

The SVD NN time estimator prospects

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CoG was selected as default time estimator

- What's wrong with NN estimator?
- Can it be fixed?

What does NN need to replace CoG?

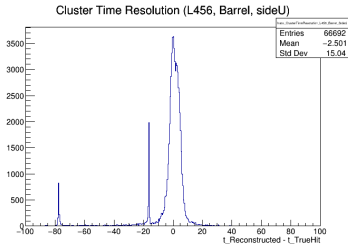
(Provided all else in NN has been fixed)

- Not enough to just be better or more stable, because
 - CoG is there and will sprout roots (calibrations, track finder etc.)
 - With Phase2 startup, focus will be on making things work rather than exploring relative merits of methods.
 - CoG is lean and NN is huge: Is the gain of NN worth the effort?
- Must be decisively better in at least one aspect
- Must provide what CoG can not
 - Does the additional 20 % precision matter somewhere?
 - Are pdf's important?

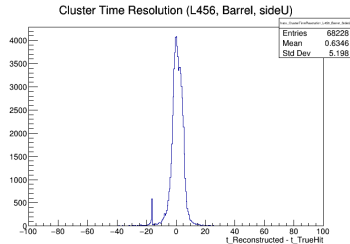


What went wrong with the NN time estimator?

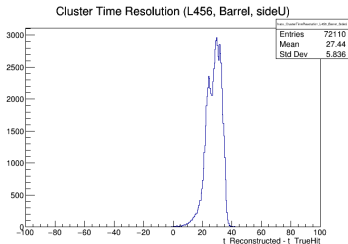
(a) NN



(a) NN without BG



(b) CoG



What's wrong?

- The NN estimator works, NN beats CoG in strip time precision.
- It is not miscalibration, NN is better calibrated than CoG.
- It is a **clustering** problem.



What went wrong with NN time estimator?

Calculation of cluster time

- NN clusterizer uses strip time pdfs to calculate cluster time pdf
 - Cluster time pdf is a product of strip time pdfs.
- When a cluster consists of signals from different hits, cluster time pdf can turn out to be zero.
 - This is converted to uniform pdf.
 - Uniform pdfs give the same time estimate (with large error), and this is where the peak in time distribution comes from.
- Splitting of heterogenous clusters based on strip time is not yet implemented.
- CoG does not feel time heterogeneity
 - or, more precisely, time homogeneity does not enter the equation with CoG time estimator.

Occasional collapse of cluster pdf

- Cluster pdf can collapse by chance, when due to random variations the product of two neighbour strip pdfs has zero overlap.
- Experience shows that this happens very rarely
- With the fine-binned network used for NN-CoG comparisons (2 ns bin), this happened in 0.04% cases.
- It can be suppressed by slight smoothing of the pdfs.



What to do with NN estimator

Implement strip-time clustering

- Summarize strip time pdfs into cluster time pdf using several partitioning hypotheses.
- Requires policy definition for border strips, so this will need some experimenting



Plans: General

Simulation comes first

- We need good simulation of strip signal formation in time
- Effects of detector heterogeneity: strip-by-strip variations, bad strips etc. - configuration data for simulation.
- This is now top priority
- SVDDigitizer re-factored and tested before February B2GM

Examine 3-sample mode

- Minimalistic data, heavily calibration-dependent (delays), a variety of failure modes.
- CoG performance expected even nearer to NN

Testbeam studies

- This we have to simulate (and reconstruct)
- We need to know the behaviour of CoG and NN estimators on real data.



Plans: NN-related

Re-implement using `mva` package

- Maybe somewhat less efficient than current C++ implementation
- Easier testing of alternative estimators
- Automated handling of estimator data.

Provide alternative to CoG

- Maintenance task
- The NN chain is nearly complete (except for time clustering), so NN can be used for comparison with CoG

Background monitoring

- Running estimate of loss rate, radiation damage and neutron flux for most important background types using SVD (and maybe PXD) data.
- This is a special application for which NN is better suited than CoG.
- For February B2GM.



Conclusions

- NN has to be much better than CoG to continue to serve as CoG alternative.
- The most important tasks at present are simulation of strip signal formation and studies of testbeam data, results toward the February B2GM.
- NN will be re-implemented using the `mva` package api.
- Beam background monitoring modules will provide running estimate of most important background rates, radiation damage and neutron flux.

