Study of retriggers (continued)

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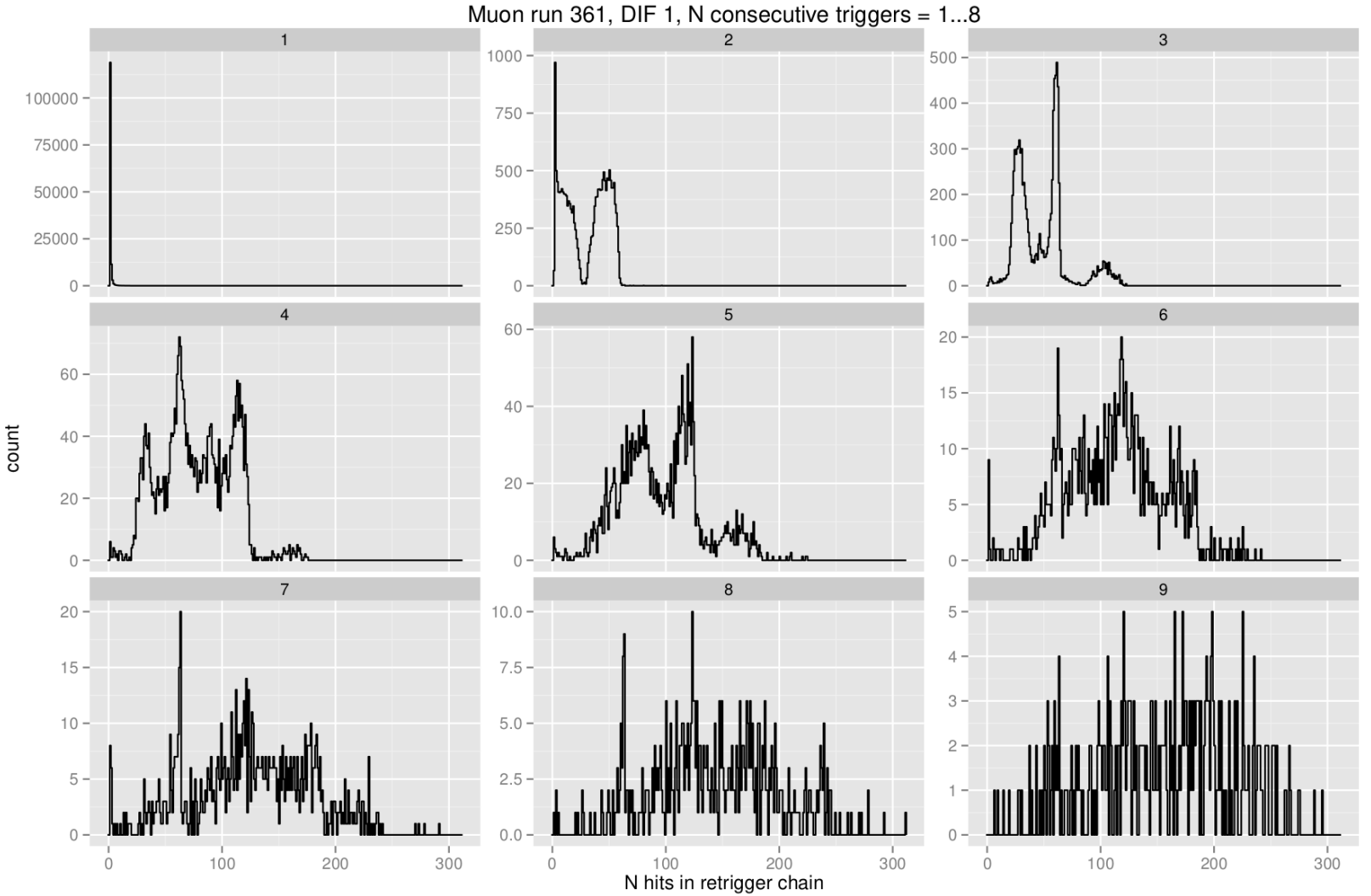
Answer to my puzzle in the previous presentation:
the total number of hits combined in full retrigger chain == multiple of 64 (64, 2*64 or 3*64).

Total # hits in ALL retriggers

… == 64, 2*64 or 3*64. Eg. in case of 3 consec. trig: N_hits(BX+1) + N_hits(BX+2) peaks at 64

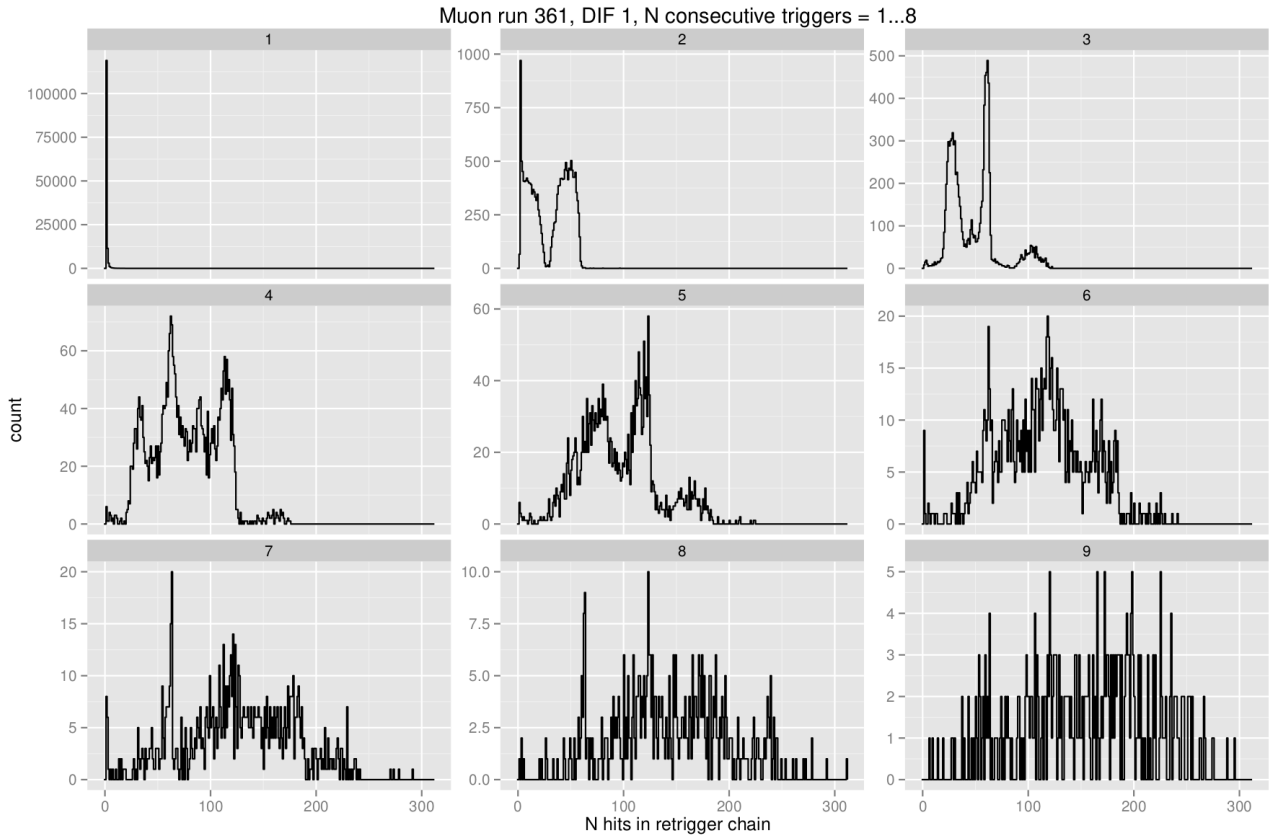


More broadly, we might consider the full retrigger as one event, which is very long compared with a typical chip speed.

Total # hits in ALL retriggers

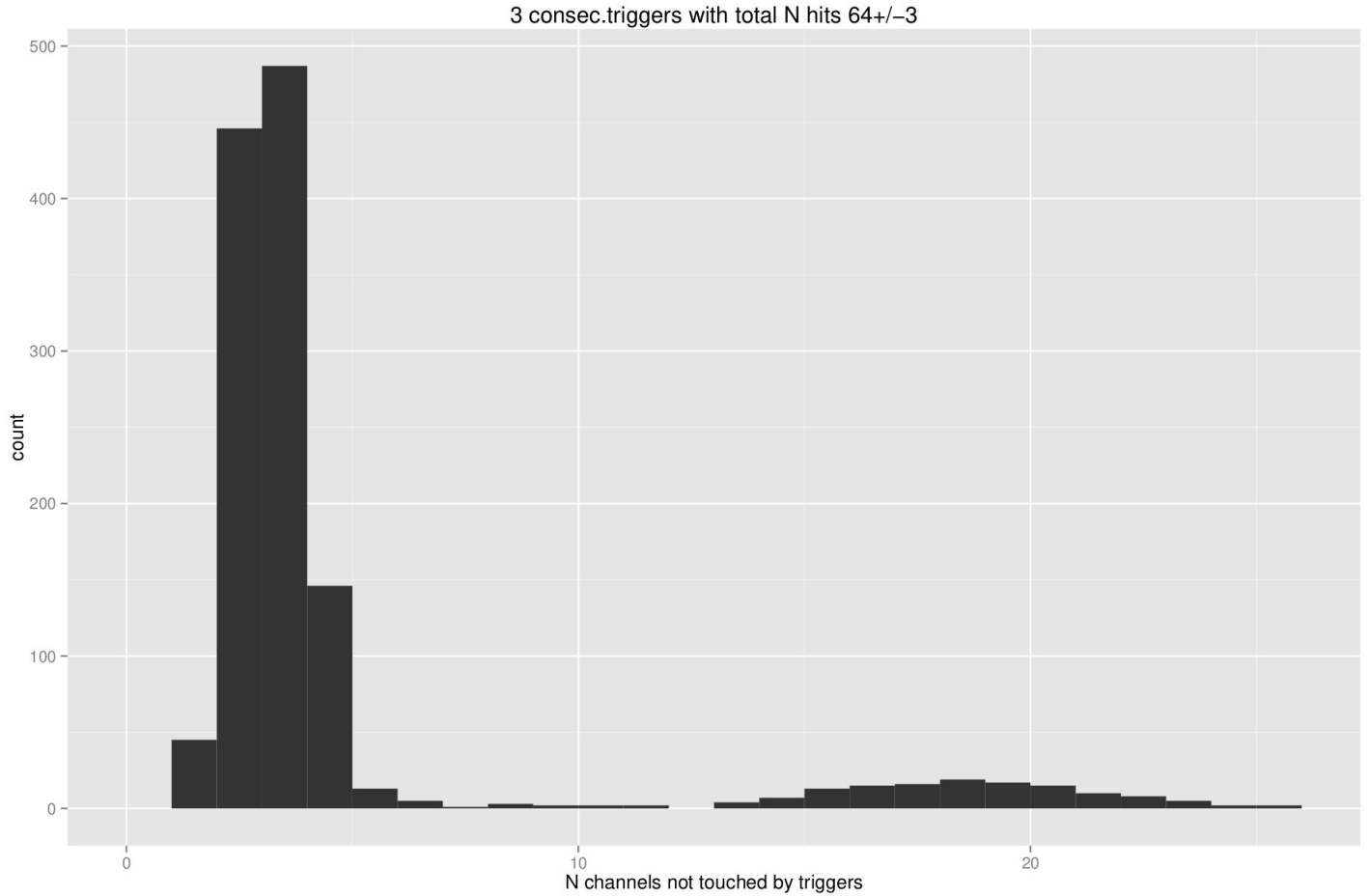
The distribution of the total number of hits in all consecutive triggers is not so obvious but the peak at 64 for 3 consec. triggers (3) is clear. I do not know about the rest, eg. why in a simple case of 2 consec. triggers (2) there is no peak at 64. I suppose, because we might see not everything: there might be something bad in all channels, but the rest just gives signals in next BX+2 below trigger thresholds. There may be a peak at 128 when every channel fires (about) twice. Once again, for the 3 consec.trigger case (BX,BX+1,BX+2), there may be invisible BX+3 etc. We know that retriggers are very much suppressed by higher trigger thresholds (at 1-2 MIPs), but this activity may always be in the chip, and may just proceed invisibly.

Note, that 5th plot has a peak at 128. Ie. the time of emitting all 64 retriggers is about (2-3)*BX = 800..1200 nsec (3*BX as 7th plot may still have a peak at 128).



Whether all channels are fired or some not and some appear twice?

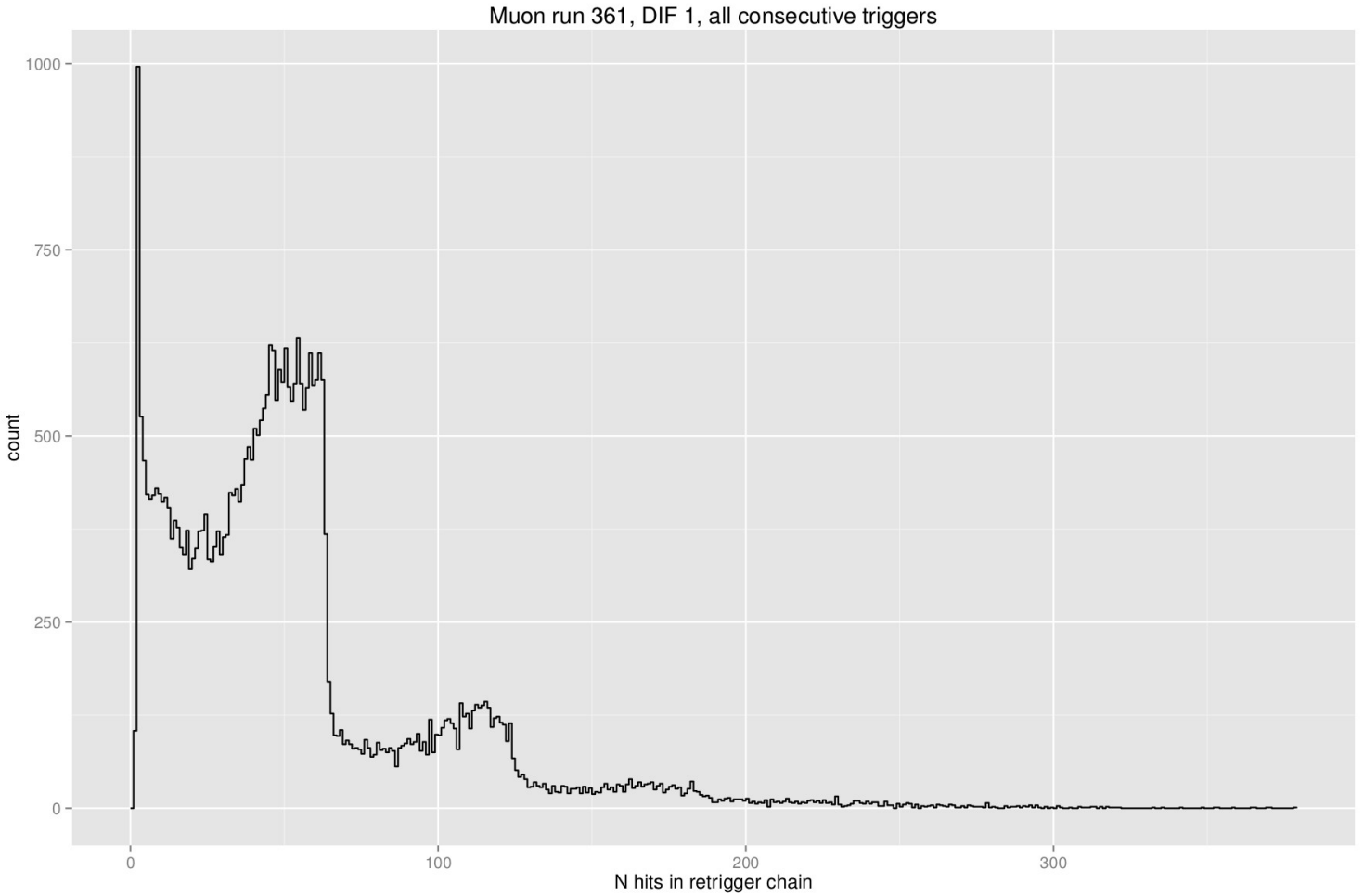
Plot below is for events from the peak at 64+/-3 for 3 consec. triggers in the previous picture. It shows a number of channels not participating (staying quiet) in all the retrigger chain. Peak around zero shows that very often (though, not always) essentially all channels are fired and only about one time. The distribution starts from 1 not from 0, as I exclude bad channel 37, such as it becomes always "quiet".
If this were a random triggering in all channels, there would be cases of channel firing 0, 2, 3, etc. times, but here we have too many single firings. So, the picture is that all channels are "excited" by the trigger in BX. Then, these "excitons" are emitted in the form of small (almost zero) signals which may fire the trigger some time in BX+1, +2 etc.



A total number of retriggered hits

a total number of hits in a *full retrigger chain.* This is the sum of all plots from the 2d slide plus similar plots for 10,11,...15 retriggered events (15 SCA's maximum).

The sharp drops at 64, 64*2, 64*3 support the idea that all 64 channels always emit their "excitation" in one of the following bunch crossings, and also they can be "re-excited" (either all 64 channels or none) one-two times. The excitations can be "visible" (with the trigger) or not, in the latter case the visible number of triggers is less than 64. But it can never be greater than 64 and this explains those sharp drops.



Brief summary

We now know that as retrigger progresses, the pedestals, initially in "excited" right and narrow positions, gradually move to the left, and as soon as they all arrive to the left positions, the retrigger stops. May be triggering by such small signals is possible only if pedestals are shifted, it is not a normal way of triggering.

So, to summarize: the new thing is that probably all channels are "excited" and fire once during a full retrigger event composed of many BX's (it is not BX+1 which triggers BX+2, but the initial BX excites all channels and these excitations are gradually relaxed in the following). Clearly, we need to search for some "excitation" which lasts very long, from BX to the end BX+n.

It looks as triggering can occur only with pedestals on the right. As the retrigger progresses, the pedestals, initially in "excited" right and narrow positions, gradually move to the left, and as soon as they all arrive to the left positions, the retrigger stops.

The retriggering signals are small, they are very close to the left threshold (though they can have compensating positive and negative parts). Note, also, the effect is much suppressed with a trigger threshold between 1-2 MIPs.

May be triggering by such small signals is possible only if pedestals are shifted, it is not a normal way of triggering.

It is possible that even if not all 64 channels have fired but pedestals return to the left, the retrigger stops. It looks as retrigger signals are too small to fire normally; since they fire only with "right" pedestals, this may imply a correlation of "excited" pedestals with the functioning of the trigger.