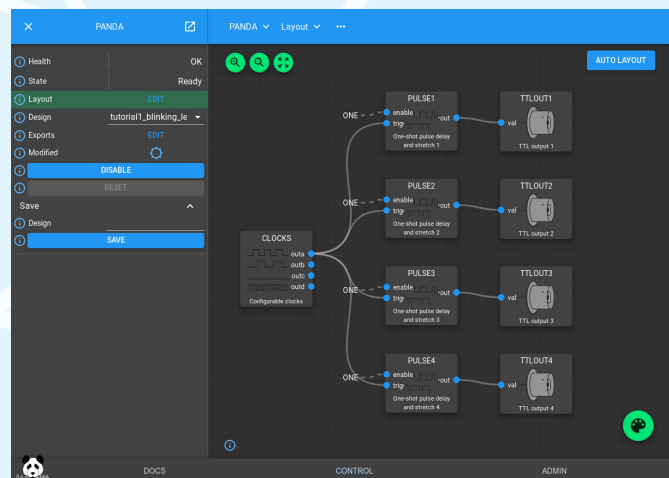# PandABox

Position and acquisition controls system

PandABox is a fully integrated position, acquisition and control system, equipped to process absolute encoder inputs. Designed to meet the requirements of many modern experiments, PandABox can synchronously calculate, control and record the position of multiple hardware components.

PandABox is the result of a collaboration between SOLEIL and DIAMOND to upgrade their position and acquisition processing platforms. PandABox provides a common encoder processing platform based on Zynq 7030 and supports multiple encoder standards. It delivers synchronous triggering, data capture and data manipulation capabilities. Based on Diamond's 'Zebra' and SOLEIL's 'SPEITBOX', PandABox offers various improvements including absolute encoder protocols, higher bandwidth data transfer and greater FPGA resources to ensure the platform is ready for the experiments of the future.

Software

PandABox is programmed through a specially designed web browser GUI. The GUI offers full access to all of PandABox's functionality via an easy to use block-based design. Each block has a specific function (e.g. trigger creation, logic) and blocks are linked together to create the desired result. Custom blocks can be programmed by the user and uploaded to PandABox to offer even greater functionality. Once programmed, PandABox can be interfaced with beamline control systems (EPICS, TANGO) for day-to-day use.

PandABox is programmed using a block-based design via a web browser GUI.
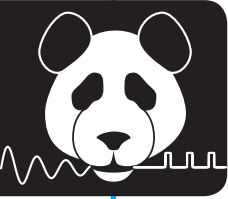
Specifications

- **Absolute and incremental encoder support**
- **Synchronous triggering and data capture**
- **Sequencing and multi-channel position compare**
- **Gigabit data transfer**
- **Easy to use browser-based GUI**
- **Expandable block-based software design**

Specification

I/O

Encoders	4 RS422 input/outputs: Incremental, SSI, BISS, enDat*
TTL	6 in, 10 out
LVDS	2 in, 2 out

Other

Setup	Initial setup via ethernet accessed, web browser based, GUI. Subsequent control can be made via EPICS **
Architecture	FPGA+ARM
FPGA	Avnet picoZed XC7Z030 (125 MHz clock)
SFP	3 channels
Clock source	Internal 125MHz, external via dedicated SMA connector
Ethernet access	Gigabit
Auxiliary	UART, JTAG and USB accessible. Onboard SD card
FMC	1 LPC-FMC connector for expansion (fixed 1.8 V)
Expansion	ADC card † Choice of monitor / control encoder boards ††

Further reading

Hardware user guide: https://www.ohwr.org/project/pandabox-hw/blob/master/PandABox_User_Guide.pdf

GUI: https://malcolmjs.readthedocs.io/en/latest/userguide/quick-start.html

Filesystem: https://pandablocks-rootfs.readthedocs.io/en/latest/index.html

FPGA: https://pandablocks-fpga.readthedocs.io/en/latest

Server: https://pandablocks-server.readthedocs.io/en/latest

* enDat support will be added in a future update.

** TANGO support is currently in development.

† 1MHz 18-bit ADC card. See: http://www.d-tacq.com/acq400ds/acq427elf-advance-product-specification.pdf

†† Monitor cards have their encoder inputs electrically connected to their outputs, enabling PandABox to monitor the encoder signals that pass through. This means the motion controller will still see the encoder, even if PandABox is turned off. The inputs and outputs on a controls card are isolated, allowing the output to depend on other inputs.