

# Tomography Reconstruction for Neutron Imaging

## New MuhRec Releases

**Anders Kaestner<sup>1</sup>** and **Christian Vedel<sup>2</sup>**

<sup>1</sup> PSI Center for Neutron and Muon Sciences, 5232 Villigen PSI, Switzerland

<sup>2</sup> ESS, DMSC, 305 Asmussens Allé, 2800 Kongens Lyngby, Denmark

### What is MuhRec?

MuhRec is tomography reconstruction tool developed with the needs for reconstructing neutron radiograph into volume images representing the distribution of attenuation coefficient in an object. We have paid particular attention to include correction methods for artifacts and biases which are characteristic for neutron imaging. The tool is implemented for CPU processing only and supports reconstruction with parallel- and cone-beam geometries.

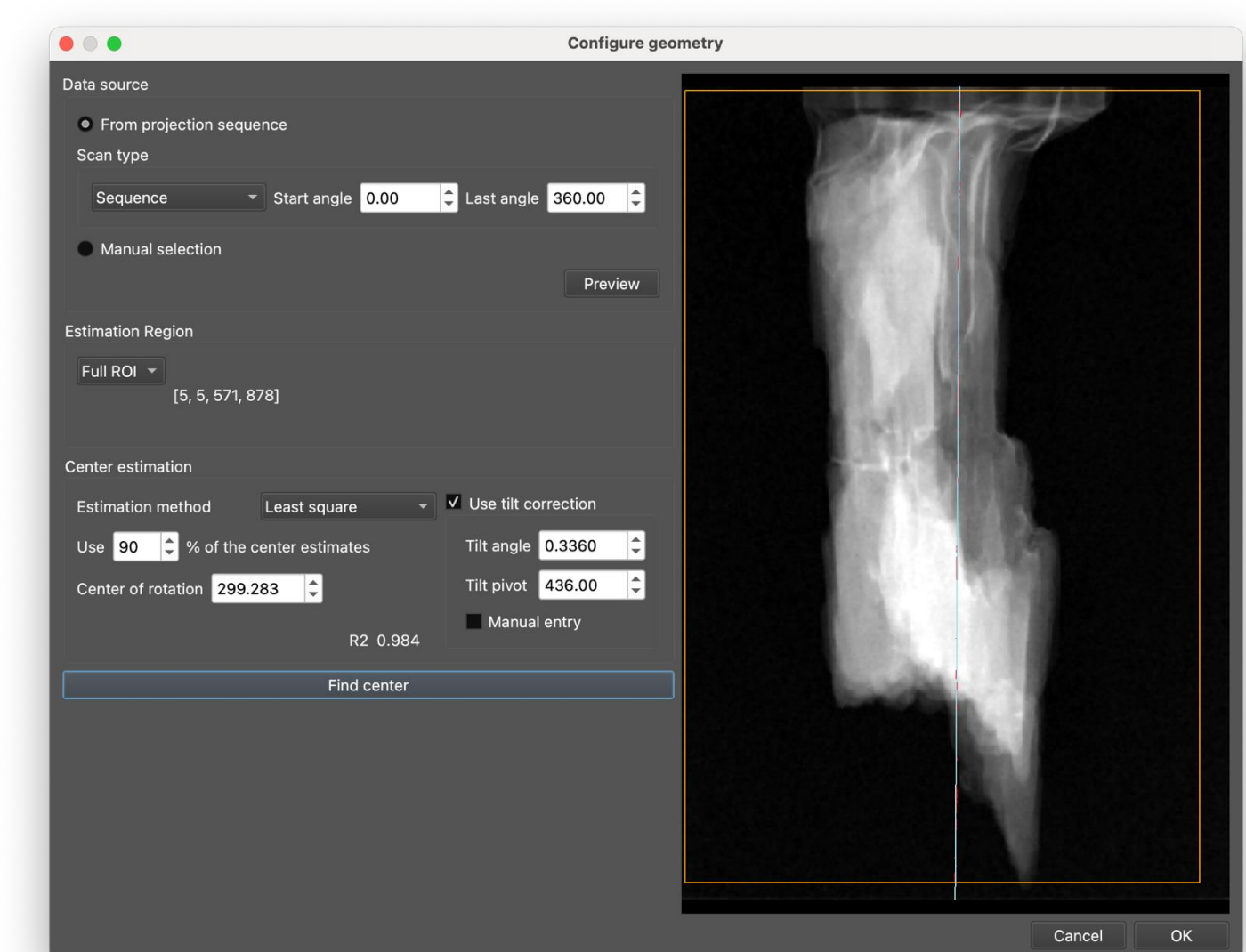
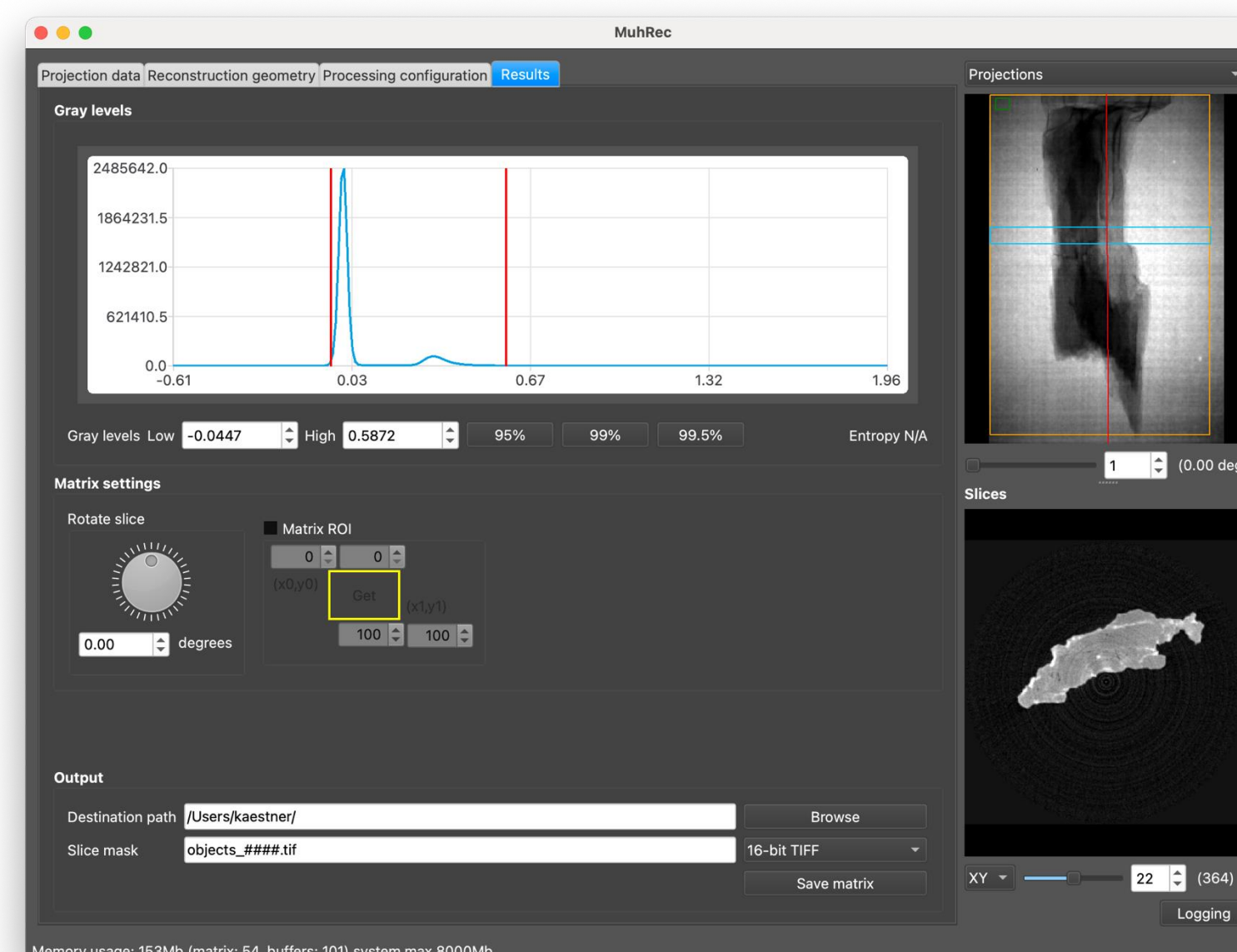


- Pixel size measurement tool.
- File sequence conversion tool.
- Approaches to skip projections.

### Modular configuration

MuhRec is designed with a modular architecture that makes it possible to configure the sequence of preprocessing modules and finally also the back-projection algorithm. The preprocessing modules are equipped with dialogs in the GUI application to facilitate the configuration.

The preprocessing includes modules for normalization, scattering correction, artifact removal etc.



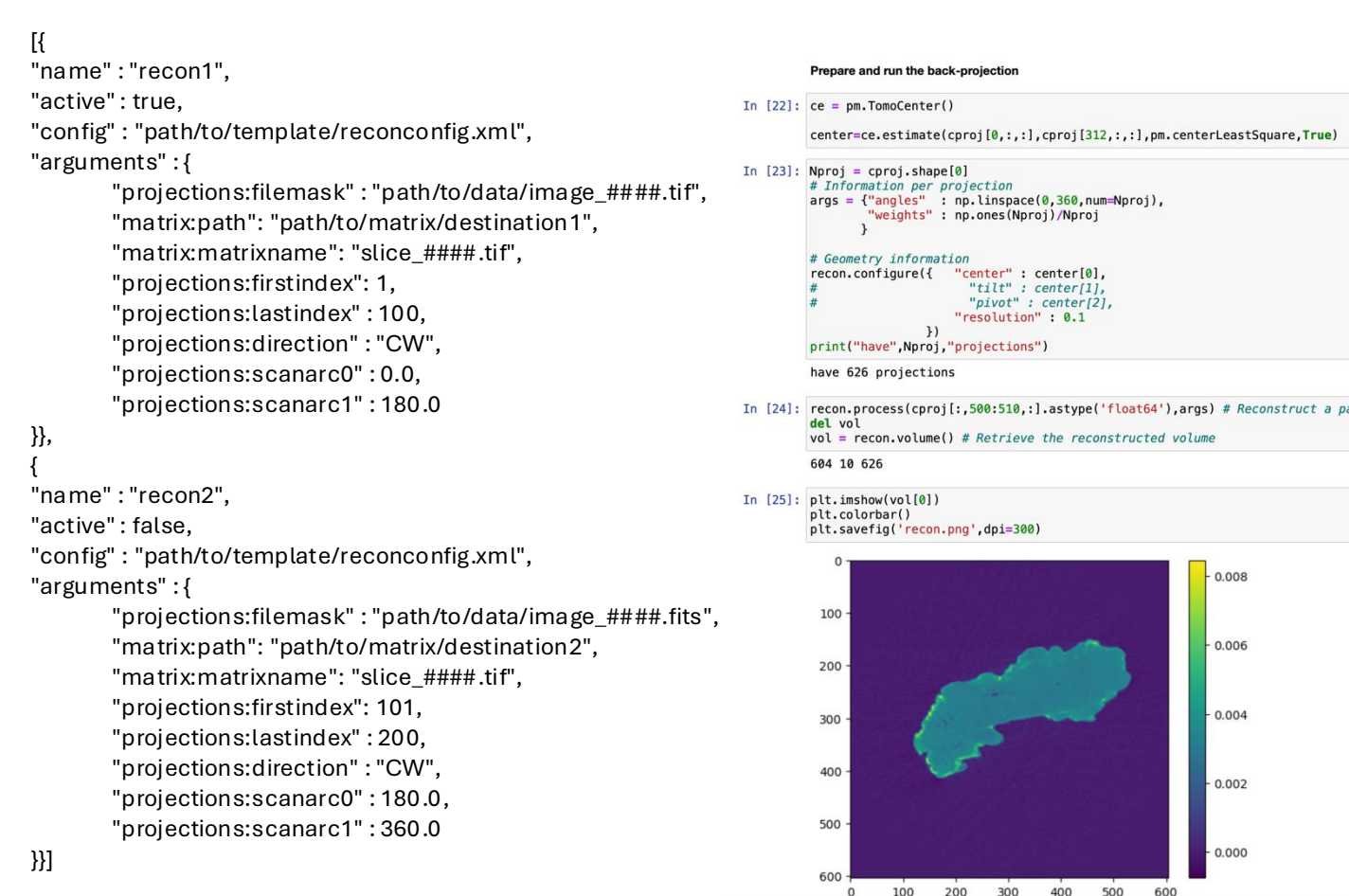
### Scripting support

Besides the interactive workflow with GUI, MuhRec also offers the ability to reconstruct multiple data sets from the command line. There are even prepared scripts for mass-reconstruction of series of tomography based on config files.

With **pyMuhRec**, it is also possible to import the core functionality as python modules which allows reconstructing the data in a python workflow. Some Jupyter notebooks are provided as examples for this option.



- Reconstruction from command line.
- Batch reconstruction using task lists.
- Python bindings of algorithms.



### Modern software engineering

An important part of modern software development is a reliable build system, using a repository, very important continuous integration which includes automatic building and testing when the sources are updated on the remote repository. The code supports C++20 and uses Qt6.8.2 for the GUI. All is build using a combination of CMake and Conan as packet manager.



- Unit tests
- Automatic build
- Multi-platform

### Improvements in the new release

The current release provides improved processing speed and quality. There also a great number issues that have been addresses to provide an overall more stable application with improved user experience. Installers were also added to both GUI application and pyMuhRec. In the current release we have also focused on sustainability, which includes a thorough clean-up of the entire code-base, revised build system and a growing set of unit tests.

