DINGO

The Interaction of Safety Interlock and Motion Control Systems for the DINGO Radiography Instrument at OPAL

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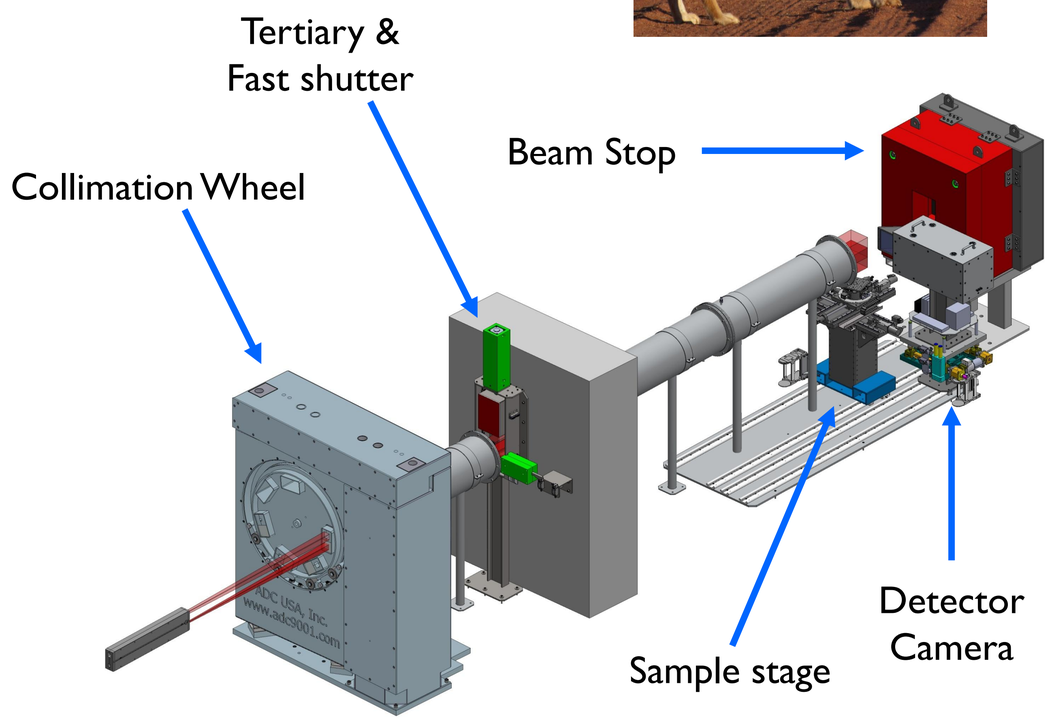
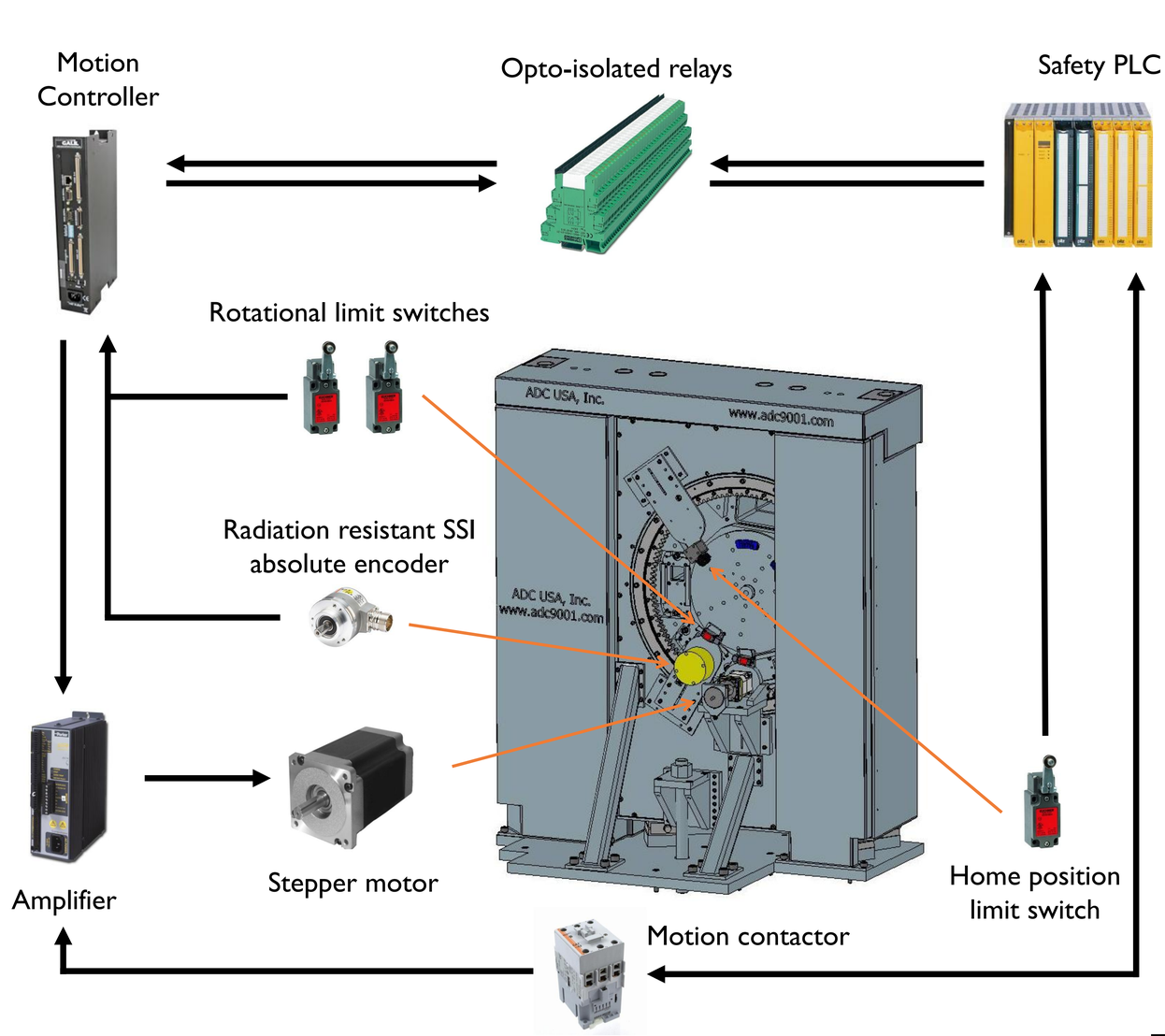
Overview

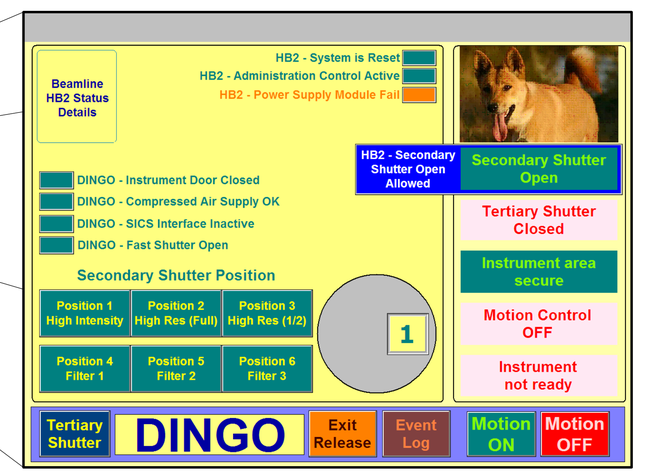
A neutron radiography/tomography instrument (DINGO) has recently been commissioned at the Bragg Institute. It utilises thermal beam HB2 of the OPAL research reactor with flux up to 4.75×10^7 neutrons $cm^{-2}s^{-1}$ at the sample. One component of the instrument is a 2.5 tonne selector wheel filled with a wax/steel shielding mixture which requires complex interaction between the safety interlock and motion control systems. It provides six apertures which are equipped with various neutron beam optics plus a solid 'shutter' section to block the beam. A standardised Galil based motion system controls the movement of the wheel while a Pilz safety PLC specifies the desired position and handles other safety aspects of the instrument. The wheel serves as a backup shutter to the fail safe Tertiary Shutter which falls under gravity.

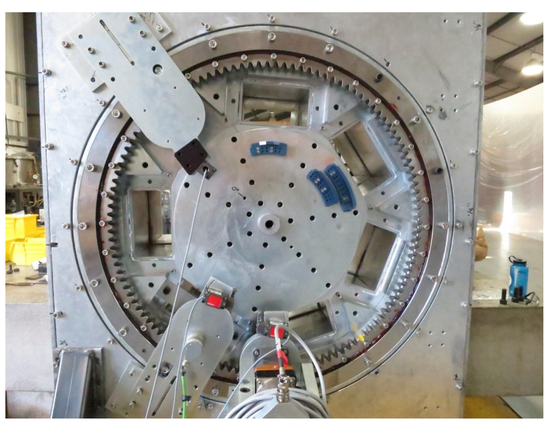


DINGO instrument layout



Collimation wheel electrical components and systems

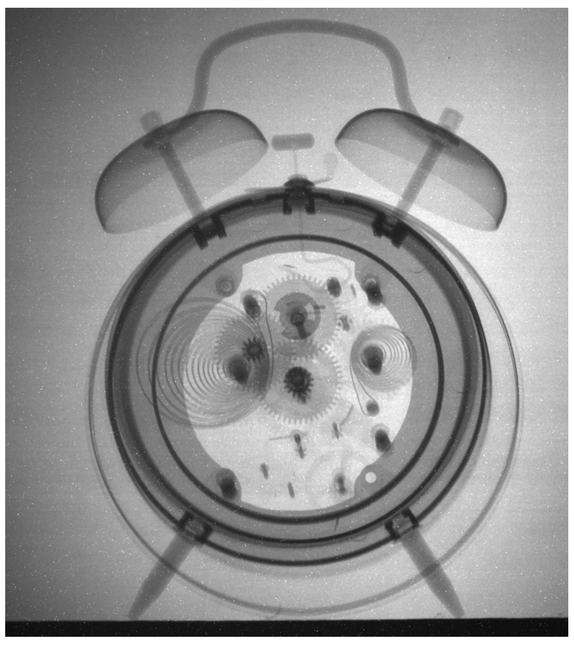




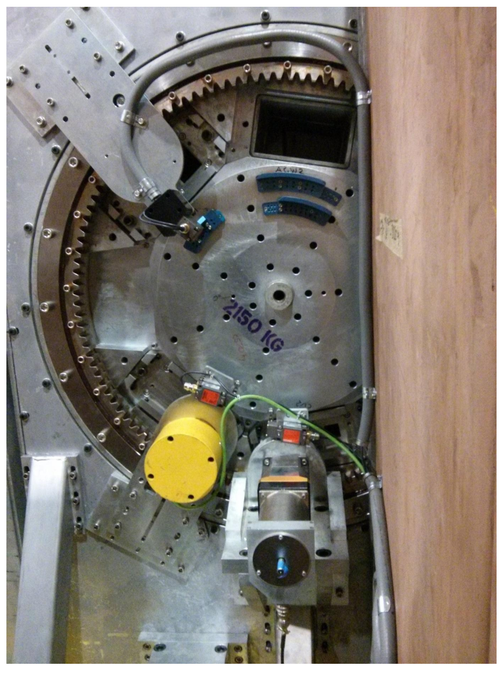
Collimation wheel during assembly

Design details

- Radiation resistant SSI absolute encoder with anti backlash gear.
- Two limit switches input to the motion controller prevent the drum from freewheeling; it can only travel ~360°.
- One dual channel Category 4 limit switch confirms the home/closed position to the Safety PLC. This position blocks the neutron beam and makes it safe to enter the enclosure.
- Motion control contactor controlled by Safety Interlock System with test pulsed feedback provides power to amplifier.
- Opto-isolated 24V relays transfer discrete signals from the motion controller to the safety PLC; allows motion and safety systems to be electronically isolated.
- Motion controller provides the following information to the Safety Interlock System: 7 bit progress value (percentage complete), 3 bit actual position & motion complete bit.
- Safety Interlock System provides the following information to the motion control: shutter enable bit, 3 bit commanded position.



First image from DINGO



Installed collimation wheel

Prepared by Paul Barron - http://www.ansto.gov.au/ResearchHub/Bragg/index.htm