INL/EXP-19-55100-Revision-0

# Metallography Box Improvements

Nicholas J Barna

July 2019


The INL is a U.S. Department of Energy National Laboratory
operated by Battelle Energy Alliance

INL/EXP-19-55100-Revision-0

# Metallography Box Improvements

**Nicholas J Barna**

**July 2019**

**Idaho National Laboratory**
**Idaho Falls, Idaho 83415**

**http://www.inl.gov**

**Prepared for the**
**U.S. Department of Energy**
**Office of Nuclear Energy**
**Under DOE Idaho Operations Office**
**Contract DE-AC07-05ID14517**

# Metallography Box Improvements

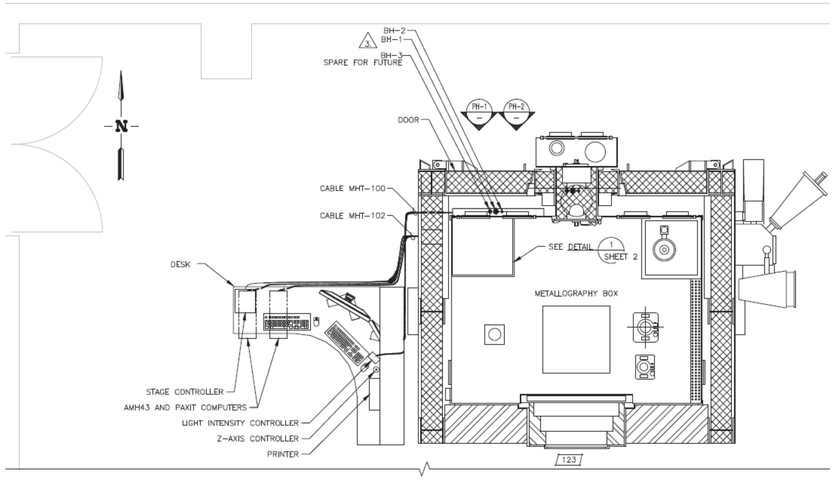
*Nuclear Remote Systems*

## Overview

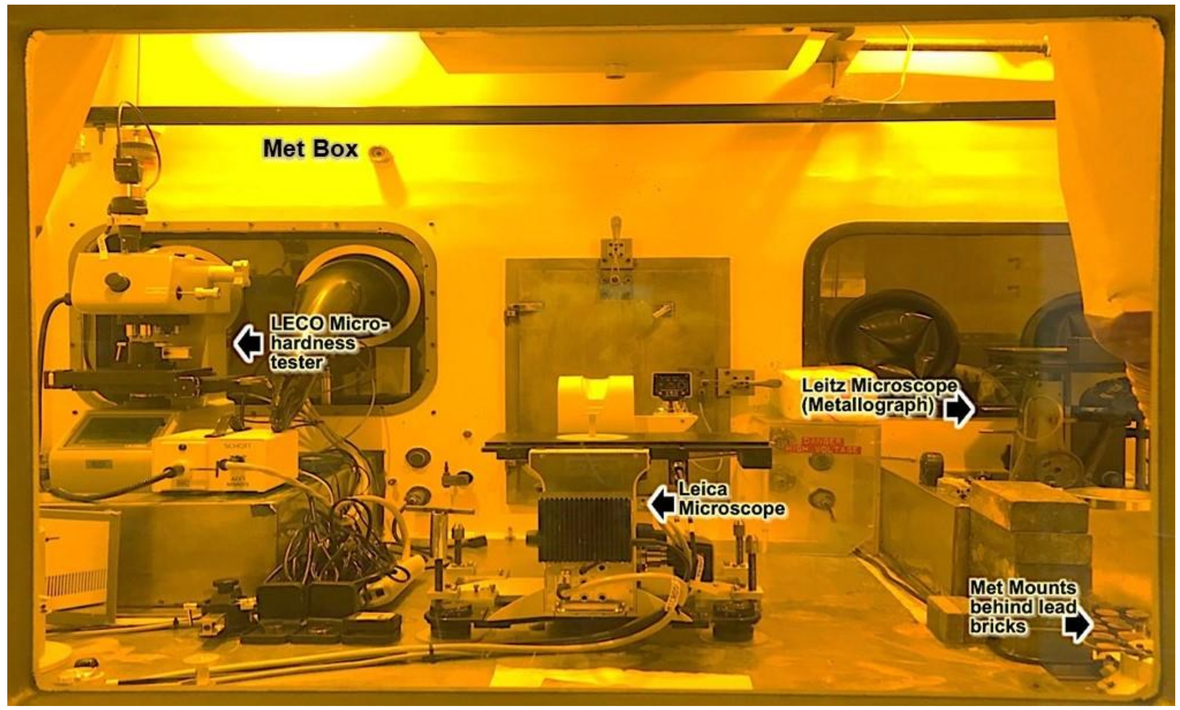
– The Metallography Box, or Met Box, is a small hot cell located outside of the main cell in the Hot Fuel Examination Facility (HFEF)
– It is used for post-irradiation examination of materials such as spent nuclear fuel
– Tests performed in the Met Box include microhardness testing, microscopy, and neutron radiography

## The Problem

– Post-irradiation microscopy is often difficult because of the lack of visibility in the Met Box
– It is frequently extremely hard to tell the position of the sample being examined under the microscope, which makes the precise adjustments necessary for microscopy nearly impossible at times
– If improper microscope adjustments are made, the sample can be severely damaged
– The Met Box dose rate is estimated to be 18rad/hr

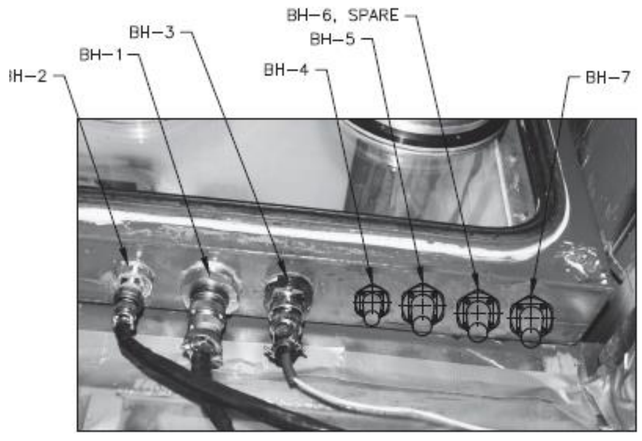



HFEF, BLDG 785 OPERATING FLOOR – PARTIAL PLAN




## Solution Method

– A camera system was the most viable method to solve the low-visibility issue
– Because the Met Box is highly radioactive, a remotely operated system is required
– Camera needs to be shielded or radiation hardened in some way, and be versatile enough for different viewing areas (<10lbs for manipulators)
– Camera needs constant power supply, so an electrical connection through the wall of the Met Box had to be engineered—military grade amphenol connectors are standard in HFEF




## Results & Conclusions

– A radiation-hardened, off-the-shelf camera was selected as an alternative to engineering a shielding system for a non rad-hard camera
– This allowed for an easily integrated remote system, a high radiation resistance without the need for additional shielding, and the necessary basic camera functions, all within budget
– It is often more cost effective to modify an off-the-shelf product rather than to engineer a solution from the ground up
– Some modifications still need to be made to the system—the cable must be fitted with the amphenol connectors and installed in the hot cell
– Finding a solution to the current awkward microscopy situation prevents the destruction of expensive nuclear samples, reduces expenditure in labor costs, and preserves lab-wide objectives for the engineering of more efficient nuclear fuel

**Nick Barna, Montana State University  Mentor: Francine Rice**

**2019 Idaho National Laboratory Intern Expo**