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PRELIMINARY RESULTS FROM FERMILAB E-800 ON THE POLARIZATION OF Ξ^-'s AND Ω^-'s PRODUCED BY POLARIZED AND UNPOLARIZED NEUTRAL BEAMS

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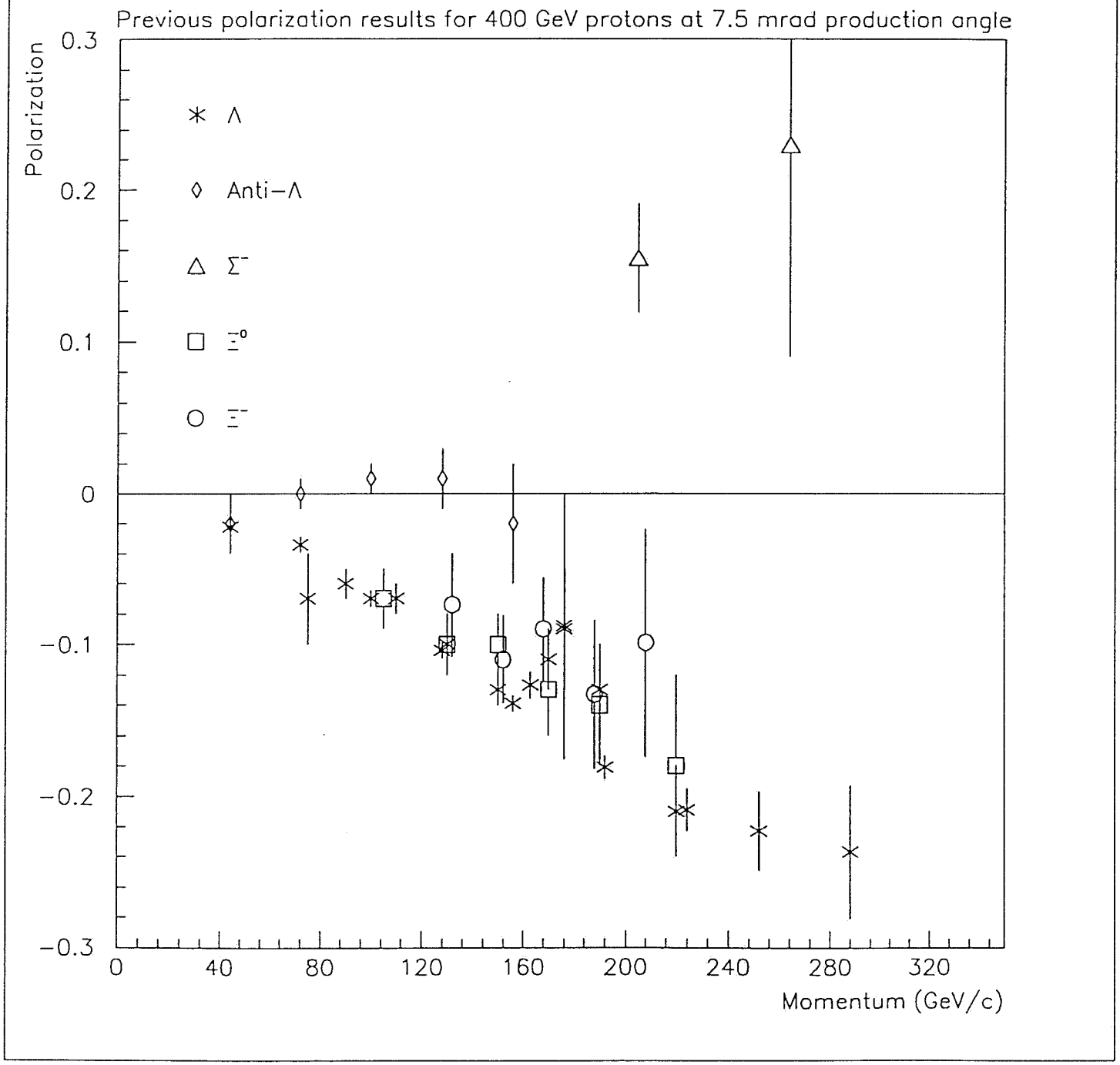
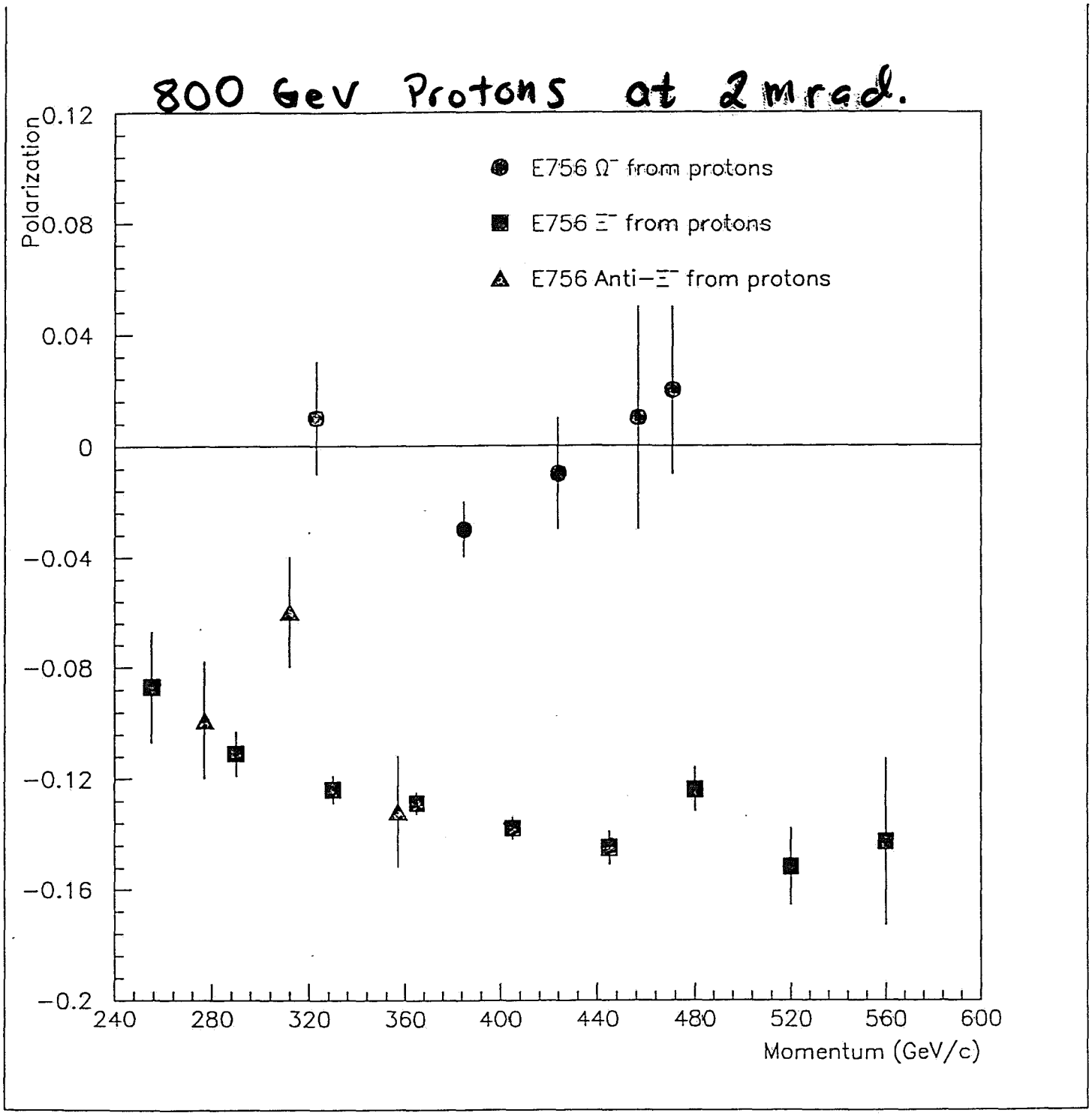
Preliminary Results.

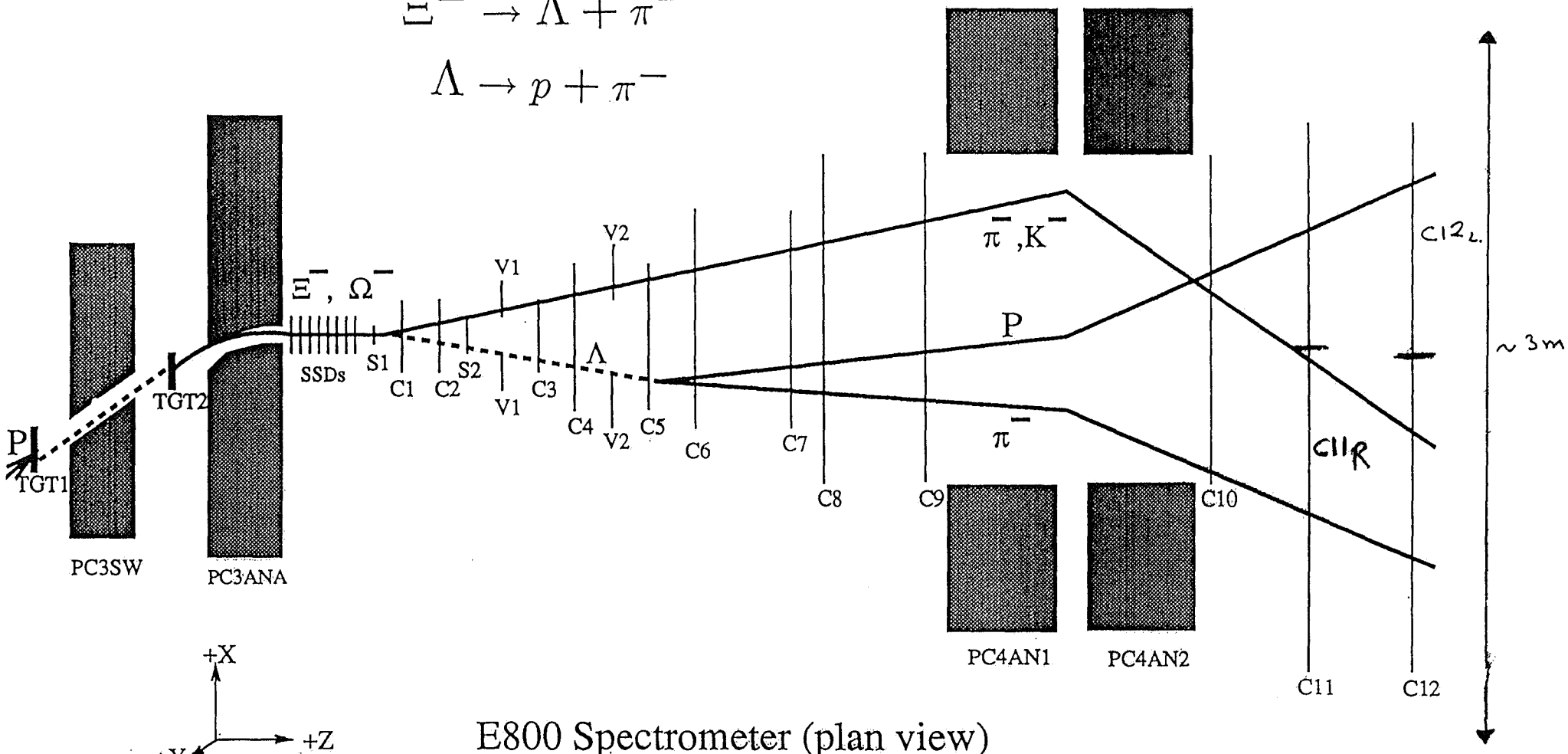
1.5 Million Ξ^- (3% of sample)

78K $\Lambda\Omega^-$ (40 % of sample)


Previous polarization results for 400 GeV protons at 7.5 mrad production angle
Polarization
0.3
0.2
0.1
0
−0.1
−0.2
−0.3
Λ
Anti−Λ
Σ⁻
Ξ⁰
Ξ⁻
0
40
80
120
160
200
240
280
320
Momentum (GeV/c)


800 GeV Protons at 2 mrad.
Polarization
0.12
0.08
0.04
0
−0.04
−0.08
−0.12
−0.16
−0.2
E756 Ω⁻ from protons
E756 Ξ⁻ from protons
E756 Anti−Ξ⁻ from protons
240
280
320
360
400
440
480
520
560
600
Momentum (GeV/c)

$$\Omega^- \rightarrow \Lambda + K^-$$
$$\Xi^- \rightarrow \Lambda + \pi^-$$
$$\Lambda \rightarrow p + \pi^-$$



E800 Spectrometer (plan view)

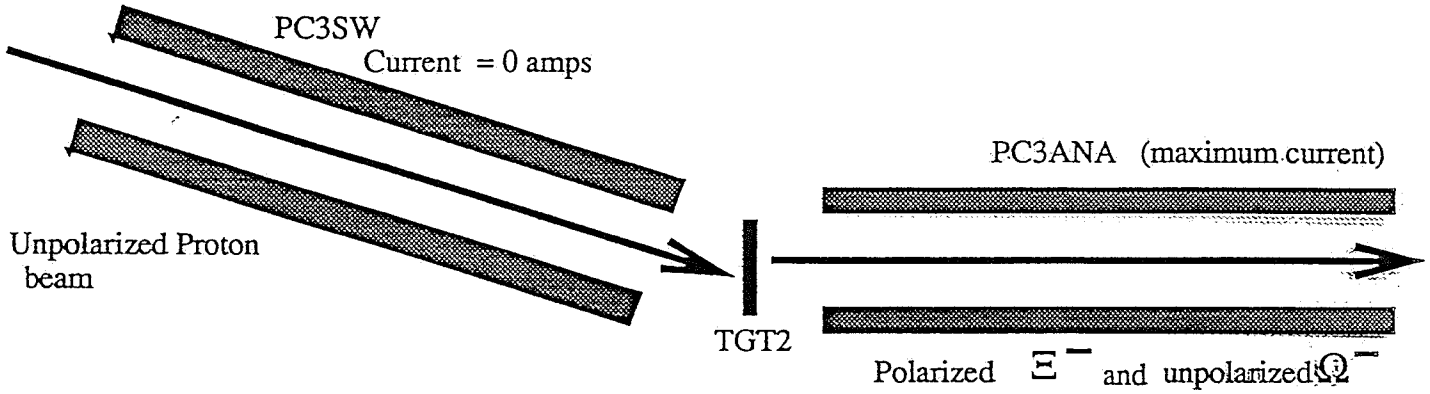
~ 80m

$$Trigger = S1 \cdot S2 \cdot \overline{V1} \cdot \overline{V2} \cdot C11_R \cdot C12_L$$

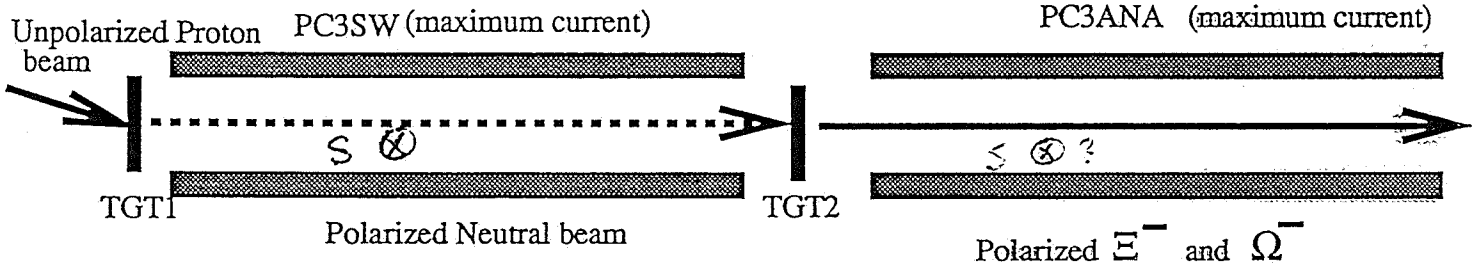
E800 Production Methods

Elevation View

a) Proton Production

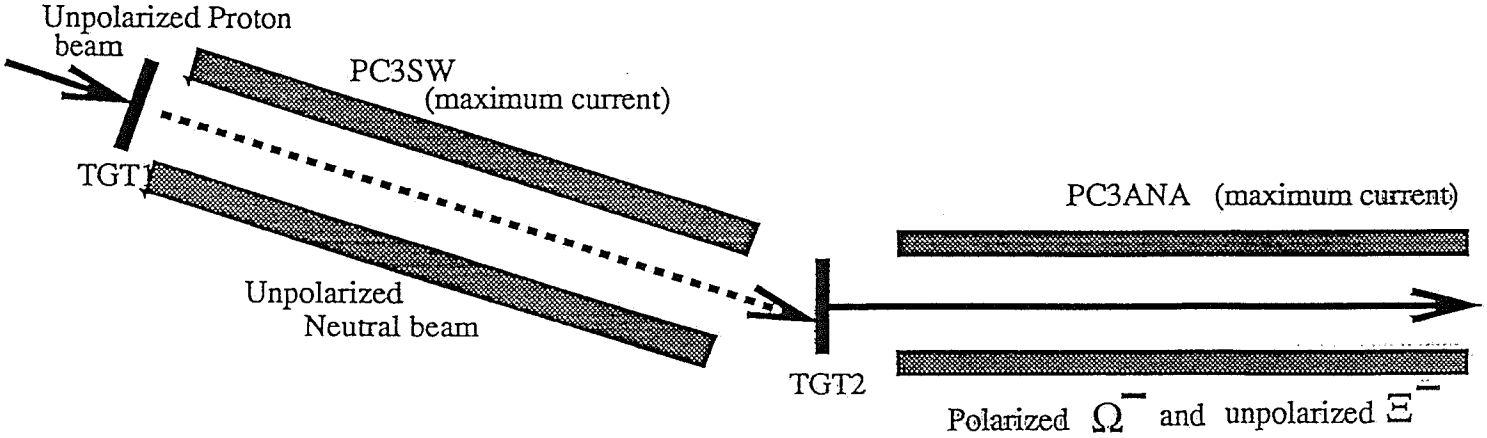


b) Spin-transfer Production

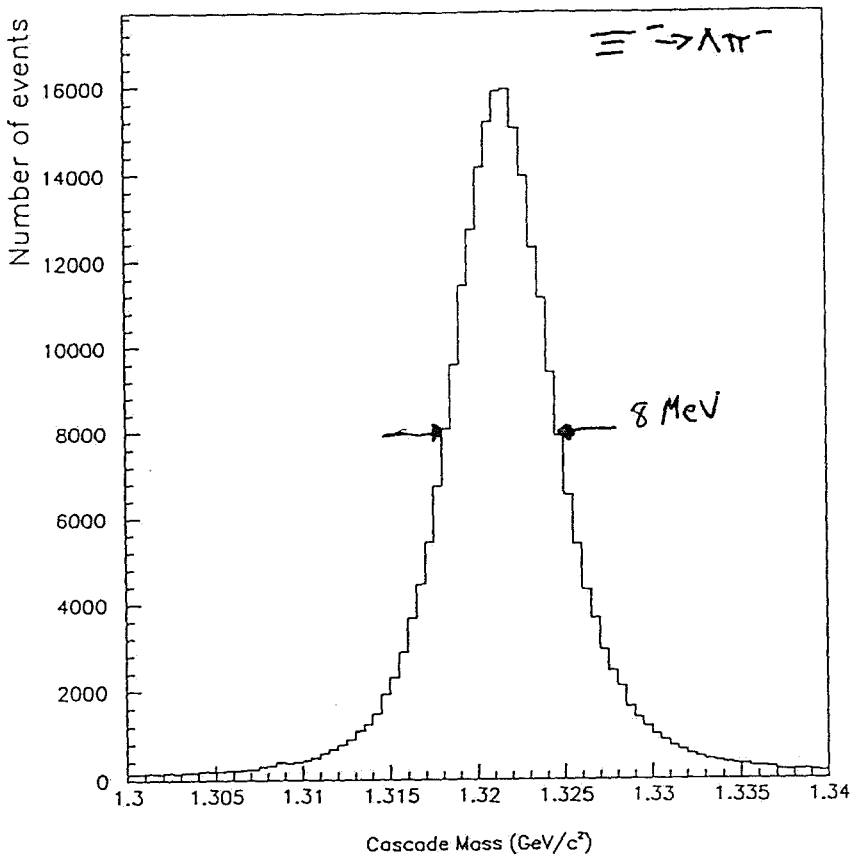


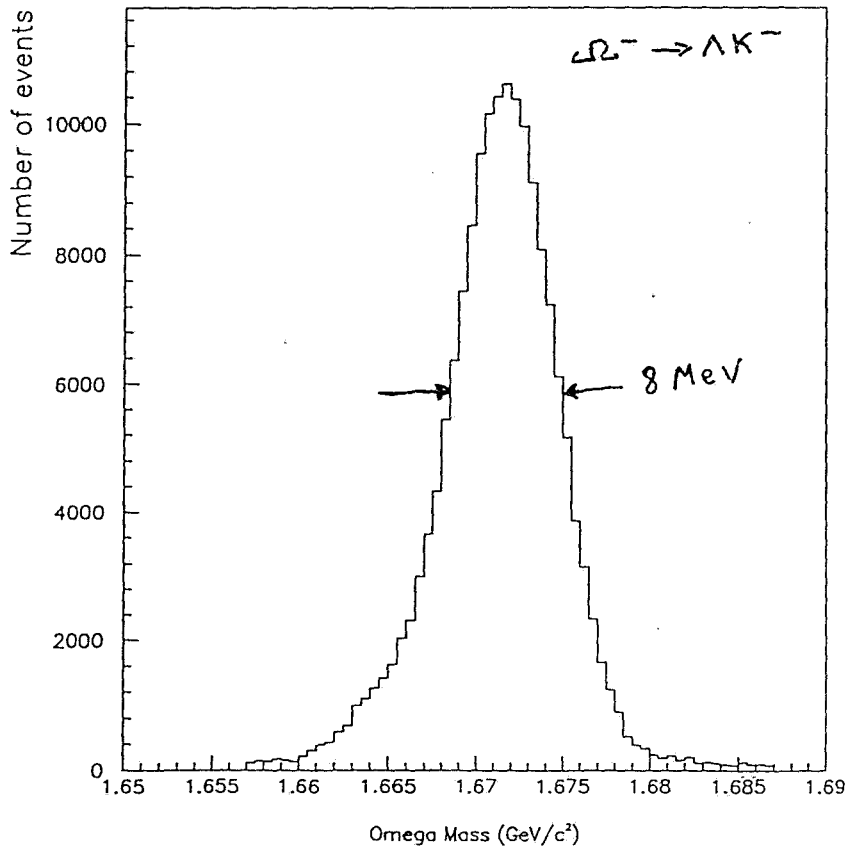
$$n, \Lambda^0, \Xi^0, \gamma, K^0$$

c) Neutral Production



$$\Xi^0 : K^0 : \Lambda^0 : n : \gamma \approx 1 : 2 : 10 : 200 : 2000$$

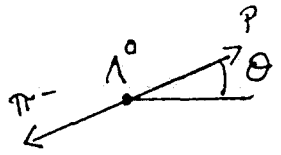

Ξ⁻→Λπ⁻
Number of events
16000
14000
12000
10000
8000
6000
4000
2000
0
8 MeV
1.3
1.305
1.31
1.315
1.32
1.325
1.33
1.335
1.34
Cascade Mass (GeV/c²)

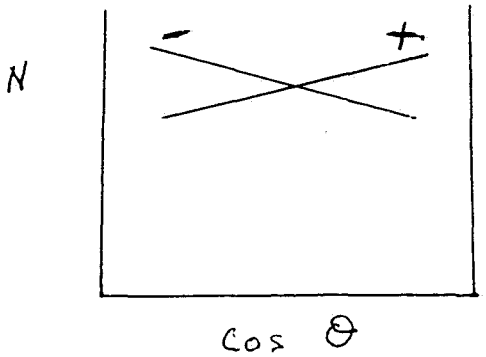

Ω⁻ → ΛK⁻
Number of events
10000
8000
6000
4000
2000
0
8 MeV
1.65
1.655
1.66
1.665
1.67
1.675
1.68
1.685
1.69
Omega Mass (GeV/c²)

$$\vec{P}_\Lambda = \gamma_{\Xi}\vec{P}_{\Xi}$$

$$\vec{P}_\Omega = \vec{P}_\Lambda$$

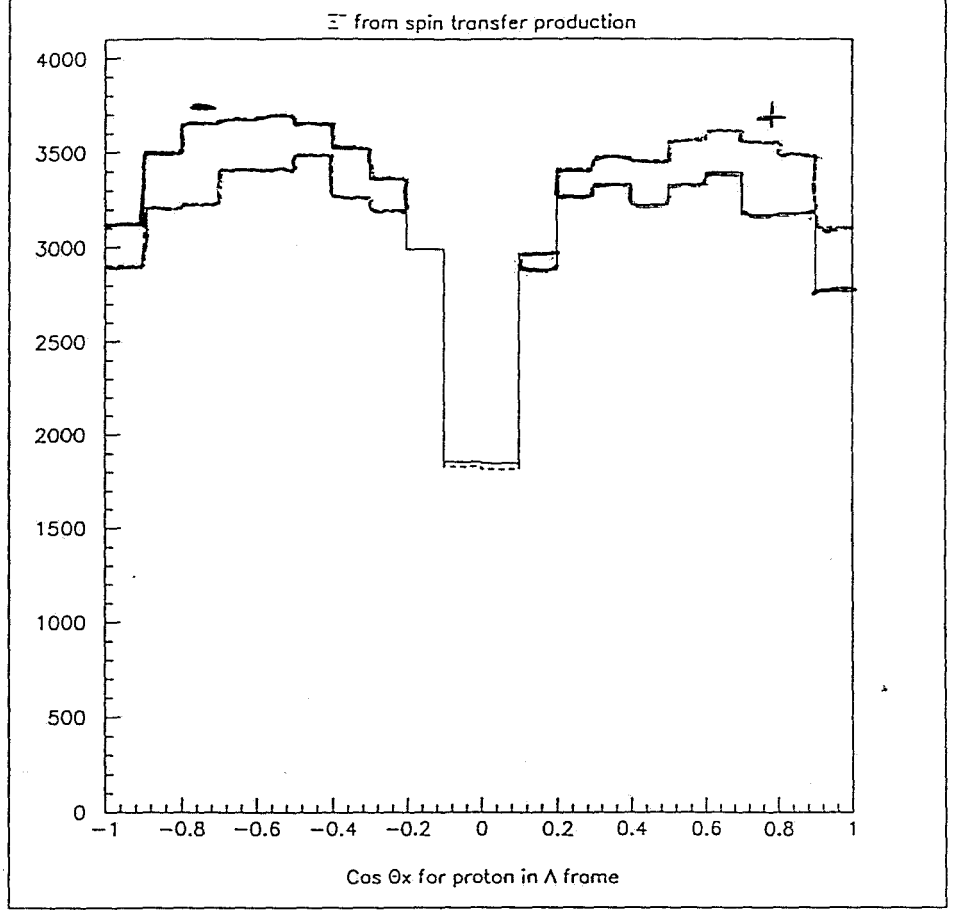
$$\frac{dn}{d(cos\theta_i)} = \frac{1}{2}(1 + \alpha_\Lambda P_{\Lambda i} cos\theta_i)$$

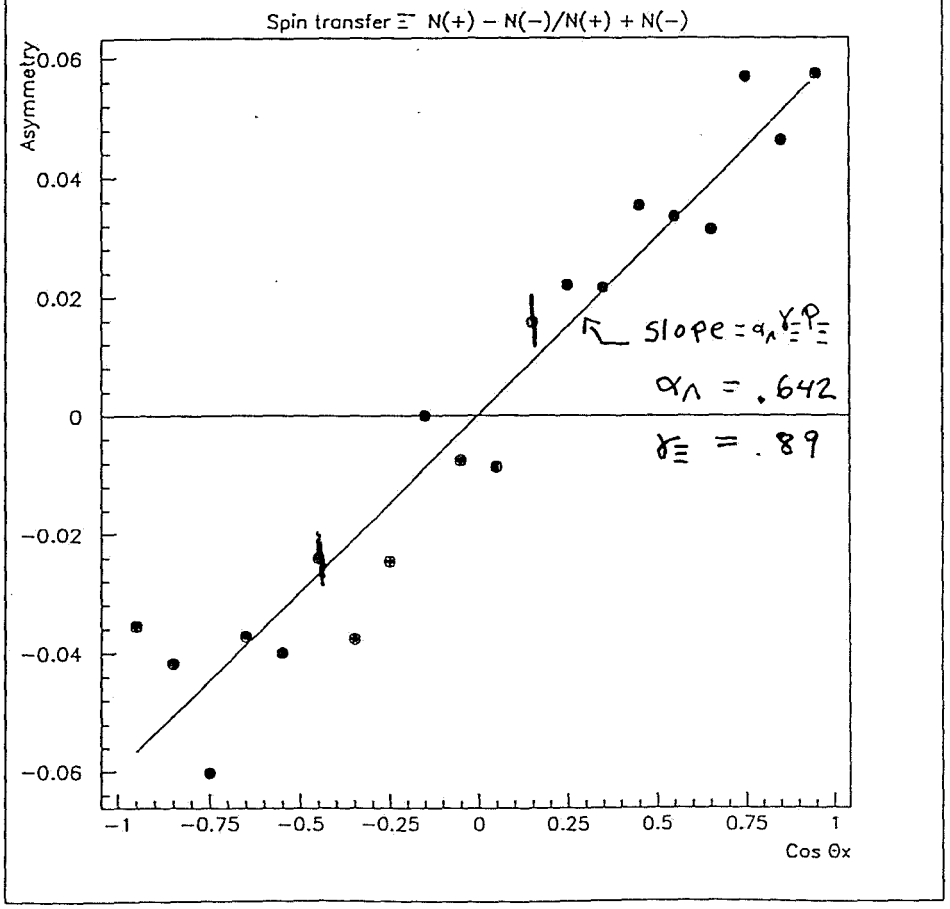


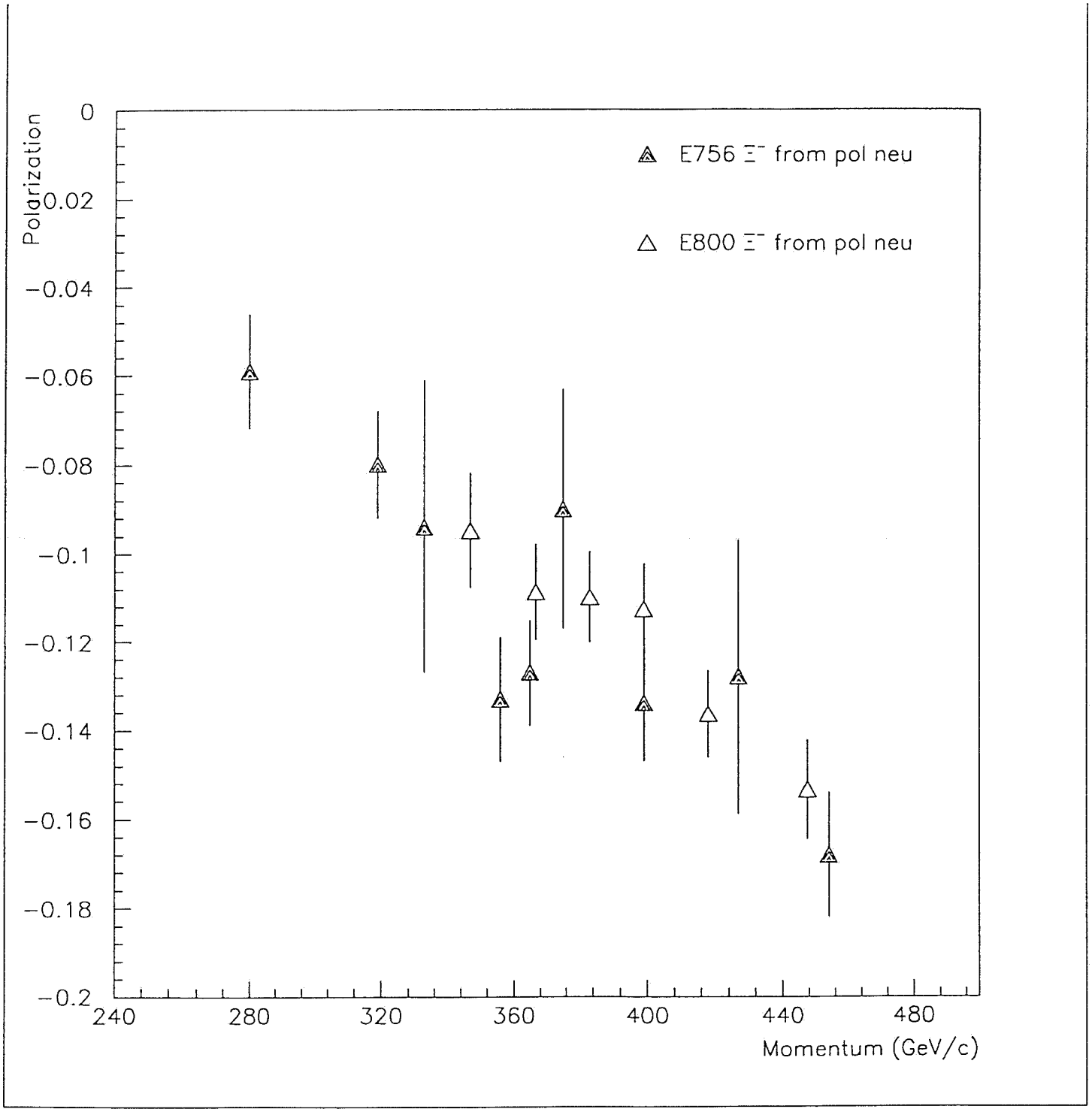


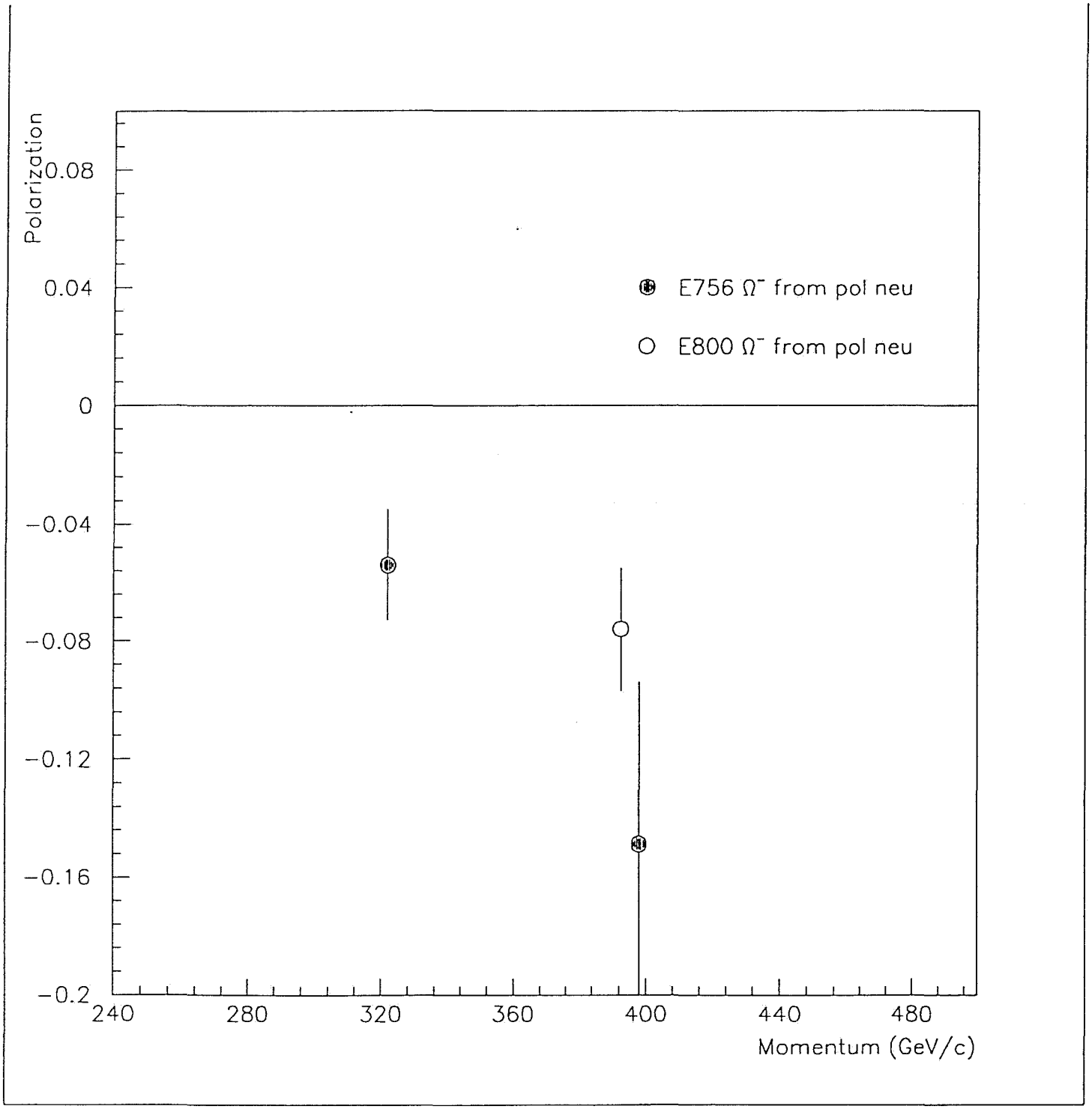
100% Acceptance

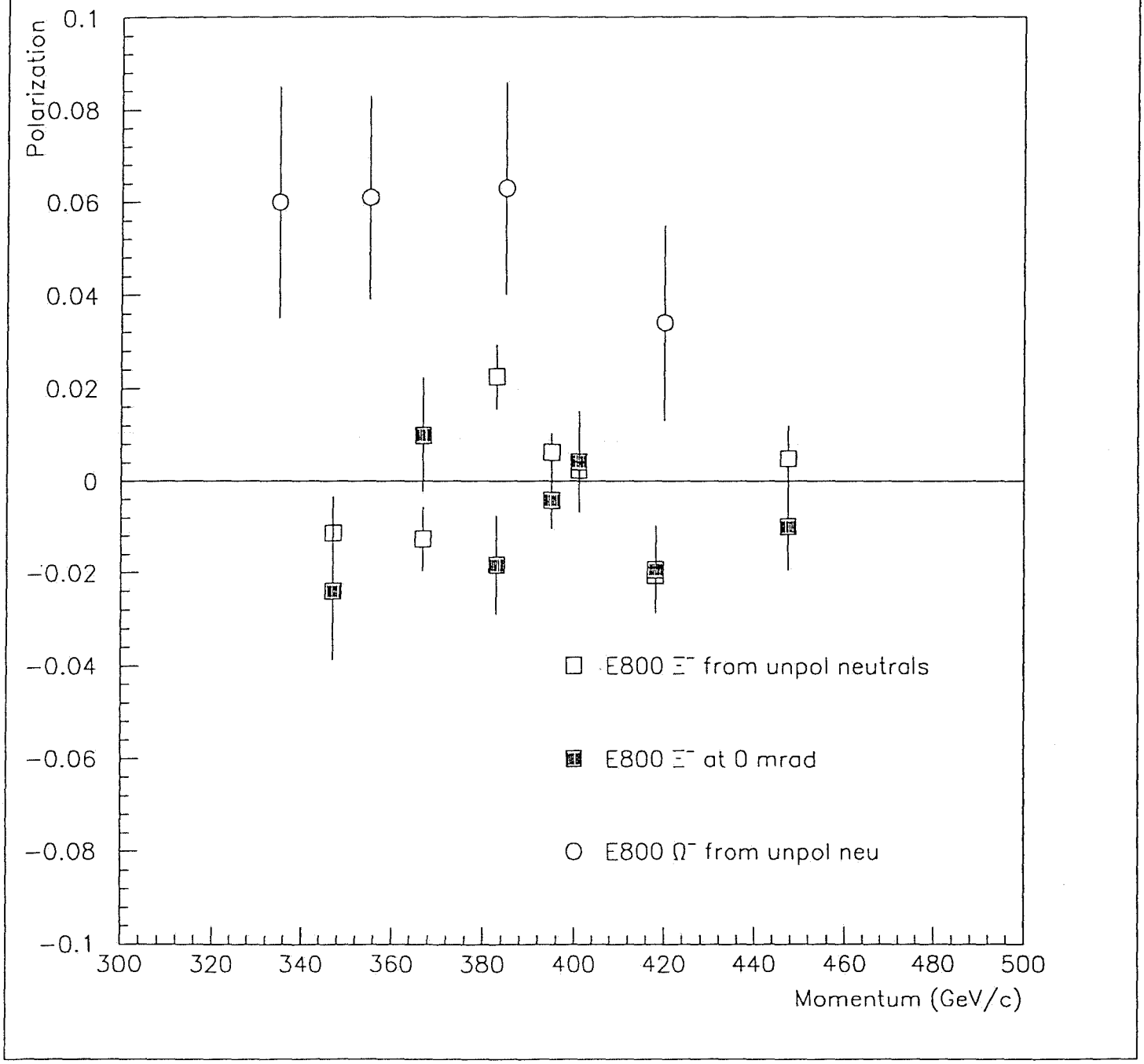
Real Data


Ξ⁻ from spin transfer production
4000
3500
3000
2500
2000
1500
1000
500
0
−1
−0.8
−0.6
−0.4
−0.2
0
0.2
0.4
0.6
0.8
1
Cos Θx for proton in Λ frame


Spin transfer Ξ⁻ N(+) − N(−)/N(+) + N(−)
Asymmetry
0.06
0.04
0.02
0
−0.02
−0.04
−0.06
−1
−0.75
−0.5
−0.25
0
0.25
0.5
0.75
1
Cos Θx
slope = αΛ γΞ PΞ
αΛ = .642
γΞ = .89


Polarization
0
0.02
−0.04
−0.06
−0.08
−0.1
−0.12
−0.14
−0.16
−0.18
−0.2
240
280
320
360
400
440
480
Momentum (GeV/c)
E756 Ξ⁻ from pol neu
E800 Ξ⁻ from pol neu


Polarization
0.08
0.04
0
−0.04
−0.08
−0.12
−0.16
−0.2
240
280
320
360
400
440
480
Momentum (GeV/c)
E756 Ω⁻ from pol neu
E800 Ω⁻ from pol neu


Polarization
0.1
0.08
0.06
0.04
0.02
0
−0.02
−0.04
−0.06
−0.08
−0.1
300
320
340
360
380
400
420
440
460
480
500
Momentum (GeV/c)
E800 Ξ⁻ from unpol neutrals
E800 Ξ⁻ at 0 mrad
E800 Ω⁻ from unpol neu

Preliminary polarization results.

Average Momentum for all samples is 395 GeV/c

All errors are statistical only.

Spin transfer

Ξ^-'s: -0.1172 $\pm$ 0.0062

Ω^-'s: -0.076 $\pm$ 0.021

Neutral production at 2 mrad

Ξ^-'s: 0.0062 $\pm$ 0.0042

Ω^-'s: 0.053 $\pm$ 0.012

0 mrad production

Ξ^-'s: -0.0042 $\pm$ 0.0062

What result might be expected for
neutral production Ω^-'s?

$$n \to \Omega^- \quad \sim \quad p \to \Omega^- \quad P = 0$$

$$\Lambda \to \Omega^- \quad \sim \quad p \to \Xi^- \quad P = -$$

$$\Xi^0 \to \Omega^- \quad \sim \quad p \to \Lambda^0 \quad P = -$$