# GPUs as a possible L1 Track Trigger

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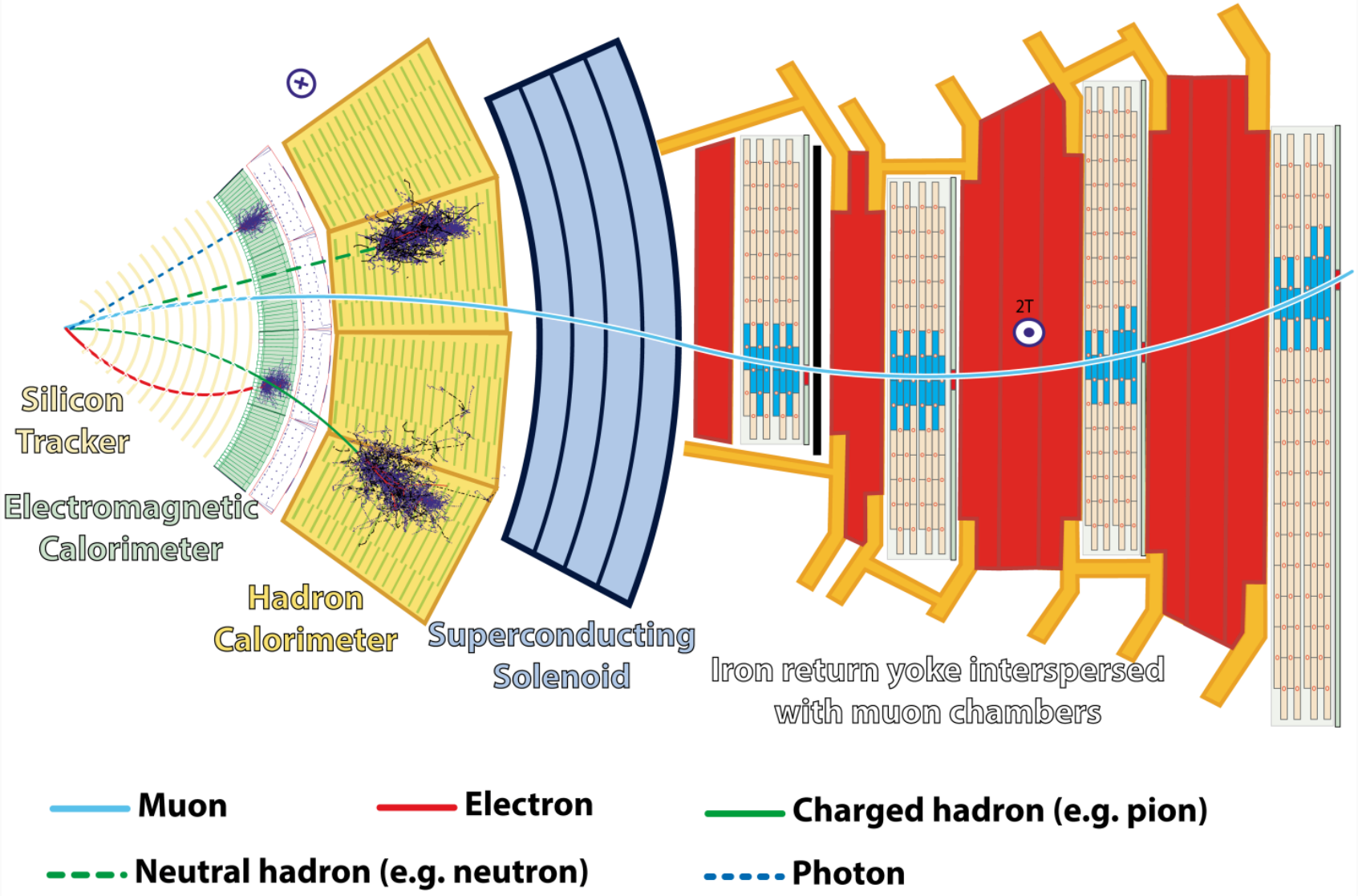
# LHC Upgrade Plans

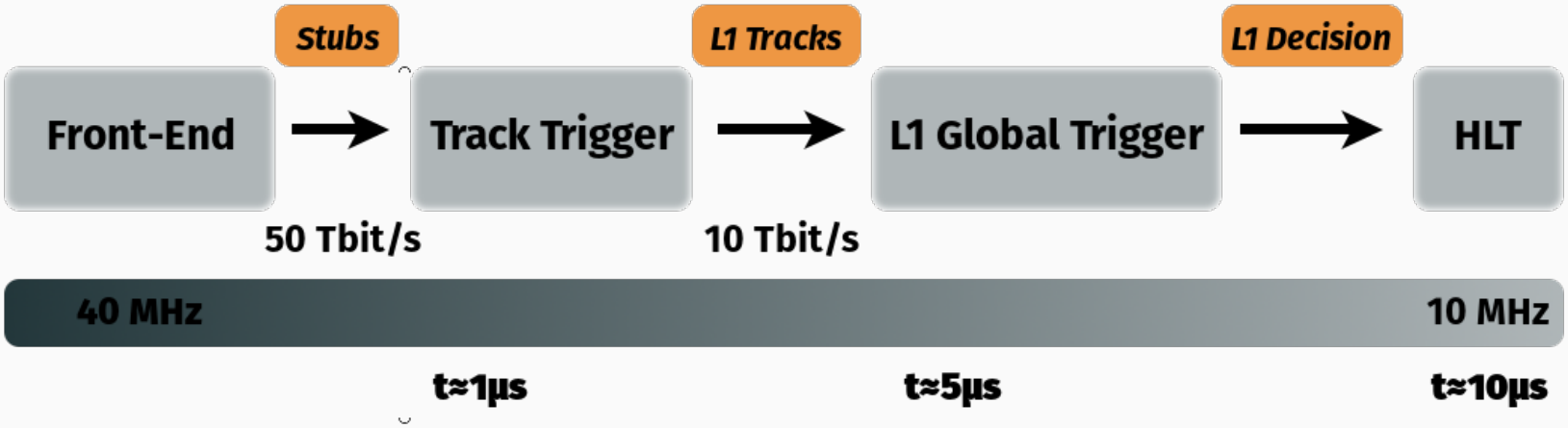
- High Luminosity-LHC: Upgrade of the LHC ($\approx$ 2025)
- Observations of events below current sensitivity level
- Current Luminosity increased by a factor of 10
- $\approx$ 12.000 Hits per Bunch crossing in the outer Tracker
- Bunch crossings happen every 25 ns

$\Rightarrow$ Complete redesign of the Tracker and the Trigger System

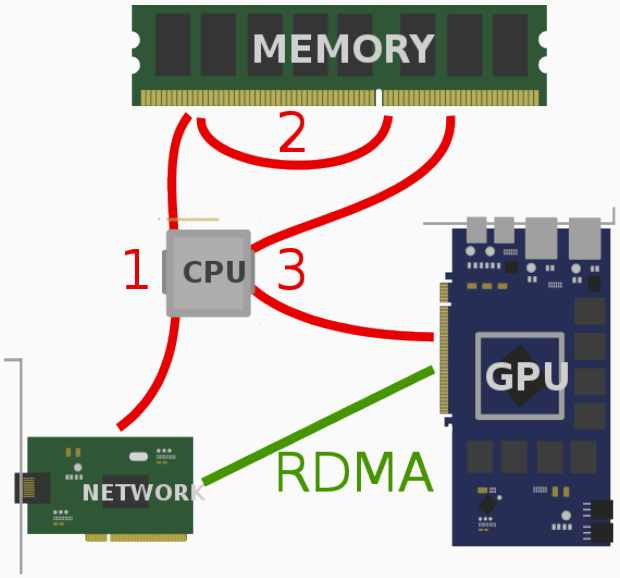
# CMS Detector Layers, Transverse Slice



# Experimental Requirements




- Low Latency
- High Frequency
- High Data Rates

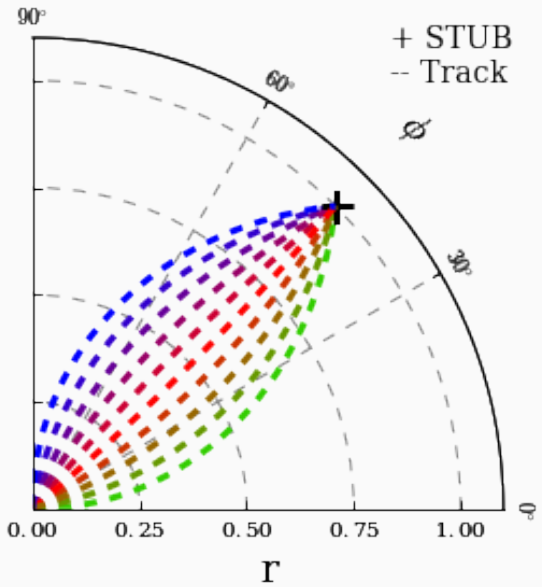


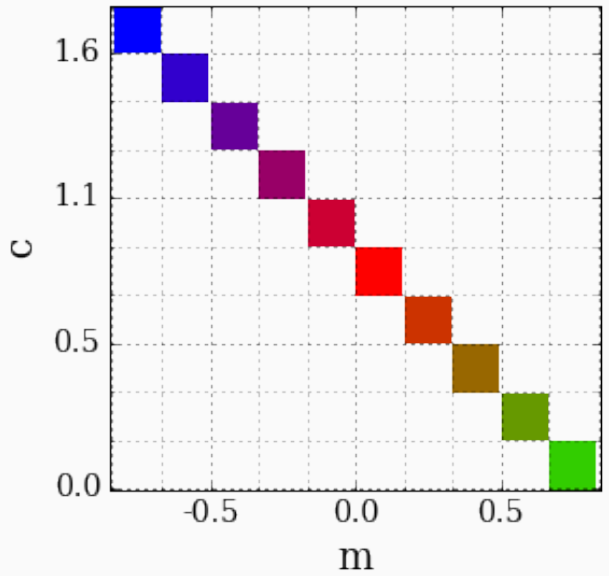
# Hough Transformation

Transformation from Normal Space to Houghspace

$$\phi(\mathrm{r}) = \mathrm{mr} + \mathrm{c}$$

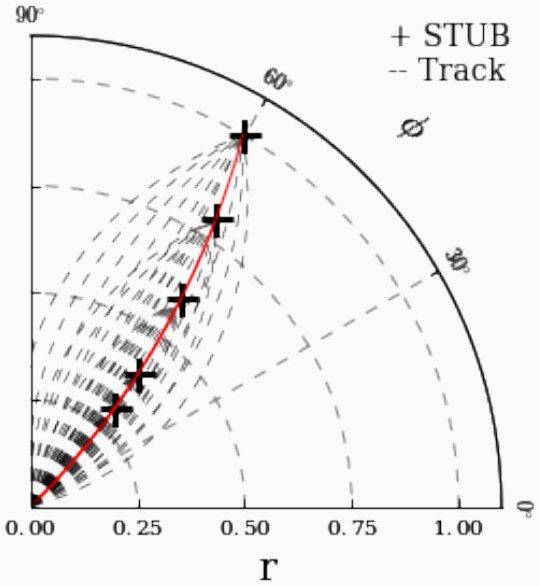
Each possible track for a stub, leads to a point in Hough Space

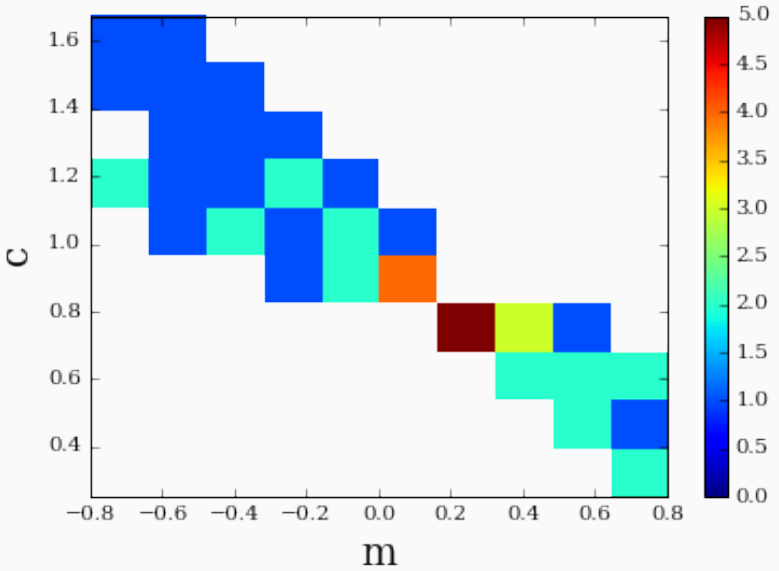


# Hough Transformation

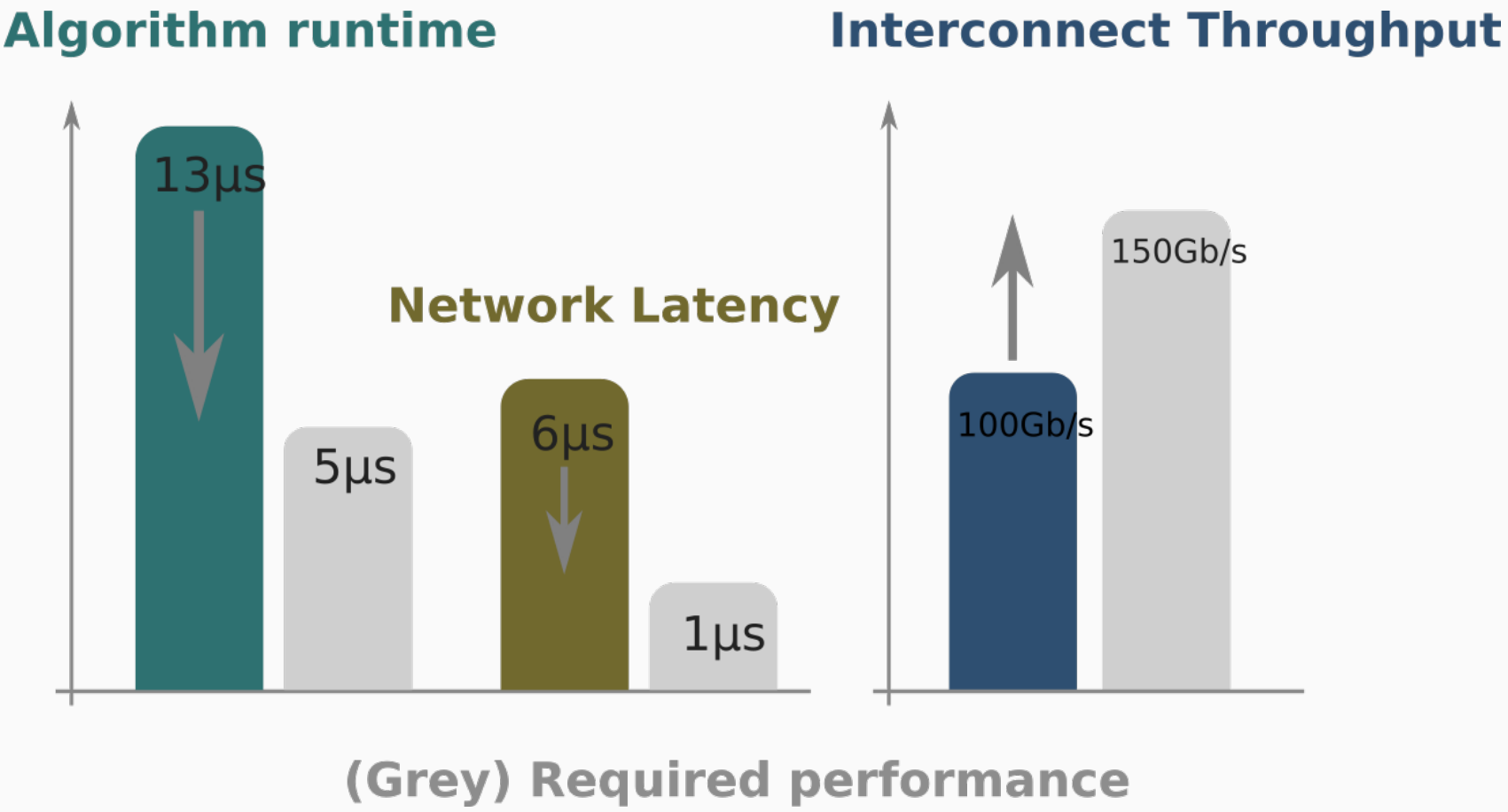
Mutliple stubs from the same track, lead to intersecting lines




More than 5 hits in one cell, lead to a readout of this cell's stubs

# Current State and Outlook




Preliminary Benchmark[1]

[1]Processing time for 1 $\phi$-sector, cotaining 500 stubs, assuming 36 $\phi$-sectors in total, benchmarking done on a TitanX, Using CUDA 7.5

Questions?

# Stub Principle