K- K+ hit discrimination using conformal mapping method

2 Problems:

1. Kaon hits identification (too many isim hits associated to K- K+)
2. Charge identification (K^- vs K^+) (before double helix fitting)

Kaon hits identification in 2 steps:

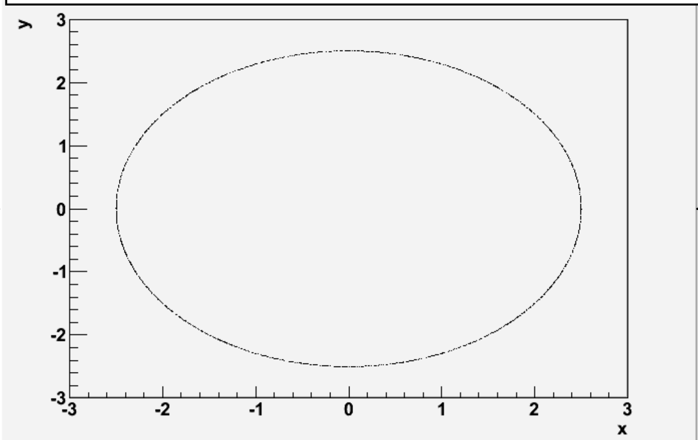
To transform from double helix to single helix:

Lorentz Trasformation with Φ Boost $p_x = 2\sin(\alpha)$ with α crossing angle

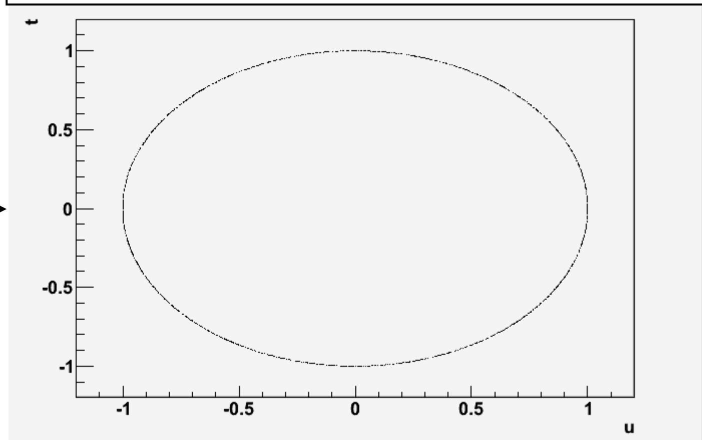
To transform from single helix to straight line:

Conformal Mapping $x,y \Rightarrow u = x / \sqrt{(x^2+y^2)}$, $v = y / \sqrt{(x^2+y^2)}$

K- K+ simulated hits on Φ C.M. frame

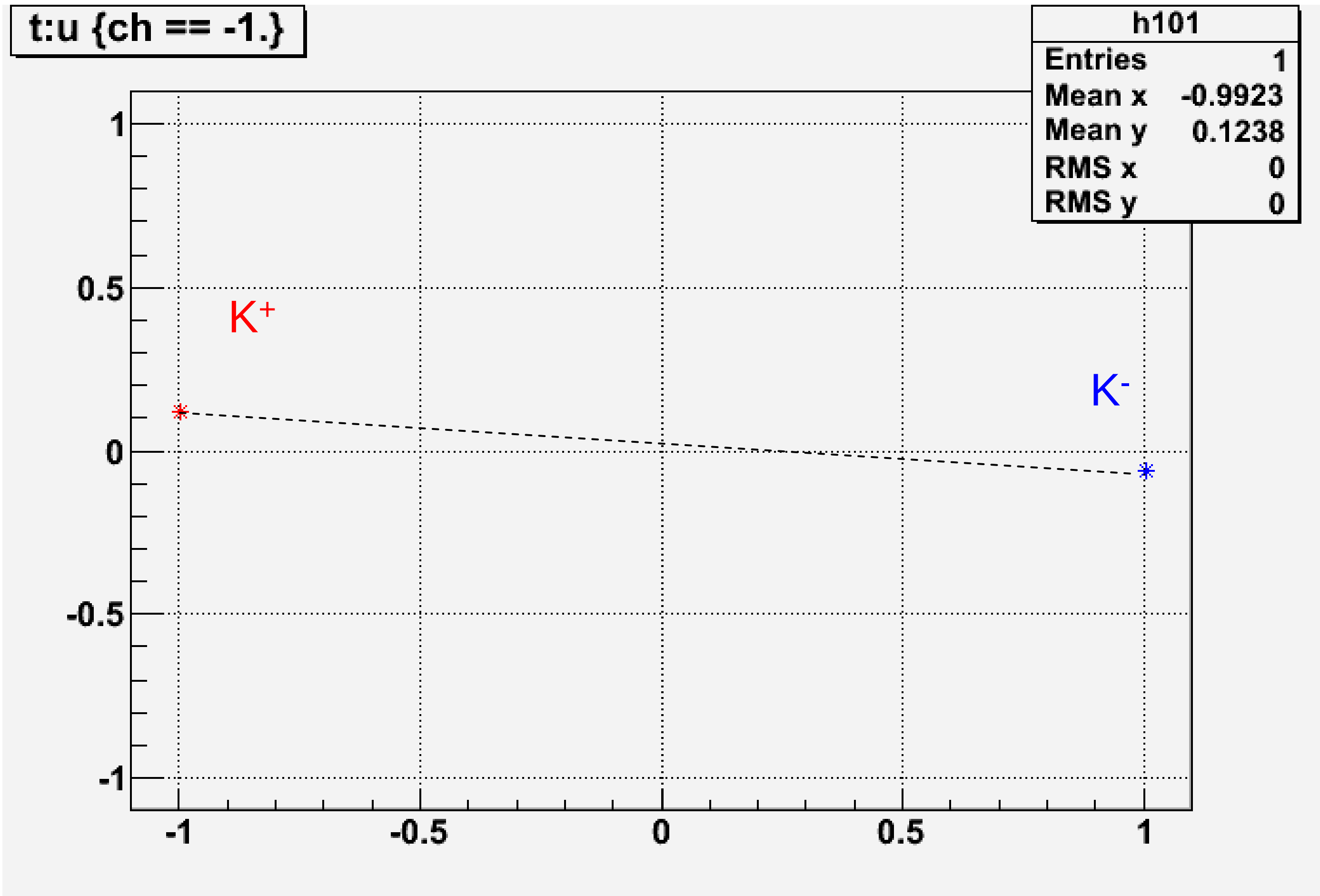


K- K+ hits on Φ C.M. frame ⊗ Conf. Map.

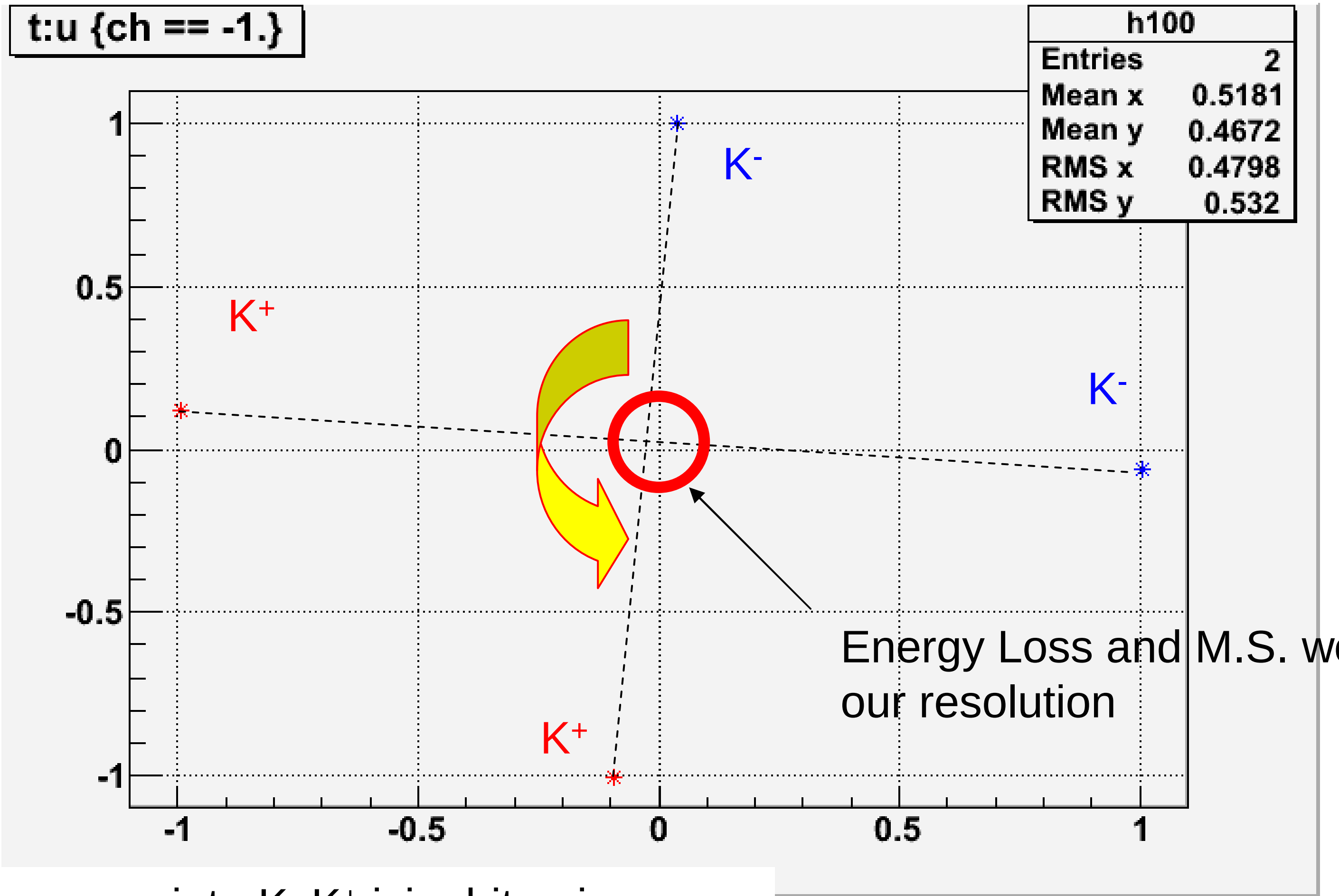


Conformal Mapping

Conformal Mapping $x,y \Rightarrow u = x / \sqrt{(x^2+y^2)},\ v = y / \sqrt{(x^2+y^2)}$
transforms the circle equation $(x-a)^2+(y-b)^2 = R^2$
to the straight line equation: $v = 1/(2b) - (a/b)u$



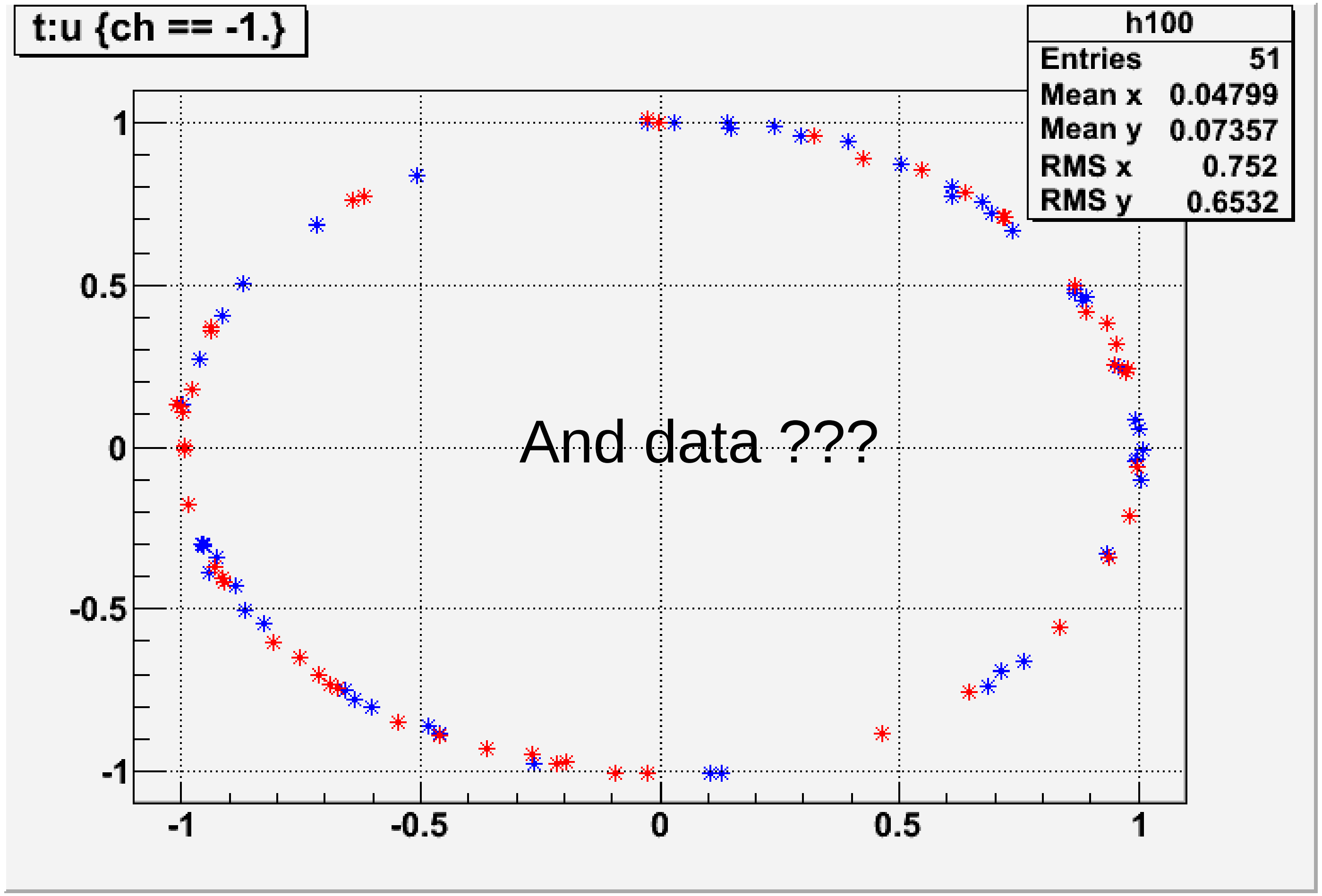
Conformal Mapping



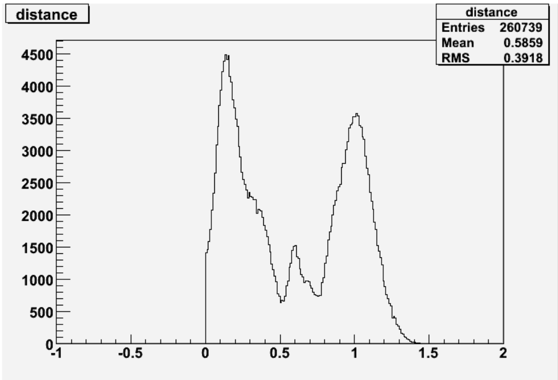
We can associate K^- K^+ isim hit pair:

1. building a straight line for each pair and
2. choosing the pair with a “proper” radius

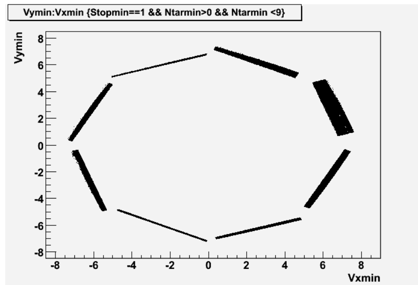
Conformal Mapping



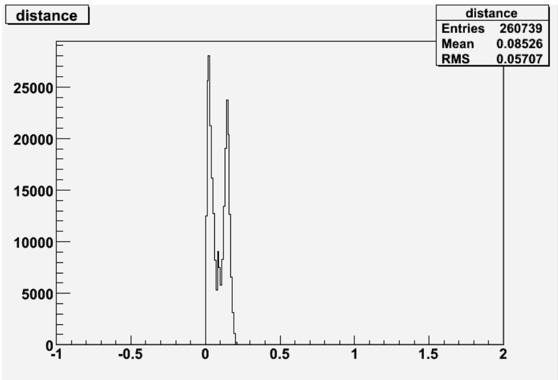
Conformal Mapping on Data



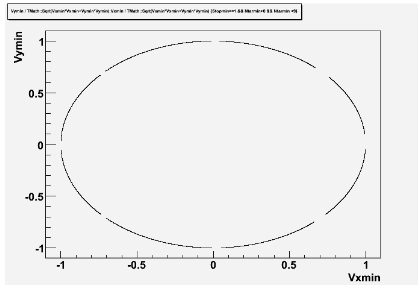
Distance straight line-origin with K^-_{stop} and K^+_{stop} vx,vy,vz coord.



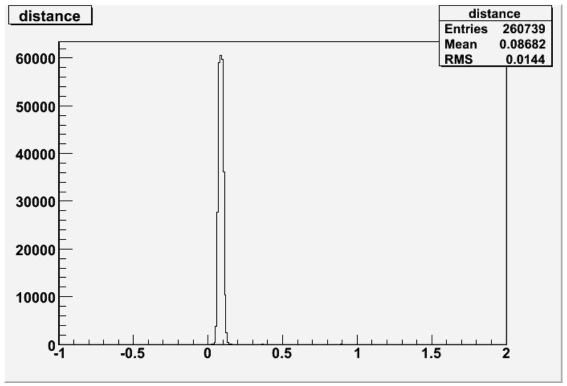
Closer to the origin



Distance with K^-_{stop} and K^+_{stop} Conformal Mapping



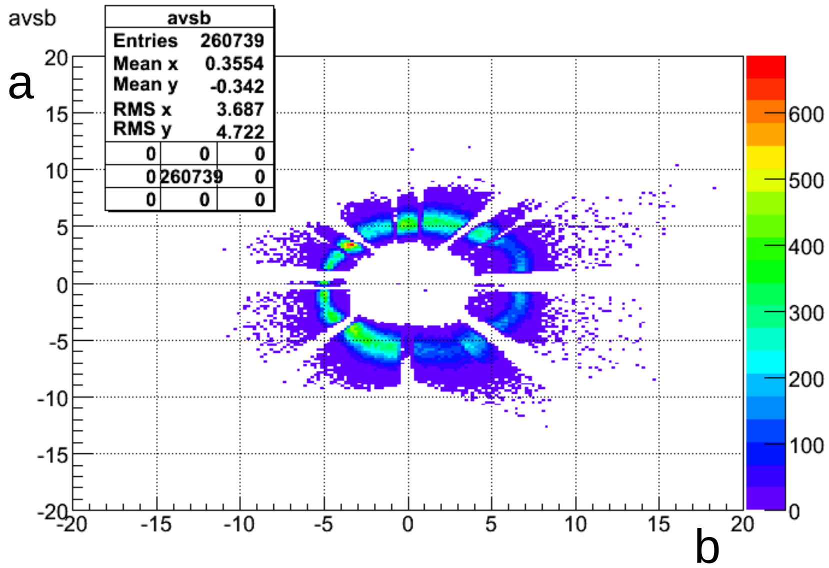
Only one bump

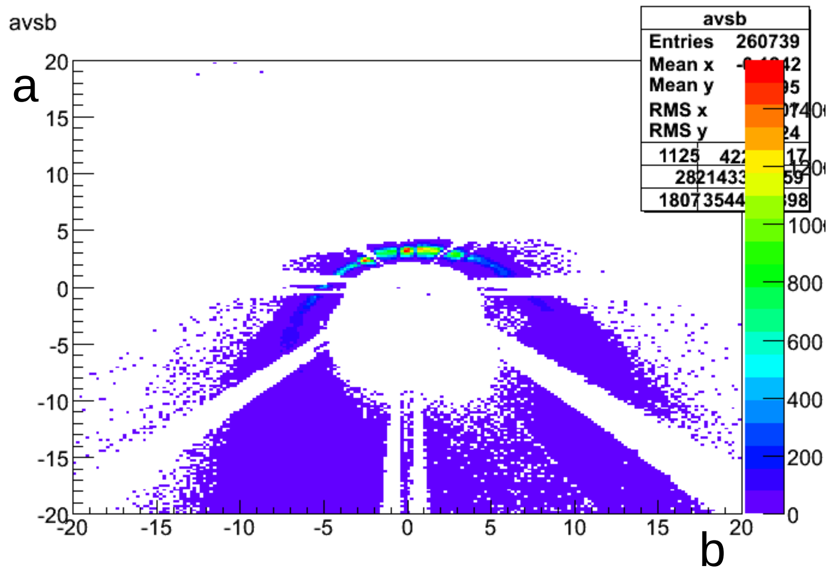


Distance with K^-_{stop} and K^+_{stop} Lorentz transformation and Conformal Mapping

Conformal Mapping on Data

Conformal Mapping x,y $\Rightarrow$ $u = x / \sqrt{(x^2+y^2)}$, $v = y / \sqrt{(x^2+y^2)}$
transforms the circle equation $(x-a)^2+(y-b)^2 = R^2$
to the straight line equation: $v = 1/(2b) - (a/b)u$
With two points we can calculate a,b (circle center coord.)
and R (circle radius):





K^-_{stop} and K^+_{stop}
Lorentz transformation
and Conformal Mapping

K^-_{stop} and K^+_{stop}
without Lorentz transformation
and with Conformal Mapping

Conformal Mapping on Data

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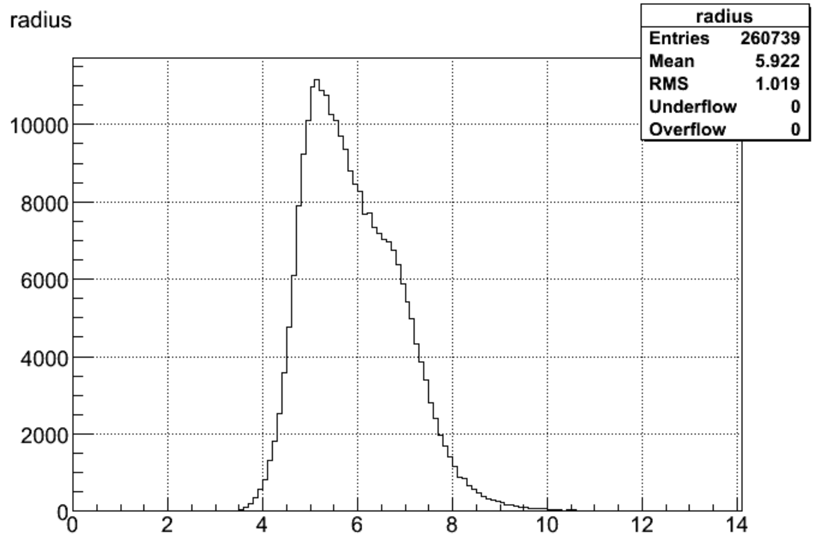
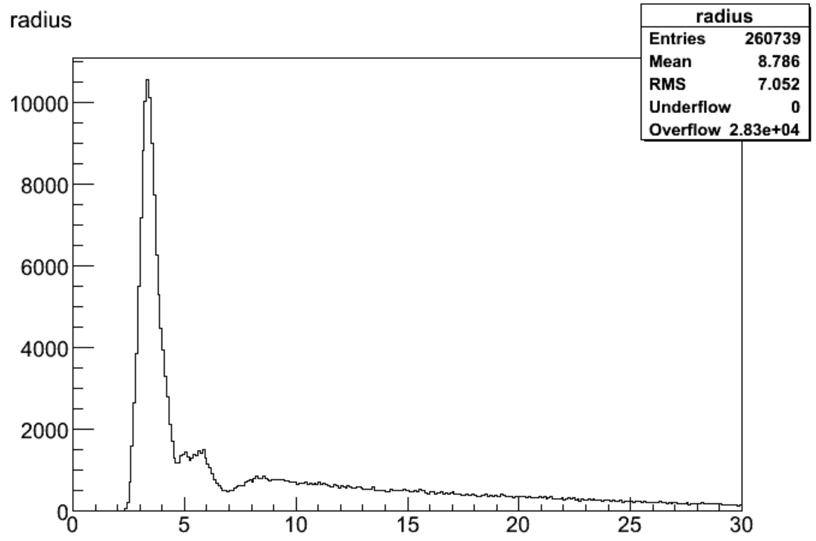


K^-_{stop} and K^+_{stop}
Lorentz transformation
and Conformal Mapping



K^-_{stop} and K^+_{stop}
w/o Lorentz transformation
and Conformal Mapping

Conformal Mapping on Data

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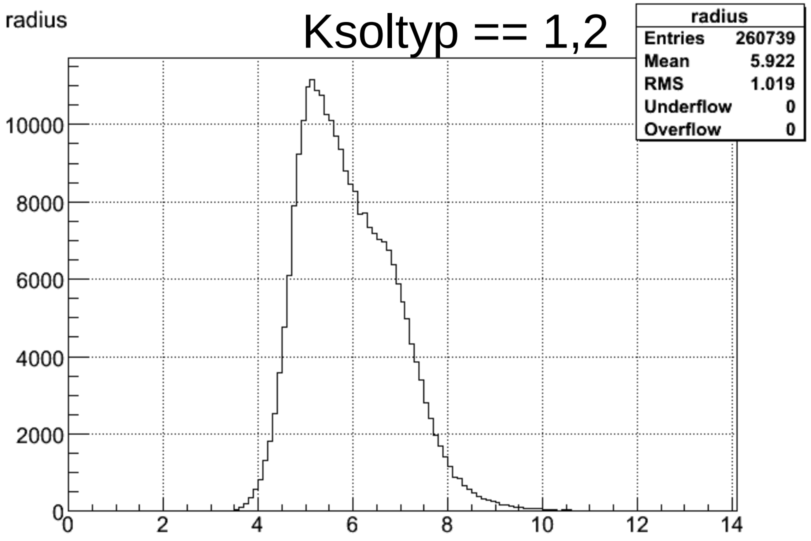
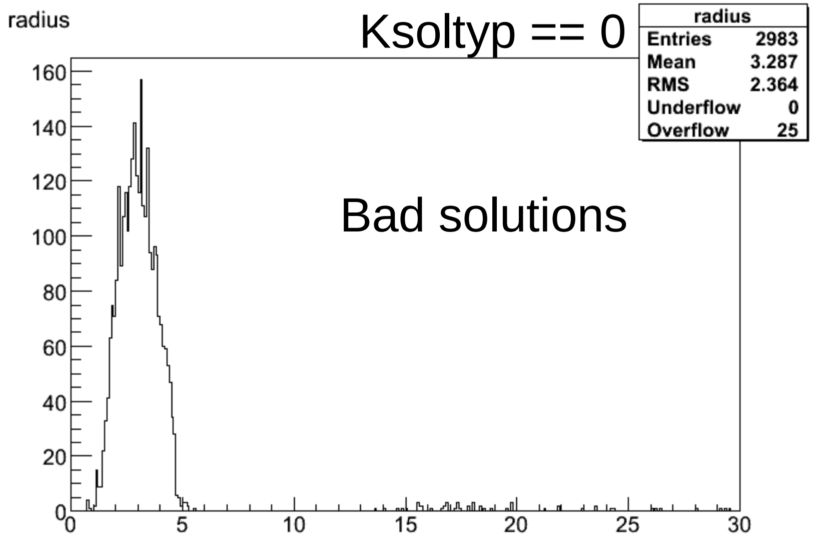


K^-_{stop} and K^+_{stop}
Lorentz transformation
and Conformal Mapping



K^-_{stop} and K^+_{stop}
Lorentz transformation
and Conformal Mapping

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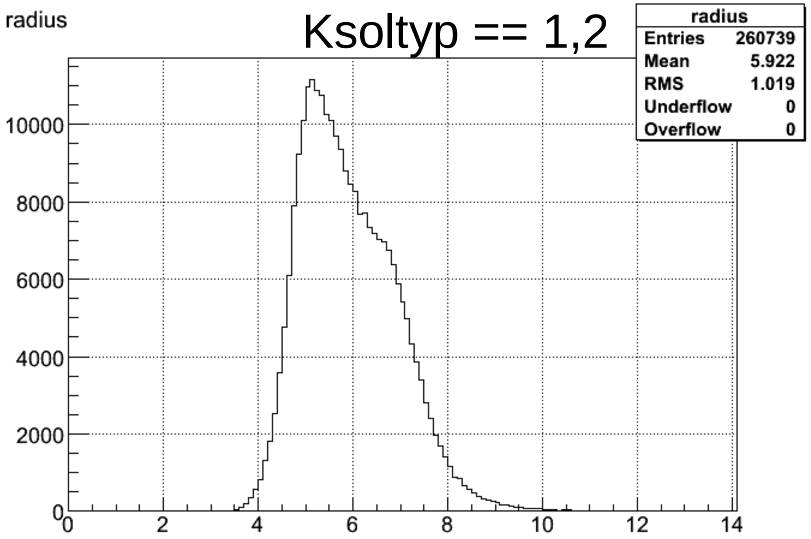
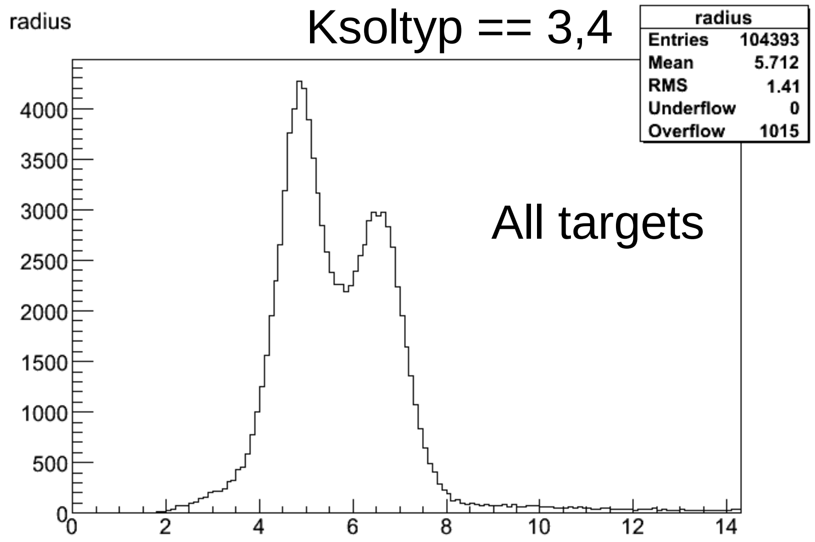


K^-_{stop} and K^+_{stop}
Lorentz transformation
and Conformal Mapping



K^-_{stop} and K^+_{stop}
Lorentz transformation
and Conformal Mapping

Conformal Mapping on Data

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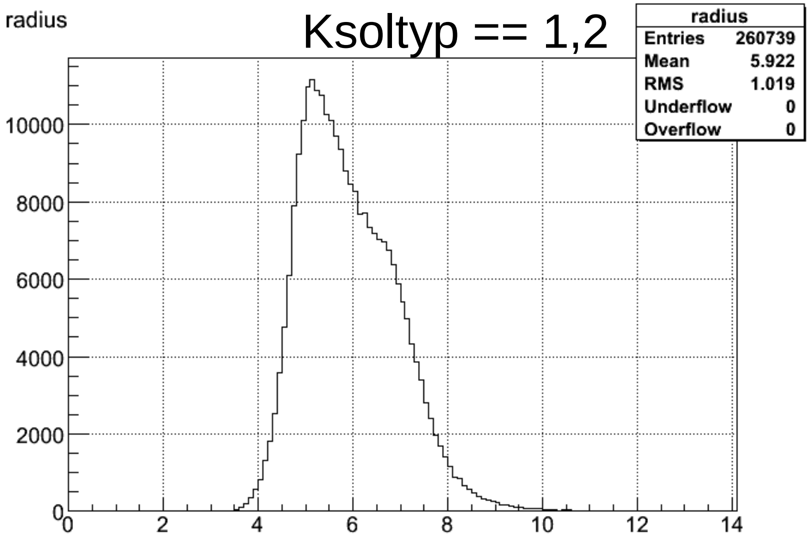

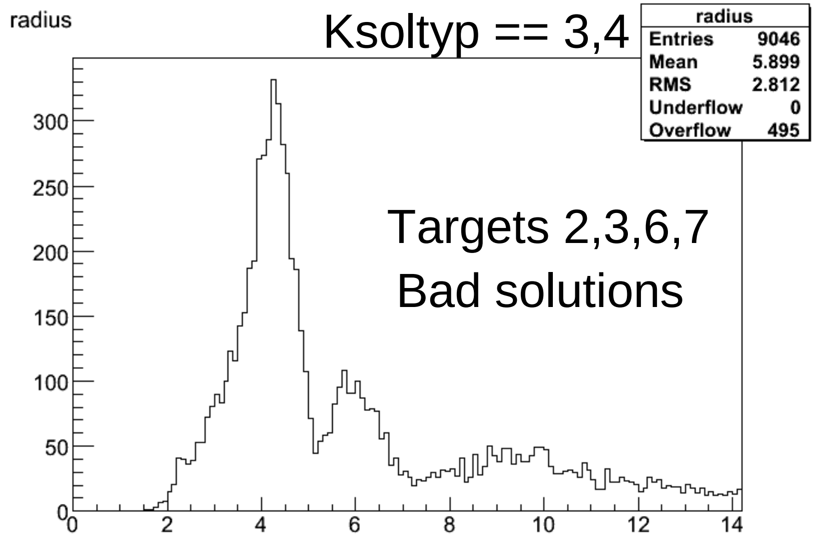

K^-_{stop} and K^+_{stop}
Lorentz transformation
and Conformal Mapping

K^-_{stop} and K^+_{stop}
Lorentz transformation
and Conformal Mapping

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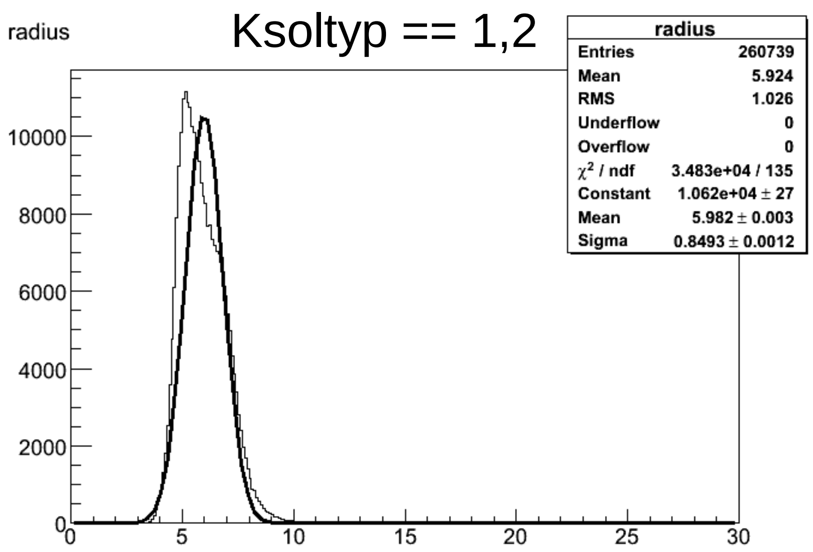
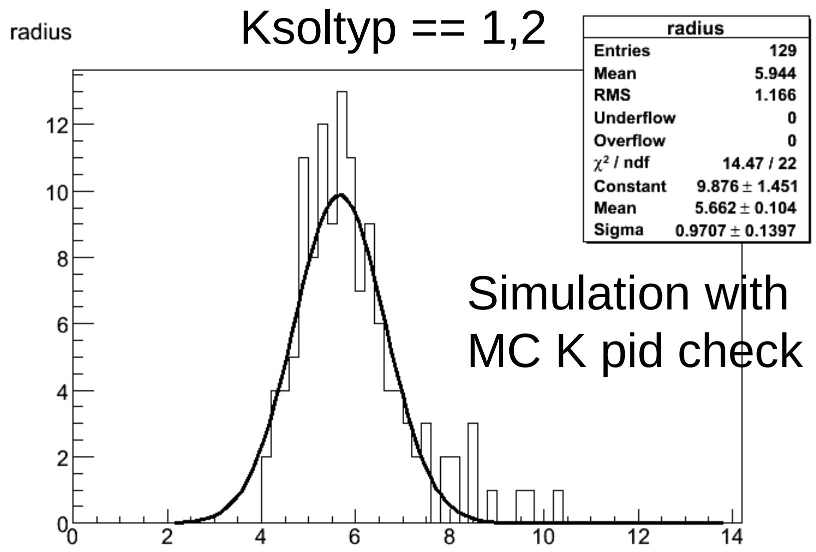


K^-_{stop} and K^+_{stop}
Lorentz transformation
and Conformal Mapping

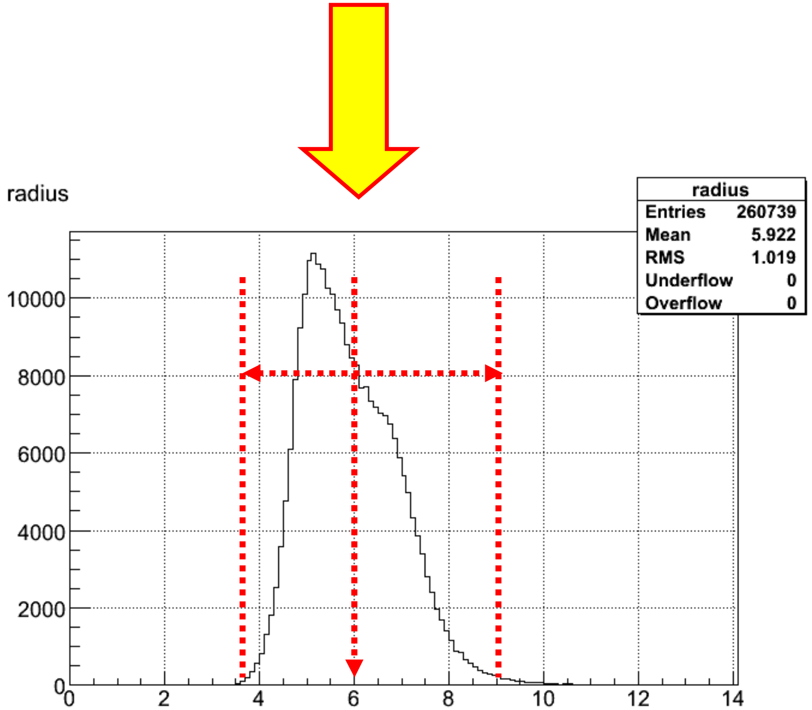


Simulation with
MC K pid check

K^-_{stop} and K^+_{stop}
Lorentz transformation
and Conformal Mapping

Conformal Mapping on Data

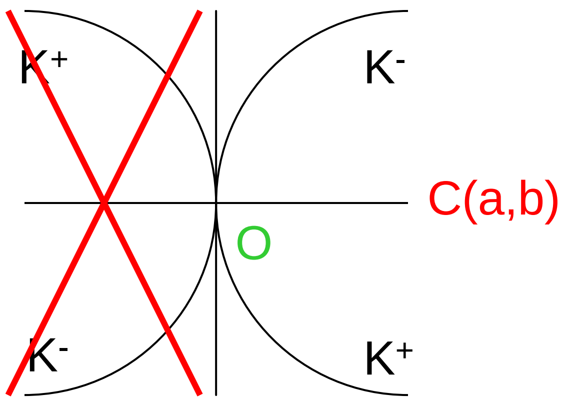
Discrimination of the right $K^- K^+$ pair

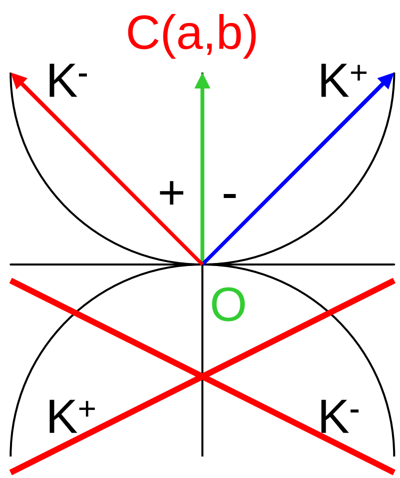


Conformal Mapping on Data

Choosing K^-_{stop} and K^+_{stop} with Lorentz transformation on Conformal Mapping is without ambiguities:

Discrimination btw K^-K^+ and K^+K^- solution looking at a,b center coordinates (only with Lorentz transformation) in respect to the origin:





C(a,b) x $K^{\pm}$ on Φ c.m. frame