Simulation of hadronic calorimeter (nHCal) for ePIC experiment

Bc. Alexander Godál

Supervisor: doc. Mgr. Jaroslav Bielčík, Ph.D.
Consultant: Ing. Alexandr Prozorov, Ph.D.

Backward HCal DSC weekly meeting

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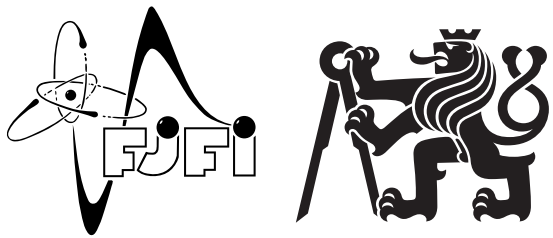
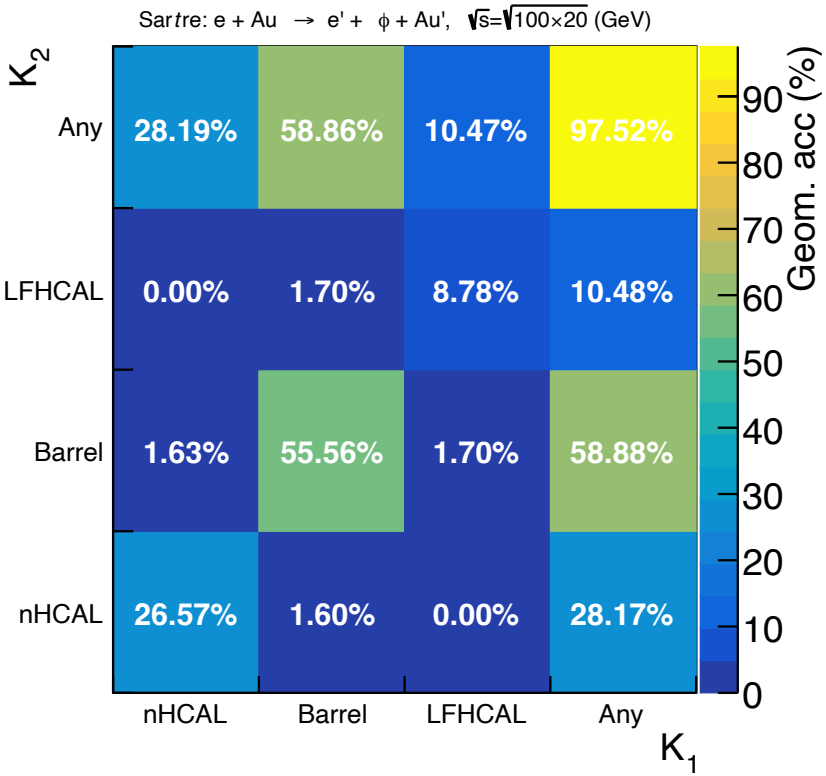
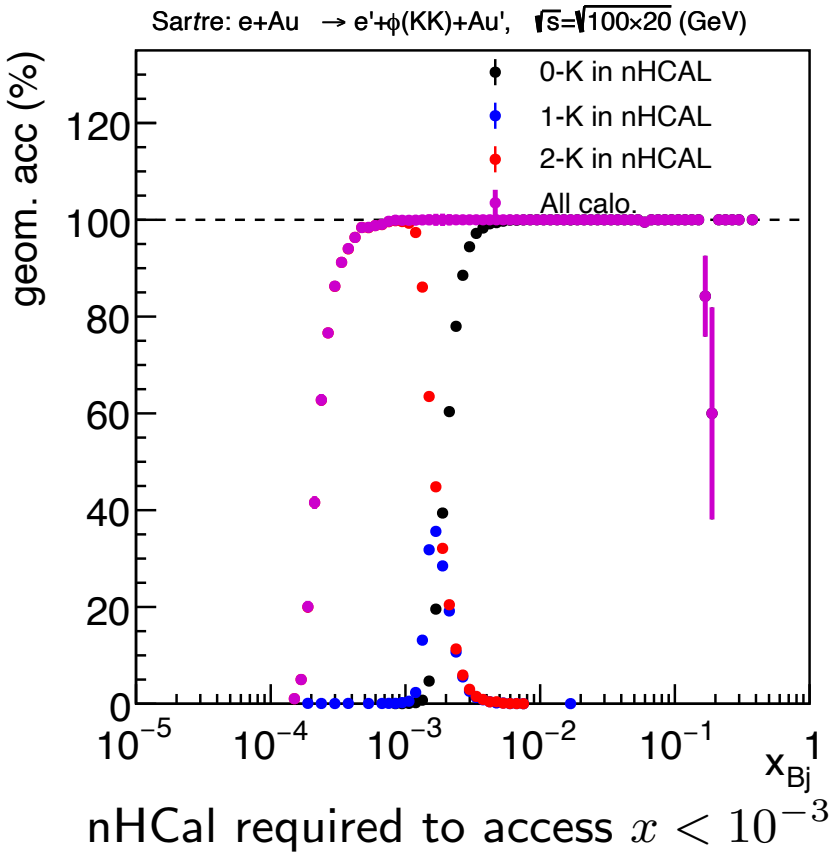


Diffractive $\phi \to K^+K^-$

- done by the nHCal group





nHCal required to access $x < 10^{-3}$

Simulations of vector mesons with nHCal

1. files taken from central production campaign (e + Au) $\rightarrow$ marked as **campaign**
   - simulated with Sar*t*re event generator (specialized for exclusive diffractive VM production)
   - `EPIC/RECO/26.02.0/epic_craterlake/`
     $\hookrightarrow$ `EXCLUSIVE/DIFFRACTIVE_PHI_ABCONV`
     $\hookrightarrow$ `/sartre1.39-1.0/eAu/coherent/bsat/10x100`
2. files simulated using the same generator $\rightarrow$ marked as **local**
   - aiming to match the configuration of the campaign files

Sartre runcard

```
eBeamEnergy = 10
hBeamEnergy = 100
A           = 197

UPC = false

numberOfEvents = 607

dipoleModel              = bSat
dipoleModelParameterSet = KMW

vectorMesonId = 333
tableSetType  = total_and_coherent
userInt       = 321
```

```
Q2min = 1
Q2max = 20
Wmin  = 1000000
Wmax  = 0

correctForRealAmplitude    = true
correctSkewedness          = true
maxLambdaUsedInCorrections = 0.4

enableNuclearBreakup       = false
maxNuclearExcitationEnergy = 3.0
applyPhotonFlux            = true
```

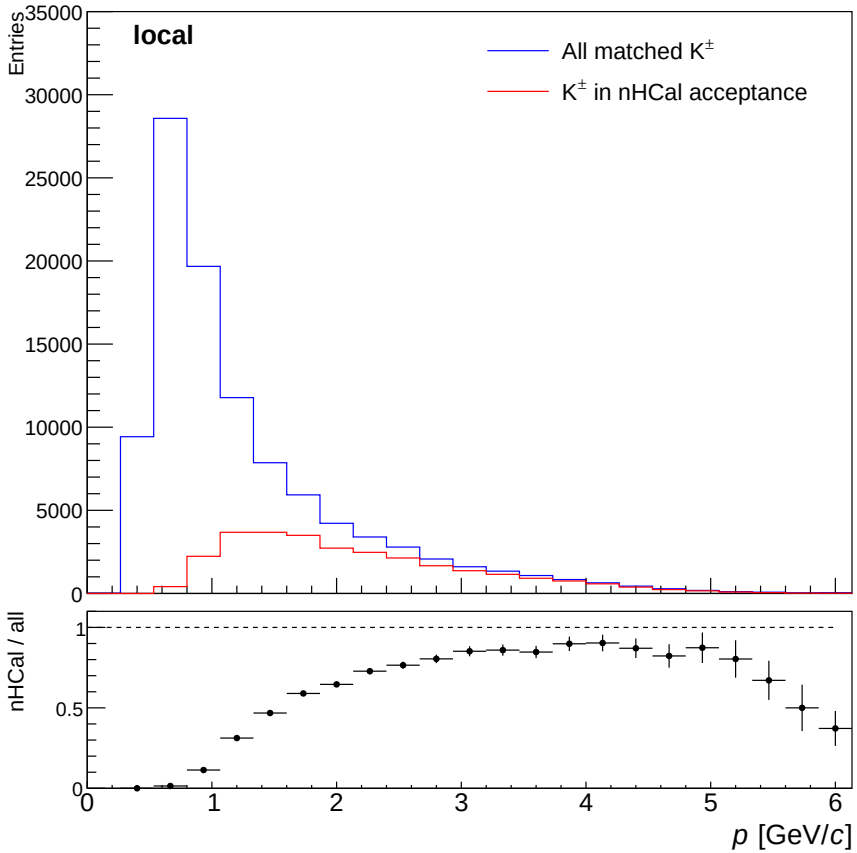
Details of simulations

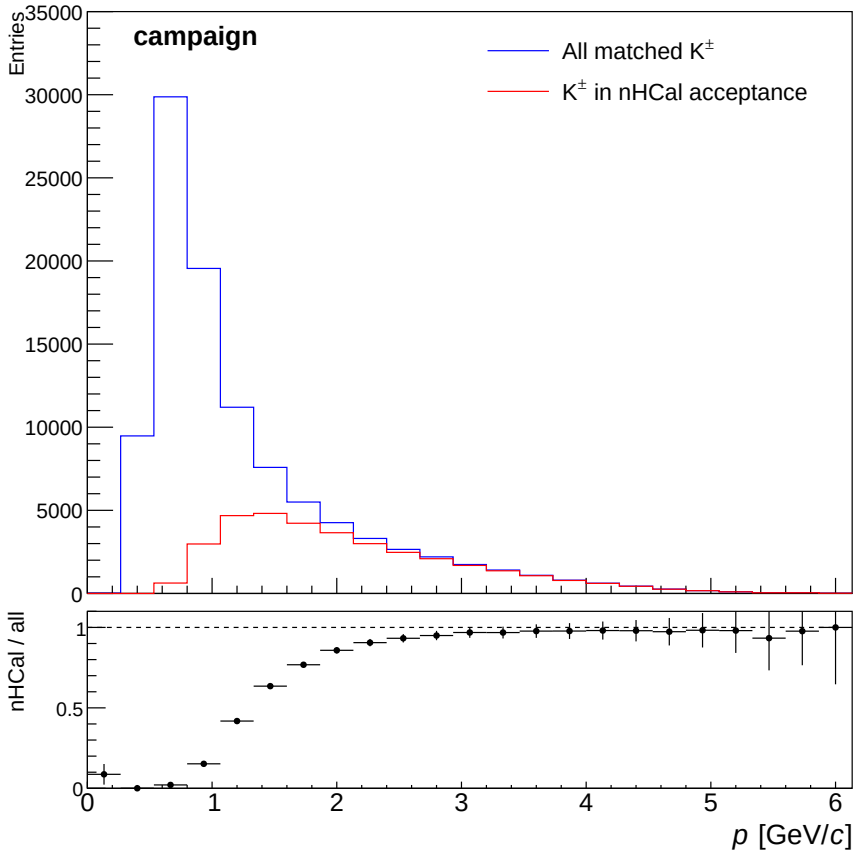
- limits:
  - ↪ $Q^2 \in (1, 20)$ GeV^2
  - ↪ $t \in (-0.5, -5.94612 \cdot 10^{-8})$ GeV^2
  - ↪ $W \in (1.95773, 63.2518)$ GeV
  - ↪ nHCal acceptance: $\eta \in (-4.14, -1.18)$
- 58,272 Sar$t$re generated events across 16 remote files
- afterburner configuration: e+Au (10×110) GeV

↪ no specific configuration for e+Au (10×100) GeV exists

Comparison of files

Reconstructed momentum of produced kaons flagged as ϕ daughters, and the same but only for kaons in the nHCal acceptance

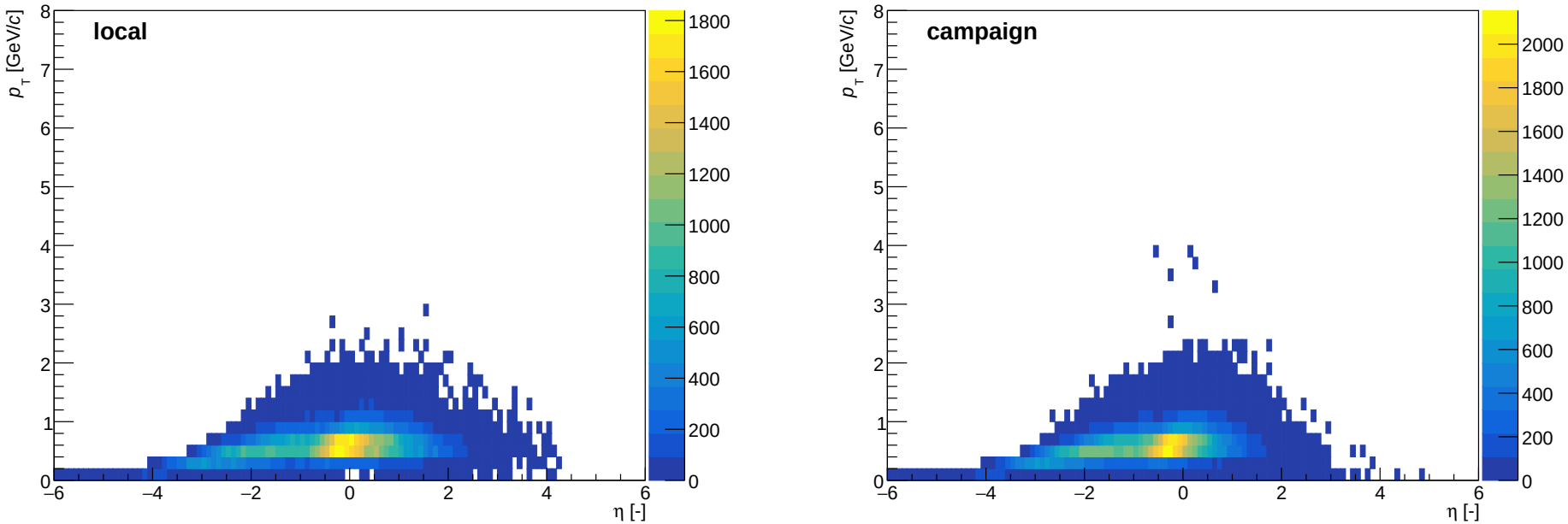




Histograms filled with momenta of reconstructed charged-particle tracks matched via ReconstructedChargedParticleAssociations to the two generator-level kaon daughters of a generator-level ϕ decaying into exactly two kaons

Comparison of files - cont.

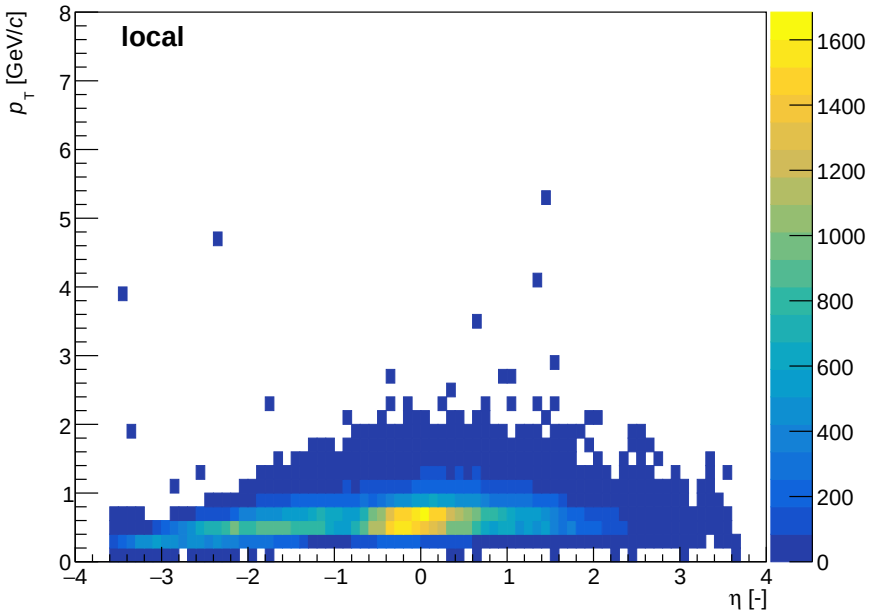
Generated kaon pseudorapidity η vs. transverse momentum p_{T}

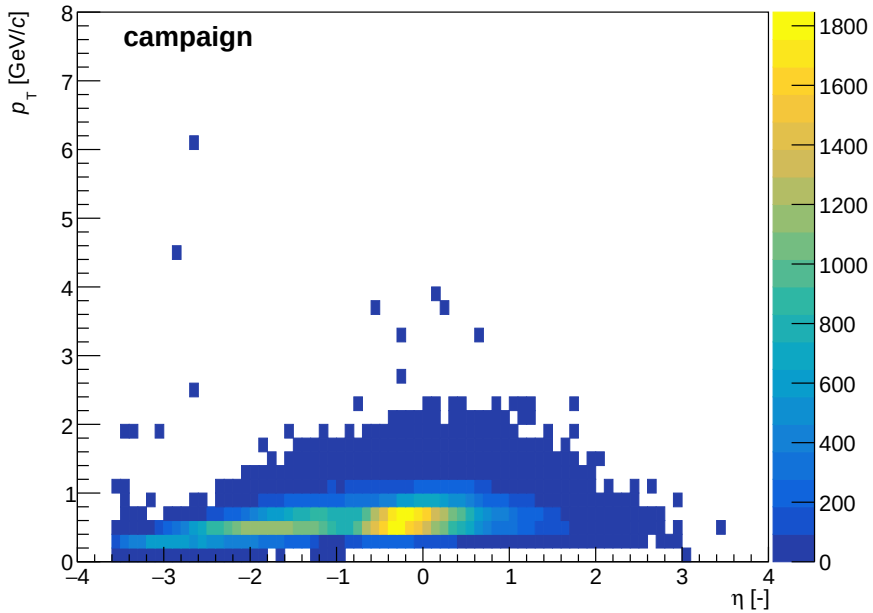


Histograms filled directly from generator-level information by looping over MCParticles and selecting kaons

Comparison of files - cont. 2

Reconstructed kaon pseudorapidity η vs. transverse momentum p_T

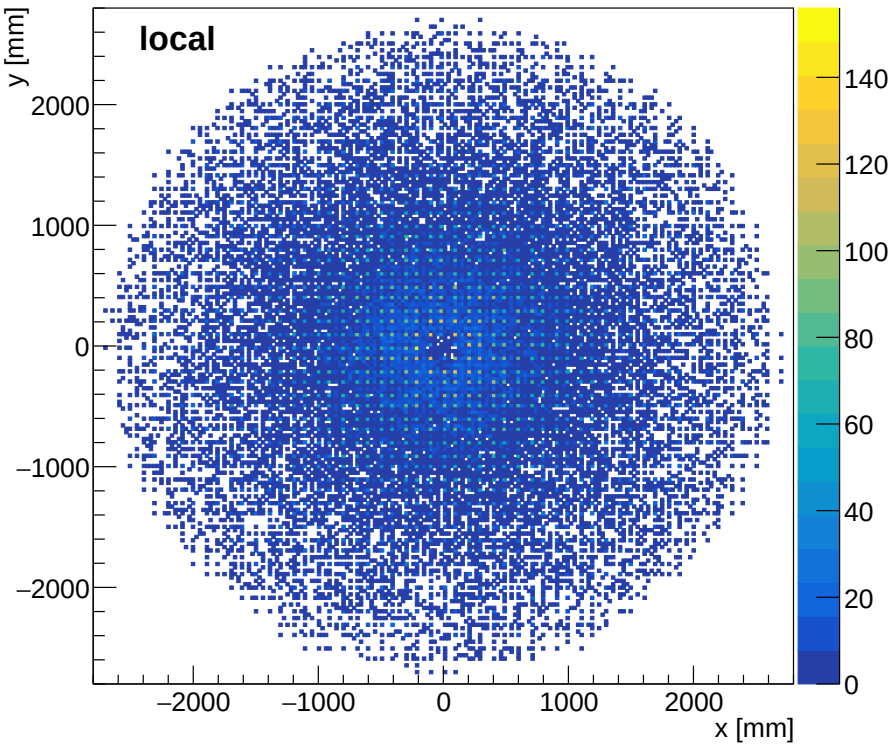


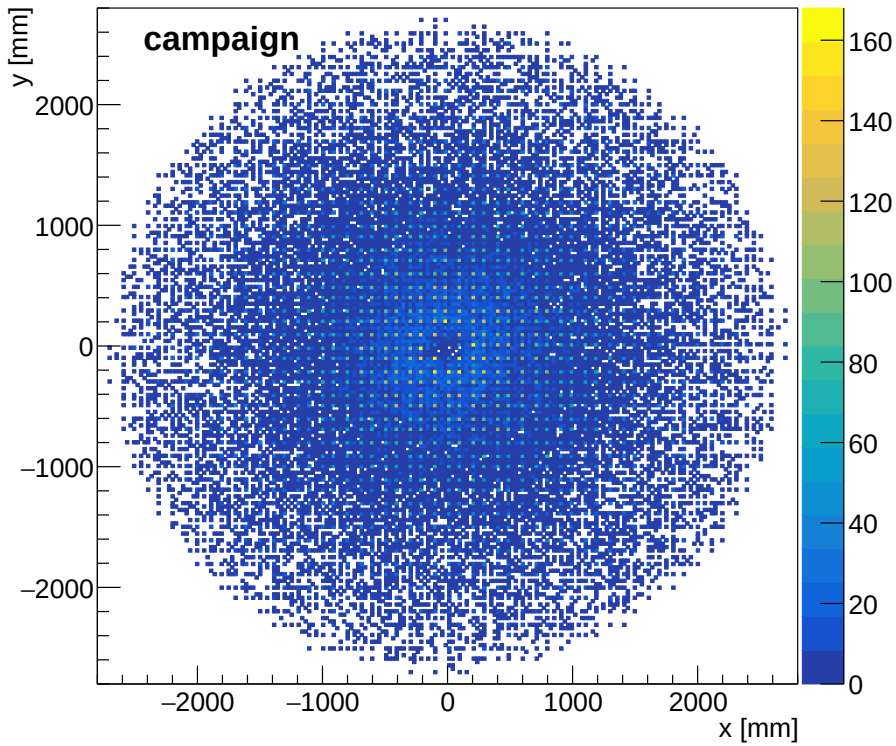


Histograms filled with pseudorapidity and transverse momentum of reconstructed $K^{\pm}$, using ReconstructedChargedParticles matched to MCParticles

Comparison of files - cont. 3

xy positions of all nHCal clusters associated, via HcalEndcapNClusterAssociations, to generated kaons

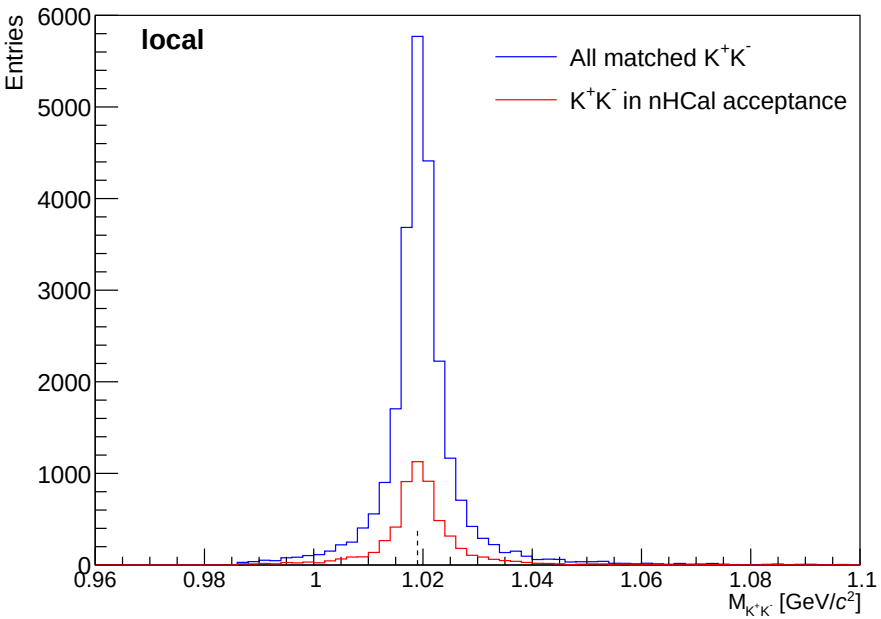


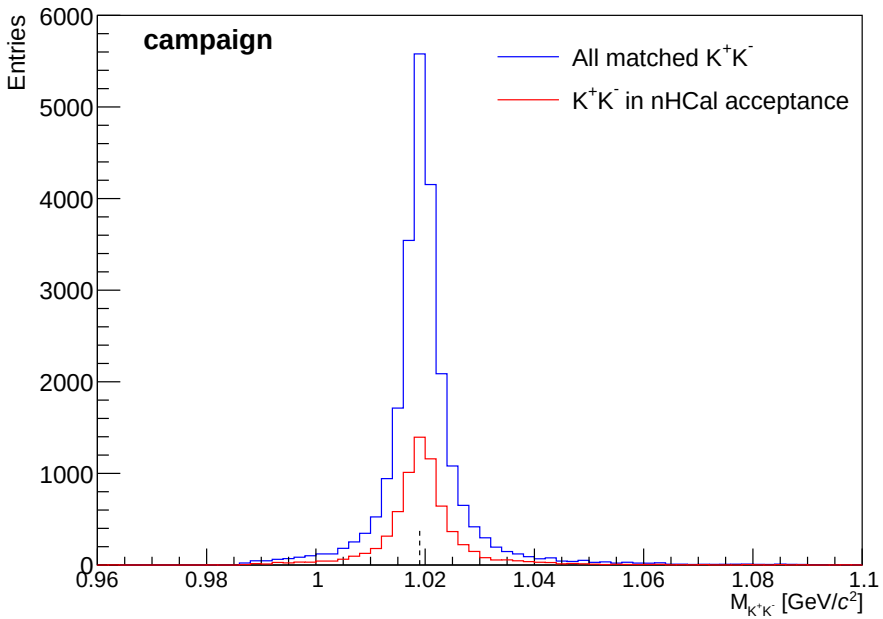


Histograms filled by looping over generator-level MCParticles and selecting kaons → for each selected kaon, all nHCal clusters associated to that MCParticle via HcalEndcapNClusterAssociations collection are identified

Comparison of files - cont. 4

Reconstructed invariant mass of produced ϕ mesons from their daughter pairs of kaons, and the same for when both kaons are in the nHCal acceptance





Histograms are filled by iterating over generator-level MCParticles to identify ϕ mesons that decay into two charged kaons $\rightarrow$ for each valid decay, if both daughter kaons are associated with reconstructed tracks the invariant mass of the pair is calculated

Thank you for your attention!