1. Topological filtering

- Attempt to filter matched roads using topological arguments (no cross-matches)
- Explanation why it failed
For a given pattern in default bank (2 2 2 2 in the example below), it would seem that there are 2*nlayers possible matches:

Default bank:  
SS-shifted bank:
For a given pattern in default bank (2 2 2 2 2 in the example below), it would seem that there are 2*nlayers possible matches:

Default bank: 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2

SS-shifted bank: 1 1 1 1 1 1 1 2 1 1 2 2 1 2 2 2
But: the picture was wrong! The layers are **not** aligned!

We have a “cross-match” not enumerated before!

So in general, we cannot make any requirement on matches (such as requiring no not being “crisscrossed”)

2 2 2 2
2 1 2 1
2. # of matching SS-shifted roads

- Distribution of # of matching roads
- How cutting on max matches affects efficiency
Given a default road, we find a list of N matching ss-shifted roads.

- Matching here means ss1=ss2 or ss1=ss2-1

- i=[0..N-1] matching ss-shifted roads are sorted by coverage.

- For each match, we create a new “road” (which only has hits in the intersection of SS's)

- Plotted above is a histogram of i values. I.e., one entry for each final road.

- Sometimes there are 50 ss-shifted roads matching a given default road!
### Efficiency vs a cut on nmatches

( + effect of Joe's 10/11 scheme )

Whbb @ $10^{34}$
Only barrel patterns; $|\eta|<1.0$
Efficiency with respect to all primary tracks (mostly pions) with $pt>1\text{GeV}$

<table>
<thead>
<tr>
<th>description</th>
<th>#matches</th>
<th>track eff</th>
<th>#roads</th>
<th>#fits (tot)</th>
</tr>
</thead>
<tbody>
<tr>
<td>default</td>
<td>N/A</td>
<td>75.87%</td>
<td>10,601</td>
<td>10,681,364</td>
</tr>
<tr>
<td>Ss-shift</td>
<td>50</td>
<td>74.91%</td>
<td>47,843</td>
<td>1,846,518</td>
</tr>
<tr>
<td>Ss-shift</td>
<td>30</td>
<td>74.83%</td>
<td>45,719</td>
<td>1,756,362</td>
</tr>
<tr>
<td>Ss-shift</td>
<td>20</td>
<td>74.70%</td>
<td>42,591</td>
<td>1,623,017</td>
</tr>
<tr>
<td>Ss-shift</td>
<td>10</td>
<td>73.83%</td>
<td>34,333</td>
<td>1,285,323</td>
</tr>
<tr>
<td>Ss-shift</td>
<td>5</td>
<td>72.15%</td>
<td>24,185</td>
<td>879,092</td>
</tr>
<tr>
<td>ss+joe</td>
<td>50</td>
<td>72.10% (?)</td>
<td>47,843</td>
<td>385,062</td>
</tr>
</tbody>
</table>

**IPAT efficiency = 85%**

Joe's reduction to majority fix is largely orthogonal to ss-shifted scheme!
Notes on efficiency

• Absolute efficiency (for all primary tracks) is still quite low. This is a general problem
  − Pions not leaving hits in outer layers?
• Relative to default case, SS-shift + joe case works well
• Additional possibilities to reduce #fits by cutting on max nmatches
3. turn-on curves

- Efficiency turn-on curves for muons and pions
- Using single mu/pi samples in region 6
- With and without SS-shifted scheme
Turn-on curves with ss-shifted arch
single muons and pions in central eta ONLY
Only barrel patterns are loaded (!)
## Summary table for efficiencies

<table>
<thead>
<tr>
<th># patt / 4</th>
<th>eff mu (def)</th>
<th>eff mu (ss)</th>
<th>eff pi (def)</th>
<th>eff pi (ss)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100000</td>
<td>0.5</td>
<td>0.3</td>
<td>0.43</td>
<td>0.26</td>
</tr>
<tr>
<td>500000</td>
<td>0.8</td>
<td>0.66</td>
<td>0.71</td>
<td>0.6</td>
</tr>
<tr>
<td>1000000</td>
<td>0.86</td>
<td>0.8</td>
<td>0.78</td>
<td>0.73</td>
</tr>
<tr>
<td>1500000</td>
<td>0.88</td>
<td>0.83</td>
<td>0.8</td>
<td>0.76</td>
</tr>
<tr>
<td>2000000</td>
<td>0.89</td>
<td>0.85</td>
<td>0.81</td>
<td>0.78</td>
</tr>
<tr>
<td>3000000</td>
<td>0.9</td>
<td>0.87</td>
<td>0.82</td>
<td>0.8</td>
</tr>
<tr>
<td>5000000</td>
<td>0.91</td>
<td>0.89</td>
<td>0.83</td>
<td>0.81</td>
</tr>
<tr>
<td>7500000</td>
<td>0.91</td>
<td>0.9</td>
<td>0.84</td>
<td>0.82</td>
</tr>
<tr>
<td>10000000</td>
<td>0.91</td>
<td>0.9</td>
<td>0.84</td>
<td>0.82</td>
</tr>
</tbody>
</table>
Resolution/efficiency plots

- Top plot: default TrigFTKSim vs IPAT
- Bottom plot: SS-shift (50 matches) + Joe 10/11
Efficiency drop due to ss-shift + Joe filtering
No difference in resolution!
No difference in resolution!
No difference in resolution!

FTK curvature resolution is slightly asymmetric (even in the default config). This had been observed before.