

Overview of reconstruction activities

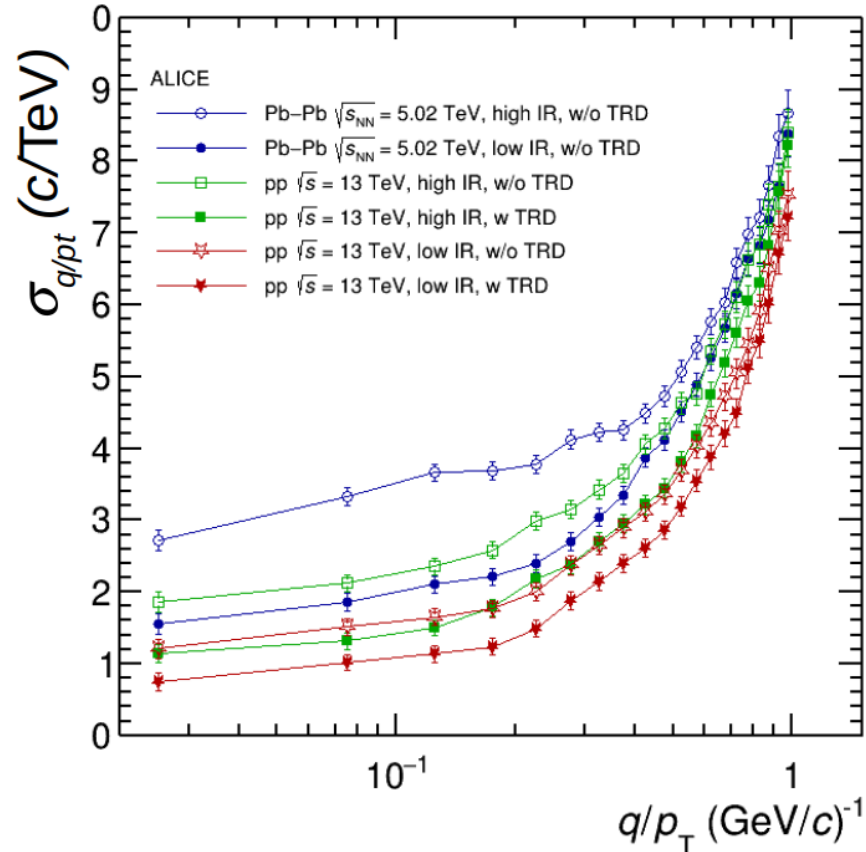
Run2

TRD in track update

(see talk by M.Ivanov)

Validated in pp (LHC15n) by Marian, before adding to official reconstruction in pp one more validation on high-Pt rich data will following analysis to be done (DPG,BTG+EMCal)

Still to be validated in PbPb



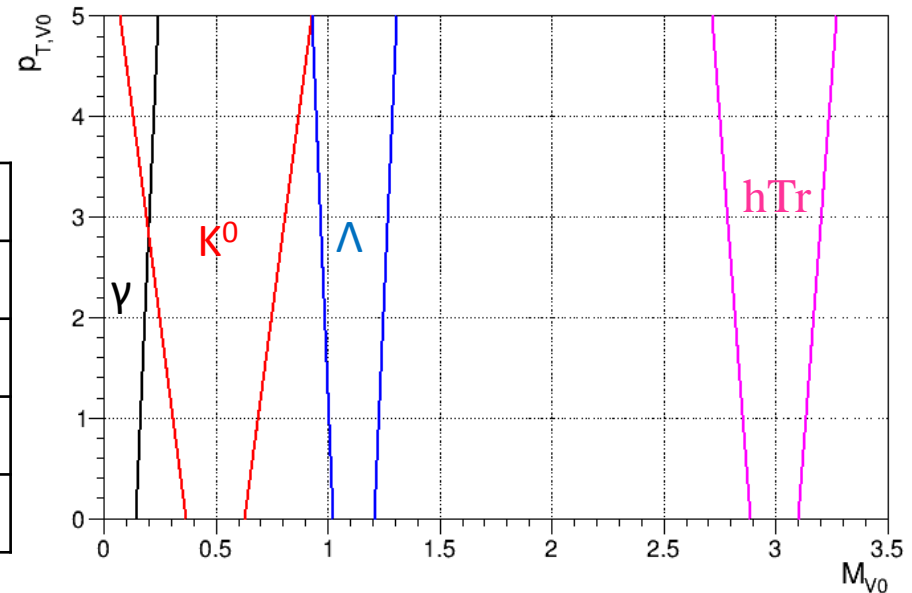
ESD/AOD size reduction

VO's

- Eliminate VO's not used in any cascade if $|\eta| > 1$ or none of hypotheses is satisfied:

$$|M_{V0} - M_{PDG}| < \Delta(p_T)$$

VO	$\Delta(p_T)$
γ	$20 \times 0.001 \times (1+p_T) + 0.12$
K^0	$20 \times 0.003 \times (1+p_T) + 0.07$
$\Lambda(\bar{\Lambda})$	$20 \times 0.001 \times (1+p_T) + 0.07$
Hyper $Tr(\bar{Tr})$	$14 \times 0.0025 \times (1+p_T) + 0.07$



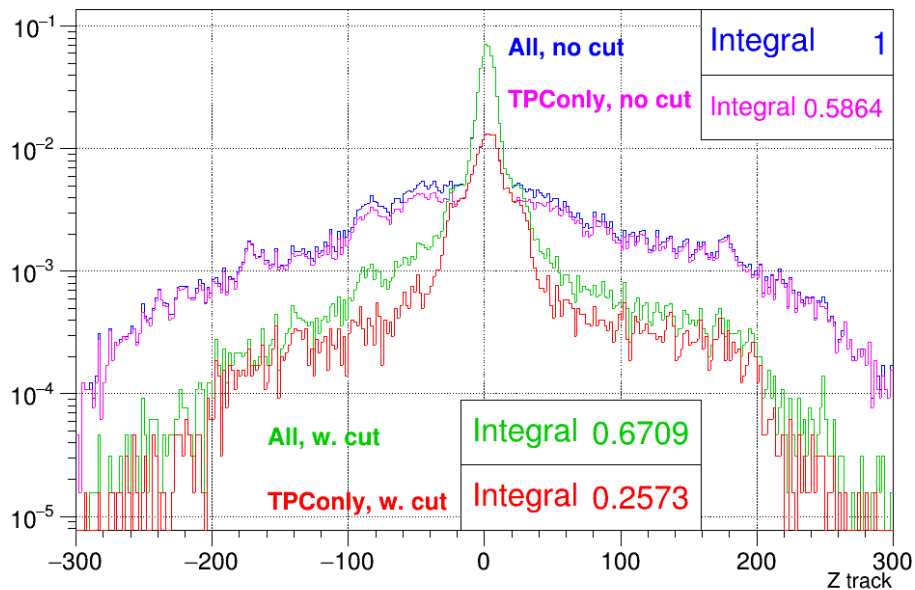
- For “Offline VO's” only: fill prong's AliExternalTrackParameter (except fX) with 0 to profit from better compression. Redundant information is automatically recovered in AliESDEvent::ConnectTracks (called by ESD Input Handler)

Tracks

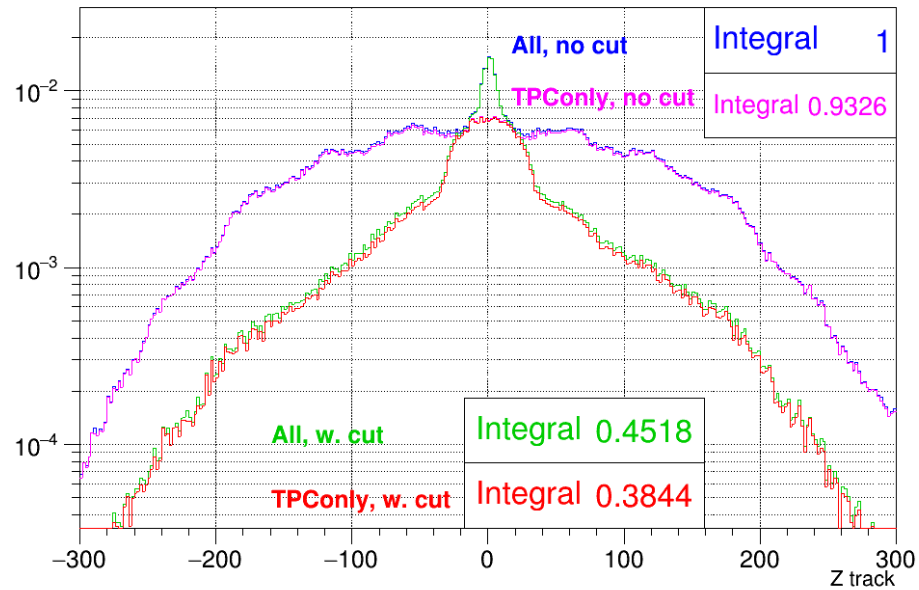
- Eliminate TPCOnly ESDTracks $!(fFlags \& (kITSin | kTRDrefit | kTOFout | kHMPIDout))$ and $|DCA_z| > 30$ if not used by any VO or matched to Calo cluster or in PHOS projection
- Eliminate ESDKinks if both legs are to be eliminated (bug fix: there were many kinks with leg index = -10)

Tracks before / after new CleanESD

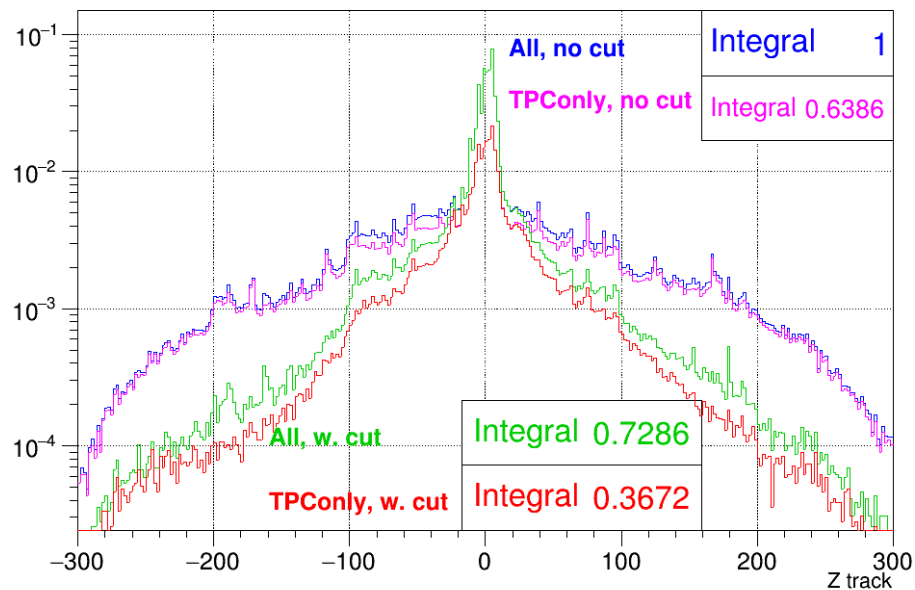
pp LHC17c, 270581, 1.5kHz



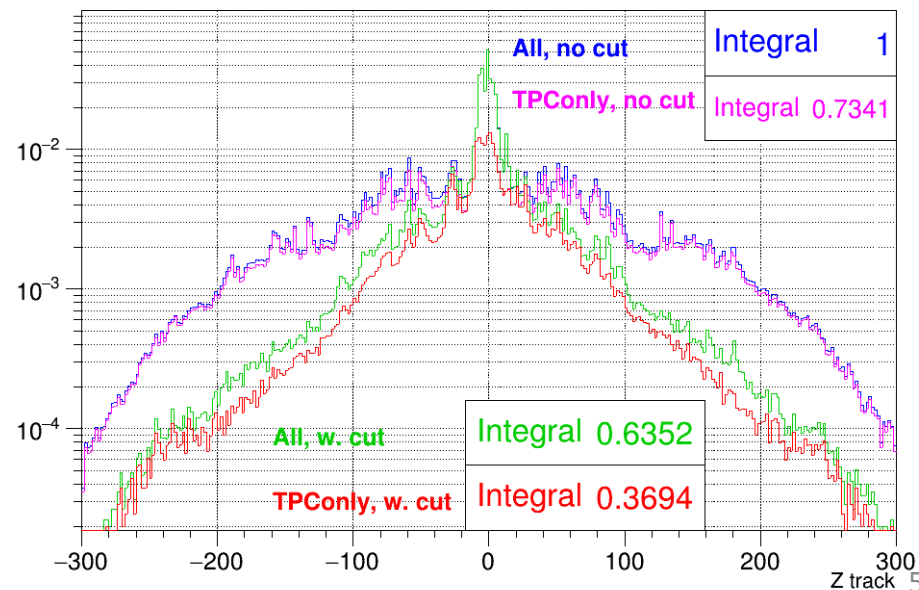
pp LHC17h 272411, 200 kHz



PbPb LHC15o, 245793, 2kHz



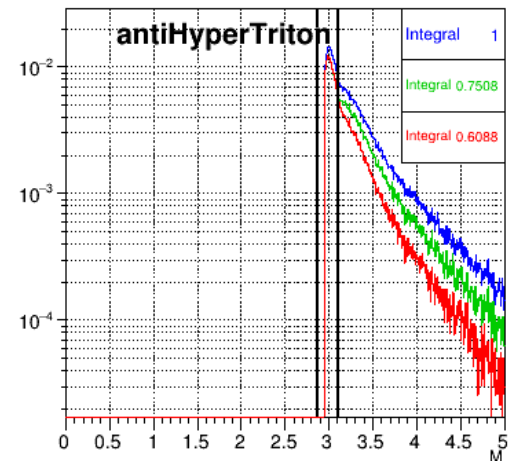
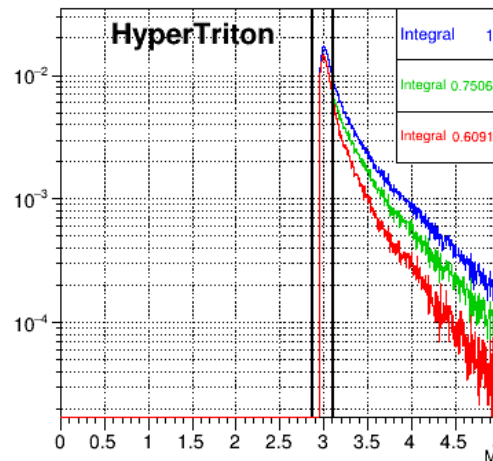
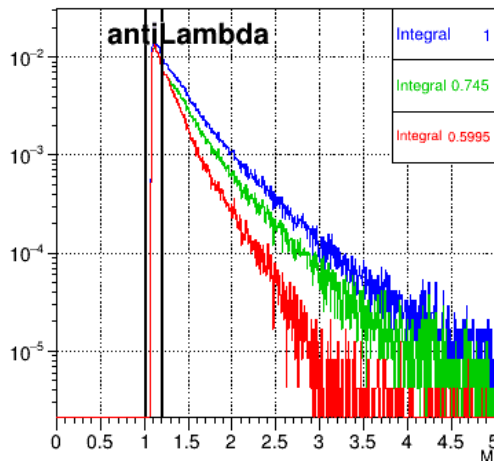
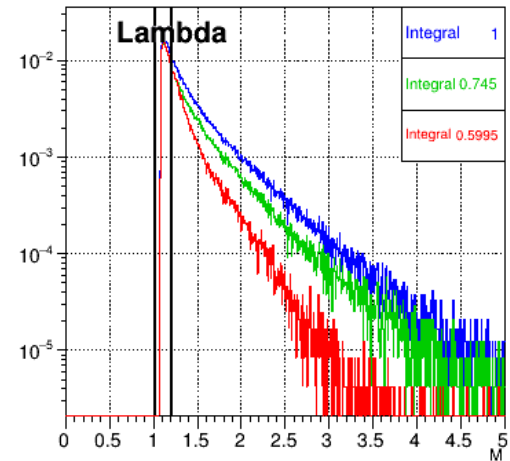
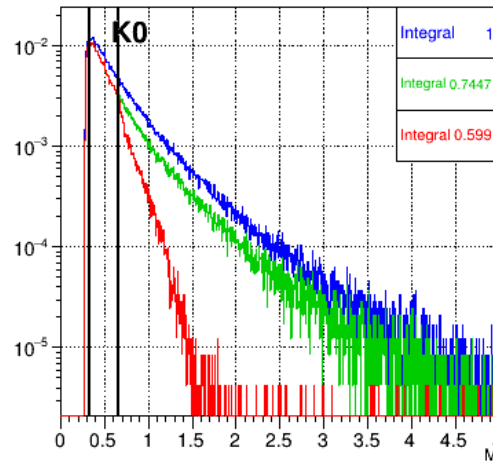
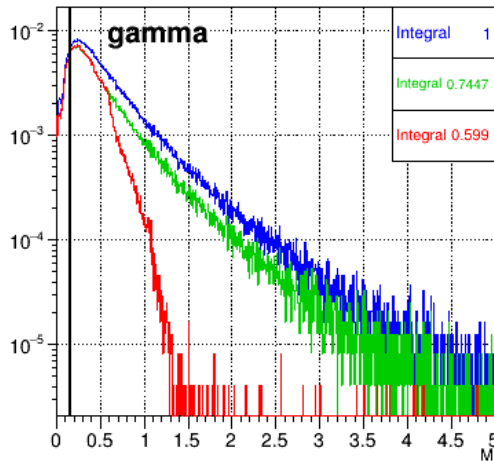
PbPb LHC15o, 246750, 7.7kHz



V0s before / after new AliESDEvent::CleanV0 (same but with different mass hypotheses)

Mass hypotheses cut for Offline V0's is applied in the V0Vertexer,
for On-Fly V0s: in CleanV0 (as well as η cut for both)

pp LHC17h 272441, 200 kHz (other systems in backup)



Final reduction

All cuts are steered by settings in AliGRPRecoParam
(see github.com/shahor02/AlRoot/blob/dev_esdcomp/GRP/MakeGRPRecoParam.C)

Larger reduction factors are possible with tighter cuts on V0s and TPConly tracks

ESD	pp 1.5kHz	pp 200kHz	PbPb 2kHz	PbPb 7.7kHz
V0s (size new/old)	0.43	0.25	0.45	0.45
V0s OnFly/Total	0.33	0.17	0.59	0.57
Tracks (size new/old)	0.76	0.48	0.79	0.69
Total (size new/old)	0.86	0.50	0.67	0.62
AOD				
Total (size new/old)	0.99	0.85	0.80	0.77

Run3

Overview of core components

ITS

- Tracking
 - Two trackers: CookedTracking (Y.Belikov) and CA (in validation, M.Puccio).
 - Both at the moment are configured to reconstruct primary tracks with vertex constraints and both require hit at every layer (configuration extra passes for CA tracker is in preparation)
- Tracklet vertexing
 - Recent PR (M.Concas, M.Puccio), provides input for trackers, in validation
 - “ideal” vertex (Y.Belikov) to fetch MC vertex as reconstructed one
- Clusterization / data compression
 - Need to implement elimination of repetitive hits in the same pixel (and implement their generation in MC: waiting for information from ITS)
 - The toolkit for cluster pattern -> pattern(s group) ID is ready (L.Barioglio) but needs to be optimized for short clusters (avoid hash calculation), in progress
 - Need to implement cluster -> ID conversion in the cluster-finder and implement compression chain

TPC

(see [talk](#) by D.Rohr)

- In general, quite advanced and shows good benchmarks (~18 s per TF with GPU)
Recent tag of O2HLTCATracking makes HLT tracking resolutions similar to offline
(with better efficiency for low p_T 's)
- Missing:
 - Track merging merging across the CE
 - Loopers legs merging
 - dE/dX calculation (fast prototype exists, also for GPU)
 - Corrections container to test reconstruction with realistic distortions
 - Clusters track based compression (prototyped)
 - Low p_T (<10 MeV) loopers finding: prospects still not clear
- Distortions calibration:
 - Residuals based calibration, cannot progress w/o TRD reconstruction
(which in turn depends on TRD simulation)
 - Calibration with readout currents: S.Gorbunov will start work on this topic

TPC-ITS matching

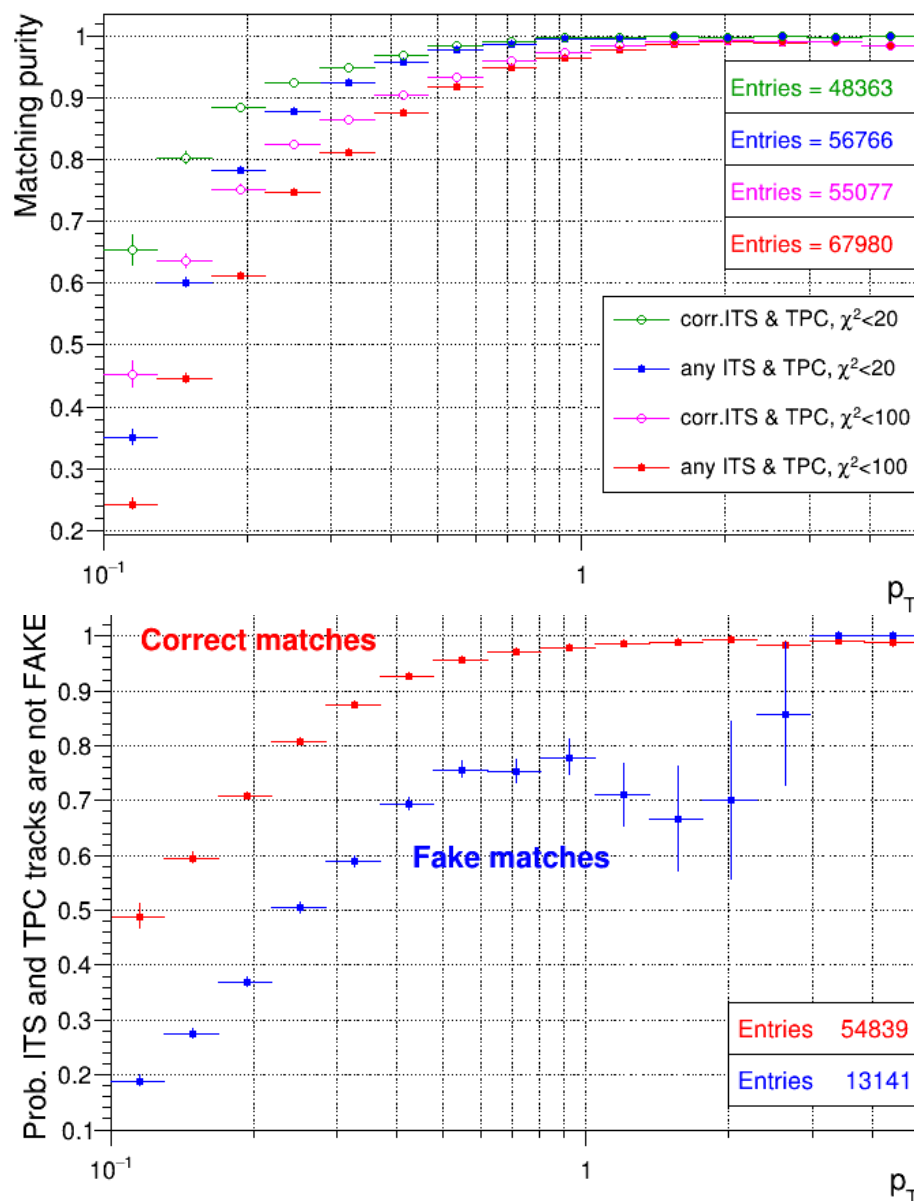
- Matching of tracks from independent TPC and ITS tracking is ready, full simulation reconstruction cycle is steered by `O2/macro/runSimRecMatchITSTPC.sh` script
- Current benchmarks (i7-7600U, 2.80GHz):
 - 20 PbPb events/s (w/o material budget calculations)
 - 1.5 PbPb events/s with TGeometry material budget extraction (fast material budget lookup object is in preparation, should make material query overhead negligible)Sufficient both for synchronous and asynchronous processing stages
- At the moment was tested only in continuous readout mode, with 53 min.bias PbPb Hijing events @ 50 kHz
Reconfiguring for triggered or mixed readout mode is not done yet but is trivial: need just to change the track time assignment in TPC and ITS
- Still to do: afterburner for TPC-track matching to ITS clusters whose (short) tracks cannot be found
(after removal of clusters from matched ITS tracks)

(Outline of the algorithm is in the back up)

TPC-ITS matching performance

- Test with “CookedTracker”, to be tested with CA tracker
- Significant amount of fake matches at $p_T < 1$ GeV
 - Partially due to the unbalanced errors: need to apply loose χ^2 cut (current $\langle \chi^2_{\text{match}} \rangle \sim 6.7$ instead of 4)
 - Most of fake matches involve fake (negative track ID) ITS or TPC (rarely) tracks
 - Fakes should have significant contribution from looper’s legs (to be checked with MC truth)
 - Time bracketing of TPC track was done with ± 8 μs safety margin due to problems in TPC tracks Z (hence t_0) definition (must converge to $Z=0$ by construction while it is not, was partially fixed in 12/03/17 tag)

[O2HLTCATracking tag from Monday 12/03/17](#)
[purity by 4%, reflected on these plots.](#)



TRD

(see [presentation](#) by O. Schmidt)

- Reconstruction with TRD tracklets within AliRoot/HLT code is in good shape, to be commissioned in HLT with raw data.
- Porting to O2 makes sense only after simulation is working.

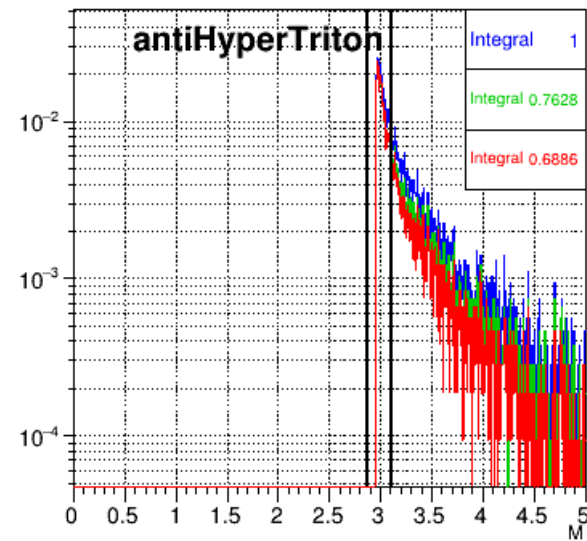
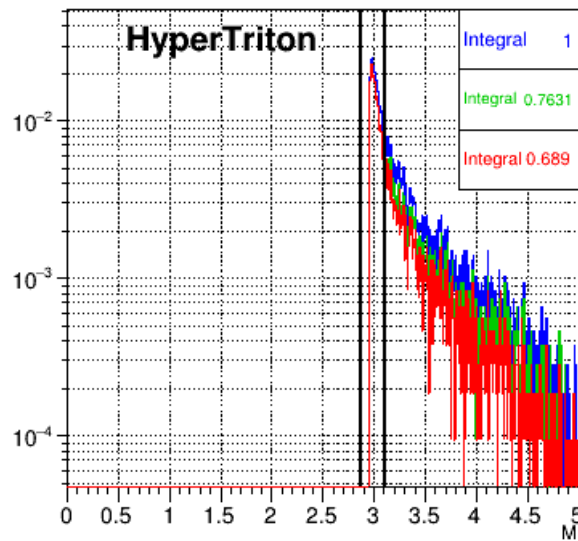
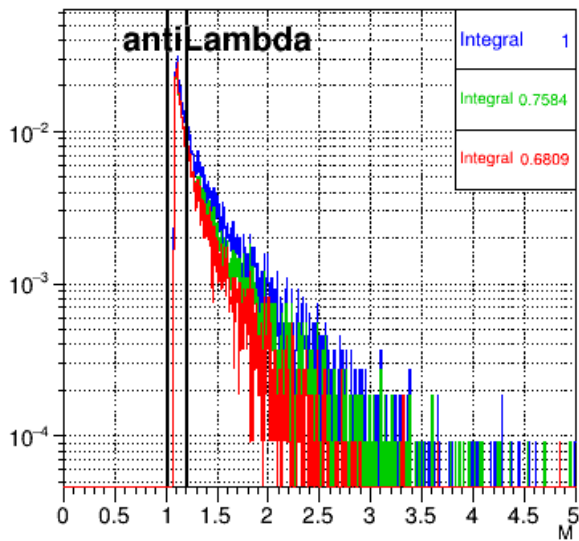
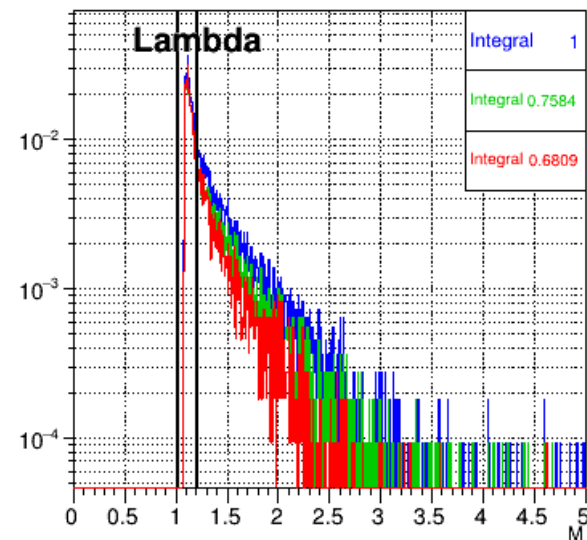
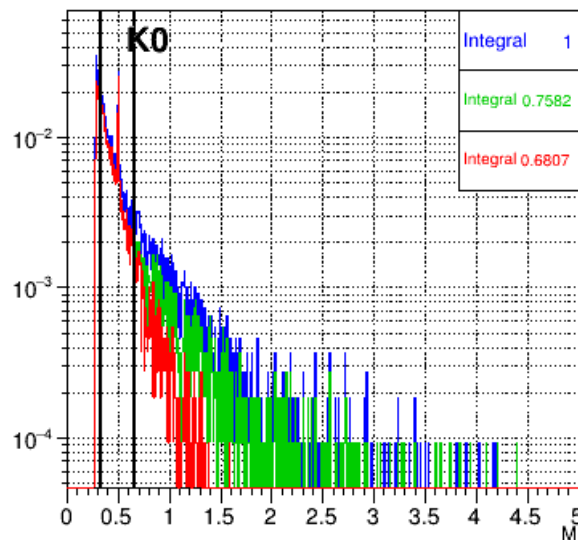
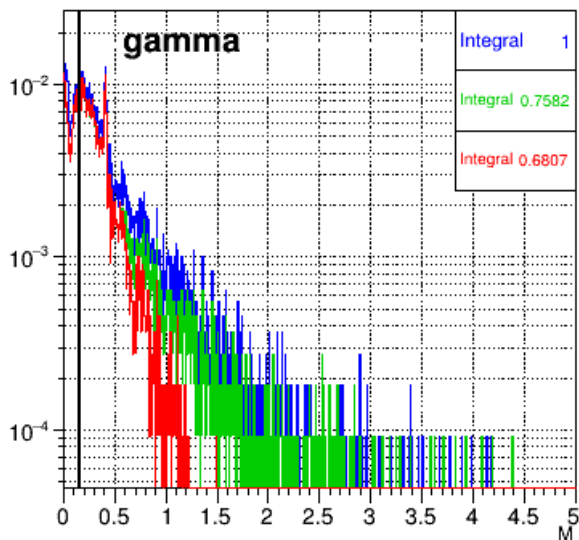
MFT

- Starts porting code from AliRoot

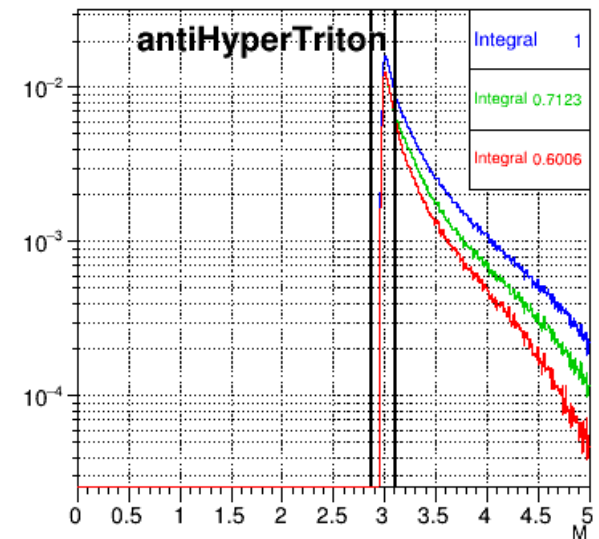
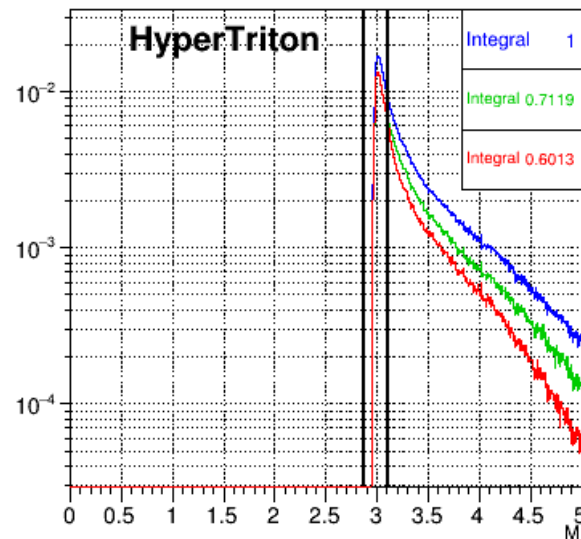
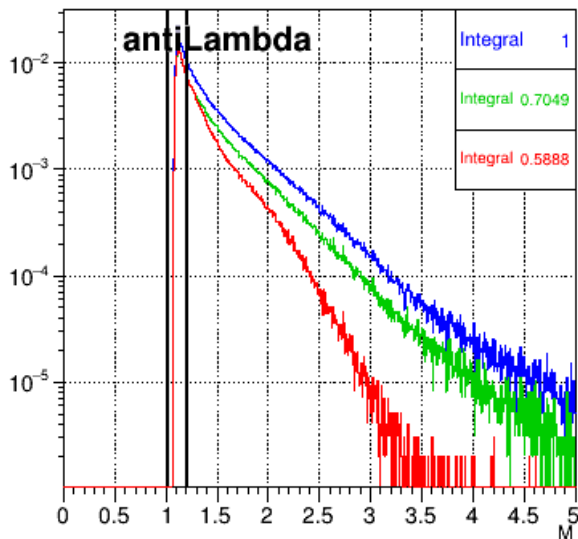
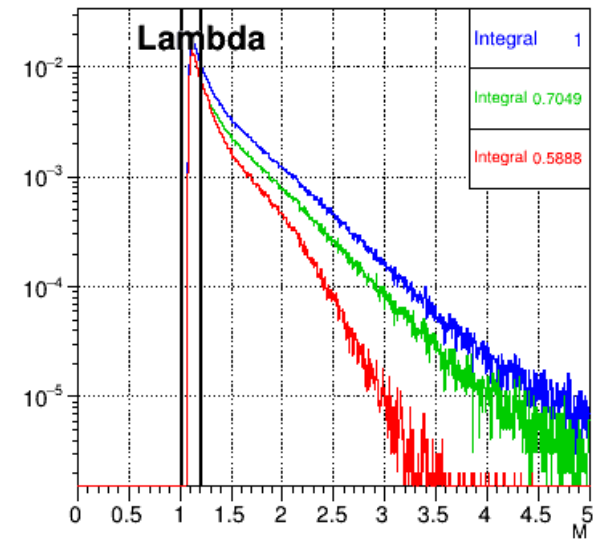
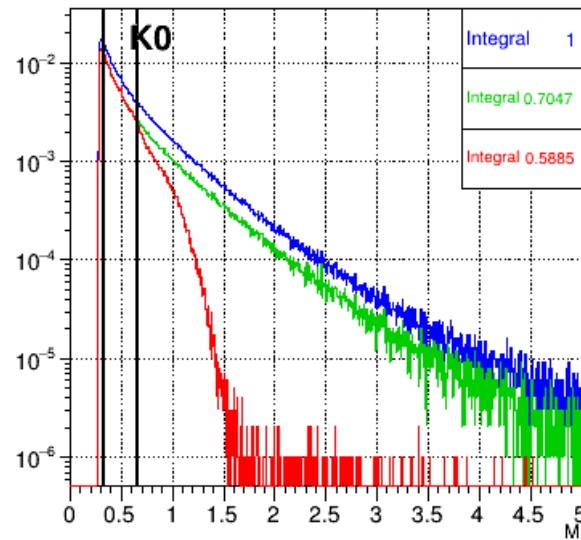
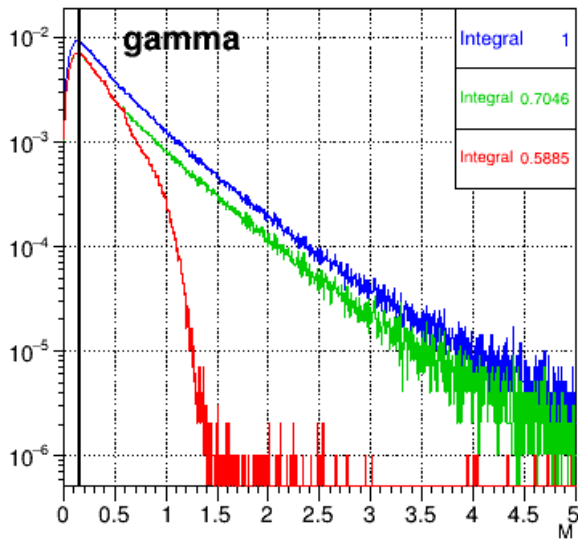
Other detectors

- Nothing at the moment

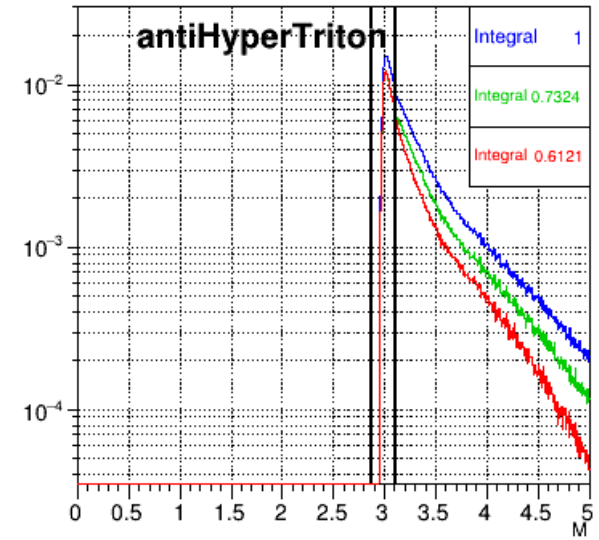
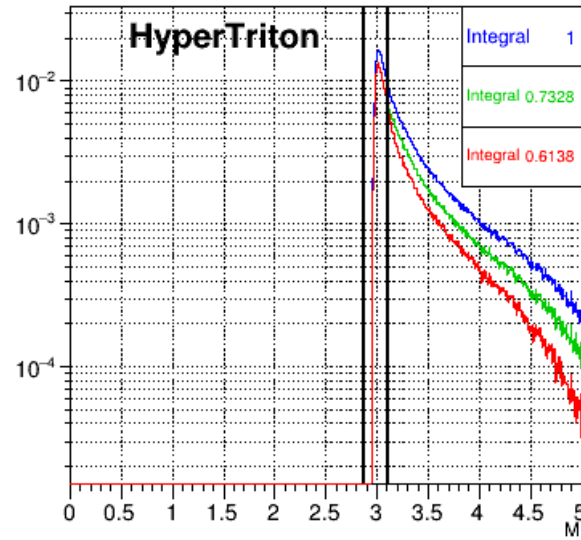
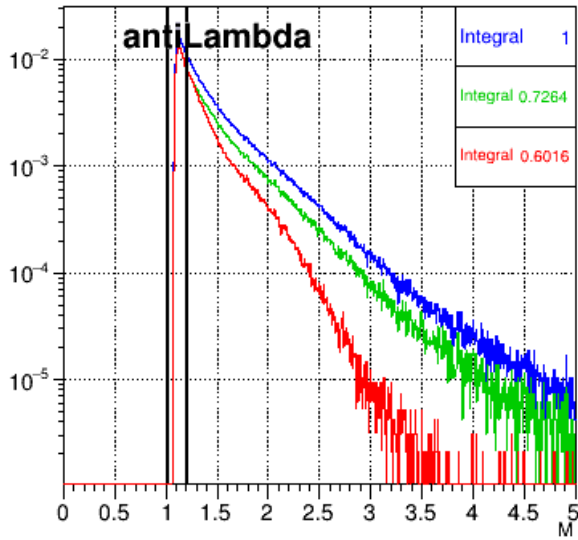
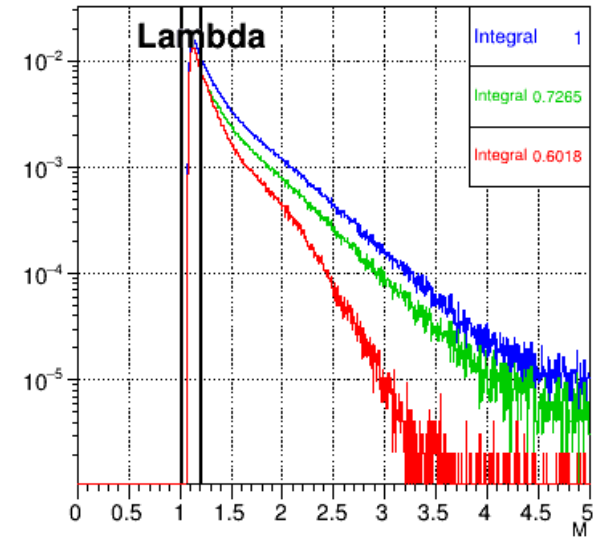
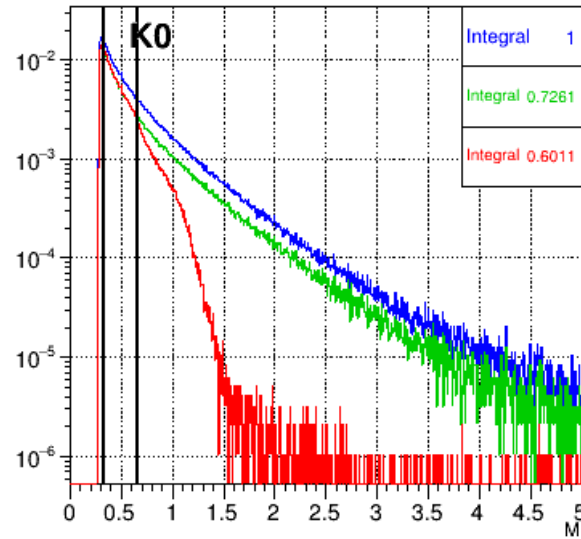
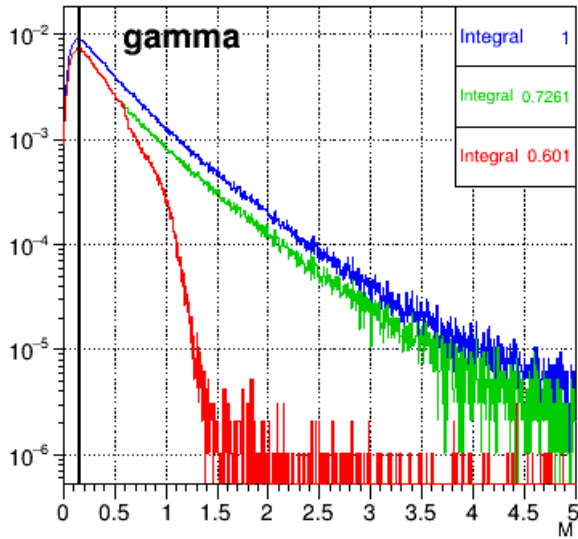
V0s reduction: pp LHC17c 270581, 1.5 kHz



V0s reduction, PbPb LHC15o, 245793, 2kHz



V0s reduction, PbPb LHC15o, 246750, 7.7kHz



Matching algorithm outline

Within TPC reconstruction

- TPC tracks are shifted in Z to converge to Z=0, track emission time t_0 estimated from used clusters time-bins + drift-time from assigned Z
- Time bracket t_{\min} and t_{\max} is assigned in such a way that within this time the track does not change the TPC side (the clusters come from)
- Tracks are supplied in one large vector<TrackTPC>

Within ITS reconstruction

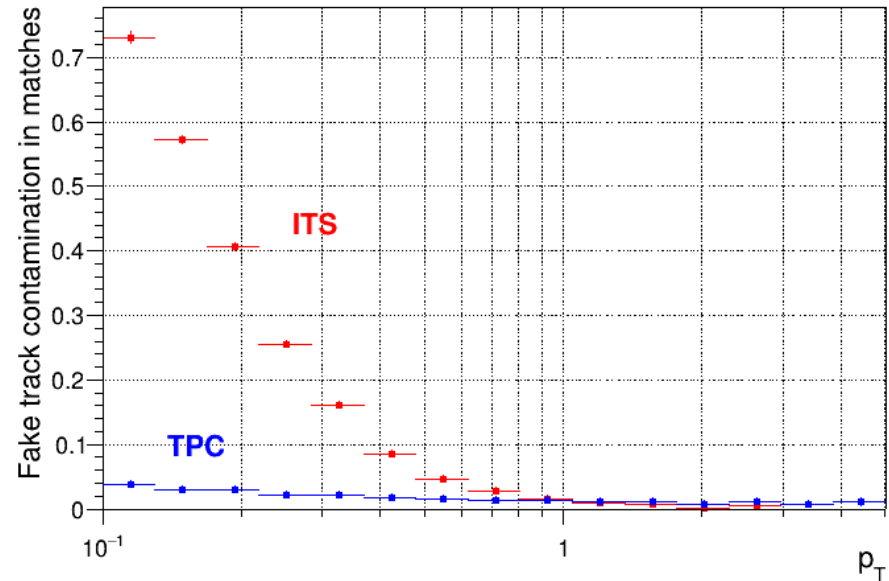
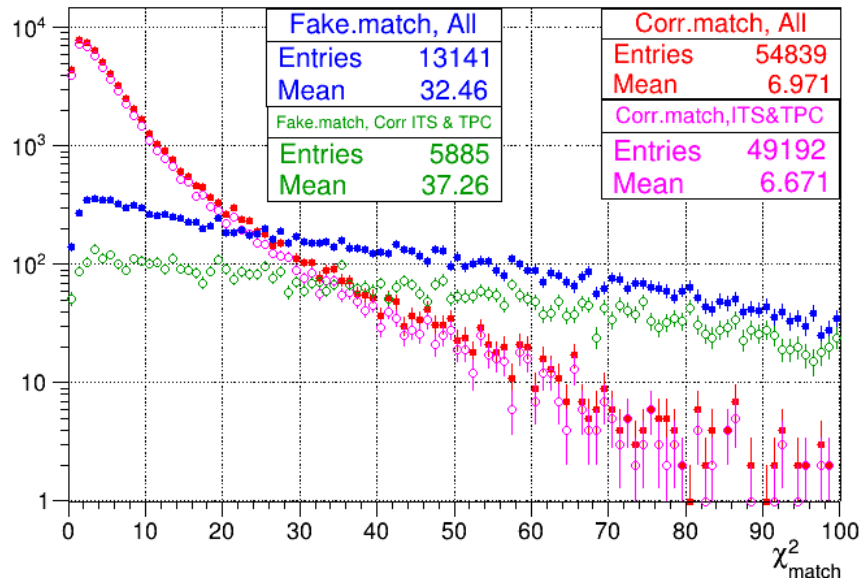
- PropagateBack param is created for every track (with material corrections)
- Tracks are supplied in arbitrary packaging (currently driven by FairRunAna)

Matching

- TPC tracks propagated to reference X, clones are filled in pools per sector, within each pool sorted by time then by $tg(\lambda)$
- Similar pools are created for ITS PropagateBack params, with ITS ROFrame converted to TPC time. For tracks close to the sector edge a copy is added to neighbouring sector pool
- For each sector: loop over TPC tracks. Pick ITS tracks with time compatible with TPC track, compare parameters difference, then pulls, if rough checks passed, calculate χ^2 between tracks (reject or stop the loop ASAP using ordering in time and $tg(\lambda)$). Store validated ITS candidates for each TPC track sorted in matching χ^2
- Select winner candidates pairs as those having best mutual χ^2 , load ITS clusters, RefitInward in ITS, assign improved track time and its error.
- Matches are stored sorted in ITS ROFrame in a single vector<TrackTPCITS>, containing refitted kinematics and `o2::dataformats::EvIndex` references on used ITS and TPC tracks

TPC-ITS matching performance

- With 4 DOFs (no Z in continuous mode!) the expected $\langle \chi^2 \rangle$ is 4 instead we see ~ 6.7 for matches with both TPC and ITS track correct



- Most of fake tracks coming from ITS (to be tested with CA tracker)