



Elettra Sincrotrone Trieste



Novel and flexible data analysis framework combining real-time interaction and remote computing resources: Software for Tomographic Processing (STP3)

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Modular Adaptive Processing Infrastructure (MAPI) [1] is a comprehensive software suite designed to streamline and enhance data analysis workflows in scientific research laboratories. MAPI selects and integrates multiple frameworks and toolkits into a web-based platform, offering a highly modular and adaptable solution for diverse data analysis requirements. By leveraging cloud computing, edge-computing, and high-performance computing (HPC) capabilities, MAPI supports distributed processing, making it suitable for various beamlines and data processing labs. We showcase MAPI's application through the implementation in the X-ray Computed Tomography (CT) beamline, resulting in the system for tomographic processing (STP3).

Modular Adaptive Processing Infrastructure at a glance

- Modular Adaptive **Processing Infrastructure**
- **Web-based platform**
- **Data analysis workflows**
- Highly **modular** and **adaptable** solution

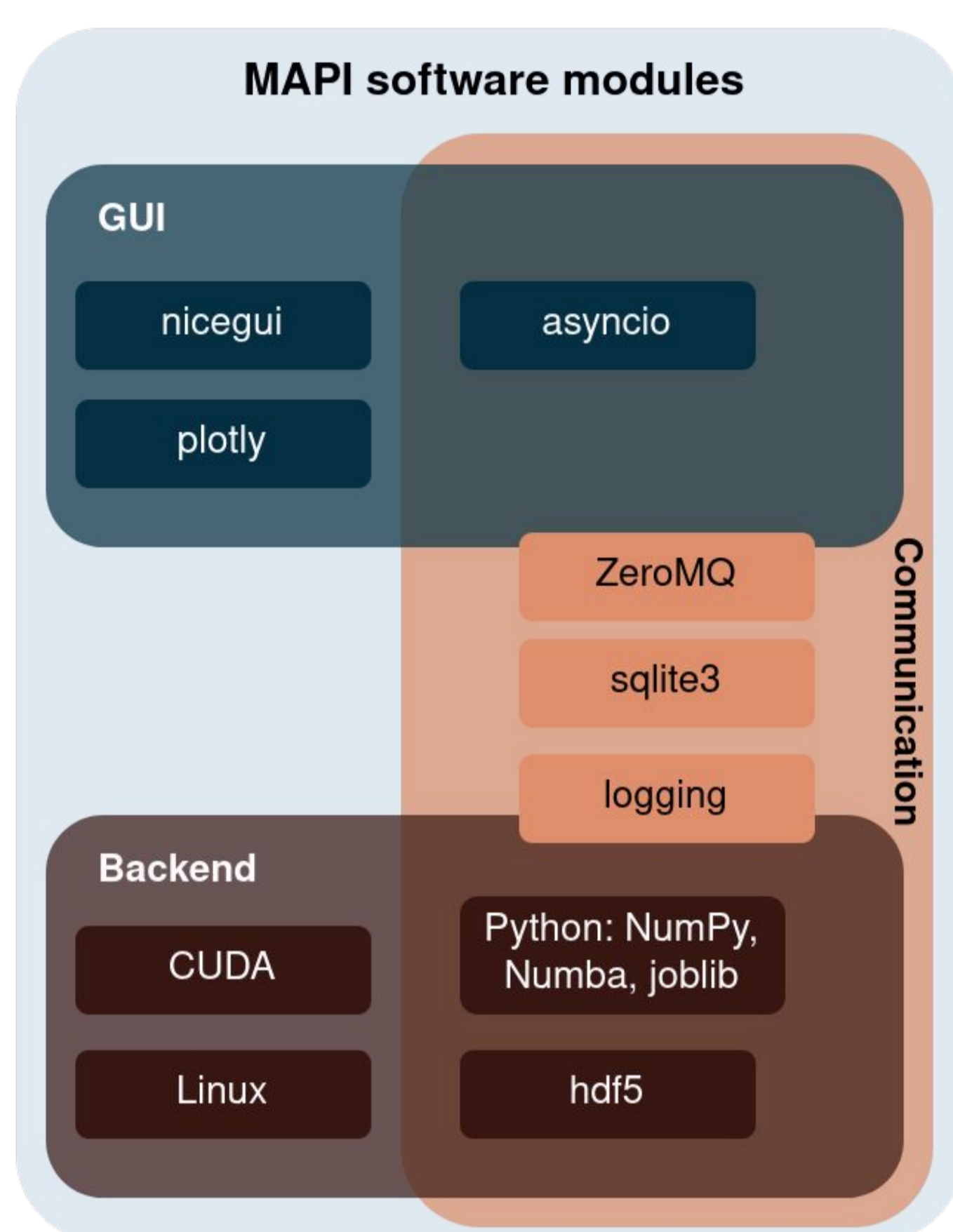
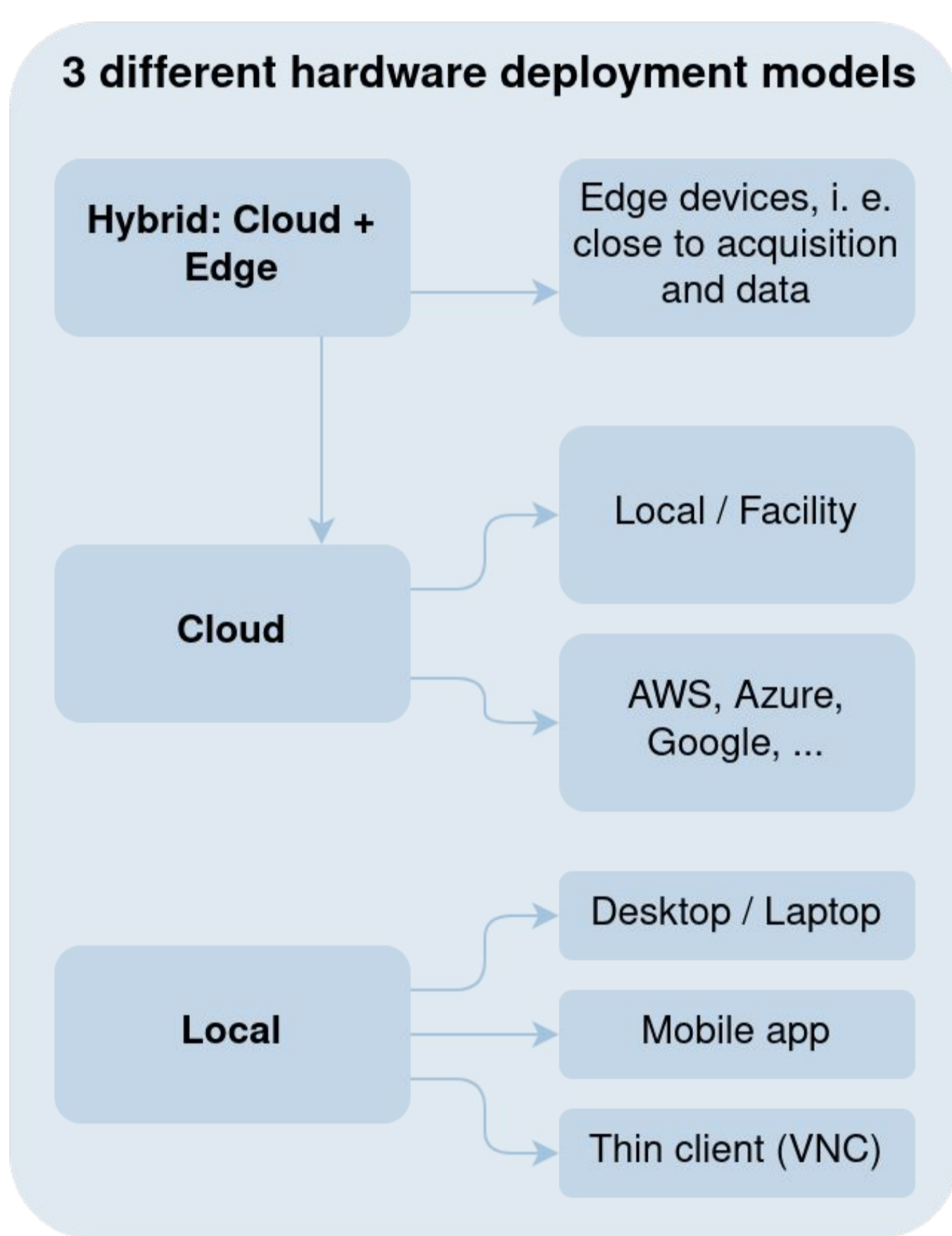


Figure 1: (Left) Three different hardware deployment models are foreseen. (Right) Overarching technologies used in MAPI. Technologies in the communication layer are the ones responsible for the modular and distributed capabilities.

System for Tomographic Processing (STP3)

- First application built using MAPI: STP3 for SYRMEP beamline
- **Goal:** external users should finish their beamtimes with processed data
- **Frontend:** two website applications communicating with the database
- **Backend:** significantly upgraded version of a desktop application that has been used previously (Python2 -> Python3, etc.) [2, 3]

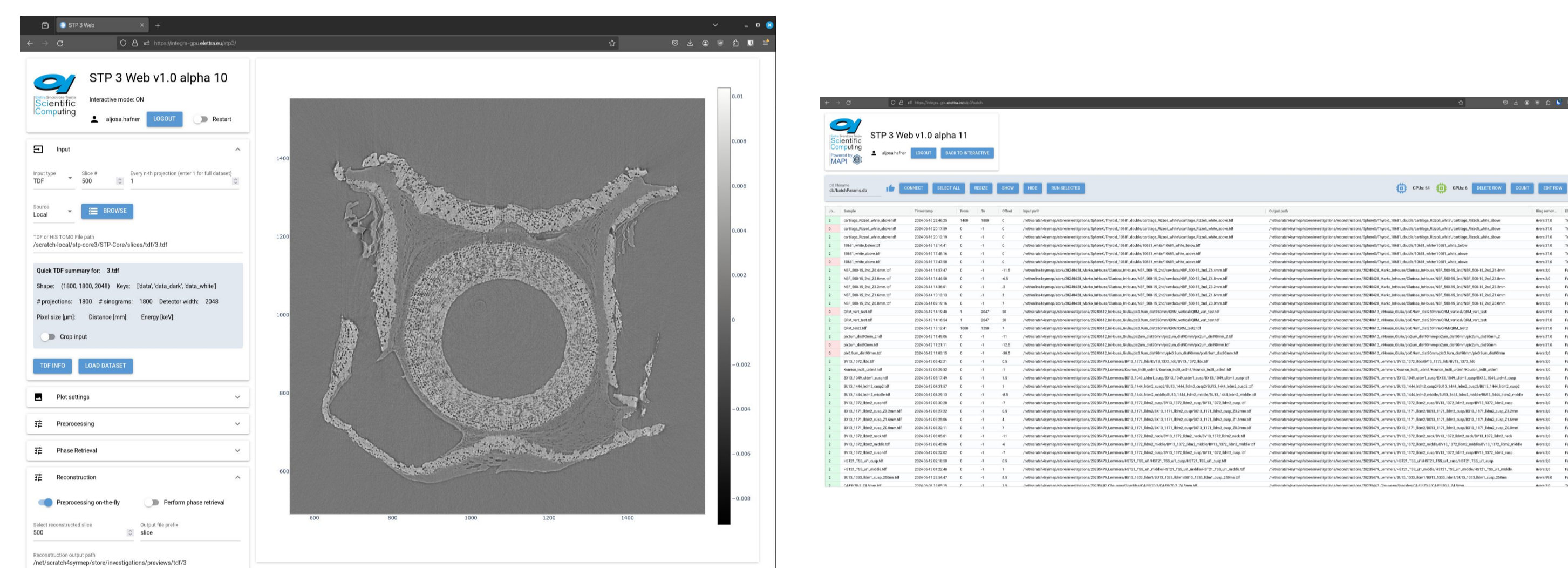


Figure 2 (top): Screenshot of the two frontend applications. The user interacts only with these two websites, allowing for a seamless usage of the whole processing pipeline.

Figure 3 (bottom): Schematic representation of the STP3 application, its integration to the Elettra's user management system VUO and how the user interacts with distributed and remote computing resources through the STP3 Web.

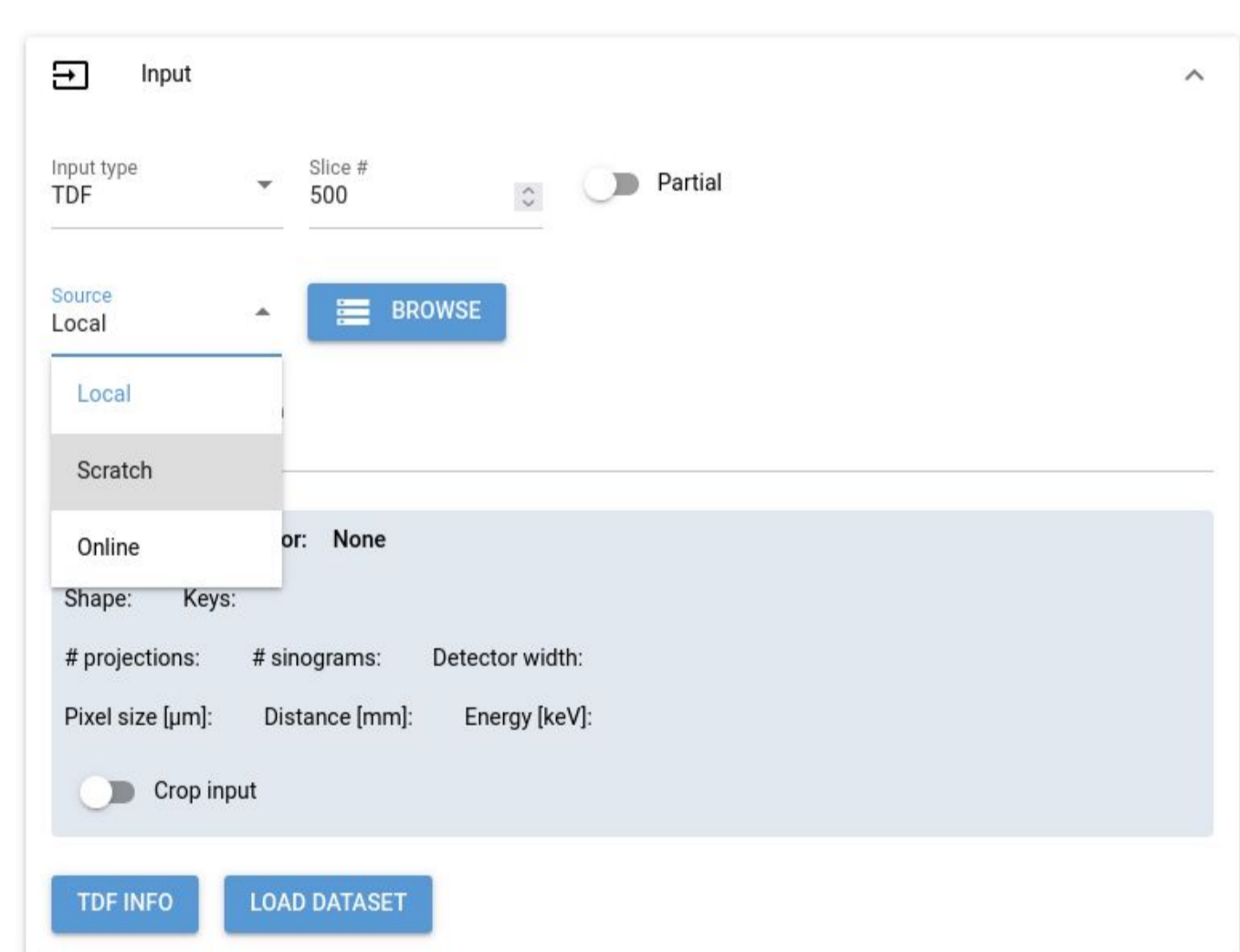
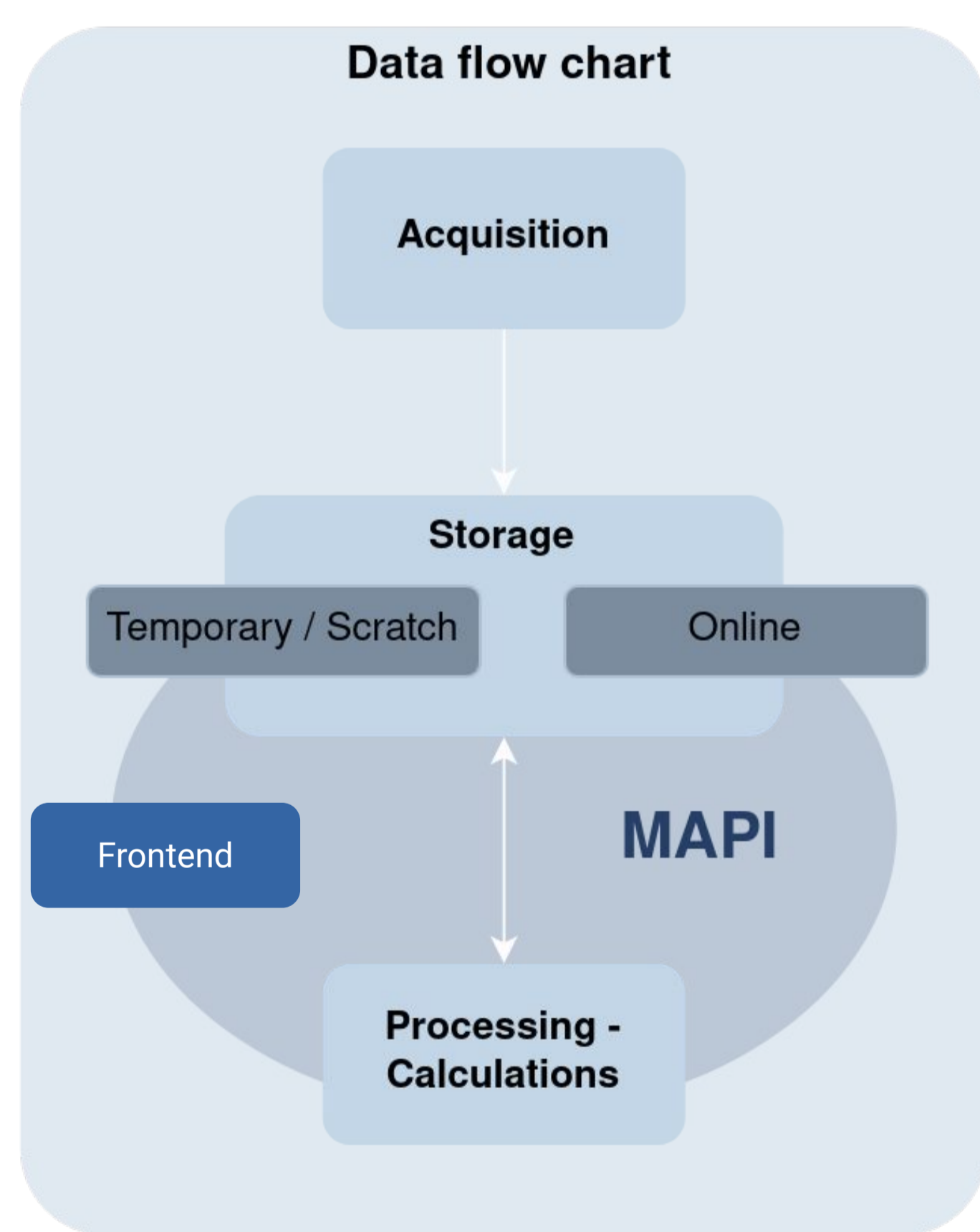
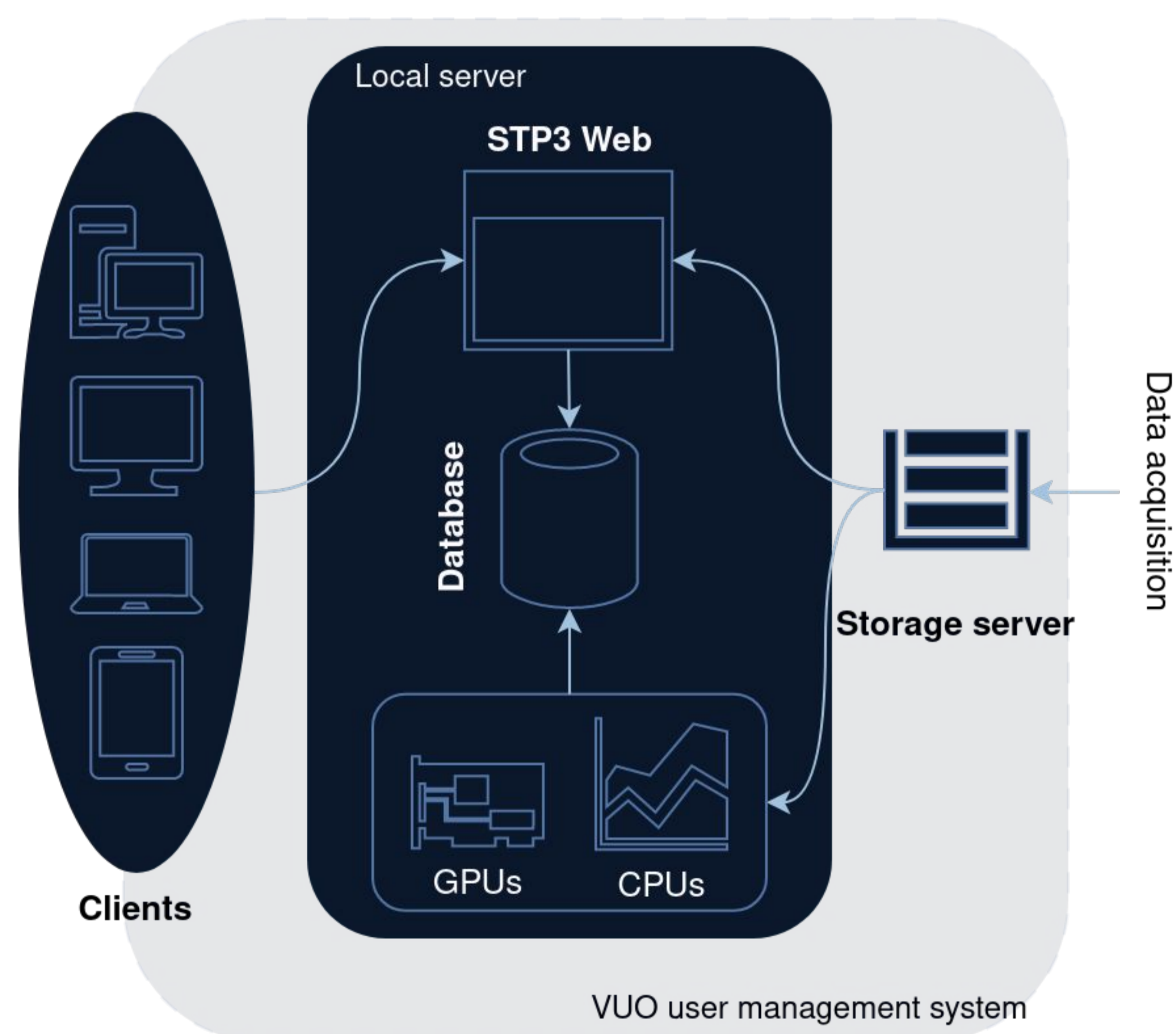


Figure 4: (Left) One of the general data flows of a typical experiment (such is also the case of STP3) with MAPI's role inside it. (Right) Section of the web interface showing the easy and straightforward selection of the data source.



Summary: All SYRMEP CT data processing works with MAPI now.

- Users leave beamtimes **with processed data**
- Tight **VUO (user management) integration**
- **Friendly** enough to be readily used by **external users (already >15)**
- **We are open for collaborations!**

Statistics (from May 7 to July 12, 2024):

- **868** CT datasets processed (30 GB each)
- **52 TB** of data I/O
- **>600%** improvement in overall speed compared to the previous system
 - reconstruction from 130' to <20'
 - other manual processes more

[1] A. Hafner and G. Kourousias, Modular Adaptive Processing Infrastructure (MAPI) 2024 (in preparation)
 [2] F. Brun et al., (2015) Fundamenta Informaticae, 141 (2-3), pp. 233-243, DOI: 10.3233/FI-2015-1273
 [3] F. Brun et al., (2017) Advanced Structural and Chemical Imaging 3:4, DOI: 10.1186/s40679-016-0036-8

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