Penta-Quark 2003 Workshop
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Photoproduction of θ^+ at Hall A /TJNAF

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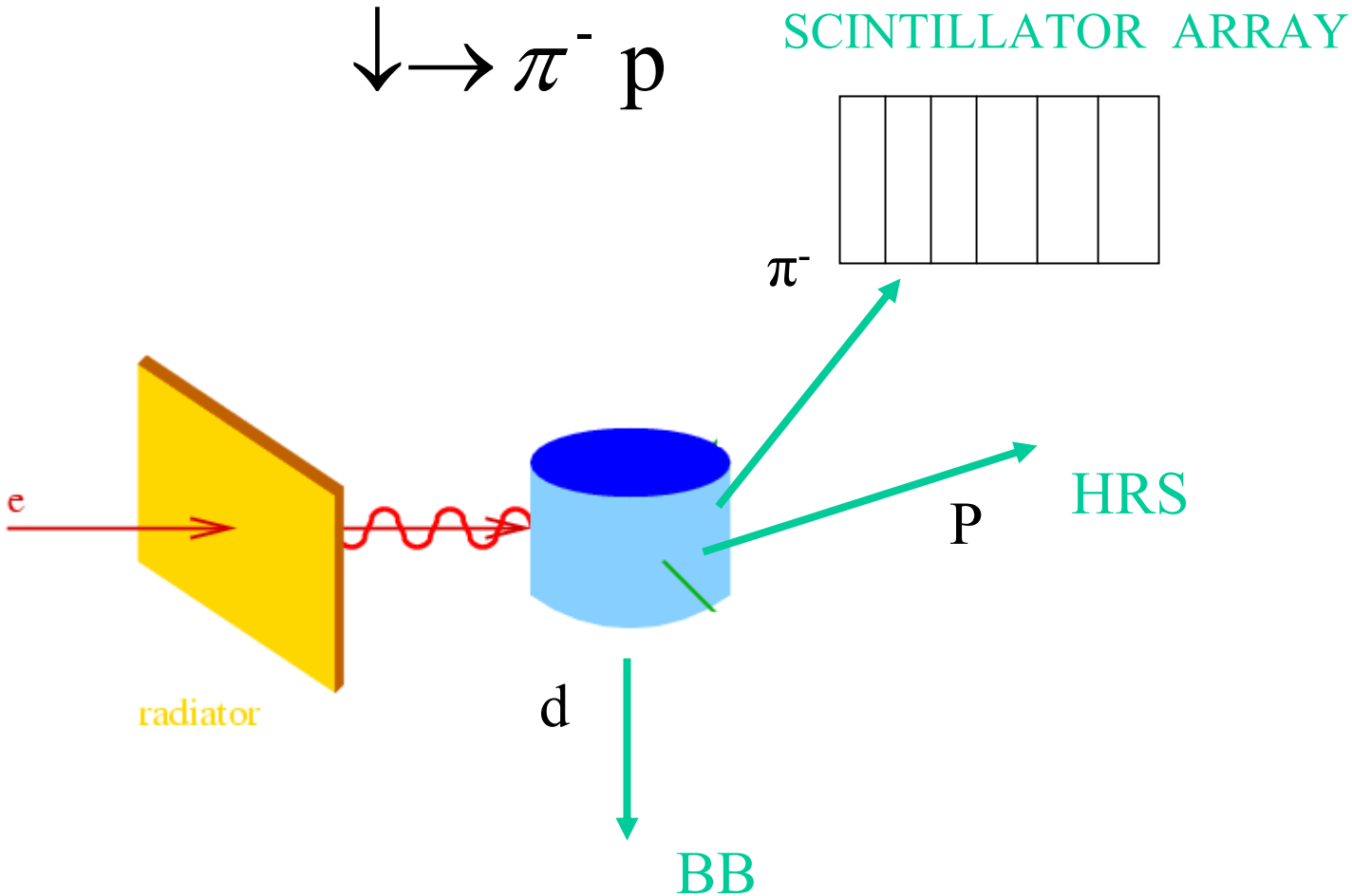
Missing mass reconstruction

$$\gamma\ \mathrm{d} \rightarrow \Lambda\ \theta^{+}$$

$\uparrow \rightarrow k^{+}\ n$

$\downarrow \rightarrow \pi^{-}\ p$



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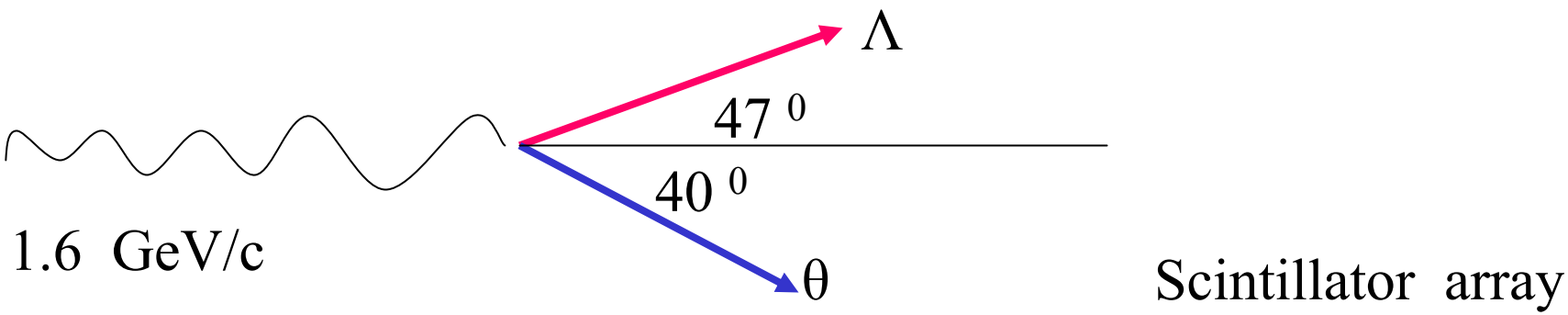
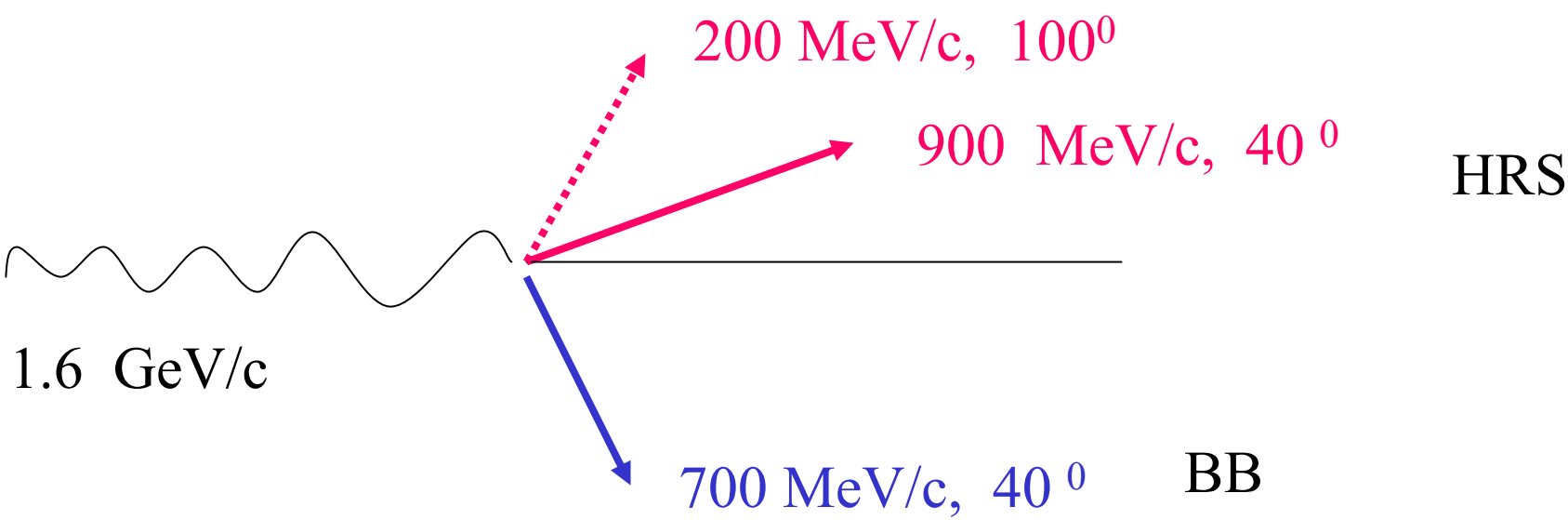




C. Schaerf presented yesterday preliminary results:

The poor man Θ^+

The Graal Collaboration

E_γ = 600-1500 MeV

We should be able to get measured cross section estimate from their measurement.

$\Theta^+ \Lambda$ Photoproduction Decays

$$\gamma + d \rightarrow \Theta^+ + \Lambda$$

$$\Theta^+ \rightarrow K^\circ\, p \rightarrow 2\pi^\circ \rightarrow 4\,\gamma$$

$$\Lambda \rightarrow \pi^-\, p$$

$$\gamma + \mathbf{d} \rightarrow 4\,\gamma + \pi^- + 2\,p$$

$$\rightarrow \Theta^+ + \Lambda$$

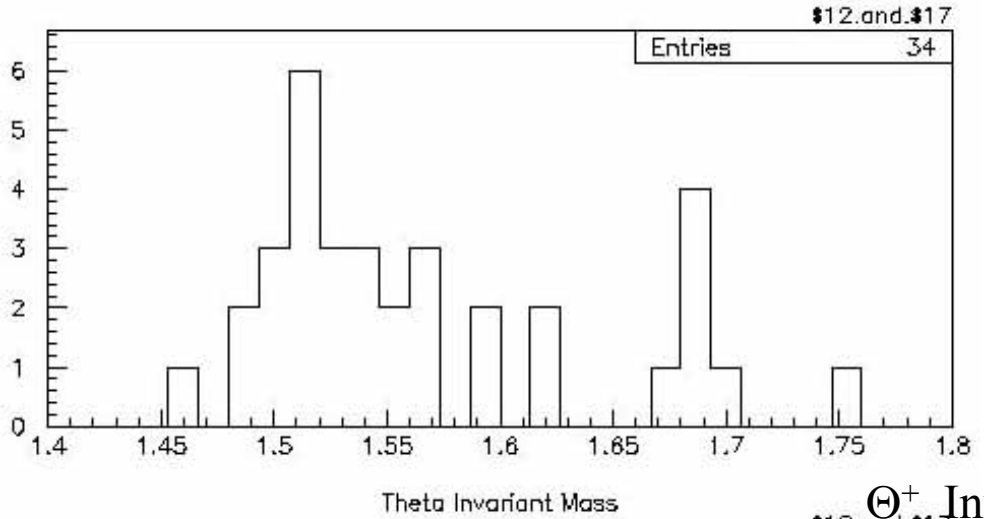
$$\Theta^+ \rightarrow K^\circ\, p \rightarrow 2\pi^\circ \rightarrow 4\,\gamma$$

$$\Lambda \rightarrow \pi^\circ\, n \rightarrow 2\,\gamma$$

$$\rightarrow 6\,\gamma + p + n$$

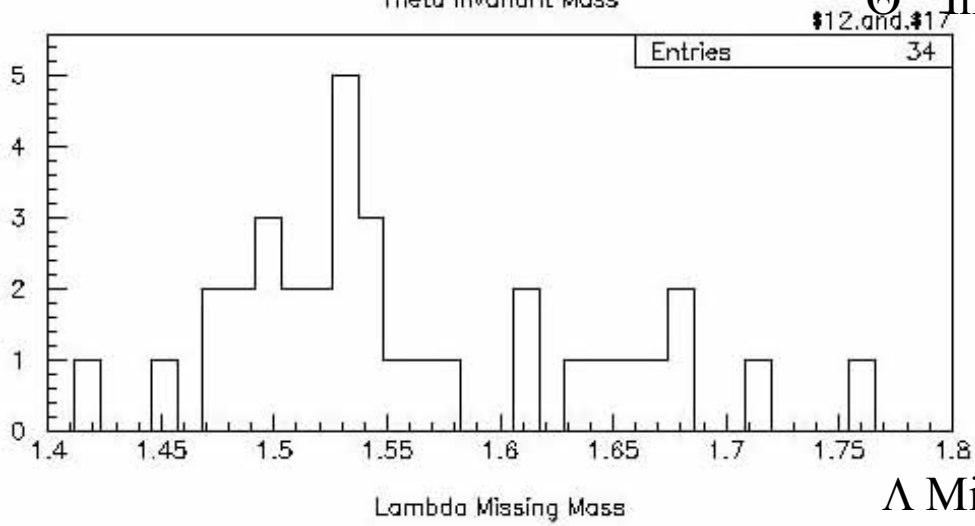
Λ Missing and Θ^+ Invariant

$$\gamma + d \rightarrow \Theta^+ + \Lambda$$



VERY PRELIMINARY

Θ^+ Invariant mass GeV



Λ Missing Mass GeV

$$\gamma \; d \rightarrow \Lambda \; \theta^{+}$$

Intrinsic parity	-	+	+	+ ?	-

ΔL = odd = 1,3,5…..

even =2,4,…

spin	1	1	½	½?

0, 1

0, 1

ΔL =1

ΔL =1

The measured angular distribution of the Λ can tell the story.

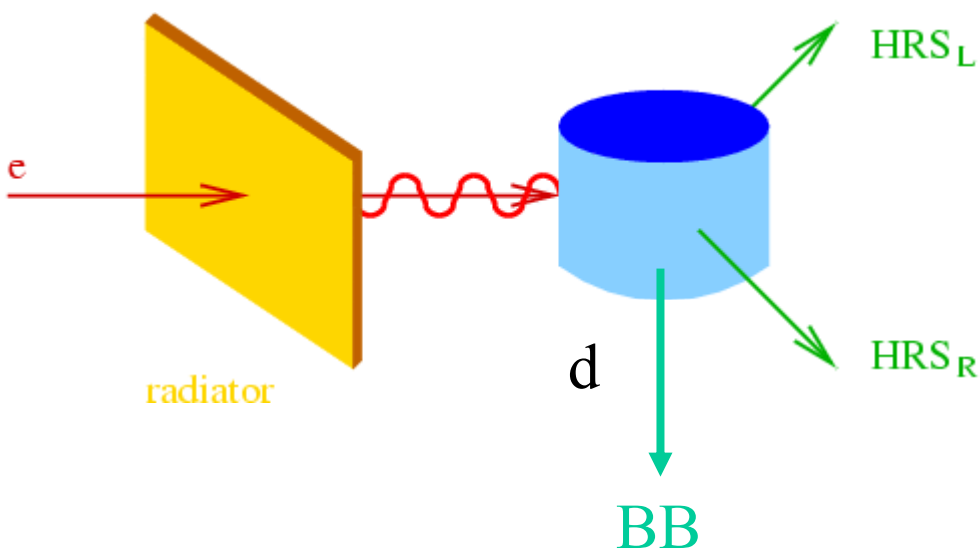
Invariant mass measurement:

$$\gamma \; p \rightarrow \bar{k}_0 \; \theta^+$$

$$\downarrow\rightarrow \; p \; k_s$$

BB $\downarrow\rightarrow$ $\pi^+ \; \pi^-$

HRS HRS



These photoproduction measurements can be carried with similar resolution and rates to the electroproduction process presented by Bogdan.

Mass resolution ~ 2 MeV

Rates: ~ 100/day

The two-body $\gamma\, d \rightarrow \Theta\, \Lambda$ can also tell us about:

Is the Θ^+ a compact 5 quark object ?

The spin and parity of the Θ^+.