**GPU-Based Track Trigger**

- **LHCb Upgrade**
  - 5× higher particle density per event → new tracking detectors
  - Pure software trigger with 40× input rate; 4 TB/s dataflow
  - Highest quality trigger decisions require full reconstruction
  - Goal: free CPU resources with GPUs/FPGAs for tracking

**SciFi Tracker**
- 3 stations with 4 layers
- Layer rotation 0°, ±45°, ±5°, 0°
- 250 µm scintillating fibres
- 2D hit information
- Resolution < 100 µm

**New GPU Algorithm**
- Combine hits from first and last layer
- Parallel treatment of all hits
- Combine all matching micro tracks
- Add hits from the middle layer for 3 information

**Database Technology for LHCb**
- Column store = lightweight compression
- Scalability, parallelism
- Stripping → ad hoc querying
- Applicable to many types of scientific data
  - E.g., genomic data

<table>
<thead>
<tr>
<th>Delorean</th>
<th>CRC Phase 2</th>
<th>CRC Phase 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>LHCb Upgrade</td>
<td>Data-intensive scans on petabytes of data</td>
<td>Extremely rare events (probability: 10^{-12} – 10^{-15})</td>
</tr>
<tr>
<td>Pure software trigger with 40× input rate; 4 TB/s dataflow</td>
<td>Diverse search predicates / complex analyses</td>
<td></td>
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</tbody>
</table>

**Sample Analysis**
- Analysis of CP violation in $B^0 \to D^+ D^-$ decays
- ML based selection with Boosted Decision Trees

**DeLorean @ Work**
- $B^0 \to D^+ D^-$ candidates

- Analysis of Run I data
- ML based selection with Boosted Decision Trees
- Cooperation within the CRC
- Unfolding based on kinematic variables
- Demonstrated with Monte Carlo data
- Will be used in future analyses

**Performance Characteristics**
- High scan efficiency
- Good scaling behaviour
- Better energy / performance ratio