Tracking system of the LHCb upgrade
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Upgraded detector

Physics motivation:
- experimental sensitivities close/better than theoretical ones (electroweak and gluonic penguins)
- expand scope to lepton flavour sector, electroweak physics, exotic searches and QCD,

Installation is foreseen between 2018-19
- New tracking system.
- Full event readout at 40 MHz.
- Upgraded trigger (fully software).
- Increase of the output rate to 20-100 kHz
- New PID system.

Upgraded NEW tracking detector system:
- VELO – pixels,
- UT – silicon strips detector,
- SciFi – scintillating fibres
Tracking system of the LHCb upgrade

**Vertex Locator (VELO)**

- Covers full LHCb acceptance
- Crucial role in tracking efficiency
- Improved impact parameter resolution (first pixel - 5.1 mm from IP)

• L-shaped module, pixel sensors
• VeloPix ASIC,
• new L-shaped RF foil
• micro-channel cooling plates
• non-uniform radiation dose \( (0.2-8 \times 10^{15} \text{ n}_{eq}/\text{cm}^2) \)
• \( V_{dep} = 1000 \text{ V after 50 fb}^{-1} \)

**Upstream Tracker (UT)**

- Essential for fast triggering.
- Fast momentum measurement.
- Crucial for \( \Lambda^0 \) reconstruction.

• Finer granularity, full acceptance coverage.
• New front-end electronics.
• Improved radiation hardness.
• Four planes of single side silicon microstrip sensors,
• 10x10 cm,
• arranged in staves,
• sensors cooled below -5°C
Tracking performance

Forward Tracking (long tracks)

Expected performance of the new tracking system is not much degraded despite much larger luminosity (higher multiplicity, more PVs etc.) wrt the current one.

Tracking for upgraded LHCb

<table>
<thead>
<tr>
<th>B hadron, P &gt; 3 GeV, p_t &gt; 0.5 GeV</th>
<th>VELO-Forward</th>
<th>VELO-UT-Forward</th>
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</thead>
<tbody>
<tr>
<td>Ghost rate [%]</td>
<td>40.6</td>
<td>12.3</td>
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<tr>
<td>Reconstruction efficiency [%]</td>
<td>94.7</td>
<td>93.4</td>
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