# Kaon TOF efficiencies in real data using $\phi \rightarrow$ KK

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# Event and track selection

- DATA: PbPb LHC10h (2.7M events with centrality < 90%)
  - V0M centrality ($|\text{cent}_{V0M} - \text{cent}_{TRK}| < 5\%$)
  - Centrality bin width = 10%
- TPC only track (std cuts) ← <span style="color:red">should be replaced by global tracks</span>
  - $|N\sigma_{TPC}^{K}| < 3$
  - $|\eta^{K}| < 0.8$, $0.3 < p_T^{K} < 2.5$ GeV/$c$
  - $|\eta^{\phi}| < 1.6$, $1.0 < p_T^{\phi} < 5$ GeV/$c$
- tested: TOF
  - Matching efficiency for kaons
  - Bayesian PID for kaons: P > 0.2, 0.4, 0.5, 0.8

# Fit function

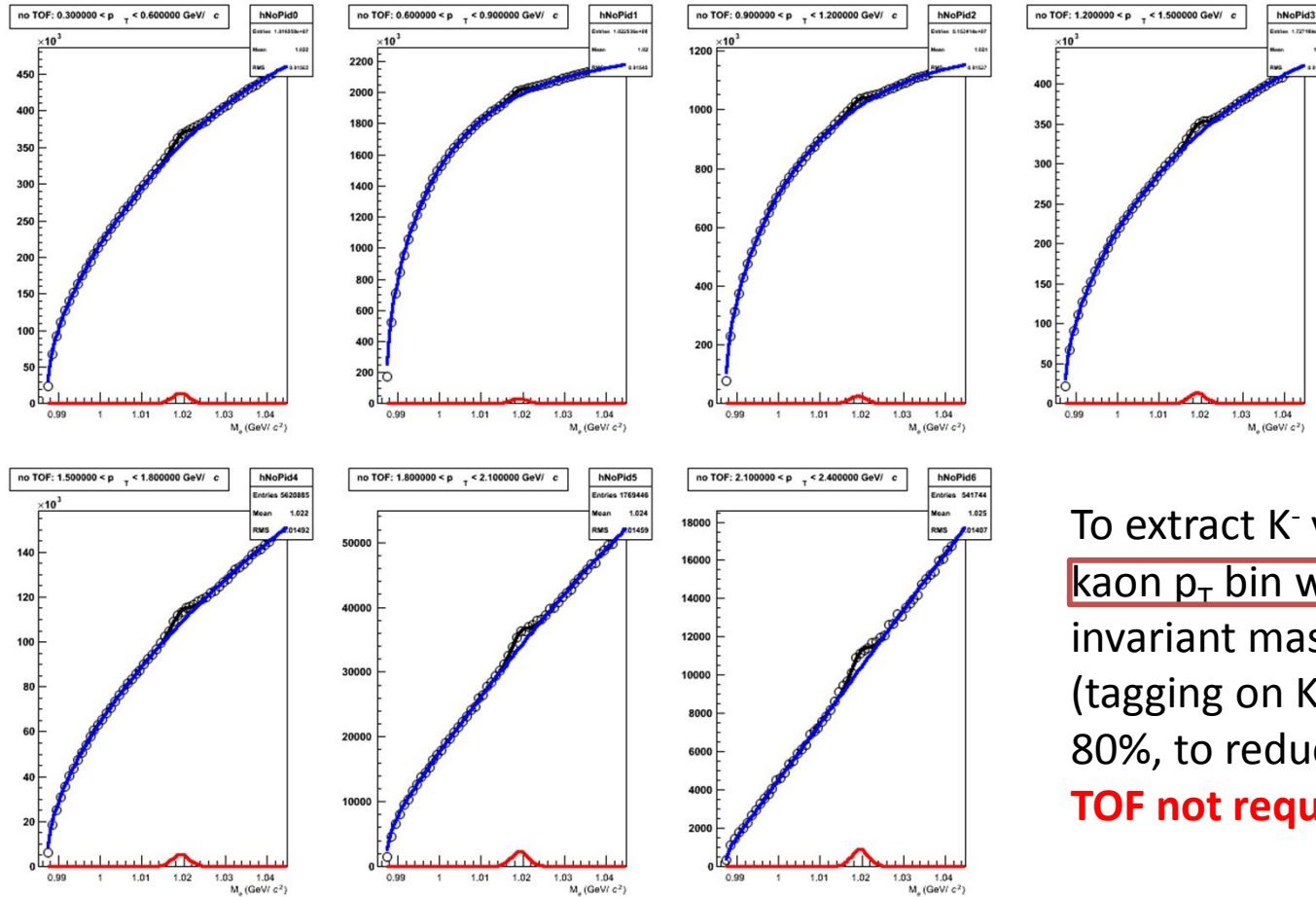Signal → Voigtian (Breit-Wigner ⊗ Gaussian)
˝ Width fixed at PDG

Background → Polinomial($\sqrt{M_{inv}}$)

- $= ax^{1/2} + bx + cx^{3/2} + dx^2 + ex^{5/2}$

- $x = M_{inv} - 0.987$
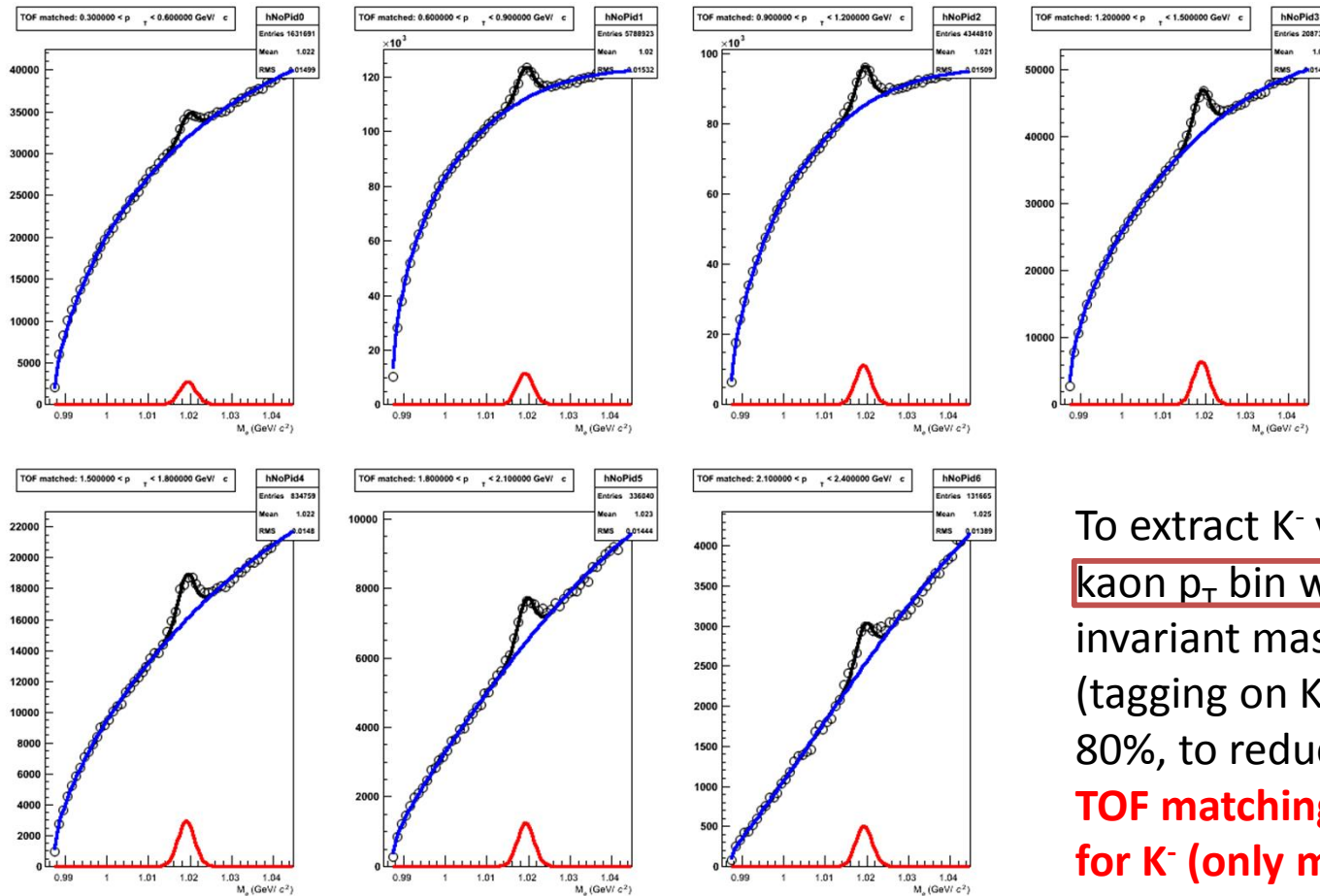
N.B. No background subtraction (only fitted)

# Fit to φ invariant mass to extract yields



**Notice that $p_T$ bins are for kaon-$p_T$!!!**

To extract $K^-$ yields in each kaon $p_T$ bin we fit the φ invariant mass distribution (tagging on $K^+$, TOF prob > 80%, to reduce background).
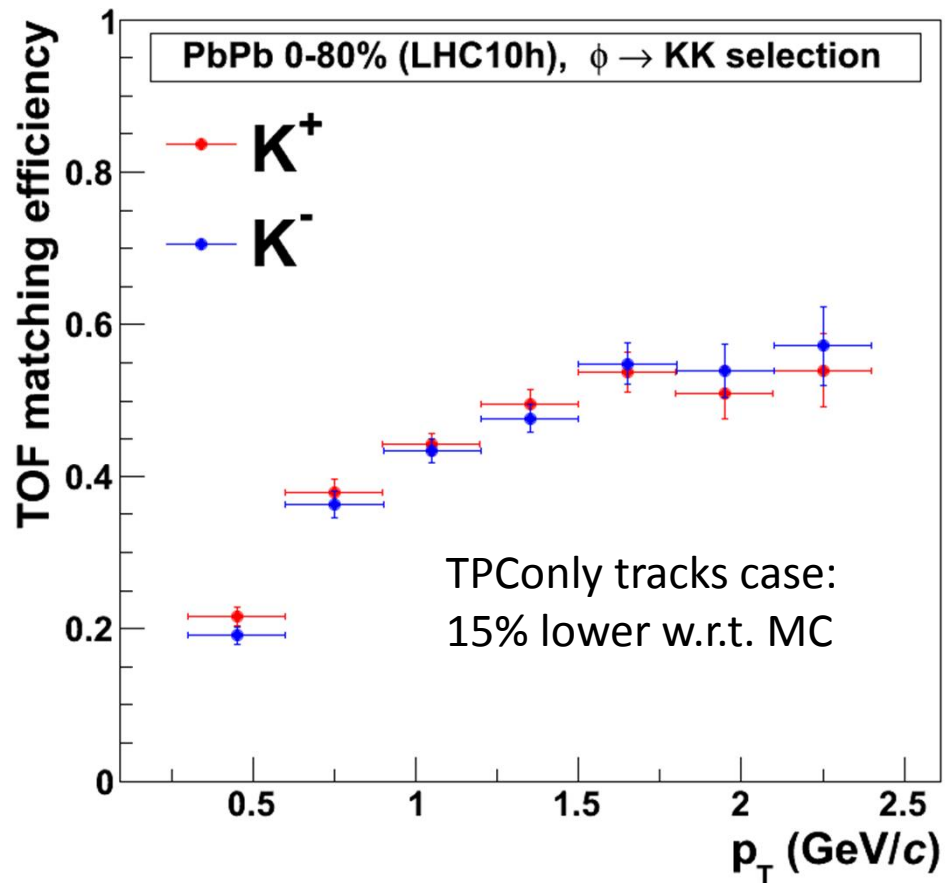**TOF not required here for $K^-$.**

# Fit to φ invariant mass to extract yields



To extract K⁻ yields in each kaon $p_T$ bin we fit the φ invariant mass distribution (tagging on K⁺, TOF prob > 80%, to reduce background). **TOF matching required here for K⁻ (only matching!).**

TOF matching means: kTOFout, kTIME:
for TPConly tracks kITSrefit not explicitely required in MC (but in DATA it is implicit)

# TOF matching eff.



PbPb 0-80% (LHC10h), $\phi \rightarrow$ KK selection

K$^+$

K$^-$

TPConly tracks case:
15% lower w.r.t. MC

TOF matching efficiency

$p_T$ (GeV/$c$)

Efficiency estimated using the yields ratio of single kaon TOF matched / NO TOF required = slide 4 / slide 3=
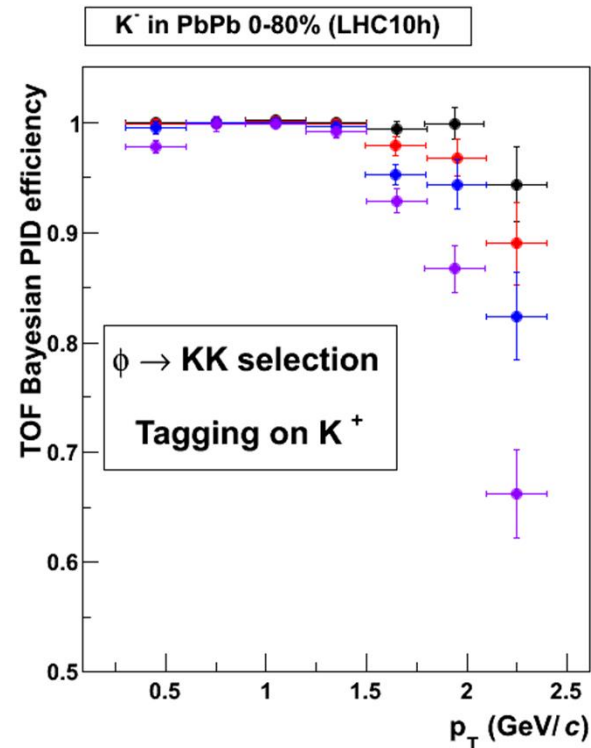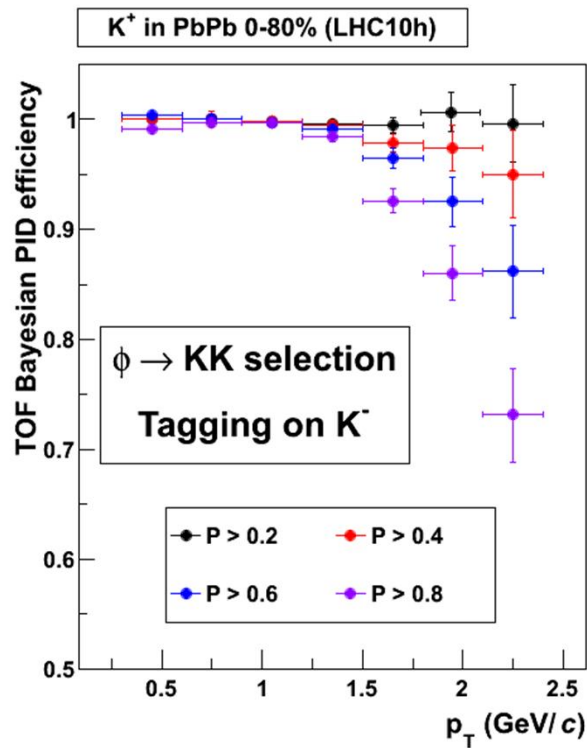TOF matching efficiency.

# Fit to φ invariant mass to extract yields
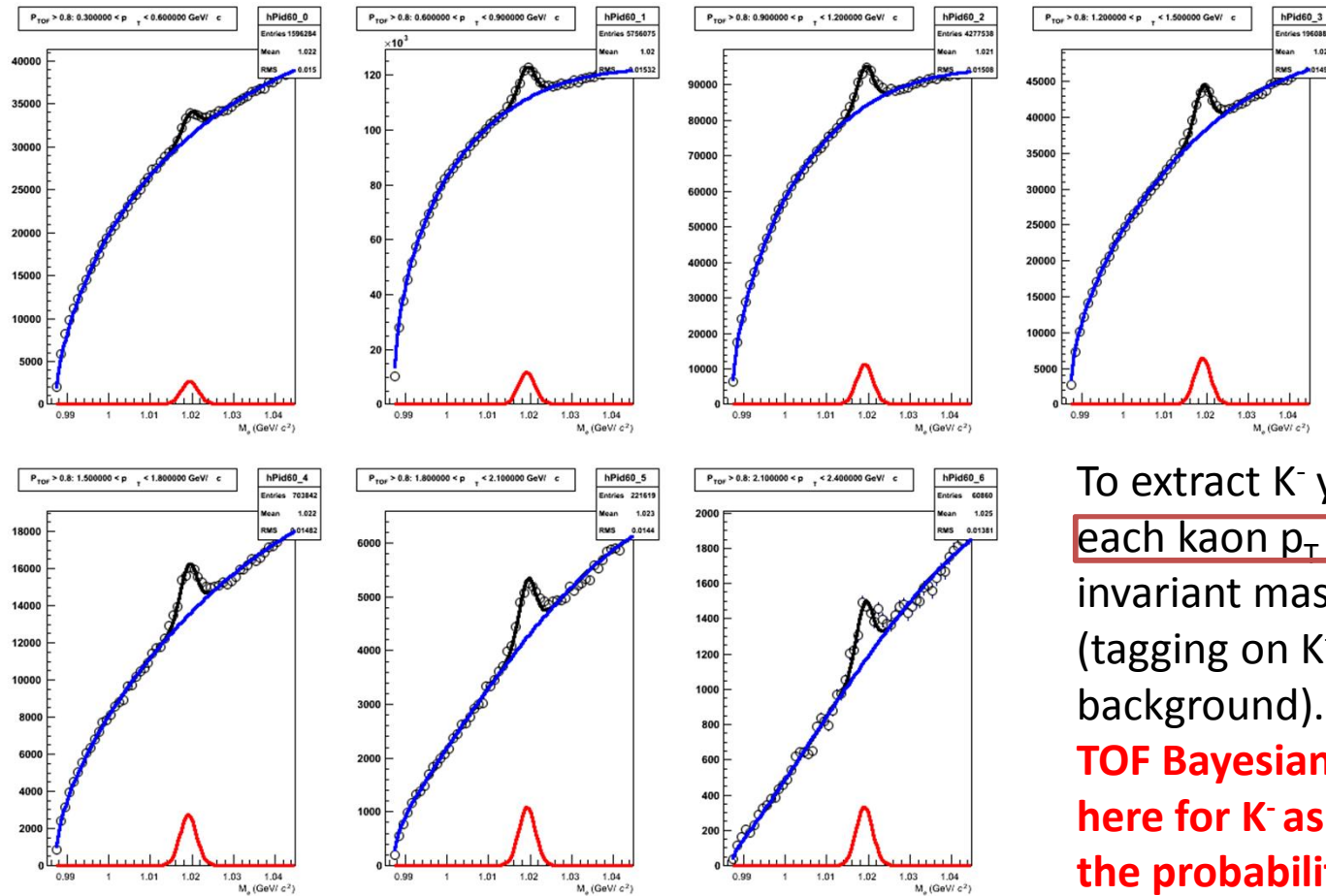


To extract K⁻ yields in each kaon $p_T$ bin we fit the φ invariant mass distribution (tagging on K⁺ to reduce background).

**TOF Bayesian PID required here for K⁻ as a function of the probability threshold (here P > 0.8).**

# TOF Bayesian PID eff.



K⁺ in PbPb 0-80% (LHC10h)

$\phi \to$ **KK selection**

**Tagging on K⁻**

P > 0.2    P > 0.4
P > 0.6    P > 0.8



K⁻ in PbPb 0-80% (LHC10h)

$\phi \to$ **KK selection**

**Tagging on K⁺**

Efficiency estimated using the yields ratio single kaon PID / single kaon TOF matched = slide 6 / slide 4=
PID efficiency.

# TO DO

˝ to redo for TPC+TOF combined Bayesian PID.

˝ to redo for TPC standalone Bayesian PID.

# backup

# Runlist and MC

137161
137231
137232
137366
137431
137539
137541
137549
137595
137608
137686
137691
137722
137752
137844

MC: LHC11a10a_bis
PbPb, Hijing standalone, LHC10h anchors, 2760GeV (repeat of LHC11a10a), ID #254

Same runs = 300k events

With TuneOnData ON.