordinates
  - 3 D modeling capability
  - Plotting (dia., length, etc.)
- Capsule and assembly straightness check
  - 0.003” over 4.5 ft
  - 0.016” over an 18 ft





Pressure and Leak Testing

- Final Test Train Assembly Integrity
- Pressure Testing (Argon)
- Leak Testing
  - Vacuum
  - Helium



Test Train Thermocouple Preparation

- Thermocouple potting
  - 2 part epoxy
- Spot welding of TC leads to TC material
- TC leads coiled inside the coiled gas flow lines (SS)
- Insert into the lead out assembly SS tube

Special Nuclear Material (SNM) Capability

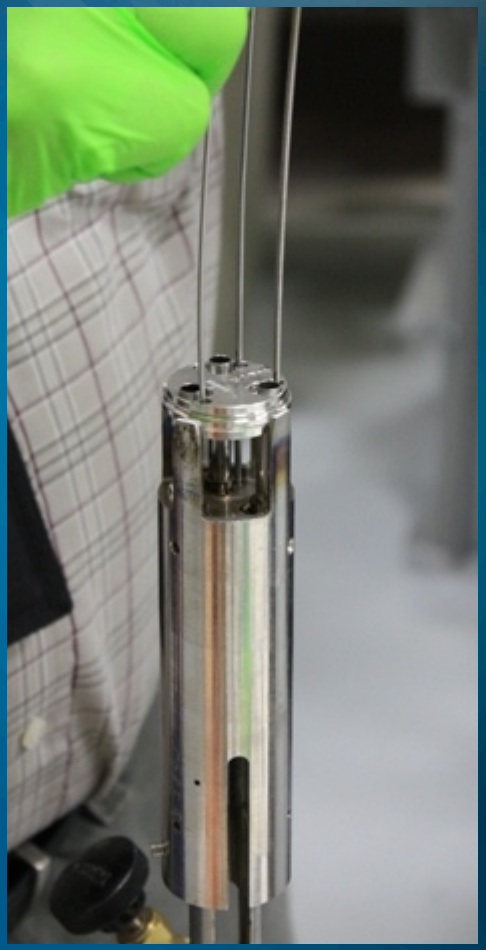
- Fuel Specimens and Compacts for insertion into Test Trains
- Storage and Handling of SNM in accordance with NM Safeguards Requirements
- Category IV NM Facility

Test Capsule Assembly

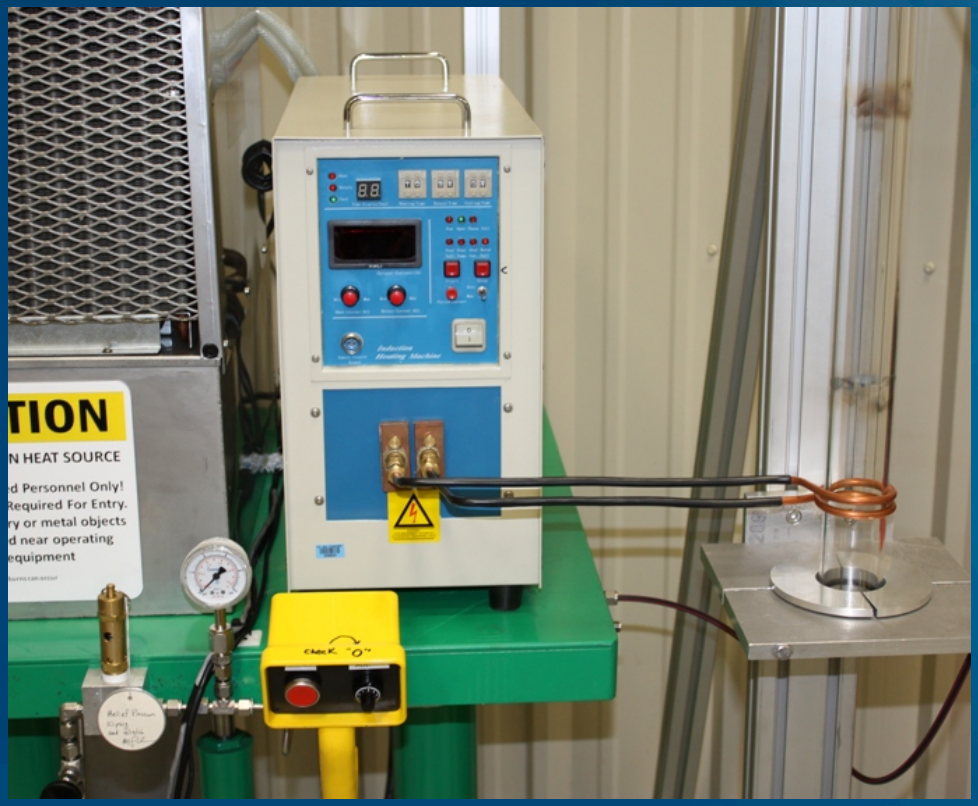
Cleaning and Electroplating

- Required for induction brazing process
- Cleaning (Acid)
  - Thermocouple leads (Inconel, Niobium, SS)
  - Gas flow tubes (Inconel, Nb, SS)
  - Capsules Ultrasonic
- Plating material
  - Nickel
  - Gold

Preparation of SS Capsule End Cap and Gas Flow Tubes for Brazing

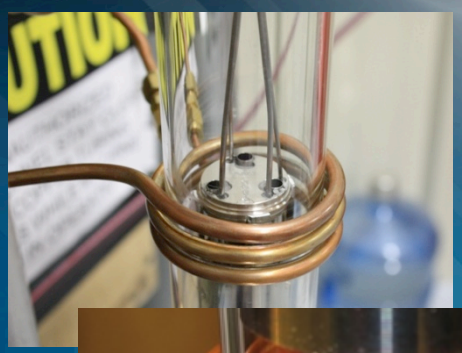


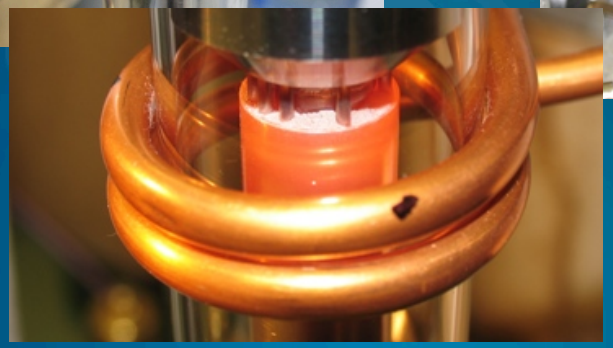
Induction Brazing Operation

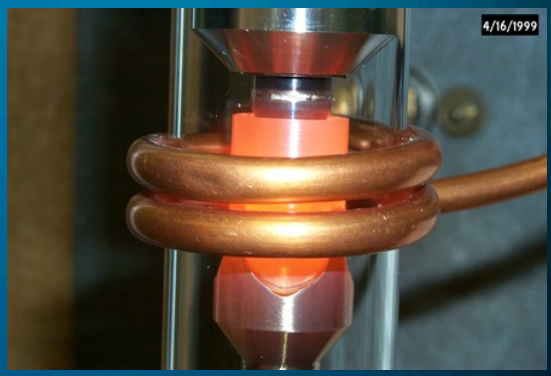


Induction Brazing

- Join dissimilar metals (SS capsule, Ni leads or tubes)
- Water cooled copper coil through which the current is applied
- Brazing Material (powder)
  - Gold
  - Silver
  - Nickel
  - Copper
  - Mixtures

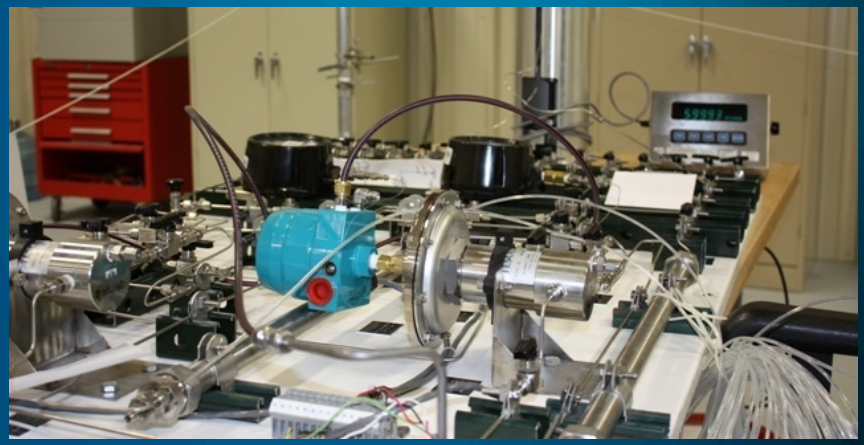




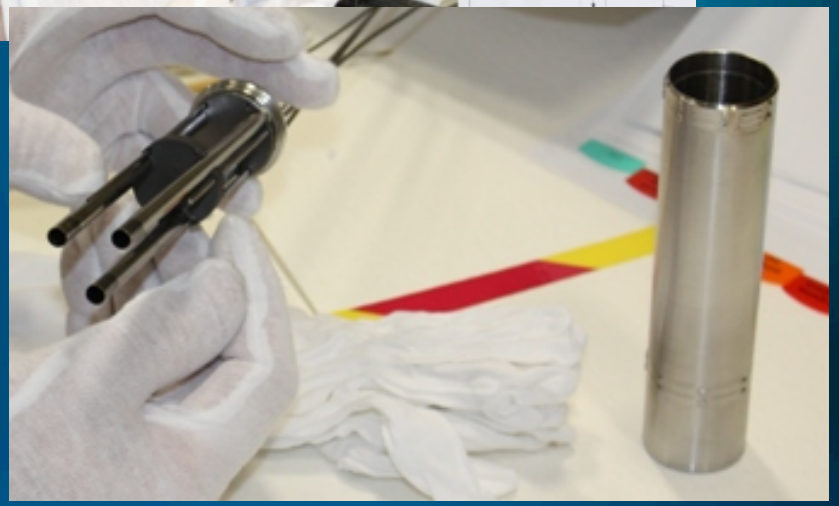


Experiment Gas Flow Control System

- Mockup in TTAF of the flow controls used in the ATR experiment control cubicle
  - Test valve operation
  - Test solenoid controls
- Gas flow is used for temperature control and test positioning in the core



Irradiation Capsule Assembly



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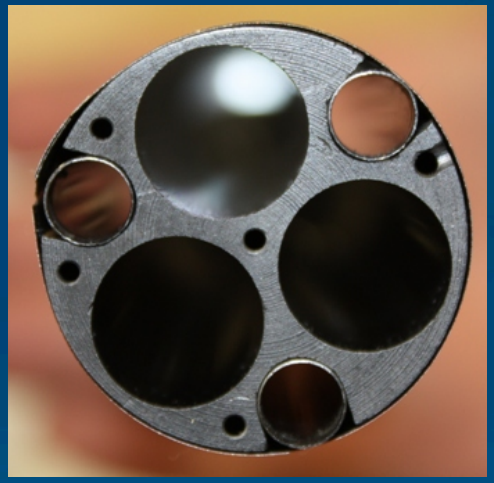

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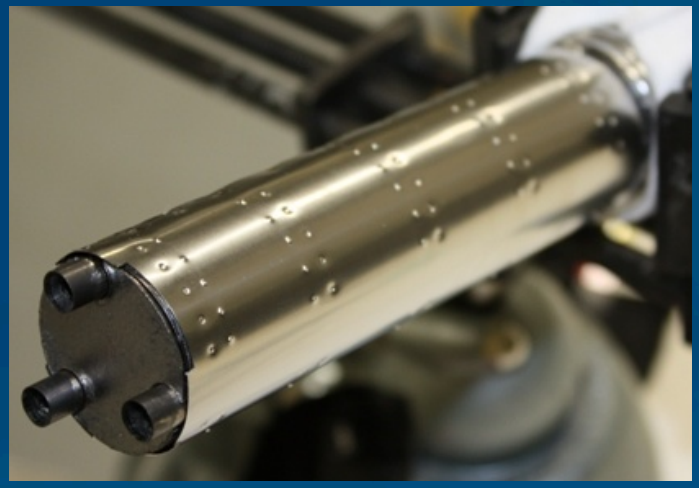
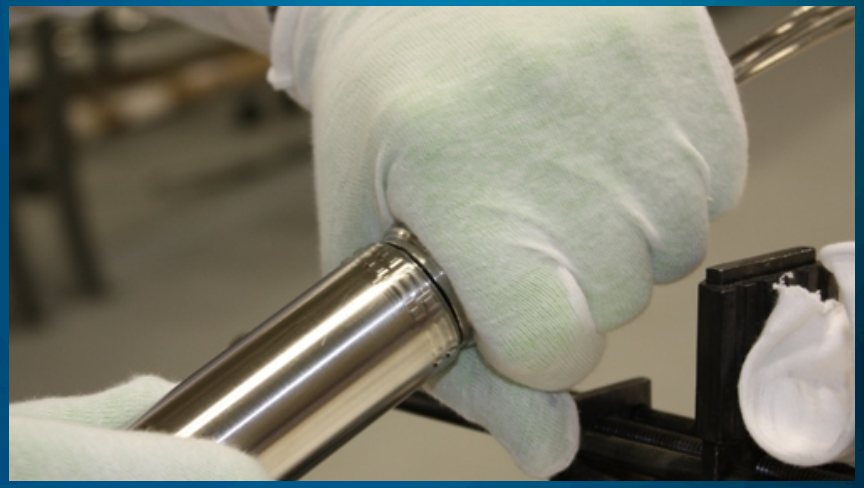
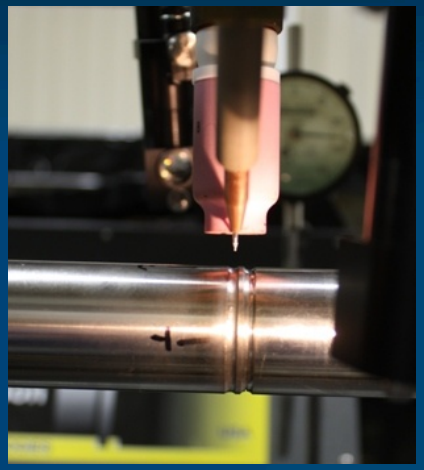
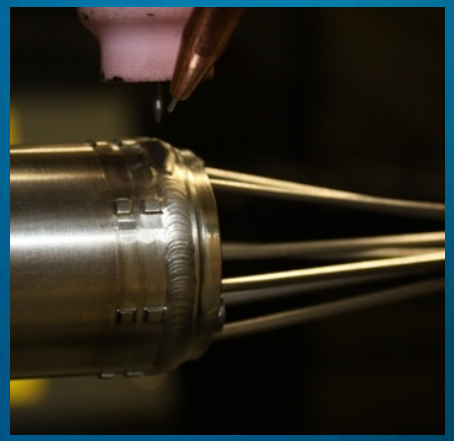


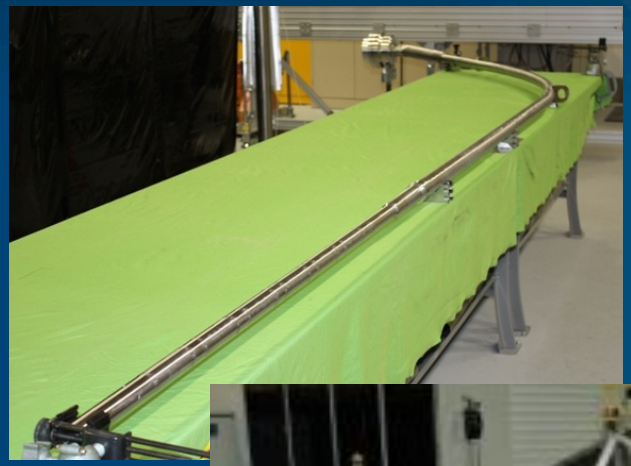


GTAW Welding Process

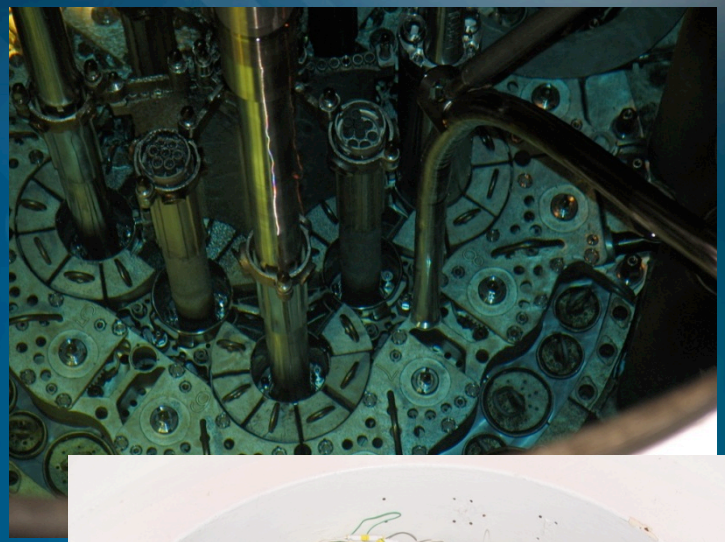


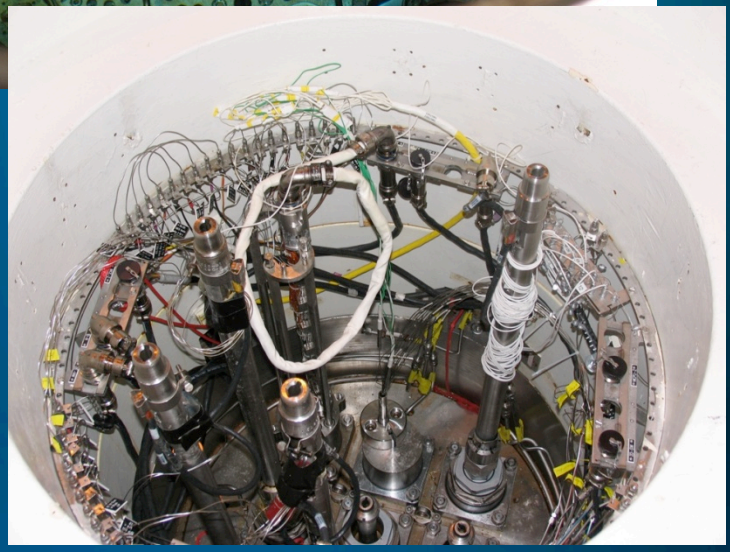


Assembled Test Train – Goal Achieved !



Experiment Insertion in ATR





INL Test Train Assembly Facility (TTAF)

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