Preliminary study of $J/\psi \to \omega p\bar{p}$

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Outline

- Motivation and experimental status
- Events selection
- Preliminary results
- Problems remaining

1. Motivation and experimental status

Motivation

- to probe the internal structure of light-quark baryons.
- search for missing baryons predicted by Quark Model.
- to obtain a better understanding of the strong interaction force in the non-perturbative regime.
- relativized pair-creation ($^3P_0$) model predicts some missing baryon states, decaying to $\Delta\pi$, $N\rho$, $N\eta$, $N\eta'$ and $N\omega$ *etc.*.
- flux-tube model predicts the masses of the low-lying hybrid baryons to be around 1.9 GeV, which is higher than those of QCD-sum rule and bag model.
- flux-tube model expects the most phenomenologically interesting decay of the low-lying hybrid baryons to be the P-wave decay to $N\rho$ and $N\omega$.

Experimental status

- the present knowledge came almost entirely from the old generation of πN experiments more than 20 years ago.
- CEBAF elctroproduction and photoproduction experiments started several years ago.
- the electron accelerator facility CB-ELSA at Bonn Univ. for photoproduction experiments are being carried on.
- the relatively large branching ratios in J/ψ decays.

  $p\bar{p}\pi^0$: $(2.0 \pm 0.1) \times 10^{-3}$, $(N^* \to \pi N)$
  $p\bar{p}\pi^-\pi^+$: $(6.0 \pm 0.5) \times 10^{-3}$, $(N^* \to \pi^-\pi^+ N)$
  $\bar{p}\pi^+ n$: $(2.0 \pm 0.10) \times 10^{-3}$, $(N^* \to N\pi)$
  $p\bar{p}\eta$: $(2.1 \pm 0.2) \times 10^{-3}$, $(N^* \to \eta N)$
  $p\bar{p}\eta'$: $(0.9 \pm 0.4) \times 10^{-3}$, $(N^* \to \eta' N)$
  $p\bar{p}\omega$: $(1.3 \pm 0.3) \times 10^{-3}$, $(N^* \to \omega N)$

2. Events selection

For charged tracks:

The tracks are required to be from MDC.

$$N_{chrg} = 4, \quad \Sigma Q = 0$$

$$mfit = 2 \quad or \quad -19$$

$$\mid \cos\theta \mid < 0.85$$

$$R_{xy} < 0.015m, \quad \mid z \mid < 0.15m$$

$$P_{txy} \geq 0.07GeV$$

When $p < 0.6$ GeV, dE/dx information is used to identify particles.

when $p \geq 0.6$ GeV, TOF information is used to identify particles.

At least one proton and one pion are required.

For neutral tracks:

$$| \cos\theta | < 0.75$$

$$E_\gamma > 0.05GeV$$

$$\alpha_{ch-neu} \geq 8^o$$

$$\chi^2_{\omega p\bar{p}} < 50.0$$

$$\chi^2_{\omega p\bar{p}} < \chi^2_{\omega\pi^+\pi^-} \quad and \quad \chi^2_{\omega p\bar{p}} < \chi^2_{p\bar{p}\pi^+\pi^-}$$

Final cuts:

$$\chi^2_{\omega p\bar{p}} < 12.0$$

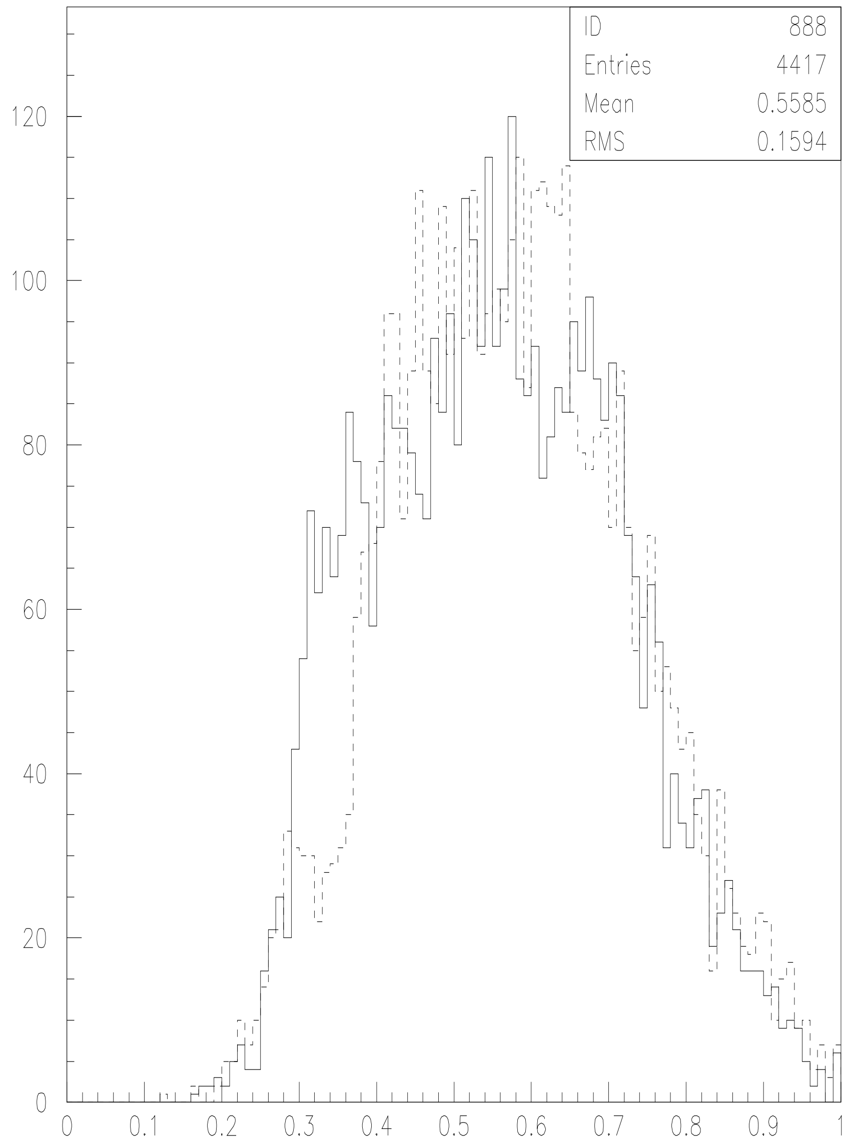
$$| M_{\gamma\gamma} - 0.135 | \quad < 0.06GeV$$

$$| M_{\pi^+\pi^-\pi^0} - 0.782 | \quad < 0.06GeV$$

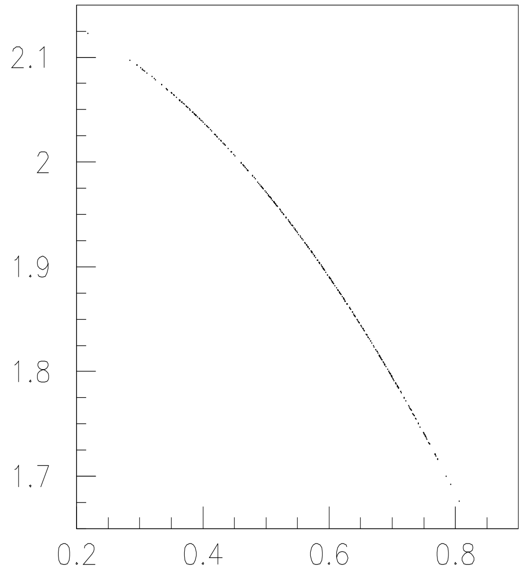
$$N_p = 2 \ , \ N_\pi = 2$$

$$\alpha_{ch-neu} \geq 15^o$$

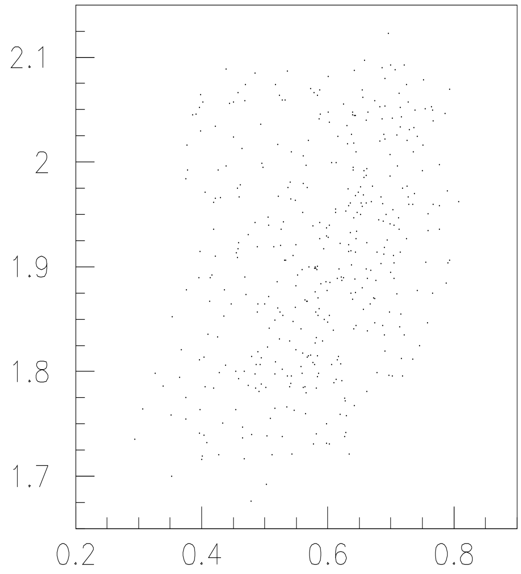
3. Preliminary results



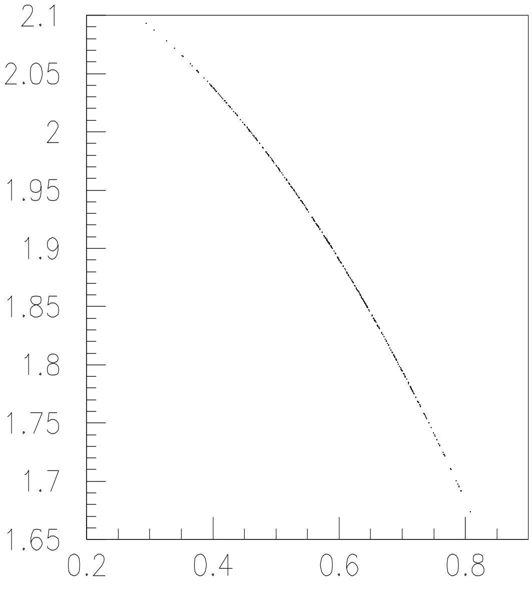
Solid histogram: momentum spectrum of $\bar{p}$
dashed histogram: momentum spectrum of p



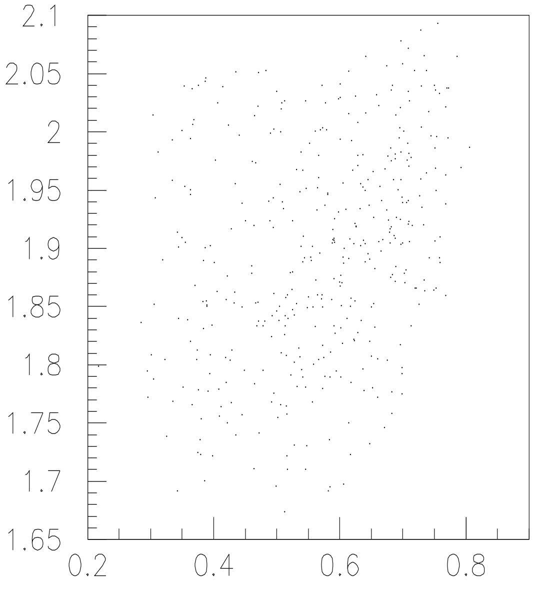
mwp VS. pbmomza



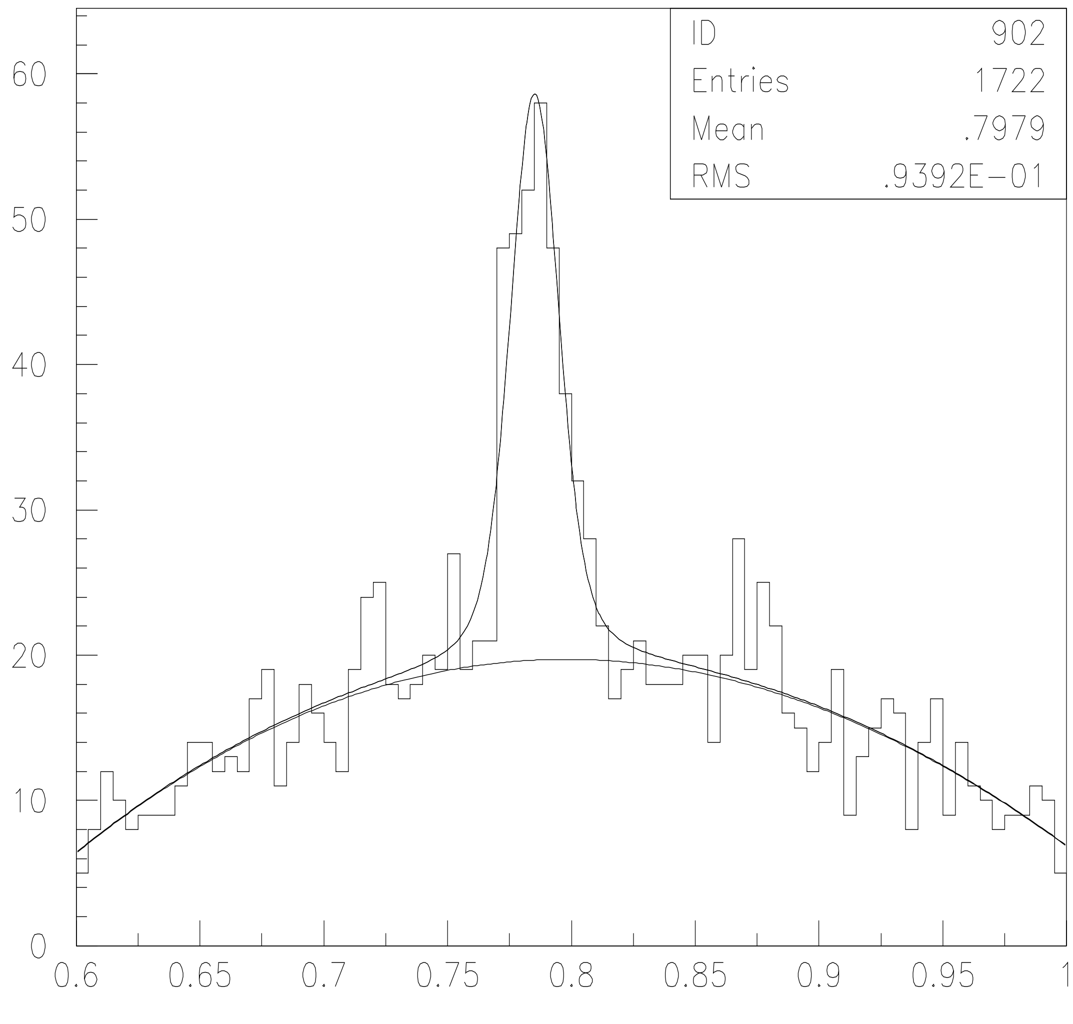
mwp VS. pmomza



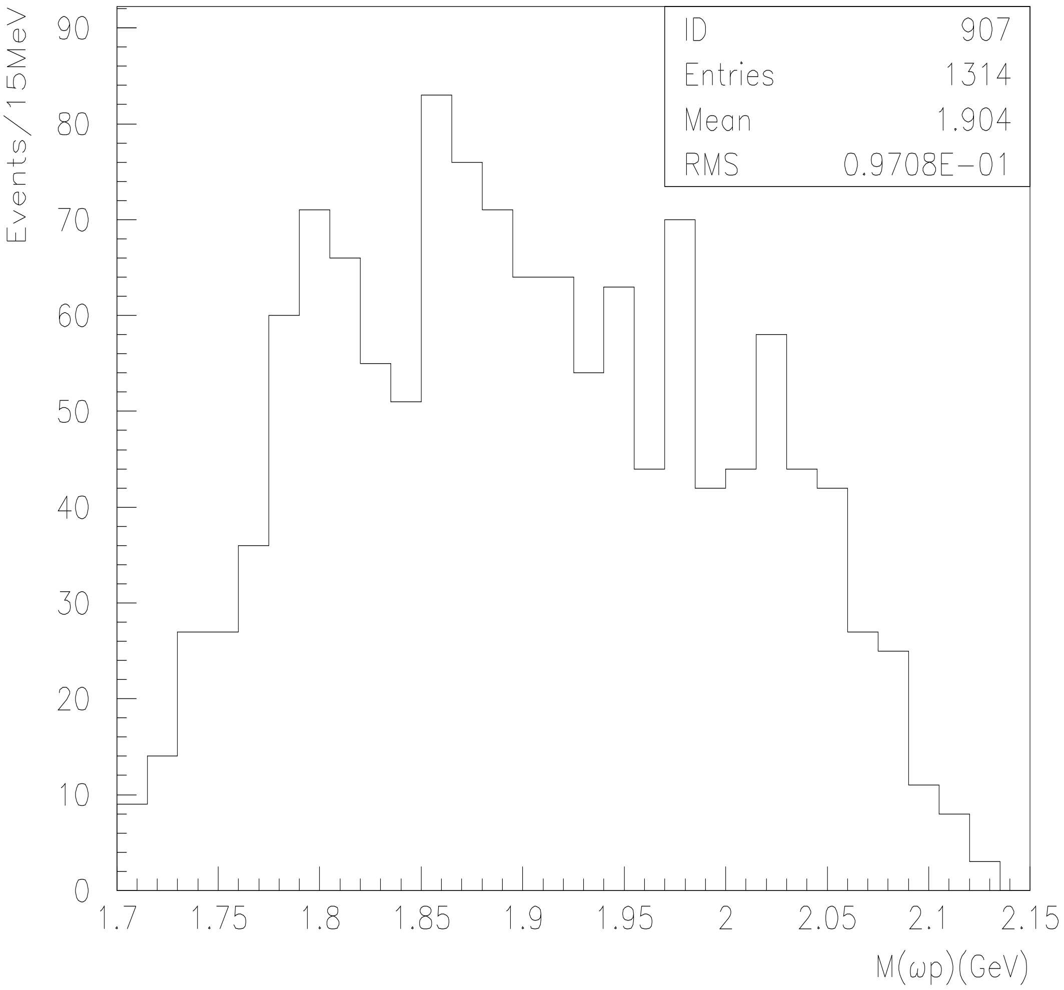
mwpb VS. pmomza



mwpb VS. pbmomza



Invariant mass spectrum of $\pi^+\pi^-\pi^0$



Invariant mass spectrum of ωp and $\omega\bar{p}$