Current and future developments of European XFEL scan tool Karabacon

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Introduction

User experiments at synchrotron and free electron laser sources typically require longer duration data acquisition while synchronously moving several actuators and motors. Most of the accelerator control systems contain scan engines and tools (for example 1. - 4.) facilitating such experimental data collections. At European XFEL, the so called scan tool "Karabacon" has been developed, and successfully used [5]. It is an extension of the Karabo [6] control system, and includes:

- Graphical user interface (Fig. 1.) with device selection tables, scan configuration and control tools, real time plots, scan history and log view.
- Command line interface (Fig. 2.) to configure and run scans in a programmatic way.
- Basic data analyses tools and extensions (Fig. 3.).
- Scan macros for tailored scan procedures involving other devices and equipment.

General Information

- Abstract motor interface handles motors and devices moved during the scan routine.
- Triggers initiate data generation for various data sources (detectors, cameras, digitizers).
- Data sources represent 1D data, typically used for online preview and alignment.
- Integrated in EuXFEL DAQ.
- Scan functionalities and tools:
  - Absolute and relative step scans in 1 and 2D.
  - Continues fly scans.
  - Scan adjustments: start and stop positions, number of steps, acquisition time, bidirectional (snake) scans, velocity control during a fly scan.
  - Arbitrary scan patters available via external patter retriever.

Graphical User Interface

- Device definition and selection via table elements.
- Scan configuration and validation panel.
- Realtime 1 and 2D plot with motor and data source selection.
- Scan history table with executed scans. Each entry in the table contains scan meta data and buttons to repeat a scan and plot results.
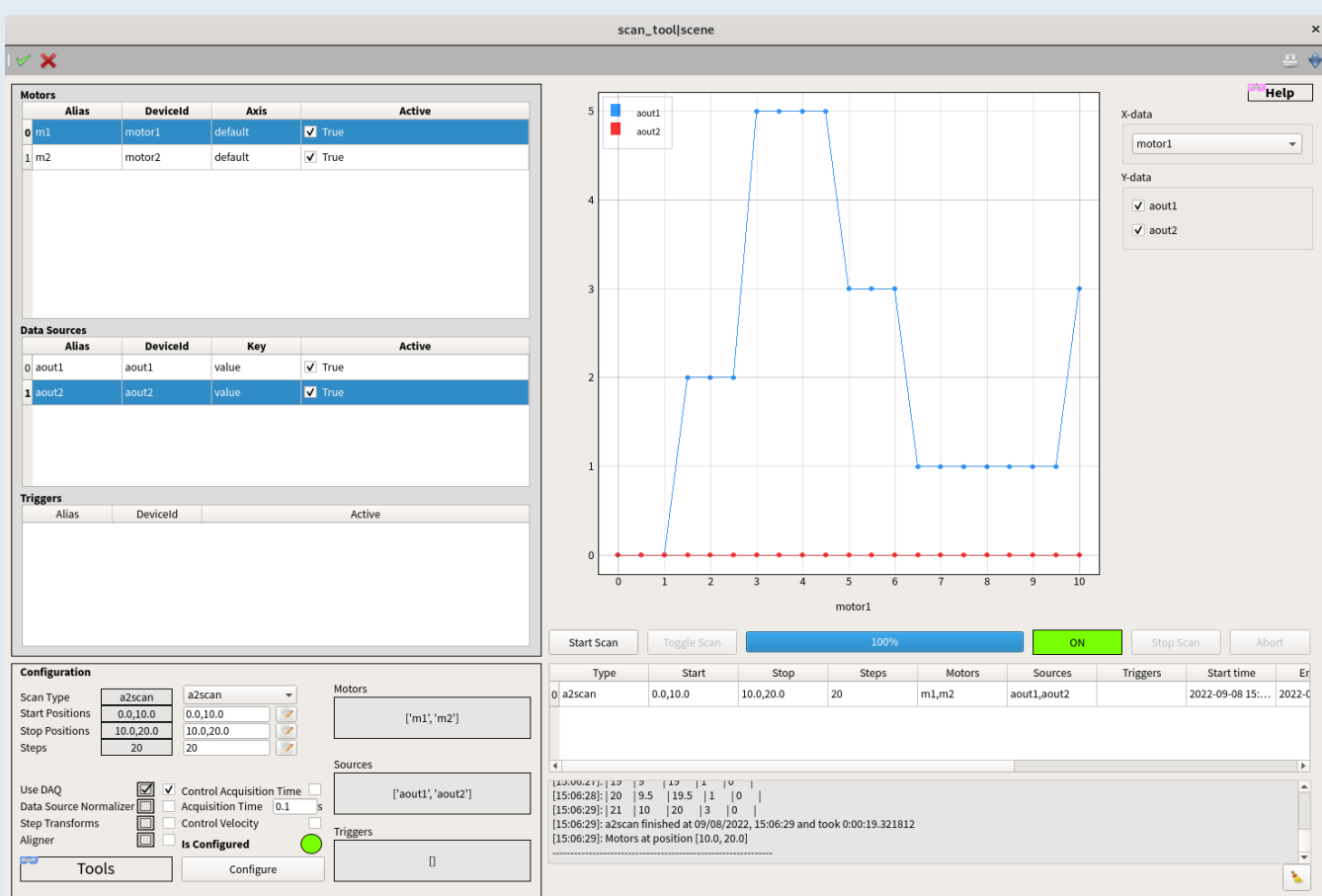

Fig. 1. Graphical user interface of Karabacon

Command Line Interface

- Based on Ipython shell provides standard python interface and libraries.
- Mimics the functionality available via main GUI.
- Allows to access and control other Karabo devices.
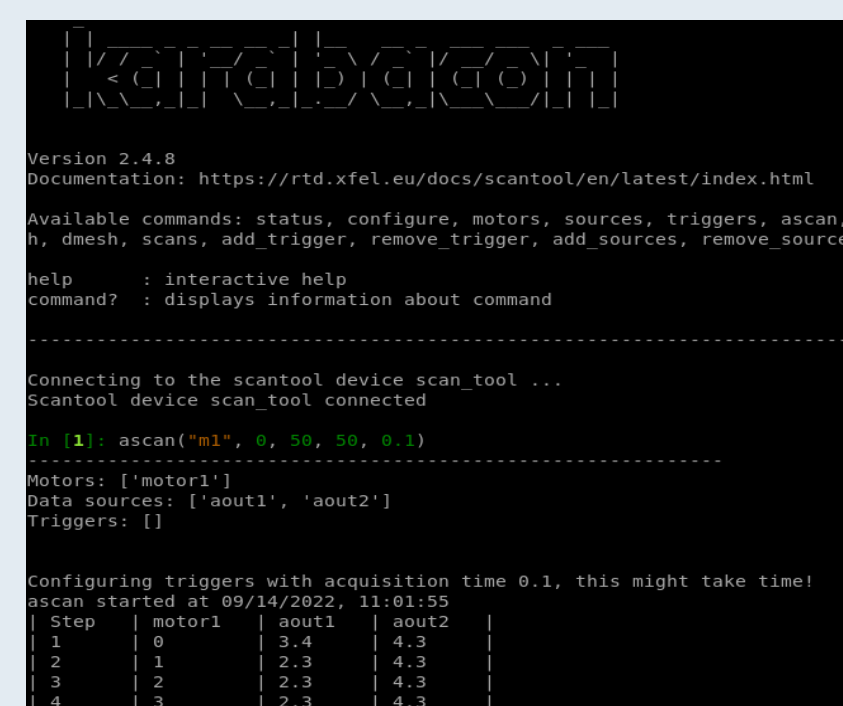- Extended scans via imported user scripts.

Fig. 2. Command Line Interface: karabacon

Extensions and Additional Tools

- Aligner extension estimates basic plot characteristics (min, max, center, step, peak, valley) and allows to move motors to the corresponding positions.
- Data source normalizer redefines data source output and motor step transform extension converts motor positions based on the user defined equations.
- External pattern retriever allows to obtain custom scan patterns (tilted grids, patterns from user specified numpy or text files).
- Currently a new device selection widget has been develop and will replace the table elements for fast and easy device definition. Widget includes device definition tree and a dialog that lists all available devices in the topology, provides filtering and allows by double clicking on the device name add corresponding device to the scan environment.
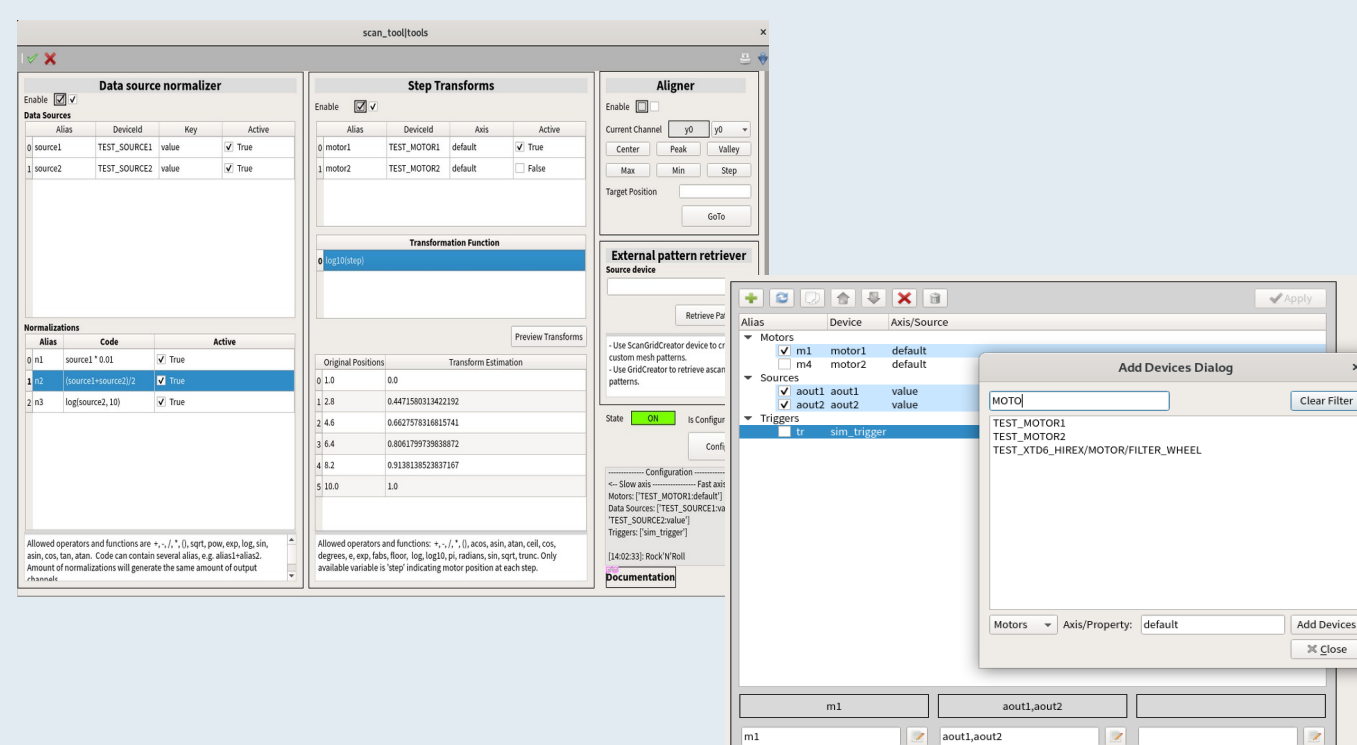

Fig. 3. a) Scan tool extensions b) Device selection widget

Summary

EuXFEL scan tool Karabacon is used daily for instrument alignment and experimental data acquisition. Graphical user and command line interfaces together with extensions provides an integrated scan environment. Upcoming developments include additional data analysis tools, enhanced scan history with scan templates and improved graphical user interface.

References

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