A Di-electron trigger at Level-0: first look

Eduardo Rodrigues, CERN

I. Motivations

II. L0 Et distributions
   - for “electron-dominated” channels
   - for some other benchmark signal channels

III. Inclusion of the di-electron trigger in the L0DU
   - possible scenarios

IV. Outlook and Future Work
Motivations

- **Di-muon versus di-electron trigger:**
  - di-muon trigger mainly focussed on identifying $J/\Psi \rightarrow \mu\mu$ decays from a b-hadron
  - can we do similar for $J/\Psi \rightarrow ee$ decays?

- **Investigations of “extreme” L0DU algorithms:**
  - on Hans’ shopping list
  - in the near future all “possible” scenarios of L0DU algorithms need to be assessed and studied

- **Studies of di-electrons at L1 have been investigated:**
  - refer to the note of Aras Papadelis (summer student)
  - can the situation be improved by improving the input to L1?
1st L0-Electron : Resolutions

Resolutions in $E_T$

$B_d \rightarrow J/\Psi(\text{ee}) K_s$

<table>
<thead>
<tr>
<th>Entries</th>
<th>Mean</th>
<th>RMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>148269</td>
<td>0.6427</td>
<td>1.683</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Entries</th>
<th>Mean</th>
<th>RMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>78504</td>
<td>0.1409</td>
<td>0.7133</td>
</tr>
</tbody>
</table>

Eduardo Rodrigues

Trigger Meeting, 10th November 2003
L0 Retention Rate

Using a di-electron trigger "à la di-muon trigger" (cf. next transparencies)
L0 E_{t} Distributions (I)

- each curve corresponds to considering separately the combination
  L0 trigger = sub-trigger + pile-up veto & multiplicity Cuts
  -> it shows how much one could in principle obtain independently from each trigger

**Max. efficiency obtainable inclusively by each trigger!**
L0 $E_t$ Distributions (II)

Max. efficiency obtainable inclusively by each trigger!
**L0 $E_t$ Distributions (III)**

Max. efficiency obtainable inclusively by each trigger!
Origin of L0 Electrons

\[ \mathbf{B_d} \to \mathcal{J}/\Psi^{(ee)} \mathbf{K_s} \]

<table>
<thead>
<tr>
<th>Channels</th>
<th>All events</th>
<th>L0-pass</th>
<th>Offline selected</th>
<th>L0-pass &amp; offline selected</th>
</tr>
</thead>
<tbody>
<tr>
<td>L0-elec1 from signal B</td>
<td>52 %</td>
<td>62</td>
<td>86</td>
<td>89</td>
</tr>
<tr>
<td>L0-elec2 from signal B</td>
<td>28</td>
<td>34</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>L0-elec3 from signal B</td>
<td>16</td>
<td>17</td>
<td>27</td>
<td>27</td>
</tr>
<tr>
<td>L0-elec1&amp;2 from signal B</td>
<td>19</td>
<td>25</td>
<td>52</td>
<td>53</td>
</tr>
<tr>
<td>L0-elec1&amp;3 from signal B</td>
<td>10</td>
<td>11</td>
<td>21</td>
<td>22</td>
</tr>
</tbody>
</table>
III. Possible scenarios:

- di-electron trigger “à la di-muon trigger”
  \[ E_{T}^{ee} = E_{T}^{e1} + E_{T}^{e2} \text{ with } E_{T}^{e2} = 0 \text{ possible} \]

- a real di-electron trigger

- other “exotic” variations …

- investigation of the simplest implementation:
  - a di-electron trigger “à la di-muon trigger”
  - overrides the global event cuts

→ LO optimization with all \( E_{T} \) thresholds free …
L0 optimization with Di-electron Trigger

1. Optimizing each channel separately on the L0 efficiency ...

<table>
<thead>
<tr>
<th>Channels</th>
<th>L0 eff. (%) TDR settings</th>
<th>L0 eff. Max. (%) TDR settings</th>
<th>L0 eff. Max. (%) with di-elec. Trig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>$B_d \rightarrow J/\Psi(\text{ee}) K_s$</td>
<td>48.3</td>
<td>69.7</td>
<td>85.0</td>
</tr>
<tr>
<td>$B_d \rightarrow K^* \gamma$</td>
<td>72.9</td>
<td>77.6</td>
<td>86.7</td>
</tr>
<tr>
<td>$B_d \rightarrow J/\Psi(\mu\mu) K_s$</td>
<td>89.3</td>
<td>93.0</td>
<td>93.2</td>
</tr>
<tr>
<td>$B_d \rightarrow \pi \pi$</td>
<td>53.6</td>
<td>54.7</td>
<td>56.7</td>
</tr>
</tbody>
</table>

Max. eff. obtained with separate optimization of each channel
(eff. calculated on independent sample)
Outlook and Future Work

- First results are encouraging ...

- Need to investigate exact origin of the L0-electrons

- Need to investigate a true di-electron trigger

- How well can one do re-optimizing L0 with a di-electron trigger?
  -> do we loose a lot for other channels (e.g. hadronic channels)?