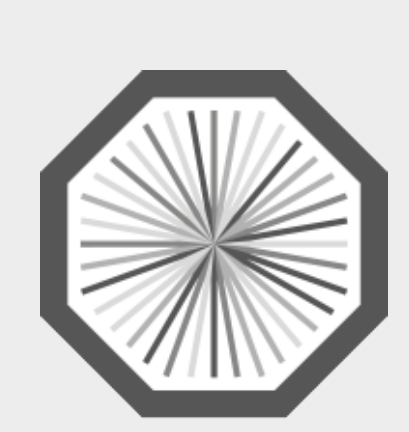


O2 Tutorial V5

Photon Conversions

Stefanie Mrozinski



Disclaimer

1. Only photon conversions will be discussed in this session

If you want to do photon analyses with the EMCal, please contact:

Joshua Koenig (joshua.koenig@cern.ch)

Marvin Hemmer (marvin.hemmer@cern.ch)

Nicolas Strangmann (nicolas.strangmann@cern.ch)



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2. Photon reconstruction/post-processing workflow is subject to change.
This is only a snapshot of the current state.



Photon selection in the photon-conversion-builder

Asynchronous reconstruction

AO2D.root

S-Vertexer

V0 table

S-Vertexer

S-Vertexer-Parameter

For more context on tracking performance and the challenges of assigning TPC-only tracks to collisions, please refer to Ruben's talk.



Photon selection in the photon-conversion-builder

Asynchronous reconstruction

AO2D.root

Table Producers (O2 Physics)

S-Vertexer

V0 table

Photon-conversion-builder (EM builder)

V0PhotonsKF, V0Legs, V0LegsXYZ ...

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Note: there is an alternative to the EM builder — the LF builder

See talk by Romain Schotter on Tuesday for more details on S-Vertexer and the LF-builder



Overview: Photon-conversion-builder

Applies **track-quality cuts** and **topological cuts** specific to photon conversions.

Refit the V0 using **KFParticle** to:

- reconstruct the conversion point,
- compute momentum at the primary vertex,
- evaluate quality parameters (χ^2/NDF , DCA, PCA, $\cos\text{PA}$).

Photon information stored in the following tables:

- V0PhotonsKF
- V0Legs
- V0LegsXYZ, V0LegsDeDxMC, and V0PhotonsPhiV



Analysis Level Tables: aod::V0PhotonsKF

More insight: [GammaTables.h](#)

o2::soa::Index<>, v0photonkf::CollisionId, v0photonkf::V0Id, v0photonkf::PosTrackId, v0photonkf::NegTrackId Conversion vertex v0photonkf::Vx, v0photonkf::Vy, v0photonkf::Vz Momentum at PV v0photonkf::Px, v0photonkf::Py, v0photonkf::Pz	Kinematics v0photonkf::MGamma Fit quality v0photonkf::ChiSquareNDF Topology v0photonkf::DCAxyToPV, v0photonkf::DCAzToPV, v0photonkf::CosPA, v0photonkf::CosPAXY, v0photonkf::CosPARZ, v0photonkf::PCA, v0photonkf::Alpha, v0photonkf::QtArm	Derived dynamic	V0PhotonsKF::E e V0PhotonsKF::Pt pt V0PhotonsKF::Eta eta V0PhotonsKF::Phi phi V0PhotonsKF::P p V0PhotonsKF::V0Radius v0radius
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Photon selection in the photon-conversion-builder

Asynchronous reconstruction

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Table Producers (O2 Physics)

Analysis Level Tables

Your Analysis Task

S-Vertexer

V0 table

Photon-conversion-builder (EM builder)

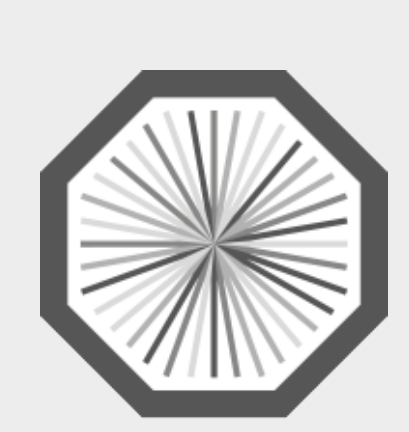
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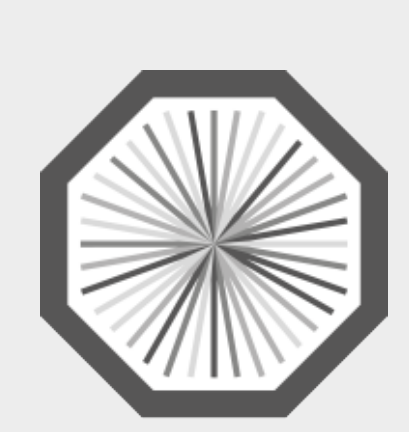
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How to access track properties?

Access track information via V0Legs: `MyMCV0Legs = soa::Join<aod::V0Legs, aod::V0LegMCLabels>;`

```
auto pos = photon.template posTrack_as<MyMCV0Legs>();  
auto ele = photon.template negTrack_as<MyMCV0Legs>();
```



How to access MC information?

Access MC information by joining: `MyMCV0Legs = soa::Join<aod::V0Legs, aod::V0LegMCLabels>;`

Subscribe to EMMCParticle table

Step 1:

```
auto pos = photon.template posTrack_as<MyMCV0Legs>();  
auto ele = photon.template negTrack_as<MyMCV0Legs>();
```

Step 2:

```
auto posmc = pos.template emmcparticle_as<aod::EMMCParticles>();  
auto elemc = ele.template emmcparticle_as<aod::EMMCParticles>();
```

Useful Tools to study background sources already implemented in: [MCUtils.h](#)



Toy example: Your turn

Step 1: find and open `/alice/O2Physics/Tutorials/PWGEM/pcm/pcmtutorial.cxx`

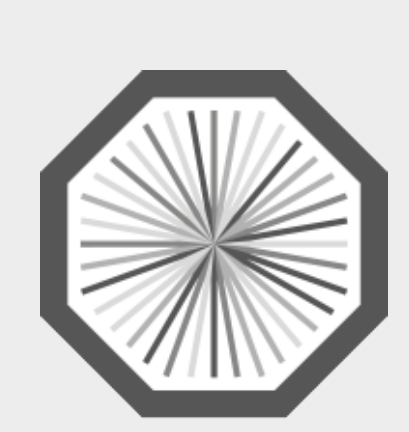
Step 2: Write a loop over all V0s in the collision

Step 3: Add a p_T histogram and fill the p_T histogram

Step 4: Add a conversion radius vs. z plot

Check if compiles...

Step 5: Add an invariant mass plot for neutral pions



Toy example: Your turn

Step 6: Download a MC file:

```
alien_cp alien:///alice/sim/2024/LHC24f4d/0/558433/AOD/001/AO2D.root file:///./AO2D.root;
```

Step 7: run the runTutorials.sh

Step 8: Check the output



What is the workflow for derived data production?

EM

Create EMEvent
EM Event Selection
Photonconversionbuilder
EM Prefilter
EM Filter EOI

Core

Event Selection Service
Multcenttable
PID TPC Service
Track Selection
Propagation Service
PID TOF merge

Potentially needed:

mc-collisions-extra

Em-association-mc-collision

Check: **Train run 530378**