Triggers and Analysis

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What is the Problem?

Cannot (and do not want to) register all events

"Known physics" occurs more often than new physics

New physics buried under tons of known stuff

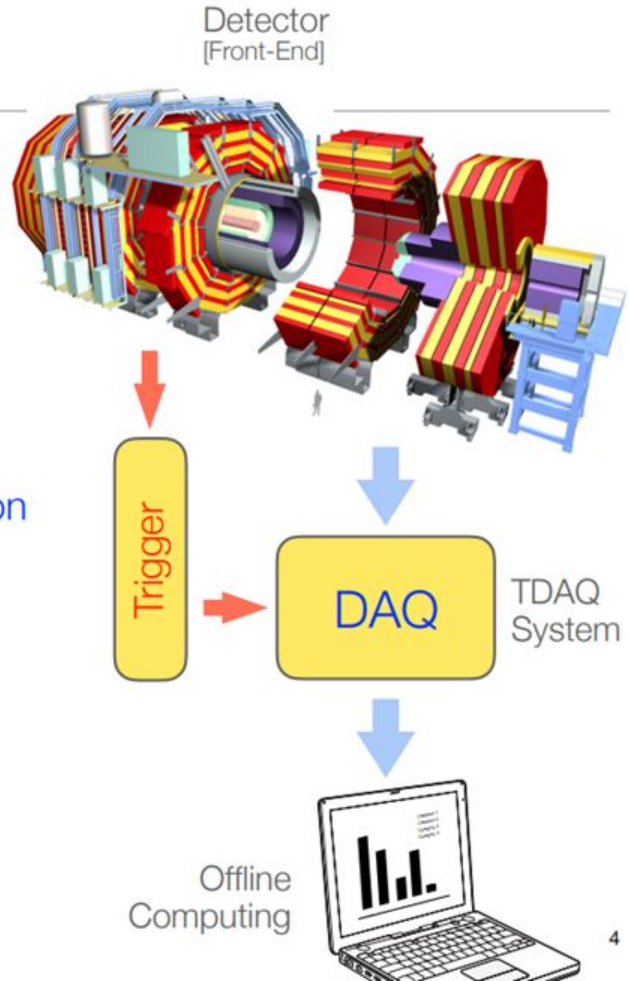
Trigger & DAQ in a Nutshell

DAQ responsible for collecting data from detector systems, digital conversion and recording to mass storage.

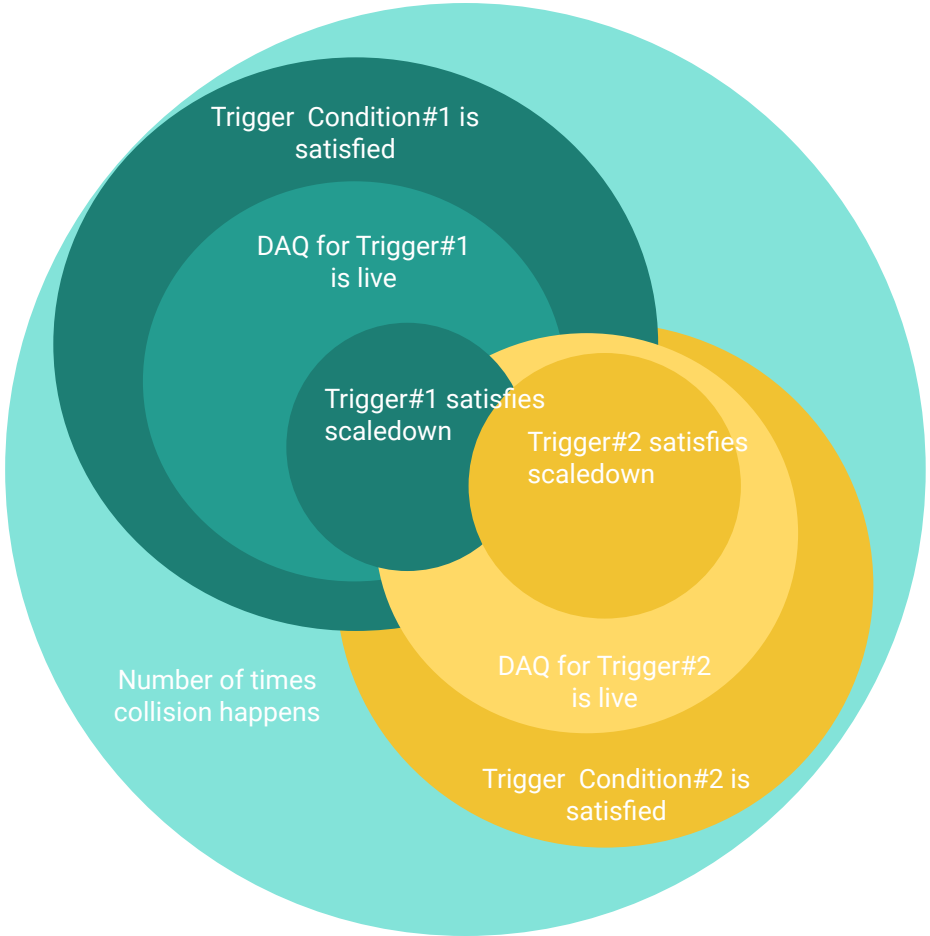
Trigger responsible for real-time selection of the subset of data to be recorded.

The combined system of Trigger/DAQ is often referred to as TDAQ.

Often interwoven …

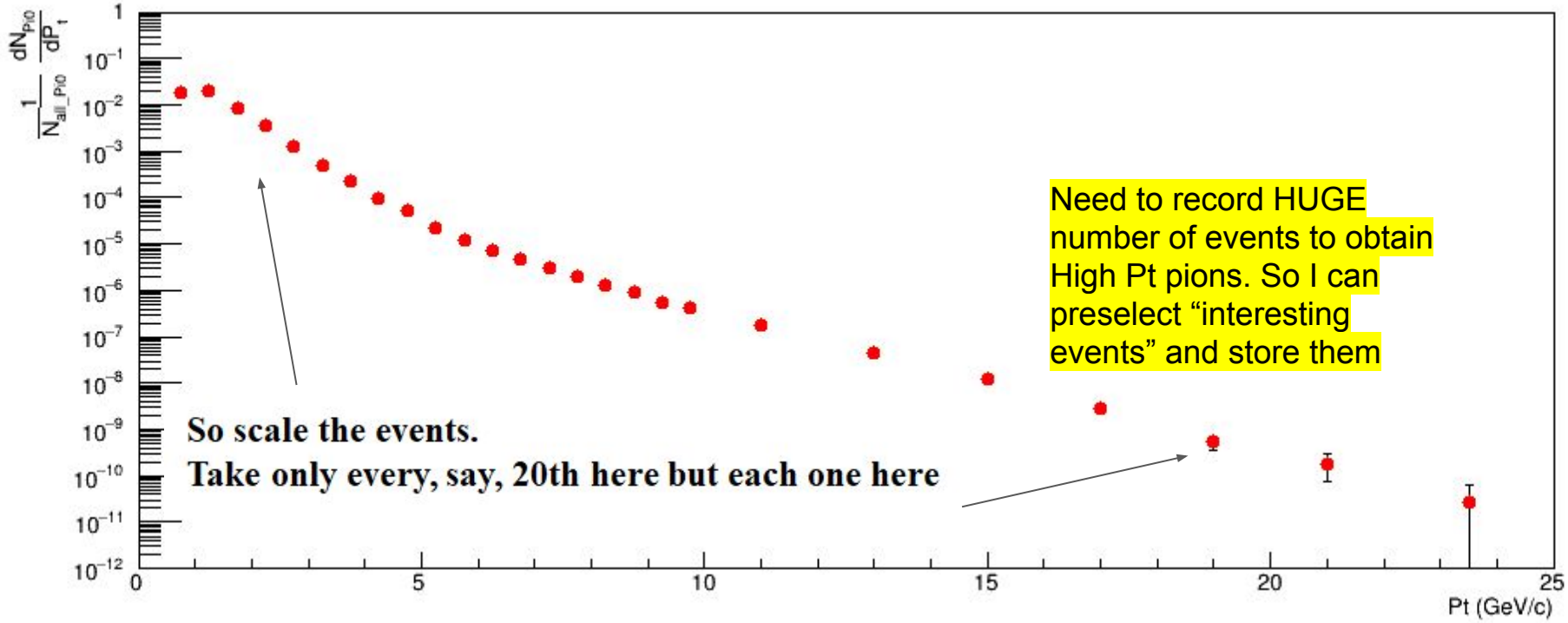


Understanding Trigger basics



Why do I need data from 2 triggers?

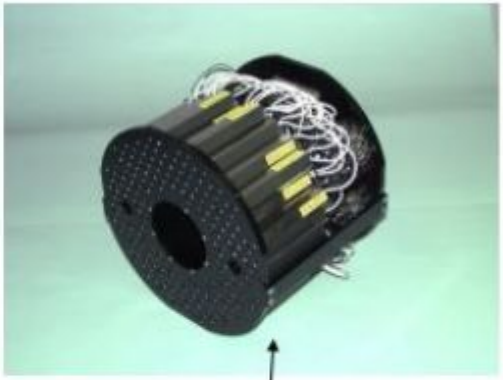
A typical pion spectrum ($\frac{1}{N_{events}} \frac{dN}{dp_t dy}$ (1/GeV)

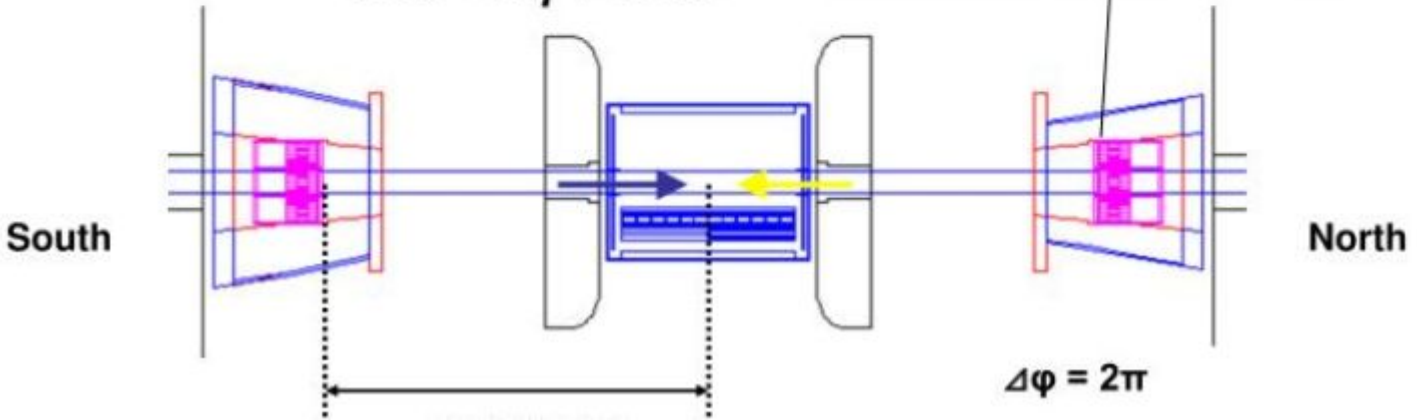


PHENIX BBC

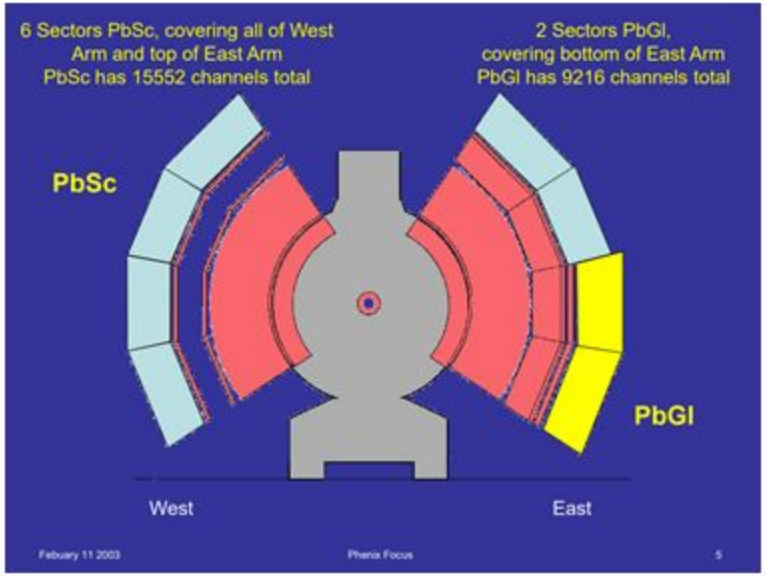
- 2 identical parts (BBC-north and -south)
- Quartz Cherenkov counter
- 64 segments each.

$$3.0 < |\eta| < 3.9$$

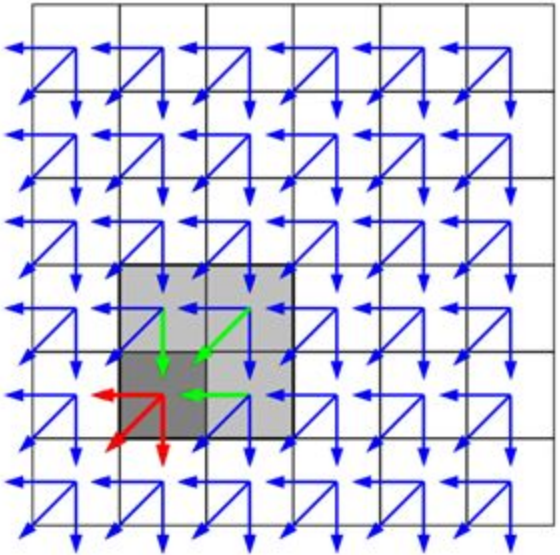




ERT trigger in PHENIX (the EMCal part)



Trigger logic in EMCal



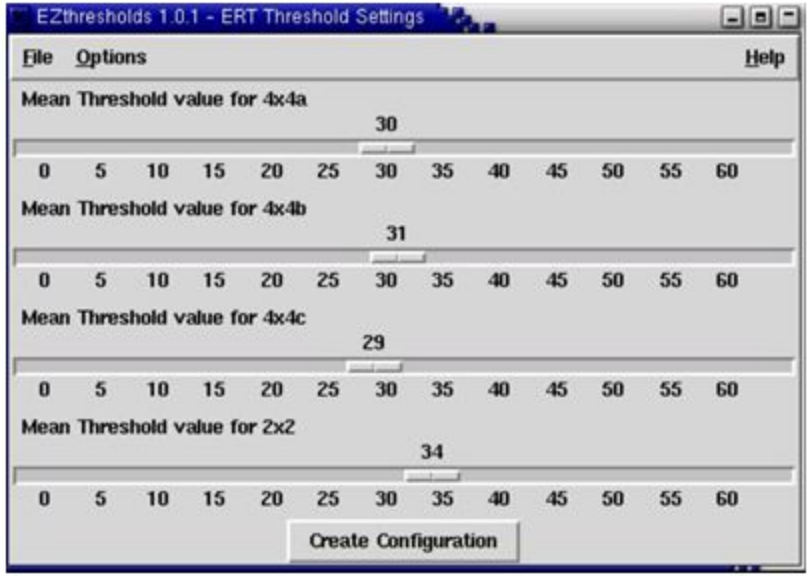
Each chip sends out 3 copies of its 2x2 sum to three neighboring chips (which may be on different ASIC cards or on different FEM's).

Each chip also receives 3 copies of sums from neighboring chips.

With its own 2x2 sum and the three incoming 2x2 sums, each chip constructs a 4x4 tile sum. Effectively, each 4x4 tile is "owned" by the chip in its lower left corner.

https://www.phenix.bnl.gov/WWW/publish/goto/trigger.html

Setting different threshold



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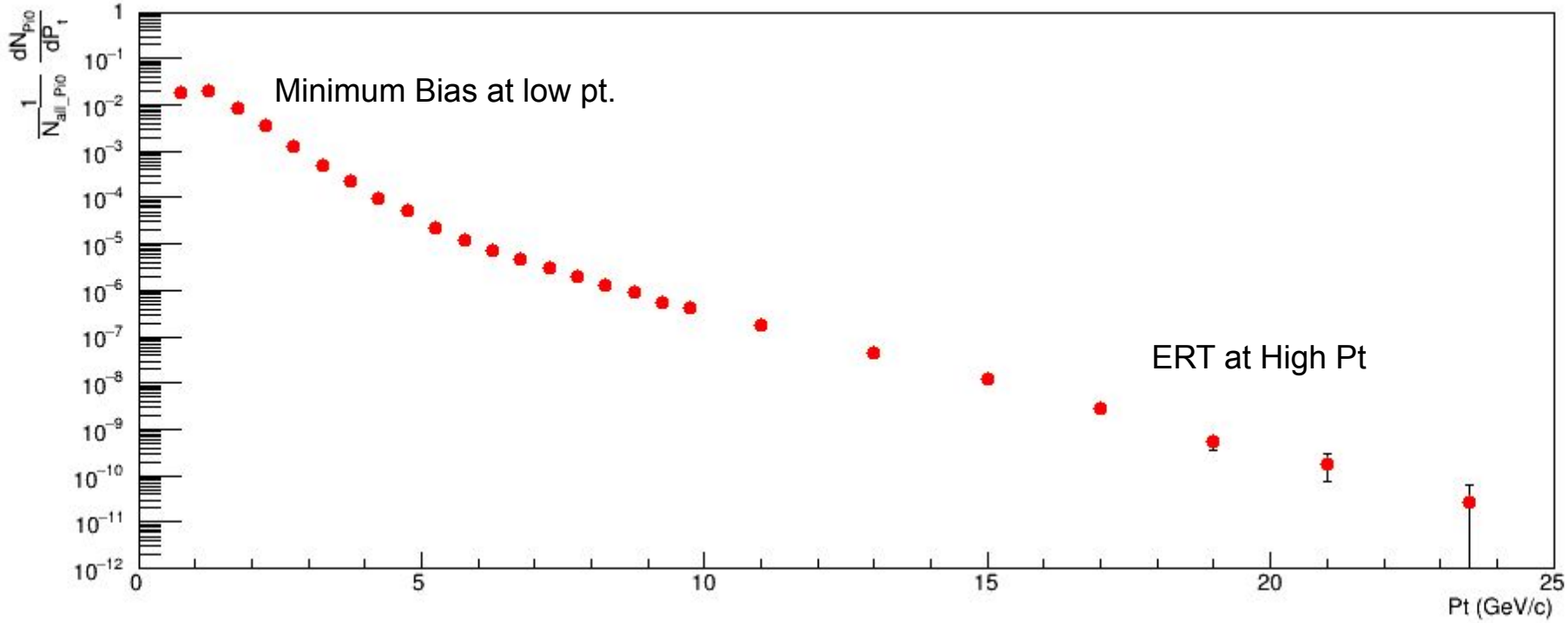
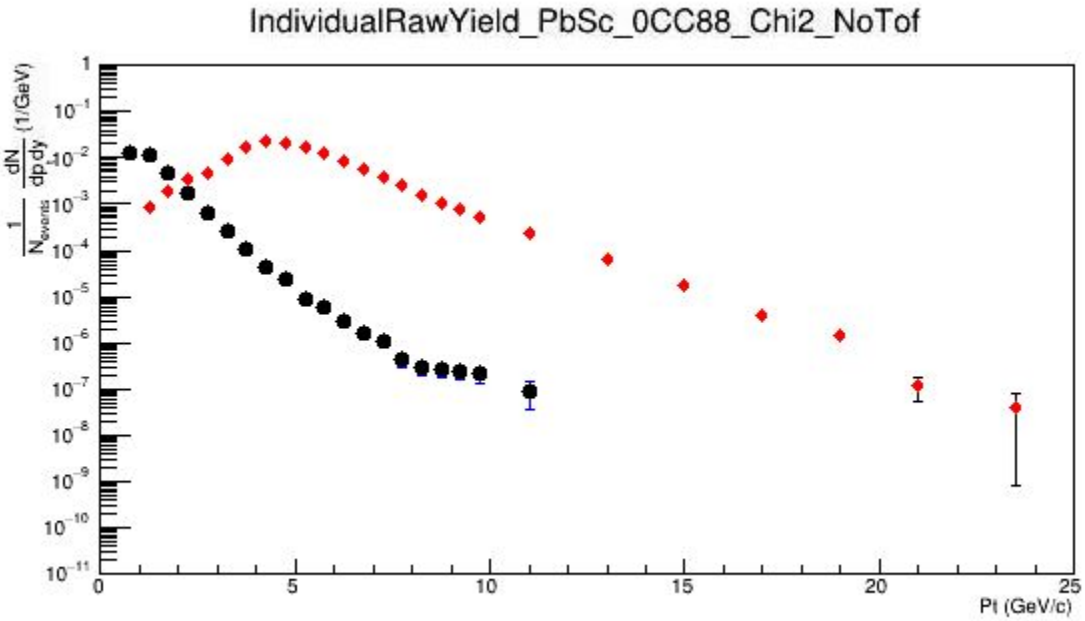
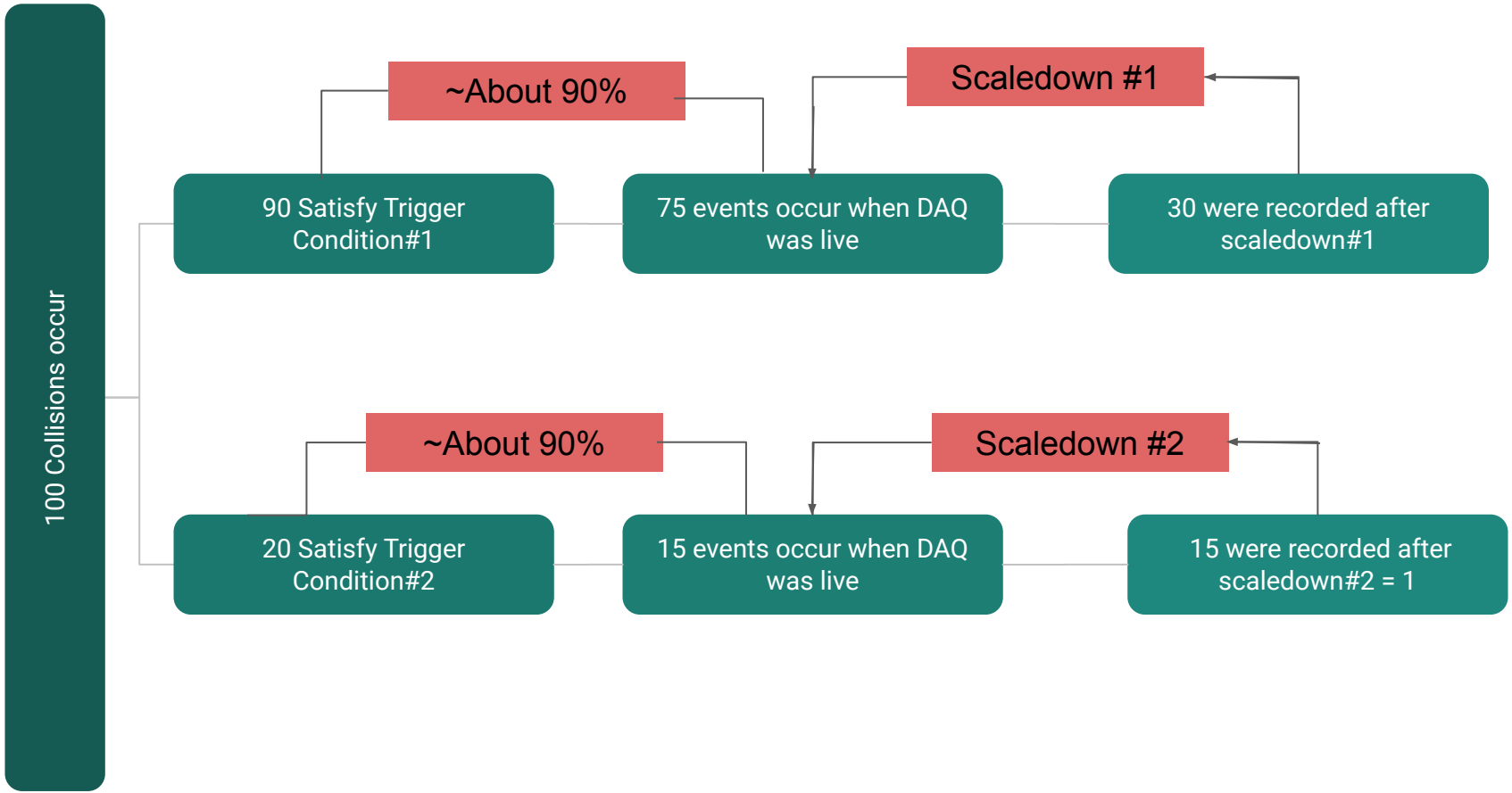


But the plot doesn’t look like this in the beginning



Understanding Trigger basics



Scale down information in RunPage

Name	Bit Mask	Scale Down	State	Raw Trigger Count	Raw Trigger Rate	Live Trigger Count	Live Trigger Rate	Scaled Trigger Count	Scaled Trigger Rate	Livetime
BBCLL1(>0 tubes)	0x00000001	35713	Enabled	754809757	664445.21	512580543	451215.27	14352	12.63	0.68
BBCLL1(>0 tubes) novertex	0x00000002	2138	Enabled	1122824786	988402.10	762428778	671152.09	356442	313.77	0.68
ZDCLL1wide	0x00000004	14285	Enabled	422321376	371761.77	298673123	262916.48	20907	18.40	0.71
BBCLL1(>0 tubes)_central_narrowvtx	0x00000008	3	Enabled	20121624	17712.70	13653833	12019.22	3413458	3004.80	0.68
BBCLL1(>0 tubes) narrowvtx	0x00000010	1492	Enabled	287162827	252784.18	194991103	171647.10	130604	114.97	0.68
ZDCNS	0x00000020	14285	Enabled	236822671	208470.66	160825816	141572.02	11257	9.91	0.68
ERT_4x4b	0x00000040	0	Enabled	152040	133.84	105280	92.68	105280	92.68	0.69

All events that satisfied the particular trigger

Number of times the trigger fired when the DAQ was live. (remember gating from before)

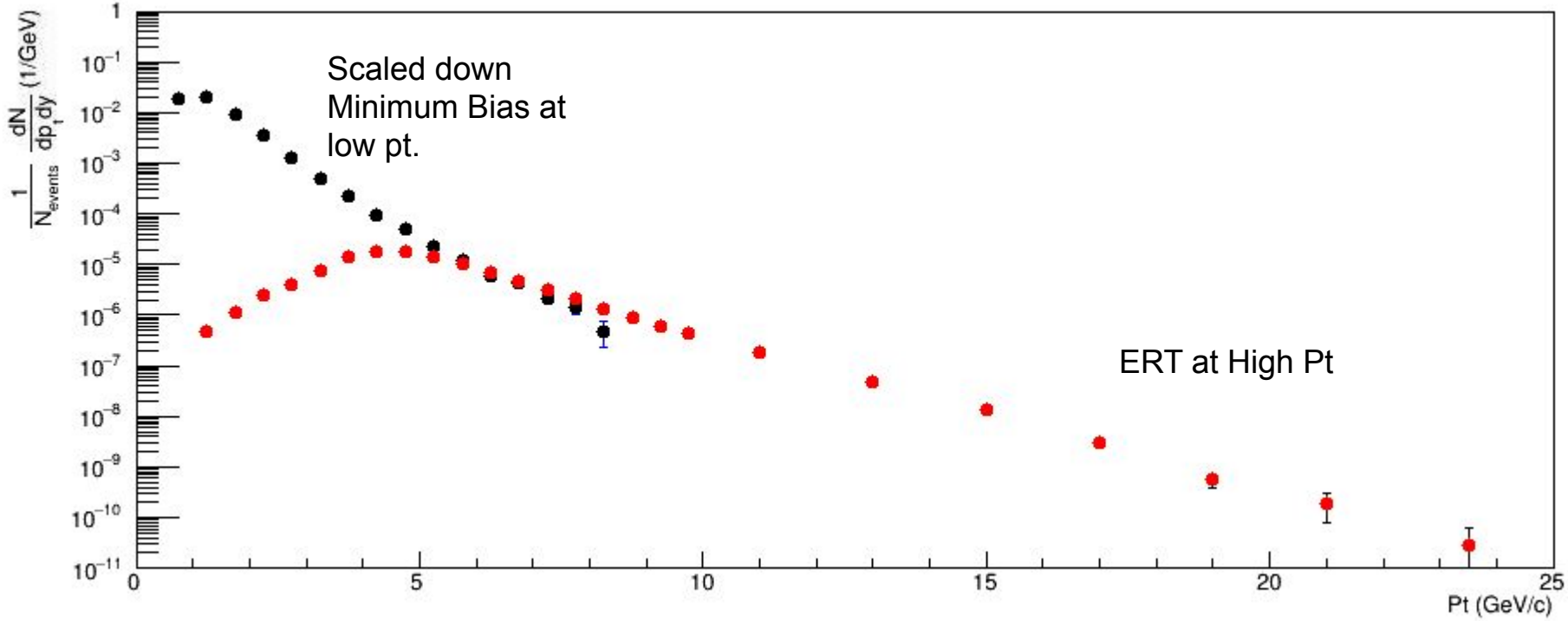
Number of times the trigger fired when the DAQ was live AND the scaledown value has reached

Excel sheet from Martin

Link to the Excel sheet with the correct Run Numbers.

	runnumber	name	scalerberraw	scalerberlive	scalerberscaled	scaledown		
454774	454774	BBCLL1(>0 tubes) narrowvtx	178952175	169412448	11858	14286.76	0.946691193	1.204820715
454777	454777	BBCLL1(>0 tubes) narrowvtx	88257973	82459012	6926	11905.72	0.93429533	1.718989217
454778	454778	BBCLL1(>0 tubes) narrowvtx	211012136	159287631	16724	9524.49	0.754874265	0.5695105
454782	454782	BBCLL1(>0 tubes) narrowvtx	199774759	189525082	24875	7619.10	0.948693834	0.306295428
454783	454783	BBCLL1(>0 tubes) narrowvtx	169200991	122451759	25714	4762.07	0.723705921	0.185193504
454784	454784	BBCLL1(>0 tubes) narrowvtx	23240870	17946298	3769	4761.55	0.772187014	1.263346845

	runnumber	name	scalerberraw	scalerberlive	scalerberscaled		
454774	454774	ERT_4x4b	131486	118582	118582	1	0.90186027
454777	454777	ERT_4x4b	58920	55716	55716	1	0.94562118
454778	454778	ERT_4x4b	139962	106840	106840	1	0.76335005
454782	454782	ERT_4x4b	220023	164131	164131	1	0.74597201
454783	454783	ERT_4x4b	326894	204963	204963	1	0.62700141
454784	454784	ERT_4x4b	30841	23162	23162	1	0.75101326
454785	454785	ERT_4x4b	8517284	2825824	2825824	1	0.33177525
454786	454786	ERT_4x4b	24696	23971	23971	1	0.97064302
454789	454789	ERT_4x4b	39550	38030	38030	1	0.96156764
454794	454794	ERT_4x4b	38028	25866	25866	1	0.68018302
454797	454797	ERT_4x4b	2813356	1379321	1379321	1	0.49027603


Scaled down
Minimum Bias at
low pt.
ERT at High Pt
$\frac{1}{N_{events}} \frac{dN}{dp_t dy}$ (1/GeV)
Pt (GeV/c)
1
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}
10^{-8}
10^{-9}
10^{-10}
10^{-11}
0
5
10
15
20
25