

Concept of an in vacuum high resolution Monochromator for IXS experiments.



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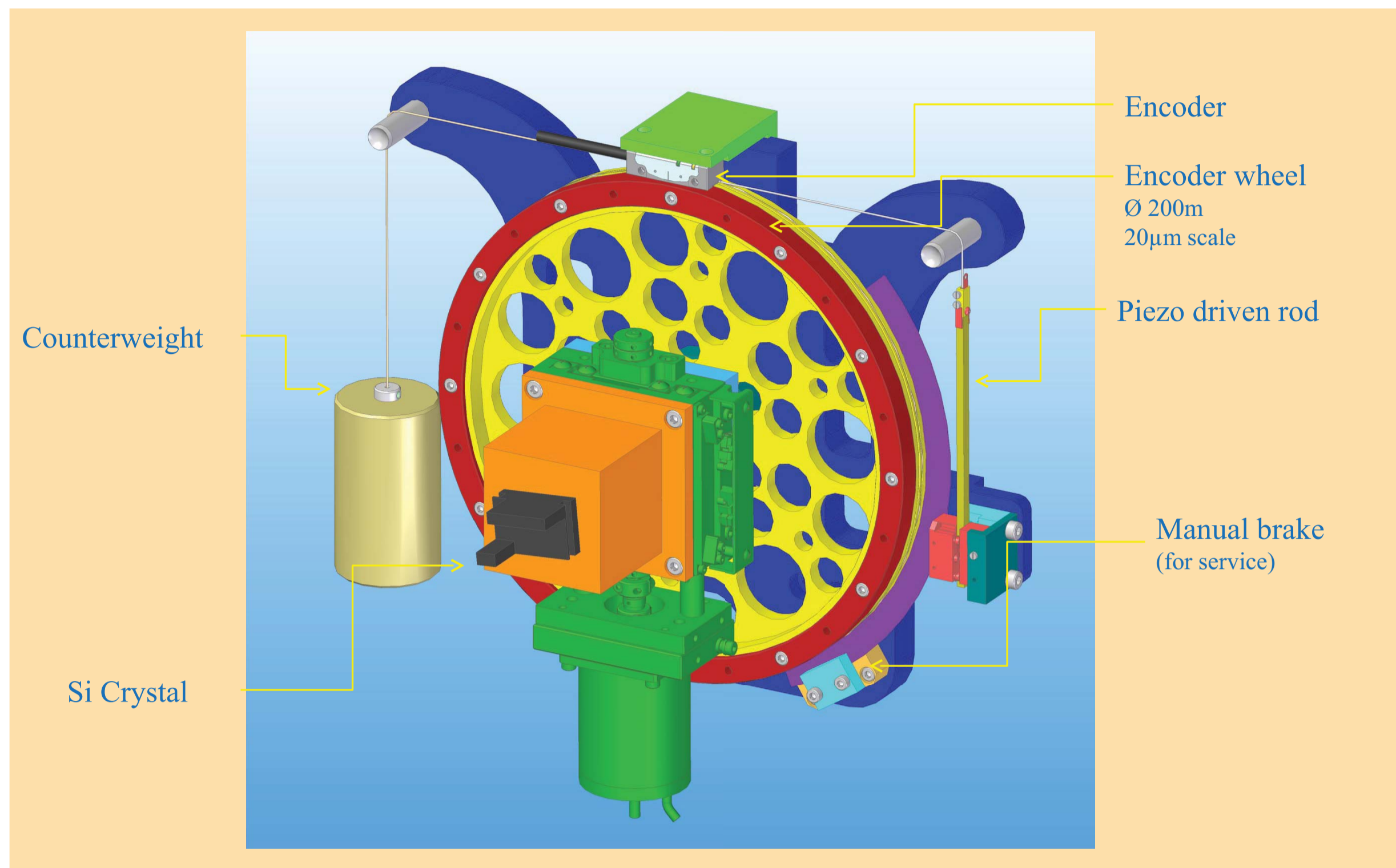
At Petra III Beamline P01 a high resolution monochromator for energies down to 2,5 keV will be installed in March 2017.

Motivation

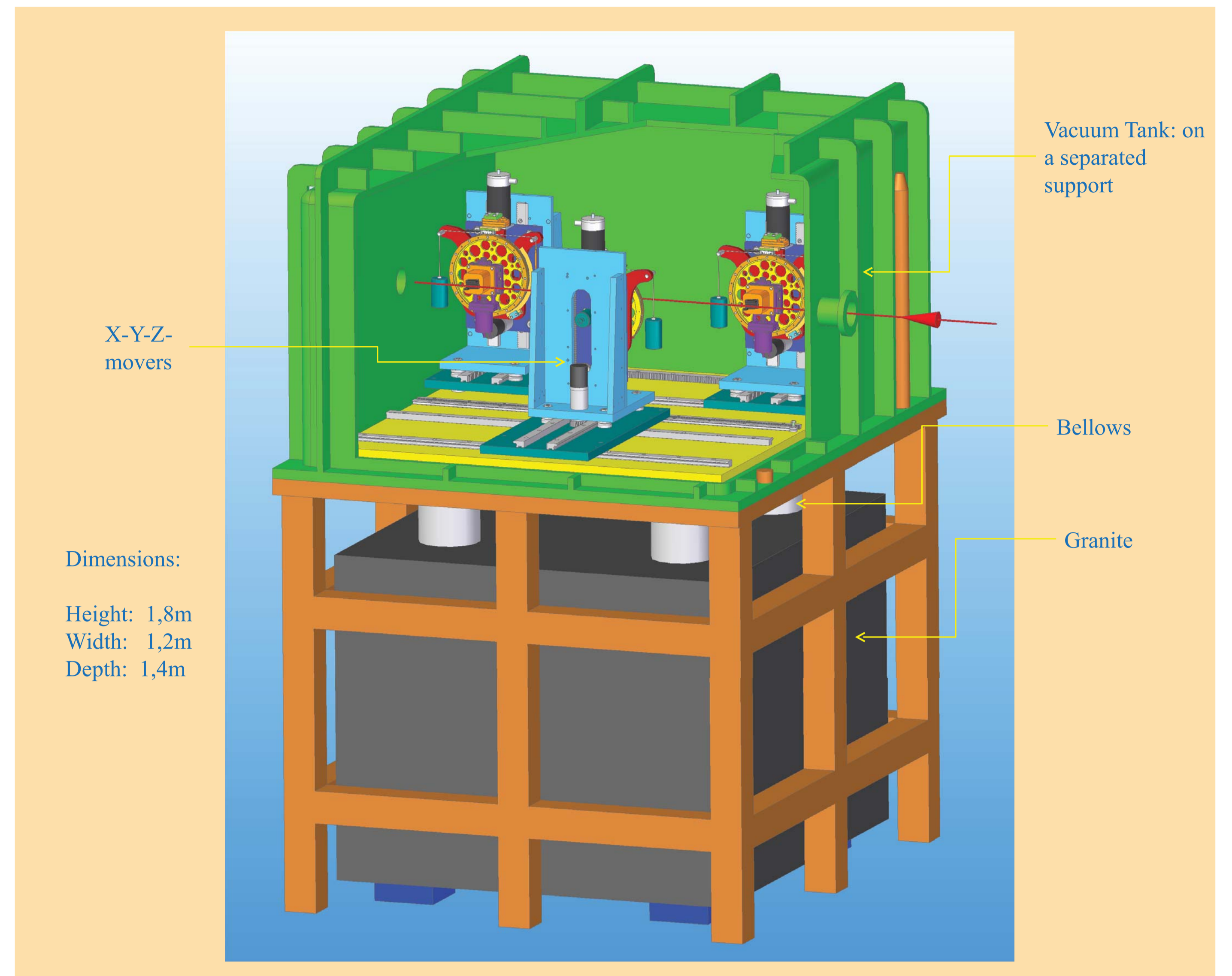
Due to high absorption of 2.5 keV photons in air (more than 99,9% at 100mm) our high precision goniometers (three independent stages) for the high resolution monochromator will have to be put into high vacuum (1×10^{-7} mbar). To our knowledge there is no vacuum compatible high precision goniometer at the market for this range of vacuum and for a load of 6kg.

Description of the concept

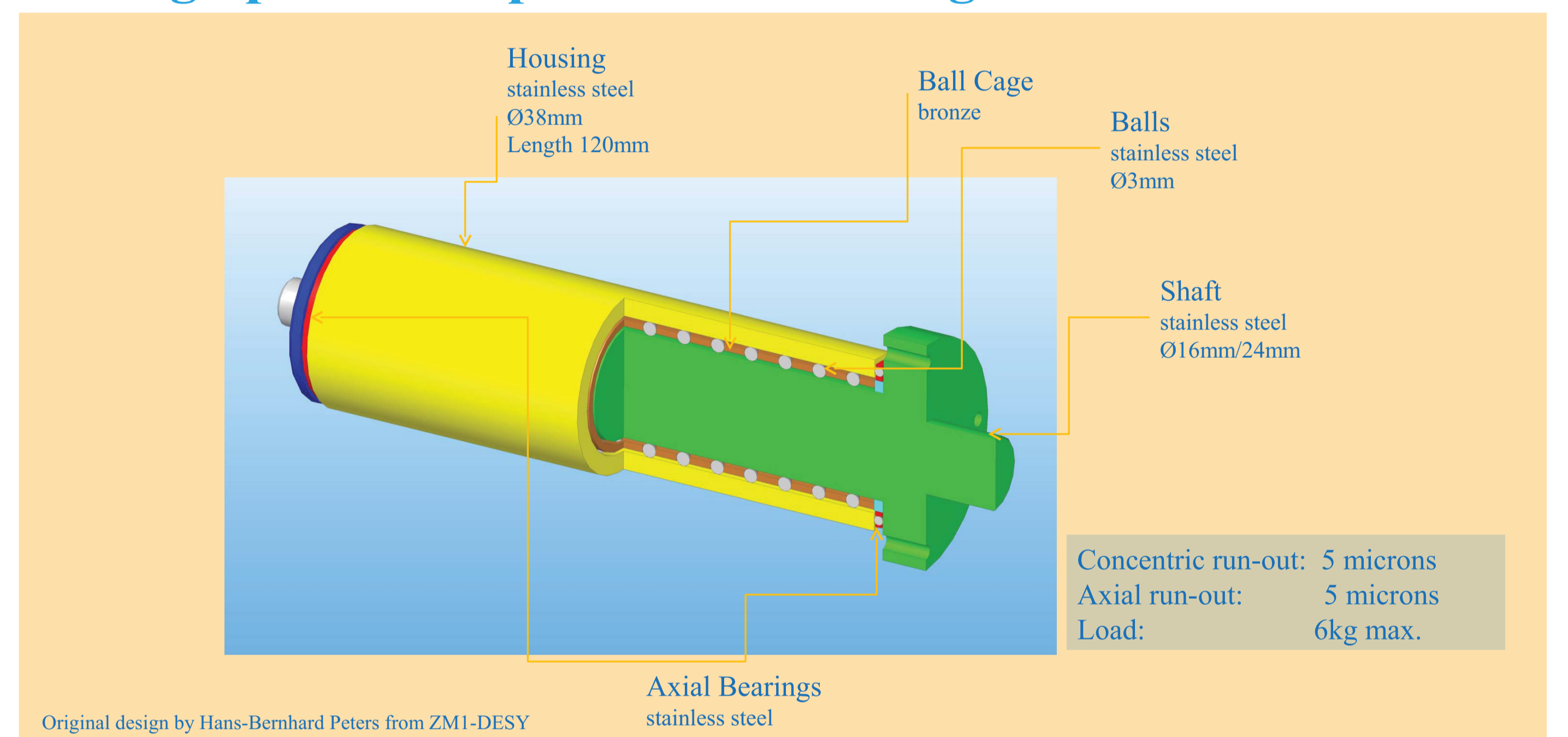
A high interpolating Encoder with 1nm resolution in combination with a long piezo driven rod is chosen to cover an angular range of 40 degrees with a resolution of 10nrad. The maximal load of the high precision spindle ball bearing is 6kg. All components must be compatible with a clean vacuum of 1×10^{-7} mbar.



High Resolution Monochromator



High precision spindle ball bearing for 10^{-7} mbar



Scientific background

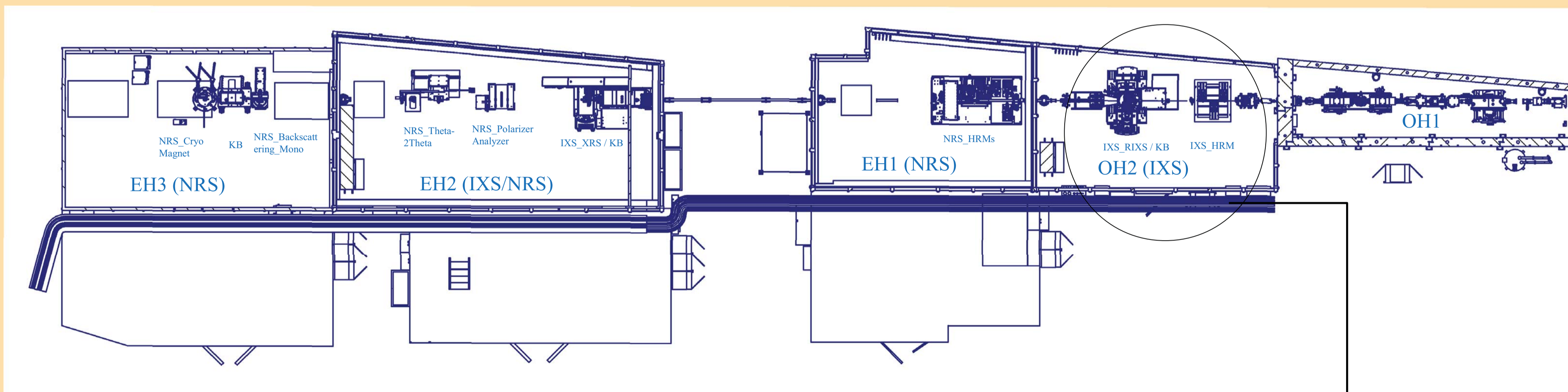
The very high resolution is needed to resolve very low energy excitations in materials. For example, phonon (atomic vibrations) energies are usually below 100meV. Also Magnetic excitations (magnons) are in this range of energy. We want to build highly efficient, high-resolution monochromators. This requires very good angular control of the monochromator crystals.

IXS research areas
geophysics, catalysis, fuel cells, Li-ion batteries, correlated electron systems...

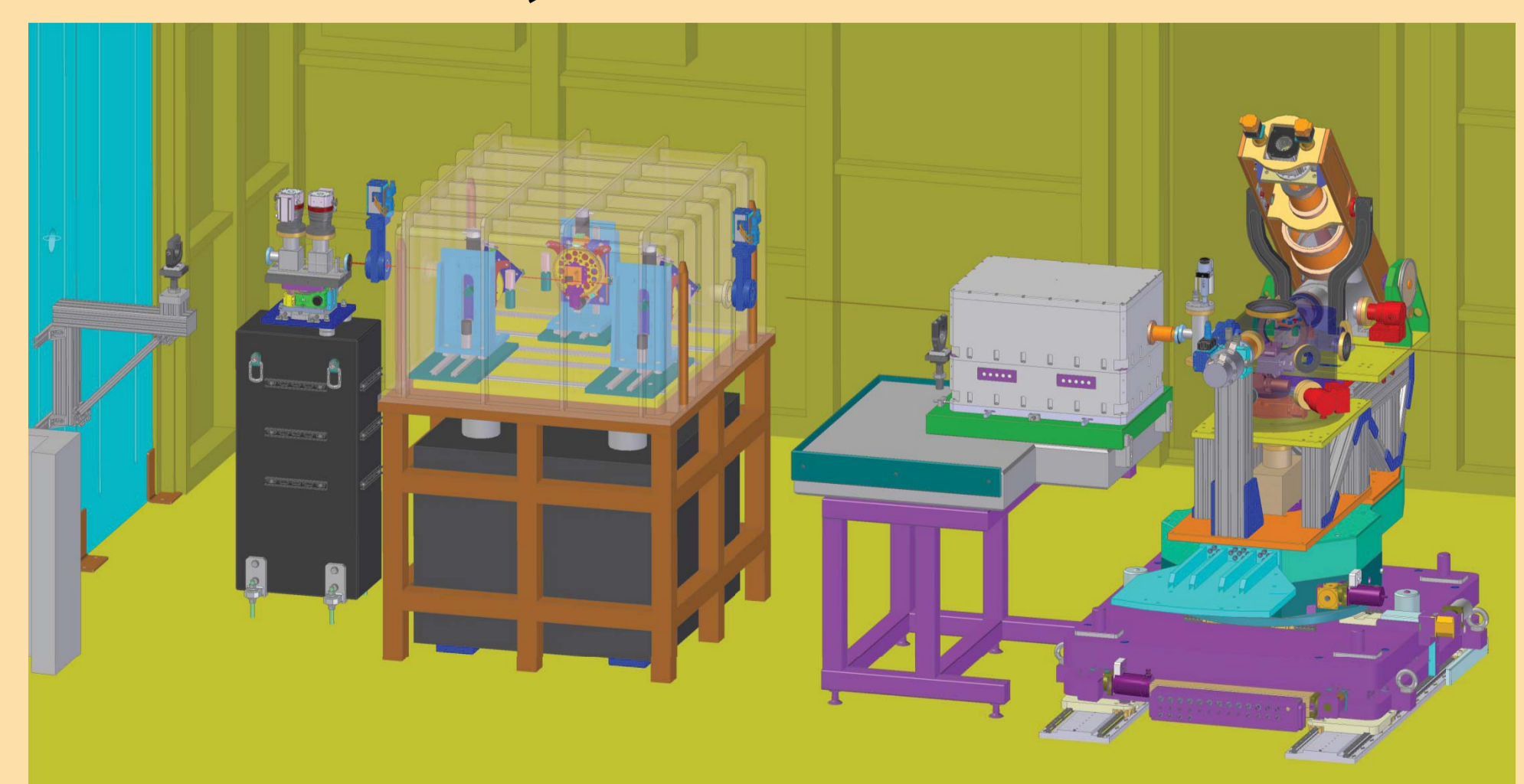
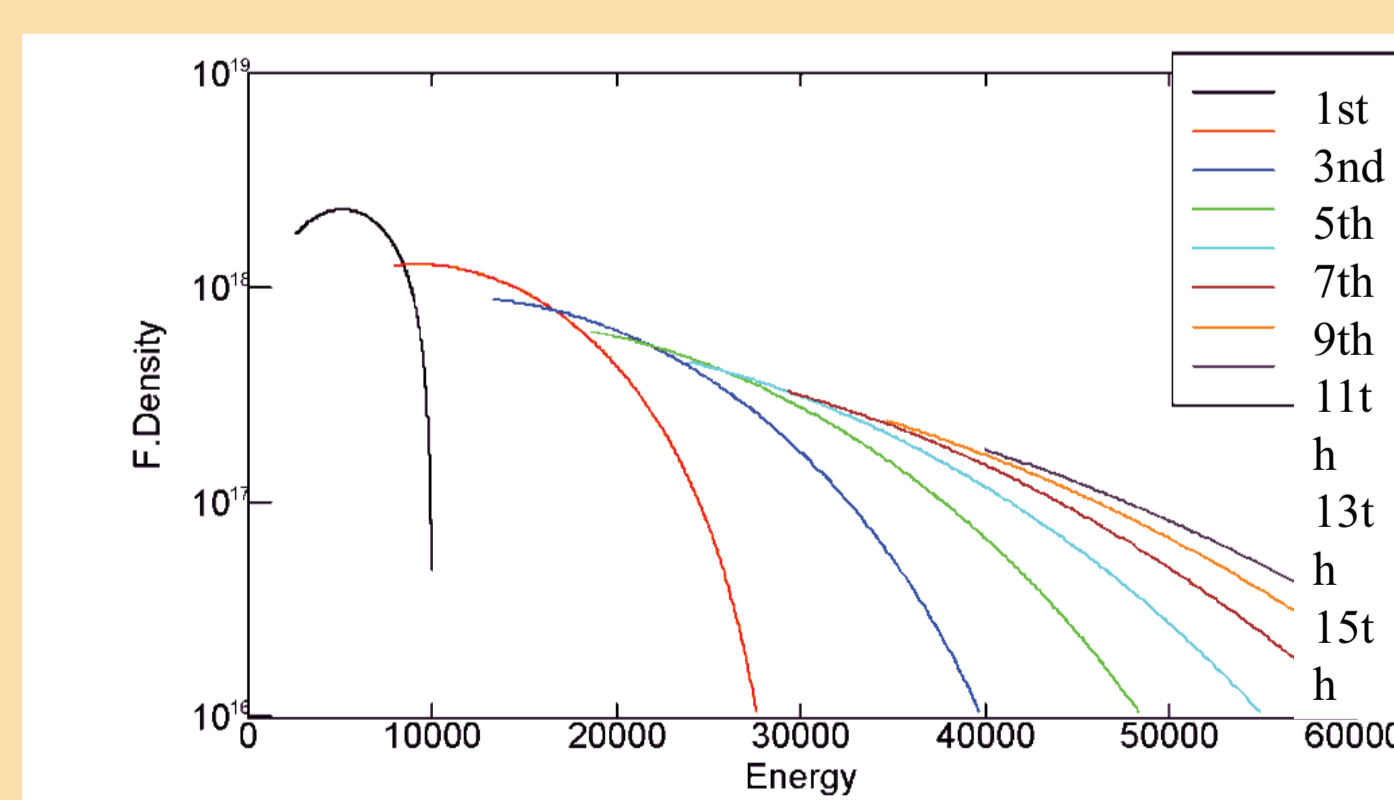
Estimated costs

One HRM unit: (x-y-z-stages included)	35.000€
Tank+Granite	70.000€
Pumps, Bellows, Valves, Gauges, Feedthroughs	55.000€
Diagnostics (not shown)	10.000
Total	240.000

The Dynamics Beamline P01 is dedicated to Nuclear Resonant and Inelastic X-ray scattering experiments.



Two new 5m long Undulators (36mm period)



MECHANICAL ENGINEERING DESIGN OF SYNCHROTRON RADIATION EQUIPMENT AND INSTRUMENTATION