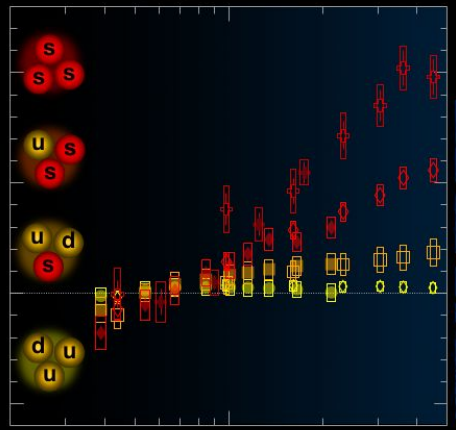
Strangeness analyses

O2 Analysis Tutorial 07/11/2023



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Strangeness reconstruction with ALICE

The identification of (multi-)strange hadrons is based on two topologies:

V^0 : neutral particle decaying weakly into a pair of charged particles (V-shaped decay)

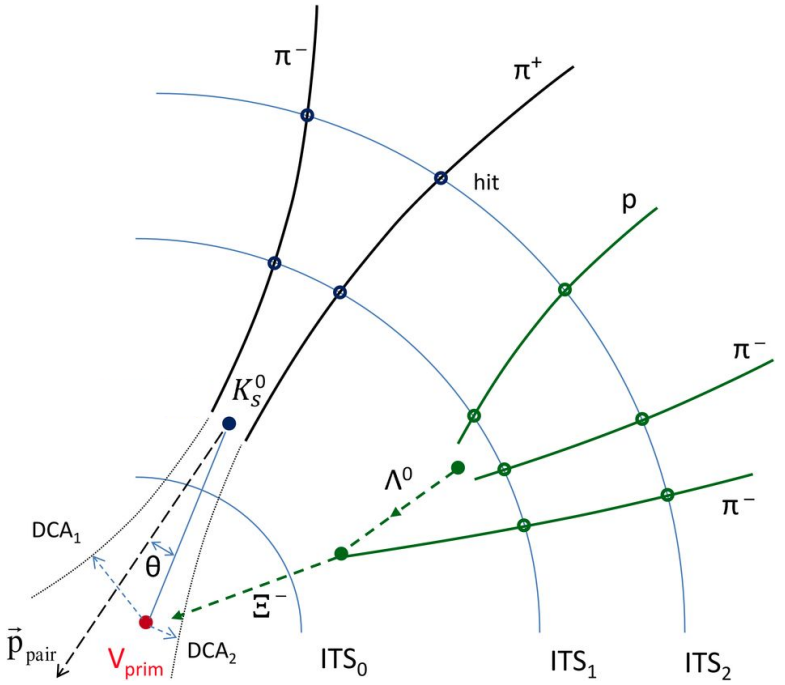
$$K_S^0 \rightarrow \pi^+ + \pi^-$$

$$\Lambda\,(\overline{\Lambda}) \rightarrow p\,(\overline{p}) + \pi^-\,(\pi^+)$$

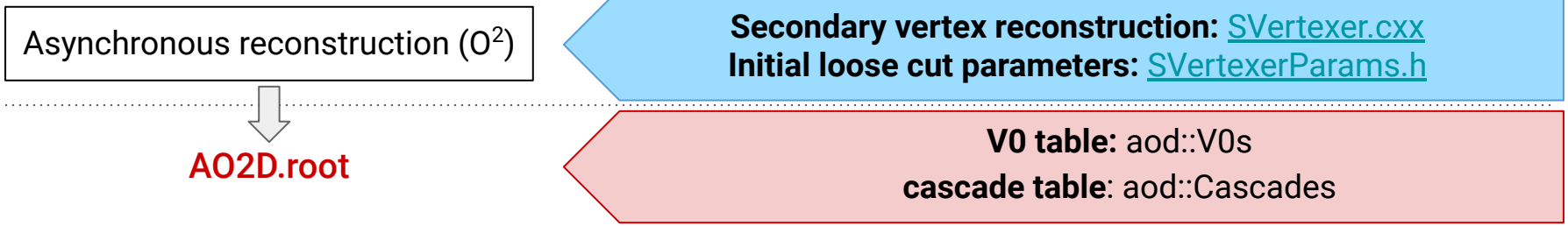
Cascade : charged particle decaying weakly into a V^0 + charged particle

$$\Xi^-\,(\overline{\Xi}^+) \rightarrow \Lambda\,(\overline{\Lambda}) + \pi^-\,(\pi^+)$$

$$\Omega^-\,(\overline{\Omega}^+) \rightarrow \Lambda\,(\overline{\Lambda}) + K^-\,(K^+)$$



The strangeness analysis workflow



The strangeness analysis workflow

Asynchronous reconstruction (O^2)

AO2D.root

Secondary vertex reconstruction: SVertexer.cxx
Initial loose cut parameters: SVertexerParams.h

V0 table: aod::V0s
cascade table: aod::Cascades

Run 3 V0 table (version 001)
Header file: Framework/Core/include/Framework/AnalysisDataModel.h
Is used in:

- o2::aod::V0s = o2::aod::V0s_001

Name		Getter	Type	Comment
o2::soa::Index	GI	globalIndex	int64_t	
o2::aod::v0::CollisionId	I	collisionId	int32	Collision index
o2::aod::v0::PosTrackId	I	posTrackId	int	Positive track
o2::aod::v0::NegTrackId	I	negTrackId	int	Negative track

Run 3 cascade table
Header file: Framework/Core/include/Framework/AnalysisDataModel.h
Is used in:

- o2::aod::Cascades = o2::aod::Cascades_001

Name		Getter	Type	Comment
o2::soa::Index	GI	globalIndex	int64_t	
o2::aod::cascade::CollisionId	I	collisionId	int32	Collision index
o2::aod::cascade::V0Id	I	v0Id	int32	V0 index
o2::aod::cascade::BachelorId	I	bachelorId	int	Bachelor track index

The strangeness analysis workflow

Asynchronous reconstruction (O^2)

AO2D.root

Secondary vertex reconstruction: SVertexer.cxx
Initial loose cut parameters: SVertexerParams.h

V0 table: aod::V0s
cascade table: aod::Cascades

ONLY IDs are stored at these tables
NO topological/kinematic variables

Run 3 V0 table (version 001)
Header file: Framework/Core/include/Framework/AnalysisDataModel.h
Is used in:

- o2::aod::V0s = o2::aod::V0s_001

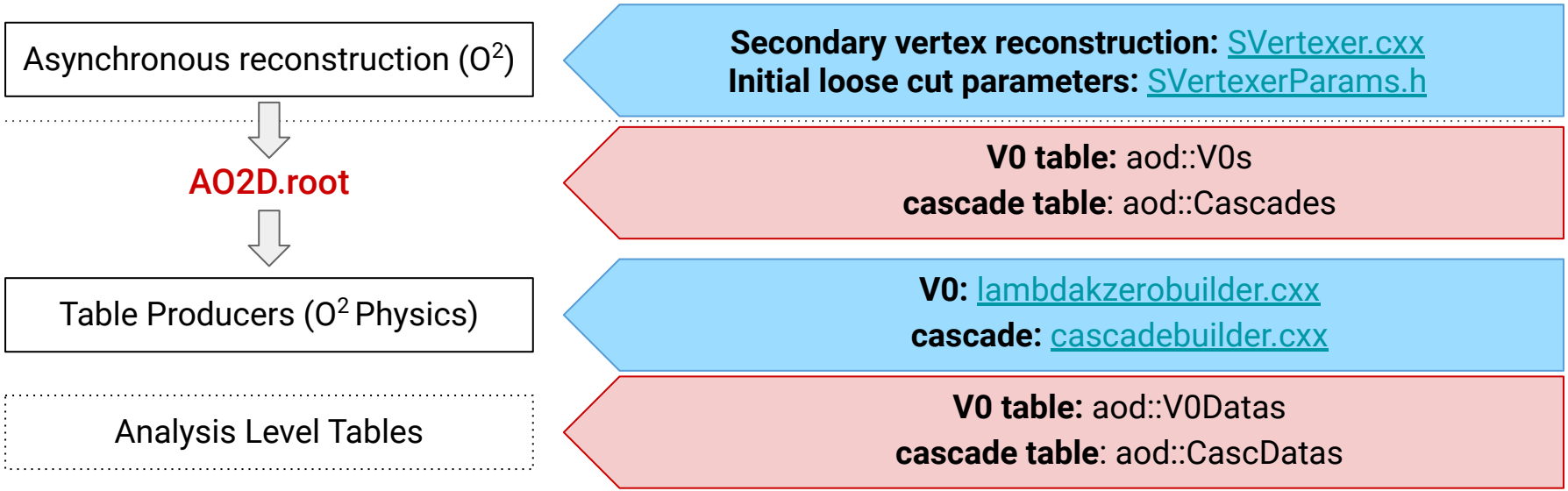
Name		Getter	Type	Comment
o2::soa::Index	GI	globalIndex	int64_t	
o2::aod::v0::CollisionId	I	collisionId	int32	Collision index
o2::aod::v0::PosTrackId	I	posTrackId	int	Positive track
o2::aod::v0::NegTrackId	I	negTrackId	int	Negative track

Run 3 cascade table
Header file: Framework/Core/include/Framework/AnalysisDataModel.h
Is used in:

- o2::aod::Cascades = o2::aod::Cascades_001

Name		Getter	Type	Comment
o2::soa::Index	GI	globalIndex	int64_t	
o2::aod::cascade::CollisionId	I	collisionId	int32	Collision index
o2::aod::cascade::V0Id	I	v0Id	int32	V0 index
o2::aod::cascade::BachelorId	I	bachelorId	int	Bachelor track index

The strangeness analysis workflow



Analysis Level Tables: aod::V0Data(Ext)

#include "PWGLF/DataModel/LFStrangenessTables.h"

	Name	Getter
Bound	v0::PosTrackId	posTrackId
	v0::NegTrackId	negTrackId
	v0::CollisionId	collisionId
	v0::V0	v0Id
Calculated	v0data::PxPos	pxpos
	v0data::PyPos	pypos
	v0data::PzPos	pzpos
	v0data::PxNeg	pxneg
	v0data::PyNeg	pyneg
	v0data::PzNeg	pxneg
	v0data::X	x
	v0data::Y	y
	v0data::Z	z
	v0data::DCAV0Daughters	dcav0daughters
	v0data::DCAPosToPV	dcapostopv
	v0data::DCANegToPV	dcanegtopv

Derived (dynamic)	v0data::Pt	pt
	v0data::V0Radius	v0radius
	v0data::V0CosPA	v0cospa
	v0data::DCAV0ToPV	dcav0topv
	v0data::MLambda	mLambda
	v0data::MAntiLambda	mAntiLambda
	v0data::MK0Short	mK0Short
	v0data::YK0Short	yK0Short
	v0data::YLambda	yLambda
	v0data::Eta	eta
	v0data::Phi	phi
	...	...
Derived (expression)	v0dataext::Px	px
	v0dataext::Py	py
	v0dataext::Pz	pz

Analysis Level Tables: aod::V0Data(Ext)

#include "PWGLF/DataModel/LFStrangenessTables.h"

	Name	Getter
Bound	v0::PosTrackId	posTrackId
	v0::NegTrackId	negTrackId
	v0::CollisionId	collisionId
	v0::V0	v0Id
Momenta of daughter tracks	v0data::PxPos	pxpos
	v0data::PyPos	pypos
	v0data::PzPos	pzpos
	v0data::PxNeg	pxneg
	v0data::PyNeg	pyneg
	v0data::PzNeg	pxneg
Calculated: Decay vertex position	v0data::X	x
	v0data::Y	y
	v0data::Z	z
Topological variables	v0data::DCAV0Daughters	dcav0daughters
	v0data::DCAPosToPV	dcapostopv
	v0data::DCANegToPV	dcanegtopv

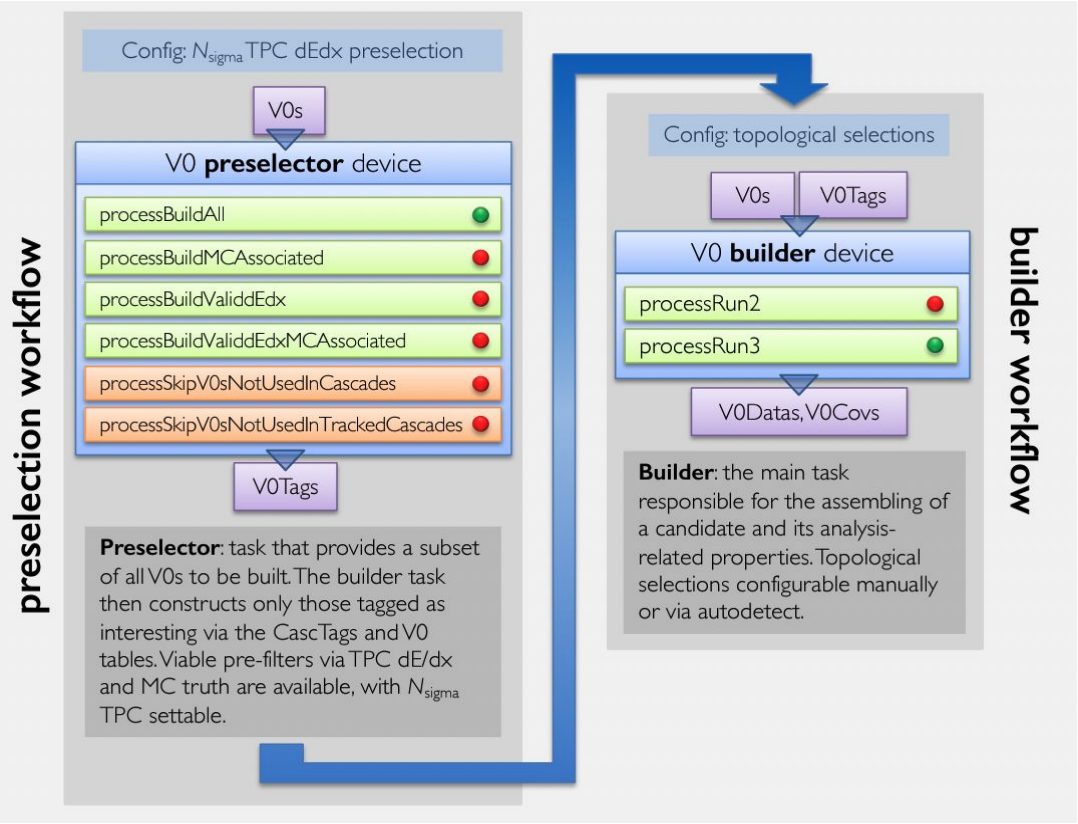
Derived (dynamic)	v0data::Pt	pt
	v0data::V0Radius	v0radius
	v0data::V0CosPA	v0cospa
	v0data::DCAV0ToPV	dcav0topv
	v0data::MLambda	mLambda
	v0data::MAntiLambda	mAntiLambda
	v0data::MK0Short	mK0Short
	v0data::YK0Short	yK0Short
	v0data::YLambda	yLambda
	v0data::Eta	eta
	v0data::Phi	phi
	...	...
Derived (expression)	v0dataext::Px	px
	v0dataext::Py	py
	v0dataext::Pz	pz

Analysis Level Tables: aod::CascData(Ext)

#include "PWGLF/DataModel/LFStrangenessTables.h"

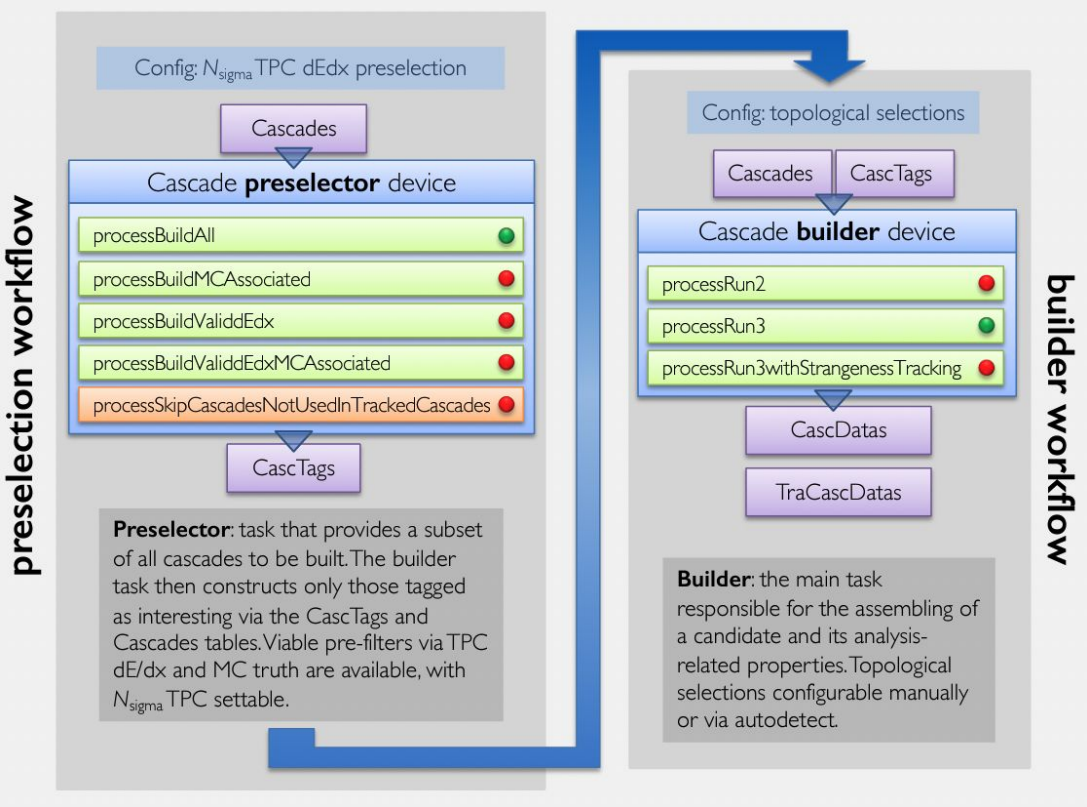
	Name	Getter
Bound	cascade::V0Id	v0Id
	cascade::BachelorId	bachelorId
	cascade::CollisionId	collisionId
	cascdata::Sign	sign
Momenta of daughter tracks	cascdata::PxPos(Neg)	pxpos(neg)
	cascdata::PyPos(Neg)	pypos(neg)
	cascdata::PzPos(Neg)	pzpos(neg)
	cascdata::PxBach	pxbach
	cascdata::PyBach	pybach
	cascdata::PzBach	pzbach
Calculated	cascdata::X	x
Decay vertex position	cascdata::Y	y
	cascdata::Z	z
Topological variables	cascdata::DCAV0Daughters	dcav0daughters
	cascdata::DCACascDaughters	dcascascdaughters
	cascdata::DCAPosToPV	dcapostopv
	cascdata::DCANegToPV	dcanegtopv
	cascdata::DCABachToPV	dcabachtopv
Derived (dynamic)	cascdata::Pt	pt
	cascdata::V0Radius	v0radius
	cascdata::CascRadius	cascradius
	cascdata::V0CosPA	v0cosPA
	cascdata::CascCosPA	casccosPA
	cascdata::MLambda	mLambda
	cascdata::MXi	mXi
	cascdata::MOmega	mOmega
	cascdata::YXi	yXi
	cascdata::YOmega	yOmega
	...	...
Derived (expression)	cascdataext::Px	px
	cascdataext::Py	py
	cascdataext::Pz	pz
	...	...

V0 table producer task



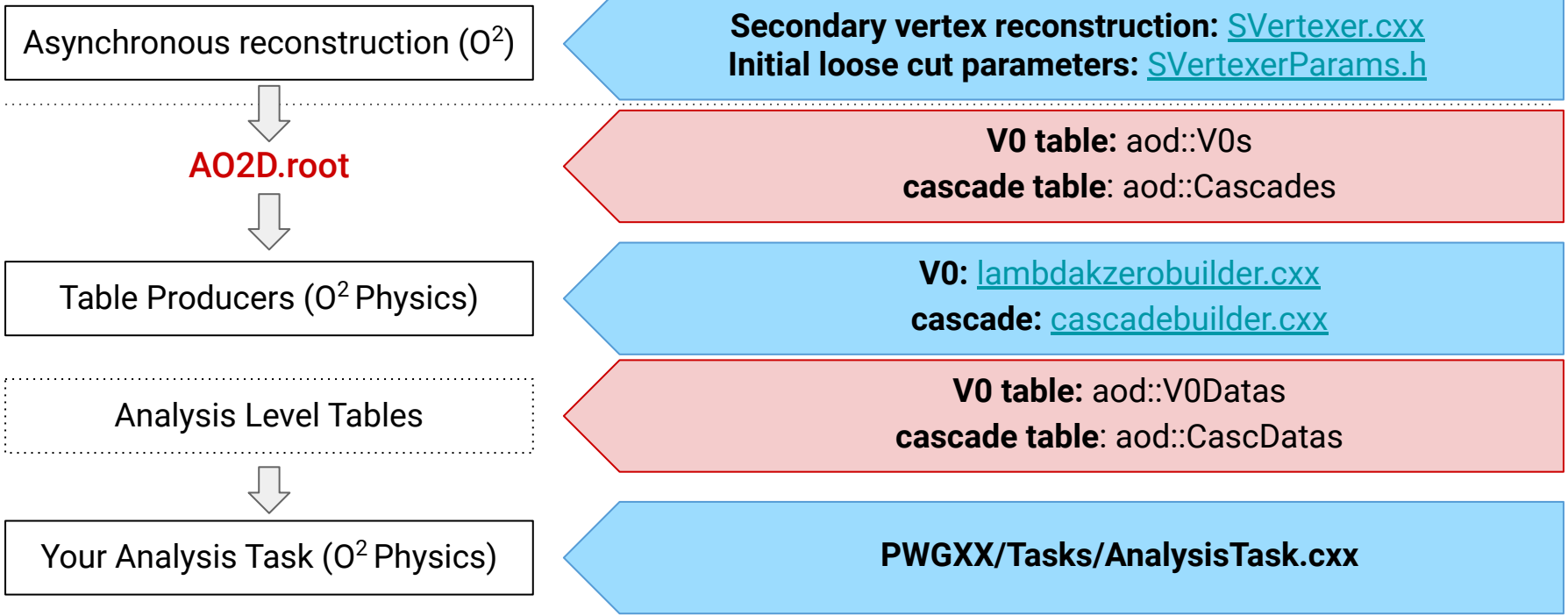
- Preselection scheme is implemented following the “mask” logic to reduce the CPU usage, make sure to use it if possible in your analysis
- Preselection usage:
  - Mandatory: choose one **processBuild**
  - Optional: choose one of the **SkipV0s**
- If this isn’t followed, expect a printout to explain what can and cannot be done!
- The logic is such that an AND of “being used in cascades” and the processBuild conditions will be applied if a **SkipV0** option is used

Cascade table producer task

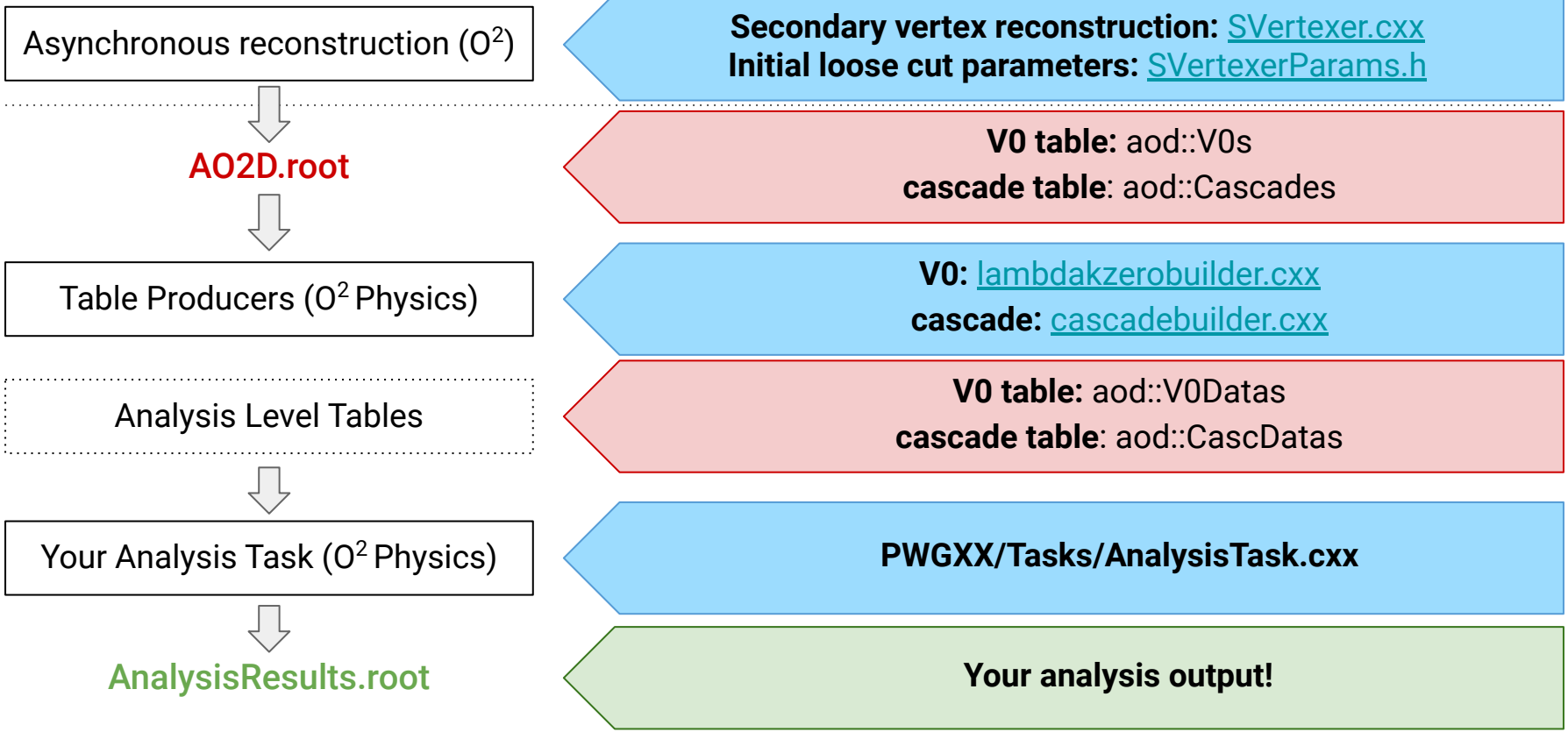


- Preselection scheme following the “mask” logic is implemented to reduce the CPU usage, make sure to use it if possible in your analysis
- Preselection usage:
  - Mandatory: choose one **processBuild**
  - Optional: skip untracked cascades
- **CascDatas**: regular cascade analysis table
- **TraCascDatas**: tracked cascade analysis table
- Simultaneous generation of regular and tracked cascades:
  processRun3withStrangenessTracking
- Sole generation of regular cascades

The strangeness analysis workflow



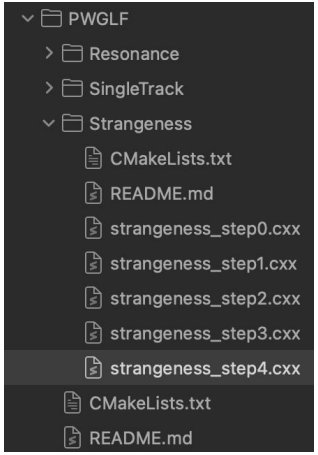
The strangeness analysis workflow



Strangeness Tutorial Task

- Dedicated to the basics of the interaction with the strangeness workflow
- You will learn how to
  - Structure your analysis task
  - Reconstruct V0-s and cascades
  - Apply PID, topological and kinematic selections
  - Access MC information of the cascades, V0-s and their daughters

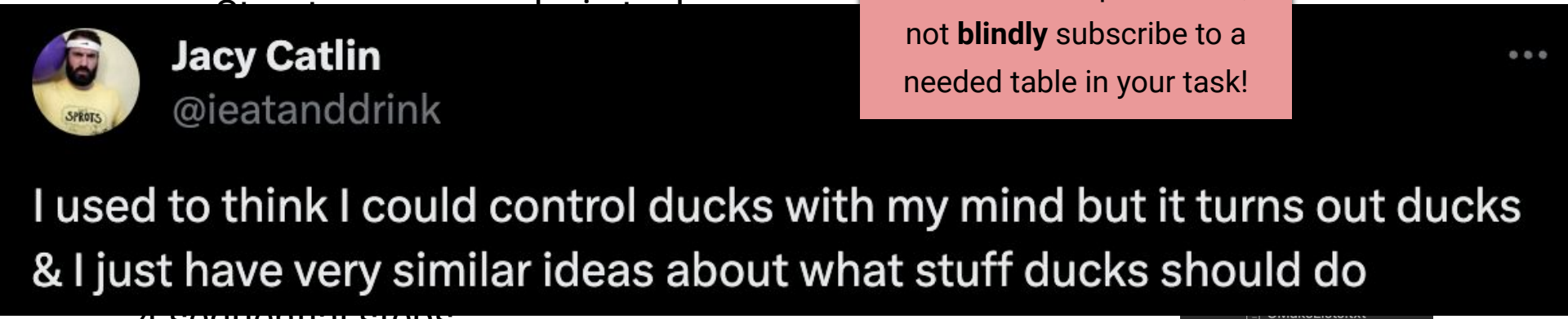
- Tutorial task is organised in the form of 4 sequential steps
- Code is already present in your **O2Physics**
  nevertheless, make sure to update the folder before the HANDS-ON session on Wednesday

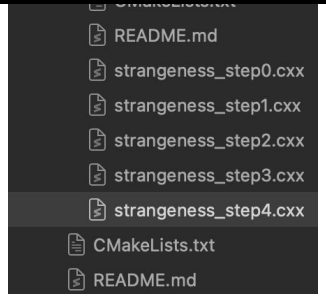


Strangeness Tutorial Task

- Dedicated to the basics of the interaction [illegible]kflow
- You will learn how to
  - [illegible]
  - 4 sequential steps
- Code is already present in your **O2Physics**
  nevertheless, make sure to update the folder before the HANDS-ON session on Wednesday

You better learn how the workflow is implemented, not **blindly** subscribe to a needed table in your task!





Step 0: loop over V0 candidates

```cpp
#include "Framework/runDataProcessing.h"
#include "Framework/AnalysisTask.h"
#include "Common/DataModel/EventSelection.h"
#include "PWGLF/DataModel/LFStrangenessTables.h"

using namespace o2;
using namespace o2::framework;
using namespace o2::framework::expressions;

// STEP 0
// Starting point: loop over all V0s and fill invariant mass histogram

struct strangeness_tutorial {
  // Histograms are defined with HistogramRegistry
  HistogramRegistry rEventSelection{"eventSelection", {}, OutputObjHandlingPolicy::AnalysisObject, true, true};
  HistogramRegistry rKzeroShort{"kzeroShort", {}, OutputObjHandlingPolicy::AnalysisObject, true, true};

  // Configurable for histograms
  Configurable<int> nBins{"nBins", 100, "N bins in all histos"};

  // Configurable for event selection
  Configurable<float> cutzvertex{"cutzvertex", 10.0f, "Accepted z-vertex range (cm)"};

  void init(InitContext const&)
  {
    // Axes
    AxisSpec K0ShortMassAxis = {200, 0.45f, 0.55f, "#it{M}_{inv} [GeV/#it{c}^{2}]"};
    AxisSpec vertexZAxis = {nBins, -15., 15., "vrtx_{Z} [cm]"};

    // Histograms
    // Event selection
    rEventSelection.add("hVertexZRec", "hVertexZRec", {HistType::kTH1F, {vertexZAxis}});

    // K0s reconstruction
    rKzeroShort.add("hMassK0Short", "hMassK0Short", {HistType::kTH1F, {K0ShortMassAxis}});
  }
```

Include required **headers**

Histogram registries and **Configurables** are declared before the **init** function

Add needed **histograms** to the registries

Step 0: loop over V0 candidates

```
#include "Framework/runDataProcessing.h"
#include "Framework/AnalysisTask.h"
#include "Common/DataMo
#include "PWGLF/DataMod

using namespace o2;
using namespace o2::fra
using namespace o2::fra

// STEP 0
// Starting point: loop

struct strangeness_tuto
  // Histograms are def
  HistogramRegistry rEv
  HistogramRegistry rKz

  // Configurable for h
  Configurable<int> nBi

  // Configurable for e
  Configurable<float> c

  void init(InitContext
  {
    // Axes
    AxisSpec K0ShortMas
    AxisSpec vertexZAxi

    // Histograms
    // Event selection
    rEventSelection.add

    // K0s reconstructi
    rKzeroShort.add("hM
  }
```

Did you know?

If you put a wooden spoon on your pot while it's boiling, the pot spoon water will the spill water pot, the boiling pot water steam spoon wood.

Include required **headers**

The order matters for the readability of your code!

Histogram registries and **Configurables** are declared before the **init** function

Add needed **histograms** to the registries

Step 0: loop over V0 candidates

```
  // Defining filters for events (event selection)
  // Processed events will be already fulfilling the event selection requirements
  Filter eventFilter = (o2::aod::evsel::sel8 == true);
  Filter posZFilter = (nabs(o2::aod::collision::posZ) < cutzvertex);

  void process(soa::Filtered<soa::Join<aod::Collisions, aod::EvSels>>::iterator const& collision,
               aod::V0Datas const& V0s)
  {
    // Fill the event counter
    rEventSelection.fill(HIST("hVertexZRec"), collision.posZ());

    for (const auto& v0 : V0s) {
      rKzeroShort.fill(HIST("hMassK0Short"), v0.mK0Short());
    }
  }
};

WorkflowSpec defineDataProcessing(ConfigContext const& cfgc)
{
  return WorkflowSpec{
    adaptAnalysisTask<strangeness_tutorial>(cfgc)};
}
```

Define **Filters** for basic event selection

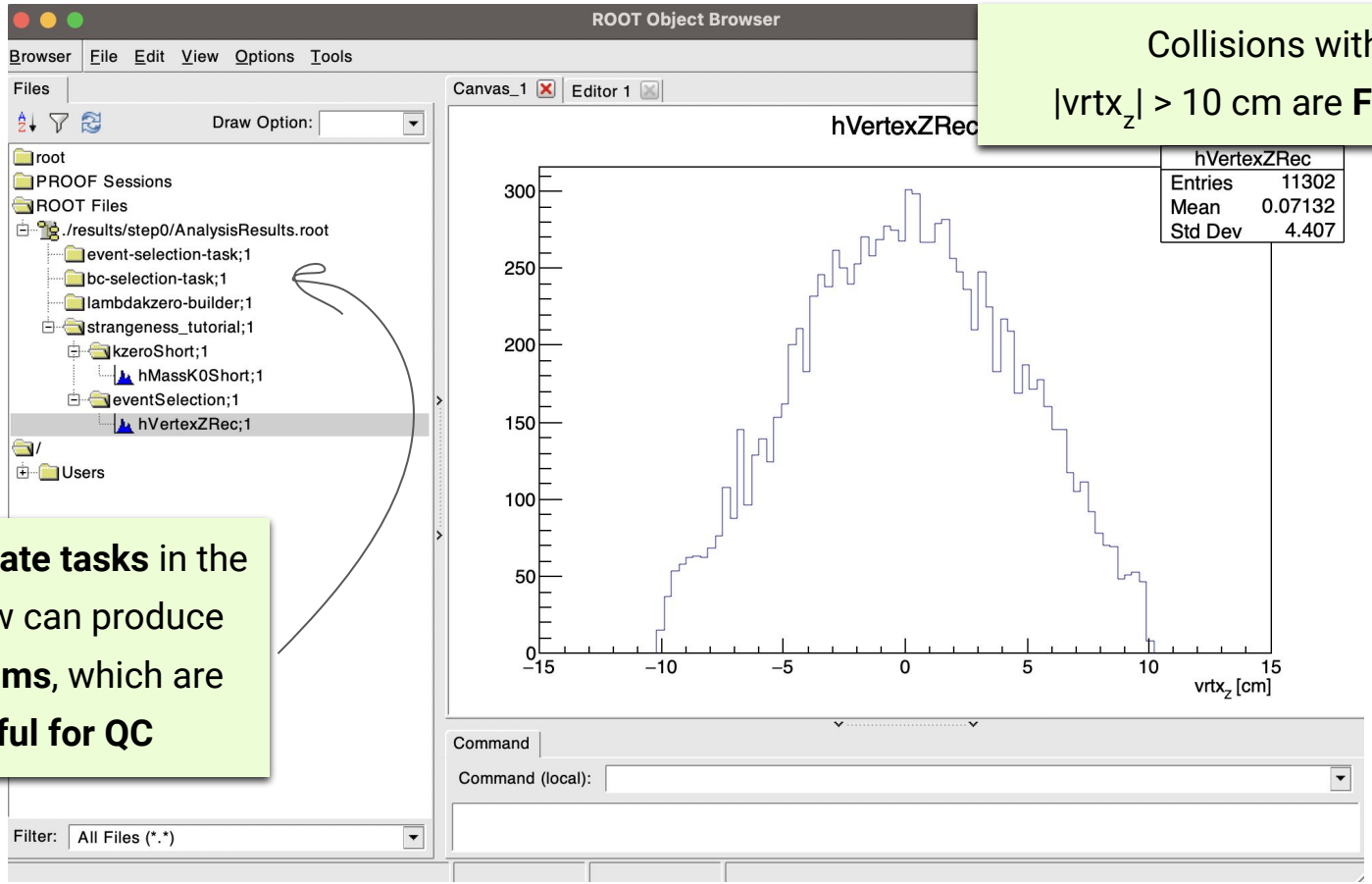
Subscribe to **aod::V0Datas** to loop over the V0s associated to each of the selected collisions

Perform a loop over V0-s and fill the invariant mass histogram

- **Converter** tasks are required for old AO2Ds
- **o2-analysis-lf-lambdakzerobuilder** produces **aod::V0Datas** table

o2-analysis-timestamp
o2-analysis-event-selection
o2-analysis-bc-**converter**
o2-analysis-tracks-extra-**converter**
o2-analysis-lf-lambdakzerobuilder
o2-analysistutorial-lf-strangeness-step0

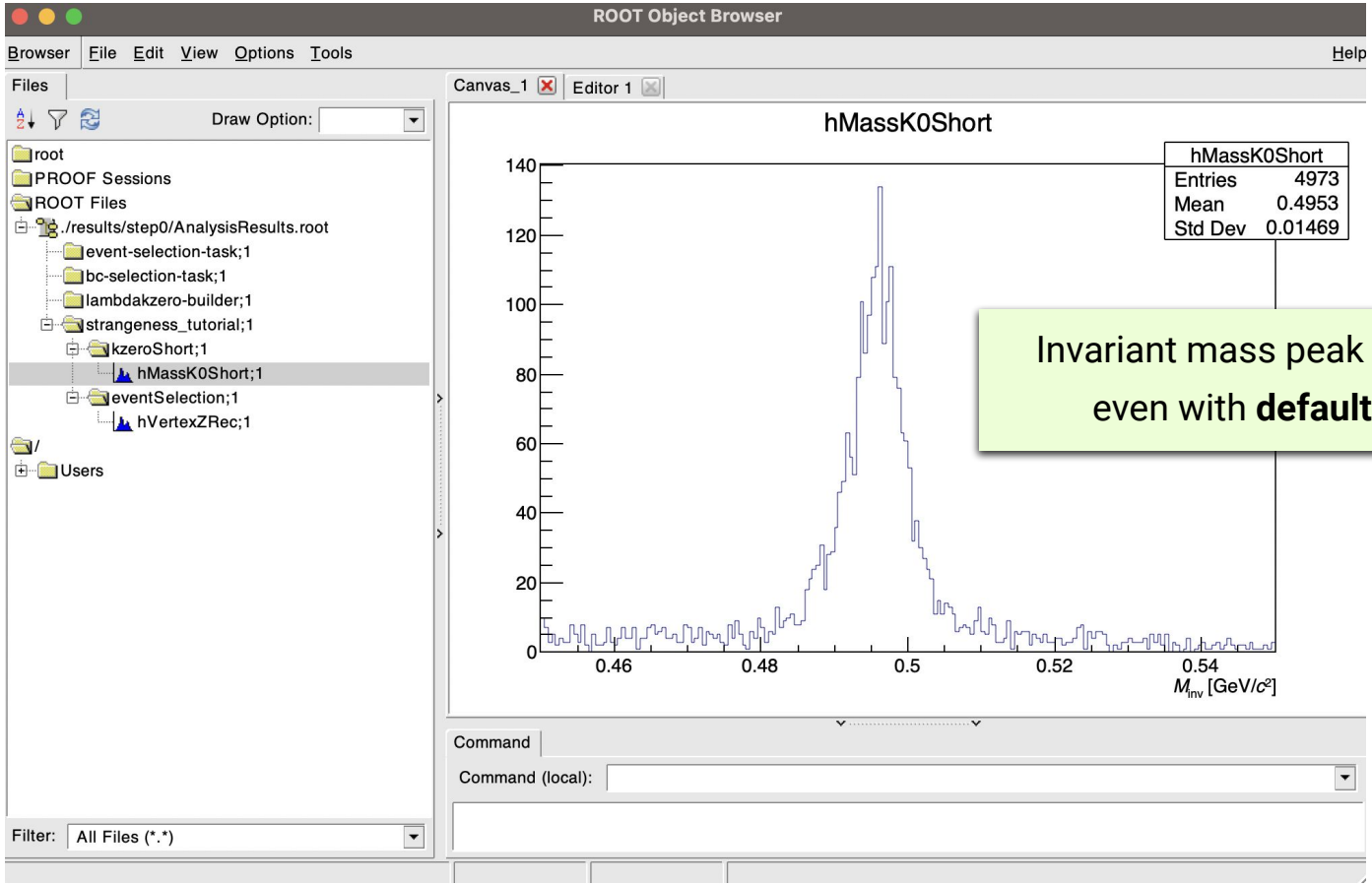
Step 0: loop over V0 candidates



Collisions with $|vrtx_z| > 10$ cm are **Filtered**

intermediate tasks in the workflow can produce **histograms**, which are **useful for QC**

Step 0: loop over V0 candidates



Invariant mass peak is already pure even with **default** set of cuts

Step 1: topological selections

```
// Configurable parameters for V0 selection
Configurable<float> v0setting_dcav0dau{"v0setting_dcav0dau", 1, "DCA V0 Daughters"};
Configurable<float> v0setting_dcapostopv{"v0setting_dcapostopv", 0.06, "DCA Pos To PV"};
Configurable<float> v0setting_dcanegtopv{"v0setting_dcanegtopv", 0.06, "DCA Neg To PV"};
Configurable<double> v0setting_cospa{"v0setting_cospa", 0.98, "V0 CosPA"};
Configurable<float> v0setting_radius{"v0setting_radius", 0.5, "v0radius"};
```

define dedicated **configurables**

```
// Filters on V0s
// Cannot filter on dynamic columns, so we cut on DCA to PV and DCA between daughters only
Filter preFilterV0 = (nabs(aod::v0data::dcapostopv) > v0setting_dcapostopv &&
                      nabs(aod::v0data::dcanegtopv) > v0setting_dcanegtopv &&
                      aod::v0data::dcaV0daughters < v0setting_dcav0dau);
```

pre-Filter on **regular** columns

```
    // Cut on dynamic columns
    if (v0.v0cosPA(collision.posX(), collision.posY(), collision.posZ()) < v0setting_cospa)
      continue;
    if (v0.v0radius() < v0setting_radius)
      continue;
```

cut on **dynamic** columns in the loop

Step 1: topological selections

- **Topological** selections are also applied when building V0 candidates!

```
"lambdakzero-builder": {
        "dcav0dau": "1",
        "dcapostopv": "0.1",
        "dcanegtopv": "0.1",
        "v0cospa": "0.995",
        "v0radius": "0.9"
}
```

```
"strangeness_tutorial": {
    "v0setting_dcav0dau": "1",
    "v0setting_dcapostopv": "0.06",
    "v0setting_dcanegtopv": "0.06",
    "v0setting_cospa": "0.98",
    "v0setting_radius": "0.5"
}
```

Step 1: topological selections

- **Topological** selections are also applied when building V0 candidates!

```
"lambdakzero-builder": {
        "dcav0dau": "1",
        "dcapostopv": "0.1",
        "dcanegtopv": "0.1",
        "v0cospa": "0.995",
        "v0radius": "0.9"
}
```

```
"strangeness_tutorial": {
    "v0setting_dcav0dau": "1",
    "v0setting_dcapostopv": "0.06",
    "v0setting_dcanegtopv": "0.06",
    "v0setting_cospa": "0.98",
    "v0setting_radius": "0.5"
}
```

- Carefully check that in the **lambdakzero-builder** configuration the selections are looser or equal to those you apply in your task

Step 1: topological selections

- **Topological** selections are also applied when building V0 candidates!

The variables must have these names!

```
"lambdakzero-builder": {
        "dcav0dau": "1",
        "dcapostopv": "0.1",
        "dcanegtopv": "0.1",
        "v0cospa": "0.995",
        "v0radius": "0.9"
        "d_UseAutodetectMode": "true"
}
```

```
"strangeness_tutorial": {
    "v0setting_dcav0dau": "1",
    "v0setting_dcapostopv": "0.06",
    "v0setting_dcanegtopv": "0.06",
    "v0setting_cospa": "0.98",
    "v0setting_radius": "0.5"
}
```

- Carefully check that in the **lambdakzero-builder** configuration the selections are looser or equal to those you apply in your task
- Smarter way is to use the **d_UseAutodetectMode** mode of the **lambdakzero-builder**! The builder will take as input values those chosen in your analysis task (or the loosest ones among several tasks where the cuts are present)

Step 2: PID selections

```
// Configurable parameters for PID selection
Configurable<float> NSigmaTPCPion{"NSigmaTPCPion", 4, "NSigmaTPCPion"};
```

```
// Defining the type of the daughter tracks
using DaughterTracks = soa::Join<aod::TracksIU, aod::TracksExtra, aod::pidTPCPi>;

void process(soa::Filtered<soa::Join<aod::Collisions, aod::EvSels>>::iterator const& collision,
             soa::Filtered<aod::V0Datas> const& V0s,
             DaughterTracks const&)
{
  // Fill the event counter
  rEventSelection.fill(HIST("hVertexZRec"), collision.posZ());

  for (const auto& v0 : V0s) {

    const auto& posDaughterTrack = v0.posTrack_as<DaughterTracks>();
    const auto& negDaughterTrack = v0.negTrack_as<DaughterTracks>();

    rKzeroShort.fill(HIST("hMassK0Short"), v0.mK0Short());

    // Cut on dynamic columns
    if (v0.v0cosPA(collision.posX(), collision.posY(), collision.posZ()) < v0setting_cospa)
      continue;
    if (v0.v0radius() < v0setting_radius)
      continue;

    if (TMath::Abs(posDaughterTrack.tpcNSigmaPi()) > NSigmaTPCPion) {
      continue;
    }
    if (TMath::Abs(negDaughterTrack.tpcNSigmaPi()) > NSigmaTPCPion) {
      continue;
    }
```

define dedicated **configurable**

subscribe to **aod::pidTPCPi** table

typecast v0 to daughter track type in order to obtain PID information of daughters

cut on number of TPC σ-s

Step 2: PID selections

```
// Configurable parameters for PID selection
Configurable<float> NSigmaTPCPion{"NSigmaTPCPion", 4.0, "NSigmaTPCPion"};
```

```
// Defining the type of the daughter tracks
using DaughterTracks = soa::Join<aod::TracksIU, aod::TracksExtra, aod:

void process(soa::Filtered<soa::Join<aod::Collisions, aod::EvSels>>::i
             soa::Filtered<aod::V0Datas> const& V0s,
             DaughterTracks const&)
{
  // Fill the event counter
  rEventSelection.fill(HIST("hVertexZRec"),
  for (const auto& v0 : V0s) {

    const auto& posDaughterTrack = v0.pos
    const auto& negDaughterTrack = v0.neg

    rKzeroShort.fill(HIST("hMassK0Short")

    // Cut on dynamic columns
    if (v0.v0cosPA(collision.posX(), coll
      continue;
    if (v0.v0radius() < v0setting_radius)
      continue;

    if (TMath::Abs(posDaughterTrack.tpcNS
      continue;
    }
    if (TMath::Abs(negDaughterTrack.tpcNSigmaPi()) > NSigmaTPCPion) {
      continue;
    }
```

Header needed:
#include "Common/DataModel/PIDResponse.h"

define dedicated
able

e to
aod::pidTPCPi table

- o2-analysis-timestamp
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- o2-analysis-lf-lambdakzerobuilder
- o2-analysistutorial-lf-strangeness-step2

typecast v0 to daughter track type in order to obtain PID information of daughters

cut on number of TPC σ-s

Step 2: accessing daughter tracks

- The V0 table (aod::V0Data) references a track table that does not contain all possibly useful track information for the analysis, for example it does not contain PID information
- → if you try to check PID of daughter tracks with reference to that table the code will fail!

```
float nsigma_pos = v0.negTrack.tpcNSigmaPi();
float nsigma_neg = v0.posTrack.tpcNSigmaPi();
```

Fails!

- You need to **de-reference the track** via a "***_as<>***" call, this allows you to look at the same index position in the more complete track table

```
using DaughterTracks = soa::Join<aod::TracksIU, aod::TracksExtra, aod::pidTPCPi>;

float nsigma_pos = v0.negTrack_as<DaughterTracks>().tpcNSigmaPi();
float nsigma_neg = v0.posTrack_as<DaughterTracks>().tpcNSigmaPi();
```

Works!

Step 3: access MC information of V0-s

```
// Defining the type of the daughter tracks
using DaughterTracks = soa::Join<aod::TracksIU, aod::TracksExtra, aod::pidTPCPi, aod::McTrackLabels>;

void processRecMC(soa::Filtered<soa::Join<aod::Collisions, aod::EvSels>>::iterator const& collision,
                  soa::Filtered<soa::Join<aod::V0Datas, aod::McV0Labels>> const& V0s,
                  DaughterTracks const&,
                  aod::McParticles const&)
```

Subscribe to **aod::McTrackLabels** and **aod::McParticles** tables

```
if (posDaughterTrack.has_mcParticle() && negDaughterTrack.has_mcParticle()) {
  auto posParticle = posDaughterTrack.mcParticle();
  auto negParticle = negDaughterTrack.mcParticle();
  if (posParticle.pdgCode() == 211 && negParticle.pdgCode() == -211) {
    rKzeroShort.fill(HIST("hMassK0ShortSelectedTruePions"), v0.mK0Short());
  }
}

// Checking that the V0 is a true K0s
if (v0.has_mcParticle()) {
  auto v0mcParticle = v0.mcParticle();
  if (v0mcParticle.pdgCode() == 310) {
    rKzeroShort.fill(HIST("hMassK0ShortTrueRec"), v0.mK0Short());
    rKzeroShort.fill(HIST("hPtK0ShortTrueRec"), v0.pt());
  }
}
```

Check that tracks come from particles and are not fake via **has_mcParticle()**

Then, access associated generated particle and compare pdg code

Step 3: access MC information of V0-s

```
// Defining the type of the daughter tracks
using DaughterTracks = soa::Join<aod::TracksIU, aod::TracksExtra, aod::pidTPCPi, aod::McTrackLabels>;

void processRecMC(soa::Filtered<soa::Join<aod::Collisions, aod::EvSels>>::iterator const& collision,
                  soa::Filtered<soa::Join<aod::V0Datas, aod::McV0Labels>> const& V0s,
                  DaughterTracks const&,
                  aod::McParticles const&)
```

Subscribe to **aod::McTrackLabels** and **aod::McParticles** tables

```
if (posDaughterTrack.has_mcParticle() && negDaughterTrack.has_mcParticle()) {
  auto posParticle = posDaughterT
  auto negParticle = negDaughterT
  if (posParticle.pdgCode() == 21
    rKzeroShort.fill(HIST("hMassK
  }
}

// Checking that the V0 is a true
if (v0.has_mcParticle()) {
  auto v0mcParticle = v0.mcPartic
  if (v0mcParticle.pdgCode() == 3
    rKzeroShort.fill(HIST("hMassK
    rKzeroShort.fill(HIST("hPtK0S
  }
}
```

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- o2-analysis-pid-tpc-base
- o2-analysis-track-propagation
- o2-analysis-lf-lambdakzerobuilder
- **o2-analysis-lf-lambdakzerolabelbuilder**
- o2-analysistutorial-lf-strangeness-step2

Check that tracks come from particles and are not fake via **has_mcParticle()**

Then, access associated generated particle and compare pdg code

Step 3: iterate over generated MC collisions

```
void processGenMC(soa::Filtered<aod::McCollisions>::iterator const& mcCollision,
                  const soa::SmallGroups<soa::Join<o2::aod::Collisions, o2::aod::McCollisionLabels, o2::aod::EvSels>>& collisions,
                  aod::McParticles const& mcParticles)
{
  if (collisions.size() < 1) // to process generated collisions that've been reconstructed at least once
    return;
  rEventSelection.fill(HIST("hVertexZGen"), mcCollision.posZ());
  for (const auto& mcParticle : mcParticles) {
    if (mcParticle.pdgCode() == 310) {
      rGenParticles.fill(HIST("hPtK0ShortGen"), mcParticle.pt());
    }
  }
}

PROCESS_SWITCH(strangeness_tutorial, processRecMC, "Process Run 3 mc, reconstructed", true);
PROCESS_SWITCH(strangeness_tutorial, processGenMC, "Process Run 3 mc, generated", true);
```

use **soa::SmallGroups** to loop only over generated collisions that have been reconstructed at least once!

add **PROCESS_SWITCH** to allow for 2 process functions: for generated and reconstructed MC levels

Step 4: loop over cascade candidates

```
void processRecMC(soa::Filtered<soa::Join<aod::Collisions, aod::EvSels>>::iterator const& collision,
                  soa::Filtered<soa::Join<aod::CascDatas, aod::McCascLabels>> const& Cascades,
                  soa::Filtered<soa::Join<aod::V0Datas, aod::McV0Labels>> const& V0s,
                  aod::V0Datas const&,
                  aod::V0sLinked const&,
                  DaughterTracks const&,
                  aod::McParticles const&)
{
```

Subscribe to **aod::CascDatas** and **aod::V0sLinked** tables

```
// Filters on Cascades
Filter preFilterCascades = (nabs(aod::cascdata::dcabachtopv) > cascadesetting_dcabachtopv &&
                            aod::cascdata::dcaV0daughters < v0setting_dcav0dau &&
                            nabs(aod::cascdata::dcapostopv) > cascade_dcapostopv &&
                            nabs(aod::cascdata::dcanegtopv) > cascade_dcanegtopv &&
                            nabs(aod::cascdata::dcabachtopv) > cascadesetting_dcabachtopv &&
                            aod::cascdata::dcacascdaughters < cascadesetting_dcacascdau);
```

pre-Filter on **regular** columns

Step 4: loop over cascade candidates

```
void processRecMC(soa::Filtered<soa::Join<aod::Collisions, aod::EvSels>>::iterator const& collision,
                  soa::Filtered<soa::Join<aod::CascDatas, aod::McCascLabels>> const& Cascades,
                  soa::Filtered<soa::Join<aod::V0Datas, aod::McV0Labels>> const& V0s,
                  aod::V0Datas const&,
                  aod::V0sLinked const&,
                  DaughterTracks const&,
                  aod::McParticles const&)
{
```

Subscribe to a full **aod::V0Datas** table in case you apply different selection on primary and secondary V0-s

Subscribe to **aod::CascDatas** and **aod::V0sLinked** tables

```
//
Fil                                achtopv) > cascadesetting_dcabachtopv &&
                    aod::cascdata::dcaV0daughters < v0setting_dcav0dau &&
                    nabs(aod::cascdata::dcapostopv) > cascade_dcapostopv &&
                    nabs(aod::cascdata::dcanegtopv) > cascade_dcanegtopv &&
                    nabs(aod::cascdata::dcabachtopv) > cascadesetting_dcabachtopv &&
                    aod::cascdata::dcacascdaughters < cascadesetting_dcacascdau);
```

Step 4: loop over cascade candidates

```
void processRecMC(soa::Filtered<soa::Join<aod::Collisions, aod::EvSels>>::iterator const& collision,
                  soa::Filtered<soa::Join<aod::CascDatas, aod::McCascLabels>> const& Cascades,
                  soa::Filtered<soa::Join<aod::V0Datas, aod::McV0Labels>> const& V0s,
                  aod
                  aod
                  Dau
                  aod
{
```

Subscribe to a f
you apply differ
s

- o2-analysis-timestamp
- o2-analysis-event-selection
- o2-analysis-bc-converter
- o2-analysis-tracks-extra-converter
- o2-analysis-pid-tpc
- o2-analysis-pid-tpc-base
- o2-analysis-track-propagation
- o2-analysis-lf-lambdakzerobuilder
- o2-analysis-lf-lambdakzerolabelbuilder
- **o2-analysis-lf-cascadebuilder**
- **o2-analysis-lf-cascadelabelbuilder**
- o2-analysistutorial-lf-strangeness-step2

Subscribe to
aod::CascDatas and
aod::V0sLinked tables

```
//
Fil                                                    ting_dcabachtopv &&
                                                       v0dau &&
                                                       postopv &&
                                                       negtopv &&
                                                       ting_dcabachtopv &&
                                                       ting_dcacascdau);
```

Step 4: loop over cascade candidates

```
const auto& v0index = casc.v0_as<aod::V0sLinked>();
if (!(v0index.has_v0Data())) {
  continue; // skip those cascades for which V0 doesn't exist
}

const auto& v0Casc = v0index.v0Data(); // de-reference index to correct v0data in case it exists
const auto& bachDaughterTrackCasc = casc.bachelor_as<DaughterTracks>();
const auto& posDaughterTrackCasc = v0Casc.posTrack_as<DaughterTracks>();
const auto& negDaughterTrackCasc = v0Casc.negTrack_as<DaughterTracks>();
```

Dereference index to correct **V0Data**

typecast V0 and cascade to our daughter track type (note **aod::pidTPCPr**)

```
// Defining the type of the daughter tracks
using DaughterTracks = soa::Join<aod::TracksIU, aod::TracksExtra, aod::pidTPCPi, aod::pidTPCPr, aod::McTrackLabels>;
```

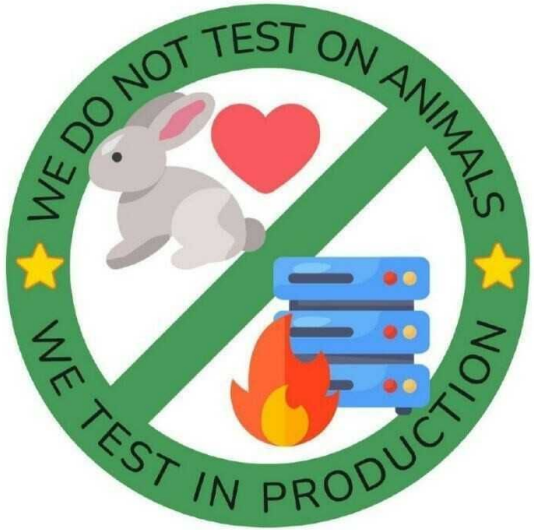
```
// Cut on dynamic columns
if (v0.v0cosPA(collision.posX(), collision.posY(), collision.posZ()) < v0setting_cospa)
    continue;
if (v0.v0radius() < v0setting_radius)
    continue;
```

cut on **dynamic** columns in the loop

Summary

In this lecture you learned:

- **strangeness tables** and how to **subscribe** to them in your analysis
- **apply simple** topological and kinematic **selections**
- **apply PID** selections
- perform an **analysis on MC**



See you at the hands-on session of Wednesday!

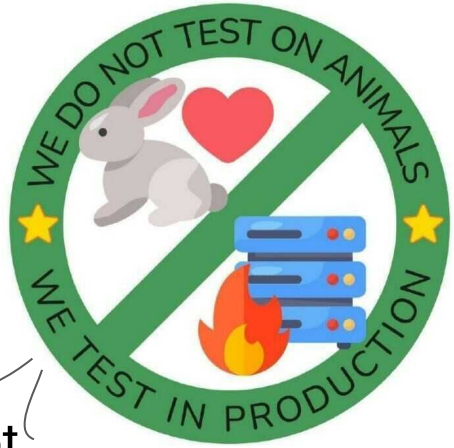
Summary

In this lecture you learned:

- **strangeness tables** and how to **subscribe** to them in your analysis
- **apply simple** topological and kinematic **selections**
- **apply PID** selections
- perform a**nalysis on MC**

Thank You

See you at the hands-on session of Wednesday!



*do not