Detector Development Activities at ALBA

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Detector Development Activities at ALBA

- 3rd generation synchrotron light source (3 GeV) at Barcelona (Spain).
- 8 operating beamlines + 3(4*) under construction.
- No pure detector development group exists (Electronics Section – 14 people)

<table>
<thead>
<tr>
<th>Beamlines</th>
<th>Description</th>
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<tbody>
<tr>
<td>BL01 MIRAS</td>
<td>Infrared Microespectroscopy</td>
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<tr>
<td>BL04 MSPD</td>
<td>Materials Science And Powder Diffraction Beamline</td>
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<tr>
<td>BL06 XAIRA</td>
<td>Microfocus Beamline For Macromolecular Crystallography</td>
</tr>
<tr>
<td>BL09 MISTRAL</td>
<td>Soft X-ray Microscopy</td>
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<tr>
<td>BL11 NCD-SWEET</td>
<td>Non-crystalline Diffraction</td>
</tr>
<tr>
<td>BL13 XALOC</td>
<td>Macromolecular Crystallography</td>
</tr>
<tr>
<td>BL16 NOTOS</td>
<td>Absorption, Diffraction &amp; Instrumentation</td>
</tr>
<tr>
<td>BL20 LOREA</td>
<td>Angle Resolved Photoemission Spectroscopy</td>
</tr>
<tr>
<td>BL22 CLAESS</td>
<td>Core Level Absorption &amp; Emission Spectroscopies</td>
</tr>
<tr>
<td>BL24 CIRCE</td>
<td>Photoemission Spectroscopy And Microscopy</td>
</tr>
<tr>
<td>BL29 BOREAS</td>
<td>Resonant Absorption And Scattering</td>
</tr>
<tr>
<td>BLxx FAXTOR*</td>
<td>Fast X-ray Tomography &amp; Radioscopy Beamline</td>
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</tbody>
</table>
Detector Development Activities at ALBA

- All beamlines in operation use commercial detectors.
- Our group give instrumentation support to beamlines (but not only related to detectors).
- Projects Developed:

  10 µm width transmissive diode
  - Two models: One quadrant & Four quadrant device Monitor $I_0$ and position.
    - Sensitivity 102 nA/µm (Beam: $4\cdot10^{11}$ ph/s @ 10 keV Beam size: ~100 µm FWHM)
  - Radiation hardness studies.
  - Possible extent to SiC (involved ESRF*)

  Four channel performant electrometer
  - From 10mA to 100pA range
  - Up to 1kV bias operation
  - 4 arbitrary analog outputs
  - Designed for Closed loops implementation
  - Acquisition Engine based in FPGA (timestamp, pre-processing, etc…)

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Detector Development Activities at ALBA

Electronics Design Integrating commercial detectors
- SiPM
- APDs
- PMTs
- ... 

Others

- **Short terms plans:**
  - Continue the development of projects with real application for our beamlines.
    - Transmissive diodes included permanently in all our hard X-ray beamlines (BL04, BL11, BL13 and BL22*)
  - Development of 5µm width transmissive diode (with CNM).
  - Continue learning about radiation hardness under Synchrotron Light.
  - Integration of transmissive diode+ Em#+piezo to create a beam tracker with nm sensitivity at frequency close to kHz regime.

- **Future plans:**
  - Development of a Detectors Group is in ALBA Strategic Plan for following years (limited resources)
  - Foster development activities with nearby institutes with strong background in detector development (mainly for high energy physics):
    - Institut de Física de Altes Energies (IFAE)
    - Centro Nacional Microelectrónica (CNM)
  - NOTOS new beamline devoted to instrumentation development including detectors development explicitly [4.5-30 keV flux $10^{11}$ ph/s]
Thank you!