Measurements of Neutral Kaons and Lambdas Production on Au+Au collisions at 62 GeV

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Topics

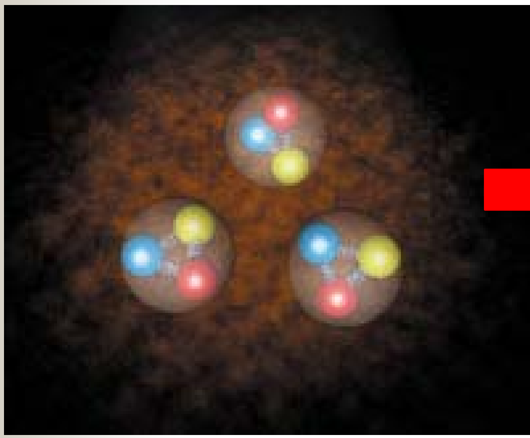
- ***Motivation***
  - ***QCD Phase Diagram***
  - ***Strangeness Production***
  - ***Why 62 GeV?***

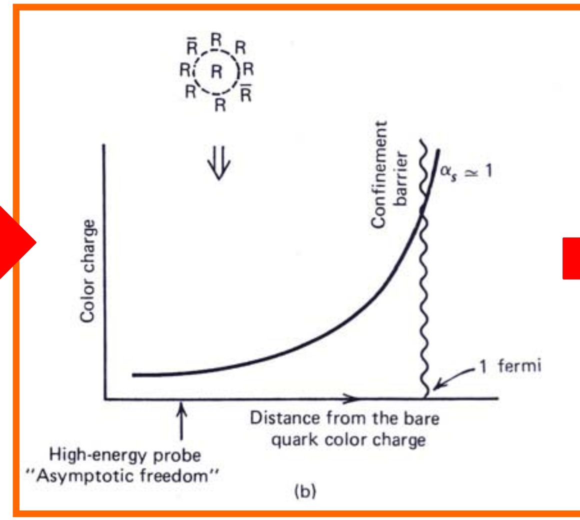
- ***STAR (Solenoidal Tracker At RHIC)***
  - ***TPC***
  - ***SVT***

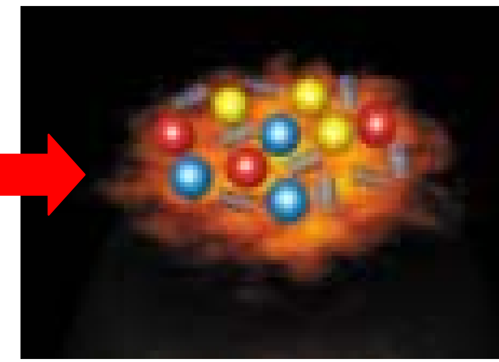
- ***Analysis***
  - ***V0 Reconstruction***

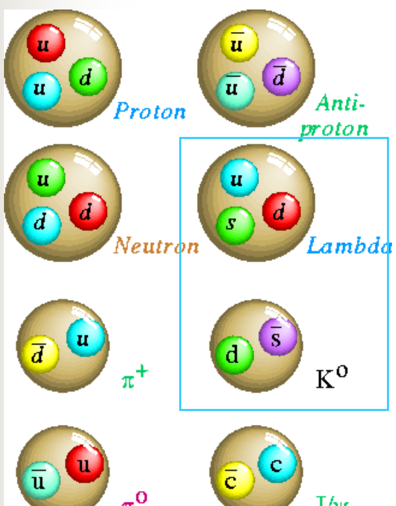
- ***Preliminary Results***

Hadronic Matter X QGP









$$V(r) = -\frac{4\alpha_S}{3r} + kr$$

QGP Latest definition

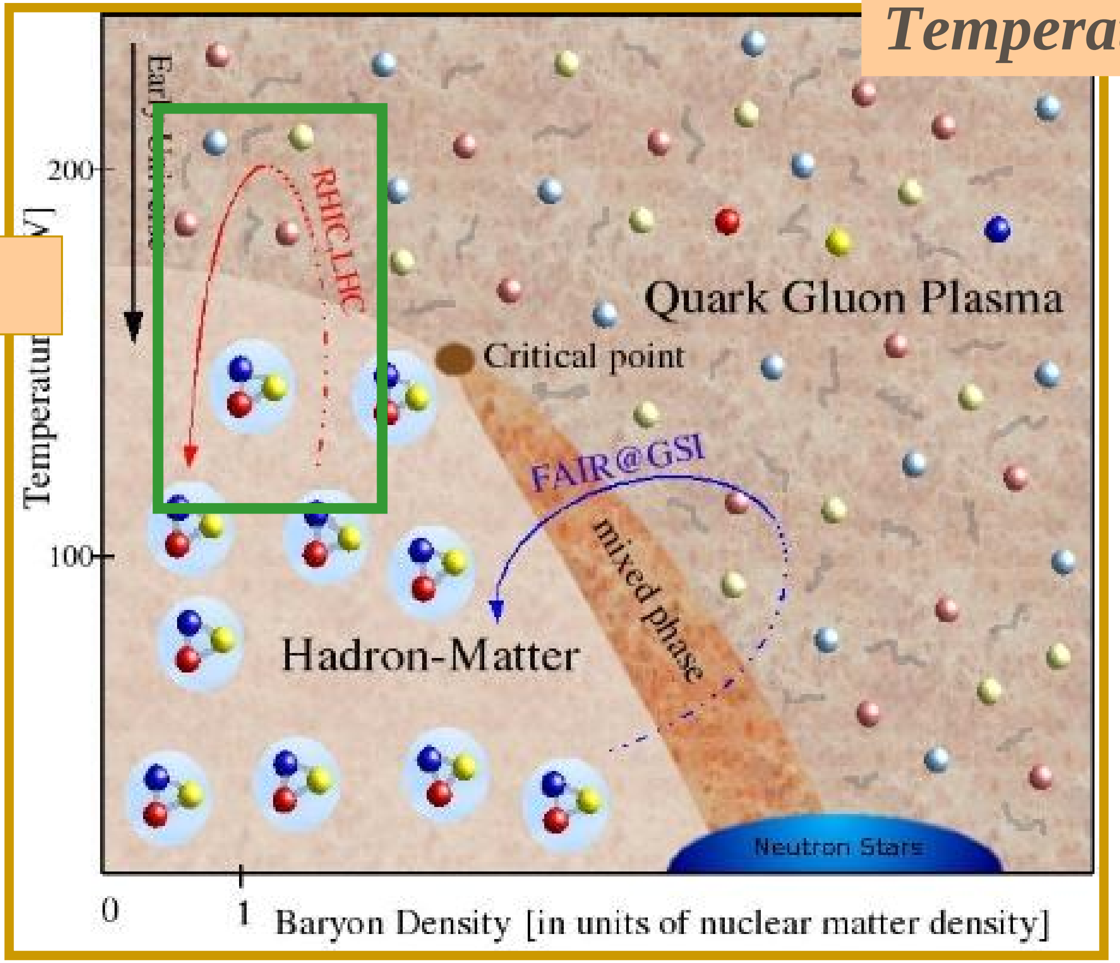
"A locally thermally equilibrated state of matter in which quarks and gluons are deconfined from hadrons, so that color degrees of freedom become manifest over nuclear, rather than merely nucleonic, volumes."

April 18, 2005

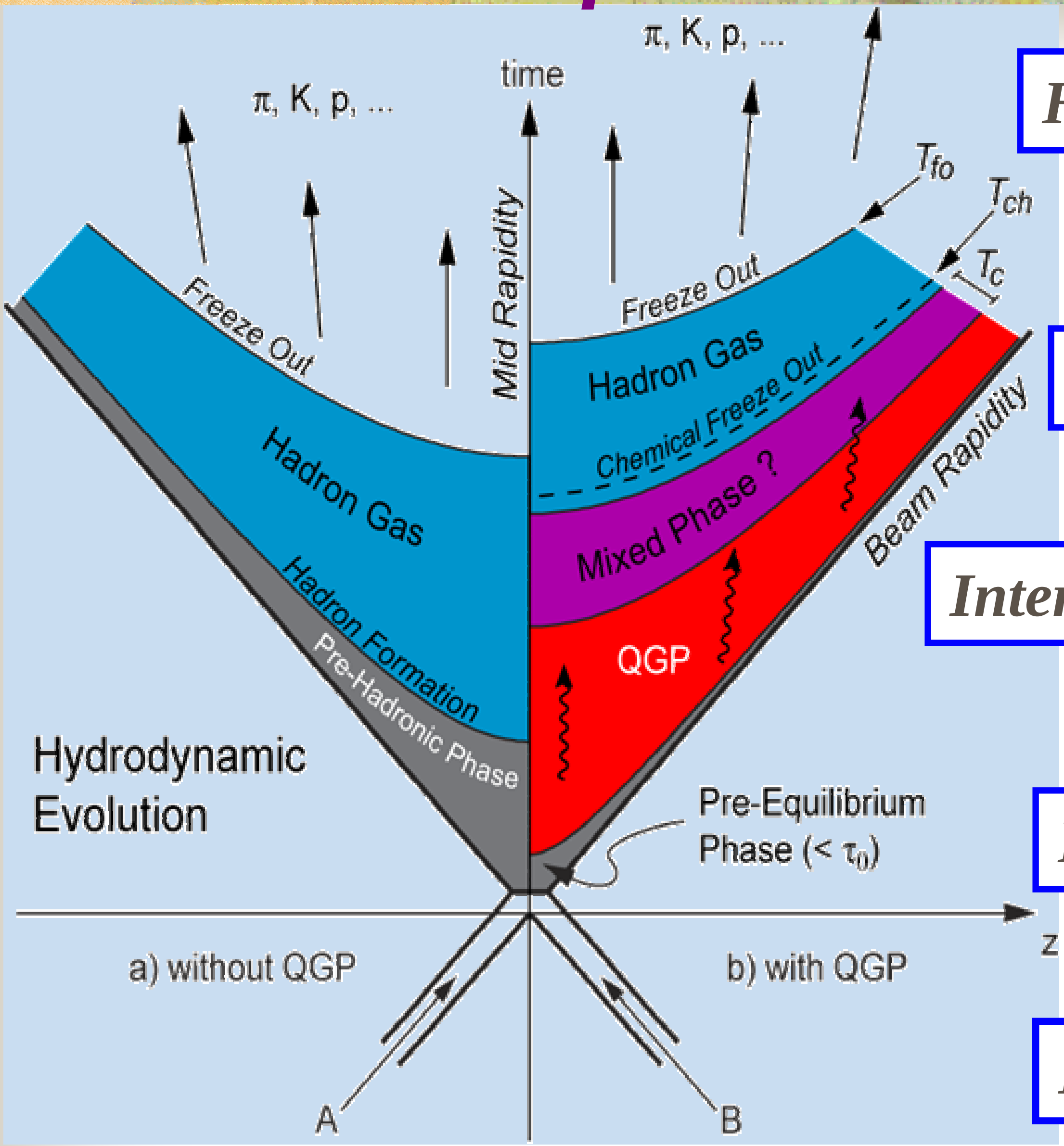
QGP

Which Temperature?

170 MeV



Time Evolution of nucleus-nucleus collisions



Hadronization Stage

Final Expansion

Intermediate thermalization

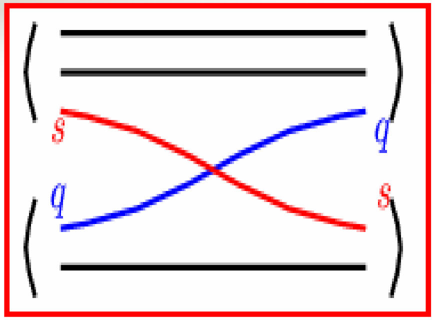
Pre-Equilibrium

Parton Scattering

Collision Dynamics

Hard Parton Scattering	Intermediate Thermalization	Final Hadronization
High p_t particles	Mini-jets	Size and Temperature ⇓ p_t spectra
Jets	Strangeness	
High Energy γs	Anti-Baryons	
Charmed Mesons	ϕ meson	

Strangeness Production

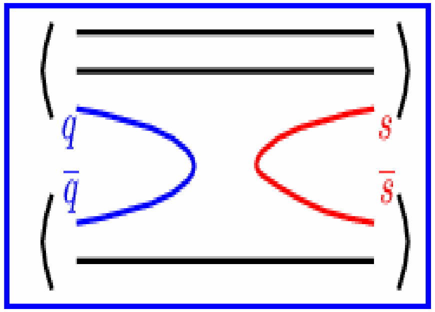


Hadronic Gas

- ***Need much more energy to produce "strange particles":***

  $\pi + N \rightarrow \Lambda + K$ (Q=530 *MeV*) (endotermic)

  $K + \overline{N} \rightarrow \overline{\Lambda} + \pi$ (exotermic)

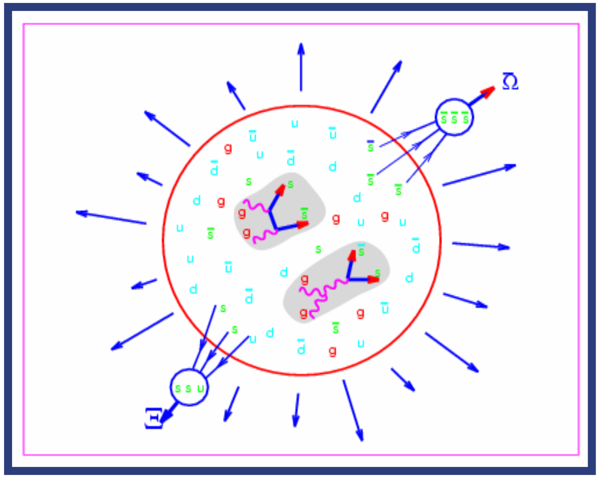


Quark Gluon Plasma

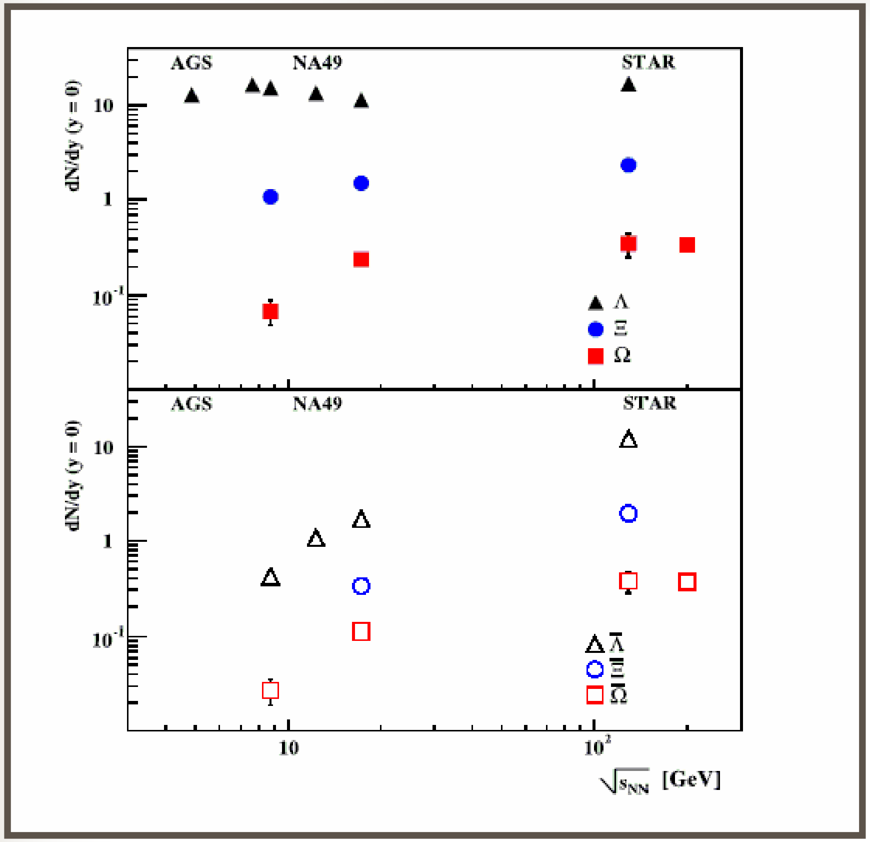
(J. Rafelski, B. Müller, PRL 48 (1982), 1066)

- Less energy is necessary to produce "strange"particles

$$g + g \rightarrow s + \bar{s} \quad (Q \approx 2m_s \approx 300\ MeV)$$



Why 62 GeV ?

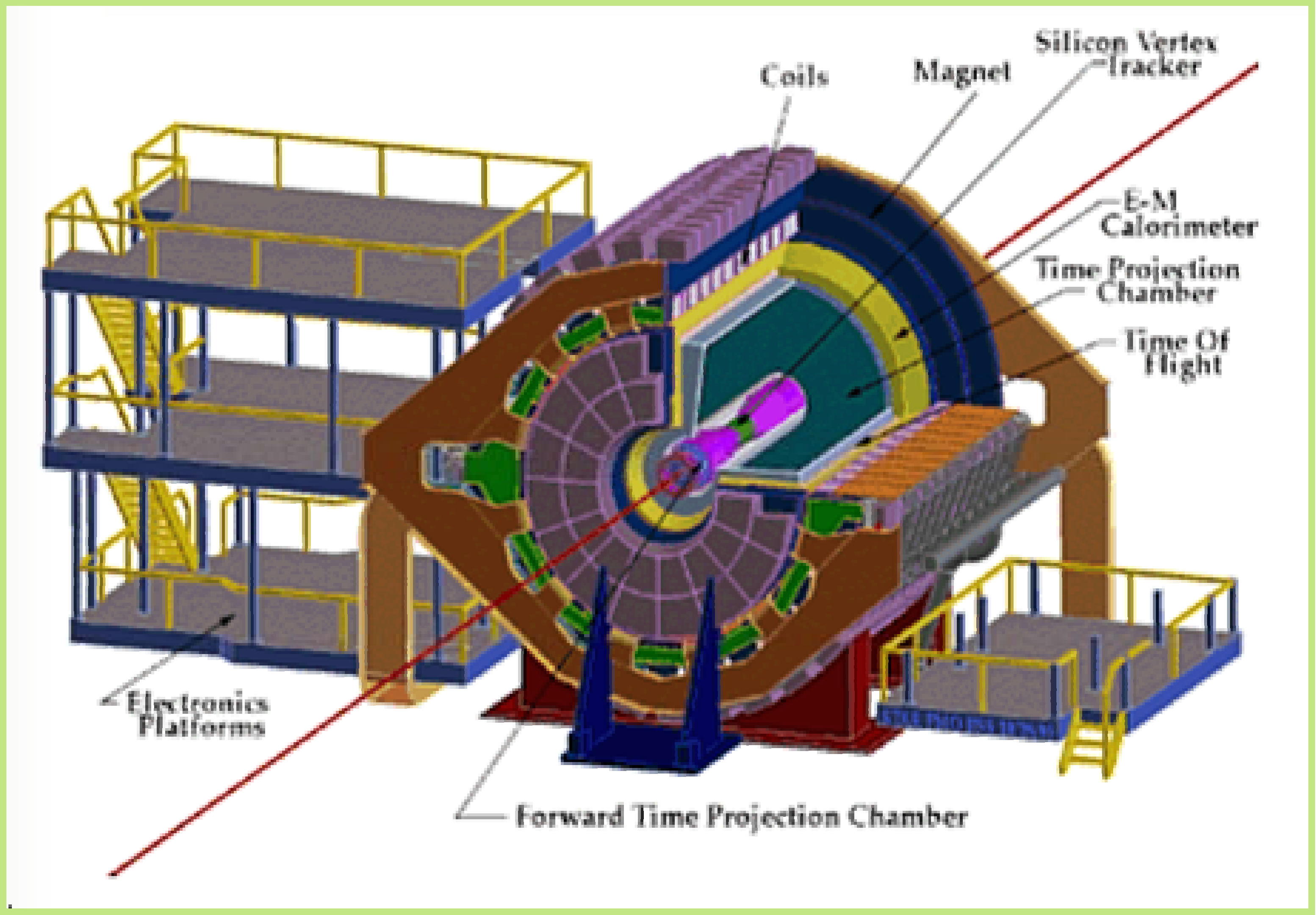


Why 62 GeV?

Following "step by step"the evolution

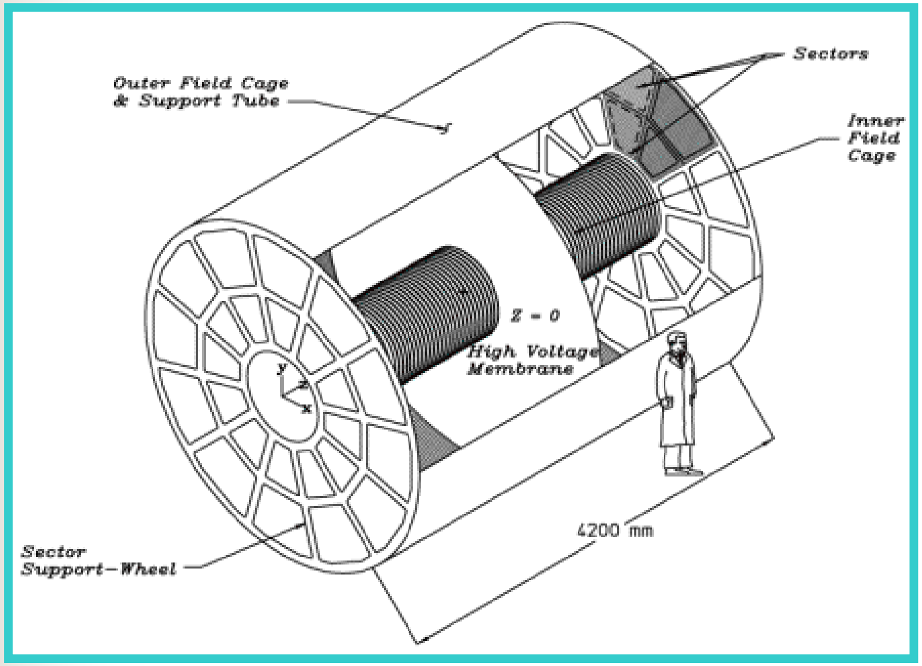
Cheking if this evolution is *smooth* or not

STAR


Coils
Magnet
Silicon Vertex Tracker
E-M Calorimeter
Time Projection Chamber
Time Of Flight
Electronics Platforms
Forward Time Projection Chamber

TPC -Time Projection Chamber

Cylindrical gas-filled tracking chamber



4.2 m in length

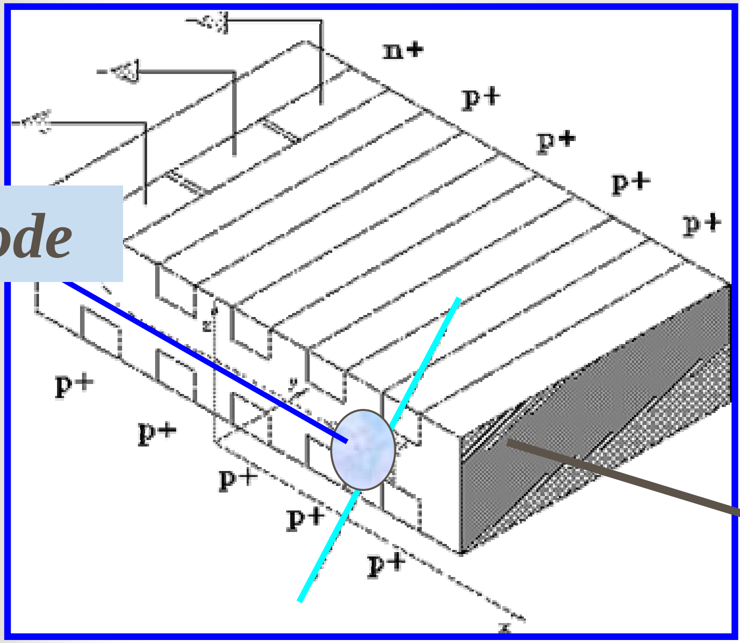
4.0 m in diameter

Inner radius 50 cm

p_t > 150 MeV/c

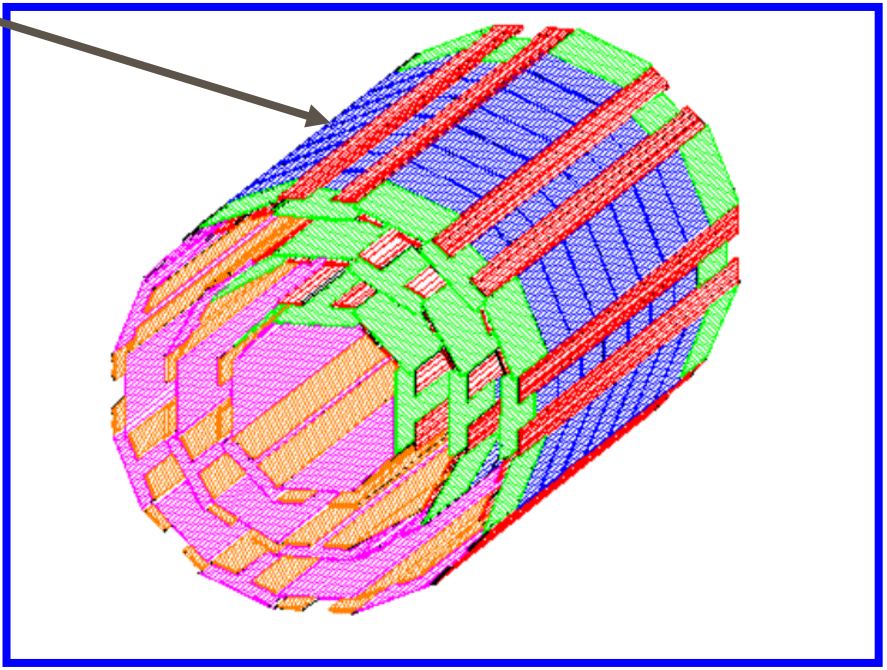
Silicon Vertex Tracker (SVT)

Anode



216 SDD-*Silicon Drift Detector*

pt > 40MeV/c



Information about:

Position and Time(100ns)

SVT Capabilities

Primary Track Reconstruction

Good Efficiency for pt > 40 MeV/c

Secondary Track Reconstruction

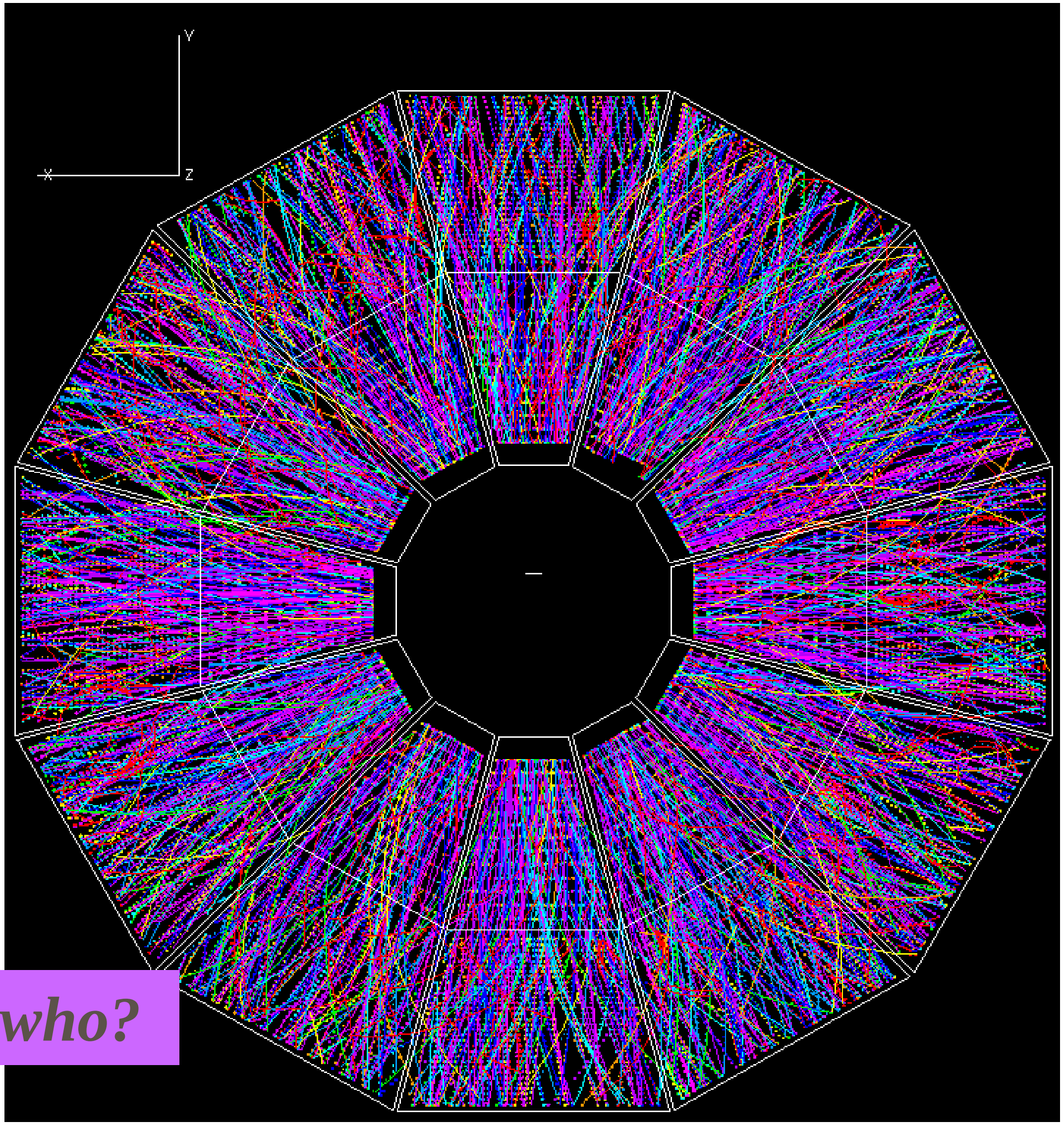
- **Superior position resolution**
- **Identification and reconstruction of decay vertices**
- **Reducing the combinatoric background**

Statistically significant sample of *short lived particles*

Analysis

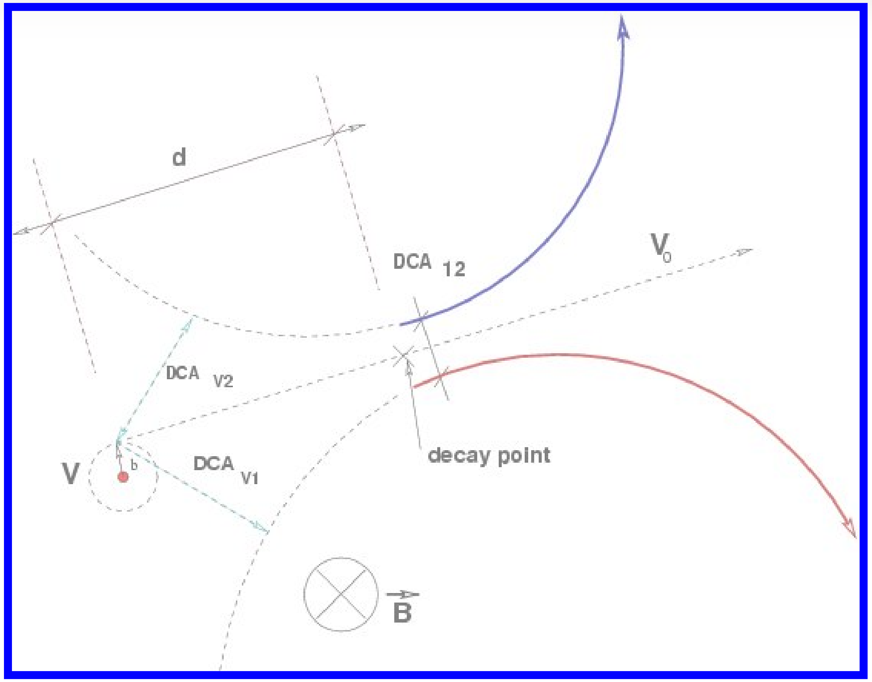
Particle	*Quark Content*	*Dominant decay mode*	*Lifetime ($c\tau$)*
$K^{\pm}$	$(u\bar{s}, \bar{u}s)$	$\mu_{\pm} + \nu_{\mu}$	***3.7 m***
K^{0}_{s}	$(d\bar{s}+\bar{d}s)$	$\pi^{+} + \pi^{-}$	***2.7 cm***
ϕ	$s\bar{s}$	$K^{+} + K^{-}$	***44.6 fm***
Λ	uds	$p + \pi^{-}$	***7.9 cm***
Ξ-	dss	$\Lambda + \pi^{-}$	***4.9 cm***
Ω-	sss	$\Lambda + K^{-}$	***2.5 cm***

Real Tracks



Who is who?

Track Reconstruction



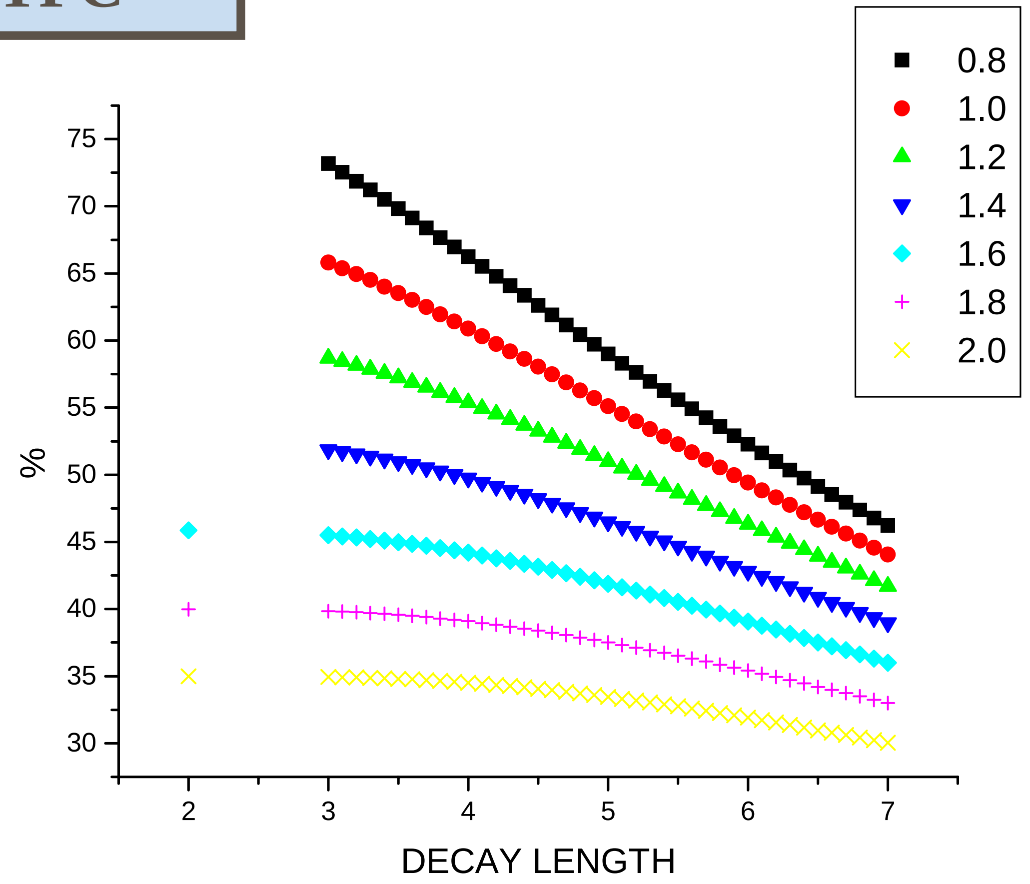
$$M_{invariant} = \sqrt{(E_1 + E_2)^2 - p^2_{mother}}$$

$$p^2_{mother} = (p_{x1} + p_{x2})^2 + (p_{y1} + p_{y2})^2 + (p_{z1} + p_{z2})^2$$

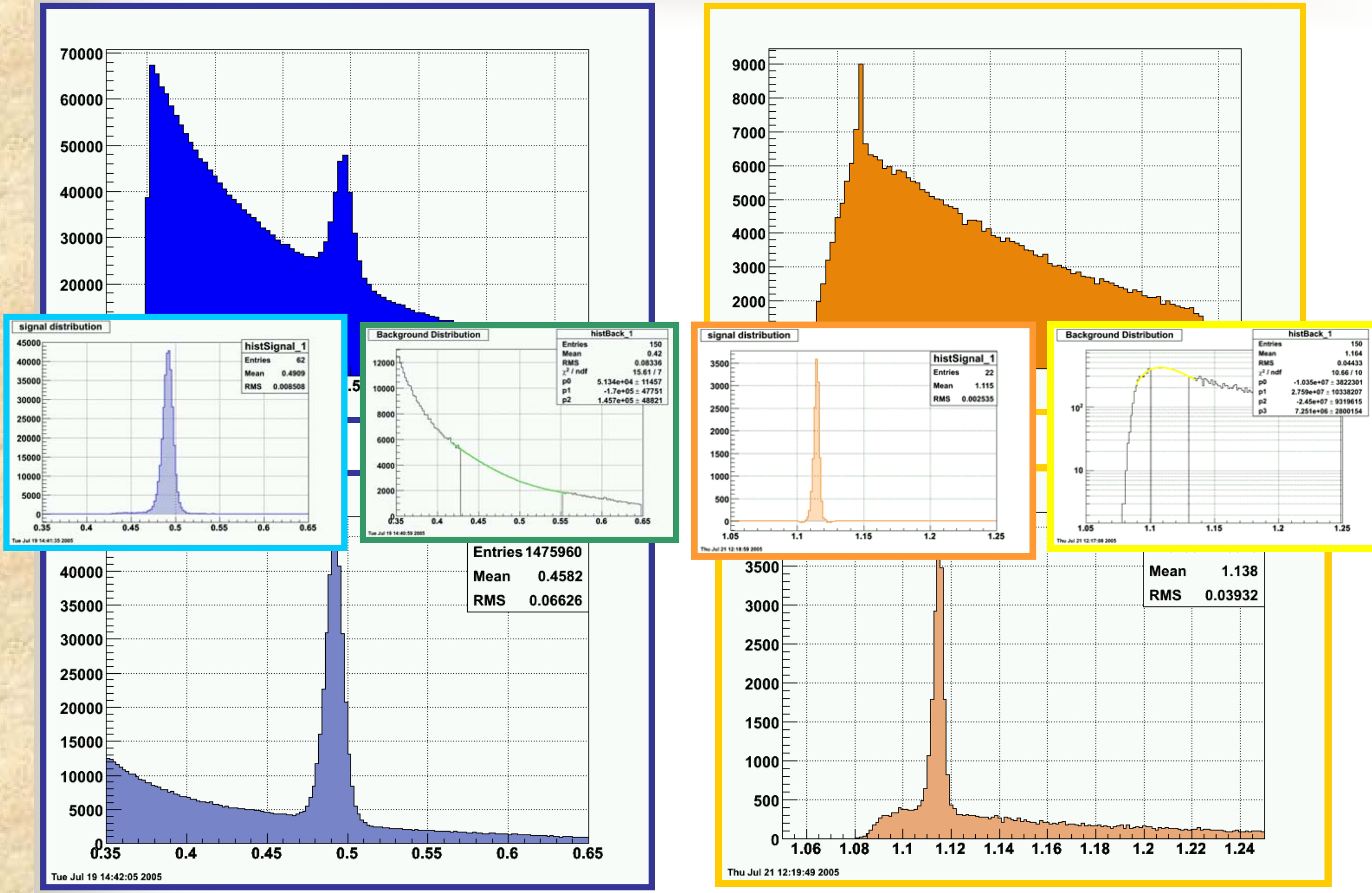
Selecting Cuts

Dca Positive Daughter to PV

Kaons-TPC



Real Data Kaon and Lambda (TPC)



Correction Factors

Geometrical Acceptance

Daughters do NOT make it into the detector

Particle decayed in another mode

Reconstruction Efficiency

Particle pass the acceptance but are NOT reconstructed

Only one daughter is reconstructed

They are not formed into V0 candidates

Fail the Geometrical Cuts

Embedding Chain

Process which envolves

Generation of the Monte Carlo Particles

Their simulation on TPC

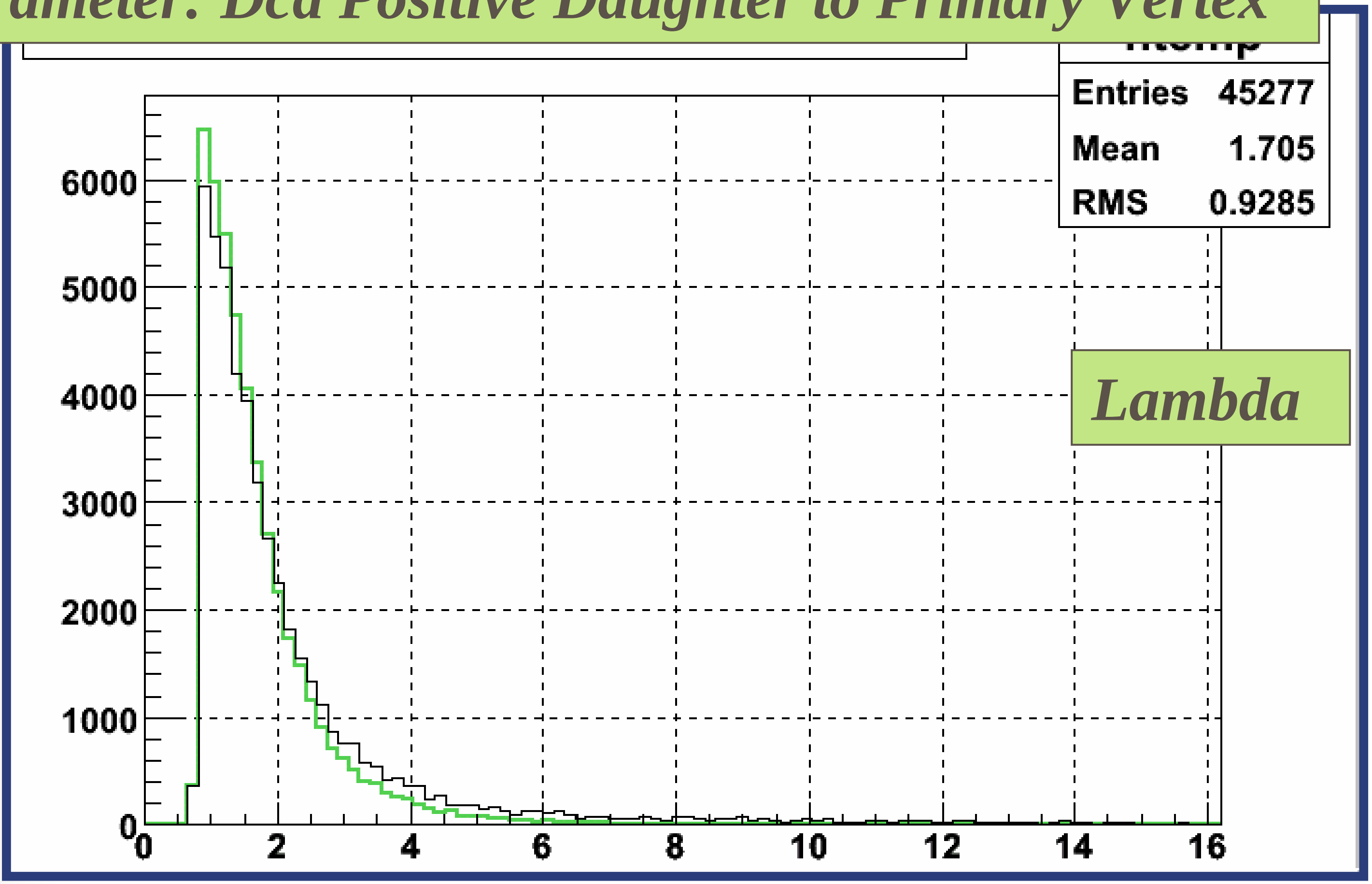
Taking a real event

Event Reconstruction

Association Process between MC and reconstruction information

Embedding

Parameter: Dca Positive Daughter to Primary Vertex



Lambda

Real Data

Embedding

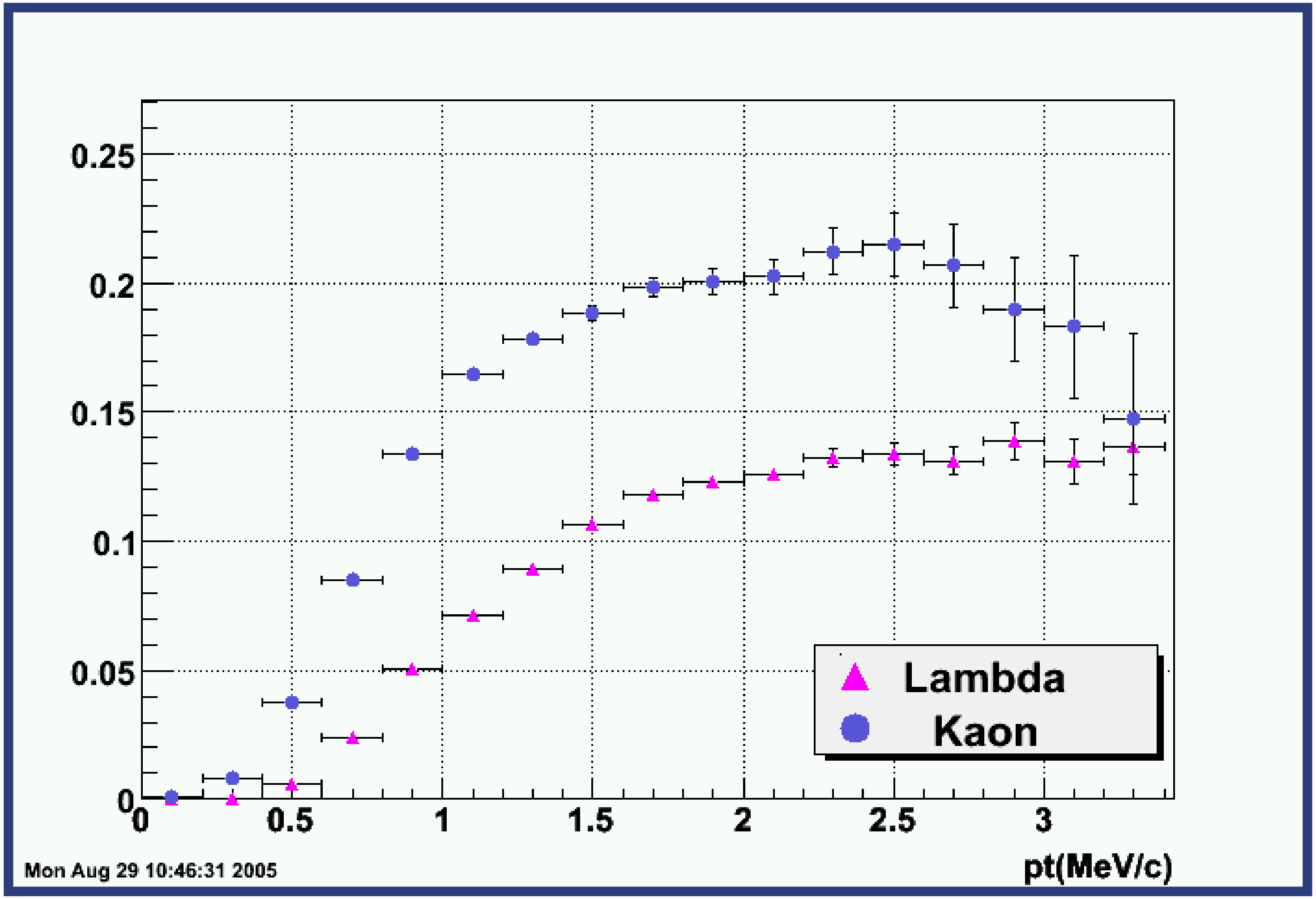
Total Correction

$$\text{Acceptance} = \frac{\text{Number of particles that pass on Geometrical Cuts}}{\text{Number of particles that are generated}}$$

$$\text{Efficiency} = \frac{\text{Number of Particles that are reconstructed}}{\text{Number of Particles that are accepted}}$$

Total Correction = *Acceptance X Efficiency X Branching Ratio*

Efficiency and Acceptance (TPC)



Future

- *Include the SVT in Analysis*
- *Compare the results between TPC and SVT*
- *Statistical Analysis*
- *Theoretical Models*