GigaFitter: the last SVT upgrade at CDF

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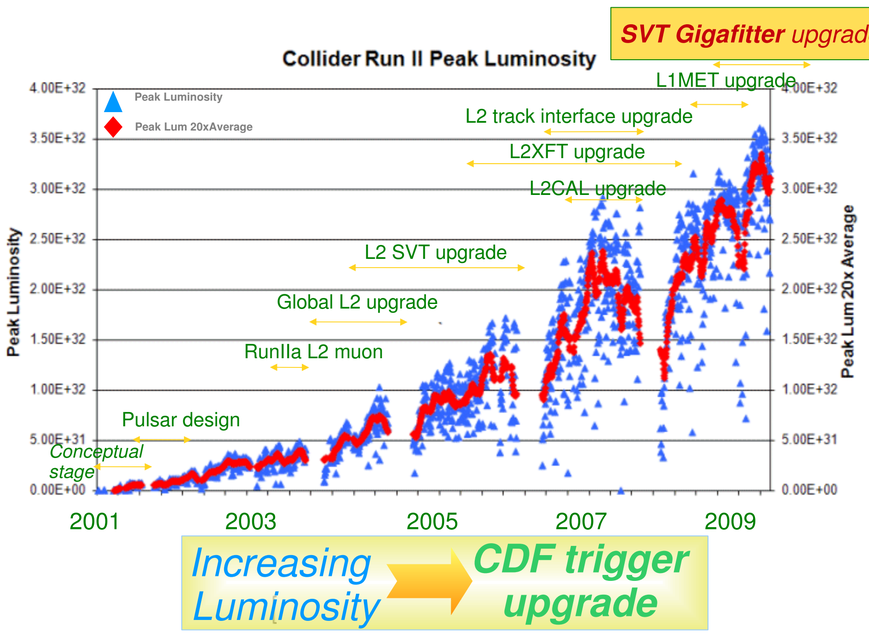
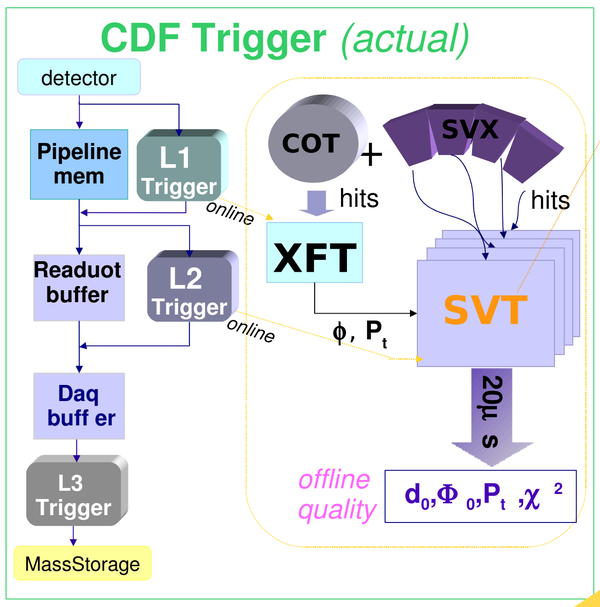




SVT tracking algorithm

Pattern recognition
Associative Memory: finds low precision tracks (roads)

Track fitting
Linear fit by TF++: refines tracks with high precision fit

Actual SVT limits

- Limited fits per road / Limited AM size ➡ Reduced acceptance
- Number of fits limited ➡ Less efficiency
- Limited precision in fits ➡ Addictional correction factors

NEXT trigger upgrade

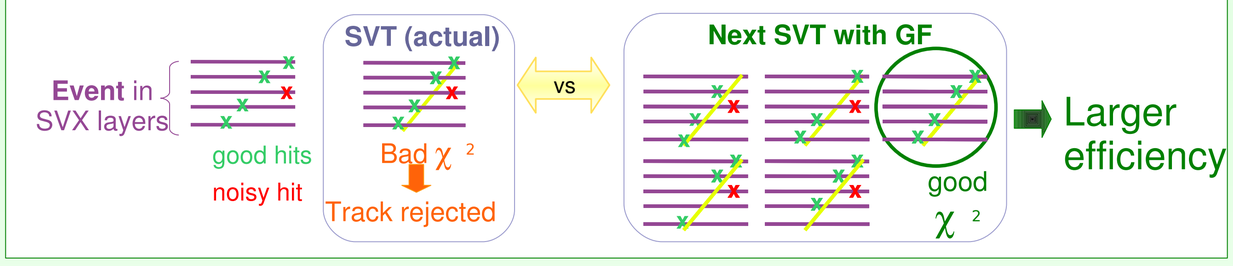
Gigafitter

Online tracking processor developed as SVT upgrade to:

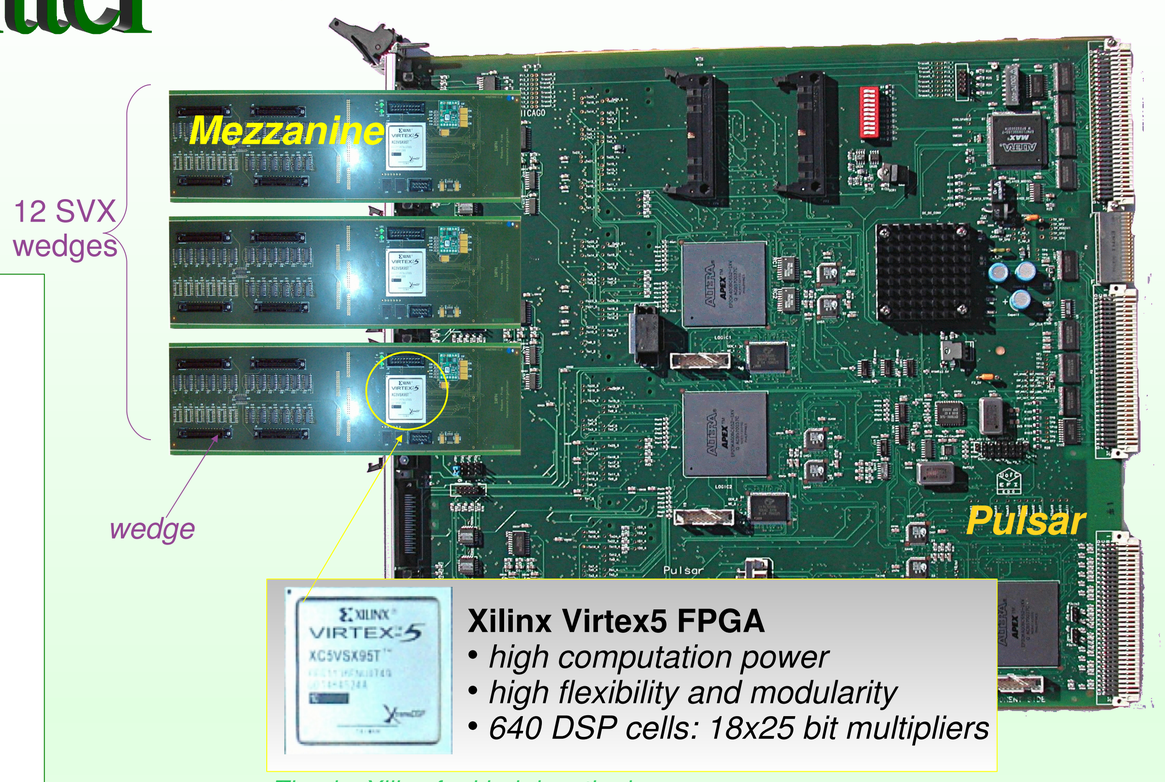
- extend track trigger **at very high instantaneous luminosity**
- increase track reconstruction efficiency
- improve the physic reach

GF features

- 3 mezzanines, 4 wedges each, 6 fit lines/wedge ➡ More speed
- Full hit resolution for linear fit scalar products, Big memories available, More constant sets ➡ More SVT acceptance
- Enough computing power to fit all combinations of SVX layers



1GF board vs **16 actual boards**

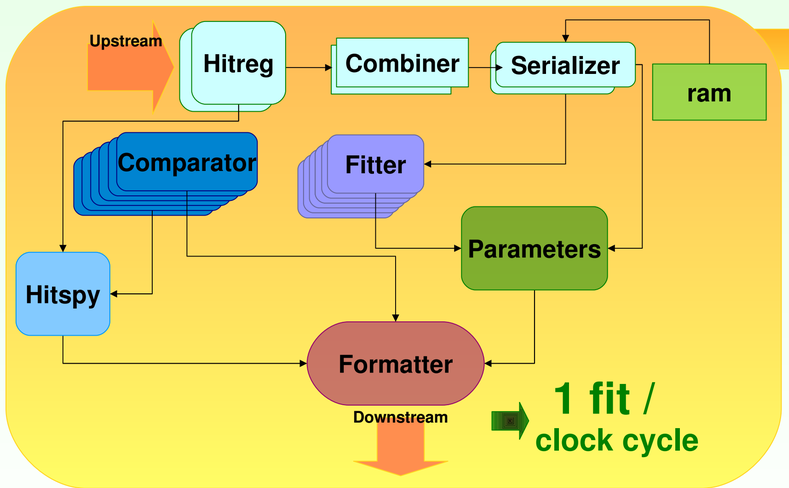


Thanks Xilinx for kind donation!

GF Algorithm

Single fit line:

- **Receive** hits from a road found in the AM. **Compute** all combinations of hits
- **Fit** all combinations in parallel, cut on χ^2. **Select** the best fit among several good.



Speed optimization

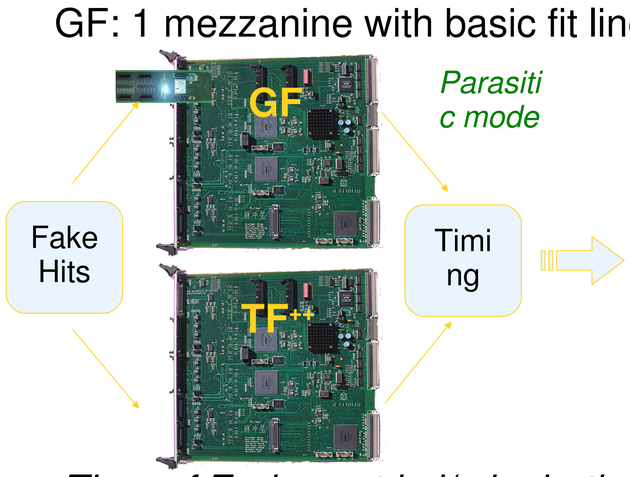
3 Single fit line/wedge ➡ **3 fits/ clock cycle**

X 4 wedges/mezzanine ➡ **12 fits/ clock cycle**

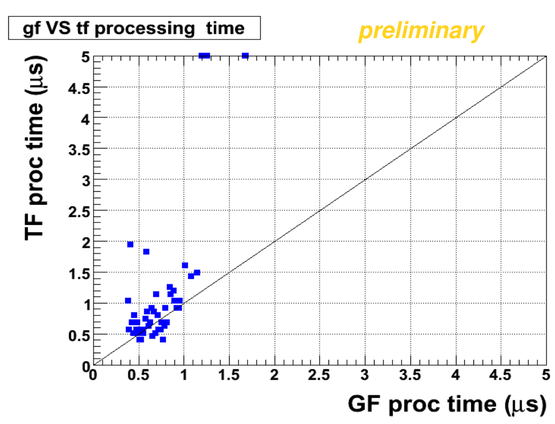
x 3 mezzanine ➡ **36 fits/ clock cycle**

Preliminary test at CDF

GF: 1 mezzanine with basic fit line (Fit line with 1Fitter-Comparator:1 fit/6 clock cycle @ 120MHz) **tested** for timing measurements



Time of End event in i/o by both systems recorded



- *GF has a fixed minimum latency of ~400ns, like TF++*
- *TF++ latency can go up if event is complex*

GF is fast enough to limit latency for all kind of events

Even if the fitting line is not optimized, the GF is faster than the current system