



EPSRC

Engineering and Physical Sciences
Research Council

NNUF update: September 2015

Chris Grovenor and Malcolm Joyce



Facilities

DCF: Expanded ion beam irradiation facilities, SPS, XRD etc.

CCFE: MRF facility for medium activity; SEM, FIB, Nanoindenter, TDS etc

NNL: Active FIB, TEM, X-ray microtomography in Central Laboratories

ADRIANA: 32-detector neutron calorimeter, low-background γ systems

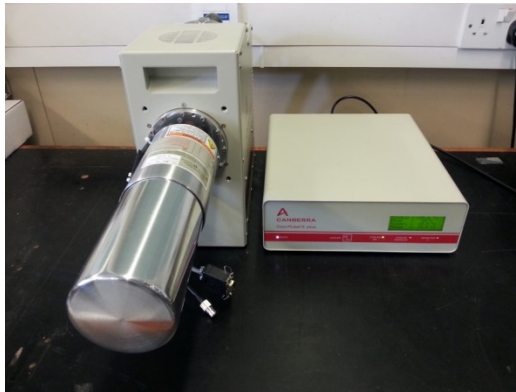
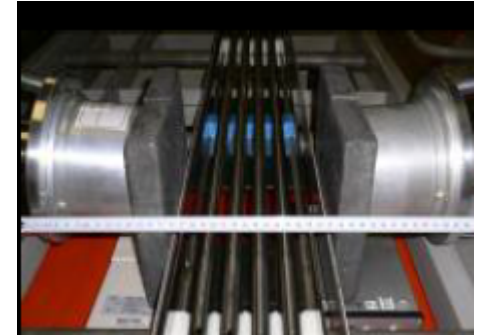
£16M NNUF initial capital spend (2013/14)

£60M NNUF additional funding announced in 2014 Autumn Statement

ADRIANA

(Advanced Digital Radiometric Instrumentation for Applied Nuclear Activities)

Lancaster -
High-order neutron multiplicity analysis of
actinide materials (32 channel array)



Liverpool - spectroscopic imaging & location of γ
contamination

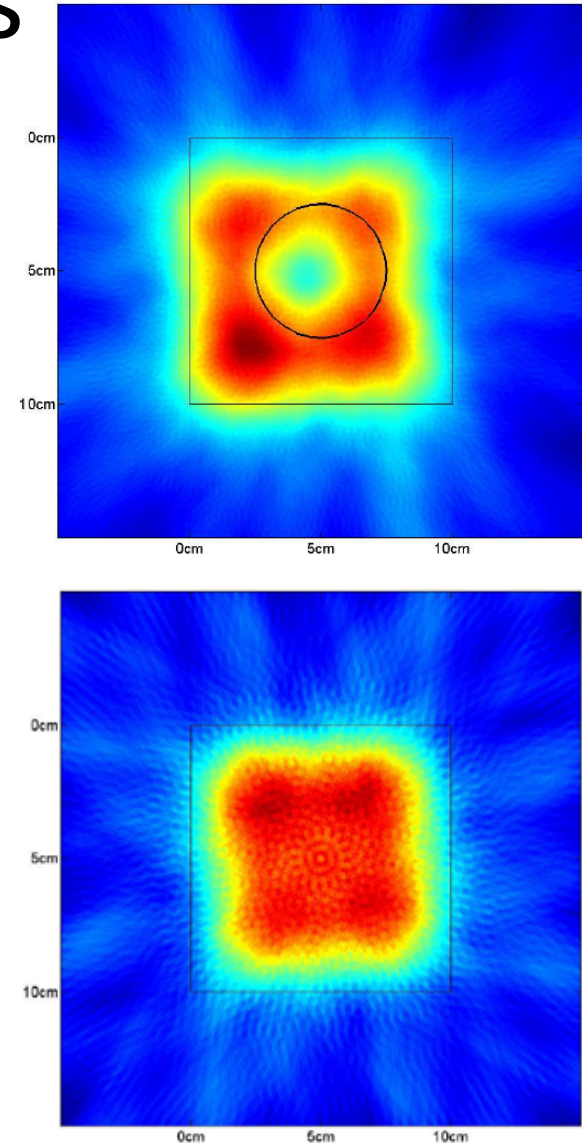


UKAEA - Ultra-low background
 γ -ray spectroscopy systems

M Joyce (Lancaster), P Nolan & L Harkness Brennan (Liverpool), S Lilley & I Jenkins (UKAEA)

ADRIANA News

- MEng project team developed a fast-neutron tomography technique and demonstrated it at NPL (patent filed). Images of concrete with and without a hole, 1-hour assessment.
- Significant because it heralds portable neutron tomography without the need for a reactor or particle accelerator, for the surveying of bridges and roads etc. in situ.
- Oral presentation at IEEE Nuclear Science Symposium in San Diego this autumn and an IEEE Trans Nucl. Sci. paper submitted
- £530k responsive mode grant from the EPSRC with CCFE to use the ADRIANA kit for time-of-flight imaging of neutron environments.

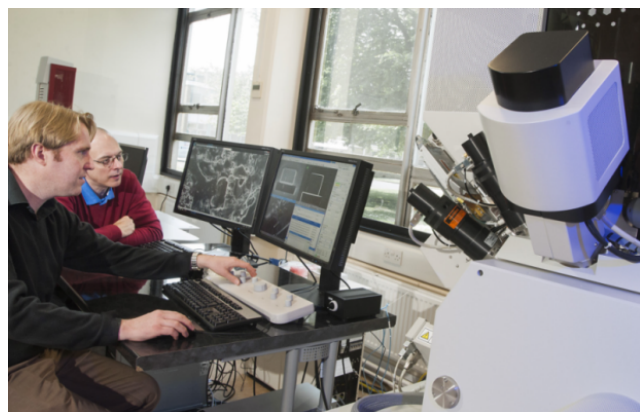
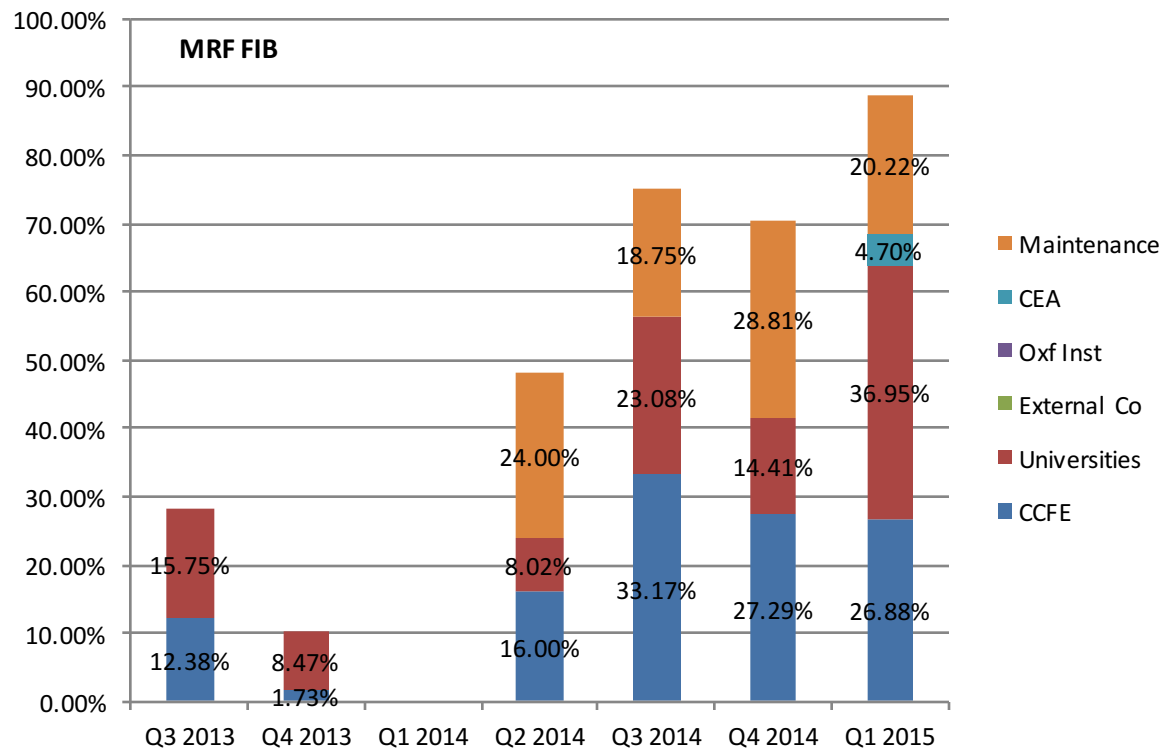


CCFE facility news

Materials Research Facility (MRF)

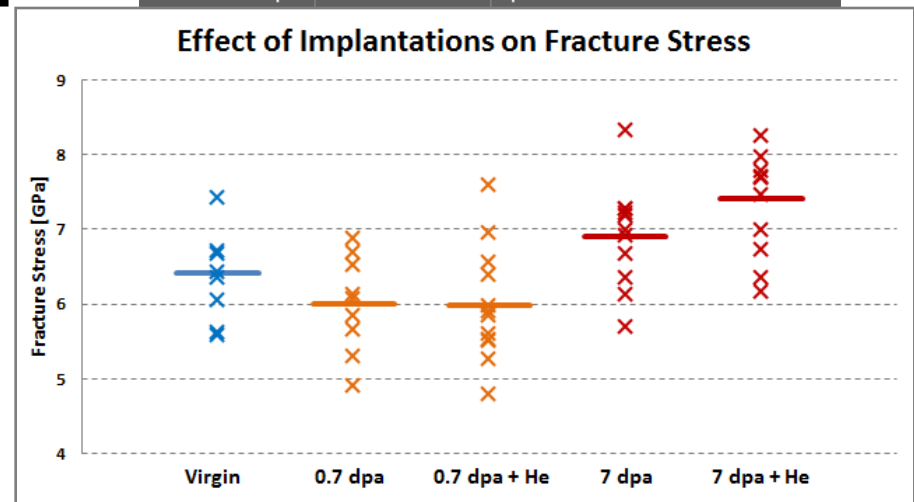
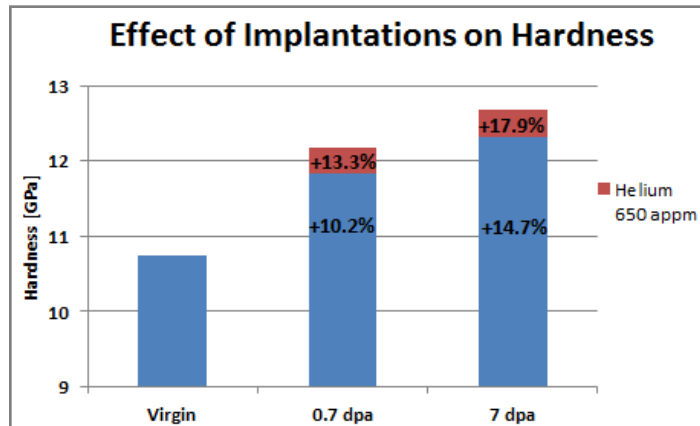
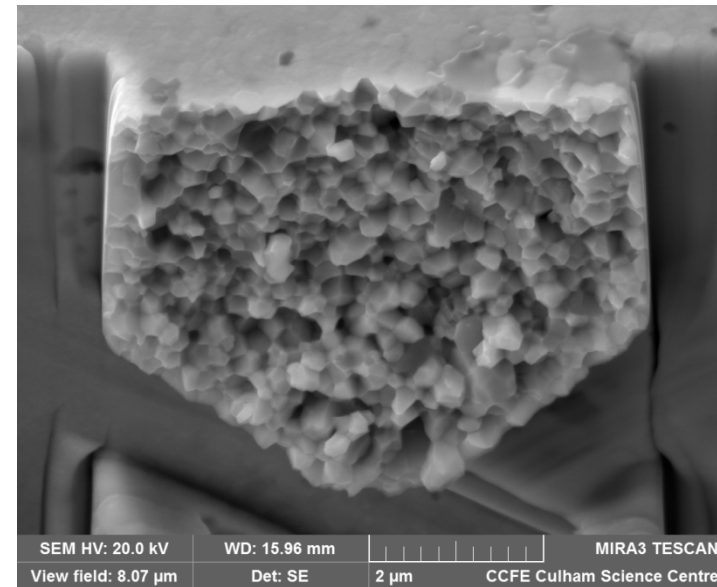
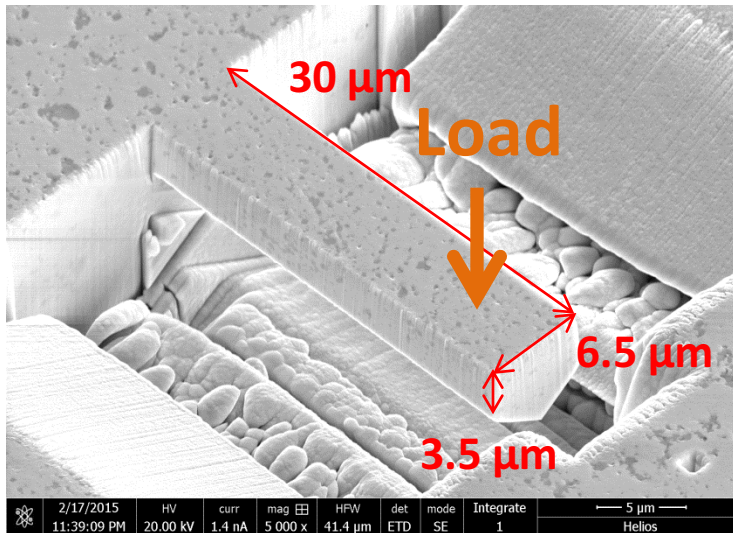
Instruments for future active use have been installed and been in operation since 2013.

Martin O'Brien will give details on MRF facility in the following talk.



Work at CCFE-MRF:

Fracture strength of W-Cr10-Ti2 under ion-irradiation



Slide courtesy of M. Lessmann (UoM)

DCF facilities news

- The second accelerator, a 2.5MV system, will arrive at DCF during October with installation complete by the end of 2015. Combined with the 5MV tandem system this will provide dual ion-beam capability at DCF.
- The high temperature vacuum furnace, 2D-XRD and spark plasma sintering systems are now fully commissioned.



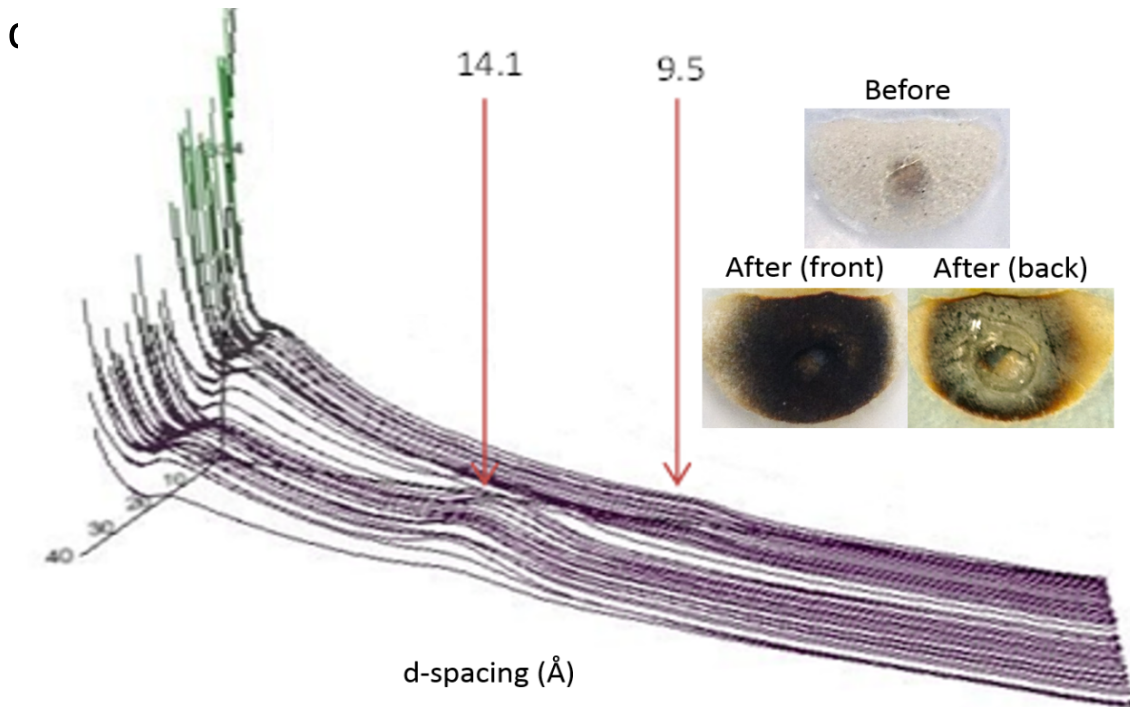
New DCF accelerator in NEC factory



• DCF results: Understanding the nature of radiation damage on phyllosilicate minerals:

The sorption and permeation properties of layered silicates are critical for radionuclide retention in a GDF. These minerals have been subjected to controlled and variable doses of γ -irradiation using the Cobalt-60 gamma irradiator and α -particles using high energy He^{2+} ions from the tandem ion accelerator at DCF. The damage was characterized by synchrotron microfocus XRD/XAS/XRF and bulk XAFS (at the DLS), IR EPR and HRTEM (Manchester).

α -particle bombardment on the key clay mineral, montmorillonite, causes a major collapse of the interlayers significantly modify their reactivity and sorption

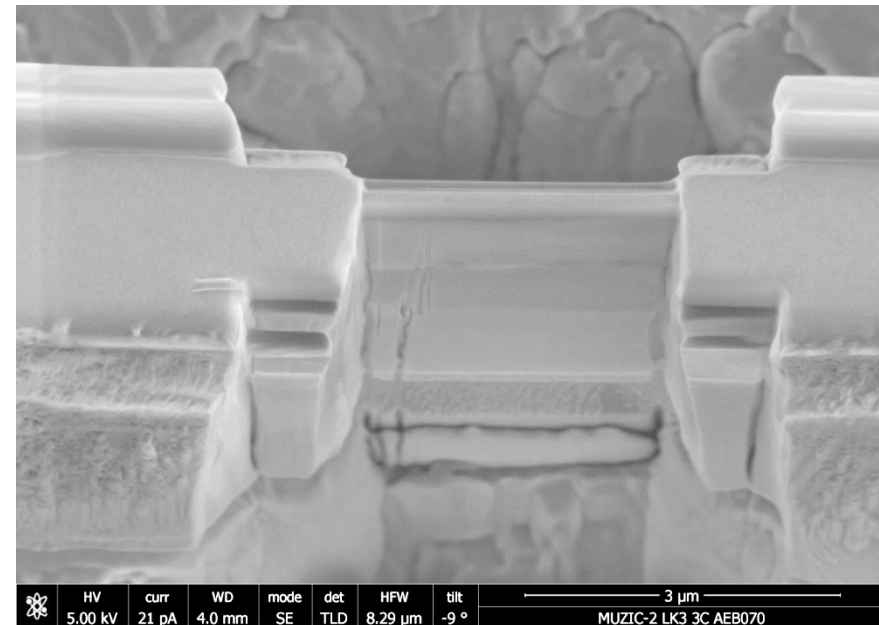


Bower, W., et al (2015) Radiation damage from long term alpha particle bombardment of silicates – a microfocus XRD and Fe K-edge XANES study. Mineral. Mag. Special Issue on Radioactive waste disposal. (in Press)

Bower, W R, et al (2015) Radiation damage in biotite mica by accelerated α -particles: a synchrotron microfocus X-ray diffraction and X-ray absorption study. Amer. Mineral. (Accepted for publication)

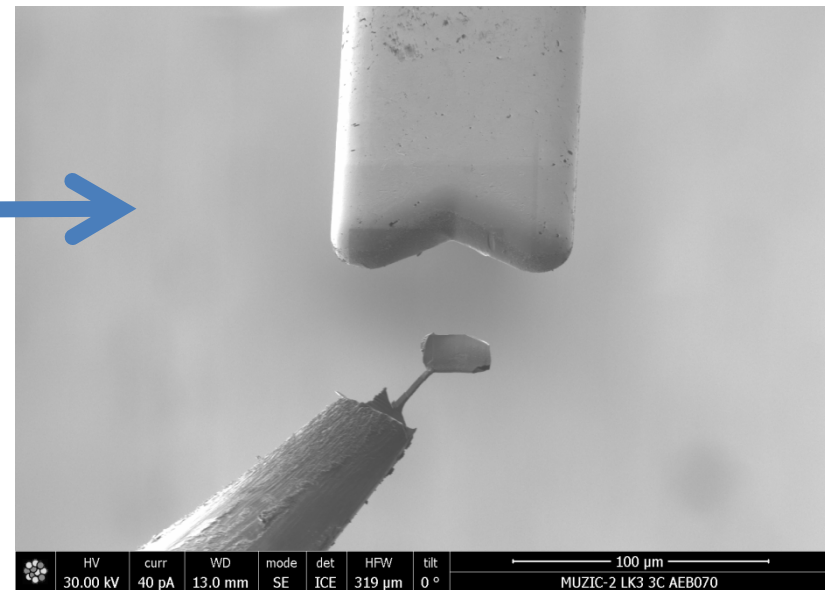
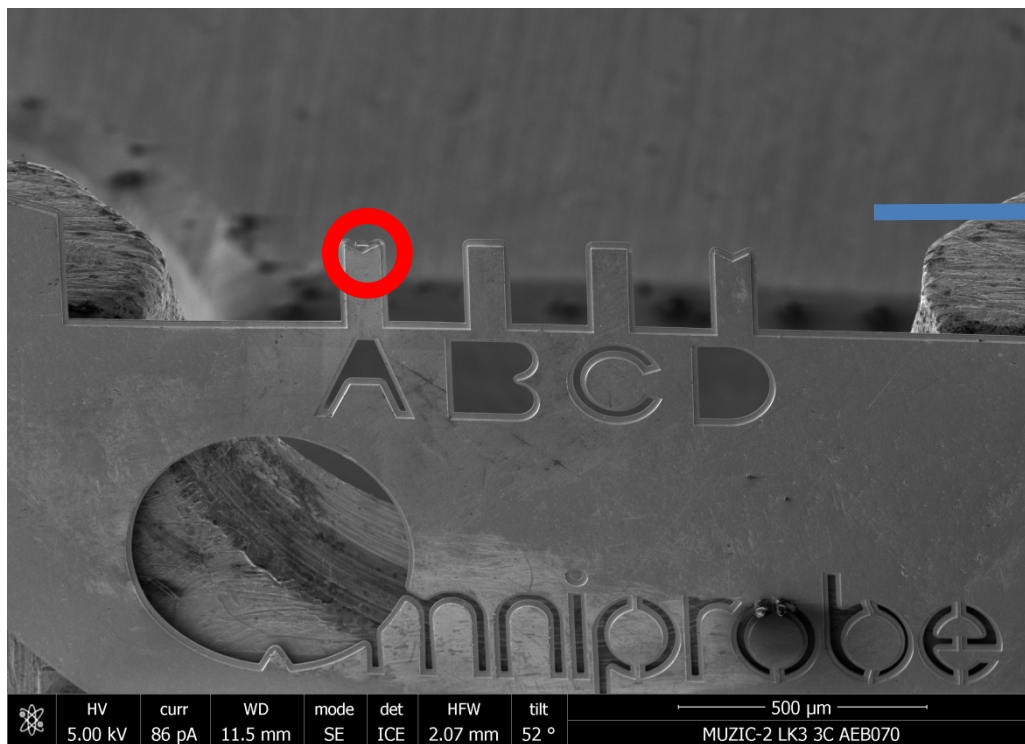
NNL facilities news

- Micro-XT is fully commissioned
- Active dual beam FIB is in final stage of installation
- FEG-TEM is due for shipping from Japan end 2015



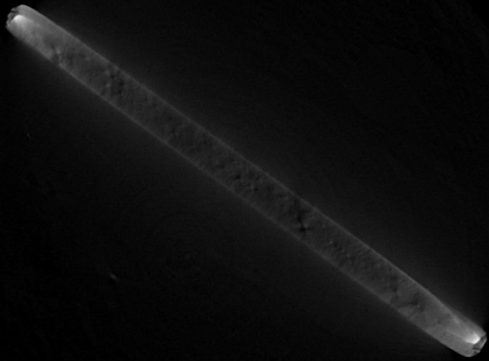
Manchester FIB Sample Finishing

As part of the international MUZIC-2 project, the NNL active FIB has been used to prepare ex-reactor Zircaloy samples for advanced TEM at UoM.

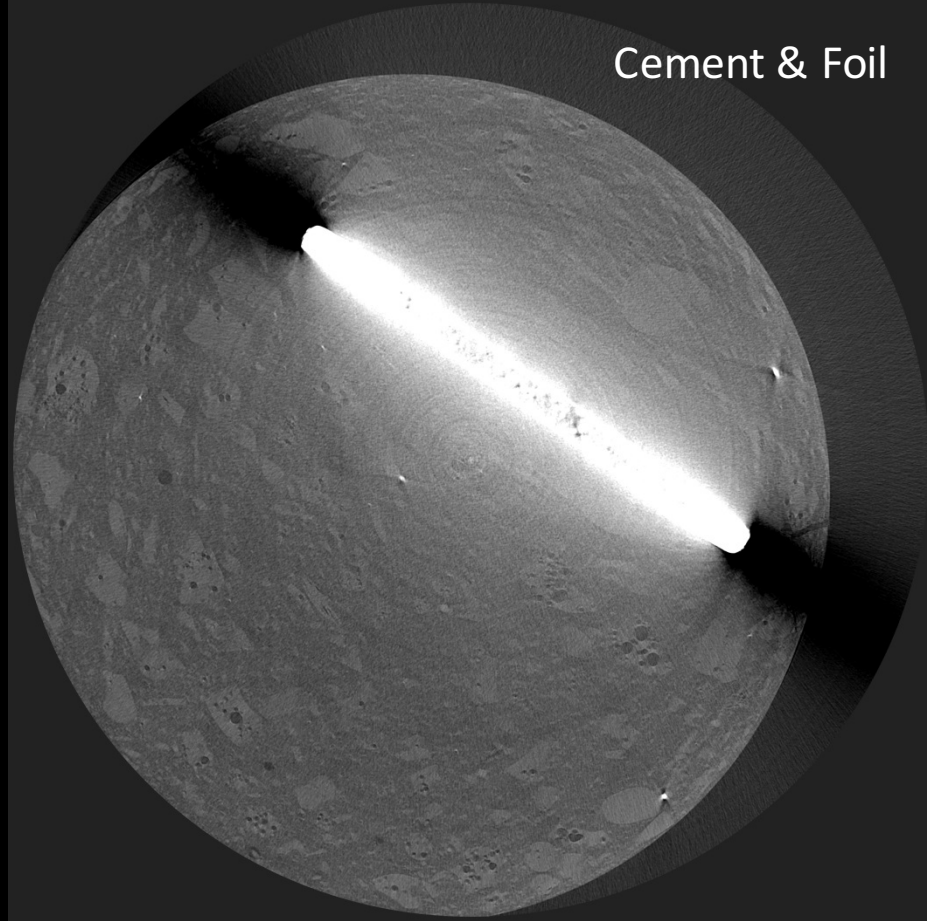


University of Sheffield PhD student used XCT in dual-energy scan mode to account for difference in attenuation in U and cement.

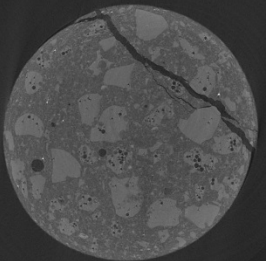
Uranium Foil



Cement & Foil



Cement



What is going on with future planning?

- Bid has been made to Treasury for future funding, £60M for capital (as per 2014 Autumn statement) and management and running costs as well (£20M).
- Likely to be no new funding until Spring 2017
- Discussions with EPSRC about how a call for funding might be organised in 2016.
- Inclusion of new MIDAS and PRL facilities under NNUF umbrella – reporting and encouraging shared use