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A multi-Hough-based displaced vertex track trigger for the Belle II Experiment

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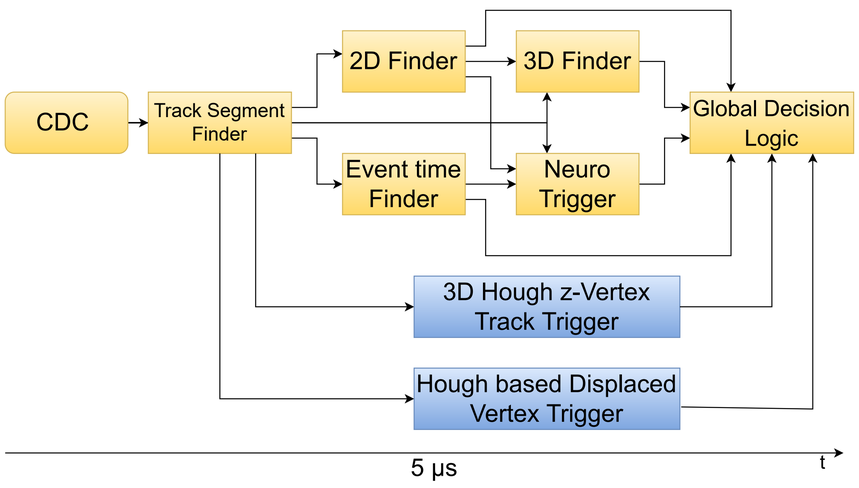
Belle II L1 Track Trigger System

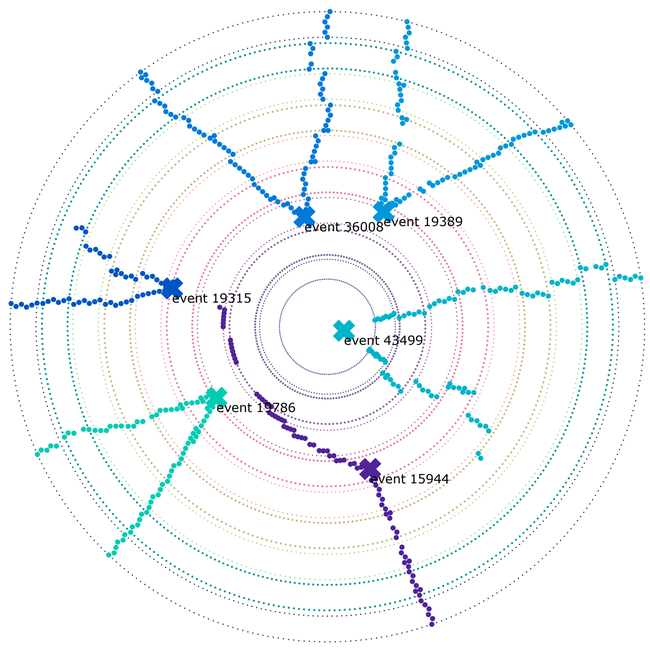
Within 5 µs, 14 336 sense wires must be evaluated at an input rate of 32 MHz to reach a trigger decision. The individual modules are distributed over several FPGAs.



Displaced Vertex Tracks

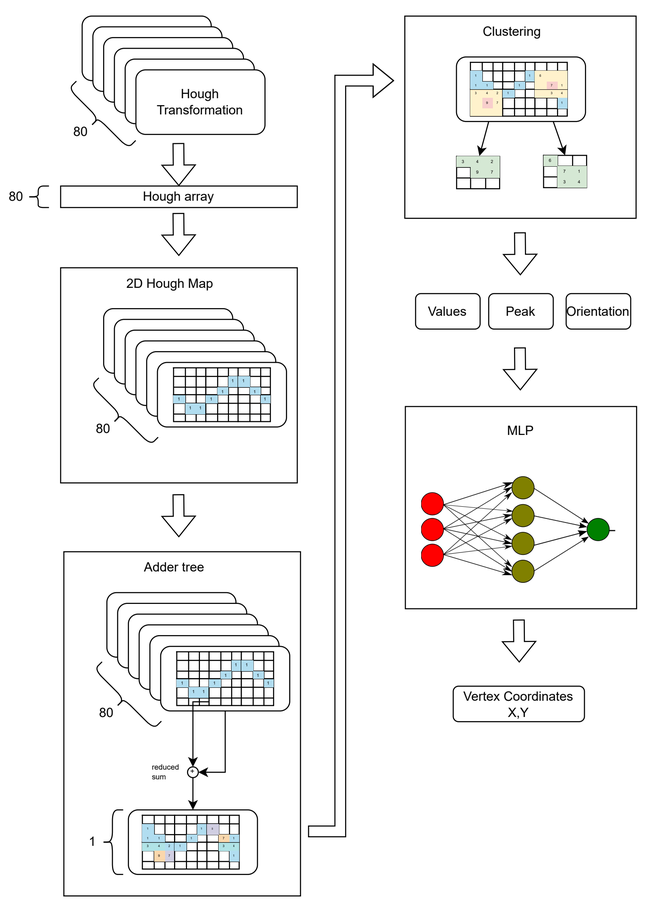
Identifying displaced-vertex tracks is crucial for the accurate measurement of particle properties and the discovery of new physics.

- Long-lived neutral particles feature a displaced vertex in the Belle II detector.
- Currently, displaced-vertex tracks are filtered out by the present L1 trigger system.
- Track finding with Hough transforms need a vertex hypothesis -> ∼ 80 „macro cells“ distributed over the CDC wire plane increases.



Hough based Displaced Vertex Trigger

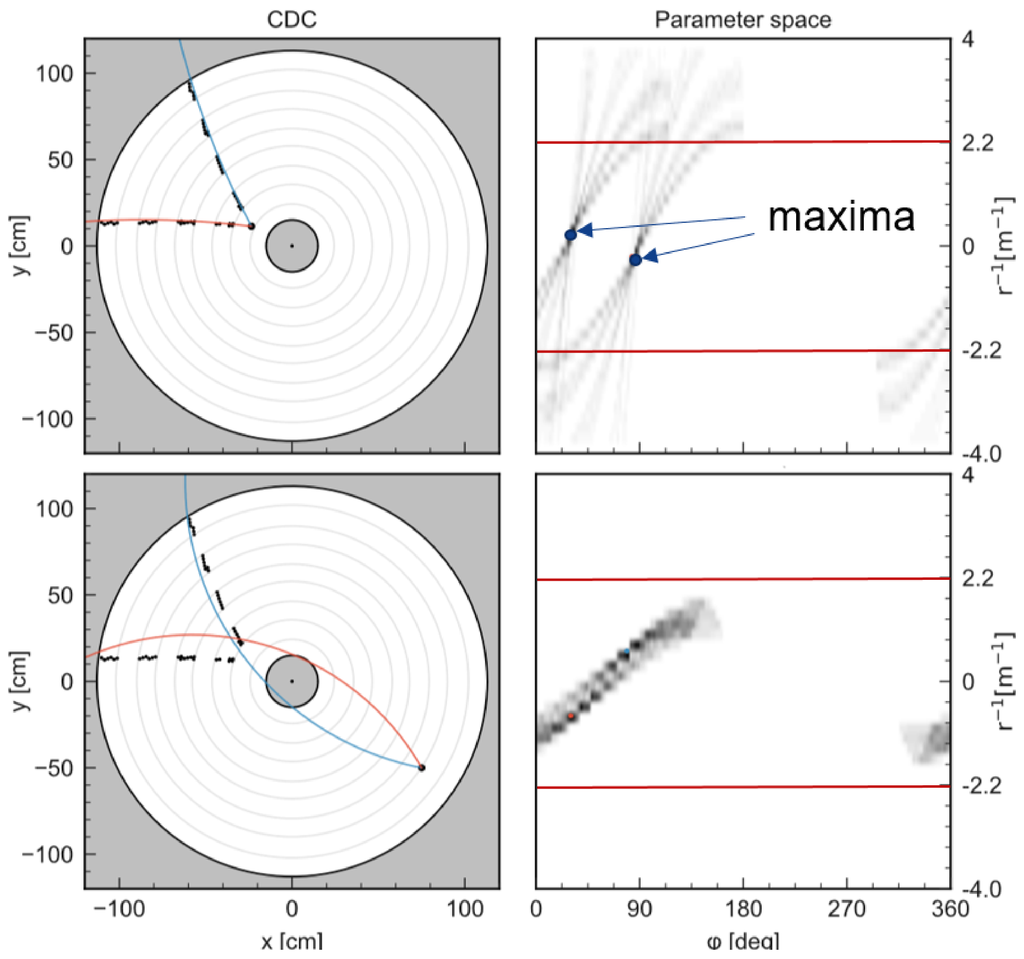
- Two tracks originating from same displaced vertex.
- 80 Hough transfors are calculated in parallel with hypothetical starting point.
- Hough curves are calculated individually and then summed into the final Hough space.
- Up to two global maxima are identified.
- Clustering performed locally around identified maxima.



	Hough		Clustering	
	total	*percent*	total	*percent*
LUT	69313	7.48 %	85807	9.26 %
FF	132413	7.15 %	43218	2.33 %
DSP	0	0 %	0	0 %

Further improvements

If the background allows, it may not be no longer necessary to find a maximum. The ratio of the pixels at the top and bottom in relation to the center might be sufficient to determine interesting candidates.



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