**TSF to ZPD I/O Format**

Stephen Bailey, 29 November 2001

6 Mar 02: Reversed segment ordering; clarified TSFy sector boundaries.  sjb
4 Apr 03: Updated frame bit definition in diagram.  sjb.

- TSFx and TSFy have identical formats except for how many segments are sent.
- Cell location (loc) has 4 bits; fine phi bins (phi) with respect to that cell has 6 bits; phi error (dPhi) has 3 bits
- Mask=1 means the segment exists.  Mask=0 means it does not and the other bits are undefined.
- The three segments within a TSFx superlayer may be in any order; e.g. segment 0 does not necessarily have a smaller phi or a higher selection rank than segment 1.
- Although the TSFy sends 6 segments per superlayer, these are in two groups of 3, each group covering one sector (2π/16 radians).  The ordering within a sector is arbitrary (just as with the TSFx) but the two groups are completely separate.  The segments in sector 0 have smaller φ values (in radians, not be confused with “phi”) than those in sector 1.
- Most significant bits are sent first.

**TSFx to ZPD**

![Diagram of TSFx to ZPD I/O Format]

- Word 0: Mask[20:0]
  - loc[3]
  - loc[2]
  - loc[1]
  - loc[0]
- Word 1: phi[5:0]
  - phi[5]
  - phi[4]
  - phi[3]
  - phi[2]
  - phi[1]
  - phi[0]
- Word 13: dPhi[2:0]
  - dPhi[2]
  - dPhi[1]
  - dPhi[0]

Unused fields:
- A1 Segment 2, A1 Segment 1, A1 Segment 0, A2 Segment 2, A2 Segment 1, A2 Segment 0, V3 Segment 2, V3 Segment 1, V3 Segment 0, A4 Segment 2, A4 Segment 1, A4 Segment 0, U8 Segment 2, U8 Segment 1, U8 Segment 0, V9 Segment 2, V9 Segment 1, V9 Segment 0, A10 Segment 2, A10 Segment 1, A10 Segment 0
### TSFy to ZPD

<table>
<thead>
<tr>
<th>Frame Bit</th>
<th>Unused</th>
<th>U5 sector 0 seg 2</th>
<th>U5 sector 0 seg 1</th>
<th>U5 sector 1 seg 2</th>
<th>U5 sector 1 seg 1</th>
<th>V6 sector 0 seg 2</th>
<th>V6 sector 0 seg 1</th>
<th>V6 sector 1 seg 2</th>
<th>V6 sector 1 seg 1</th>
<th>A7 sector 0 seg 2</th>
<th>A7 sector 0 seg 1</th>
<th>A7 sector 1 seg 2</th>
<th>A7 sector 1 seg 1</th>
<th>A7 sector 1 seg 0</th>
<th>A7 sector 1 seg 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>27:19</td>
<td>18</td>
<td>17</td>
<td>16</td>
<td>15</td>
<td>14</td>
<td>13</td>
<td>12</td>
<td>11</td>
<td>10</td>
<td>9</td>
<td>8</td>
<td>7</td>
<td>6</td>
<td>5</td>
<td>4</td>
</tr>
</tbody>
</table>

#### 6 bit phi

The 6 bits of phi[5:0] cover the full range of 0 to 63. This is different than the current 5 bit LUT which starts at phi=1. The fine phi bin locations with respect to the cell center, edges, and centers of neighboring cells are as follows:

```
0 15 16 31 32 47 48 63
```