Weekly report

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1. (FCFM-BUAP) 2.(ICN-UNAM)

ACO meeting

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Outline

- Review send to Pablo Roig for procceding DPyC
- I obtain plots for Eta, phi, Pt efficiency, dcaxy, dcaz for DATA ESD/ MC ESD comparison for:

  --ITSTPC2011 track cuts

  --TPC Only track cuts

  --TPC Only+TPC refit track cuts

- Review send to Pablo Roig for procceding DPyC

Review of recent results on heavy-ion physics and astroparticle physics in ALICE at the LHC

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Abstract.
In this work we present a summary of the most relevant results on heavy-ion and astroparticle physics in ALICE. The summary includes a brief overview of the current status on the characterization of the hot and dense QCD medium created in the heavy-ion collisions produced at the LHC, as well as the intriguing finding of collective-like phenomena in small collision systems.

1. Introduction

ALICE (A Large Ion Collider Experiment [1]) is a dedicated heavy-ion detector to exploit the unique physics potential of nucleus-nucleus interactions at the Large Hadron Collider (LHC) energies. The main goal of the detector is to study the physics of strongly interacting matter at extreme energy densities, where we have evidence that a new phase of matter, the quark-gluon plasma (QGP), is formed [2, 3, 4, 5]. Although several important measurements have been carried out by the LHC high energy physics experiments (CMS, ATLAS and LHCb), the present work focuses on results from ALICE and it is based on a recent review on heavy-ion physics at the LHC [6]. In this paper, we discuss the discovery of QGP-like phenomena in small collision systems, proton-proton (pp) and proton-led (p–Pb) collisions. And also, we briefly discuss other contributions of ALICE in astroparticle physics.

2. The ALICE apparatus

Particle identification (PID) is an important tool to study the hot and dense matter created in heavy-ion collisions. Therefore, ALICE [7] is an experiment specialized in PID from low (≈ 0.15 GeV/c) up to high (20 GeV/c) transverse momenta. The central barrel of ALICE is placed inside a large solenoidal magnet which provides a magnetic field of 0.5 T. It is dedicated to detect hadrons, electrons, and photons produced at mid-pseudorapidity, $|\eta|<0.8$. It comprises an Inner Tracking System (ITS) of high-resolution silicon detectors, a cylindrical Time-Projection Chamber (TPC), and particle identification arrays of Transition-Radiation Detectors (TRD) and of Time-Of-Flight (TOF) counters. Additional central subsystems, not-covering full azimuth, are a ring-imaging Cherenkov detector for High-Momentum Particle IDentification (HMPID), and

Analysis and run selection

Software: Aliroot:v5-07-20 Aliphysics:vAN-20160204
Event shape classes: (PWGLF/SPECTRA/Spherocity)
Analysis macros: AddTransverseEventShapeTask.C
AliAnaTransverseEventShapeTask.cxx
AliAnaTransverseEventShapeTask.h

LHC15f pass2: (44.6 mill of evts) (after all ev selection)
LHC15g3a3 Monash Tune (43.2 mill of evts) (after all ev selection)
good runs*:
226500, 226495, 226483, 226476, 226472, 226468, 226466,
226452, 226445, 226444, 226225, 226220, 226170, 226062,
225768, 225766, 225763, 225762, 225757, 225753, 225719,
225717, 225716, 225710, 225709, 225708, 225707, 225705,
225587, 225586, 225579, 225578, 225576, 225322, 225315,
225314, 225313, 225310, 225309, 225307, 225305, 225106,
225052, 225051, 225050, 225043, 225041, 225037, 225035,
225031, 225026

(*) http://twiki.cern.ch/twiki/bin/viewauth/ALICE/PWGLF13TeVanalysis

Event, track and physics selection

Event Selection

Trigger: KINT7
Rejection of AliESDEvent::IsIncompleteDAQ
Vertex selection
SPD Pile-up rejection
Background rejection
Multivertex Pile-up rejection
low diagonal cut OFO &V0M applied
Vertex conditions for 2015 data (NEW added) (this reduce the sample of evts)

https://twiki.cern.ch/twiki/bin/view/ALICE/PWGPPEvSelRun2pp

**https://twiki.cern.ch/twiki/bin/view/ALICE/AliceHMTFCodeSnippets#Physics_Selection

Physics Selection

- MinNCrossedRowsTPC = 120; *
- MinRatioCrossedRowsOverFindableClustersTPC=0.8;
- MaxFractionSharedTPCCluster = 0.4;
- Maxchi2perTPCcl=4.;
- Max dcaz ITSTPC=2.0;
- SetDCAToVertex2D(kFALSE);
- SetRequireSigmaToVertex(kFALSE);
- RequireTPCRefit(kTRUE);
- RequireITSRefit(kTRUE);
- AcceptKinkDaughters(kFALSE);
- MaxDCAToVertexXYPtDep("0.0182+0.0350/pt^1.01"); *
- SetMaxChi2TPCConstrainedGlobal(36.);

Track selection taken for each analysis

- So Analysis, Hybrid-track cuts for primary charged particles with $|\eta|<0.8$ and $0.15<p_T<10$ GeV/c.
- $\langle p_T \rangle$ Analysis, Golden-track cuts with $|\eta|<0.8$ and $0.15<p_T<10$ GeV/c.
- Multiplicity:
  - Reference multiplicity selection with $|\eta|<0.8$
  - V0M percentil selection

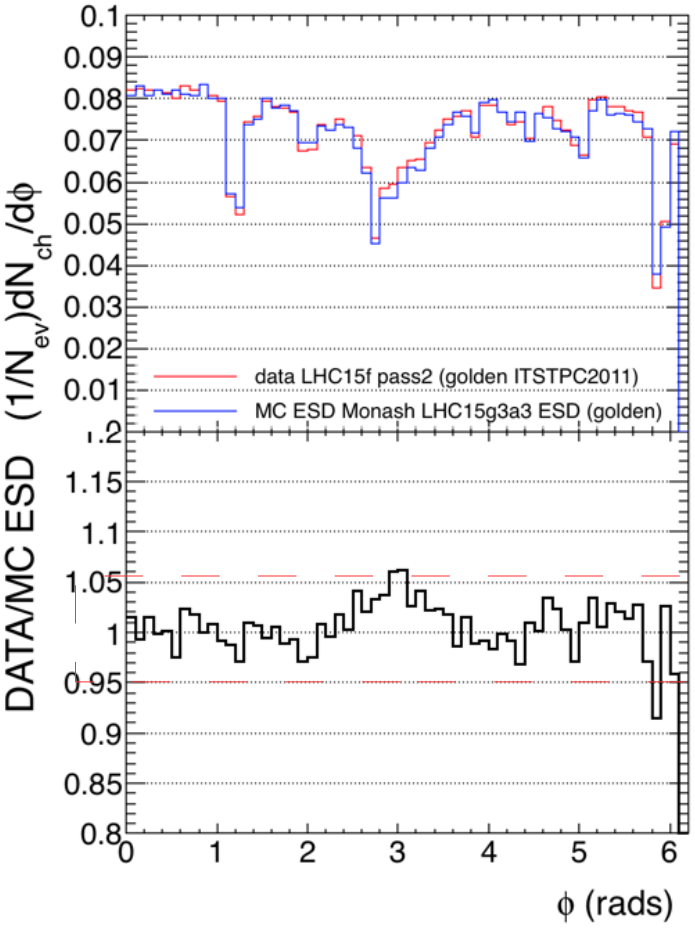
To study MC/DATA dependence for different cuts: ITSTPC2011 golden DATA vs MC NEW

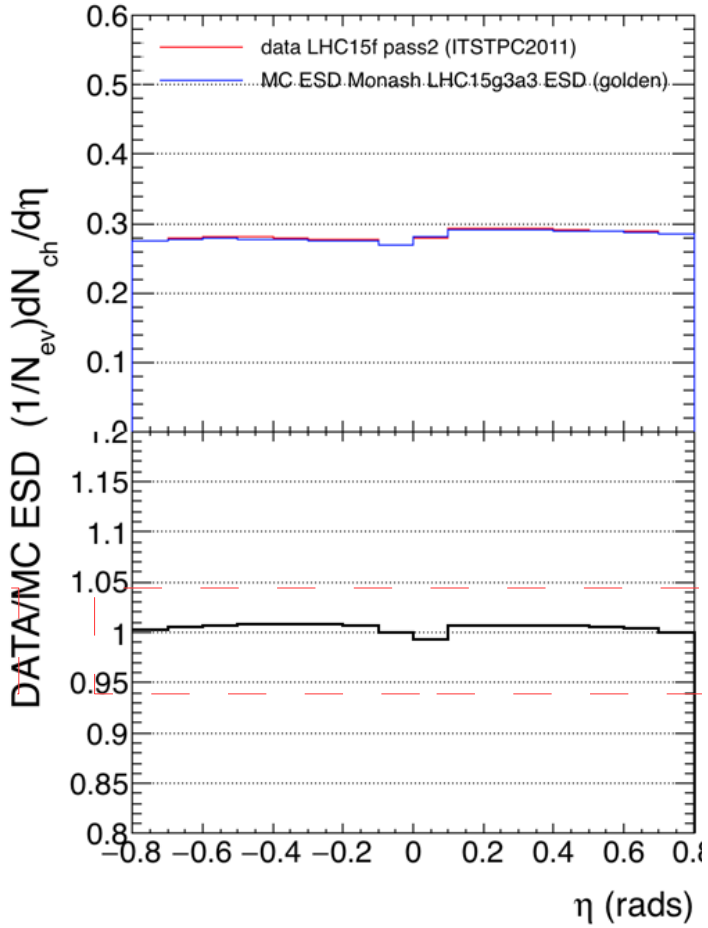
ITSTPC2011 golden

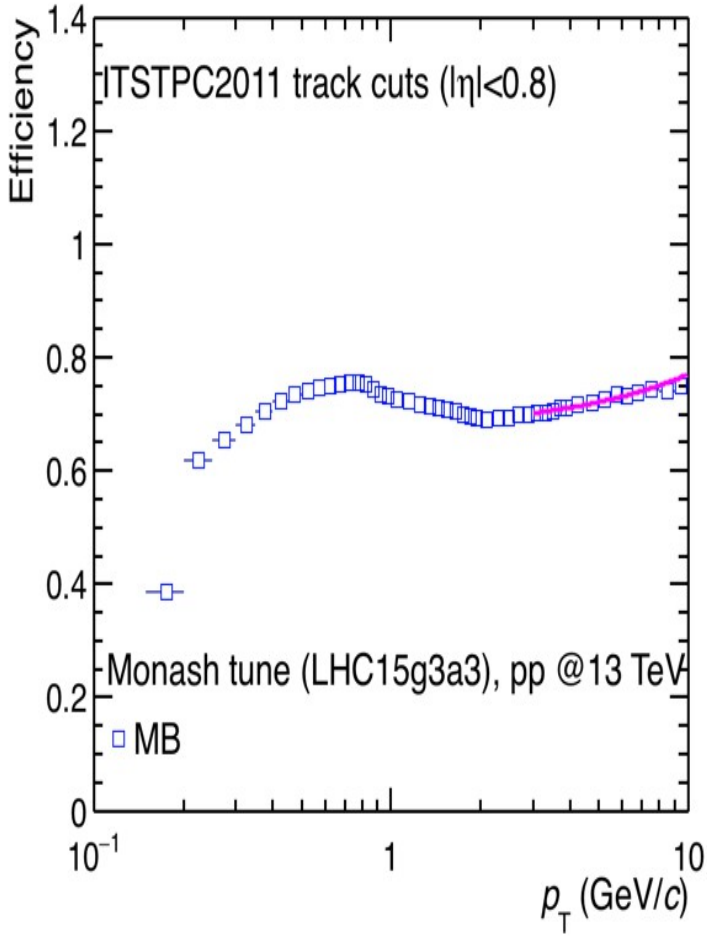
```
AliAnalysisFilter* trackFilterGolden = new AliAnalysisFilter("trackFilter");

    AliESDtrackCuts* esdTrackCuts = new AliESDtrackCuts("AliESDtrackCuts");
      esdTrackCuts->SetRequireTPCRefit(kTRUE);
      esdTrackCuts->SetAcceptKinkDaughters(kFALSE);
      esdTrackCuts->SetMinNCrossedRowsTPC(120);
      esdTrackCuts->SetMinRatioCrossedRowsOverFindableClustersTPC(0.8);
      esdTrackCuts->SetMaxChi2PerClusterTPC(4.0);
      esdTrackCuts->SetMaxFractionSharedTPCClusters(0.4);
      esdTrackCuts->SetRequireITSRefit(kTRUE);
      esdTrackCuts->SetClusterRequirementITS(AliESDtrackCuts::kSPD,AliESDtrackCuts::kAny);
      esdTrackCuts->SetMaxChi2PerClusterITS(36.);
      esdTrackCuts->SetDCAToVertex2D(kFALSE);
      esdTrackCuts->SetRequireSigmaToVertex(kFALSE);
      esdTrackCuts->SetMaxDCAToVertexZ(2.0);
      esdTrackCuts->SetMaxDCAToVertexXYPtDep("0.0182+0.0350/pt^1.01");
      esdTrackCuts->SetMaxChi2TPCConstrainedGlobal(36.);
  trackFilterGolden->AddCuts(esdTrackCuts);
```

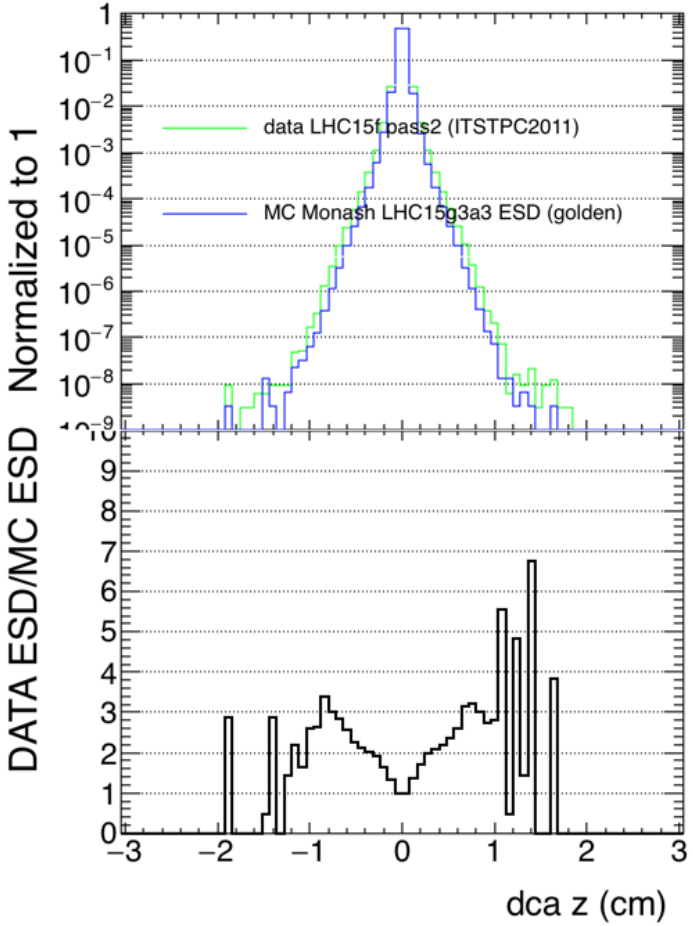
To study MC/DATA dependence for different cuts: -ITSTPC2011 golden DATA vs MC

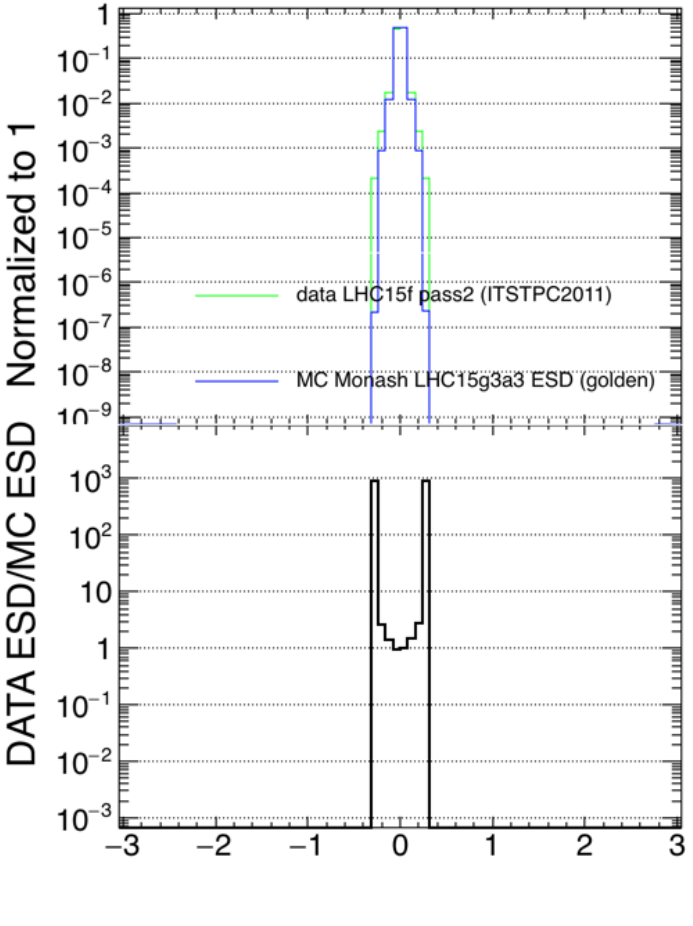


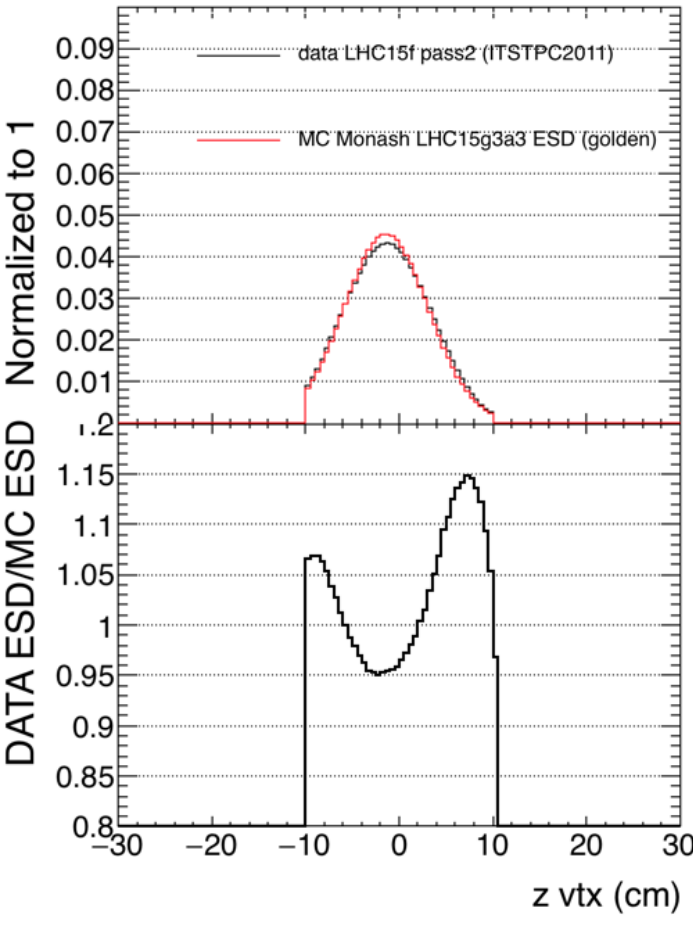




To study MC/DATA dependence for different cuts: -ITSTPC2011 golden DATA vs MC





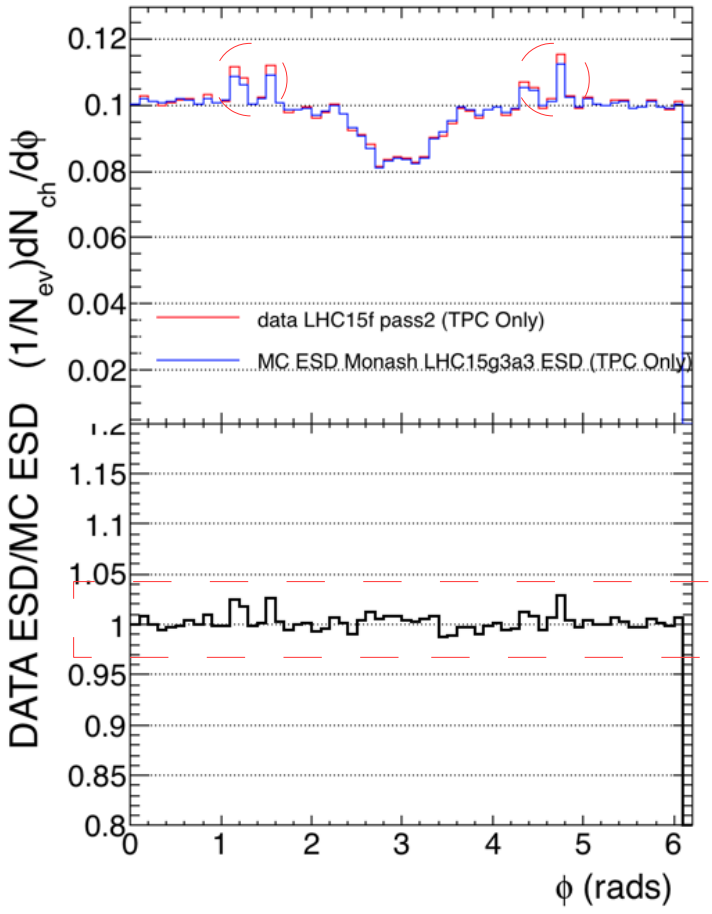


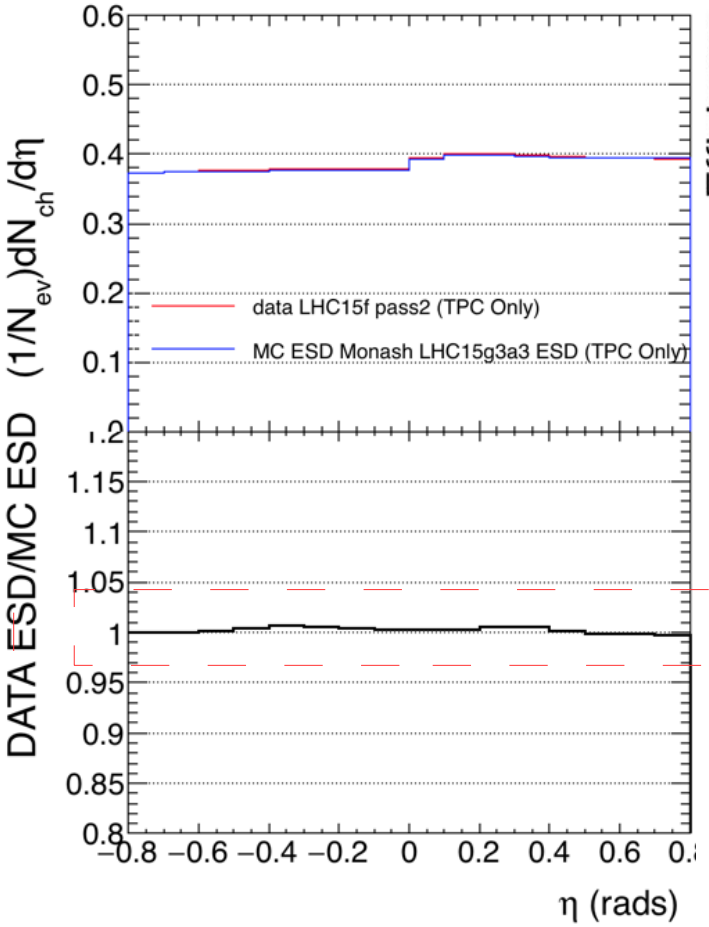
To study MC/DATA dependence for different cuts: TPC Only DATA vs MC NEW

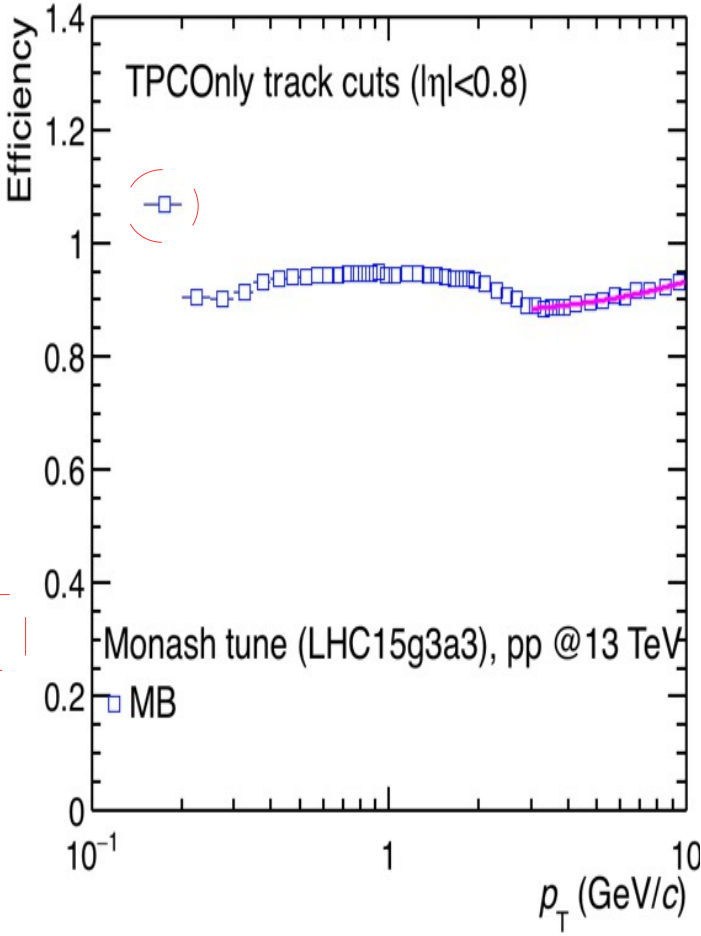
TPC Only cuts

```
AliAnalysisFilter* trackFilterTPCOnly = new AliAnalysisFilter("trackFilter");
      AliESDtrackCuts* esdTrackCuts = new
AliESDtrackCuts("AliESDtrackCuts");
            esdTrackCuts->SetAcceptKinkDaughters(kFALSE);
            esdTrackCuts->SetMinNClustersTPC(70);
            esdTrackCuts->SetMaxChi2PerClusterTPC(4);
            esdTrackCuts->SetDCAToVertex2D(kTRUE);
            esdTrackCuts->SetRequireSigmaToVertex(kFALSE);
            esdTrackCuts->SetMaxDCAToVertexZ(3.2);
            esdTrackCuts->SetMaxDCAToVertexXY(2.4);
       trackFilterTPCOnly->AddCuts(esdTrackCuts);
```

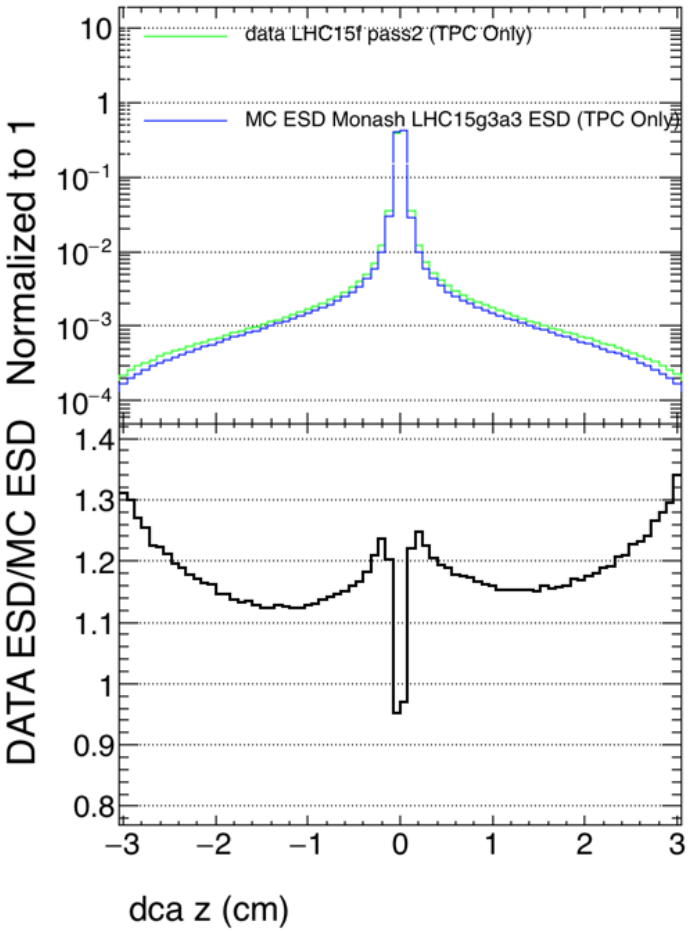
To study MC/DATA dependence for different cuts: TPC Only DATA vs MC NEW

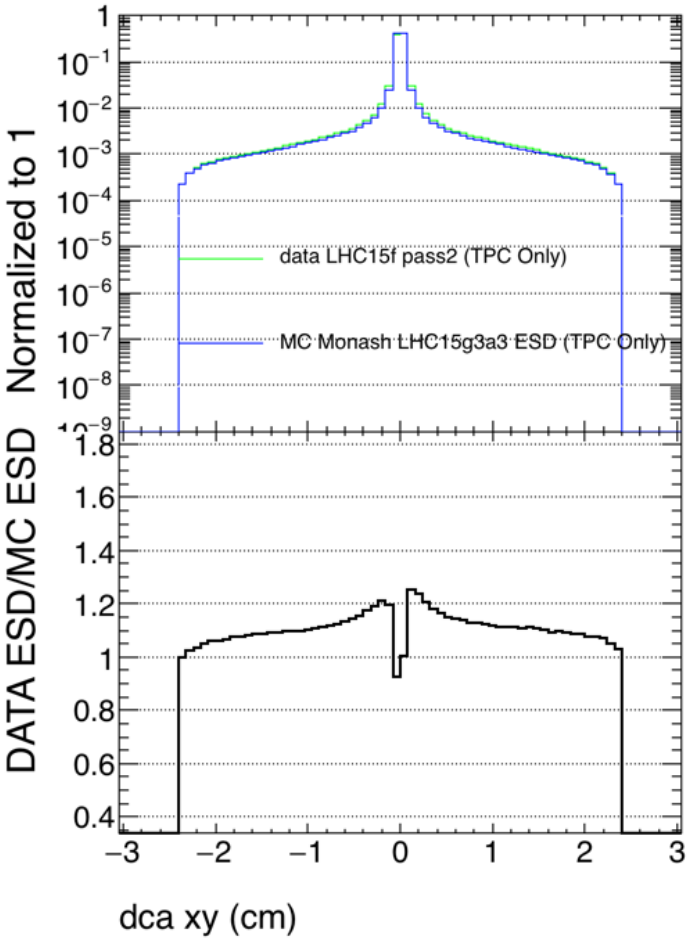


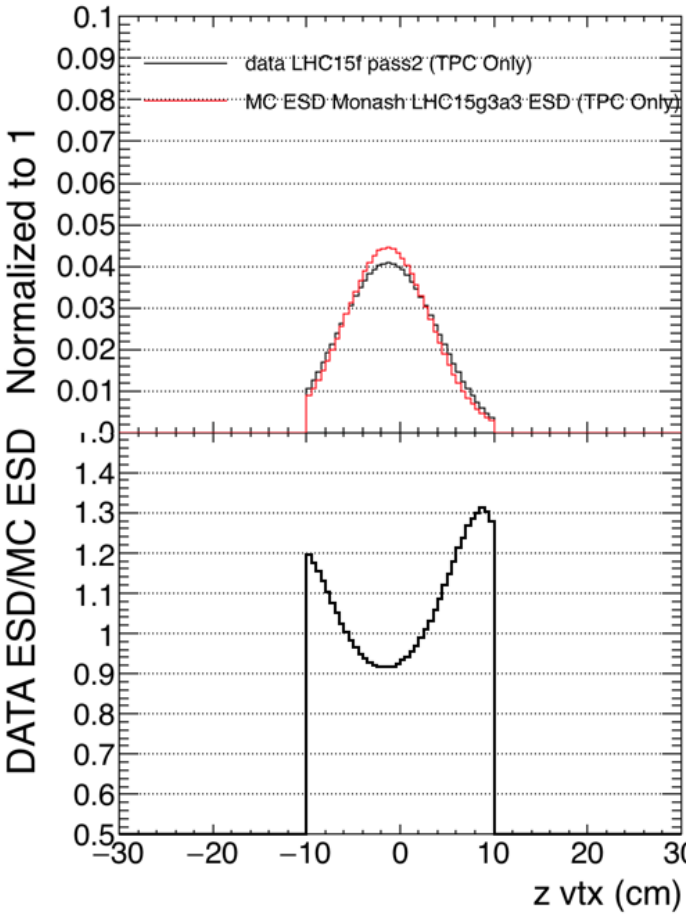




To study MC/DATA dependence for different cuts:
-TPC Only Data vs MC NEW







To study MC/DATA dependence for different cuts: TPC Only+ TPC refit DATA vs MC NEW

TPC Only cuts

```
AliAnalysisFilter* trackFilterTPCOnly = new AliAnalysisFilter("trackFilter");
      AliESDtrackCuts* esdTrackCuts = new
AliESDtrackCuts("AliESDtrackCuts");
          esdTrackCuts->SetAcceptKinkDaughters(kFALSE);
            esdTrackCuts->SetMinNClustersTPC(70);
            esdTrackCuts->SetMaxChi2PerClusterTPC(4);
           esdTrackCuts->SetRequireTPCRefit(kTRUE);
          esdTrackCuts->SetDCAToVertex2D(kTRUE);
          esdTrackCuts->SetRequireSigmaToVertex(kFALSE);
            esdTrackCuts->SetMaxDCAToVertexZ(3.2);
            esdTrackCuts->SetMaxDCAToVertexXY(2.4);
    trackFilterTPCOnly->AddCuts(esdTrackCuts);
```

Jobs ready but need to download...

To do for continue

same comparison DATA/MC:

-Check Antonio's corrections.

-Hybrid cuts (to test the cuts and to get the results)