MicroCT pipeline at the SYRMEP beamline of Elettra

The SYRMEP beamline at Elettra, devoted to hard X-ray imaging (8 - 40 keV), has a multidisciplinary microCT set-up allowing to easily switch from monochromatic to filtered white-beam configuration for different application fields: from pre-clinical to biomedical imaging, from material science to geology and cultural heritage studies. Despite of different set-ups and image acquisition modalities, a common TANGO-based control system allows to manage the procedures of energy selection and positioning of the monochromator crystals, rotation axis alignment, selection of tomographic scanning parameters with different types of detectors and several acquisition strategies (such as extended field of view, automatic acquisition of contiguous volumes, etc...). Users, through the use of a custom-developed GUI (based on Taurus) can manage a hexapod-based sample stage allowing the positioning and alignment of samples with respect to the detector FOV. The GUI is highly intuitive and it allows to select more complex options such as the integration and setup of specific *in situ* devices. MicroCT data are directly converted in HDF5 format and saved on a scratch zone of the Elettra storage system. A preview file, corresponding to a sub-VOI and available short after the acquisition, is automatically generated allowing users to start the slice reconstruction to have an immediate feedback on its quality, scanning parameters choice or sample stability/evolution. This operation is performed using the *SYRMEP Tomo Project (STP)* software to perform the digital image processing required by parallel beam, absorption and propagation-based phase-contrast microCT experiments. *STP* is presently available at the Elettra Scientific Computing group GitHub repository only for Windows 64-bit machines (https://github.com/ElettraSciComp/STP-Gui). The underlying idea of *STP* was, indeed, to let users perform post-beamtime optimization, fine tuning and/or additional tests with common hardware at their home institution. In its present configuration, *STP* is completely executed on the local workstations of the beamline. However, an optimized reconstruction pipeline in which the reconstruction core is performed remotely on a GPU-based HPC server, while the *STP* user interface is kept local, is currently being developed. Such configuration will allow to reduce reconstruction times, possibly by up to an order of magnitude, thus allowing improved performances in high-throughput imaging experiments. The possibility to apply a sample-based lossy compression to raw data (projections) prior to reconstruction will be also discussed.
Complementary to the above described pipeline is the implementation of software solutions for a more efficient online evaluation of the reconstructed volumes: an example of application will be presented, providing almost instantaneous reconstruction and visualization of a selected subset of the whole imaged volume.
A crucial step in the pipeline at SYRMEP is the possibility to perform a preliminary data processing (filtering, segmentation) on reconstructed data. To that aim the custom-developed *Pore3D* software library is applied. This library is presently available with a wrapper based on the IDL language, but a new Python wrapper is presently under development.

A demo session will show how a zoom microCT experiment is set and conducted at SYRMEP, preliminary examples and results using the new version of *STP* on the Elettra server and the Python wrapper of *Pore3D*. The present bottlenecks in the microCT pipeline at SYRMEP will be also interactively discussed.