

The $pp \rightarrow d\pi^+\pi^0$ Reaction – A Case of $\Delta\Delta$ Excitation without ABC-Effect

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Outline

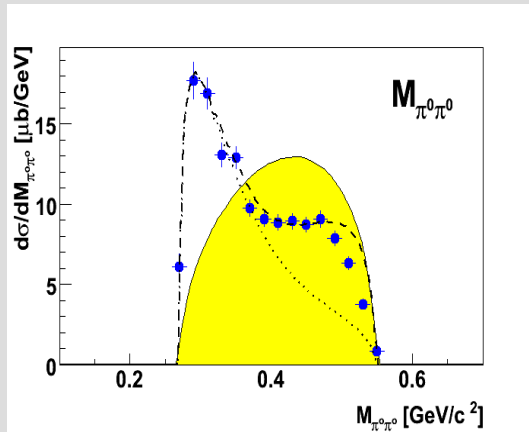
- Detector
- Motivation
- Particle identification
- Results
- Outlook

Motivation

ABC-effect

$$pd \rightarrow {}^3\text{He}\pi^0\pi^0$$

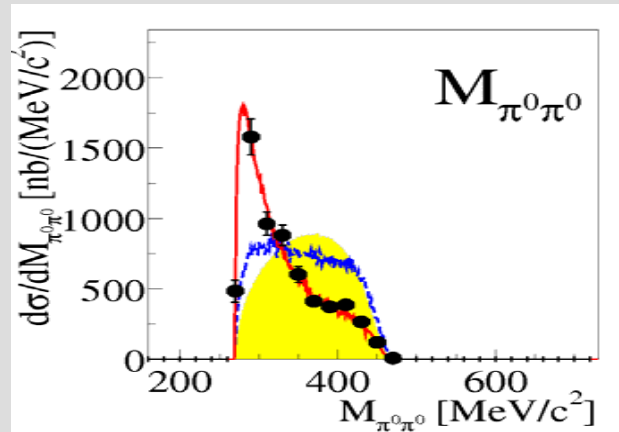
$$@T_p=895 \text{ MeV}$$



ABC

$$pn \rightarrow d\pi^0\pi^0$$

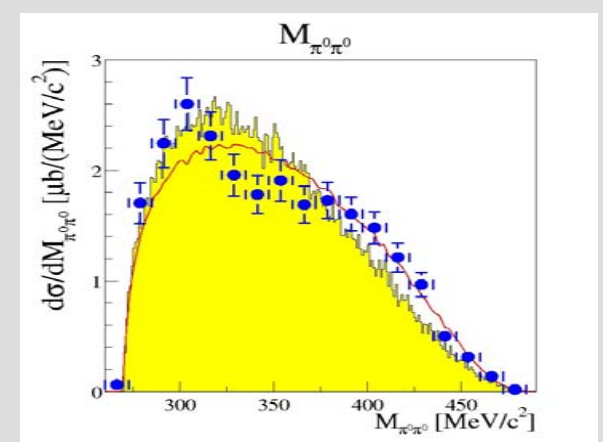
$$@T_p=1030 \text{ MeV}$$



ABC

$$pp \rightarrow pp\pi^0\pi^0$$

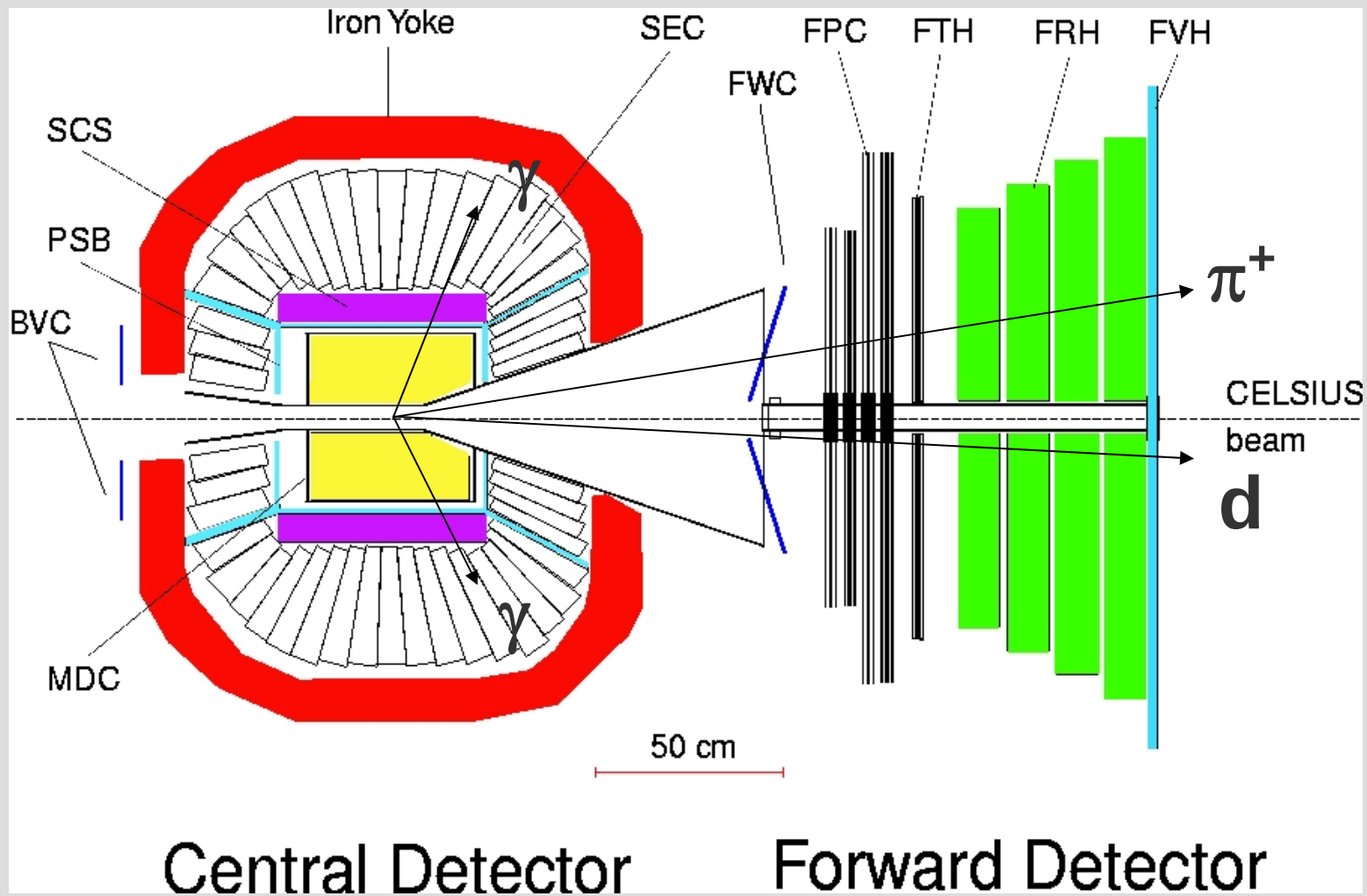
$$@T_p=1100 \text{ MeV}$$



~~ABC~~ (?)

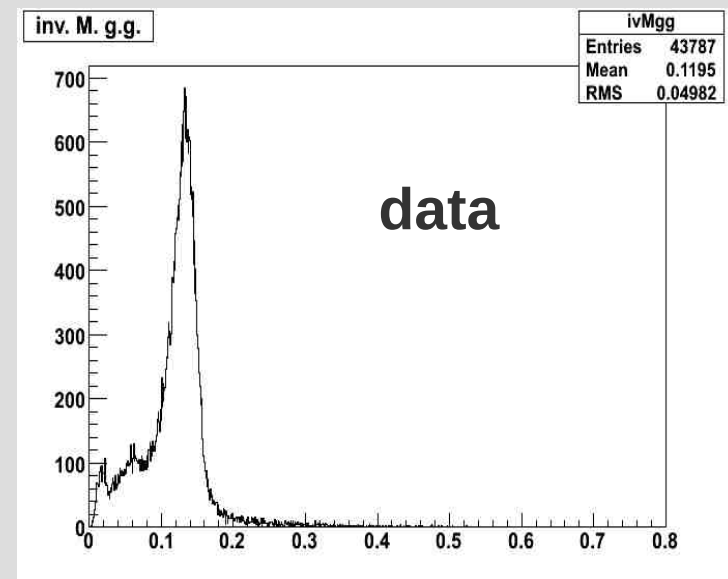
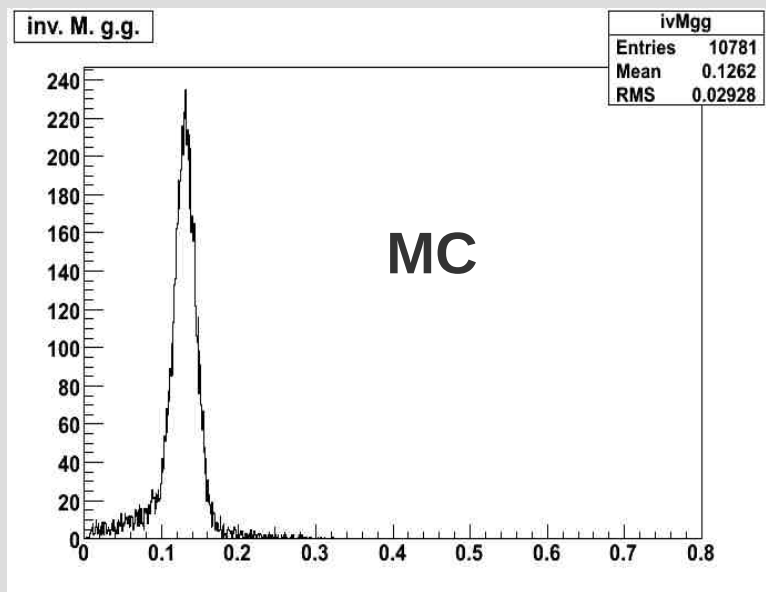
What about isovector $pp \rightarrow d\pi^+\pi^0$ @1100MeV?

WASA 4 π detector



Identification π^0

via invariant mass:

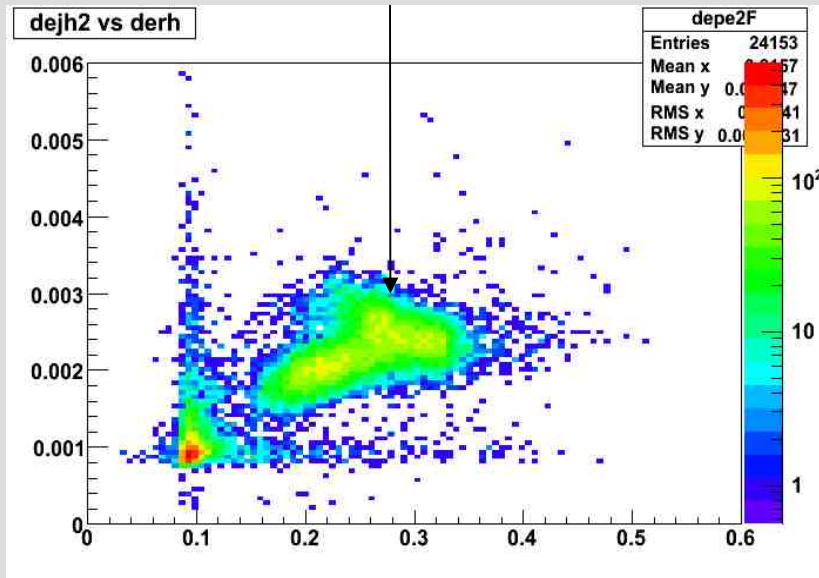


$M_{\gamma\gamma}$
 $\Rightarrow \pi^0$ safely identified
but $pp \rightarrow pp\pi^0$

$pp \rightarrow d\pi^+\pi^0$ vs background

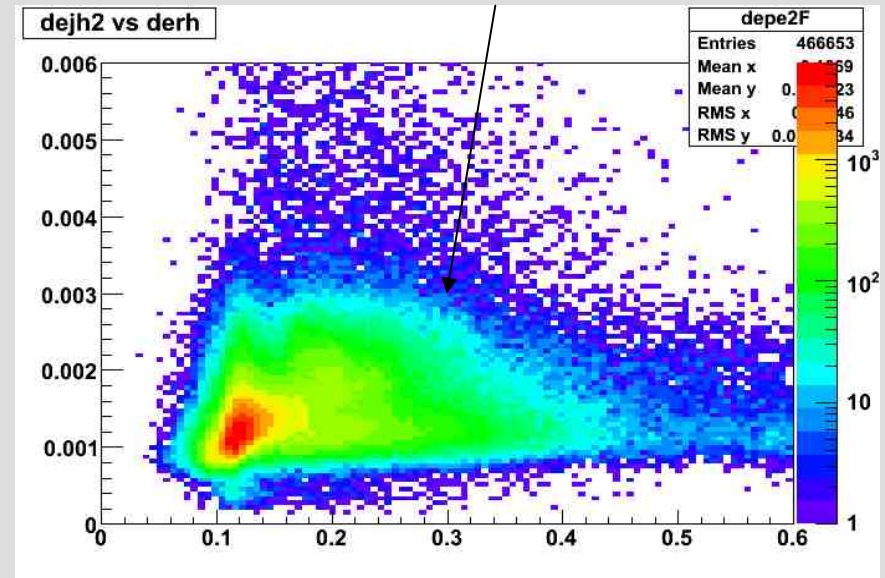
dE_i/E

d



MC

d?



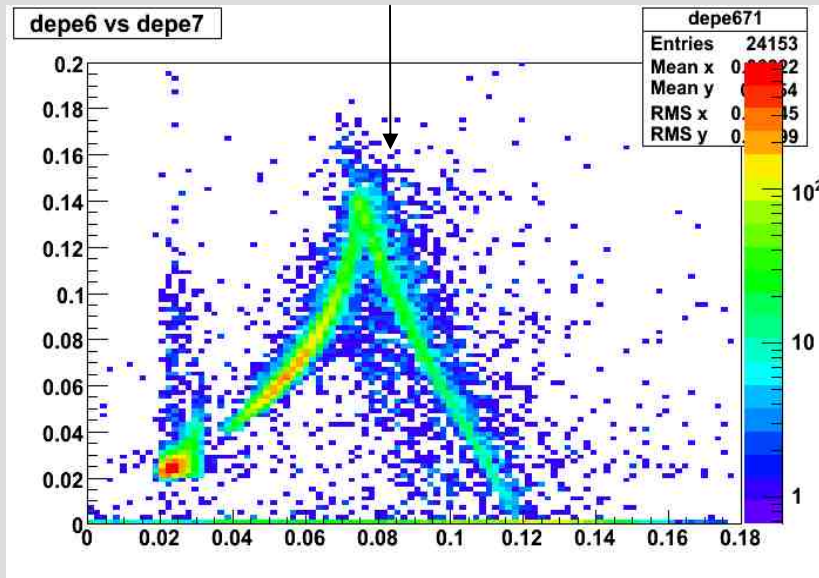
data

dE_i/dE_j cuts?

$pp \rightarrow d\pi^+\pi^0$ vs background

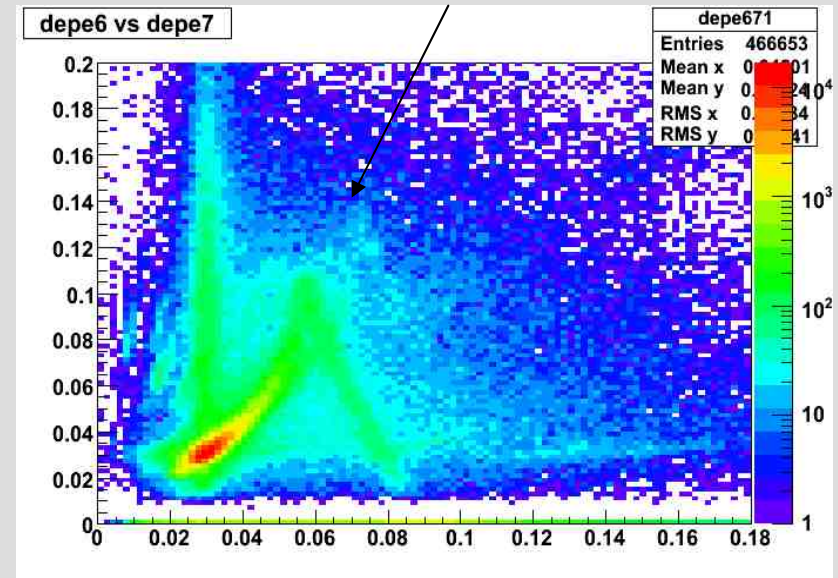
dE_i/dE_j

d



MC

d?



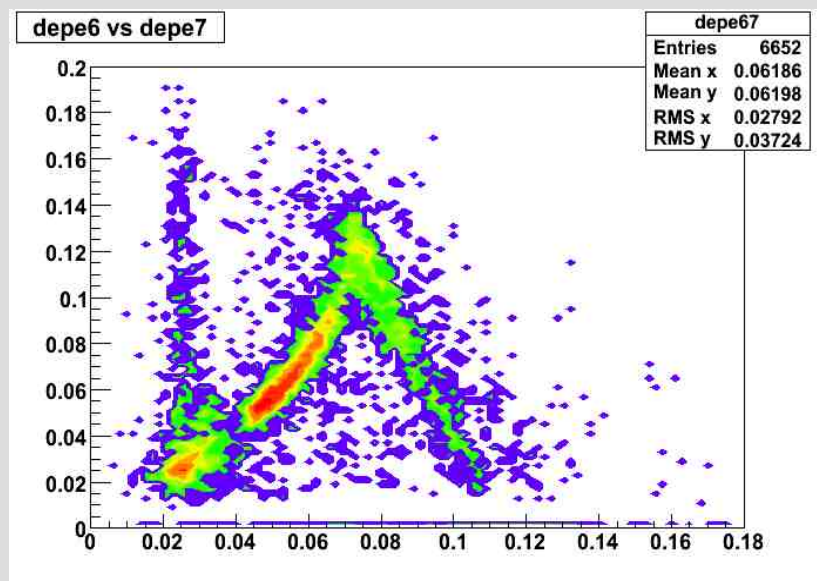
data

=> a few dE_i/dE_j cuts not enough

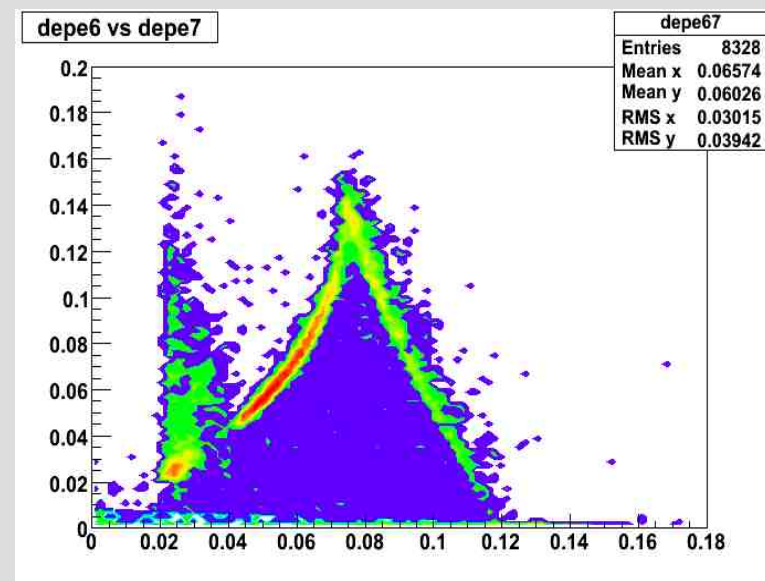
Neural Net

Neural Net “cuts” on all dE_i/dE_j plots
=>

MC



data



Theoretical considerations

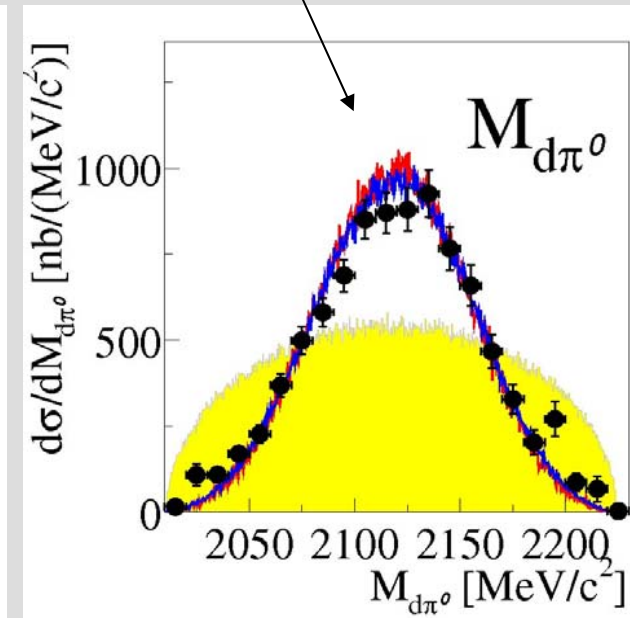
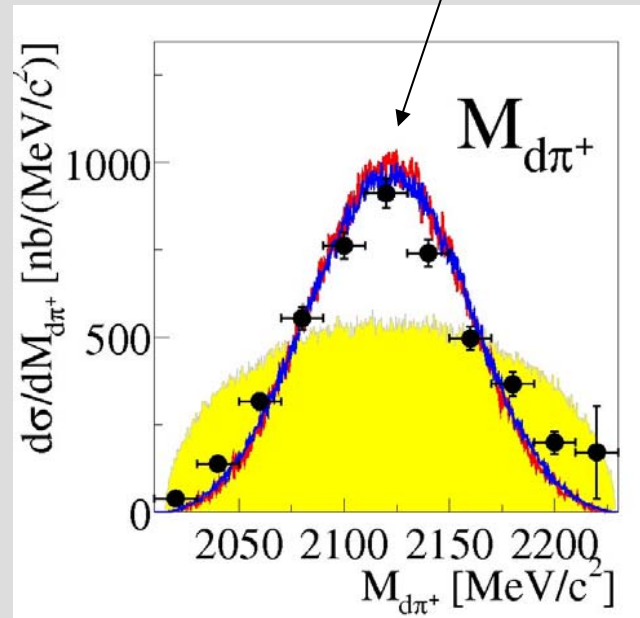
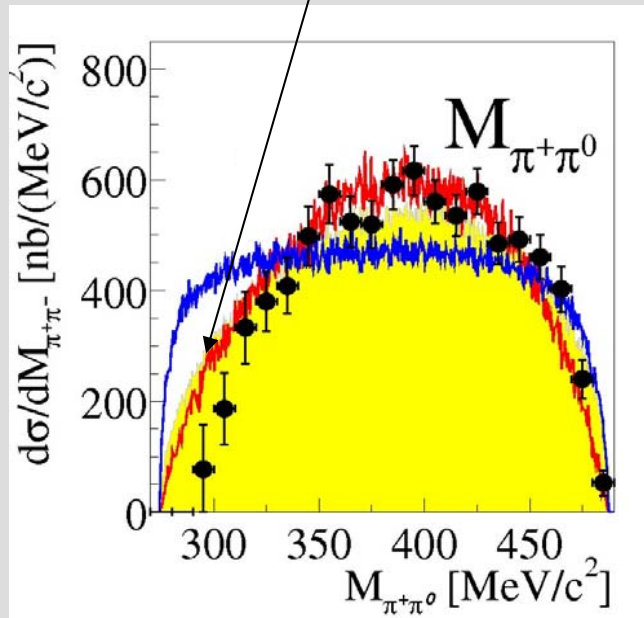
1.1 GeV $\Rightarrow$ $\Delta\Delta$ -region

$$\underbrace{pp}_{l=1} \rightarrow \underbrace{d}_{l=0} \quad \underbrace{\pi^+\pi^0}_{l=1}$$

$\pi^+\pi^0$ in p- wave due to Bose symmetry $\Rightarrow L=1 \Rightarrow$
 ρ -channel $\Rightarrow \mathbf{k}_1 \times \mathbf{k}_2$

Results

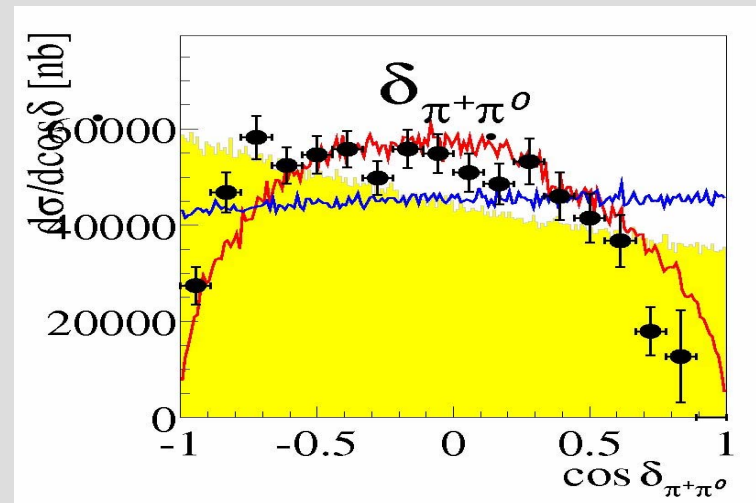
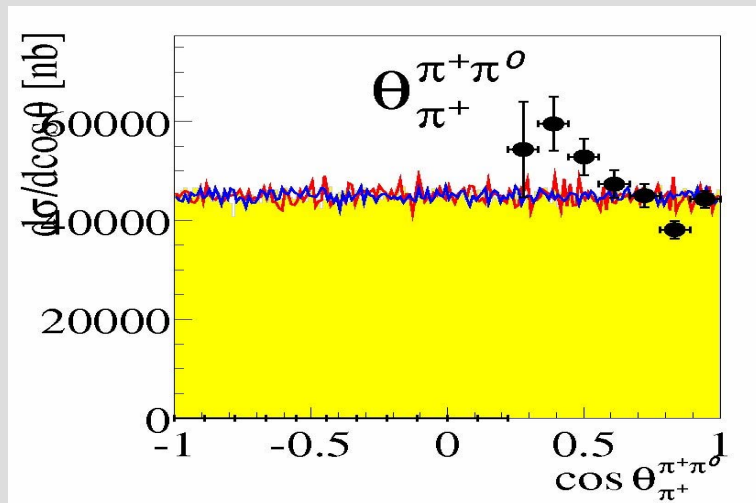
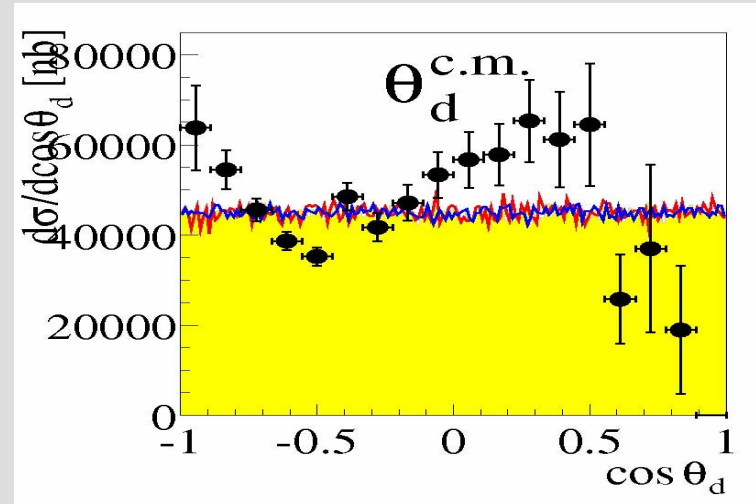
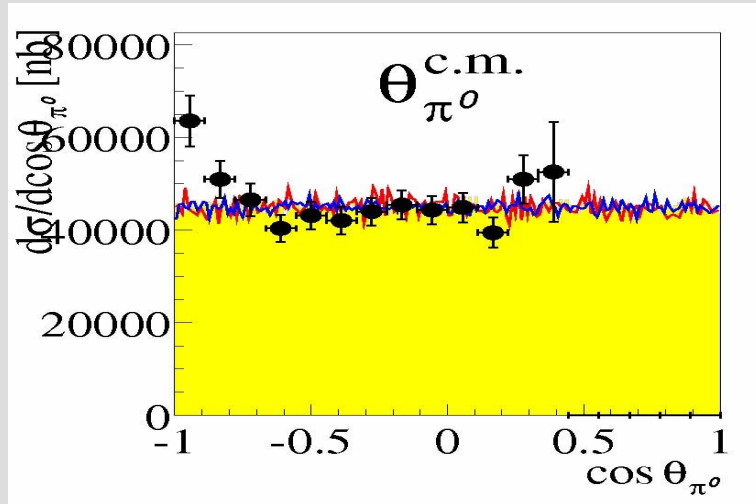
no ABC



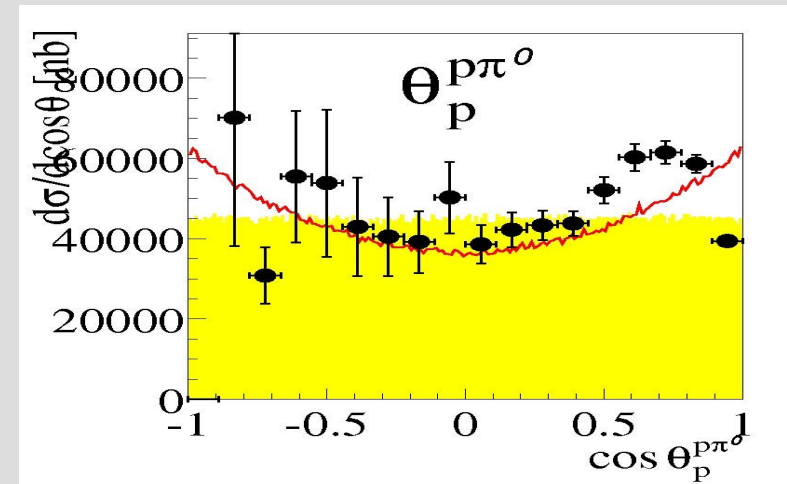
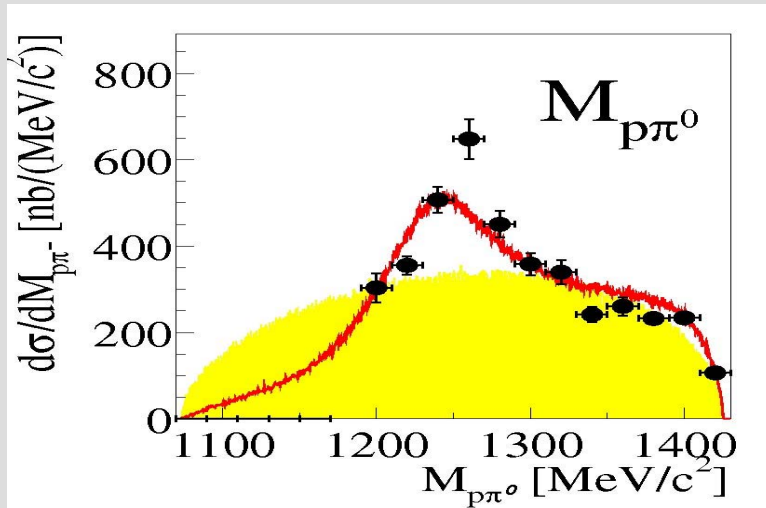
$\Delta\Delta^*(k_1 \times k_2)$

$\Delta\Delta$

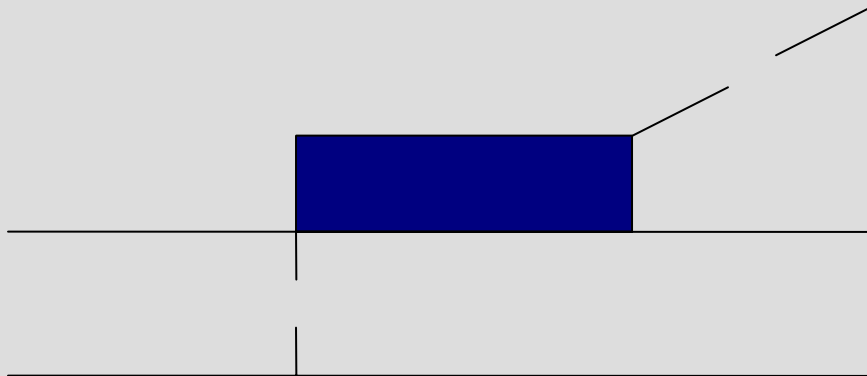
Results



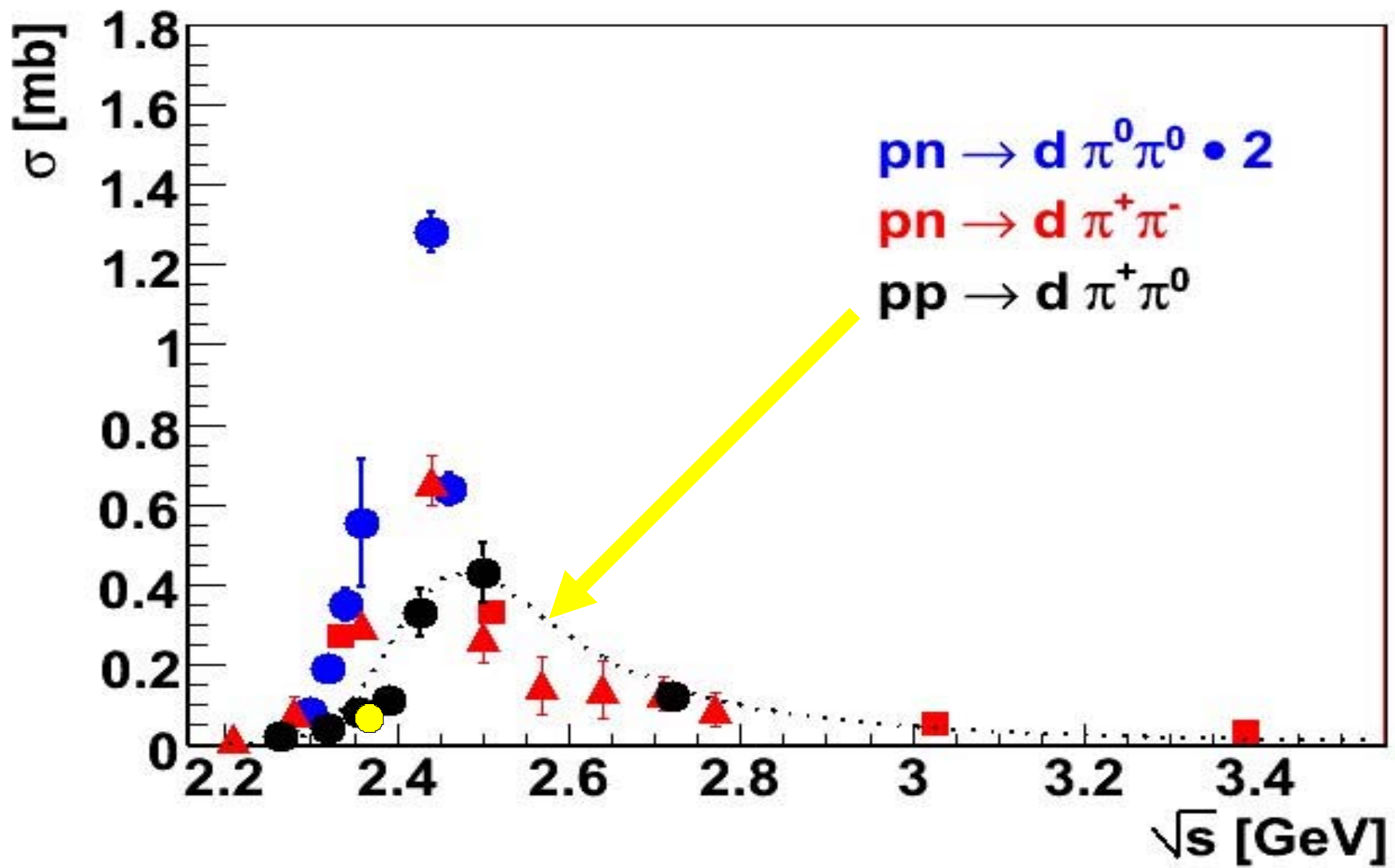
Calibration with $pp \rightarrow pp\pi^0$



Model: Δ with single π exchange



Cross section



Outlook

- in $pp \rightarrow d\pi^+\pi^0$ no ABC-effect
- $pp \rightarrow d\pi^+\pi^0$ at different energies?
- $pp \rightarrow pn\pi^+\pi^0$?

summary

