Inefficiencies in simulation / analysis

How to deal with “imperfections”: dead channels / calibration time evolutions

M. Ungaro

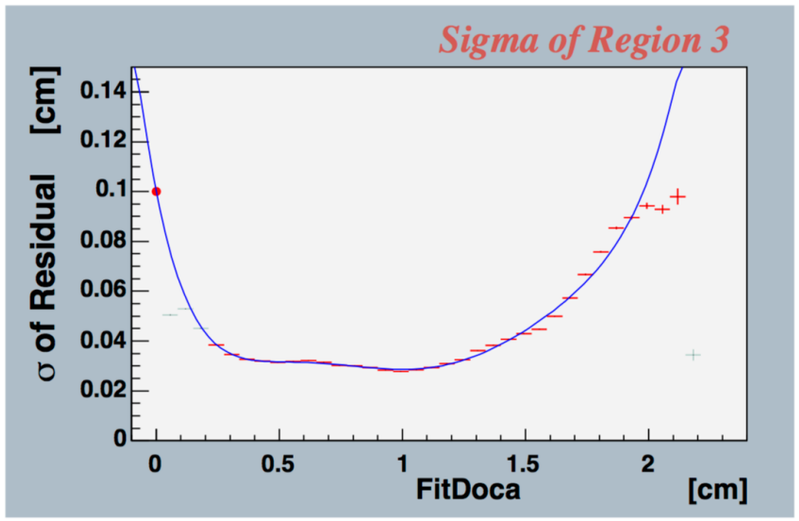
Detectors responces vary with run

Convolution of calibration / dead channels

In CLAS6 we averaged some quantities:

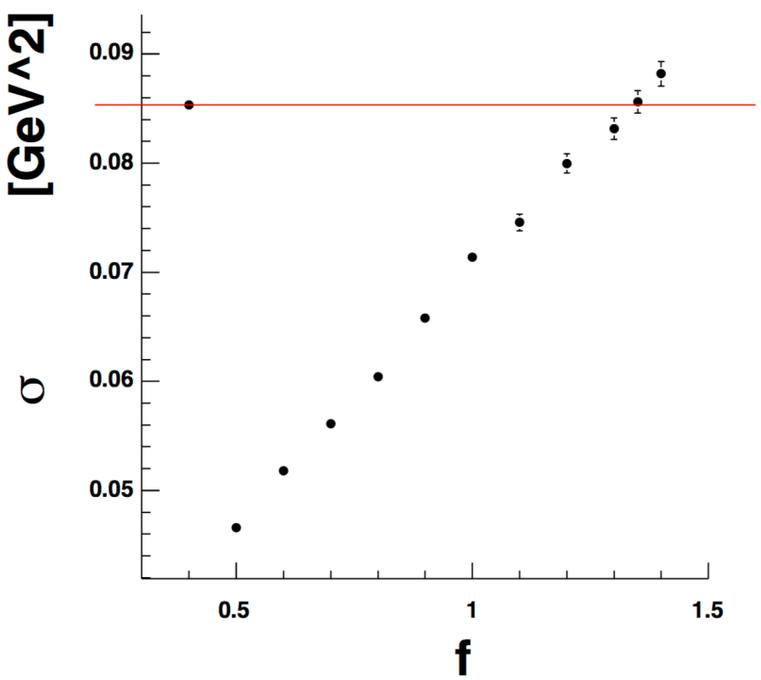
DC resolution:

- gpp a,b,c parameters



FTOF resolution:

- f parameter



Detectors responces vary with run

Convolution of calibration / dead channels

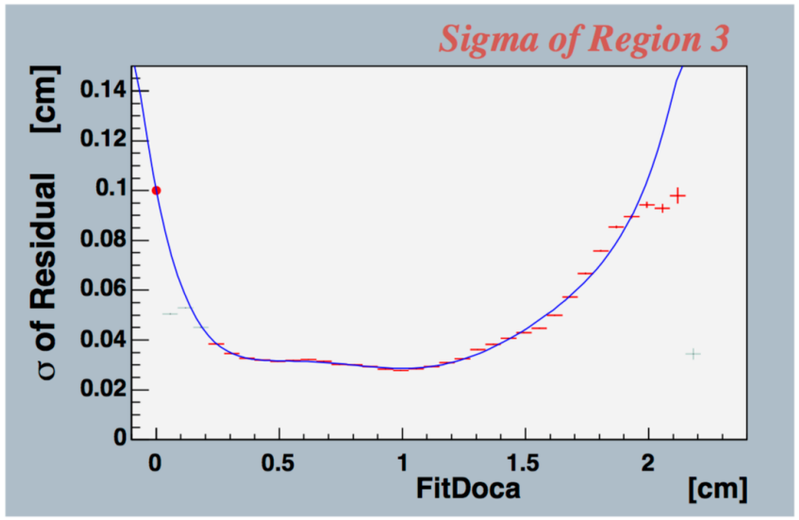
In CLAS6 we averaged some quantities:

DC resolution:

- gpp a,b,c parameters

WRONG: we “accused” the DC of being responsible for something they were not!

a,b,c = 1.5, even 2!!



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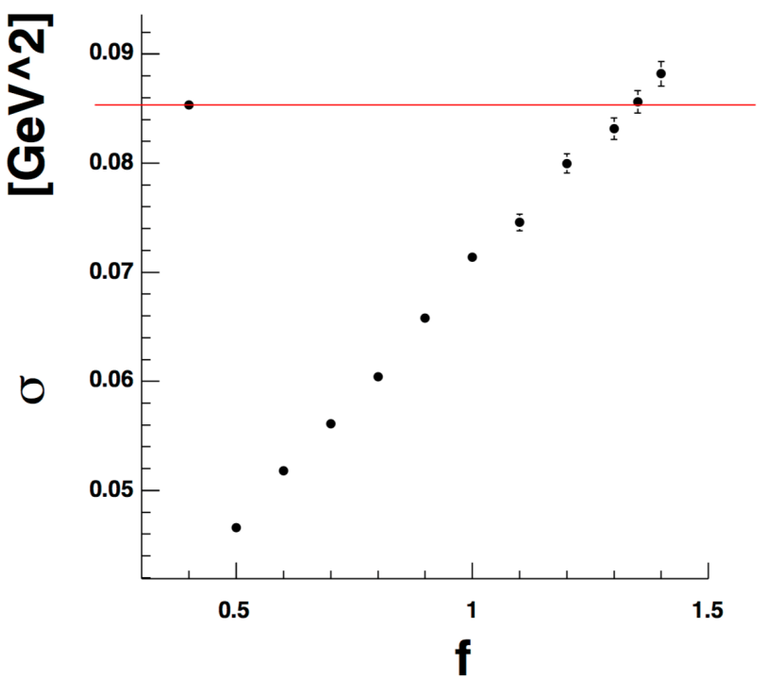
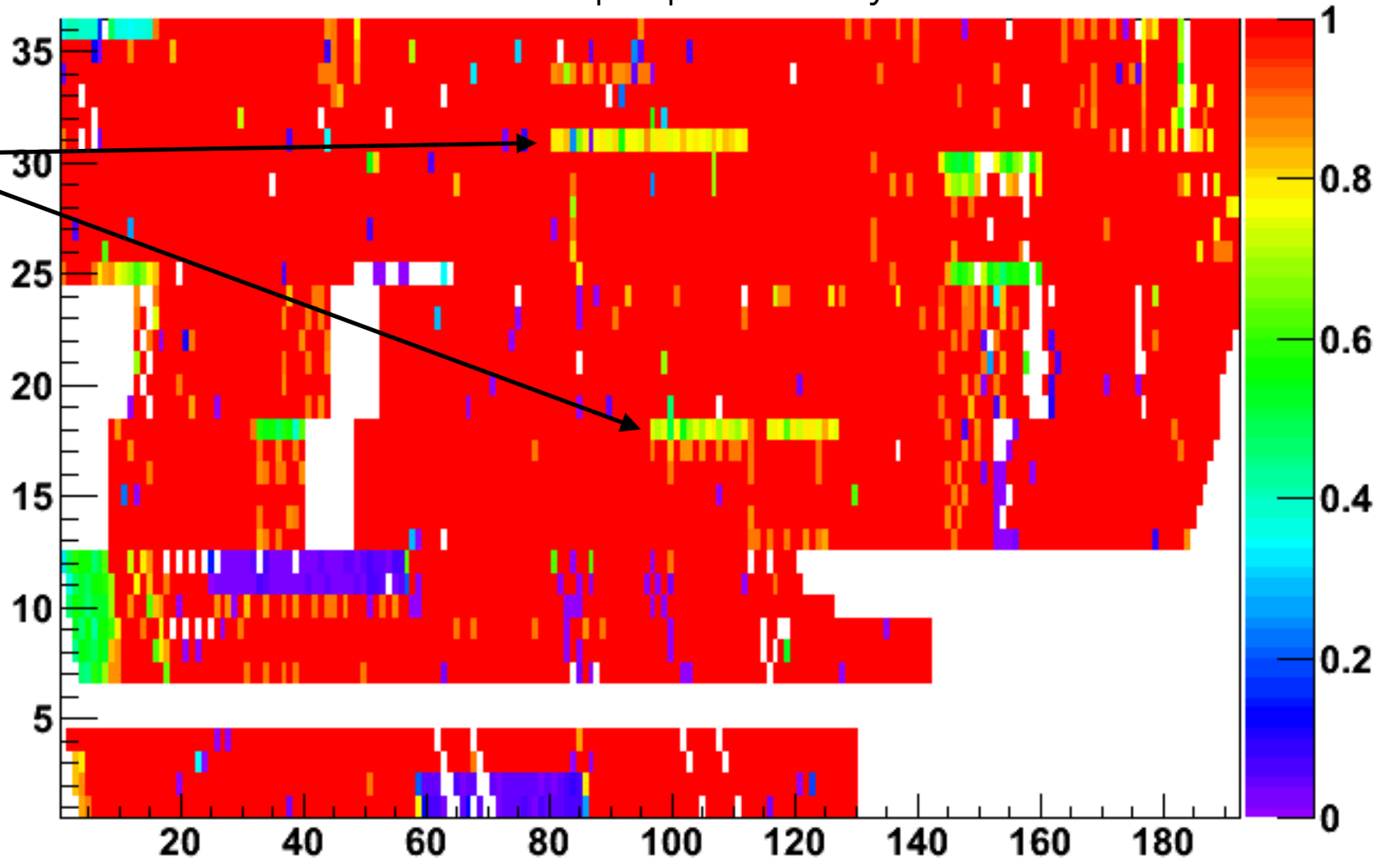


Detectors responces vary with run

DC Efficiency for g12
runs contributed proportionally to their FC Q

dead 50% of the time, correlated!



Sometimes we calculate “average inefficiencies”
“Ok” if we take into account correlations.

Wanted:

Ability to do analysis in the both ways:

- “classical”: average resolution, average inefficiencies. **Constants are in one run.**

- “advanced” calibrations / inefficiencies **run by run.**

“classical” way

-RUNNO=10 option

-N=100,000 generates:

100,000 events with constants from run number 10

✅ Done in GEMC

run by run simulations

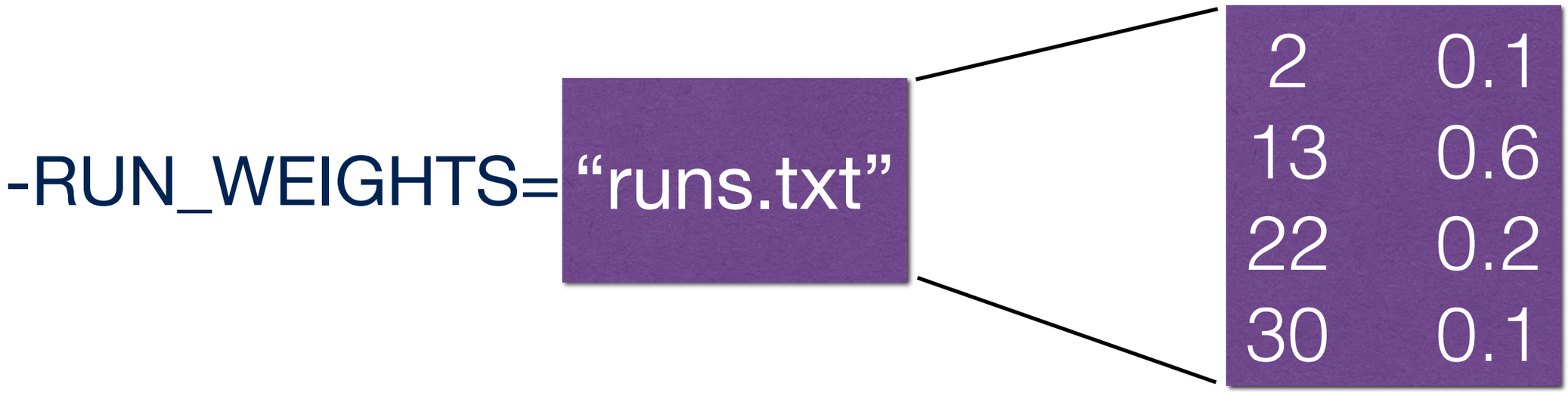
- correlations between channels and detectors are automatically taken care of

- time evolution of calibration

Problem:

We have to generate events with statuses proportional to the number of events (or charge) for each run.

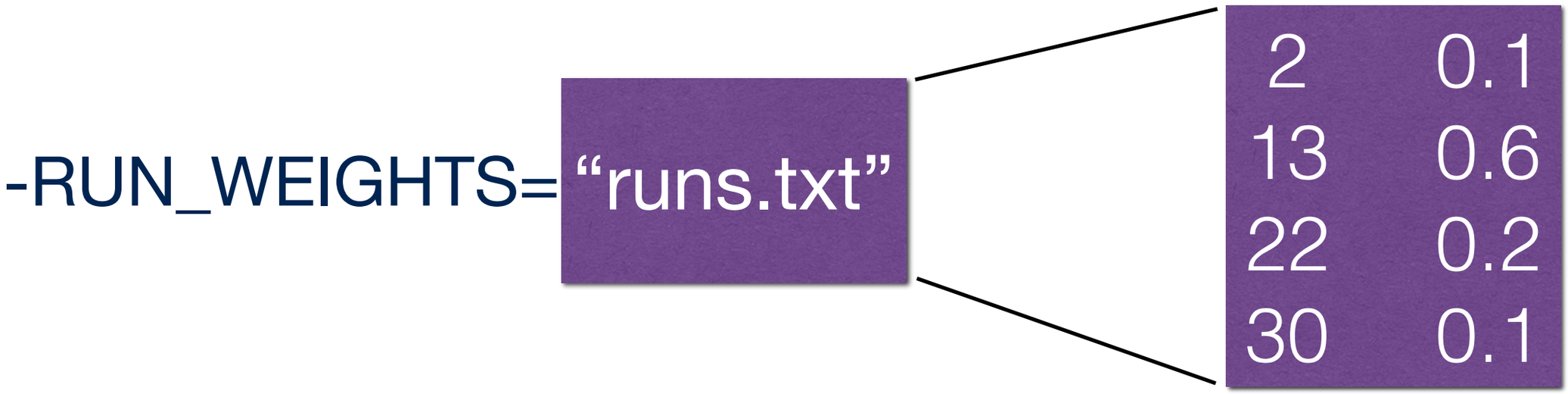
run by run simulations



-N=100,000 generates:

10,000 with constants from run 2
60,000 with constants from run 13
20,000 with constants from run 22
10,000 with constants from run 30

run by run simulations

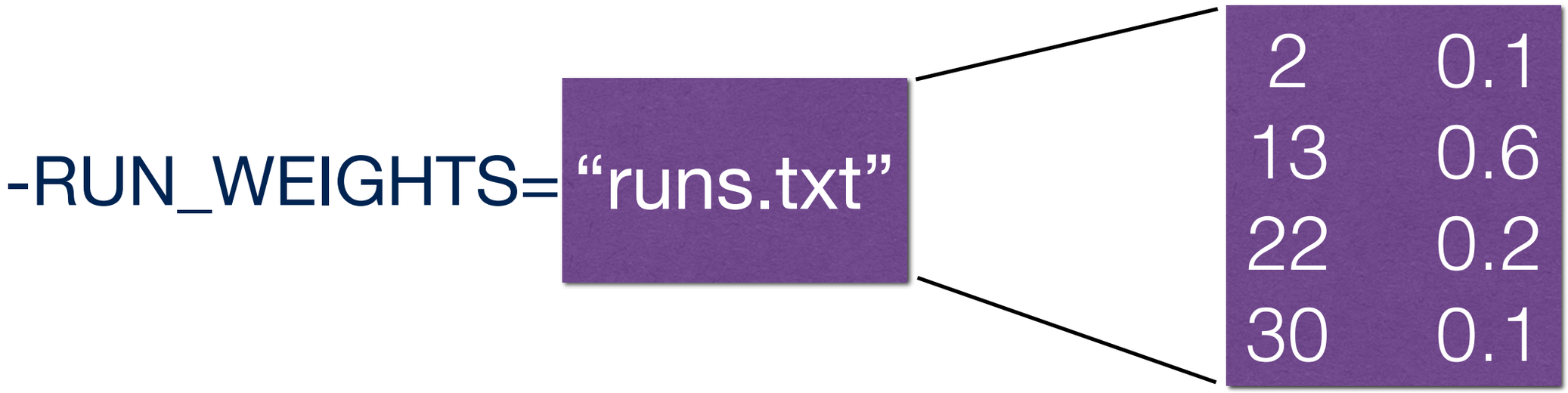


-N=100,000 generates:

10,043 with constants from run 2
59,901 with constants from run 13
20,034 with constants from run 22
10,022 with constants from run 30

In reality we want to randomize this. So even 100 events is a true sample of 500 runs.

run by run simulations



-N=100,000 generates:

10,043 with constants from run 2
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- **Run number put in header bank**
- **Events are ordered by run**

✅ Done in GEMC

run by run simulations

TEST: FTOF paddle

-RUN_WEIGHTS="runs.txt" -N=100000

DB status “3”

for paddle 11 in run 13
for paddle 13 in run 22
for paddle 15 in run 30

run by run simulations

TEST: FTOF paddle

-RUN_WEIGHTS="runs.txt" -N=100000

```
> Run weights table loaded:
   - run: 2     weight: 0.1      n. events: 10043
   - run: 13    weight: 0.6      n. events: 59901
   - run: 22    weight: 0.2      n. events: 20034
   - run: 30    weight: 0.1      n. events: 10022
```

DB status “3”

for paddle 11 in run 13
for paddle 13 in run 22
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run by run simulations

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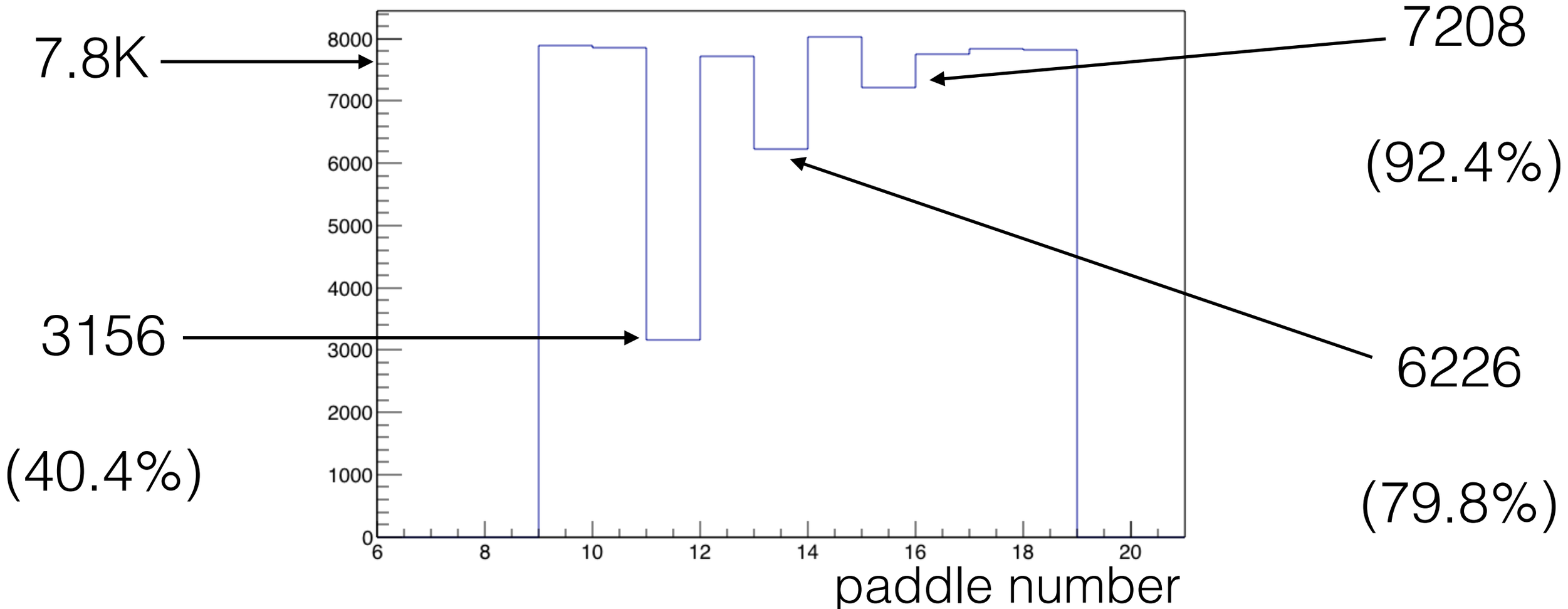


run by run simulations

gemc has “advanced” digitization

ADC:

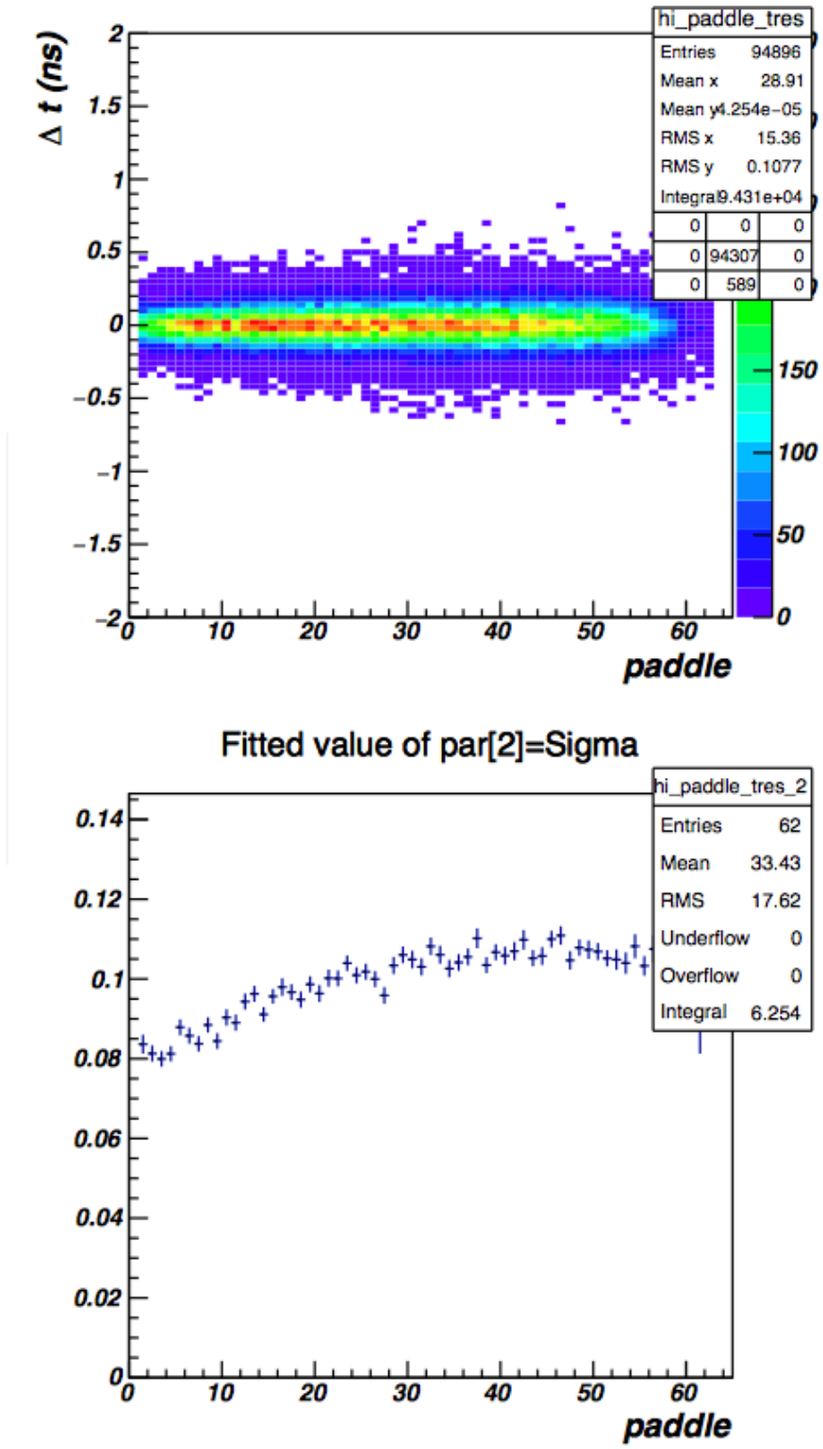
- Attenuation according to exponential law
- Conversion from energy to ADC based on MIP signal (dEdxMIP=2 MeV/cm, countsForAMinimumIonizing=2000)

TDC:

- Delay due to light propagation in the paddle (effective velocity)
- Parameterized Time Walk
- Gaussian time spread based on parameters that will be matched to data (σ2=σ02+σ12/√EPMT Conversion from time to TDC (time2tdc=20ns−1)

Output: both “smeared” and “unsmeared” TDCs

Status:
0 – fully functioning
1 – noADC
2 – noTDC
3 – noADC, noTDC(PMT is dead)
5 – any other reconstruction problem



Summary

- We can now use both “classical” and “advanced” mode of dealing with calibration / dead channels time evolution.

- “advanced” mode automatically takes care of correlations within a detector and between detectors

- “advanced” mode will produce a sample of events that is representative of a whole run period. Even 100 events for 500 runs.

- How: can use a spreadsheet with run / luminosity weight columns

2	0.1
13	0.6
22	0.2
30	0.1