Status of the L1.5 Trigger Design

1. The Concept

2. Results of design/simulation
   - 4/4 layers (not efficient enough)
   - 3/4 layers
   - 3/4 layers, requiring inner layer
   - 3/4 layers, inverting second layer

3. Future work

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The Level 1.5 Concept


- Use SVD2 z information in trigger
  - replace CDC-z info lost
  - reject beam-gas interactions passing level-1

- Wait for Halny digitisation (25.4 μs) → L1.5

- Working in z view only

- Group 16/32 strips together into trigger-strips

- Trigger-strip patterns to Xilinx → valid combinations

- Working with SVD2 geometry from Hara-san
  - generate valid patterns with straight lines + dithering
  - test efficiency with GSIM tracks
  - test rejection with z-displaced GSIM tracks
Naive Efficiency

- Efficiency requiring hits in 4 out of 4 layers

- Clearly too simplistic

- Efficiency drops anywhere one hit is lost
Make the Obvious Improvement

- Efficiency requiring hits in 3 out of 4 layers

- $z$ distribution of
  - generated tracks (solid)
  - triggered tracks (dotted)

- Good efficiency in desired region ($|z| < 4$ cm)

- Fake tracks near $z = -8.0$ cm not good
The Cause of *Ghosting at* $-z$

- *Ghosts* result from ganging of $z$ strips

- Hit pattern could have been a track from $z = \pm 2$ cm

- Easy fix: Require a hit on the inner layer
First Attempt to Remove *Ghost Roads*

- Can kill most ghost roads by requiring $2/3 + \text{Inner layer}$

![Graph showing data distribution]

- Basically OK
- Slight inefficiencies near gap between inner half-ladders
- Relies heavily on good health of inner ladders (radiation?)
A Radical Suggestion to Improve \( z \) Ghosting

- Invert second layer ladders → break multiplexing symmetry

- Reduces *ghosting* by a factor of 3
- Allows "any 3 out of 4" improving efficiency
- Increases \( r_\phi - r_z \) ambiguities in BELLE forward direction
- Could just accept *ghosting* if inner ladder dies.
Next steps

- Partition trigger patterns into 18 $\phi$ slices
- Generate/study sample of background events
  - More than one track per event
  - Events that would pass the L1 CDC trigger
- Develop/define interface with other Belle triggers
- 9U VME board layout started
- Automating transfer of trigger logic into Xilinx