

# Libera Spectra

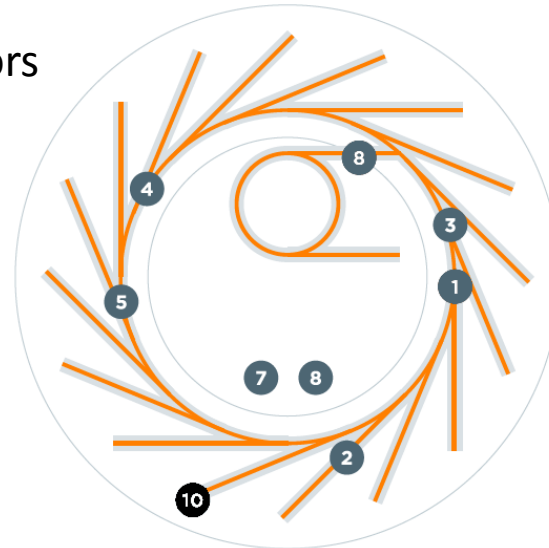
*Elvis Janežič, MTCA Workshop for Industry and Research, December 2012, DESY*

# What is Libera Spectra?

**Libera Spectra is a high-performance digital pulse processor intended for spectroscopy studies.**

It is designed for semiconductor detectors in energy dispersive x-ray experiments.

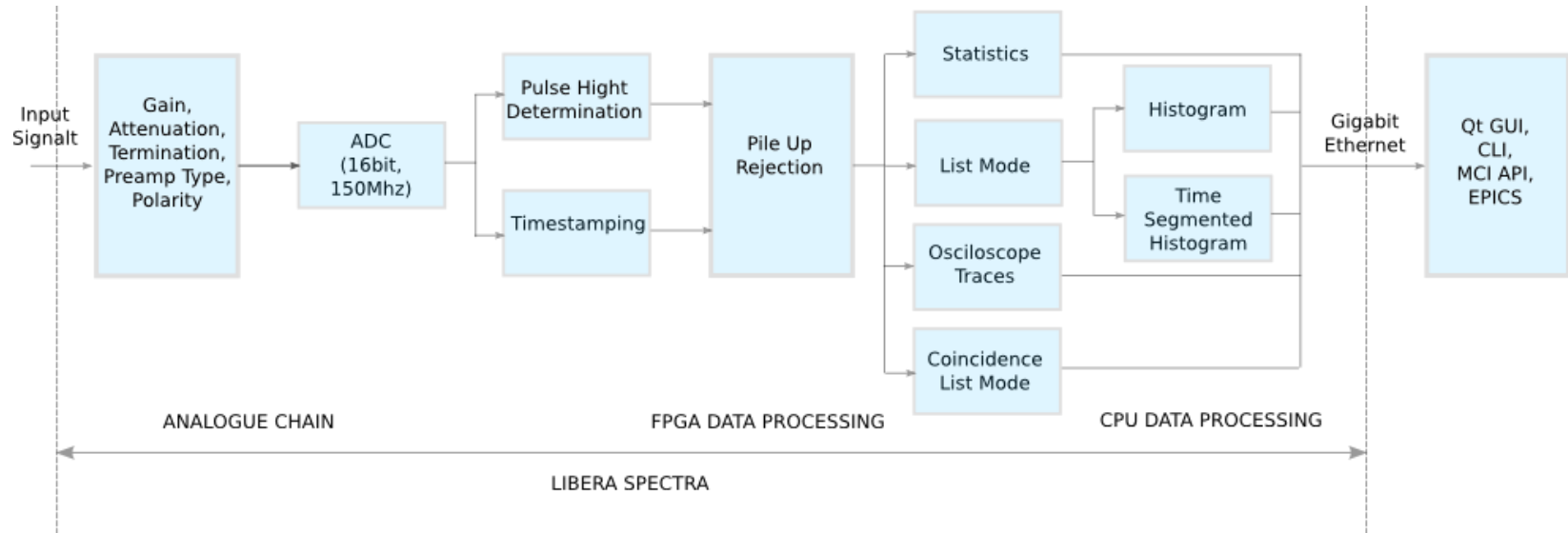
On synchrotrons it is located in the experimental hutch on the end of the beamline.



# Measurement system



# How does it work?



# User Setting and Control system integration

## Basic:

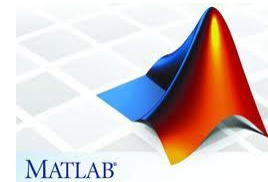
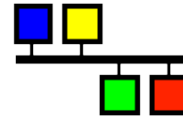
```
<node> boards.s5cX.channels.Y.hw.preamp.polarity
```

- Pulse polarity: Positive or Negative
- Gain range: 40dB
- Filtering time: 100ns to 20us
- Thresholds: Noise, Pulse Detection

## Fine tuning:

- Gap time, Pulse Reset, Bias....

**EPICS**



# Applications

## Histogram

## Time Segmented Histogram

- X-mapping

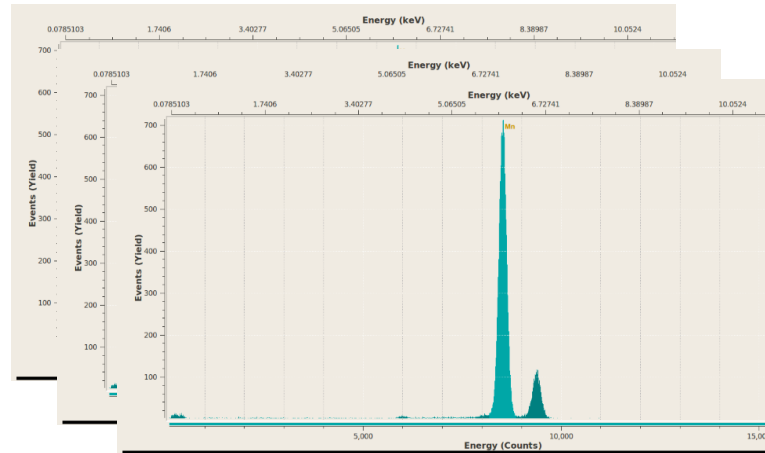
## List mode

- Huge amount of data

## Coincidence list mode

- Captures events before and after trigger
- Less overhead data

## Statistics



## Statistics

- Real time [ms]
- Live time [ms]
- Pile-up dead time [ms]
- Reset dead time [ms]
- Dead time [%]
- Input events
- Output events
- ICR
- OCR
- OCR/ICR[%]

Event in list mode

Pulse timestamp [ADC clock cycles]

Pulse amplitude [ADC counts]

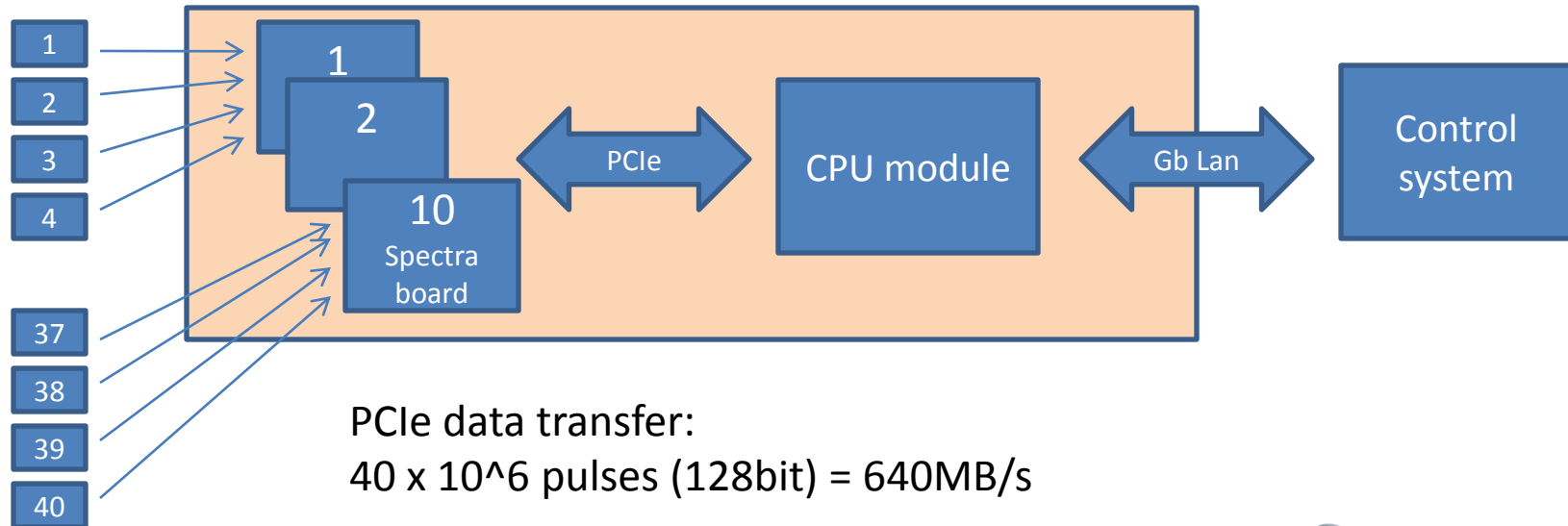
Segmentation counter [counts]

Coincidence counter



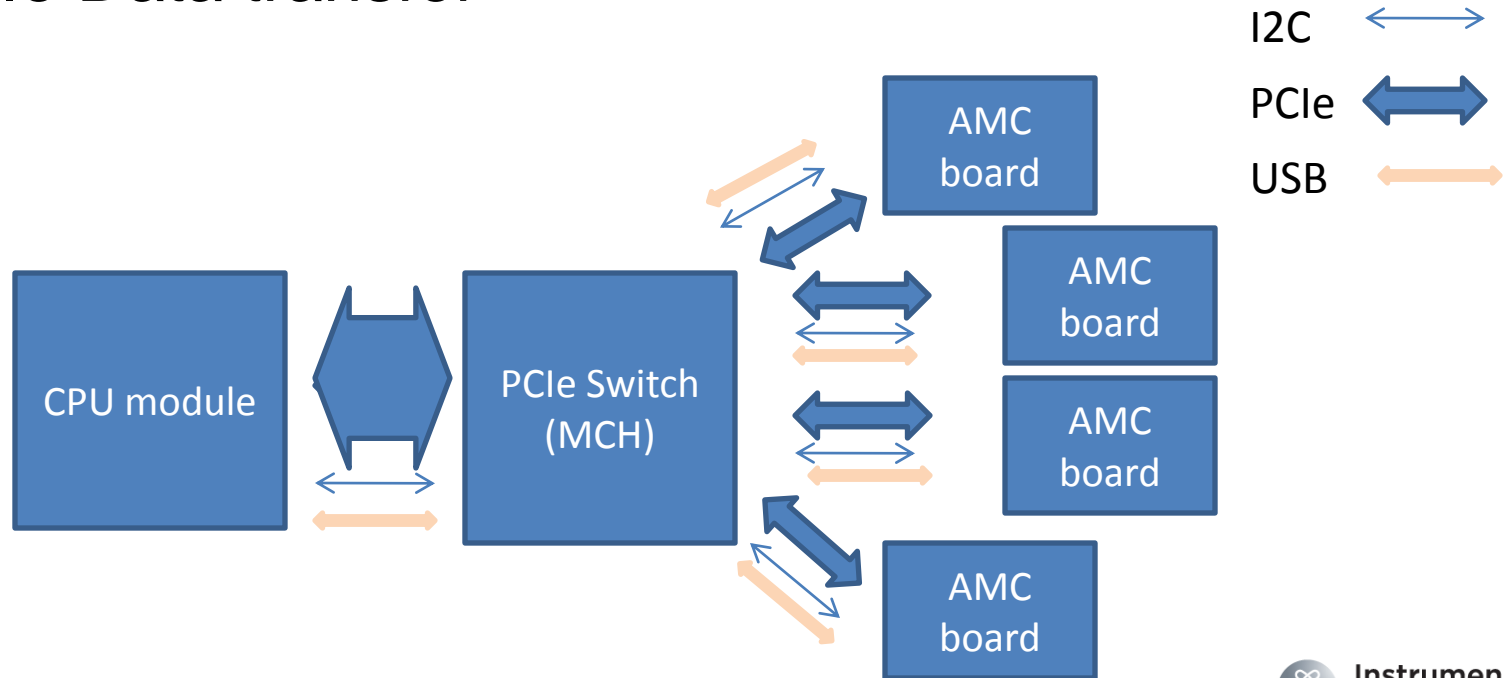
# Data transfer

Gb LAN data transfer:  
 $40 \times 250\text{kB} \times 1000/\text{s} = 10\text{GB}/\text{s}$



PCIe data transfer:  
 $40 \times 10^6 \text{ pulses (128bit)} = 640\text{MB}/\text{s}$

# PCIe Data transfer





# Specifications 1/2

Analog input channels: 4

Signal swing: 10 Vpp

Digital input/output channels: 4

ADC frequency (for sampling analog input signals): up to 160 MHz

ADC resolution (for sampling analog input signals): 16 bit



## Specifications 2/2

Data processing:

- Xilinx Virtex 6 FPGA
- SBC (Intel i5) with 4GB RAM

Data throughput (Gigabit Ethernet): 1Gb/s



## Benefits 1/2

Good resolution (FWHM):

- Low electronic added noise
- 16bit ADC

Scalable:

- 4 input channels per instrument
- Grouping up to 10 instruments in a single MTCA.4 system

Fast:

- Up to 1MCPS for all channels
- Filtering time from 100ns



## Benefits 2/2

### Applications:

- Histogram,
- Time Segmented Histogram
- List Mode
- Coincidence List mode

### Libera BASE SW framework :

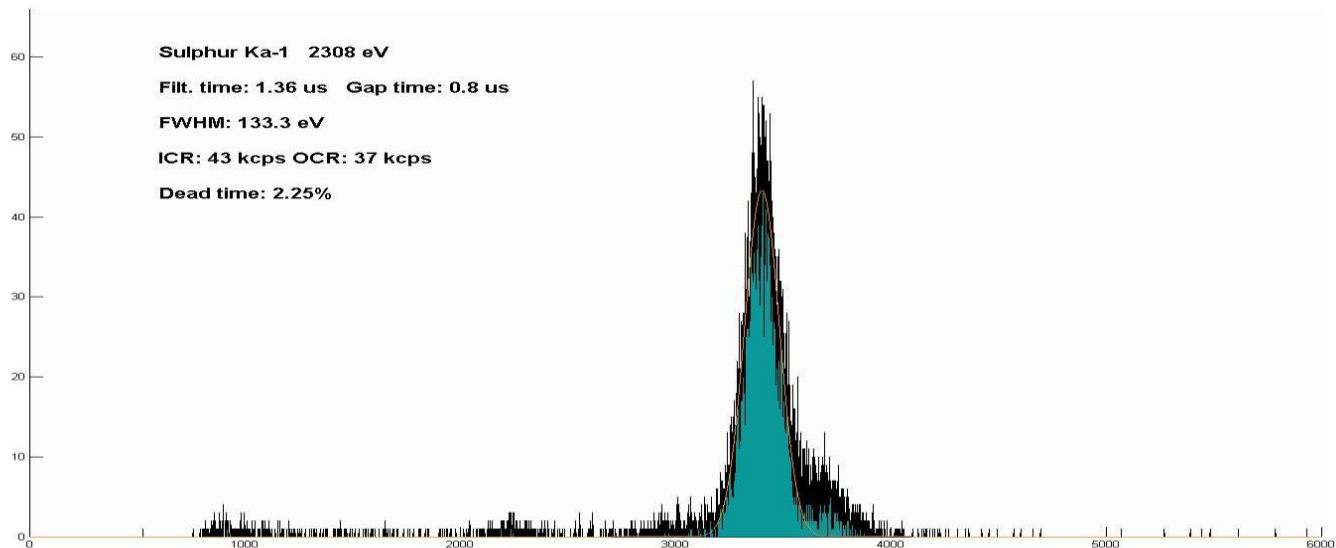
- Possibility to add additional applications
- Custom made algorithms

### Control system integration:

- Custom GUI (Matlab, LabView, ...)
- EPICS



# Remarks



# EvRx Moudule

