RICHSbus GUI
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Ring Imaging CHerenkov detector

1. Cherenkov radiation occurs when a charged particle travels faster than light in a given medium.

2. Similar to sonic boom, but emits a cone of Cherenkov photons ($\sim$ 150 nm).

3. Light cone intersects detectors to form a conic section.

   - Due to internal reflection, only part of the conic section is traced out ($\sim \frac{1}{3}$ at 25°).
   - Conic section reconstructed to calculate Cherenkov angle.

4. By measuring Cherenkov angle, we can determine the velocity of the charged particle via $cos\Theta = \frac{1}{n\beta}$.

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5. With velocity and momemtum we can find the mass of the particle, thereby identifying it!

6. Main goal is to separate charged kaons from charged pions.

7. Examples:

   - Studying rare decay $\overline{B}^{\circ} \to \pi^{+}\pi^{-}$ where background is $\overline{B}^{\circ} \to K^{-}\pi^{+}$.
   - CP violation rate asymmetry in $\overline{B}^{\circ} \to K^{-}\pi^{+}$ versus $\overline{B}^{\circ} \to K^{+}\pi^{-}$.
   - Incidence of $B \to \rho\gamma$ where $B \to K^{*}\gamma$ is dominant.

Details. . .

1. Create Cherenkov photons with LiF radiator (1 cm, $n = 1.5$).

2. Proximity focusing = no focusing.

3. Photons multiply in gas consisting of

   - Methane - good quenching gas, keeps things stable.
   - TEA (triethylamine) - low ionization potential in vacuum UV range ($\sim$ 150 nm).

4. Photosensitive detectors (cathode pads) read position of incident photons.

RICHSbus Component

1. Sbus = Slow Bus.
   - Slower than the data rate.
   - Monitors critical parameters.
2. Complex Electronics:
   - Eight crates, each crate has 14 or 15 slots, each slot has 3 cells.
   - Each cell corresponds to a chain of 10 chips, 64 channels per chip.
   - Each channel has an amplifier, shaper, and buffer output.
   - Small signal $\rightarrow$ amplifier $\rightarrow$ sequencer $\rightarrow$ out.
   - Read in with receiver and digitized on databoard.
3. Component is a C++ program that reads the data from the databoard.
4. Problems with datapath:
   - Spread in histograms due to differences in 8 and 10 bit datapaths.
   - Differing lengths of cables = differing resistances.

RICHSbus GUI

1. Java-based GUI that communicates with Componenent to display critical parameters.

2. Problems:

   - Had to figure it out myself.
   - Does not update continuously.
   - Does not display alarms (i.e. out of range values).
   - No way to analyze data it displays.
   - Cannot easily be used by shifters.

Accomplished:

1. Modified RICHSbusGUI to non-GUI that writes data to files.

2. Data consists of critical parameters (i.e. voltage).
   - Makes sure data is good.
   - Without monitoring we are blind!

3. Data read with generic data analysis program (mn_fit), similar to PAW.
   - Displays histograms for critical parameters.
   - Use histograms to adjust mean and rms value.

Future:

1. Modify RICHSbusComponent

- Downgrade fatal alarms.
- Make limits on alarms narrower.
- Recompile Component with updated library.
- Make data acquisition continuous.

2. Modify RICHSbusGUI

- Update data continuously on screen.
- Incorporate a histogram.
- Incorporate graphical alarms.
- Construct easy layout for shifters.