

O2-DQ tutorial : Event filtering and skimming

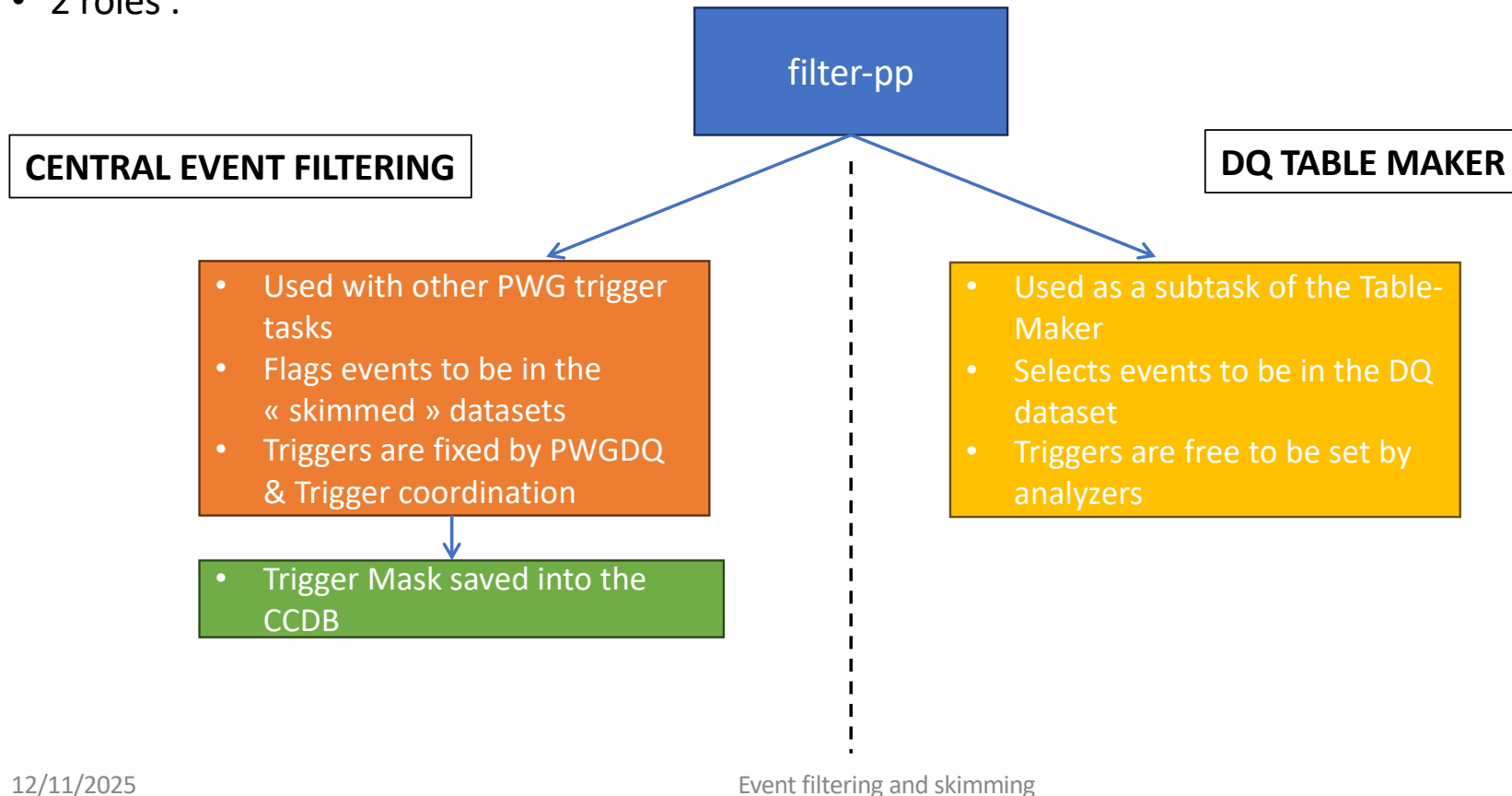
O2 Analysis Tutorial 5.0 – DQ framework

Wednesday November 12th 2025

Victor FEUILLARD

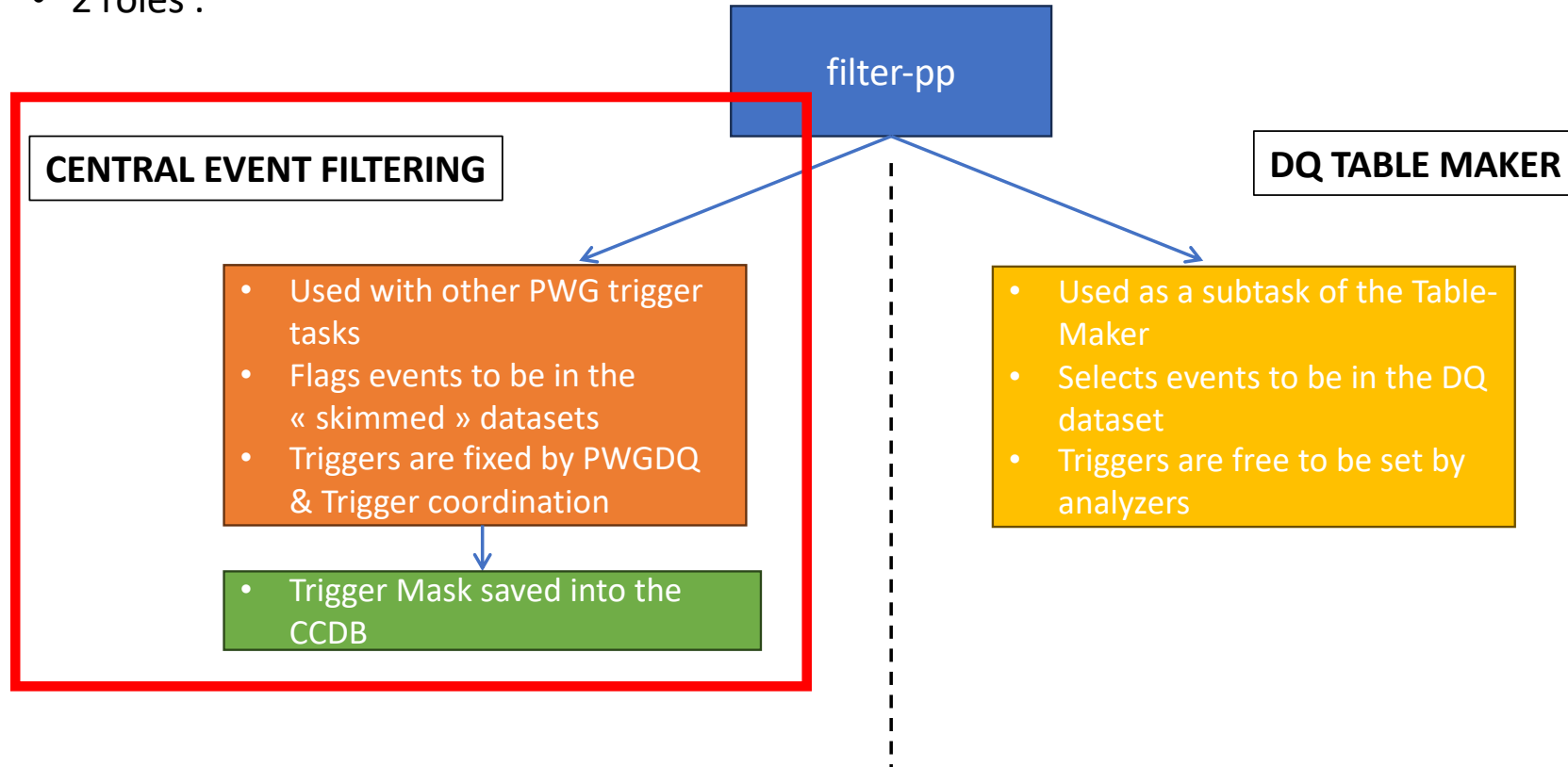
Introduction

- The task is O2Physics/PWGDQ/Tasks/filterPPwithAssociation.cxx
- 2 roles :



Part I – The CEFP task

- The task is O2Physics/PWGDQ/Tasks/filterPPwithAssociation.cxx
- 2 roles :



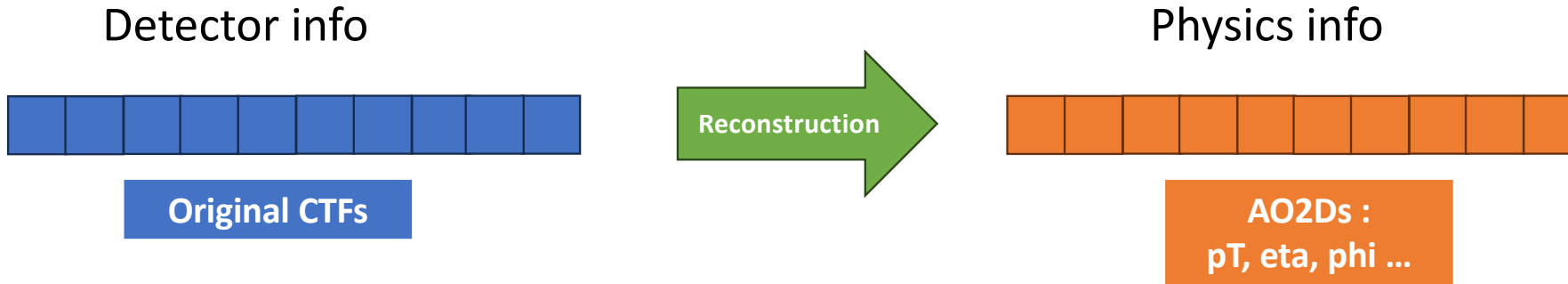
The Filtering process

Detector info

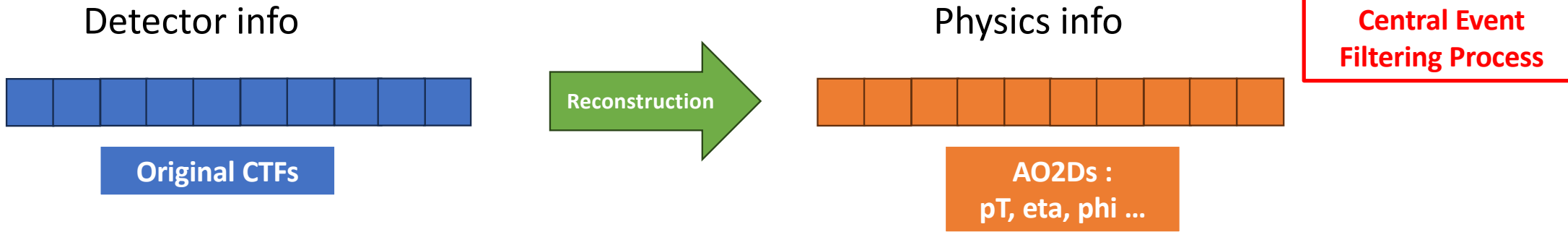


Original CTFs

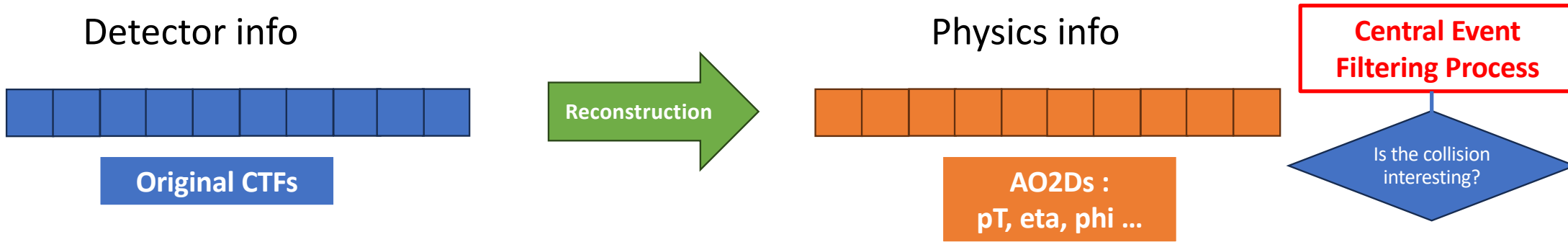
The Filtering process



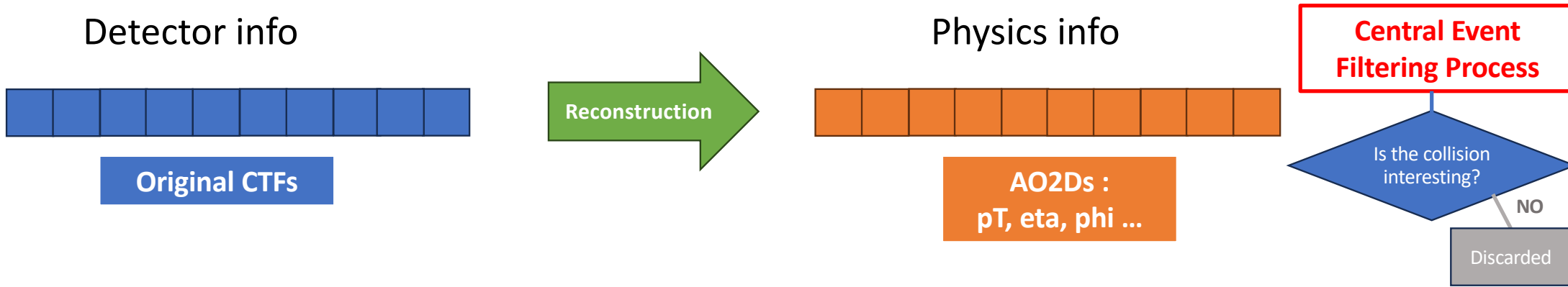
The Filtering process



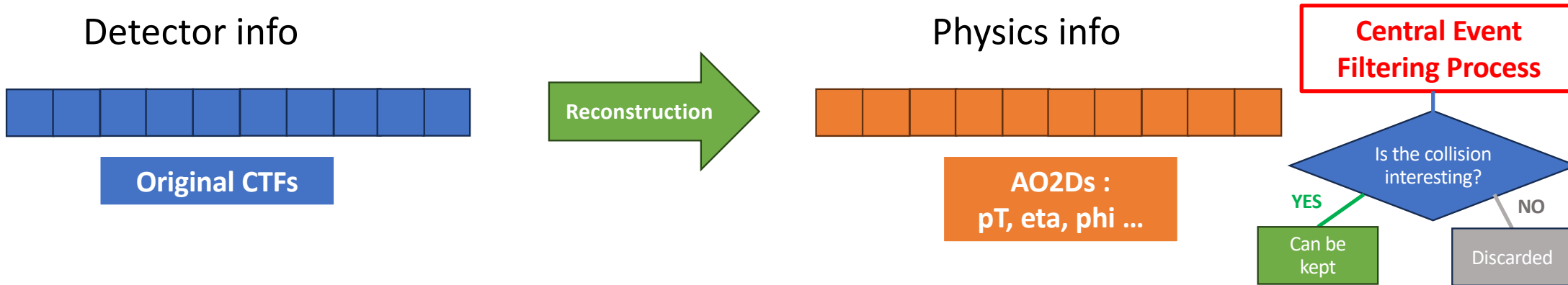
The Filtering process



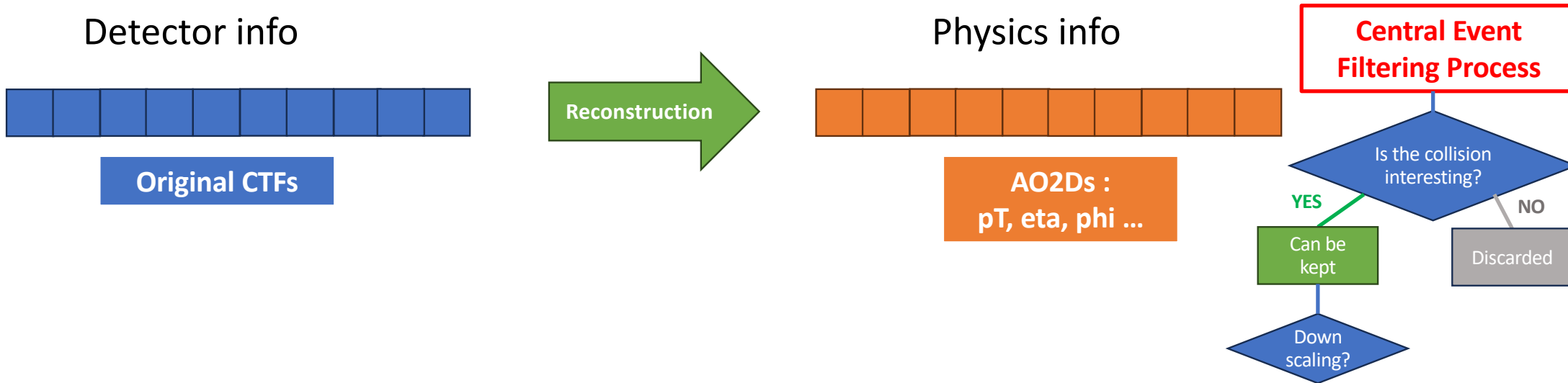
The Filtering process



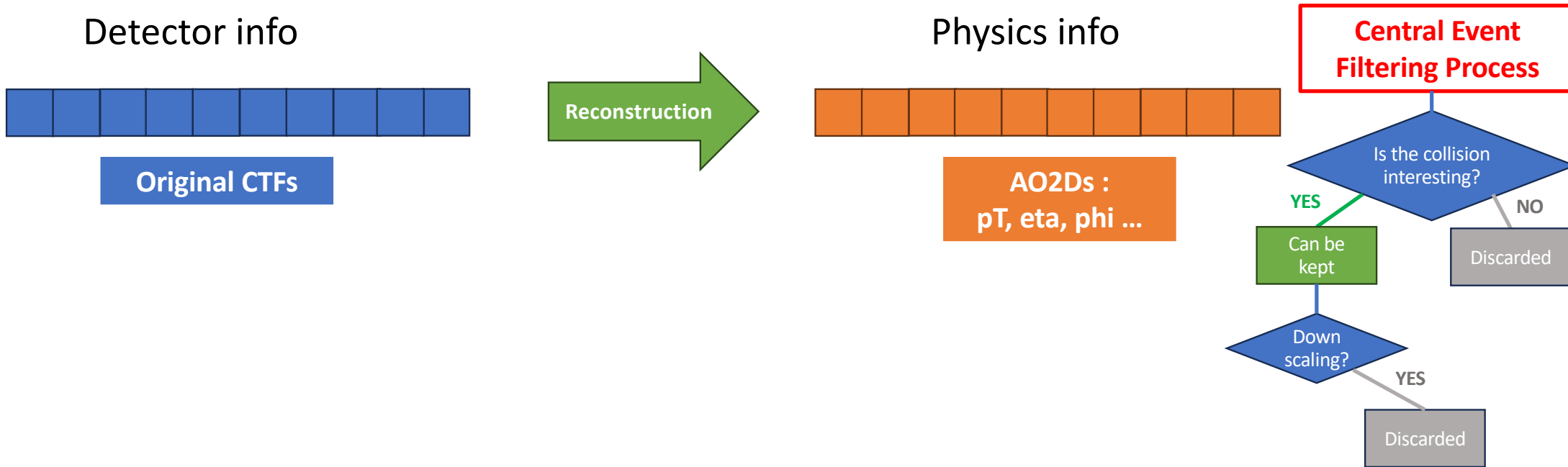
The Filtering process



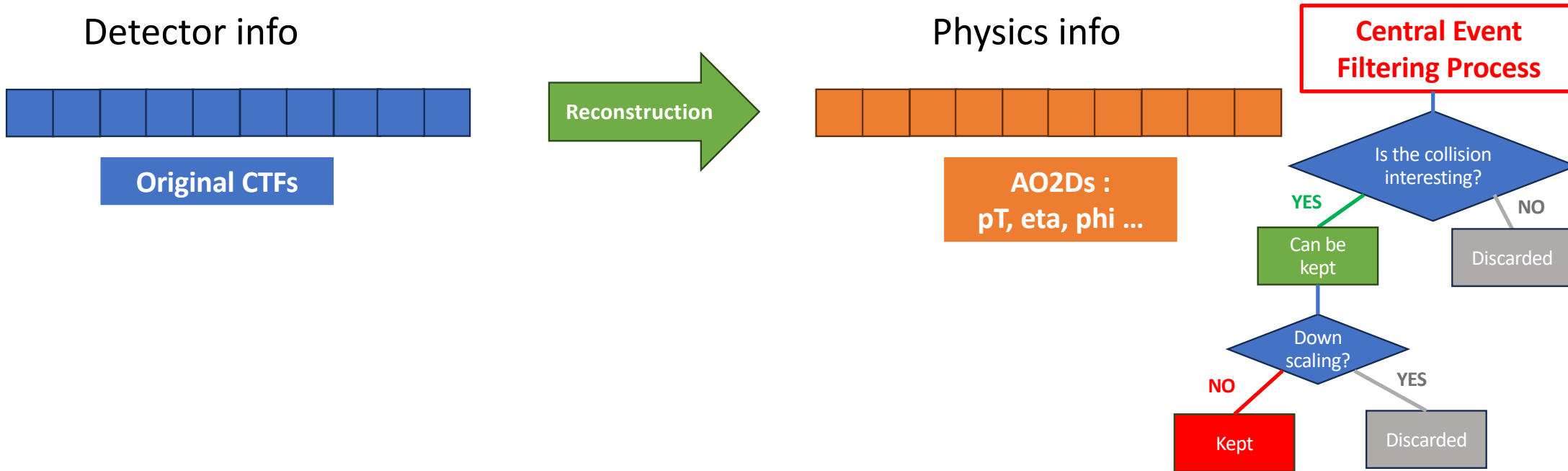
The Filtering process



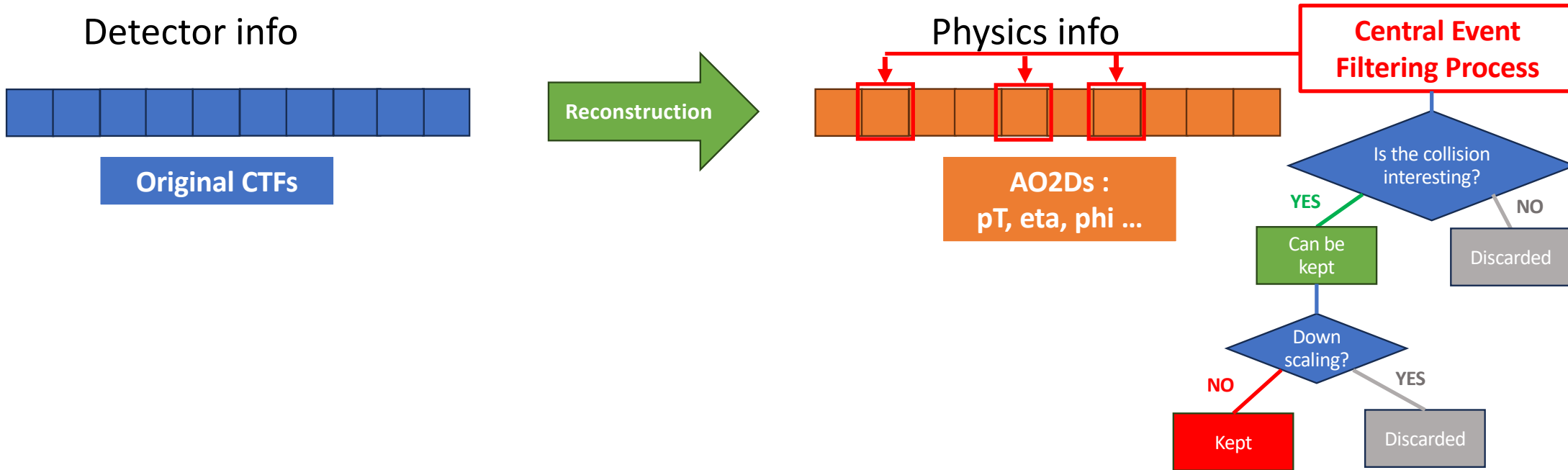
The Filtering process



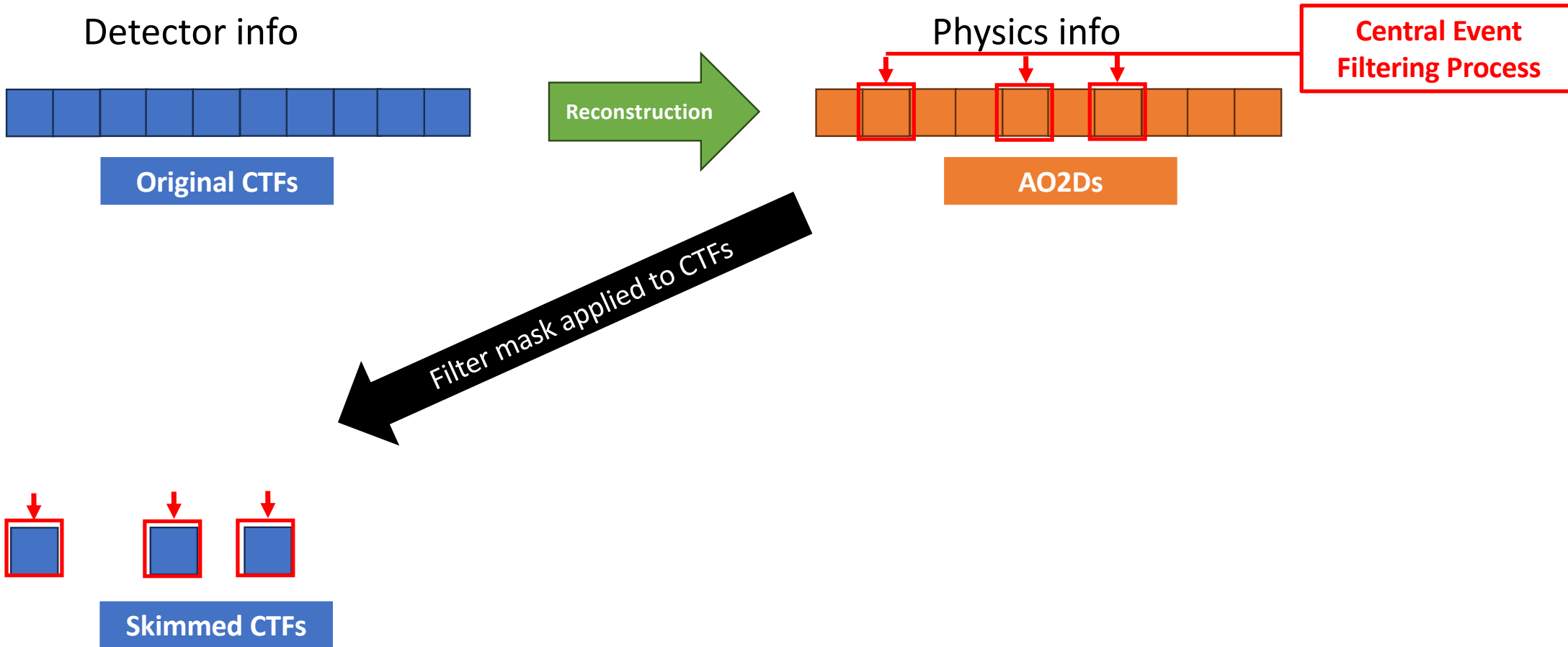
The Filtering process



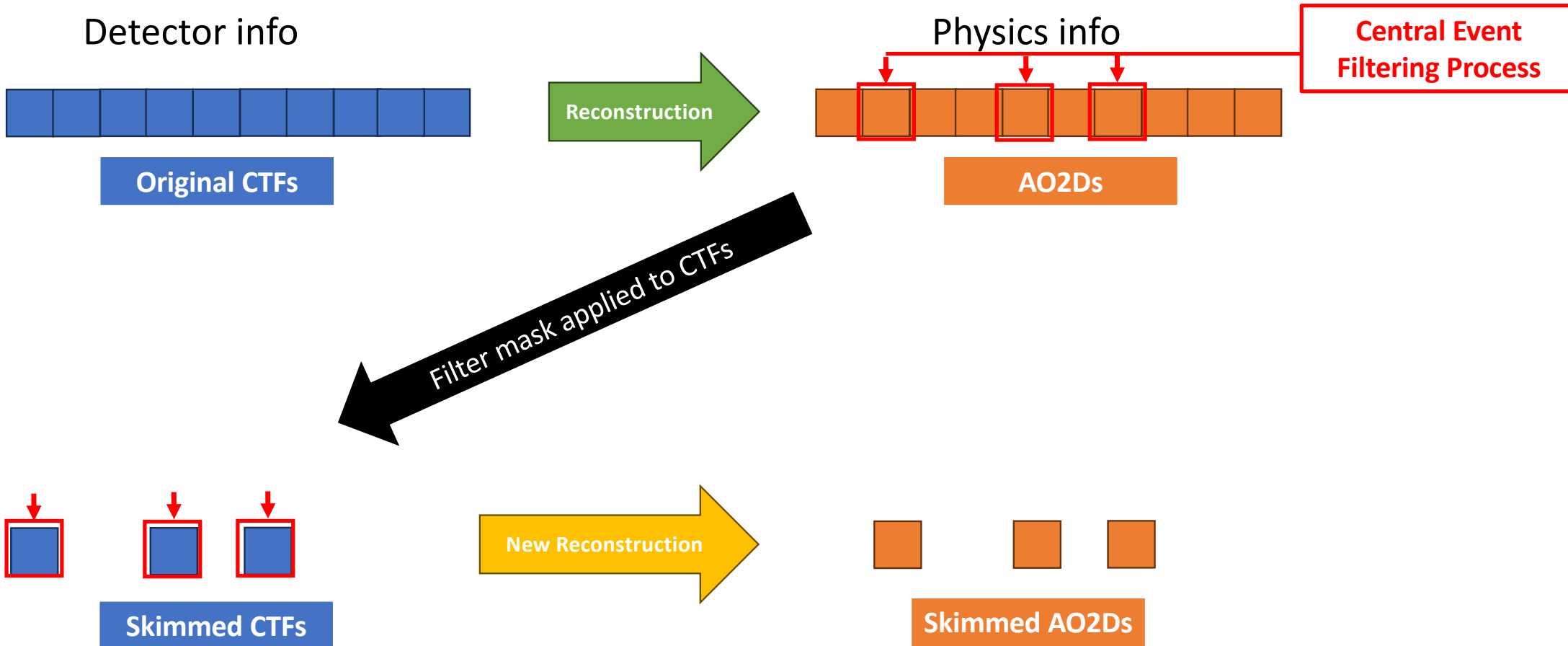
The Filtering process



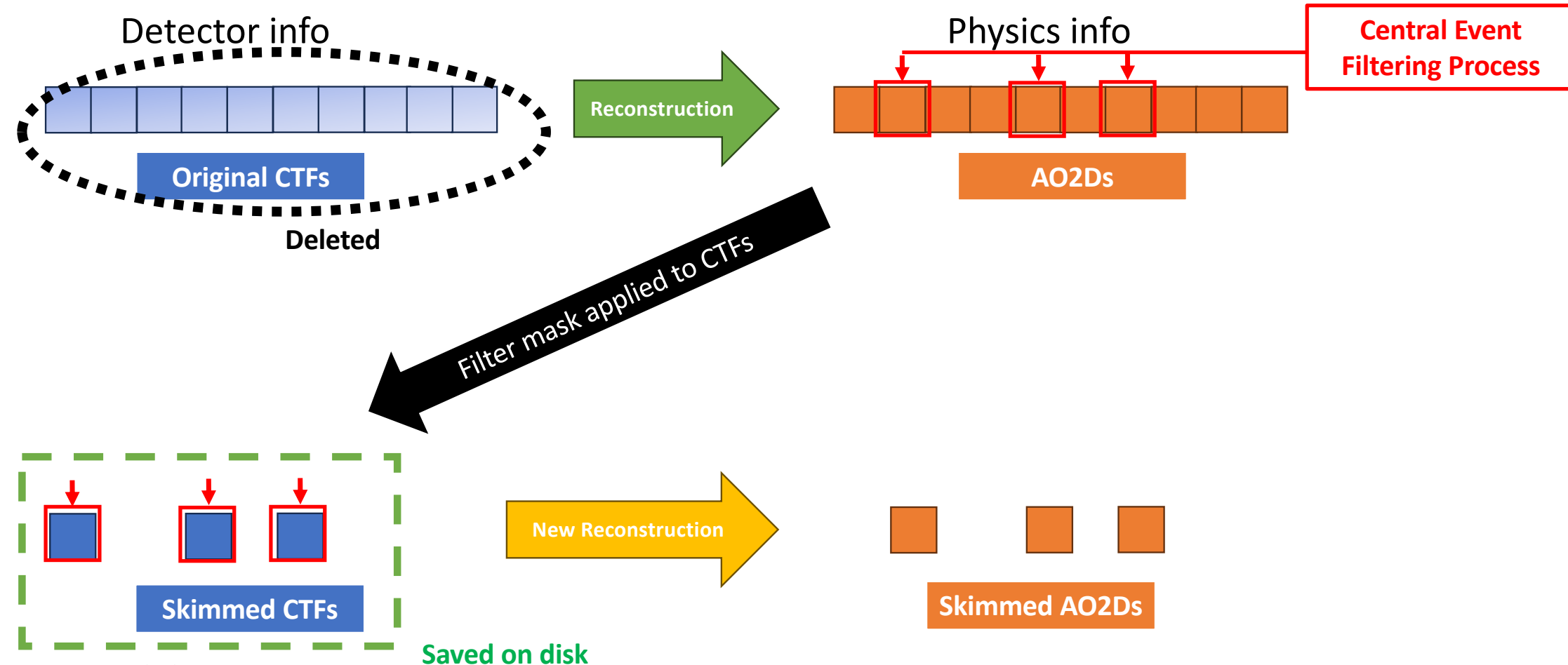
The Filtering process



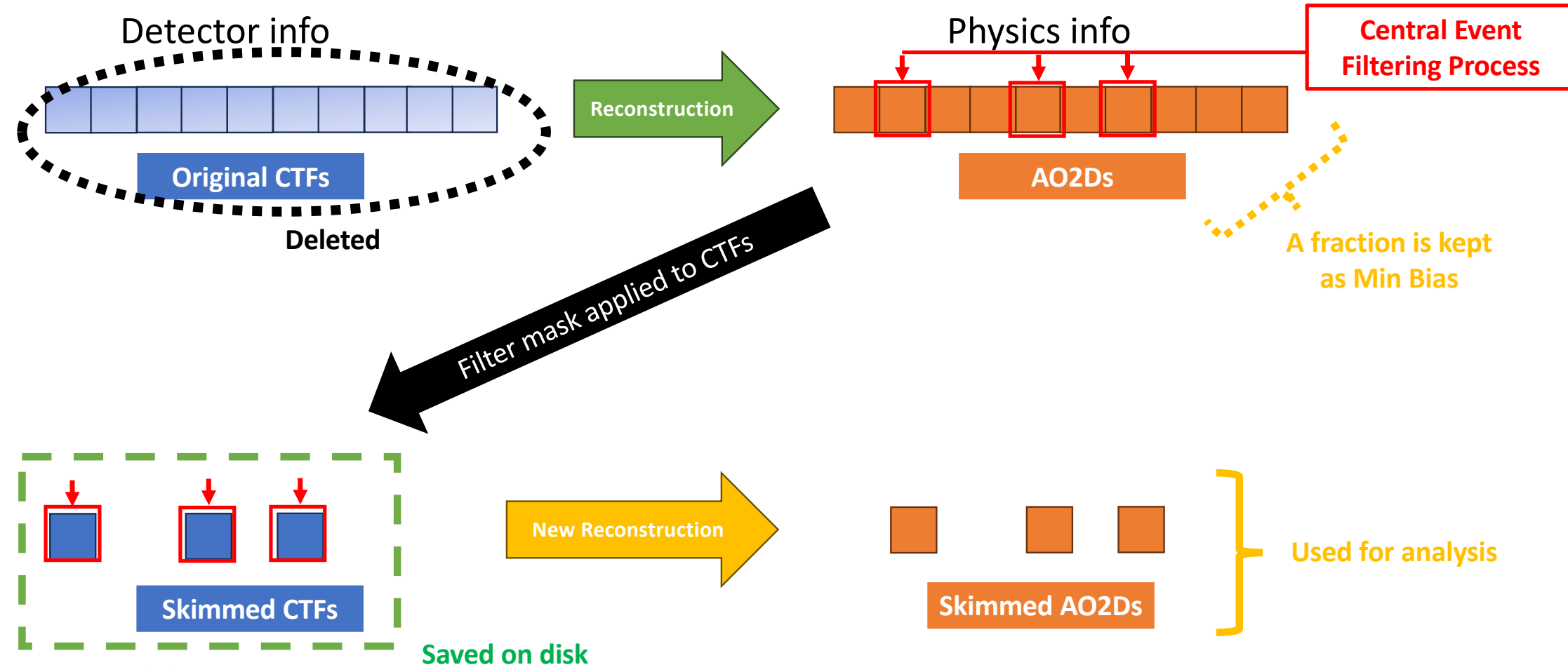
The Filtering process



The Filtering process



The Filtering process



Datasets on hyperloop

- Types of datasets :

My Analyses
All Analyses
Dashboard

AliHyperloop

Train Submission
Train Runs
Datasets
DPG Runlists
?

Datasets

Reset all filters

Derived data
Show staging status
Show removed datasets

Name	Description	Type	Production name	DPG runlist	Last used	Last month	✓✗
LHC24an	Search 3 records...	DATA	Search 3 records...	Search 3 records...	Off	Search	✓
LHC24an_pass1_skimmed	https://its.cern.ch/jira/browse/O2-5475 apass1_skimmed of LHC24an - pp 13.6 TeV	DATA	LHC24an_apass1_skimmed LHC24an_apass1_skimmed LHC24an_apass1_skimmed LHC24an_apass1_skimmed LHC24an_apass1_skimmed LHC24an_apass1_skimmed LHC24an_apass1_skimmed	all CBT CBT_calor CBT_electronPID CBT_fw CBT_hadronPID CBT_muon CBT_muon_global	10/11/25	25	✓
LHC24an_pass1_skimmed_small	https://its.cern.ch/jira/browse/O2-5475 apass1_skimmed of LHC24an - pp 13.6 TeV	DATA	LHC24an_apass1_skimmed LHC24an_apass1_skimmed LHC24an_apass1_skimmed LHC24an_apass1_skimmed LHC24an_apass1_skimmed LHC24an_apass1_skimmed LHC24an_apass1_skimmed	all CBT CBT_calor CBT_electronPID CBT_fw CBT_hadronPID CBT_muon CBT_muon_global	10/11/25	28	✓
LHC24an_pass1_MinBias	https://its.cern.ch/jira/browse/O2-5642 apass1_sampled of LHC24an - 13.6 TeV	DATA	LHC24an_apass1_sampled LHC24an_apass1_sampled LHC24an_apass1_sampled LHC24an_apass1_sampled LHC24an_apass1_sampled LHC24an_apass1_sampled LHC24an_apass1_sampled	all CBT CBT_calor CBT_electronPID CBT_hadronPID CBT_muon CBT_muon_global	07/11/25	7	✓

Datasets on hyperloop

- Types of datasets :

My Analyses All Analyses Dashboard AliHyper

Datasets

 Reset all filters

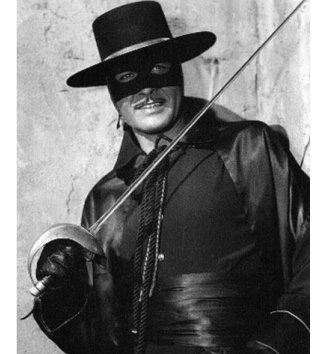
Name	Description	Type
LHC24an	Search 3 records...	DATA
LHC24an_pass1_skimmed	https://its.cern.ch/jira/browse/O2-5475 apass1_skimmed of LHC24an - pp 13.6 TeV	DATA
LHC24an_pass1_skimmed_small	https://its.cern.ch/jira/browse/O2-5475 apass1_skimmed of LHC24an - pp 13.6 TeV	DATA
LHC24an_pass1_MinBias	https://its.cern.ch/jira/browse/O2-5475 apass1_sampled of LHC24an - 13.6 TeV	DATA

Skimmed AO2Ds with filter
information

Original AO2Ds without filter
information

The Zorro tool

- Central skimming produces trigger masks that are saved into ccdb
- Temporary repository : Users/m/mpuccio/EventFiltering/OTS/
- Zorro (Zorro.h, Zorro.cxx) is the tool to manage the trigger masks stored into ccdb
- Configurables in the table-maker



```
// Zorro selection
struct : ConfigurableGroup {
    Configurable<bool> fConfigRunZorro{"cfgRunZorro", false, "Enable event selection with zorro"};
    Configurable<std::string> fConfigZorroTrigMask{"cfgZorroTriggerMask", "fDiMuon", "DQ Trigger masks: fSingleE, fLMeeIMR, fLMeeHMR, fDiElectron, fSingleMuLow, fSingleMuHigh, fDiMuon"};
    Configurable<bool> fConfigRunZorroSel{"cfgRunZorroSel", false, "Select events with trigger mask"};
    Configurable<uint64_t> fBcTolerance{"cfgBcTolerance", 100, "Number of BCs of margin for software triggers"};
} fConfigZorro;
```

-  **Warning:**
 - The usage of zorro excludes the usage of the filter-pp task, you cannot use both the tools together
 - User can combine more triggers (e.g. fDiMuon, fSingleMuLow)
 - Be sure that the dataset you are using contains the « skimmed » keyword, otherwise it will break (no ccdb)

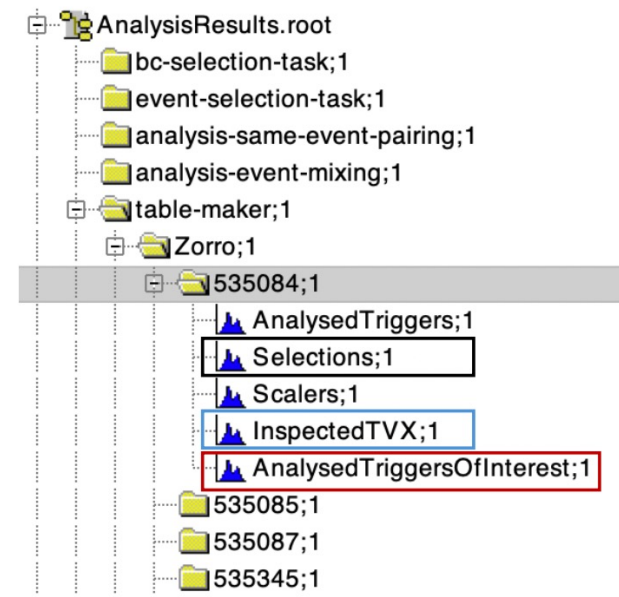
The Zorro tool - configuration

- In the table-maker task configuration

table-maker		
processOnlyBCs	 	0
...		
cfgRunZorro	 	1
cfgRunZorroSel	 	1
...		
cfgZorroTriggerMask	 	fDiElectron

The Zorro tool - Information in the CCDB

- For each analysed run you get:
 - The number of analysed triggers in your hyperloop train (both trigger of interest and other triggers)
 - The T0TVX triggers inspected originally by the skimming
 - The originally selected number of events per triggers (the Selections histogram)
- To know the equivalent T0TVX triggers sampled you need to do:
 - Sum all the originally inspected T0TVX triggers
 - Sum all the originally selected events for your trigger of interest
 - Sum the number of analysed triggers of interest



$$N_{TVX} = (\text{Inspected TVX}) \frac{\text{Analyzed Triggers Of Interest}}{\text{Number of Triggers Of Interest in the Skimming}}$$

- It is done to avoid double counting in the normalisation as more than one collision can be compatible with the triggered BC
- See also the presentation on [Software triggers](#)

Credits : Luca Micheletti

List of DQ Triggers

- The DQ triggers are : fSingleElectron, fDiElectron, fSingleMuonLow, fSingleMuonHigh, fDimuon, fElectronMuon

Electron Trigger		
	2022	2023 - 2025
Single e p_T	$> 1.0 \text{ GeV/c}$	$> 1.0 \text{ GeV/c}$
Single e η	$[-0.9 ; 0.9]$	$[-0.9 ; 0.9]$
Is SPD Any	yes	yes
TPC χ^2	< 4.0	< 4.0
TPC N Clusters	$[70 ; 160]$	$[70 ; 160]$
n-σ_e	$[-4.0 ; 4.0]$	$[-4.0 ; 4.0]$
n-σ_π	> 2.5	> 2.5
n-σ_p	> 2.5	> 2.5
PID post-calibration	Yes	No
Track-collision association	No	Yes
m_{ee}	$> 0 \text{ GeV/c}^2$	$> 1.8 \text{ GeV/c}^2$

Muon Trigger		
	2022	2023 - 2025
Single μp_T	$> 0.7 (4.0) \text{ GeV/c}$	$> 0.7 (20.0) \text{ GeV/c}$
Single $\mu \eta$	$[-4.0 ; -2.5]$	$[-4.0 ; -2.5]$
R_{abs}	$[17.6 ; 89.5]$	$[17.6 ; 89.5]$
$p \times \text{DCA}$	$\sim 6 \sigma_{p \times \text{DCA}}$	$\sim 10 \sigma_{p \times \text{DCA}}$
Matching MCH-MID	No	Yes
Track-collision association	No	Yes
$m_{\mu\mu}$	$> 1.8 \text{ GeV/c}^2$	$> 1.8 \text{ GeV/c}^2$

List of DQ Triggers

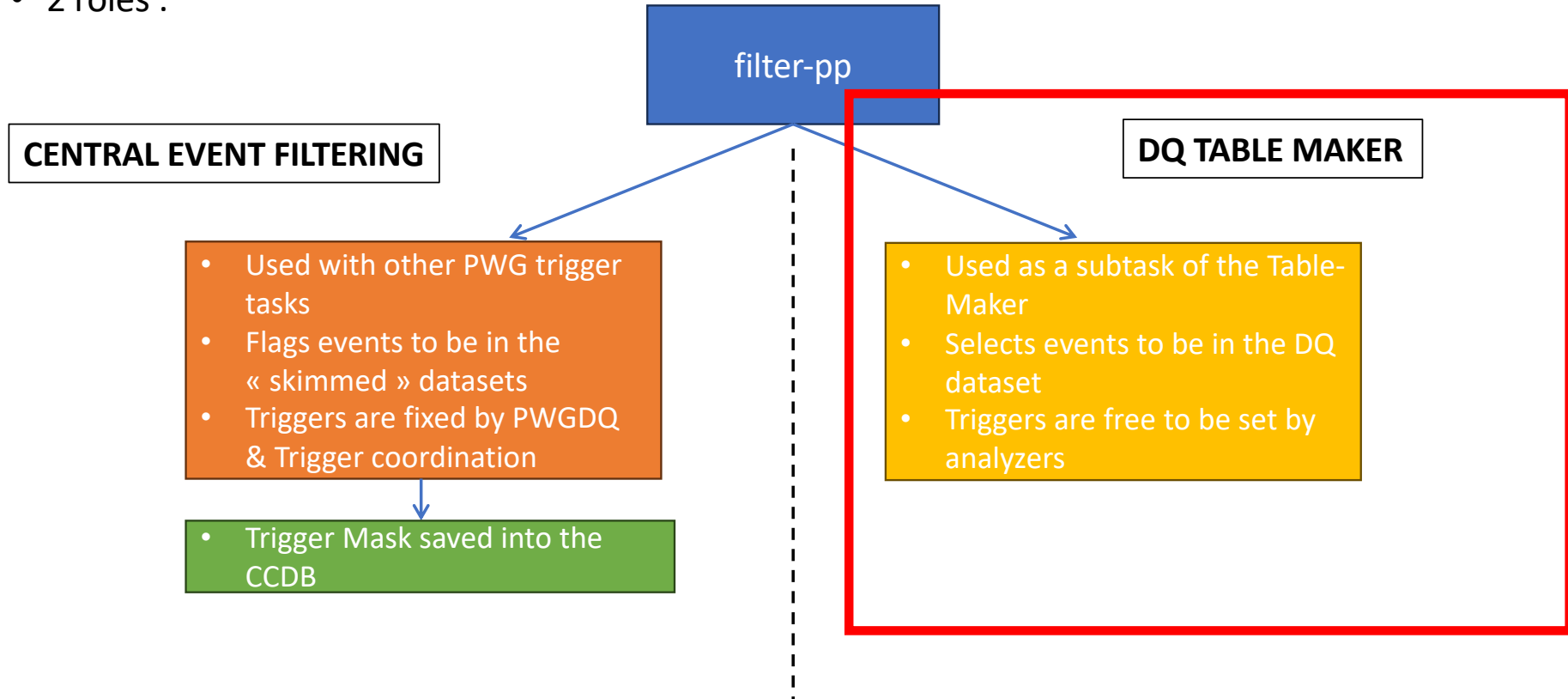
- The DQ triggers are : fSingleElectron, fDiElectron, fSingleMuonLow, fSingleMuonHigh, fDimuon, fElectronMuon

Electron Muon Trigger			
	2025		2025
Single e p _T	> 0.7 GeV/c	Single μ p _T	> 1.0 GeV/c
Single e η	[-0.9 ; 0.9]	Single μ η	[-4.0 ; -2.5]
Is SPD Any	yes	R _{abs}	[17.6 ; 89.5]
TPC χ ²	< 4.0	p x DCA	~6 σ _{p x DCA}
TPC N Clusters	[70 ; 160]	Matching MCH-MID	Yes
n-σ _e	[-3.0 ; 3.0]		
n-σ _π	> 2.5		
n-σ _p	> 2.5		
PID post-calibration	No		
Track-collision association	YES		
m _{eμ}	> 0 GeV/c ²		

- Trigger list can be found : <https://twiki.cern.ch/twiki/bin/viewauth/ALICE/PWGDQDileptonsQuarkonia>

Part II – Local filtering

- The task is O2Physics/PWGDQ/Tasks/filterPPwithAssociation.cxx
- 2 roles :



The filter task

- The filter task can be used as a dependency of the table-maker and table-reader task
- The « with Filter » processes need to be enabled in the table-maker :

table-maker		
processBarrelOnly	 	0
processBarrelOnlyWithCent	 	0
processBarrelOnlyWithCov	 	0
→ processBarrelOnlyWithEventFilter	 	1

- Can only be used on Min. Bias data and it excludes the usage of the zorro tool, you cannot use both tools together

Filter Subtasks

AOD.root

DQEventSelectionTask: preselect the events to be examined

Example : *eventStandardNoINT7*

DQBarrelTrackSelection : preselect the electron tracks to be examined

Example : *jpsiO2MCdebugCuts2_Corr*, *jpsiO2MCdebugCuts4_Corr*

DQMuonsSelection : preselect the muon tracks to be examined

Example : *muonLowPt*, *muonLowPt*

DQFilterPPTask :

- Checks if event is selected
- Looks at the list of provided cuts (electron + muon)
- Looks if a pair selection is added to the condition
 - Single track selection : *trackSelection::1*
 - Pair selection : *trackSelection:pairSelection:1*
- IMPORTANT : the list of cuts must be the same in the **DQBarrelTrackSelection** & **DQMuonsSelection** and in the **DQFilterPPTask** AND IN THE SAME ORDER
- Runs over the events to see if there are tracks matching the given criteria
- Example : *"jpsiO2MCdebugCuts2_Corr::1, jpsiO2MCdebugCuts4_Corr:pairNoCut:1, muonLowPt::1, muonLowPt:pairNoCut:1"*



Bitmap of selection attached to the event (+ eventual QA histograms)
With this example : [*Single electron* ; *Electron pair* ; *Single muon* ; *Muon pair*]

Filter : cut configuration

- Event Selection subtask :

d-q-event-selection-task		
processDummy		0
processEventSelection		1
cfgEventCuts		eventNoTFBorder
cfgWithQA		1

Defines the event selection

Plot control histograms (or not)

- The list of available cuts can be found in :
<https://github.com/AliceO2Group/O2Physics/blob/master/PWGDQ/Core/CutsLibrary.cxx>

Filter : cut configuration

- Barrel track selection subtask :

path to the postcalibration TPC PID maps

Defines the cuts for barrel track

Defines the cuts for barrel track in the emu trigger

use the postcalibration TPC PID maps (if needed)

Plot control histograms (or not)

d-q-barrel-track-selection		
processDummy		0
processSelection		1
ccdb-no-later-than		-1
ccdb-path-tpc		EventFiltering/PWGDQ/TPCPID/PostCalib
ccdb-url		http://alice-ccdb.cern.ch
cfgBarrelTrackCuts		Electron2025_4,lmee_skimmingtesta_TOF_pionrej_
cfgBarrelTrackCutsForEMu		ElectronForEMu
cfgPropTrack		1
cfgTPCpostCalib		0
cfgWithQA		1

- The list of available cuts can be found in :
<https://github.com/AliceO2Group/O2Physics/blob/master/PWGDQ/Core/CutsLibrary.cxx>

Filter : cut configuration

- Line 18-23 : forward track selection subtask :

Defines the cuts for barrel track

Defines the cuts for muons in the emu trigger

Repropagates muon tracks to vertex

Plot control histograms (or not)

d-q-muons-selection		
processDummy		0
processSelection		1
ccdb-url		http://alice-ccdb.cern.ch
cfgMuonsCuts		muonLowPt210SigmaPDCA,MuonHigh2023,muonL
cfgMuonsCutsForEMu		MuonForEMu
cfgPropMuon		1
cfgWithQA		1
geoPath		GLO/Config/GeometryAligned
grpmagPath		GLO/Config/GRPMagField

- The list of available cuts can be found in :
<https://github.com/AliceO2Group/O2Physics/blob/master/PWGDQ/Core/CutsLibrary.cxx>

Filter : cut configuration

- Trigger subtask :

Cuts for barrel track + inv. mass. cuts

Cuts for emu + inv. mass. cuts

Cuts for muons + inv. mass. cuts

Repropagates muon tracks to vertex

Include (or not) like sign pairs in the e+e- trigger

Include (or not) like sign pairs in the mu+mu- trigger

Include (or not) like sign pairs in the emu trigger

Plot control histograms (or not)

d-q-filter-p-p-task		
processDummy		0
processFilterMuonPP		0
processFilterPP		1
ccdb-url		http://alice-ccdb.cern.ch
cfgBarrelSels		Electron2025_4::1,lmee_skimmingtesta_TOF_pionr
cfgElectronMuonSels		ElectronForEMu:MuonForEMu:pairNoCut:1
cfgMuonSels		muonLowPt210SigmaPDCA::1,MuonHigh2023::1,mu
cfgPropMuon		1
cfgWithBarrelLS		false,true,true,false
cfgWithElectronMuonLS		true
cfgWithMuonLS		false,false,false
cfgWithQA		1

Exercise : dq-filter-pp

- Run the filter-pp with the configurationFilterPP.json file:

```
o2-analysis-dq-filter-pp-with-association -b --configuration json://configurationFilterPP.json
| o2-analysis-timestamp -b --configuration json://configurationFilterPP.json
| o2-analysis-track-propagation -b --configuration json://configurationFilterPP.json
| o2-analysis-trackselection -b --configuration json://configurationFilterPP.json
| o2-analysis-tracks-extra-v002-converter -b --configuration json://configurationFilterPP.json
| o2-analysis-pid-tof-full -b --configuration json://configurationFilterPP.json
| o2-analysis-multiplicity-table -b --configuration json://configurationFilterPP.json
| o2-analysis-fwdtrackextension -b --configuration json://configurationFilterPP.json
| o2-analysis-event-selection -b --configuration json://configurationFilterPP.json
| o2-analysis-fwdtrack-to-collision-associator -b --configuration json://configurationFilterPP.json
| o2-analysis-track-to-collision-associator -b --configuration json://configurationFilterPP.json
| o2-analysis-pid-tpc -b --configuration json://configurationFilterPP.json
| o2-analysis-pid-tof-base -b --configuration json://configurationFilterPP.json
| o2-analysis-pid-tpc-base -b --configuration json://configurationFilterPP.json
| o2-analysis-ft0-corrected-table -b --configuration json://configurationFilterPP.json
--aod-file AO2D.root
```

- Open the **AnalysisResults.root** file. Check the «*d-q-filter-p-p-task*» folder. Look at the «*Statistics*» histogram to see the number of selected events
- Change the list of triggers in the configuration and run the task again. Compare the results

Exercise : Zorro tool

- Run the table-maler with the configurationZorro.json file:

```
o2-analysis-dq-table-maker -b --configuration json://configurationZorro.json
| o2-analysis-timestamp -b --configuration json://configurationZorro.json
| o2-analysis-track-propagation -b --configuration json://configurationZorro.json
| o2-analysis-trackselection -b --configuration json://configurationZorro.json
| o2-analysis-tracks-extra-v002-converter -b --configuration json:// configurationZorro.json
| o2-analysis-pid-tof-full -b --configuration json://configurationZorro.json
| o2-analysis-pid-tof-beta -b --configuration json://configurationZorro.json
| o2-analysis-multiplicity-table -b --configuration json://configurationZorro.json
| o2-analysis-event-selection -b --configuration json://configurationZorro.json
| o2-analysis-fwdtrackextension -b --configuration json://configurationZorro.json
| o2-analysis-fwdtrack-to-collision-associator -b --configuration json://configurationZorro.json
| o2-analysis-track-to-collision-associator -b --configuration json://configurationZorro.json
| o2-analysis-pid-tpc -b --configuration json://configurationZorro.json
| o2-analysis-pid-tof-base -b --configuration json://configurationZorro.json
| o2-analysis-pid-tpc-base -b --configuration json://configurationZorro.json
| o2-analysis-ft0-corrected-table -b --configuration json://configurationZorro.json
--aod-file AO2D.root
```

- Open the **AnalysisResults.root** file. Check the «*table-maker*» folder. Look at the histograms in the «*Zorro*» subFolder to see the triggered of events
- Change the Zorro triggers in the configuration and run the task again. Compare the results

Thank you for your attention!

Contact persons :

- DQ trigger (2022-2024) : victor.jose.gaston.feuard@cern.ch
- DQ trigger (2025-now) : andreas.ulveseth.mikalsen@cern.ch
- Central Event Filtering : fabrizio.grosa@cern.ch