ForMAX Beamline

A beamline for multi-scale and multi-modal structural characterisation of hierarchical materials

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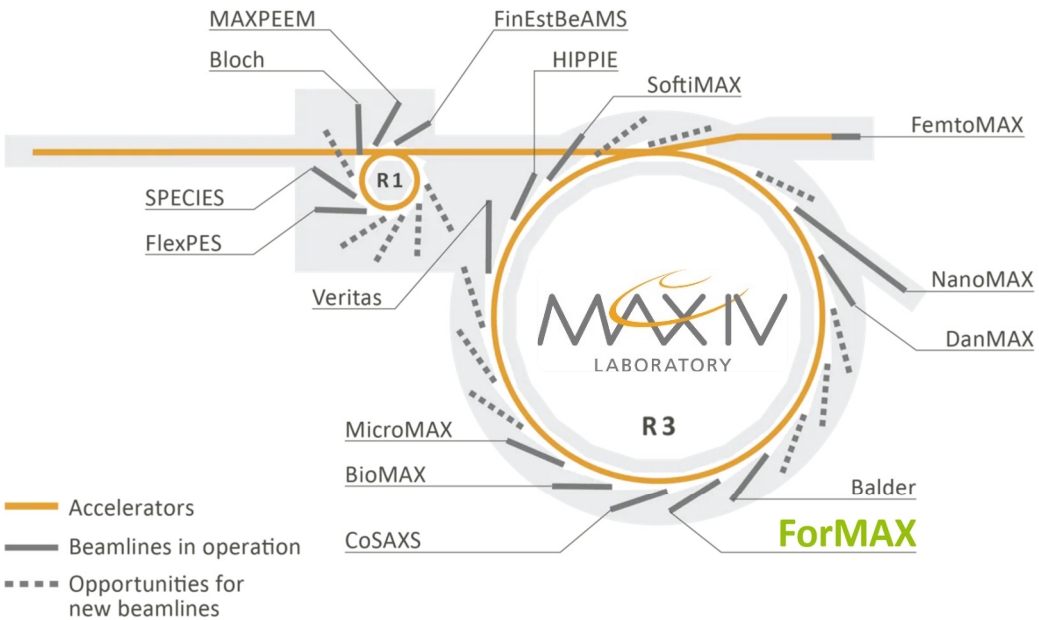
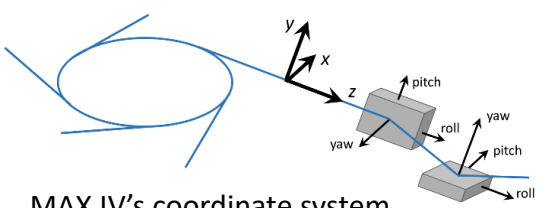
MEDSI 2023 Beijing
Mechanical Engineering Design of Synchrotron Radiation Equipment and Instrumentation

MAX IV

ForMAX – Outline

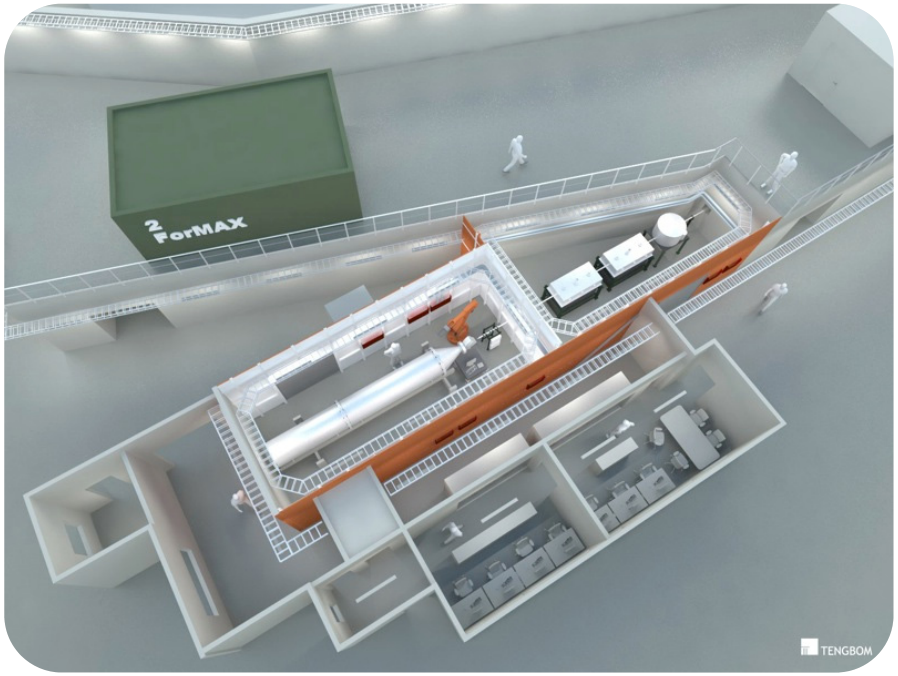
- Introduction
- Scientific case
- Optics
- Experimental station
- Experimental modes
- Sample manipulation
- Other setups
- First experiments
- Conclusions





MAX IV's coordinate system.

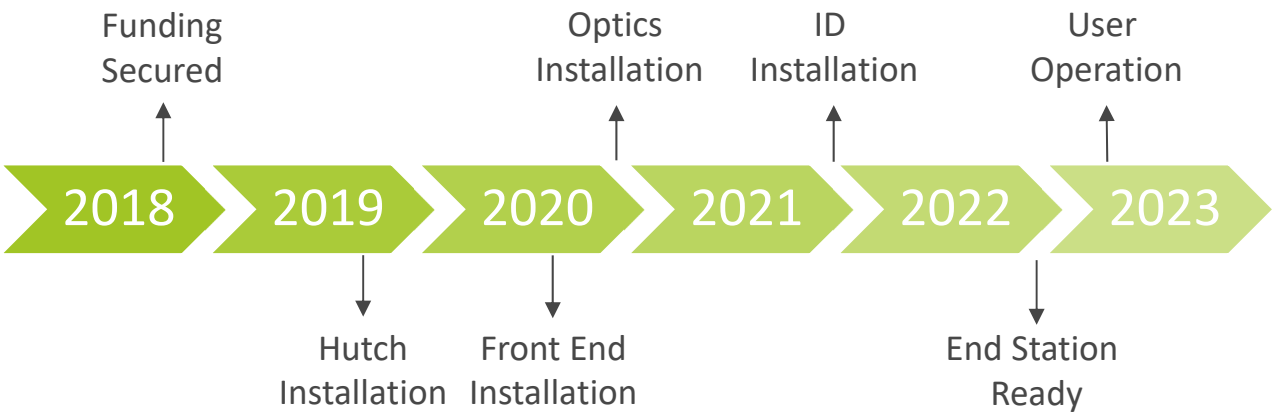
ForMAX – Introduction



Knut and Alice Wallenberg Foundation

TREESEARCH

Beamtime Allocation:
- 50 % Treesearch members (non-proprietary)
- 50 % open calls



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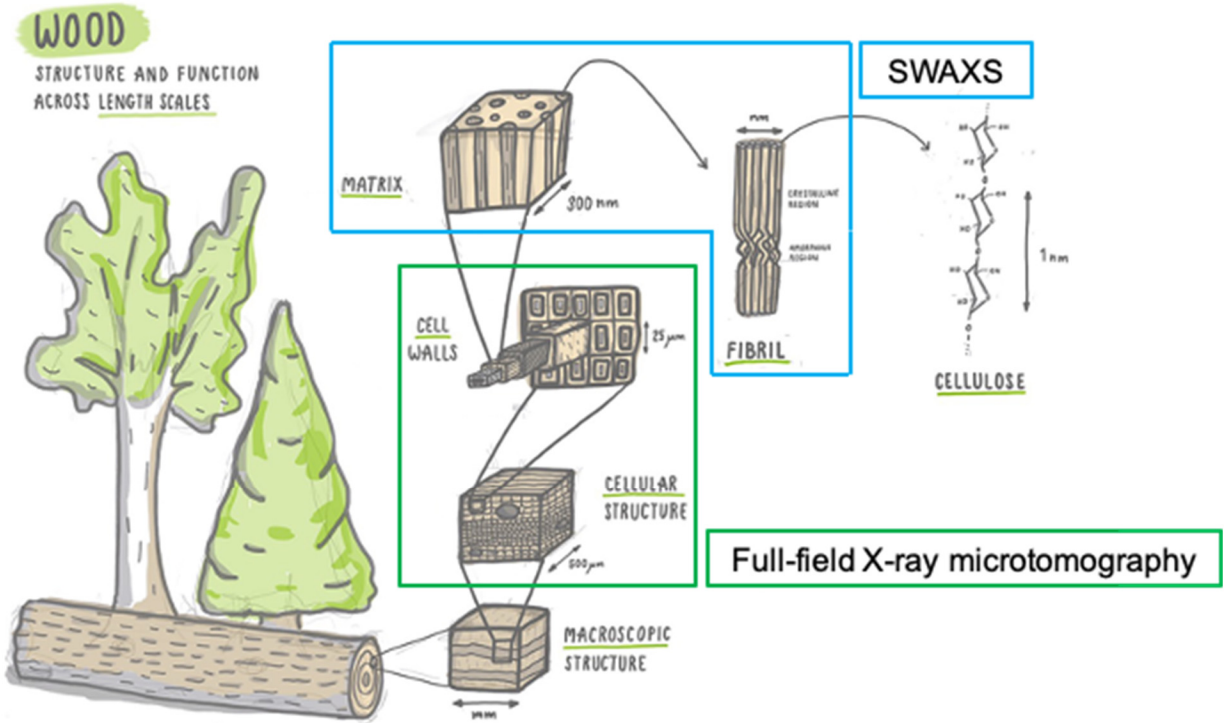
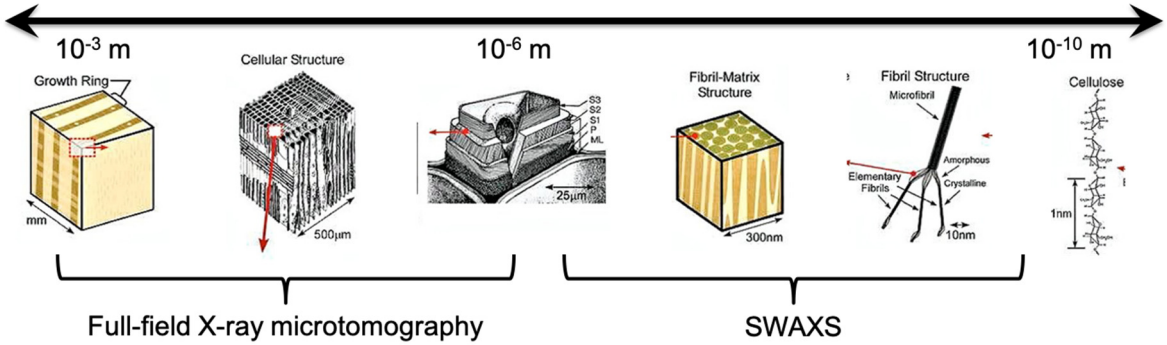
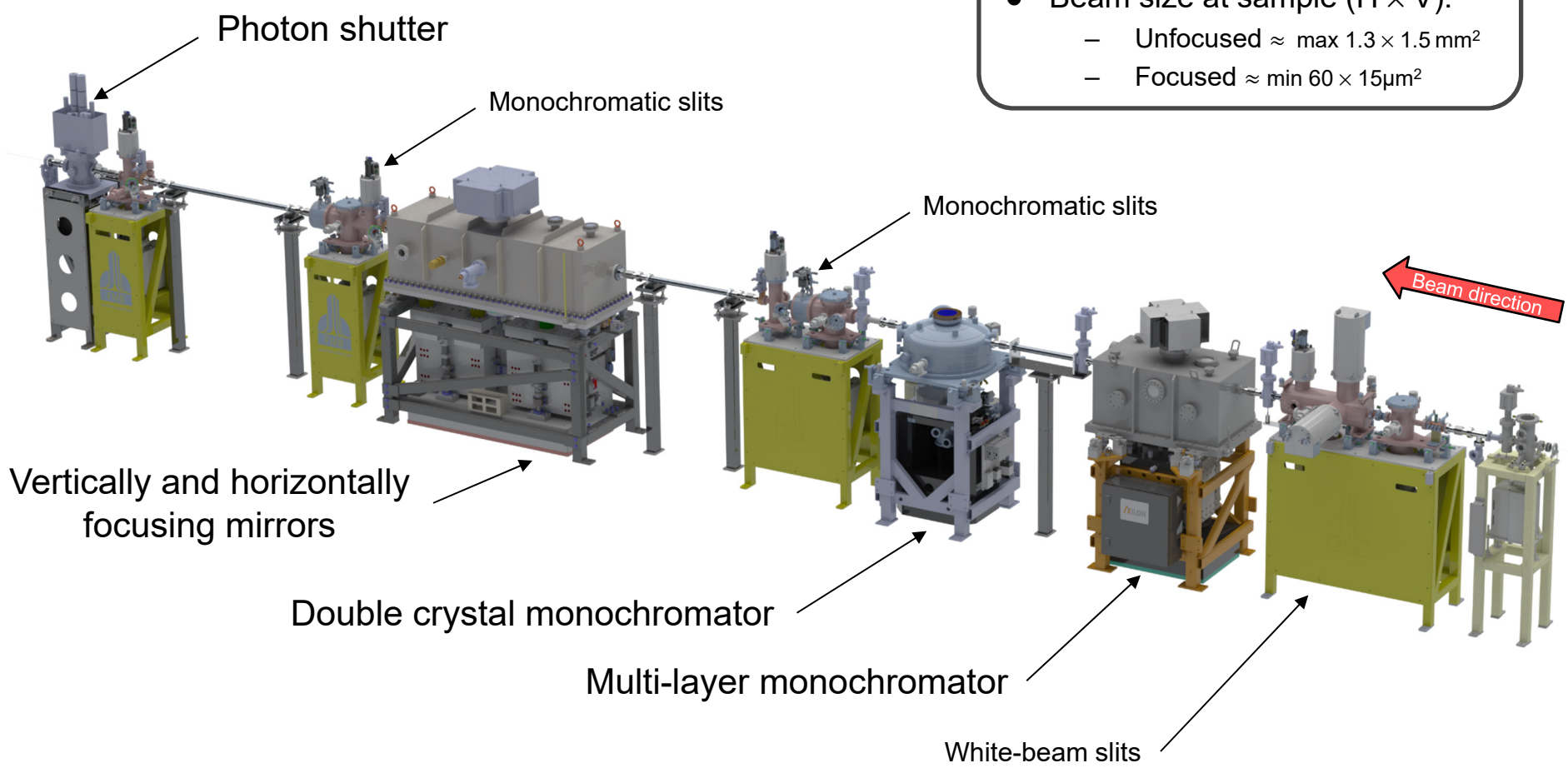
ForMAX – Scientific Case



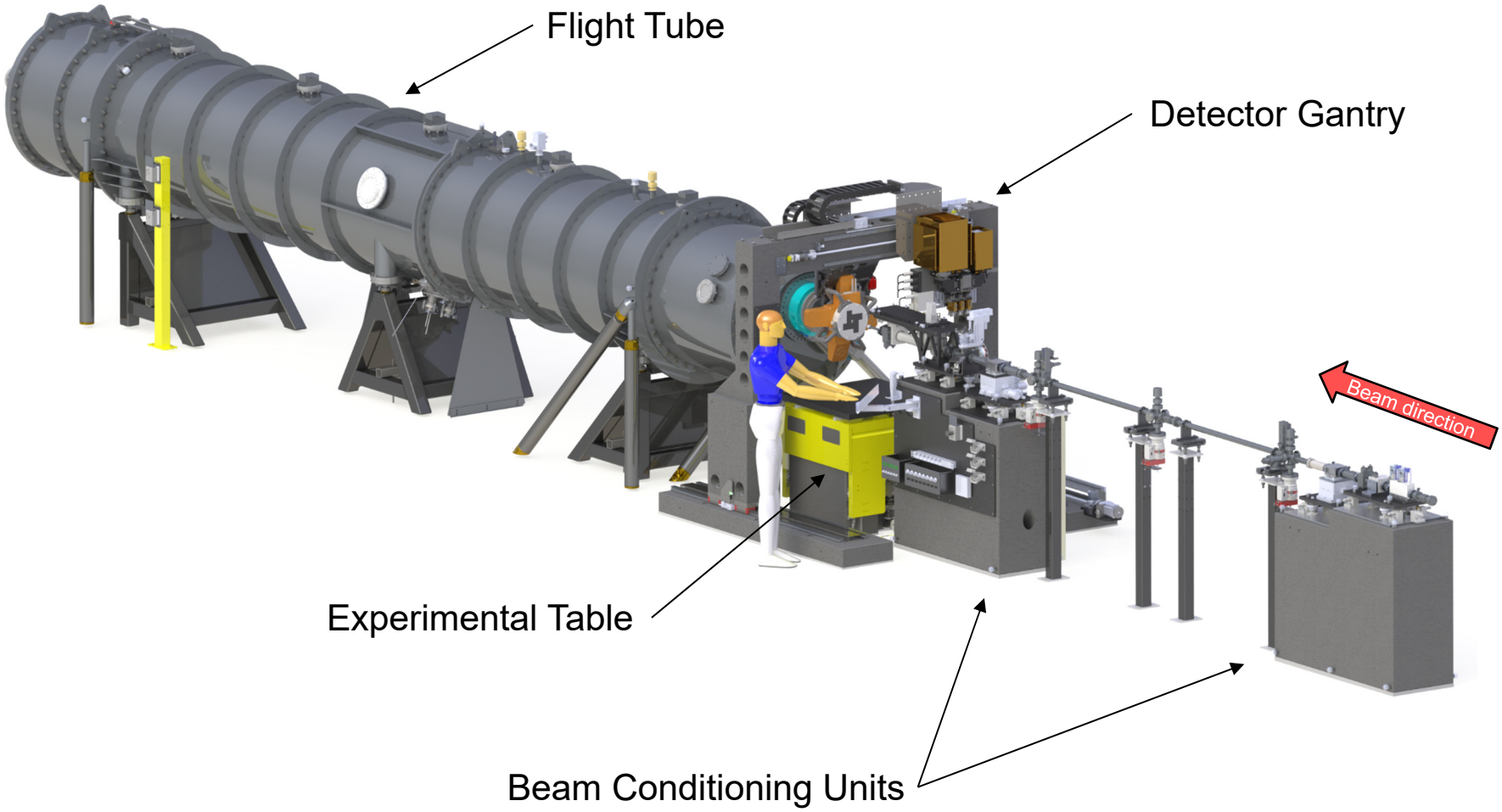


ForMAX – Optics

- Energy range: E = 8-25 keV
- Beam size at sample (H × V):
  - Unfocused ≈ max 1.3 × 1.5 mm²
  - Focused ≈ min 60 × 15μm²



ForMAX – Experimental Station



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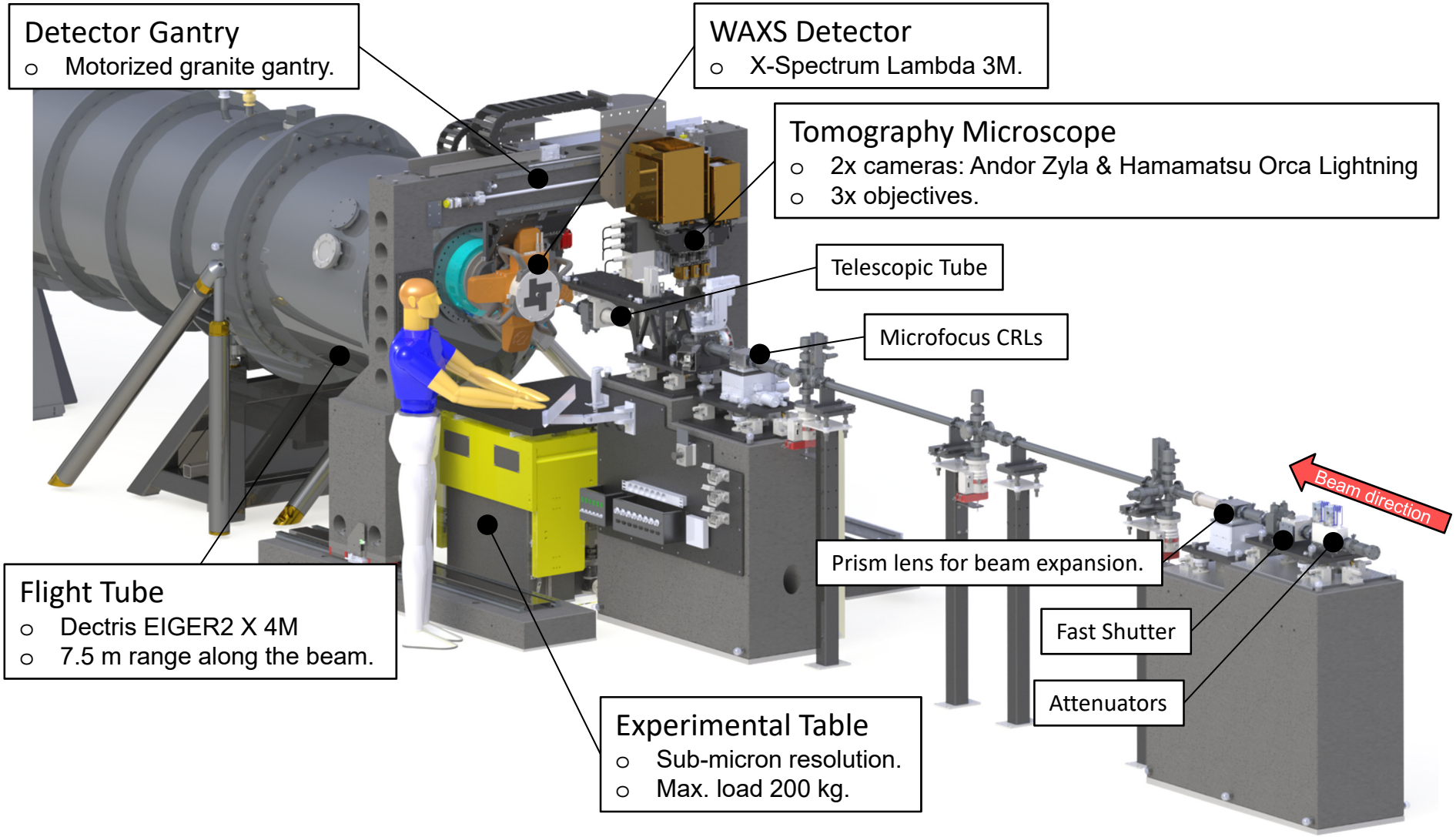

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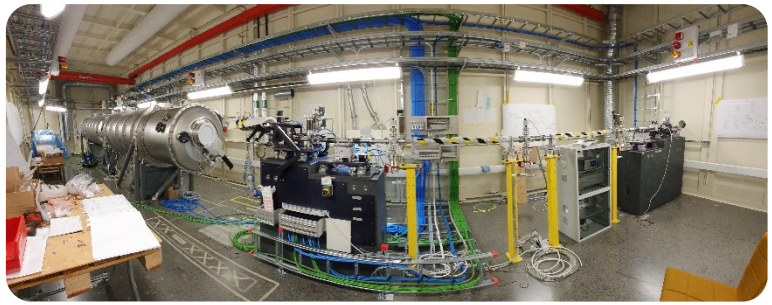
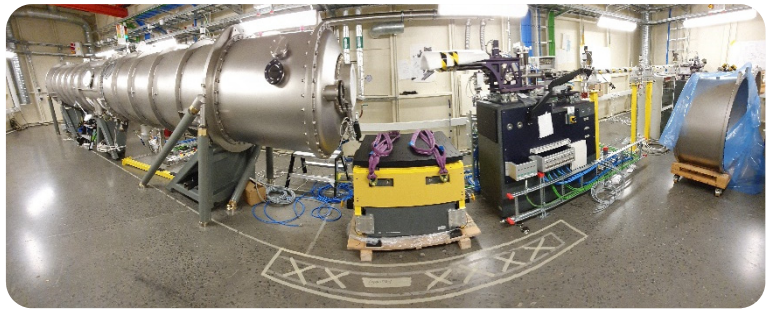
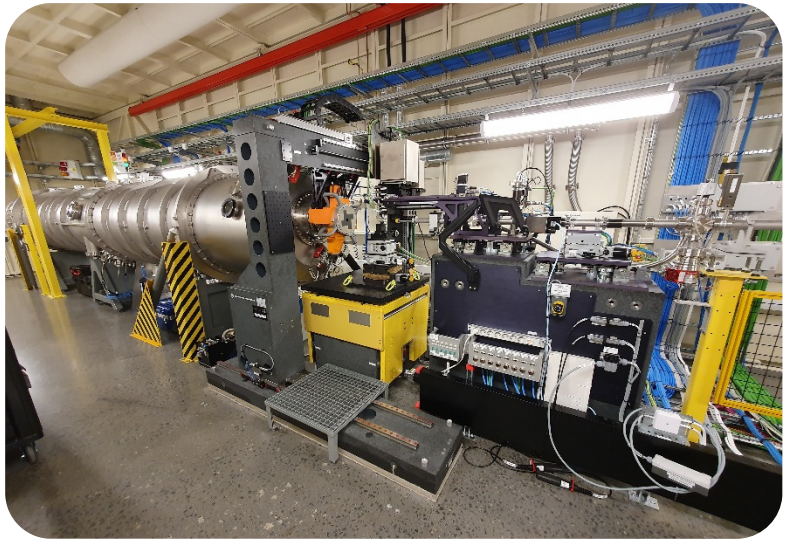






ForMAX – Experimental Modes

SAXS

ForMAX – Experimental Modes

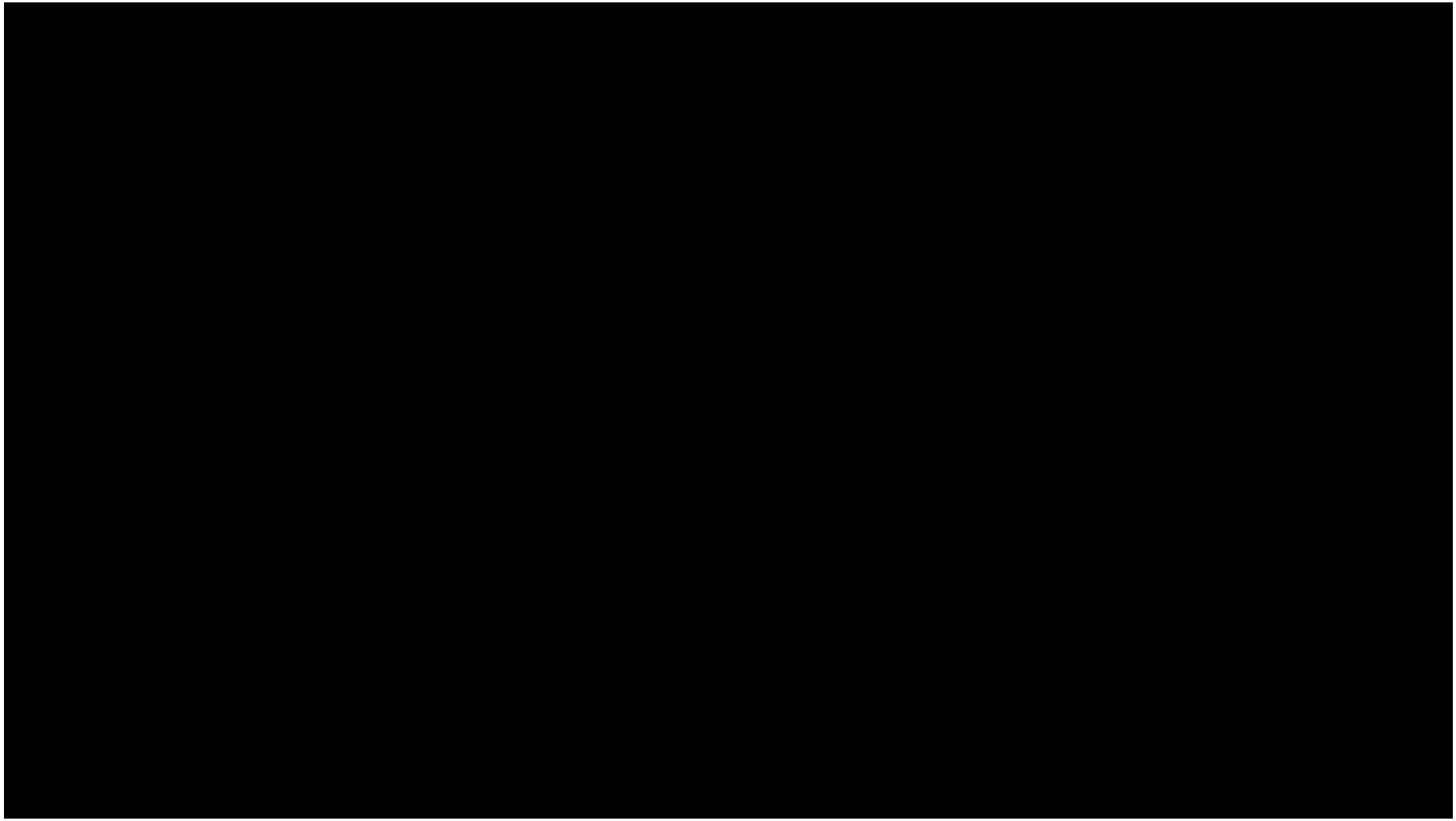
SWAXS

ForMAX – Experimental Modes

Full-field tomography

ForMAX – Experimental Modes

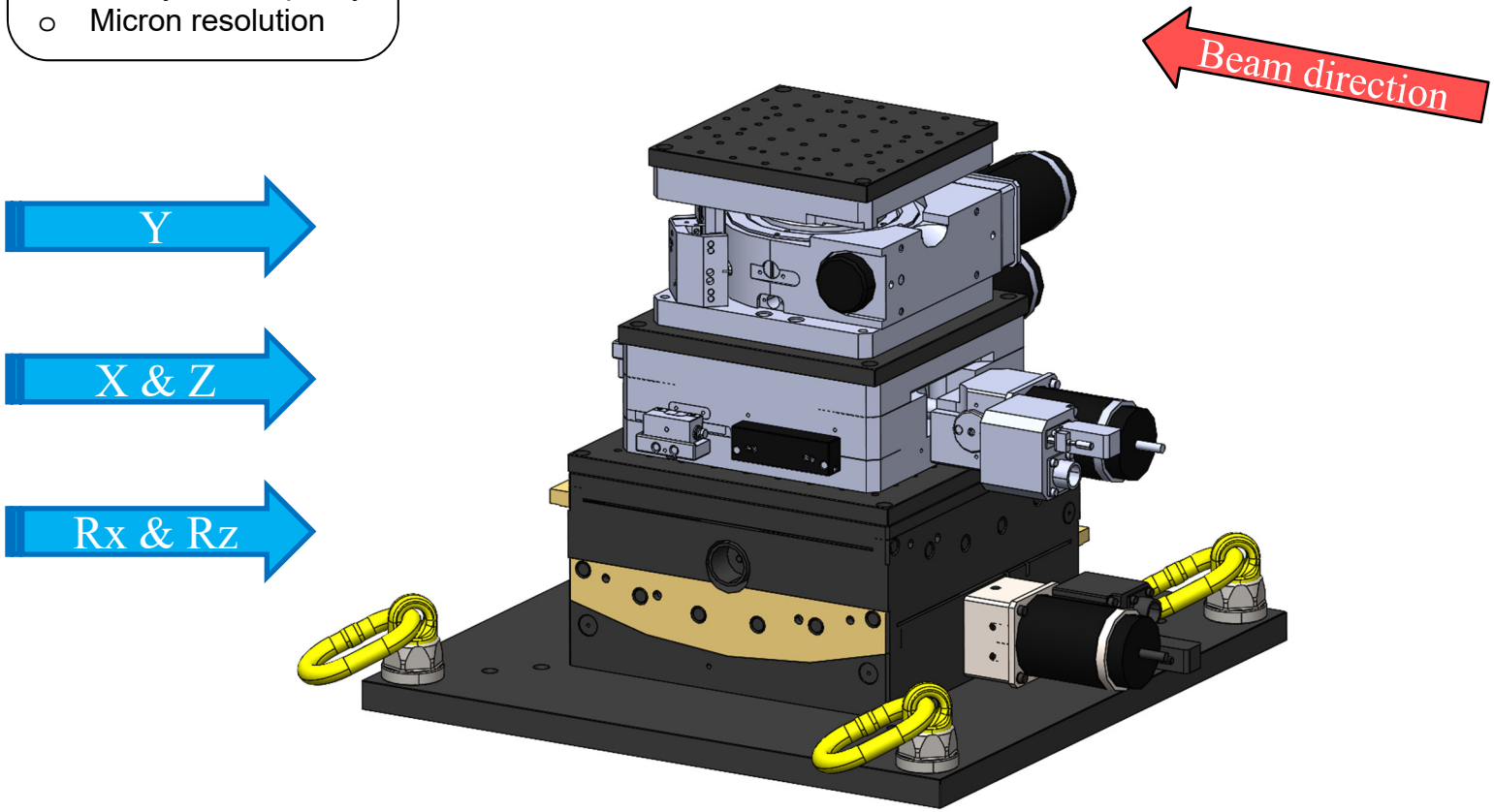
Sequential SWAXS and full-field tomography



ForMAX – Sample Manipulation

SWAXS

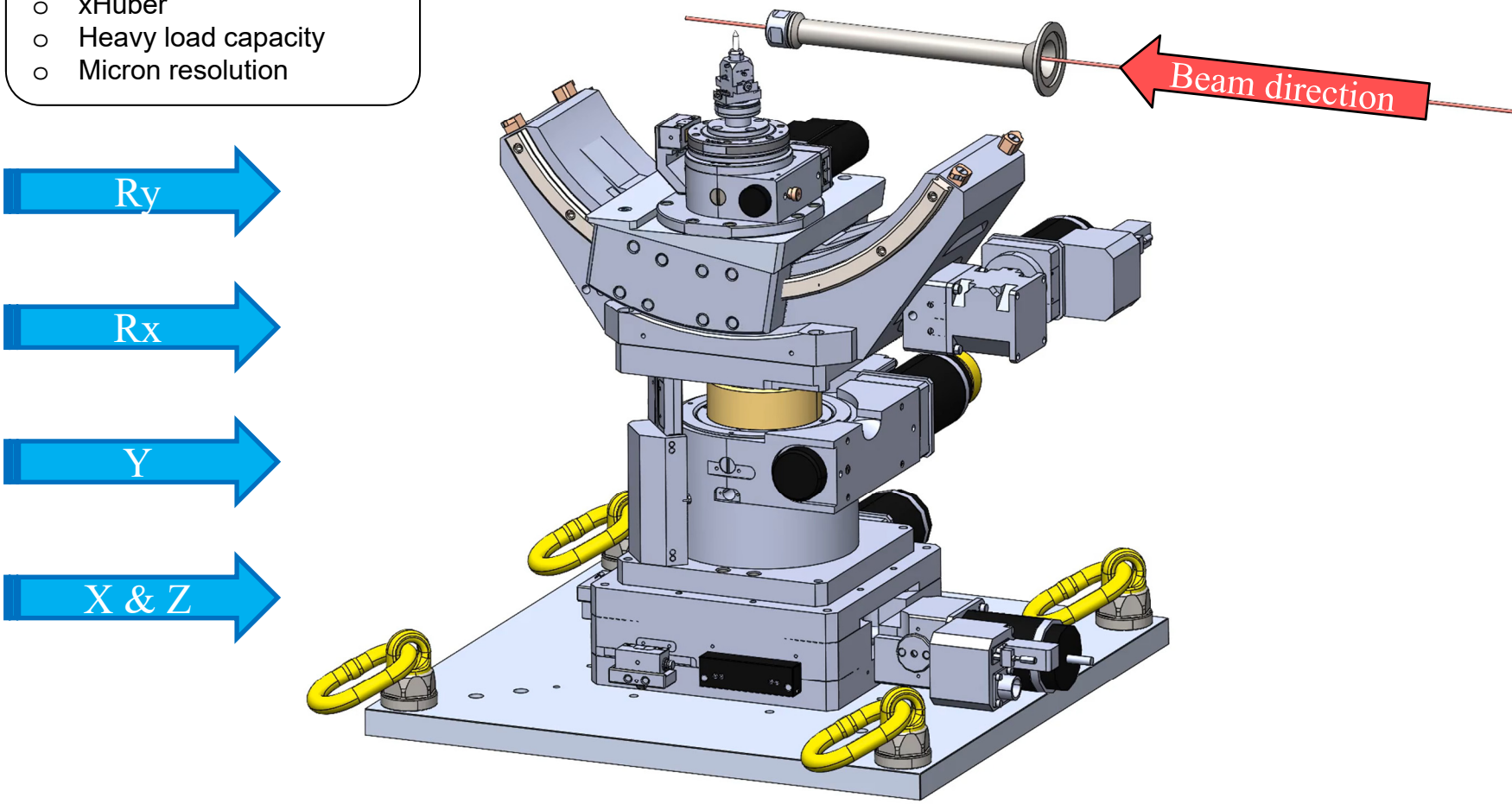
- xHuber
- Heavy load capacity
- Micron resolution



ForMAX – Sample Manipulation

SWAXS Imaging

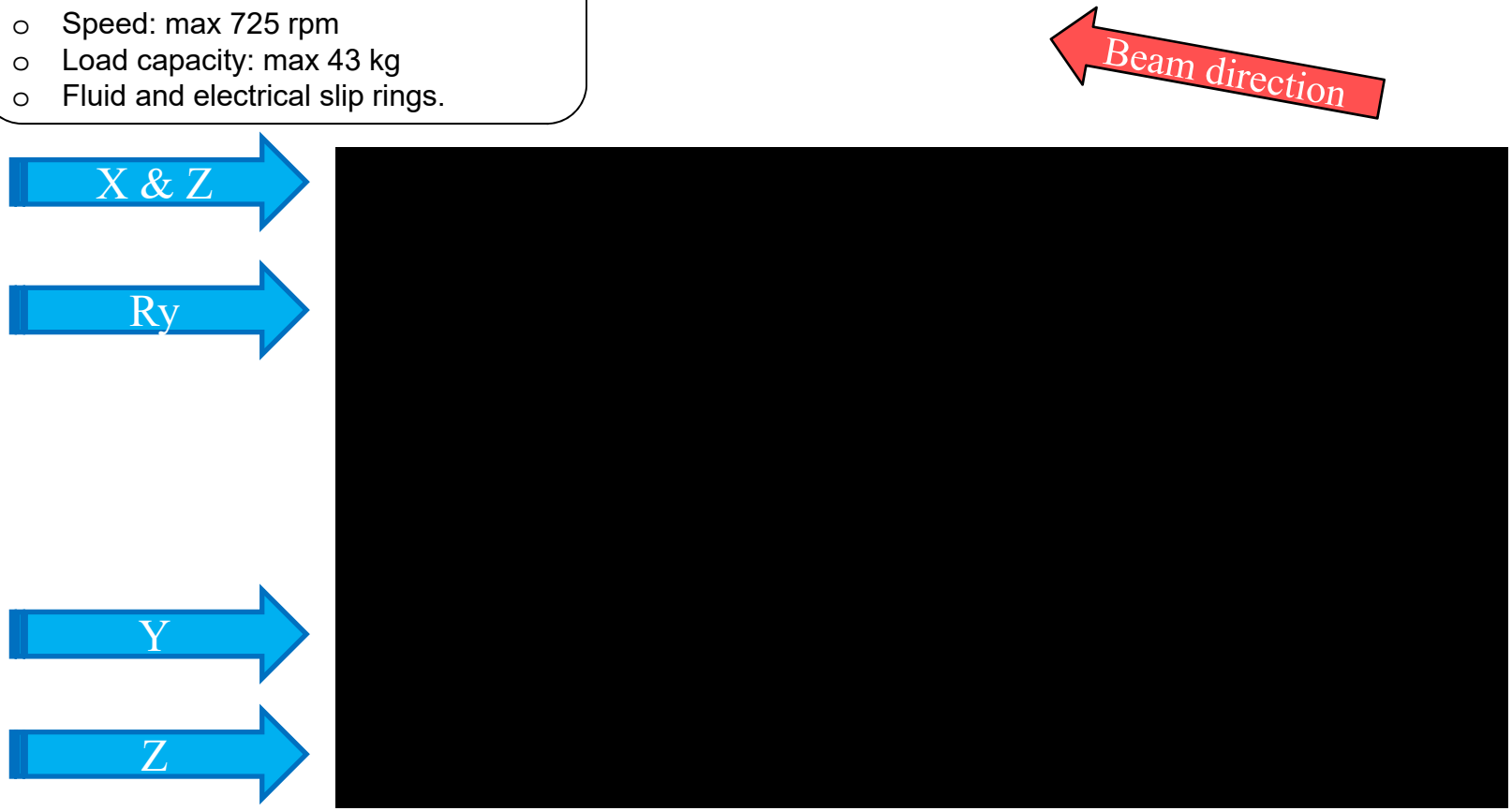
- xHuber
- Heavy load capacity
- Micron resolution



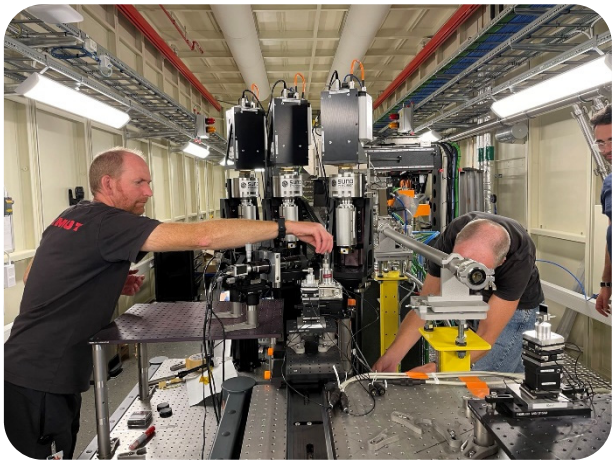
ForMAX – Sample Manipulation

Full-field tomography

- Lab Motion
- Speed: max 725 rpm
- Load capacity: max 43 kg
- Fluid and electrical slip rings.

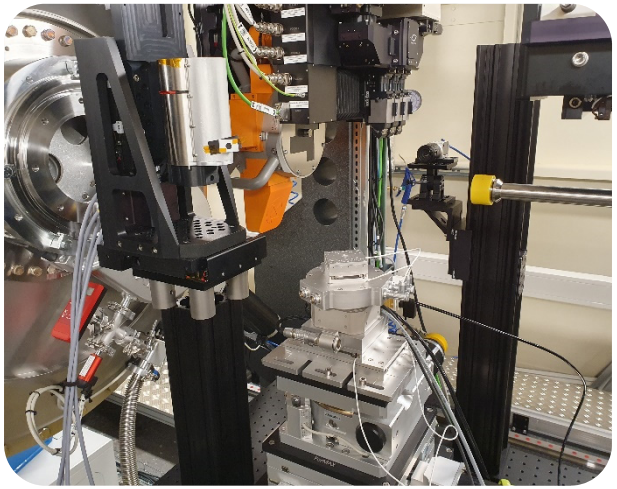


ForMAX – Other Setups



X-ray multi-projection imaging

Rheometer in experimental table

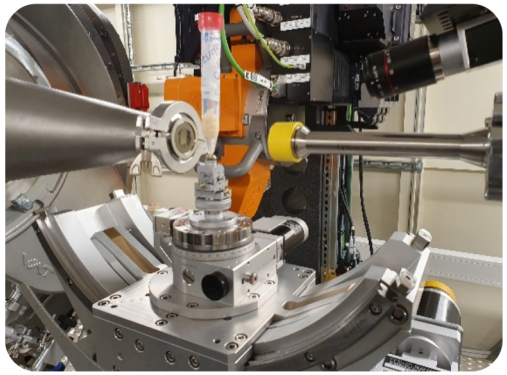


Integration of user's equipment

ForMAX – First Experiments

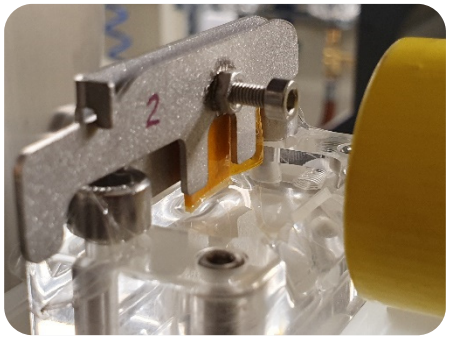
SWAXS - Rheometer
Cellulose composite

Fast radiography
Foam in compression



SWAXS Imaging
Rat brain scan

Fast radiography
Multi-filament paper



SWAXS
Moisture dynamics in wood

Micro-Tomography
Bamboo toothpick cross-section

ForMAX – Conclusions

- **Unique design for studying structures at different scales using tomography and SWAXS.**
- **Versatile and adaptable experimental station.**
- **Supports multiple experimental modes and alternative setups.**
- **Modular sample manipulation systems.**
- **Promising first experimental results.**

ForMAX – Acknowledgements

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Thank you for your attention!

Any questions?