ALICE data flow

Data Preparation Group

Analysis Tutorial

29 November 2018

Outline

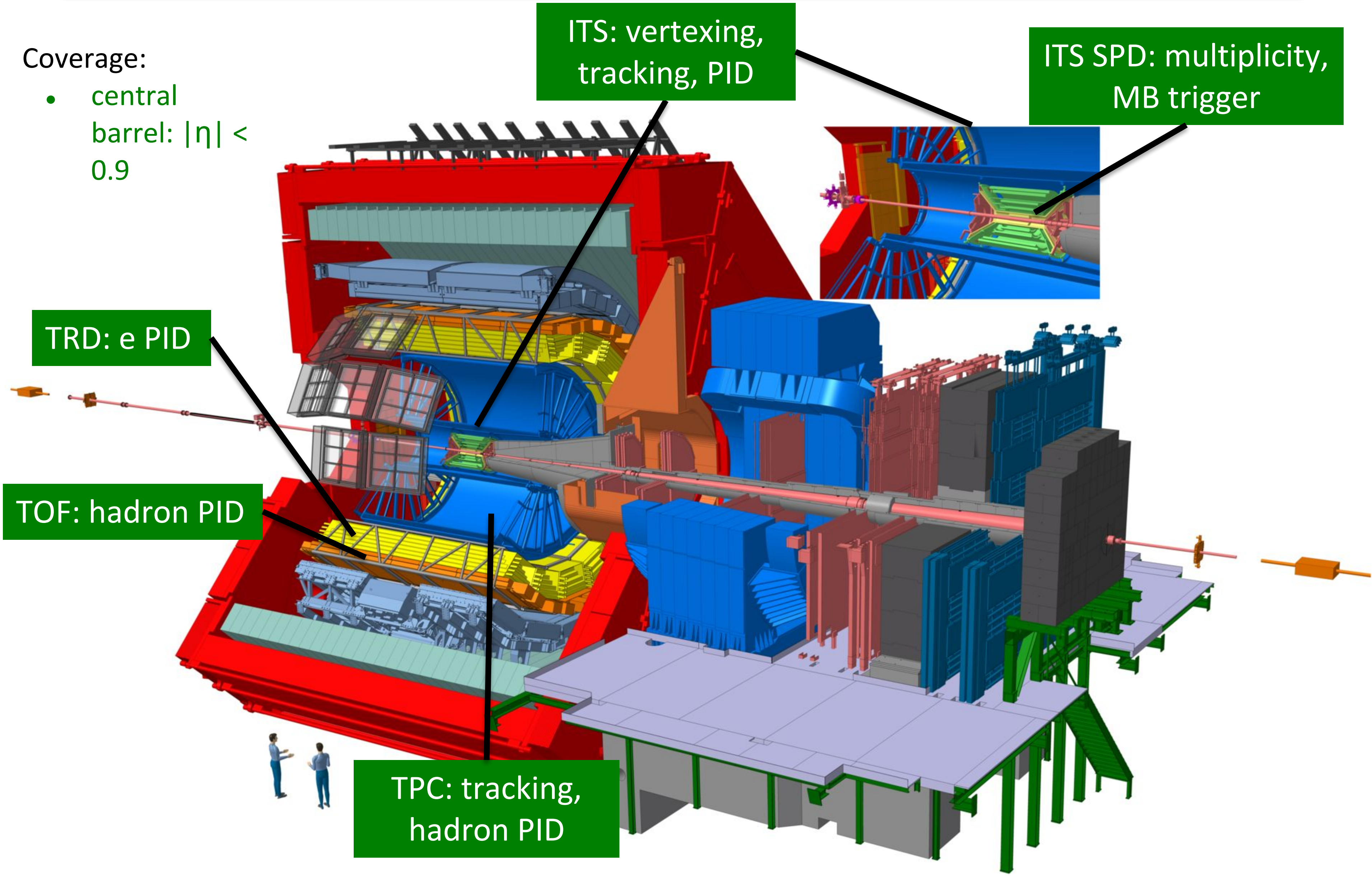
- Reconstruction steps **from raw data to ESDs**
  - Track, primary vertex, decay vertices
- **Calibration and CDB**
  - Online and offline calibration, reconstruction passes
- **Monte Carlo simulation** chain
- **ESD and AOD**
  - ESD and AOD contents, ESD->AOD filtering
- **Event properties and selection**
  - Physics selection, pileup rejection, centrality determination
- **Track properties and selection**
  - Track cuts (ESD vs. AOD), TPC-ITS matching efficiency, …

The ALICE detector

More details during the talk

Coverage:

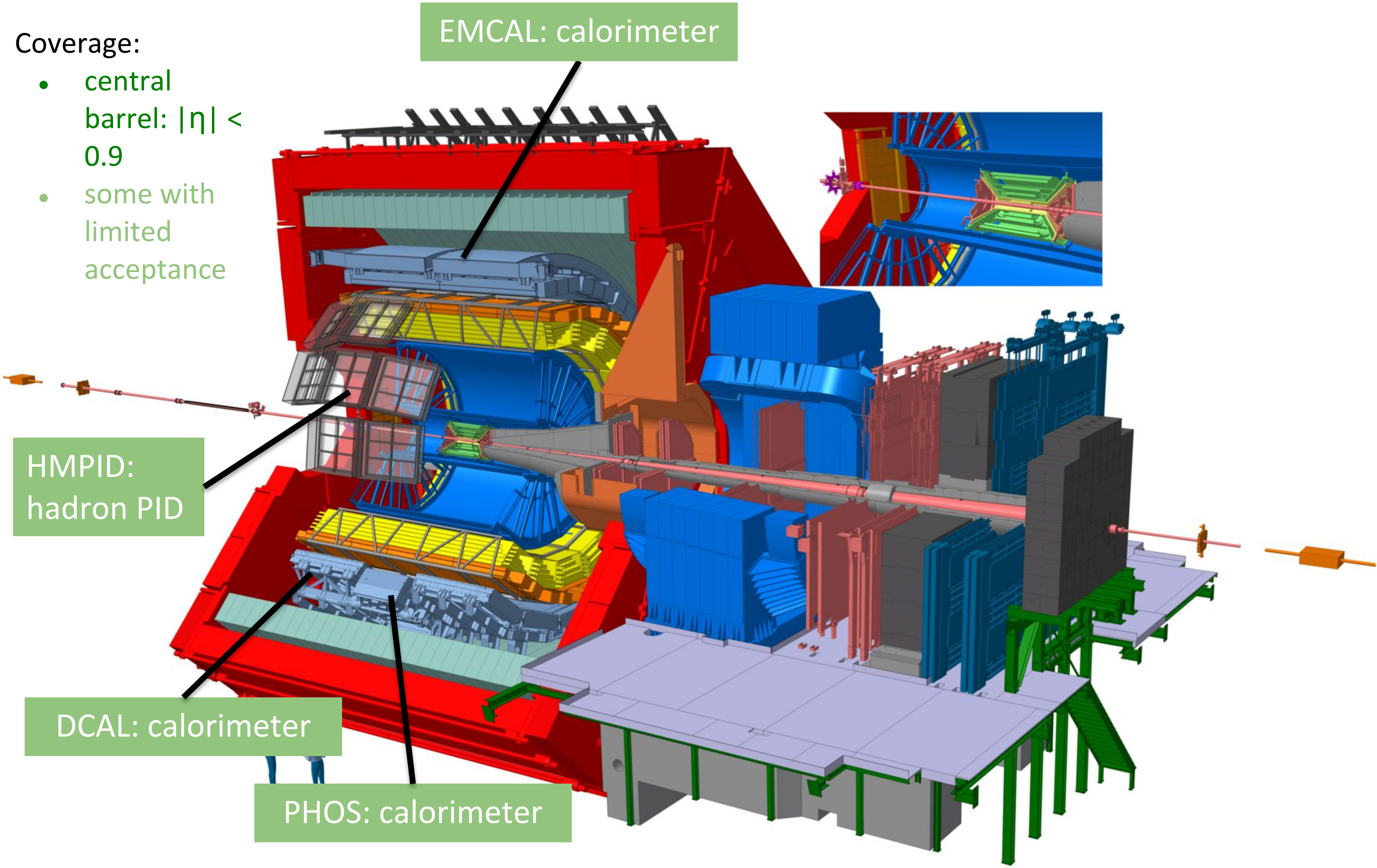
- central barrel: |η| < 0.9



The ALICE detector

Coverage:

- central barrel: $|\eta| < 0.9$
- some with limited acceptance

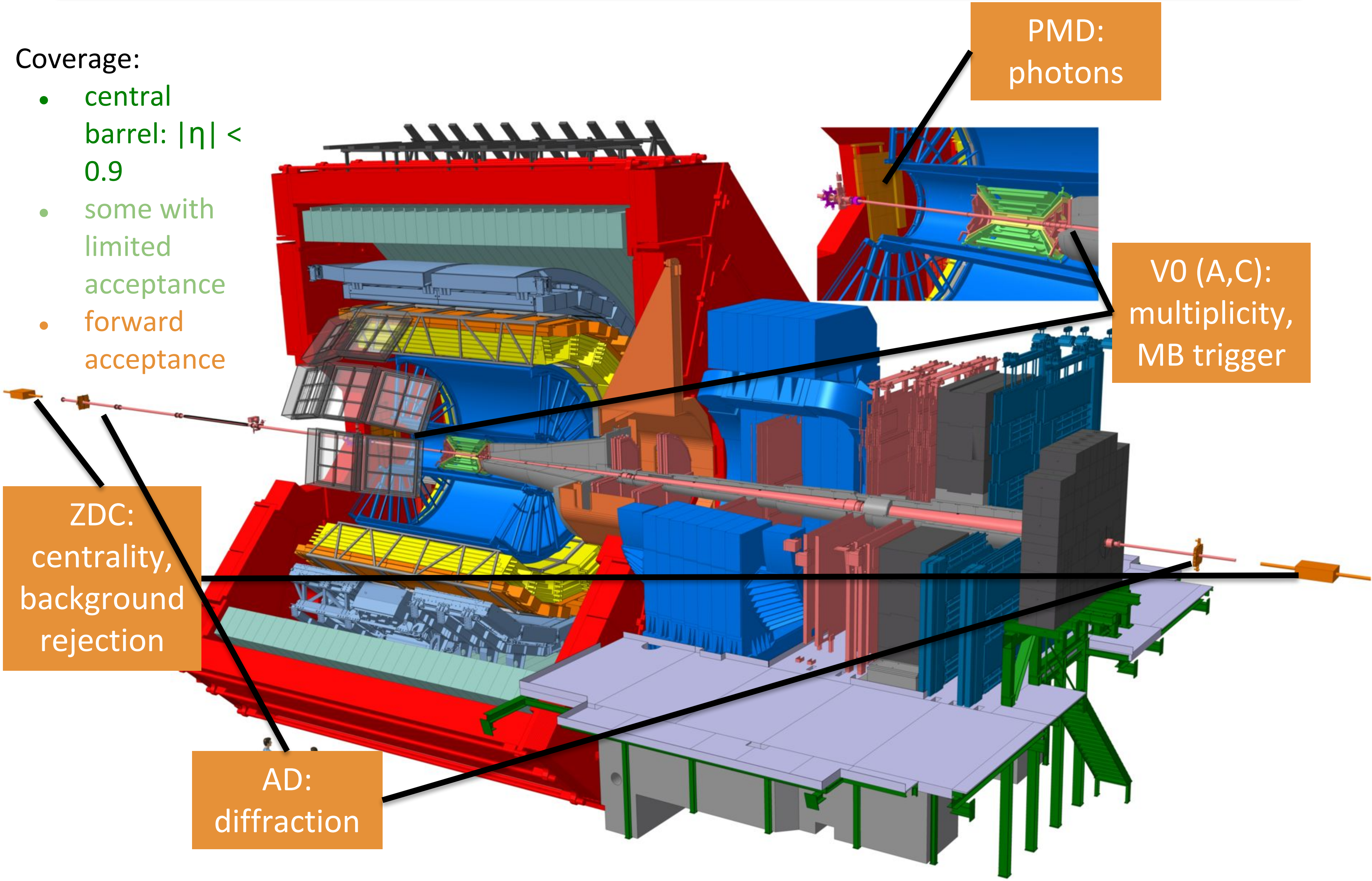


The ALICE detector

More details during the talk

Coverage:

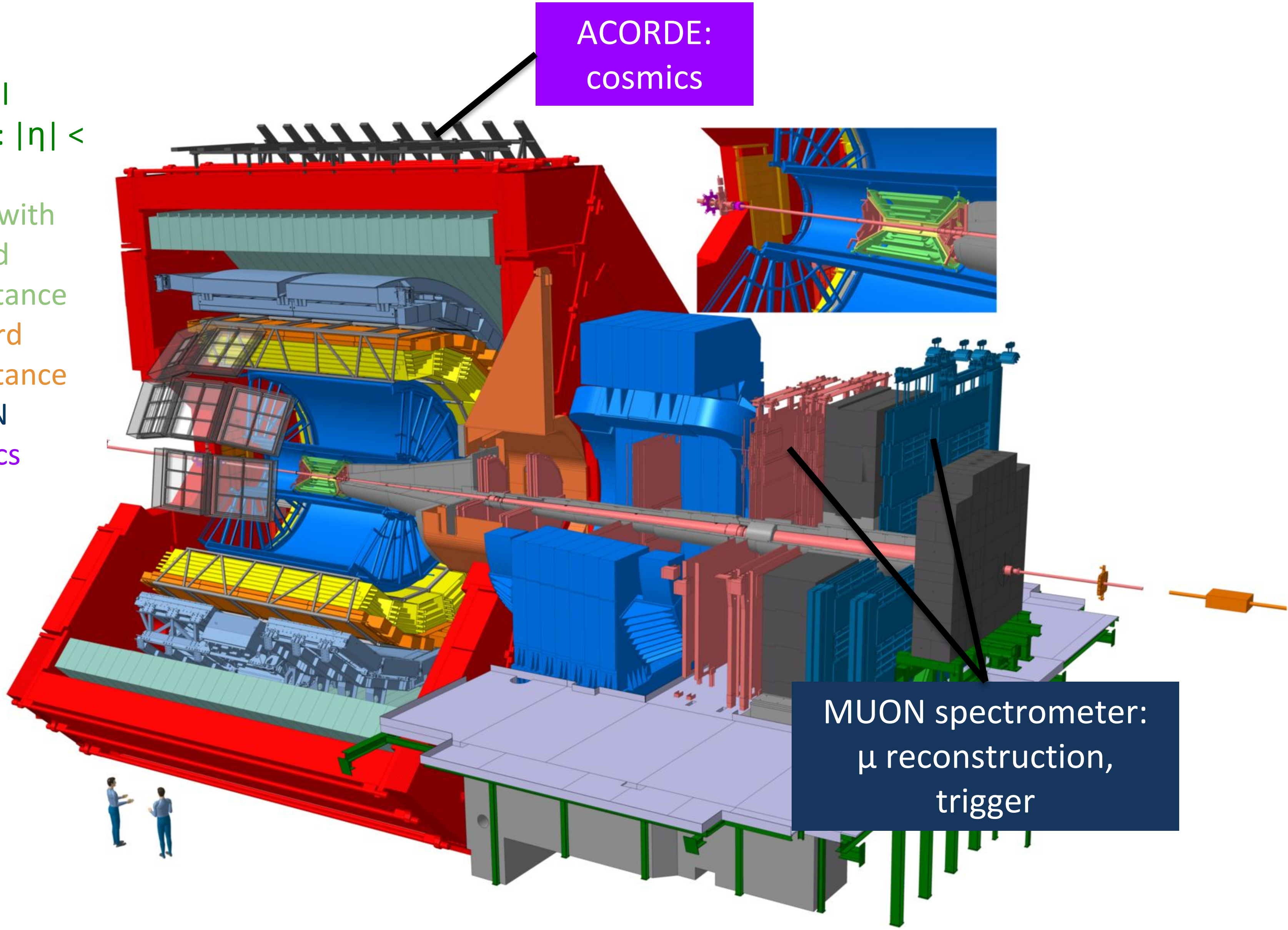
- central barrel: $|\eta| < 0.9$
- some with limited acceptance
- forward acceptance



The ALICE detector

Coverage:

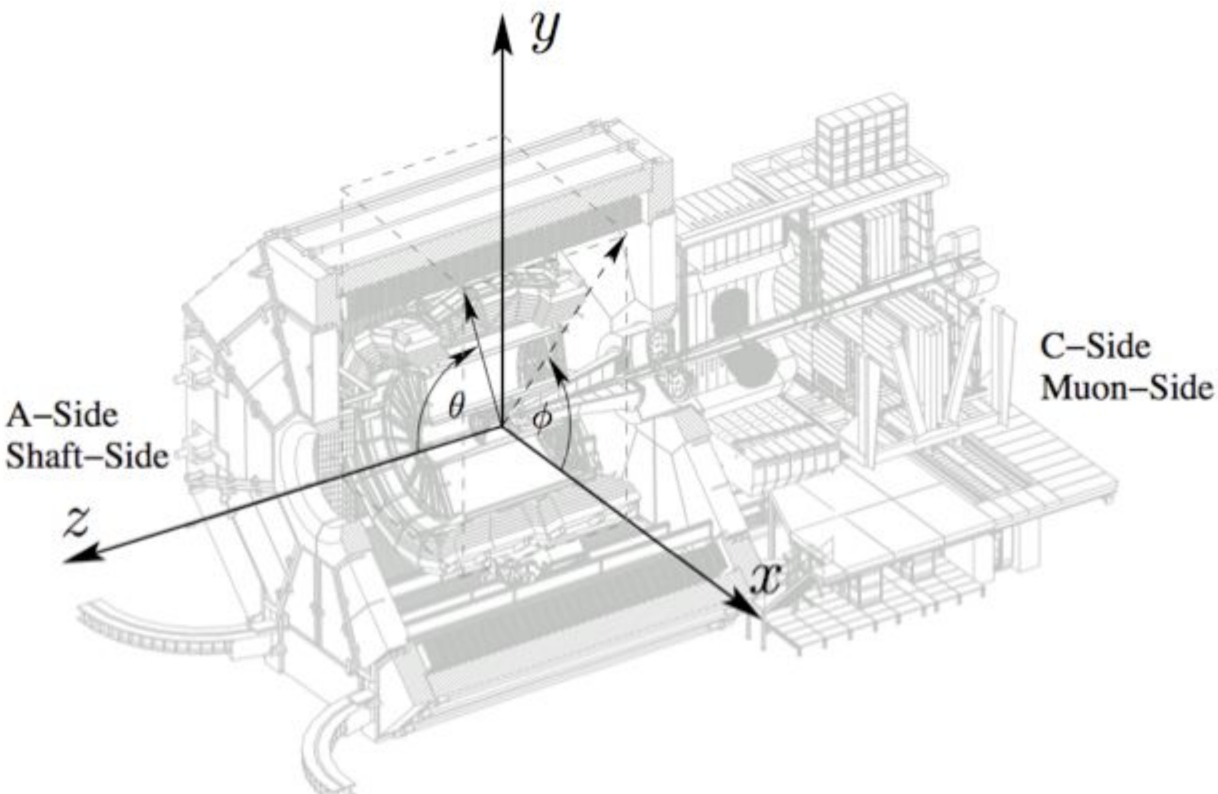
- central barrel: $|\eta| < 0.9$
- some with limited acceptance
- forward acceptance
- MUON
- cosmics



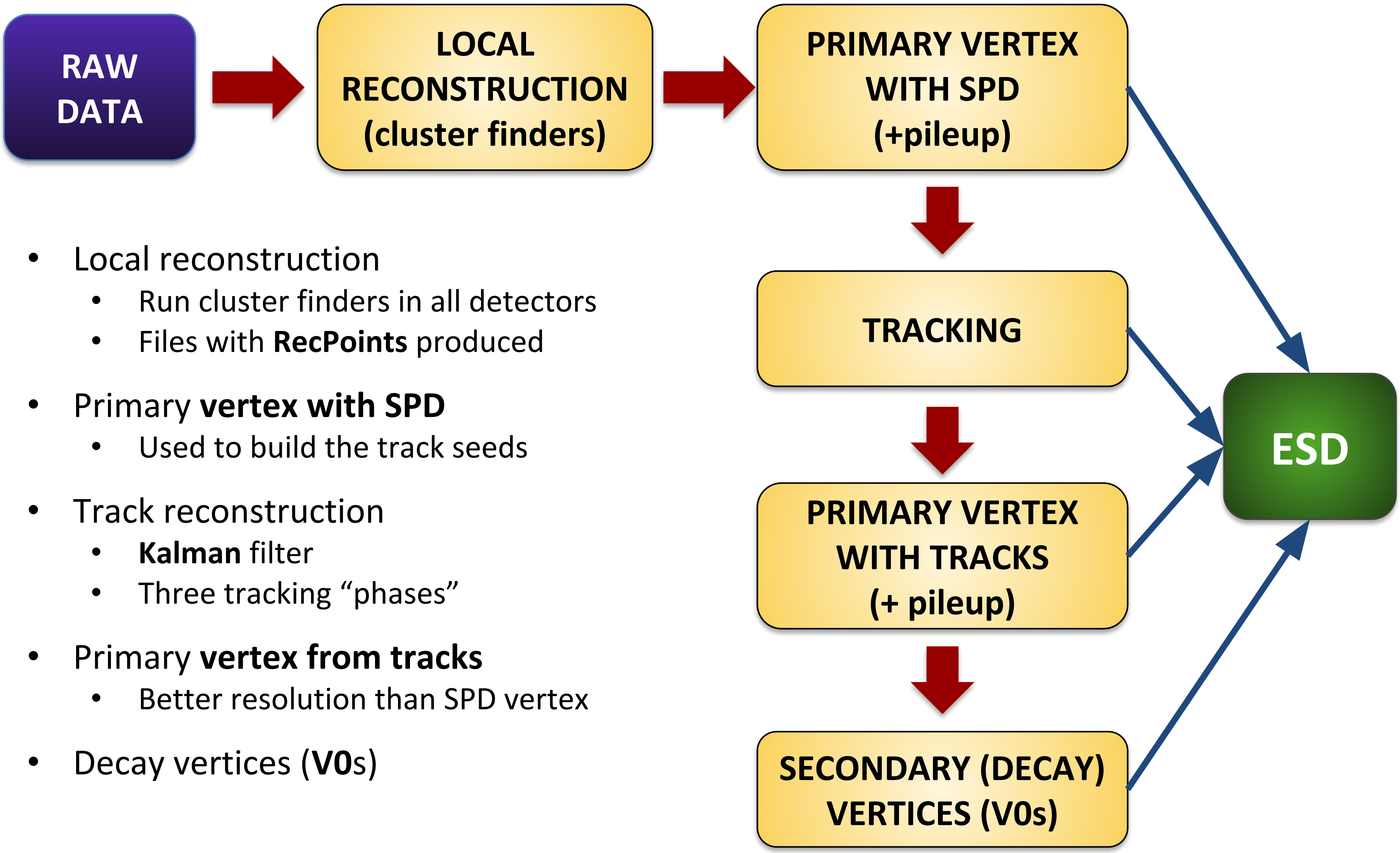
RECONSTRUCTION: FROM RAW DATA TO ESD

ALICE global reference system

- **z axis** along the beam direction
  - Muon arm in the negative z direction (negative pseudorapidity η)
- **x axis** points towards the centre of the LHC
- **y axis** points upwards



General reconstruction strategy



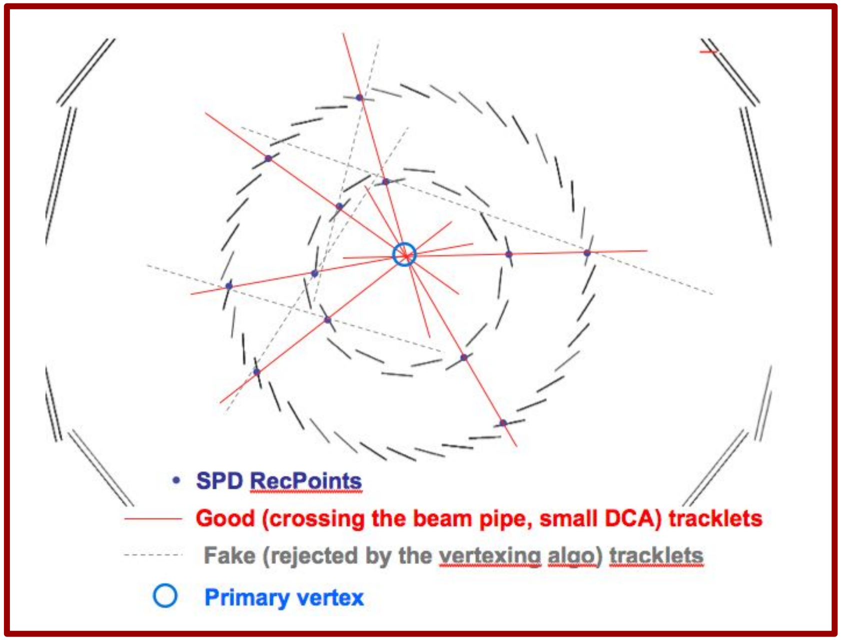
- Local reconstruction
  - Run cluster finders in all detectors
  - Files with **RecPoints** produced
- Primary **vertex with SPD**
  - Used to build the track seeds
- Track reconstruction
  - **Kalman** filter
  - Three tracking “phases”
- Primary **vertex from tracks**
  - Better resolution than SPD vertex
- Decay vertices (**V0**s)

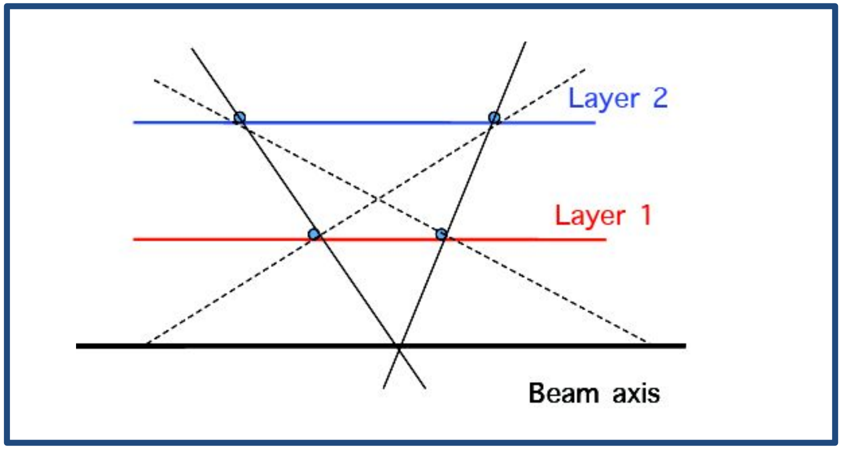
Local reconstruction

- **Local detector reconstruction: clusterization step**
  - Raw data of each detector data are converted into **clusters**
  - Clusterization is performed separately for each detector
- **Cluster** (or **RecPoint**) = groups of adjacent detector cells firing
  - Corresponds to a hit (energy deposition) produced by a ***crossing particle*** (or by a ***shower*** in the calorimeters)
  - **Characterized by:**
    - Positions, signal amplitudes, signal times, cluster shapes…
    - … and their associated errors
  - Used as input for track (and tracklet) reconstruction for tracking detectors (ITS, TPC, TRD)
  - Matched to tracks for PID detectors (TOF, HMPID, EMCAL...)
  - Clusters from calorimeters (EMCAL, PHOS) stored in ESDs
    - Used, e.g. for photon reconstruction: a cluster with no tracks in the vicinity is a neutral particle candidate

Primary vertex from SPD

- **Interaction vertex** position reconstructed from pairs of SPD points (tracklets)
  - Search for **pileup** from SPD tracklets not pointing to the “main” interaction vertex
- **3D reconstruction**
  - Default in pp and p-A
  - Not used in A-A where the faster Z-only vertex is used
- **Z-only reconstruction**
  - Fallback in pp and p-A if the 3D fails (low multiplicity events)
  - Default in A-A





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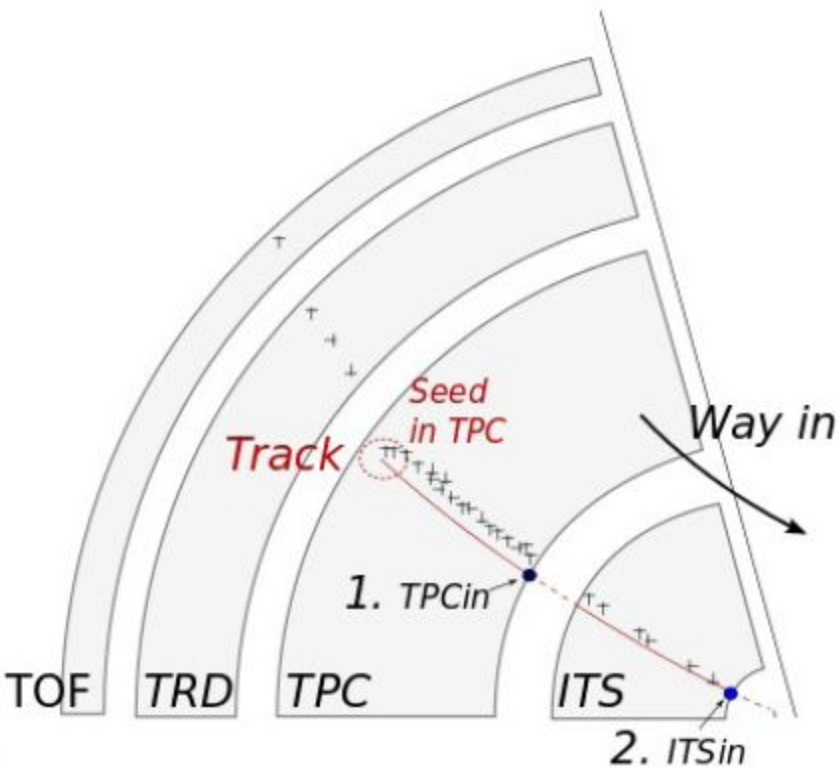
Tracking: Kalman filter

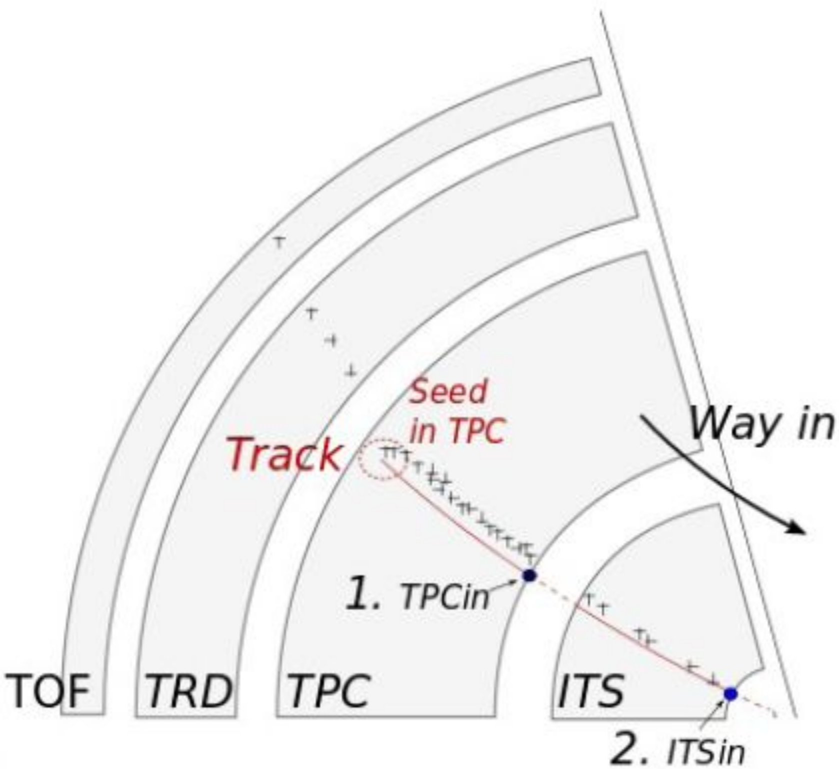
- **Local method**: the track parameters are estimated 'locally' at a given point in space
  - Naturally accounts for local track peculiarities: stochastic physics processes (multiple scattering, energy loss), B field
- Simultaneous **track recognition** (*track finding*) and **reconstruction** (*track fitting*)
  - Needs **"state vector"** (= track parameterisation) + **"evolution equation"** (= how state vector varies from current to next "step")
  - Requires to **start from a track "seed"** (first track candidate)
- Tracking **procedure**:
  - Extrapolate the current estimate to the next "step" (*prediction*)
  - Combine the prediction with the next state vector measurement (*filtering*) -> improved determination of track parameters
  - Repeat prediction and filtering steps as many times as we have measurements of the state vector.

Tracking: seeding



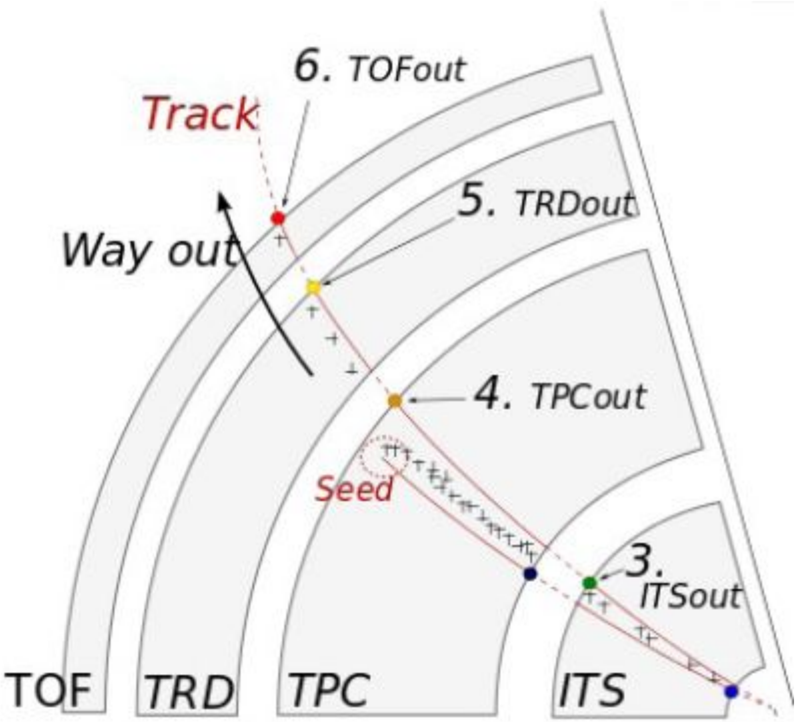
- **Track seeds** built using SPD primary vertex and pairs of TPC RecPoints in adjacent pad rows
  - Seeding **starts at outer TPC radius**, where hit density is minimal
  - Seeds for candidate secondary tracks built from 3 TPC points w/o using the SPD vertex

Tracking: 1st phase -> inward



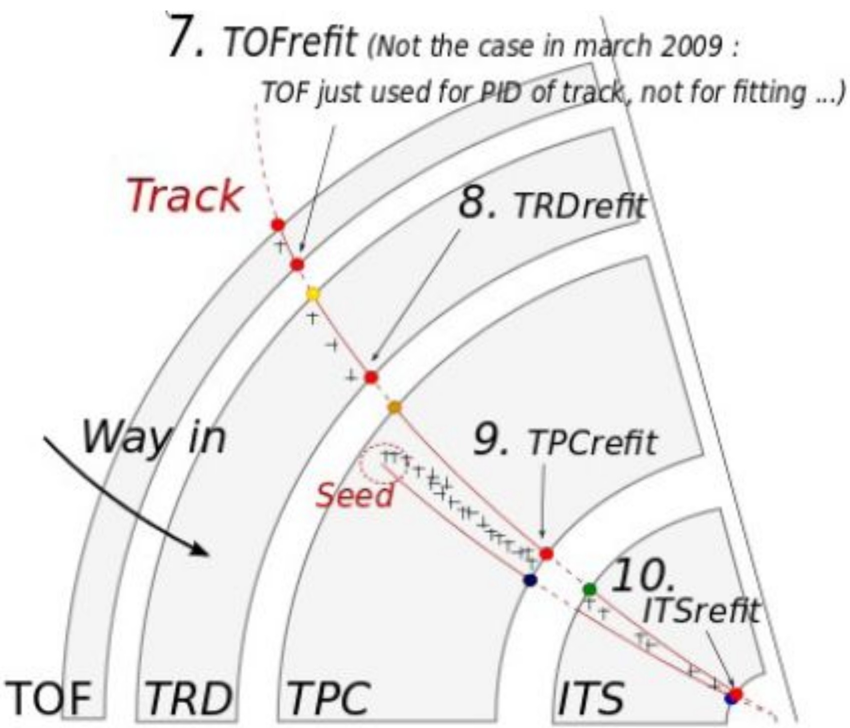
- Track seeds are **projected inward** using a Kalman filter algorithm
  - Updated at each step with the nearest TPC cluster provided that it fulfils a proximity cut
  - Continue until the inner radius of the TPC is reached
  - Preliminary particle id. based on TPC dE/dx (used for energy loss correction in next steps)
- Track **prolongation to the ITS**
- **ITS standalone tracker:** find tracks from ITS points not attached to TPC prolongations

Tracking: 2nd phase -> outward



- **Back propagation** of tracks with the Kalman filter
  - From the interaction vertex to the TPC outer radius, using the clusters found in previous step
  - Update particle id. based on TPC dE/dx (used for energy loss correction in next step)
- **Prolongation** to TRD, TOF, HMPID, EMCAL, PHOS
  - Association of reconstructed points in these detectors
  - Track length calculation
- *ITS standalone tracks* propagated only up to the outer ITS radius

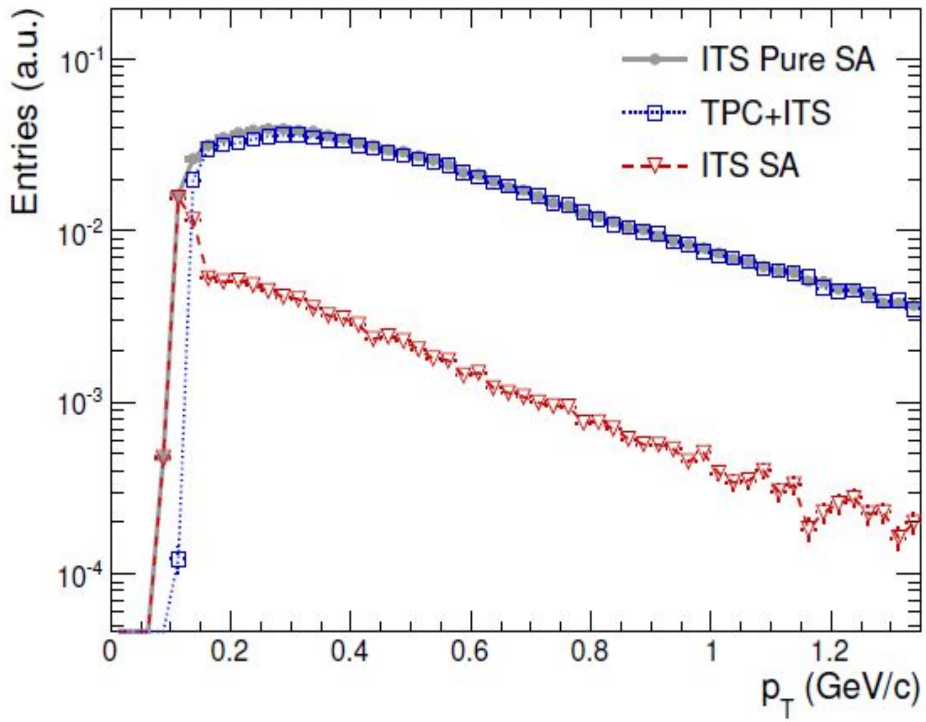
Tracking: 3rd phase -> refit inward



- **Re-fit** of the track in the **inward** direction with the Kalman filter
  - Clusters from the previous steps used in the refit
  - Best determination of the track parameters and covariance matrix
- Tracks propagated to their Distance of Closest Approach (DCA) to the SPD vertex

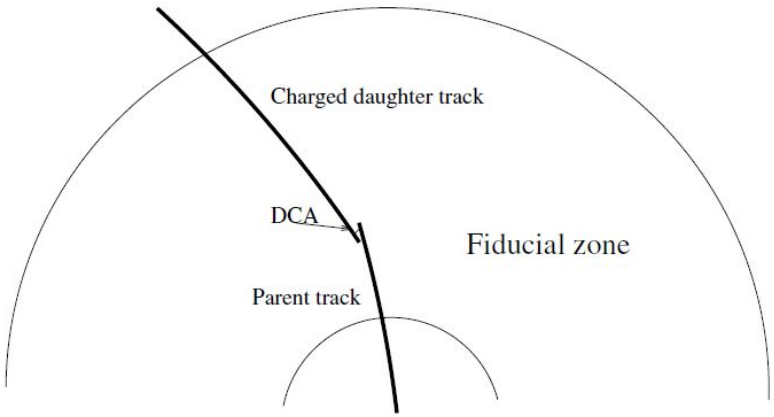
Tracks: global, ITS standalone

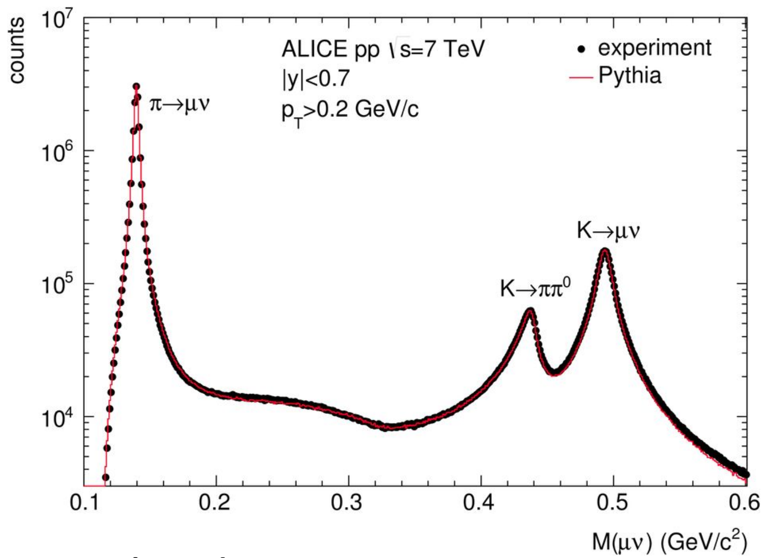
- **Global (TPC+ITS) tracks** = TPC tracks prolonged to ITS with successful refit inward step
- **ITSsa** = ITS only tracks, built from ITS clusters not attached to TPC prolongations
  - Complementary to global tracks
  - Recover: low-p_T tracks not reconstructed in TPC, high-p_T tracks in regions between TPC sectors
- **ITS pure SA**: ITS-only tracks built using all ITS clusters
  - Enabled only in pp and p-Pb
  - For checks+specific analyses



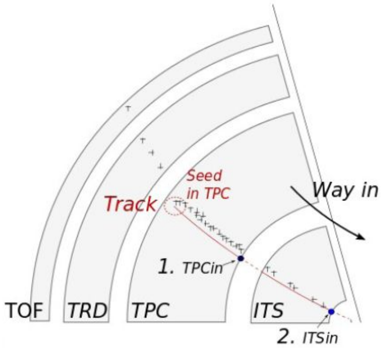
- **NOTE:** ITS-only tracks have worse p_T resolution than TPC+ITS

Kinks



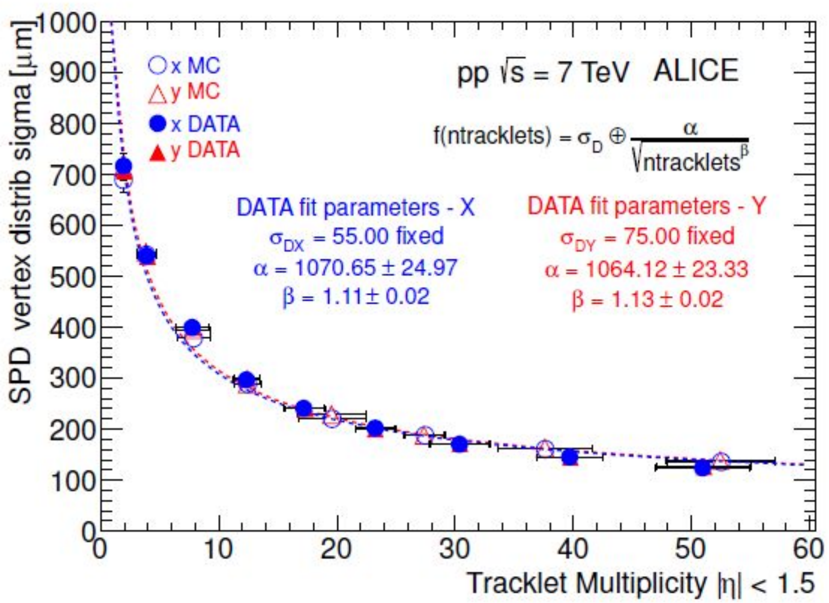


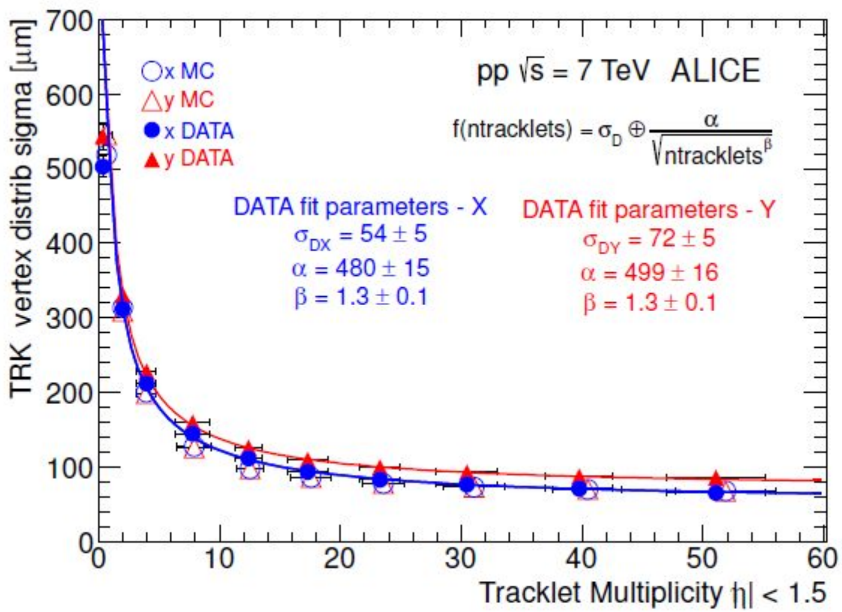
- **Kink** = topological signature of charged particles decaying into 1 charged + 1 neutral particles (e.g. K→μν, π→μν)
- Search for kinks inside the volume of the TPC after the first inward tracking step
  - Large decay angle kinks = pairs of tracks with same charge that intersect each other in a fiducial volume
  - Small decay angle kinks = "breakpoint" (i.e. change in direction) between the upstream and downstream parts of a track



Primary vertex from tracks

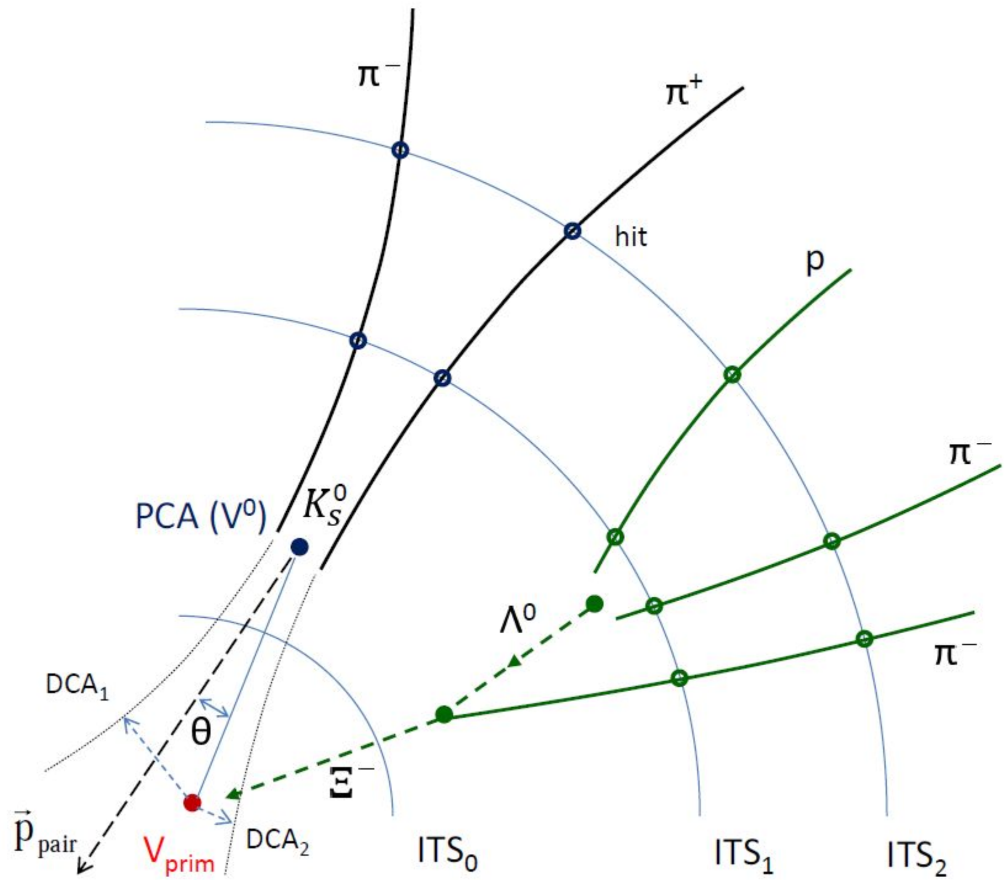
- **Primary vertex** determined from reconstructed **TPC+ITS tracks**
  - Better resolution than SPD vertex
  - Lower efficiency (at low multiplicity) than SPD vertex
  - Pileup tagging via multiple vertices (*MultiVertex*)
- Primary vertex also determined from track parameters using only TPC information (**TPC-only**)
  - Poor resolution, not to be used in analysis





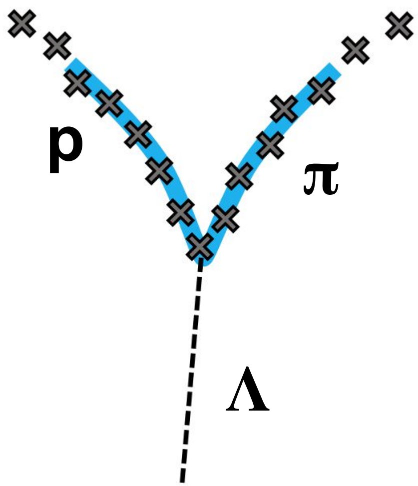
Secondary vertices

- Search for **photon conversions** and secondary vertices from **weak decays** of long-lived (**strange**) **hadrons**
  - Tracks with **large DCA** to the primary vertex
  - Select on **decay topology**



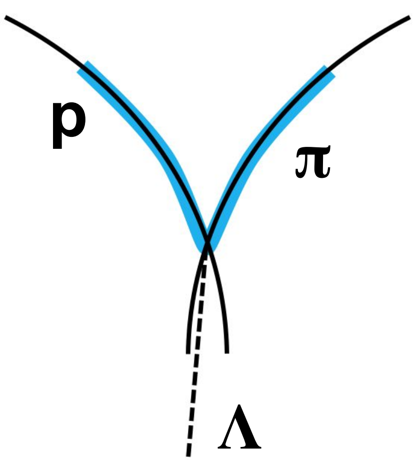
- V0 candidates:
  - $K^0_s \rightarrow \pi\pi$
  - $\Lambda \rightarrow p\pi$
  - $\gamma \rightarrow ee$
- Cascade candidates
  - $\Xi \rightarrow \Lambda\pi \rightarrow p\pi\pi$

V0 candidates: Λ and K^0_S



On-the-fly V0s: clusters -> V0 candidate

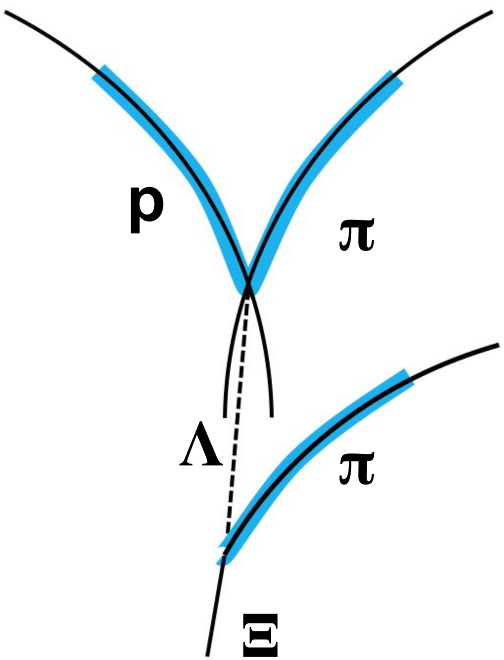
- V0s found **during tracking**
- **Good**: Raw cluster info used: ideal resolution + causality cut (no clusters before decay point)
- **Bad**: cannot be replayed at analysis level e.g. with looser selections



Offline V0s: Tracks -> V0 candidate

- V0s found **based on reco'ed tracks**
- **Good**: high level of abstraction: runs on ESD tracks and can be replayed and reconfigured at will
- **Bad**: less-than-ideal resolution because of cluster association before decay point

Cascade candidates: Ξ and Ω



Cascades: V0 + track -> cascade candidate

- Only cascades based on offline V0s have been used in ALICE so far
- **Same strategy as V0s**, but larger number of topological selections (total: 10 selections)
- **A selection on Λ invariant mass** is also performed (typically we select a window of 6-10 MeV/c^2 around the PDG mass (1115 MeV/c^2))
- However, for the cascade invariant mass calculation, **we use the perfect Λ mass** for the V0 daughter

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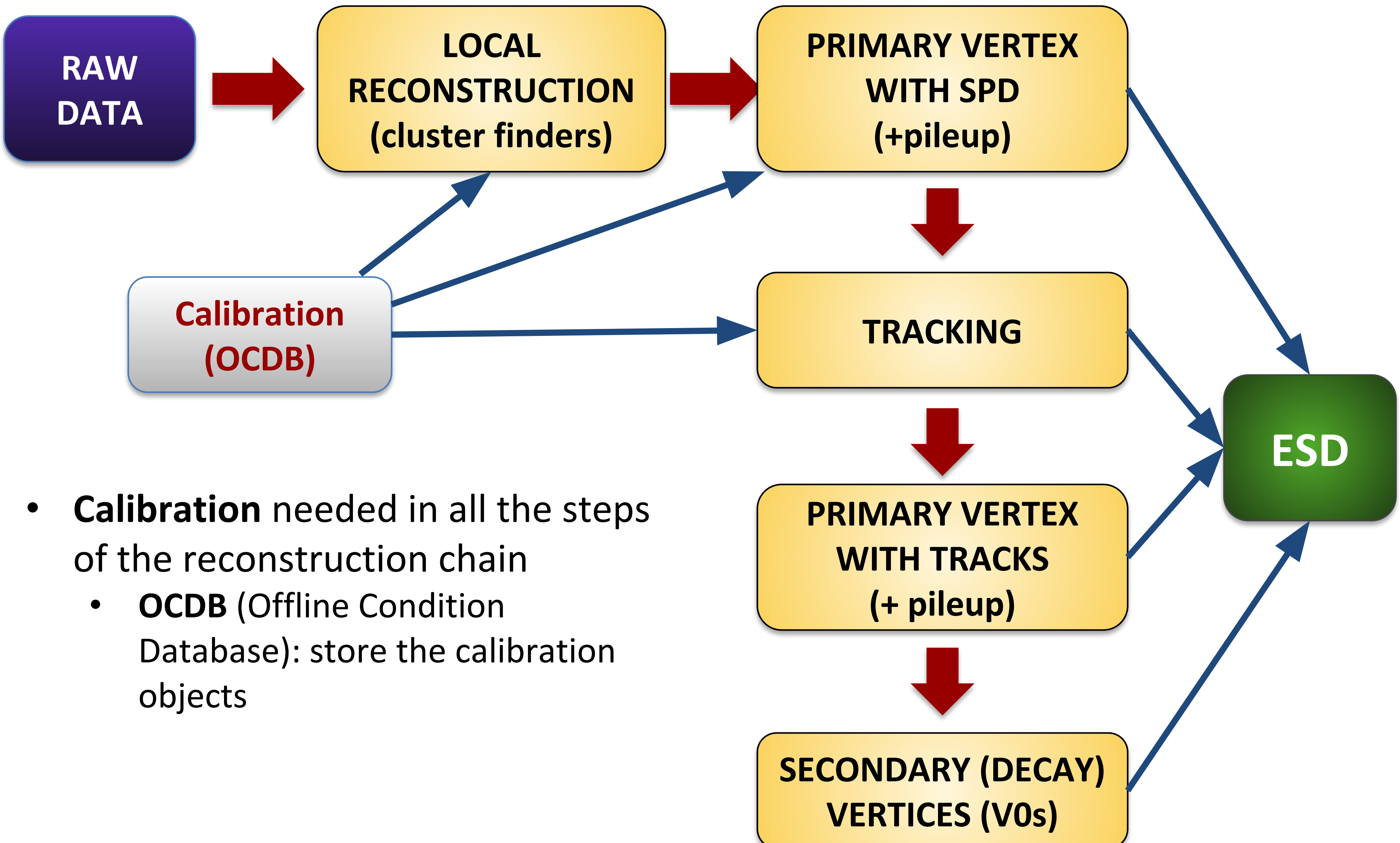
RAW DATA PRODUCTION CHAIN

General reconstruction strategy

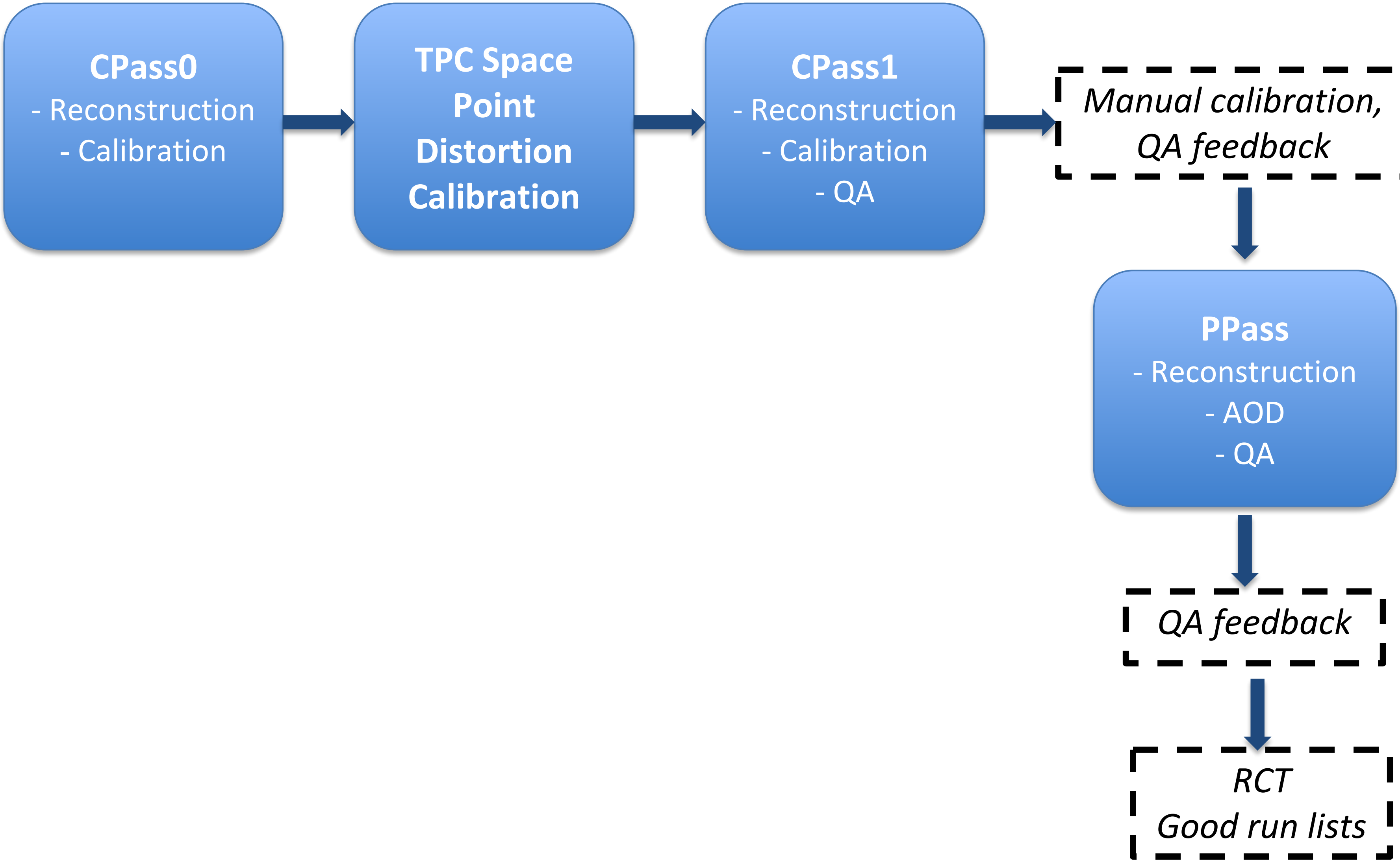


- **Calibration** needed in all the steps of the reconstruction chain
  - **OCDB** (Offline Condition Database): store the calibration objects

Calibrations

- The reconstructed data quality (resolution, minimisation of biases, particle identification …) critically depends on the quality of the **calibrations** used in the reconstruction, e.g.:
  - Maps of *dead and noisy elements*, *gain*, signal amplitudes
  - For drift detectors (SDD, TPC): *drift velocity*, drift field maps, *distortions*…
    - example in backup (slide 111)
  - Actual position of the detectors (*alignment*)
  - Geometry of the *luminous region*
- **Sources of calibration**:
  - *Online*, via **Shuttle** (not discussed here)
    - From dedicated calibration runs, or calibration triggers or also from interaction events
  - *Offline*, via **automatic** calibration passes (**CPass0, CPass1**)
  - *Offline*, via “**manual analysis**”

Raw data processing steps

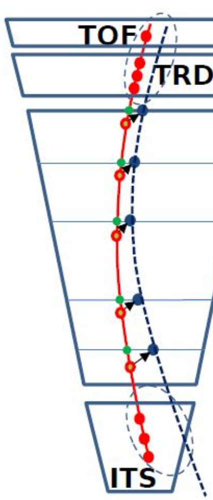


Calibration chain: CPass0

- CPass0 **reconstruction**:
  - Performed run-wise, starts promptly after the data taking
  - Typically uses a mixture of CINT7 (MB) and HM triggers
- CPass0 reconstruction is followed by
  - CPass0 **calibration train** (= standard analysis train which runs over the ESDs + friends) and fills calibration objects which are stored in the **OCDB** for several detectors
    - **TPC, TRD, TOF, T0, Luminous region**
  - **TPC space point distortion** calibrations

TPC Space Point distortions

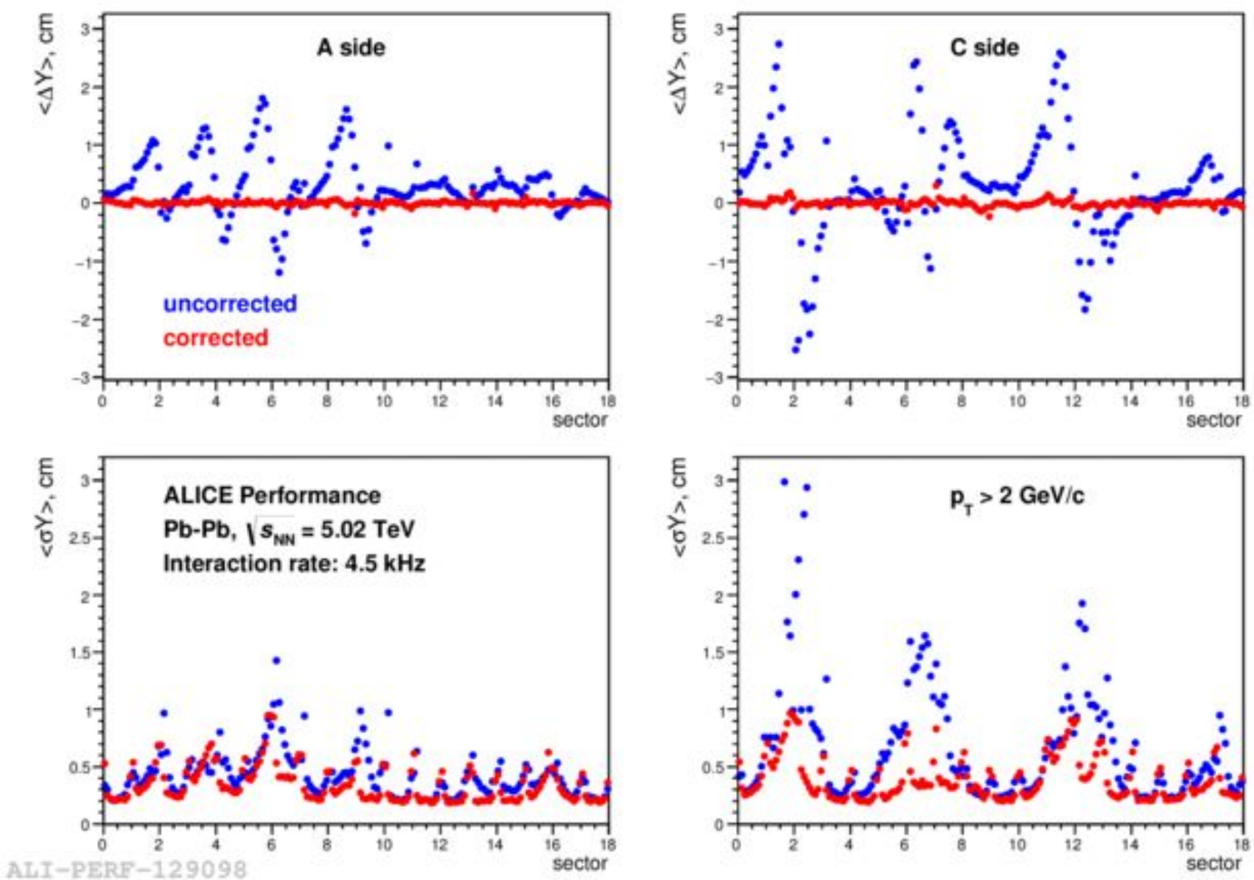
- Distortions in the TPC drift field due to space charge
  - More pronounced in Run2 with Ar gas (2015-2016-2018)
  - Up to O(5 cm) effect on the reconstructed space points
  - Need to be corrected, target precision O(0.2 mm)
  - Scale ~linearly with luminosity
  - Granularity of the correction is O(20-40mins)
    - Enough to guarantee ~constant distortions within one time-bin
- Procedure:



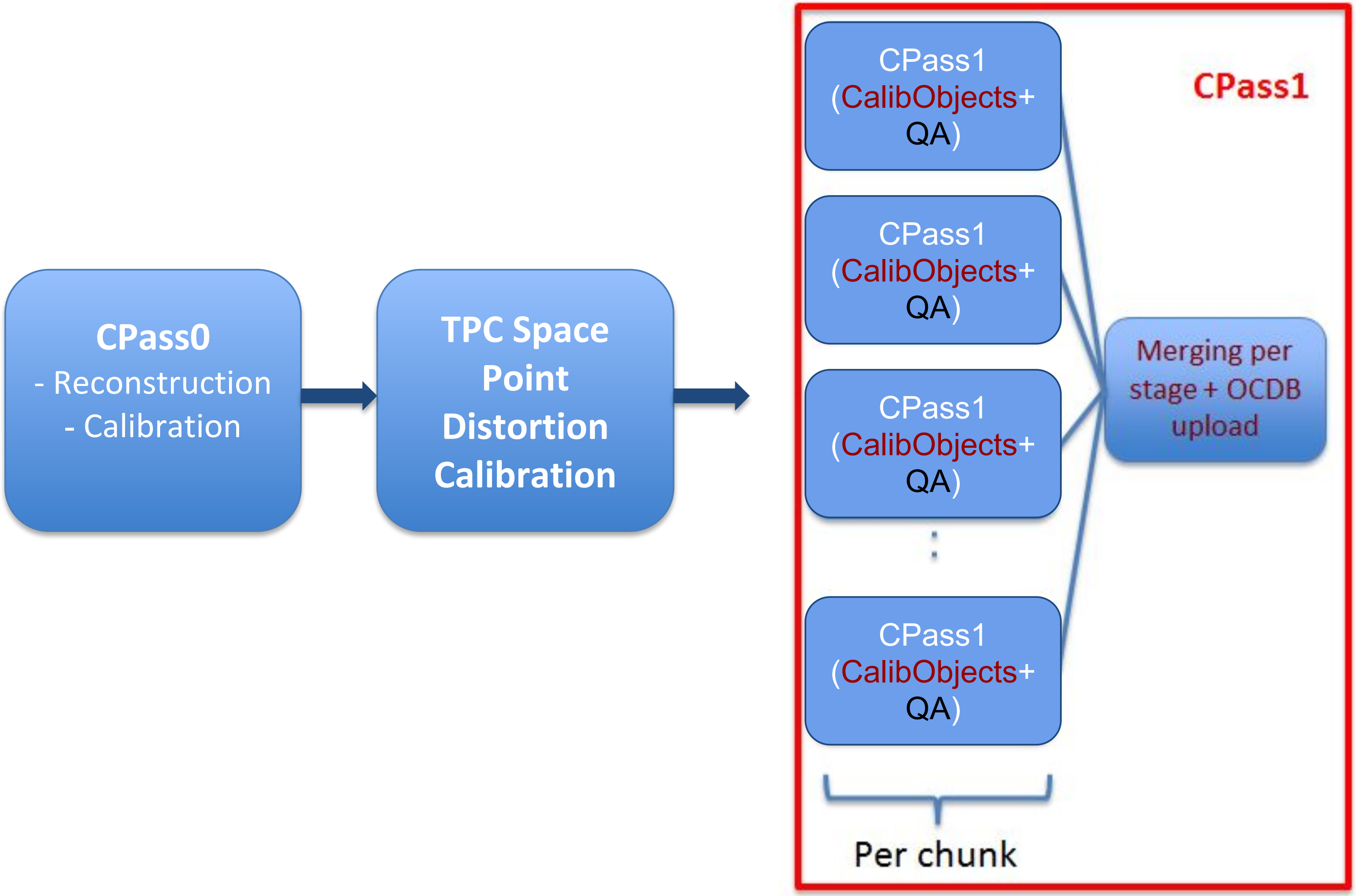
1. TPC reconstruction with large road-widths to not loose TPC clusters attachment
2. Match to ITS and TRD/TOF
3. Refit ITS-TRD-TOF part and interpolate to TPC as a **reference** of **true track** at every pad-row
4. Collect Y, Z differences between **distorted cluster** and **reference** points in sub-volumes (voxels) of TP
5. Extract 3D vector of distortion in every voxel
6. Create smooth parameterization (DB object) to use for correction during following reconstruction

TPC Space Point distortions

- Distortions in the TPC drift field due to space charge
- After correction: bias on the Distance of Closest Approach of the TPC track to the vertex reduced below intrinsic resolution



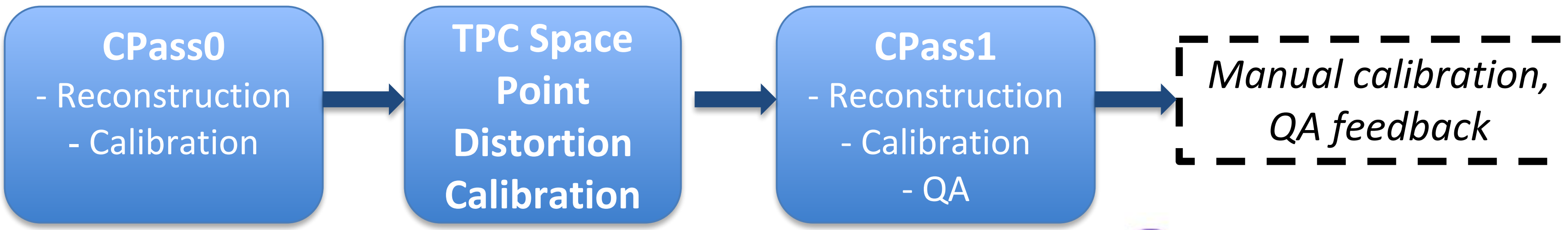
Calibration chain: CPass1



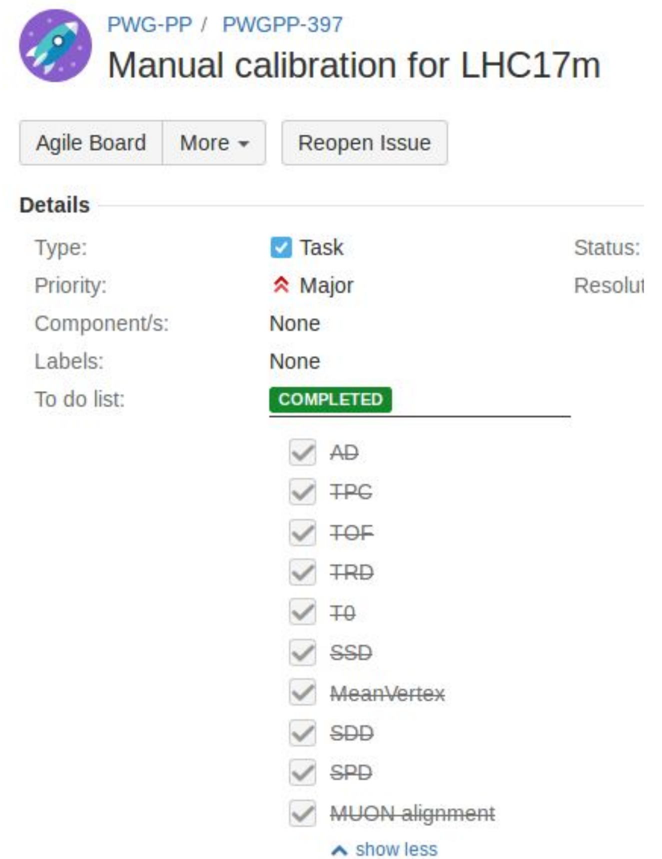
Calibration chain: CPass1

- CPass1 **reconstruction**:
  - Performed run-wise, starts after the completion of CPass0
  - Uses a subsample (~10%) of CINT7 (MB) triggers
- CPass1 **goals:**
  - *Refined calibrations* after reconstruction with TPC calibrated from CPass0 and TPC SP distortion corrections (**plus AD** calibration)
  - *Quality assurance* of the detector calibrations extracted from CPass0
- CPass1 reconstruction followed by:
  - **Calibration train**: fill calibration objects + store in **OCDB**
  - **QA train** -> produce root files with QA information

After CPass1: QA+manual calibration



- After CPass0/1 is done for **all runs of a period**, a ~4-day window is opened for
  - **Quality Assurance** checks
  - **Manual calibration** for:
    - Calibrations that need more statistics than that of a single run
      - E.g. TOF channel-by-channel t0 offset when needed
    - Smoothen/fix calibrations for runs affected by fluctuations
      - E.g. luminous region



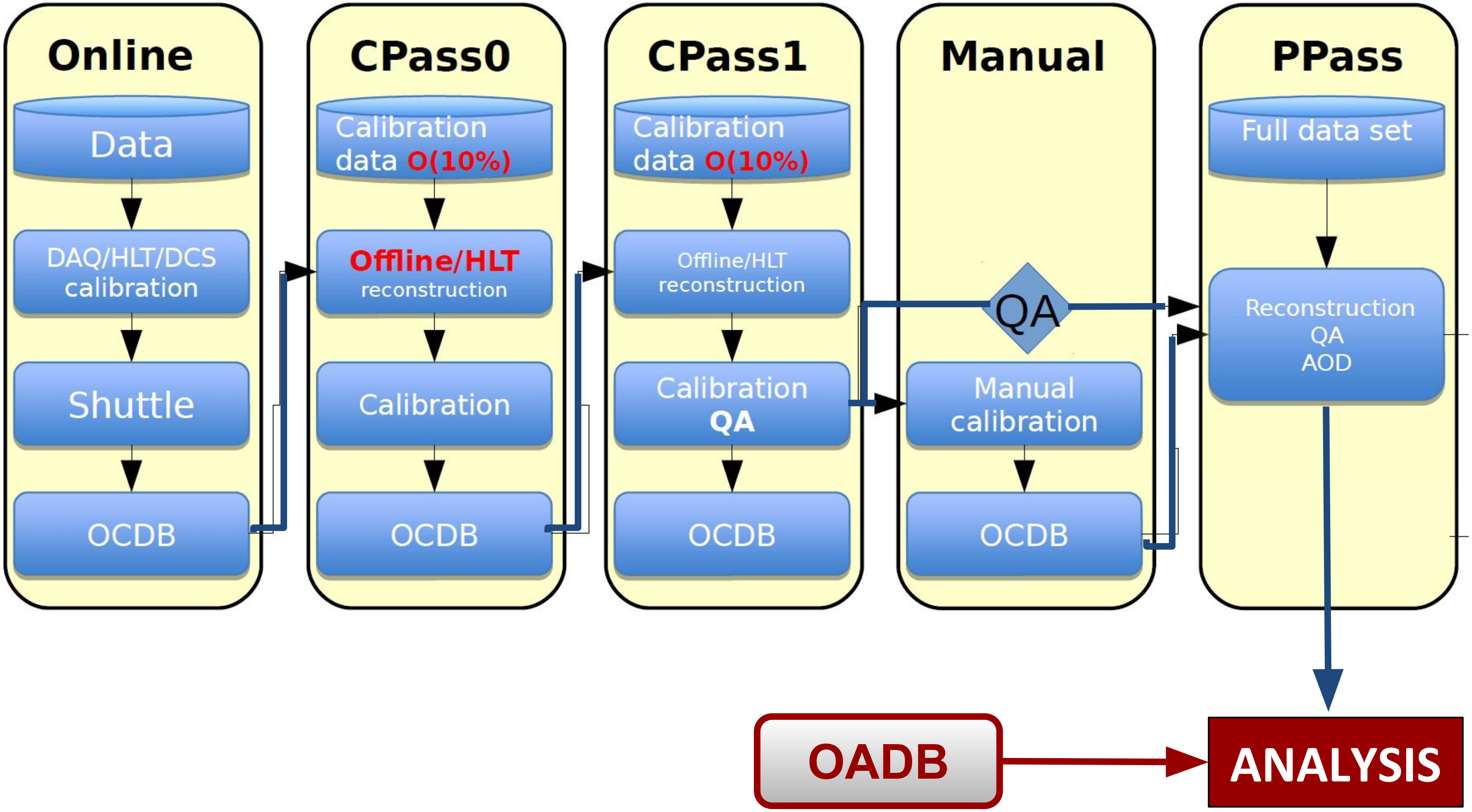
muon_calo reconstruction

- Aim: fast reconstruction for detectors that do not need the automatic calibration of CPass0/1
- Involved detectors:
  - MUON, EMCAL, PHOS, T0, ITS, V0, ZDC, AD

```
// Set reconstruction flags (skip detectors here if neded with -<detector name>
rec.SetRunReconstruction("ALL -TPC -TRD -TOF -HLT -PMD");
```

- Performed for all good PHYSICS runs in the logbook
- Starts promptly after the data taking
  - In parallel with CPass0/1
- QA performed in parallel with CPass1 QA

Offline Analysis Data Base

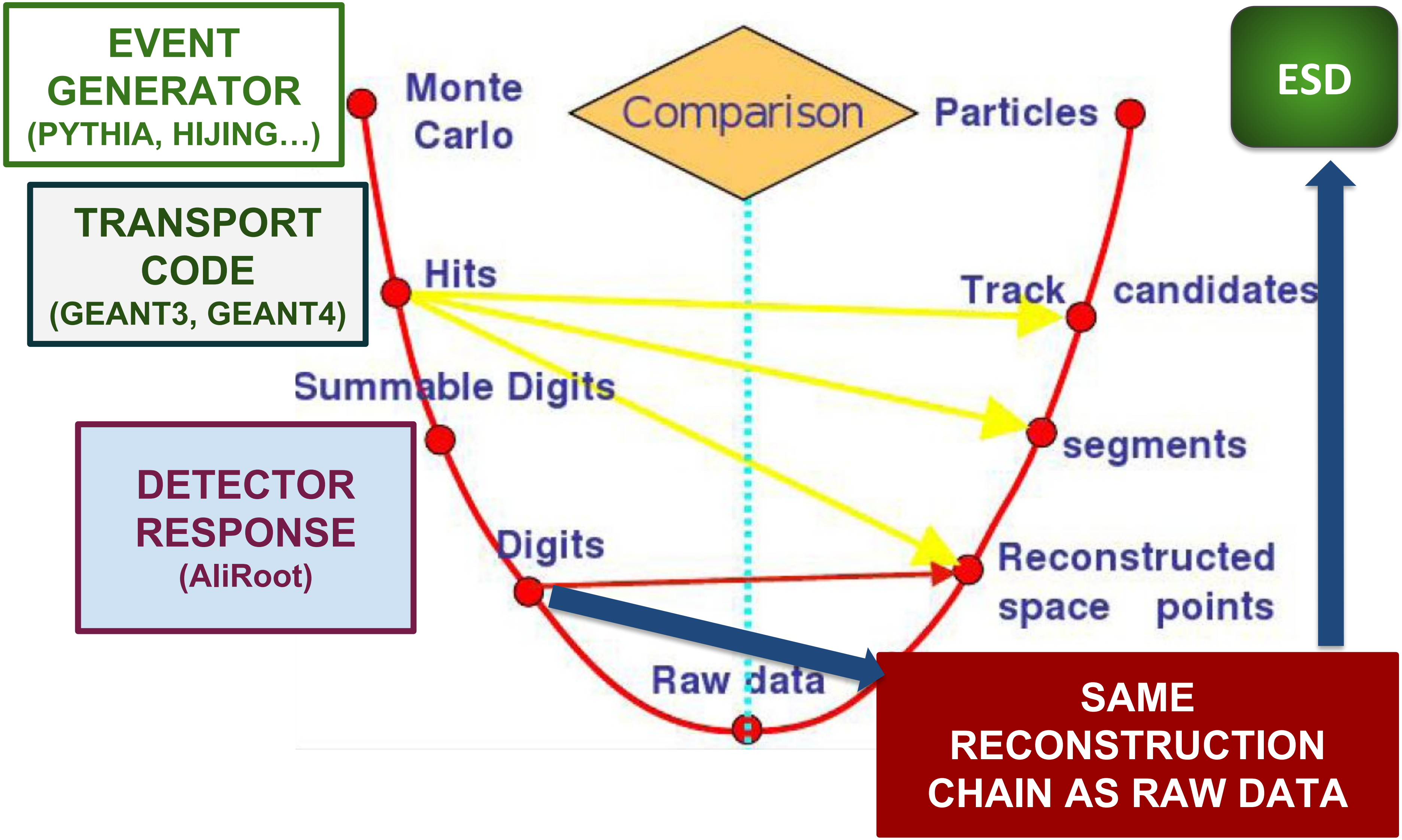


Offline Analysis Data Base

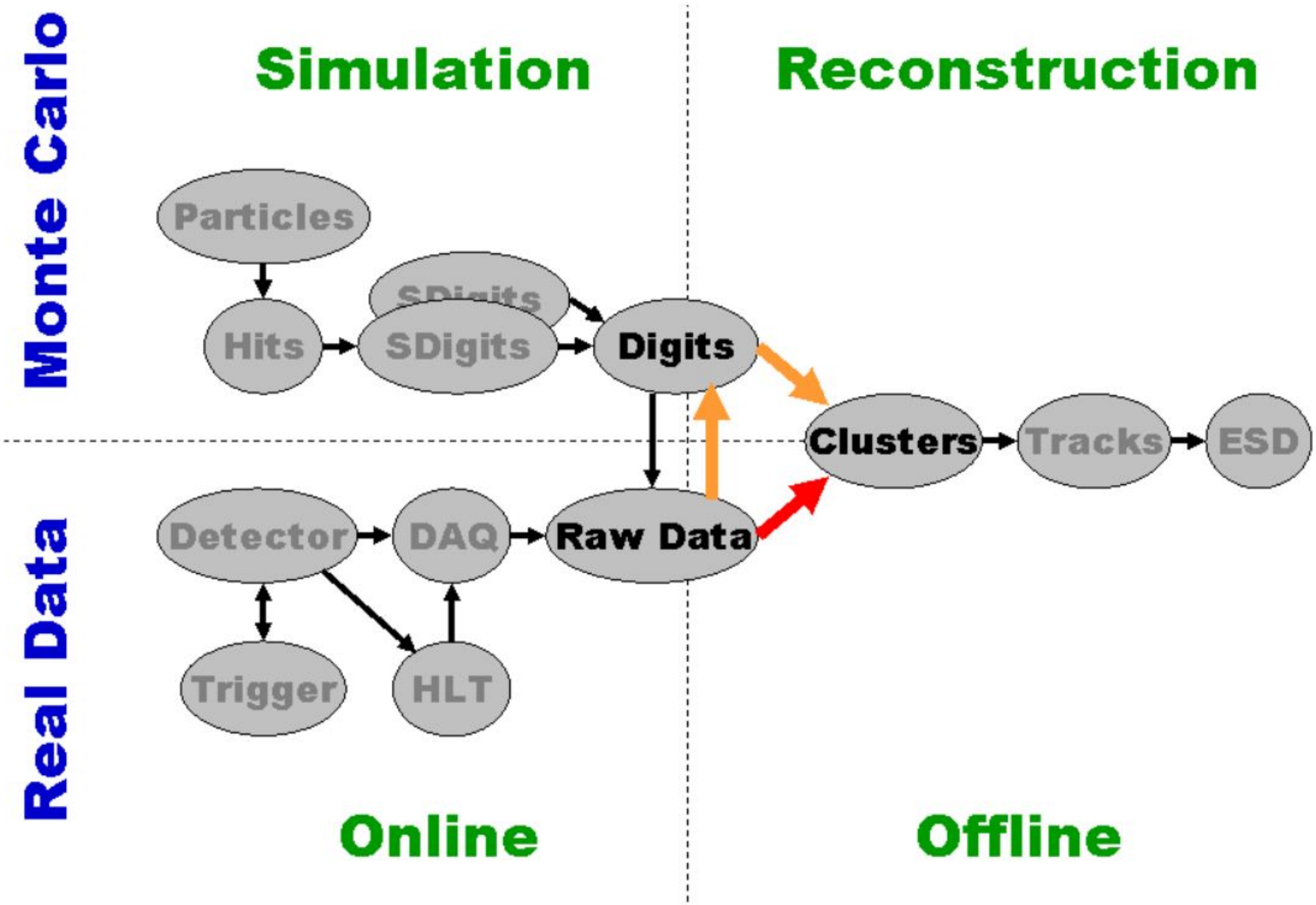
- Calibrations needed at the analysis level, e.g.
  - **Splines** to parametrise the expected **TPC dE/dx** for particle species
    - https://twiki.cern.ch/twiki/bin/view/ALICE/TPCSplines
  - **Centrality/multiplicity** percentiles from estimators
    - https://twiki.cern.ch/twiki/bin/viewauth/ALICE/AliMultSelectionCalibStatus
  - **Event plane** flattening corrections
- Calibration files produced asynchronously w.r.t. reconstruction pass
  - Usually slightly after muon_calo or PPass completion
- Stored in **OADB**
  - Directories in AliPhysics, under $ALICE_PHYSICS/OADB
  - Need to use recent enough AliPhysics tag in your analysis if you need latest calibrations

MONTE CARLO SIMULATIONS

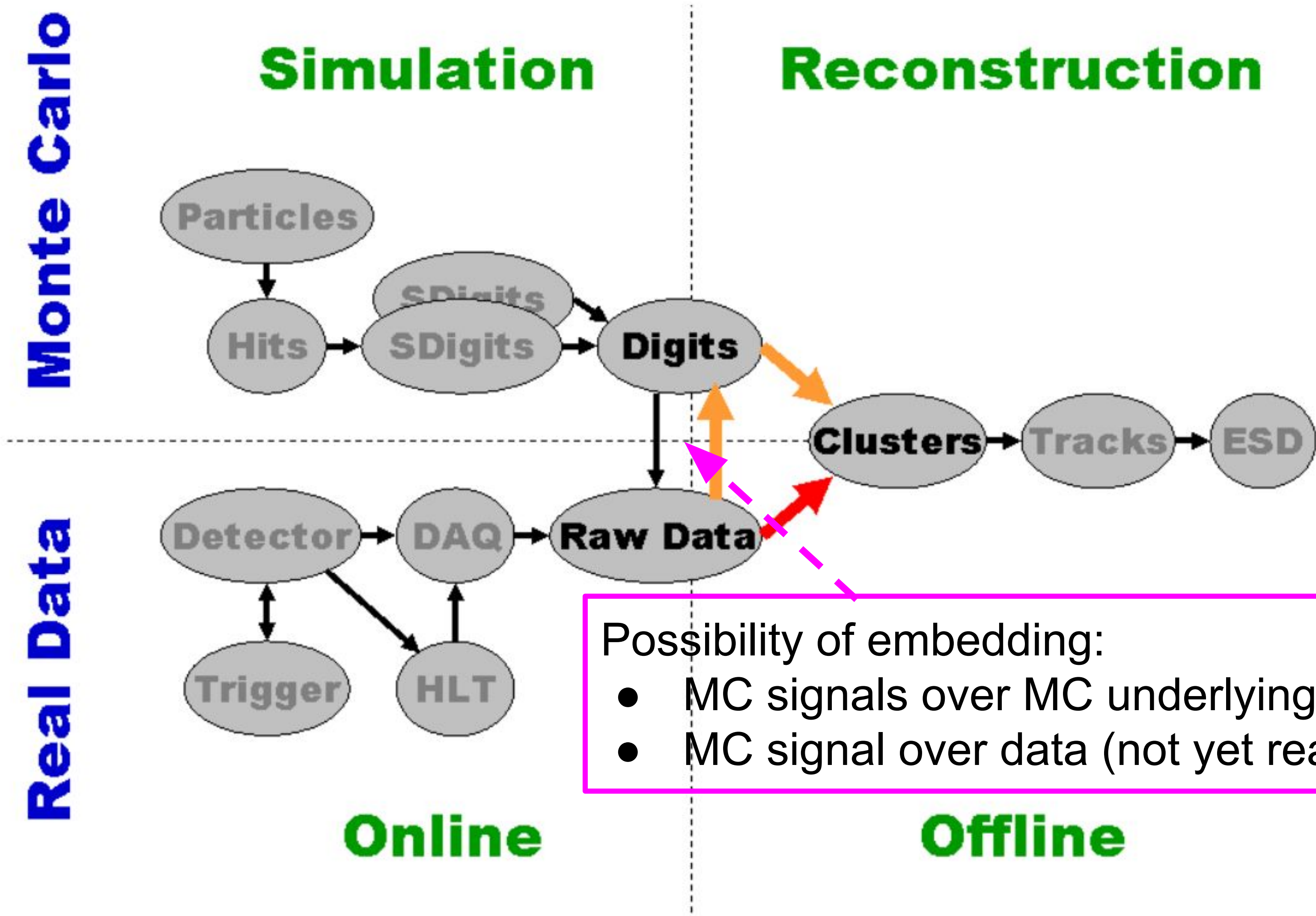
Monte Carlo chain



Monte Carlo vs. raw data chain



Monte Carlo vs. raw data chain

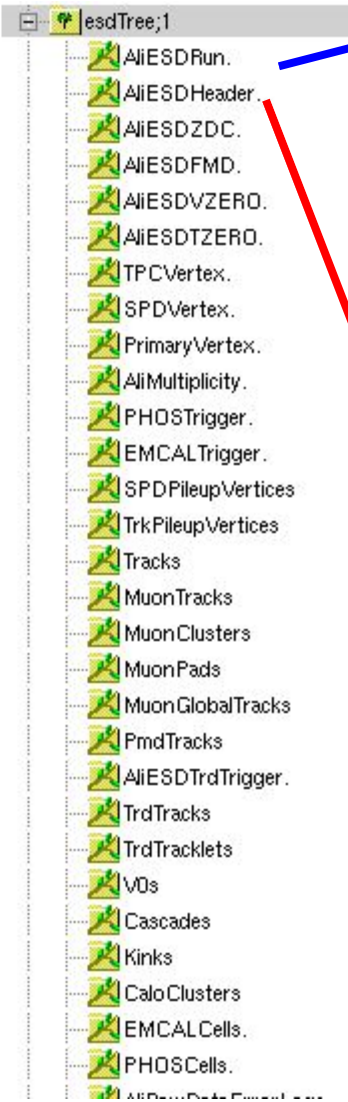


Possibility of embedding:

- MC signals over MC underlying event
- MC signal over data (not yet ready)

ESD EVENTS AND TRACKS

AliESDs.root contents (1)



ESD run

```
Float_t        fCurrentL3;        // signed current in the L3     (LHC co
Float_t        fCurrentDip;       // signed current in the Dipole (LHC co
Float_t        fBeamEnergy;       // beamEnergy entry from GRP
Double32_t     fMagneticField;    // Solenoid Magnetic Field in kG : for
Double32_t     fMeanBeamInt[2][2]; // mean intensity of interacting and
Double32_t     fDiamondXY[2];     // Interaction diamond (x,y) in RUN
Double32_t     fDiamondCovXY[3];  // Interaction diamond covariance (x,y)
Double32_t     fDiamondZ;         // Interaction diamond (z) in RUN
Double32_t     fDiamondSig2Z;     // Interaction diamond sigma^2 (z) in R
UInt_t         fPeriodNumber;     // PeriodNumber
Int_t          fRunNumber;        // Run Number
Int_t          fRecoVersion;      // Version of reconstruction
Int_t          fBeamParticle[2];  // A*1000+Z for each beam particle
TString        fBeamType;         // beam type from GRP
```

ESD header

```
// Event Identification
ULong64_t     fTriggerMask;         // Trigger Type (mask) 1-50 bits
ULong64_t     fTriggerMaskNext50;   // Trigger Type (mask) 51-100 bits
UInt_t        fOrbitNumber;         // Orbit Number
UInt_t        fTimeStamp;           // Time stamp
UInt_t        fEventType;           // Type of Event
UInt_t        fEventSpecie;         // Reconstruction event specie (1-
UInt_t        fPeriodNumber;        // Period Number
Int_t         fEventNumberInFile;   // Running Event count in the file
UShort_t      fBunchCrossNumber;    // Bunch Crossing Number
UChar_t       fTriggerCluster;      // Trigger cluster (mask)
```

AliESDs.root contents (2)

- esdTree;1
  - AliESDRun.
  - AliESDHeader.
  - AliESDZDC.
  - AliESDFMD.
  - AliESDVZERO.
  - AliESDTZERO.
  - TPCVertex.
  - SPDVertex.
  - PrimaryVertex.
  - AliMultiplicity.
  - PHOSTrigger.
  - EMCALTrigger.
  - SPDPileupVertices
  - TrkPileupVertices
  - Tracks
  - MuonTracks
  - MuonClusters
  - MuonPads
  - MuonGlobalTracks
  - PmdTracks
  - AliESDTrdTrigger.
  - TrdTracks
  - TrdTracklets
  - V0s
  - Cascades
  - Kinks
  - CaloClusters
  - EMCALCells.
  - PHOSCells.

PRIMARY VERTEX FROM TPC

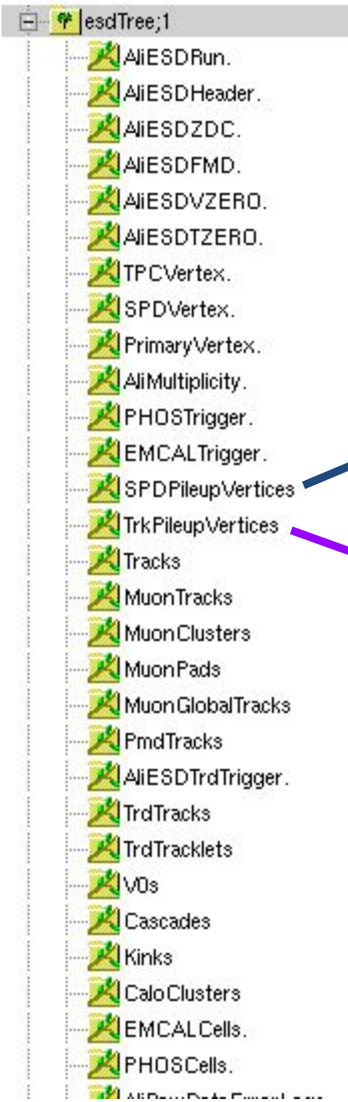
PRIMARY VERTEX FROM SPD

PRIMARY VERTEX FROM TPC+ITS TRACKS

NOTE on AliESDEvent::GetPrimaryVertex

```
const AliESDVertex * AliESDEvent::GetPrimaryVertex() const
{
  //
  // Get the "best" available reconstructed primary vertex.
  //
  if(fPrimaryVertex){
    if (fPrimaryVertex->GetStatus()) return fPrimaryVertex;
  }
  if(fSPDVertex){
    if (fSPDVertex->GetStatus()) return fSPDVertex;
  }
  if(fTPCVertex) return fTPCVertex;
```

AliESDs.root contents (3)



ARRAY OF PILEUP VERTICES FROM SPD

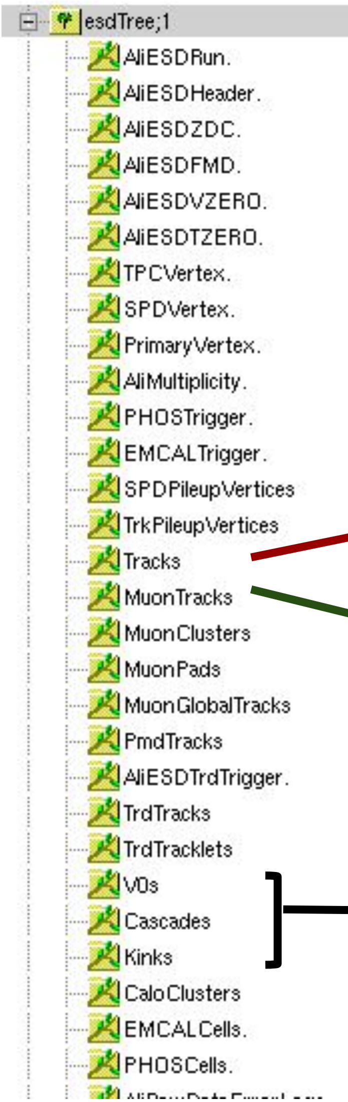
ARRAY OF PILEUP VERTICES FROM TPC+ITS TRACKS (MultiVertex)

+ PILEUP-TAGGING METHODS

```
virtual Bool_t  IsPileupFromSPD(Int_t minContributors=5,
                                Double_t minZdist=0.8,
                                Double_t nSigmaZdist=3.,
                                Double_t nSigmaDiamXY=2.,
                                Double_t nSigmaDiamZ=5.) const;

virtual Bool_t IsPileupFromSPDInMultBins() const;
```

AliESDs.root contents (4)



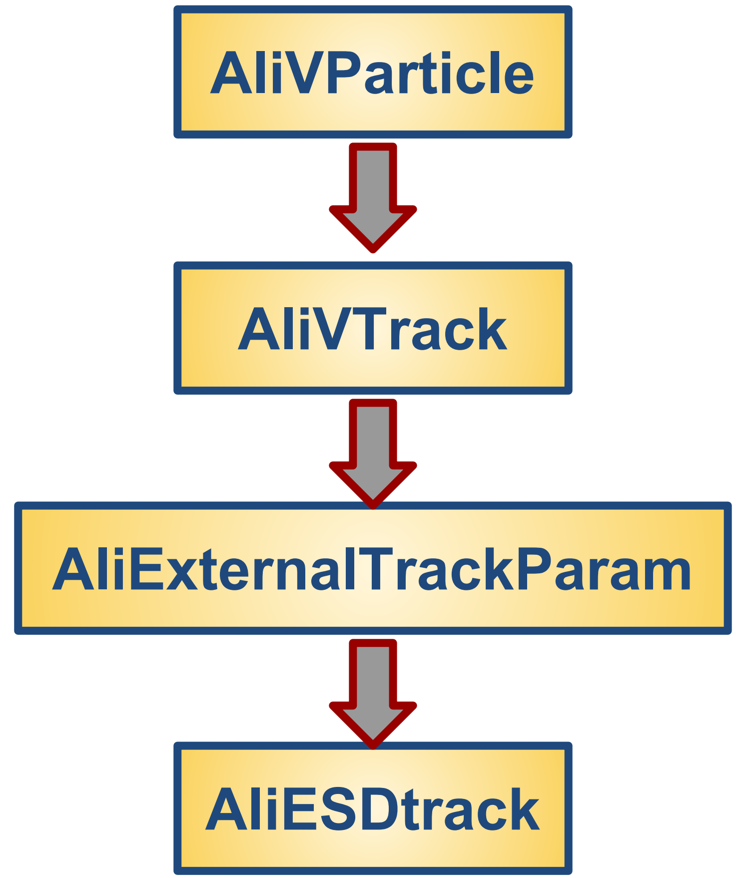
ARRAY OF AliESDtracks (CENTRAL BARREL)

ARRAY OF AliESDMuonTracks (MUON ARM)

ARRAYS OF V0s, CASCADES, KINKS

AliESDtrack

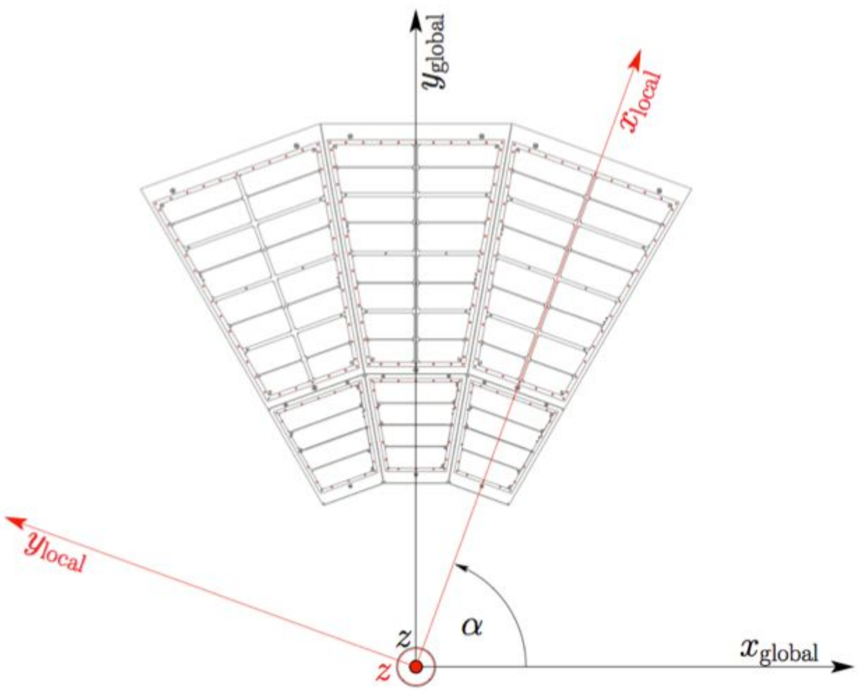
- Inherits from **AliExternalTrackParam**:
  - Store track parameters and covariance matrix
  - Methods to get momentum, position impact parameter …
  - Methods to “propagate” the track along its trajectory
- Additional information on track properties, e.g.:
  - Status bit (TPC in, …., ITS refit)
  - chi2 of track fit (per detector)
  - Number of attached clusters (per detector), TPC findable clusters, ITS per-layer info, ...
  - PID related information (track length, TOF time, EMCAL cluster…)

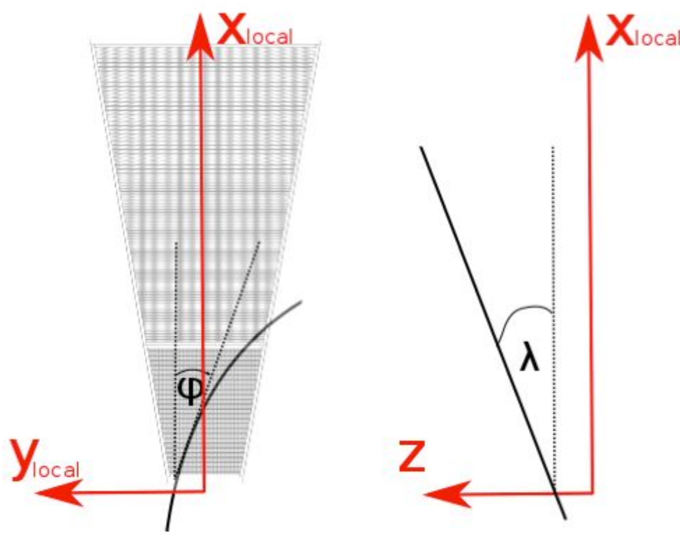


Track parameterisation

- STEER/STEERBase/AliExternalTrackParam
- Track parameters in the **“local” reference system**

```
Double32_t          fX;     // X coordinate for the point of parametrisation
Double32_t          fAlpha; // Local <-->global coor.system rotation angle
Double32_t          fP[5];  // The track parameters
Double32_t          fC[15]; // The track parameter covariance matrix
```



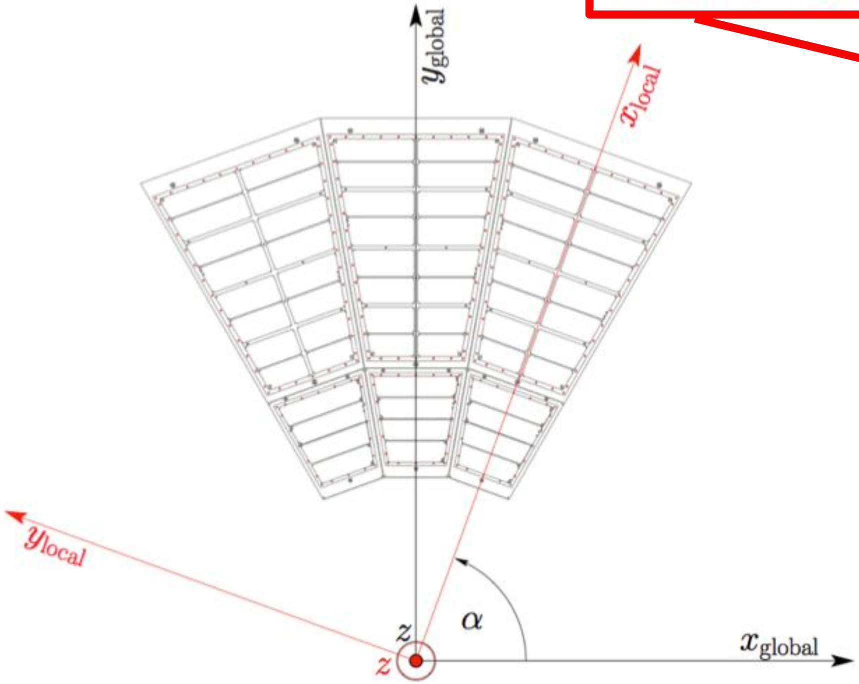


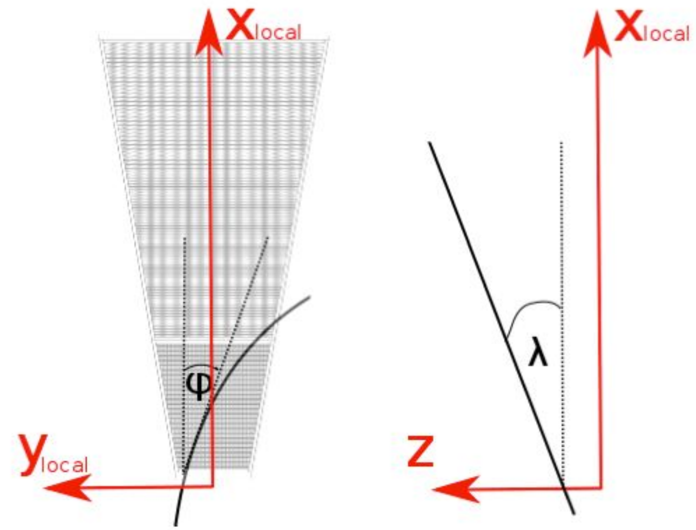
Track parameterisation

```
Double32_t          fX;     // X coordinate for the point of parametrisation
Double32_t          fAlpha; // Local <-->global coor.system rotation angle
Double32_t          fP[5];  // The track parameters
Double32_t          fC[15]; // The track parameter covariance matrix
```

```
param0:   local Y-coordinate of a track (cm)
param1:   local Z-coordinate of a track (cm)
param2:   local sine of the track momentum azimuthal angle
param3:   tangent of the track momentum dip angle
param4:   1/pt (1/(GeV/c))
```

$$(y, z, \sin(\varphi), \tan(\lambda), 1/p_t)$$

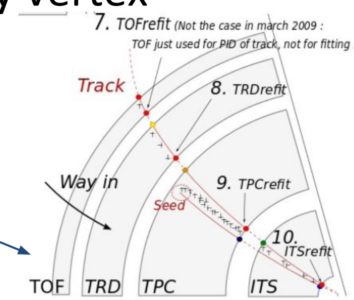


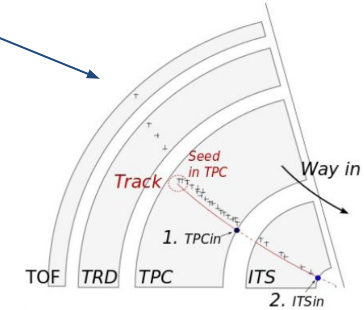


Parameterizations in AliESDtrack

- **Main parameterization** is **at the DCA to the primary vertex** (note: primary vertex not included in the track fit)
  - **Optimal** for **primary particles**

- <u>Five additional parameterizations</u> (snapshots along the trajectory at different tracking steps) stored in AliESDtrack:
  - ***GetConstrainedParam()*** = track parameters constrained at the primary vertex **-> used for analyses that need uniform φ coverage + optimal resolution for primaries (e.g. jets)**
  - ***GetInnerParam()*** = Track parameters at the inner wall of the TPC (from refit step, before ITS refit) **-> used for TPC pid**
  - ***GetTPCInnerParam()*** = TPC-only parameters propagated at DCA to the primary vertex, corrected for material between TPC and vertex (from first inward fit kTPCin)
  - ***GetOuterParam()*** = Track parameters at the point of max. radial coordinate reached in the PropagateBack step
  - ***GetOuterHmpParam()*** = Track parameters at HMPID





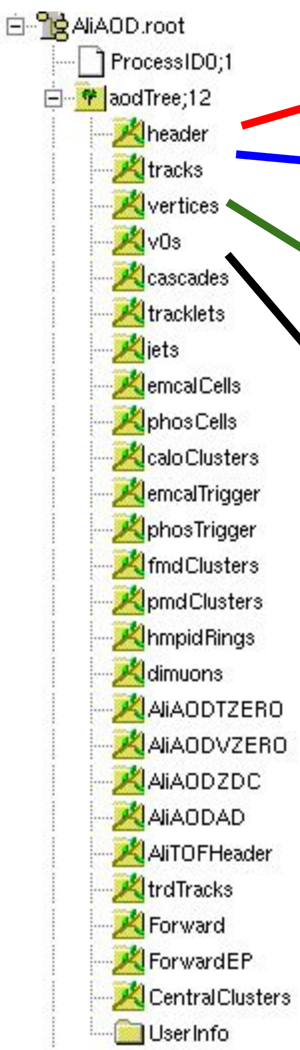
FROM ESD TO AOD

Analysis Object Data (AOD)

- **AOD files** should be the main source for physics analysis
  - Lighter than ESDs
- Produced from ESDs as last step of the PPass (and muon_calo) reconstruction or in dedicated AOD refiltering productions
  - Analysis train for AOD creation defined in the macros ***AliDPG/AOD/AODtrain.C*** (raw data) and ***AliDPG/AOD/AODtrainsim.C*** (MC)
- The main “wagon” is the analysis task ***$ALICE_ROOT/ANALYSIS/ESDfilter/AliAnalysisTaskESDfilter.cxx***
  - Creates **AliAOD.root** and **AliAOD.Muons.root** files
  - In case of MC productions: the “kinematic tree” of generated particles is converted into a tree of AliAODMCParticle objects and stored in AliAOD.root
  - Additional information, e.g. for D-meson and photon conversion stored in dedicated delta-AOD files: **AliAOD.VertexingHF.root** and **AliAODGammaConversion.root**

AliAOD.root

- Similar structure as AliESDs.root



AliAODHeader: event properties
- **run number, mag field, diamond info ...**

Array of AliAODTracks
- **Central barrel tracks, muon tracks, kinks**

Array of vertices (primary, pileup, decay…)
- **AliAODVertex objects**

ARRAYS OF V0s, CASCADES
- **AliAODv0, AliAODcascade objects**

AliAODTrack

- Inherits from **AliVTrack** and not from AliExternalTrackParam)
- Different parameterisation w.r.t. AliESDtrack:

```
// Momentum & position
Double32_t    fMomentum[3];       // momemtum stored in pt, phi, theta
Double32_t    fPosition[3];       // position of first point on track or dca
```

  - Momentum components and position at DCA to vertex
  - Covariance matrix
  - Only parameters at the DCA to the vertex are stored
- Can be converted to AlIExternalTrackParam via AliExternalTrackParam::CopyFromVTrack

AODtrack selection: filter bits

- AOD tracks have a **filter-bit mask** (data member *fFilterMap*)

```
UInt_t          fFilterMap;          // filter information, one bit per set of cuts
```

  - Store information about whether the track satisfies standard sets of quality criteria
  - Each bit correspond to a given set of cuts, e.g.:

```
enum AODTrkFilterBits_t {
  kTrkTPCOnly              = BIT(0), // Standard TPC only tracks
  kTrkITSsa                = BIT(1), // ITS standalone
  kTrkITSConstrained       = BIT(2), // Pixel OR necessary for the electrons
  kTrkElectronsPID         = BIT(3),    // PID for the electrons
  kTrkGlobalNoDCA          = BIT(4), // standard cuts with very loose DCA
  kTrkGlobal               = BIT(5),  // standard cuts with tight DCA cut
  kTrkGlobalSDD            = BIT(6), // standard cuts with tight DCA but with requiring the first SDD
  kTrkTPCOnlyConstrained = BIT(7) // TPC only tracks: TPConly information constrained to SPD vertex
};
```

- N.B.: the filter bits can change from production to production. Documentation is available in this twiki: https://twiki.cern.ch/twiki/bin/viewauth/ALICE/PWGPPAODTrackCuts
- The usage of a filter bit is recommended but might not be enough for your analysis! **You should be aware what it corresponds to!**

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Filter-bit example (AOD145)

Bit	Cuts	Methods
Bit 0 (001)	Standard cuts on primary tracks	GetStandardTPCOnlyTrackCuts() (*)
Bit 1 (002)	ITS stand-alone tracks(ESD Track Cuts)	SetRequireITSStandAlone(kTRUE)
Bit 2 (004)	Pixel OR (necessary for the electrons) AND Standard track cuts (SetFilterMask(1) of AliESDtrackCuts)	SetClusterRequirementITS(AliESDtrackCuts::kSPD, AliESDtrackCuts::kAny)
Bit 3 (008)	PID for the electrons AND Pixel Cuts (SetFilterMask(4) of AliESDpidCuts)	SetTPCnSigmaCut(AliPID::kElectron, 3.5)
Bit 4 (016)	Standard Cuts with very loose DCA	GetStandardITSTPCTrackCuts2011(kFALSE) SetMaxDCAToVertexXY(2.4) SetMaxDCAToVertexZ(3.2) SetDCaToVertex2D(kTRUE)
Bit 5 (032)	Standard Cuts with tight DCA cut	GetStandardITSTPCTrackCuts2011()
Bit 6 (064)	Standard Cuts with tight DCA but with requiring the first SDD cluster instead of an SPD cluster tracks selected by this cut are exclusive to those selected by the previous cut	GetStandardITSTPCTrackCuts2011() SetClusterRequirementITS(AliESDtrackCuts::kSPD,AliESDtrackCuts::kNone) SetClusterRequirementITS(AliESDtrackCuts::kSDD,AliESDtrackCuts::kFirst)
Bit 7 (128)	TPC only tracks,constrained to SPD vertex in the filter	GetStandardTPCOnlyTrackCuts **esdfilter->SetTPCOnlyFilterMask(128)**
Bit 8 (256)	Extra cuts for Hybrids: - first the global tracks we want to take	AliESDtrackCuts::GetStandardITSTPCTrackCuts2011(kFALSE) SetMaxDCAToVertexXY(2.4) SetMaxDCAToVertexZ(3.2) SetDCAToVertex2D(kTRUE) SetMaxChi2TPCConstrainedGlobal(36) SetMaxFractionSharedTPCClusters(0.4) **esdfilter->SetHybridFilterMaskGlobalConstrainedGlobal((1<<8));** // these normal global tracks will be marked as hybrid
Bit 9 (512)	Than the complementary tracks which will be stored as global constraint, complement is done in the ESDFilter task	SetClusterRequirementITS(AliESDtrackCuts::kSPD,AliESDtrackCuts::kOff) SetRequireITSRefit(kTRUE) **esdfilter->SetGlobalConstrainedFilterMask(1<<9);** // these tracks are written out as global constrained tracks esdfilter->SetWriteHybridGlobalConstrainedOnly(kTRUE); // write only the complement
Bit 10(1024)	Standard Cuts with tight DCA cut, using cluster cut instead of crossed rows	GetStandardITSTPCTrackCuts2011(kTRUE,0) (**)

Global and TPC only tracks

- **Global tracks**
  - Treated in AliAnalysisTaskESDfilter::ConvertTracks
  - **An ESD track is converted into AOD track and stored in the AOD track array if:**
    - it passes at least 1 of the selection (filter bit) cuts
    - OR if it belongs to vertex contributors (e.g. was used for primary vertex reconstruction)
- **TPC only tracks**: **filter bit 128** (1<<7) - all other bits are reset
  - Treated in AliAnalysisTaskESDfilter::ConvertTPCOnlyTracks
  - All tracks passing standard TPC-only cuts stored with:
    - TPC-only track parameters from kTPCin step (*GetTPCInnerParam*) constrained to SPD vertex
    - Unconstrained momentum and position are also stored
    - AOD track ID, *AliAODTrack::GetID()*, set to *negative value*

Hybrid tracks

- **Global hybrid tracks**: filter bit 256 (1<<8)
  - Treated in AliAnalysisTaskESDfilter::ConvertTracks
  - Tracks **passing standard TPC+ITS cuts , SPD hit request and golden chi2 cut** are marked as filter bit 256
- **Complementary hybrid tracks**: filter bit 512 (1<<9) - all other bits are reset
  - AliAnalysisTaskESDfilter::ConvertGlobalConstrainedTracks
  - All tracks passing **standard TPC+ITS cuts** have **no hits in SPD** are stored in the AOD track array with
    - Global track parameters constrained to primary vertex (*GetConstrainedParam*)
    - Unconstrained momentum and position are also stored
    - AOD track ID, *AliAODTrack::GetID()*, set to *negative value*

AODtrack selection: filter bits

- Track selection can be done using the filter bits using these methods of AliAODTrack

```
Bool_t  TestFilterBit(UInt_t filterBit) const {
  return (Bool_t) ((filterBit & fFilterMap) != 0);}
Bool_t  TestFilterMask(UInt_t filterMask) const {
  return (Bool_t) ((filterMask & fFilterMap) == filterMask);}
```

- Examples:

```
for(Int_t iTrack=0;iTrack<nTracks;iTrack++){
 AliAODTrack *aodTrack = aod->GetTrack(iTrack);
 if(!aodTrack) continue;
 // filter bit 128 denotes TPC-only tracks, use only them
 if(!aodTrack->TestFilterBit(128)) continue;
```

```
Bool_t IsAcceptedTrack(const AliAODTrack *aodTrack) {
  if (!aodTrack) return kFALSE;
  if(!aodTrack->TestFilterMask(BIT(5))) return kFALSE; // standard TPCITS with tight DCA
```

```
if(!(aodtrack->TestFilterBit(AliAODTrack::kTrkGlobalNoDCA) ||
     aodtrack->TestFilterBit(AliAODTrack::kTrkITSsa))) return kFALSE;
```

Filter bits: where and how they are defined

The filter bits can change from production to production (documentation here)

- The filter bit scheme used for a given production is defined by the macro $ALICE_ROOT/ANALYSIS/ESDfilter/macros/AddTaskESDFilter.C

```
Bool_t AddTrackCutsLHC10bcde(AliAnalysisTaskESDfilter* esdFilter);
Bool_t AddTrackCutsLHC10h(AliAnalysisTaskESDfilter* esdFilter);
Bool_t AddTrackCutsLHC11h(AliAnalysisTaskESDfilter* esdFilter);
Bool_t AddTrackCutsLHC15f(AliAnalysisTaskESDfilter* esdFilter);
Bool_t enableTPCOnlyAODTracksLocalFlag=kFALSE;

AliAnalysisTaskESDfilter *AddTaskESDFilter(Bool_t useKineFilter=kTRUE,
                                           Bool_t writeMuonAOD=kFALSE,
                                           Bool_t writeDimuonAOD=kFALSE, /*obsolete*/
                                           Bool_t usePhysicsSelection=kFALSE,
                                           Bool_t useCentralityTask=kFALSE, /*obsolete*/
                                           Bool_t enableTPCOnlyAODTracks=kFALSE,
                                           Bool_t disableCascades=kFALSE,
                                           Bool_t disableKinks=kFALSE,
                                           Int_t runFlag = 1500, // The first 2 digits are the year, the second
                                                                 //2 digits are used to distinguish sub-periods (if needed)
                                           Int_t  muonMCMode = 3  ,
                                           Bool_t useV0Filter=kTRUE,
                                           Bool_t muonWithSPDTracklets=kTRUE,
                                           Bool_t isMuonCaloPass=kFALSE,
                                           Bool_t addPCMv0s=kTRUE)
{
 // Creates a filter task and adds it to the analysis manager.
  // Get the pointer to the existing analysis manager via the static access method.
  //==============================================================================
  AliAnalysisManager *mgr = AliAnalysisManager::GetAnalysisManager();
  if (!mgr) {
```

4 main methods, defining different “schemes” used for different periods

Various parameters: “runFlag” defines which of the above 4 methods is used

EVENT SELECTION

Triggers in ALICE

- The ALICE experiment cannot record all events:
  - *Large detector readout time (up to 1 ms/event)*
  - *Data storage limitations*
- We need some non-negligible activity in ALICE detectors to start the data acquisition (**Minimum bias triggers**)
  - Mainly based on V0, SPD and T0:
    - pp 2010: SPD | V0A | V0C (**INT1**)
    - pp 2012: T0A & T0C within a given time window (**INT8**)
    - pp 2015-2017 and p-Pb: V0A & V0c (**INT7**)
- We may be interested in rare observables for which we can collect enough statistics only requiring specific signatures in ALICE the detectors (**rare triggers**)
  - Most common rare triggers (used in coincidence with SPD or V0 or T0 triggers)
    - Muon triggers (single muon, dimuon)
    - Calorimeter triggers (EMCAL, PHOS)
    - Ultra-peripheral collisions (Muon, T0F+SPD)

Triggers classes

Trigger Classes: product of several trigger requirements

- *Typical trigger class name:* **CEMC7EGA-B-NOPF-CENTNOTRD**

Descriptor — **BC mask** — **PF protection** — **Cluster**

Descriptor: *combination of trigger inputs (AND, OR, VETO logic is possible)*

BC mask: *information about interactions (beam-beam, beam-gas, satellite, etc.)*

Past-Future protection: *rejects events with multiple collisions from different bunch crossings*

Cluster: *group of detectors to be read out if the trigger conditions is satisfied*

CLUSTERS

CLUSTERS	Detectors																			
	ACORDE	CPV	DAQ TEST	EMCAL	FMD	HMPID	MUON TRG	MUON TRK	PHOS	PMD	SDD	SPD	SSD	T0	TOF	TPC	TRD	TRIGGER	V0	ZDC
	✓			✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ALLNOTRD	✓			✓	✓	✓	(✓)	✓	(✓)		✓	(✓)	✓	(✓)	✓	✓		✓	(✓)	✓
CENTNOTRD	✓			(✓)	✓	✓					✓	(✓)	✓	✓	(✓)	(✓)		✓	(✓)	✓
ALL	✓			✓	✓	✓	✓	✓	(✓)		✓	(✓)	✓	✓	✓	✓	(✓)	✓	(✓)	✓
CENT	✓			(✓)	✓	✓					✓	✓	✓	✓	✓	✓	(✓)	✓	(✓)	✓
FAST				✓		✓						✓	✓	✓	✓	✓	(✓)	✓	(✓)	✓
MUON							(✓)	✓				✓		✓				✓	(✓)	✓

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Trigger aliases

→ Definitions of trigger aliases in: `AliVEvent::EOfflineTriggerTypes`

Trigger	Definition
AliVEvent::kMB	BIT(0), Min. bias trigger in PbPb 2010-11
AliVEvent::kINT1	BIT(0), V0A | V0C | SPD minimum bias trigger
AliVEvent::kINT7	BIT(1), V0AND minimum bias trigger
AliVEvent::kMUON	BIT(2), Single muon trigger in pp2010-11, INT1 suite
AliVEvent::kHighMult	BIT(3), High-multiplicity SPD trigger
...	...
AliVEvent::kAny	0xffffffff, to accept any defined trigger

(See all trigger definitions in `$ALICE_ROOT/STEER/STEERBase/AliVEvent.h`)

→ Assignment of trigger classes to aliases and definition of background and quality checks is stored in OADB. Check details in `$ALICE_PHYSICS/OADB/macros/BrowseAndFillPhysicsSelectionOADB.C`

→ Several aliases can be fired at the same time

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Physics Selection

The Physics Selection class (`AliPhysicsSelection`) is used to select collision candidates in data samples collected by ALICE

- Reject background and poor quality events according to predefined requirements
- Select events within the trigger class fired
- Aliases can be used to group similar trigger class names:

  Example: alias `AliVEvent::kMUSH7`
  - CMSH7-B-NOPF-MUON
  - CMSH7-S-NOPF-MUON
  - CMSH7-S-NOPF-ALLNOTRD

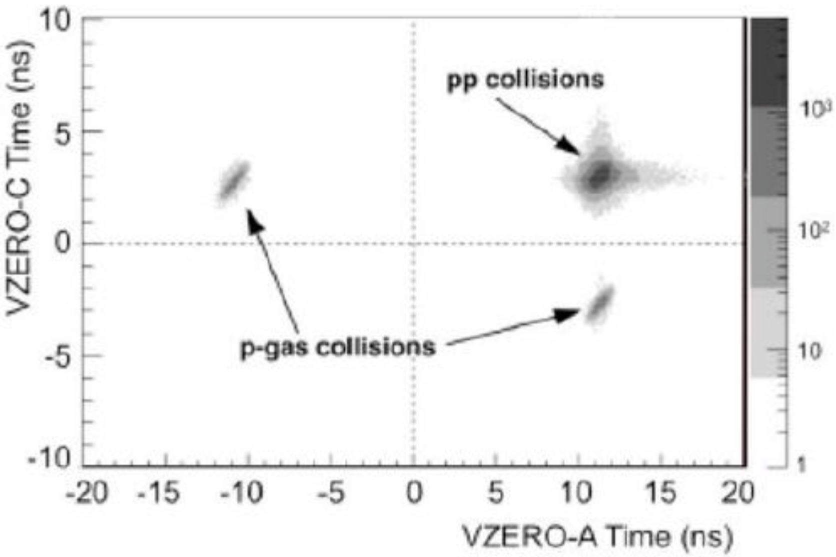
- Basic usage: *how to select the events in your analysis task*

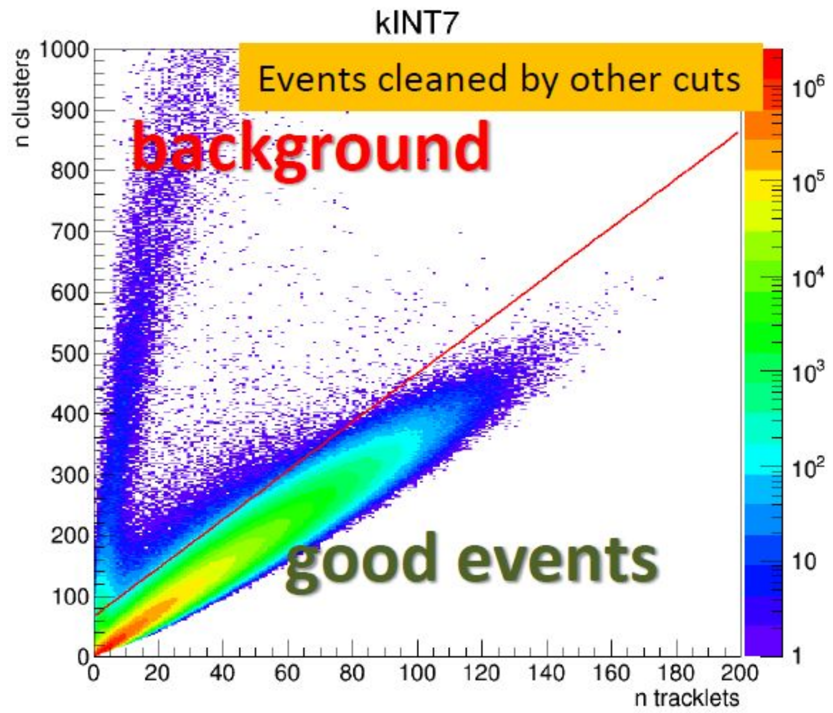
```
// in your UserExec
UInt_t fSelectMask = fInputHandler->IsEventSelected();
Bool_t isINT7selected = fSelectMask & AliVEvent::kINT7;
```

(see more in https://twiki.cern.ch/twiki/bin/view/ALICE/AliDPGtoolsEventProp#Event_selection)

Physics Selection

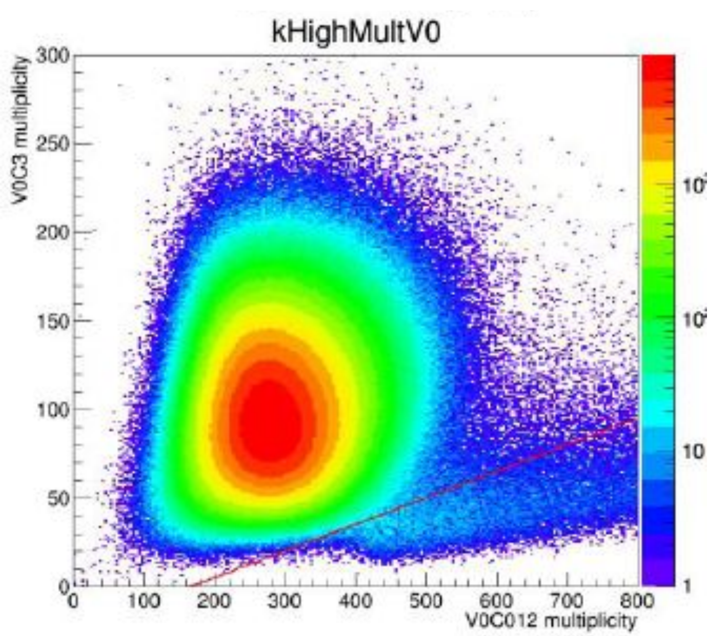
- Basic selections:
  - V0A and V0C time information
  - Cluster-vs-tracklet background cut (now in user hands)
  - ZDC timing cuts (in Pb-Pb and p-Pb)
  - Incomplete event rejection

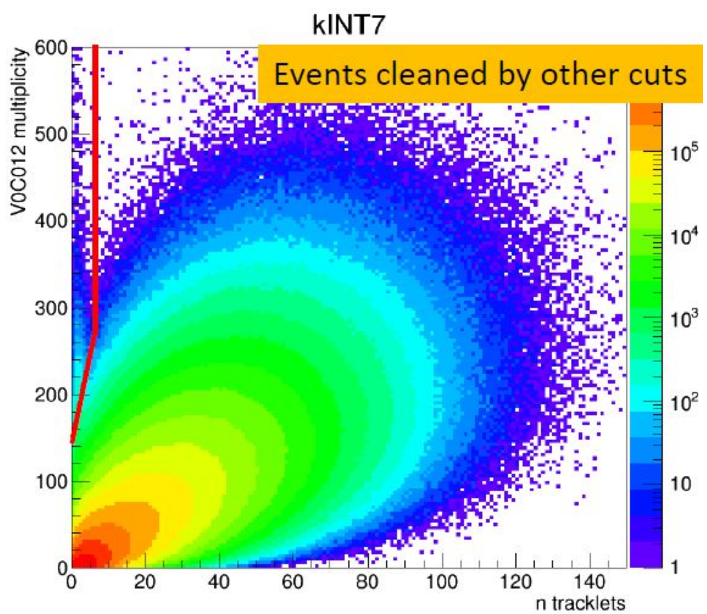




Physics Selection

- Basic selections:
  - V0A and V0C time information
  - Cluster-vs-tracklet background cut (now in user hands)
  - ZDC timing cuts (in Pb-Pb and p-Pb)
  - Incomplete event rejection (in p-Pb, pp2015)
- Further background cuts in Run2
  - V0C012 vs V0C3 asymmetry cut
  - V0C012 vs tracklet background cut





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Physics Selection

- Basic selections:
  - V0A and V0C time information
  - Cluster-vs-tracklet background cut (now in user hands)
  - ZDC timing cuts (in Pb-Pb and p-Pb)
  - Incomplete event rejection (in p-Pb, pp2015)
- New background cuts
  - V0C012 vs V0C3 asymmetry cut
  - V0C012 vs tracklet background cut
- Pileup cuts
  - Out-of-bunch pileup cut based on V0 past-future info
  - Out-of-bunch pileup cut based on online-vs-offline V0M correlation
  - Out-of-bunch pileup cut based on online-vs-offline SPD FO correlation

Pileup removal

Two main categories of pileup:

1. Same bunch-crossing pileup

two or more collisions occurring in the same bunch crossing

→ seen by all detectors

→ reconstructed points in drift detectors (TPC and SDD) are in the "correct" spatial position

→ can be removed at the ***event selection*** level with cuts based on ***multiple reconstructed vertices***

2. Out-of-bunch pileup

one or more collisions occurring in bunch crossings different from the one which triggered the acquisition

→ detectors are affected differently depending on their readout time

→ reconstructed points in drift detectors are spatially shifted (z for TPC, rϕ for SDD) by $\Delta s = v^{drift}.\Delta t$

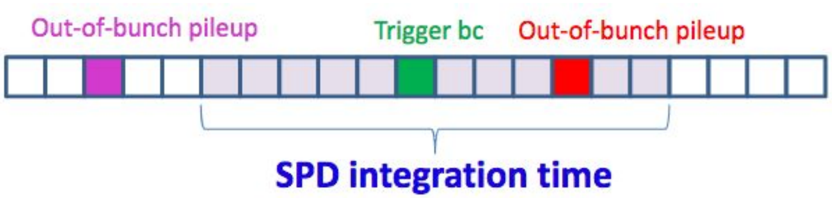
→ can be removed at the ***event selection*** level and also based on ***track selection*** cuts

Pileup removal

Tools for pileup tagging, removal, mitigation:

(see dedicated Twiki page for details: https://twiki.cern.ch/twiki/bin/view/ALICE/AliDPGtoolsPileup)

- **Past-Future protection:** allows to remove out-of-bunch pileup from outside the SPD readout time (300ns) - *do not help within SPD integration time window*



Should be activated for pp and p-Pb analyses in the Physics Selection task:

```
AddTaskPhysicsSelection(isMC, kTRUE)
```

- **Multiple vertices with the SPD:** sensitive to same-bunch and out-of-bunch pileup within the SPD readout window
  → *can be accessed via:*

```
AliESDEvent::IsPileUpFromSPD()
AliESDEvent::IsPileUpFromSPDInMultBins() //mult. dep.
```

- **Multiple vertices with tracks:** simultaneous vertex finding using ITS, TPC and TOF (if available) - *wider time coverage than SPD*
  → *can be accessed via:*

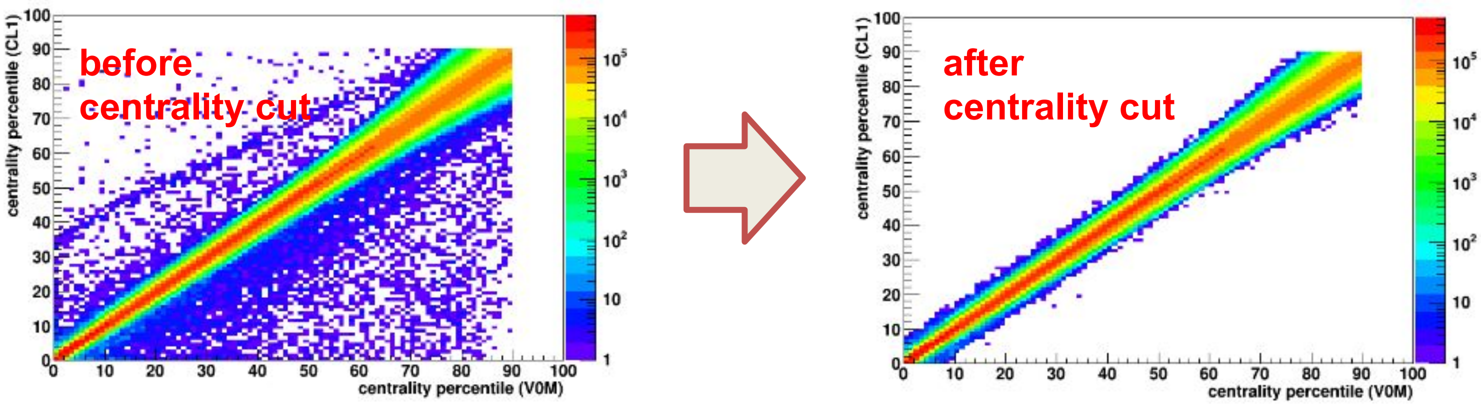
```
AliAnalysisUtils::IsPileUpMV(AliVEvent *event)
```

Pileup removal

Tools for pileup tagging, removal, mitigation:

(see dedicated Twiki page for details: https://twiki.cern.ch/twiki/bin/view/ALICE/AliDPGtoolsPileup)

- **Correlations between centrality estimators (Pb-Pb):** cut on correlation between V0 and CL0, CL1 centralities



- **Removing tracks from out-of-bunch pileup collisions:**
  - *require tracks with **ITS hits** (in particular to SPD)*
  - *require matching to TOF and **TOF bunch crossing ID=0***
  - *require tracks to point to the main vertex via **DCAz cut***

Primary Vertex selection

Primary vertex information can be retrieved from ESD and AOD events

```
AliVVertex* vtx = event->GetPrimaryVertex();
```

(AliVVertex can be casted to ESD or AOD vertex)

This method will return (following this order):

1. *the vertex reconstructed from tracks*
2. *the SPD vertex (if the track vertex is not available)*
3. *the vertex from TPC tracks (if also the SPD vertex is not available)*

A set of selections can be applied at the analysis level in order to reject events with poorly reconstructed vertex

- ➔ *Selection on **contributors to vertex***
- ➔ *Selection on SPD **vertex type** (3D or z reconstruction)*
- ➔ *Special selections for SPD vertex (based on z resolution/dispersion)*
- ➔ *Cut on **absolute distance between track and SPD vertices** (Pb-Pb 2011)*
- ➔ *Cut on **absolute and nsigma distance between track and SPD vertices** (Pb-Pb 2015)*

By construction, the main vertex is the one with the largest number of contributors - *additional vertices found are treated as **pileup** vertices*

Event Selection Class: AliEventCuts

A general class for event selections is available:

(see more instructions in: https://twiki.cern.ch/twiki/bin/view/ALICE/AliDPGtoolsEventProp#Event_selection_class)

→ main functionalities similar to those of `AliESDtrackCuts`

→ provides a method to check if a given AliVEvent is accepted:
`AliEventCuts::AcceptEvent(AliVEvent *ev)`

→ Simple usage:

Add to the class member of your task:

```
class MyAliAnalysisTask {
  public:
  ...
  AliEventCuts fEventCuts; // Event cuts
  ...
}
```

Enable selection QA plots (if wanted):

```
// fList is your output TList
fEventCuts.AddQAplotsToList(fList);
```

In your `UserExec` *method:*

```
AliVEvent *ev = InputEvent();
if (!fEventCuts.AcceptEvent(ev)) {
  PostData(1, fList);
  return;
}
```

Event Selection Class: AliEventCuts

A general class for event selections is available:

(see more instructions in: https://twiki.cern.ch/twiki/bin/view/ALICE/AliDPGtoolsEventProp#Event_selection_class)

→ Retrieves the information about primary vertex and multiplicity after calling `AliEventCuts::AcceptEvent(AliVEvent* ev)`

```
float centrality = fEventCuts.GetCentrality(); //centrality from the default estimator
const AliVVertex* vtx = fEventCuts.GetPrimaryVertex(); //best primary vertex available
```

→ Advanced usage: *set cuts manually*

example of manual settings used in pp Run 2 event selection

add in your AddTask or in the UserCreateOutputObjects method

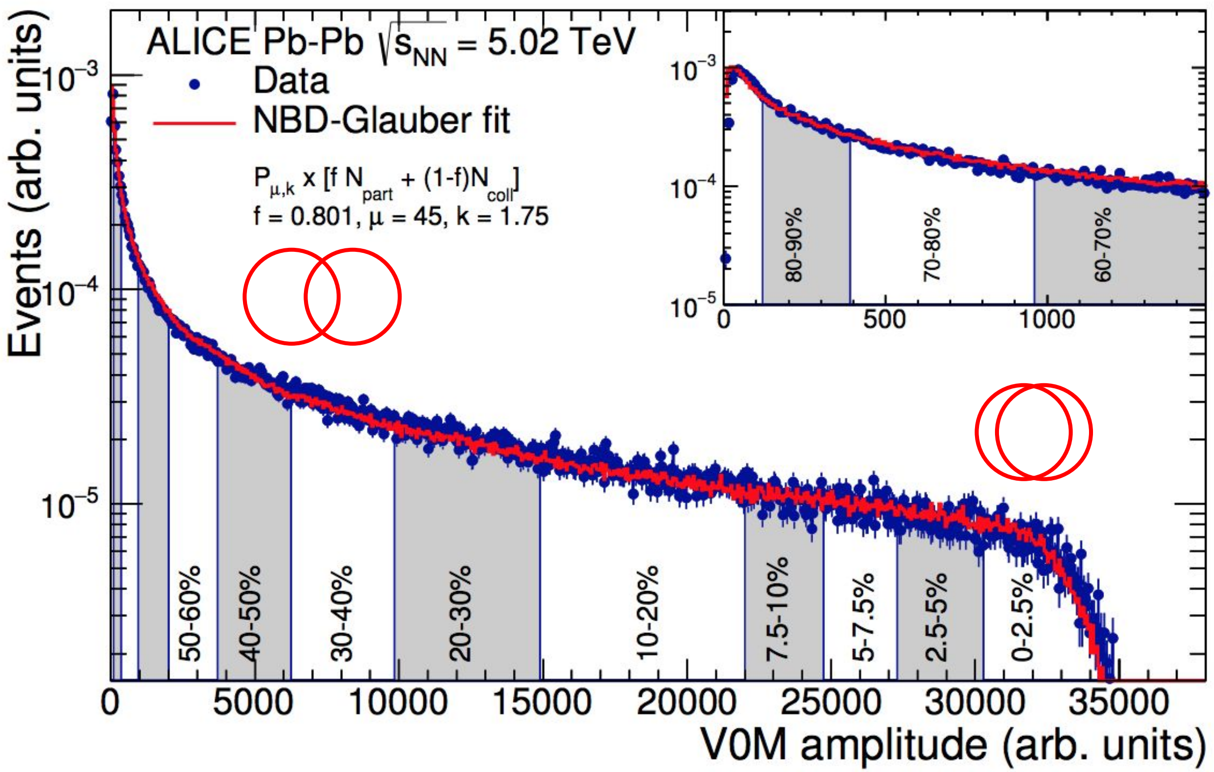
```
fEventCuts.SetManualMode(); //Enable manual mode
fEventCuts.fRequireTrackVertex = true;
fEventCuts.fMinVtz = -10.f;
fEventCuts.fMaxVtz = 10.f;
fEventCuts.fMaxDeltaSpdTrackAbsolute = 0.5f;
fEventCuts.fMaxResolutionSPDvertex = 0.25f;
fEventCuts.fTriggerMask = AliVEvent::kINT7;
fEventCuts.fRejectDAQincomplete = true;
fEventCuts.fSPDpileupMinContributors = 3;
fEventCuts.fSPDpileupMinZdist = 0.8;
fEventCuts.fSPDpileupNsigmaZdist = 3.;
fEventCuts.fSPDpileupNsigmaDiamXY = 2.;
fEventCuts.fSPDpileupNsigmaDiamZ = 5.;
fEventCuts.fTrackletBGcut = true;
```

EVENT CHARACTERISATION

More info here:
https://indico.cern.ch/event/387210/contributions/918223/attachments/1203723/1753174/DDChinellato-AliMultSelection-PhysicsForum1.pdf

Centrality selection in Pb-Pb

- Selecting events by impact parameter: impossible
- Next best thing: **select events** based on charged particle multiplicity measured in the V0 detectors: forward η to minimize auto-correlation biases
- Done in the "**AliMultSelection**" framework (also in pp, p-Pb!)



more info: https://aliceinfo.cern.ch/Notes/node/456

Centrality selection in Pb-Pb

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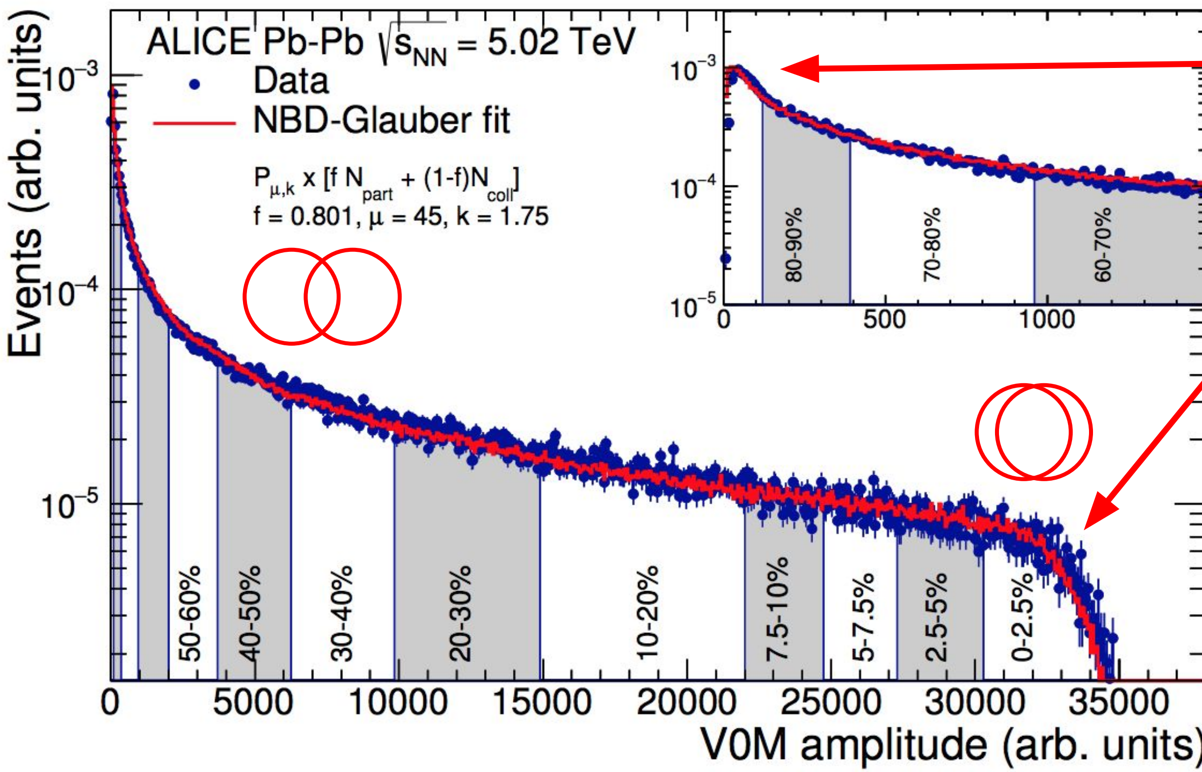
- Done in the "**AliMultSelection**" framework (also in pp, p-Pb!)



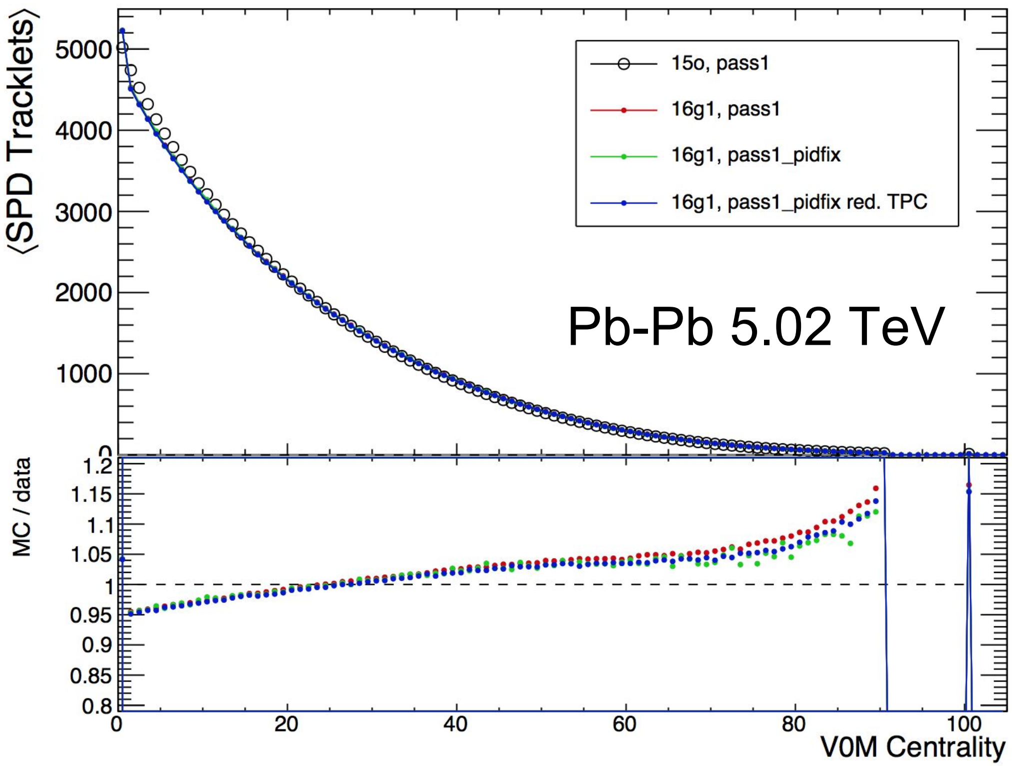
Very low multiplicity: discarded due to contamination from EM processes

Glauber MC model: A geometric approach to calculate participating and colliding nucleons
In this plot: coupled to a negative binominal (NBD) for describing multiplicity

more info: https://aliceinfo.cern.ch/Notes/node/456

Centrality in Pb-Pb: MC

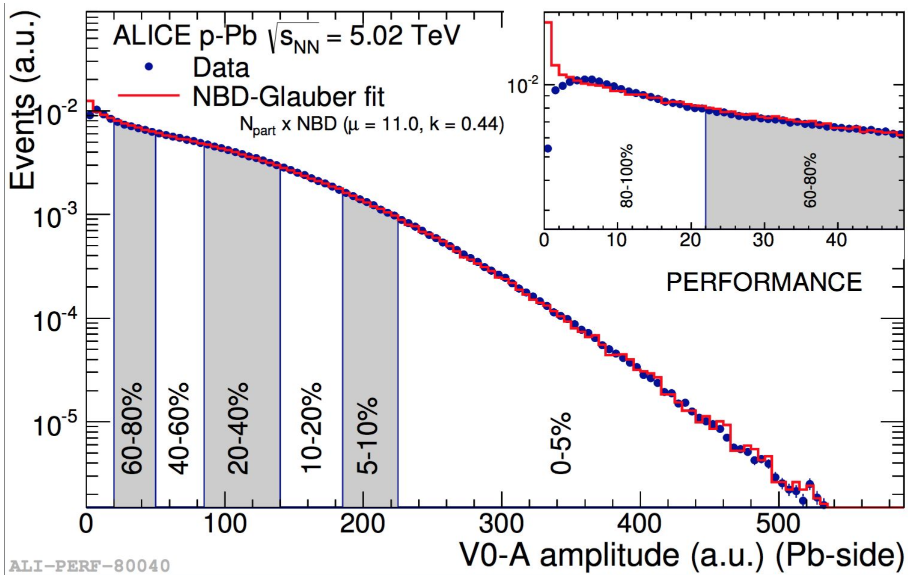
- In MC, the objective of the centrality selection is not to produce *percentiles* but rather to provide a <N_{ch}> for *a given percentile selection* that matches what is seen in data: ideal for **efficiency correction calculations**

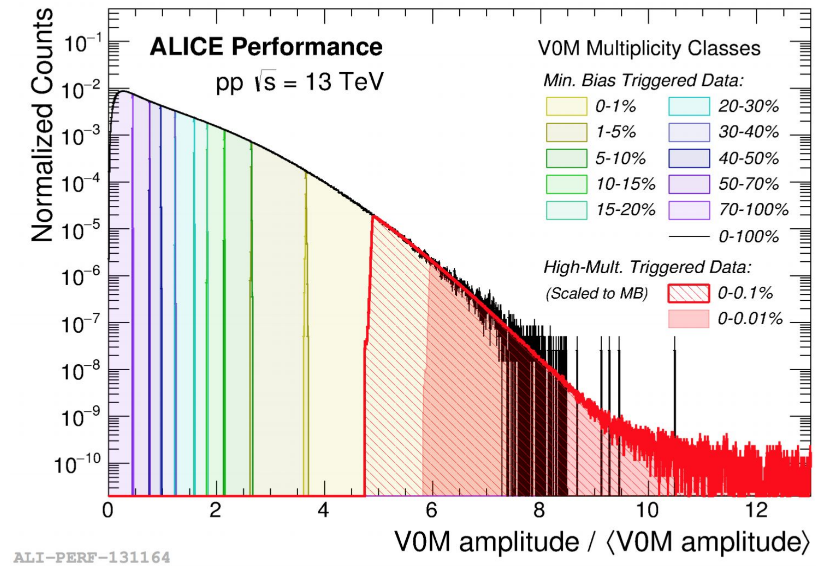


- Works fairly well up to a level of approximately ~5%-10%
- Strongly centrality dependent corrections usually assigned a small systematic uncertainty due to this
- The <SPD tracklet> plot is **available as standard QA** in AliMultSelection for x-checks
  - (more info here)

more info: https://aliceinfo.cern.ch/Notes/node/456

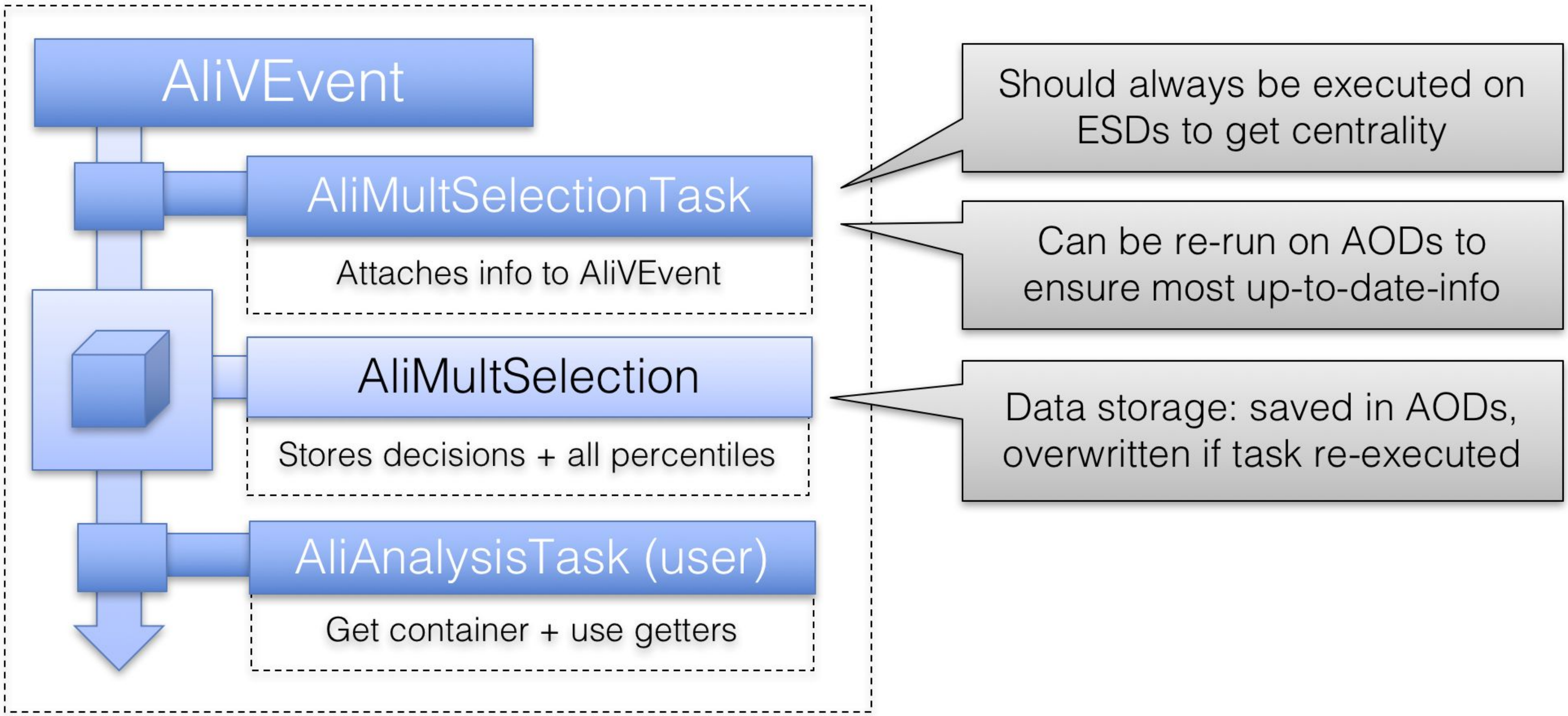
Centrality in p-Pb, pp





- pp and p-Pb are also sliced in V0A+V0C amplitudes, with notable differences:
- **pp**: typically we select slices of the INEL>0 cross-section, with the INEL>0 condition being "at least one SPD tracklet inside |η|<1.0". **Correcting to the physical INEL>0 event class** has to be done at analysis level
- **p-Pb**: typically we select slices of the visible V0A cross-section. **Correcting for the vertex determination efficiency** has to be done at analysis level
- N.B.: corrections not needed in Pb-Pb: close to 100% efficiency!

AliMultSelection: operation



Analysis usage consists of:

1) Get AliMultSelection object

```
AliMultSelection *obj = (AliMultSelection*) lVEvent-> FindListObject("MultSelection");
```

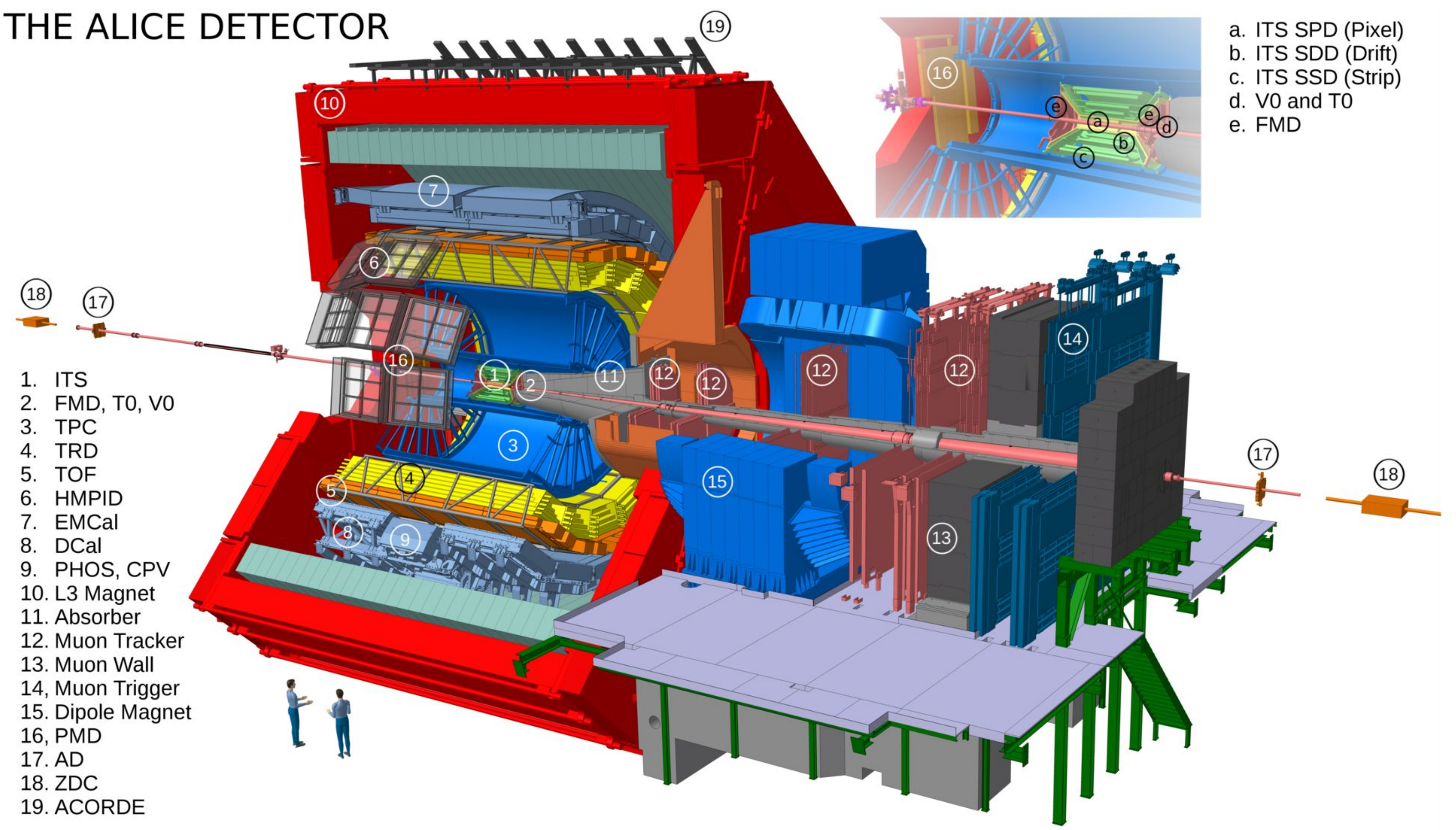
2) Get desired multiplicity percentile

```
obj->GetMultiplicityPercentile(“V0M”);
```

TRACK SELECTION on ESD and AOD

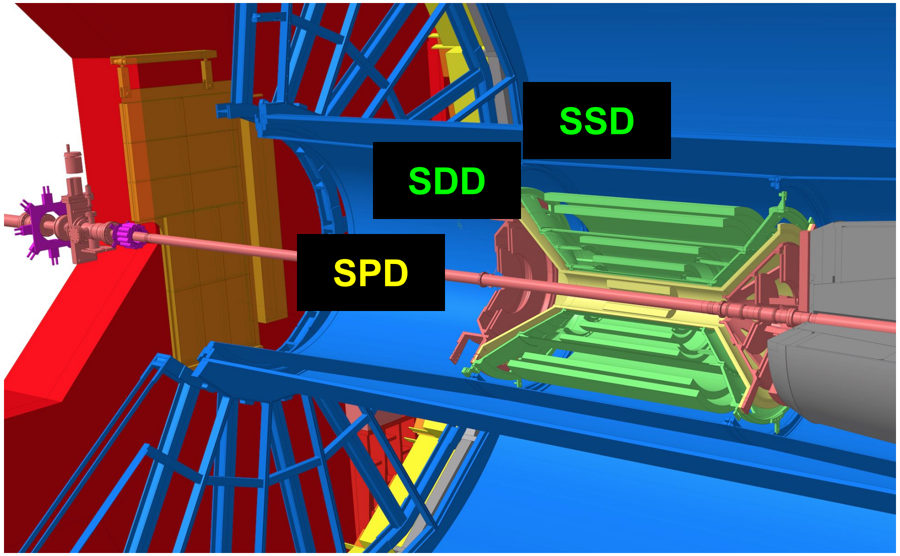
(also using material from the tutorial prepared by Z Conesa del Valle and A Kalweit for the ALICE Physics Week 2013)

ALICE Barrel tracking detectors



Inner Tracking System

- 3 sub-detectors with in total 6 layers
- Silicon Pixel detector: SPD
- Silicon Drift detector: SDD
- Silicon Strip detector: SSD



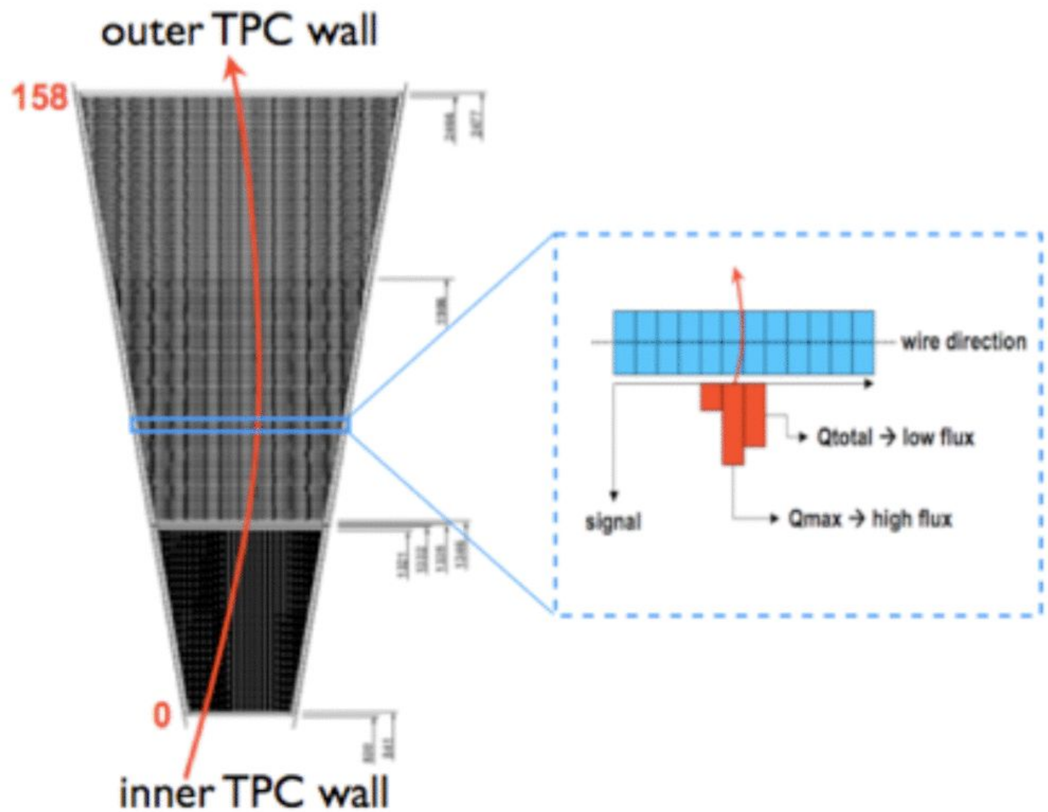
- Up to 6 hits (clusters) in the ITS can be attached to a track:

AliESDtrack::GetNcls(Int_t idet = 0)
AliESDtrack::HasPointOnITSLayer(Int_t i)

AliAODTrack::GetITSNcls()
AliAODTrack:: HasPointOnITSLayer(Int_t i)

Time Projection Chamber

- The ALICE TPC provides up to 159 space points (clusters) corresponding to the number of pad rows.
- The signal can be below threshold for low ionizing particles.



Definition of a TPC cluster can be found in the backup

ESD track selection: AliESDtrackCuts

- There are default cut sets available which are a very good starting point for all analyses (however, there is not a default cut set which is perfect for every analysis):

```
AliESDtrackCuts * fESDTrackCuts = AliESDtrackCuts::GetStandardITSTPCTrackCuts2010(kTRUE);
fESDTrackCuts->SetEtaRange(-0.8,+0.8);
```

- Inside the track loop:

```
if (!fESDTrackCuts->AcceptTrack(track)) continue;
```

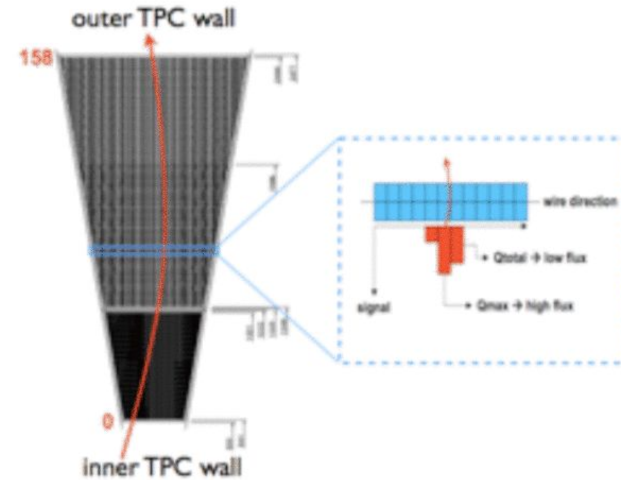
- Standard cut sets are defined for 2010 and 2011
- The 2011 standard cuts are a valid baseline also for Run2 data

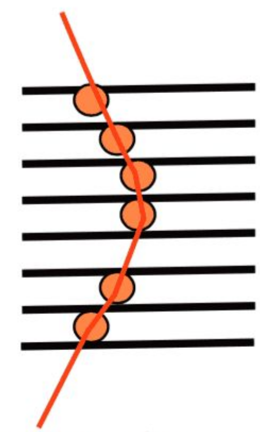
AliESDtracks: TPC cuts

```
AliESDtrackCuts* esdTrackCuts = new AliESDtrackCuts;
// TPC
if(clusterCut == 0)  esdTrackCuts->SetMinNClustersTPC(50);
else if (clusterCut == 1) {
  esdTrackCuts->SetMinNCrossedRowsTPC(70);
  esdTrackCuts->SetMinRatioCrossedRowsOverFindableClustersTPC(0.8);
}
else {

  esdTrackCuts->SetMinNClustersTPC(50);
}
esdTrackCuts->SetMaxChi2PerClusterTPC(4);
esdTrackCuts->SetAcceptKinkDaughters(kFALSE);
esdTrackCuts->SetRequireTPCRefit(kTRUE);
// ITS
esdTrackCuts->SetRequireITSRefit(kTRUE);
esdTrackCuts->SetClusterRequirementITS(AliESDtrackCuts::kSPD,
                                       AliESDtrackCuts::kAny);
if(selPrimaries) {
  // 7*(0.0015+0.0050/pt^1.1)
  esdTrackCuts->SetMaxDCAToVertexXYPtDep("0.0105+0.0350/pt^1.1");
  esdTrackCuts->SetMaxChi2TPCConstrainedGlobal(36);
}
esdTrackCuts->SetMaxDCAToVertexZ(2);
esdTrackCuts->SetDCAToVertex2D(kFALSE);
esdTrackCuts->SetRequireSigmaToVertex(kFALSE);

esdTrackCuts->SetMaxChi2PerClusterITS(36);
```





6 clusters / 7 crossed rows

AliESDtrackCuts: TPC cuts

```
AliESDtrackCuts* esdTrackCuts = new AliESDtrackCuts;
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if(clusterCut == 0)  esdTrackCuts->SetMinNClustersTPC(50);
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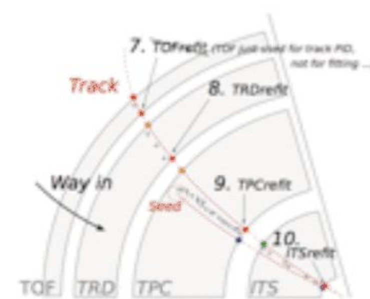
```



AliESDtrackCuts: TPC cuts

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if(selPrimaries) {
  // 7*(0.0015+0.0050/pt^1.1)
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esdTrackCuts->SetMaxDCAToVertexZ(2);
esdTrackCuts->SetDCAToVertex2D(kFALSE);
esdTrackCuts->SetRequireSigmaToVertex(kFALSE);

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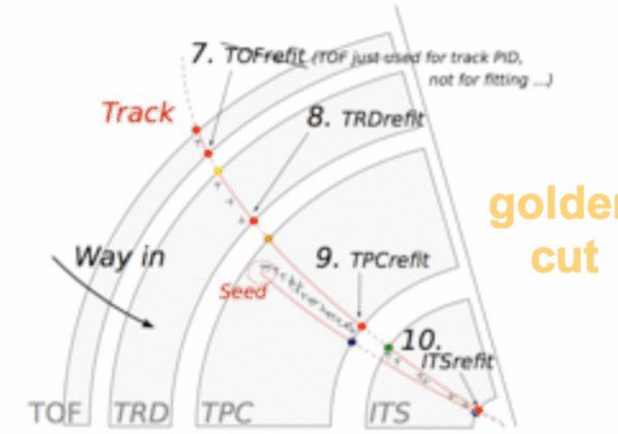
```



$(y, z, \sin(\varphi), \tan(\lambda), 1/p_t)$

χ^2-difference between: TPConly track parameters extrapolated to the primary vertex and global track parameters. Removes fake high-pt tracks due to wrong association of ITS clusters.

AliESDtrackCuts: ITS cuts

```
AliESDtrackCuts* esdTrackCuts = new AliESDtrackCuts;
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else if (clusterCut == 1) {
  esdTrackCuts->SetMinNCrossedRowsTPC(70);
  esdTrackCuts->SetMinRatioCrossedRowsOverFindableClustersTPC(0.8);
}
else {

  esdTrackCuts->SetMinNClustersTPC(50);
}
esdTrackCuts->SetMaxChi2PerClusterTPC(4);
esdTrackCuts->SetAcceptKinkDaughters(kFALSE);
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                                       AliESDtrackCuts::kAny);
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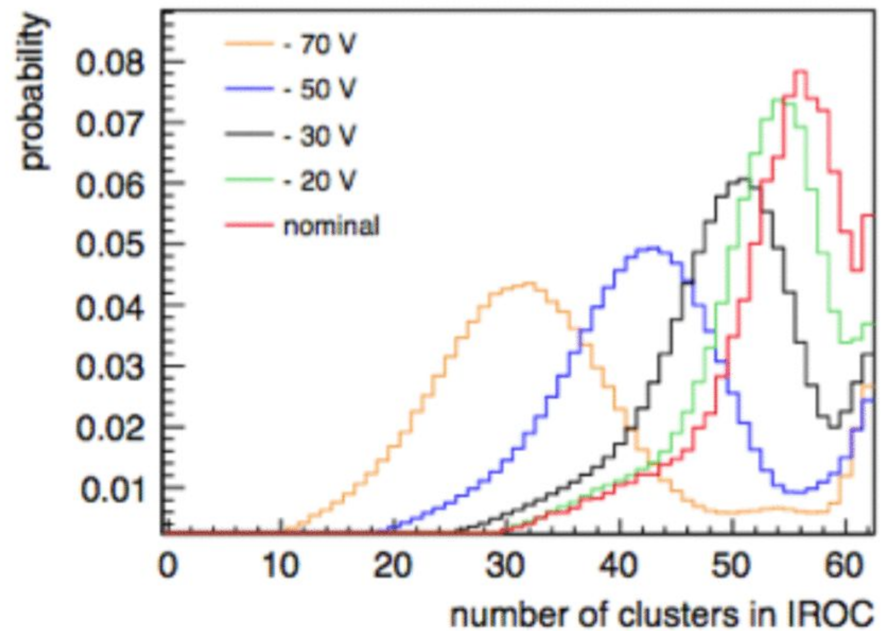
esdTrackCuts->SetDCAToVertex2D(kFALSE);
esdTrackCuts->SetRequireSigmaToVertex(kFALSE);

esdTrackCuts->SetMaxChi2PerClusterITS(36);
```

Cut at ≈ 7σ of impact parameter resolution.
N.B.: resolution is only given for the tracks which fulfill the other cuts.

Track properties depend on detector conditions

- The effect of the cuts depends on the detector performance. Typical examples:
  - Phi-homogeneity of SPD-cluster cut depends on the number of active modules which changed with time.
  - Number of TPC clusters depends on the gain of the chambers which also changed with time.
  - Chamber boundaries: high momenta tracks close to the chamber boundaries have naturally less clusters which is difficult to reflect in MC. N.B.: these clusters are not used for PID (a cut on TPC-PID or *track->GetTPCsignalN()* partially removes tracks on the boundaries.



DPG ALICE • Data Preparation Group

TRACKING: PERFORMANCE and EFFICIENCY

Standard procedure for efficiency systematic uncertainties

https://twiki.cern.ch/twiki/bin/view/ALICE/AliDPGtoolsTrackSystematicUncertainty

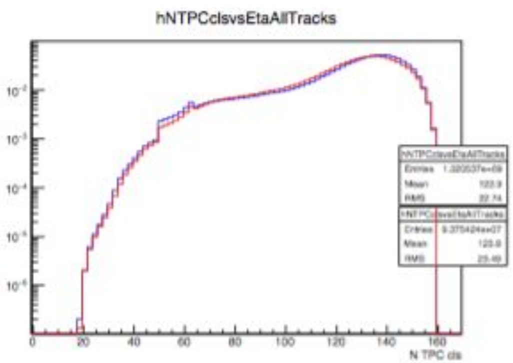
- Systematic on tracking efficiency estimated from two contributions:
  1. Track finding and selection in the TPC → estimated by TPC cut variation
  2. TPC-ITS matching (prolongation with a specific set of selections in ITS) → estimated by comparing matching efficiency in data and MC

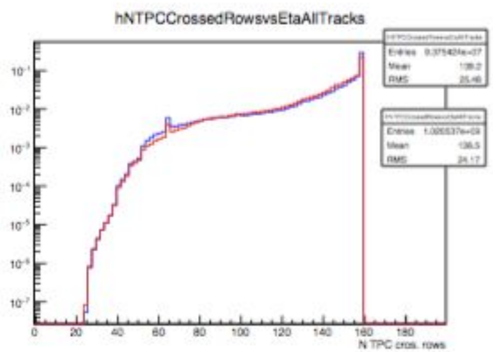
Variation of TPC track selections

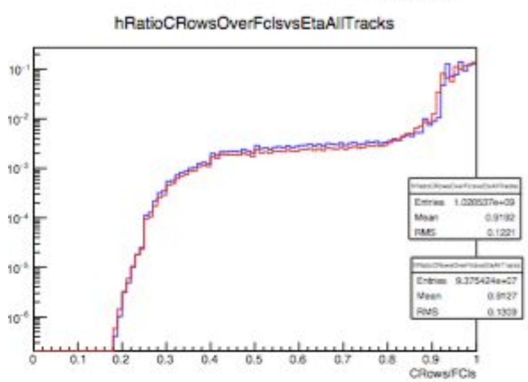
- This is an example, we will try to propose a standard procedure, but may depend on analysis
- Stdcuts: n_{TPCcls}>70; χ^2/cl<4; CrRows/Findb>0.8; $|\eta|$<0.8
- Variations: add/remove tighter cuts
  - stdcuts + TPC crossed rows > 120 - (5/pT)
  - stdcuts + TPC N clusters > 0.5 * TPC crossed rows
  - stdcuts + TPC signal N > 0.5 * TPC crossed rows
  - stdcuts + TPC crossed rows/TPC findable clusters > 0.9
- Compare corrected yields

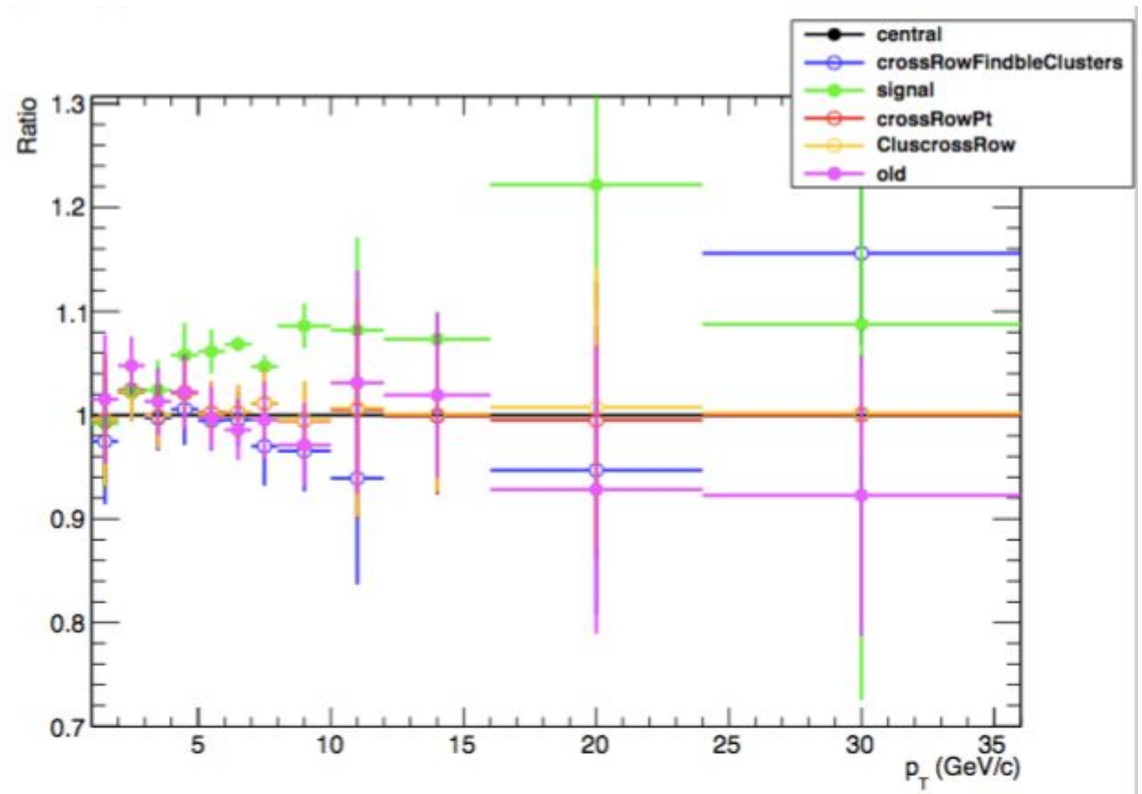
Variation of TPC track selections: example for D^0 cross section in pp 7 TeV

(results from pass 4 data)







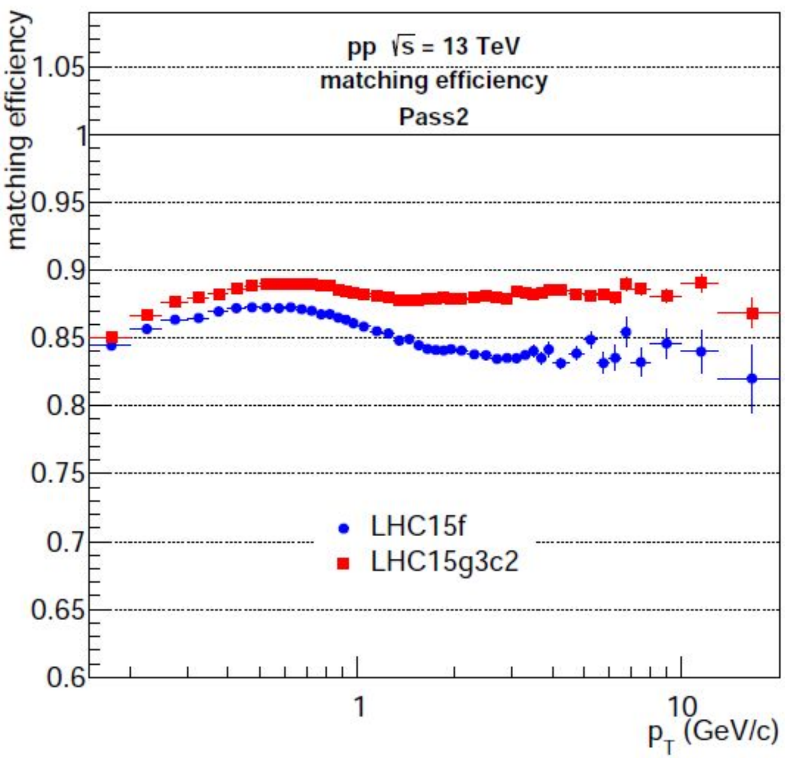


- stdcuts + TPC crossed rows > 120 - (5/pT)
- stdcuts + TPC N clusters > 0.5 * TPC crossed rows
- stdcuts + TPC signal N > 0.5 * TPC crossed rows
- stdcuts + TPC crossed rows/TPC findable clusters > 0.9

Matching efficiency systematic unc.

- A contribution to the systematic uncertainty on the tracking efficiency is commonly estimated by comparing the fraction of TPC tracks prolonged to ITS (+ hit in SPD) in data and MC (matching efficiency)

- The matching efficiency for charged tracks can differ significantly between data and MC (up to 6-8%)
- However: the comparison is affected not only by how well the MC describes the tracking, but also by the relative contributions of primary and secondary particles in data and MC



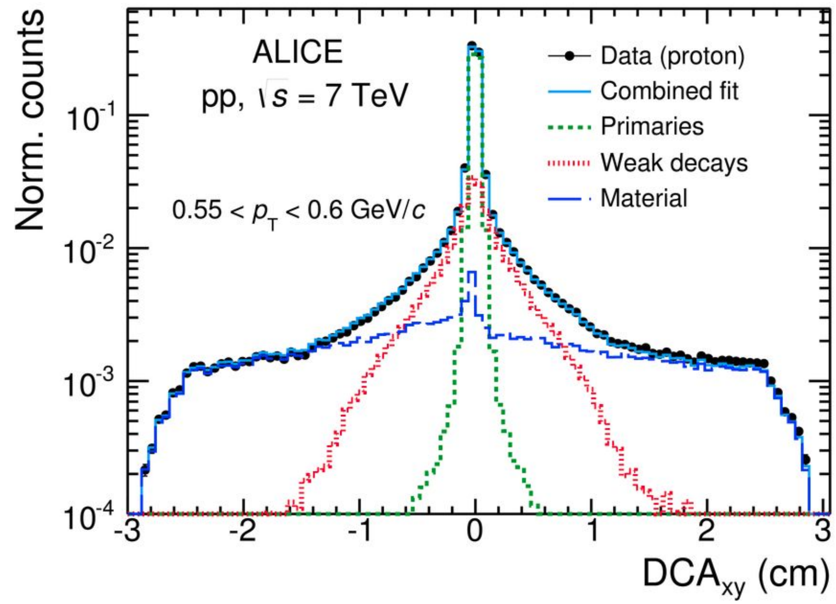
Physical primary particles

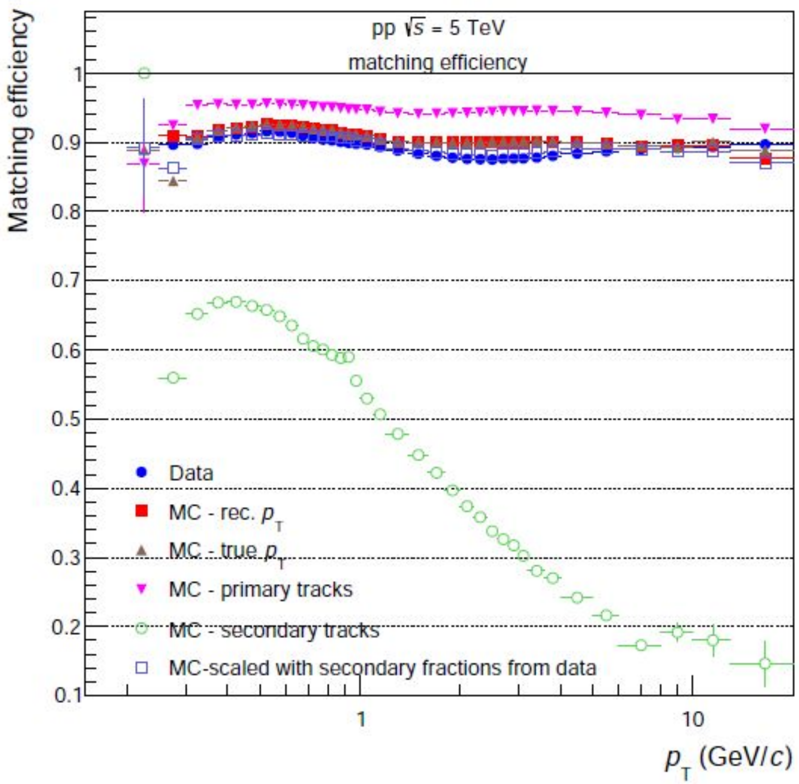
- **Physical primary particles:**
  - Definition: *A primary particle is a particle with a mean proper lifetime τ larger than 1 cm/c, which is either a) produced directly in the interaction, or b) from decays of particles with τ smaller than 1 cm/c*
  - Tagging of primaries implemented in AliRoot code in:
    - ESD/Kinematics: AliStack::IsPhysicalPrimary()
    - AOD: AliAODMCParticle::IsPhysicalPrimary()

- **Secondary particles:** distinguished in two categories
  - Produced in **weak decays of long-lived (strange) hadrons**
    - Tagged with: AliStack::IsSecondaryFromWeakDecay
  - Produced in **interactions in the detector material**
    - Tagged with: AliStack::IsSecondaryFromMaterial

Primary vs. secondary particles

- **Impact parameter** (Distance of Closest approach of track to interaction vertex) distribution
  - Peaked at 0 for primary particles
  - Wider for secondaries





- TPC->ITS track prolongation efficiency (**matching efficiency**)
  - Substantially lower matching efficiency for secondaries than for primaries

Matching efficiency systematic unc.

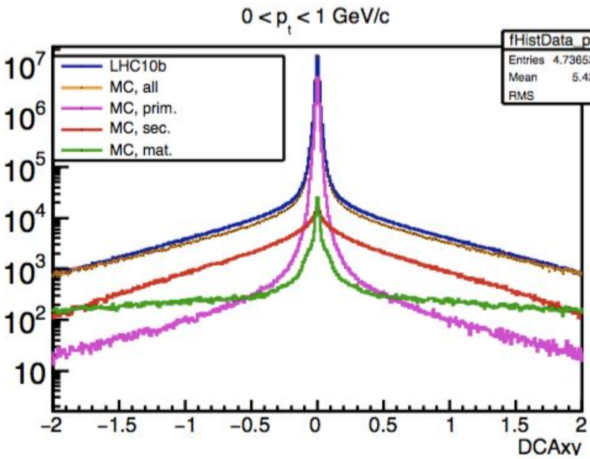
- Defined from the ratio of matching efficiencies in data and MC, with fraction of secondaries "equalised" in data and MC using DCA fits
  - Procedure introduced for charged-particle p_T spectra and R_{AA} analysis (https://aliceinfo.cern.ch/Notes/node/472)
  - Provided a task for general use (selections can be changed): PWGPP/EvTrkSelection/AliAnalysisTrackingUncertaintiesAOT

3 main ingredients:

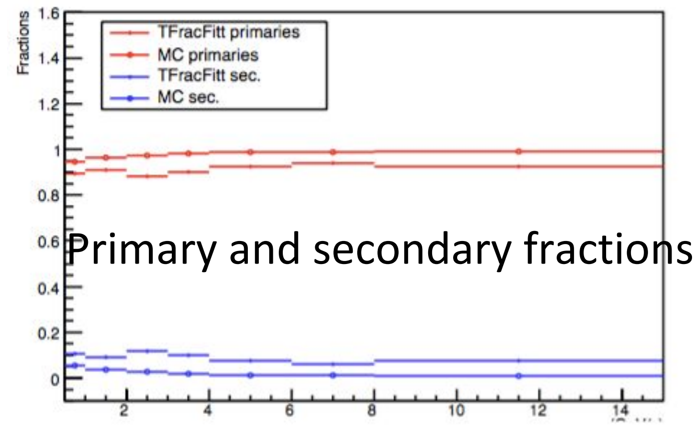
1) Matching efficiencies for particle types: $Eff^{MC}_{primaries}$, $Eff^{MC}_{secondaries}$, $Eff^{Data}_{inclusive}$
2) Primary fraction from data: $f'_{primaries}$
3) Combine into inclusive efficiency:
   $Eff^{MC}_{inclusive} = f'_{primaries} \times Eff^{MC}_{primaries} + (1 - f'_{primaries}) \times Eff^{MC}_{secondaries}$

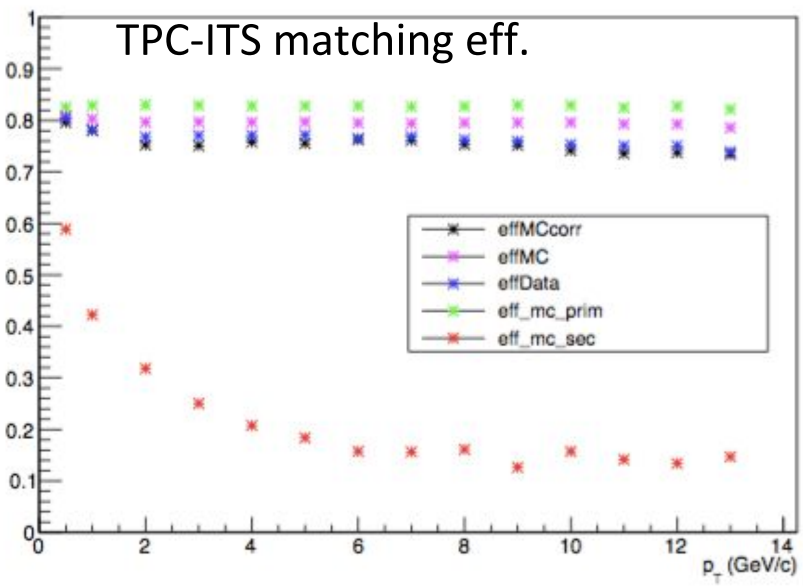
Systematic uncertainty: $(Eff^{Data}_{inclusive} - Eff^{MC}_{inclusive})/Eff^{Data}_{inclusive}$

Example: pp 7 TeV (pass 4)

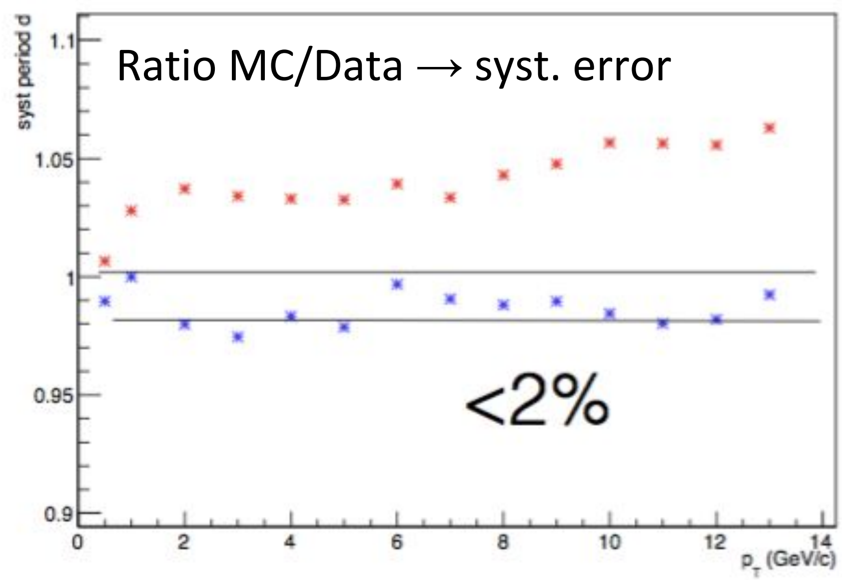


→



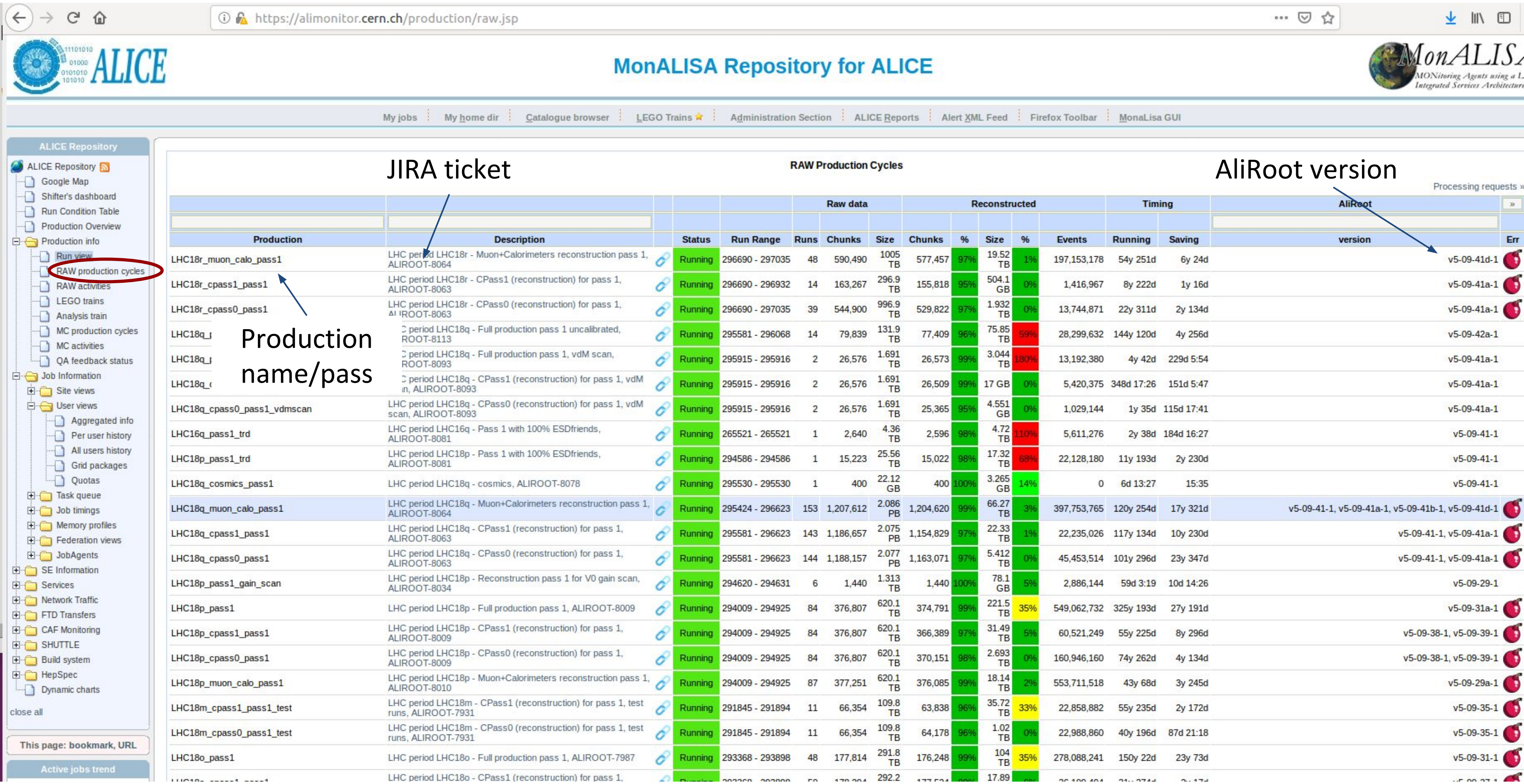


→



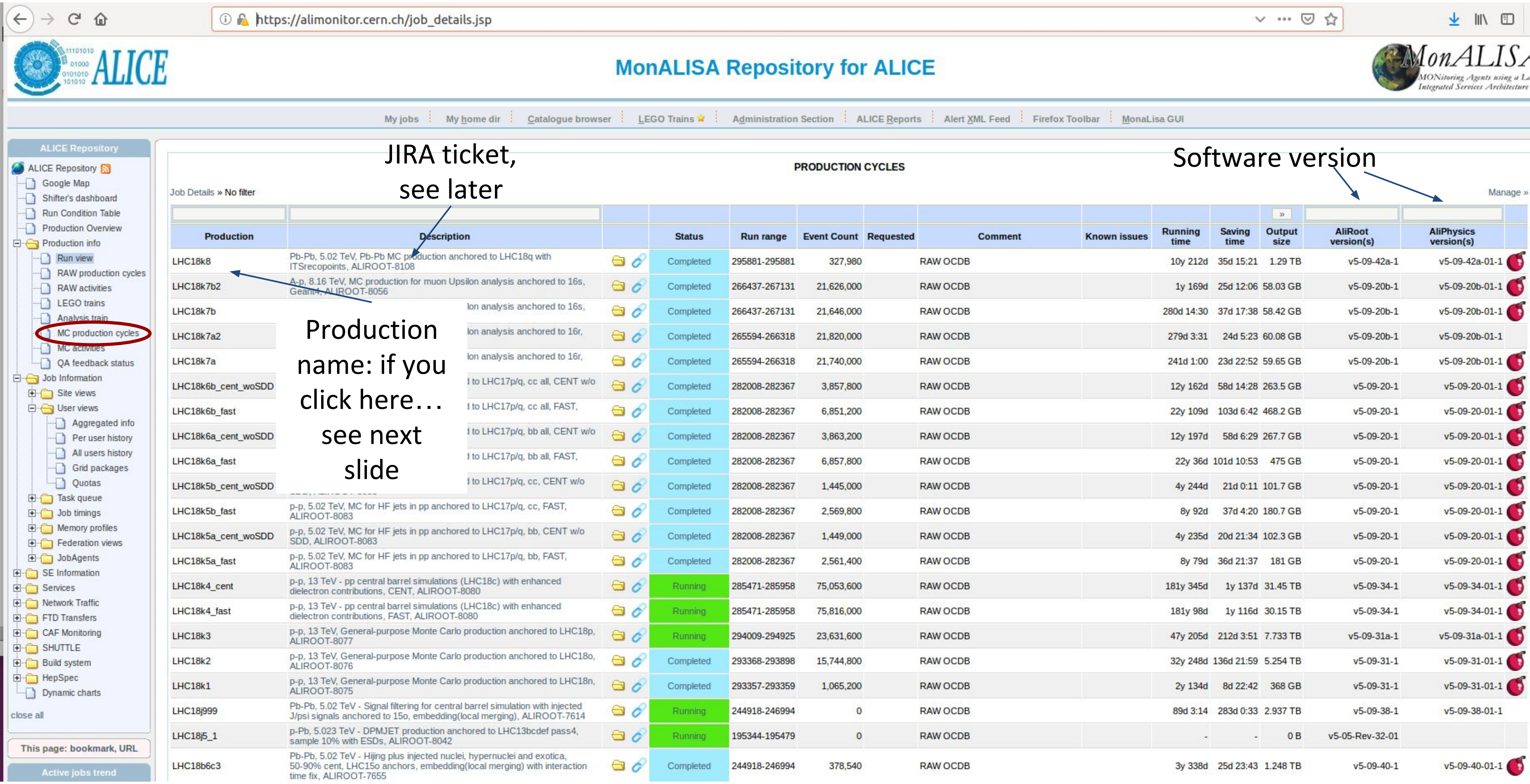
Miscellanea

MonALISA - data productions



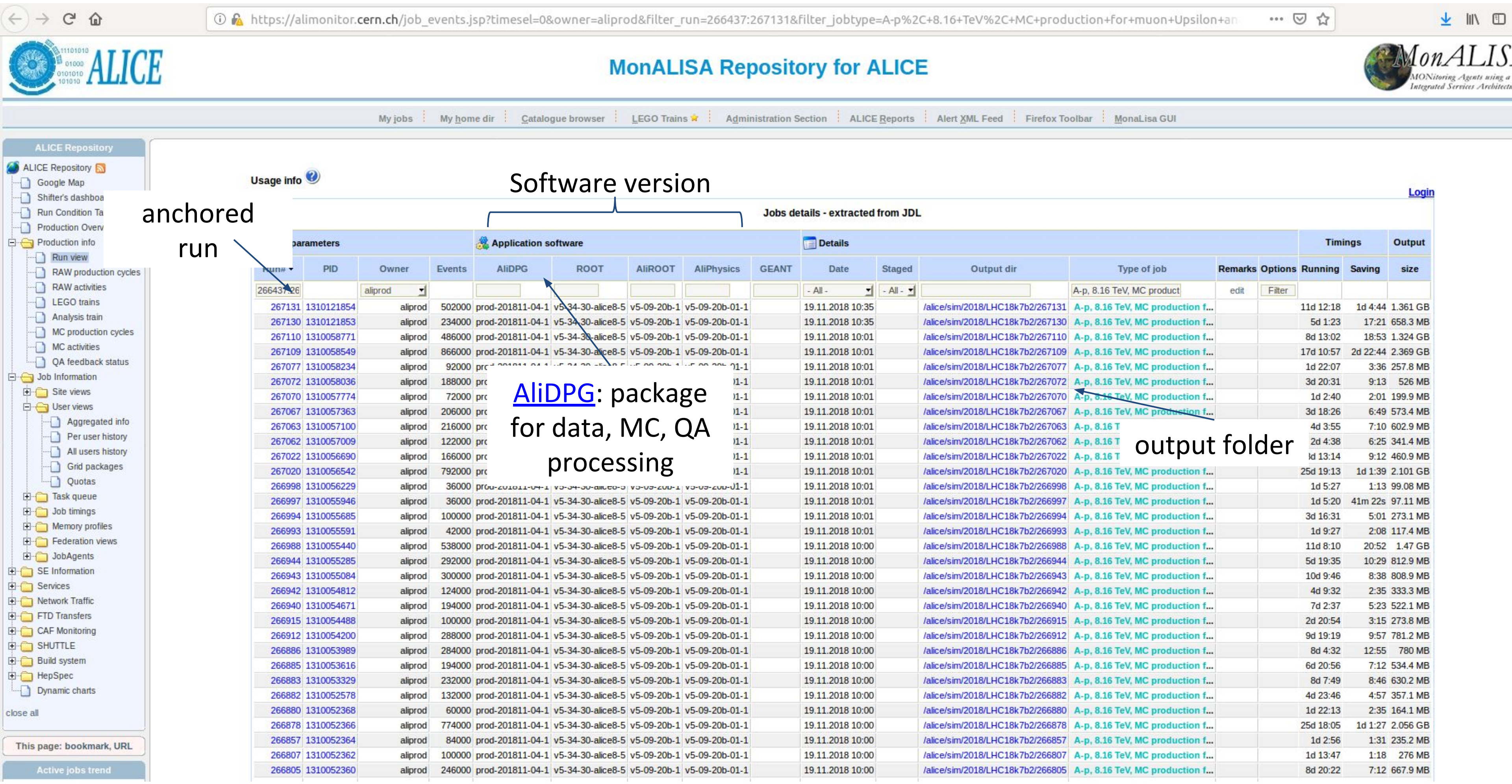
				Raw data			Reconstructed					Timing		AliRoot
Production	Description	Status	Run Range	Runs	Chunks	Size	Chunks	%	Size	%	Events	Running	Saving	version
LHC18r_muon_calo_pass1	LHC period LHC18r - Muon+Calorimeters reconstruction pass 1, ALIROOT-8064	Running	296690 - 297035	48	590,490	1005 TB	577,457	97%	19.52 TB	1%	197,153,178	54y 251d	6y 24d	v5-09-41d-1
LHC18r_cpass1_pass1	LHC period LHC18r - CPass1 (reconstruction) for pass 1, ALIROOT-8063	Running	296690 - 296932	14	163,267	296.9 TB	155,818	95%	504.1 GB	0%	1,416,967	8y 222d	1y 16d	v5-09-41a-1
LHC18r_cpass0_pass1	LHC period LHC18r - CPass0 (reconstruction) for pass 1, ALIROOT-8063	Running	296690 - 297035	39	544,900	996.9 TB	529,822	97%	1.932 TB	0%	13,744,871	22y 311d	2y 134d	v5-09-41a-1
LHC18q_[illegible]	[illegible] period LHC18q - Full production pass 1 uncalibrated, [illegible]ROOT-8113	Running	295581 - 296068	14	79,839	131.9 TB	77,409	96%	75.85 TB	59%	28,299,632	144y 120d	4y 256d	v5-09-42a-1
LHC18q_[illegible]	[illegible] period LHC18q - Full production pass 1, vdM scan, [illegible]ROOT-8093	Running	295915 - 295916	2	26,576	1.691 TB	26,573	99%	3.044 TB	180%	13,192,380	4y 42d	229d 5:54	v5-09-41a-1
LHC18q_[illegible]	[illegible] period LHC18q - CPass1 (reconstruction) for pass 1, vdM [illegible]n, ALIROOT-8093	Running	295915 - 295916	2	26,576	1.691 TB	26,509	99%	17 GB	0%	5,420,375	348d 17:26	151d 5:47	v5-09-41a-1
LHC18q_cpass0_pass1_vdmscan	LHC period LHC18q - CPass0 (reconstruction) for pass 1, vdM scan, ALIROOT-8093	Running	295915 - 295916	2	26,576	1.691 TB	25,365	95%	4.551 GB	0%	1,029,144	1y 35d	115d 17:41	v5-09-41a-1
LHC16q_pass1_trd	LHC period LHC16q - Pass 1 with 100% ESDfriends, ALIROOT-8081	Running	265521 - 265521	1	2,640	4.36 TB	2,596	98%	4.72 TB	110%	5,611,276	2y 38d	184d 16:27	v5-09-41-1
LHC18p_pass1_trd	LHC period LHC18p - Pass 1 with 100% ESDfriends, ALIROOT-8081	Running	294586 - 294586	1	15,223	25.56 TB	15,022	98%	17.32 TB	68%	22,128,180	11y 193d	2y 230d	v5-09-41-1
LHC18q_cosmics_pass1	LHC period LHC18q - cosmics, ALIROOT-8078	Running	295530 - 295530	1	400	22.12 GB	400	100%	3.265 GB	14%	0	6d 13:27	15:35	v5-09-41-1
LHC18q_muon_calo_pass1	LHC period LHC18q - Muon+Calorimeters reconstruction pass 1, ALIROOT-8064	Running	295424 - 296623	153	1,207,612	2.086 PB	1,204,620	99%	66.27 TB	3%	397,753,765	120y 254d	17y 321d	v5-09-41-1, v5-09-41a-1, v5-09-41b-1, v5-09-41d-1
LHC18q_cpass1_pass1	LHC period LHC18q - CPass1 (reconstruction) for pass 1, ALIROOT-8063	Running	295581 - 296623	143	1,186,657	2.075 PB	1,154,829	97%	22.33 TB	1%	22,235,026	117y 134d	10y 230d	v5-09-41-1, v5-09-41a-1
LHC18q_cpass0_pass1	LHC period LHC18q - CPass0 (reconstruction) for pass 1, ALIROOT-8063	Running	295581 - 296623	144	1,188,157	2.077 PB	1,163,071	97%	5.412 TB	0%	45,453,514	101y 296d	23y 347d	v5-09-41-1, v5-09-41a-1
LHC18p_pass1_gain_scan	LHC period LHC18p - Reconstruction pass 1 for V0 gain scan, ALIROOT-8034	Running	294620 - 294631	6	1,440	1.313 TB	1,440	100%	78.1 GB	5%	2,886,144	59d 3:19	10d 14:26	v5-09-29-1
LHC18p_pass1	LHC period LHC18p - Full production pass 1, ALIROOT-8009	Running	294009 - 294925	84	376,807	620.1 TB	374,791	99%	221.5 TB	35%	549,062,732	325y 193d	27y 191d	v5-09-31a-1
LHC18p_cpass1_pass1	LHC period LHC18p - CPass1 (reconstruction) for pass 1, ALIROOT-8009	Running	294009 - 294925	84	376,807	620.1 TB	366,389	97%	31.49 TB	5%	60,521,249	55y 225d	8y 296d	v5-09-38-1, v5-09-39-1
LHC18p_cpass0_pass1	LHC period LHC18p - CPass0 (reconstruction) for pass 1, ALIROOT-8009	Running	294009 - 294925	84	376,807	620.1 TB	370,151	98%	2.693 TB	0%	160,946,160	74y 262d	4y 134d	v5-09-38-1, v5-09-39-1
LHC18p_muon_calo_pass1	LHC period LHC18p - Muon+Calorimeters reconstruction pass 1, ALIROOT-8010	Running	294009 - 294925	87	377,251	620.1 TB	376,085	99%	18.14 TB	2%	553,711,518	43y 68d	3y 245d	v5-09-29a-1
LHC18m_cpass1_pass1_test	LHC period LHC18m - CPass1 (reconstruction) for pass 1, test runs, ALIROOT-7931	Running	291845 - 291894	11	66,354	109.8 TB	63,838	96%	35.72 TB	33%	22,858,882	55y 235d	2y 172d	v5-09-35-1
LHC18m_cpass0_pass1_test	LHC period LHC18m - CPass0 (reconstruction) for pass 1, test runs, ALIROOT-7931	Running	291845 - 291894	11	66,354	109.8 TB	64,178	96%	1.02 TB	0%	22,988,860	40y 196d	87d 21:18	v5-09-35-1
LHC18o_pass1	LHC period LHC18o - Full production pass 1, ALIROOT-7987	Running	293368 - 293898	48	177,814	291.8 TB	176,248	99%	104 TB	35%	278,088,241	150y 22d	23y 73d	v5-09-31-1
[illegible]	LHC period LHC18o - CPass1 (reconstruction) for pass 1,	[illegible]	[illegible]	[illegible]	[illegible]	292.2	[illegible]	[illegible]	17.89	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

MonALISA - MC productions



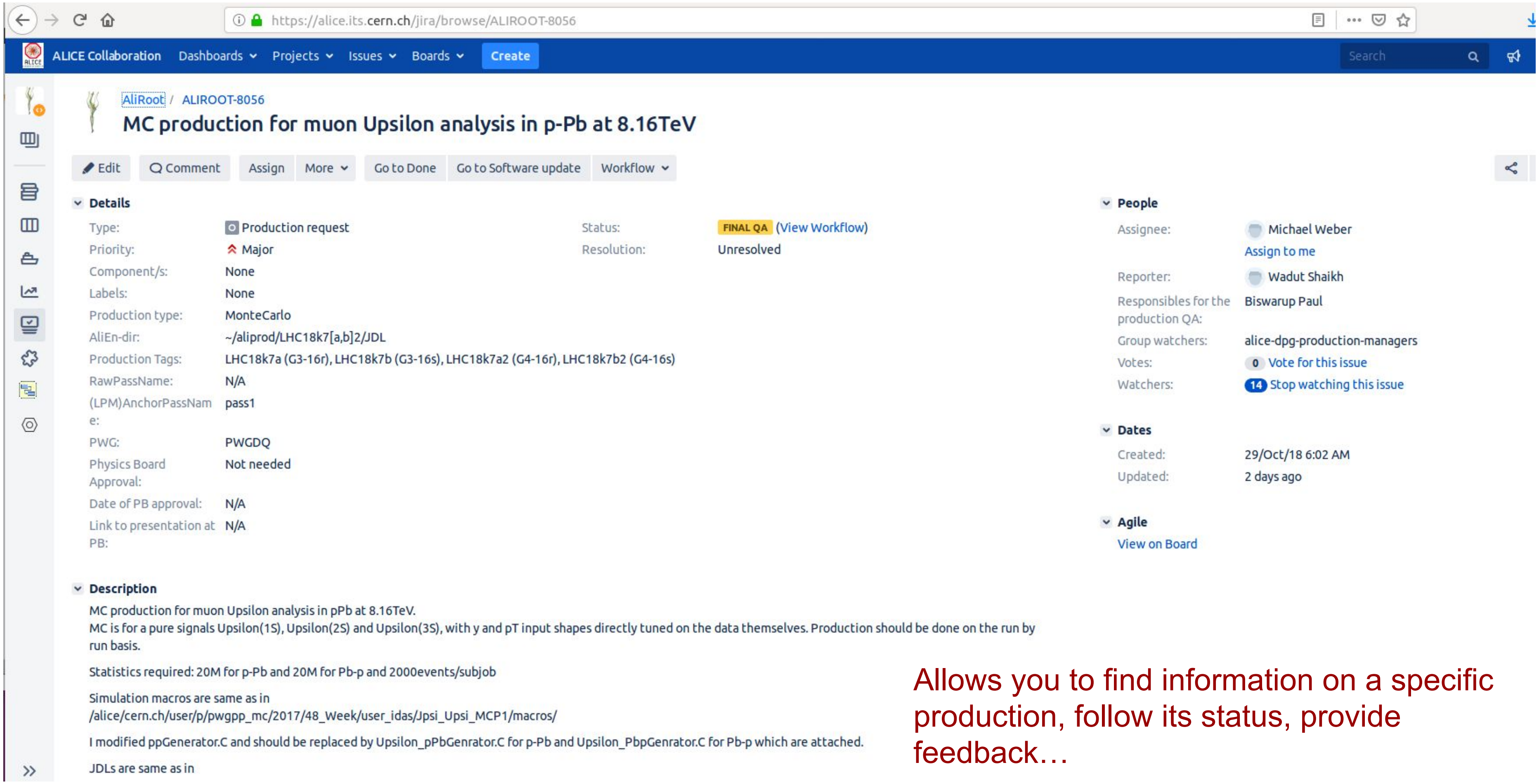
Production	Description	Status	Run range	Event Count	Requested	Comment	Known issues	Running time	Saving time	Output size	AliRoot version(s)	AliPhysics version(s)
LHC18k8	Pb-Pb, 5.02 TeV, Pb-Pb MC production anchored to LHC18q with ITSrecopoints, ALIROOT-8108	Completed	295881-295881	327,980		RAW OCDB		10y 212d	35d 15:21	1.29 TB	v5-09-42a-1	v5-09-42a-01-1
LHC18k7b2	A-p, 8.16 TeV, MC production for muon Upsilon analysis anchored to 16s, Geant4, ALIROOT-8056	Completed	266437-267131	21,626,000		RAW OCDB		1y 169d	25d 12:06	58.03 GB	v5-09-20b-1	v5-09-20b-01-1
LHC18k7b	…lon analysis anchored to 16s,	Completed	266437-267131	21,646,000		RAW OCDB		280d 14:30	37d 17:38	58.42 GB	v5-09-20b-1	v5-09-20b-01-1
LHC18k7a2	…lon analysis anchored to 16r,	Completed	265594-266318	21,820,000		RAW OCDB		279d 3:31	24d 5:23	60.08 GB	v5-09-20b-1	v5-09-20b-01-1
LHC18k7a	…lon analysis anchored to 16r,	Completed	265594-266318	21,740,000		RAW OCDB		241d 1:00	23d 22:52	59.65 GB	v5-09-20b-1	v5-09-20b-01-1
LHC18k6b_cent_woSDD	…to LHC17p/q, cc all, CENT w/o	Completed	282008-282367	3,857,800		RAW OCDB		12y 162d	58d 14:28	263.5 GB	v5-09-20-1	v5-09-20-01-1
LHC18k6b_fast	…to LHC17p/q, cc all, FAST,	Completed	282008-282367	6,851,200		RAW OCDB		22y 109d	103d 6:42	468.2 GB	v5-09-20-1	v5-09-20-01-1
LHC18k6a_cent_woSDD	…to LHC17p/q, bb all, CENT w/o	Completed	282008-282367	3,863,200		RAW OCDB		12y 197d	58d 6:29	267.7 GB	v5-09-20-1	v5-09-20-01-1
LHC18k6a_fast	…to LHC17p/q, bb all, FAST,	Completed	282008-282367	6,857,800		RAW OCDB		22y 36d	101d 10:53	475 GB	v5-09-20-1	v5-09-20-01-1
LHC18k5b_cent_woSDD	…to LHC17p/q, cc, CENT w/o	Completed	282008-282367	1,445,000		RAW OCDB		4y 244d	21d 0:11	101.7 GB	v5-09-20-1	v5-09-20-01-1
LHC18k5b_fast	p-p, 5.02 TeV, MC for HF jets in pp anchored to LHC17p/q, cc, FAST, ALIROOT-8083	Completed	282008-282367	2,569,800		RAW OCDB		8y 92d	37d 4:20	180.7 GB	v5-09-20-1	v5-09-20-01-1
LHC18k5a_cent_woSDD	p-p, 5.02 TeV, MC for HF jets in pp anchored to LHC17p/q, bb, CENT w/o SDD, ALIROOT-8083	Completed	282008-282367	1,449,000		RAW OCDB		4y 235d	20d 21:34	102.3 GB	v5-09-20-1	v5-09-20-01-1
LHC18k5a_fast	p-p, 5.02 TeV, MC for HF jets in pp anchored to LHC17p/q, bb, FAST, ALIROOT-8083	Completed	282008-282367	2,561,400		RAW OCDB		8y 79d	36d 21:37	181 GB	v5-09-20-1	v5-09-20-01-1
LHC18k4_cent	p-p, 13 TeV - pp central barrel simulations (LHC18c) with enhanced dielectron contributions, CENT, ALIROOT-8080	Running	285471-285958	75,053,600		RAW OCDB		181y 345d	1y 137d	31.45 TB	v5-09-34-1	v5-09-34-01-1
LHC18k4_fast	p-p, 13 TeV - pp central barrel simulations (LHC18c) with enhanced dielectron contributions, FAST, ALIROOT-8080	Running	285471-285958	75,816,000		RAW OCDB		181y 98d	1y 116d	30.15 TB	v5-09-34-1	v5-09-34-01-1
LHC18k3	p-p, 13 TeV, General-purpose Monte Carlo production anchored to LHC18p, ALIROOT-8077	Running	294009-294925	23,631,600		RAW OCDB		47y 205d	212d 3:51	7.733 TB	v5-09-31a-1	v5-09-31a-01-1
LHC18k2	p-p, 13 TeV, General-purpose Monte Carlo production anchored to LHC18o, ALIROOT-8076	Completed	293368-293898	15,744,800		RAW OCDB		32y 248d	136d 21:59	5.254 TB	v5-09-31-1	v5-09-31-01-1
LHC18k1	p-p, 13 TeV, General-purpose Monte Carlo production anchored to LHC18n, ALIROOT-8075	Completed	293357-293359	1,065,200		RAW OCDB		2y 134d	8d 22:42	368 GB	v5-09-31-1	v5-09-31-01-1
LHC18j999	Pb-Pb, 5.02 TeV - Signal filtering for central barrel simulation with injected J/psi signals anchored to 15o, embedding(local merging), ALIROOT-7614	Running	244918-246994	0		RAW OCDB		89d 3:14	283d 0:33	2.937 TB	v5-09-38-1	v5-09-38-01-1
LHC18j5_1	p-Pb, 5.023 TeV - DPMJET production anchored to LHC13bcdef pass4, sample 10% with ESDs, ALIROOT-8042	Running	195344-195479	0		RAW OCDB		-	-	0 B	v5-05-Rev-32-01	
LHC18b6c3	Pb-Pb, 5.02 TeV - Hijing plus injected nuclei, hypernuclei and exotica, 50-90% cent, LHC15o anchors, embedding(local merging) with interaction time fix, ALIROOT-7655	Completed	244918-246994	378,540		RAW OCDB		3y 338d	25d 23:43	1.248 TB	v5-09-40-1	v5-09-40-01-1

MonALISA - example



parameters				Application software					Details						Timings		Output
Run#	PID	Owner	Events	AliDPG	ROOT	AliROOT	AliPhysics	GEANT	Date	Staged	Output dir	Type of job	Remarks	Options	Running	Saving	size
266437:26		aliprod							- All -	- All -		A-p, 8.16 TeV, MC product	edit	Filter			
267131	1310121854	aliprod	502000	prod-201811-04-1	v5-34-30-alice8-5	v5-09-20b-1	v5-09-20b-01-1		19.11.2018 10:35		/alice/sim/2018/LHC18k7b2/267131	A-p, 8.16 TeV, MC production f...			11d 12:18	1d 4:44	1.361 GB
267130	1310121853	aliprod	234000	prod-201811-04-1	v5-34-30-alice8-5	v5-09-20b-1	v5-09-20b-01-1		19.11.2018 10:35		/alice/sim/2018/LHC18k7b2/267130	A-p, 8.16 TeV, MC production f...			5d 1:23	17:21	658.3 MB
267110	1310058771	aliprod	486000	prod-201811-04-1	v5-34-30-alice8-5	v5-09-20b-1	v5-09-20b-01-1		19.11.2018 10:01		/alice/sim/2018/LHC18k7b2/267110	A-p, 8.16 TeV, MC production f...			8d 13:02	18:53	1.324 GB
267109	1310058549	aliprod	866000	prod-201811-04-1	v5-34-30-alice8-5	v5-09-20b-1	v5-09-20b-01-1		19.11.2018 10:01		/alice/sim/2018/LHC18k7b2/267109	A-p, 8.16 TeV, MC production f...			17d 10:57	2d 22:44	2.369 GB
267077	1310058234	aliprod	92000	pr[illegible]	[illegible]	[illegible]	[illegible]01-1		19.11.2018 10:01		/alice/sim/2018/LHC18k7b2/267077	A-p, 8.16 TeV, MC production f...			1d 22:07	3:36	257.8 MB
267072	1310058036	aliprod	188000	pr[illegible]	[illegible]	[illegible]	[illegible]01-1		19.11.2018 10:01		/alice/sim/2018/LHC18k7b2/267072	A-p, 8.16 TeV, MC production f...			3d 20:31	9:13	526 MB
267070	1310057774	aliprod	72000	pr[illegible]	[illegible]	[illegible]	[illegible]01-1		19.11.2018 10:01		/alice/sim/2018/LHC18k7b2/267070	A-p, 8.16 TeV, MC production f...			1d 2:40	2:01	199.9 MB
267067	1310057363	aliprod	206000	pr[illegible]	[illegible]	[illegible]	[illegible]01-1		19.11.2018 10:01		/alice/sim/2018/LHC18k7b2/267067	A-p, 8.16 TeV, MC production f...			3d 18:26	6:49	573.4 MB
267063	1310057100	aliprod	216000	pr[illegible]	[illegible]	[illegible]	[illegible]01-1		19.11.2018 10:01		/alice/sim/2018/LHC18k7b2/267063	A-p, 8.16 T[illegible]	[illegible]	[illegible]	4d 3:55	7:10	602.9 MB
267062	1310057009	aliprod	122000	pr[illegible]	[illegible]	[illegible]	[illegible]01-1		19.11.2018 10:01		/alice/sim/2018/LHC18k7b2/267062	A-p, 8.16 T[illegible]	[illegible]	[illegible]	2d 4:38	6:25	341.4 MB
267022	1310056690	aliprod	166000	pr[illegible]	[illegible]	[illegible]	[illegible]01-1		19.11.2018 10:01		/alice/sim/2018/LHC18k7b2/267022	A-p, 8.16 T[illegible]	[illegible]	[illegible]	[illegible]d 13:14	9:12	460.9 MB
267020	1310056542	aliprod	792000	pr[illegible]	[illegible]	[illegible]	[illegible]01-1		19.11.2018 10:01		/alice/sim/2018/LHC18k7b2/267020	A-p, 8.16 TeV, MC production f...			25d 19:13	1d 1:39	2.101 GB
266998	1310056229	aliprod	36000	[illegible]	[illegible]	[illegible]	[illegible]01-1		19.11.2018 10:01		/alice/sim/2018/LHC18k7b2/266998	A-p, 8.16 TeV, MC production f...			1d 5:27	1:13	99.08 MB
266997	1310055946	aliprod	36000	prod-201811-04-1	v5-34-30-alice8-5	v5-09-20b-1	v5-09-20b-01-1		19.11.2018 10:01		/alice/sim/2018/LHC18k7b2/266997	A-p, 8.16 TeV, MC production f...			1d 5:20	41m 22s	97.11 MB
266994	1310055685	aliprod	100000	prod-201811-04-1	v5-34-30-alice8-5	v5-09-20b-1	v5-09-20b-01-1		19.11.2018 10:01		/alice/sim/2018/LHC18k7b2/266994	A-p, 8.16 TeV, MC production f...			3d 16:31	5:01	273.1 MB
266993	1310055591	aliprod	42000	prod-201811-04-1	v5-34-30-alice8-5	v5-09-20b-1	v5-09-20b-01-1		19.11.2018 10:01		/alice/sim/2018/LHC18k7b2/266993	A-p, 8.16 TeV, MC production f...			1d 9:27	2:08	117.4 MB
266988	1310055440	aliprod	538000	prod-201811-04-1	v5-34-30-alice8-5	v5-09-20b-1	v5-09-20b-01-1		19.11.2018 10:00		/alice/sim/2018/LHC18k7b2/266988	A-p, 8.16 TeV, MC production f...			11d 8:10	20:52	1.47 GB
266944	1310055285	aliprod	292000	prod-201811-04-1	v5-34-30-alice8-5	v5-09-20b-1	v5-09-20b-01-1		19.11.2018 10:00		/alice/sim/2018/LHC18k7b2/266944	A-p, 8.16 TeV, MC production f...			5d 19:35	10:29	812.9 MB
266943	1310055084	aliprod	300000	prod-201811-04-1	v5-34-30-alice8-5	v5-09-20b-1	v5-09-20b-01-1		19.11.2018 10:00		/alice/sim/2018/LHC18k7b2/266943	A-p, 8.16 TeV, MC production f...			10d 9:46	8:38	808.9 MB
266942	1310054812	aliprod	124000	prod-201811-04-1	v5-34-30-alice8-5	v5-09-20b-1	v5-09-20b-01-1		19.11.2018 10:00		/alice/sim/2018/LHC18k7b2/266942	A-p, 8.16 TeV, MC production f...			4d 9:32	2:35	333.3 MB
266940	1310054671	aliprod	194000	prod-201811-04-1	v5-34-30-alice8-5	v5-09-20b-1	v5-09-20b-01-1		19.11.2018 10:00		/alice/sim/2018/LHC18k7b2/266940	A-p, 8.16 TeV, MC production f...			7d 2:37	5:23	522.1 MB
266915	1310054488	aliprod	100000	prod-201811-04-1	v5-34-30-alice8-5	v5-09-20b-1	v5-09-20b-01-1		19.11.2018 10:00		/alice/sim/2018/LHC18k7b2/266915	A-p, 8.16 TeV, MC production f...			2d 20:54	3:15	273.8 MB
266912	1310054200	aliprod	288000	prod-201811-04-1	v5-34-30-alice8-5	v5-09-20b-1	v5-09-20b-01-1		19.11.2018 10:00		/alice/sim/2018/LHC18k7b2/266912	A-p, 8.16 TeV, MC production f...			9d 19:19	9:57	781.2 MB
266886	1310053989	aliprod	284000	prod-201811-04-1	v5-34-30-alice8-5	v5-09-20b-1	v5-09-20b-01-1		19.11.2018 10:00		/alice/sim/2018/LHC18k7b2/266886	A-p, 8.16 TeV, MC production f...			8d 4:32	12:55	780 MB
266885	1310053616	aliprod	194000	prod-201811-04-1	v5-34-30-alice8-5	v5-09-20b-1	v5-09-20b-01-1		19.11.2018 10:00		/alice/sim/2018/LHC18k7b2/266885	A-p, 8.16 TeV, MC production f...			6d 20:56	7:12	534.4 MB
266883	1310053329	aliprod	232000	prod-201811-04-1	v5-34-30-alice8-5	v5-09-20b-1	v5-09-20b-01-1		19.11.2018 10:00		/alice/sim/2018/LHC18k7b2/266883	A-p, 8.16 TeV, MC production f...			8d 7:49	8:46	630.2 MB
266882	1310052578	aliprod	132000	prod-201811-04-1	v5-34-30-alice8-5	v5-09-20b-1	v5-09-20b-01-1		19.11.2018 10:00		/alice/sim/2018/LHC18k7b2/266882	A-p, 8.16 TeV, MC production f...			4d 23:46	4:57	357.1 MB
266880	1310052368	aliprod	60000	prod-201811-04-1	v5-34-30-alice8-5	v5-09-20b-1	v5-09-20b-01-1		19.11.2018 10:00		/alice/sim/2018/LHC18k7b2/266880	A-p, 8.16 TeV, MC production f...			1d 22:13	2:35	164.1 MB
266878	1310052366	aliprod	774000	prod-201811-04-1	v5-34-30-alice8-5	v5-09-20b-1	v5-09-20b-01-1		19.11.2018 10:00		/alice/sim/2018/LHC18k7b2/266878	A-p, 8.16 TeV, MC production f...			25d 18:05	1d 1:27	2.056 GB
266857	1310052364	aliprod	84000	prod-201811-04-1	v5-34-30-alice8-5	v5-09-20b-1	v5-09-20b-01-1		19.11.2018 10:00		/alice/sim/2018/LHC18k7b2/266857	A-p, 8.16 TeV, MC production f...			1d 2:56	1:31	235.2 MB
266807	1310052362	aliprod	100000	prod-201811-04-1	v5-34-30-alice8-5	v5-09-20b-1	v5-09-20b-01-1		19.11.2018 10:00		/alice/sim/2018/LHC18k7b2/266807	A-p, 8.16 TeV, MC production f...			1d 13:47	1:18	276 MB
266805	1310052360	aliprod	246000	prod-201811-04-1	v5-34-30-alice8-5	v5-09-20b-1	v5-09-20b-01-1		19.11.2018 10:00		/alice/sim/2018/LHC18k7b2/266805	A-p, 8.16 TeV, MC production f...			8d 20:22	7:12	667.9 MB

JIRA - example



Allows you to find information on a specific production, follow its status, provide feedback…

Address: *https://alice.its.cern.ch/jira/browse/ticket_ID (e.g: ALIROOT-8056)*

[Guidelines](#) for Run2 samples

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2

Some datasets had several reconstruction passes. In this page, you can find information about them.

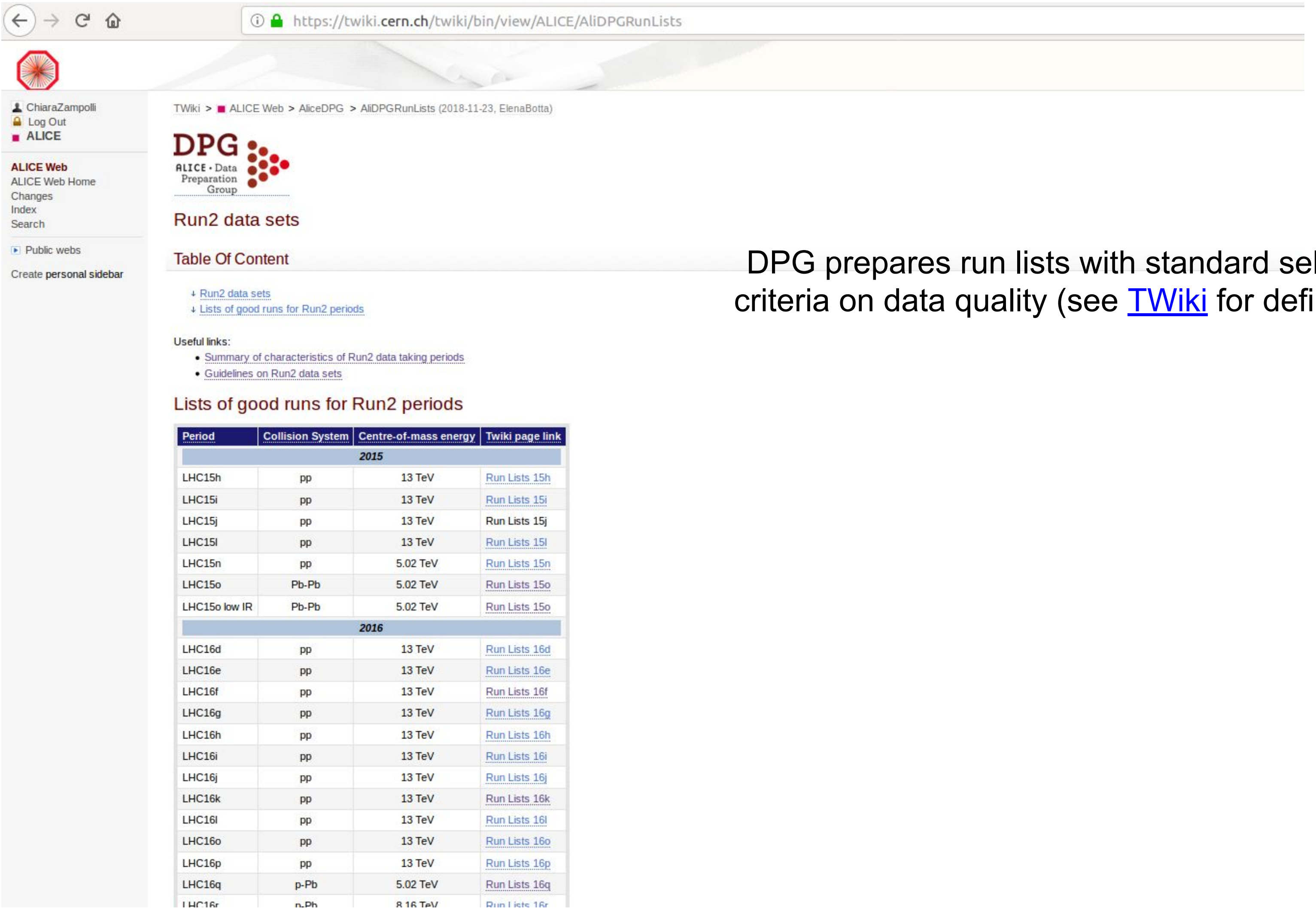
Table Of Content

- Aliroot versions and properties used in the reconstruction of run2 samples
- Known reconstruction issues
  - The PIDFIX issue
  - The COOKDEDX issue
  - The INVARIANT issue
  - Fake high-pt tracks
  - Impact parameter bias
  - Wrong assignment of V0 daughter to AOD cascades
- How to merge together different 15o reconstruction passes (see here for the run lists)
  - 15o HighIR pass1 and pass1_pidfix
  - 15o HighIR and low IR
  - pp reference (LHC15n)
  - pPb 2016 data (LHC16q, LHC16r, LHC16s, LHC16t)
  - pp 5 TeV data, 2017 sample (LHC17p, LHC17q)

Aliroot versions and properties used in the reconstruction of run2 samples

Period	Pass	Aliroot version	Characteristics						
			TPC cluster error assigment (1) and TPC SP maps	BB in tracking (2)	PID in TPCin step (3)	EMCAL online trigger data stream	TOF Calib	SPD1 Lorentz angle	TOF trigger maxipads
Pb-Pb									
LHC15o lowIR	pass2	v5-08-09a	Old	Wrong, 5-sigma	All pions	OK	Old	Bug	Bug
	pass3_lowIR_pidfix	v5-08-13l	New	Correct, 15-sigma	All pions	OK	Old	Bug	Bug
	pass4_lowIR_pidfix_cookdedx	v5-08-13q-cookdedx	New	Correct, 15-sigma	Fixed	OK	Old	Bug	Bug
	pass5_lowIR	v5-08-24	New+fix (5)	Correct, 15-sigma	Fixed	OK	Improved	Fixed	Bug
LHC15o highIR									
group1	pass1	v5-08-13d	New	Wrong, 5-sigma	All pions	Needs offline fix (4)	Old	Bug	Bug
group2	pass1	v5-08-13e	New	Wrong, 5-sigma	All pions	OK	Old	Bug	Bug
group3	pass1	v5-08-13h	New	Wrong, 5-sigma	All pions	OK	Old	Bug	Bug
group4	pass1_pidfix	v5-08-13l	New	Correct, 15-sigma	All pions	OK	Old	Bug	Bug
pp 5 TeV									
LHC15n	pass2	v5-08-13d	New	Wrong, 5-sigma	All pions		Old	Bug	n.a.
	pass3	v5-08-13s-cookdedx	New	Correct, 15-sigma	Fixed		Old	Bug	n.a.
	pass4	v5-08-24	New+fix (5)	Correct, 15-sigma	Fixed		Improved	Fixed	n.a.
LHC17p	pass1_FAST	v5-09-20	New+fix (5)	Correct, 15-sigma	Fixed		Improved	Fixed	Fixed
	pass1_CENT_wSDD	v5-09-20	New+fix (5)	Correct, 15-sigma	Fixed		Improved	Fixed	Fixed
	pass1_CENT_woSDD	v5-09-20	New+fix (5)	Correct, 15-sigma	Fixed		Improved	Fixed	Fixed

Run lists



https://twiki.cern.ch/twiki/bin/view/ALICE/AliDPGRunLists

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TWiki > ALICE Web > AliceDPG > AliDPGRunLists (2018-11-23, ElenaBotta)

Run2 data sets

Table Of Content

- Run2 data sets
- Lists of good runs for Run2 periods

Useful links:

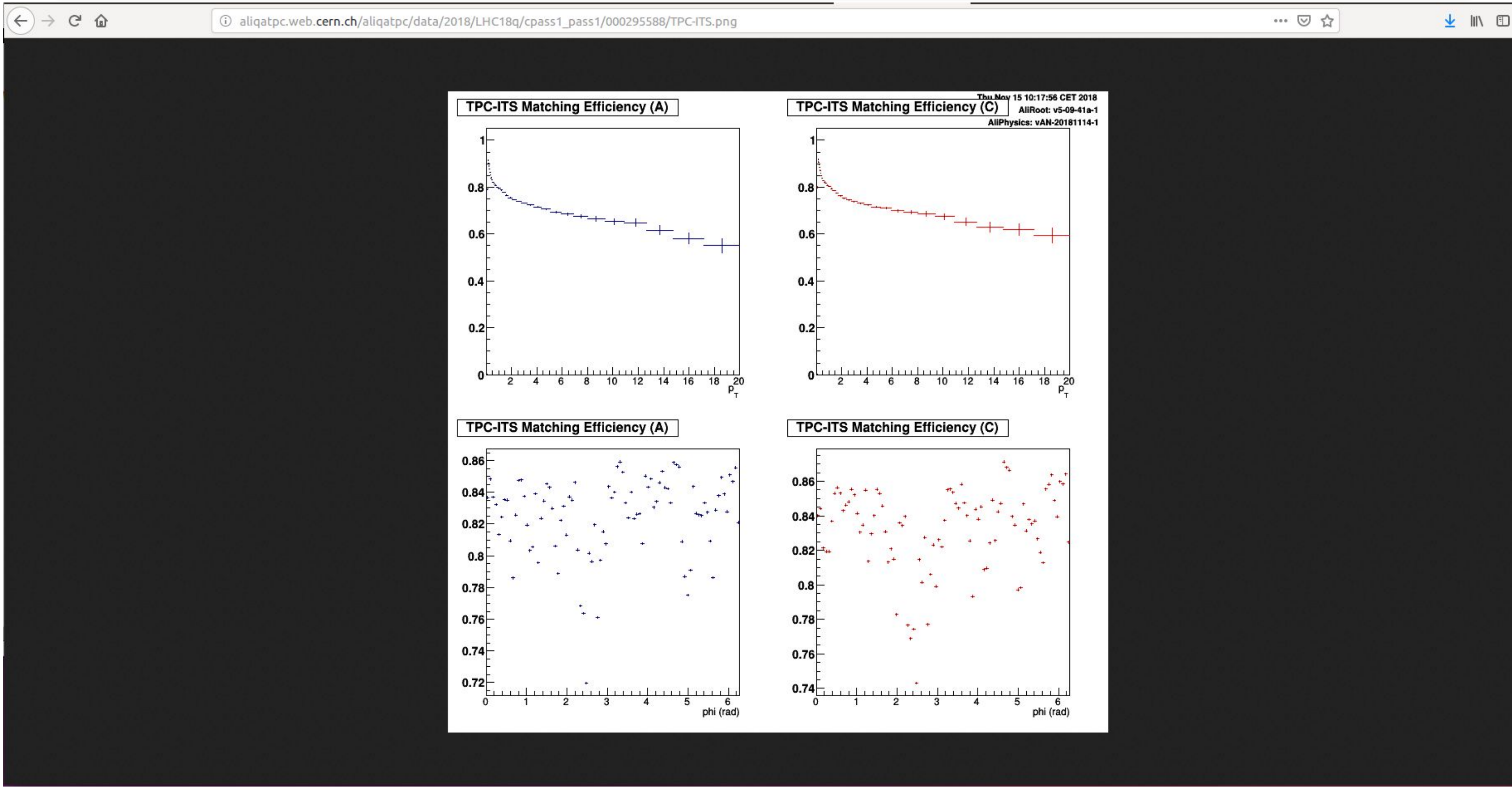
- Summary of characteristics of Run2 data taking periods
- Guidelines on Run2 data sets

Lists of good runs for Run2 periods

Period	Collision System	Centre-of-mass energy	Twiki page link
2015			
LHC15h	pp	13 TeV	Run Lists 15h
LHC15i	pp	13 TeV	Run Lists 15i
LHC15j	pp	13 TeV	Run Lists 15j
LHC15l	pp	13 TeV	Run Lists 15l
LHC15n	pp	5.02 TeV	Run Lists 15n
LHC15o	Pb-Pb	5.02 TeV	Run Lists 15o
LHC15o low IR	Pb-Pb	5.02 TeV	Run Lists 15o
2016			
LHC16d	pp	13 TeV	Run Lists 16d
LHC16e	pp	13 TeV	Run Lists 16e
LHC16f	pp	13 TeV	Run Lists 16f
LHC16g	pp	13 TeV	Run Lists 16g
LHC16h	pp	13 TeV	Run Lists 16h
LHC16i	pp	13 TeV	Run Lists 16i
LHC16j	pp	13 TeV	Run Lists 16j
LHC16k	pp	13 TeV	Run Lists 16k
LHC16l	pp	13 TeV	Run Lists 16l
LHC16o	pp	13 TeV	Run Lists 16o
LHC16p	pp	13 TeV	Run Lists 16p
LHC16q	p-Pb	5.02 TeV	Run Lists 16q
LHC16r	p-Pb	8.16 TeV	Run Lists 16r

DPG prepares run lists with standard selection criteria on data quality (see TWiki for definitions)

QA repositories - example



The automatic QA from data and MC production is saved in dedicated repositories on the web, e.g.:

http://aliqatpc.web.cern.ch/aliqatpc/data/2018/LHC18q/cpass1_pass1/000295588/TPC-ITS.png

detector — production type — year — period (or MC cycle name) — pass — run (you can also have trending plots)

IF YOU NEED MORE INFORMATION

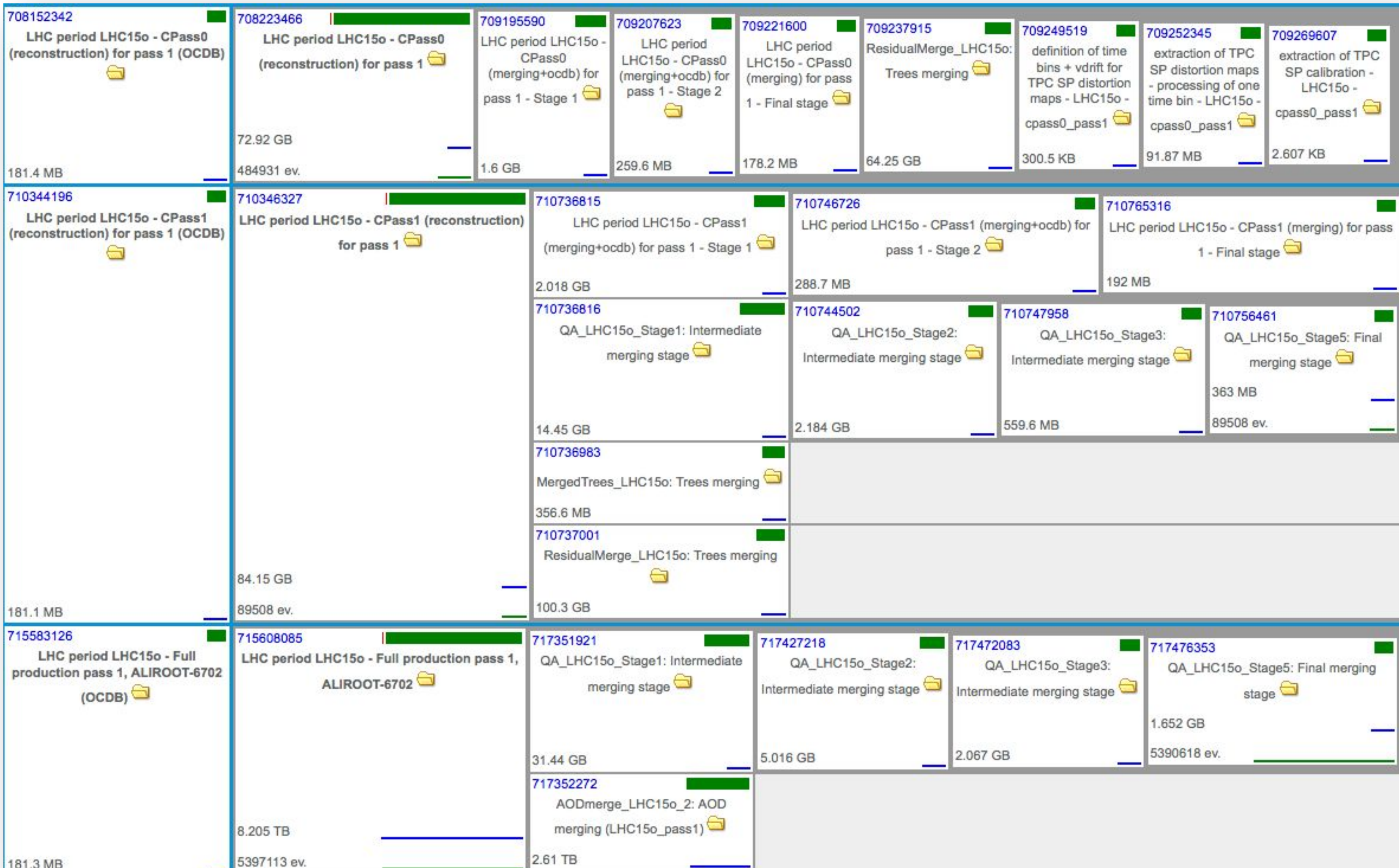
DPG twiki pages

- More detailed information can be found in: https://twiki.cern.ch/twiki/bin/viewauth/ALICE/AliceDPG

- Any feedback on these twiki pages is more than welcome
  - It will help us to improve them and keeping them up-to-date
- For any question, doubt, suggestion, constructive criticism, contact us: alice-dpg-coordination@cern.ch

Backup

Raw data processing chain: jobs



Each box is a grid job ⟶ several (27) masterjobs per run in the chain

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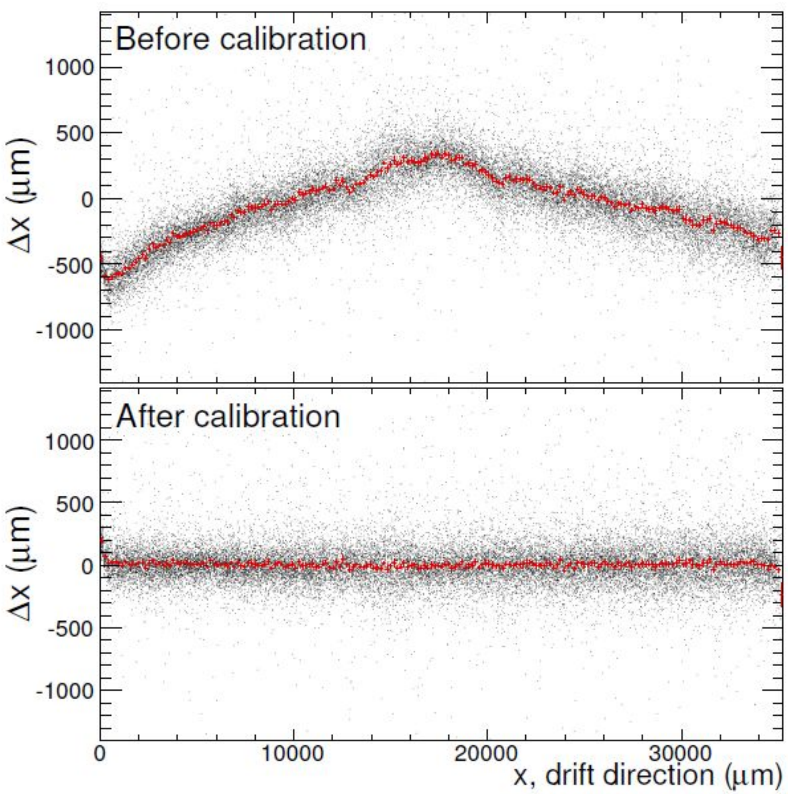
Online calibration

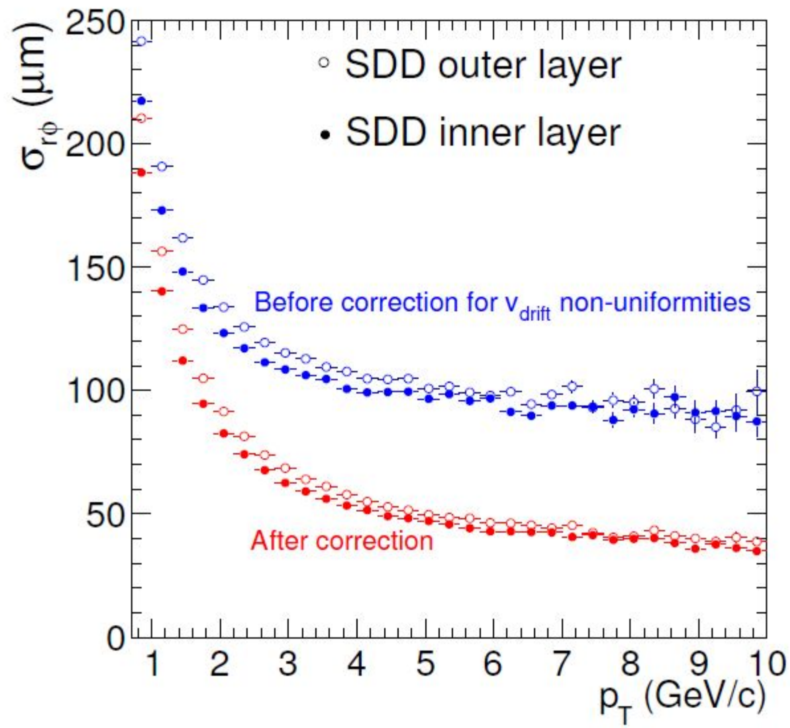
- At the end of the run (physics or special calibration run) a **Detector Algorithm** (DA) is run, the online calibration parameters are produced, collected by the **Shuttle** together with the **DCS data points** and stored in the **OCDB**
- Examples:

System	Condition data	Special runs	Physics runs online
SPD	trigger chip map and thresholds		half-stave status pixel noise
SDD		anode ped (peds) anode gain, status (puls) anode v_{drift} (inject)	
SSD		strip ped, noise, status (peds)	
TPC	$P, T(x,y,z)$ pad status trigger t_0	pad gain (Kr) pad noise (peds) v_{drift} (laser) pad status (puls)	v_{drift} (laser)

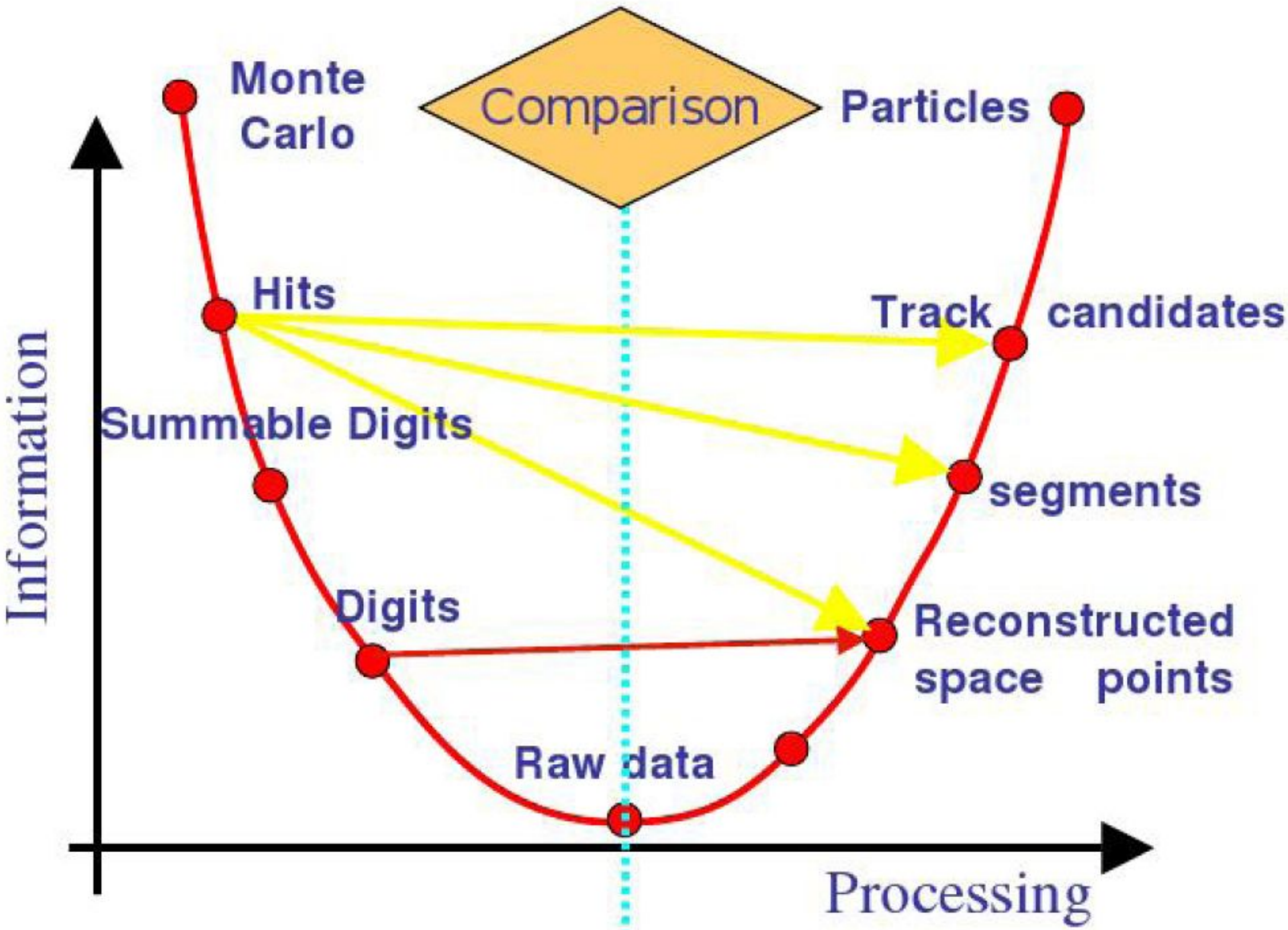
Example: SDD manual calibration

- Calibration at fill level of:
  - Drift velocity residual calibration + time0 + map for non-uniformities of the drift field
  - ADC -> keV calibration for dE/dx in bins of drift time

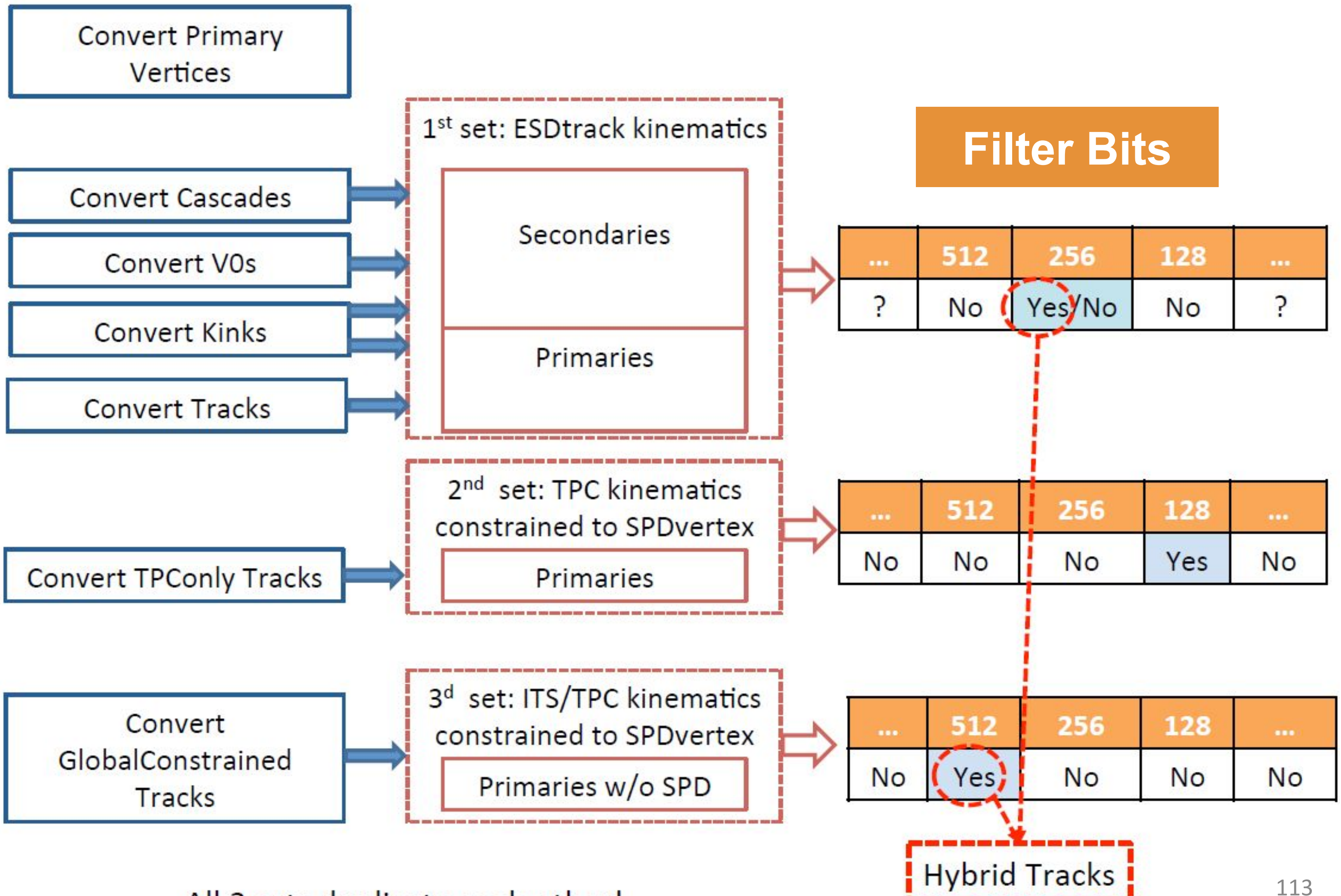




Monte Carlo chain



ESD -> AOD filtering



All 3 sets duplicate each other!

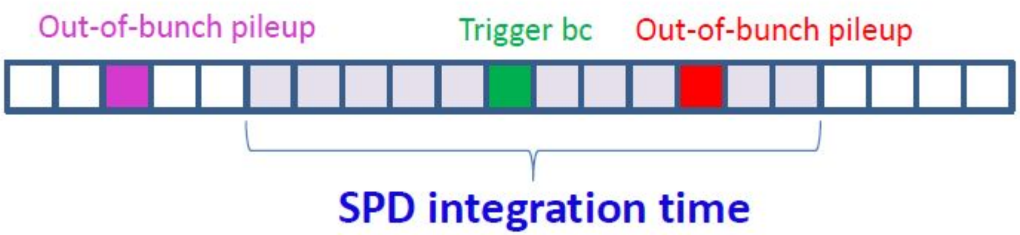
Out of bunch pileup

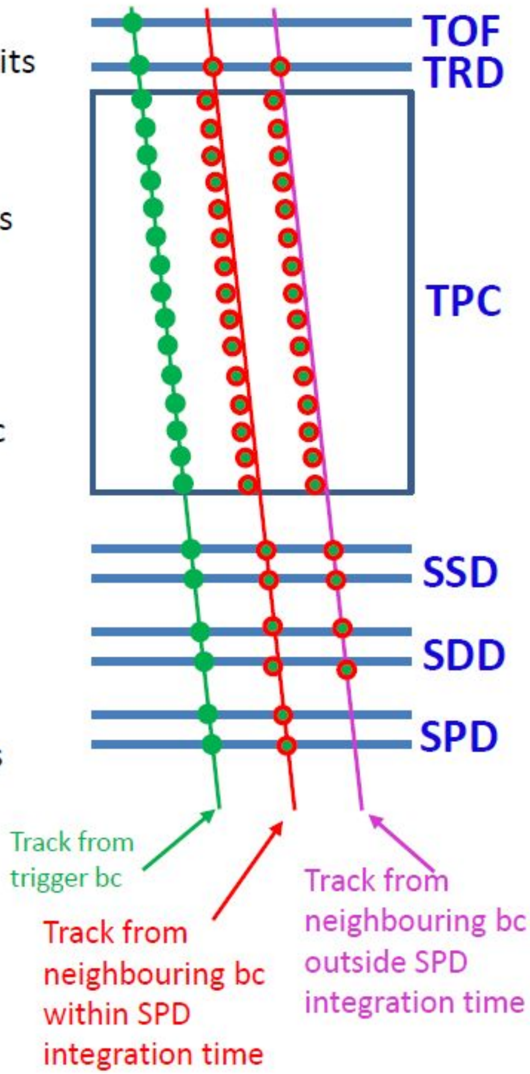
Integration times in central barrel:

- **SPD**: 300 ns (12 bcs) - out-of-bunch hits indistinguishable from trigger hits
- **SDD:** ~6 us (240 bcs) – radial drift ~0.5mm/100ns.
  Tracking tolerance: σ~0.5 mm for pp (0.2 mm for Pb-Pb)
- **SSD:** ~1 us (40 bcs) - out-of-bunch hits indistinguishable from trigger hits
- **TPC:** ~100 us (4000 bcs) – z-drift ~2.5mm/100ns.
  ITS-TPC track matching tolerance: σ~5 mm
- **TRD:** ~1 us (40 bcs) - radial drift ~2.5mm/100ns.
- **TOF**: ~0.5 us (20 bcs) – time info allows to identify tracks from trigger bc however not all analyses require TOF hit matching

Conclusions:

- SPD hit requirement cleans up tracks from neighbouring bunches
  - Does not help in case of pileup within SPD integration time
- Need to remove residual out-of-bunch pileup in SPD integration time
- Out-of-bunch pileup removal is crucial in multiplicity-differential studies





TPC clusters

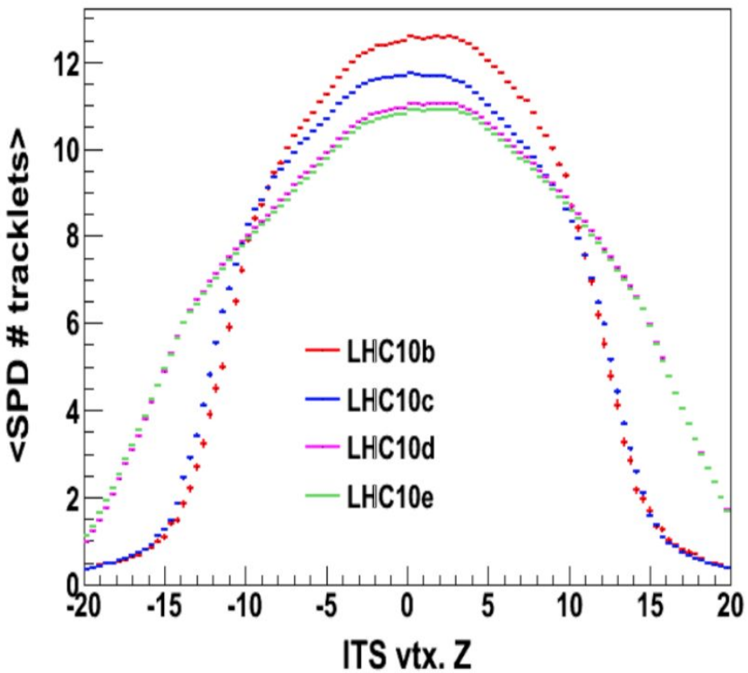
- The ALICE TPC provides up to 159 space points (clusters) corresponding to the number of pad rows.

- The signal can be below threshold for low ionizing particles.

Def. 1 (*TPC cluster*)

A charged particle traversing the TPC induces a signal on a given pad-row. If the charge in a search window of 5 pads in wire direction and 5 bins in time direction exceeds a certain threshold and fulfills all necessary quality criteria, it is called a cluster. Therefore the maximum number of clusters per track n_{cl} is 159, which corresponds to the number of pad rows in a TPC sector. Curling track parts are reconstructed as separate tracks. The number of clusters assigned to a track is related to the track length in the sense that low p_t-tracks which do not reach the outer wall of the TPC have less clusters assigned. However, the relation is not straightforward, because the pad length in the TPC is increasing with radial distance to the center.

Centrality: vertex-Z corrections



- Our **detector acceptance changes** depending on the PV position along the beam axis (z direction)
- Thus, the average raw value of any estimator may change with vertex-Z
- **This can be corrected for**: instead of calibrating based on N_{raw}, we calibrate N_{corr}:

$$N_{corr} = N_{raw} / \langle N_{raw}\ (\text{vtx-Z}) \rangle$$

- $\langle N_{raw}$ (vtx-Z)$\rangle$ is usually a polynomial fit to the averages measured in data. **Example in figure: pp @ 7TeV**
- May be more or less important (V0M -> dependence partially cancels out as V0A↑ = V0C↓ and vice-versa, SPD-based estimators -> very sensitive)