\[ \langle \chi^2 \rangle \]

- **Original**
- **Cross-check (sector boundaries ignored)**
- **Using beam spot in hit selection**

\[ \phi, \text{ degrees} \]
# Beam Spot & Road Def'ns

<table>
<thead>
<tr>
<th>Fitting Mode</th>
<th>$\sigma(\sigma_b)$</th>
<th>Fraction in narrow</th>
<th>Amplitude $\chi^2$ vs. $\phi$</th>
<th>Avg. $\chi^2$ &amp; rate</th>
<th>Number of good tracks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.55</td>
<td>78%</td>
<td>0.29(4)</td>
<td>2.4 / 37%</td>
<td>4880</td>
</tr>
<tr>
<td>2</td>
<td>1.51</td>
<td>75%</td>
<td>0.26(4)</td>
<td>2.2 / 37%</td>
<td>4879</td>
</tr>
<tr>
<td>3</td>
<td>1.39</td>
<td>71%</td>
<td>0.08(3)</td>
<td>2.0 / 33%</td>
<td>6137</td>
</tr>
<tr>
<td>4</td>
<td>1.39</td>
<td>71%</td>
<td>0.08(3)</td>
<td>2.0 / 33%</td>
<td>6212</td>
</tr>
<tr>
<td>5</td>
<td>1.40</td>
<td>72%</td>
<td>0.08(3)</td>
<td>2.0 / 41%</td>
<td>6210</td>
</tr>
</tbody>
</table>

Mode 1 = original 3xN fits  
2 = reselect hits, still using (0,0) for everything. (=1)  
3 = same hits-in-road. Reselect for fitting using beam spot  
4 = redo hits-in-road with (0,0) and reselect for fitting using beam spot (=3)  
5 = redo hits-in-road and reselect for fitting both steps using beam spot
Beam Spot & Road Width

Vary the road half-width and find that

(1) A slightly narrower road gives more good tracks, but too narrow throws hits...

(2) the pass fraction has a small variation
Beam Spot & Road Width

A pseudo-trigger*: Plot efficiency vs. rejection when beam spot is used in hits-in-road selection

*Trigger: maximum $\sigma_b$ in event

Denominators: events with at least one good STT track

Each curve: different road width

Widest road = 2mm

Narrowest road

Relative Rejection

Run186066
Beam Spot & Road Width

A pseudo-trigger: Plot efficiency vs. rejection when beam spot is *not* used in hits-in-road selection

Each curve: different road width

Widest road

Narrowest road

Relative Efficiency vs. Relative Rejection
Beam Spot & Road Width

Directly Compare with and without beam spot.

With beam spot is better
Roughly 20% better rejection if beam spot is used in hits-in-road assignment

1 = with beam spot same performance as without

10/23/03 Hobbs
**Beam Spot & Road Width**

Mode A = redo hits-in-road with (0,0)

B = redo hits-in-road and \((r_b, \phi_b)\)

Hits for fitting always uses beam spot

<table>
<thead>
<tr>
<th>Mode/ ½ Width</th>
<th>(\sigma(\sigma_b))</th>
<th>Fraction in narrow peak</th>
<th>Amplitude (\chi^2) vs. (\phi)</th>
<th>Avg. (\chi^2) &amp; rate</th>
<th>Number of good tracks</th>
</tr>
</thead>
<tbody>
<tr>
<td>A / 2.0 mm</td>
<td>1.39</td>
<td>71%</td>
<td>0.07</td>
<td>2.0 / 33%</td>
<td>6212</td>
</tr>
<tr>
<td>B / 2.0 mm</td>
<td>1.40</td>
<td>72%</td>
<td>0.08</td>
<td>2.0 / 41%</td>
<td>6210</td>
</tr>
<tr>
<td>A / 1.0 mm</td>
<td>1.44</td>
<td>71%</td>
<td>0.07</td>
<td>2.0 / 37%</td>
<td>7316</td>
</tr>
<tr>
<td>B / 1.0 mm</td>
<td>1.49</td>
<td>75%</td>
<td>0.08</td>
<td>2.0 / 45%</td>
<td>7328</td>
</tr>
<tr>
<td>A / 0.5 mm</td>
<td>1.4</td>
<td>63%</td>
<td>0.07</td>
<td>1.8 / 40%</td>
<td>6998</td>
</tr>
<tr>
<td>B / 0.5 mm</td>
<td>1.50</td>
<td>71%</td>
<td>0.08</td>
<td>1.9 / 47%</td>
<td>8098</td>
</tr>
<tr>
<td>A / 0.25 mm</td>
<td>1.71</td>
<td>53%</td>
<td>0.53</td>
<td>2.0 / 66%</td>
<td>4921</td>
</tr>
<tr>
<td>B / 0.25 mm</td>
<td>1.53</td>
<td>65%</td>
<td>0.06</td>
<td>1.5 / 49%</td>
<td>7672</td>
</tr>
</tbody>
</table>
Conclusions

Using the beam spot in the hit section is important

1. $3\times-4\times$ improvement in $\phi$ dependence of fit $\chi^2$
2. Number of “good tracks” up 27%

Also useful useful beam spot in hit to road matching with 1-2 mm road?

1. Retain #1 above
2. A 1 mm road does
   increase “all good tracks” by 20%
   small increase in number of b-quark good tracks
   pass fractions relatively stable
   reduce the fitting times (secondary consideration)

but efficiency vs. rejection slightly worse. Keep 2mm and add beam spot?
0.25 mm road, $\langle N_{\text{hits}} \rangle = 1.9$

- 0.5 hits: 3.1
- 1.0 hits: 5.0
- 2.0 hits: 8.4