

# Motion Control at ISIS

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ISIS Design Division: Motion Control



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# Timeline

- 13 Years ago: Motion Controller Standardised
- Huge Increase in the number of Motion Axes on Beamlines
- Over 600 Axes of motion across beamlines and instruments
- Still no holistic view within the Design Division or ISIS
- 4 Years Ago: Steve Cox joined IDD as sole motion control guy
- 2 Years Ago: Decision to form a dedicated team



# Motion Control Team

Electrical Engineer  
Background in Controls and  
Operations Group  
Originally the sole person  
devoted to Motion Control

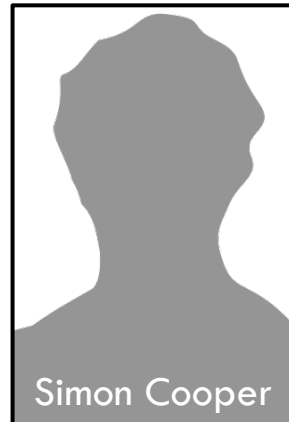


Team  
Leaders



Mechanical Engineer  
Background in Beamline  
Design involving a number of  
innovative motion axes

*Mechatronics  
Graduates*



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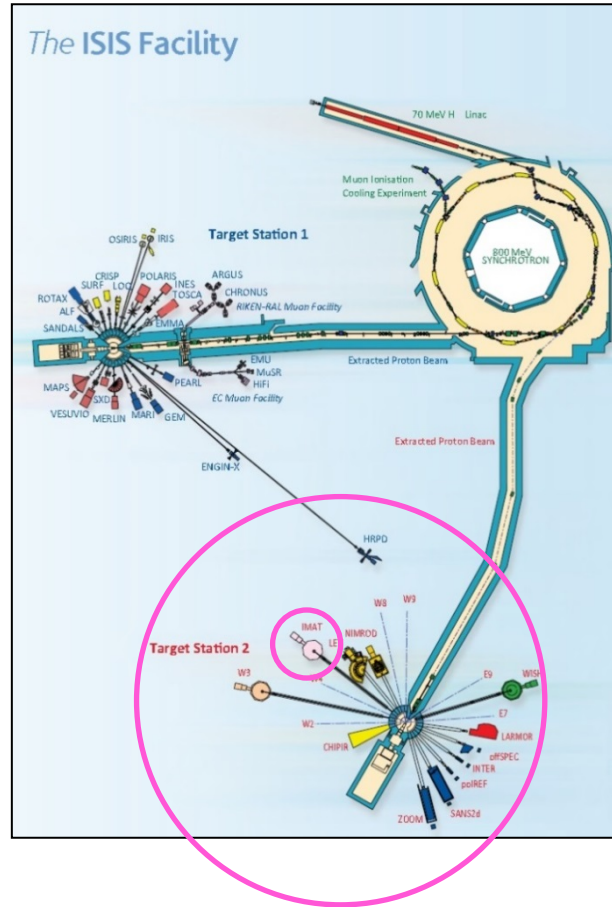
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## Areas of Work

- Testing
- Commissioning
- Prototyping
- Technical Advice
- Controls Programming
- Individual Design Projects
- Overview of Motion Control at ISIS
  - Increasing Collaboration with other groups
  - Standardisation
  - Safety
  - Future Directions



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IMAT Camera Positioning System



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# IMAT Sample Positioning System



- 1.5T Z Jacking Stage
- 1m Ø Rotation Stage
- Crossed X and Y
- Removable 3 Axis Tomography Stack
- Absolute Encoders
- Integrated Cable Management

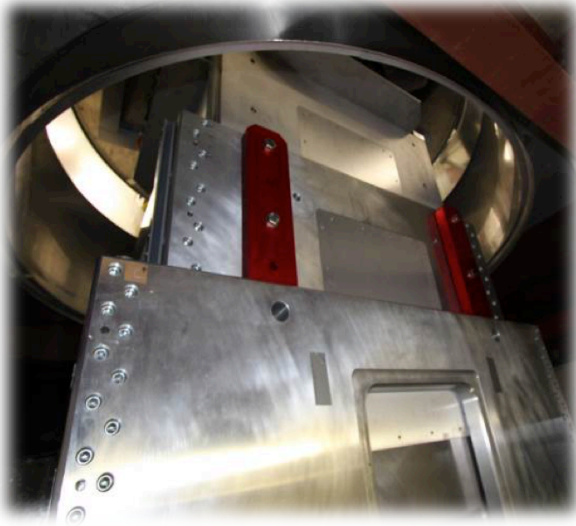
\*Acknowledgement:  
Barry Fell, STFC Daresbury  
SPS Manual – Figures & Specs



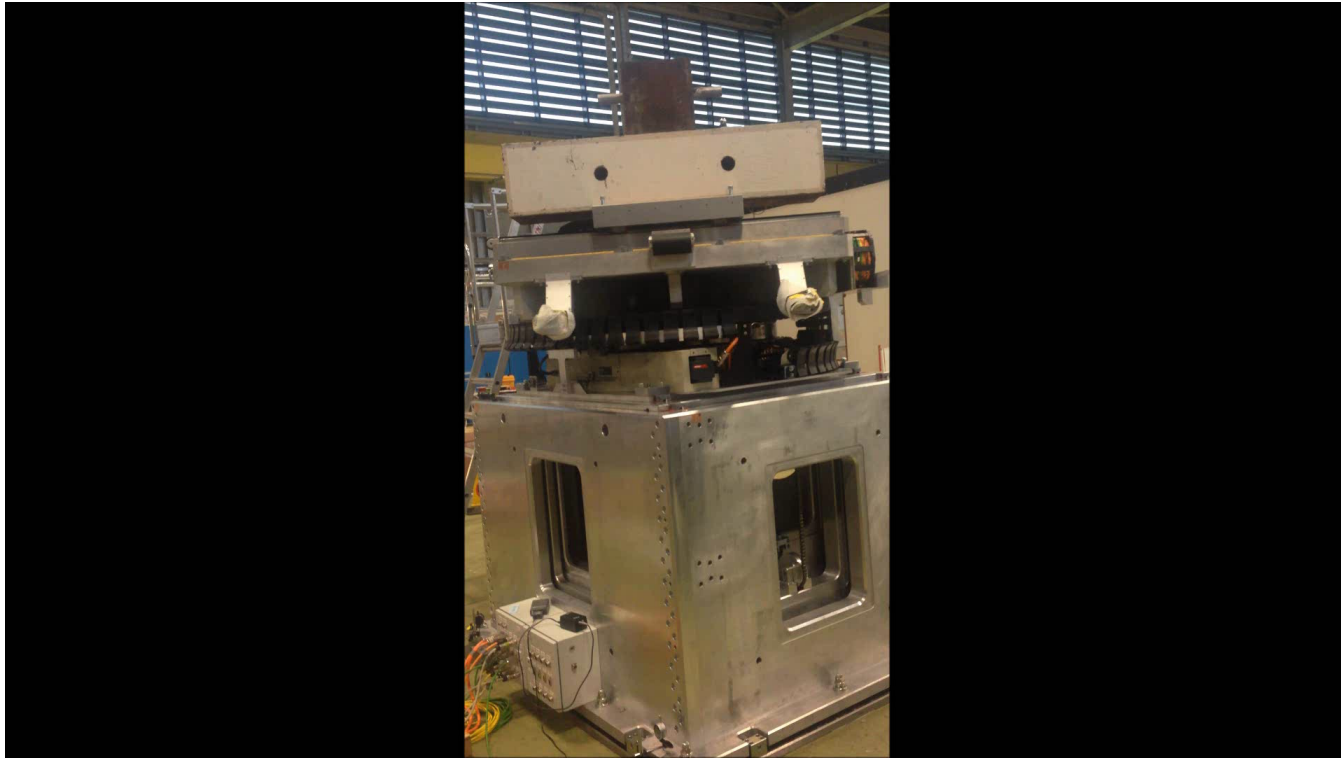
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# The Z Height Jacking Stage

- 2 stage tier design to keep within the overall maximum height 3780mm
- Fixed central jacking screw with rotating nut
- Load cell integrated into jacking screw

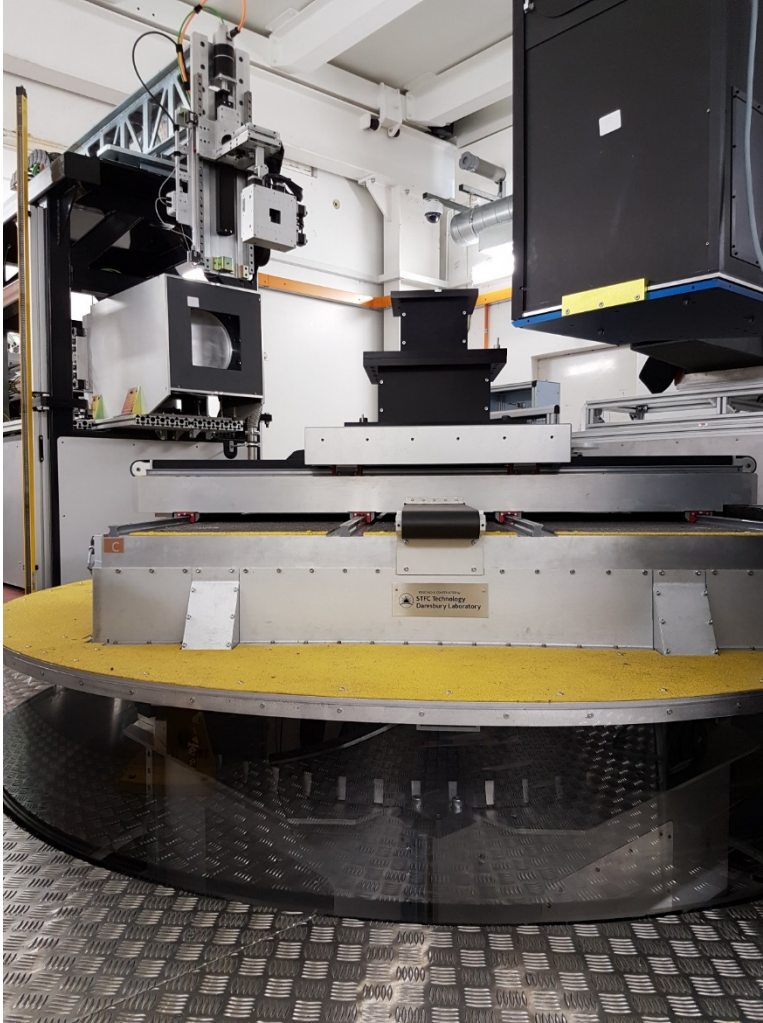


# Rotation Stage





# Ongoing work with the SPS



- Safety Stop System Integration (BS EN 13849)
- Beckhoff AX Drives
- EPICS integration – ESS Collaboration
- Dual Encoders on both axes
- Migrating all axes to one Motion Control system
- Improved blockhouse temperature control



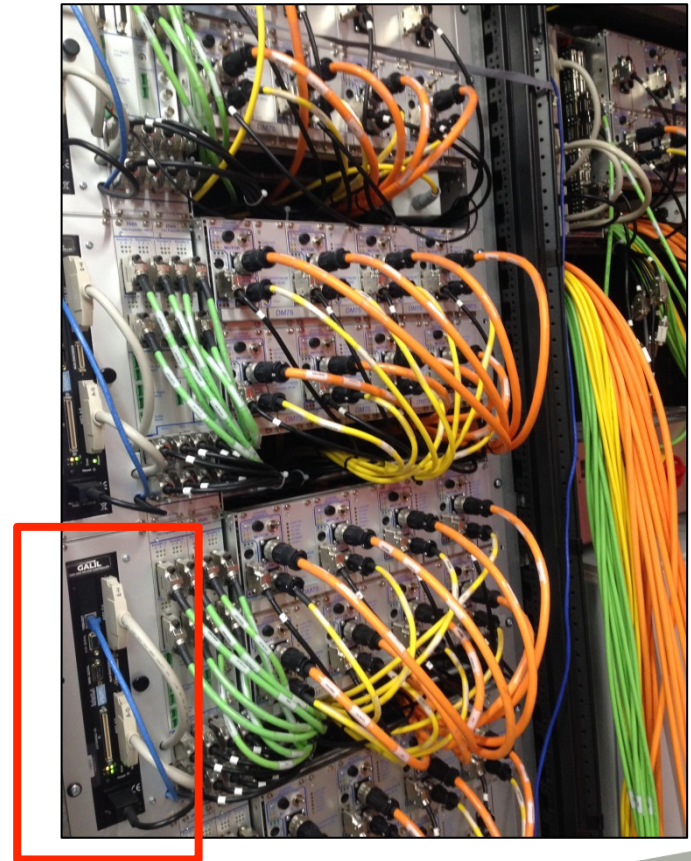
# Problems with the Z and Rotation Amplifier Drives and Motors

- SPS was intended to be driven entirely from ISIS Standard Motion Control System (1<sup>st</sup> Gen Galil based system)
- The external drives were very susceptible to electrical noise – This caused problems at RPI factory with testing
- Dual encoder loop with ISIS Standard MCU (1<sup>st</sup> Gen Galil based system) was bench tested with drive but performance was too poor to use
- Motors were too small and could not cope with gearbox internal friction losses
- Resulted in a decision being required late on in project



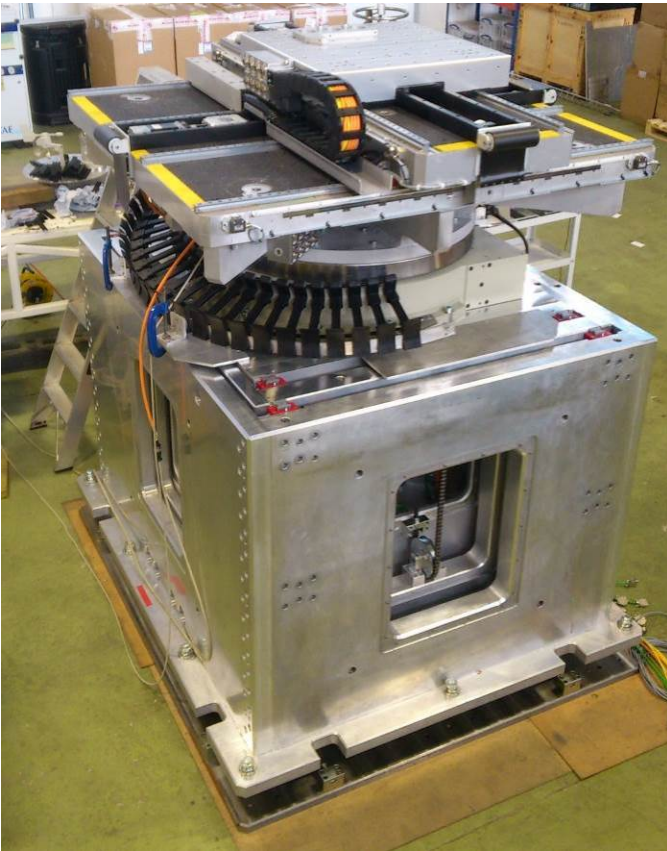
# Future Directions

- Current Control System
  - 8-Axis Controller From Galil
- 2<sup>nd</sup> Gen Standard Motion Control Unit
- Development:
  - Integration with PPS and other PLC systems
  - real time fieldbus
  - synchronised clocks
  - Feedback time stamping
  - synchronised axes moves
  - dynamic closed loop control



# Final Thoughts for ESS

## #WeCare



- Temperature control of the experimental area
- Test equipment limitations for checking against a specification
- EPICS Motor Record can not deliver dynamic closed loop control
- Neutron detector pixel size







# Questions?



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