Photon Polarization Switch at ALBA

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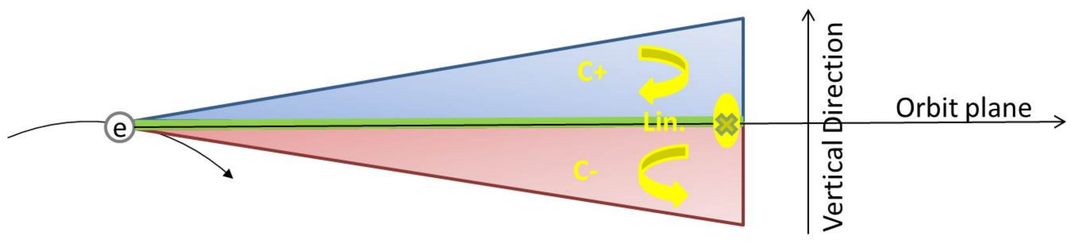
Abstract

The polarization of the synchrotron radiation produced by a bending magnet can be selected by properly choosing the vertical emission angle. At beamlines this can be done by moving a slit to block unwanted polarization: this method is time consuming and not very reproducible. Another option is to fix the slit position, generate a local bump with the electron beam, and vary the emission angle at the source point such that the sample is illuminated with the desired polarization. At ALBA, we have implemented this option within the Fast Orbit Feedback, which allows to perform the angle switch in less than one minute without affecting other beamlines. This report describes the implementation of this technique for the dipole beamline MISTRAL at the ALBA Synchrotron.

Polarization Distribution

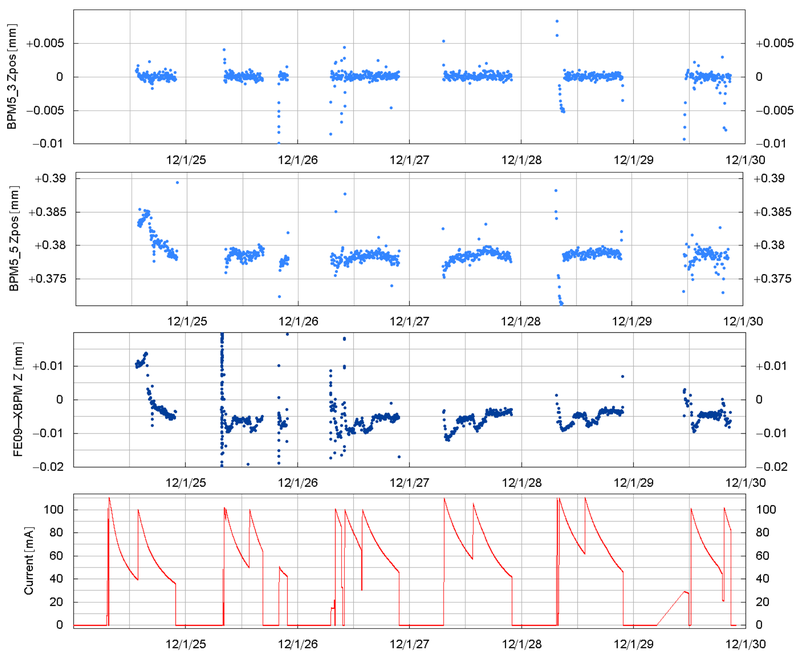
The distribution of the synchrotron radiation produced by a bending magnet depends on the emission angle.



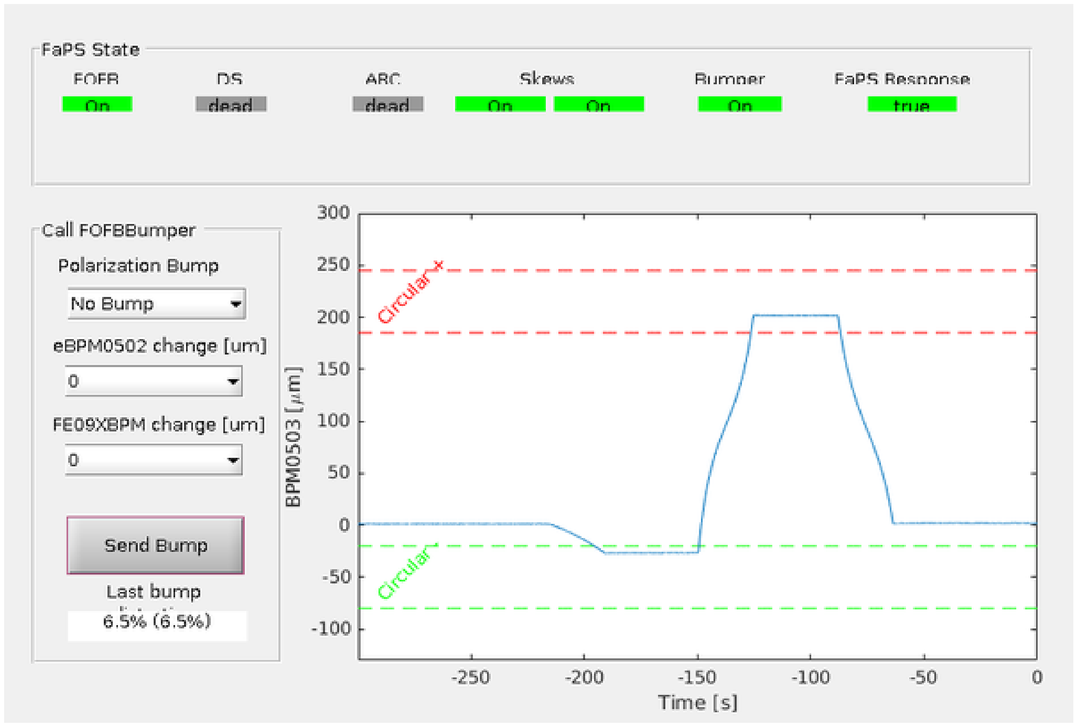
FOFB for Polarization Switch

- Distributed system @5 kHz damping up to 100 Hz
- Diamond CC + PSI protocol
- 16 FOFB processing nodes:
  - PMC FPGA sniffer board (Micro-Research EVR-230)
  - Correction Calculation CPU (4 Cores)
  - Optical Link Interface (to the correctors)
- Horizontal: 88 BPMs (Libera Brilliance)
- Vertical: 87 BPMs + **1 XBPM** (Libera Brilliance + Libera Photon) + 1 BPM
- 88 Correctors (Hor. and Vert.) integrated in sextupoles + 1 Cor. Vert.
- + 1 Skew (No FOFB!)

XBPM in FOFB

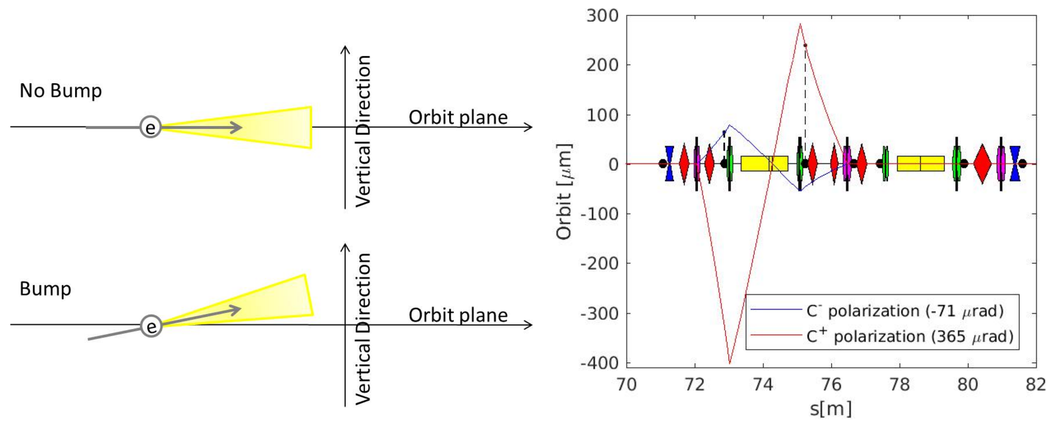


User GUI



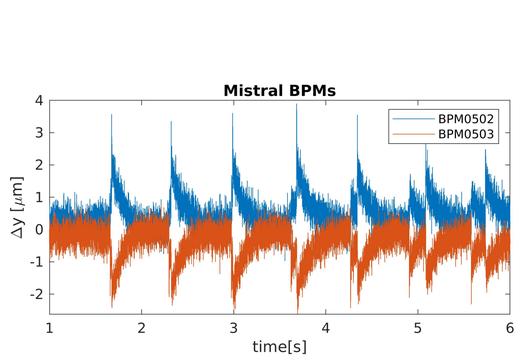
Switching Mechanism

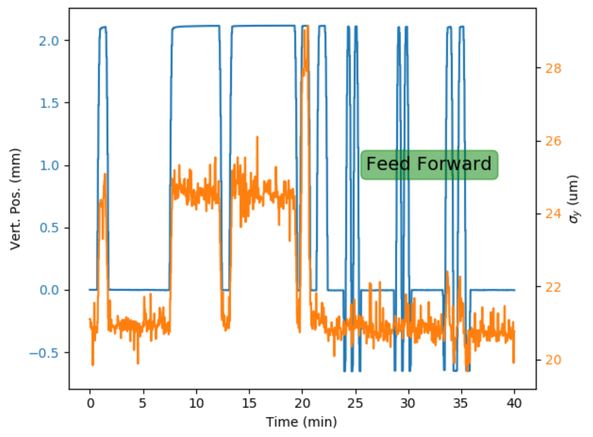
Locally change the direction of the electron beam by performing a bump by changing BPMs offsets



Implementation – I

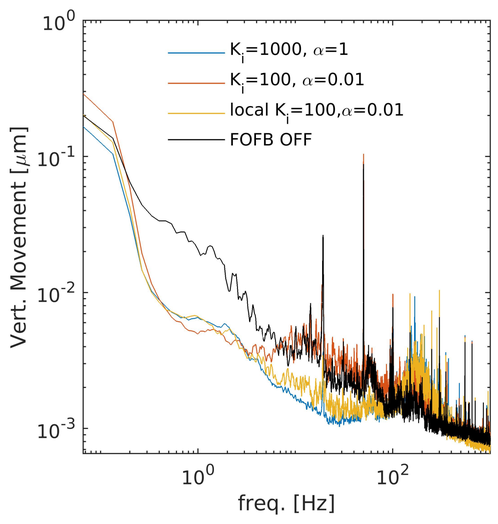
- BPM offset modified inside Liberas: Dev. Sever not fast enough
- Feed-forward for beam size stability while changing polarization

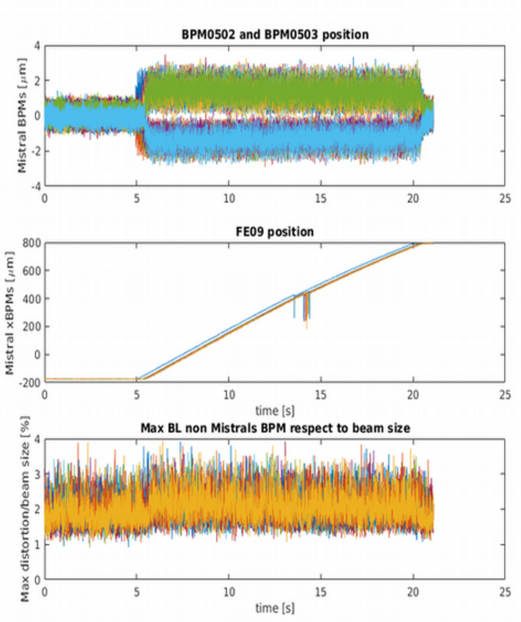




Implementation – II

- Local reduction of regularization and gain at MISTRAL source point
- Automatic range modification in Libera Photon disabled



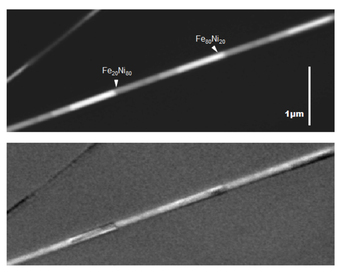


Perturbation

$$\frac{\text{Orbit distortion}}{\text{Vertical Beam Size}} < 5\%$$

	C+	C-	0	Lin.
C+	–	5%	4.6%	4.3%
C-	5%	–	3.8%	3.8%
0	4.6%	3.8%	–	3.9%
Lin.	4.3%	4.6%	4.3%	–

Results @ MISTRAL



Images of cylindrical magnetic nanowires with modulated composition, comparing the absorption (top) and magnetic (bottom) contrast. Sample by C. Fernández-González et al., IMDEA Nanociencia.