Comparison $(D_+ - P_+)$ relative phase in $\eta\pi^0$ and $\eta\pi^-$ systems

V.L.Korotkikh

6 May 2006

E852 collaboration

Scobeltsyn Institute of Nuclear Physics
Moscow State University, 119992 Moscow, Russia

Let's compare the relative phases $(D_+ - P_+)$ in $\eta\pi^0$ and $\eta\pi^-$ systems. We take the fit resonant parameters from [1] and [2] (see Table 1 and Table 2).

The Breit-Wigner amplitude $\Delta(m, m_k, \Gamma_k)$ is

$$\Delta(m, m_k, \Gamma_k) \;=\; \frac{m_k^0 \cdot \Gamma_k^0}{(m^2 - (m_k^0)^2) + i(m_k^0 \Gamma_k(m))} \;=\; e^{i\varphi_k(m)} \left|\Delta(m, m_k^0, \Gamma_k^0)\right|. \quad (1)$$

Here $\varphi_k(m)$ is a BW phase of wave amplitude. The widths $\Gamma_k(m)$ are well known functions of mass, which are proportional parameter Γ_k^0. We miss the background factor of D_+ wave because it has no a complex phase.

A relative phase is determined as

$$\delta(m) = \varphi_1(m) - \varphi_2(m) + constant \quad (2)$$

and *constant* is an arbitrary value as a production phase.

You see that the moving of relative phase $(D_+ - P_+)$ is close in both cases $\eta\pi^0$ and $\eta\pi^-$ systems (see fig. 2) in mass region 1.2 - 1.4 GeV. A shift of relative phase curves in figures along the ordinate axis is arbitrary. But the relative phase $(D_+ - P_+)$ is similar to the moving phase of a_2 - resonance (D_+) in this region (fig.1). So the main reason of this is a narrow width of a_2 - resonance in $\eta\pi^0$ and $\eta\pi^-$ systems.

Table 1: Fitted BW Resonance Parameters (MDF) in $\eta\pi^0$ system.

Partial Wave	Mass, MeV/c^2	Width, MeV/c^2
D_+	1320	96
P_+	1270	334

Table 2: Fitted BW Resonance Parameters (MDF) in $\eta\pi^-$ system.

Partial Wave	Mass, MeV/c^2	Width, MeV/c^2
D_+	1317	127
P_+	1370	385

References

[1] Draft 5. "Analysis of the$\eta\pi^0$ system with the decay $\eta \to \pi^+\pi^-\pi^0$", (2006)
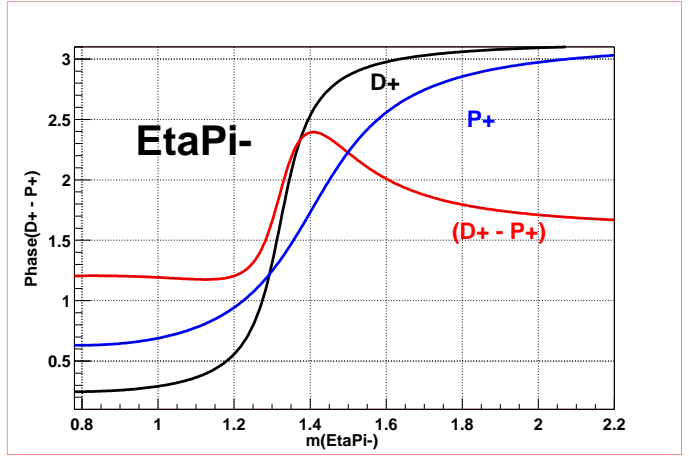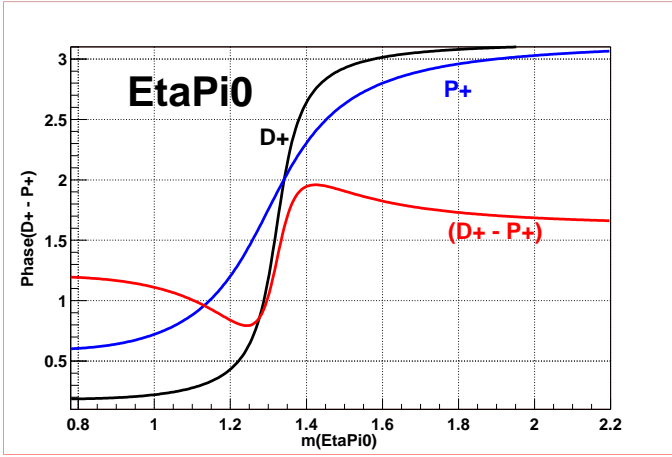
[2] S.U. Chung *et al.*, Phys. Rev. D **60**, 092001 (1999).

Figure 1: $D+$, $P+$ and relative $(D_+ - P_+)$ phases in a)$\eta\pi_0$ system and b)$\eta\pi_-$ system. The resonant parameters in Table 1 and 2. .
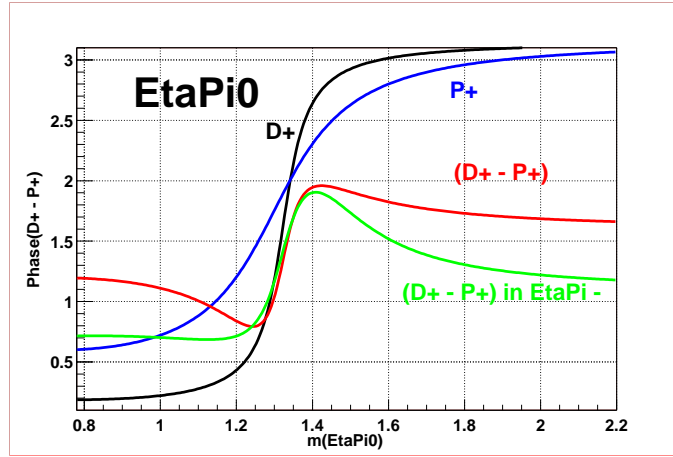

Figure 2: $D+$, $P+$ and relative $(D_+ - P_+)$ phases in $\eta\pi_0$ system and a comparison with the relative phase of $\eta\pi_-$ system .