

Performance parameterization for production validation

Motivation

Reconstruction parameterization tuning example

Tools and use cases

Motivation

Performance of reconstruction/calibration/simulation can be described by multidimensional functions

Functions in general does not factorized:

- $f(x_0, x_1, x_2, \dots) \neq f(x_0) \times f(x_1) \times f(x_2) \dots$

Standard analysis/QA projections of of function - histogram used

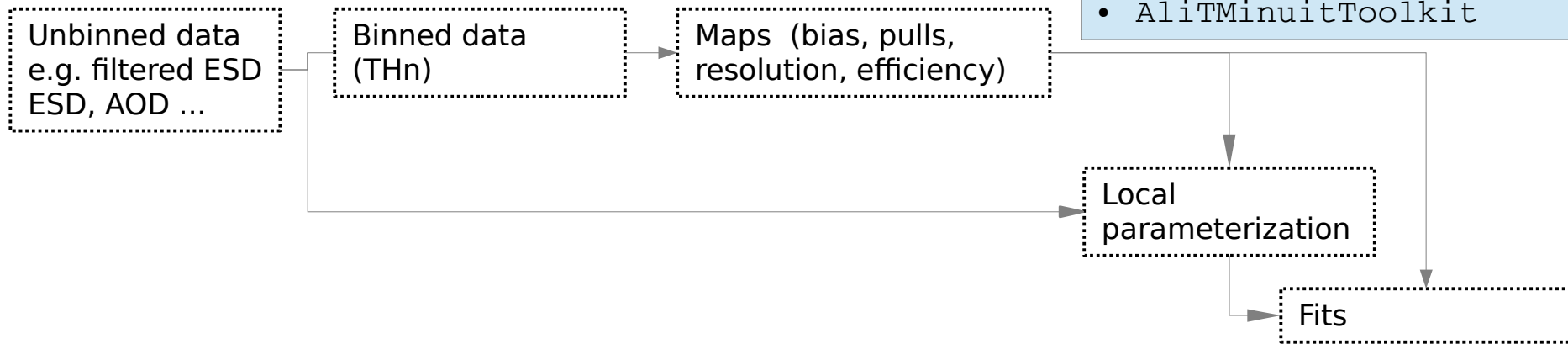
More effective to support Nd histogram/functions

Use cases: N-dimension tools

Tools developed. To be more actively used also in physic analysis to exchange knowledge/information

Tools:

- THn
- TStatToolkit
- AliTreePlayer
- AliNDLocalregression
- AliTMinuitToolkit



Standard approach for TPC space point distortion calibration

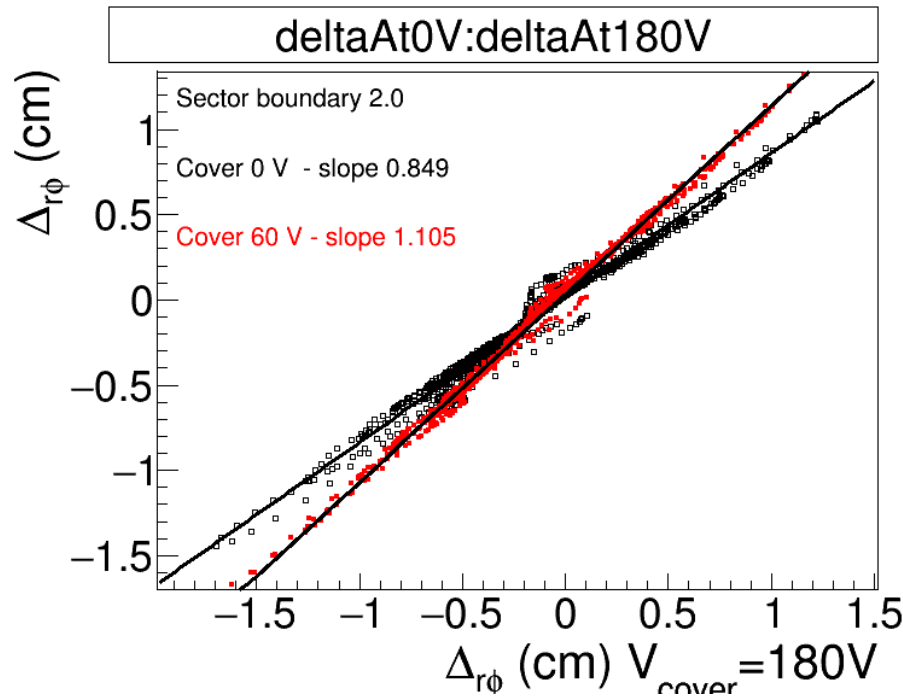
- Maps for correction
- Maps to investigate sclaing of distortion
- Investigation of origin

Similar approach to compare reconstruction production (Expert QA)

- new features
- pass1/pass2
- LHC13b/LHC13e

MC/real data comparison

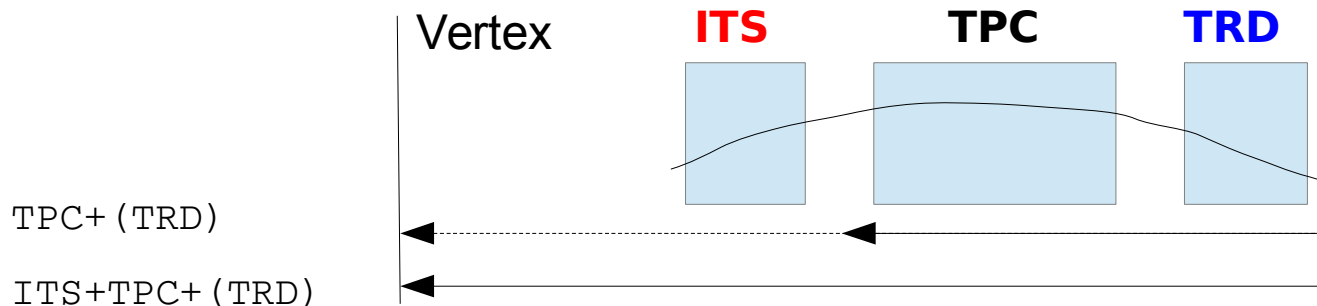
Use case: Distortion maps correlation fit



Correlation of distortion maps for 3 different cover voltage setting

- points in the plots distortion in individual bin of distortion maps
 - X axis - reference distortion
 - Y axis - distortion for modified conditions
- lines - expected linear scaling

Reconstruction benchmark. Example.



Residual histogram maps parameterization (with predefined binning)

- $\text{param}(\text{TPC}+(\text{TRD})) - \text{param}(\text{ITS}+\text{TPC}+(\text{TRD}))$

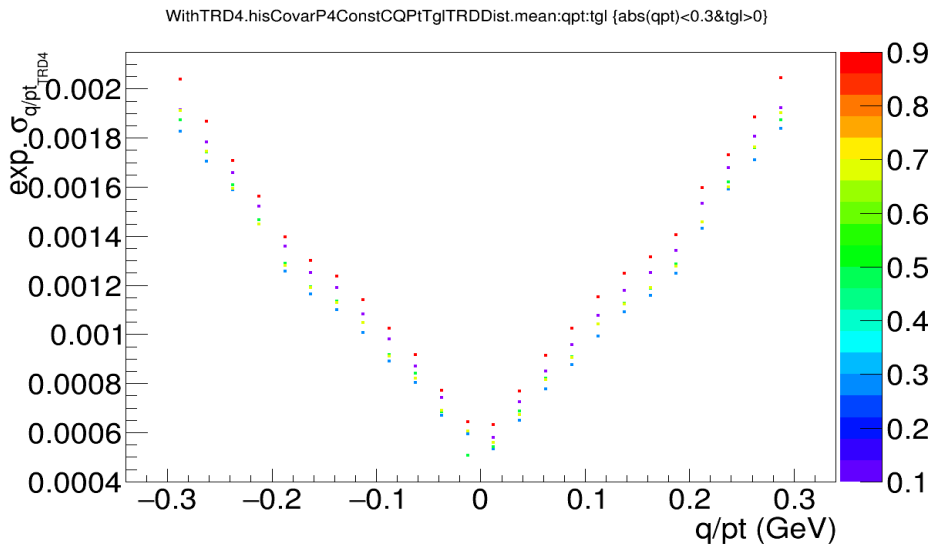
Performance parameterization (predefined binning)

- $\text{delta}(\text{rphi}, \text{phi}, \text{q/pt}): \text{q/pt}:\text{theta}:\text{mult}$
- $\text{pulls}(\text{rphi}, \text{phi}, \text{q/pt}): \text{q/pt}:\text{theta}:\text{mult}$
- $\text{pulls}(\text{rphi}, \text{phi}, \text{q/pt}): \text{q/pt}:\text{theta}:\text{mult}$
- matching eff., χ^2 , NCI ...

Residual mis/calibration parameterization (maps)

- $\text{delta}(\text{rphi}, \text{phi}, \text{q/pt}): \text{phi}:\text{q/pt}:\text{theta}$
- matching eff., χ^2 , Ncl ...

Example: Pt resolution map comparison



Expected $1/p_t$ resolution at 0.0004 GeV/c
→ $\sigma_{p_t}/p_t \sim 4\%$ at 100 GeV/c

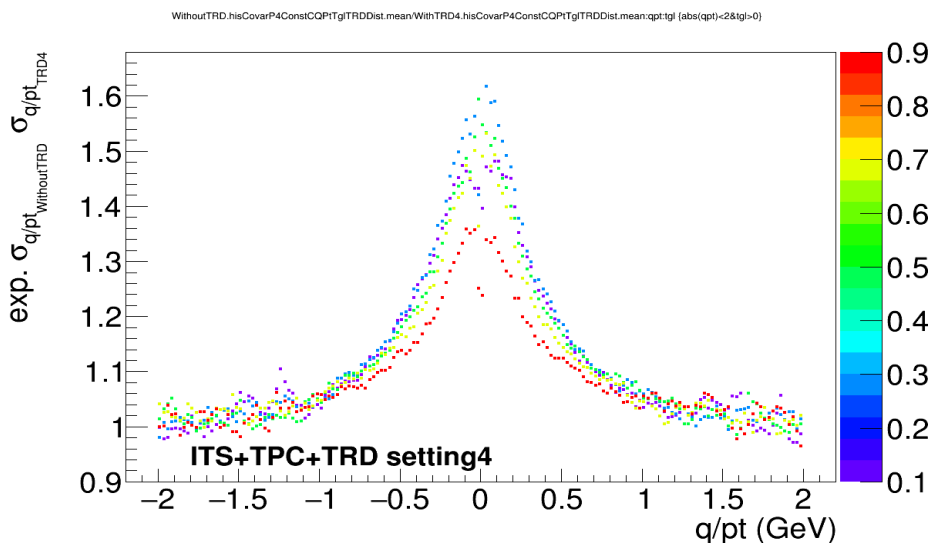
Without/With TRD setting 4

1.3-1.6 improvement at high pt ($q/pt \sim 0$)

color code - track inclination angle

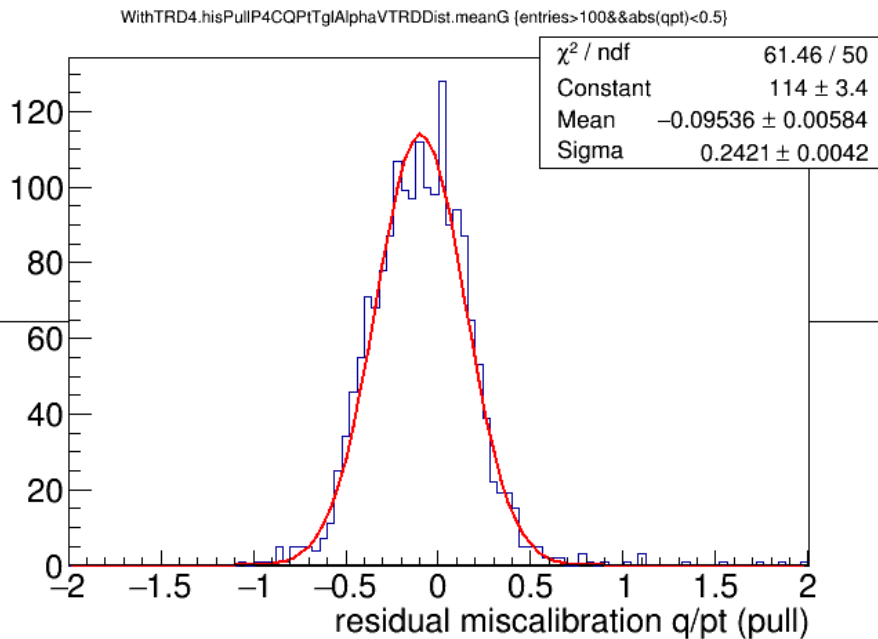
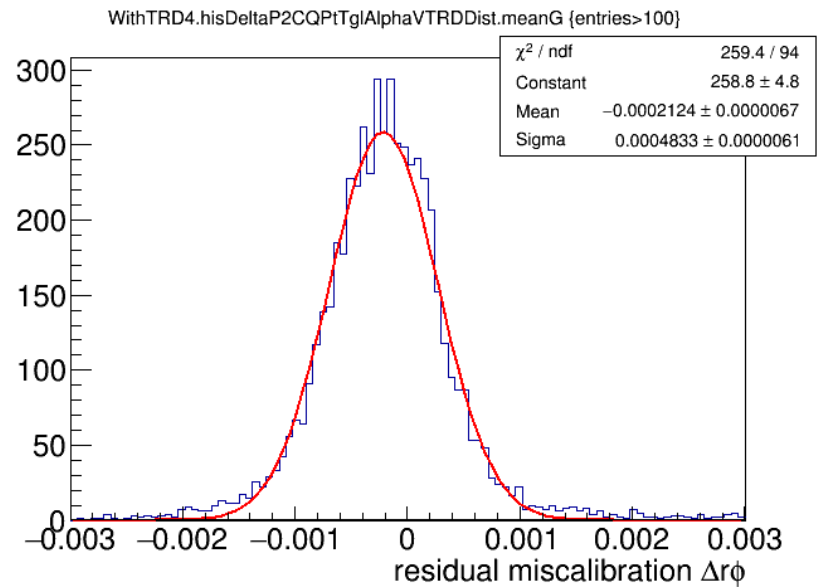
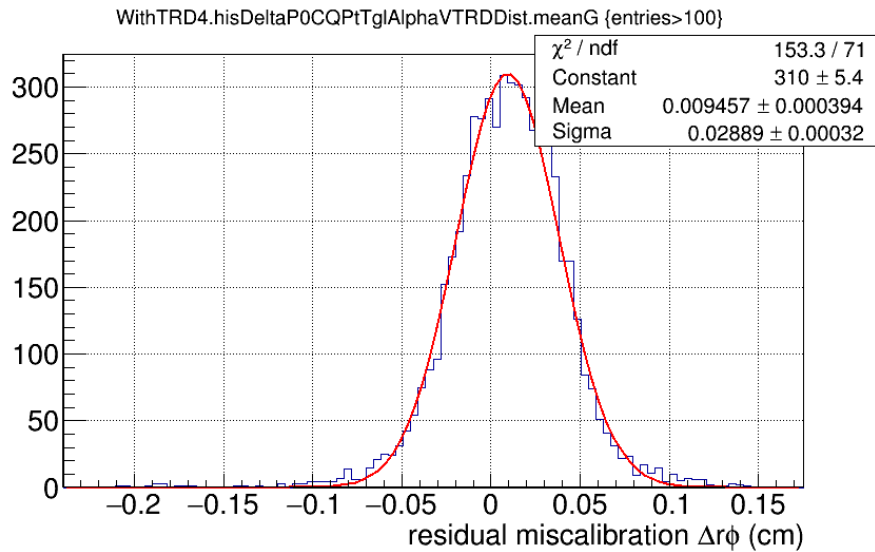
- ~ 0 full diffusion

- \sim small outer radii (close to TRD)



More examples tomorrow

Example: Residual mis-calibration

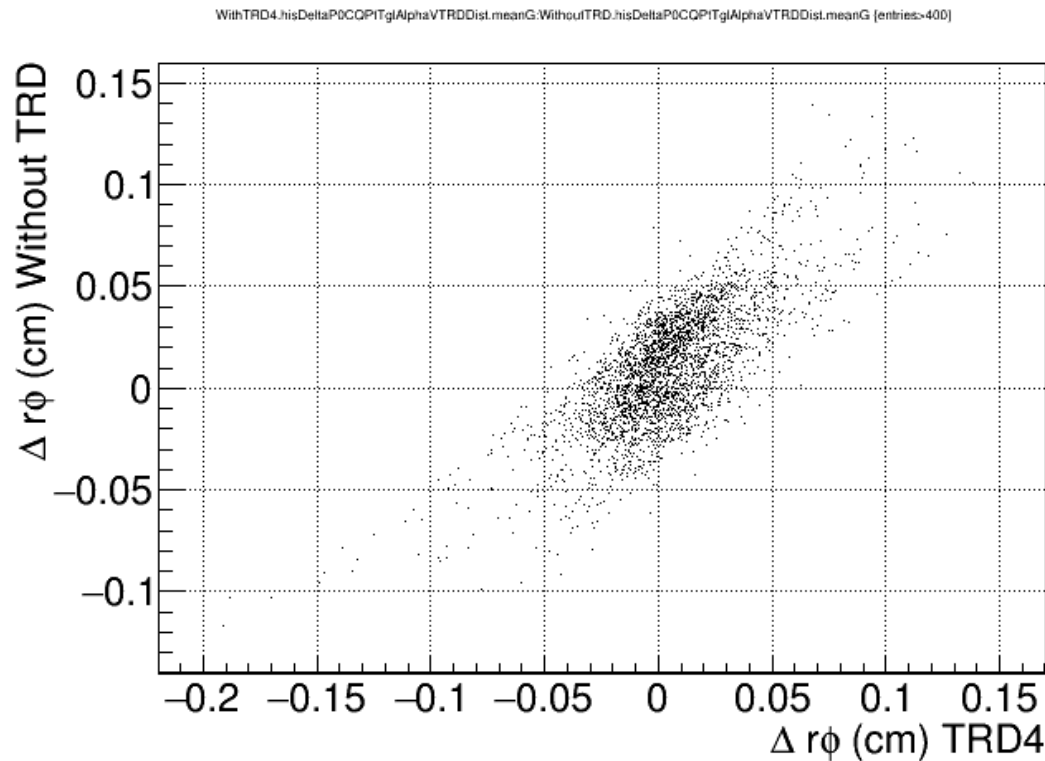


Residual mis-calibration

Histogram of mean bias in small $\phi(90), \eta(10)$ and q/pt bins

Residual mis-calibration < 0.5
sigma of intrinsic resolution

Example: Reconstruction comparison

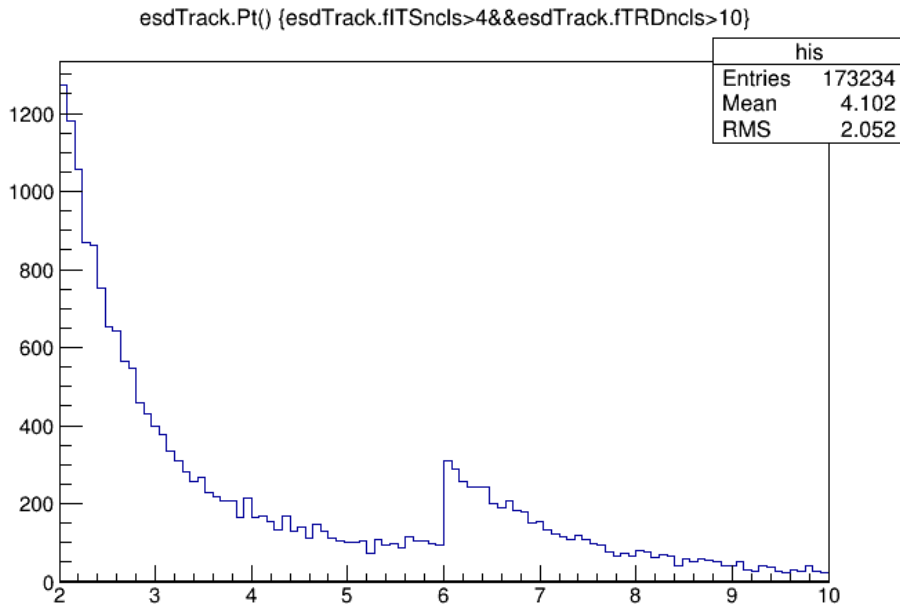


- Extrapolation for 2 different reconstruction scenarios
 - with/without TRD
 -

Reconstruction benchmark

Offline trigger - LHC15n period

- Performance trigger
 - track - $pt > 6$ GeV
 - V0s:
 - gamma candidate $pt > 2$
 - Others $pt > 4$
- Calibration trigger
 - $N_{spd}/N_{all} > 80\%$ - pile-up cleaning
 - $N_{spd} > 50\%$ - enhanced multiplicity to save CPU



4 reconstruction setting

Feedback time:

- Reconstruction within **2-4 hours**
 - 1400 cores
- Analysis, performance characterization - **5 minutes**
 - laptop

Conclusion

N dimensional approach for performance characterization implemented and successfully used in QA/calibration/reconstruction performance characterization

- many aspects not possible to investigate using simple projections

Code and knowledge to do shared with physics community

- Use cases identified e.g:
 - LHC13c/LHC13d,e,f
 - LHC10h/LHC11h