HLT2 TOPOLOGICAL TRIGGER

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WHAT IS THE TOPOLOGICAL TRIGGER?

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- Generic trigger for **decays into charged hadron final states** (+ muons)
  - Can also select prompt charm
- Look for 2,3,4 track combinations in a wide mass window
  - Can trigger on signal despite reflections or missed tracks
- Use fast-track fit to improve signal efficiency and minbias rejection

TOPO ARCHITECTURE

HLT1 output rate ~ 30kHz

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HLT1 output rate ~ 30kHz

Topo output rate ~ few 100 Hz

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Topological: use only "robust" cuts (no significance cuts), and aim for an output rate of ~ a few kHz

Topo output rate ~ few 100 Hz

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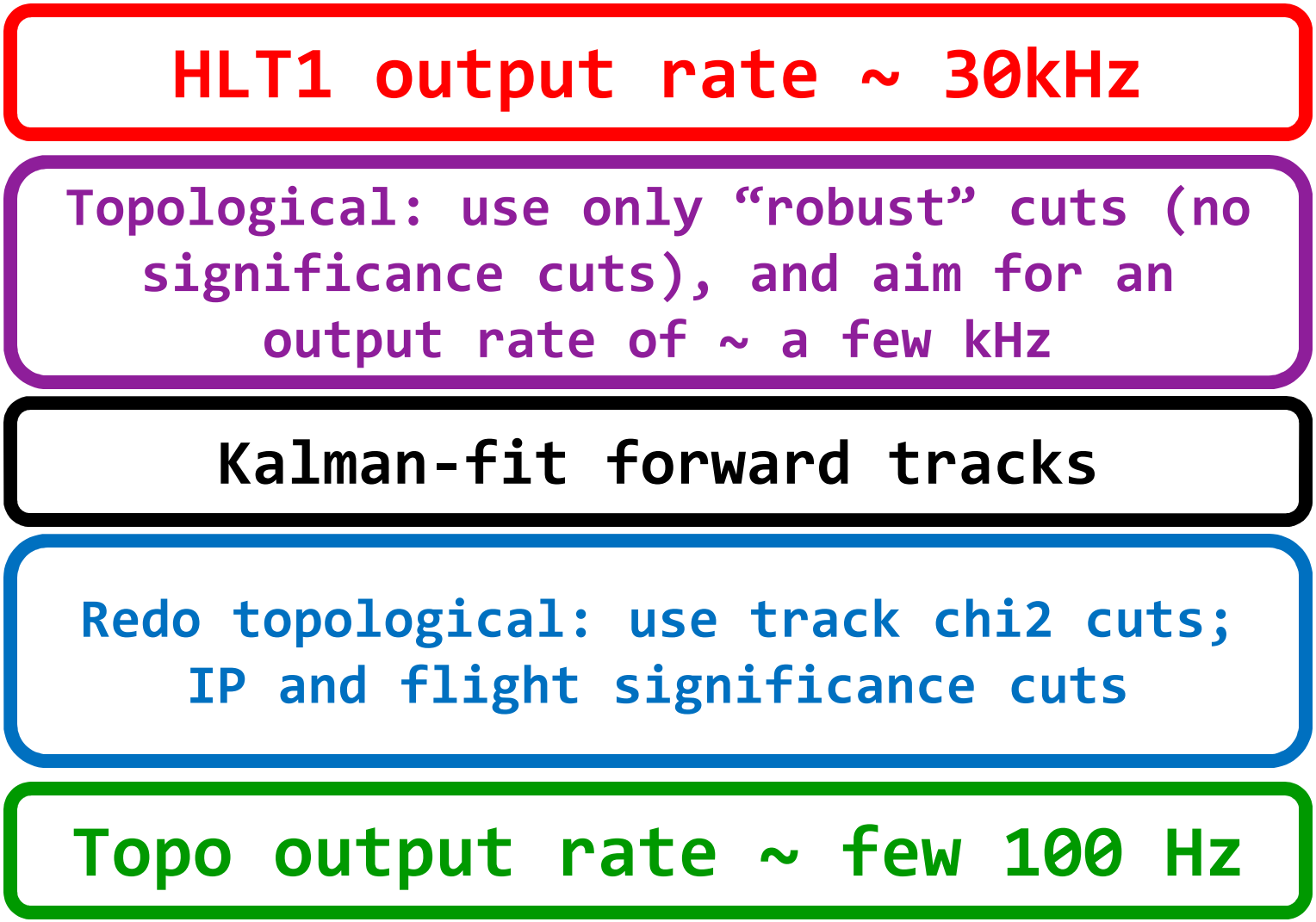
HLT1 output rate ~ 30kHz

Topological: use only "robust" cuts (no significance cuts), and aim for an output rate of ~ a few kHz

Kalman-fit forward tracks

Topo output rate ~ few 100 Hz

TOPO ARCHITECTURE



WHAT TRACK FIT DO WE USE?

- **Use the "fast" track fit**
  - 1-iteration Kalman, simplified material description
- **Use 2D primary vertices**, as in HLT1
  - Fitting 3D primary vertices is under investigation and could improve efficiencies somewhat

WHAT KINDS OF CUTS DOES THE TOPO USE?

TRACK LEVEL CUTS

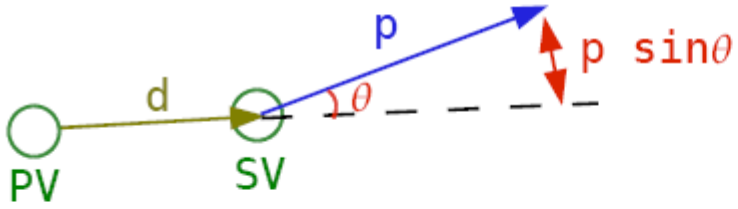
- **Before the track fit**
  - All tracks must have some minimum IP/PT to reduce combinatorics
  - The highest PT track in the combination must have a substantial PT (e.g. > 1.5 GeV)
- **After the track fit**
  - Cut on the Chi^2 of the track to eliminate ghosts
  - Repeat previous IP/PT cuts with better track parameter measurements

VERTEX CUTS

- The 2,3,4-body combinations are vertexed
  - All tracks used must have the same “best” primary vertex
  - Tracks used to form the vertex must satisfy maximum DOCA criteria with respect to each other
  - The decay vertex must be separated from the primary vertex
    - Both overall distance and radial distance are cut on

POINTING CUT DEFINITION

POINTING



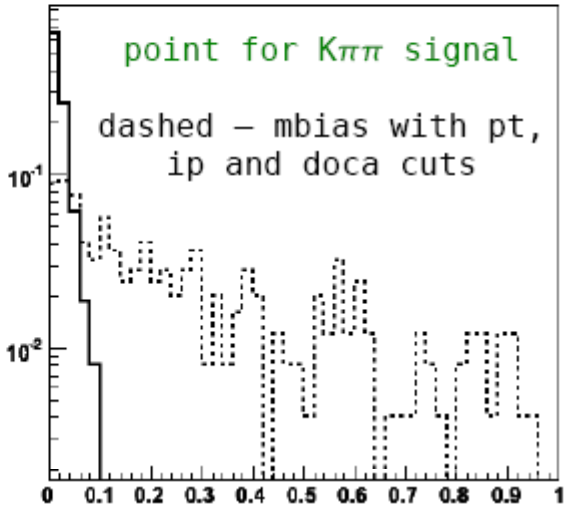
p = vector sum of daughters 3-momenta

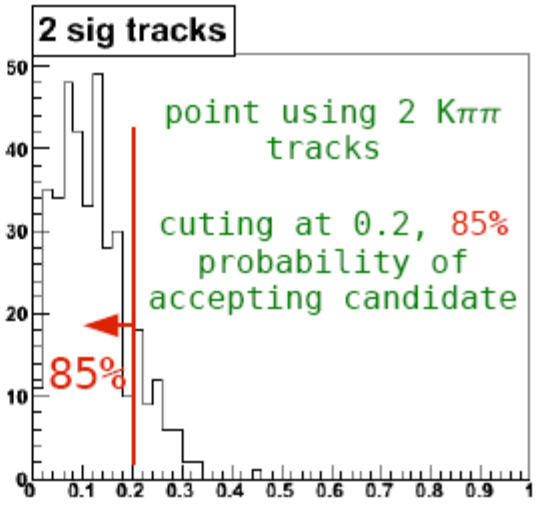
ptdaus = pt sum of B daughters

$$POINT = \left(1 + \frac{PTDAUS}{p \sin\theta}\right)^{-1}$$

- distribution range 0 – 1
  signal < 0.1
- used in HLT1 hadron alley
- cutting at 0.2 is a good strategy to select events which loose 1 track

  n-1 recovers 85% of candidates which loose one track





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Thanks Gabriel!

MASS CUTS

- The mass window is currently between 4 and 6 GeV
- Can remove upper mass window with small (~5%) increase in minbias rate

SUMMARY

- Topological trigger is a generic trigger aimed at selecting decays into multiple charged tracks
- Now implemented in the standard LHCb software framework as part of Hlt2
- In order to try it out (with DV v22r1):
  - **getpack Hlt/HltConf; tag=spradlin_20090317**
  - **getpack Hlt/HltSelections; tag=gligorov_20090317**
  - **getpack Phys/LoKiPhys; tag=spradlin_20090310**
  - **getpack Phys/LoKiArrayFunctors; tag=spradlin_20090310**
  - **Run Hlt2 as normal.**