

Double polarization in π^0 photoproduction from FROST

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CLAS Hadron Spectroscopy Group Meeting

September 26, 2009

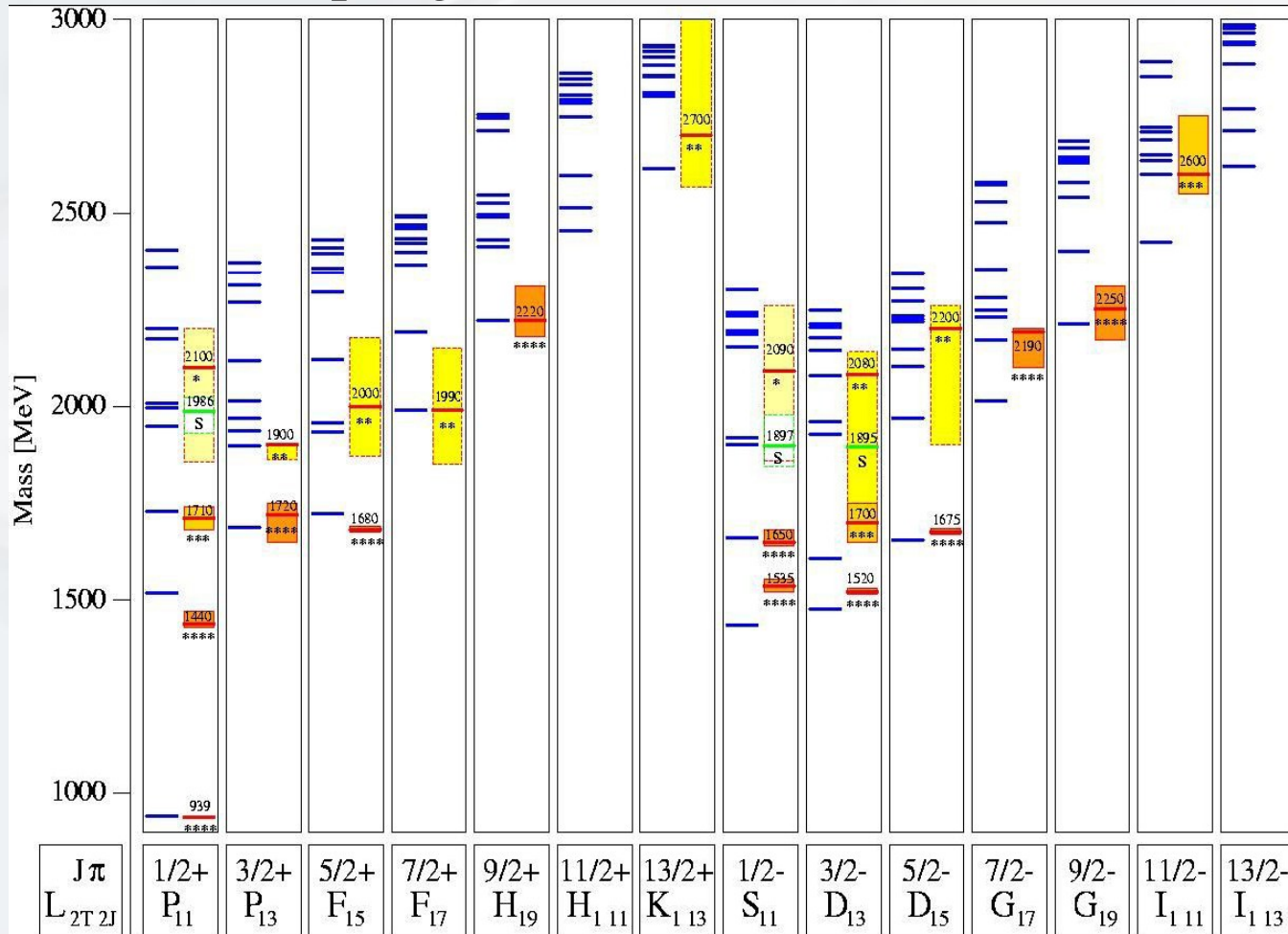
Outline

1. Motivation
2. FROST Experiment
3. Analysis

Baryon Resonance

N^* and Δ^* by Quark model

Mass, width, couplings to various modes are not well known



FROST (FROzen Spin Target)

Study of excited nucleon states (N^* and Δ^*)

→ Understand the structure of the nucleon

→ Analyze decay products due to short lifetime

Double polarization experiments is important

Photon		Target			Recoil			Target + Recoil			
	–	–	–	–	x'	y'	z'	x'	x'	z'	z'
	–	x	y	z	–	–	–	x	z	x	z
unpolarized	σ_0	0	T	0	0	P	0	$T_{x'}$	$-L_{x'}$	$T_{z'}$	$L_{z'}$
linear pol.	$-\Sigma$	H	$(-P)$	$-G$	$O_{x'}$	$(-T)$	$O_{z'}$	$(-L_{z'})$	$(T_{z'})$	$(-L_{x'})$	$(-T_{x'})$
circular pol.	0	F	0	$-E$	$-C_{x'}$	0	$-C_{z'}$	0	0	0	0

Asymmetry E and G

Photon beam

- Circularly and linearly polarized
- 0.5 ~ 2.4 GeV (electron beam 1.645 & 2.478 GeV)

Target

- Butanol (C_4H_9OH)
- 82 ~ 85% of polarization

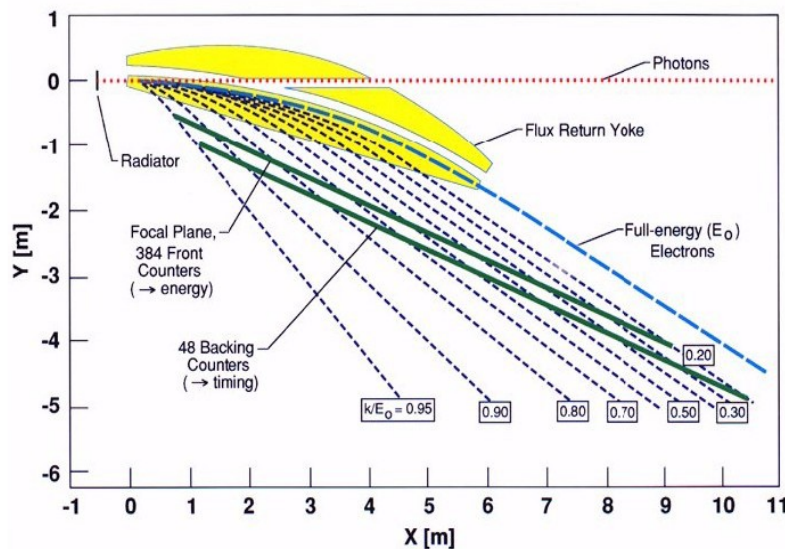
Production

- 10.5 Billion trigger
- *trigger: at least one charged particle in CLAS

Circularly polarized photon beam

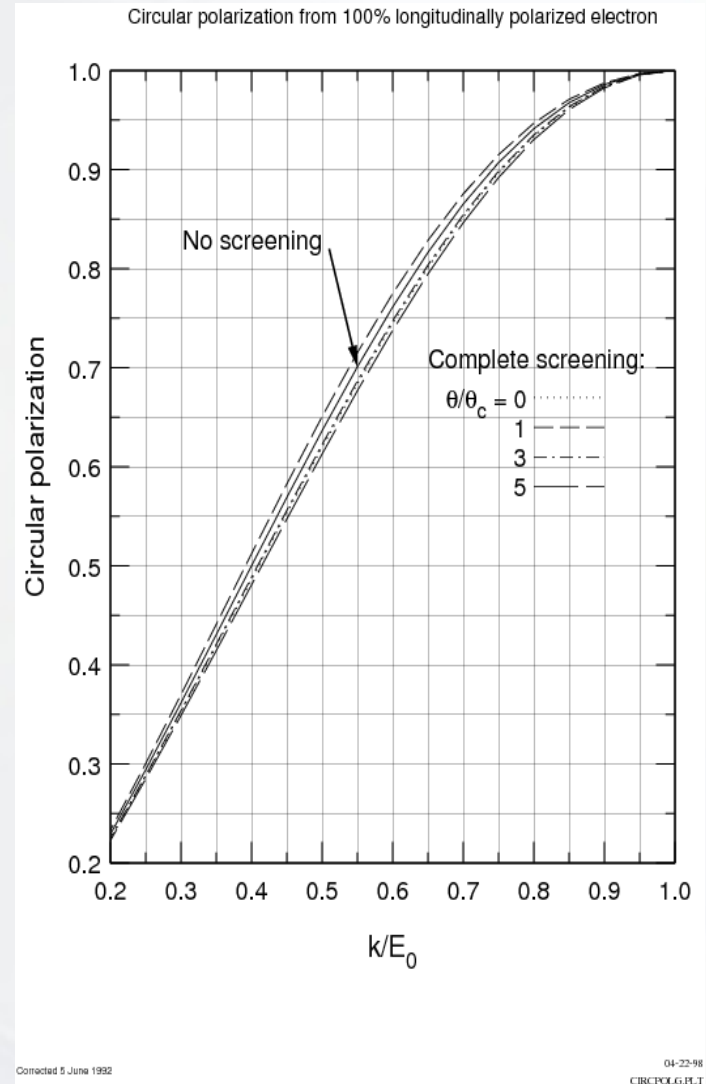
Bremsstrahlung

use linearly polarized electron beam



$$P(\gamma) = P(e) \frac{4x - x^2}{4 - 4x + 3x^2}$$

$$x = \frac{k}{\epsilon_1} = \frac{(\text{photon energy})}{(\text{incident electron energy})}$$



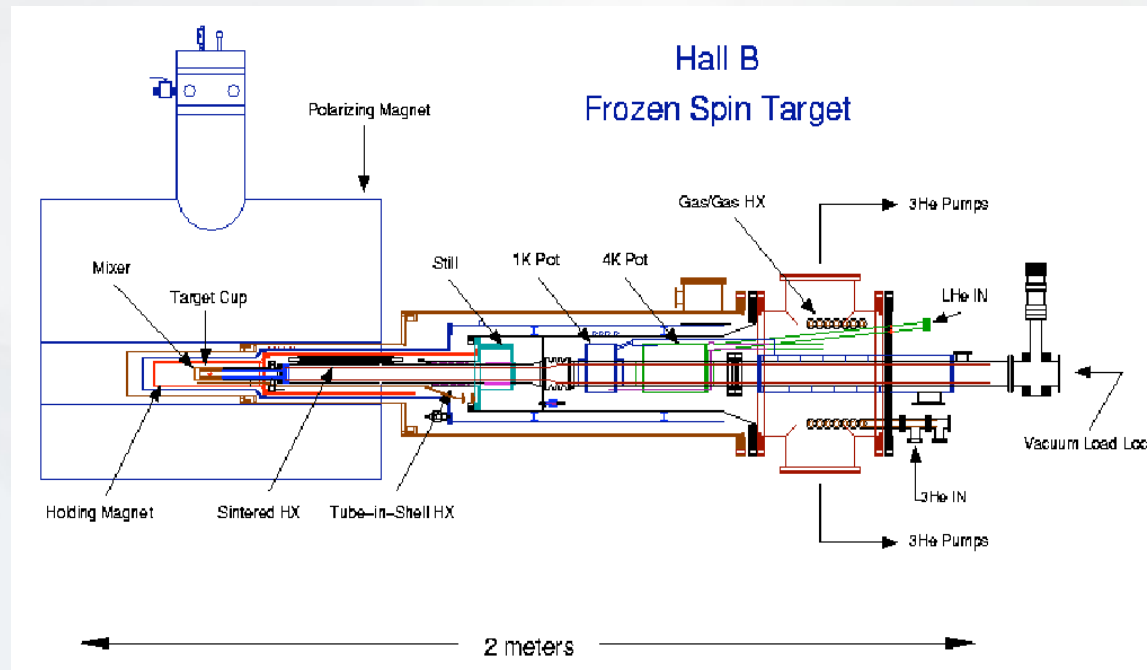
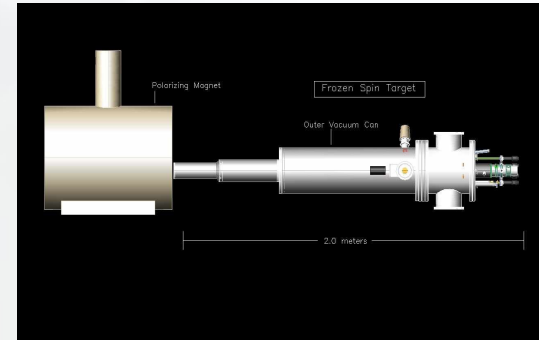
Target

Butanol(C_4H_9OH)

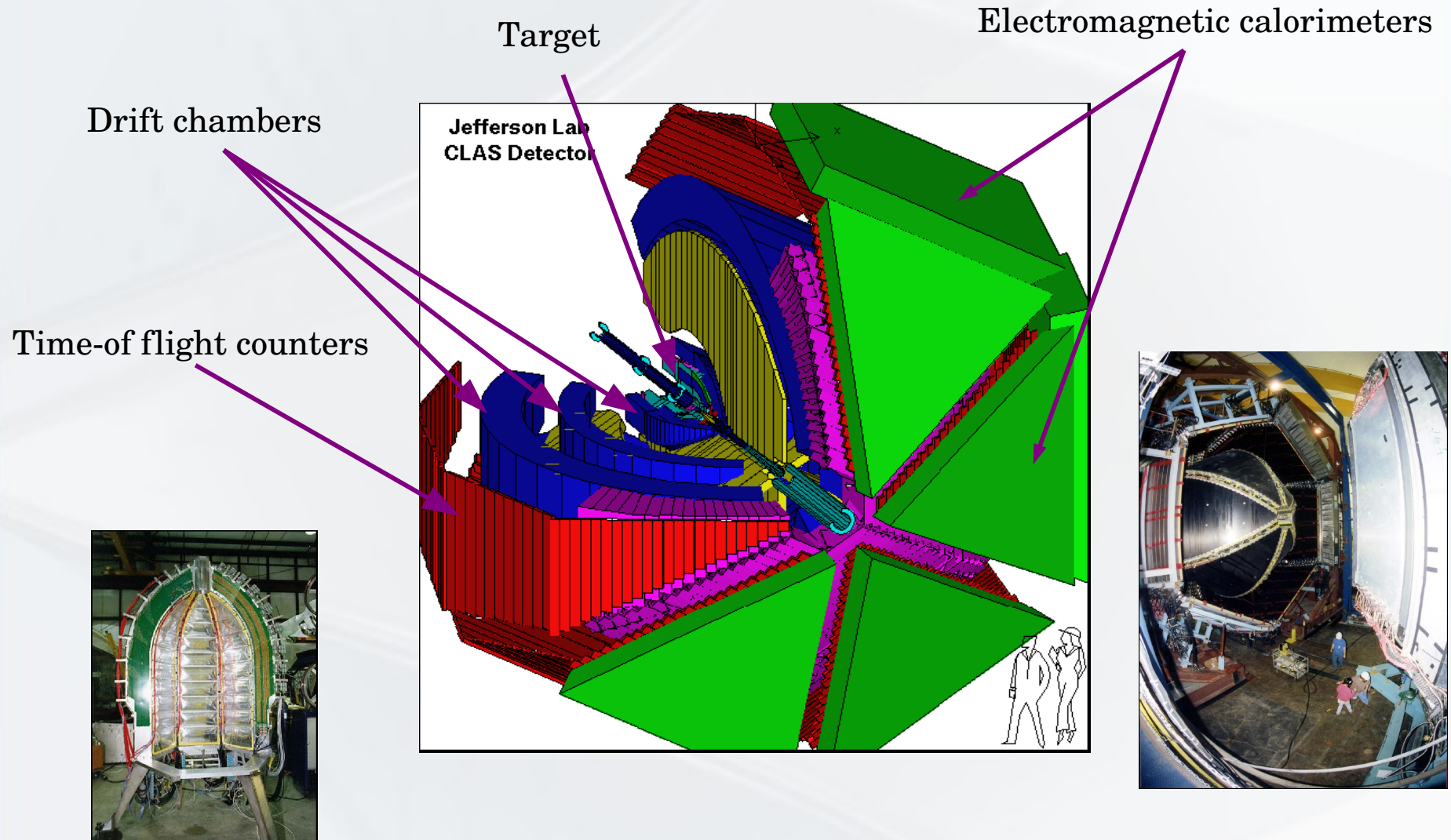
length 50mm

diameter 15mm

Holding mode (0.5T, 28 ~30 mK)

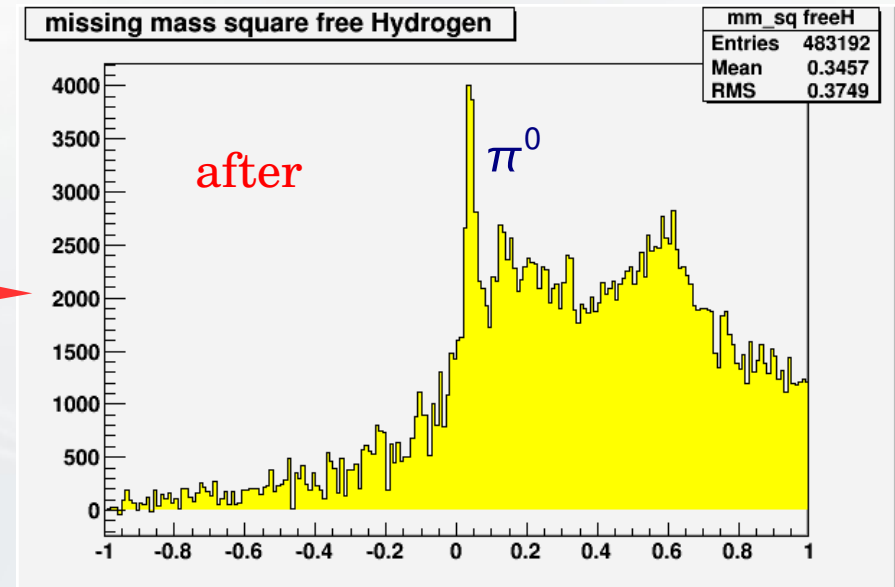
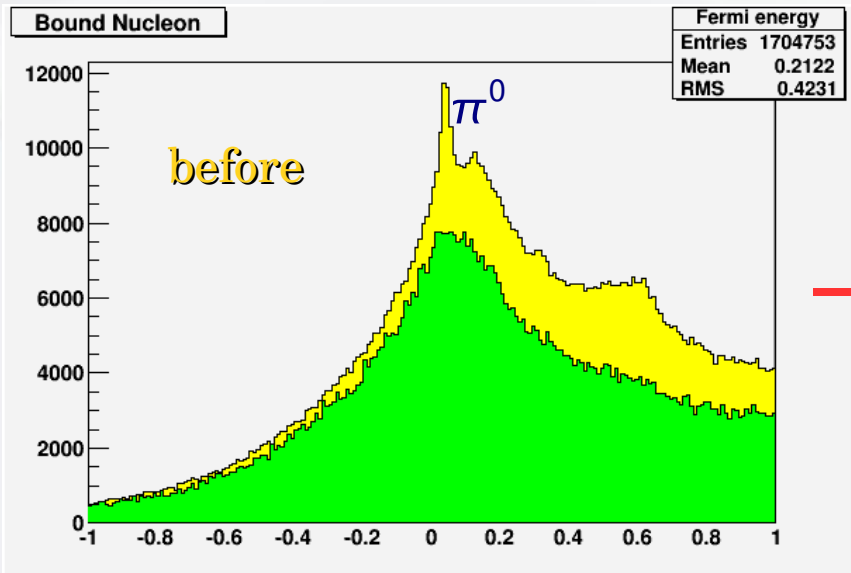
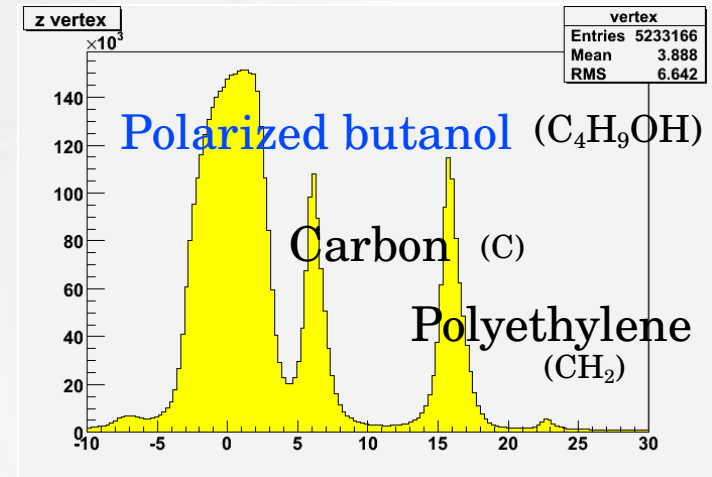


CLAS



$\gamma p \rightarrow \pi^0 p$ missing mass square

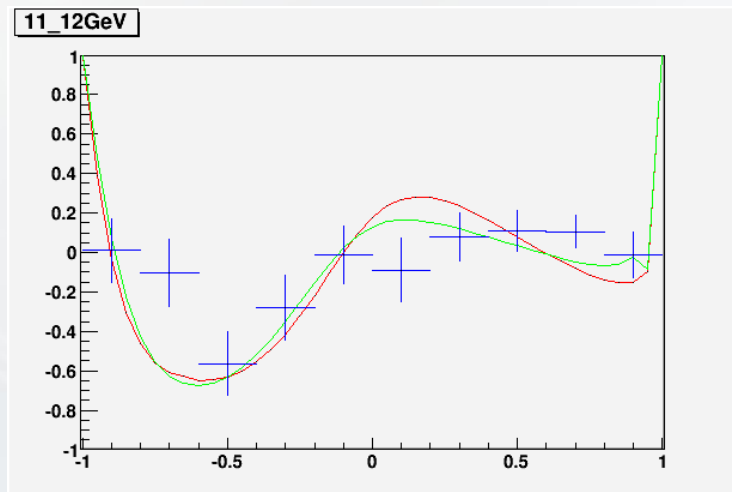
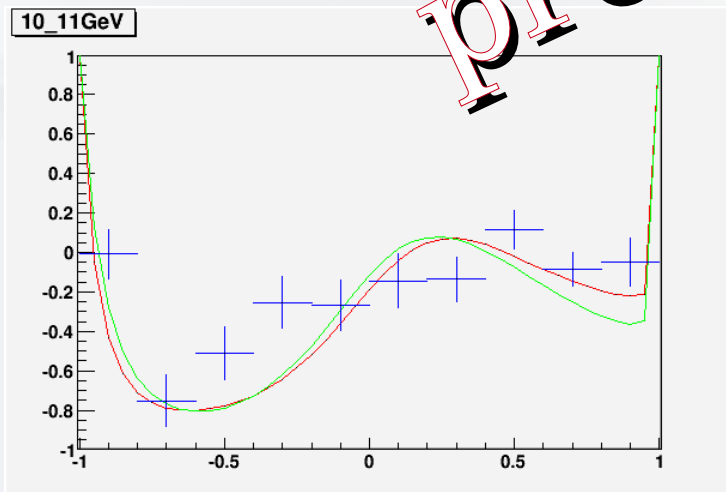
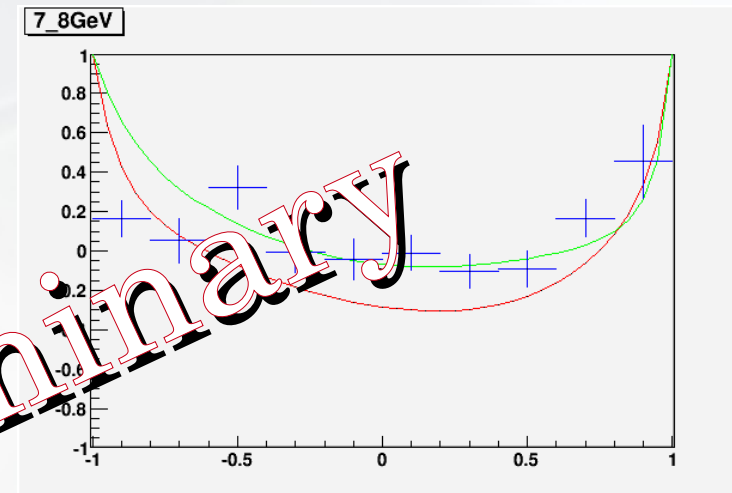
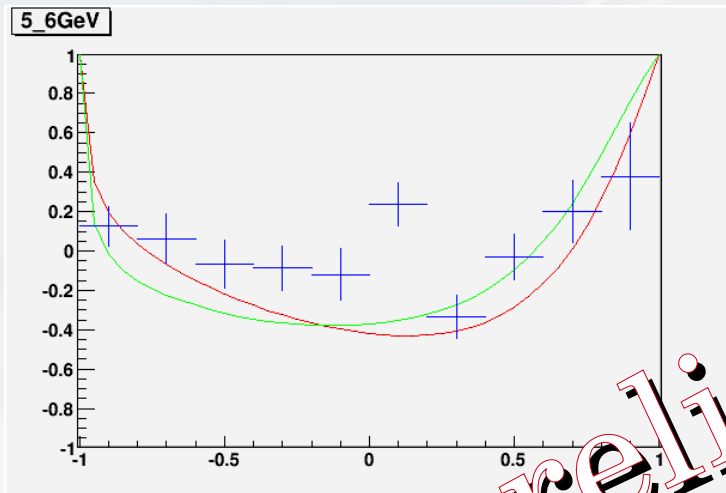
Bound nucleon
→ Fermi momentum



Helicity asymmetry E

$$E = \frac{D_{eff}}{P_T P_y} \frac{N_{1/2} - N_{3/2}}{N_{1/2} + N_{3/2}}$$

SAID —
MAID2007 —



preliminary

Summary

My preliminary results will be changed with

(1) Energy loss, momentum loss corrections

(2) Omit bad events

(3) Use suitable factors, polarizations