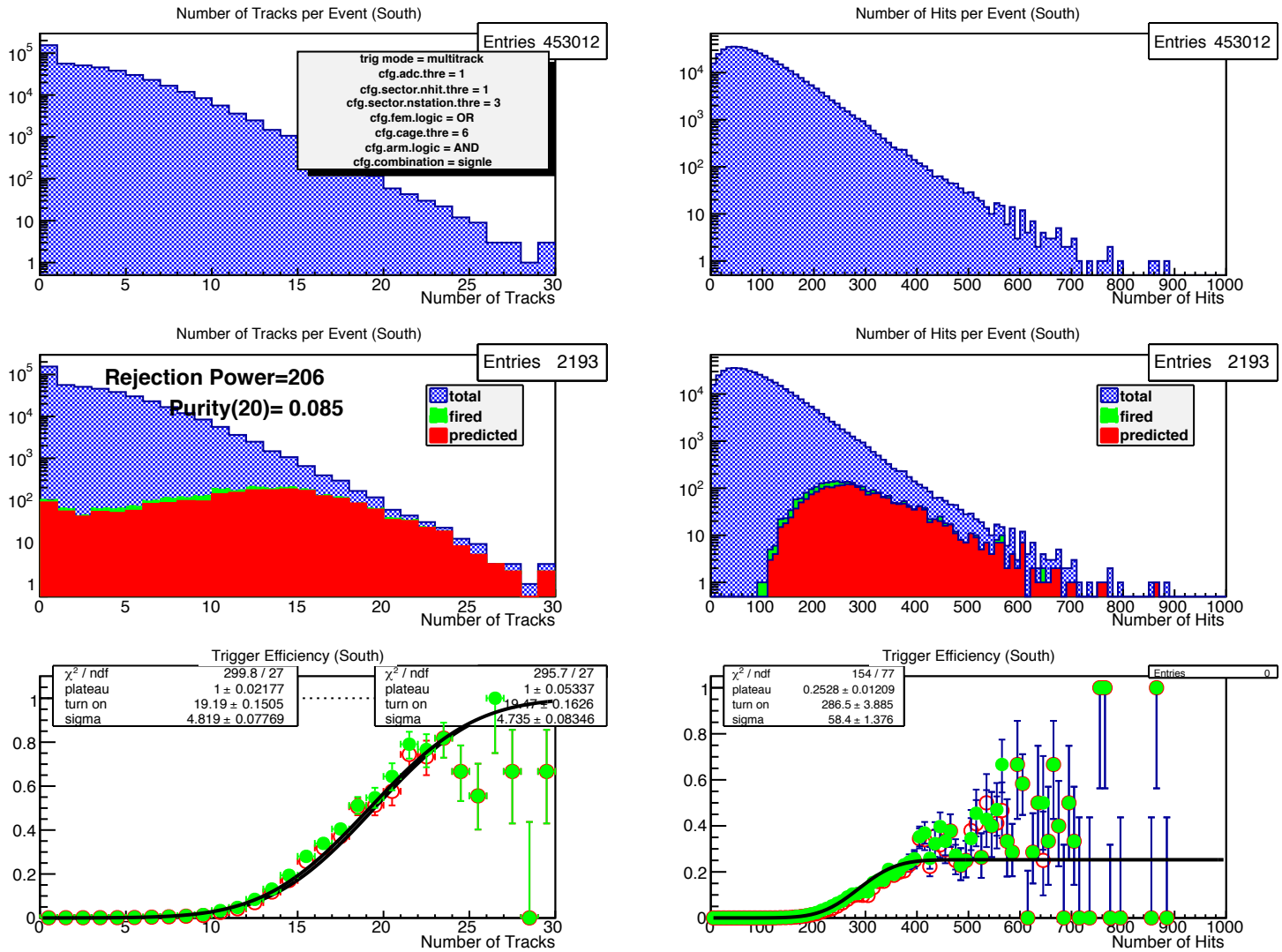
High Multiplicity Trigger Operation Status

RIKEN/RBRC
Itaru Nakagawa
On behalf of
Toru Nagashima, Aaron Key, SeYoung Han, Shoichi Hasegawa

TRIGGER TURN ON

Turn On Curve (South)

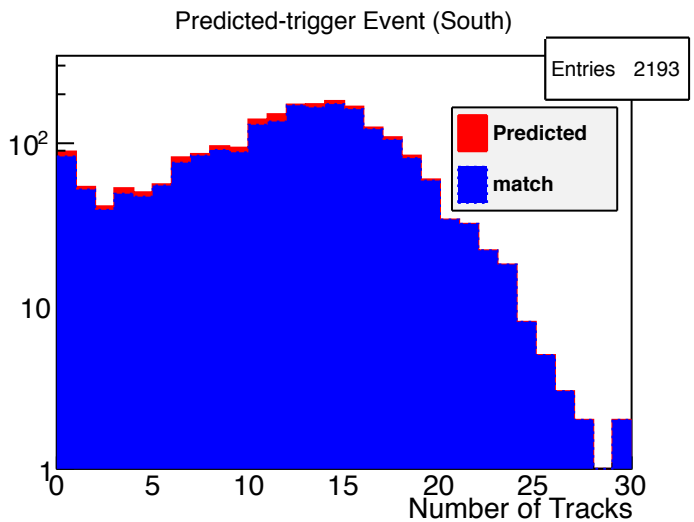
Run# 425692

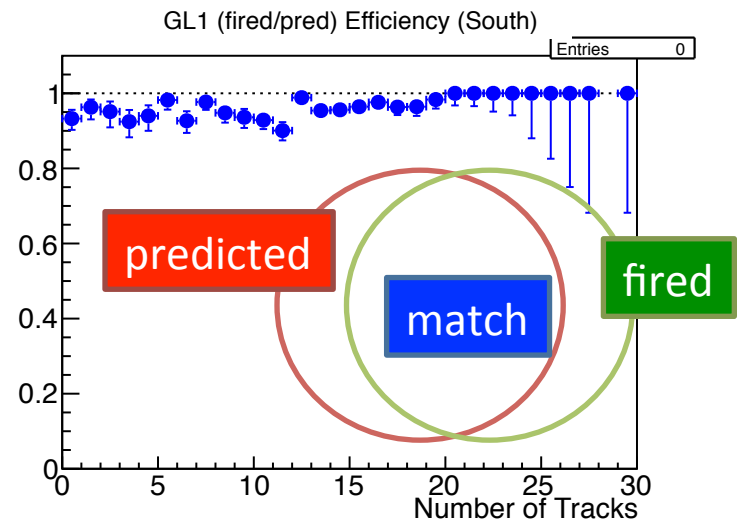


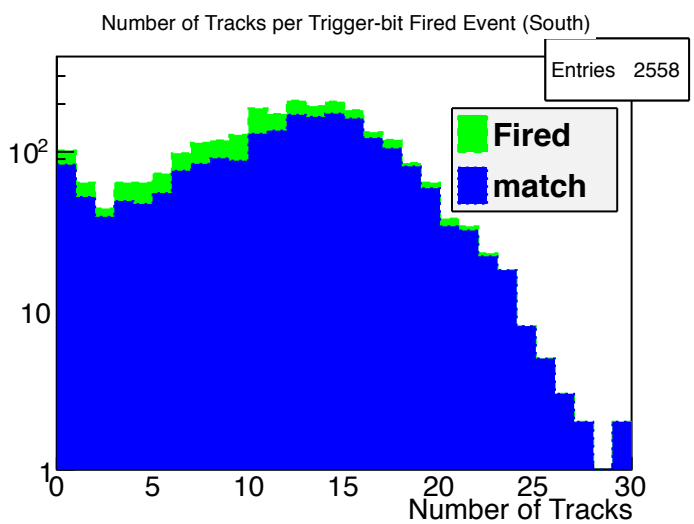
Rejection power w.r.t MUID1D

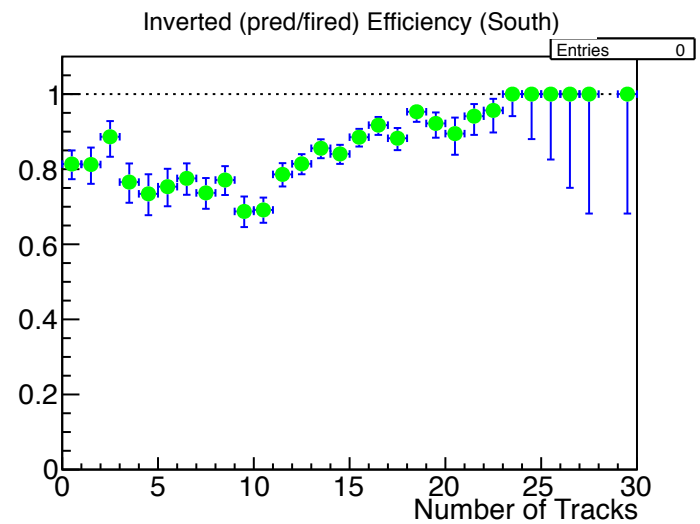
GL1 Efficiency (South)

Run# 425692

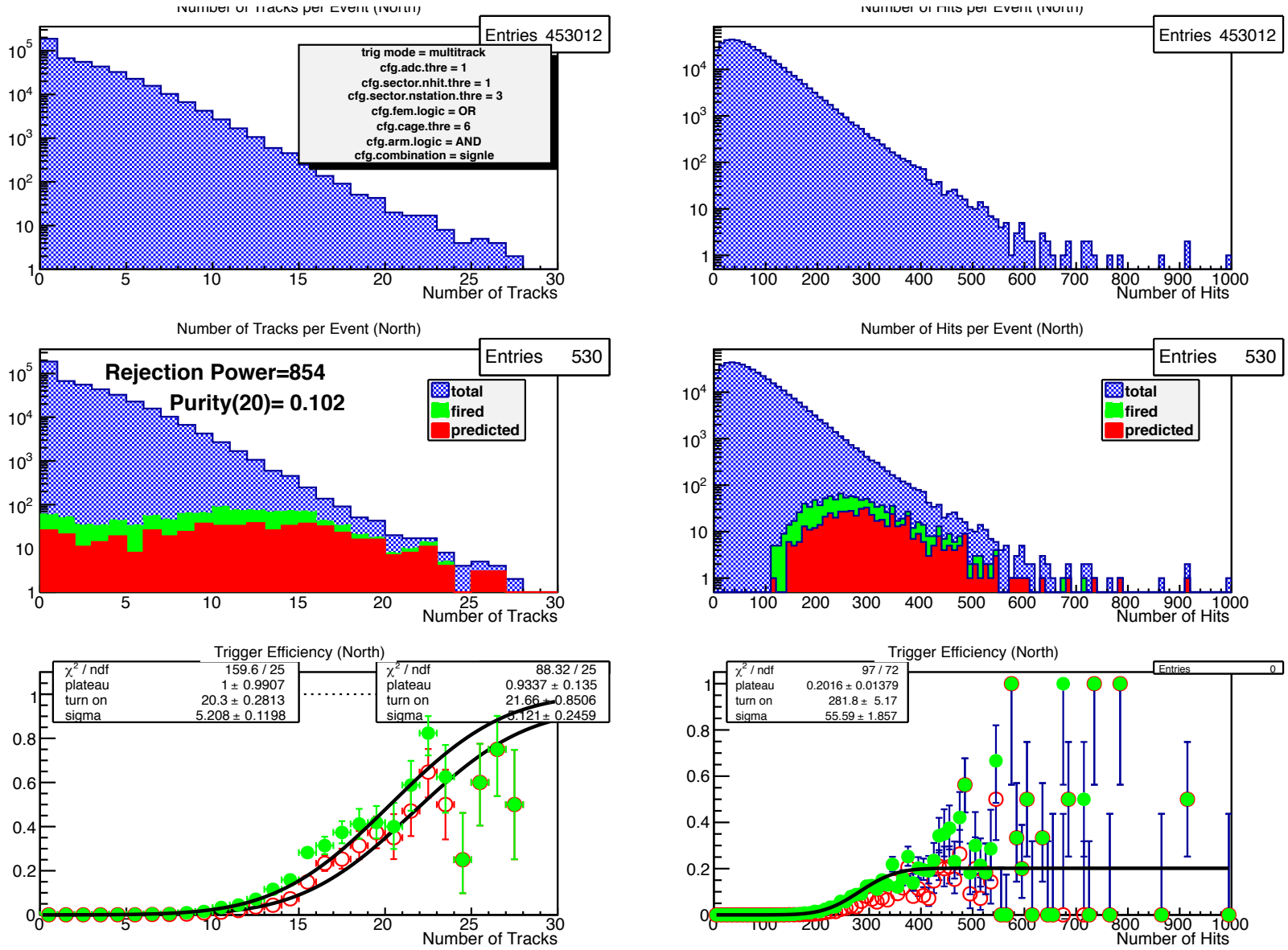








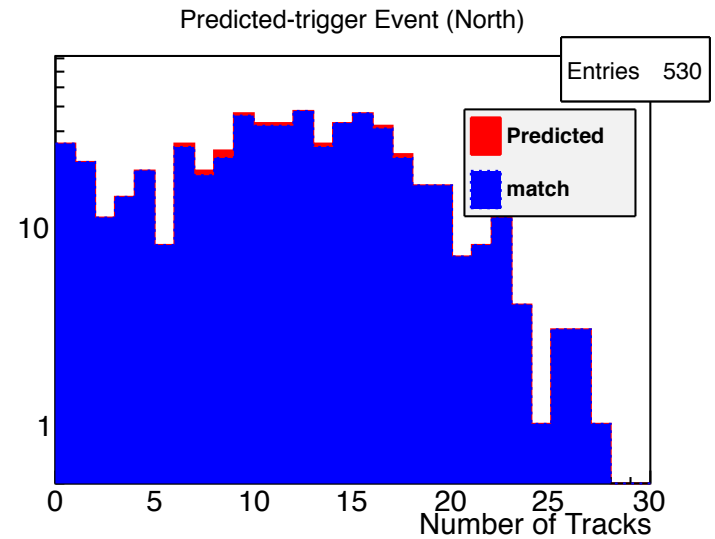
Turn on Curve (North)

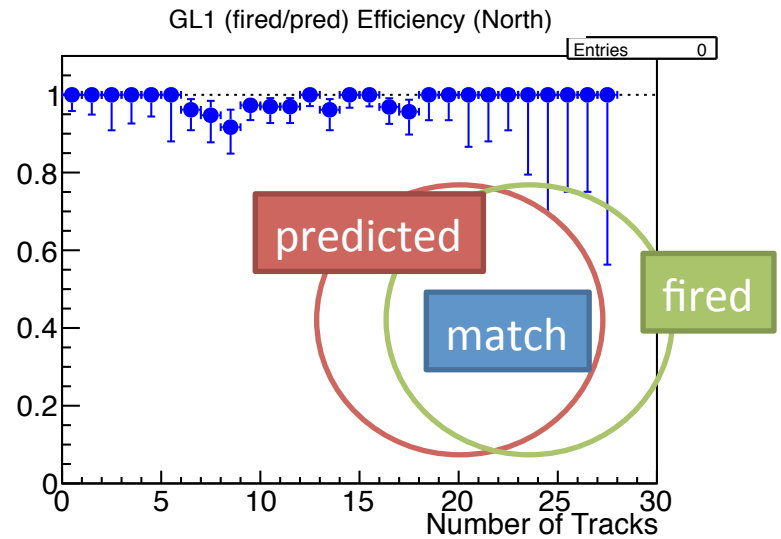


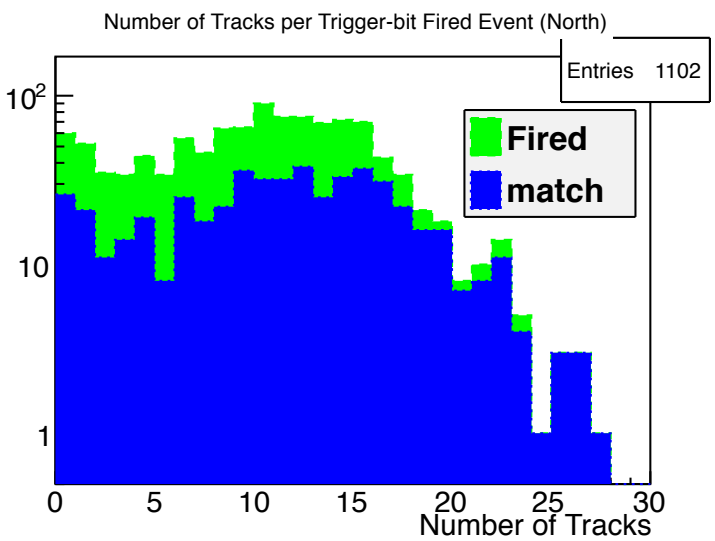
Somehow contamination of 40% fake trigger

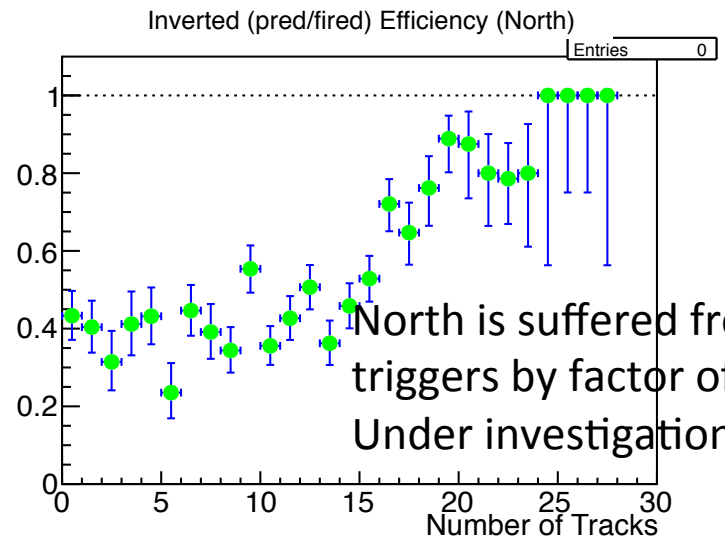
GL1 Efficiency (North)

Run# 425692





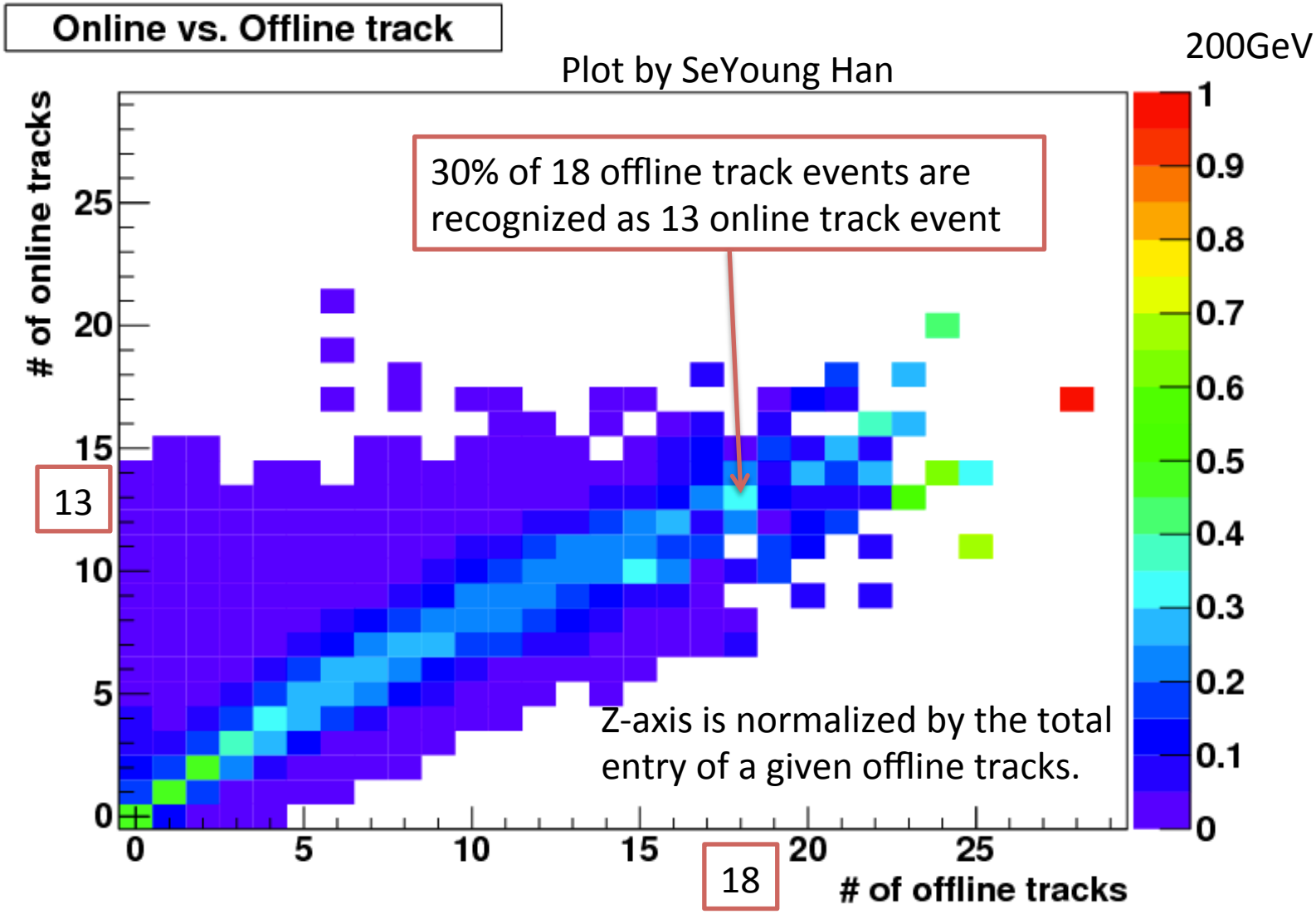




North is suffered from fake triggers by factor of 1.4 or so. Under investigation

ONLINE TRACK VS OFFLINE TRACK

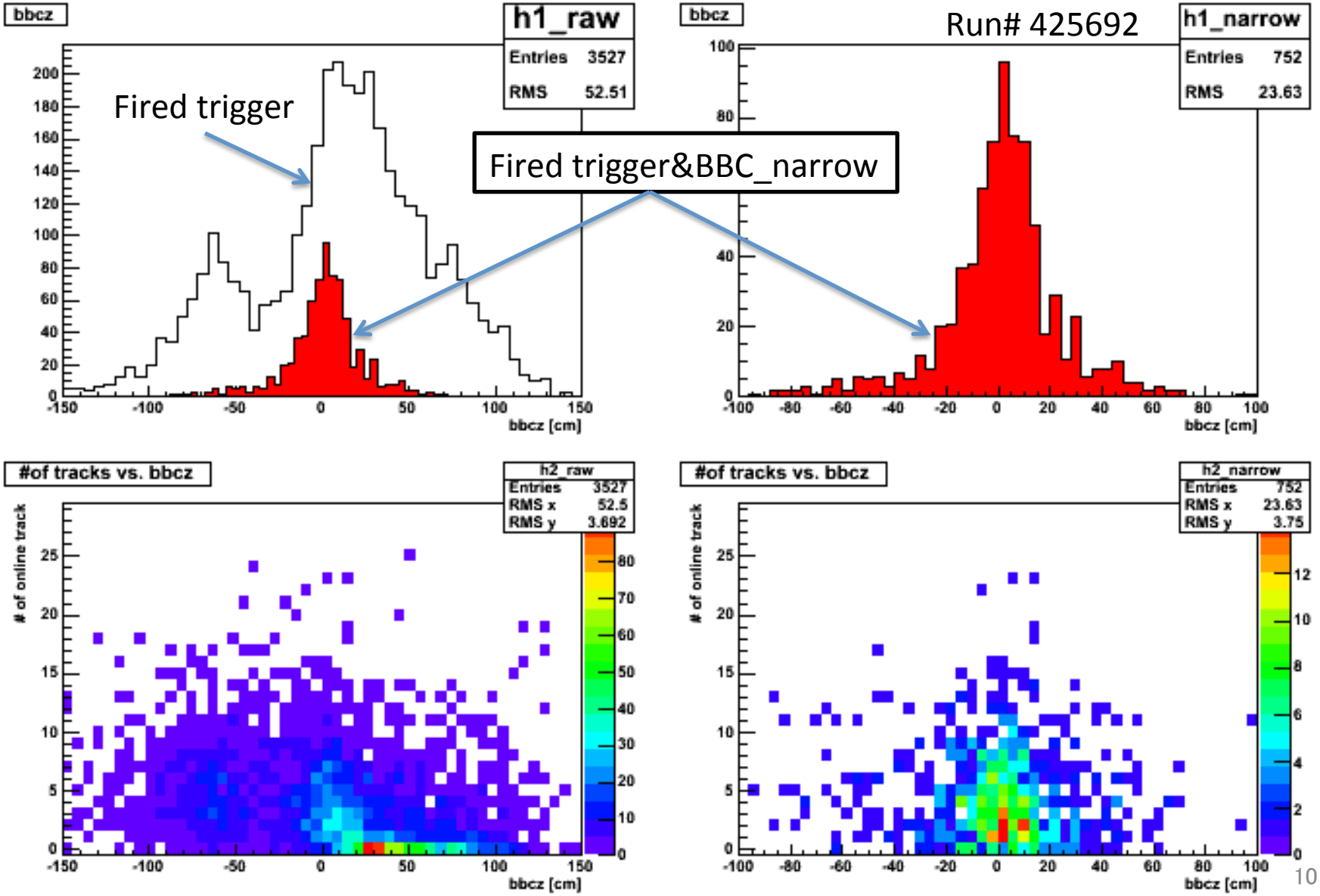
Online vs. Offline Track Correlation



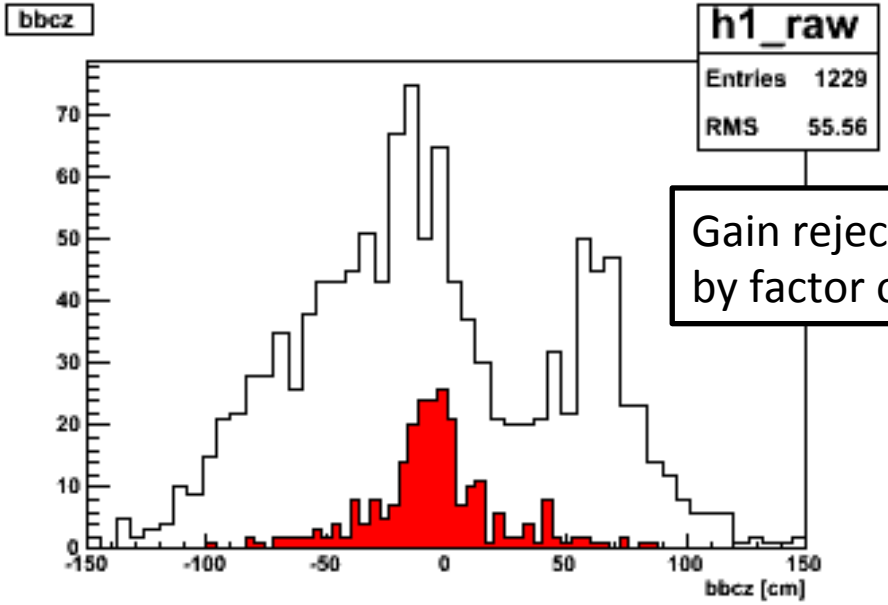
Online track (=active FEMs) is limited upto 24/arm. Therefore the curve saturates at higher #of tracks

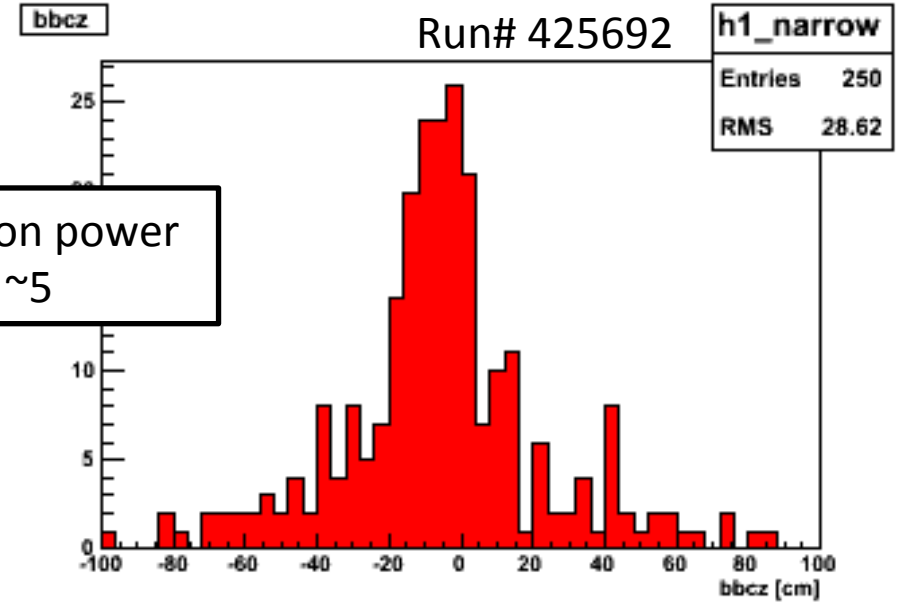
BBC-Z VERTEX DEPENDENCE

FVTX_HighMult_S bbcz dependence

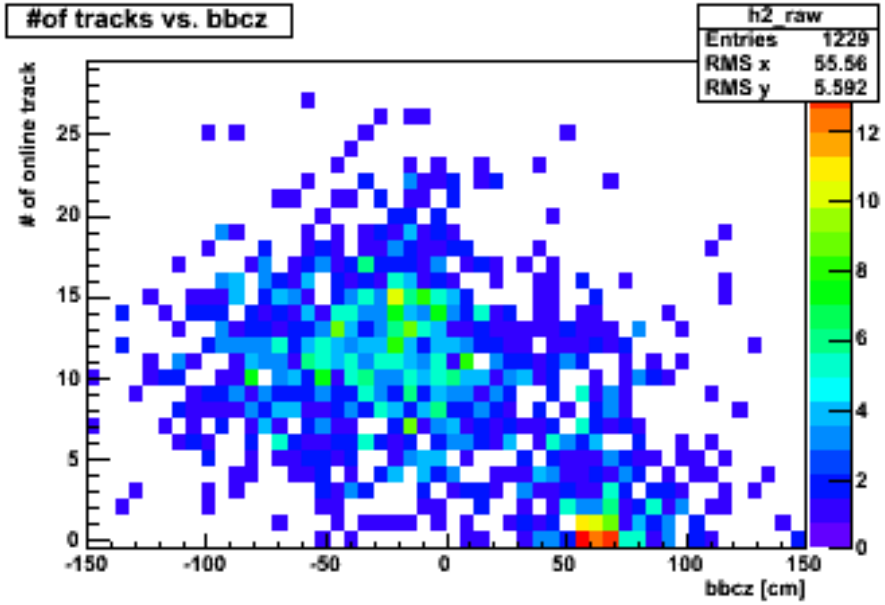


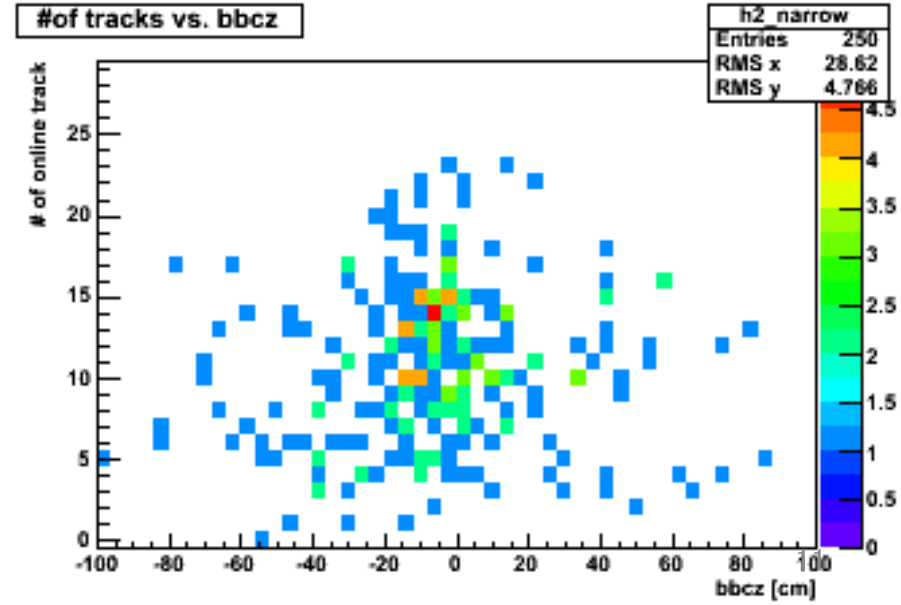
FVTX_HighMult_N bbcz dependence





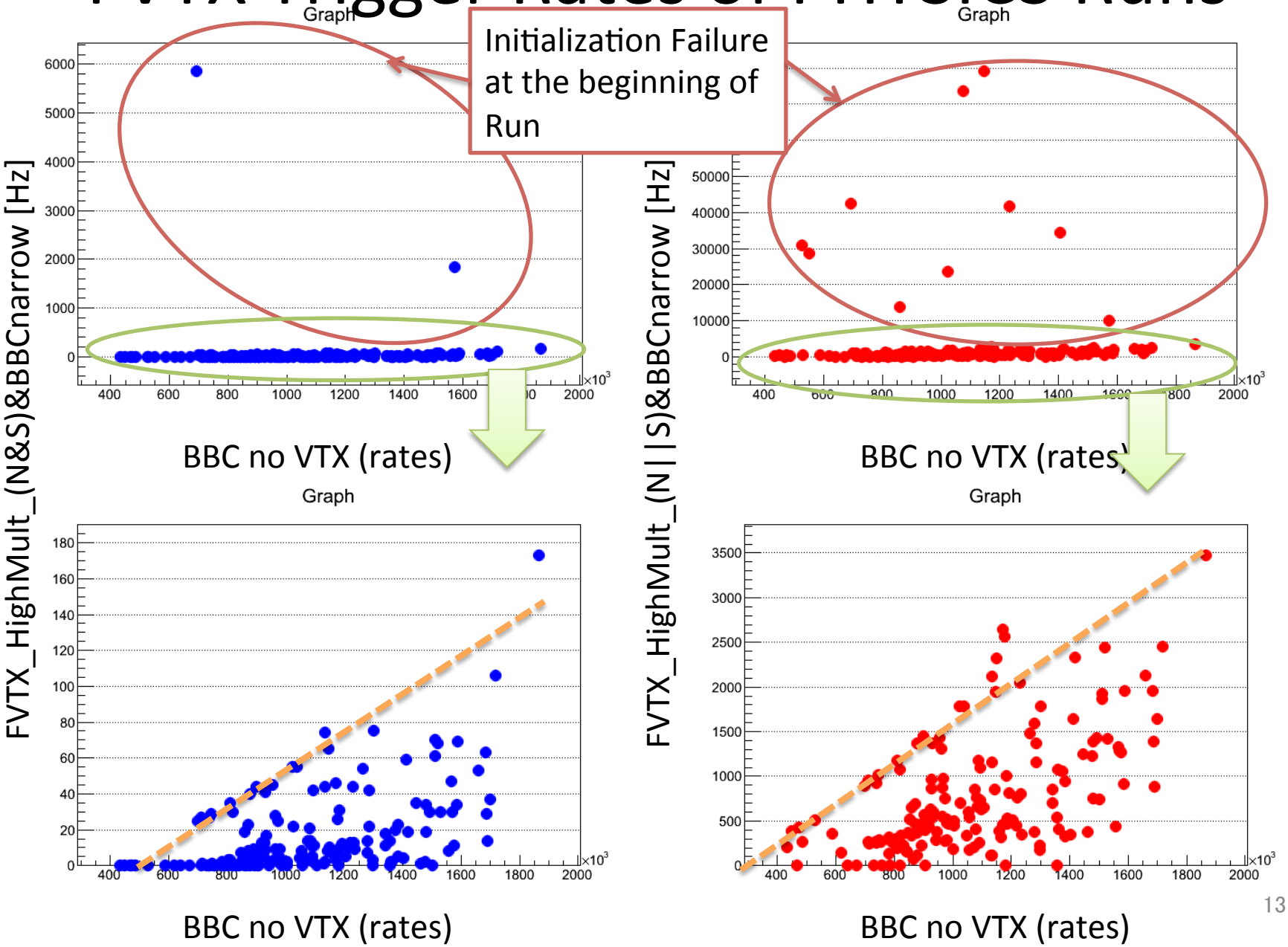
Gain rejection power by factor of ~5



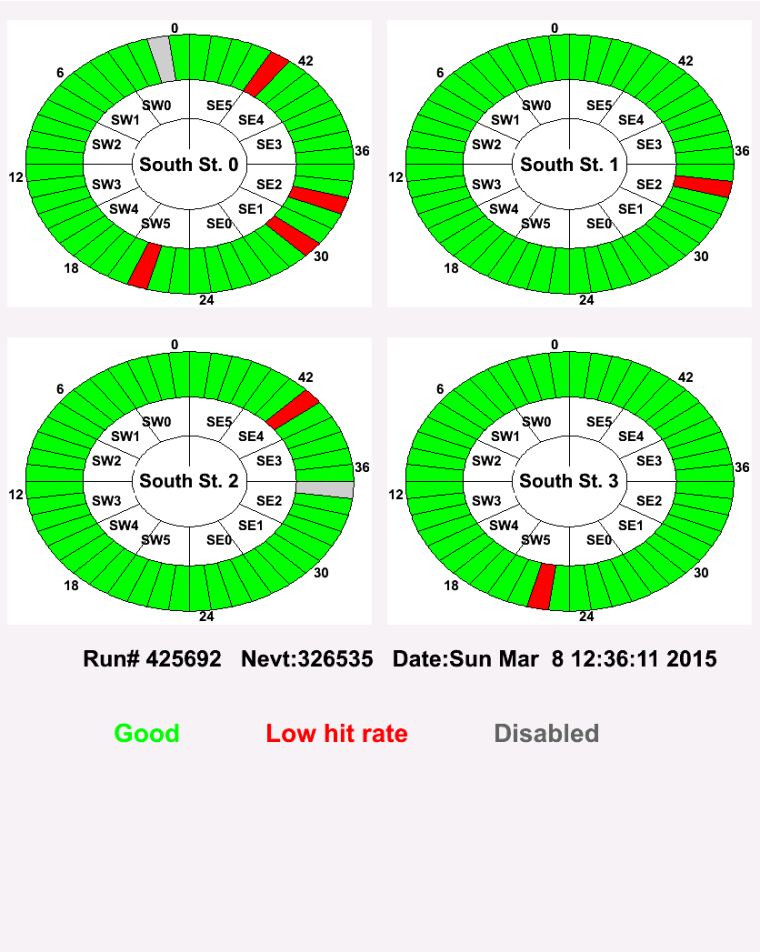


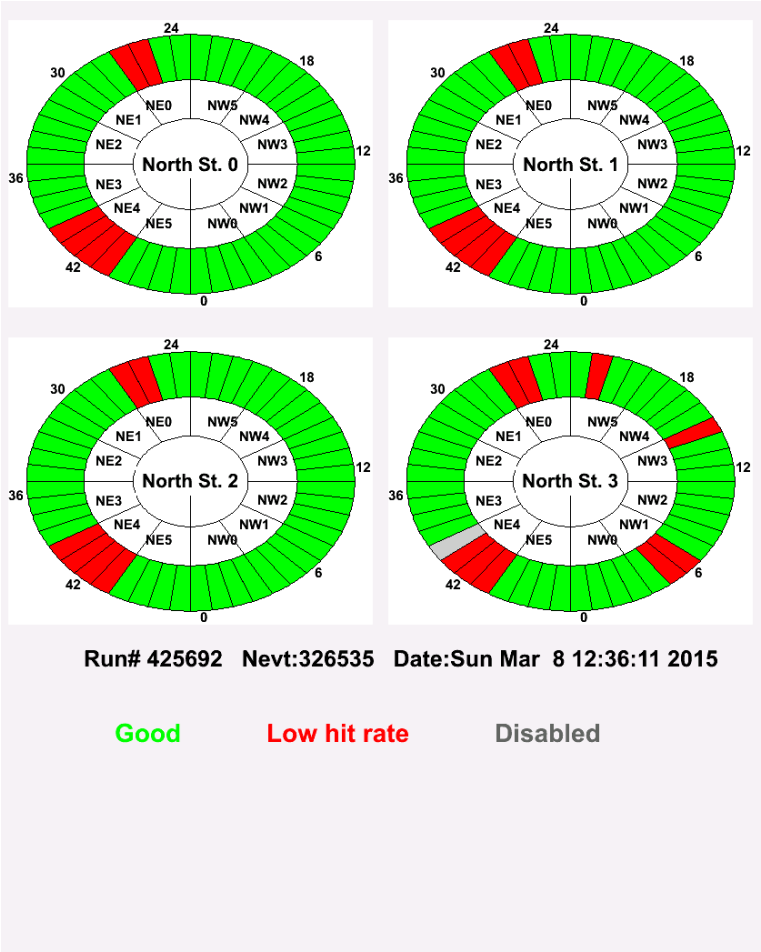
TRIGGER RATES

FVTX Trigger Rates of PHYSICS Runs

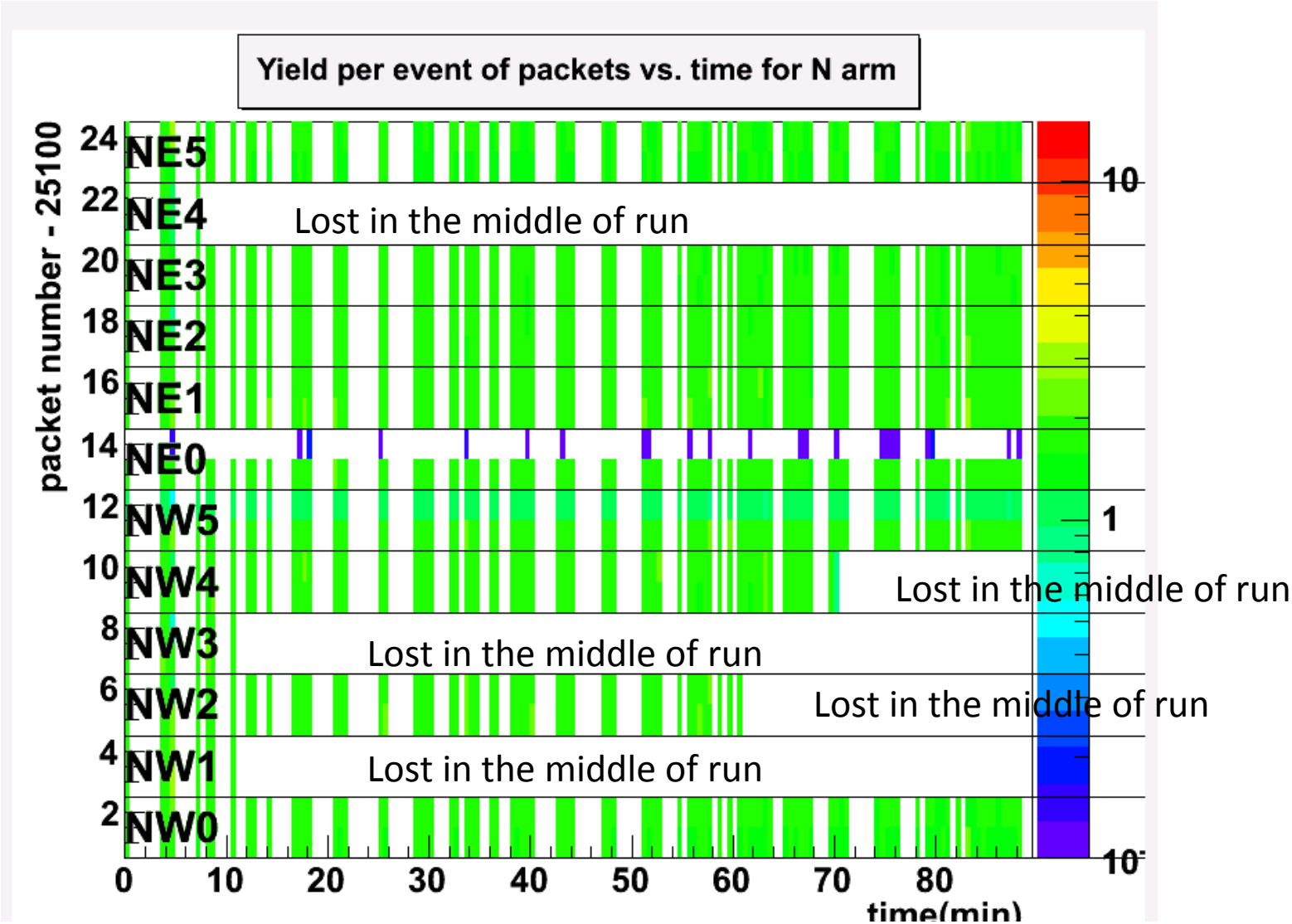


FVTX Packet Drop Off Issue

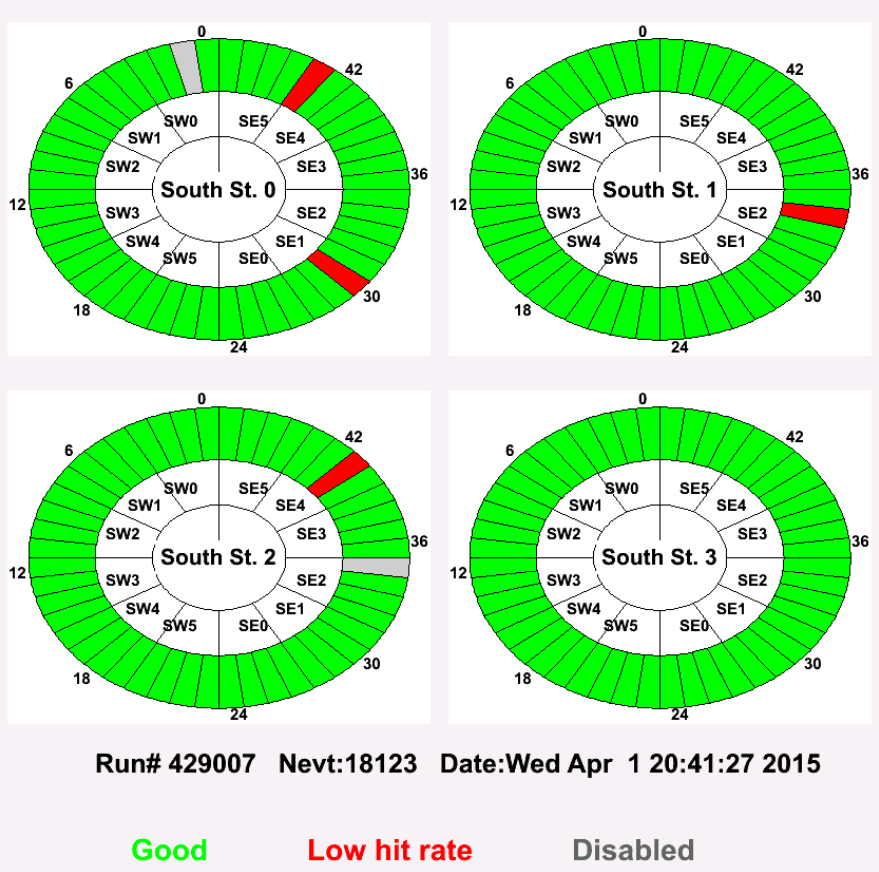


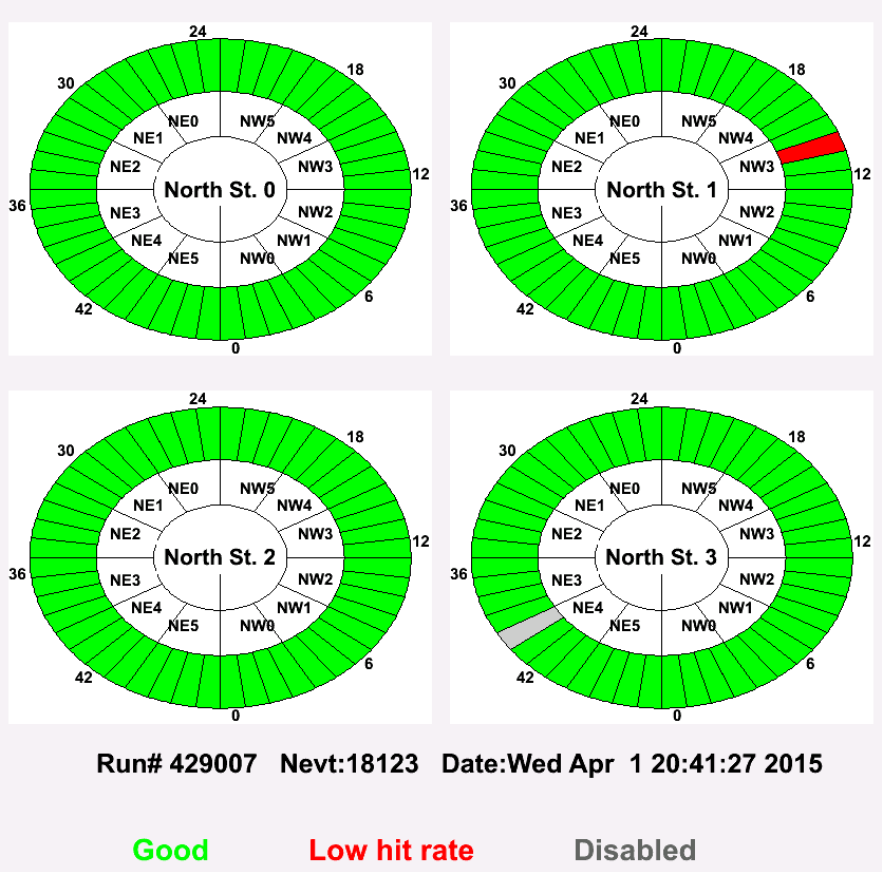


Packet Drop Off



Latest Physics Run





Situation is better lately (last week). However, we don't know the real cause of this, so it may come back any time.

Run Summary

www.phenix.bnl.gov/WWW/run/daq/runcontrol/RunSummary.php?RunNumber=429027

Indico Run PHENIX goo 辞書 Yahoo! JAPAN ニュース 理研電話帳 アップル tmp Google マップ 関数電卓 ガーミンコネクト ONE TOKYO

Run Summary | Broadcast Mess... | Muon Tracker -... | https://www.ph... | Garmin Connect... | PHENIX PLHF P... | AGENDA MODIF... | https://www.ph...

select * from trigger where runnumber = 429027 order by bitnb

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	6050	Enabled	1169688569	628526.90	1056883911	567911.83	174662	93.85	0.90
BBCLL1(>0 tubes) novertex	0x00000002	10890	Enabled	2127777780	1143351.84	1922479875	1033035.93	176520	94.85	0.90
ZDCLL1wide	0x00000004	215	Enabled	24710880	13278.28	22645294	12168.35	104839	56.33	0.92
BBCLL1(noVtx)&(ZDCN||ZDCS)	0x00000008	497	Enabled	231229358	124250.06	211867230	113845.91	425436	228.61	0.92
BBCLL1(>0 tubes) narrowvtx	0x00000010	684	Enabled	448878466	241202.83	405572641	217932.64	592076	318.15	0.90
ZDCNS	0x00000020	215	Enabled	27946435	15016.89	25266707	13576.95	116975	62.86	0.90
ERT_4x4b	0x00000040	0	Enabled	220439	118.45	191497	102.90	191497	102.90	0.87
ERT_4x4a&BBCLL1	0x00000080	0	Enabled	1359673	730.61	1233561	662.85	1233561	662.85	0.91
ERT_4x4c&BBCLL1(narrow)	0x00000100	1	Enabled	1752209	941.54	1606211	863.09	803106	431.55	0.92
ERTLL1_E&BBCLL1(narrow)	0x00000200	0	Enabled	189453	101.80	174269	93.64	174269	93.64	0.92
FVTX_HighMult_N_AND_S&BBCLL1narrow	0x00000400	0	Enabled	180965	97.24	165763	89.07	165763	89.07	0.92
FVTX_HighMult_N_OR_S&BBCLL1narrow	0x00000800	5	Enabled	5133450	2758.44	4709189	2530.46	784864	421.74	0.92
MPC_N_S_A	0x00001000	0	Enabled	4630327	2488.09	4116489	2211.98	4116489	2211.98	0.89
MPC_S_B	0x00002000	0	Enabled	979705	526.44	875893	470.66	875893	470.66	0.89
MPC_S_C&ERTLL1_2x2	0x00004000	0	Enabled	46900	25.20	42905	23.05	42905	23.05	0.91
MPC_S_C&MPC_S_C	0x00008000	0	Enabled	17049	9.16	15410	8.28	15410	8.28	0.90
CLOCK	0x00010000	196077	Enabled	17513268989	9410676.51	15838626325	8510814.79	80777	43.41	0.90
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1163591	625.25	1163591	625.25	0.89
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	48484	26.05	48484	26.05	0.91
MPC_N_C&MPC_N_C	0x00080000	0	Enabled	23957	12.87	18051	9.70	18051	9.70	0.75
[illegible]	[illegible]	0	Enabled	28034	15.06	20087	10.79	20087	10.79	0.72
[illegible]	[illegible]	0	Enabled	11045	5.93	7760	4.17	7760	4.17	0.70
MUIDLL1_N1D&BBCLL1novtx	0x00400000	18	Enabled	4399122	2363.85	3908127	2100.01	205690	110.53	0.89
MUIDLL1_S1D&BBCLL1novtx	0x00800000	9	Enabled	2292861	1232.06	2063535	1108.83	206353	110.88	0.90
MUON_N_SG3&MUIDLL1_(1D||1H)&BBCLL1novtx(nopp)	0x01000000	0	Enabled	1013949	544.84	868316	466.59	868316	466.59	0.86

FVTX TRIGGER PARAMETER OPTIMIZATION

Constraints and Options

- Suppose 400 Hz total band width
- 2 trigger bits are available. Following 2 options are available:
  1. North & BBC_narrow + South & BBC_narrow
     - Optimize thresholds to satisfy 200Hz for each trigger
  2. (North&South)&BBC_narrow + (North|| South)&BBCnarrow
     - How much fraction better be assigned to AND and OR trigger mix, respectively?

Presently Running

Single Trigger Optimization

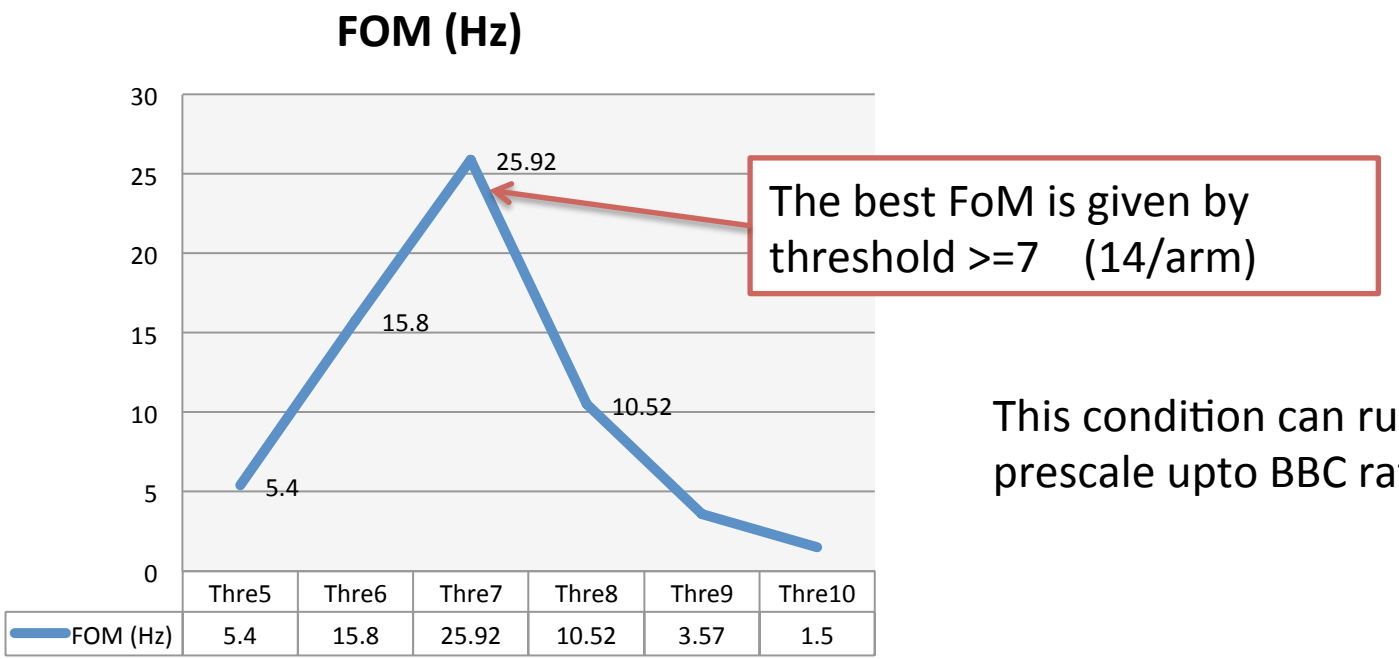
BBC rate ~ 1MHz.

Threshold/cage	5	6	**7**	8	9	10
Purity >= 20	0.027	0.079	**0.162**	0.263	0.357	0.6
Efficiency*	1	1	**1**	1	1	1
Rates (Hz)	2560	640	**160**	40	10	2.5
Prescale**+1	12.8	3.2	**1**	1	1	1
FOM*** (Hz)	5.4	15.8	**25.92**	10.52	3.57	1.5

*Efficiency was assumed ~ 1 due to insufficient statistics.

** Prescale factor was calculated assuming 200Hz/arm

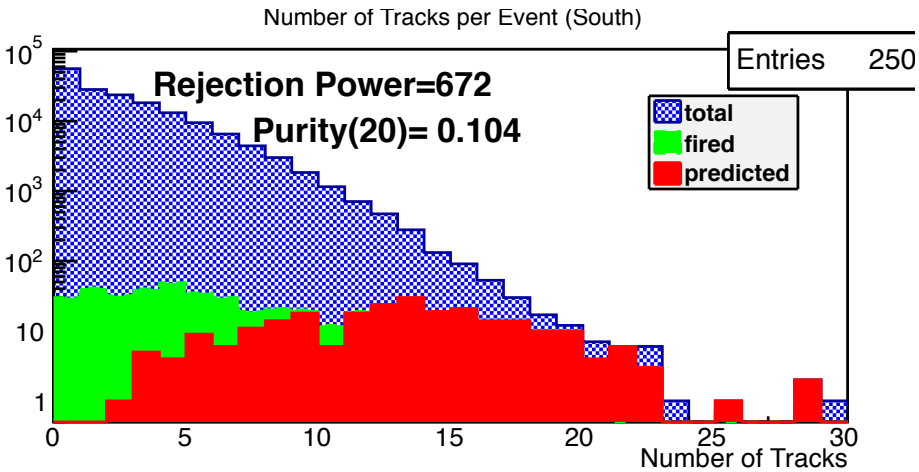
*** FoM = Purity * Efficiency/ (Prescale+1) * rates [Hz] (rates of >20 tracks)

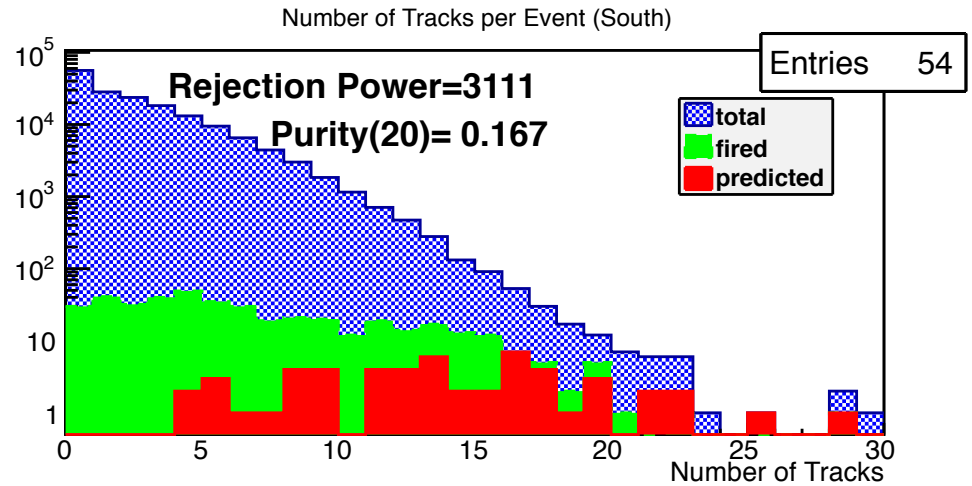


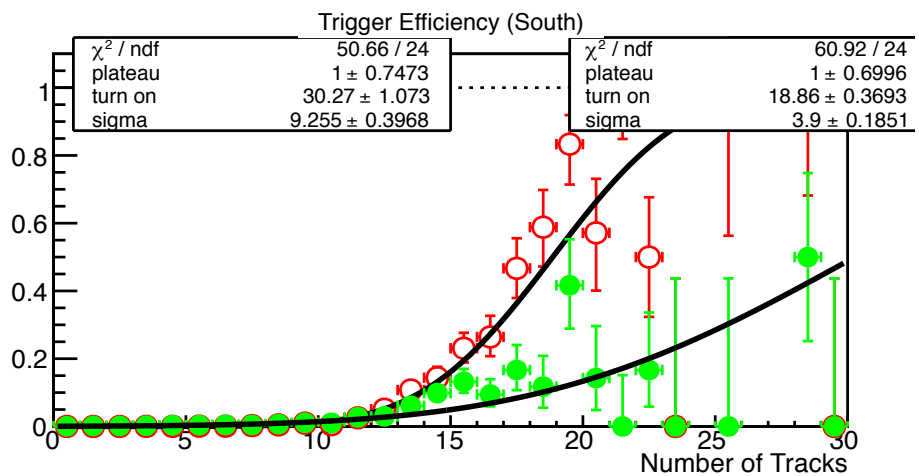
This condition can run without prescale upto BBC rate ~ 1MHz

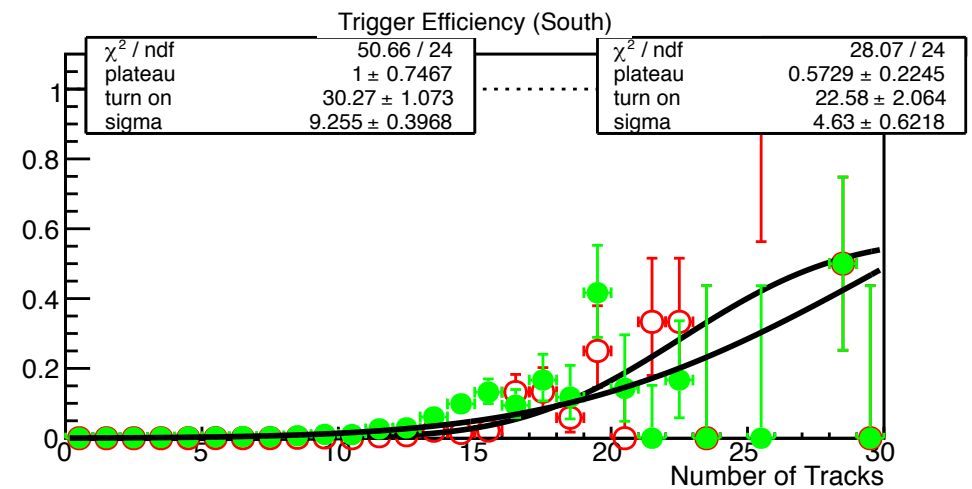
Single Trigger Turn On Curve

See only red predicted dots and hists. Ignore green dots/hists. The data was taken in different condition.









 # track ≥ 12/arm

 # track ≥ 14/arm

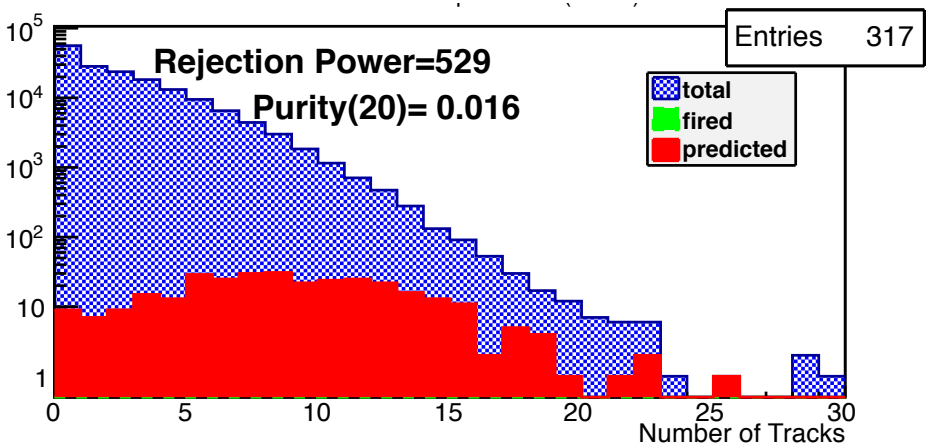
North&South Coincidence

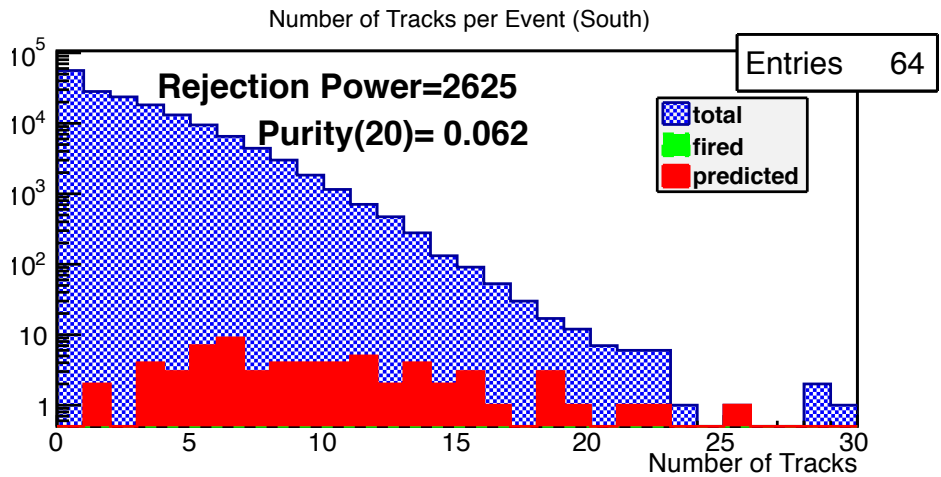
Threshold/ cage	Coinc Counts	Coinc Rates [Hz]	Precale	Efficiency	Purity>20	FoM [Hz]
4	317	500	2.25	1	0.016	3.56
5	**64**	**100**	**1**	**1**	**0.062**	**6.20**
6	16	27	1	1	0.188	5.08
7	1					

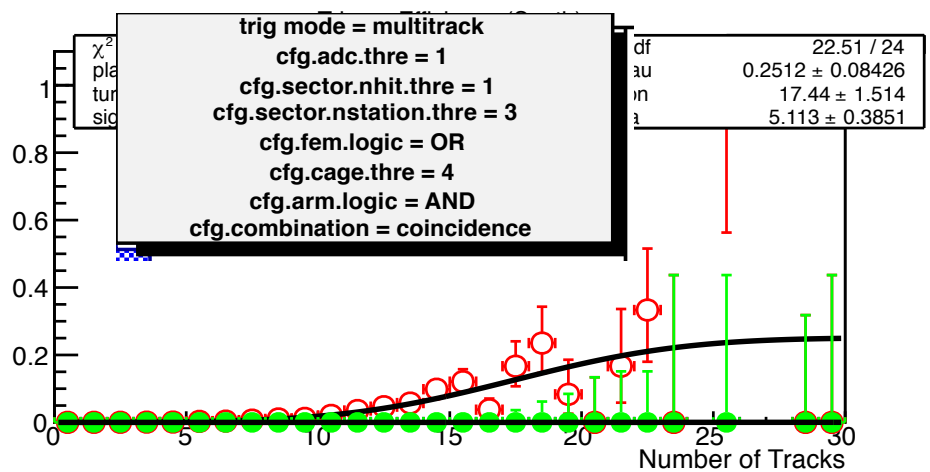
- The best parameter is the threshold>=5 (10/arm) which provide 6.2Hz trigger rates of greater than 20 tracks/arm (40tracks/both_arm) event.
- The coincidence rates is 100Hz at BBC~1MHz. Rest of 300Hz can be assigned to North or South trigger (2.5kHz/arm @ BBC rate of 1MHz).

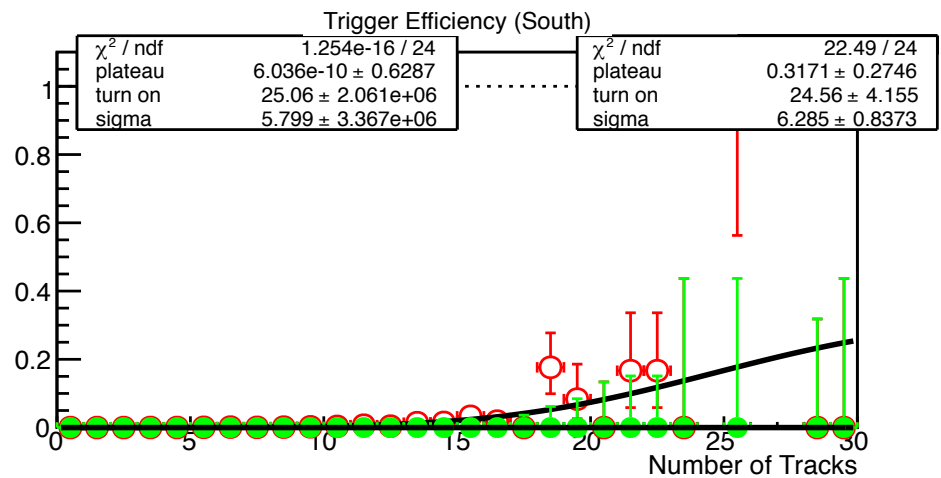
Coincidence Trigger Turn on

Run#425931 (MB Samples)









# of track Threshold >= 8/arm

# of track Threshold >= 10/arm

Summary

1. North & BBC_narrow + South & BBC_narrow option:
   - Run with threshold>=14/arm
   - Accumulate >20 track/arm events about ~ 25Hz.
2. (North&South)&BBC_narrow + (North|| South)&BBCnarrow
   - Run with threshold >=10/arm
   - Accumulate > 40 track/both_arm events about ~6Hz
   - Accumulate > 20track/arm events about 4~5Hz.

prescaled

MB vs. FVTX_S Purity

Run#425397

> # of Tracks	MB	FVTX_S
5	31.3%	74.8%
10	4.1%	35.7%
15	0.037%	11%
20	0.03%	2.3%
25	0.004%	0.70%
30	0.0005%	0.18%

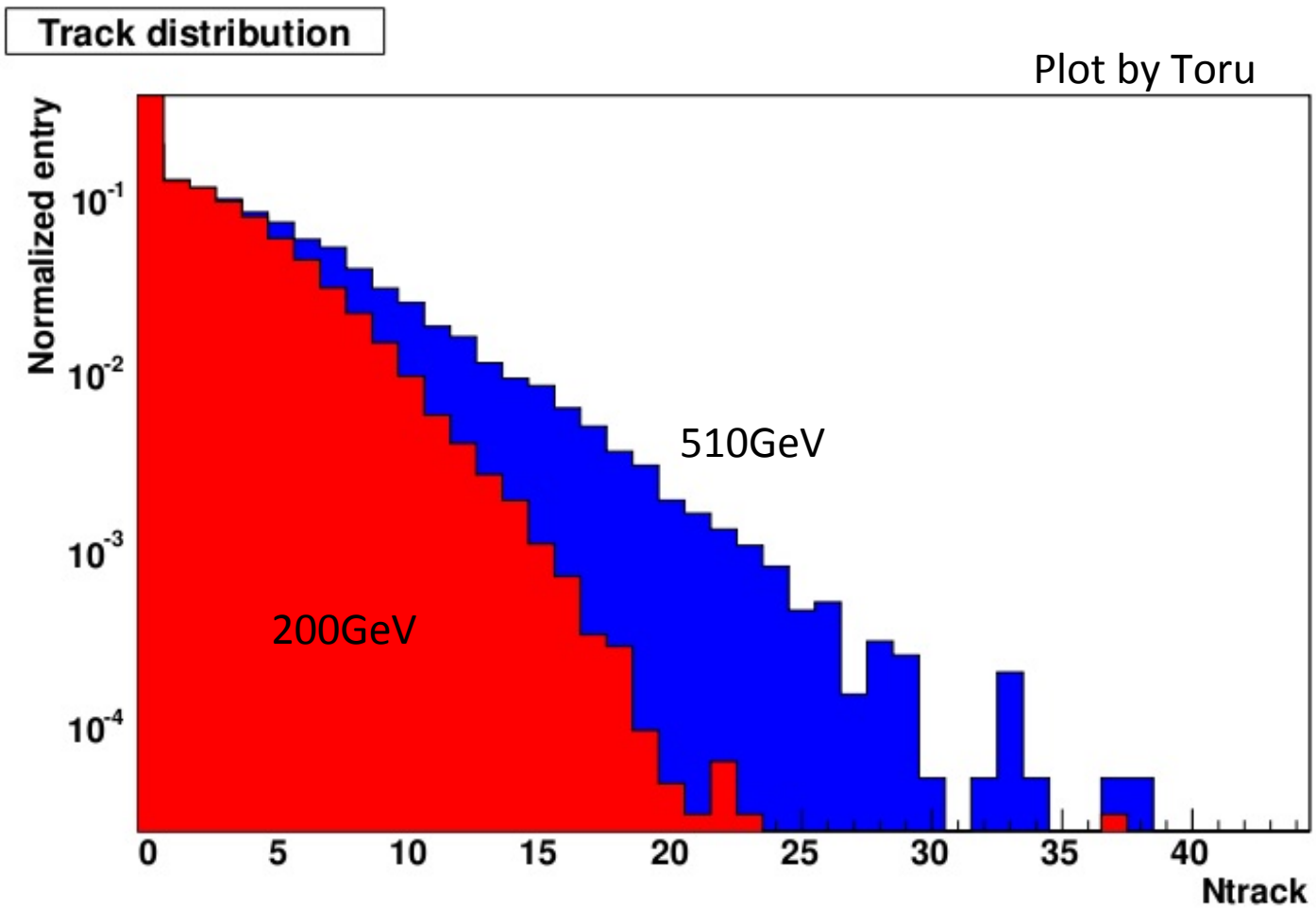
Statistics Estimate

- 400Hz x 6/9 weeks ~ 300M x 0.66 = 400Mevents
- 400M x 0.08 purity = 32 Mevents

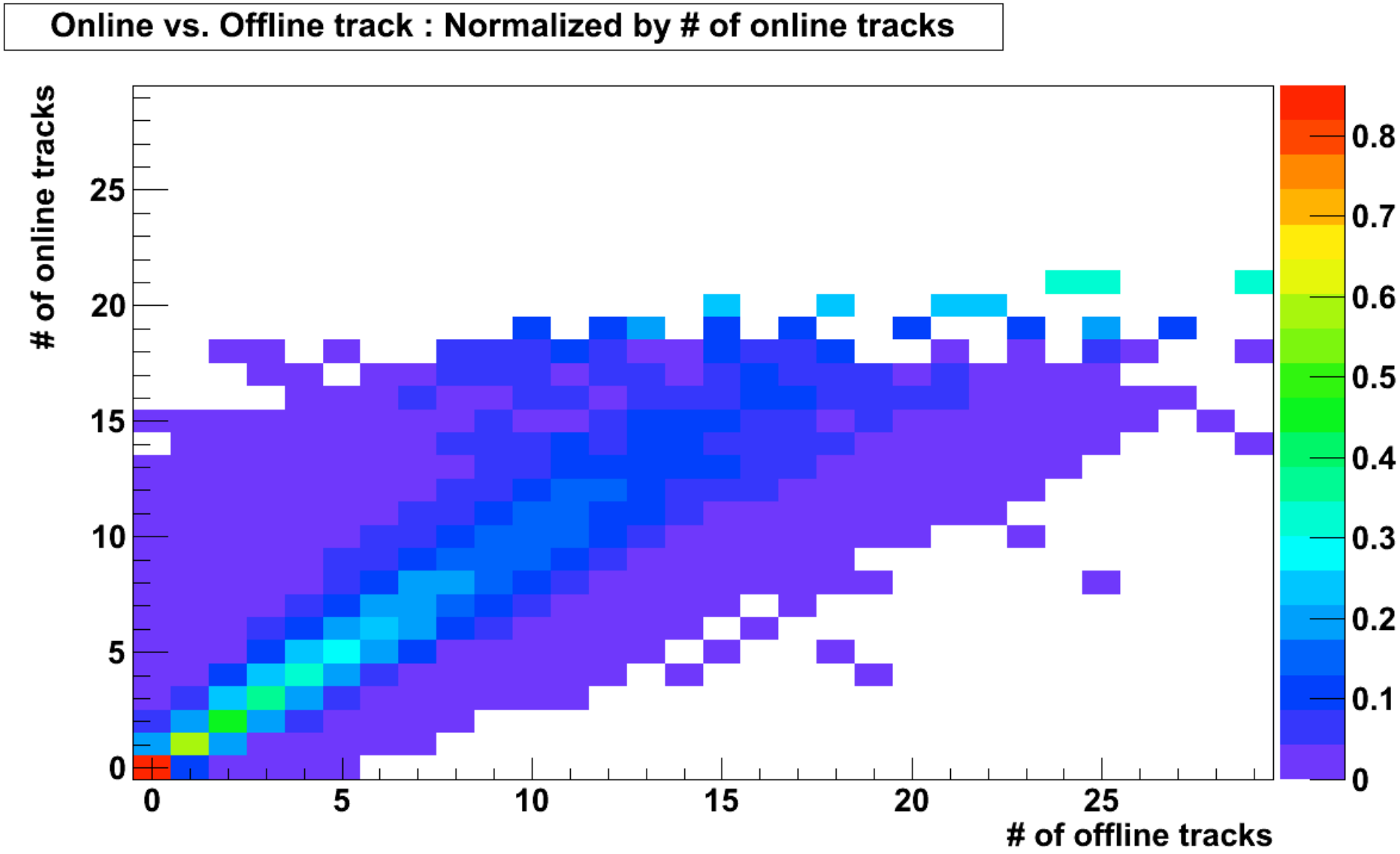
80M events 0-5% Central dAu in Run8

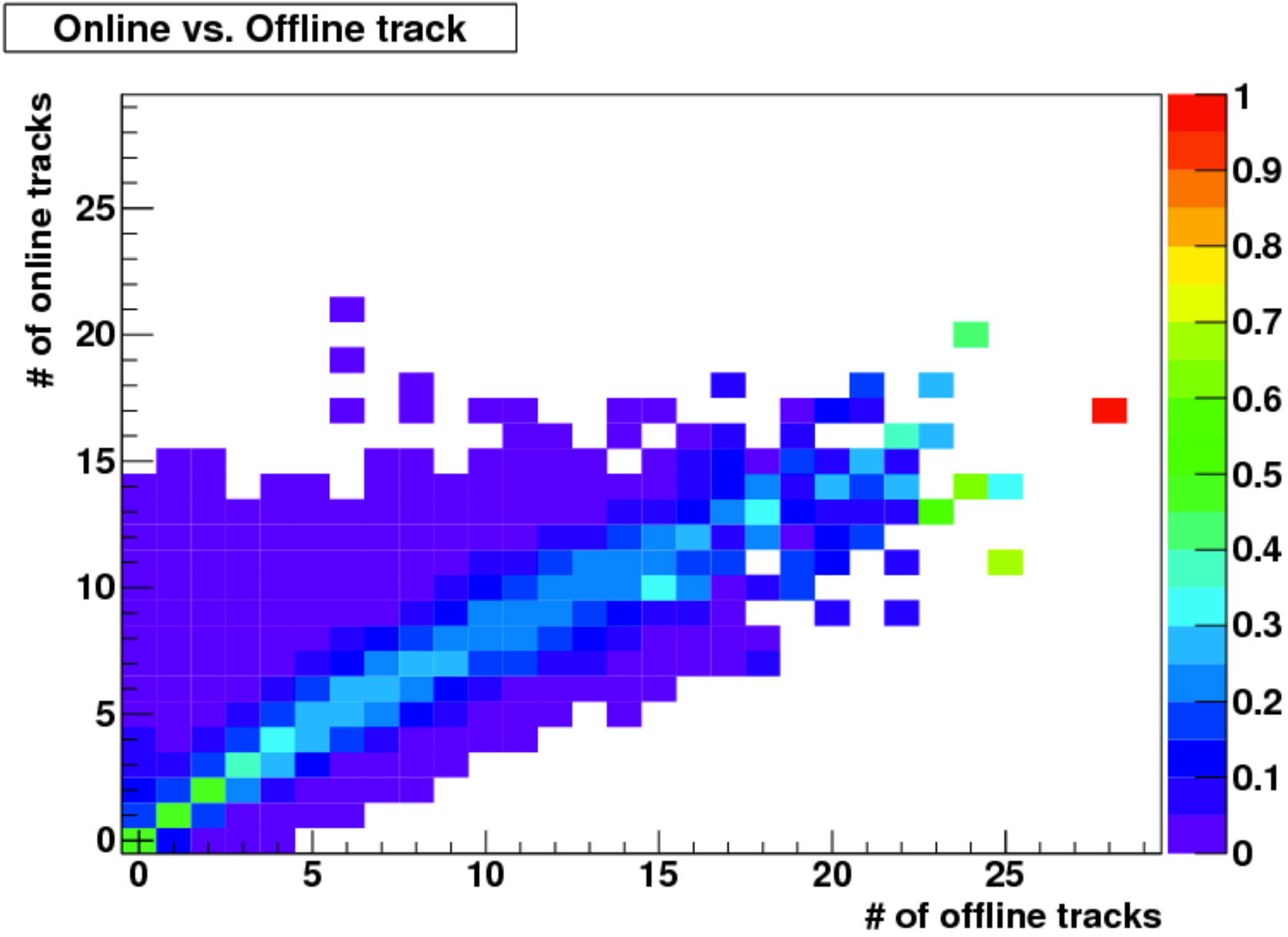
BACKUP

200GeV vs. 500GeV

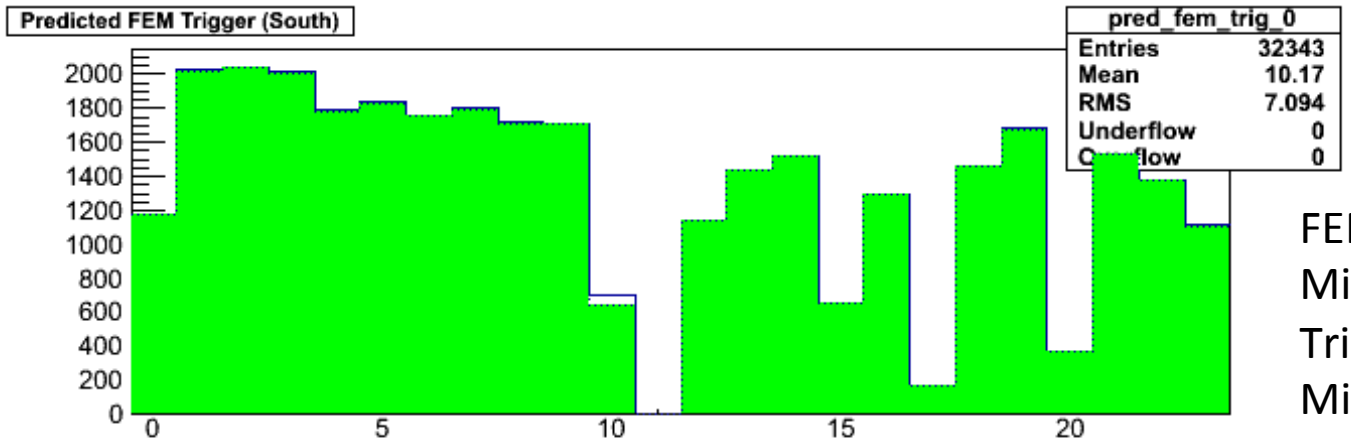


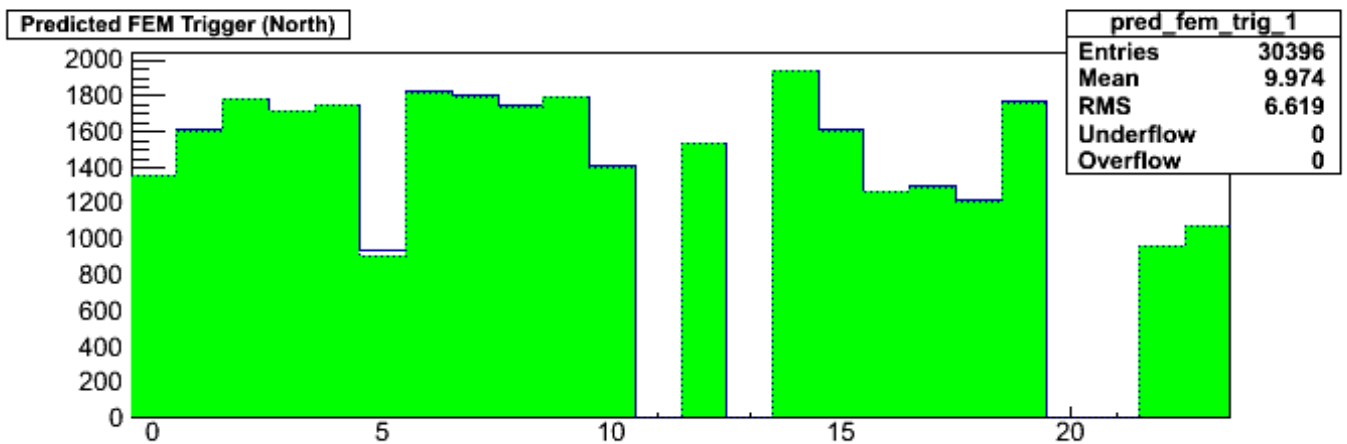
Normalized by Online Track




Online vs. Offline track
# of online tracks
# of offline tracks
0
5
10
15
20
25
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

Trigger Efficiency FEM by FEM





FEMIB Logic : OR
Minimum FEMs : 1
Trigger config logic : AND
Minimum hits : 4
Minimum wedges : 3

Run425571 (2015-03-07 22:16:25)
South GL1 Eff = 0.995, Inv Eff=0.914
North GL1 Eff= .996, Inv Eff=0.858

North event rate : ~ 5.0k
South event rate : ~ 5.3k