

B-tagging at High Level Trigger for the Run II

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Context

2012

8 TeV
50 ns
<PU> ~ 25

In order to select useful events for physics analysis among the millions produced every second, a 2-level trigger system has been developed for the CMS experiment. The second level, the High Level Trigger (HLT) runs a fast version of the CMS offline reconstruction software using a computer farm. During the Run II which will begin mid June, the ability to distinguish b-jets among the increasing number of jets produced per bunch crossing will become fundamental. The b-tagging will then be important for Top quark physics but also for Higgs boson and beyond the Standard Model physics.

2015

13 TeV
25 ns
<PU> 20 to 50

Run I

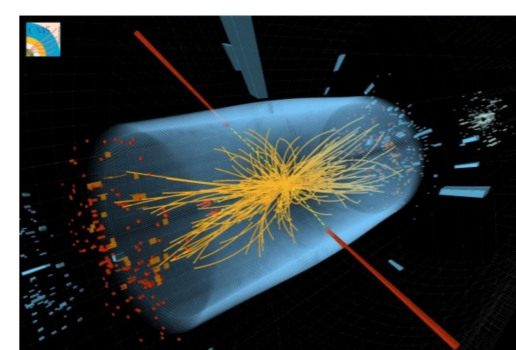
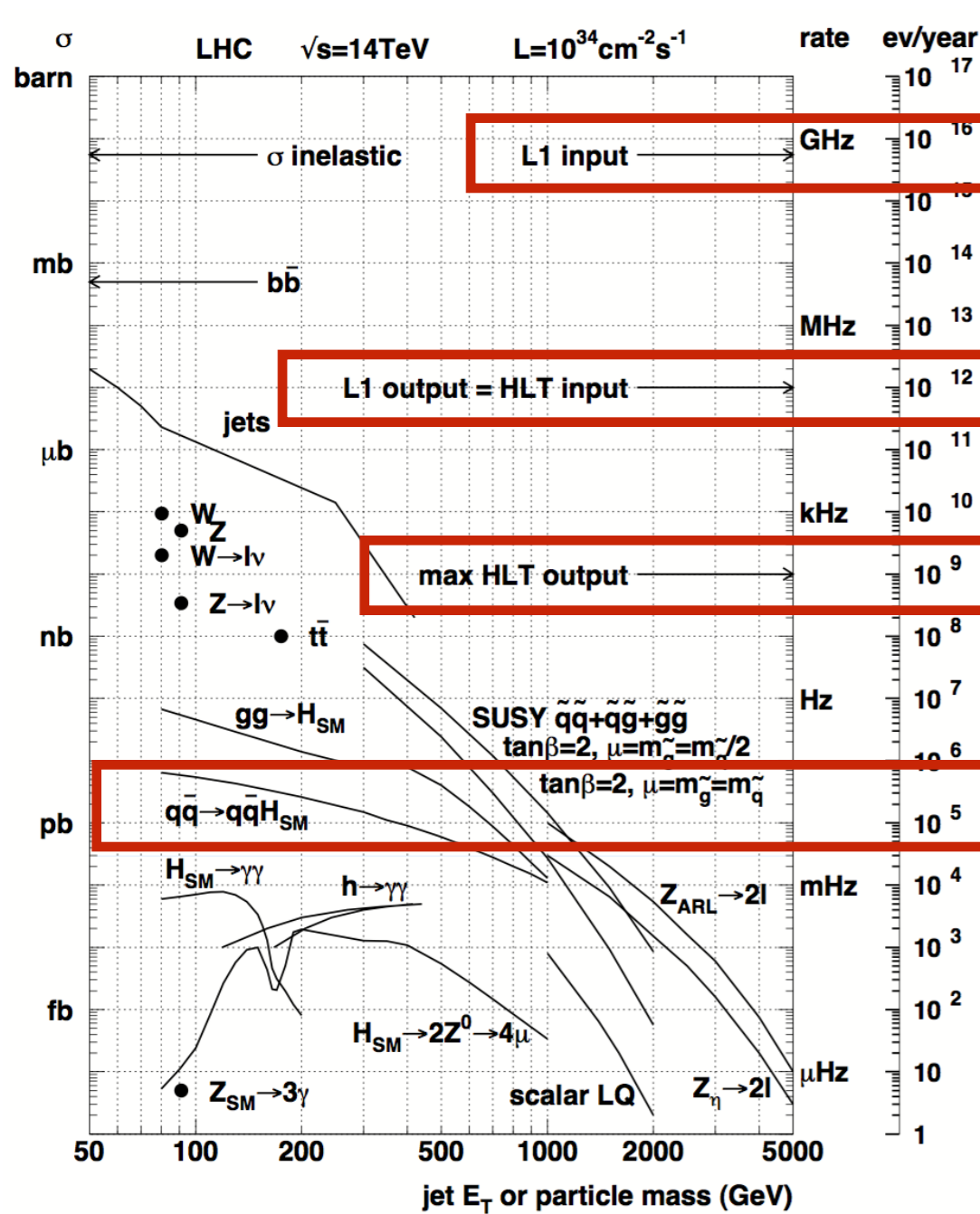
Long Shut Down

NOW

Run II

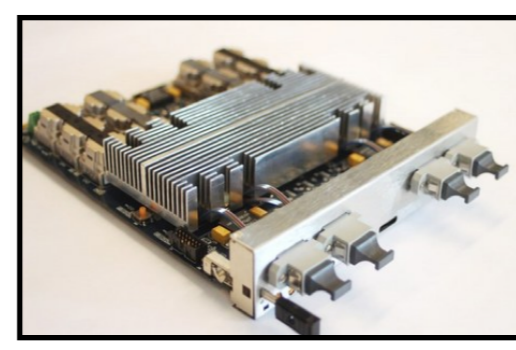
Pile-up (PU) : number of collisions per bunch crossing

CMS Trigger



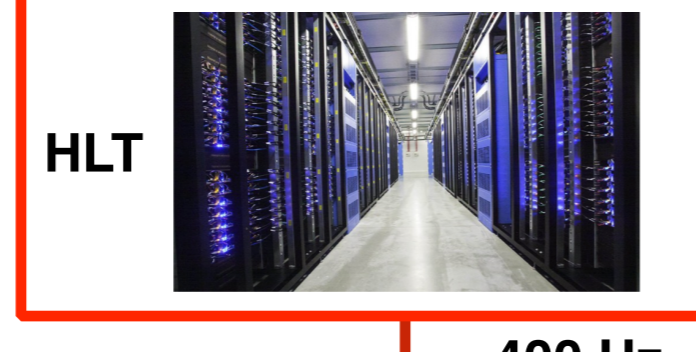
Collisions

40 MHz



Electronics

100 kHz

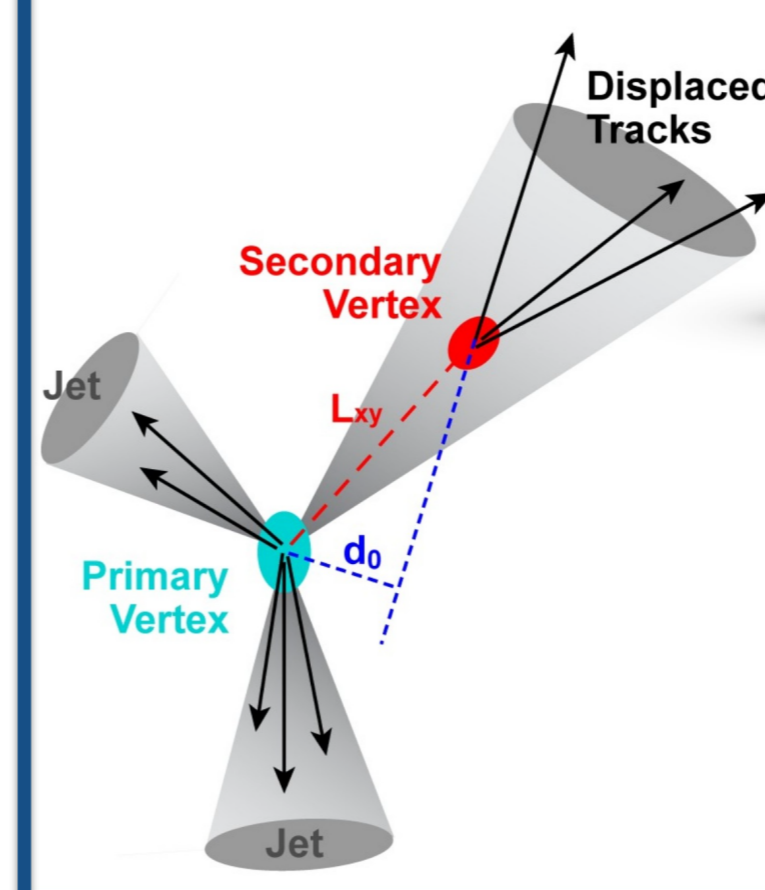


Software

~ 400 Hz

STORAGE

B-tagging



Properties of B hadrons in b-jets:

- Large mass
- Long life-time (1.5 ps)
- Large $c\tau$
- High number of charged particles per decay
- 20% probability of leptonic decay

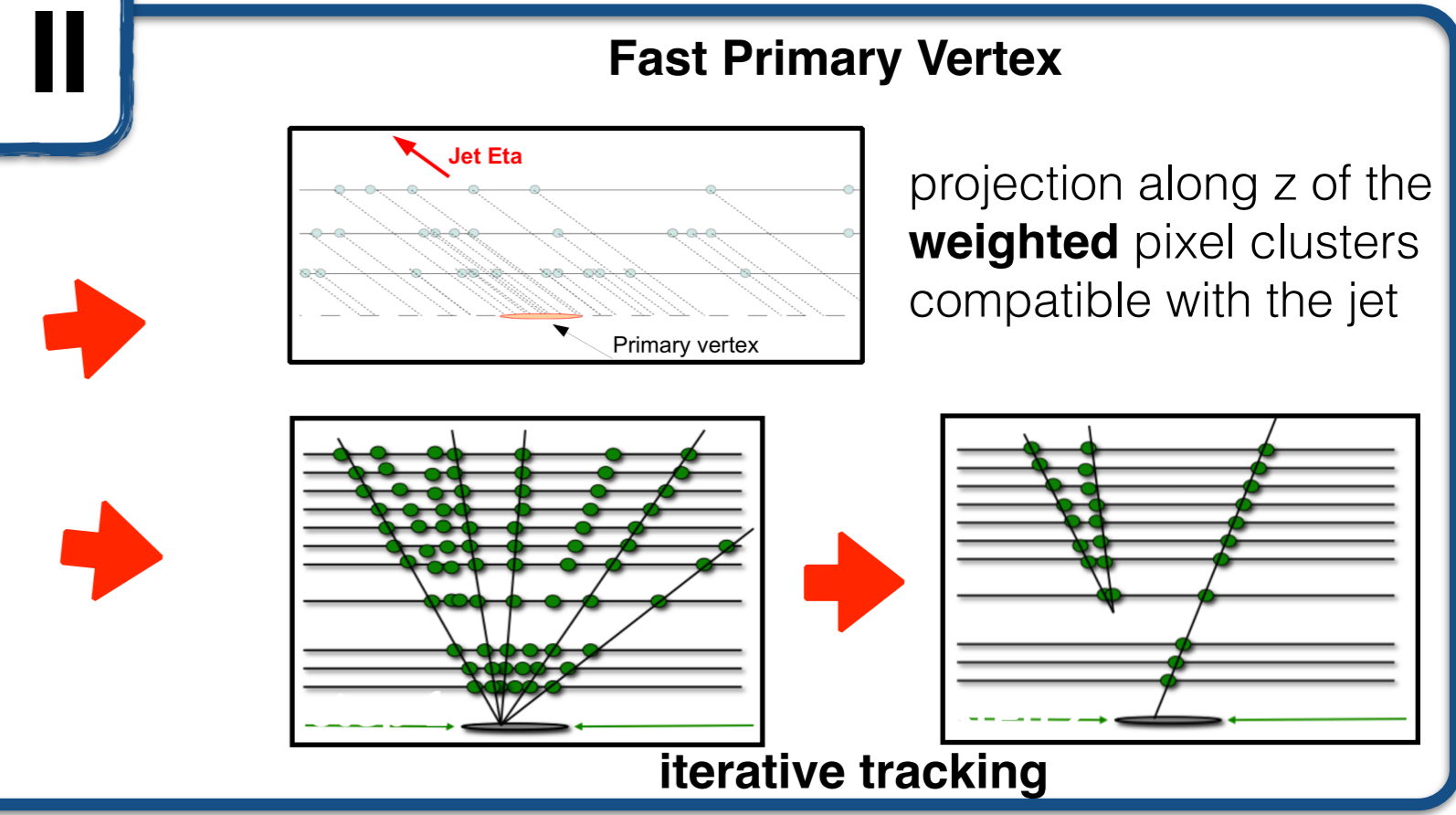
Variables:

- vertices:**
secondary vertex displaced from the primary vertex
- tracks:**
displaced tracks with large impact parameter

Combined Secondary Vertex tagger

Improvements for b-tagging at HLT for Run II

- reconstruct pixel clusters **compatible with jets**
- use **weighted** pixel clusters to find an initial primary vertex
- reconstruct regional pixel tracks compatible with the PV
- use the pixel tracks to reconstruct the PV more accurately
- reconstruct the full tracks (**iterative tracking**)
- find the PV again using the full tracks**
- do b-tagging



Performances

The new version of the b-tag sequence at HLT allows better performances while reducing the processing time and making it stable with pile-up.

