

"Panda" : Position and Acquisition processing Platform

A collaboration between SOLEIL&Diamond



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MOCRAF workshop, ICALEPCS 2015, Melbourne, 17 October 2015



"Panda" : Position and Acquisition processing Platform. A collaboration between SOLEIL&Diamond to upgrade ZEBRA & SPIETBOX

- Diamond and SOLEIL context
- The existing platforms, Zebra & SPIETBOX
- Diamond and SOLEIL collaboration
- « Panda » platform

DIAMOND AND SOLEIL CONTEXT



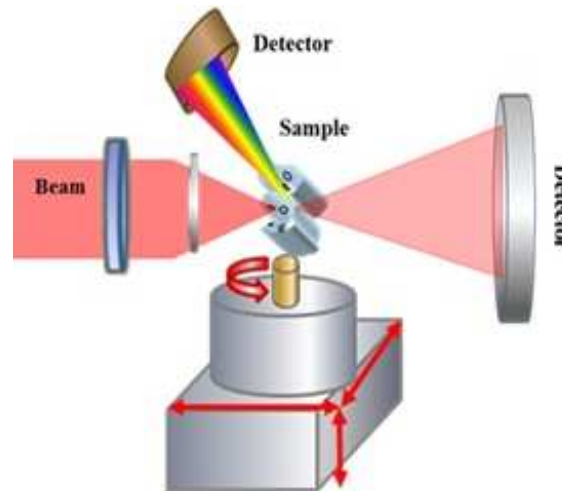
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Objectif

Main challenge for control and acquisition

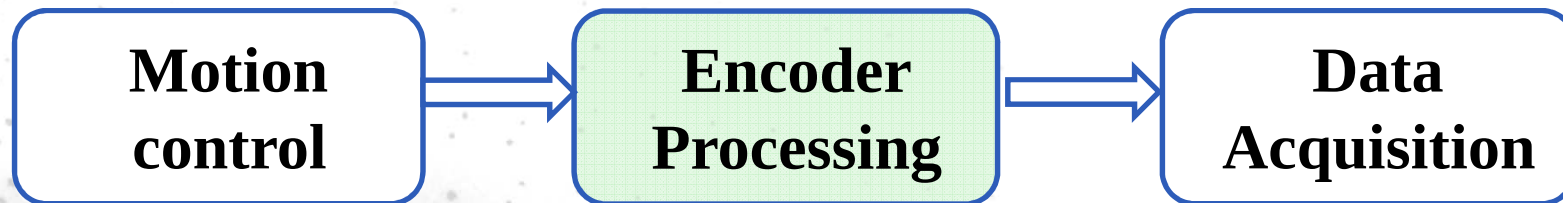
To improve electron beam stability and photon energy accuracy



To synchronize detectors with optics that select photon energy to acquire only useful data

To perform fastest continuous acquisition to save time

- the Panda project aim at **connecting Motion control and data acquisition** to provide a platform for simultaneous and multi-technique scanning applications.



- Panda will provide a encoder processing, common synchronous triggering and data capture platform for simultaneous and multi-technique scanning applications

THE EXISTING PLATFORMS, ZEBRA & SPIETBOX



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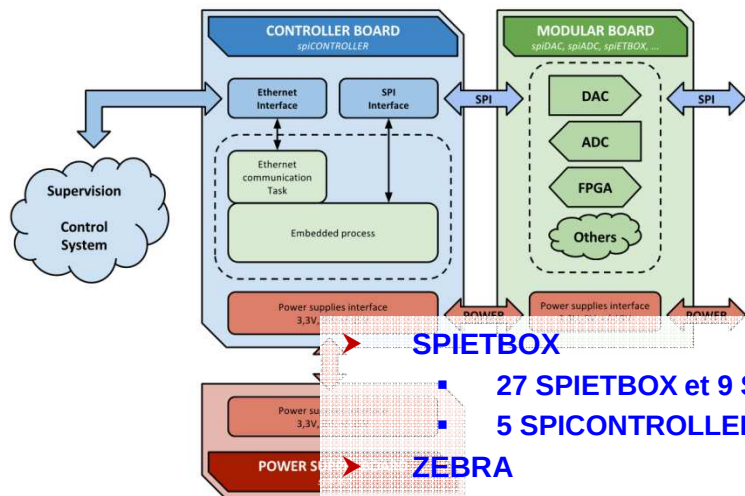
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SPIETBOX & ZEBRA

Processing board for TTL and SSI encoder and delivering triggers

SPIETBOX



SPIETBOX

- 27 SPIETBOX et 9 SPICONTROLLER in operation on beamline
- 5 SPICONTROLLER et 15 SPIDAC in operation on the machine

ZEBRA

- 44 units are deployed at Diamond.
- 20 units are deployed at other facilities (through Quantum Detectors).

SPI BOARD PACKAGE

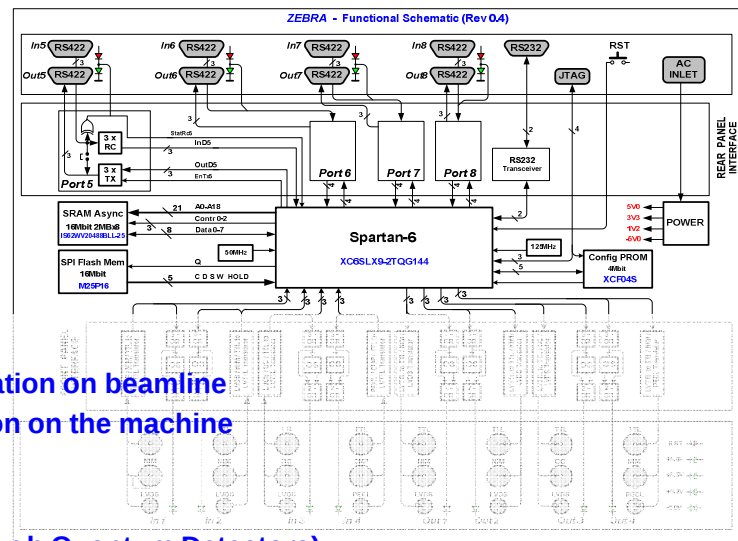
Integrated to TANGO



SPICONTROLLER connected to SPIETBOX

Integrated in a 3U rack

ZEBRA



ZEBRA Architecture

Integrated to EPICS



ZEBRA

Integrated in a 1U Rack



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Hardware interface and Firmware Functionalities

➤ Hardware interface

- Digital inputs/outputs: TTL, LVDS, PECL, NIM, Open Collector
- Incremental and SSI encoder Inputs/outputs
- Input clocks

-- Commun to both platform

--Specific to ZEBRA

--Specific to SPIETBOX

➤ Firmware fonctionnalités

- Adder of 2 TTL Encoder
 - Eccentricity compensation of a mechanical axis (Diffractometer 2C, Monochromator)
- Level translation RS422 to TTL for continuous scan and Flyscan
- Duplicate encoder signal
- Time or Position Based Triggers Generation
- Protocol Conversion
 - Quadrature to PULSE and DIR signals
 - SSI 12 Bits to SSI 25 Bits (Control Box)
- Flyscan / Mapping
 - Position or time based.

➤ SPICONTROLLER & SPIETBOX

- Interface to communicate with Tango and configure SPIETBOX
- « SPI_UDP » : Convert HW trigger to SW trigger.

➤ Zebra

- Position capture
- Data acquisition



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DIAMOND AND SOLEIL COLLABORATION



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PandA (Position and Acquisition) Motion Project

Collaboration between SOLEIL and DIAMOND Electronics group

- Both synchrotrons identify the need to upgrade their encoder processing platform :
 - ZEBRA for DIAMOND
 - SPIETBOX for SOLEIL
- Requirements:
 - Manage FPGA obsolescence,
 - Operational requirements for simultaneous and multi-technique scanning,
 - Support of multiple encoder standards,
 - Increase number of input and output and processing power.
- Both institutes want to develop a solution addressing the same level of requirements:
 - standardize hardware, in order to reduce number of systems which need to be developed and maintained by the support staff.
 - a ready to use and complete solution, in order to install quickly and easily all the hardware and software components.



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PandA organisation

► Organisation

- Collaboration: leadership for development shared between both institutes

DIAMOND	SOLEIL
FPGA – Zynq Processor Design	Hardware Schematic Design
FPGA – Zynq Logic Design	Hardware PCB Layout (*)
Linux Kernel Development	Mechanical design
Linux Application Development	

- Video conference meeting organized every two weeks and all documents shared on a private [Github](#) repository during project development
- Development done under CERN OHL Licence and shared on OHWR (www.ohwr.org) at the end of the project.



ZEBRA



« PandA » Motion project



SPIETBOX



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PANDA PLATFORM

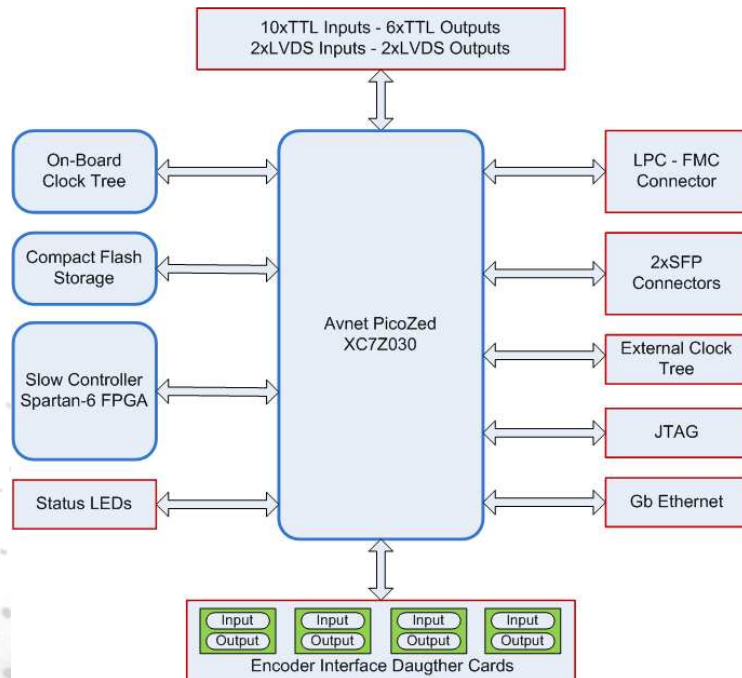
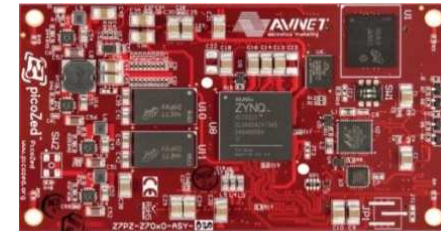


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PandA HW Platform

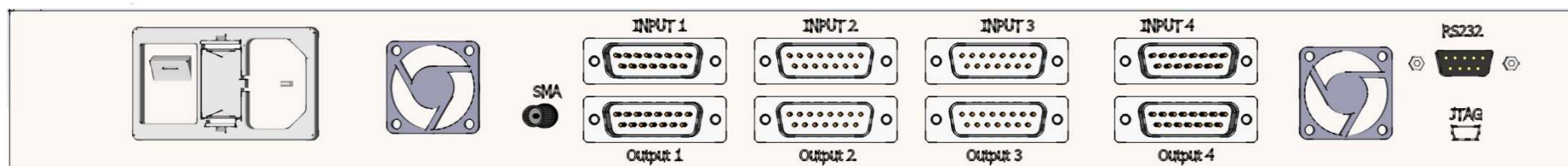
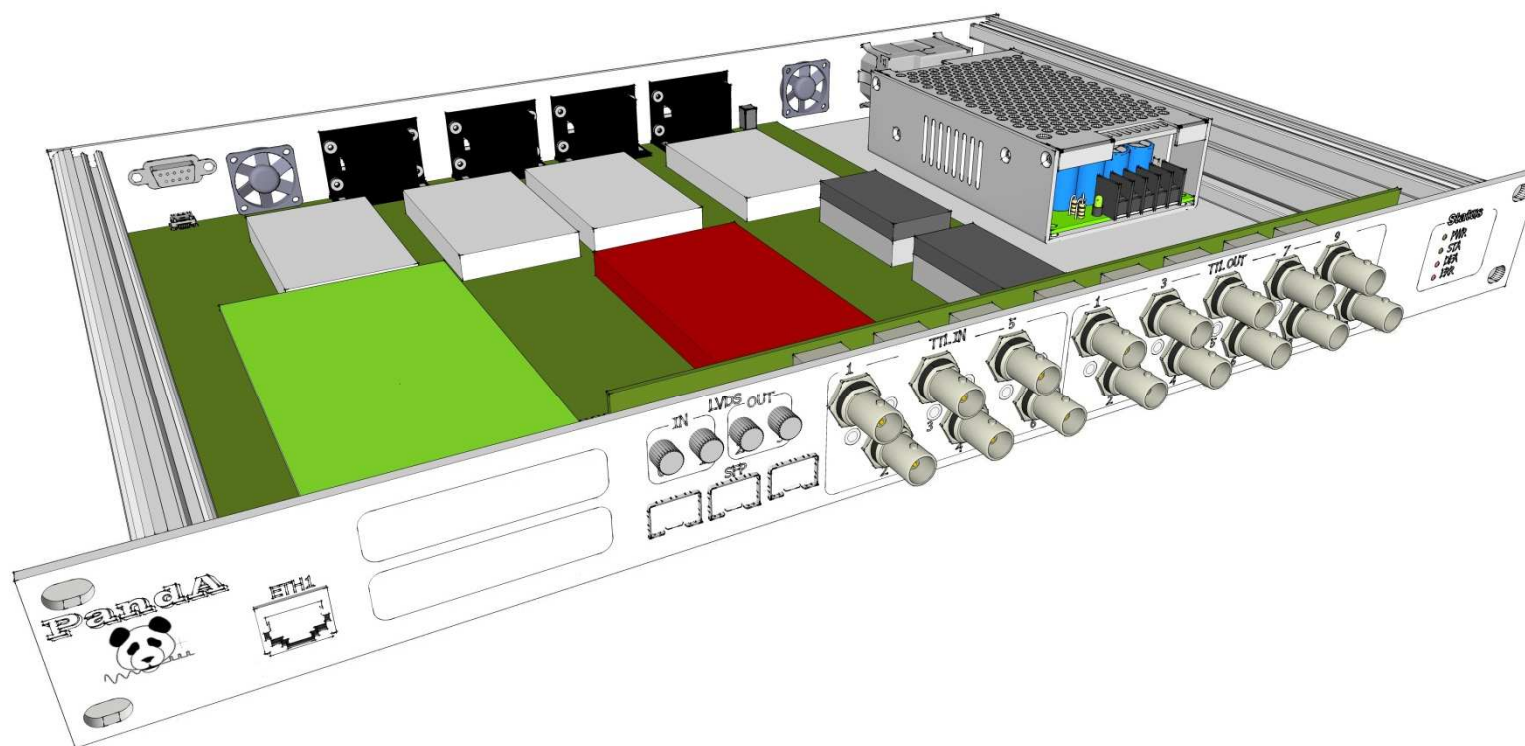
- Platform developed around an off the shelf product: [Avnet PicoZed « Z7030 »](#)
 - SOC ZYNQ
 - Solution selected to upgrade the FPGA in order to:
 - Reduce development time and cost
 - Focus on applications' interface



- HW Architecture around « PicoZed »
 - 4-Channel Encoders Inputs / outputs
 - Multi-Channel TLL and LVDS Inputs/outputs
 - FMC LPC (fixed to 1,8V)
 - On board clock tree
 - 3 SFP (IPBus, Timing, DCC or Custom)
 - 1 Gigabit Ethernet for Control and DAQ

HW ARCHITECTURE

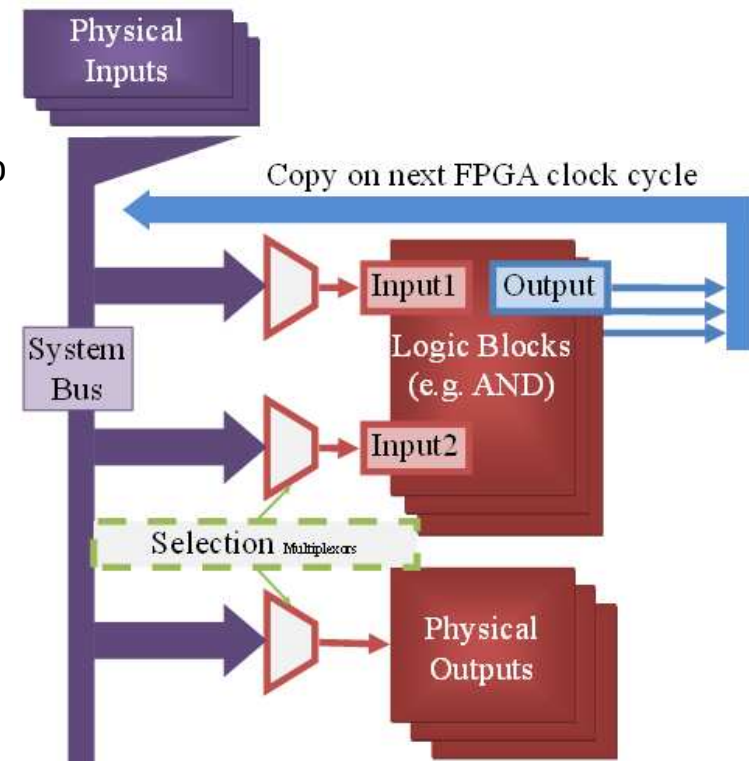
PandA Mechanics



Rack 1U, 19"

PandA Firmware Functionalities

- PandA aims to improve:
 - Wide set of configurable logic blocks and event sequencer.
 - Function Generators, Timer/Counter, Pulse Generator, SR Gate blocks
 - Position Compare Trigger Generation:
 - On trajectory or specific position
 - Region of interest (ROI)
 - Finite, infinite, in position, time or on external events.
 - Analog and Digital I/O support
 - LPC FMC connector.
 - Data Capture and Acquisition
 - Fully configurable System and Position Bus concept.



CONCLUSION



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Conclusion

➤ Identified applications:

- SOLEIL:
 - Flyscan for measurement under electrical field on CRISTAL beamline
 - Averaging 4 encoders for continuous scan on DEIMOS beamline.
- DIAMOND:
 - Interfacing an Endat absolute encoder on I12 beamline.
 - Mapping project for IO5-1, I14 and I08 beamlines.

➤ Project planning

- HW, FW specifications → [validated](#)
- HW schematic → [In progress](#)
- FW development → [In progress](#)
- First PandA box → [Expected for Summer 2016.](#)

Collaboration, an efficient answer to mutualized resources and to share experiences



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