INL/MIS-23-72821-Revision-0

Retractable Sensor Poster for ANIMMA 2023 Conference

June 2023

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Changing the World's Energy Future

Idaho National Laboratory

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Experiment Design

Retractable Sensor

Introduction

Material Test Reactors (MTRs) such as the Advanced Test Reactor (ATR) at the Idaho National Laboratory (INL) are used to irradiate nuclear fuels and materials to evaluate their performance after high levels of exposure to a reactor in-pile environment. The test environment within these reactors are extremely harsh and long-term exposure causes sensor decalibration or failure. Most tests only require data points at daily intervals meaning that the sensor need not be in place continuously for the full experiment.

Purpose and Objective

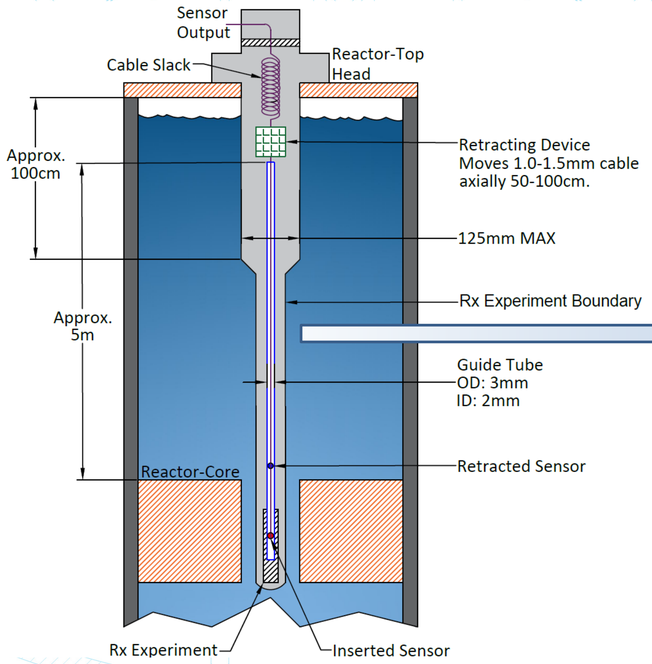
One proposed solution to the issue described above is to have a sensor which can be periodically inserted through a guide tube into the test region and retracted; in addition to its own reading, it would provide reference check on the sensors installed permanently. This has the potential to extend the life of the sensor and keep it within calibration.

Challenges

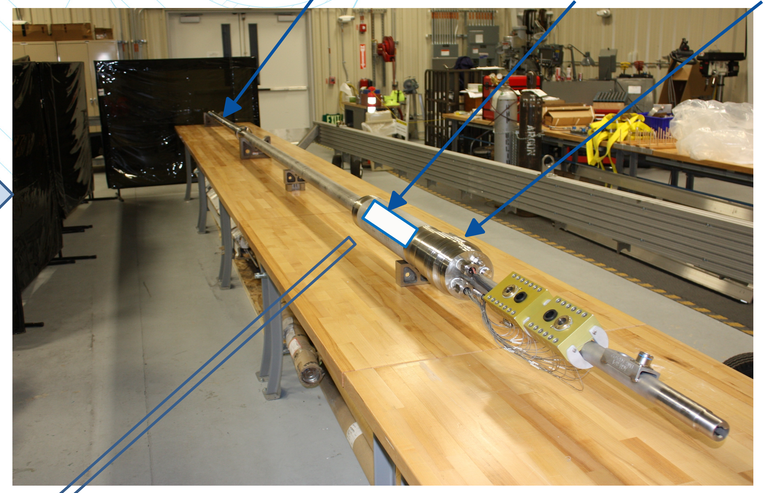
The primary goal of this project was to reduce the overall size of the mechanism so that it could be mounted in the confined space of a reactor experiment. This was done by reducing the size of the drive mechanism compared to previous iterations.

Summary

The mechanism is constrained by the size of the test assembly. In order for the design to be viable it must fit within the upper pipe section seen in the upper right image.

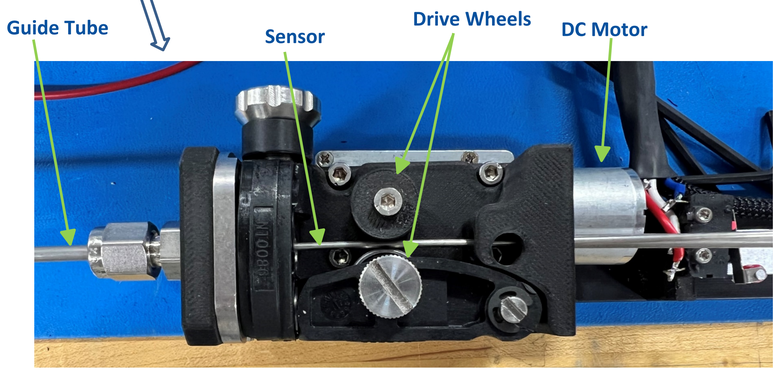


Schematic of retractable sensor installed in reactor experiment



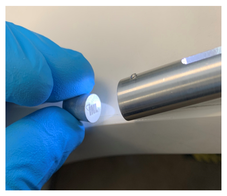
Example of instrumented ATR fuels test and possible location of retractable sensor drive system

Retractable sensor complete setup in upper part of test

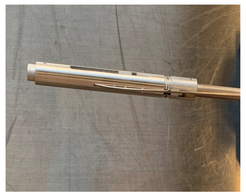


Drive Mechanism

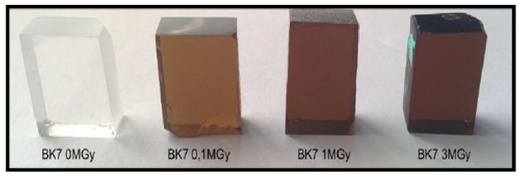
A holy-grail application for optical fibers would be imaging of specimens during irradiation – a robust retractable sensor setup is an enabling technology for this application. It would allow periodic imaging of specimens without substantial damage to the optical fibers.



Target and imaging



In-core lens assembly



Degradation of optical fiber materials due to gamma irradiation

Project Team

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