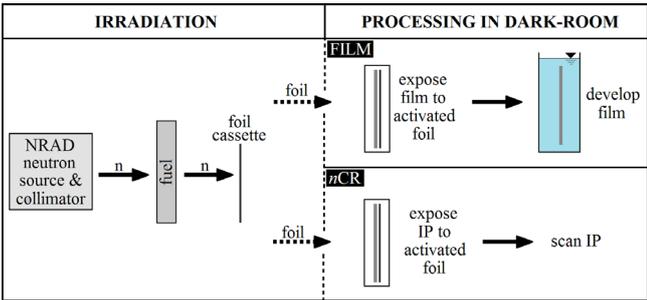


Conversion from Film to Computed Radiography at Idaho National Laboratory

Idaho National Laboratory (INL) performs neutron radiography of highly-radioactive objects including used nuclear fuel. INL's Neutron Radiography Reactor (NRAD) is a 250kW TRIGA reactor located beneath one of the world's largest hot cells.

Prior to installing the ScanX Discover HR computed radiography (CR) system, INL used the foil-film transfer method. Highly-radioactive specimens are positioned for inspection using an elevator. Cassettes containing dysprosium and indium foils are placed behind the specimens and irradiated to produce both thermal and epithermal neutron radiographs. Then the film is exposed by the irradiated foils in order to produce a radiograph.



Now, the photographic film in this process has been replaced with photostimulable phosphor imaging plates (IP's) and the darkroom has been replaced by the ScanX HR computed radiography scanner.

During the scanner evaluation and process characterization, Dr. Aaron Craft found "...the ScanX HR provides higher basic spatial resolution than any other scanner, which we evaluated using the ASTM duplex wire gauge."

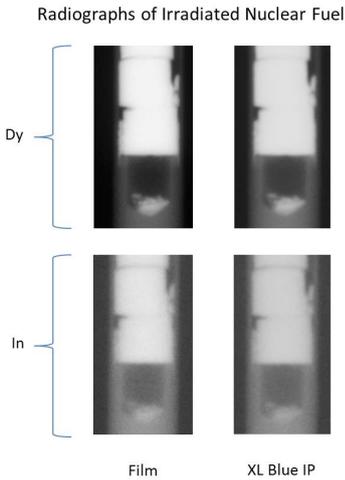
X-rays were used to characterize the entire process prior to migrating to CR, and Dr. Craft did significant optimization using the programmable parameters of the CR scanner. He commented "The ScanX HR allows access to scanner parameters that no other scanner provides, which enables us to fine tune the system to better match our process and needs."



Hot Fuel Examination Facility (HFEF)

Once the process was optimized, INL found that using CR resulted in a much faster process for producing radiographs.

CR imaging plates are more sensitive than film and thus require less exposure time. In addition the CR system provides a linear response to exposure dose, unlike film.



The original process took up to 14 hours to produce results since the irradiated foils must be in contact with the photographic film for 12+ hours to make a usable exposure. Using digital imaging plates, the same exposure takes only 20 minutes before the IP can be scanned to produce the digital radiograph.



NRAD reactor

Comparing the old and new processes shows the dramatic increase in efficiency:

Dr. Craft stated that the quality of the final image from the CR system is similar to the original film process. He also noted that the CR images have improved latitude and show structural material (clad) better than film.

Parameter	Film	nCR	nCR
Conversion foil	Dy	Dy	In (no Cd filter)
Neutron beam exposure time	22 minutes	10 min	10 min
Foil-detector exposure time	12+ hours	5 min	5 min
Wet film processing	Yes	No	No
Scan into digital image	Yes	Yes	Yes
Relative fraction of max exposure	100%	2.5%	12%
Scanner resolution	-	50 µm	50 µm
PMT Voltage	-	950 V	850 V
TOTAL	~14+ hours	<30 min	<30 min

In summary, Idaho National Laboratory has demonstrated and validated the utility of neutron radiography using the ScanX Discover HR computed radiography system to increase efficiency and benefit their facility operations.



ScanX Discover HR

