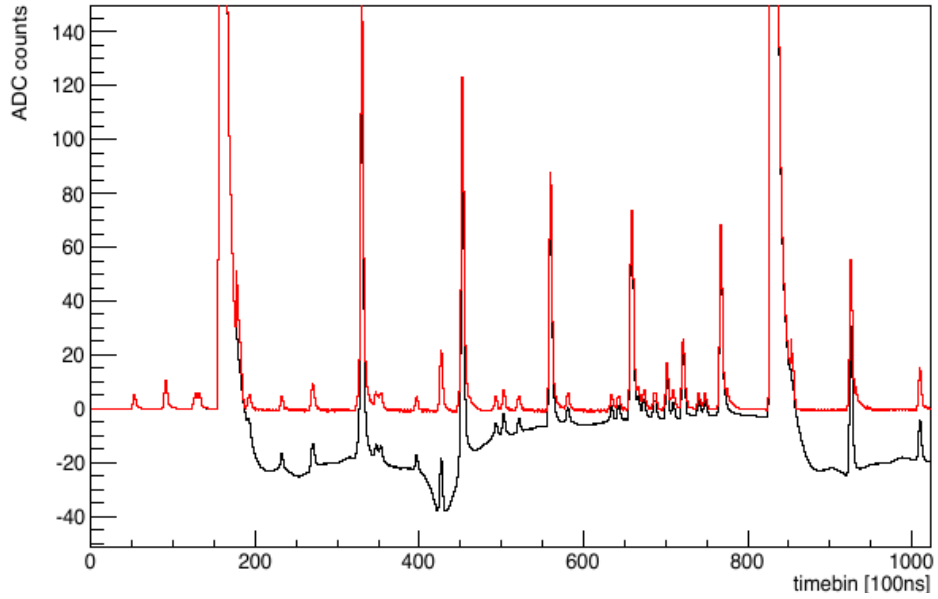
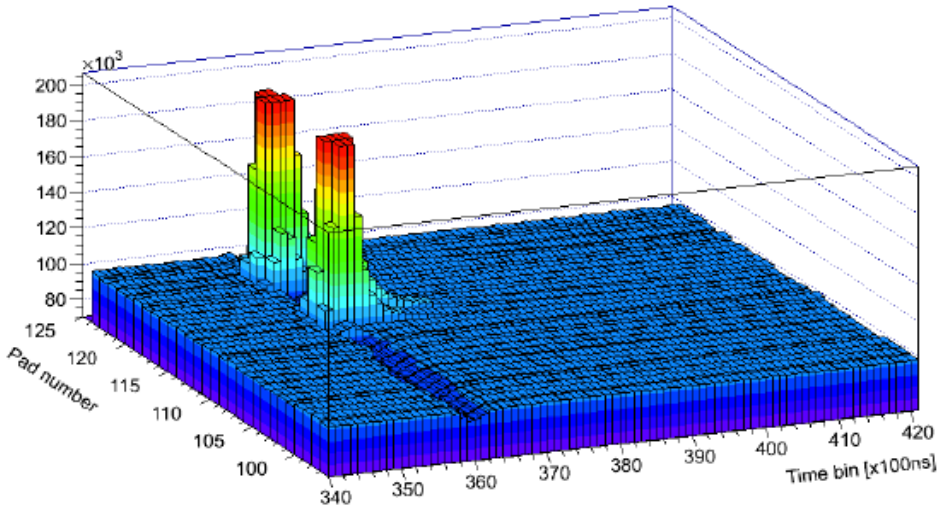
# Reconstruction status and plans

# Ion-tail and cross-talk high IR



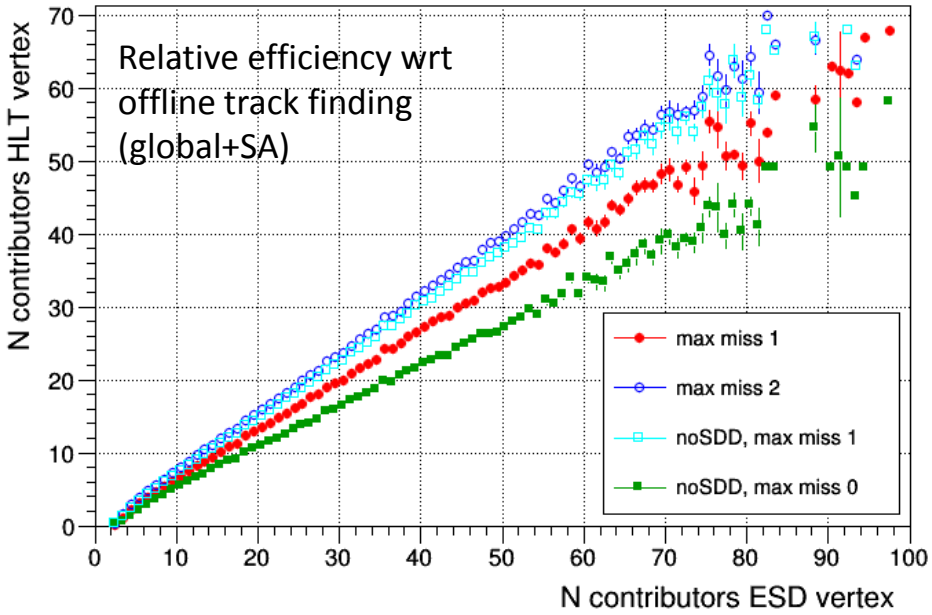

- Ion tail was not fully corrected in electronics (ALTRO chip)
- Removal of capacitors on chambers → cross talk among pads
- Lower baseline
- Bias on cluster charge → dE/dx deteriorates
- Correction in software
- Final checks ongoing
- Ready for p-Pb reprocessing

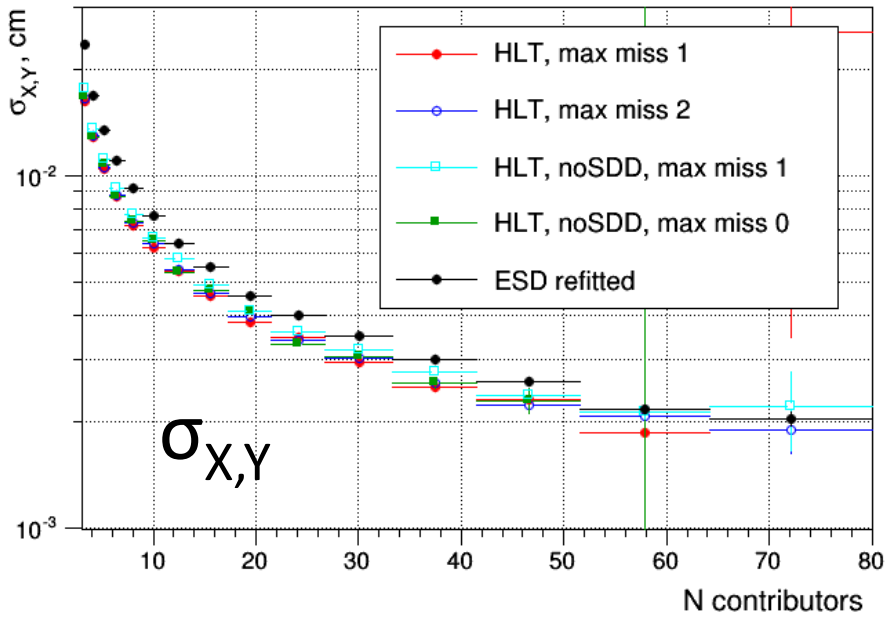
# ITS Standalone tracker/vertexer for HLT

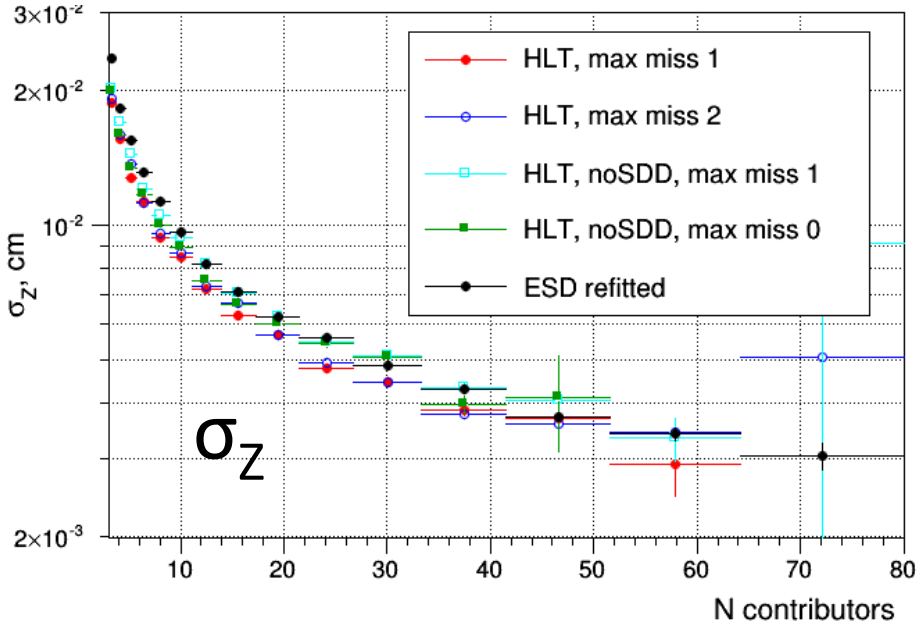
- Needed for TPC calibration & LR determination
- Rebuild SPD tracklets from HLT SPD vertex
- Finds their extrapolation in full ITS.
- Use found tracks to reconstructs primary vertex
- By definition finds primary tracks only
- Plan to implement vertexer also for offline code

Speed for p-p MC LHC14i2/192708 (i7-2600@3.4GHz)

| | |
|---|---|
| full ITS max miss 1 | 5.0 kHz |
| full ITS max miss 2 | 4.8 kHz |
| no SDD max miss 0 | 6.7 kHz |
| no SDD max miss 1 | 6.0 kHz |



# Alignment for Run2

New TRD modules, new SPD modules (revived), lot of interventions -> need full realignment

Cosmic data collected (back-to-back with +- 3sectors difference; SPD touched in ~ 3 $10^{-4}$)

| B | Runs | TOF+TPC+SSD(+SPD) $10^6$ | TOF+TRD+TPC+SSD(+SPD) $10^6$ |
|---|---|---|---|
| 0 | 42 | 10(8) | 5(3) |
| + | 47 | 24(22) | 11(10) |
| - | 51 | 53(4) | 22(2) |

~ 0.5% should have hit at least in SSD → would allow ITS – TRD/TOF global alignment w/o TPC.

## Methods

Barrel:

- ITS internal alignment with MillePede (cannot be directly extended to other detectors)
- Kalman filter
- Old framewrok for TRD alignment (needs reliable TPC tracks)
- Global alignment with MillePede (in development)

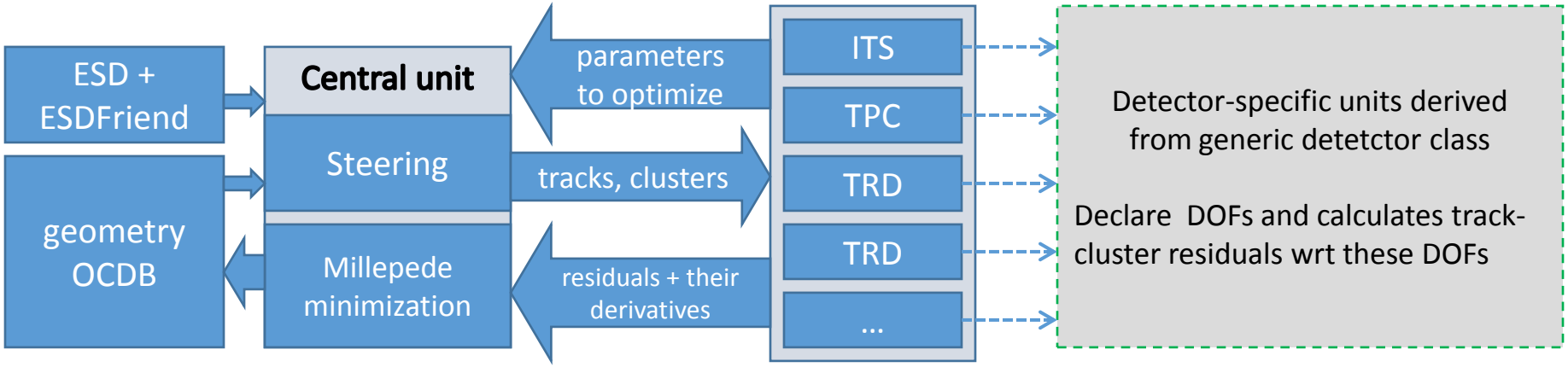
Muon:

- Existing MillePede framework, works both with Dipole:OFF and Dipole::ON data, but data with field alone will require more efforts to align (availability of field OFF data is not probable)

# Global alignment with Millepede

- Currently ITS and TPC are aligned internally, then they are aligned globally one with respect to other
- Outer detectors aligned relying on TPC tracks, w/o any feedback on TPC alignment/calibration
- This affect TPC-dependent detectors alignment due to the residual TPC miscalibrations
- TPC wants to change its calibration strategy: use interpolation of tracks from "perfectly" aligned ITS-TRD/TOF to TPC volume and process residuals wrt TPC clusters as distortions

⇒ Use global algorithm for simultaneous refitting of detector's alignment (and calibration) parameters and tracks (Millepede - already used for ITS and Muon standalone alignment).




- Framework will provide base classes to handle standard geometrical degrees of freedom (in AliAlignObj parameterization supporting TGeo conventions) – must be ready by beginning of Run2
- Detectors which want to implement calibration simultaneously to alignment must implement corresponding degrees of freedom (derivatives of residuals vs DOF, initial values extraction from OCDB and interpretation of fit results) – will not be fast

- Development was constantly delayed due to other priorities, now need to catch up…

# Global alignment with Millepede

- Assumption: measurement residual $\Delta F(\vec{\alpha}, \vec{p}) = \frac{dF}{d\vec{\alpha}}\,\delta\vec{\alpha} + \frac{dF}{d\vec{p}}\,\delta\vec{p}$
  where $\vec{\alpha}$ is the vector of individual track parameters
  (e.g. AliExternalTrackParam) and $\vec{p}$ is the vector of global parameters (alignment, calibration etc)

## Track Model:

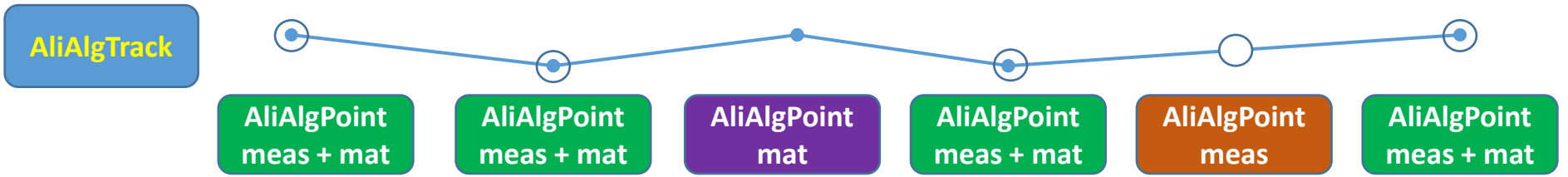
- Alice's Kalman track is not directly applicable to Millepede: defines parameters only locally while alignment needs derivatives of residuals at different points wrt parameters at well defined point
- Still, preferable to use the same (AliExternalTrackParam) model as for tracking, to have the same propagation systematics

→ **AliAlgPoint** :

- tracking frame definition, measurement in tracking frame, integrated material info (x/X0, xρ)

→ **AliAlgTrack** :

- Array of AliAlgPoint objects with either measurement or material or both
- AliExternalTrackParam – usual parameters defined at fixed X,α, first estimate is obtained by usual Kalman inward refit (to be added 2 legs smoothing in case of cosmics)
- 2 free MS parameters per point containing material (+1 for E.loss – not tested)
- Methods to calculate residuals and numerical derivatives at every point with measurment



# Global alignment with Millepede

Provided by framework
Alignable volume
Volume with measurement
Full detector (root of hierarchy)

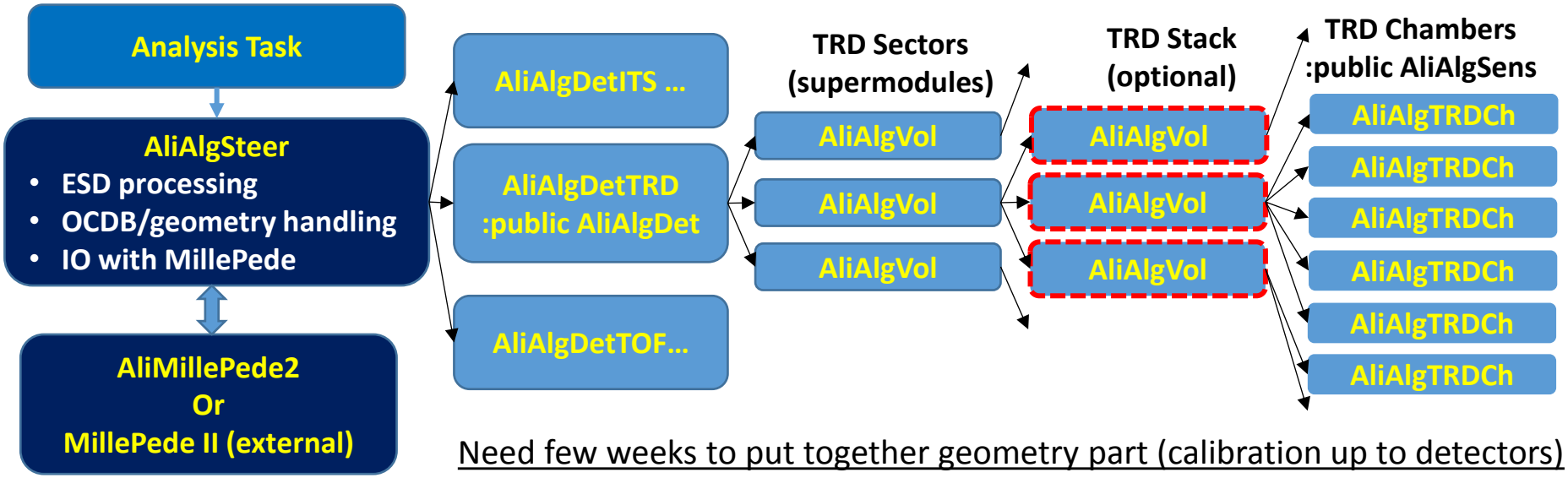
**AliAlgVol**
- **Local2Global matrix**
- *** Parent AliAlgVol**
- Alignment DOFs:
  - **Local Δ: [x,y,z,φ,θ,ψ] (local Euler angles)**
  or
  - **Global Δ: [X,Y,Z, Φ,Θ,Ψ] (Euler angles wrt origin)**

**AliAlgDet: public AliAlgVol**
- **Methods for**
  - **undoing/applying detector calib.**
  - **interpreting/writing minimization results**

**AliAlgSens : public AliAlgVol**
- **Tracking2Local matrix**
- **Methods for**
  - **derivatives vs its own and parents DOF's**
  - **AliTrackPoints (friends) → AliAlgPoints conversion**

Implemented for each detector

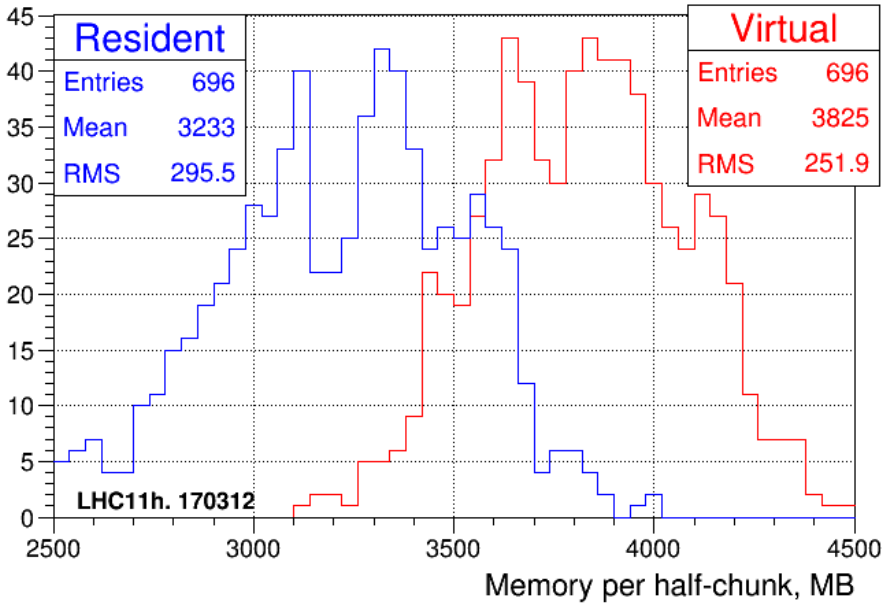
- Calibration DOF's (may be time/run dependent) and their derivatives calculation
- Methods to cook matrices (if needed)
- Methods to interpret results

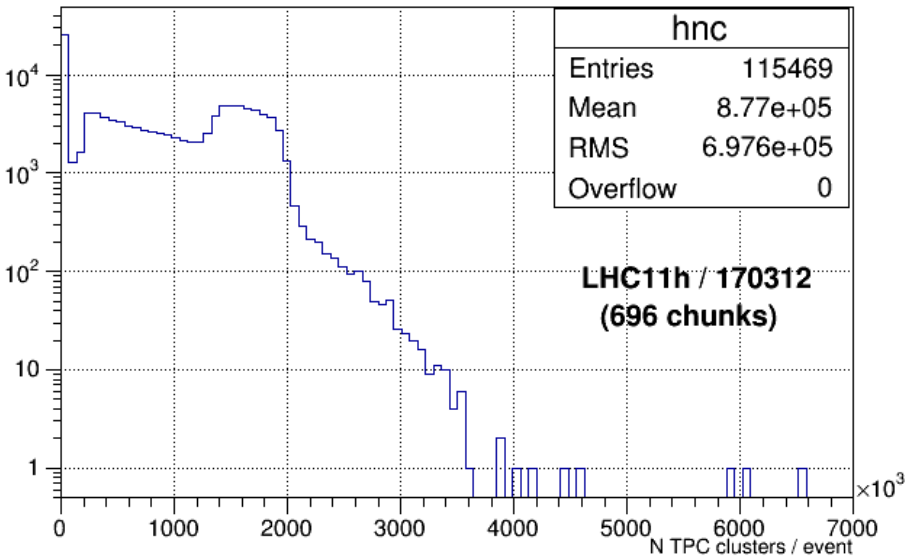



Need few weeks to put together geometry part (calibration up to detectors)

# Memory consumption in PbPb

Example of LHC11h (run 170312, 696 half-chunks checked)




Main consumer: TPC clusters

1 TClonesArray for TPC clusters per pad-row (max 2500 clustesr/padrow)

→ asymptotically will reach 14.3M clusters once all arrays expanded to maximum

→ 80 Bytes/cluster → 1.1 GB

At least 20 Bytes per cluster are redundant (debug info pointer, Bool_t vs bit …) but modification will be backward incpompatible

Need to implement less greedy container

# Dormant tasks

- TPC related (collected under JIRA ATO-19):
  - PWGPP-55: Improving TPC/ITS matching efficiency and its systematic error (seeding TPC by standalone ITS tracks)
  - PWGPP-56: Improving double track resolution
  - PWGPP-71: Filtering of outlier HM events – handling of laser triggers (?)

- Including TRD in tracking (Jira PWG-PP-1):
  - Coding part done, blocked by global alignment + TPC calibration

- ITS related:
  - ALIROOT-2493 Global tracking forces some pairs of tracks to have almost the same momentum: test production (PbPb) with 2 alternative patches is still pending.