Australian Government

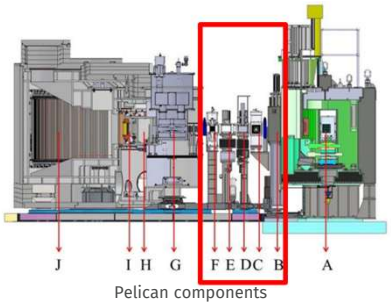
ANSTO

Design and Engineering of Neutron Instruments Meeting XV, CNEA 2026

Redesign of Pelican's Optics Stage

Project Background

- Pelican is a cold-neutron time-of-flight spectrometer at the Australian Centre for Neutron Scattering
- Pelican's Optics Stage is the region between the monochromator and the sample tank. It houses 2 Fermi choppers, a focusing guide, polariser and air option, 2 slit packages and a beam monitor, as well as all associated gamma and neutron shielding
- Current issues with Pelican's operation:
  - Flexibility within all joints, obvious during moves to change wavelength (around MTTH) and detector position (around STTH).
  - Lack of reproducibility within the movements of Pelican.
  - Complexity within shielding design.
  - Underutilised second (high-intensity) Fermi chopper.
  - Missing polarisation capability.
  - Large maintenance efforts required for alignment.
  - Airskates are used (rather than airpads), which are non-precise.



Pelican components

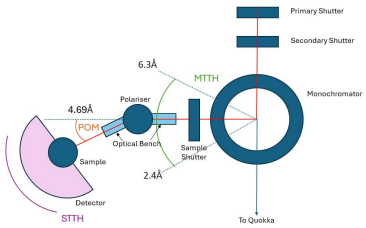
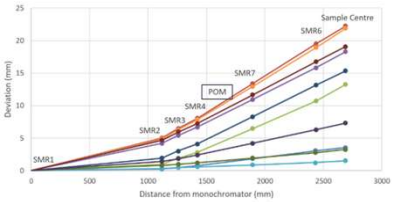


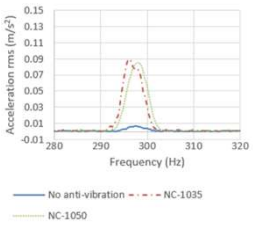
Diagram of Pelican movement



FARO Laser Tracker MTTH Results

Issue Diagnosis

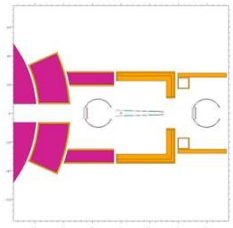
- FARO laser tracker measurements
  - The sample centre could deviate from the expected position up to 22mm during a single movement., forcing the scientists to complete further alignments after each movement.
  - Activating/de-activating the airskates causes a deviation in position.
- Anti-vibration testing
  - All Fermi choppers were originally mounted on anti-vibration mounts (Barry's Control T-94).
  - Anti-vibration testing illustrated that no anti-vibration mounts were more effective at vibration damping, due to balancing of internal magnetic levitating bearings. *(Thank you for the support from STFC and SKF)*

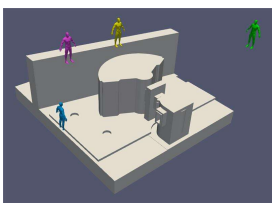
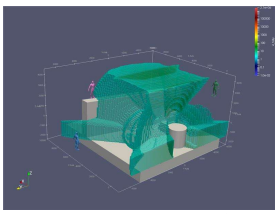


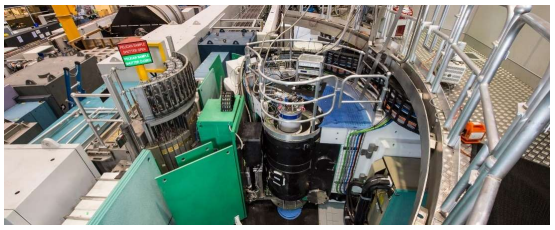
Anti-vibration testing results (sample)

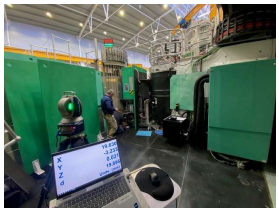
New Design

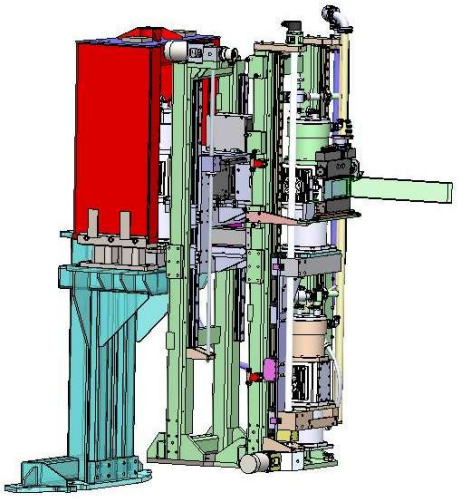
- Master Fermi Chopper Translation
  - Master Fermi chopper translation stage has been designed, allowing for translation between high-intensity and high-resolution Fermi choppers within 10 minutes.
- Optics Option Translation
  - Redesigned and consolidated (two stages into one) redesigned translation for air, focussing guide and polariser options.
  - Allows for translation within 6 minutes between options.
  - Shielding integrated supported by this stage.
- Redesigned Shielding
  - MCNP 6 was used to simulate gamma and neutron dose rates under proposed shielding configurations. Paraview was utilised to visualise dose rates around enclosure.
  - Health Physics surveys were used as feedback to update and validate the shielding model.
  - Four critical locations were identified around Pelican enclosure for shielding simulations.
  - Shielding has been redesigned to be modular.
- New MTTH rail design
  - Replacement MTTH rail, including rail carriages.
- Airskates Replacement
  - Possibility of replacing airskates (10mm lift) with airpads (0.04mm lift). High-level of dance floor accuracy and flatness required. Floor mapping using FARO completed as a feasibility study.
- Planned installation for 2027

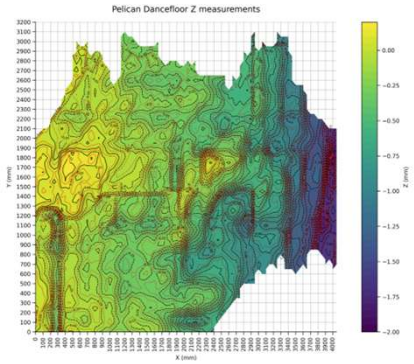

Screenshot of MCNP geometry for shielding simulations



Paraview model of Pelican (top) blank, (bottom) with $3\mu Svlhr$ gamma dose envelope


Current Pelican setup


Setup for FARO laser tracker measurements


SolidWorks model of proposed new Fermi chopper translation and optics option translation stages. Shielding hidden.



Mapping of Pelican floor flatness for airpads feasibility study

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