

ENGINEERING CHALLENGES OF THE VMXI BEAMLINE

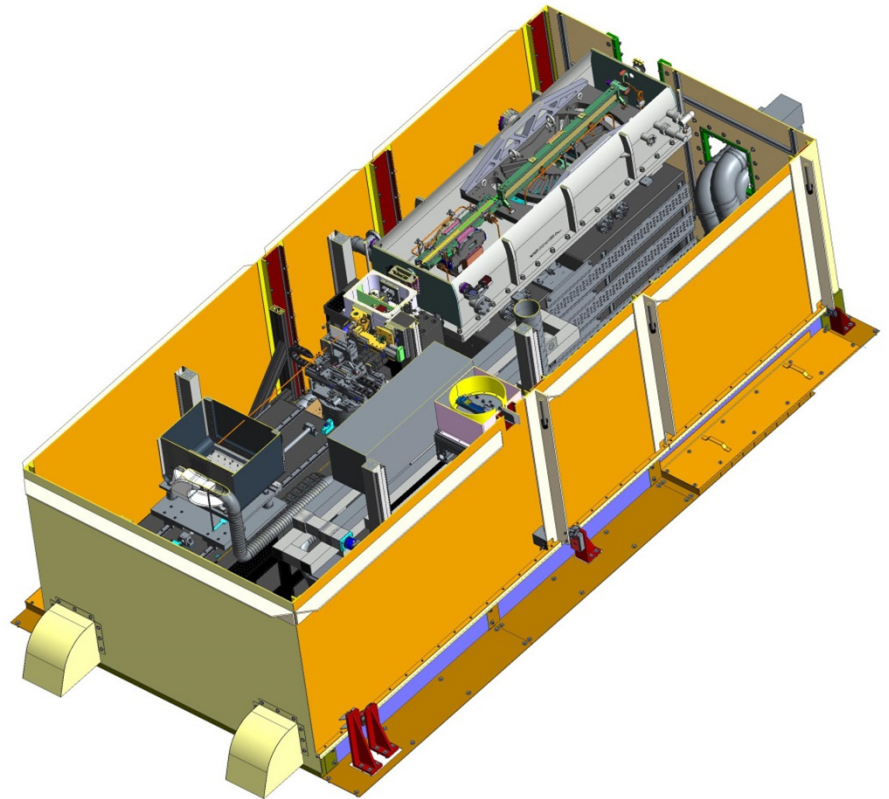
MEDSI 2016

Dr Jon Kelly



Talk Outline

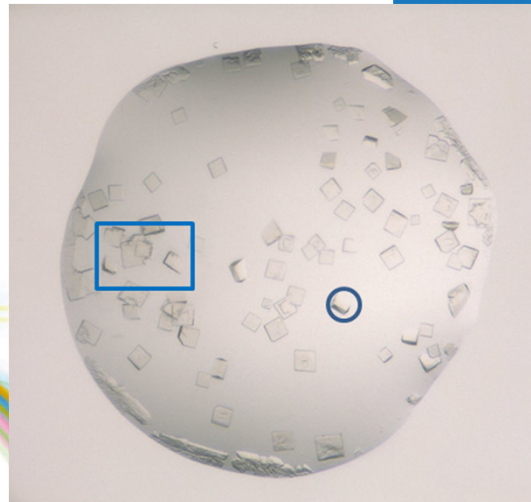
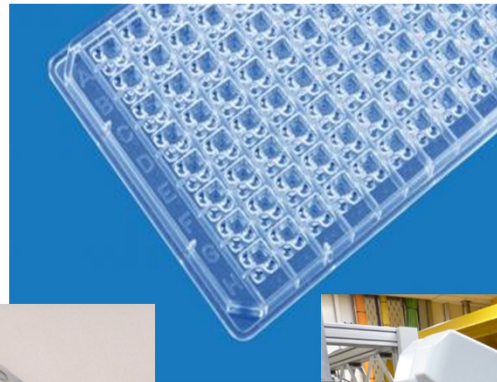
- Introduction to the VMXi Beamline
- DMM & Beamline
- Sample Loading
- On-axis Viewing
- Beam Conditioning
- Sample Goniometer
- Air Con CFD
- Conclusion



VMXi Beamline

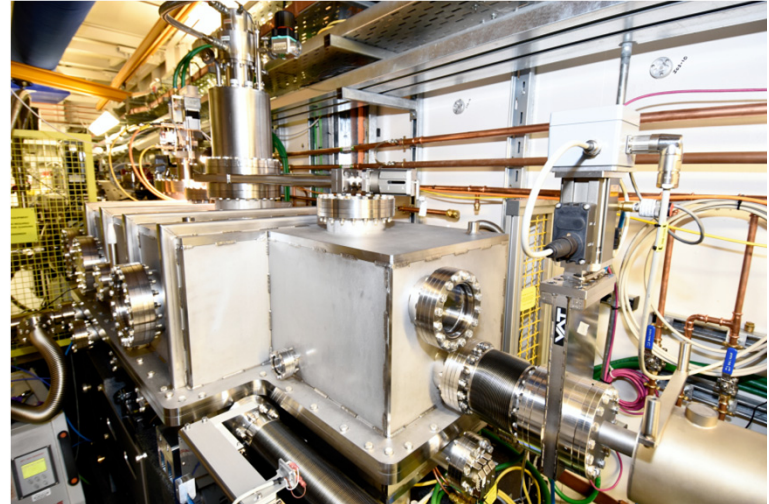
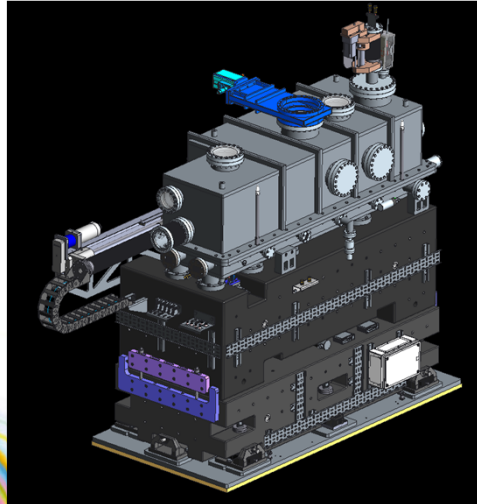
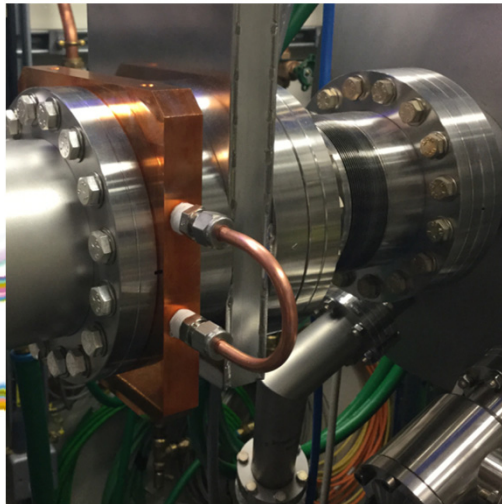
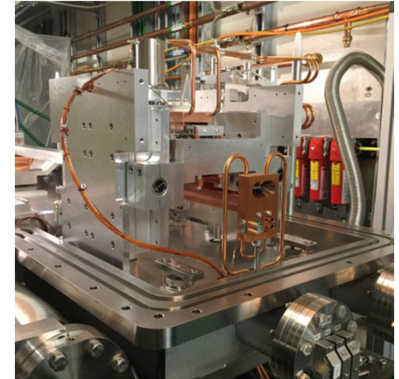
In-situ Versatile Macromolecular Crystallography

- Crystals measured from within the SBS plate
- Fully automated
- Remote access
- High throughput
- High data capture rate
- High flux



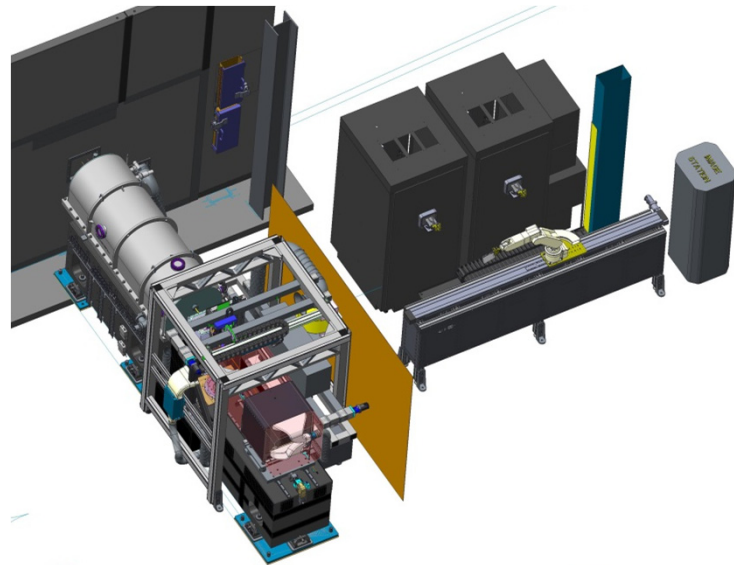
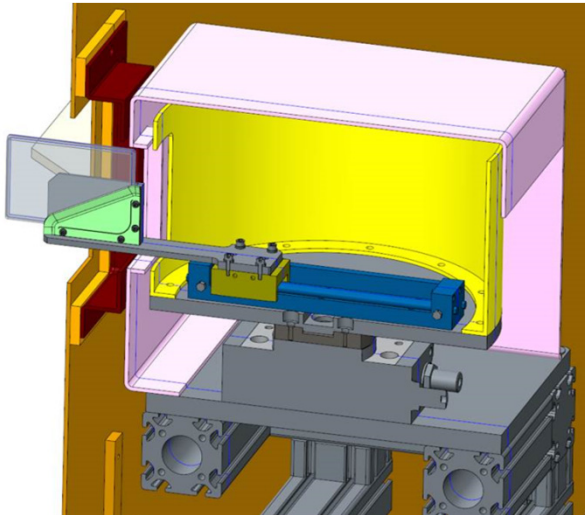
DMM & Beamline

- DMM Operates over 10-25 keV
- Designed to operate with ~ 500 W
- Beam Stability at sample 34 nrad RMS 1-350 Hz
- Diamond Power Filters
- CuCrZr Alloy Masks



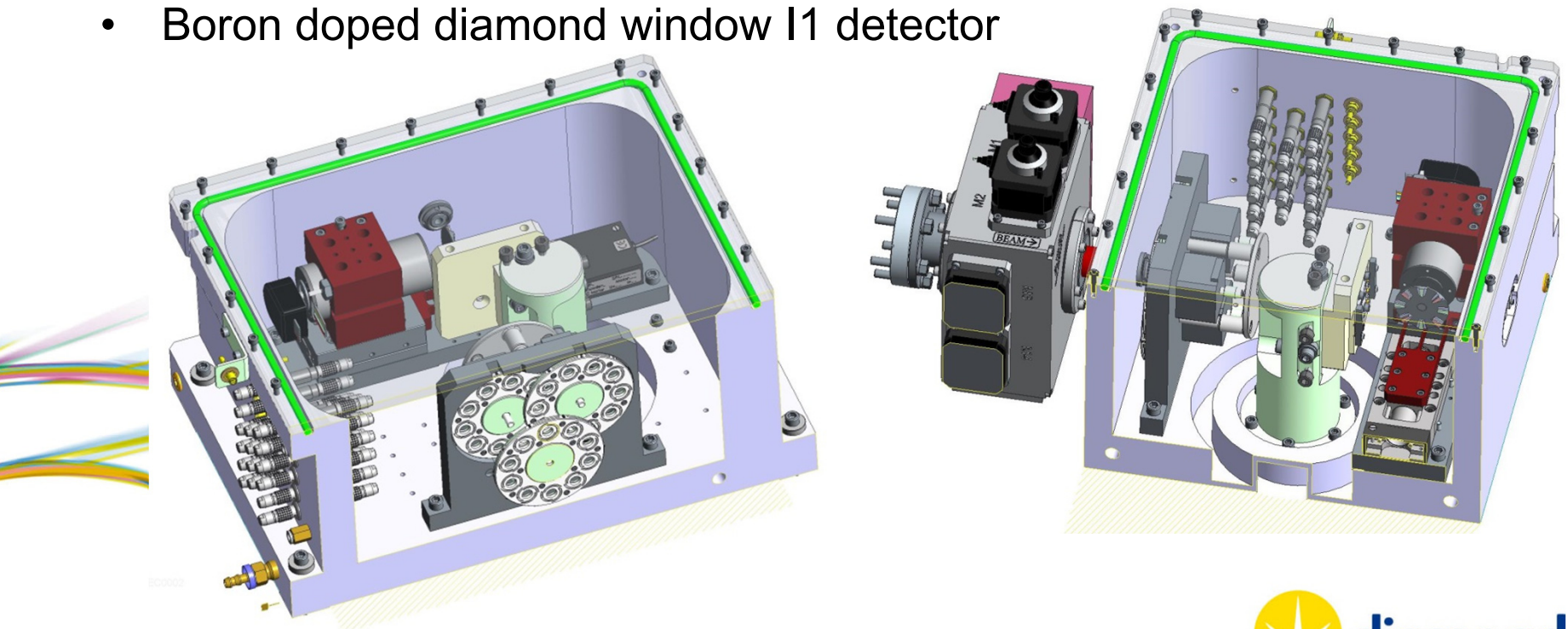
Sample Loading

- Formulatrix units present plate thru rear hatch
- External 6 axis robot
- Pneumatic revolving fail safe load-lock
- Internal temperature controlled storage
- Internal gantry robot
- Numerous in-position switches & bar code readers



Beam Conditioning

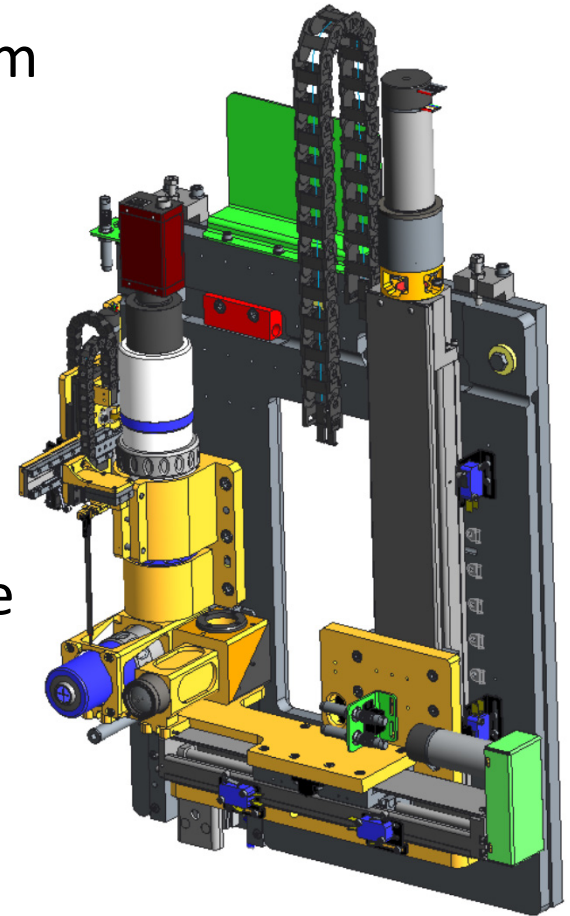
- He water cooled environment
- 3D printed flexure attenuator foil mounts
- Single crystal diamond XBPM
- DC Servo Shutter/Chopper, open time < 3 ms, transition time < 20 μ s
- Boron doped diamond window I1 detector



On-axis Viewing

Fast & Repeatable lens insertion mechanism

- Mounted upon a granite arch
- Optimum lens for pattern recognition
- Drilled lens for commissioning
- Lenses driven onto axis by servo stages
- Kinematic location features
- He pipe for scatter reduction
- Aperture stick on fast retract servo stage

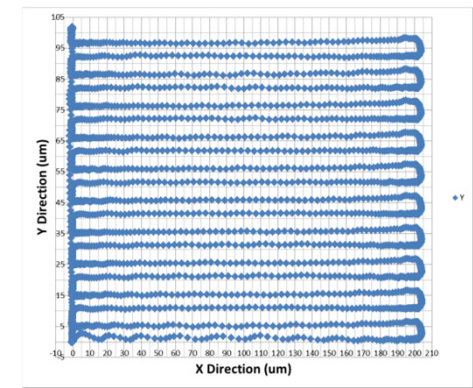
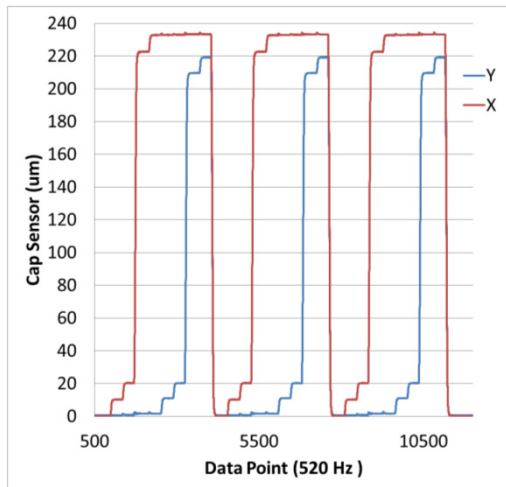
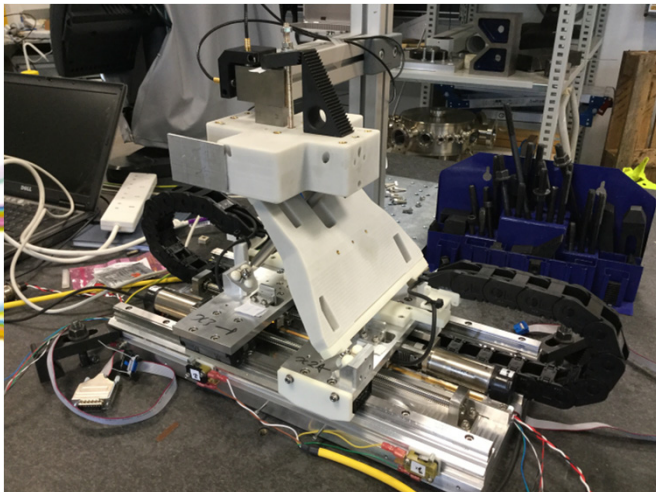
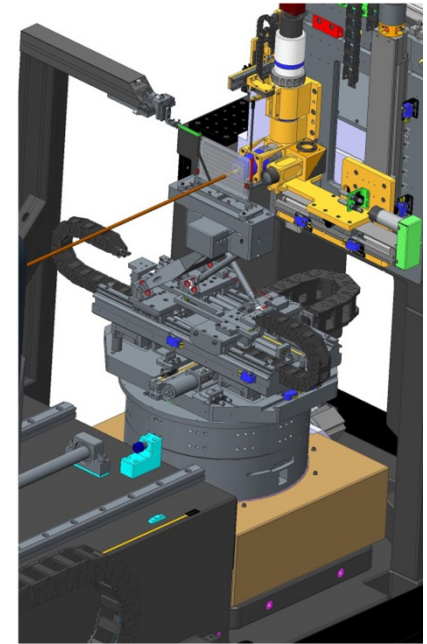


7 Axis Sample Goniometer

Aim: Large range, high speed, high accuracy

- Base X/Z stage < 50 nm bi-dir repeatability
- Air bearing Omega rotation
- Sample Z Stage
- Parallel kinematic X/Y stage
- Pneumatic sample tilt 0° - 20°

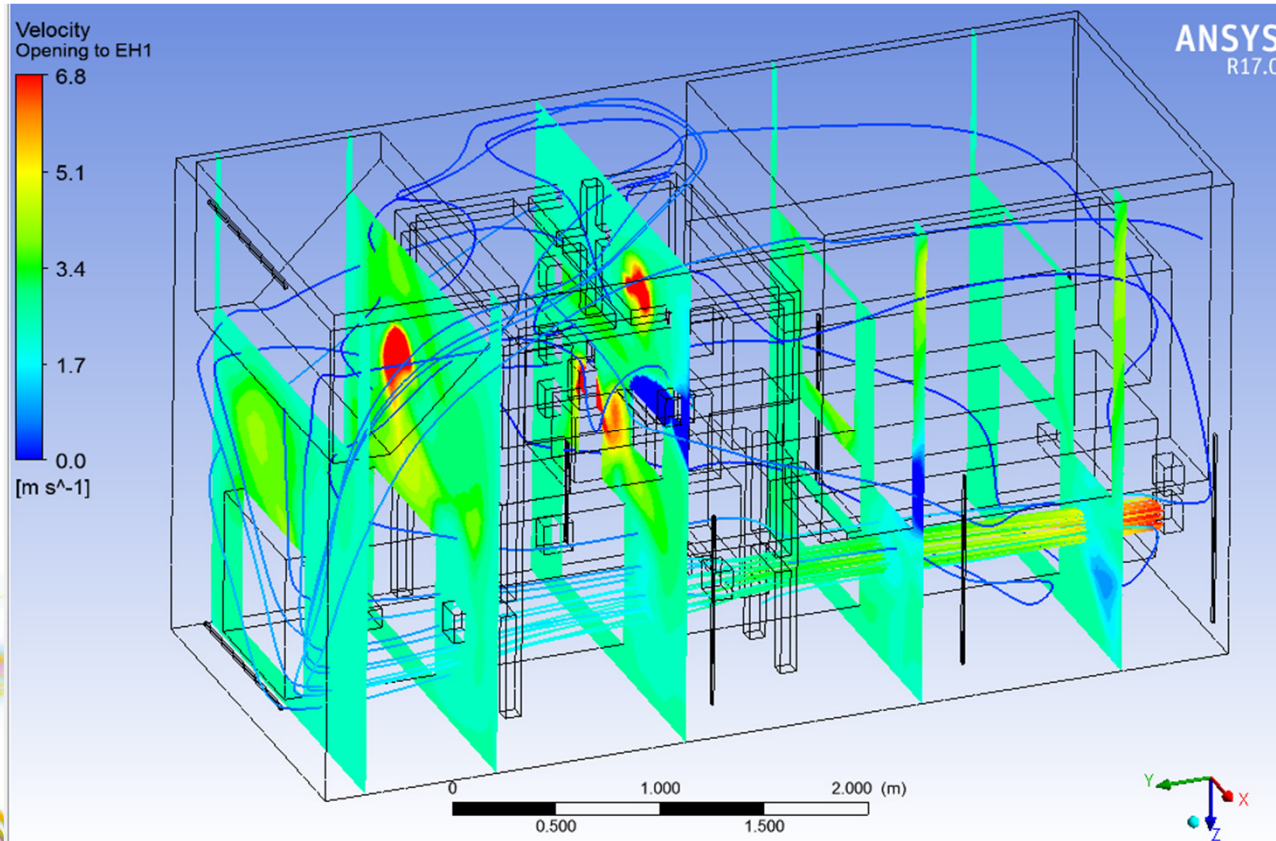
Prototype X/Z test < 200 nm bi-dir repeatability



Air Conditioning CFD

Aim: Good thermal stability $\pm 0.1^\circ\text{C}$

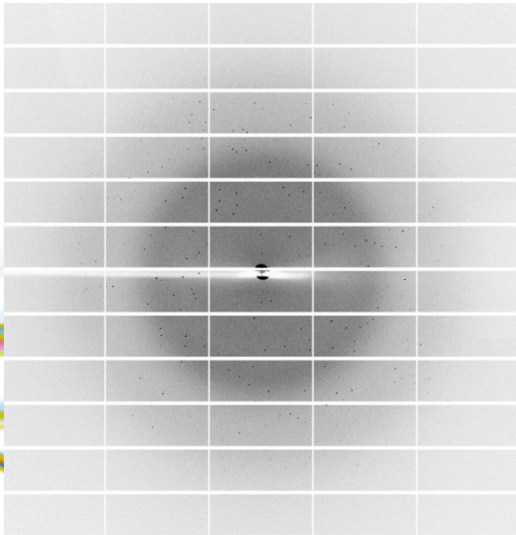
- Prevent 4°C air passing sample position
- Minimise heat loads by ducting away detector heat



Conclusion

The Endstation is currently being assembled & commissioned with first user planned for December

Thank you



Structure solved with DMM beam