

Libera

Solutions for Beamlines

Vladimir Poučki, Libera Workshop, 15 October 2010, Solkan, Slovenia

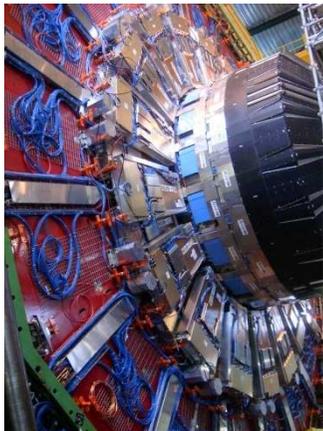
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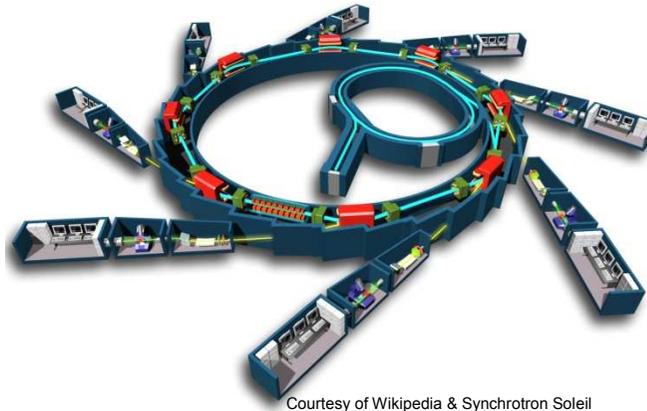


Beamlines, Sensors

- experimental stations – end of beamlines
- various sensors
- sensors: CVD, diamond detectors, ion chamber..
- CVD & ion chamber → current in the range of nA.



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Courtesy of Wikipedia & Synchrotron Soleil



Electronics

- numerous read-out electronics
- PicoAmper meters
- custom-made electronics
- data processing
- software interface for displaying/analyzing the data
- many different solutions



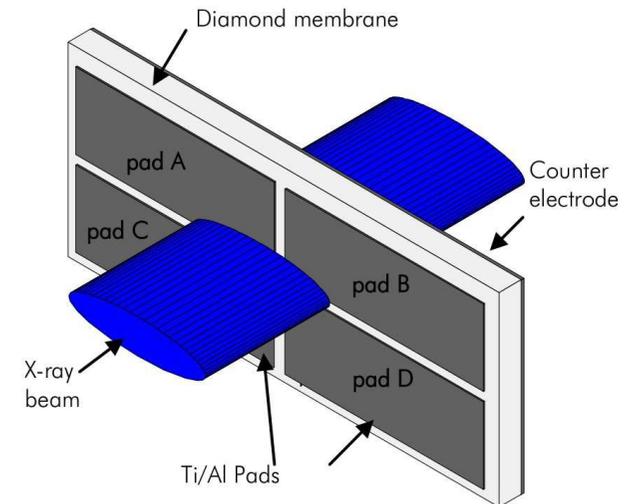
Libera Photon



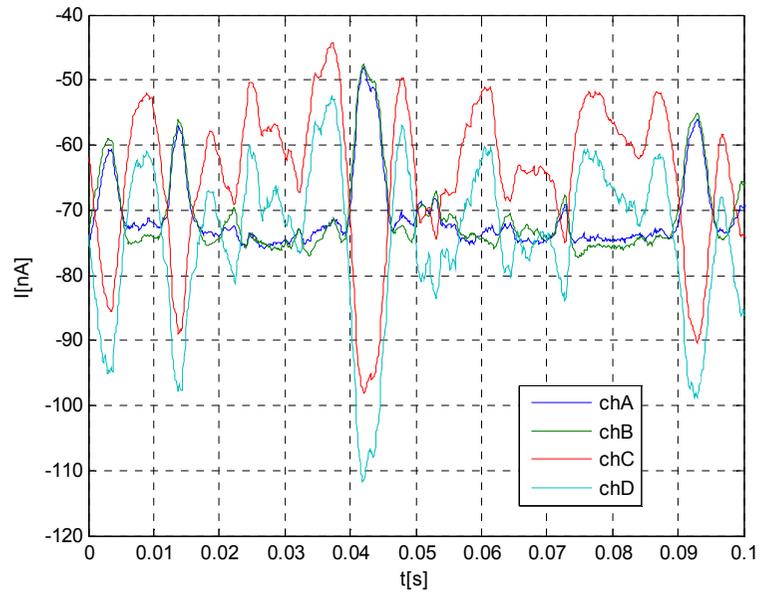
- Photon Beam Position Processor
- diamond-based sensors (CVD)
- Ionization chambers
- internal bias voltage source
- EPICS, GUI
- replacement of picoAmpere meters

CVD Diamond Sensor

- CVD diamond sensor at SLS (Switzerland)
- Libera Photon as photon BPM. Direct connection with sensor.
- current signal in nA range
- numerous measurements
- data acquisition at 10kHz and 10Hz rate



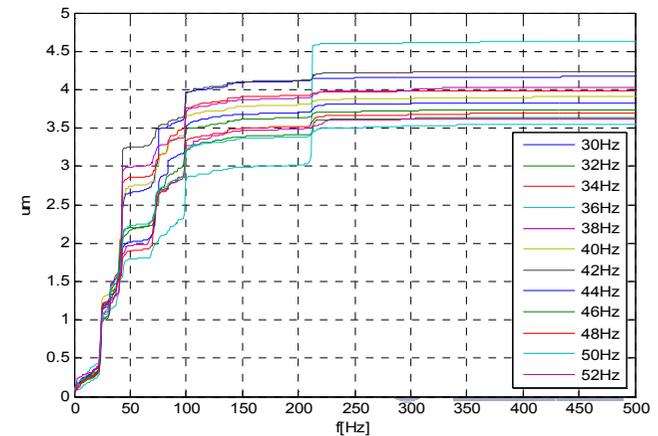
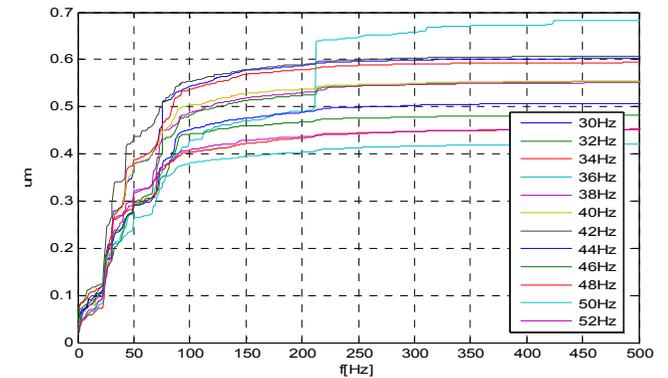
CVD Diamond Sensor at SLS



- data @ 10kS/s
- bandwidth is 2 kHz
- clear anti correlation of top and bottom pads (vertical beam motion)

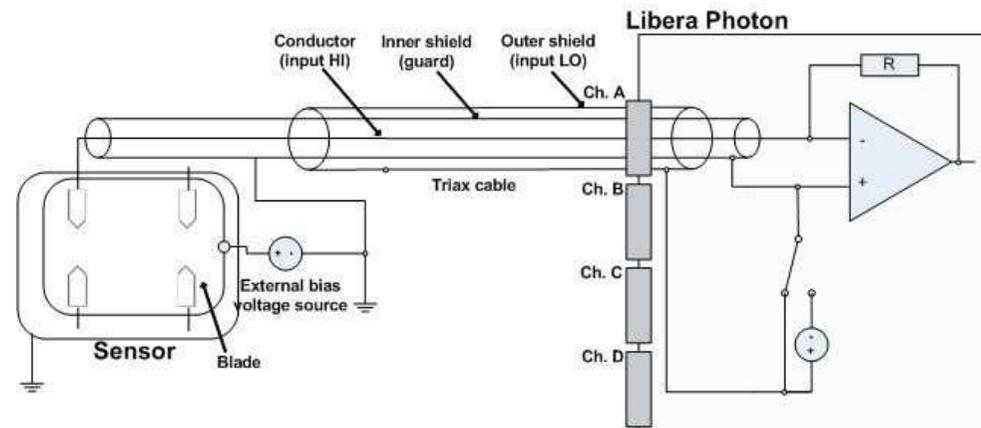
CVD Diamond Sensor at SLS

- Frequency analysis of beam movement
- Frequency of the pump was changed from 30 to 52 Hz in steps of 2 Hz
- Spectrum of horizontal and vertical position



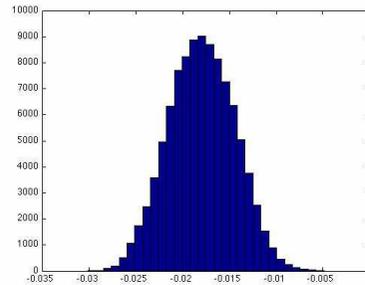
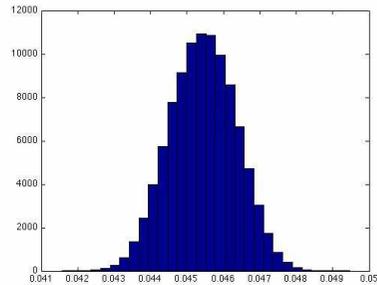
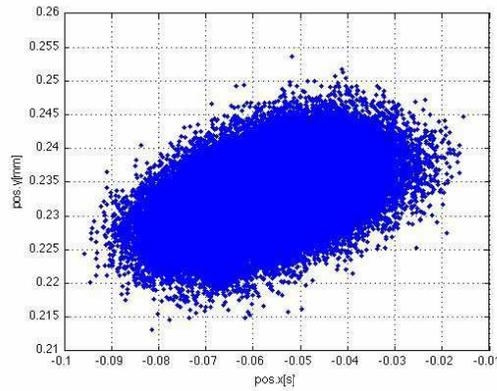
Libera Photon on Ion Chamber

- Beamline BM16 at ESRF (France)
- Four bunch mode
- External bias voltage
- Current of ~ 30 nA



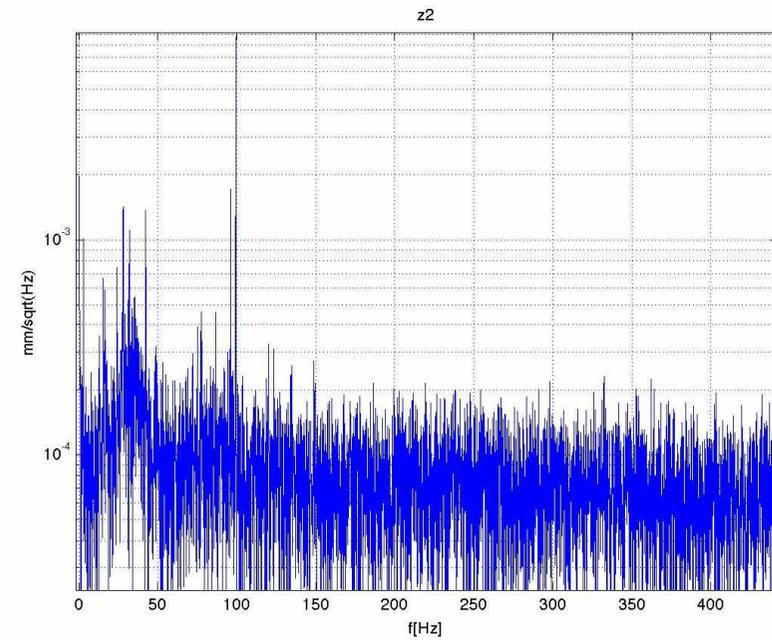
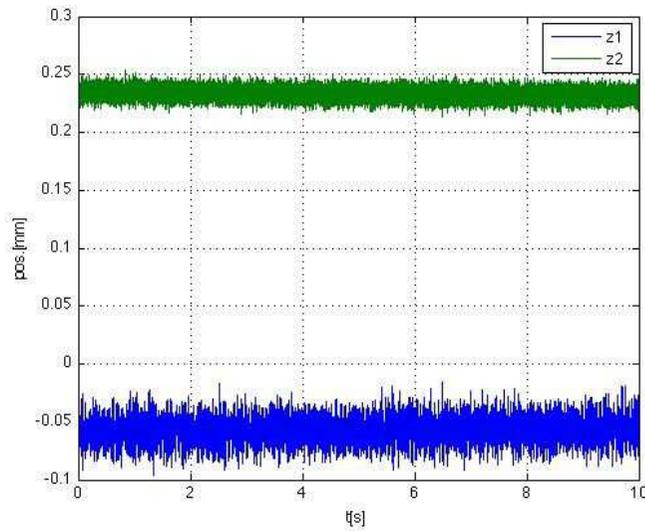
Libera Photon on Ion Chamber

- Beam Profile
- 10kHz data rate
- Beam centered on the Ion Chamber



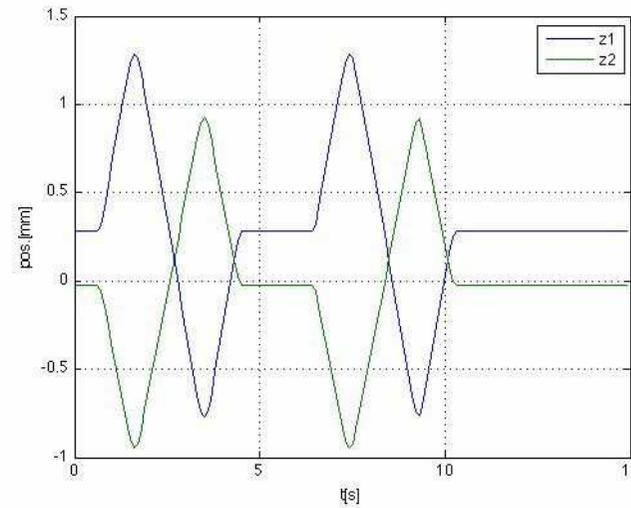
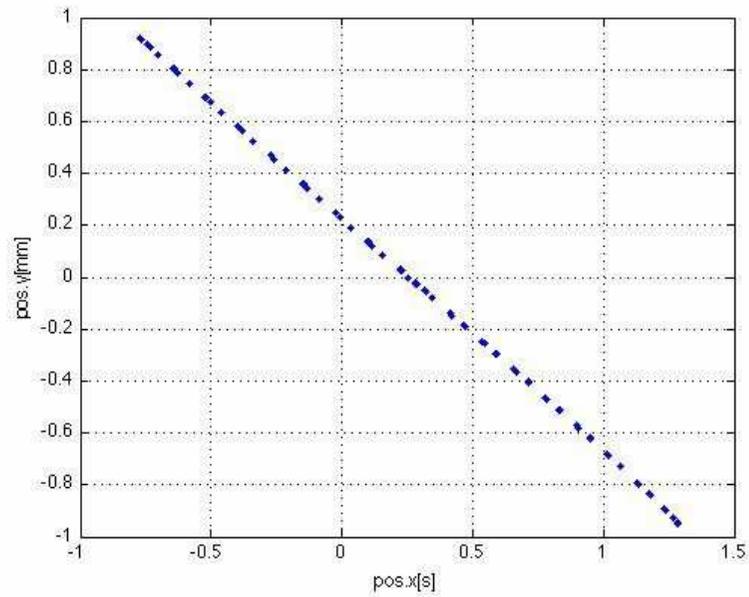
Libera Photon on Ion Chamber

- Position
- Spectrum



Libera Photon on Ion Chamber

- Movement of ion chamber
- System linearity
- Positions



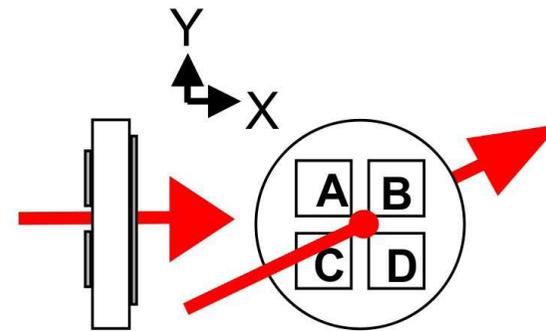
X-Ray Beam Position Studies



- Diamond Detector
- Voltage Output
- Single Crystal Diamond
- All-in-one
- Position resolution in tens of nm

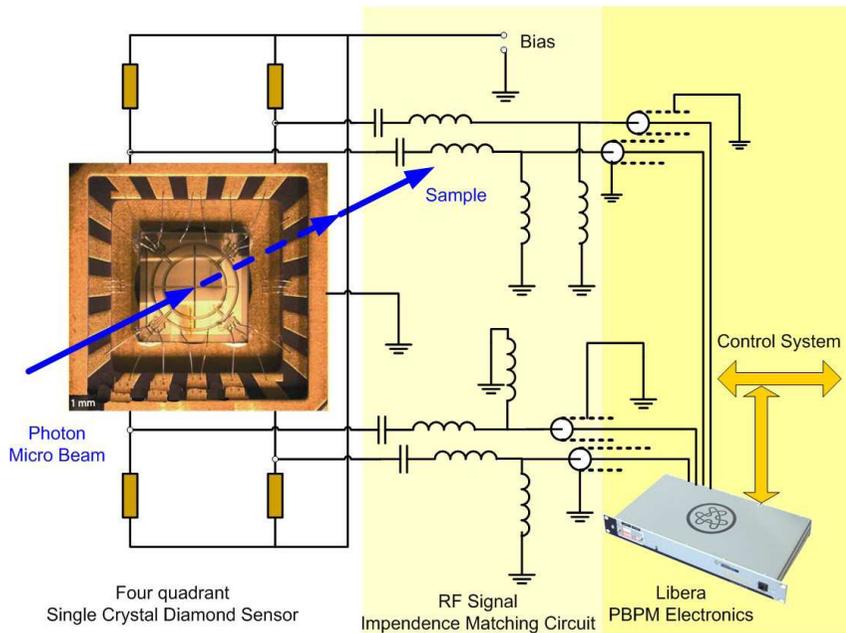
Single Crystal Diamond Sensor

- H. Graafsma, B. Šolar (DESY),
J. Morse (ESRF)
- Doris (DESY) beamline
- 25 μm beam at the DORIS III F4
- 16 keV peak energy



$$X = \frac{(A+C)-(B+D)}{A+B+C+D}$$
$$Y = \frac{(A+B)-(C+D)}{A+B+C+D}$$

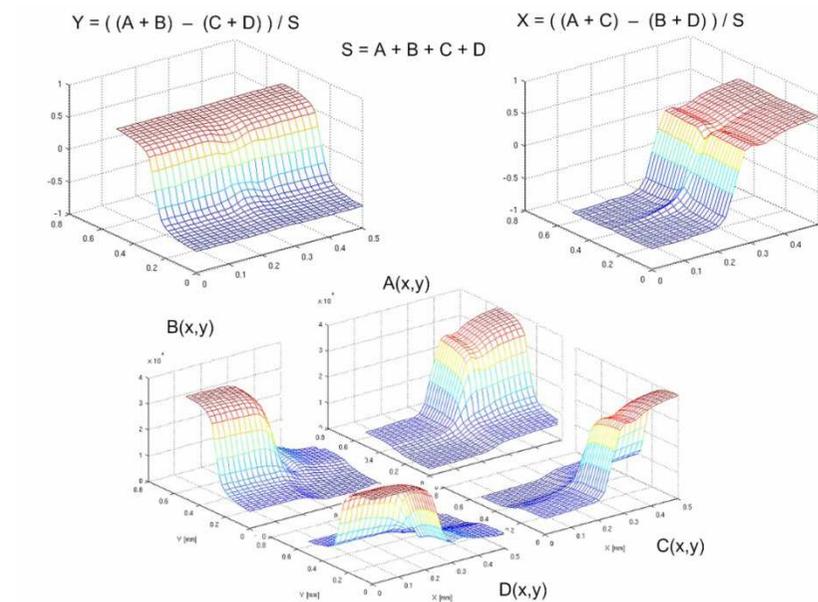
Single Crystal Diamond sensor



- 0.1 mm thick sensor
- 100 μm quadrant gap
- Impedance matching circuits
- 50 ohm input
- 130 Msamples/s readout electronics

Single Crystal Diamond Sensor

- Coarse 0.5mm x 0.5mm region scan
- Micro and submicron beams
- Small size, can be placed close to the sample
- Feedback system/optics e-beam
- Extremely fast response/ bunch rate



Conclusions of the Diamond Sensor Experiment with Libera

- Excellent sensitivity
 - X-Y response to the mechanical shock 3m away from the hutch!
 - 20 nm RMS@ 200Hz BW
- Flexibility
 - Arbitrary BW (TBT → ~Hz)

