ÚSTAV TECHNICKÉ A EXPERIMENTÁLNÍ FYZIKY
ČVUT V PRAZE

Acquisition Software

Status overview - June 23, 2020

Developed and prepared by Petr Mánek and Lukáš Meduna

Long-term goals and vision

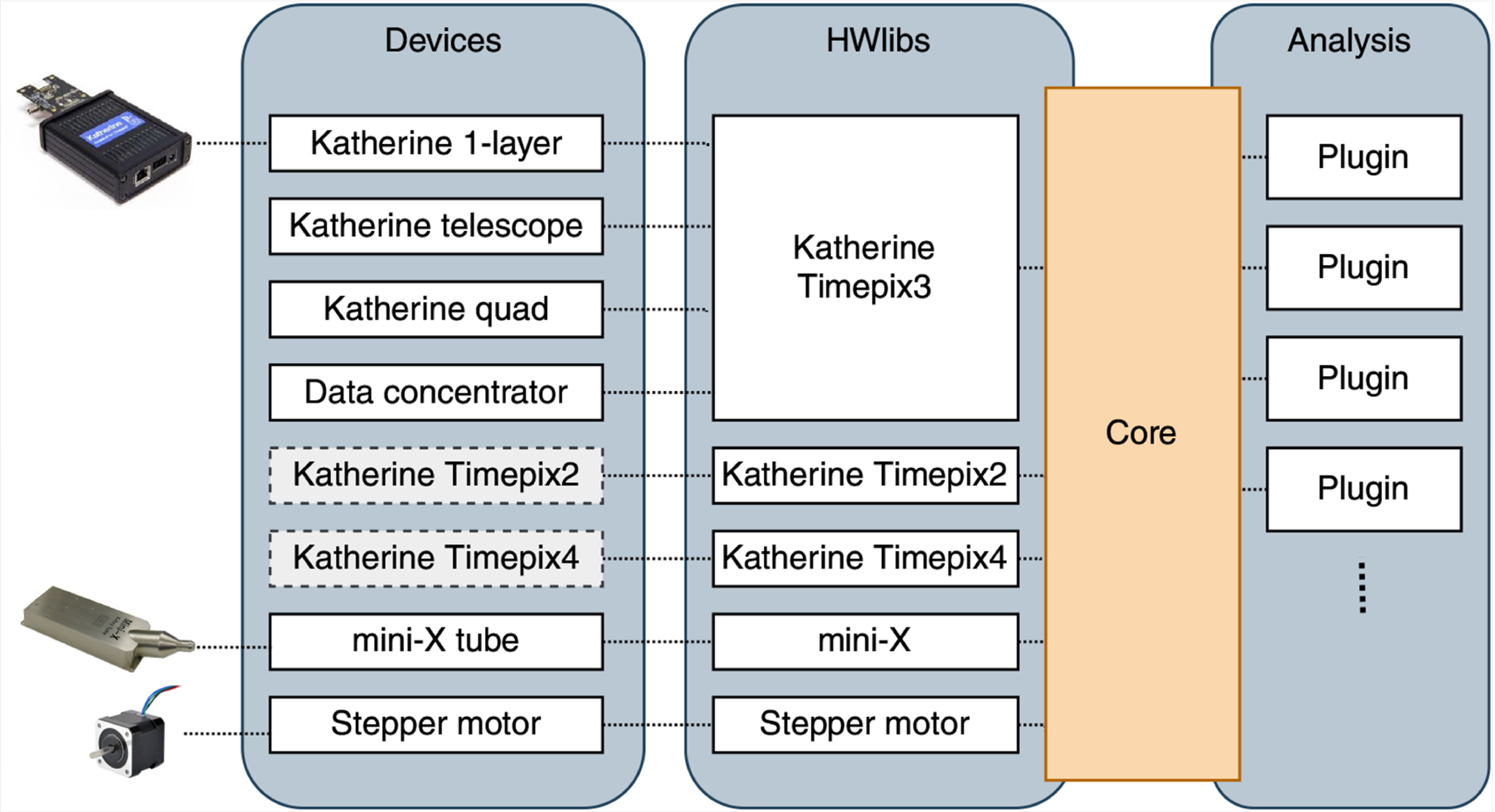
- Fast, reliable and extensible SW for acquisition
  - Fast = get the maximum speed (even from upcoming TPX4)
  - Extensible = new HW won't need complete rewrite (only new HWlib)
- Suitable for:
  - Short measurements (e.g. test beams, calibration)
  - Long and remote measurements (e.g. ATLAS)
  - Demonstration purposes (e.g. conferences)
- Support for Windows, macOS, Linux guaranteed
- Acquisition scripting

Goal 1: Katherine Timpix3 acquisition

- GUI to control acquisition, view and store results
    - Simple - start / stop acquisition
    - Advanced - DACs, Bias, acquisition mode, etc.
- Energy calibration, timewalk correction and clustering
- Support for all modes of TPX3 (ToA & ToT, ToA only, Event count & iToT)
- Live preview window
- Save data to file as hits or clusters in text or binary format (MM format)

Architecture

- Modern C++, Qt, plugins
- HWlibs can be written for wide variety of devices
  - TPX2, X-ray tube, etc.
- Motivation: separate data code from HW code → Core
  - Core manages devices through HWlibs
  - Physicist (you 😉) only write analysis plugins that use Core
- Analysis can request 2 levels of device access:
  - Data access: read hits, clusters, coincidences
  - Control access: start or stop acquisition, change configuration


Devices
HWlibs
Analysis
Katherine 1-layer
Katherine telescope
Katherine quad
Data concentrator
Katherine Timepix2
Katherine Timepix4
mini-X tube
Stepper motor
Katherine Timepix3
Katherine Timepix2
Katherine Timepix4
mini-X
Stepper motor
Core
Plugin
Plugin
Plugin
Plugin

Current state

- Core fully implemented
  - Registers of HWlibs and Analysis plugins available
  - Responds to (dis)connected devices
  - Correctly gives data/control access to analyses upon request
  - Facilitates start/stop acquisition commands
  - Manages hit data flow (up to ~420 MHit/s on a laptop)
  - Shuts down gracefully when the program is terminated with acquisition in progress

Current state

- Katherine + Timepix3 HWlib is functional for ToA & ToT mode
  - Sends configuration, control commands
  - Decodes hit data during acquisition
- Timepix3 file device HWlib is working (reads data from files)
- File I/O fully implemented: can read/write hits and clusters in text/binary format

Next steps

- Finish remaining pixel modes of Timepix3
- Clustering - reuse Petr's / Lukáš's algorithms
- Core hardening and robust testing (simulate errors, attempt to break things, add extra checks)
- Documentation
- Prepare GUI (architecture, layout user testing, etc.)
- Data storing plugin
- Reading / saving of configuration (incl. copying of Burdaman settings)

Questions? Suggestions? Want to join us?

- We appreciate your feedback
- Any thoughts about future use cases are welcome!
- What devices (apart from TPX3 and X-ray tube) are used during measurements?

Thank you for listening!