

Libera

# Libera Photon

*Peter Leban, Libera Workshop, Solkan, 14 October 2010*

*[peter.leban@i-tech.si](mailto:peter.leban@i-tech.si)*

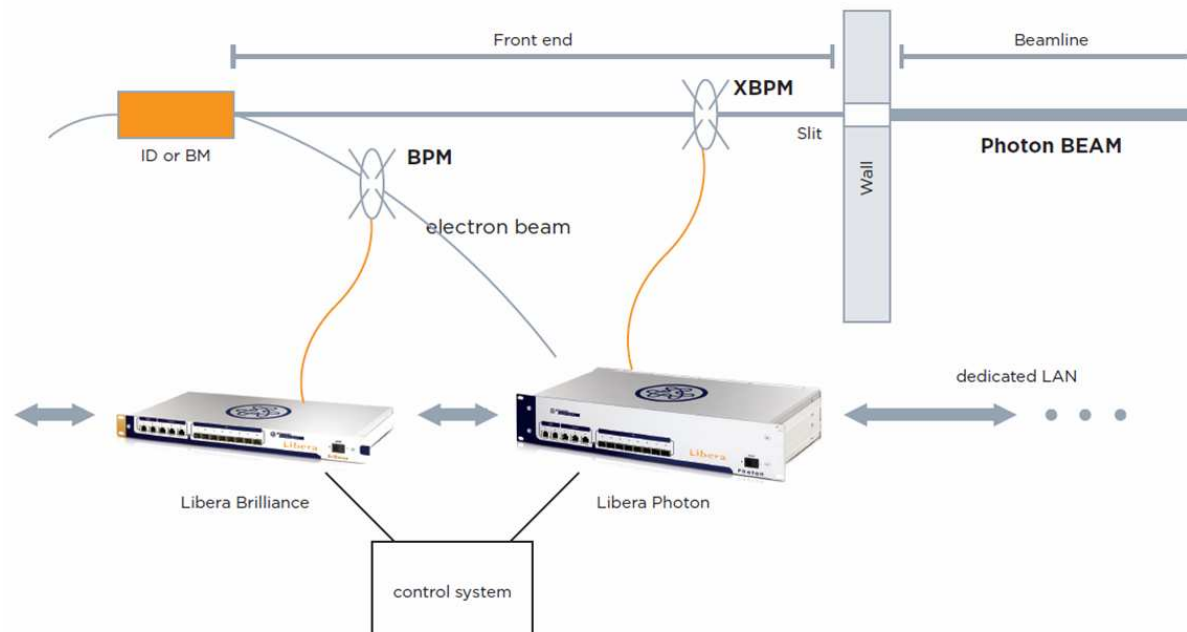
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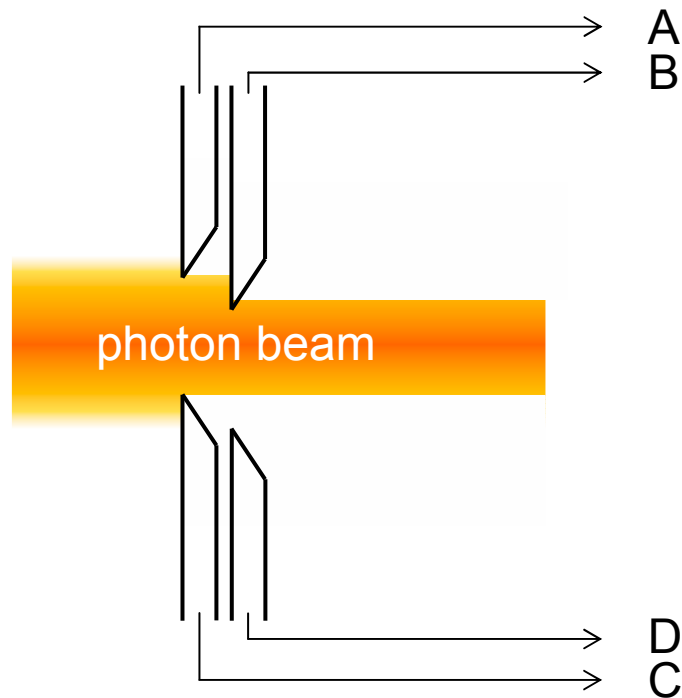
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# Photon Beam Position Processor – Requirements



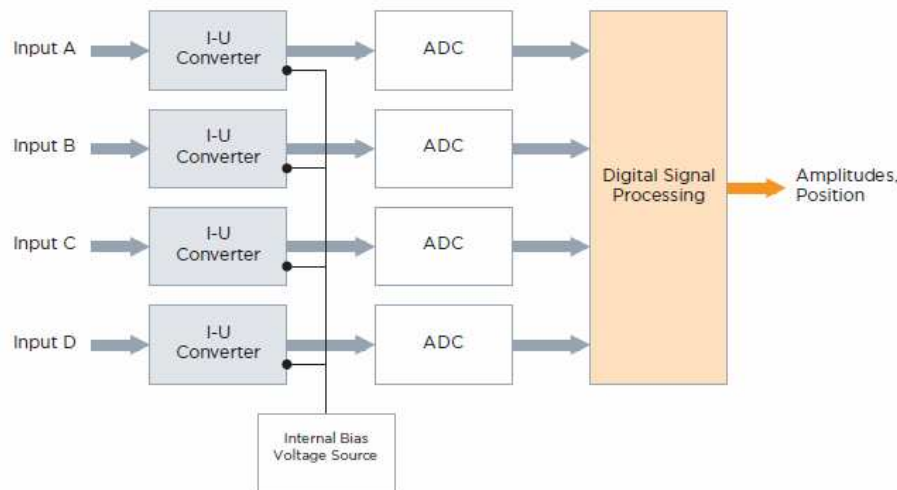
- High precision, wide range measurement (pico to milliAmps)
- Compatibility with sensors
- Position calculation formulas
- Synchronization with electron BPMs

## How It Works



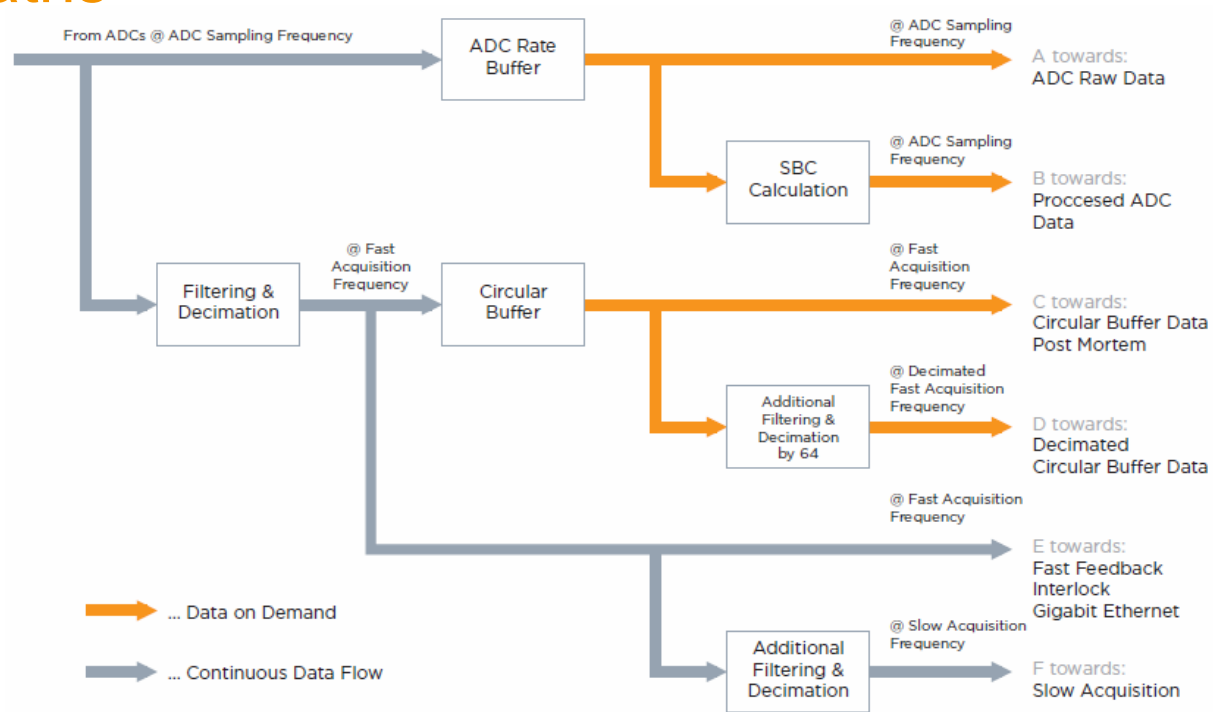
- 2 sensor configurations (ID or BM)
- up to 1.85 mA per channel
- internal BIAS voltage source (up -150 V)
- external BIAS voltage source supported
- geometry factors included in the DSP

## Digital Signal Processing



- **24-bit ADCs @ ~ 100 kHz sampling rate**
- **compensation of internal and external influences**
- **internal calibration source**
- **automatic range control**
- **synchronization with machine revolution frequency (optional)**

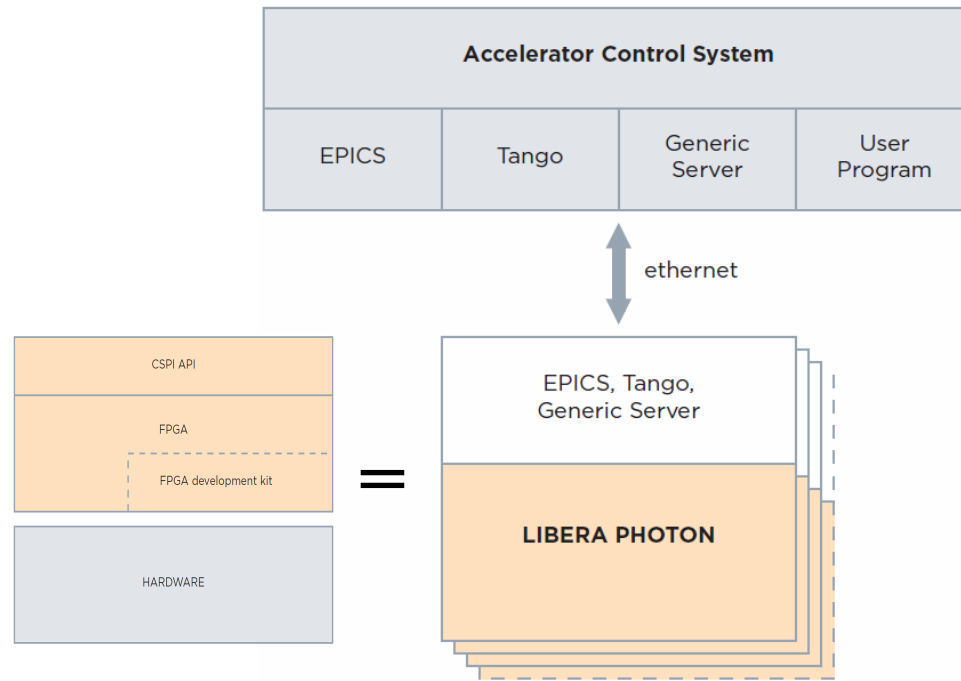
# Data Paths



# Software Interfaces

## The interface to the Control system

- EPICS driver
- Generic server
  
- **Remote access = local access**
- **Software sources available**



Photon beam position processor

Libera

## Libera Photon



- **4 current inputs / 7 measurement ranges**
- **Current-to-voltage conversion**
- **Precision in the nm range**
- **Based on proven platform**
- **Low beam flux dependence**
- **Excellent noise floor / RMS**



## Performance

| Range                   | Bandwidth | Current resolution | Position resolution | Current dependence |
|-------------------------|-----------|--------------------|---------------------|--------------------|
| $\pm 2$ nA              | 0.5 kHz   | 3 pA               | 3 $\mu\text{m}$     | 1.2 $\mu\text{m}$  |
| $\pm 20$ nA             | 1 kHz     | 4 pA               | 0.3 $\mu\text{m}$   | 0.8 $\mu\text{m}$  |
| $\pm 200$ nA            | 2 kHz     | 7 pA               | 0.07 $\mu\text{m}$  | 0.7 $\mu\text{m}$  |
| $\pm 2$ $\mu\text{A}$   | 2 kHz     | 20 pA              | 0.02 $\mu\text{m}$  | 0.6 $\mu\text{m}$  |
| $\pm 20$ $\mu\text{A}$  | 2 kHz     | 180 pA             | 0.02 $\mu\text{m}$  | 0.5 $\mu\text{m}$  |
| $\pm 200$ $\mu\text{A}$ | 2 kHz     | 1.8 nA             | 0.02 $\mu\text{m}$  | 0.3 $\mu\text{m}$  |
| $\pm 1.85$ mA           | 2 kHz     | 18 nA              | 0.01 $\mu\text{m}$  | 0 $\mu\text{m}$    |

## Test Cases

- **Various performance / functional testing (SOLEIL Synchrotron)**  
Beam current dependence, RMS values, BIAS voltage source issue discovered & fixed, speed of FOFB correction, parallel tests with electron BPMs (Libera Electron)
- **Test with CVD sensors (Swiss Light Source)**  
4 plate sensor, nA current ranges
- **Performance test in the front-end (KEK PF)**  
Different positions (sensor #1, #2), angle measurement, beam bumps
- **The effect of FOFB on photon beam (NSRRC, SOLEIL Synchrotron, ELETTRA)**  
The RMS, FOFB effectiveness, frequency spectrum

## First References

- **CLS (Canada)**
- **DIAMOND Light Source (Great Britain)**
- **KEK PF (Japan)**
- **KIT – ANKA**
- **NSRRC – TLS (Taiwan)**
- **NSRL – HLS (China)**
- **PSI – SLS (Switzerland)**
- **SOLEIL Synchrotron (France)**

## Conclusion

- **Usage on front-end XBPM sensors**  
plug and play
- **Usage on other sensors types (e.g. CVD, ionization chamber)**  
beamlines, close to experiment
- **Fast Global Orbit Feedback ready**  
full synchronization with electron beam position processors (Libera Electron / Brilliance / Brilliance+)