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TAIPAN

Triple-axis spectrometer

Taipan is a triple-axis spectrometer used to measure neutron inelastic scattering, which is a key technique for the measurement of excitations in materials. These measurements provide information on the forces between atoms, or interactions between magnetic moments. Taipan will be one of the best thermal-beam triple-axis spectrometers in the world, as it has been designed to maximise the number of neutrons that reach the sample.

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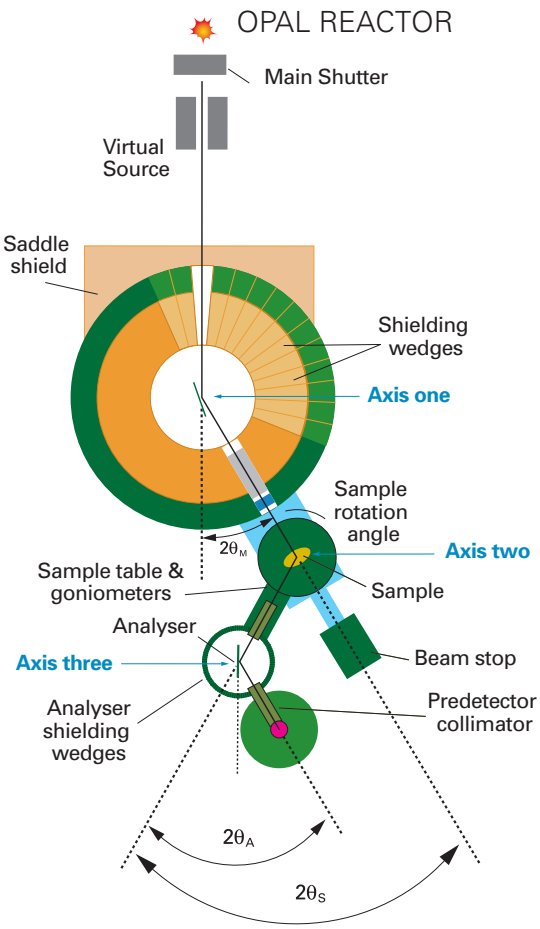

What makes Taipan special?

Triple-axis spectrometers:

- measure how much energy has been lost or gained by neutrons in the scattering process, providing information on the energy spectrum of the sample.
- interpret the scattering in terms of dynamics or how the atoms move within the sample.

This is particularly important in understanding:

- how materials change structure (eg: phase transitions).
- other thermodynamic properties of solids (eg: specific heat, magnetic susceptibility).

Taipan is highly configurable and versatile, and has the most intense thermal beams in the whole facility, together with the lowest background levels. A substantial number of experiments will be performed on the instrument, particularly when looking for weak scattering effects.

Triple-axis spectrometry is based on inelastic neutron scattering, which occurs when the energy of the neutron changes as a result of interaction with the sample. Taipan uses inelastic scattering to investigate molecular vibrations and magnetic properties, and can provide information not accessible by any other means.

Instrument overview:

The machine consists of three independent axes of rotation:

- the **first axis** monochromates the beam – selects neutrons of a particular energy
- the **second axis** is the sample to be studied, which scatters the beam
- the **third axis** is the analyser, which analyses the energy of the scattered beam

Application: Study of superconductors

Superconductivity is a phenomenon occurring in certain materials at extremely low temperatures, characterised by exactly zero electrical resistance and the exclusion of the interior magnetic field.

Superconductors are used to make some of the most powerful electromagnets known to man, including those used in Magnetic Resonance Imaging machines. They can also be used for magnetic separation, where weakly magnetic particles are extracted from a background of less or non-magnetic particles, as in the pigment industries.

Instrument specifications:

Taipan is located on the thermal neutron guide TG4 in reactor beam hall

Beam size:
50 x 180 mm high at reactor face

Angular ranges:
- $15° < 2\theta_m < 85°$
- $-145° < 2\theta_s < 115°$
- $-110° < 2\theta_A < 110°$

Monochromators:
- Pyrolytic Graphite (002) with Energy Range: ~ 5 – 60 meV
- Copper (200) with Energy Range: ~ 14 – 160 meV
- 200 x 200 mm² in 9 x 11 segments (W x H) with continuous horizontal and vertical focussing

Sample area:
- beam size at monochromator shielding exit 50 x 130 mm (W x H)
- flux at sample position is projected to be ~ 2 x 10^8 $ncm^{-2}s^{-1}$ at 50 meV

Analyser:
- Pyrolytic Graphite (002) 24' mosaic
- 160 x 140 mm in 5 x 7 segments (W x H) with continuous horizontal and vertical focusing

Polarisation Analysis:
- Provided by m=3 polarising supermirror benders before and after the sample

Soller collimators:
- Pre-monochromator collimators: 15', 30', Open; 90 x 185 mm² (W x H)
- Post-monochromator, pre-analyser and pre-detector, collimators: 20', 40', Open; 50 x 130 mm² (W x H)

Detector:
- ^{3}He detector, Ø25 mm x 100 mm, p=10 bars
- or Ø50 mm x 100 mm, p=5 bars

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