DAQ system based on TANGO, Sardana and PandABox for Millisecond Time Resolved Experiment at the CoSAXS beamline of MAX IV Laboratory

V. K. Silva, A. Freitas, R. Appio, B. Ahn, M. Lindberg, A.E. Terry, T.S. Plivelic
MAX IV Laboratory, Lund, Sweden
Contact information: vanessa.silva@maxiv.lu.se

INTRODUCTION

MAX IV is the first 4th generation synchrotron of the world. CoSAXS beamline is located at the 3 GeV ring featuring high photon flux ~ $10^{12} - 10^{13}$ ph/s and small X-ray spot size. These characteristics enables fast image data acquisition and, consequently, high time resolution experiment to be performed.

CoSAXS supports a dual detector system positioned inside a vacuum vessel for simultaneous SAXS and WAXS data acquisition. SAXS detector is a Eiger2 4M, a hybrid pixel X-ray detector. WAXS detector is a Pilatus 2M in a L-shape configuration. The current available sample environment at the beamline offers either an IR or an UV laser as a perturbation source for the time-resolved experiment.
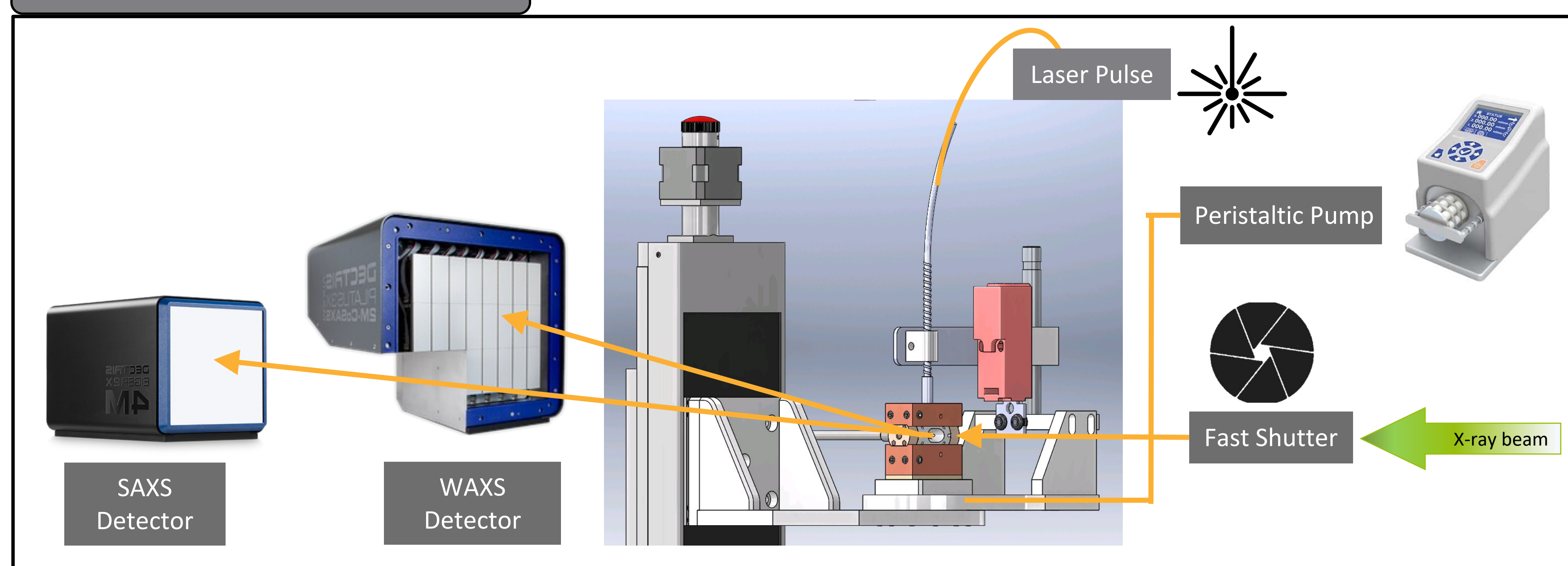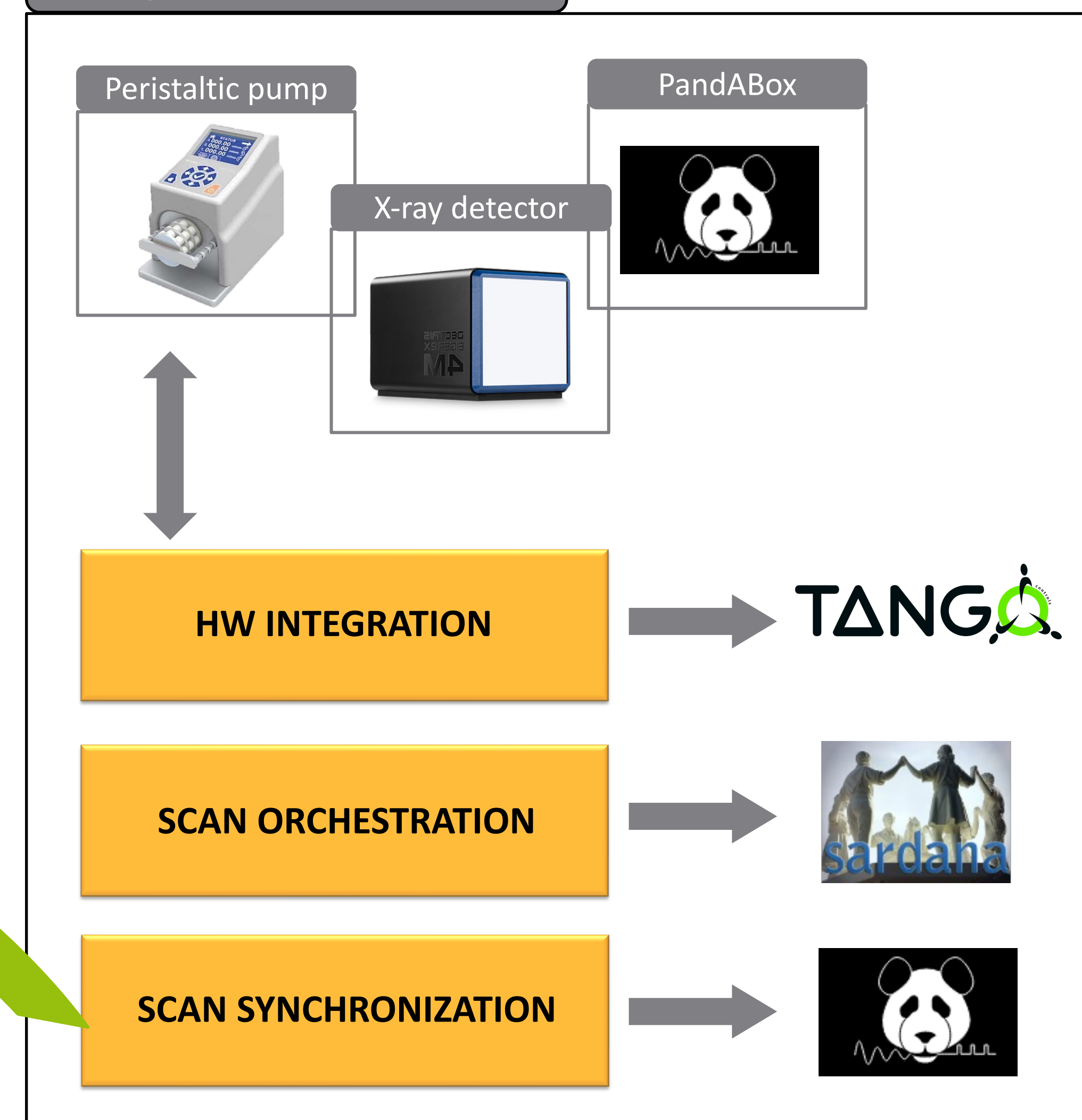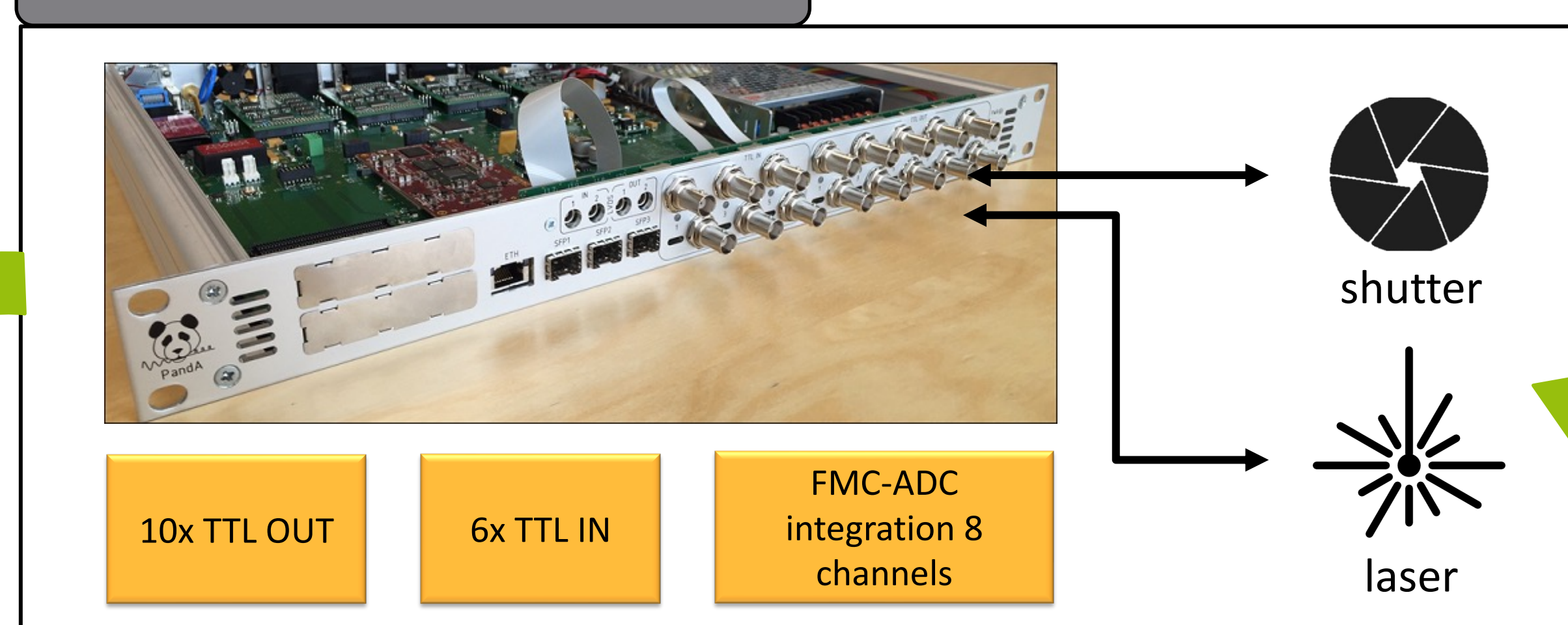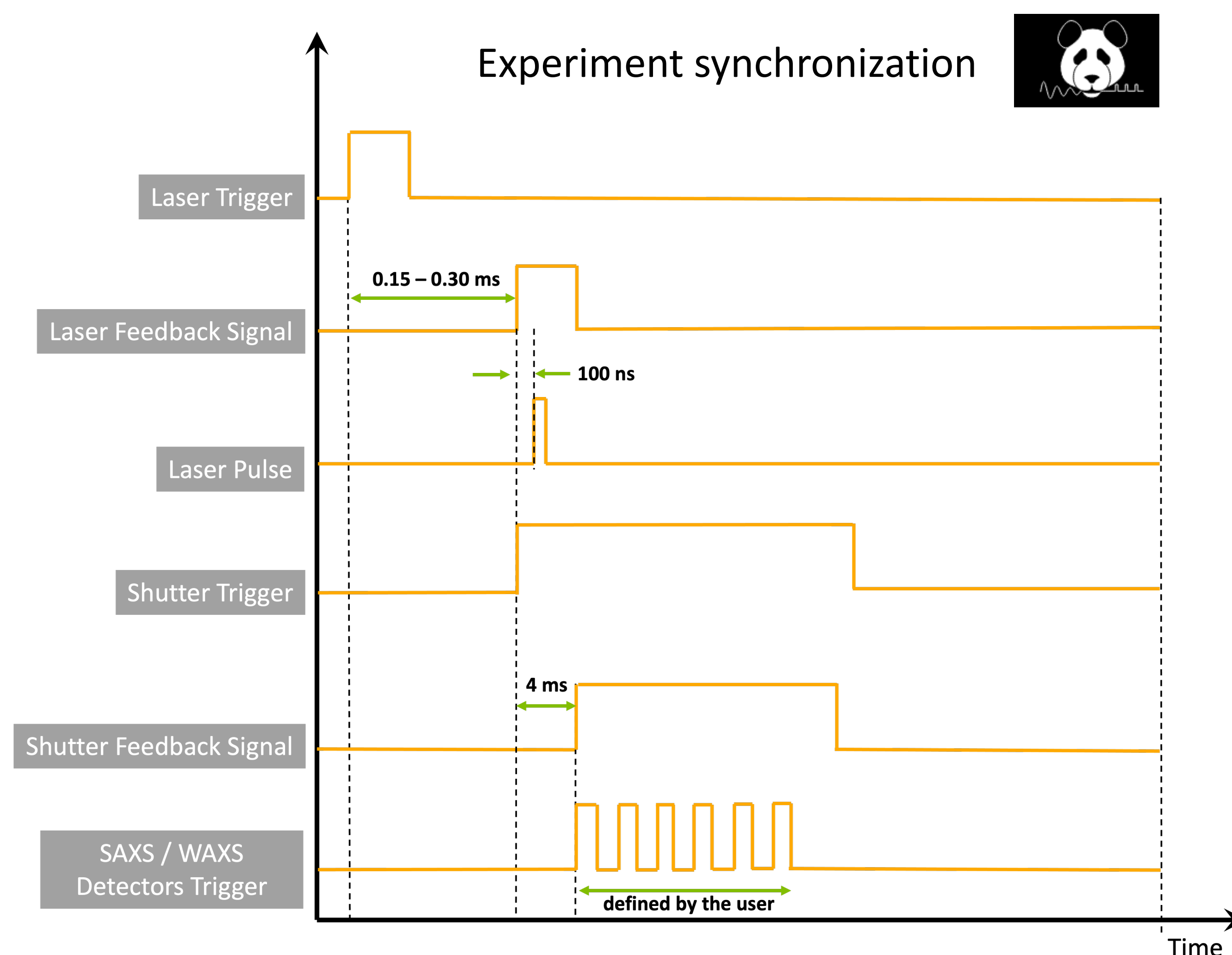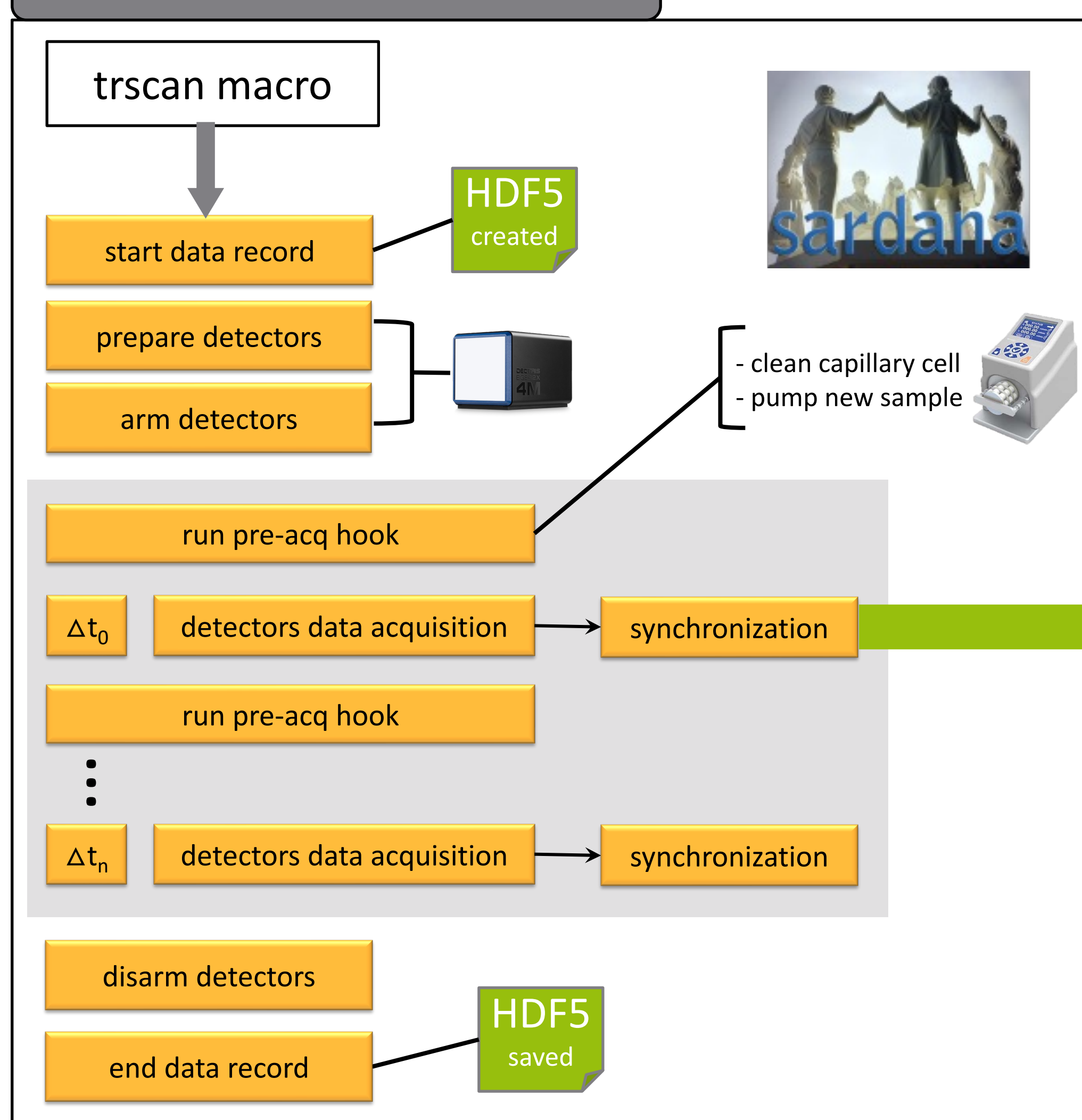

MAX IV Laboratory

CoSAXS beamline

Experimental Setup

- Laser Pulse
- Peristaltic Pump
- Fast Shutter
- X-ray beam
- SAXS Detector
- WAXS Detector

System Overview

- Peristaltic pump
- X-ray detector
- PandABox
- HW INTEGRATION → TANGO
- SCAN ORCHESTRATION → sardana
- SCAN SYNCHRONIZATION

PandABox

- shutter
- laser
- 10x TTL OUT
- 6x TTL IN
- FMC-ADC integration 8 channels

Time-resolved scan orchestration

- trscan macro
- start data record — HDF5 created — sardana
- prepare detectors
- arm detectors
  - clean capillary cell
  - pump new sample
- run pre-acq hook
- Δt_0 detectors data acquisition → synchronization
- run pre-acq hook
- Δt_n detectors data acquisition → synchronization
- disarm detectors
- end data record — HDF5 saved

Experiment synchronization

- Laser Trigger
- Laser Feedback Signal — 0.15 – 0.30 ms
- Laser Pulse — 100 ns
- Shutter Trigger
- Shutter Feedback Signal — 4 ms
- SAXS / WAXS Detectors Trigger — defined by the user
- Time

MAX IV Laboratory

MAX IV Laboratory has operated successfully for more than 30 years and is currently operating the new MAX IV synchrotron facility in Lund. Fully developed it will receive more than 2 000 scientists annually, from Sweden and the rest of the world. They will do research in areas such as materials science, structural biology, chemistry, geology, physics and nanotechnology. MAX IV is the largest and most ambitious Swedish investment in national research infrastructure. It is the brightest source of x-rays worldwide, inaugurated June 2016. MAX IV Laboratory is hosted by Lund University.