Libera

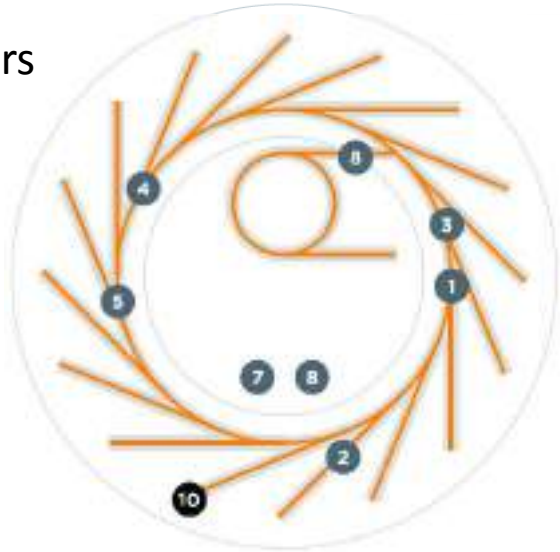
Libera Spectra

Elvis Janežič, Libera Workshop, October 2012, Solkan

What is Libera Spectra?

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

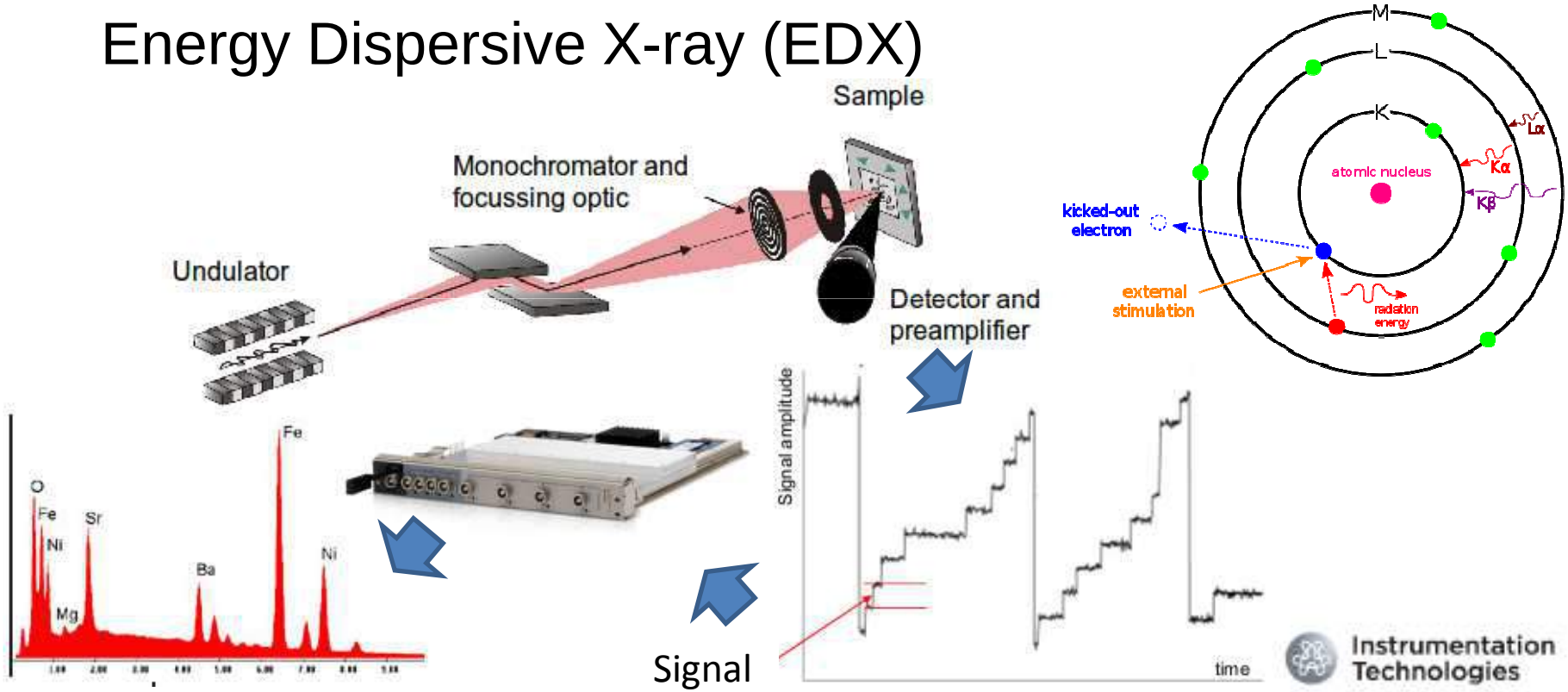
It is designed for semiconductor detectors in energy dispersive x-ray experiments.



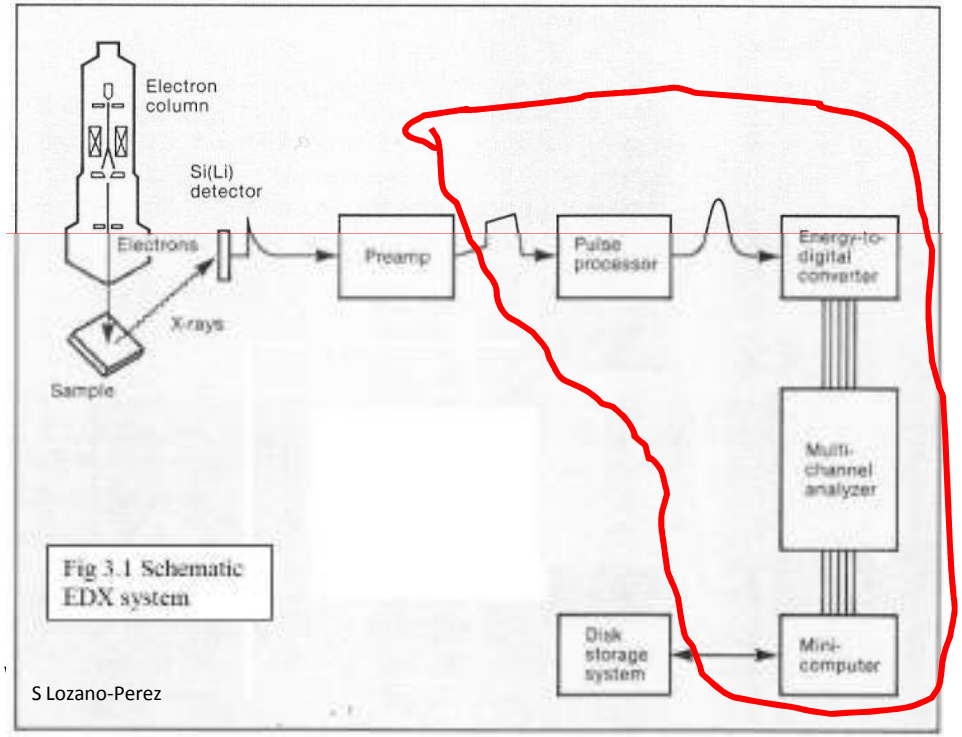
On synchrotrons it is located in the experimental hutch on the end of the beamline.

Instrumentation Technologies

Energy Dispersive X-ray (EDX)



DPP, Detector readout, MCA, DSP…?



Analog system	**Digital system**
•Pulse processor	
•Energy to digital converter	•Libera Spectra
•Multichanel analyzer	
•Mini computer	•SBC

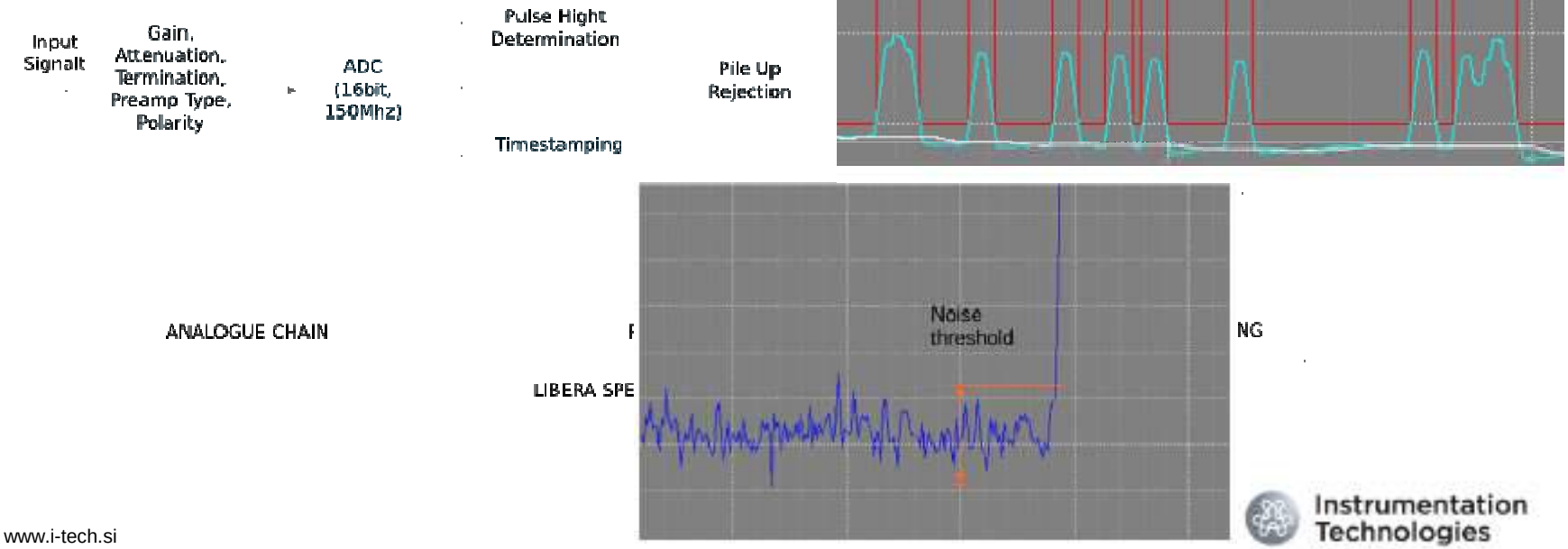
Instrumentation Technologies

Libera

Measurement system

Instrumentation Technologies

How does it work?



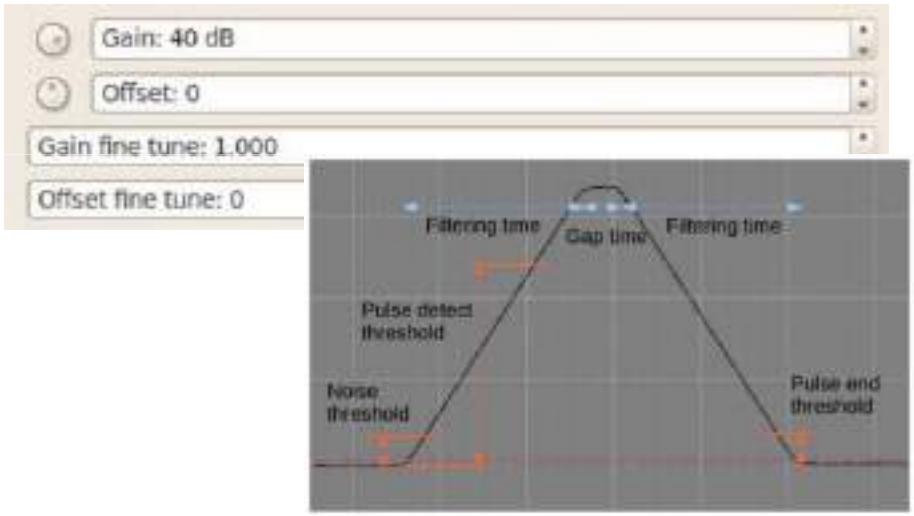
Instrumentation Technologies

User Setting

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

Basic:

- Polarity: Positive or Negative
- Gain: 40dB
- Filtering time: 100ns to 10us
- Tresholds: Noise, Pulse Detection

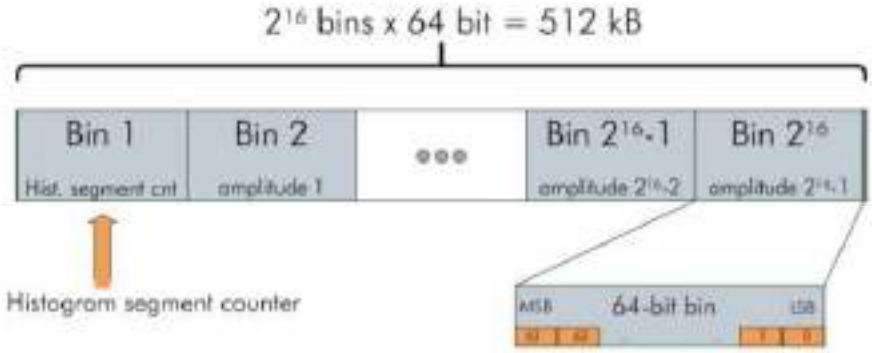


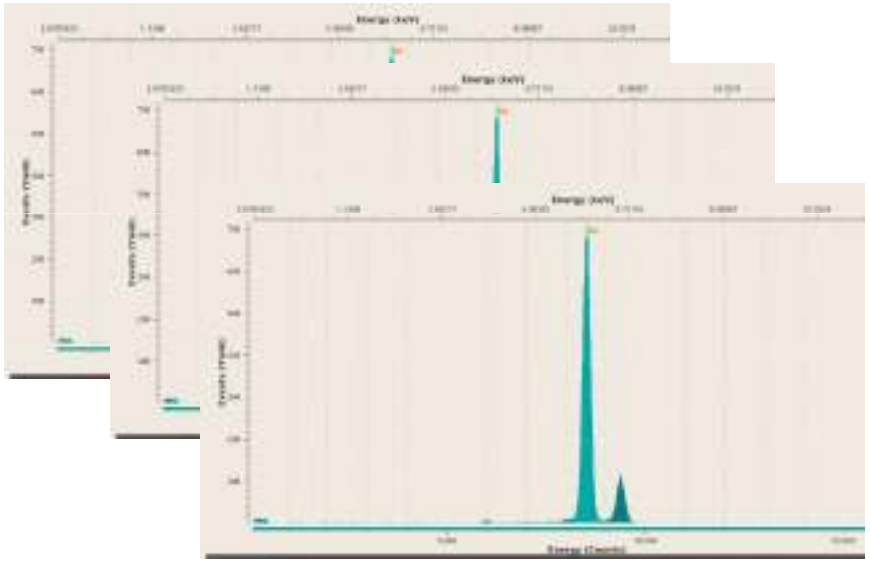
Fine tuning:

- Gap time, Pulse Reset, Bias….

Instrumentation Technologies

Histogram and Time Segmented Histogram





Time Segmented Histogram:

- On trigger records a histogram
- X- mapping

Instrumentation Technologies

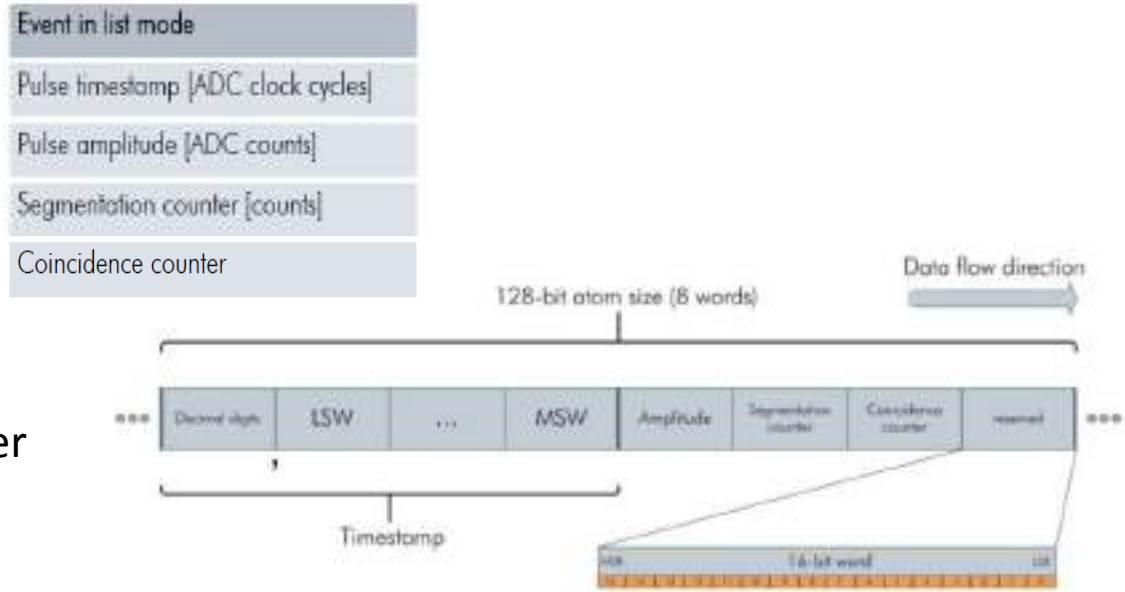
List Mode and Coincidence List Mode

List mode:

- Huge amount of data

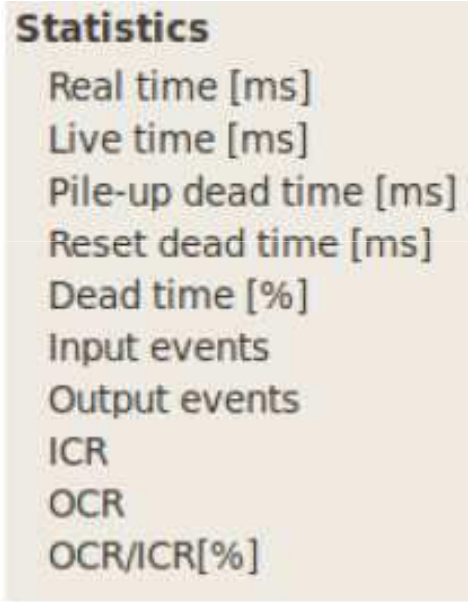
Coincidence List Mode:

- Records pulses before and after the coincidence trigger
- Less data



Statistics

- Basic statistics
- ROI
- FWHM
- Graph Calibration: ADC counts to eV
- Binning: 256 to 2^16



Specifications 1/2

Analog input channels: 4 @ 50Ω or 500Ω
Signal swing: -5V to 5V

Digital input/output channels: 4
ADC frequency (for sampling analog input signals): 100 – 160 MHz
ADC granularity (or 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

Instrumentation Technologies

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 framework :
- •possibility to add additional applications
- •Custom made algorithms

Control system integration:
- •Custom GUI
- •EPICS
- •MCI