



$$\tau^{\pm} \longrightarrow \pi^{\pm} \pi^{+} \pi^{-} \pi^{0} \nu$$

Roger Barlow

Durham Meeting: April 2005





Talk does not contain

Selection details - 14 cuts, tag by lepton or π or ρ

π/K separation

Detailed Monte Carlo comparisons

Normalisation

Background subtraction

All the data

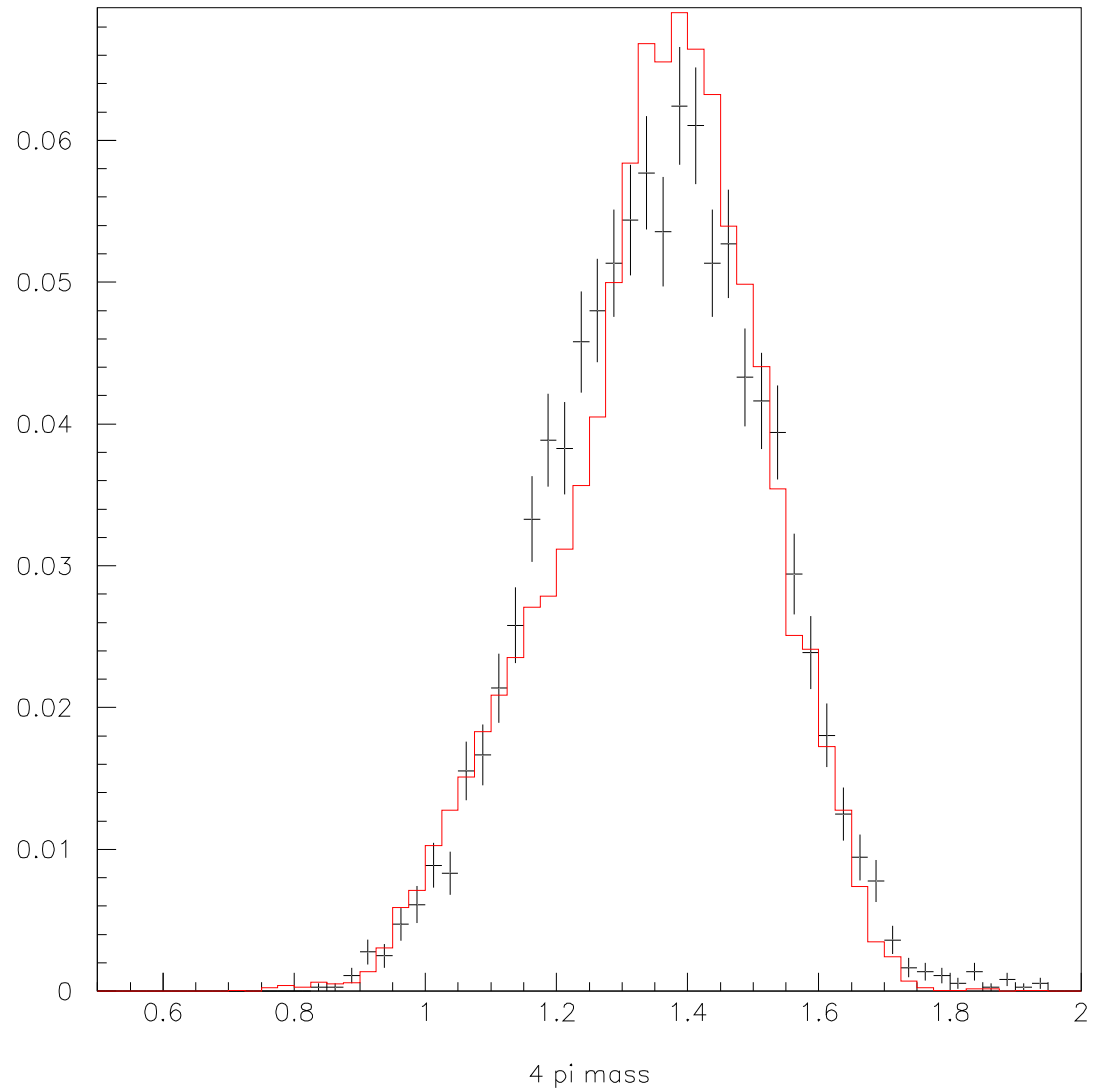
Collaboration approval



$$M(4\pi)$$

No obvious structure

Monte Carlo (red)
simulation of
hadronic τ decays
far from perfect
agreement with data
(black)





$M(3\pi)$

With $\tau^+ \rightarrow \pi^+ \pi^+ \pi^- \pi^0$
(+C.C.):

Three charge states:

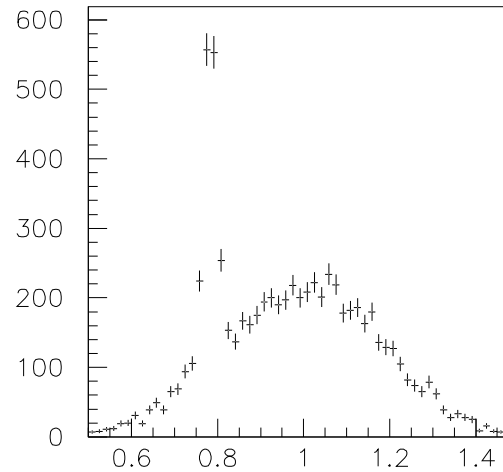
Neutral: $\pi^+ \pi^- \pi^0$
(times 2)

Large ω peak

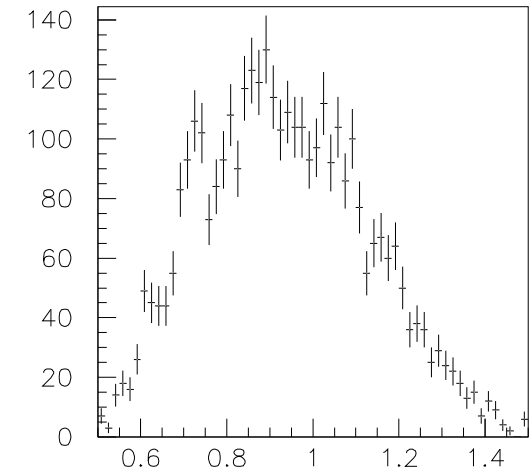
Charge one: $\pi^+ \pi^+ \pi^-$

Charge two: $\pi^+ \pi^+ \pi^0$

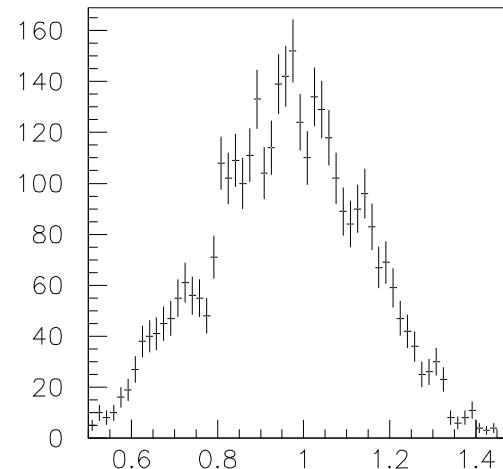
Charge one state (red)
mass lower than charge two state (green).



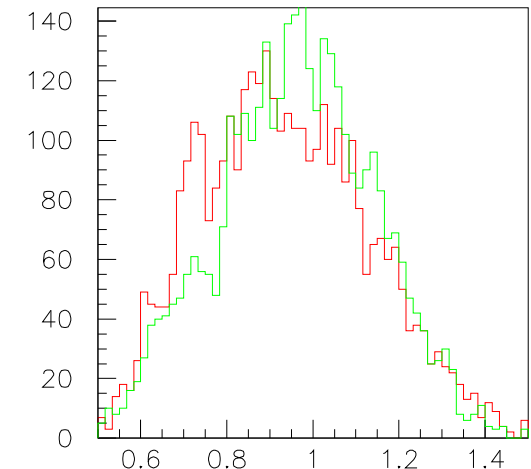
$(3\pi)^0$ mass



$(3\pi)^+$ mass



$(3\pi)^{++}$ mass



$(3\pi)^+$ mass

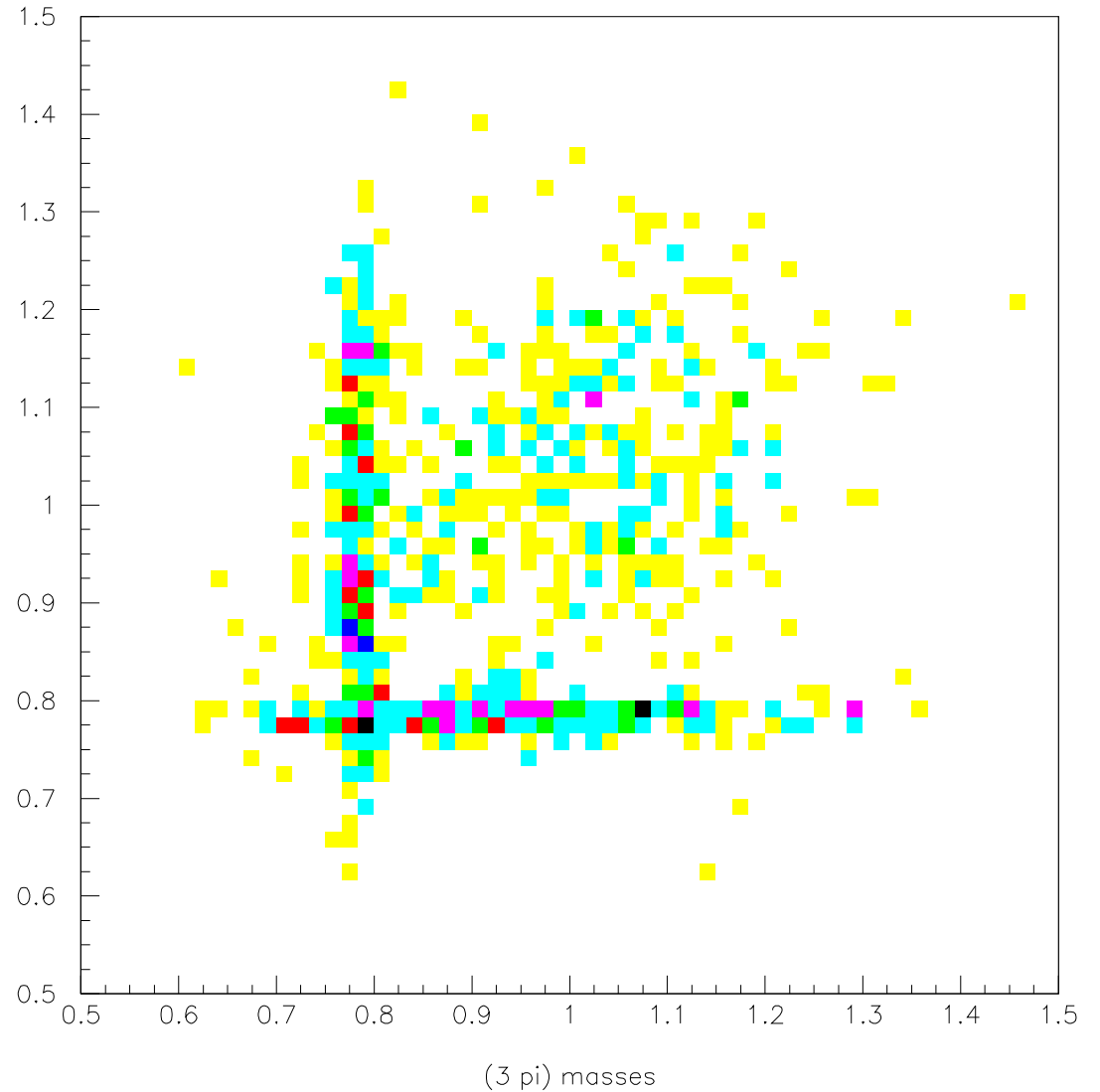


$M(3\pi)$ correlations

Mass plot of two neutral combinations

Strong structure. Much is $\omega\pi$ and much isn't.

Nothing obvious in other $M(3\pi)$ and $M(4\pi)$ correlation plots

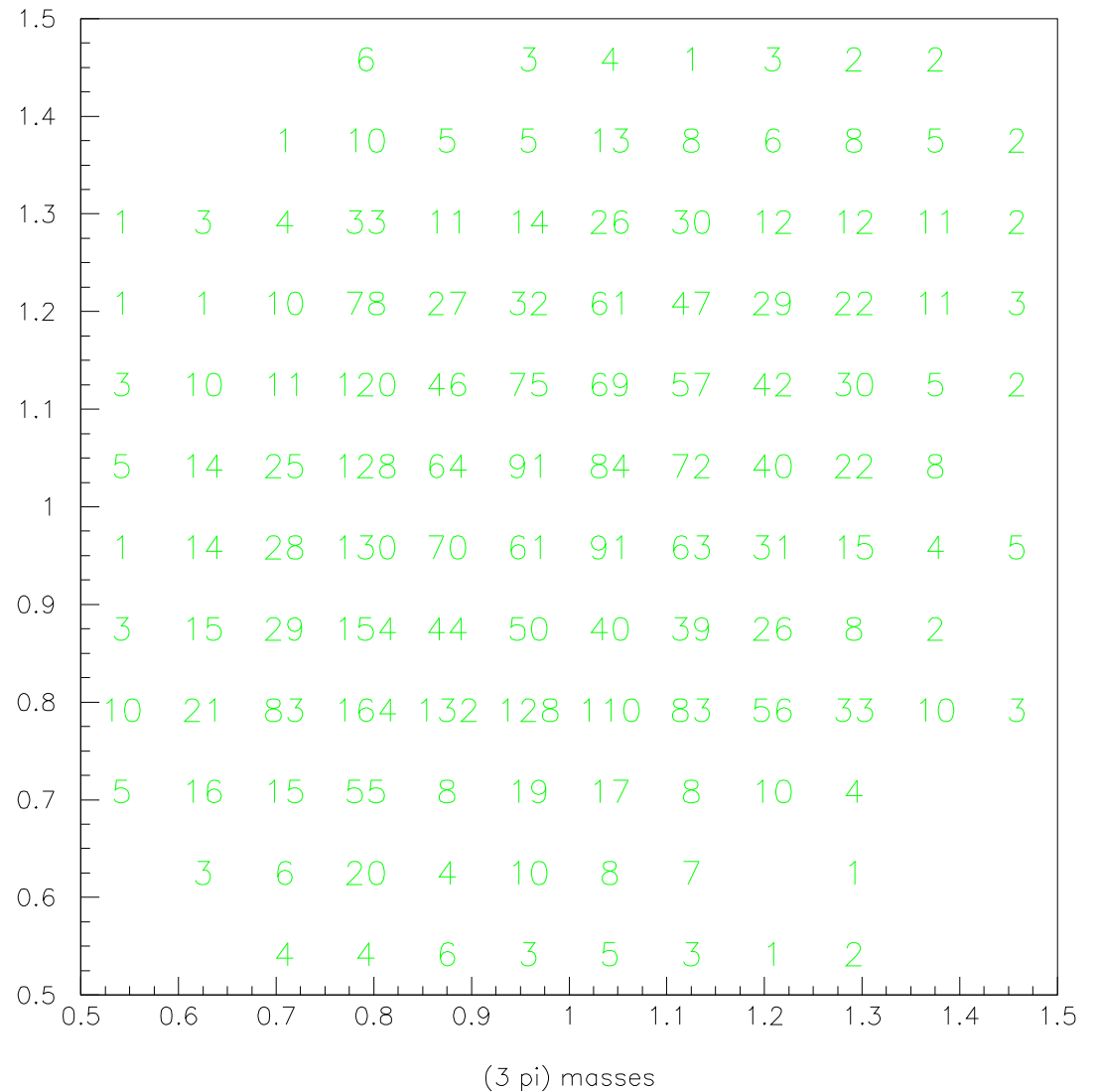




Interference?

Indications that peak
is less than the sum of
its parts.

Destructive interference?





Study of $\omega\pi$ events

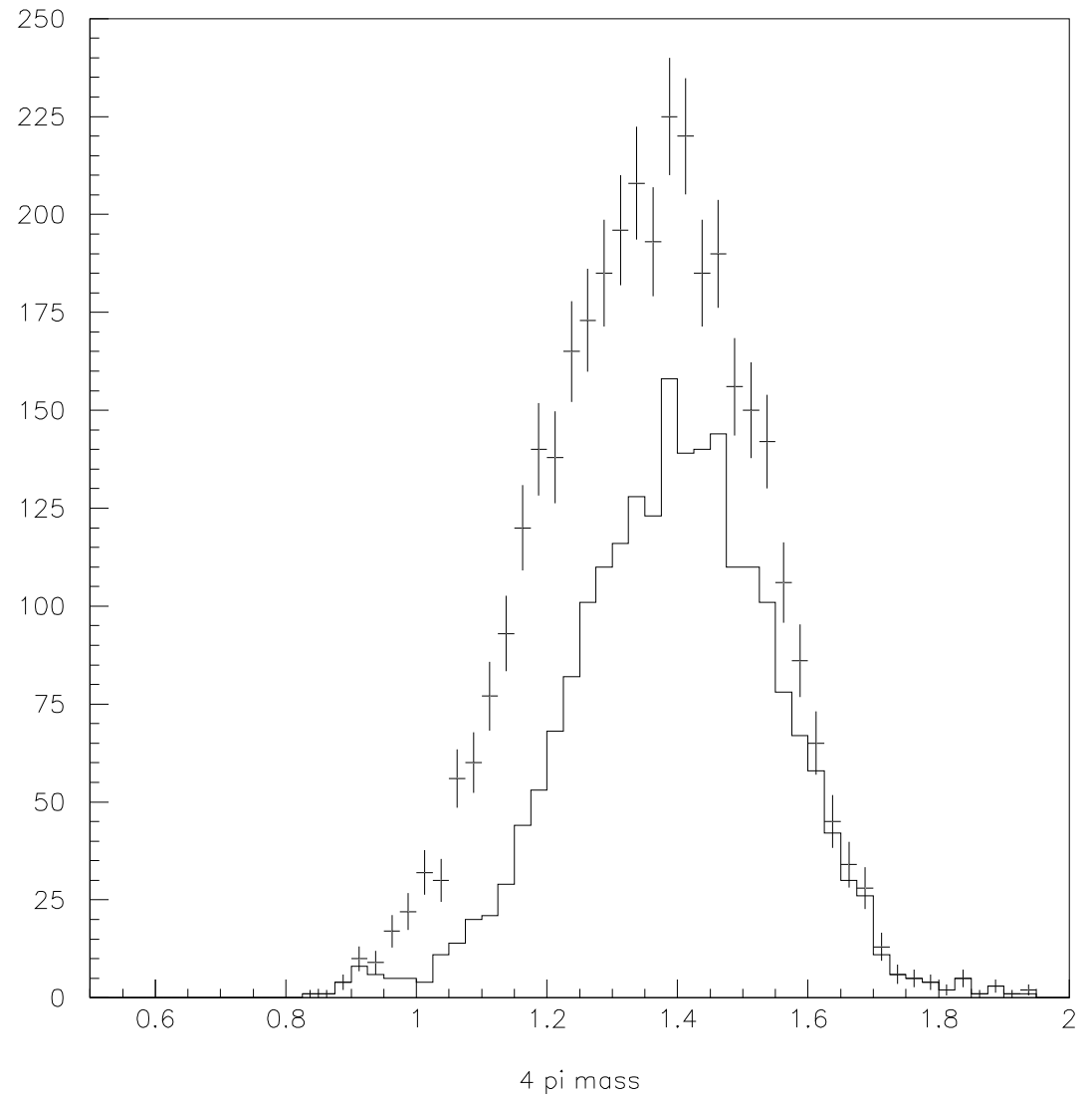
In progress. Straightforward. Dalitz plot behaviour and angular distributions of lone pion as expected and as seen in previous experiments.



Remove ω events

ω produced at
low $M(4\pi)$ values

Is this dynamics
or kinematics?

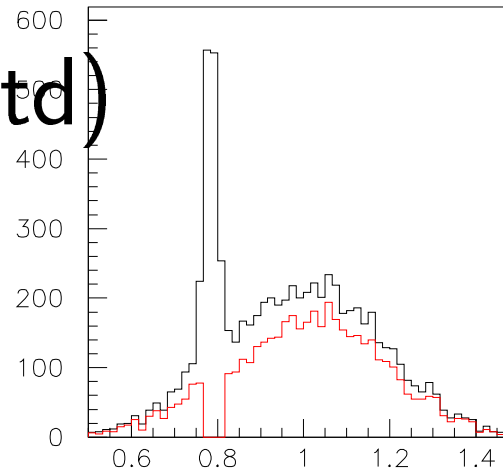




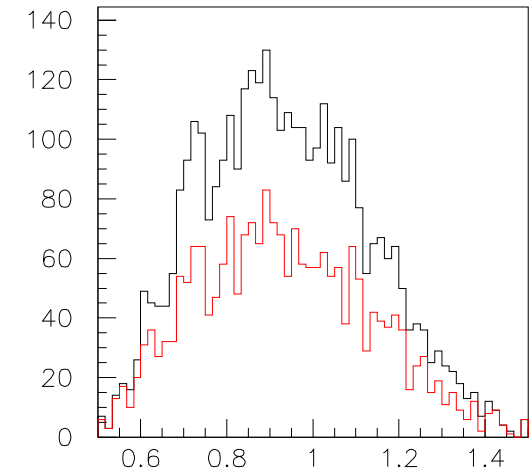
Remove ω events (contd)

No great effect on other 3π mass distributions

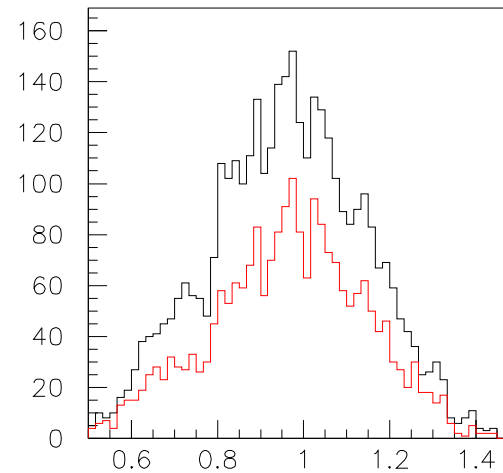
Difference between plus-one and plus-two masses persists



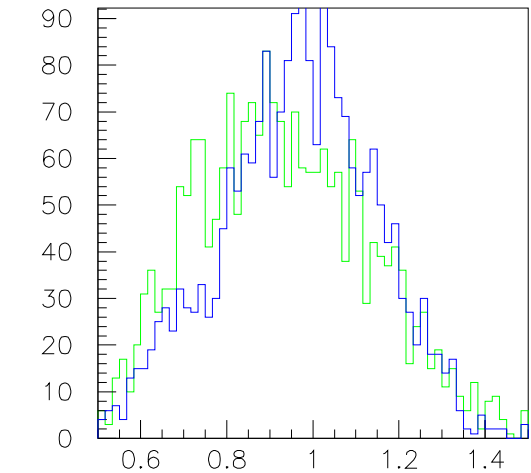
(3 pi)0 mass



(3 pi)+ mass



(3 pi)++ mass



(3 pi)+ mass



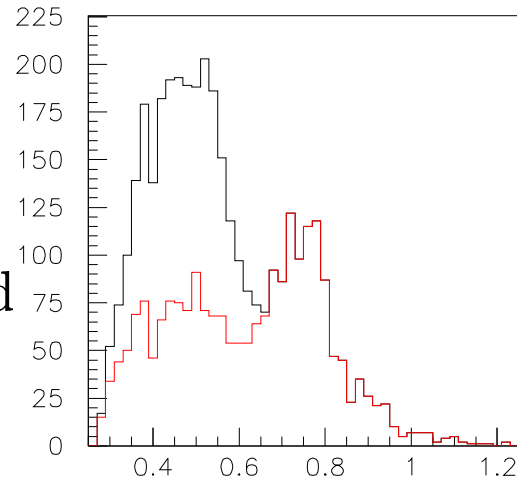
$M(2\pi)$ distributions

Total and with ω removed

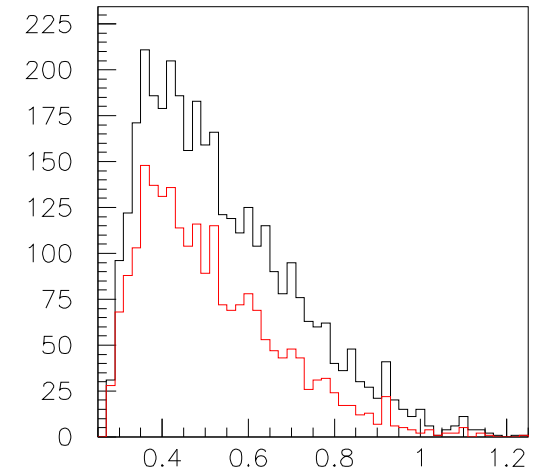
$\pi^-\pi^0$ has very strong ρ

$\pi^+\pi^0$ has some ρ

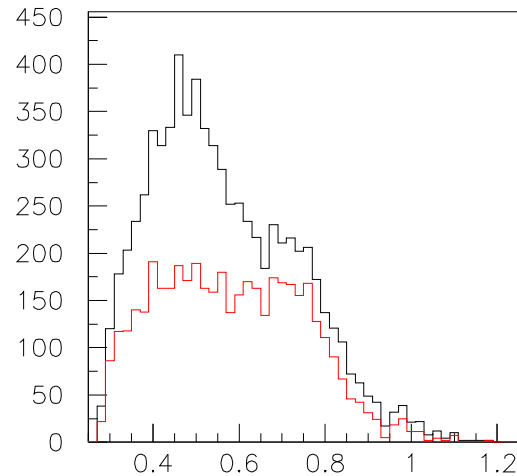
$\pi^+\pi^-$ has a little ρ



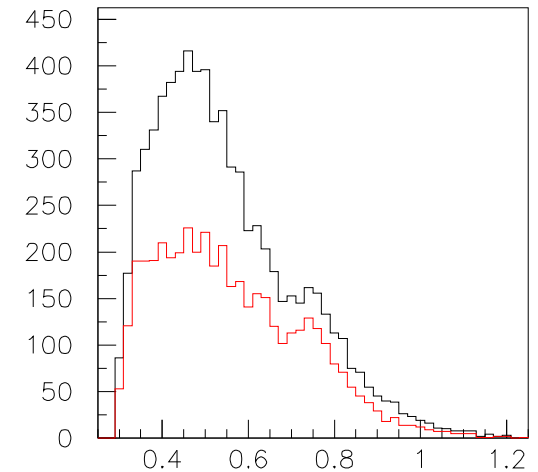
(2pi)- mass



(2pi)++ mass



(2pi)+ mass



(2pi)0 mass



Conclusion: questions

Very high statistics coming...
with πK separation.

What else can be plotted?

What can be learnt?