INJECTORS BLM SYSTEM:
PSB RING INSTALLATION AT EYETS

Christos Zamantzas on behalf of the BLM team.
PSB Expert Name Convention

**Vertical Position:**
(0 to 2 letters; only for BR, BI, BT)
1, 2, 3 or 4 – ring separation
12 or 34 – across rings
None – all rings

**Detector type:**
I – IC
S – SEM
L – LIC
F – FIC
D – Diamond
A – ACEM

**Radial Position:**
E – external
I – internal
T – top
B – bottom
L – left to beam direction
R – right to beam direction
X – between beam pipes

**Accelerator** (2 or 3 letters):
LT – LINAC Transfer
LTB – LINAC Transfer to Booster
LBE – LINAC to Booster Emittance
LBS – LINAC to Booster Spectrometer
BR – Booster Ring
BI – Booster Injection
BE – Booster Extraction
BT – Booster Transfer
BTP – Booster Transfer to PS
BTM – Booster Transfer to Measurement
BTY – Booster Transfer to Isolde

**System type:**
B – BLEDP
O – OASIS
V – VFC/ADC

**Period/Section** (2 to 4 letters):
for the ring:
01-16 – period & L1-L5 – fixed
or for the transfer lines:
xxx – distance [m] (BTY line)
xx – 10, 20 for first, second etc. (for all other lines)
New Rack at BAT41E

- Complete new rack installed
  - Acquisition crate
  - Processing crate
  - HV crate
  - HV distribution

- 4 module pairs
  - Acquisition and processing cards

- 32 Channels connected
  - FIC detectors

- 8 channels spare

- Two HV power supplies
  - Second PSU is for redundancy
Custom Supports

- Special supports for:
  - BR12.BLMFB.3L3.E
  - BR12.BLMFB.10L3.E

- Non standard installation of the vacuum clamps
  - Not enough space to fit detector

- Need to verify the signal difference

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DEVELOPMENT
System Development

- Advanced versions of Firmware and Software available.
- Direct Ethernet connection to each acquisition module available for detailed analysis and debugging.
  - 2 µs samples continuously
- Through FESA class, system provides synchronised with the basic period
  - Several integrals
  - ‘Evolution’ data, i.e. 1 ms samples during beam presence.
- Functionalities under verification:
  - loading of settings/thresholds,
  - system status information and
  - interlocking.

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## System Diagnostic Data [2/3]

Below is a table containing diagnostic data for various components:

<table>
<thead>
<tr>
<th>Component</th>
<th>Parameter</th>
<th>Value 1</th>
<th>Value 2</th>
<th>Value 3</th>
<th>Value 4</th>
<th>Value 5</th>
<th>Value 6</th>
<th>Value 7</th>
<th>Value 8</th>
<th>Value 9</th>
<th>Value 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Component A</td>
<td>Parameter A</td>
<td>Value 1A</td>
<td>Value 2A</td>
<td>Value 3A</td>
<td>Value 4A</td>
<td>Value 5A</td>
<td>Value 6A</td>
<td>Value 7A</td>
<td>Value 8A</td>
<td>Value 9A</td>
<td>Value 10A</td>
</tr>
<tr>
<td>Component B</td>
<td>Parameter B</td>
<td>Value 1B</td>
<td>Value 2B</td>
<td>Value 3B</td>
<td>Value 4B</td>
<td>Value 5B</td>
<td>Value 6B</td>
<td>Value 7B</td>
<td>Value 8B</td>
<td>Value 9B</td>
<td>Value 10B</td>
</tr>
</tbody>
</table>

*Note: The table is not fully visible in the image.*
Parameters Setup

- [Image of the interface for parameter setup]

Parameters listed include:
- **FEC**
- **Thresholds**
- **Capture**
- **Interlock**
- **General**

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**Date**: 25/04/2017
Beam Interlocks [1/3]
Beam Interlocks [2/3]
BEAM MEASUREMENTS
All channels operational
Pattern of losses seems identical in most locations

More noise visible since much smaller signal to measure
TODO List (short term)

- Finalise software configuration
  - Update monitor names

- Request data logging
  - Measurements (Running Sums & Evolution buffer)
  - Threshold values (on change)
  - System Diagnostic and Monitoring

- Setup Threshold DB (InCA)
  - Connect to the update property
Thank you
Interlock Functionality

HW interlock (Machine Protection)

- Continuous (500kHz refresh rate) comparison between losses over 5 integration periods (between 2us to 1.2s) and 5 threshold values.
- Each time one of the integrated values exceeds the relevant threshold → Beam Permit removed for all users.
- Beam Permit latched → need operator reset.

SW interlock (Machine Optimization)

- Look at maximum of each integration period for each user at the end of the cycle
- Measured values compared to a second set of thresholds (1 per channel and per USER)
- If a channel value is for 1 USER above the relevant threshold for n times → block (and latch) the USER injections
- n : settable (per channel and per user) from 1 to 16

For both HW and SW interlocks

- Thresholds will be driven remotely from DB to the FPGA via an INCA interface