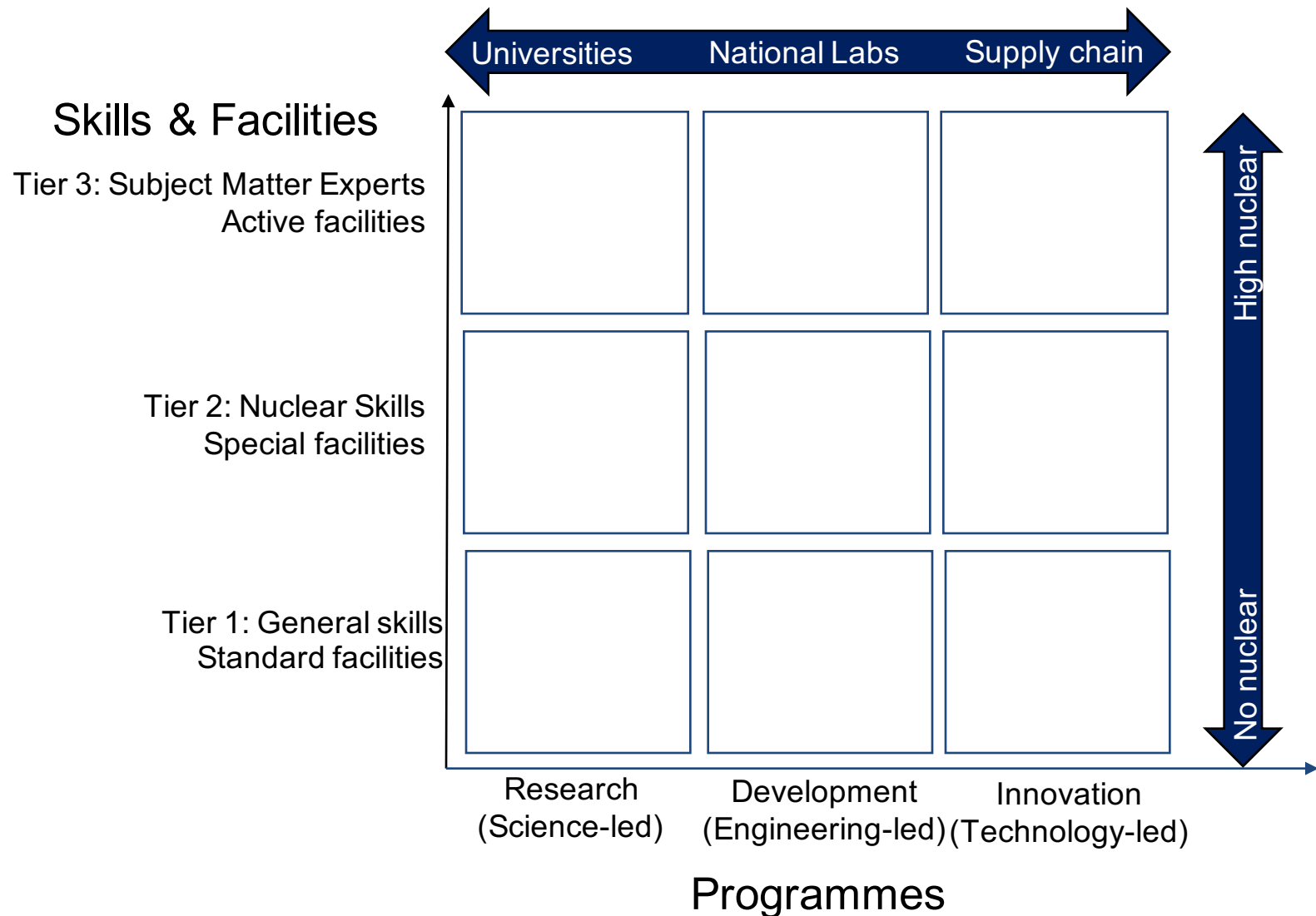




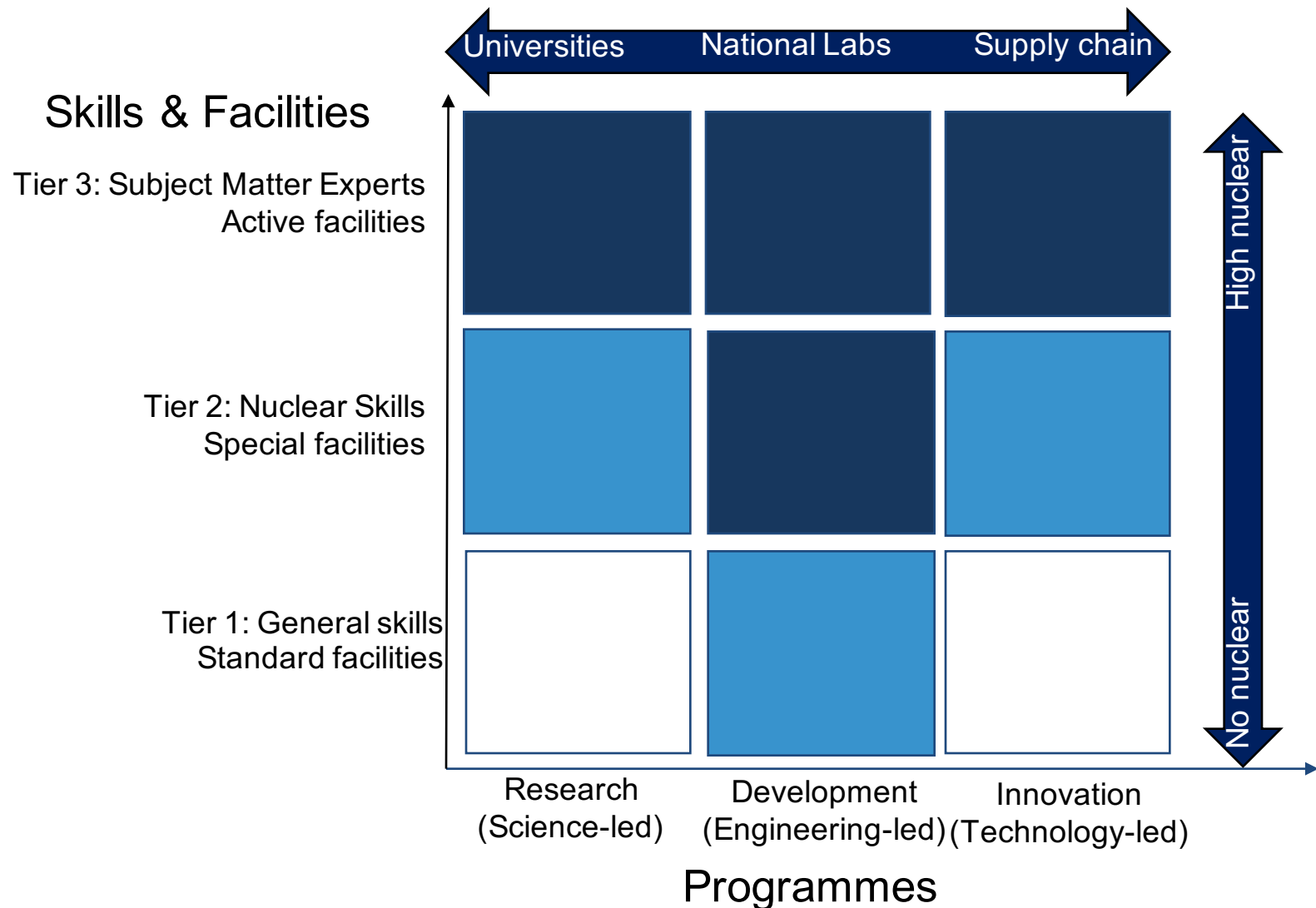
Science, Technology and Innovation

*Nuclear Academics Meeting
9 September 2015*

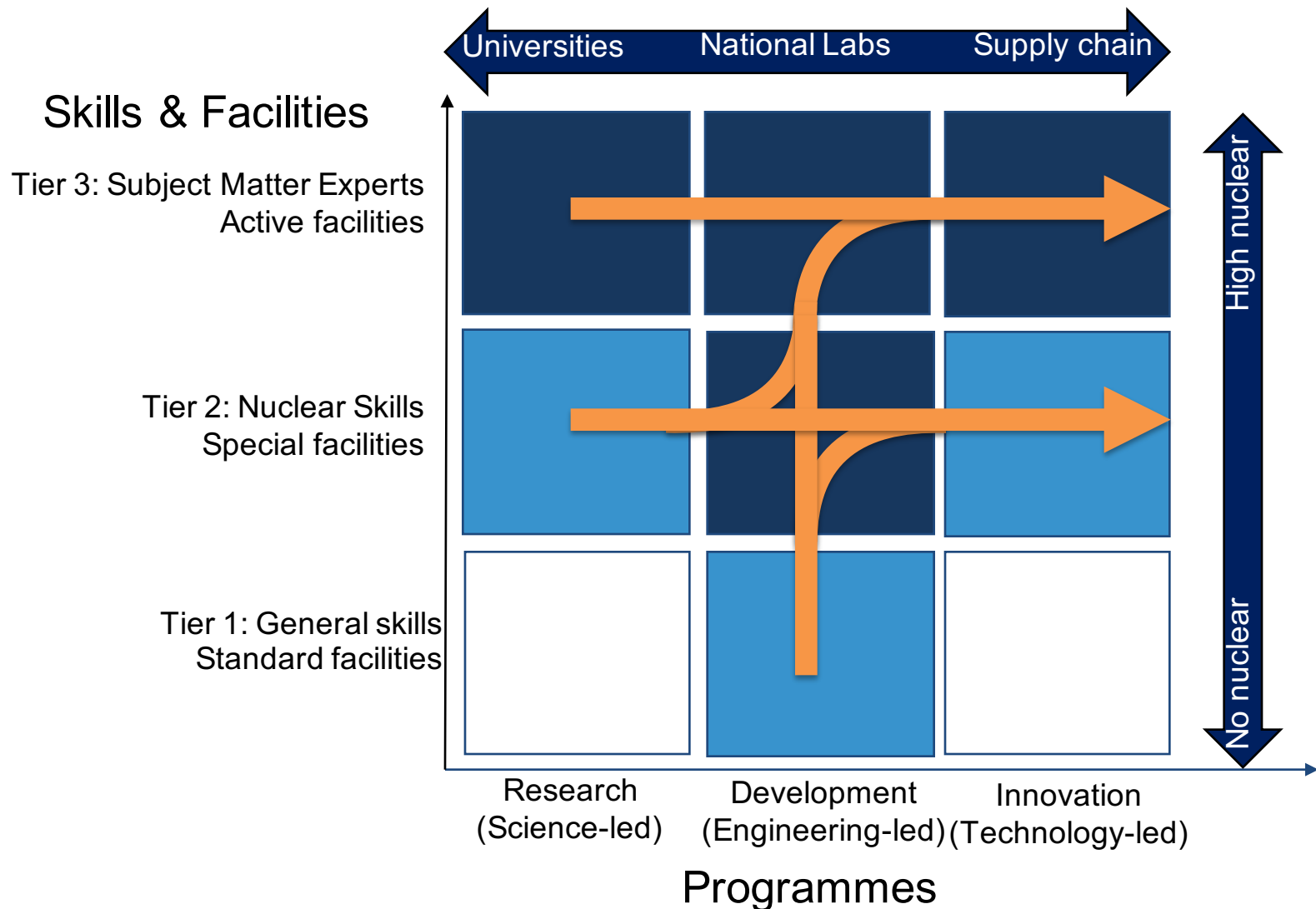
Capability Matrix



NNL S&T Capability Matrix

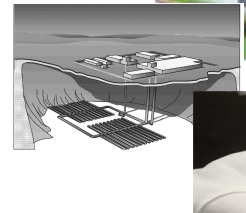


Innovation Paths

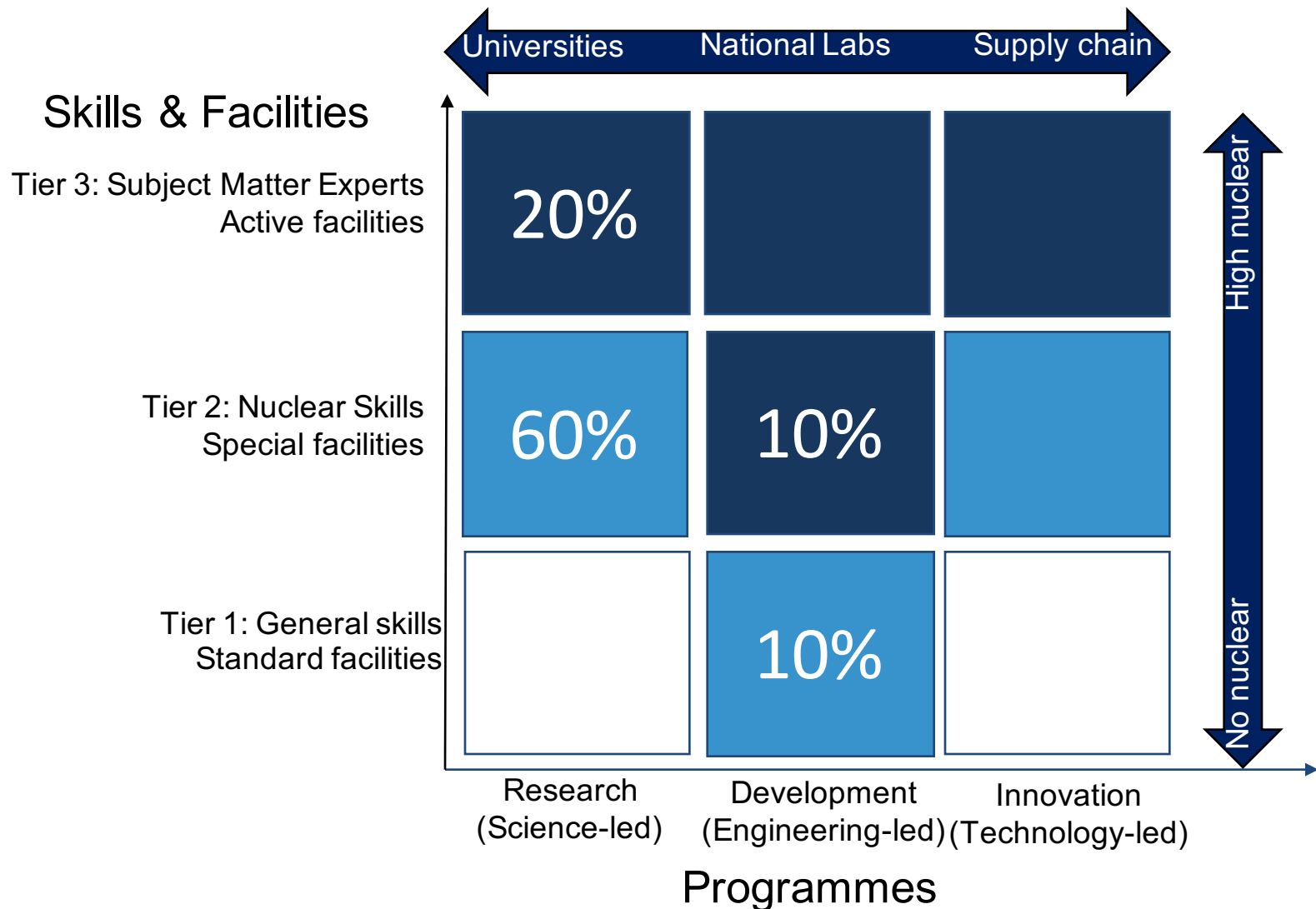


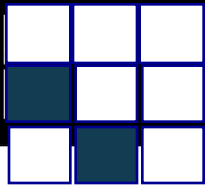
National Programmes

- Continued operation of existing reactors
- Legacy waste management / decommissioning
- New nuclear build
- Geological disposal
- Plutonium stockpile disposition
- Naval propulsion support programme
- Advanced reactors (Gen IV) and fuel cycles
- Space Power systems
- Security, non-proliferation & safeguards
- Deterrent technologies
- Nuclear Fusion

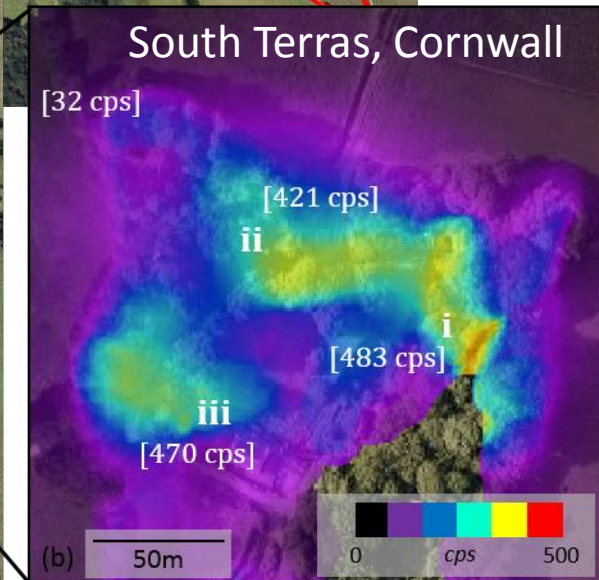


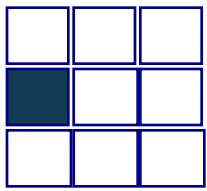
NNL-University Interactions





Development and application of UAV systems for low altitude radiation mapping of nuclear sites



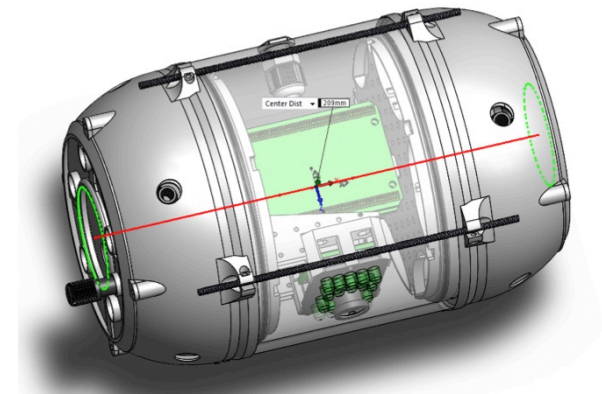


AVEXIS Underwater Robots

Two versions under development:

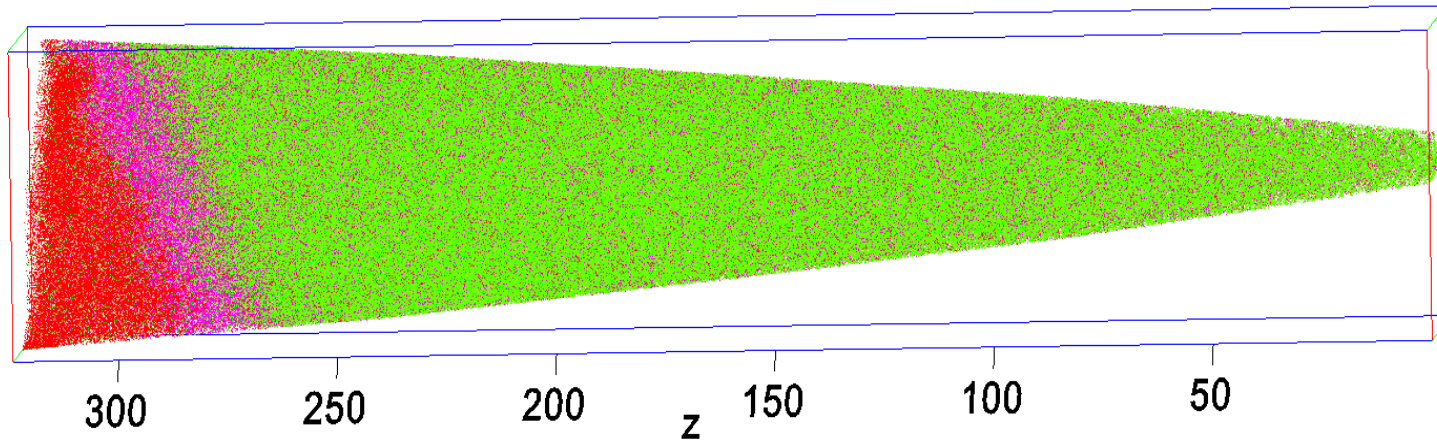
1. Untethered spherical robot for autonomous monitoring of ponds.
2. Tethered cylindrical version for exploration of hard to reach areas within Sellafield's legacy ponds.

Robots contain video cameras and CZT detector for measuring radiation dose.



3D printed design.
Very low cost.

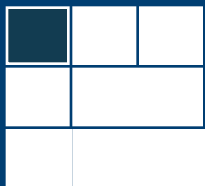
Fuel cladding performance



Atom probe data of a Zircaloy oxide. Metal (red), sub-oxide (pink) and oxide (green).

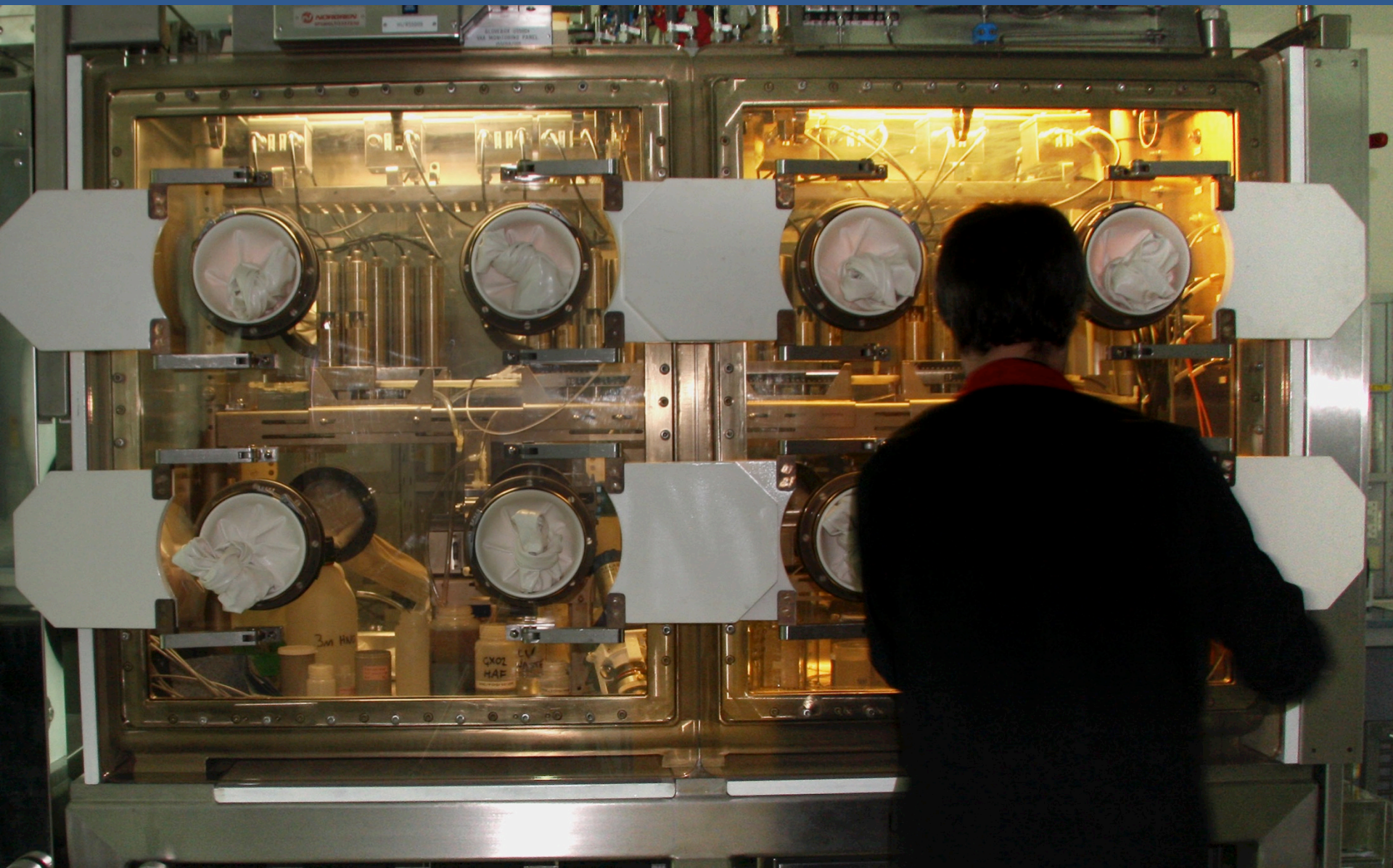


Slice (10nm thick) through the APT data of a Zircaloy oxide showing the distribution of Sn atoms. Green surface indicates the boundary between oxide and sub-oxide and the red surface the boundary between sub-oxide and metal.

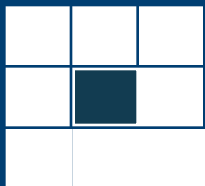


NNL PuMA Laboratory

NATIONAL NUCLEAR
LABORATORY



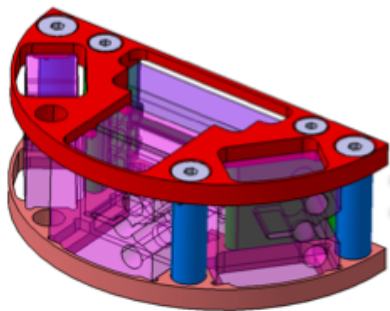
- Measurement of hydrogen and nitrous acid formed by plutonium & americium alpha radiolysis of nitric acid
- Modelling neptunium extraction in an NNL designed Advanced PUREX process
- Hydrogen evolution from radiolysis of organic TODGA solutions
- Chloride adsorption on to actinide oxide surfaces
- Water radiolysis when adsorbed on PuO_2 surfaces
- Mass transfer kinetics in the innovative-SANEX process
- Modelling Np redox reactions and hydroxamic acid redox chemistry
- Americium based space battery development



UK secondee to JHR

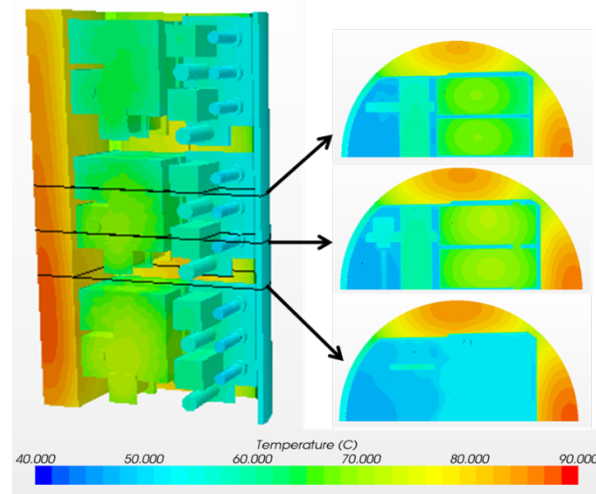
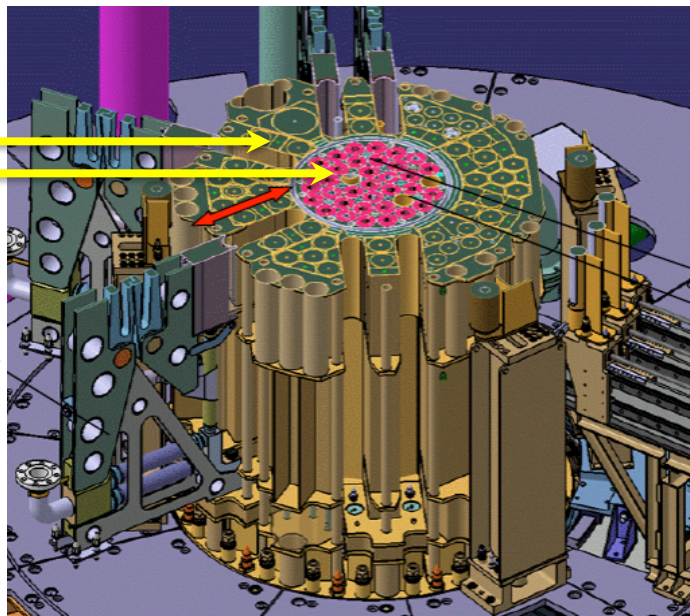
Rob Bamber, CCFE: Current activities

JHR core



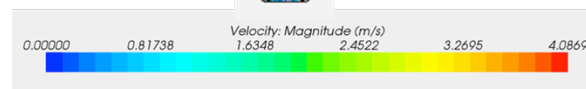
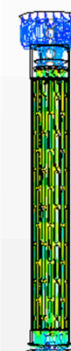
1. Design (incl Thermo-Hydraulic) of surveillance sample devices (pannier above)

Matching of sample temp to vessel in-service temp



2. Thermohydraulics modelling (CFD) of panniers (above) and other test devices (Be blanks) (left)

3D modelling with code STAR-CCM



3. Design of fusion specific test device

Work to commence shortly on completion of a survey



JHR: Background to secondments

- UK has been a full signatory to the JHR Consortium Agreement since March 2013
- CEA encourages secondees from all signatories to participate in the development of JHR experimental devices and capabilities
- Would be based at a CEA site in France, for periods of 1-2 years
- CEA make a financial contribution to living expenses in France but salary to be paid by home organisation
- Secondee remains an employee of their home organisation and will return there afterwards

