

A Multi-sample Holder for the MSPD Beamline at ALBA

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Abstract

At the high resolution powder diffraction end station of the Materials Science and Powder Diffraction (MSPD) beamline at ALBA Synchrotron, several samples are measured on a daily basis. Thus, an automatic sample exchanger is a great asset to the beamline, permitting a more efficient use of beam time. Even if a robot arm is the more suitable option for a sample exchanger device, in terms of cost, compactness and versatility MSPD needs another approach. ALBA engineering division has developed a multi-sample holder that allows the loading of up to eight samples and exchanging between them with a resolution of less than a micron. This new design consists of a customized and motorized linear stage that has been designed to fit into the present three-circles diffractometer, on top of the positioning stages, avoiding any possible collision with the Eulerian cradle. In addition, this new holder permits the use of different types of samples like capillaries in fast spinners, coin cell batteries and electro-chemical cells. Finally, the system is compatible with the usual sample conditioning equipment on the end station such as the hot blower, cryostream, beamstop, chiller, etc.

Specifications

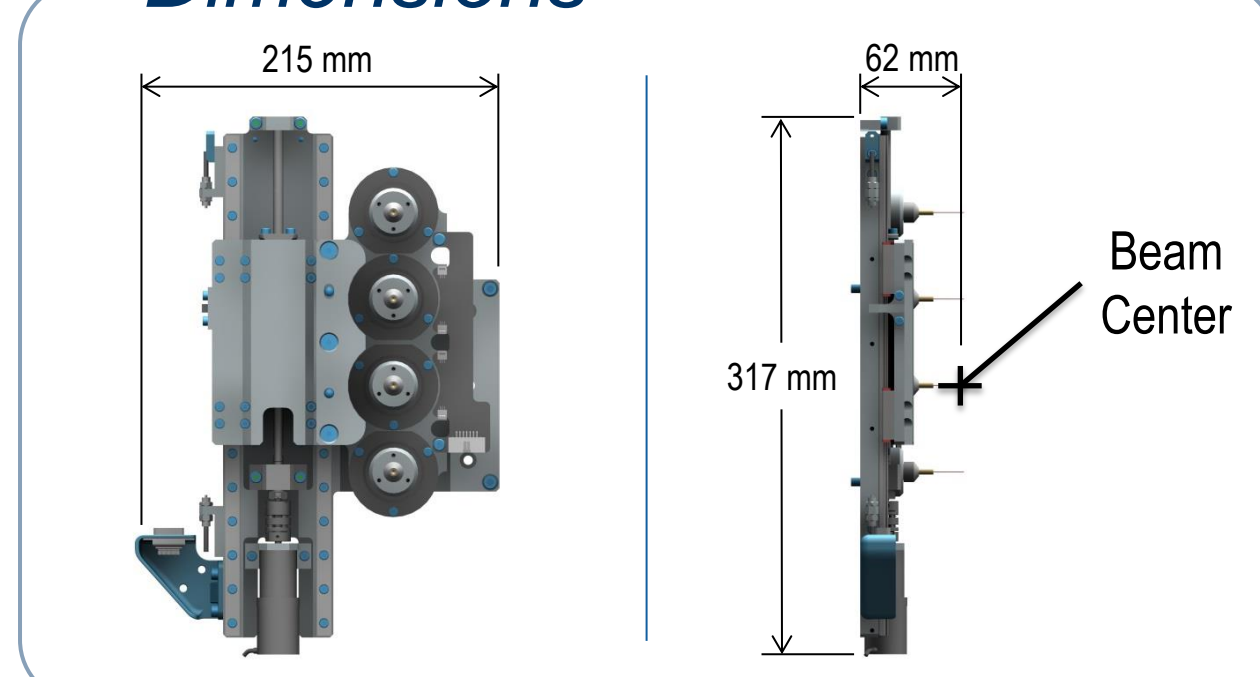
The multi sample holder complies with the following specifications:

- Linear resolution of 0.3 μm (full step).
- Repeatability of 0.75 μm .
- Range of 166mm (± 83 mm).
- Compact and integrated in the Eulerian cradle.
- Compatible with sample conditioning equipment.
- It provides 4 positions for coin cell batteries.
- It provides 3 positions for electrochemical cells.
- It provides 4 positions for fast spinners in its current design or 8 in a new configuration in development.

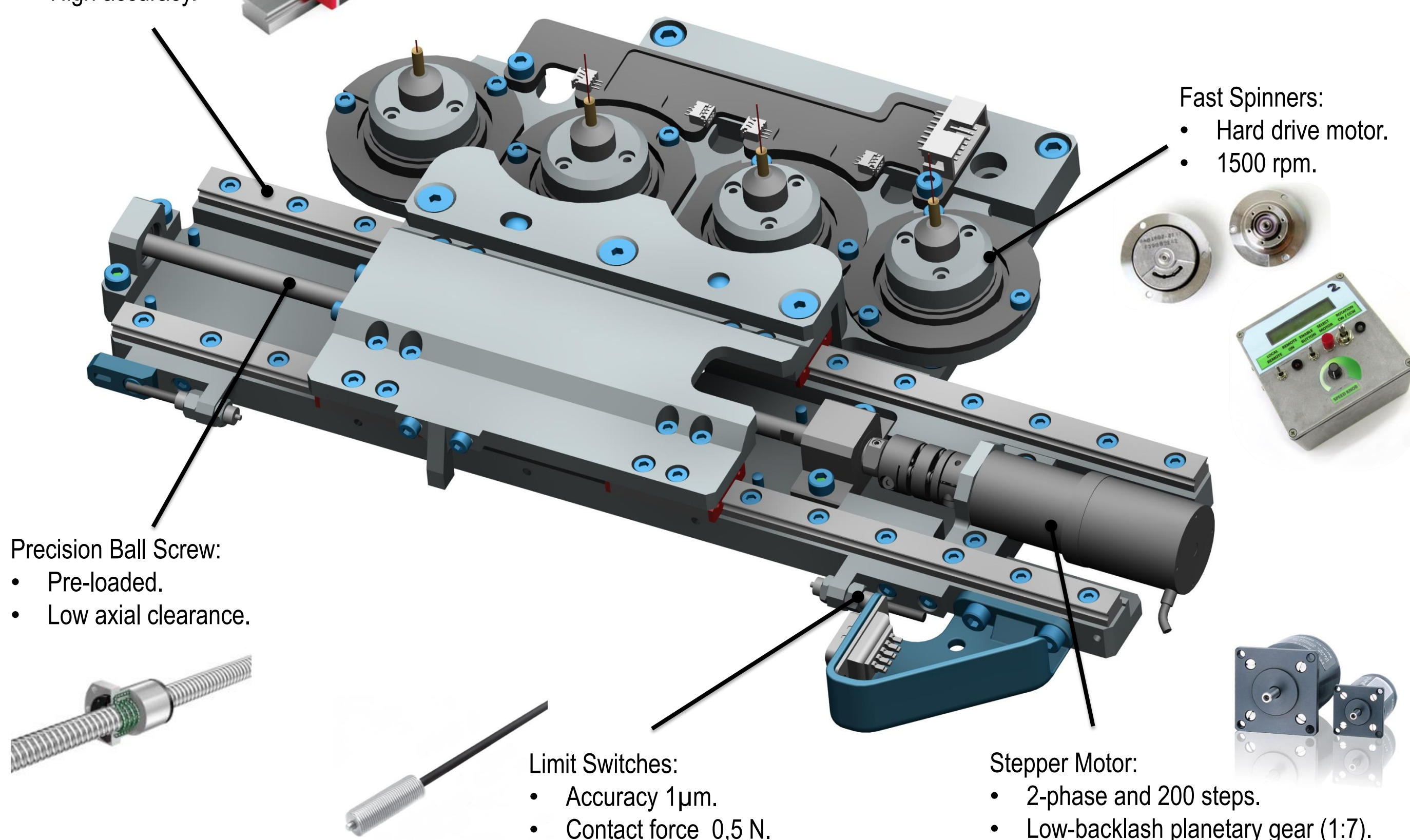
Design

- Multi-sample holder is a motorized linear stage consisting of a precision ball screw and preloaded linear guides actuated by a stepper motor.

Dimensions

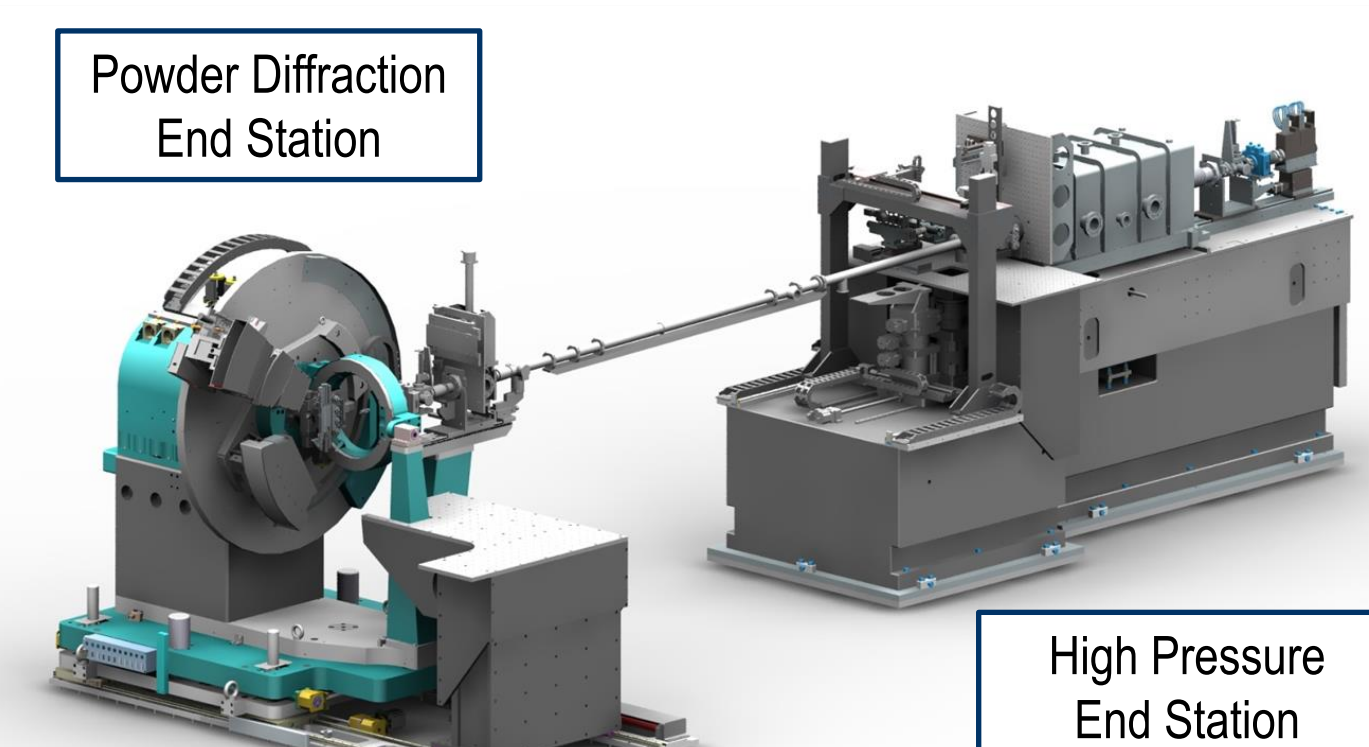
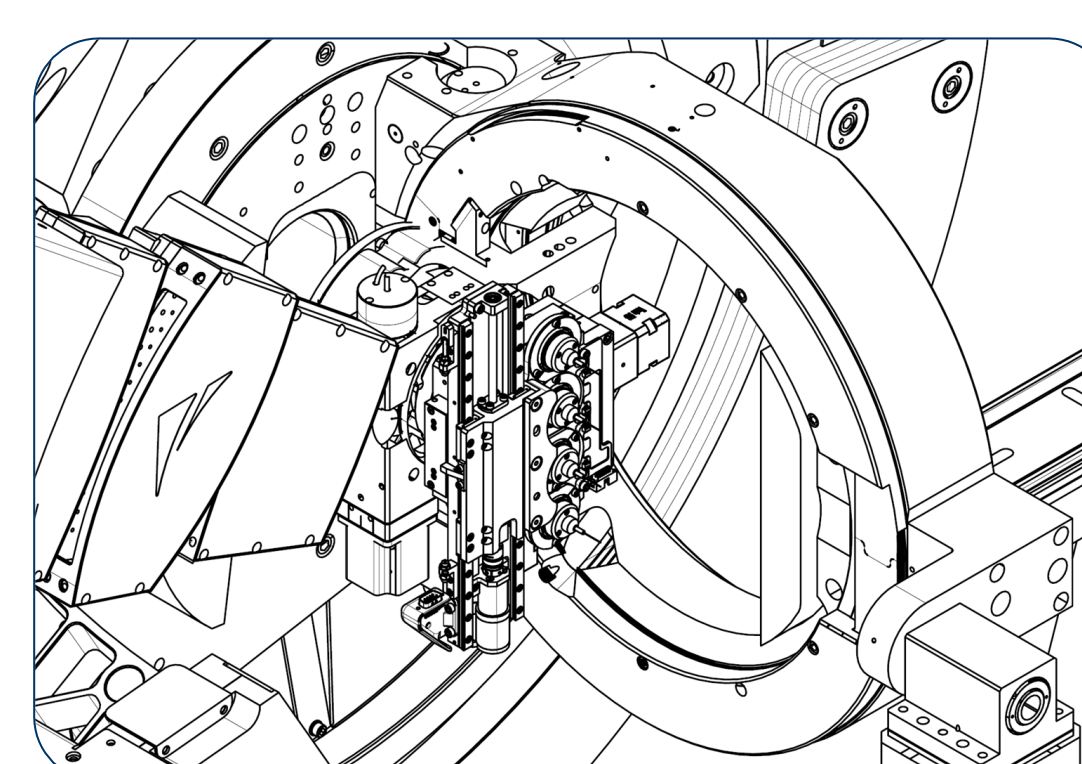


- Guides and carriages
- Pre-loaded.
 - High accuracy.



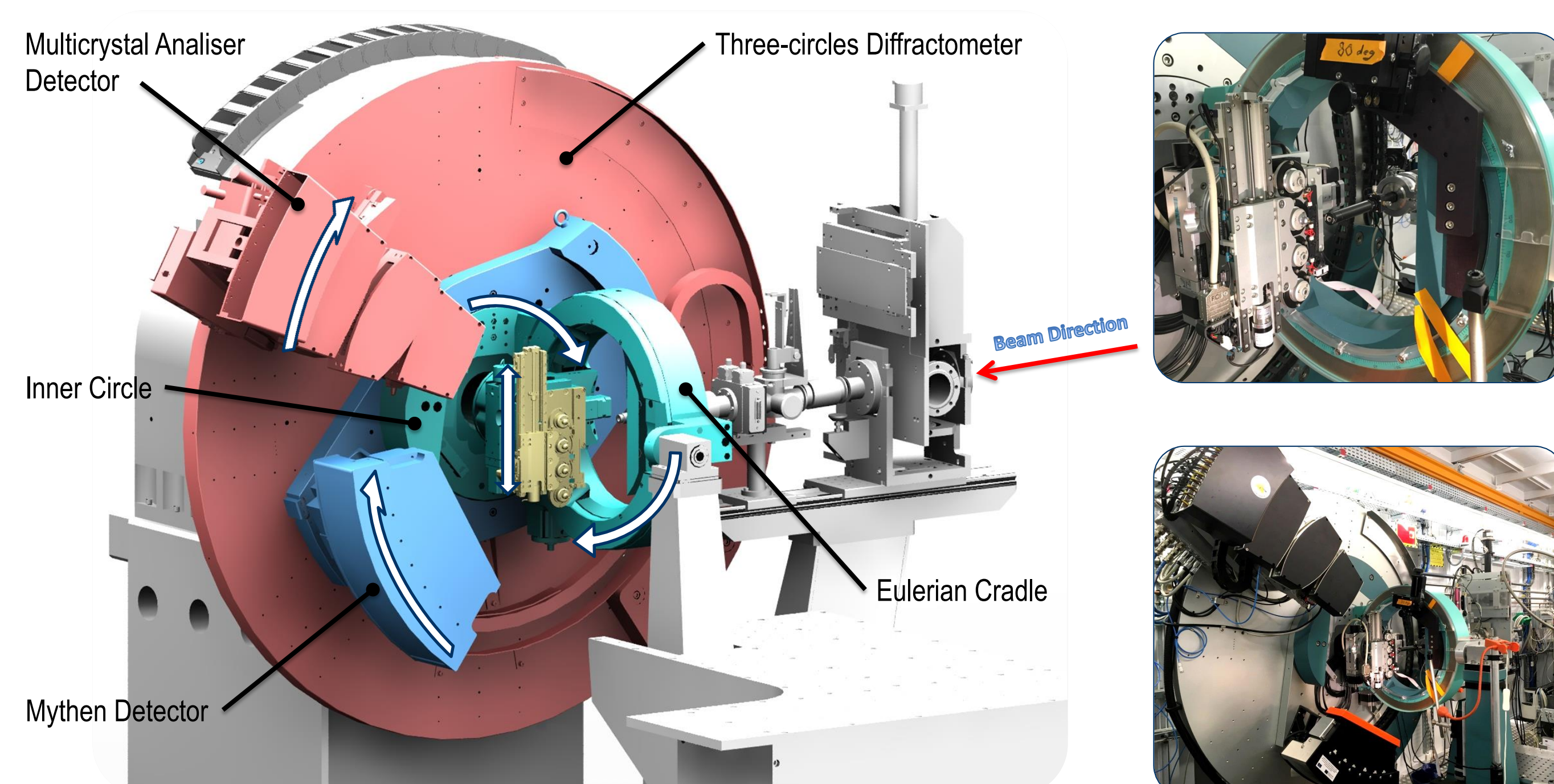
MSPD End Station

- Multi-sample holder position in the MSPD Powder Diffraction End Station.



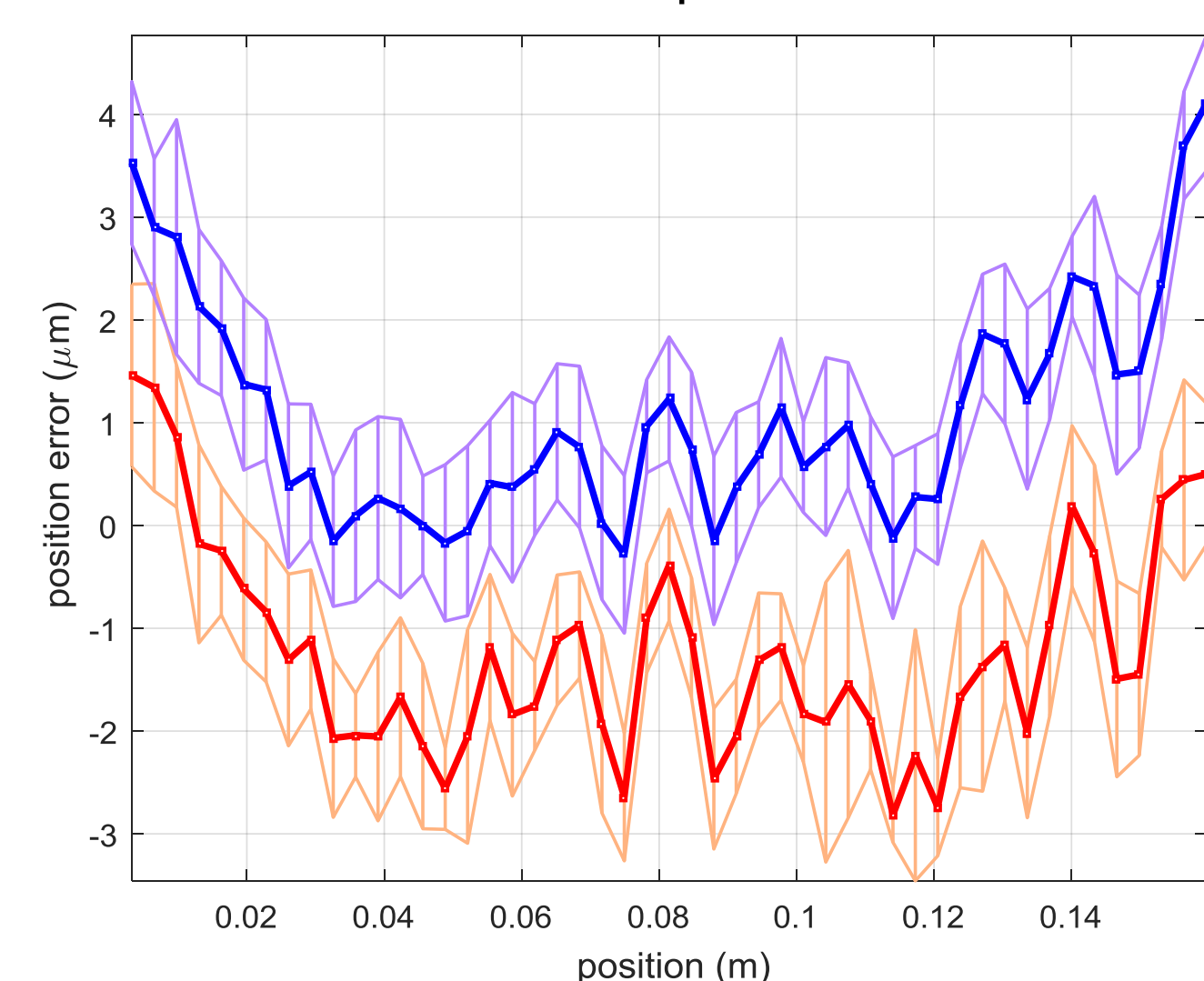
Integration

- Multi-sample holder is installed on top of the positioning stages of the three-circles diffractometer.



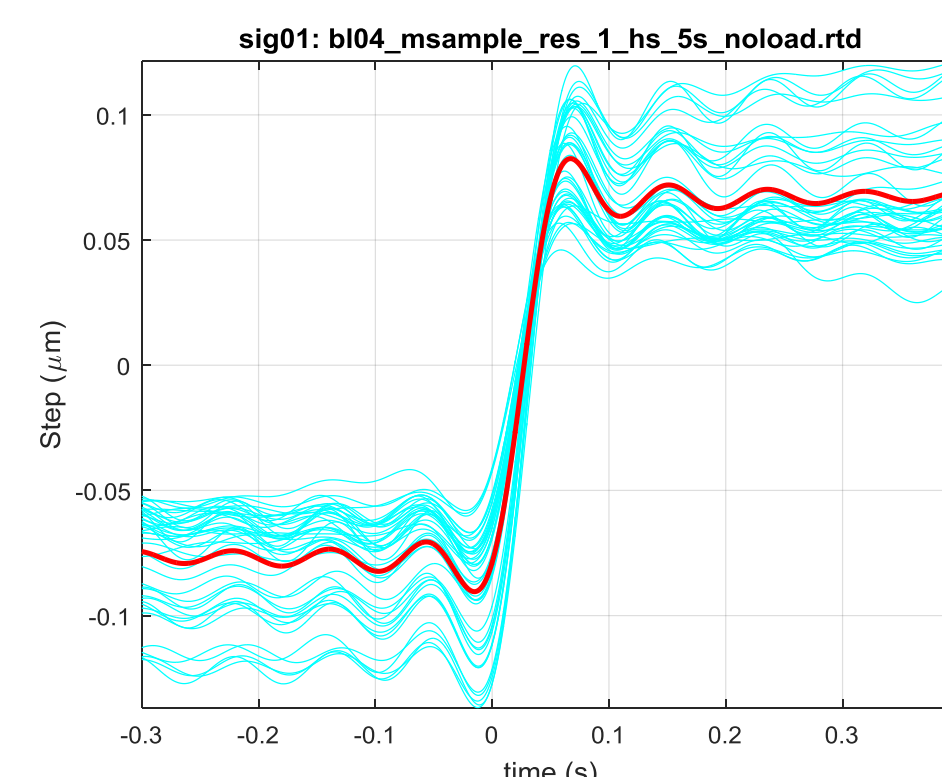
Metrology Tests

- Position error vs motor position measured with a Renishaw ML10 interferometer in open loop.

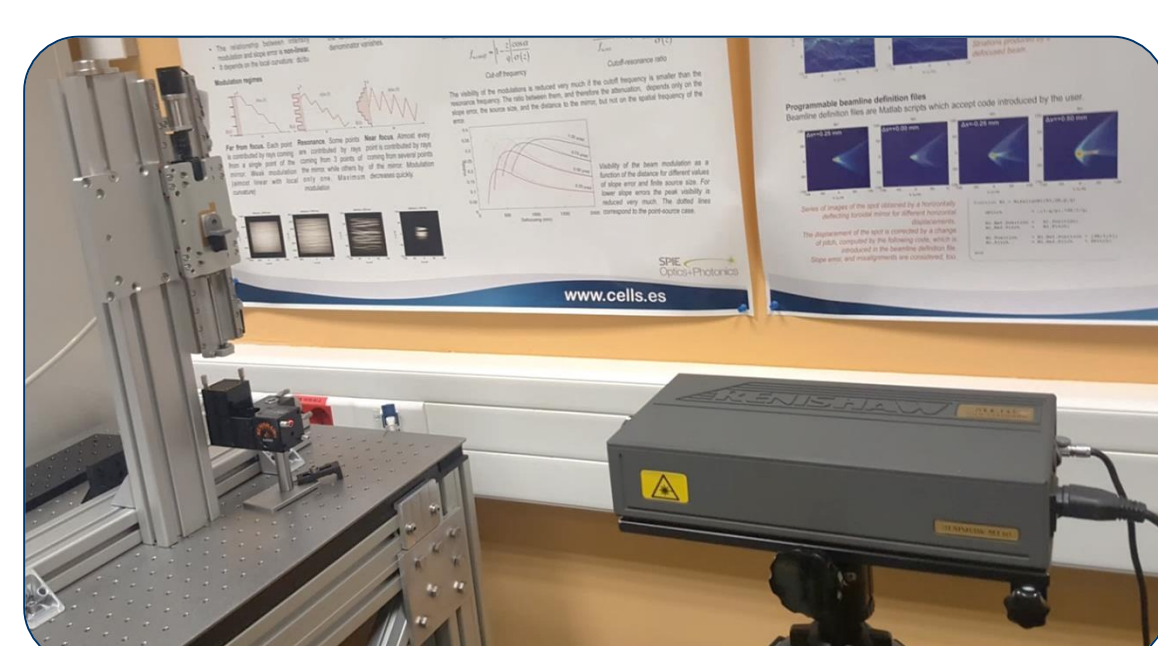


Explored Range	0.156 m
Avg. resolution	0.1562 $\mu\text{m}/\text{hs}$
Backlash/Hysteresis	2.32 μm
Repeatability	0.75 μm
Linearity	4.39 μm
Sampling noise	18 nm

- Resolution tests in dynamic mode performed to test the mechanical response of the system to the minimum achievable step size.



- Experimental setup for the metrology characterization.



Sample Configurations

- Fast spinners for capillaries:
- Coin cell batteries:
- Electrochemical cells:

