Development of the RIXS manipulator

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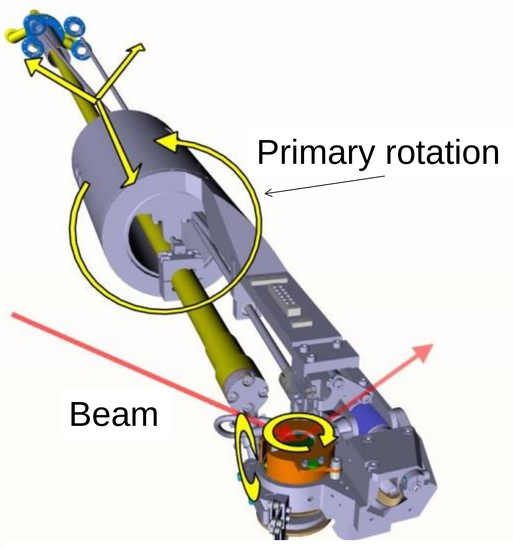
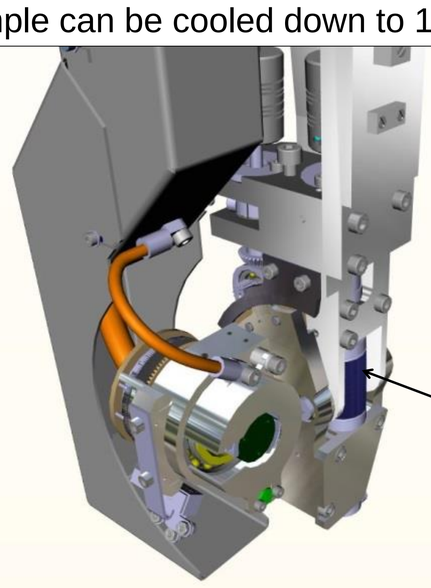
Carving Manipulator

The RIXS manipulator is a further development of the carving manipulator which is used to position solid samples. It has six degrees of freedom and the kinematics is designed in a way that all tree rotations can be executed without moving the center of the sample.

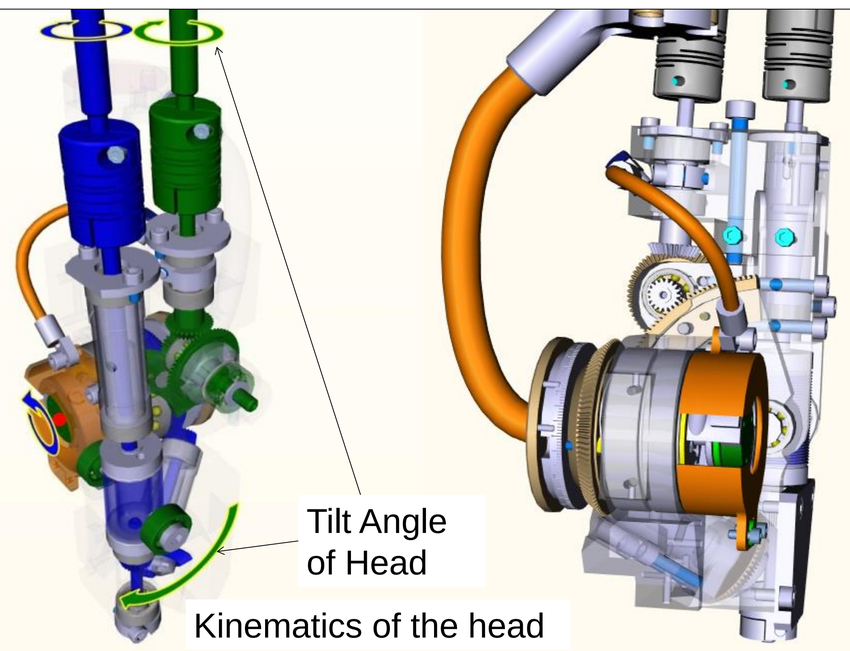
The head is in a vacuum chamber and the sample can be cooled down to 14°K.



Carving Manipulator with 6 degrees of freedom



Head of Carving Manipulator



Kinematics of the head

RIXS Manipulatur

For the RIXS Manipulator (Resonant Inelastic X-ray Scattering), an angular range of the primary rotation of 0° - 180° is needed. In the Carving Manipulator design, the bellow and the bearing obstructs the beam at small angles. To solve this problem, the bellow is shifted away from the axis and a goniometer bearing was developed.

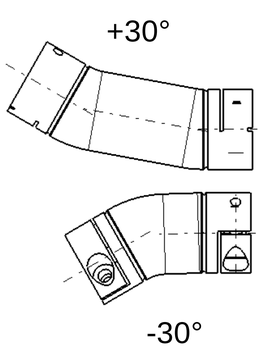
This results in a combined lateral, axial and angular movement for the bellow, that have been tested in a separate test setup.

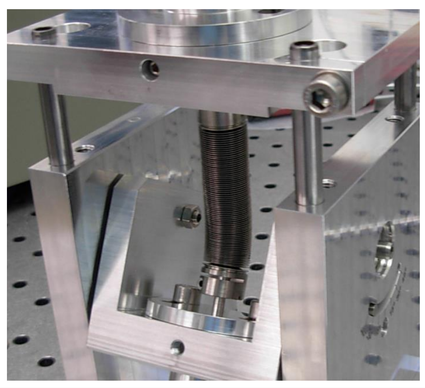
For the goniometer bearing, shells and balls of ceramics are used.

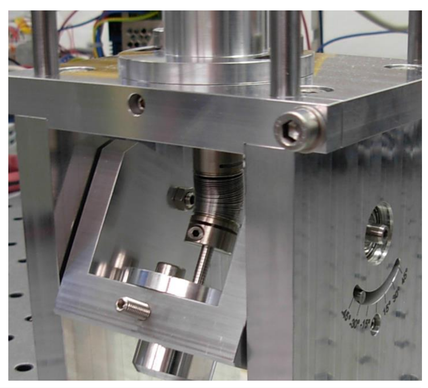
Main parameter

6 independent degrees of freedom

Vacuum	: <10E-10 mbar
Cryo	: 14° K
Precision	: 20µm
Non-magnetic	
Gears in PEEK and Titan Grade 5	
Mech. Parts	: Titan Grade 5
Tilt Angle of Head	: +/- 30°



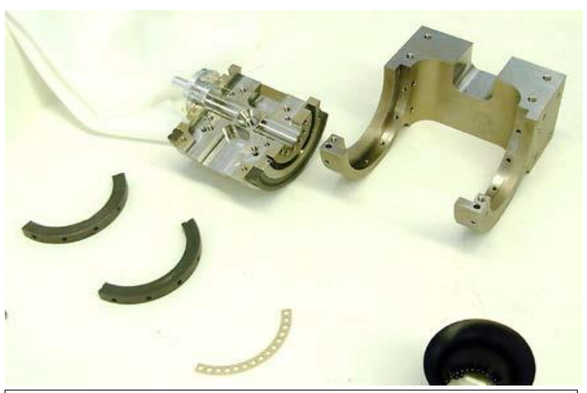




Test of the bellow

By changing the angle of the head, the lenghts of the bellow is changing.

Different configurations were tested to optimize stability, clearance, force and durability

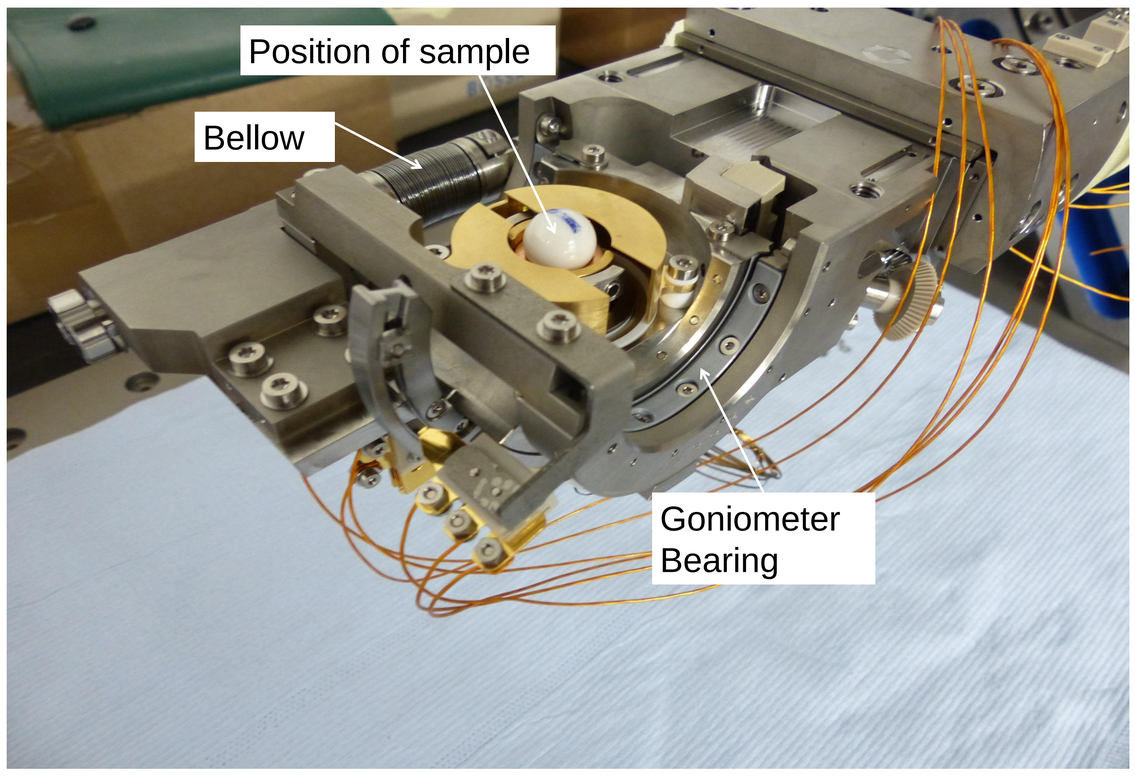


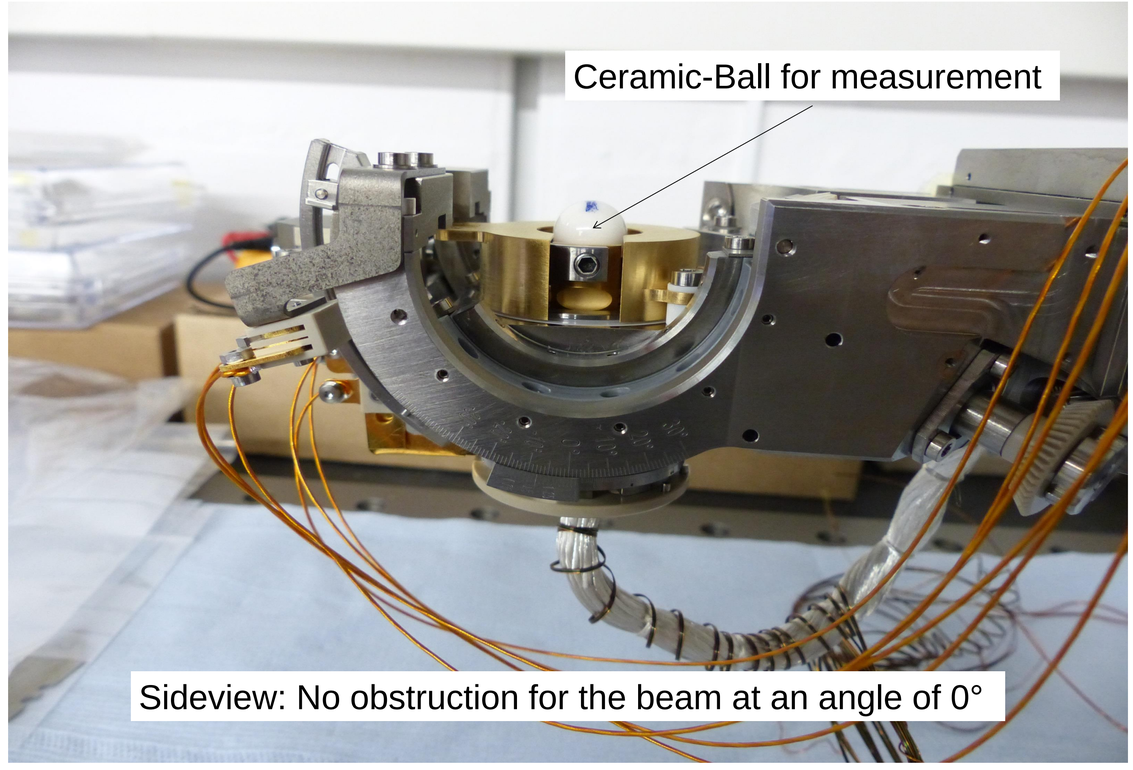
Goniometer bearing

Travel range: +/- 30°

Bearing shell and balls: Si_3N_4

Ball cage: PEEK





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