A few Ideas for Precision Timing and High Granularity

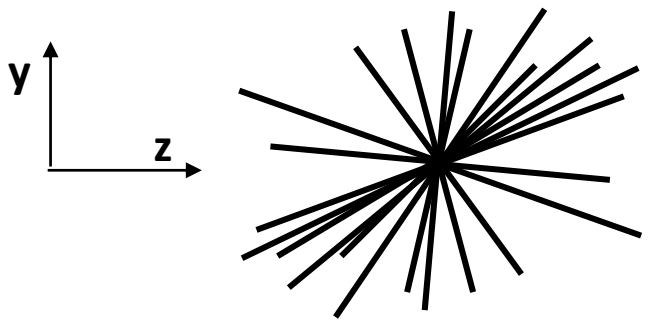
U. of Iowa

See tomorrow's talk by Abraham Seiden about the UFSD in tomorrow's Vertex and tracking parallel session, and by Usha Mallik about HGTD in tomorrow's CALOR session

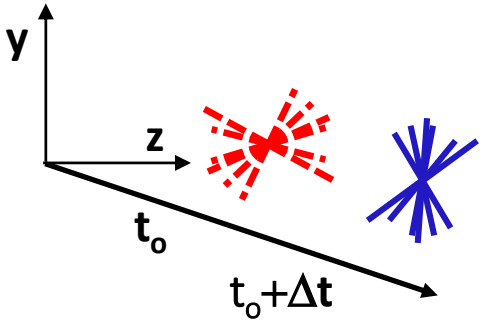
Detector Control System: Control, Monitoring and Configuration

Effect of Timing at the HL-LHC

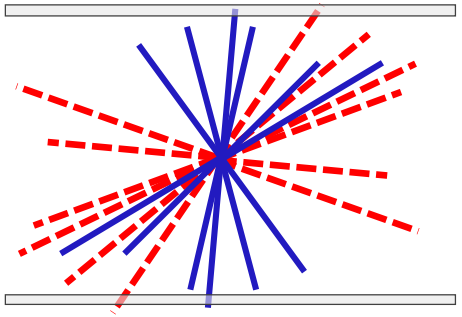
Adds "extra time dimension"



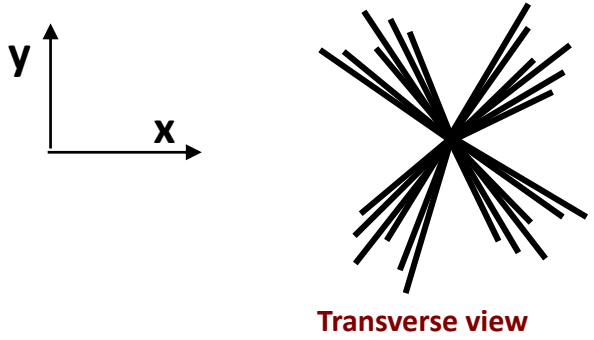
Longitudinal view



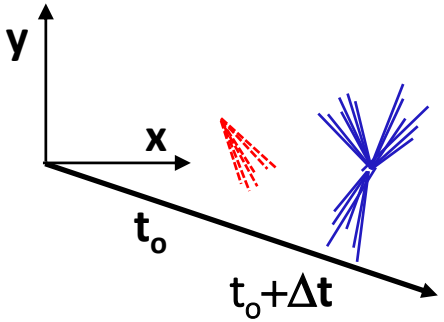
Timing

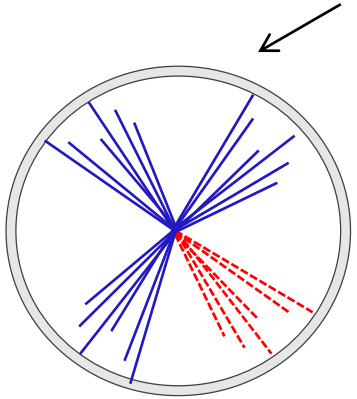


Timing layer



Transverse view



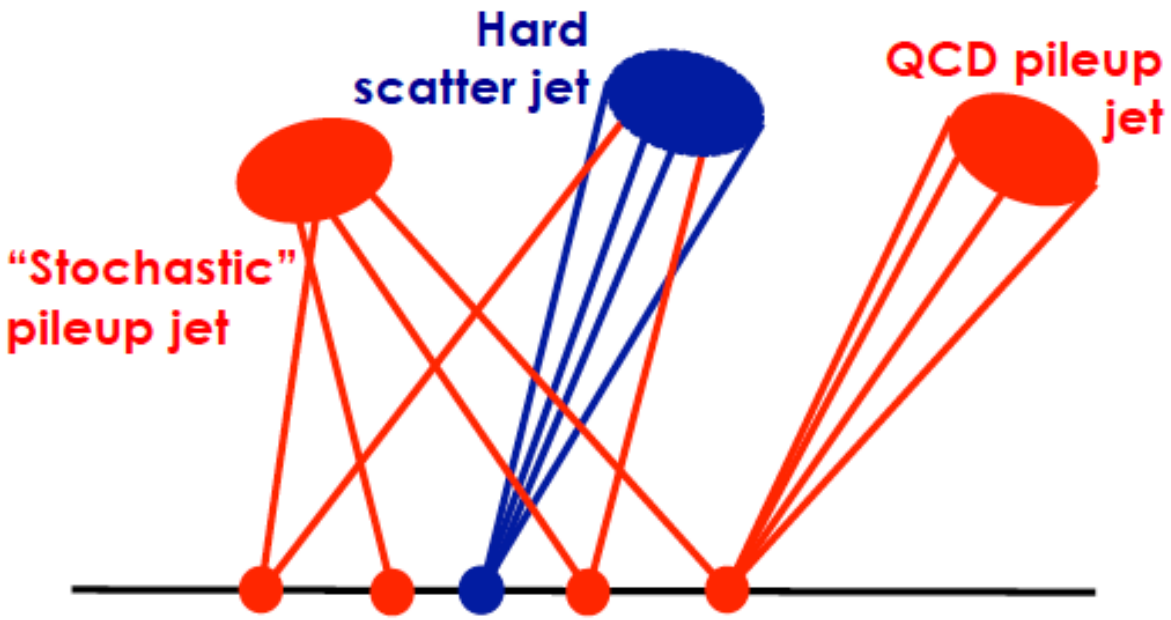


Slide from Hartmut Sadrozinski, UCSC

ATLAS High Granularity Timing Detector (HGTD) : Precision timing of ~30 ps

Using Ultra-fast silicon detectors (UFSD) :

Separate Hard scatter from pileup events, in the same bunch crossing of 25 ns



HS jet concentrated in space and time, use this information very efficiently with kinematic selections and high precision.

Use it to get the hits on HGTD to drastically reduce the pile-up hits, especially the stochastic ones, reducing trigger rates.

Major goal of Phase 2 upgrade focus on precision measurements.
So measure VBF physics with quark jet tag.

If both quark jets are forward, easy to tag the production vertex

Combine HGTD information with already present CALOR information for e, γ or jet information, CALO-TOPO trigger.

If FTK tracking (from ITK) info available (likely), combine vertex information with CALOR and event topology.

Select and define specific targeted categories with kinematics, put into trigger

Simulation is progressing well.

Major challenges: clock uncertainty of LHC IP ~175 ps

Vertex uncertainty in z-position : 150 – 200 ps (spread)