Pixel Efficiency

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High Voltage Bias Scans

- Regular scans are carried out to monitor the performance of the silicon sensors.

- Measuring depletion voltage is one way to observe effects of radiation.

- Comparison of observation to the theoretical model shows good agreement so far.
Points were fitted with a turnon curve: $1 / (1 + \exp[(V_{50} - X)/TW])$, where $V_{50}$ is the 50% Efficiency Point ($V_{50}$) and TW is the Turnon Width. The 95% Efficiency Point was calculated: $V_{95} = V_{50} + 2.944 \times TW$

Consider detector „fully depleted” at 95% efficiency
First 3 measurements on Layer 3 overlap

Only one measurement was performed on Layer 2 so far
All HV scans up to date – $V_{95}$
Plots from the model were generated after the data points were measured. Was there a retuning of the model?
Efficiency Loss studies

- Dynamic Efficiency losses
  - Efficiency seen to depend on:
    - Instantaneous Luminosity
    - L1 Trigger Rate
    - Position on orbit

- Single Event Upset, other losses
  - Intermittent low efficiency ROCs
  - FED errors
Fill 2103: HF, BSC and BRAN Rates

Fill 2040: HF, BSC and BRAN Rates

FED errors and bad modules are eliminated.
Excluded FED errors and intermittent bad ROCs (explained later)
Dynamics Efficiency Loss

- Max efficiency is 99.95%: small systematics in the measurement
- „Low instantaneous lumi”: efficiency loss seems mostly due to buffer filling
- „High instantaneous lumi”: there is also a common offset
- High number of DCol errors, not seen previously
- Most of the errors seen on intermittent bad ROCs are not signaled by FED errors
Low Eff ROCs – Fill 2040– Layer 1

- ROCs switch off after certain point, but recover after a PAUSE/RESUME
- FED errors excluded
- Module with FED errors is still low on efficiency
The number of bad ROCs vs time – BPix

- The number of bad ROCs seems to increase linearly with time.
- Straight lines show starts of new runs, which reset the intermittent bad ROCs.
- 2 additional PAUSE/RESUME found in DAQ elog for Fill 2105: 14 Sep 2011 – 10:34, 15:46 (GMT+1).
  → Fill 2105 started at 0:14 (GMT)