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Subject: TPC digitization blocks everything for too many cluster events

Posted by [StefanoSpataro](#) on Thu, 03 Jun 2010 20:04:36 GMT

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Dear all,

I have noticed, producing many events with different momentum values, that sometimes the digi macro persists on some well defined events even for tenth of minutes!

In particular, the detector which is "blocking" the digitization is the TPC.

This is a sample of "blocking" event, produced when I was trying to simulate one single pion events from 0.5 to 4 GeV/c:

```
PndTpcClusterizer:: 20278 clusters created
41409 electrons arriving at readout
Aggregating drifted electrons into avalanches finished.
41409 Avalanches created
0 aggregations done.
77354 Signals created
PndTpcElectronicsTask::Exec
Building up padmap ...finished. 317 pads hit
.....
```

After 20 minutes it is still blocked at the same event. This happens also many times... in this particular case 20278 clusters created, 41409 avalanches.

I copy a "normal" TPC event:

```
PndTpcClusterizer:: 674 clusters created
1214 electrons arriving at readout
Aggregating drifted electrons into avalanches finished.
1214 Avalanches created
0 aggregations done.
2260 Signals created
PndTpcElectronicsTask::Exec
Building up padmap ...finished. 287 pads hit
.....
166 Digis created
```

In this case "only" 674 clusters. Digitization time... less than 1 second.

I can understand that for large events the required digitization time is high, but 20 minutes are really too much, I think. I am not sure if, at the end, we will be able to analyse them or they will be simply too much noisy. In the latter case, maybe a rejection of events with a too high number of clusters/avalanche in tpc could help making the digitization a bit faster, without losing too much signal. Or maybe sometimes the code enters inside a too large loop that could be optimized, I don't know.

I would call for comments from the TPC experts.

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Subject: Re: TPC digitization blocks everything for too many cluster events

Posted by [Stefano Spataro](#) on Sun, 06 Jun 2010 18:21:31 GMT

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Hello,  
this weekend I have run many events, and the problem appeared in a ... strong way!

At the event 5533:

```
PndTpcClusterizer:: 30582 clusters created
65536 electrons arriving at readout
Aggregating drifted electrons into avalanches finished.
65536 Avalanches created
0 aggregations done.
126730 Signals created
PndTpcElectronicsTask::Exec
Building up padmap ...finished. 232 pads hit
.....
1575 Digis created
```

It took 24 hours, from saturday 20:04 to sunday 20:13 to digitize one single event.

I think, as soon as possible this should be fixed, if not it results hard to simulate "many" events. I have digged a bit in the code, and if I have understood well PndTpcElectronicTask should be the guilty guy. But I have not understood how.

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Subject: Re: TPC digitization blocks everything for too many cluster events

Posted by [Felix Boehmer](#) on Sun, 06 Jun 2010 22:02:20 GMT

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Dear Stefano,

as I told you, I am unfortunately unable to investigate this in detail right now, since I have limited internet access in my hotel.

Can you give me any more information on the type of event? I would guess some low momentum decay product is spiraling in the chamber, producing tons of digits.

Please supply me with more information. Until then I suggest you introduce a cutoff on the avalanches.

Cheers

Felix

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Subject: Re: TPC digitization blocks everything for too many cluster events

Posted by [Malgorzata Gumberidze](#) on Mon, 07 Jun 2010 14:05:45 GMT

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I have the same problem as Stefano.

I'm using pandaroot revision 8473 for my simulation. What i do is to simulate with pgun electrons with the momenta 0-5GeV/c. I'm running 10k events. Simulations get block at the event 1201, and it take a lot of time, till it pass problematic event. I'm already waiting 20 minutes.

this is a last print out which i get:

```
***** PndEmcMakeBump, event: 1201 *****
Digi at (66, 68) was a local max. Energy = 1.46065
EMC header: fired crystals= 26, digi= 15, Total energy= 1.66663 [GeV],
Reconstructed clusters= 3, Total energy in clusters= 1.65603 [GeV]
-I- PndTofHitProducerIdeal: 2 TofPoints, 2 Hits created.
-I- PndTofHitProducerIdeal: 0 SciFTofPoints, 0 sciF Hits created.
PndTpcClusterizer:: 26737 clusters created
51323 electrons arriving at readout
Aggregating drifted electrons into avalanches finished.
51323 Avalanches created
0 aggregations done.
103810 Signals created
PndTpcElectronicsTask::Exec
Building up padmap ...finished. 397 pads hit
```

Few months ago i was doing the same kind of simulations with the older version of the revision, and i didn't have this kind of problem.

gosia

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Subject: Re: TPC digitization blocks everything for too many cluster events  
Posted by [Jens Sören Lange](#) on Tue, 08 Jun 2010 06:49:30 GMT  
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Hi all,  
yes, the same happens not only for pgun, but sometimes for EvtGen generated events, which are "normal" input events (i.e. there is a priori no low momentum particle in the generated event). It means: if these are spiraling tacks, they must originate from Geant.  
However, it is not blocked. It is true that it takes a lot of time, but it continues. I had events which needed ~2 hours (same as Gosia, ~30000 clusters or more), but they are always finished. One can also see in the CPU consumption ("top") that it continues to run.  
cheers, Soeren

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Subject: Re: TPC digitization blocks everything for too many cluster events  
Posted by [Stefano Spataro](#) on Tue, 08 Jun 2010 07:10:28 GMT  
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I agree, it is not blocked.

In my case, the guilty event needed 24 hours, but after the digitization continued. The only problem consists in how many "guilty" events are inside one sim file.

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Subject: Re: TPC digitization blocks everything for too many cluster events  
Posted by [Sebastian Neubert](#) on Wed, 09 Jun 2010 06:03:11 GMT

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Dear colleagues,

there have been a few modifications in the ElectronicsTask (or more correctly in the components it uses) that have been introduced while we were studying the real data from our test-chamber. If the problem has appeared after these modifications then one should look into the PulseShapeAnalysis or the ClusterFinder.

Obviously there are several options to circumvent the problem but I would strongly suggest to cut out "bad" events (with a lot of primary clusters from a spiraling particle) since in fact they will be reconstructable most of the time. So this is only an option if you need a fast simulation and do not plan to study any efficiencies!

I will look into the digitization if I find a bug there but it might take some time. In the meantime it would be helpful if you could turn on all digitization output for the tpc (SetPersistence for all tasks, plus SetSamplePersistence for the ElectronicsTask) and plot the Signal amplitudes, Sample amplitudes and Digi amplitudes (A few events are enough) Maybe we can tune some cuts there.

Cheers! Sebastian.

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Subject: Re: TPC digitization blocks everything for too many cluster events  
Posted by [Sebastian Neubert](#) on Wed, 09 Jun 2010 08:05:38 GMT

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Hi!

I spotted a mistake in my recent post - what I meant was: "I would strongly suggest NOT to cut out "bad" events..."

Sebastian.

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Subject: Re: TPC digitization blocks everything for too many cluster events  
Posted by [Jens Sören Lange](#) on Wed, 09 Jun 2010 08:29:19 GMT

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Hi Sebastian, yes, I was just about writing the same!!

I completely agree that it is important to keep these events in.

This is real background which will occur in data taking as well.

I actually think this might be Bremsstrahlung in the detector material, beampipe or TPC gas (by Geant) with gamma->e+e- and then curling e+/-.

I suspect so because it seems to occur more often in J/Psi->e+e- (about 1/1000 events) than in J/Psi->mu+mu- (rough estimate is ~1/10000 events or even less).  
cheers, Soeren

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Subject: Re: TPC digitization blocks everything for too many cluster events  
Posted by [Malgorzata Gumberidze](#) on Wed, 16 Jun 2010 16:29:00 GMT  
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Hi,

So what i have done is to run simulation (pgun) for positrons with the momentum range 0.15- 5 GeV/c . For one of the event, e.g. 246, simulations takes 6 minutes. This is not the worst case of event. Here is printout which i'm getting on the screen. in addition i'm attaching plot which is showing amplitude of the sample: PndTpcSample.famp()

```
-----  
----- PndTpcDigiPar -----  
-- Context/Purpose: PndTpcDefaultContext
```

```
-----  
PndTpcGasFile: Int_t 0  
EField: Double_t 400  
AttachFlag: Int_t 0  
LogitudinaldiffusionFlag: Int_t 1  
TransversediffusionFlag: Int_t 1  
DriftDistortionFlag: Int_t 0  
zGem: Double_t -40  
zMax: Double_t 110  
Gain: Double_t 4000  
Supression: Double_t 0.001  
Spread: Double_t 0.02  
MinSignalAmp: Double_t 10  
rMin: Double_t 15.5  
rMax: Double_t 41.5  
PadPlaneFile: Int_t 24  
PadShapeFile: Int_t 14  
PadShapeRange: Double_t 0.5  
PadShapeStep: Double_t 0.02  
PadShapeIntStep: Double_t 0.01  
ADCThreshold: Int_t 10  
ADCMax: Int_t 100000  
ADCBits: Int_t 12  
SamplingFreq: Double_t 40  
T0_wallclock: Double_t -60000  
TimeBits: Int_t 28  
PSAThreshold: Int_t 100  
Shaper_tDiff: Double_t 50  
Shaper_tInt: Double_t 50  
Shaper_tSig: Double_t 2
```

TOTPSA: Int\_t 1  
GAUSSIANNNOISE: Int\_t 0  
GAUSSIANNNOISEAMP: Int\_t 0  
Rate: Double\_t 0.02  
-----

PndTpcClusterizer:: 18573 clusters created  
39515 electrons arriving at readout  
Aggregating drifted electrons into avalanches finished.  
39515 Avalanches created  
0 aggregations done.  
73880 Signals created  
PndTpcElectronicsTask::Exec  
Building up padmap ...finished. 1094 pads hit  
.....  
1497 Digis created  
PndTpcClusterFinderTask::Exec  
387 cluster created containing 1497 digis from 1497  
Hit array contains 3 hits  
PndEmcMakeCluster, event: 1

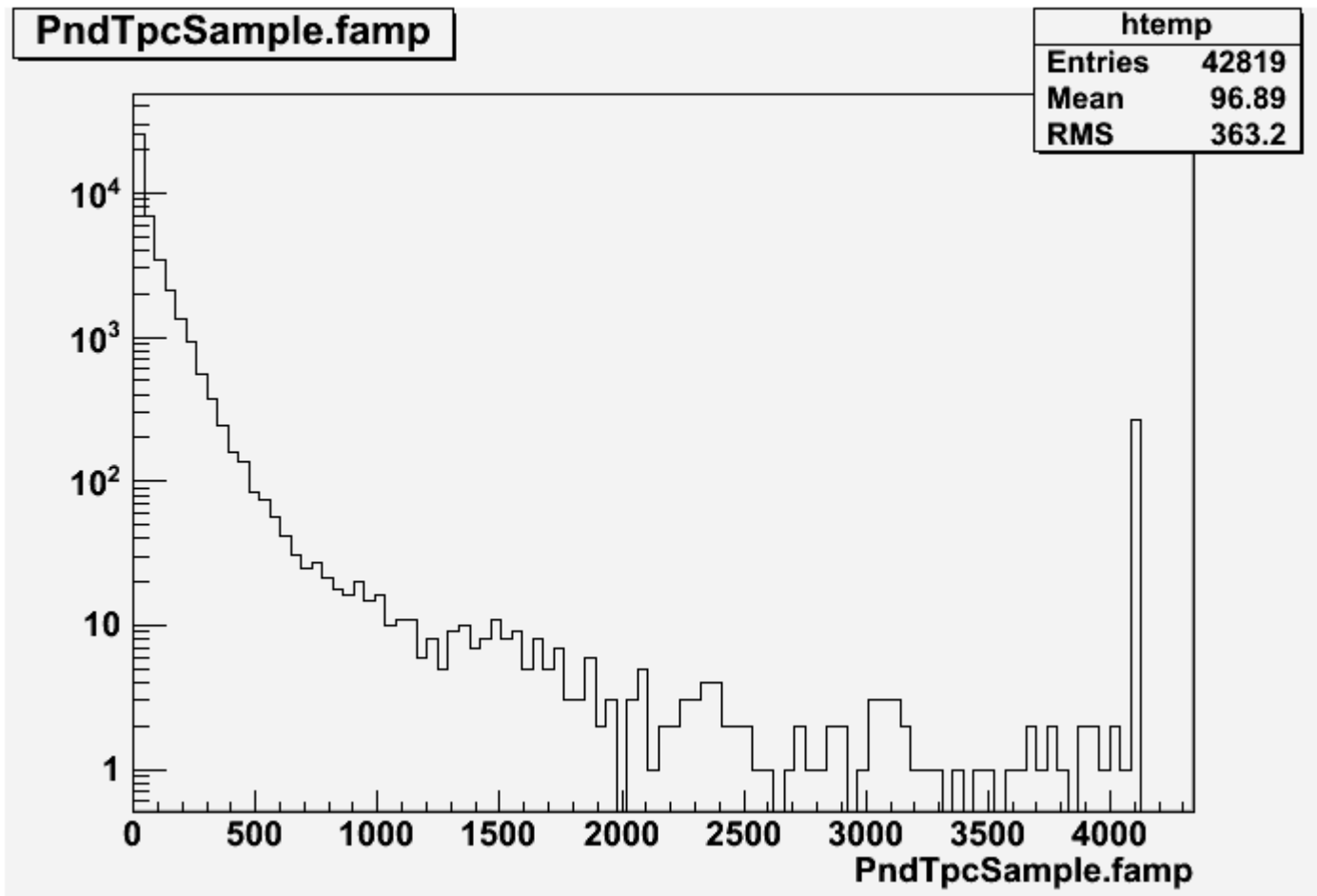
Hope it will help you, i can also plot different distributions, but it would be nice if you would be more exact what to plot.

best regards,  
gosia

## File Attachments

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1) [sample.gif](#), downloaded 273 times




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Subject: Re: TPC digitization blocks everything for too many cluster events  
 Posted by [Stefano Spataro](#) on Tue, 22 Jun 2010 17:08:08 GMT  
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Dear all,  
 I think I have found the guilty guy. Which is not tpc digitization, not exactly.  
 Putting some thousands of cout in PndTpcElectronicTask::Exec, I have found that the code  
 sticks at the following line:

```
dig->SetLinks(FairMultiLinkedData(kTpcSignal, sigIdMap[padIt->first]));
```

Now we have understood why the problem was not appearing before: because it is related to  
 the new fairlink propagation! If I comment out this line, the code is slow for the "heavy" events,  
 but it is processed in a "reasonable" amount of time...  
 I have taken my wonderful 5533 event, it took 24 hours with FairLink line, 1 minute without....

I suppose there is something bad in the linking procedure for tpc, for large events, maybe  
 because the too many objects to handle.

Another slow line, but two orders of magnitude faster than the link line, is the following:

```
PndTpcDigitizationPolicy().Digitize(sv,&samplelist,ffrontend,fpulseshape);
```

The code is stucked there for the guilty event, but just for 10 seconds per iteration of the padmap. I am not sure if this is a "feature" or if this could be optimized somehow, I leave the word to digitization experts.

About the SetLinks, I would suggest for the moment to comment out the line, in order to make the digit faster. If somebody wants to check the guilty event, just send me a mail and I could give him the path at GSI where to get a root file with... many problems.

Regards

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Subject: Re: TPC digitization blocks everything for too many cluster events  
Posted by [Felix Boehmer](#) on Tue, 22 Jun 2010 18:14:38 GMT

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Dear Stefano,

many thanks for the effort you put into this! I didn't look into it yet, but I have to admit I also did not suspect the linking to be the culprit.

Are there any known performance issues with the FairLinks involving any other detectors?

Cheers

Felix

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Subject: Re: TPC digitization blocks everything for too many cluster events  
Posted by [Stefano Spataro](#) on Tue, 22 Jun 2010 18:26:38 GMT

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From what I have seen, all the "handbrakes" were at the tpc level... I should run many events to see if the same effect appears also with other detectors, tomorrow I will try the whole file w/o the SetLink line... and maybe I could tell you.

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Subject: Re: TPC digitization blocks everything for too many cluster events  
Posted by [Jens Sören Lange](#) on Tue, 22 Jun 2010 18:45:55 GMT

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that's great Stefano. thanks so much.

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Subject: Re: TPC digitization blocks everything for too many cluster events  
Posted by [Malgorzata Gumberidze](#) on Tue, 22 Jun 2010 20:44:49 GMT

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Hi Ste,

I have commented the same line in my code:



```
dig->SetLinks(FairMultiLinkedData(kTpcSignal, sigIdMap[padIt->first]));
```

and now event which before took several hours is fine,  
it take maybe 30 seconds.

good job,  
gosia

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Subject: Re: TPC digitization blocks everything for too many cluster events  
Posted by [Bjoern Spruck](#) on Thu, 24 Jun 2010 08:32:24 GMT

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Felix Boehmer wrote on Tue, 22 June 2010 20:14

Are there any known performance issues with the FairLinks involving any other detectors?

I would expect a similar behavior in Detectors where you have a lot of secondaries. This might be DIRC (with Cherenkov photons on) and EMC. For EMC some cleaning procedure is applied before the linking takes place.

I could comment out that cleaning and check what is happening then.

Bjoern

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Subject: Re: TPC digitization blocks everything for too many cluster events  
Posted by [Tobias Stockmanns](#) on Thu, 24 Jun 2010 11:06:26 GMT

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Dear colleagues,

I have studied the FairLink problem in more detail. The problem is the enormous amount of data created for the TPC. For one special event it has: 19281 PrimäriClusters, 42958 Drifted Electrons, 42958 Avalanches, 80300 Signals and 1,674,929 Digis.

All this objects have links to the previous one. I could speed up the linking by a factor of 2 by using `std::set` instead of `std::vector`. Nevertheless this one event takes 500 s on my PC. I think that for the TPC one should bypass the linking and only connect the `TpcClusters` with the MC points and only for dedicated studies one switches on linking.

Cheers,

Tobias

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