

Focus Finder for Microfocus Characterization @ P04.



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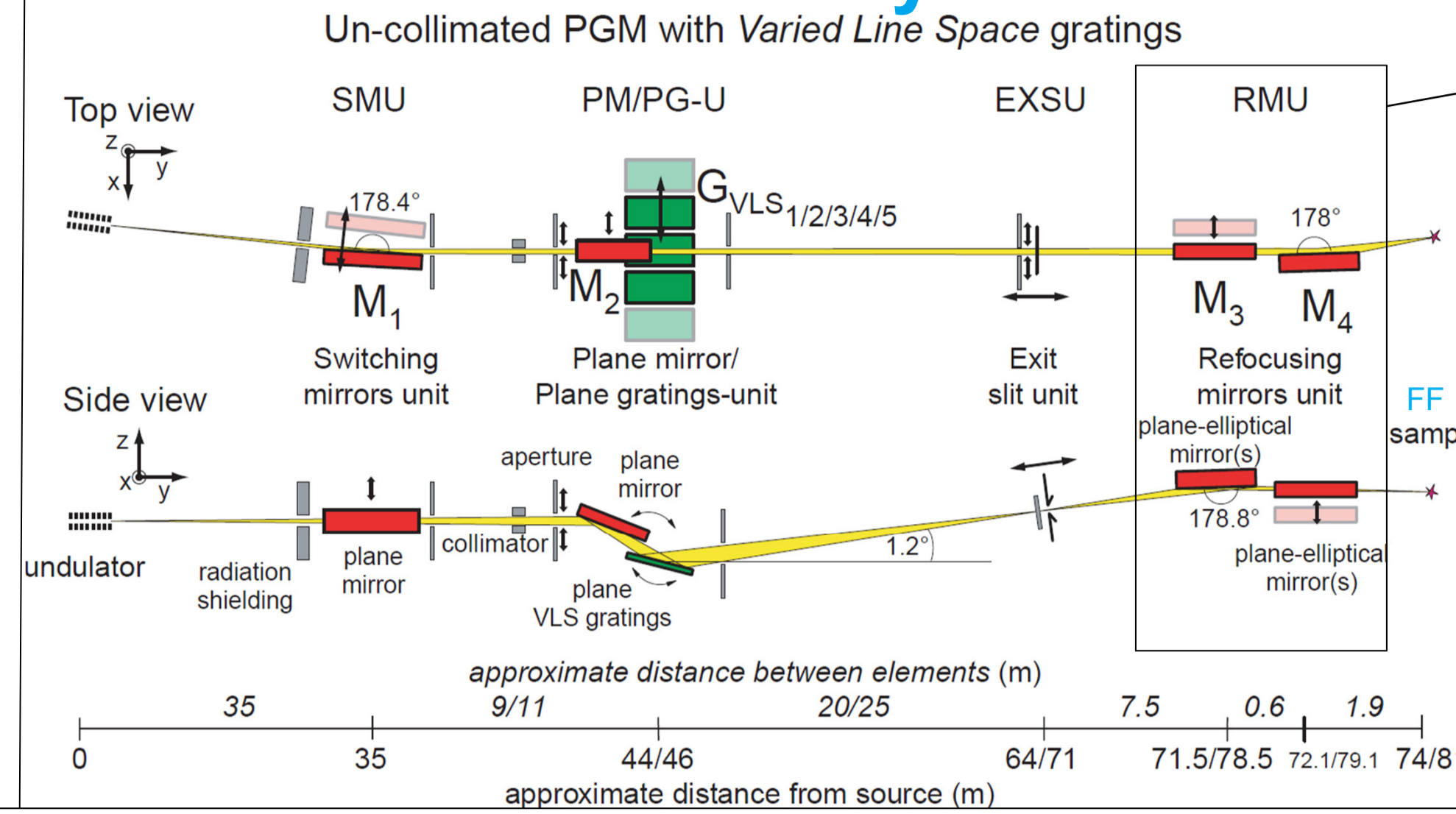
Motivation

The exact position of the focus is crucial in an experiment. Because of the inaccuracy in manufacturing, measuring and assembling, it is hard to predict the exact position of the actual focus.

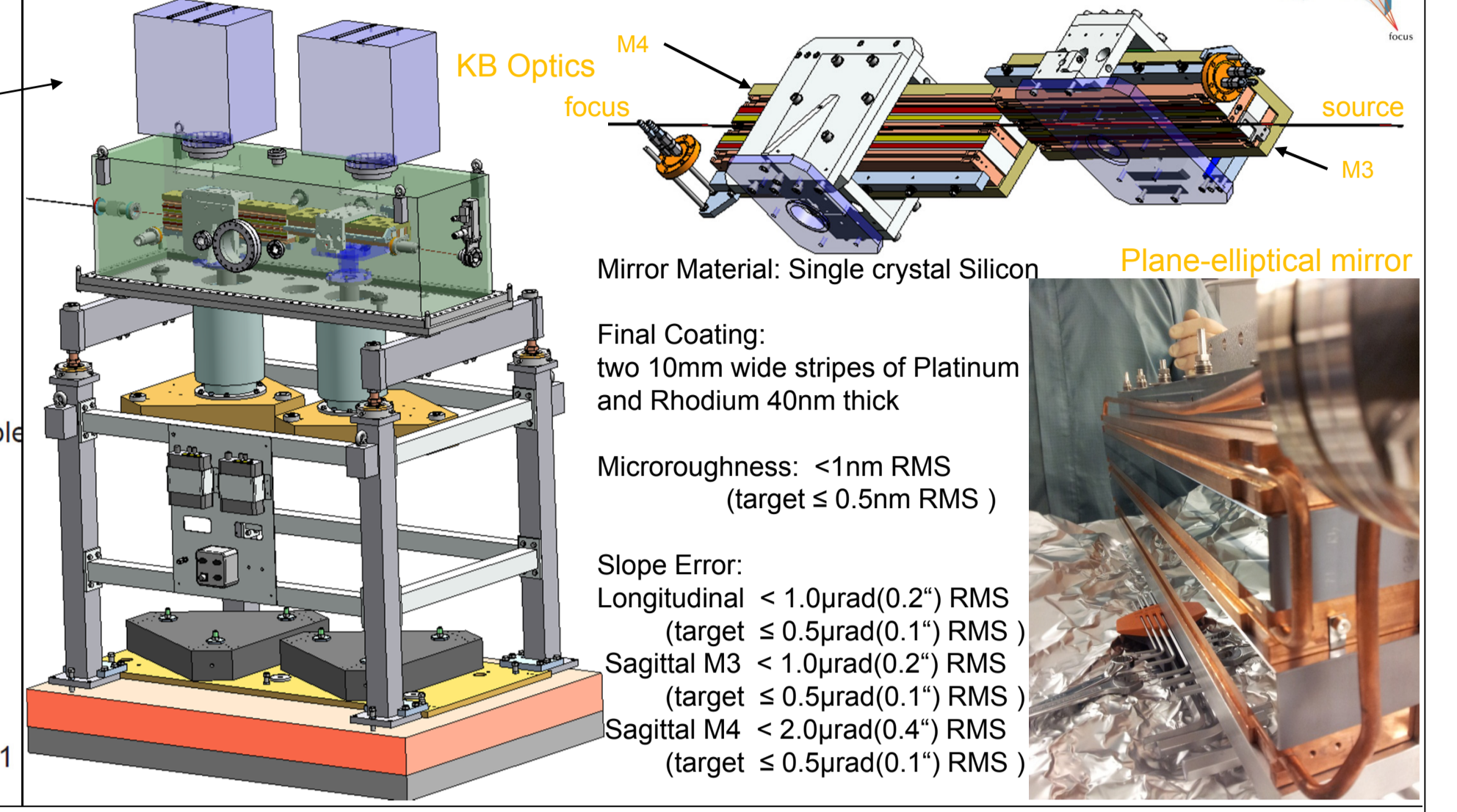
The purpose of the Focus Finder is to find and characterize the focal spot of the P04 XUV Beamline at PETRA III, but likewise of any focussed xray beam. The device is ment to simplify and speed up the calibration and alignment of a beamline and its optical components.

The working principle is optical analysis of the longitudinal beam shape. A YAG-Screen is used to make the X-ray radiation visible for the hi-res camera. Mounted on a precision slide, images of the current beam-shape are taken and processed in MATLAB. The image with the minimum number of illuminated pixel corresponds to the focus.

P04 XUV-Beamline Layout

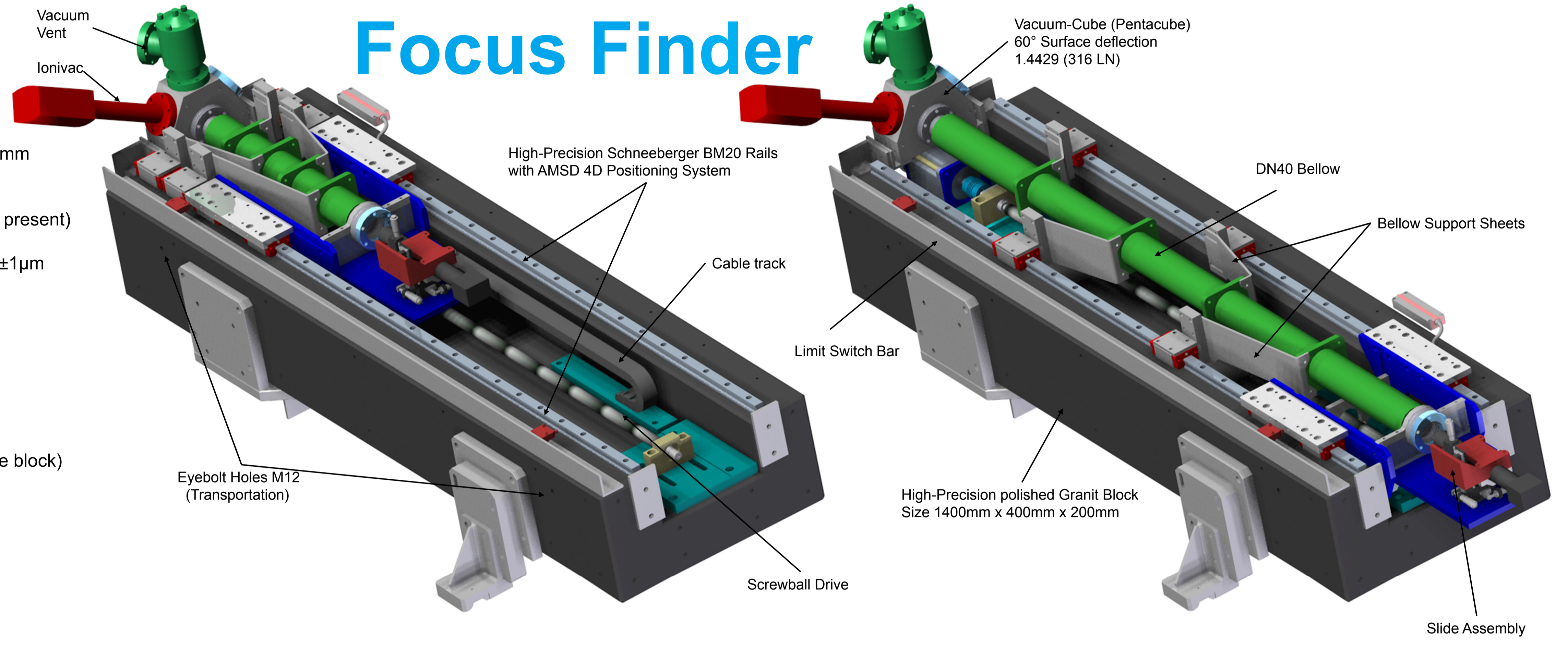


Refocussing Mirror Unit RMU

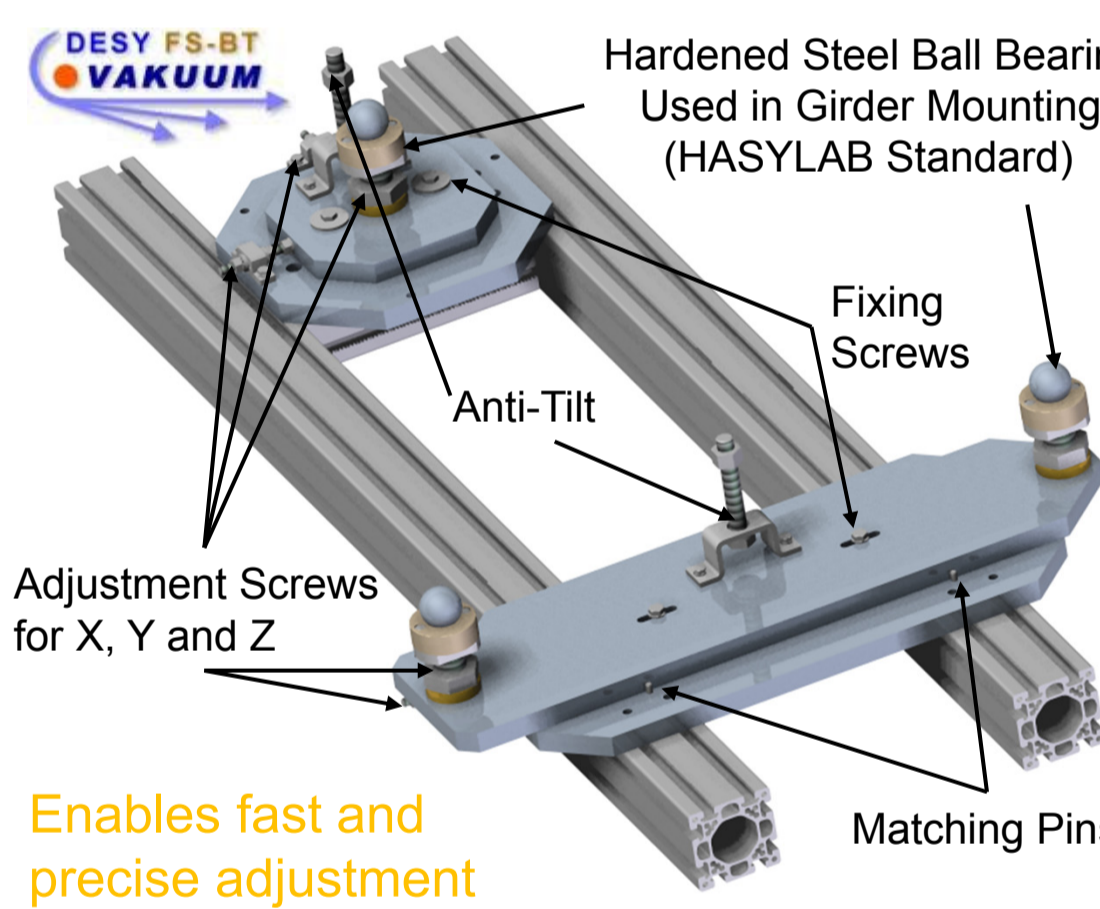


Characteristics

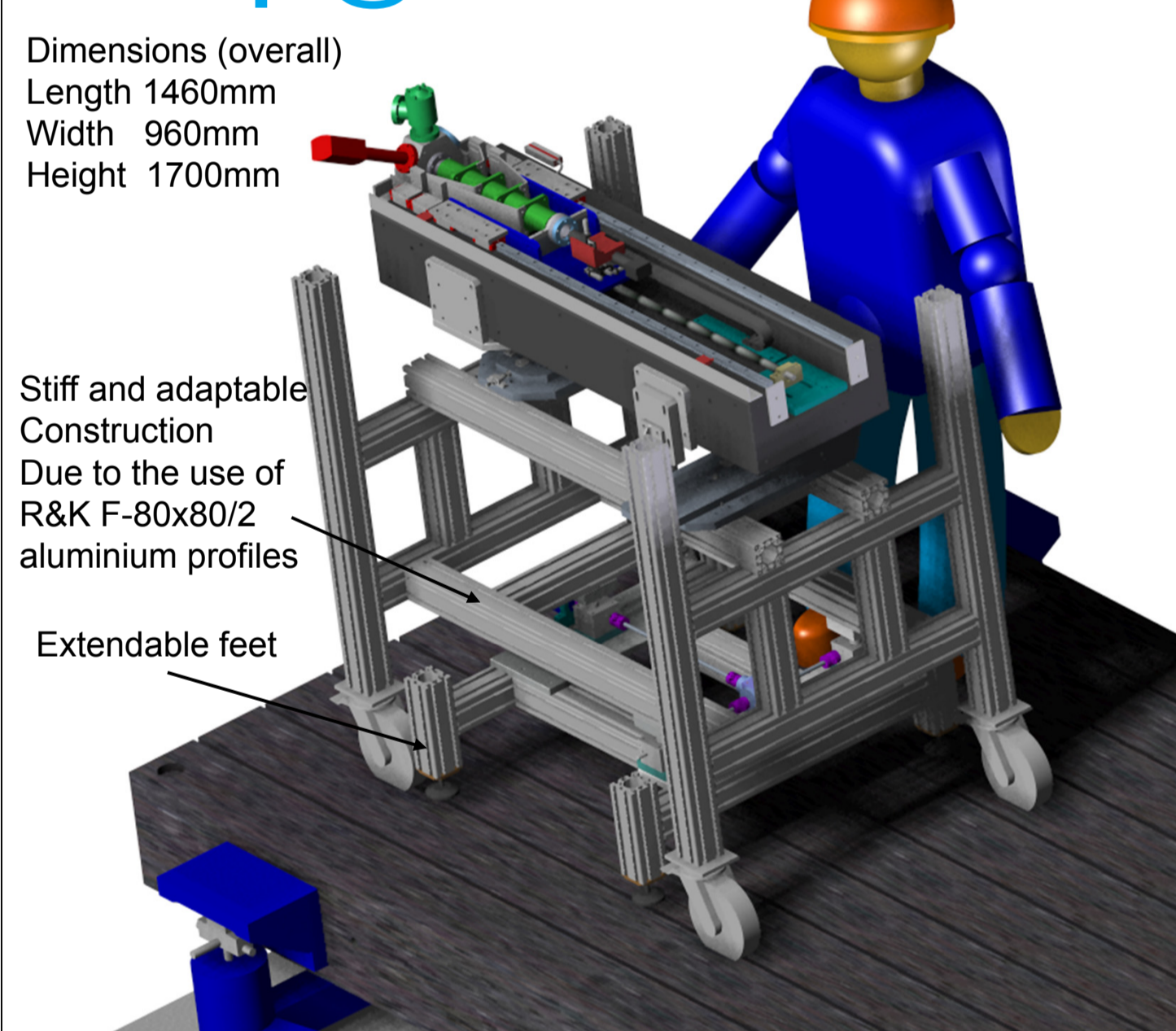
- Simple and fast alignment
- 3-Point ball mounting
- 6 Degrees of freedom adjustable
- XYZ-Fine-adjustability for optics $\pm 5\text{mm}$
- XYZ-Manipulator precision $1\mu\text{m}$
- Minimum focus size $5\mu\text{m} \times 5\mu\text{m}$ (at present)
- Target focus size $1\mu\text{m} \times 1\mu\text{m}$
- Focus point longitudinal tolerance $\pm 1\mu\text{m}$
- Lateral tolerance $5\mu\text{m}/1000\text{mm}$
- Lifetime bellow 100.000 cycles
- Scan speed 30mm/s
- 1006mm scan distance
- Ratio ballscrew drive 10mm/1U
- High reproducibility $<< 10\mu\text{m}$
- Overall weight 380kg (250kg granite block)
- Overall length 1480mm
- Overall width 960mm
- Overall height 1700mm
- Maximal lifting force 1500kg
- Mobility, crane-lift, fork-lift
- Anti-tilt system
- Multi-use platform



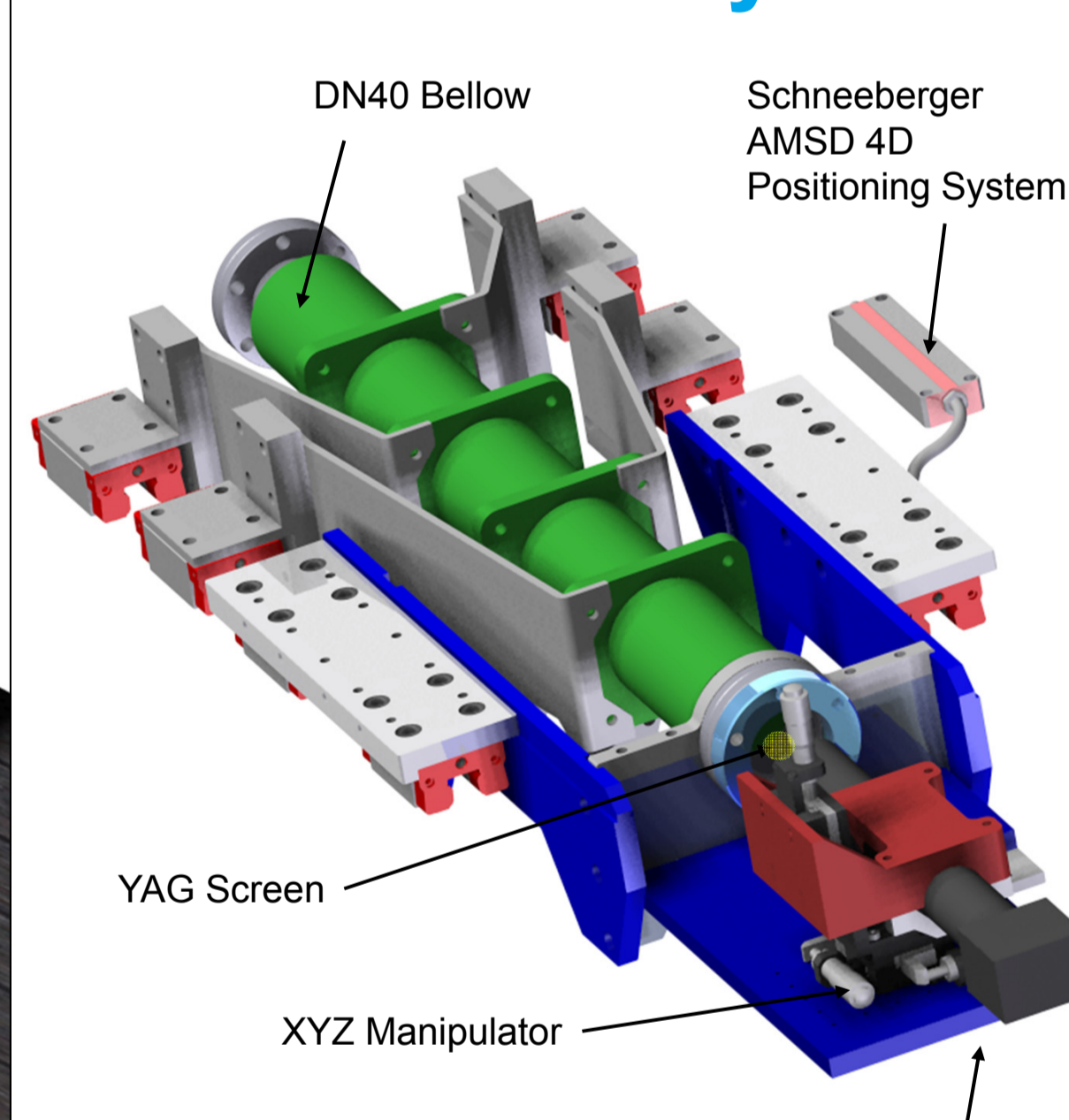
DESY 3-Point Mount



Setup @ P04



Slide Assembly



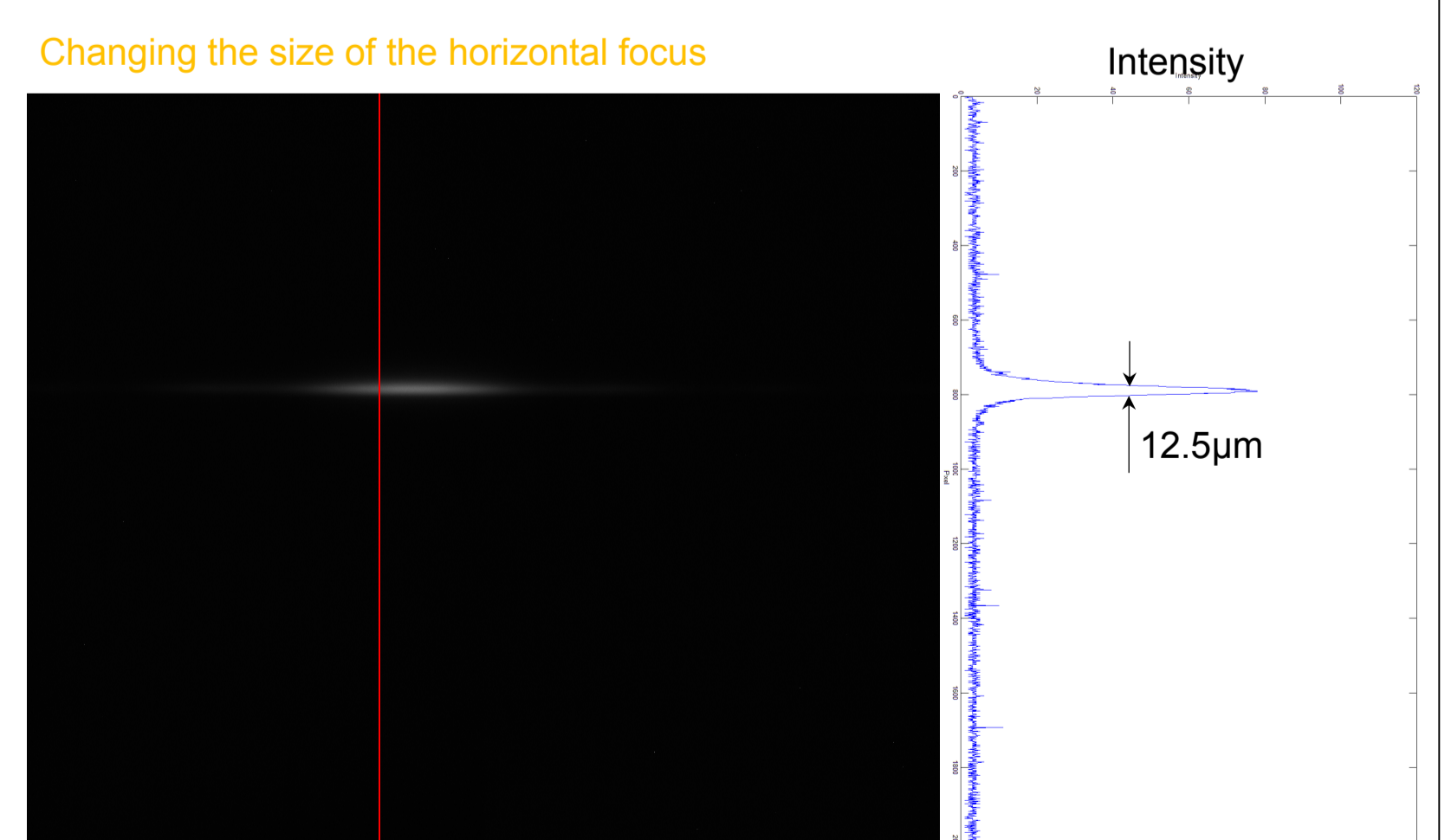
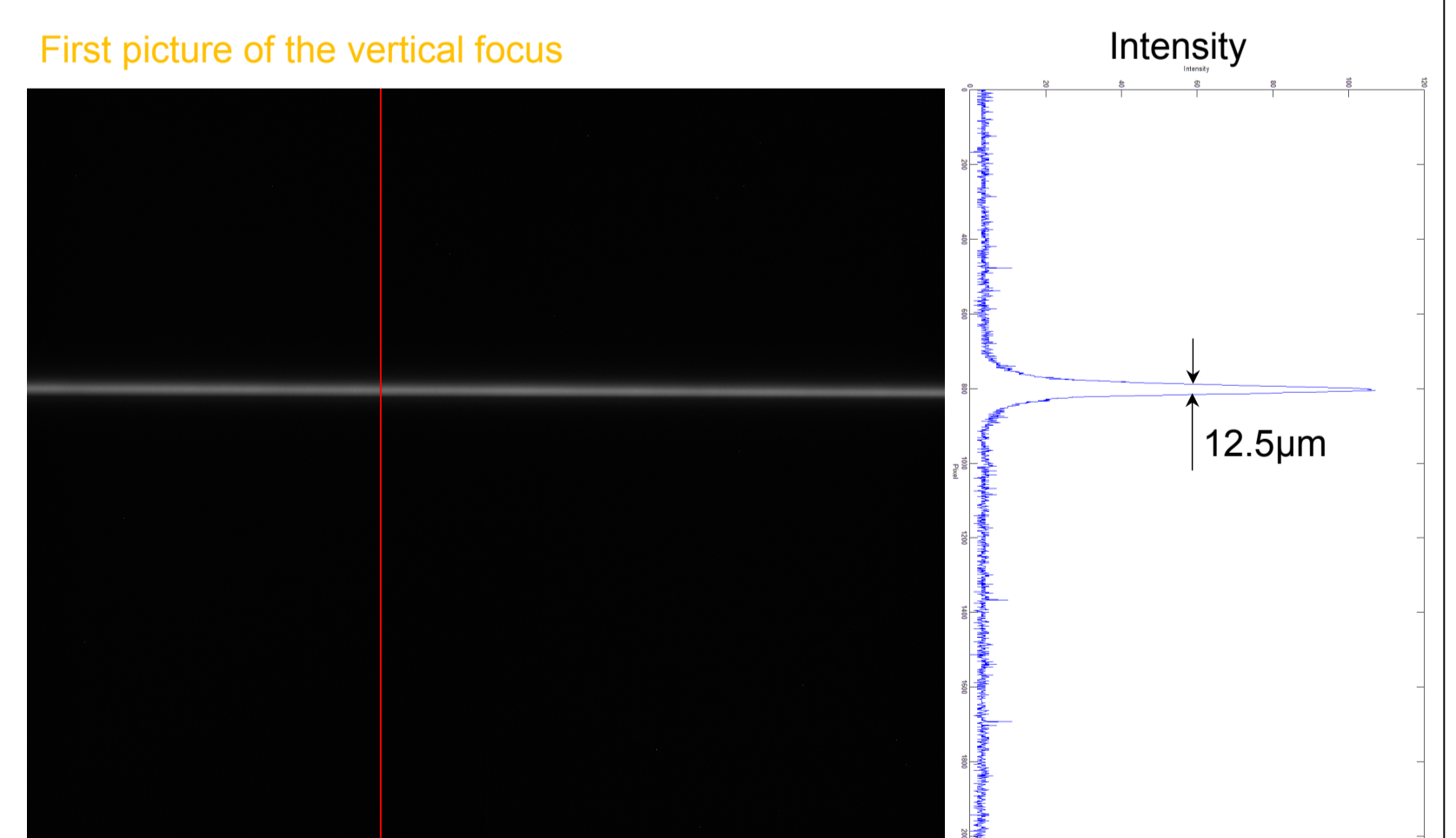
Results & Outlook

First successful tests have shown that the Focus Finder is operational. The requirements for accuracy were met. The alignment of the system to the beam is simple and fast. First data on the focus of the beam was gathered and processed.

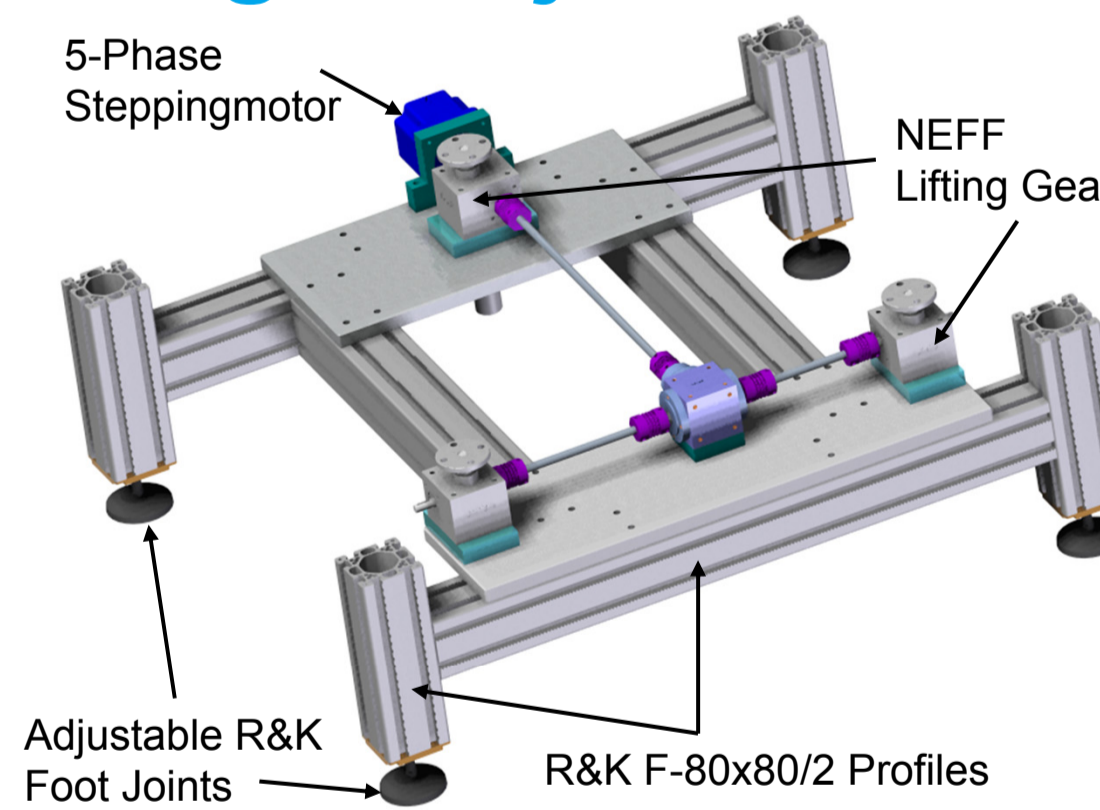
However at present, minor improvements are needed. Such as adjusting the focus of the camera, smoothening the run of bellow-supports and installing the lifting structure. It is expected that the device will improve further in accuracy.

Currently a vibration of the images with $5\mu\text{m}$ amplitude is observed, due to missing height adjustment support (test was performed on rubber wheels).

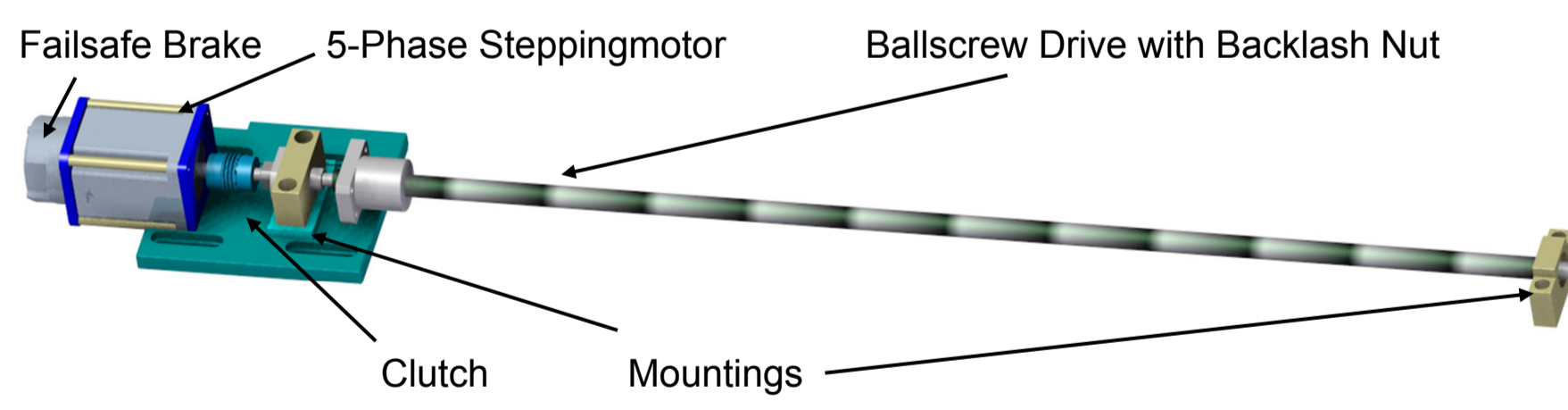
Below are the pictures of the first scan. The size of the vertical focus was measured to be smaller than $12.5\mu\text{m}$.



Height adjustment



Ballscrew Drive



Camera



Aknowledgements

- | | | |
|---|---|---|
| Mechanical Workshop -Team
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Björn Hager | XFEL
Jens Buck
Markus Ilchen |
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And many many more... Thank you for your support!!!

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