

# Trigger and luminosity studies

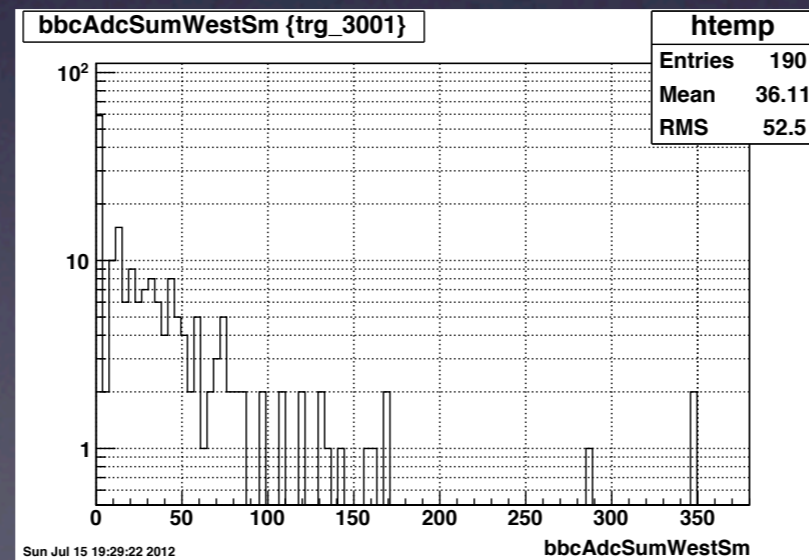
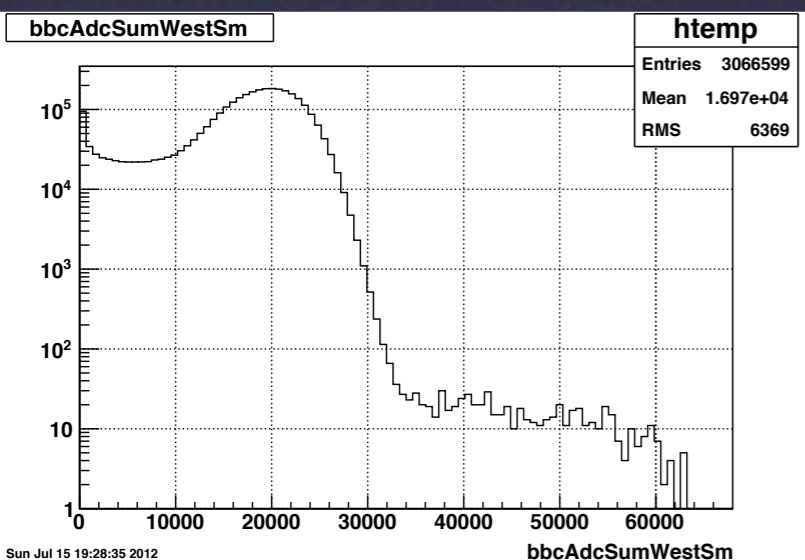
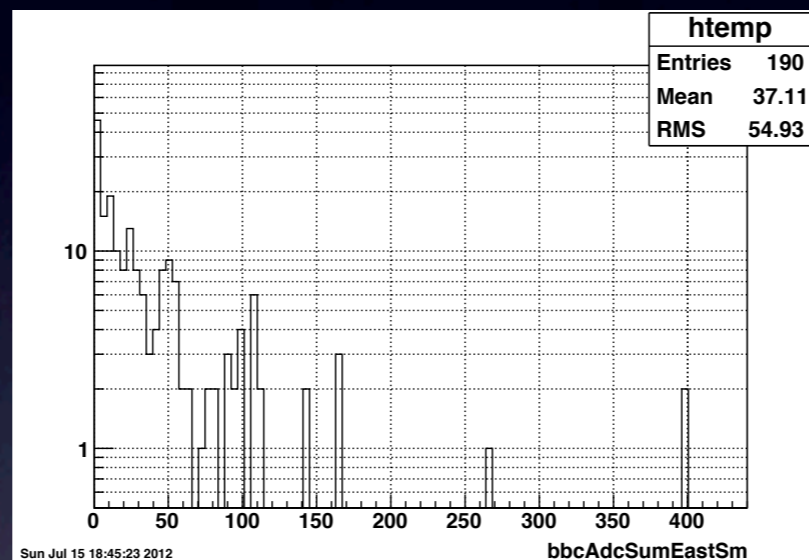
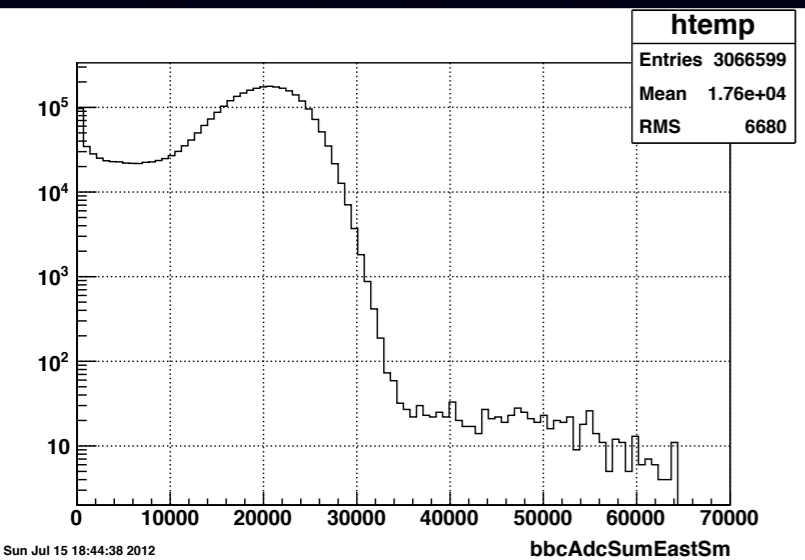
R. Debbe BNL

I'm reading ZDC\_monitor triggers in st\_physics streams.  
I want to mimic the actual trigger conditions offline and  
count how many events are selected.

All events

UPC\_Main

I selected an  
upper threshold  
of 100 for the  
BBC small Veto.



```

root4star [20] tv__tree->Scan
("trg_2001:nCtbHits", "bbcAdcSumEastSm<400&&bbcAdcSumWestSm<400&&trg_3000>0&&
(zdcEastUA>50&&zdcEastUA<1200)&&(zdcWestUA>50&&zdcWestUA<1200)&&
(nTofHits>=2&&nTofHits<7)", "", 371670, 0);

```

\*\*\*\*\*

```

*   Row   *      lastDSM(0)   *   nBTofHits *

```

\*\*\*\*\*

```

*   1878 *           0           *     3 *
*   8688 *   1000 0000 0000 *     2 *
*  14631 *   0100 0000 0000 *     2 *
*  20676 *   0100 0000 0000 *     2 *
*  26039 *   0100 0000 0000 *     3 *
*  27664 *           0           *     2 *
*  32724 *   0010 0000 0000 *     3 *
*  35565 *   1000 0000 0000 *     2 *
*  36051 *   1100 0100 0000 *     4 *
*  36102 *   0100 0100 0000 *     3 *

```

\*\*\*\*\*

```
root4star [23] tv__tree->Scan
("trg_2004:zdcSum", "bbcAdcSumEastSm<400&&bbcAdcSumWestSm<400&&trg_3000>0&&
(zdcEastUA>50&&zdcEastUA<1200)&&(zdcWestUA>50&&zdcWestUA<1200)&&
(nCtbHits>=2&&nCtbHits<7)", "", 371670, 0);
```

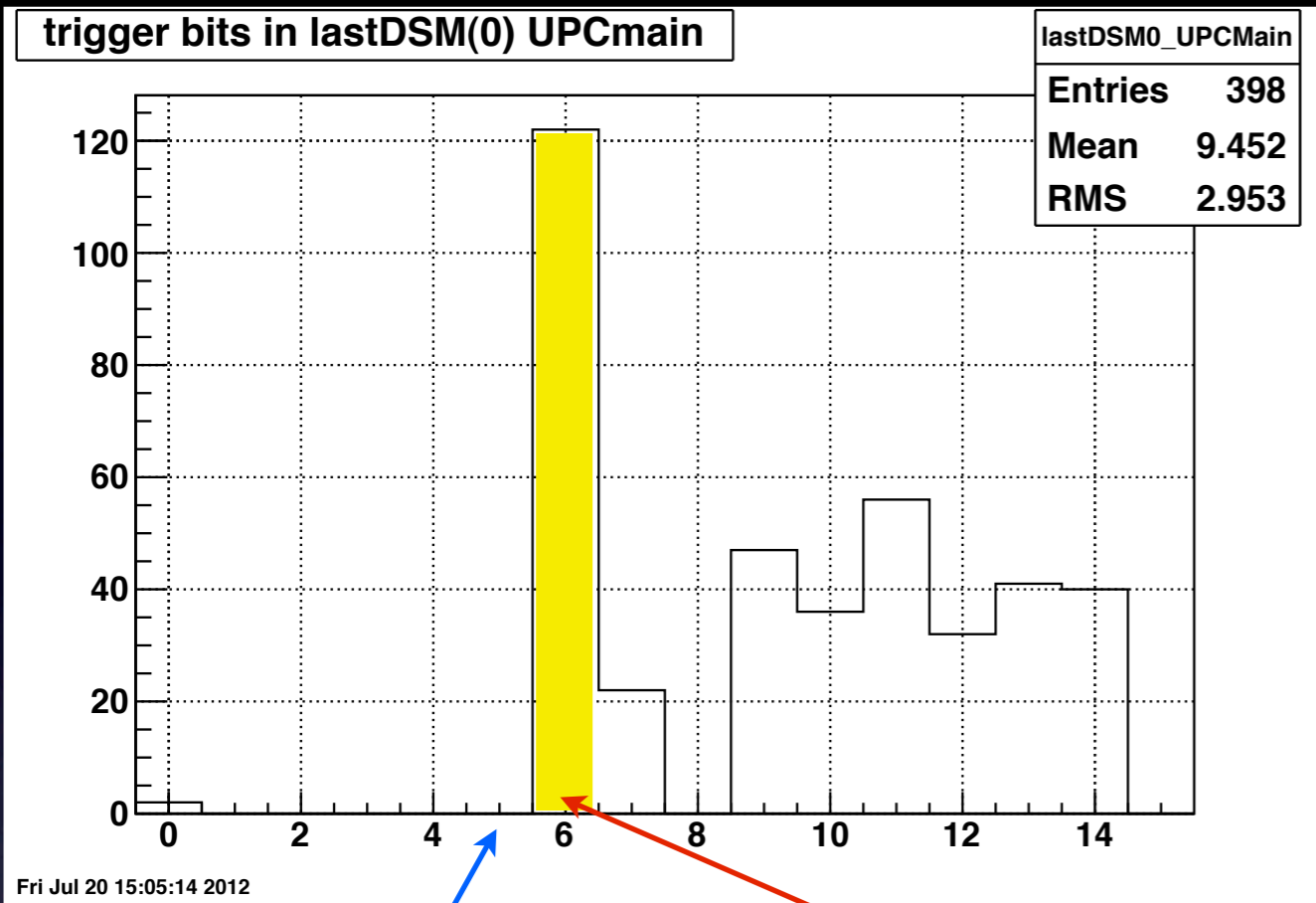
```
*****
```

* Row *	* lastDSM(I) *	* zdcTimeDiff *
* 1878 *	* 1100 0011 1110 0101 *	* 735 *
* 8688 *	* 0011 1100 0000 *	* 771 *
* 14631 *	* 0011 1100 0000 *	* 761 *
* 20676 *	* 0100 0011 1101 0111 *	* 749 *
* 26039 *	* 0011 1100 0100 *	* 763 *
* 27664 *	* 0011 1100 0000 *	* 727 *
* 32724 *	* 1000 0011 1110 0100 *	* 763 *
* 35565 *	* 0011 1100 0000 *	* 755 *
* 36051 *	* 0011 1100 0000 *	* 758 *
* 36102 *	* 0011 1100 0000 *	* 778 *

```
*****
```

6 out of 10

# lastDSM(0) for UPC\_Main events



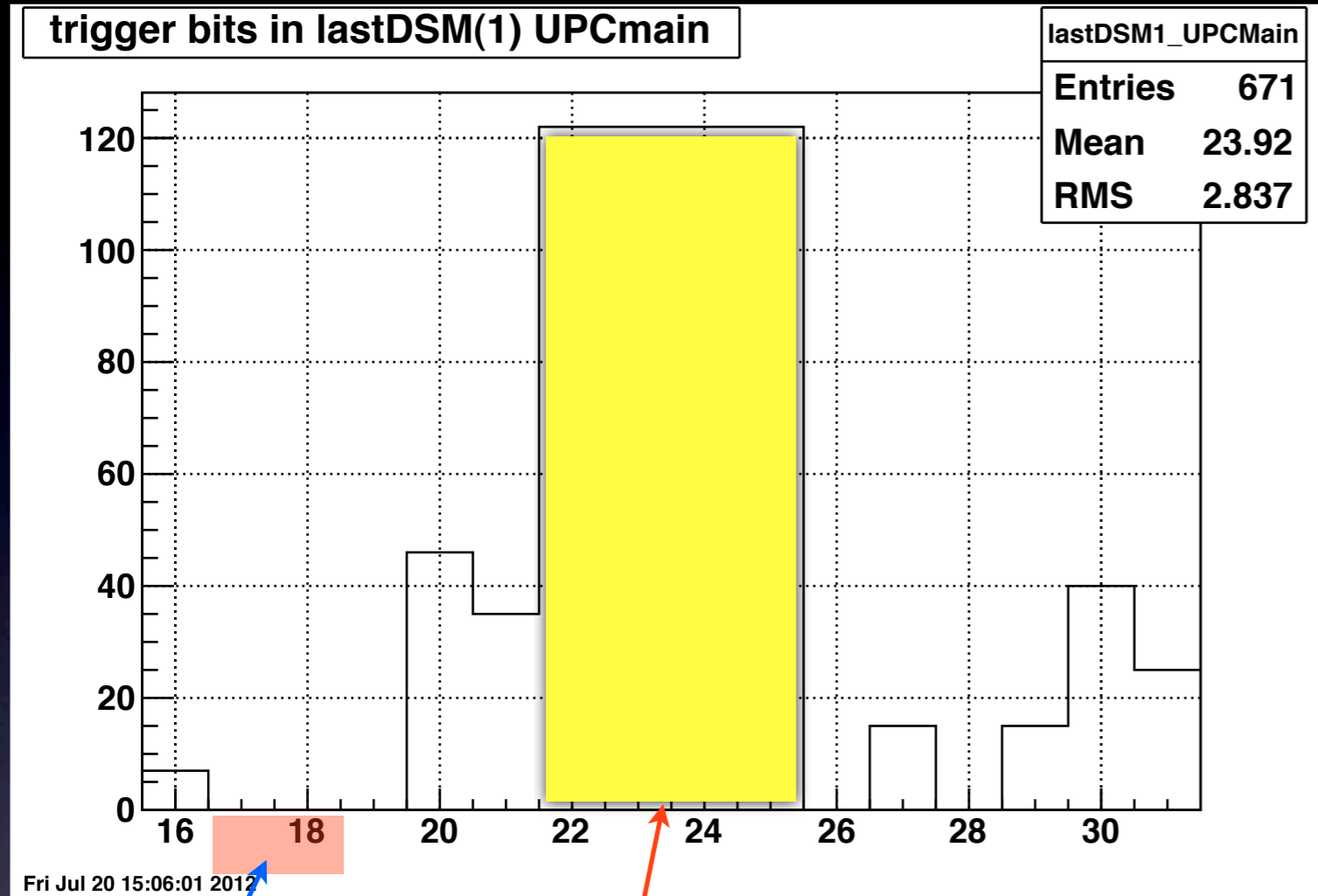
bit 5

! TOFmult1 -1 6 (use 6)  
translates to  $n \leq 6$

bit 6

TOFmult2 (1) 1 100 use 1  
translates to  $n > 1$

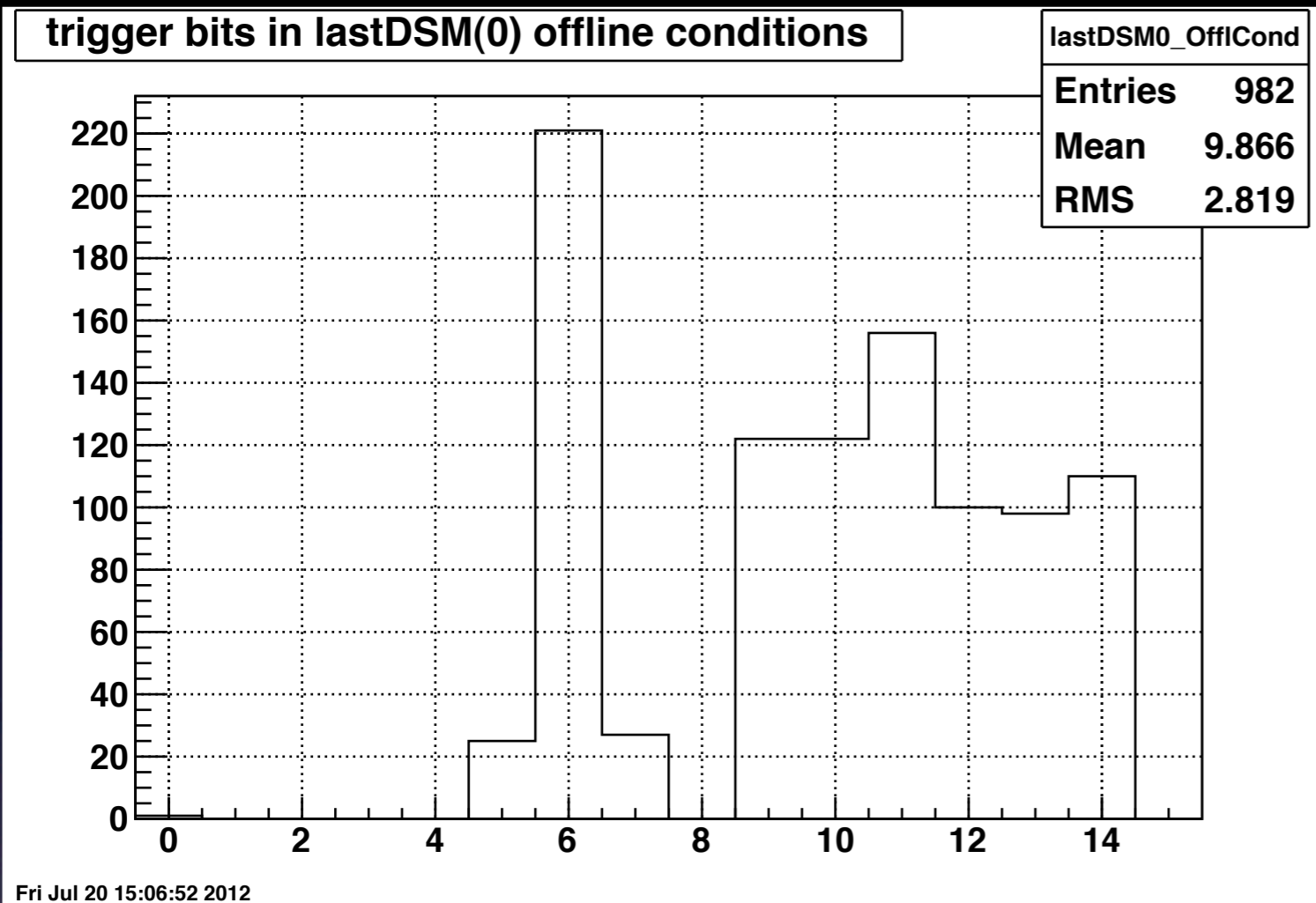
# lastDSM(I) for UPC\_Main events



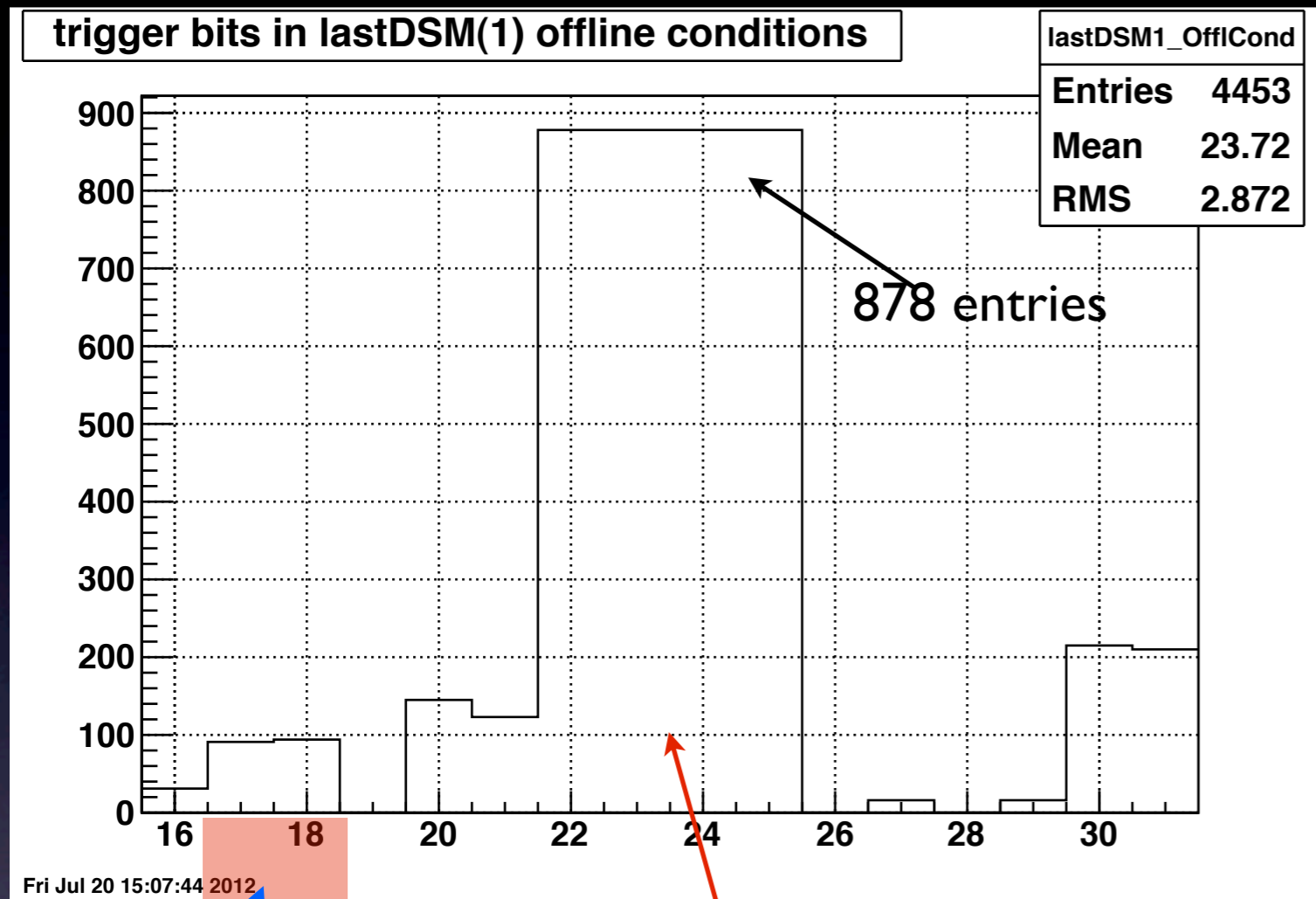
bits 17 18  
BBC veto

bits 22-25  
ZDC cuts

# lastDSM(0) for Offline conditions



# lastDSM(1) for Offline conditions



There are 878 events that satisfy the offline conditions.

BBC veto should be empty

ZDC related bits are fully efficient.



The final pass counts how many of the events that satisfy the offline cuts have the correct UPC\_Main bit pattern: ---- --|| ||-- -00- ---- ---- -|0- ----

878 ZDC\_monitor events satisfy offline cuts.

285 ZDC\_monitor events have correct bit pattern

The overall efficiency of the UPC\_Main trigger appears to be equal to 32.5%

## TOF - Track matching

```
for(int iPairs=0;iPairs<pPairs_;iPairs++) {  
//use events that have at least one TOF track  
//and pairs that share the same vertex with the TOF track  
//  
// we need to loop over the tof hits and check their vertex index  
haveAmatch = 0;  
int whichTrack = 0;  
for(Int_t tf =0;tf<tofTracks_;tf++) {  
    TOFvertexIndex = tofTracks_mVertexIndex[tf];  
    if(pPairs_tr1_vertexIndex[iPairs]==TOFvertexIndex){  
        haveAmatch = tf+ 1; whichTrack = 1;break;}  
    if(pPairs_tr2_vertexIndex[iPairs]==TOFvertexIndex){  
        haveAmatch = tf+ 1; whichTrack = 2; break;}  
    }  
if(!haveAmatch) continue;
```

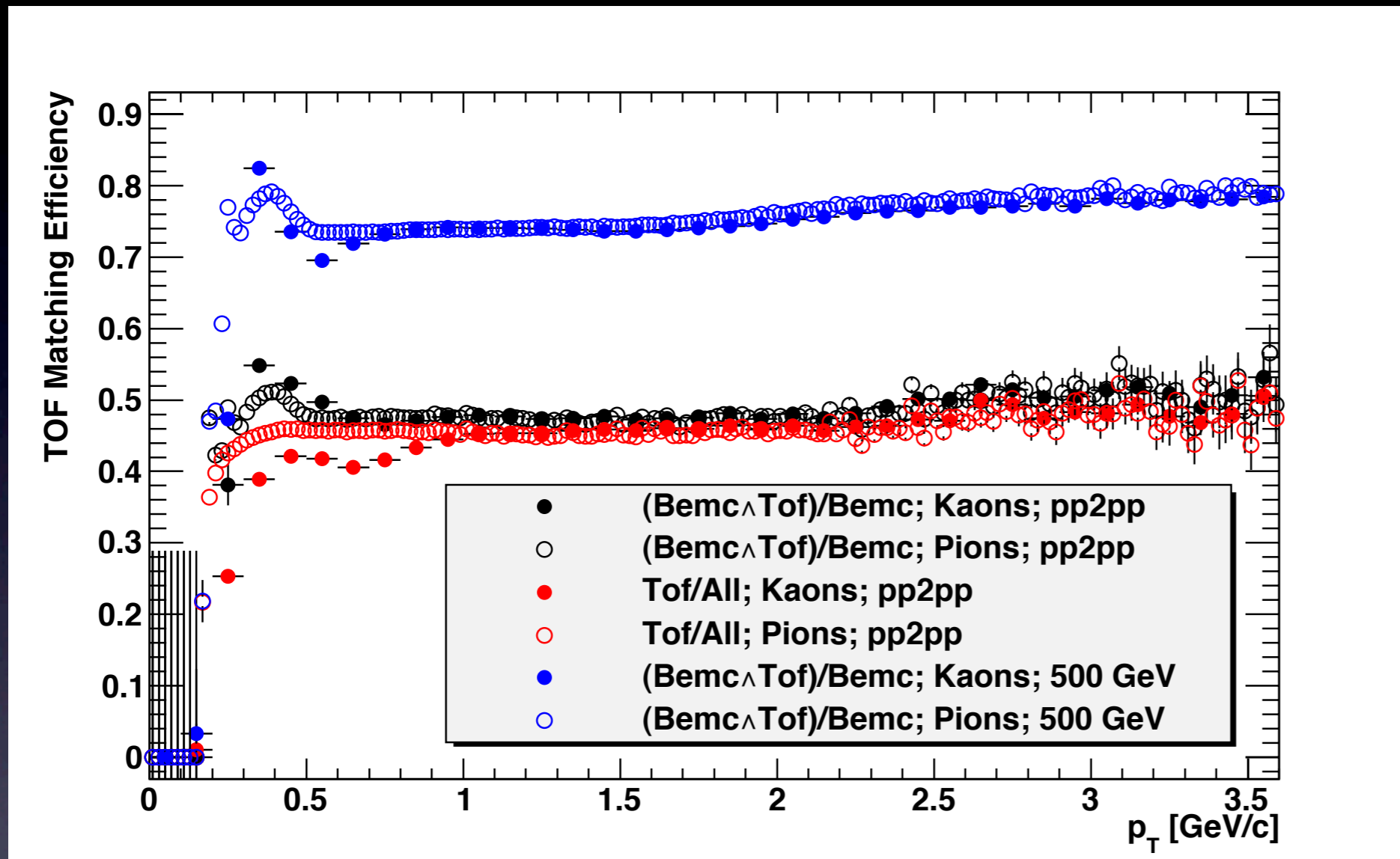
We make the connection to TOF because run 10 data has pile up (several events recorded in the TPC). We need to identify the tracks for the triggered event.

My first attempt at extracted some estimate of how many events are rejected because of this TOF condition used counts of events with at least one UPC pair and events with at least one UPC pair matched to TOF.

$$(\text{Events with pairs} + \text{TOF}) / (\text{Events with pairs}) = 0.45$$

I started to use an overall correction to our normalization of 45% TOF matching

# Similar numbers are found in other analyses:



For us the relevant quantity is TOF/All pions in an similar multiplicity environment.

# Luminosity extraction

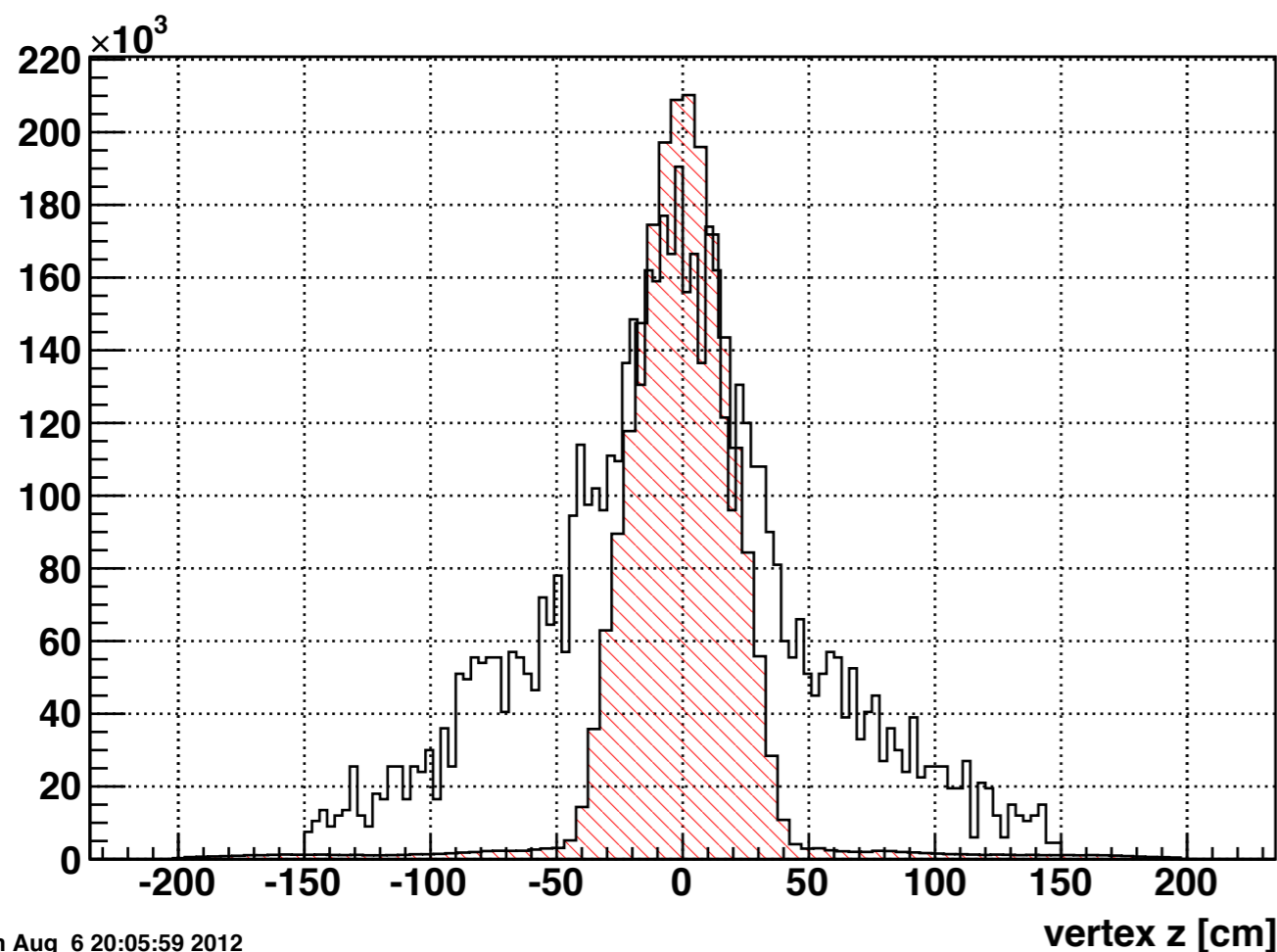
The heart of the algorithm lays in the following formula:

$$\int \text{Lumi}_{\text{Trig}} = \sum_{\text{runs}} (\text{N}_{\text{events}}^{\text{Base}} \cdot \text{Prescale}^{\text{Base}}) / (\text{Prescale}^{\text{Trig}} \cdot \sigma_{\text{Base}})$$

The luminosity is calculated using a minimum biased trigger labelled as Base (vpd\_minbias) which has a stable cross section  $\sigma_{\text{Base}} = 6 \text{ b}$

PrescalBase and PrescaleTrig are read from the database. We should not correct for PrescaleTrig any more.

If we decide to continue using the luminosity extracted with minbias\_monitor we have to restrict our z vertex coordinate to values smaller than  $|z| < 50$  cm



Mon Aug 6 20:05:59 2012

red hatched is the z vertex distrib. for minbias\_monitor in run 10

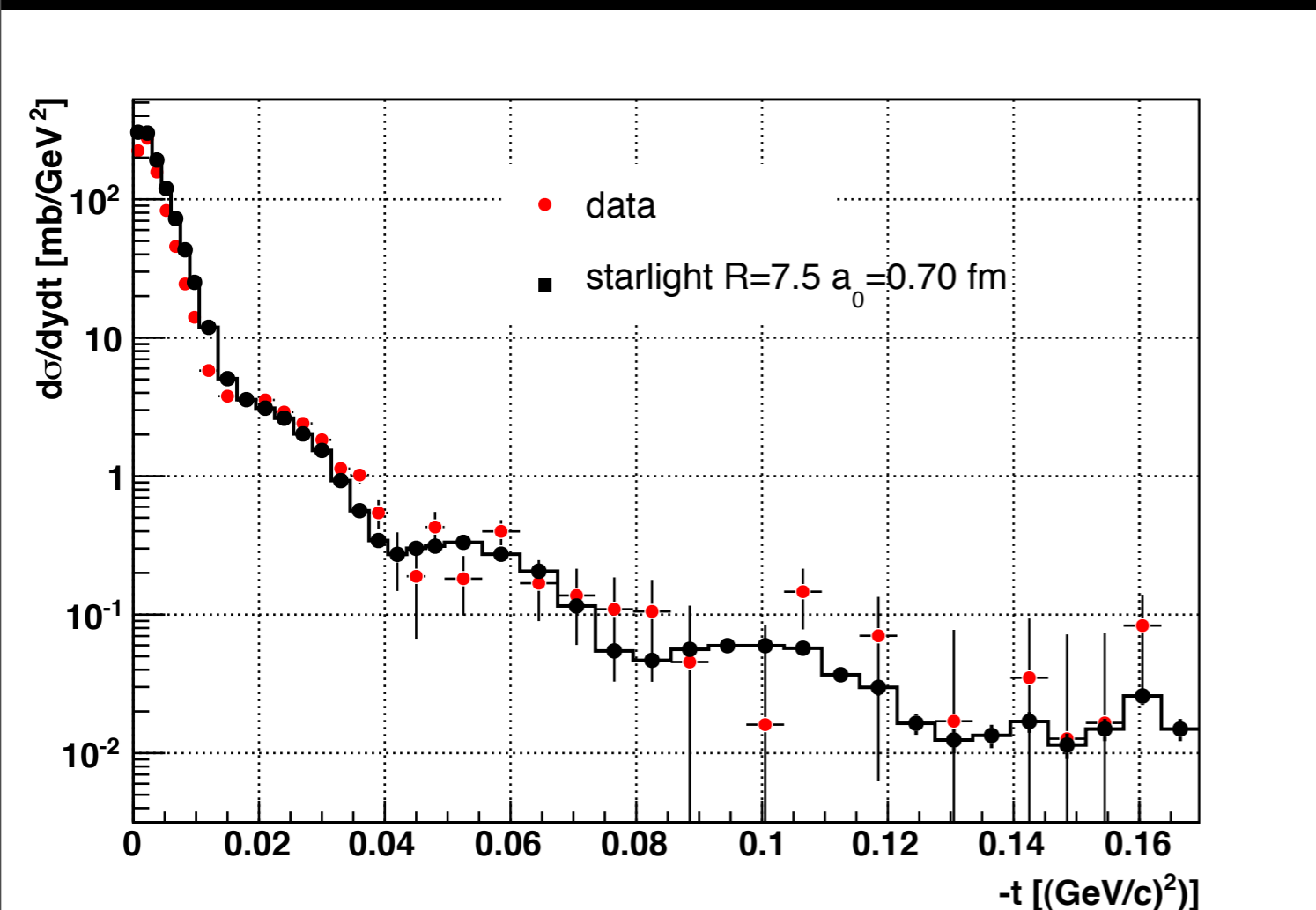
Black histogram is distrib. of z vertex for  $\rho$  candidates.

minbias_monitor	0/-	+/+	+/+	+/+	+/+	+/+	+/+	+/+	+/+	ZDC-TAC(22)	+
										ZDC-E(23)	+
										ZDC-W(24)	+
										VPD-E(30)	+
										VPD-W(31)	+
										Laser_protection(96)	-

## With these corrections the normalization of our results would then be:

```
// luminosity from run 11039046 to 11077018 is 679.262 (ub)-1
//
// scale dN/dt and get result in mb
//
mySpectra->Scale(1./679262.);
mySpectra->Scale((1./2.)*(1./0.44)); // (1./Δy) (1./efficiency*acceptance)
mySpectra->Scale(1./0.35); // trigger efficiency
mySpectra->Scale(1./0.45); // TOF hit matching to track
```

# Normalization and comparison to StarLight



At this point in the analysis we use StarLight as our standard for the correct normalization. And that allows us to connect to the previous STAR  $\rho$  analysis (PRC77)

The best tool for this normalization studies is the  $\rho$  rapidity distribution, because  $d\sigma/dt$  continues to have one loose end: the shape of the incoherent component. We are using a power law but incoh. is expected to drop to 0 at  $t \rightarrow 0$ . More results soon.



## Run 10 and 11 reanalysis

Both run 10 (P10ik) and 11 (P11id) MuDst have been reprocessed with StPeCMake which has an updated UPC pair definition to include TOF and BEMC information per track.

The new trees do not carry the complete TOF class information to reduce size of output. It turns out the biggest effect on output size came from `MaxPrimaryTracks = 12` which is now down to 6

The output trees can be found in:

run 10 old versions:

/star/data01/pwg/mdmintha/Run10OldTtree/0EBB0D...	20GB
/star/data01/pwg/mdmintha/Run10OldTtree/284A0...	29GB
/star/data01/pwg/mdmintha/Run10OldTtree/305BE...	14GB
/star/data01/pwg/genevb/CAE9...	36GB
Total size	99GB

The last set (CAE9...) is a courtesy from Gene. All others were written under my name and exhausted my disk quota. We need to change the owner of these files.

Run 10 new output trees are in:

/star/data01/pwg/ramdebbe/run10AuAu200tree/561661464594734..

/star/data01/pwg/ramdebbe/run10AuAu200tree/72466D5AA59FD..

/star/data01/pwg/ramdebbe/run10AuAu200tree/C4426B62478A5..

/star/data01/pwg/ramdebbe/run10AuAu200tree/D89BB6AC054C..

Total size            52GB

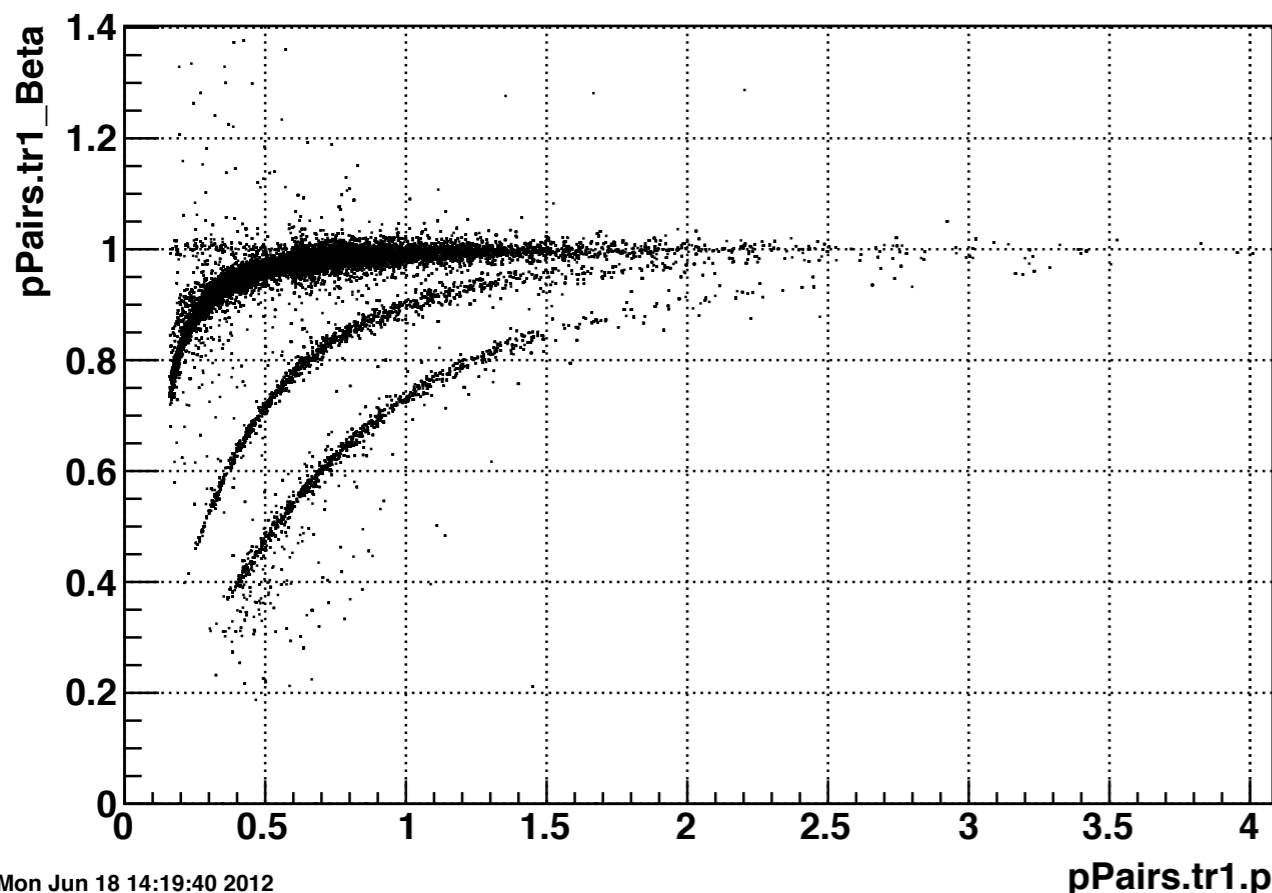
Run 11 new output trees are in:

/star/data01/pwg/ramdebbe/run11AuAu200tree/E4D763853F3FB..  
/star/data01/pwg/ramdebbe/run11AuAu200tree/9CE3D78A03479..  
/star/data01/pwg/ramdebbe/run11AuAu200tree/C439D0B685ABF..  
/star/data01/pwg/ramdebbe/run11AuAu200tree/CB5BD7EFB2C4F..

Total size:           29GB

The luminosity calculator list 17 Million events ( $2173.1 \mu\text{b}^{-1}$ )  
We collected 12.6 Million UPC\_Main events

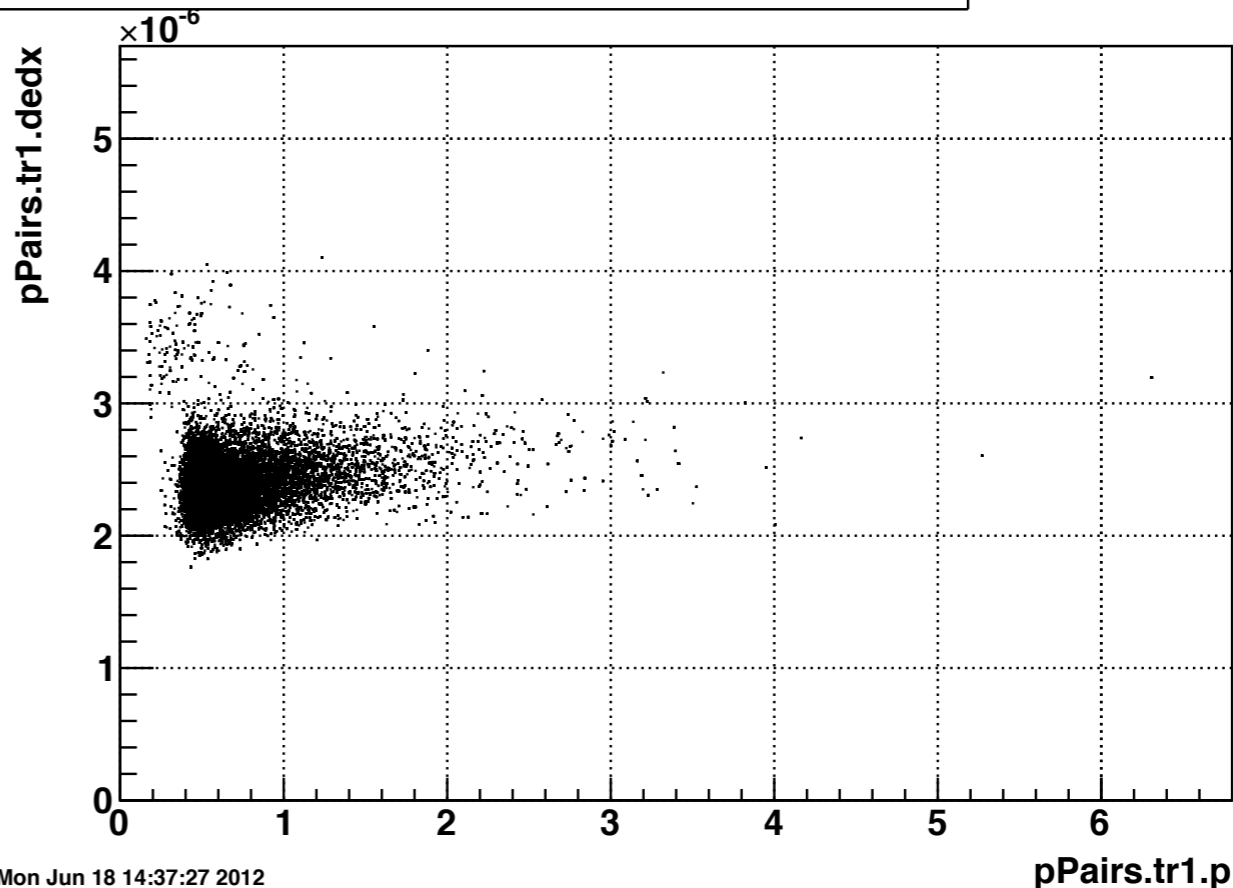
pPairs.tr1\_Beta:pPairs.tr1.p {pPairs.tr1\_Beta>100.}



Mon Jun 18 14:19:40 2012

With a cut of 5%  
around 1  
(relativistic)  
we can separate  
electrons from pions  
in dEdx plot

pPairs.tr1.dedx:pPairs.tr1.p {pPairs.tr1.p<10.&&abs(pPairs.tr1\_Beta-1.)<0.05}



Mon Jun 18 14:37:27 2012

Whenever there is  
TOF information the  
matching between  
TOF and the UPC  
tracks is right.

## Things to do before publication:

- Redo luminosity calculation to recover z vertex range.
- Check and double check trigger eff. and TOF matching.
- Produce  $d\sigma/dy$  for  $\rho$  to check normalization.
- Improve our description of background.
- Determine best shape of incoherent background.
- Produce a draft in letter format.
- Start debugging run II production.