Bragg Peaks
> for neutron users
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OPAL news

The last 3 months at OPAL have been full of excitement. The reactor itself went critical again on 9th May, following approval of the modified fuel design by ARPANSA, our nuclear regulator, on 1st May. OPAL reached full power (20 MW) two weeks later. An occasion to be celebrated with a sausage sizzle: for a change Greg Storr, the head of Reactor Operations, is serving sausages.

The cold-neutron source continues to run well. This seventh operation cycle came to an end on 28 June and the next reactor cycle is planned to begin on 7 July running for about 30 days; so we can expect having neutrons at our second neutron school in the second half of July.

At the end of last year we reported that a reflector vessel defect (seepage of light water into heavy water) needed repair. This impure heavy water will need to be replaced with pure heavy water in the future. Taking this into account, we expect to have a schedule for the next few months' reactor operation shortly.

Around the instruments

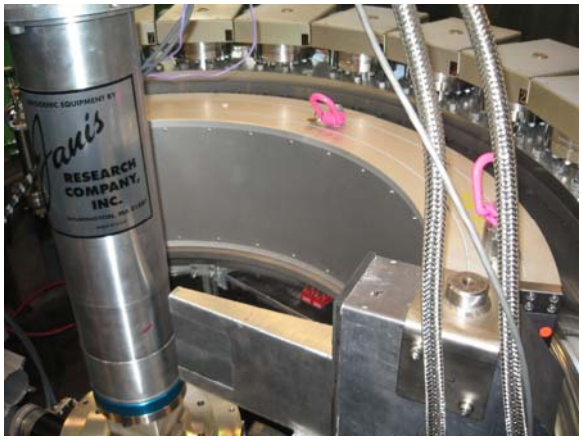
Radiation survey on the reflectometer Platypus (neutron-guide hall).

The restart of our neutron instrumentation was dedicated to radiation surveys at different reactor power settings, especially exciting for some of the instruments seeing neutrons the first time. Below are photos of the radiation survey on the three-axis spectrometer Taipan in the reactor-beam hall (left) and the powder diffractometer Echidna in the neutron-guide hall (right).

We have now had neutrons into all 7 initial instruments, and representative data sets have been taken from standard samples using the main detector(s) on 5 of the instruments.

Echidna *(high-resolution powder diffractometer) and* ***Wombat*** *(high-intensity powder diffractometer)*

The two powder diffractometers have made their submissions for operating licences to ARPANSA, and we are hopeful of getting these licences very soon.



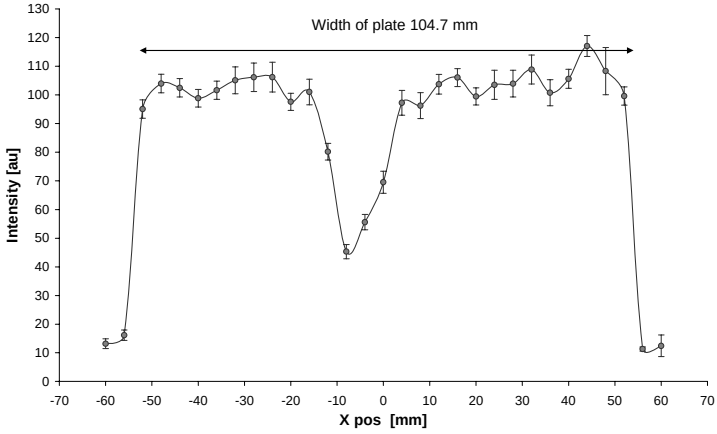
On Wombat, one of the most common applications will be mapping out phase diagrams over temperature.

Now that OPAL has restarted, commissioning on Wombat with neutrons has recommenced, and the instrument has been tested with the radial collimator and the cryofurnace both operating, see photo above.

Kowari *(strain scanner)*

Kowari's first "experiment" was carried out shortly after OPAL went back to full power. Following radiation surveys a weld was scanned along the transverse direction of the weld. The next steps are optimisation of the instrument and submitting an ANSTO internal licence application followed by submitting our application to ARPANSA for our operating licence.

First weld scanned on Kowari, June 2008: the scan was done along the transverse direction (perpendicular to the weld) at the centreline indicated on the plate.

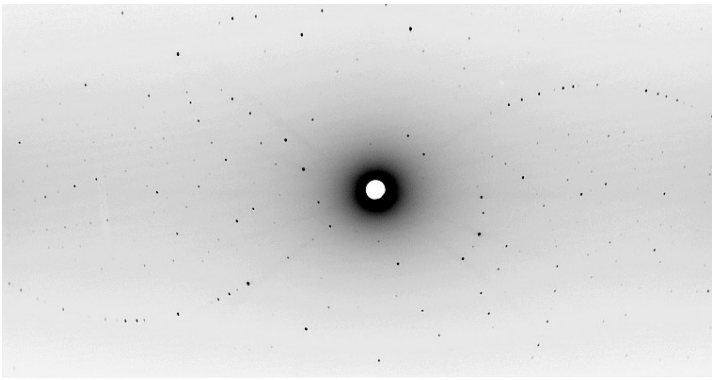


Neutron intensity versus position across the weld: from the shape a width of the plate of 104.7 mm can be reconstructed. The position of weld corresponds to the dip in intensity.

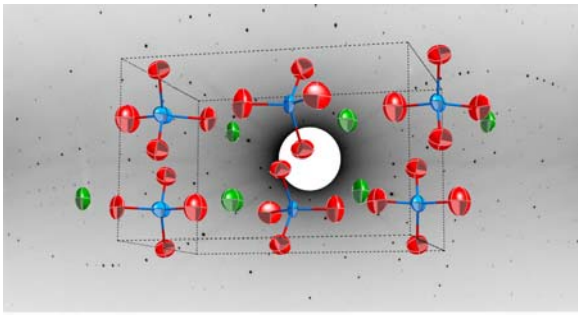
After a factory acceptance test in England (see last Bragg Peaks) in early April the load frame arrived at the Bragg Institute in early May. By the end of the month the load frame had past all required tests and user training had been conducted for 5 ANSTO scientists. The load frame is ready for use ex-situ for any required tension, compression or fatigue testing; it is anticipated that it will be available for use on Kowari in about 2 months' time.

Koala *(quasi-Laue diffractometer)*

On Thursday 19 June, Ross Piltz and Alison Edwards conducted the first neutron diffraction experiment using the Koala Laue diffractometer – the first image was recorded on a crystal of rock salt (NaCl), like the Braggs who recorded their first X-ray diffraction images from salt for their ground-breaking studies.



Subsequently, we took a neutron diffraction pattern (shown above) from a crystal of potassium permanganate ($KMnO_4$) – a more complex material which has a larger unit cell and from which more diffraction spots result. The structure refinement using the Koala data set is shown in the picture below (thanks to Chris Ling).



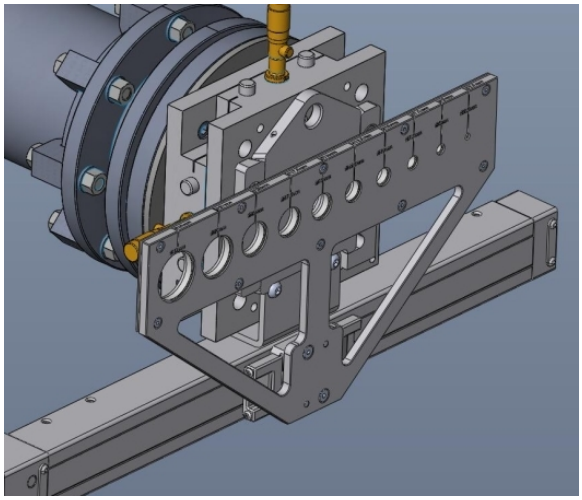
The image shown was recorded in a 10 minute exposure from a 2 x 2 x 2.5 mm^3 crystal. The data on this image would have taken about half

a day to measure on the decommissioned 2TanA instrument. We look forward to probing the practical limits of this instrument.

Quokka *(small-angle neutron scattering, SANS)*

Software and testing continues on Quokka's 1m^2 area detector, now installed on its carriage in the detector vessel (see photo below), and final safety checks have been done on the safety interlock system.

The latest pieces of the instrument hardware to arrive are the components of the instrument's motorised sample aperture array (pictured below). This system, which will be installed during the commissioning period of the next few months, will enable full automatic control of the instrument optics for optimised SANS data collection.

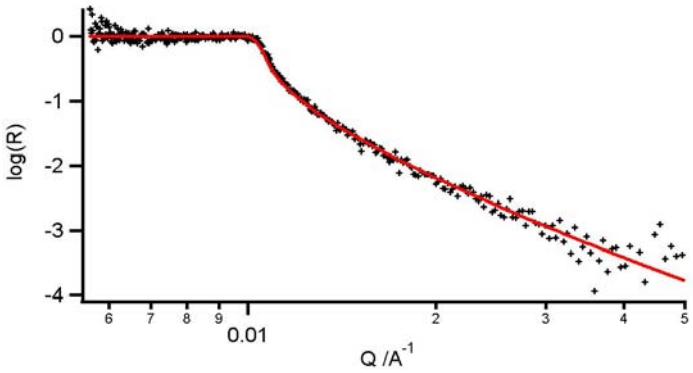


Platypus *(reflectometer)*

After the reactor restarted the first important task was to perform a thorough radiation survey (see photo on page 1), checking that things were ok to begin hot commissioning.

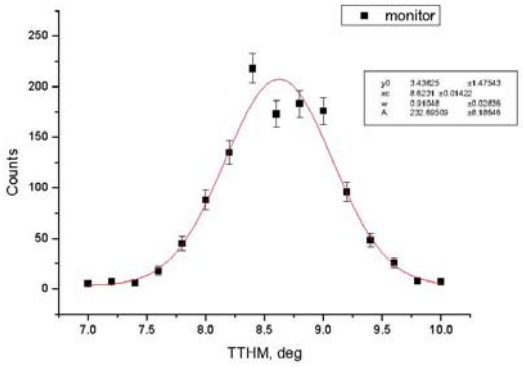
At the moment, we are performing the usual calibrations for a reflectometer, viz. aligning the slit systems, checking disc chopper operation, etc. During this phase we have been able to measure a couple of preliminary reflectivity curves.

The curve below is a measurement from the silicon-air interface (collected at the lowest angular setting). Bear in mind that the instrument is just starting the calibration phase, so things aren't perfect (the instrument was not completely characterised and no background has been subtracted).



Taipan *(thermal three-axis spectrometer)*

On the 20th of May 2008, Taipan, our thermal 3-axis spectrometer, had its first shutter opening at low reactor power (see photo on page 1). The rocking curve of the pyrolytic monochromator in the flat configuration was measured with the low-efficiency incident beam monitor. Subsequent radiation surveys conducted at low and full power show radiation levels consistent with expectations both outside the shielding wall as well as on the surface of the monochromator drum.



Electrical work is in progress, including modifications of the monochromator cable chain and field wiring of the motors and absolute encoders on the monochromator and secondary spectrometer. Integration with the data acquisition software will commence as soon as the wiring is complete.

Announcements

Commissioning of instruments

We are hopeful of getting the operating licences for our first 2 instruments (Echidna and Wombat) very soon. As users may recall, this was one of two preconditions for scheduling approved experiments from last year's proposal call, the other being a publishable schedule for the operation of OPAL itself.

Once we have run some of these approved user experiments, we intend to make the next call for user proposals on at least four instruments, the four diffractometers (Echidna, Wombat, Kowari and Koala), and maybe one of the cold-neutron instruments Platypus or Quokka. We will keep users posted about these milestones and further developments via our website and specific e-mails to the ANBUG membership.

ANSTO – AINSE Neutron School on Materials, 20-25 July 2008

Our school will provide training for newcomers to neutron scattering focussing on important classes of structural and functional materials, e.g. concrete and geopolymers, magnetic materials, soft matter and biomaterials, and metals. Some 30 participants will not only have lectures, but also practical sessions on the instruments and data analysis on neutron techniques available at ANSTO, i.e. powder diffraction, single-crystal diffraction, small-angle scattering, reflectometry, and inelastic scattering using three-axis spectrometers.
Further details about the school can be found on www.ansto.gov.au/bragg/science/conferences_and_workshops/neutron_school_08.html.

Faces

Alice Klapproth, coming from the University of Göttingen, Germany, is a newcomer to the Bragg Institute. She is working on the nucleation of gas hydrates using neutron scattering as part of a joint postdoc position between CSIRO and ANSTO.

Daniel Bartlett (left) and Tony Lam (right) are already known from their previous stays at the Bragg Institute. Tony is working on software development for the neutron-beam instruments.

Dan is a technical officer with an electrical background supporting the neutron-beam instruments.

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