

# ASI program roadmap

**Advanced Sensors and Instrumentation (ASI)  
Annual Program Webinar**

October 24 – 27, 2022

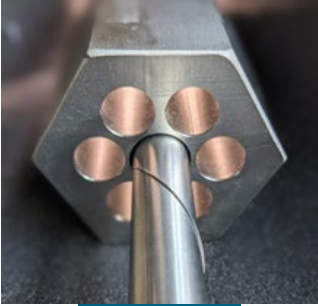
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Idaho National Laboratory

# Introduction

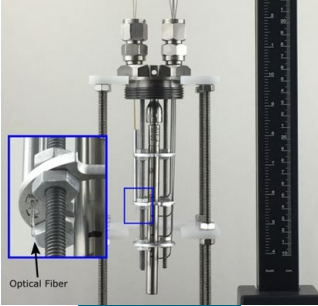


## Sensors for Advanced Reactors




- Reactor power monitoring
- Structural Health Monitoring
- Optical fibers
- Thermometry
- Rad-hard electronics

## Sensors for Irradiation Experiments



- LVDT
- Passive monitors
- Material properties characterization
- Sensor qualification

## Sensors Integration



- Advanced controls
- Communication
- Nuclear Energy Sensors database

Neutron energy spectrum unfolding methods  
using self-powered neutron detectors (SPND)

Optimization of In-Situ Sensor Arrangements for  
Power Distribution Synthesis



Research reactor test for feasibility demonstration



MARVEL deployment  
for advanced controls  
development

Fast reactor  
demonstration facility  
(ie, MCRE) deployment  
for energy spectrum  
characterization



## Sensors for Advanced Reactors

Reactor power monitoring  
**Structural Health Monitoring**  
Optical fibers  
Thermometry  
Rad-hard electronics

## Sensors for Irradiation Experiments

LVDT  
Passive monitors  
Material properties characterization  
Sensor qualification

## Sensors Integration

Advanced controls  
Communication  
Nuclear Energy Sensors database

## Rad-hard transducers and methods for acoustic based SHM

- Advanced manufacturing and embedding processes:
- Electric Field Assisted Sintering (INL)
  - Hot Confined Rolling (PNNL)
  - Laser assisted Powder Bed Fusion (ORNL – MRP)

PNNL workshop  
summer 2024



METL test for feasibility  
demonstration

Irradiation test  
design for nuclear  
demonstration

# FY24 outlook

## Sensors for Advanced Reactors

Reactor power monitoring  
Structural Health Monitoring  
**Optical fibers**  
Thermometry  
Rad-hard electronics

## Sensors for Irradiation Experiments

LVDT  
Passive monitors  
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## Sensors Integration

Advanced controls  
Communication  
Nuclear Energy Sensors database

Testing and characterization to develop mechanistic explanation for unsaturated drift of fiber optic sensors during high-dose irradiation



Applications

Pressure sensor

Strain, SHM (embedded)

Corrosion sensor

Imaging (fiber bundle)

Contactless deformation sensor

Opto-acoustic methods

# FY24 outlook

## Sensors for Advanced Reactors

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Optical fibers  
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## Sensors for Irradiation Experiments

LVDT  
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Sensor qualification

## Sensors Integration

Advanced controls  
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Nuclear Energy Sensors database

## Application of Printed Strain Gauges in Prototypical Nuclear Reactor Conditions



Structural Health  
Monitoring

Complement  
LVDTs for nuclear  
materials testing



# FY24 outlook

## **Sensors for Advanced Reactors**

Reactor power monitoring  
Structural Health Monitoring  
Optical fibers  
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## **Sensors for Irradiation Experiments**

LVDT  
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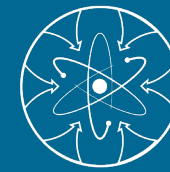
## **Sensors Integration**

**Advanced controls**  
Communication  
Nuclear Energy Sensors database

**Real-Time Control for Optimization of Core Thermal Performance Using Combined Digital Twin and Identified Sensor Set**



Reactor power monitoring  
(MARVEL deployment)



# Thank You

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