Improving the Trigger Efficiency for the WH-Lνbb analysis at the CDF experiment

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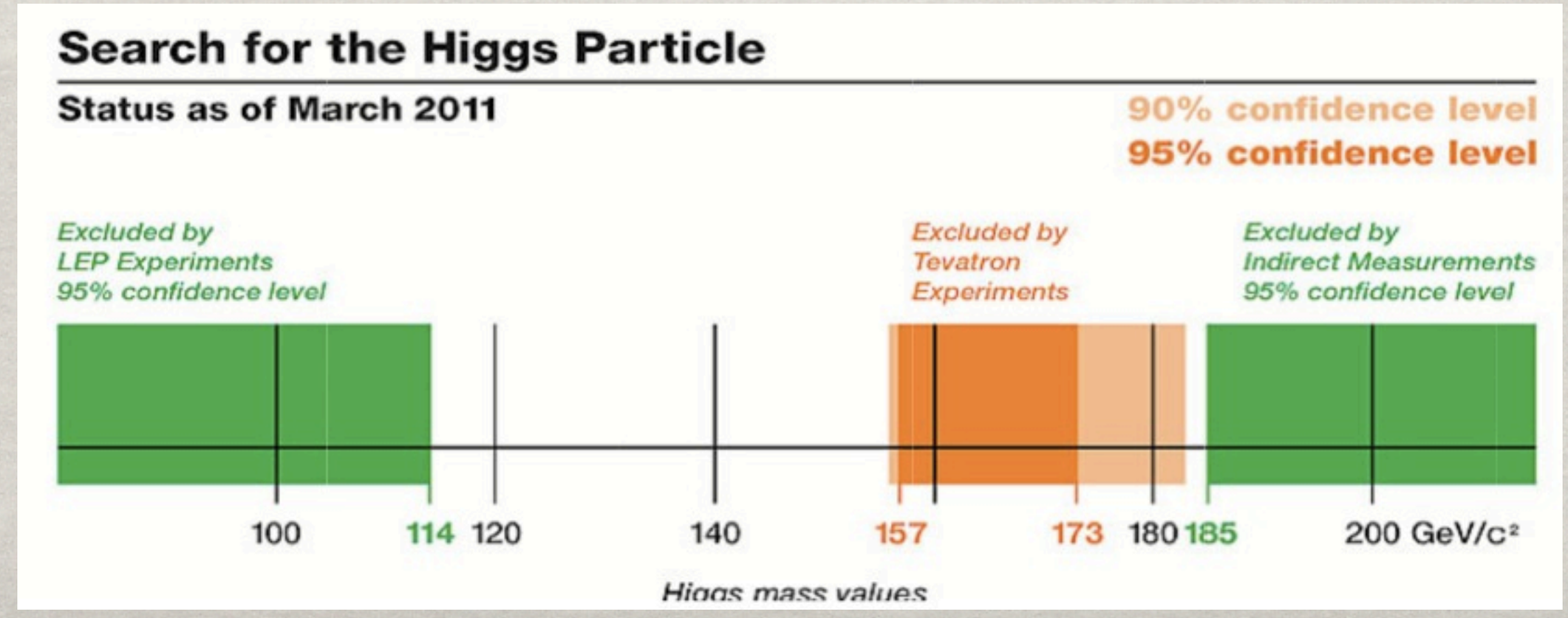
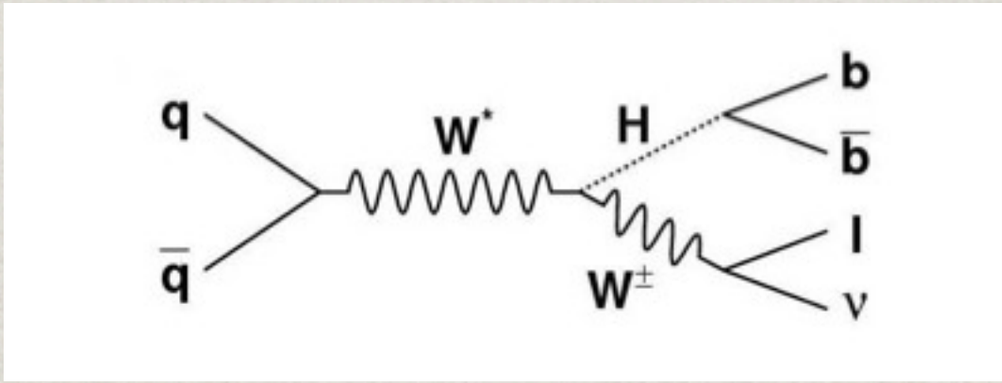
On behalf of CDF Collaboration

Search for Higgs

- In standard model, Higgs mechanism is responsible for the spontaneous symmetry breaking.
- For Higgs mass less than 135 GeV/c^2, Higgs is preferably decay into b quark-anti-quark pair.
- The Tevatron sensitivity is very close to SM Higgs now.



SM Higgs Associate Production with W



- At Tevatron, WH->lνbb is the most sensitive channel.
- In this analysis, Higgs boson will decay into bb, and W will decay into an electron or muon and its associated neutrino.
- Thus, we are looking for a lepton, two b jets and a large missing energy.

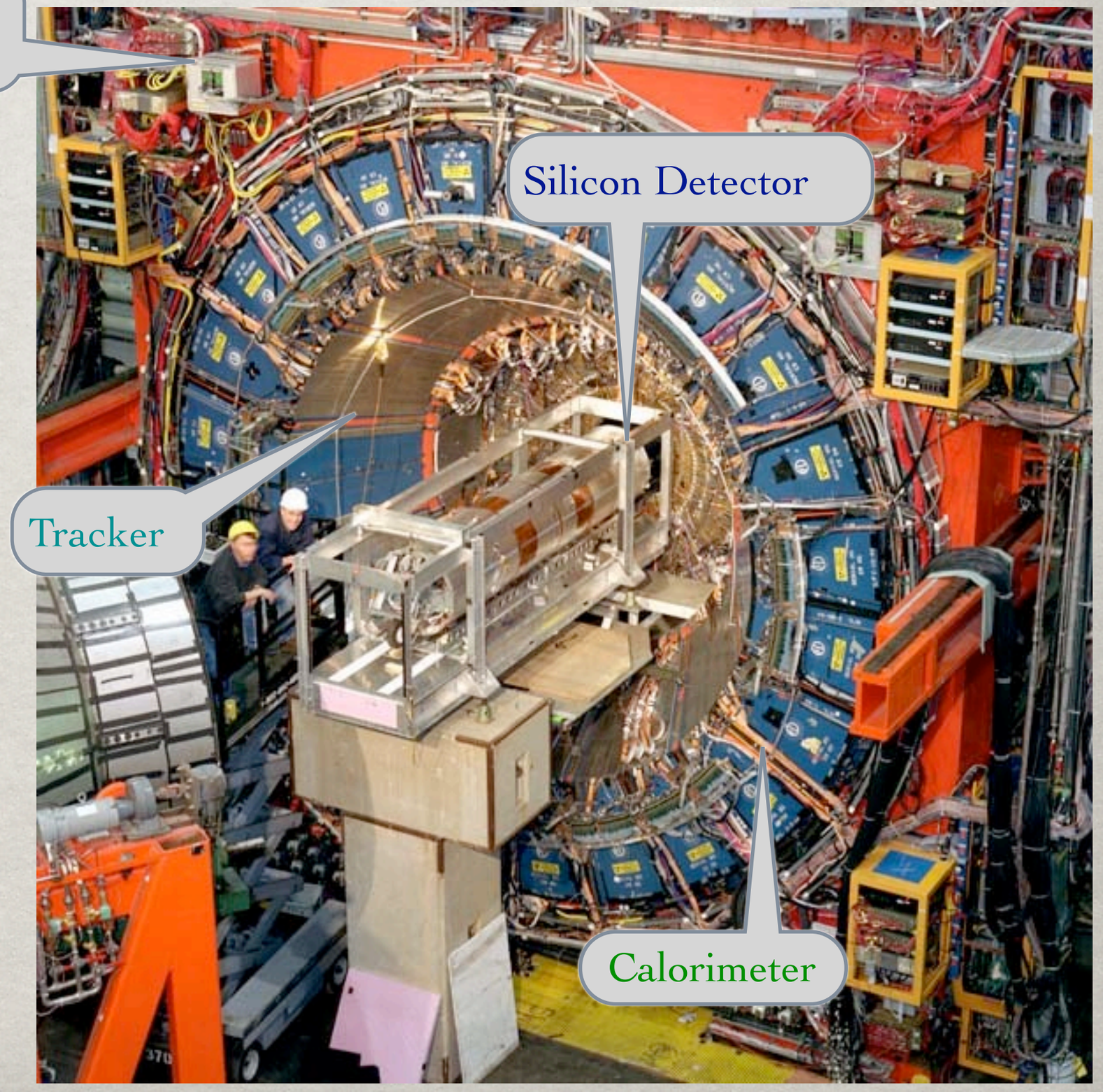
Tevatron

- Running for 10 years.
- Circumference: 4 mile
- Center of mass energy: 1.96 TeV

CDF

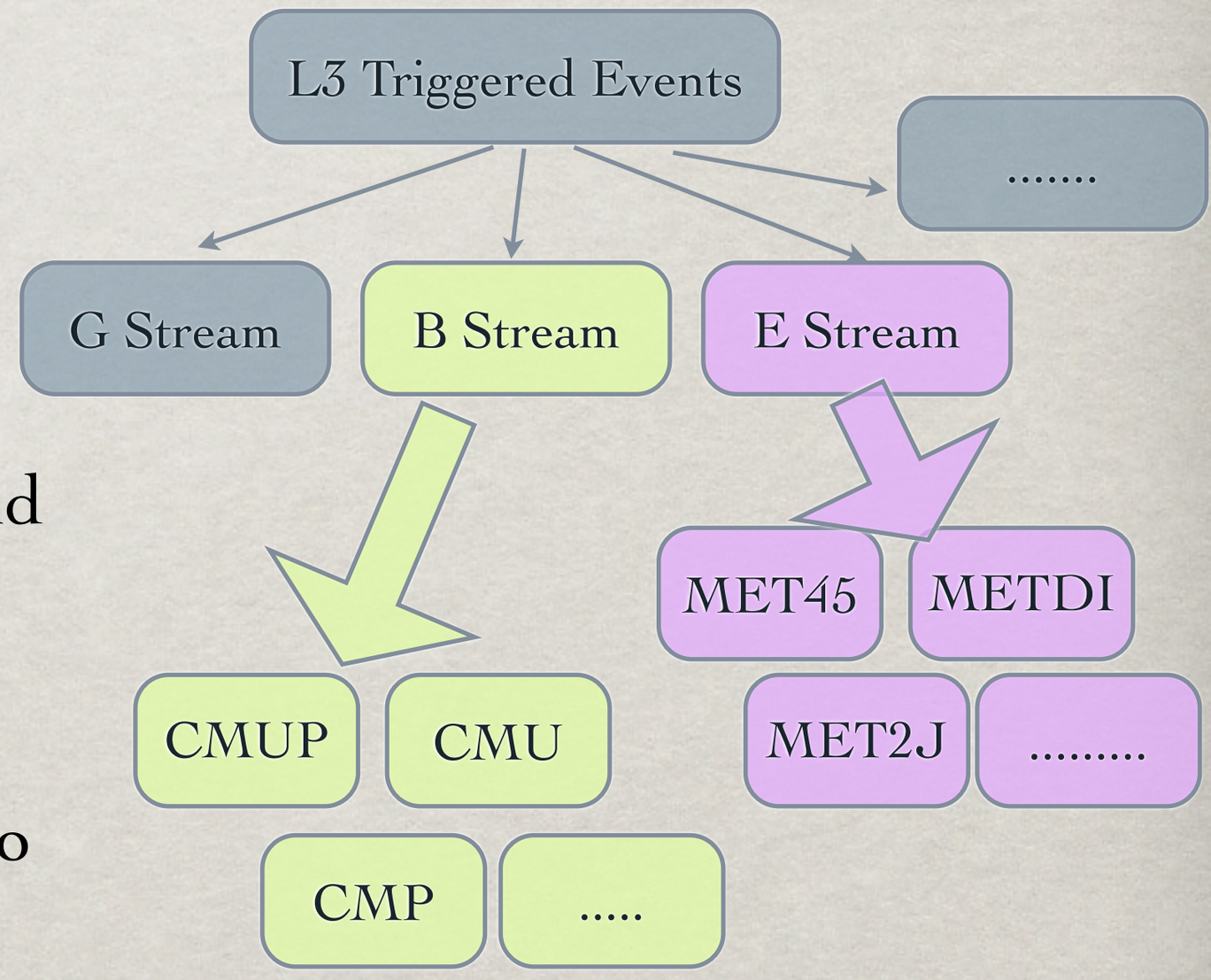
- From inside to outside

1. Silicon Detector
2. Tracker
3. Calorimeter
4. Muon Detector

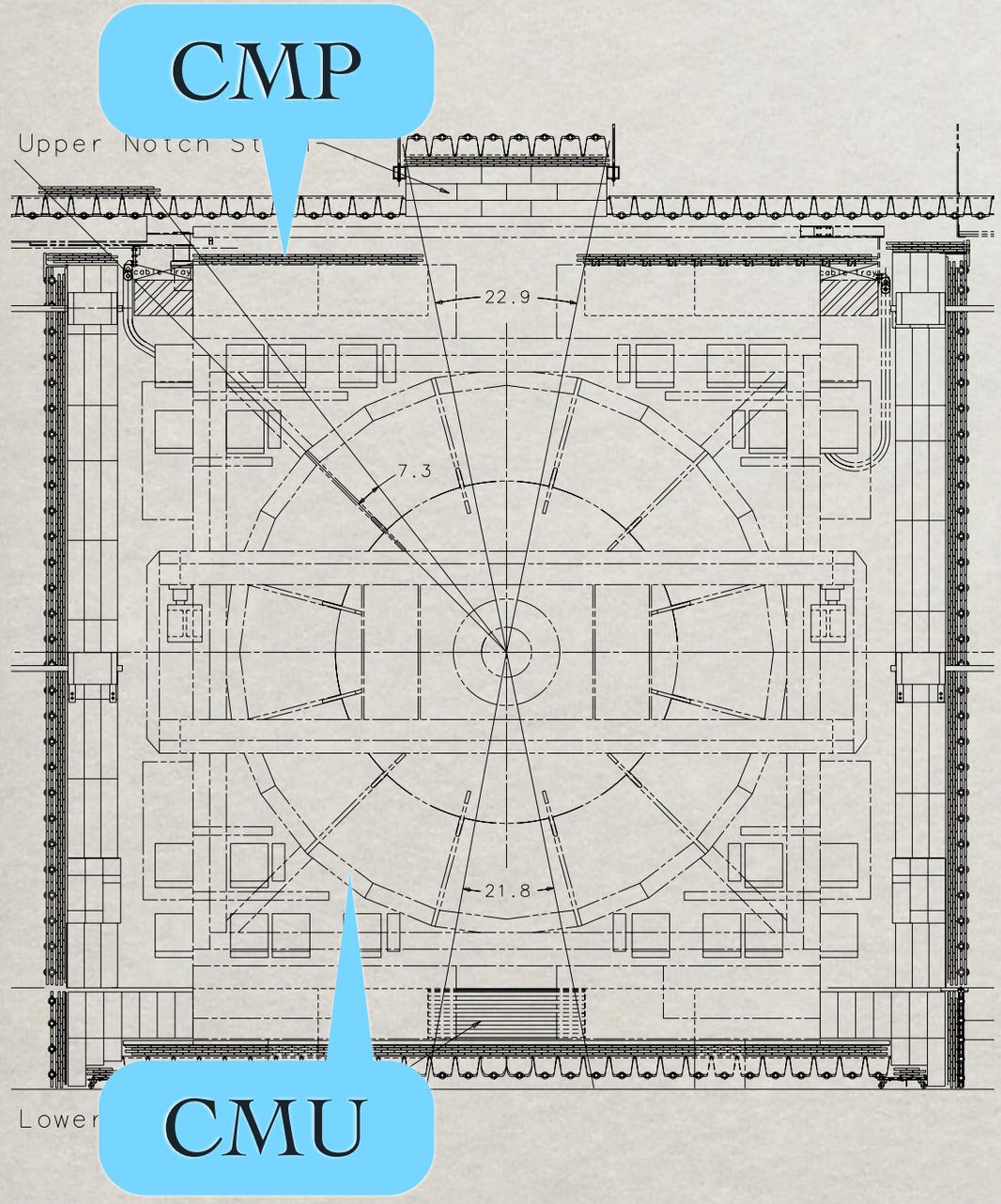


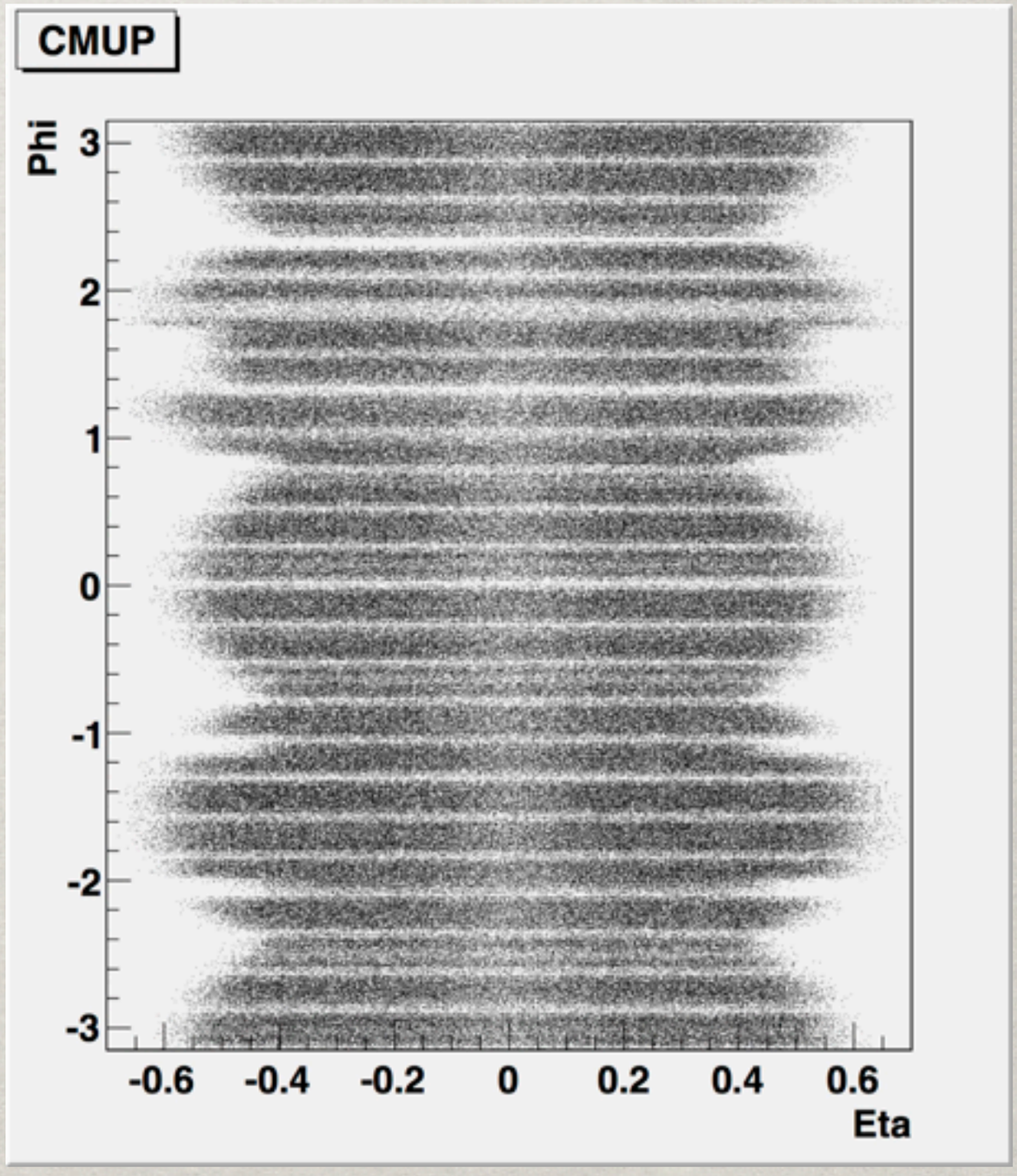
DAQ System of CDF

- At CDF, there are 1.7 million collisions per second.
- After applying three level triggers, 200 events per second will be recorded on disk.
- Event will be stored in different streams, according to which trigger is fired for the event.



Muon Detector in CDF





CMU: **C**entral **MU**on chamber
CMP: **C**entral **M**uon u**P**grade

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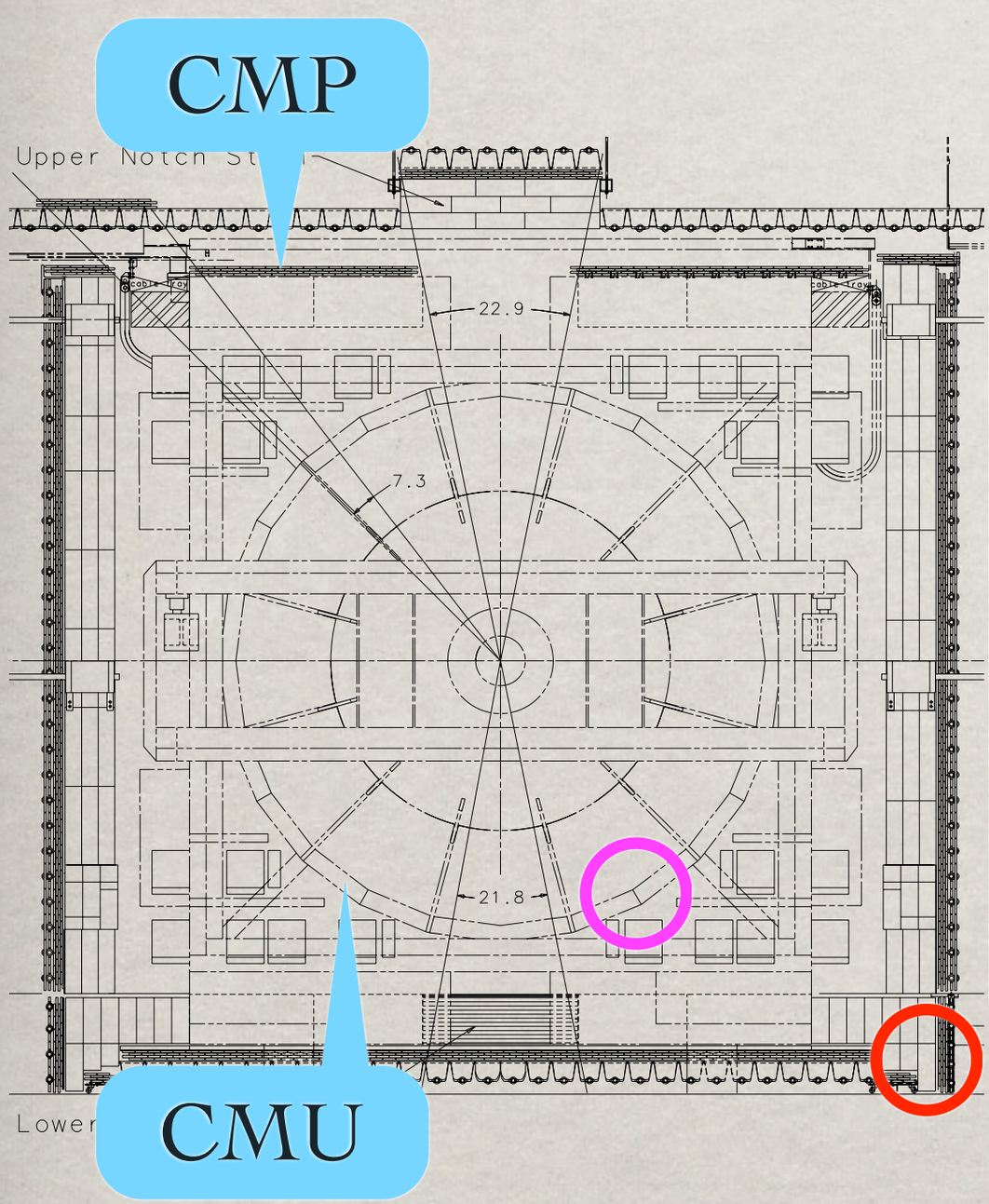

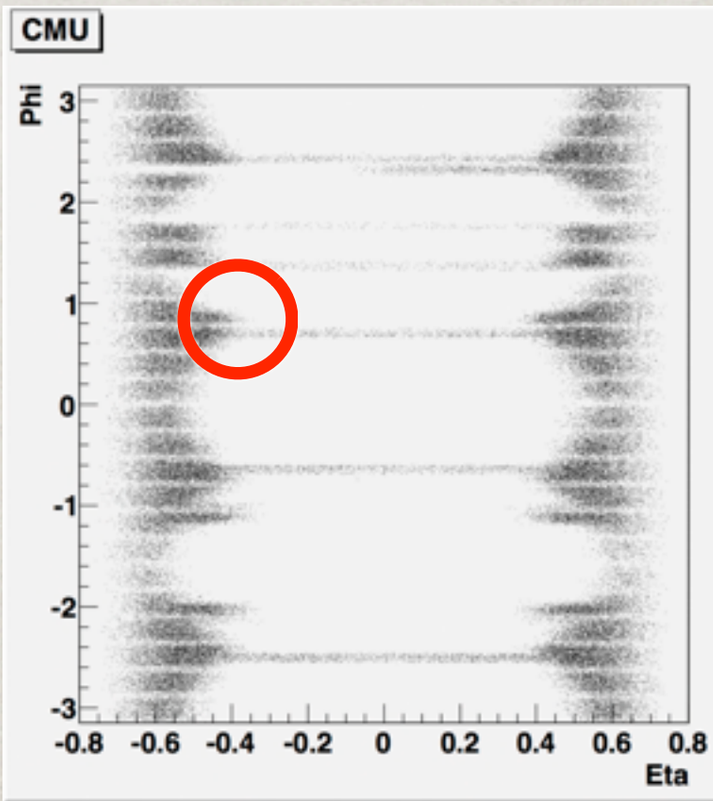

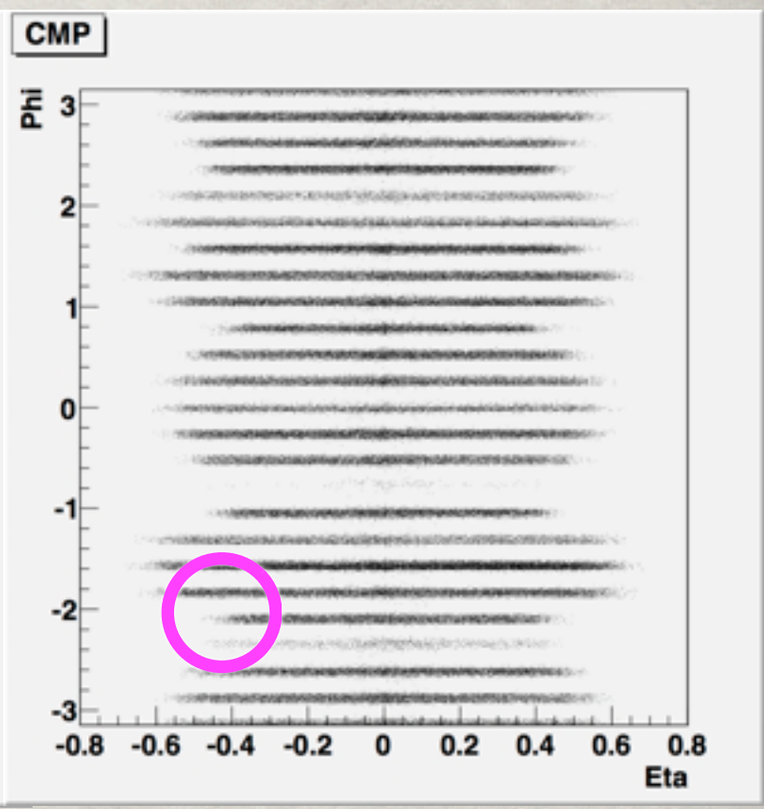

Potential Gain

Lepton Type	EPS	B Stream	E Stream	Overlapping	Net Count	Gain
CMUP	29307	32890	16493	16419	32964	12.48%
CMU	3589	3453	4419	1841	6031	68.04%
CMP	4090	4517	4993	2315	7195	75.92%

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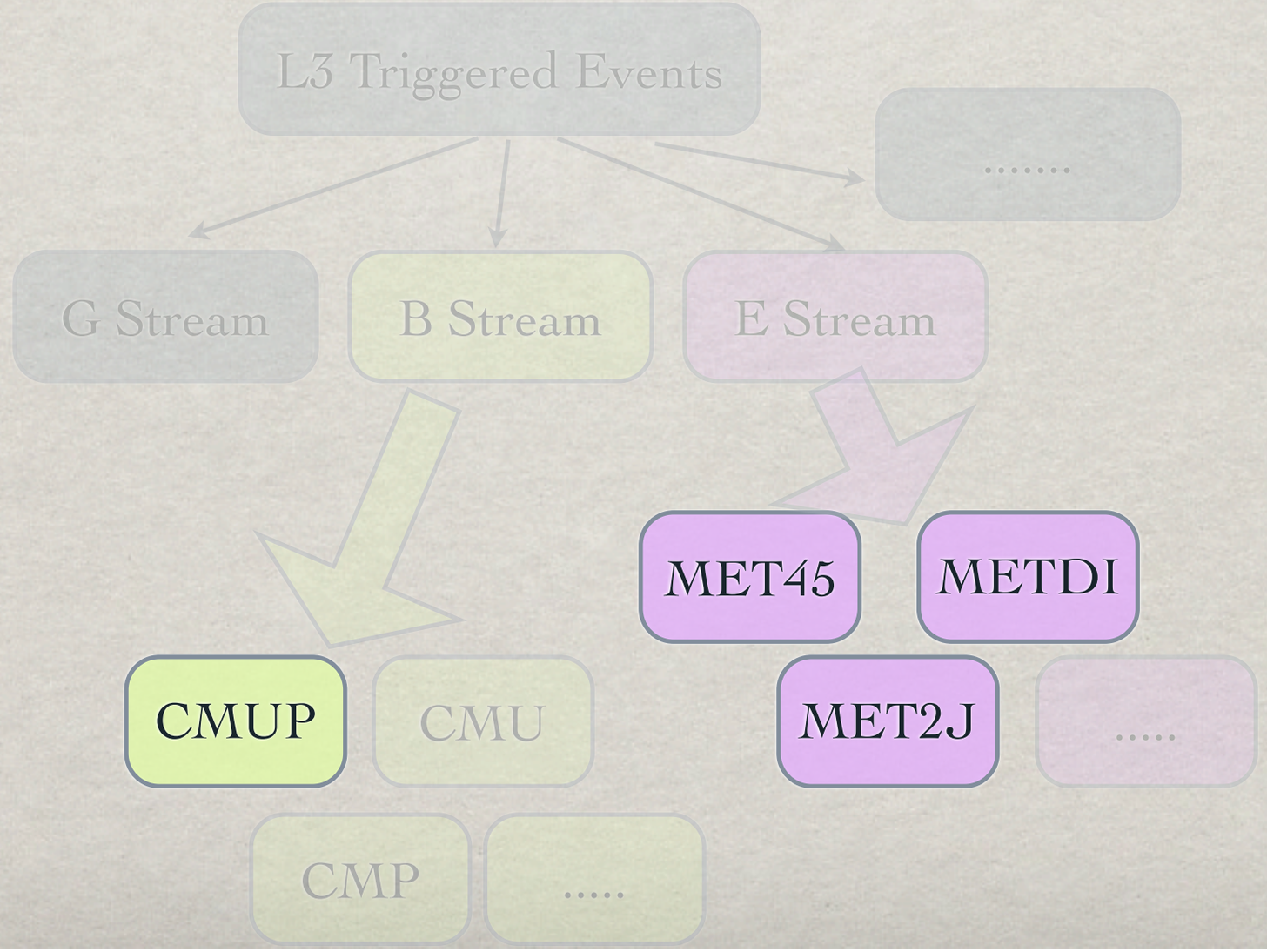

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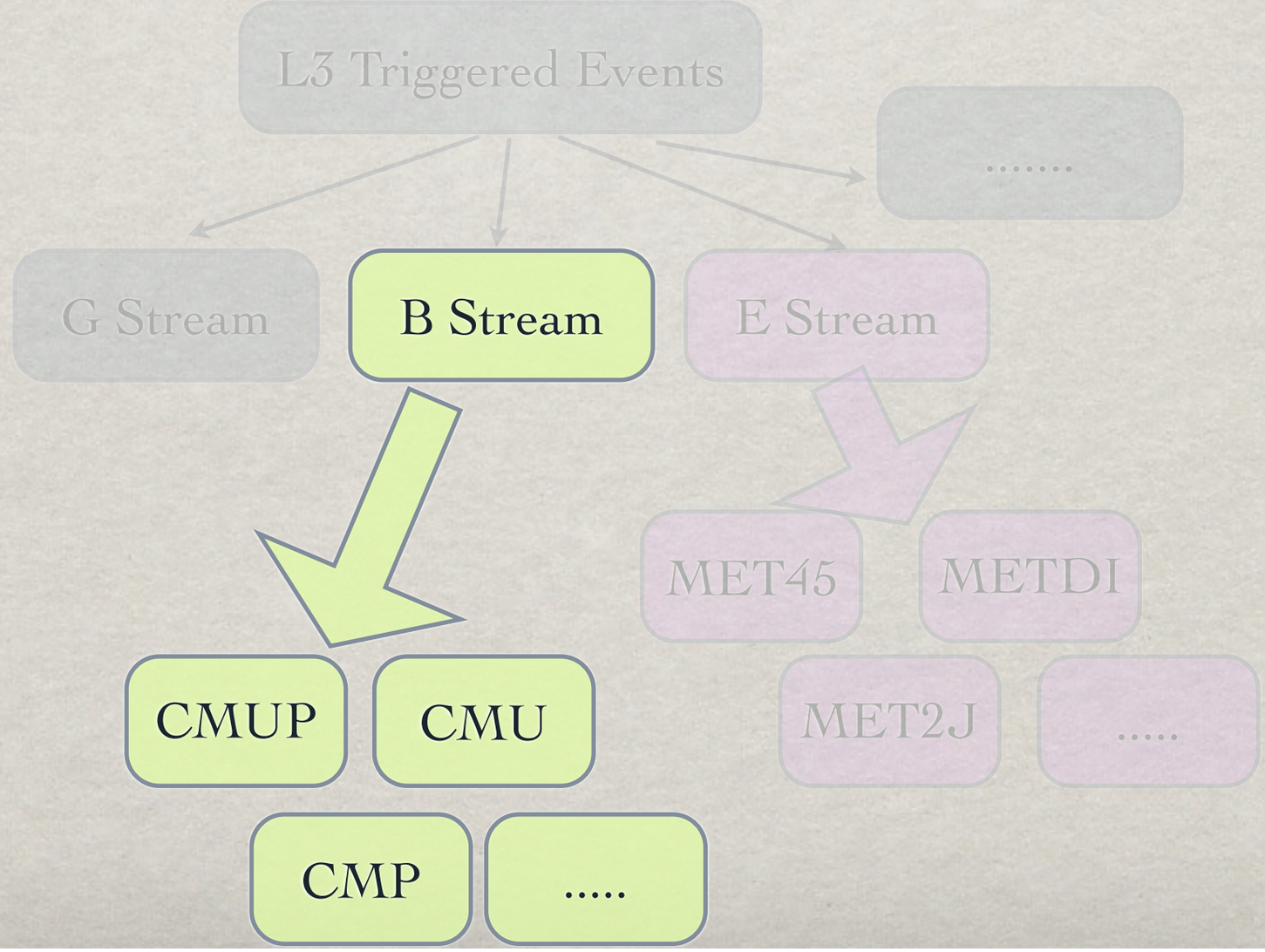

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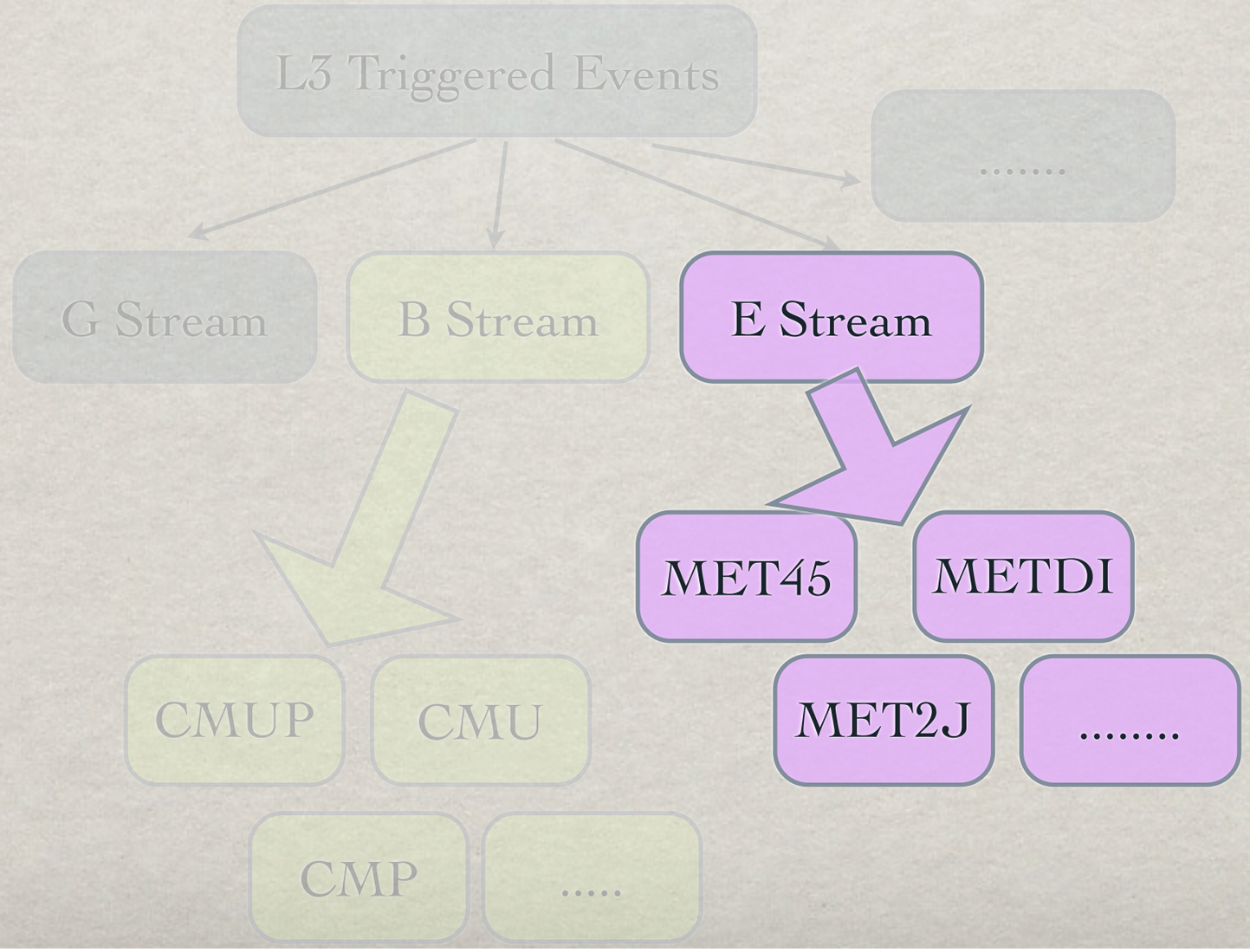

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- Almost all CMUP leptons in E Stream are also in B Stream.
- We can use 100% for the trigger efficiency for CMUP in B Stream.

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- The overlap ratio for CMU and CMP is not as high as CMUP.
- We need to use both B Stream and E Stream data for CMU and CMP lepton

Background Table

Bkg	111.04 ± 34.3
Obs	87 ± 0
WH115	1.27 ± 0.16
ZH115	0.11 ± 0.01
Sensitivity	0.120

B Stream Muon: CMUP(EPS)

Bkg	143.97 ± 43.9
Obs	114 ± 0
WH115	1.71 ± 0.21
ZH115	0.16 ± 0.02
Sensitivity	0.143

B Stream Muon: CMUP CMU CMP(SESAPS)

Bkg	123.99 ± 34.8
Obs	119 ± 0
WH115	1.54 ± 0.19
ZH115	0.15 ± 0.02
Sensitivity	0.138

E Stream Muon(EPS)

Bkg	112.63 ± 32
Obs	109 ± 0
WH115	1.35 ± 0.17
ZH115	0.13 ± 0.02
Sensitivity	0.127

E Stream Muon(SESAPS)

- Calculated by applying trigger efficiency to simulation results. Only for the most sensitive b-jet category.

- In this category, the signal gain is 8.9%.

Summary

- For all muon category, we got 1.2 more signal events. that is 9.1% improvements.
- For all lepton category, the signal gain is about 4%.
- For future, we are going to improve the trigger efficiency for other muon types at CDF.
- With several other improvements like this, Tevatron will have the sensitivity to Higgs Boson for low mass range.

Thank You