MUID noisy events rejection
status update : January 25, 2013

A fraction of events show very large activities in MUID, and could be caused by either electronics noise (ringing) and/or large beam backgrounds. These events slow down the production/reconstruction, due to many false road candidates as input for MUTR etc. The events would need to be rejected for any physics analysis involving the muon arms. (The MUIDLL1 trigger has a rejection for these sort for events, but for users of other triggers, the noisy events have to be rejected.)

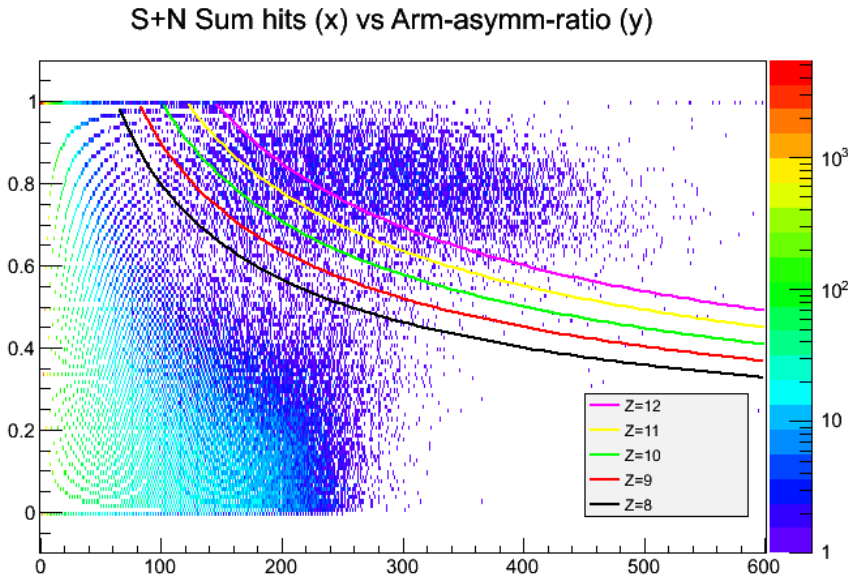
In the Jan 23 analysis meeting (see update.pdf in this dir) , there were concerns expressed that we should be careful to not cut away any real events, and some action items were given:

1. plot cut on asymmetry ratio plot
2. look at asymmetry plot for different running conditions/triggers
3. quantify fraction of rejected physics events, and depending on that potentially loosen cut

These will be reported on below.

Total number of hits per event - UU : Asymmetry ratio 2

The first request was to overlay cut curves on the distribution - now added in the figure below.

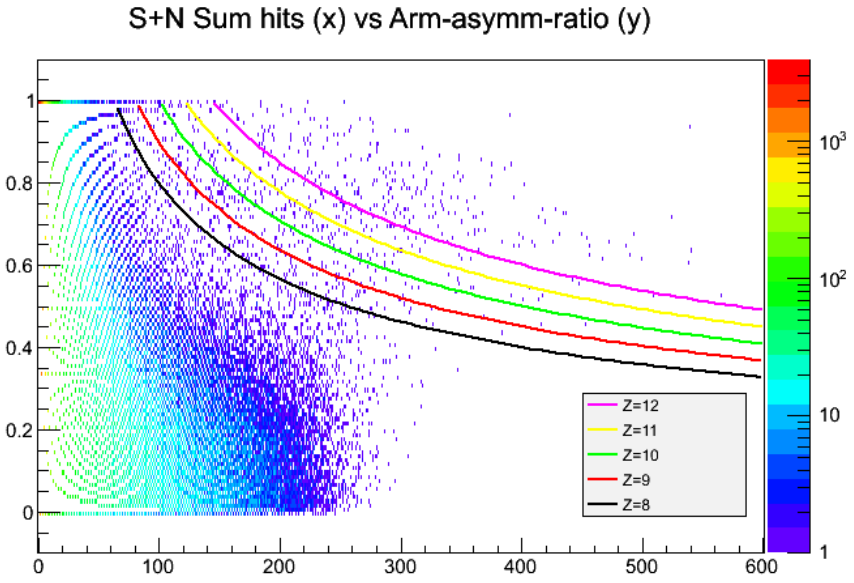


Cut/Z	Rejected	Accepted	Rej./Tot
8	10485	110131	8.7%
9	9730	110886	8.0%
10	8833	111783	7.3%
11	7739	112877	6.4%
12	6381	114235	5.3%

The cut $Z = 8$ was the previous default cut. The number of accepted and rejected events for this run is shown in the table. The issue at hand is then how many of the rejected events may actually be good ones...? I try to do some estimates re. that in the next slides.

Results for scaled MinBias events 3

The next request was to look at the yield for different trigger selections. I first selected all events in the file that had a 'scaled' MinBias trigger [for this run: bitmask 0x26; BBCLL1>1 tubes, with novertex and narrowvtx versions included] so as not to be influenced by whatever other triggers (some may be susceptible to noise) that were in the event sample.

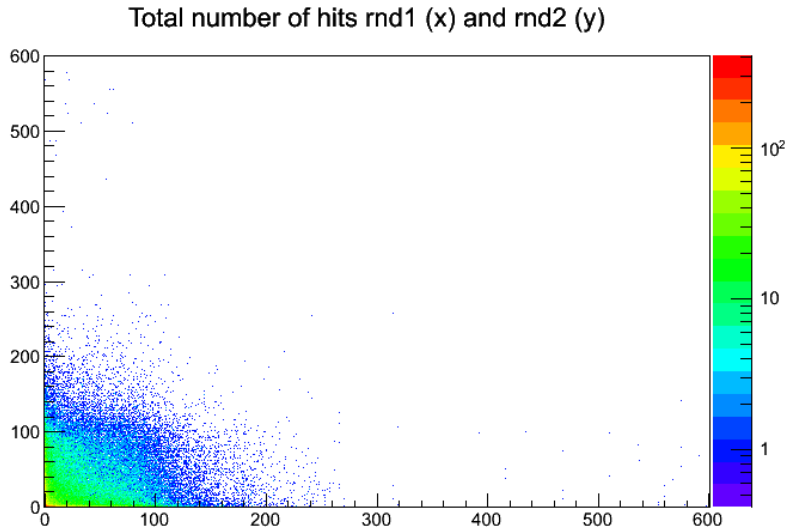


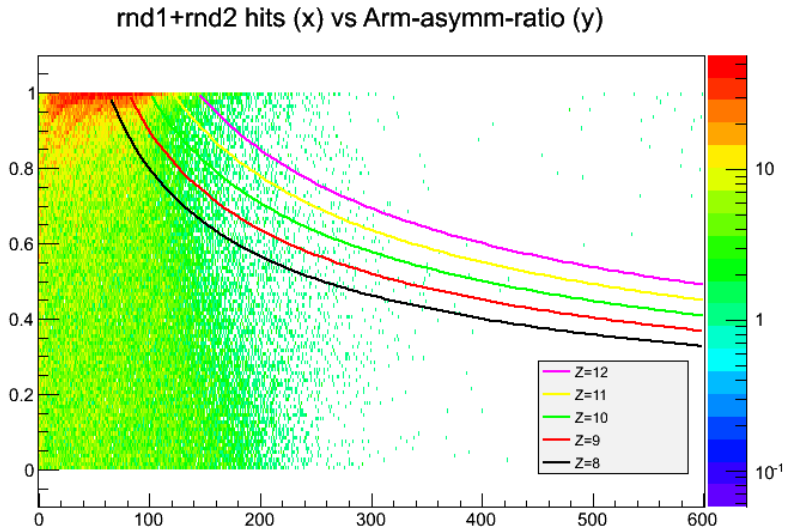
Cut/Z	Rejected	Accepted	Rej./Tot
8	853	90731	0.93%
9	649	90935	0.71%
10	487	91097	0.53%
11	343	91241	0.37%
12	254	91330	0.28%

The reject and accept numbers for this selection is shown in the table. Signficantly smaller than the all-inclusive version (all triggers, previous slide)

Random check

Another thing suggested at the meeting was to do an MC/statistics study in the two arms and see what the chances would be for rejecting OK events, i.e. to have a significant asymmetry occuring naturally. I wasn't quite sure how to best do that (since it would critically depend on what you assume for the correlation between the two arms), but what I ended up doing was taking the distribution of hits per event in the North arm from the studied PRDF file, and get two random numbers from it, and call those the yields for arm1 and arm2 in that 'event'. The plots show the 2D plot for arm1 vs arm2 (random scatter), and the asymmetric ratio constructed from these values.





Results for random events 5

The reject and accept numbers for the (100k) random events in the plots on the previous slide is shown in the table.

Cut/Z	Rejected	Accepted	Rej./Tot
8	12451	87549	12.4%
9	6741	93259	6.7%
10	3185	96815	3.2%
11	1497	98503	1.5%
12	727	99273	0.7%

Since we assumed here that there was no correlation what-so-ever between the two arms, I think this is a very conservative estimate of how many real events the cut might remove.
- instead it perhaps shows how significantly more efficient a tighter cut is at rejecting un-correlated entries :-)

Summary

Let us review the collected pieces of information:

1. The rejection of all events on file (i.e. all triggers) went from $\sim 8.7\%$ to 5.3% when we increase the cut from $Z = 8$ to $Z = 12$.
2. The rejection of scaled MB events went from $\sim 0.93\%$ to 0.28% when we increase the cut from $Z = 8$ to $Z = 12$.
3. The rejection of random events went from $\sim 12.4\%$ to 0.7% when we increase the cut from $Z = 8$ to $Z = 12$.

I guess this still doesn't quite tell us what we really want to know, namely how many events that are rejected should not have been rejected. I would say based on item 2, for the 'scaled MB' events, where there would presumably be some ringing events, and events with background in this sample too (remember that the selection was on scaled rather than live trigger info) so that should also be a conservative estimate of how many real events we might be cutting away. In the interest of not cutting away too much already in the production step, I would certainly be OK with loosening the default cut to $Z = 12$ to be sure that any event selection effect should be of the order 0.3%, or hopefully significantly less.

Possible to-do

I think the two further checks that could be done would be:

1. as I think Richard H mentioned at the analysis meeting: one could check the amount of single muon and dimuon candidates with and without the cut (approx. no effect seen already for the $Z == 8$ cut as far as I understood)

2. look at e.g. Hijing and see how many events would be removed by the cut in simulations (I think it should not be too many)

On an additional note, I was informed by Ralf Seidl that some hadron shower events he was studying in simulations (showers only in one arm or the other, i.e. maximal asymmetry), failed the $Z = 8$ cut. I checked the 1521 events that had been removed and they would have been accepted if the cut had been loosened to $Z = 11$, and therefore hopefully $Z = 12$ should hopefully provide some safety margin also from this concern.

I checked in the modification to use $Z = 12$ as the default cut value in MuiooReco (can also be modified from the reco macro level if needed) on Fri Jan 25.