Plan of Tracker Alignment MC studies

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TKR Alignment MC Studies

• Objectives.
  – Evaluation of alignment precision.
    • Alignment parameters for perfect TKR in MC.
    • Alignment parameters for misaligned TKR in MC.
  – Evaluation of misalignment correction procedure.
    • Comparison between data and MC.

• Boundary conditions.
  – Mechanical precision is not much worse than the specification (SCIPP 97/32).
  – Detector placement precisions.
    • Displacement in z direction < 20 µm.
    • Displacement in xy plane < 50 µm.
    • Rotation < 0.3 mrad.
Implementation of Misalignment

- **No modification of TKR geometry.**
  - Changing geometry for each detector is too complicated and probably unnecessary for small misalignment.
  - Hits are generated with nominal detector positions.

- **Misalignment by Digi.**
  - Digi recalculates the hit position in the SSD according to misalignment parameter and track slope (see equations below).

\[
\begin{align*}
x & = x_{shf} + z_{rot}y + z (z_{shf} + y_{rot}x_{rot}y) \\
y & = y_{shf} + z_{rot}x + z (z_{shf} + y_{rot}x_{rot}y)
\end{align*}
\]
Misalignment Correction in Tracking

• Track finder ignores misalignment.
  – Rotation correction requires 3D space point information.
  – Effect of misalignment is considered negligible.

• Alignment parameters are obtained by independent alignment program. \[(x_{shf}, y_{shf}, z_{shf}, y_{rot}, x_{rot}, z_{rot})\]

• Track fitter takes into account misalignment.
  – Recalculate xy hit position at the nominal z position according to misalignment parameters and track slope.
    \[
    \begin{align*}
    x &= x + x_{shf} + z_{rot} y / (z_{shf} - y_{rot} x + x_{rot} y) \\
    y &= y + y_{shf} + z_{rot} x / (z_{shf} - y_{rot} x + x_{rot} y)
    \end{align*}
    \]
  – Alternatively, in addition to xy, z value of hit can be recalculated.
    • Greater modification is required for track fitter.
      \[
      \begin{align*}
      x &= x + x_{shf} + z_{rot} y \\
      y &= y + y_{shf} + z_{rot} x \\
      z &= z + z_{shf} - y_{rot} x + x_{rot} y
      \end{align*}
      \]