The LEAPS-INNOV 5.2 Online Metrology Development Program

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The LEAPS*-INNOV** Task 5.2 is a collaborative R&D program intended to explore and develop the possibilities offered by fiber connected interferometers for typical applications in photon sources experiments, like the online metrology in several degrees of freedom of the sample position. The objective of the poster is to diffuse information on Task 5.2 current plans and to establish contacts about existing / on-going works and possible collaborations in the field of interferometers based metrology.

Introduction

- Moving sample in X-ray beam with nanometric accuracy (tomography, microscopy) => Online metrology of sample position required.
- During the last decade several models of compact fiber connected Fabry-Pérot or Michelson interferometers became commercially available (Attocube, qutools, SIOS, Smaract, …). **Compact, Non-contact, Affordable cost =>** attractive online metrology sensors… with some limitations.
- **Objectives of LEAPS-INNOV Task 5.2:** analyse the performances of these interferometers for our applications; compare them with alternative sensors trough lab tests and the construction of demonstrators.

Participants. Collaborations

- Current participants: ALBA-CELLS (Joan Casas, Carles Colldelram Peroliu), ESRF (coordinator) (Ludovic Ducotté, Philippe Marion, Francois Villar), HZB (coordinator) (Klaus Kiefer, Matthias Neeb, Stefan Rehbein, Gerd Schneider), PTB (Jens Flügge, Ralf Geckeler), SOLEIL (Yves-Marie Abiven, Cedric Bourgoin, Alain Lestrade, Javier Perez)
- Collaborations: Please **contact us if interested** in these works and in a possible collaboration.

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Planned R&D works

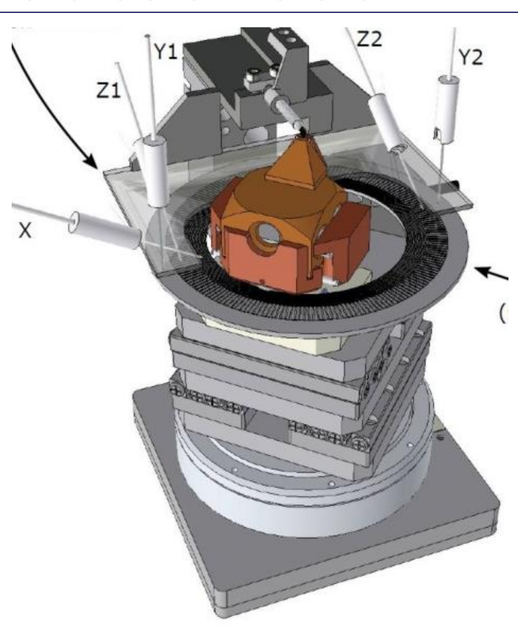
LEAPS-INNOV Task 5.2 is a **four year program started in April 2021**. The current plan includes several parts:

A/ Analysis and lab tests: performances and limitations of interferometers:

- Lab tests defined according to needs for real projects: Interferometers on curved targets. Acceptance of mis-alignment and tilts. …
- Measure non-linearities (cyclic errors). Correction methods.
- Compare performances and limitations of several commercial interferometers for typical applications.
- Interferometer beam tracking systems for larger range.
- Instabilities induced by air turbulences on interferometer measurement signal.

B/ Design and construction of two demonstrators:

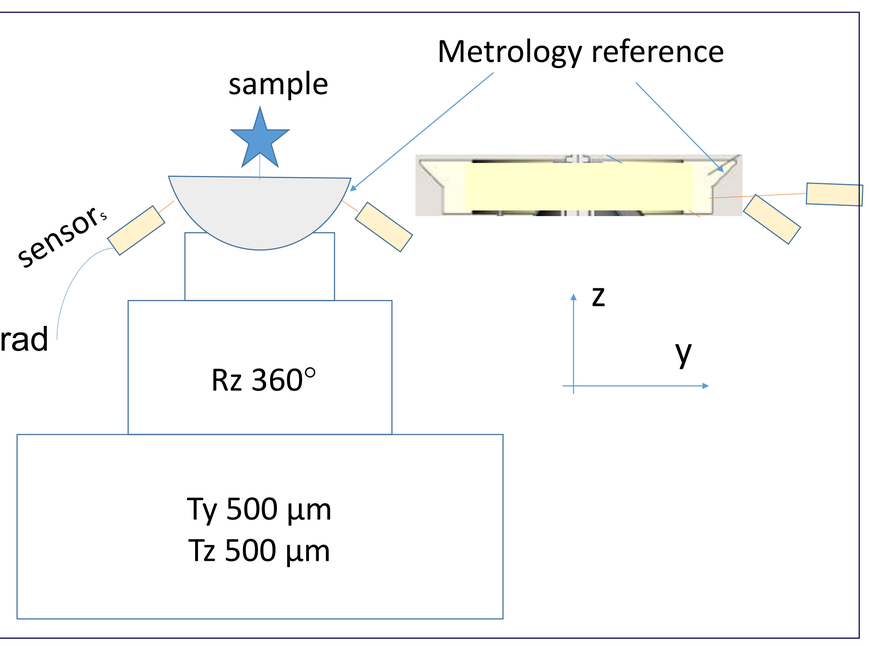
- Two different online metrology systems will be integrated in the two demonstrators, both measuring sample position along translation and rotation motions.



Ultimate tests with X-Rays (tomography experiments) at HZB.

Specifications (under discussion):

- Ty, Tz range: 500 µm
- Rz: continuous rotation
- All dof measured with accuracy of 5nm / 200nrad



* LEAPS: The League of European Accelerator-Based Photon Sources. https://leaps-initiative.eu/

** LEAPS-INNOV is a pilot project submitted in reply to the INFRAINNOV-04-2020 European Union call for the implementation of open innovation and new strategies and tools for partnership with industry within the photon science community. It involves in particular the European synchrotron radiation light sources and free electron laser large-scale research infrastructures.