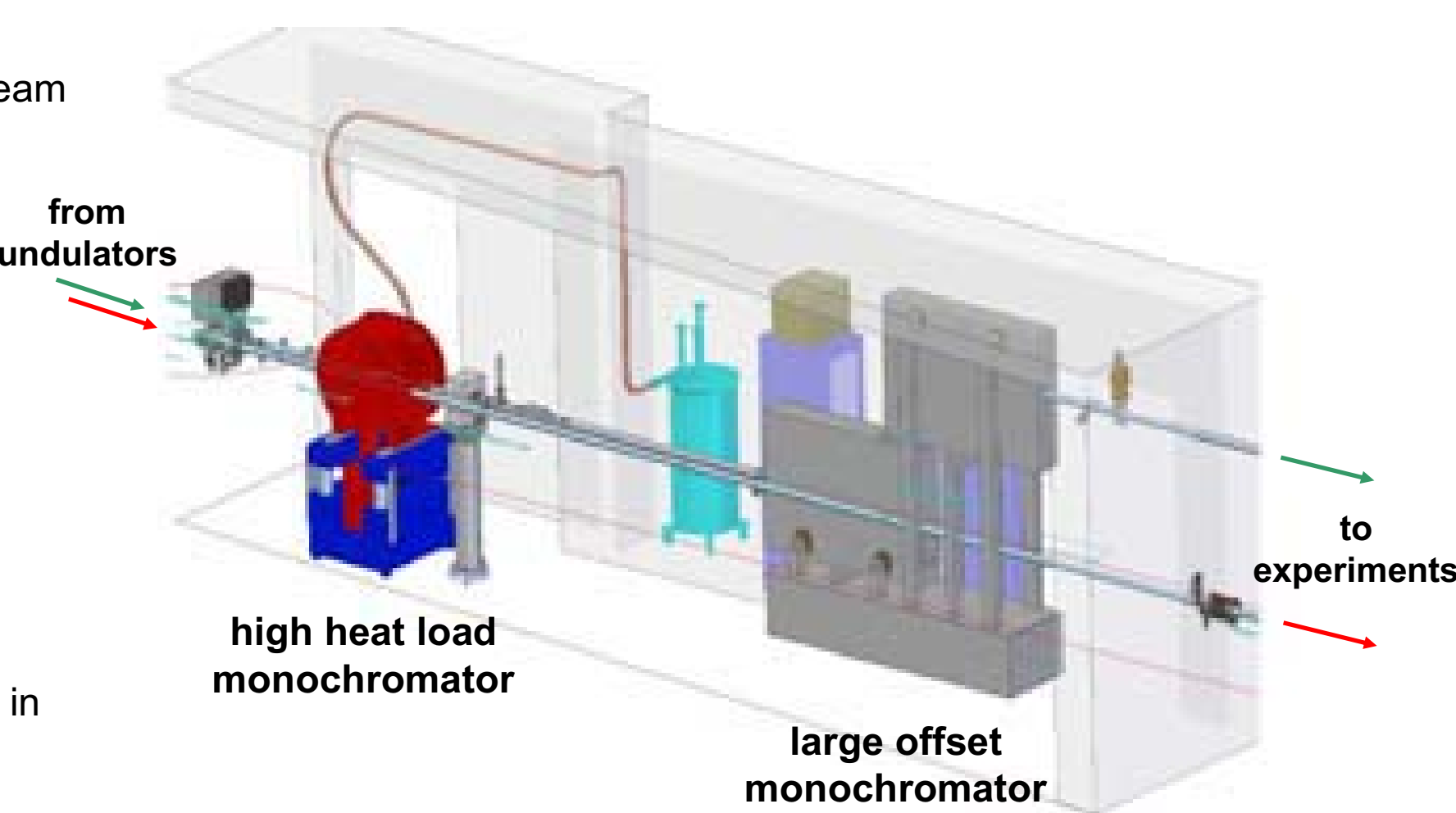


Laser based X-ray Beam Stabilization for the Large Offset Monochromator at PETRA III, Beamline P08.

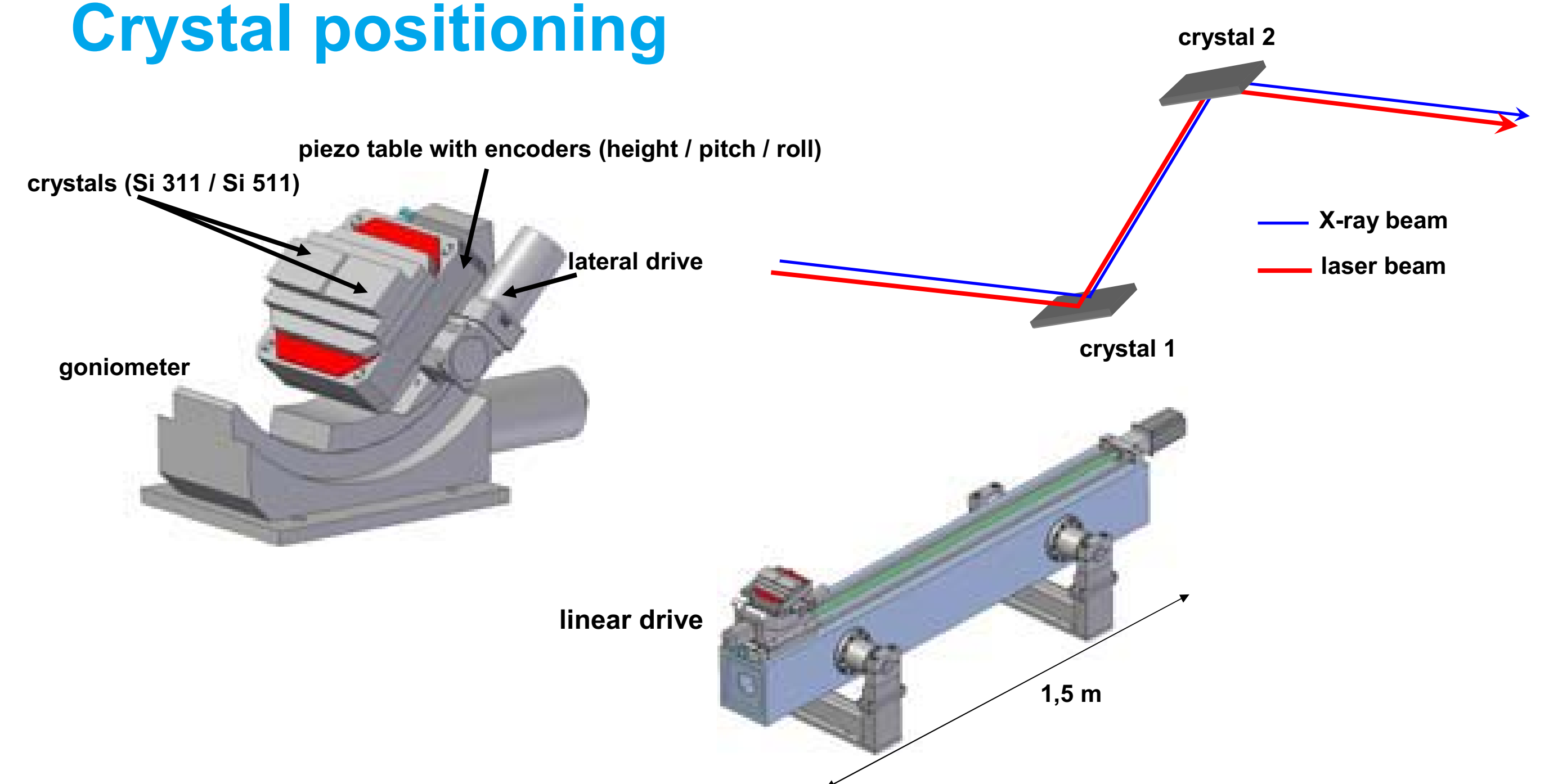
J. Horbach, M. Degenhardt
Deutsches Elektronen-Synchrotron DESY, FS-BT

Requirements

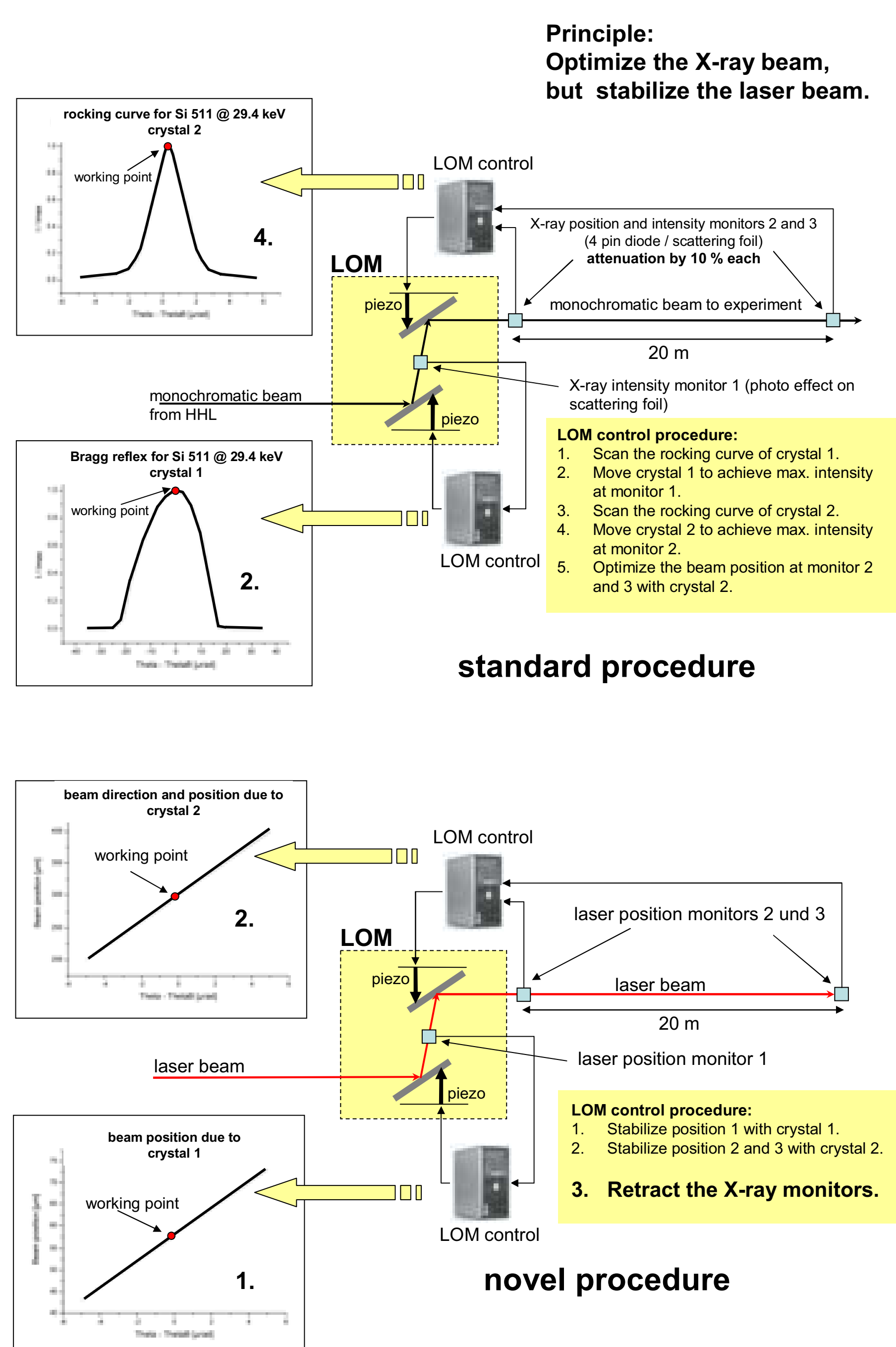
- Selection of a small energy band out of the high heat load monochromator beam
- Vertical shift of the beam by 1.25 m
- Stabilization of the beam position at the experiment
- Energy range
 - Si 311: 5.4 – 18.8 keV
 - Si 511: 8.4 – 29.4 keV
- smallest step: 10 meV
- Precision of the beam position at the experiment (distance approx. 20 m): 10 μ m in lateral and vertical direction
 - Angular accuracy of 0.5 μ rad needed



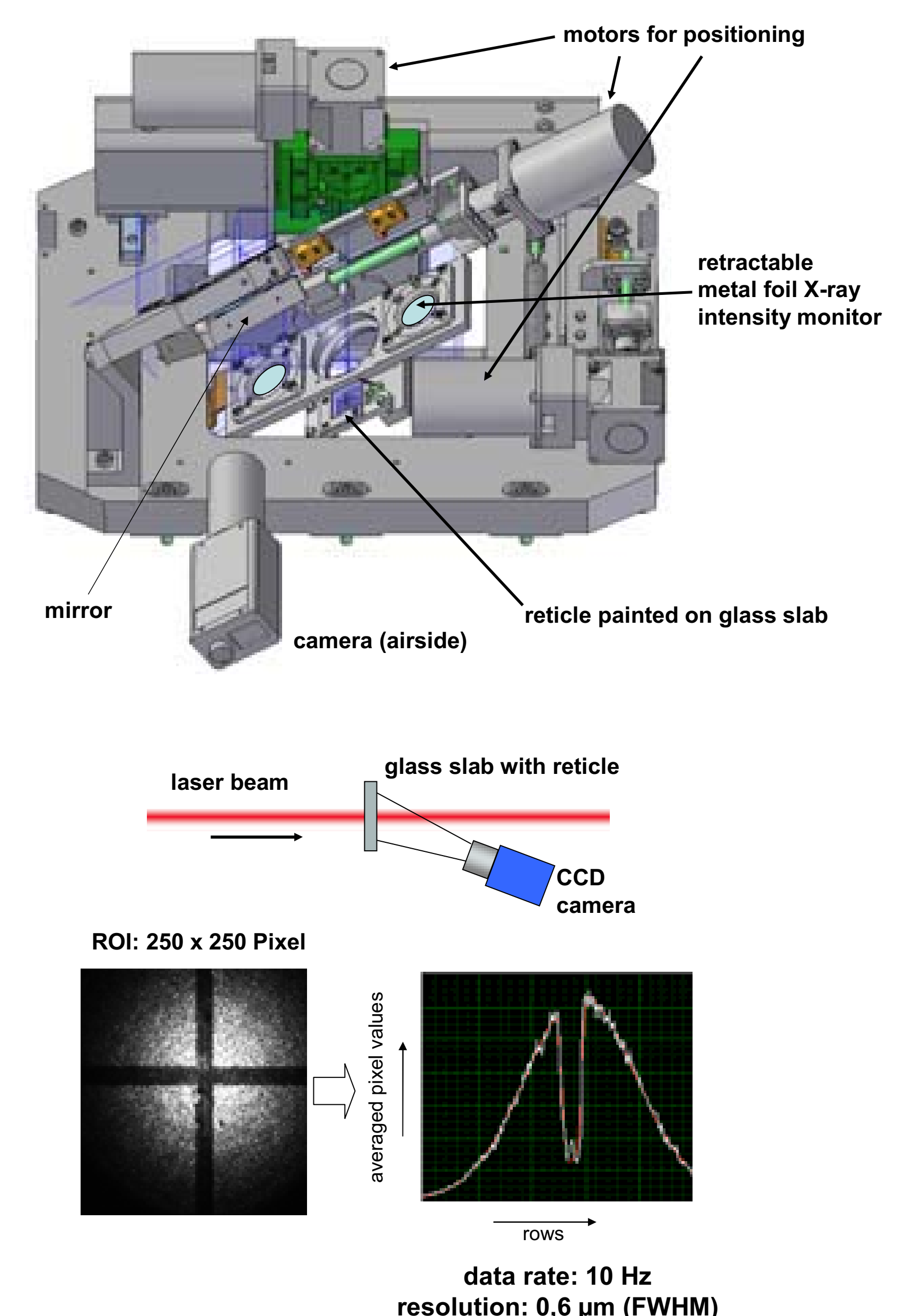
Crystal positioning



Beam stabilisation concept shown generically for pitch piezo



Sensor unit between vacuum vessels

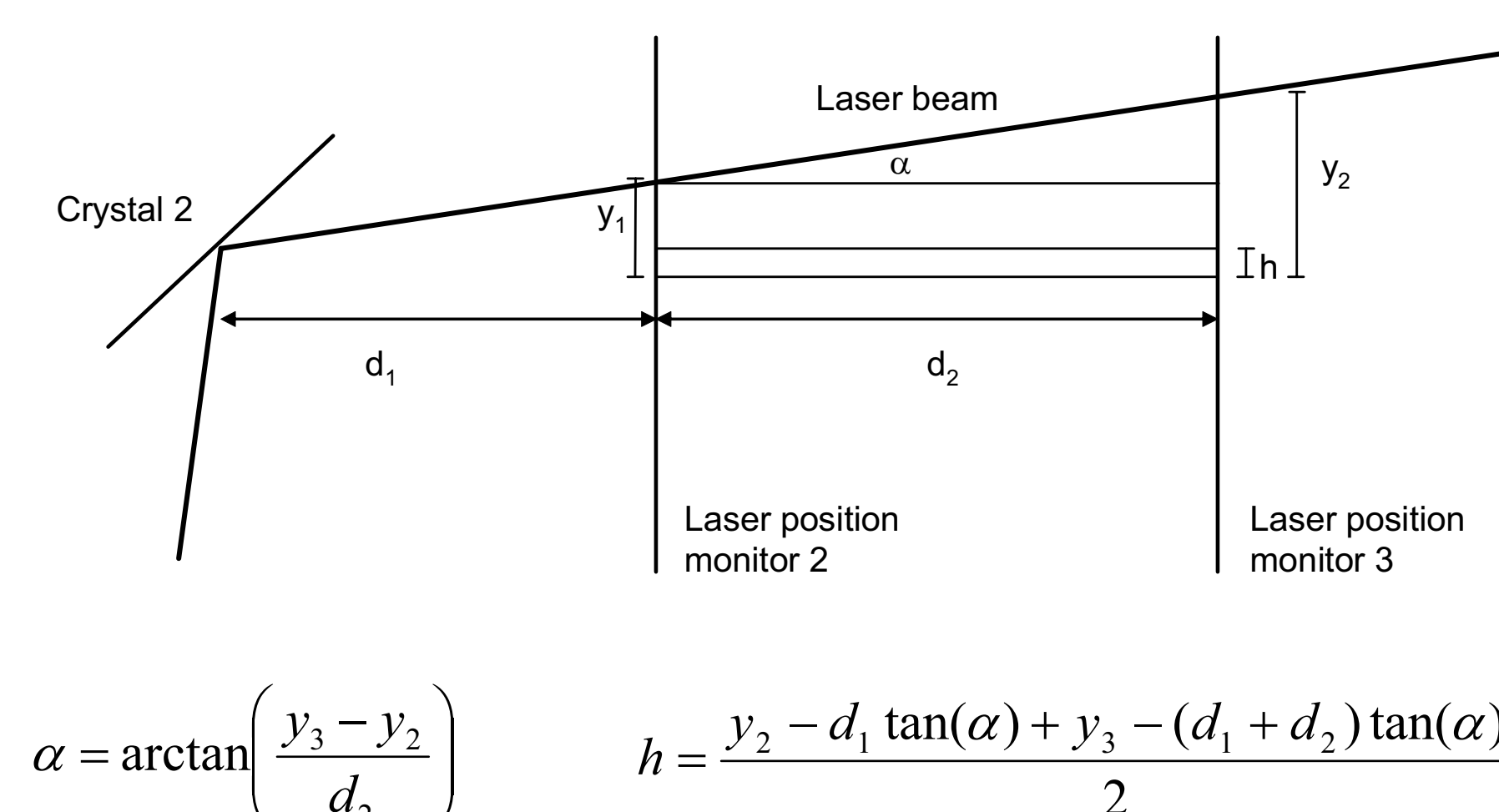


Stabilisation test using laser beam as feedback

Deviation from target laser position:

	Average	Standard deviation
Pitch BPM1 [μ rad]	0,00171	0,497
Roll BPM1 [μ rad]	0,00161	0,452
Pitch BPM 2+3 [μ rad]	0,0017	0,17
Roll BPM 2+3 [μ rad]	-0,0018	0,159
Height BPM 2+3 [μ m]	0,00017	0,547

The deviation is reduced by a factor of 1000, comparing the stabilized setup (8h measuring time) to the unstabilized setup (1h measuring time).



Conclusion and Outlook

- The system showed its feasibility to stabilize the laser beam position and direction.
- The stabilization can be used for the correction of long term deviations (i.e. thermal drift).
- Further tests will be done using X-ray beam position monitors for tracking of the X-ray and for feedback.

References

- [1] Design of a Large Offset Monochromator at PETRA III: J. Horbach, M. Degenhardt, U. Hahn, H.B. Peters, H. Schulte-Schrepping
Nucl. Instrum. Methods A (2009, to be published)