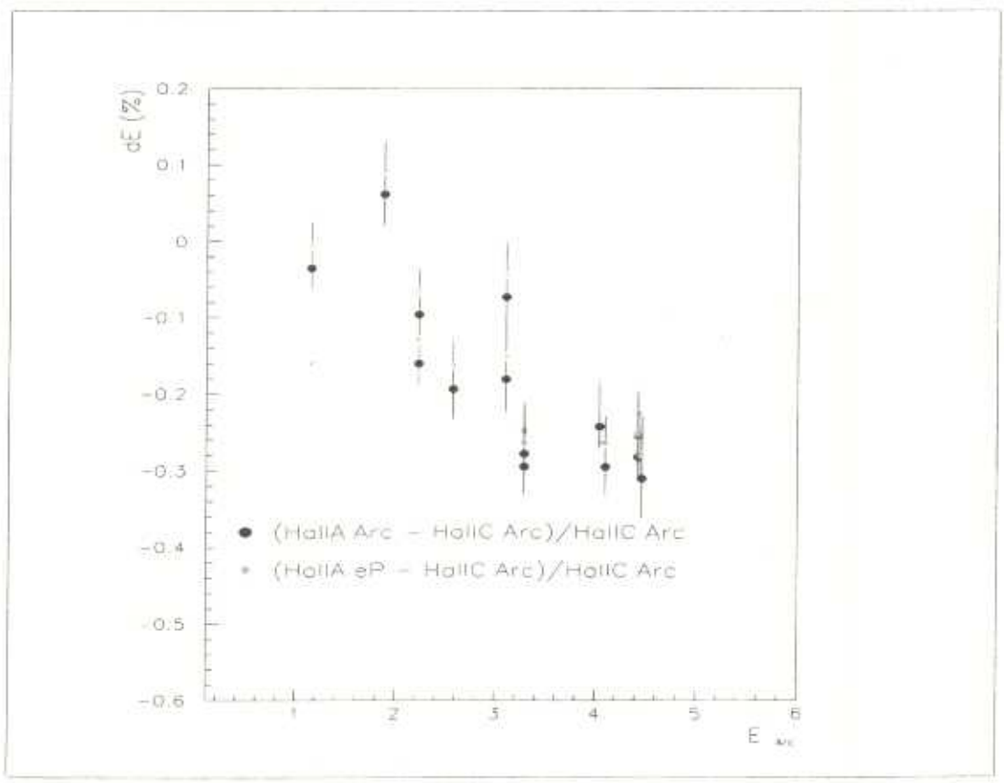
Christy II

HallC Kinematics: HMS offsets and all that.

- Are there kinematic offsets intrisic to the setup of HallC?

- Individual experiments have typically determined HallC spectrometer offsets in P, θ - generally with small kinematic sets.

- HallC Arc measurements have typically yielded beam energies larger than HallA.



$$dW = \delta W/\delta E * \Delta E + \delta W/\delta E' * \Delta E' + \delta W/\delta\theta * \Delta\theta$$

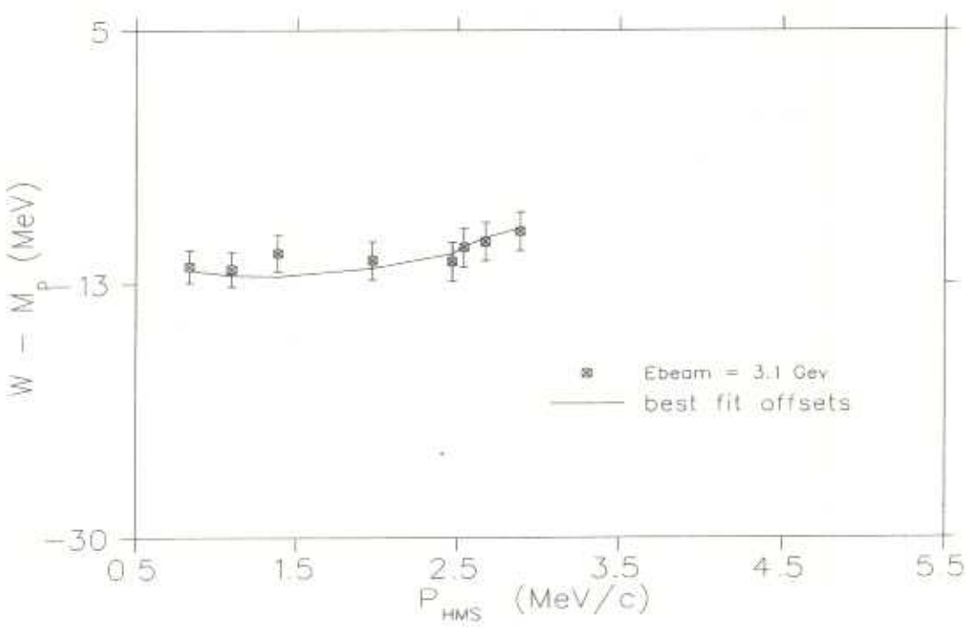
$$\Delta E = \delta E / E \qquad \Delta E' = \delta E' / E'$$

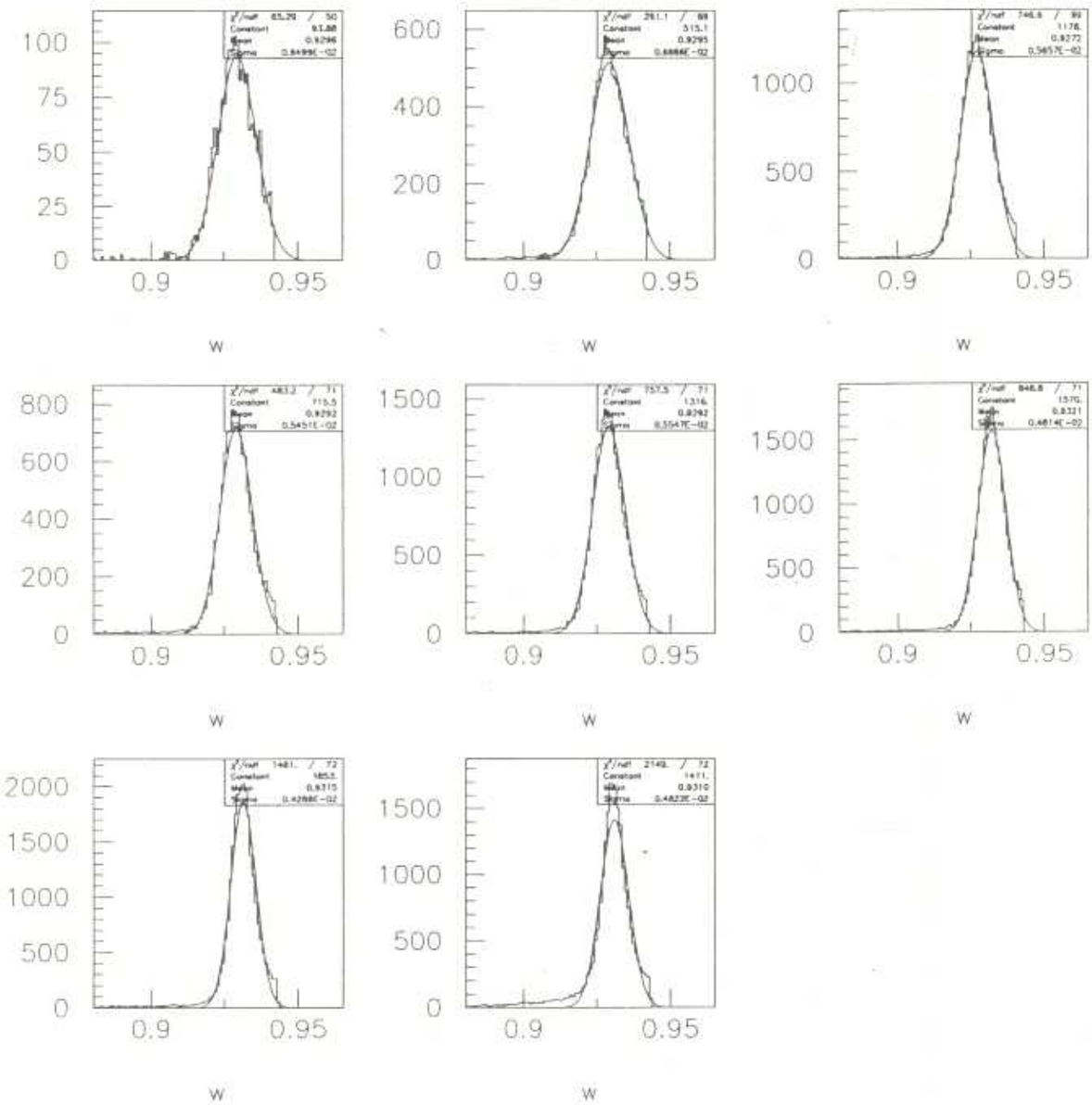
Where $dW_{Exp} = W_{Exp} - Mp$

ΔE, ΔE, and $\Delta\theta$ are adjusted to give the best fit to dW_{Exp}.

Corrections to dW are made for:

- Ionization energy loss
- Radiative effects
- Beam position on target




100
75
50
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500
0
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0.95
W

- Problem is underconstrained:

  - Assume $\Delta E'$ and $\Delta\theta$ are constants for all E.

  - Allow ΔE to vary with E .

  - As many different kinematics were fit simultaneously, as were available

- Checked for consistency with eP coincidence data where possible.

- Checked for consistency with previous eP coincidence studies. (K. Garrow)

E (GeV)	E' (GeV)	θ (deg)	$\Delta W(MeV)$	dW/dE	dW/dE'	dW/dθ
2.238	0.731	80.0	-9.0	0.754	-2.246	-1.776
	0.731	80.0	-8.7			
	0.846	70.0	-9.0	0.871	-2.246	-1.961
	1.008	59.0	-8.1	1.087	-2.246	-2.125
	1.154	51.0	-10.0	1.188	-2.246	-2.213
	1.325	43.0	-10.3	1.365	-2.246	-2.231
	1.325	43.0	-10.4			
	1.596	32.0	-7.7	1.644	-2.246	-2.088
	1.853	22.0	-8.9	2.243	-2.246	-1.714
	2.050	13.0	-9.4	2.111	-2.246	-1.140
3.119	0.832	78.00	-11.4	0.858	-3.124	-2.797
	1.094	62.01	-11.7	1.128	-3.124	-3.319
	1.382	50.00	-10.8	1.425	-3.124	-3.639
	1.968	32.90	-11.6	2.032	-3.124	-3.683
	2.465	23.00	-11.9	2.464	-3.124	-3.213
	2.538	19.49	-10.8	2.617	-3.124	-2.916
	2.672	16.00	-10.4	2.759	-3.124	-2.539
	2.888	12.50	-9.6	2.886	-3.124	-2.087
4.420	1.562	51.02	-18.6	1.607	-4.429	-5.912
	1.802	45.00	-19.1	1.855	-4.429	-6.207
	2.093	38.99	-18.0	2.154	-4.429	-6.414
5.506	2.557	35.51	-22.8	2.628	-5.520	-9.018
	2.746	33.02	-22.5	2.822	-5.520	-9.085
	2.746	33.00	-21.4	2.824	-5.520	-9.085
	2.950	30.50	-20.7	3.007	-5.520	-9.096
	3.169	28.00	-20.9	3.257	-5.520	-9.038
	3.402	25.50	-19.5	3.496	-5.520	-8.291
	3.646	23.00	-19.0	3.746	-5.520	-8.653
	3.899	20.50	-18.5	4.005	-5.520	-8.896
	4.155	17.99	-12.9	4.267	-5.520	-7.793
	4.771	13.02	-8.3	4.771	-5.520	-6.355
5.661	3.868	22.60	-11.3	3.861	-5.678	-9.024
	4.304	18.60	-7.8	4.295	-5.678	-8.333
	4.737	14.60	1.1	4.726	-5.678	-7.247
	5.132	10.6	8.3	5.119	-5.678	-5.133

Table 1: Table of kinematics, measured ΔW, and derivatives.

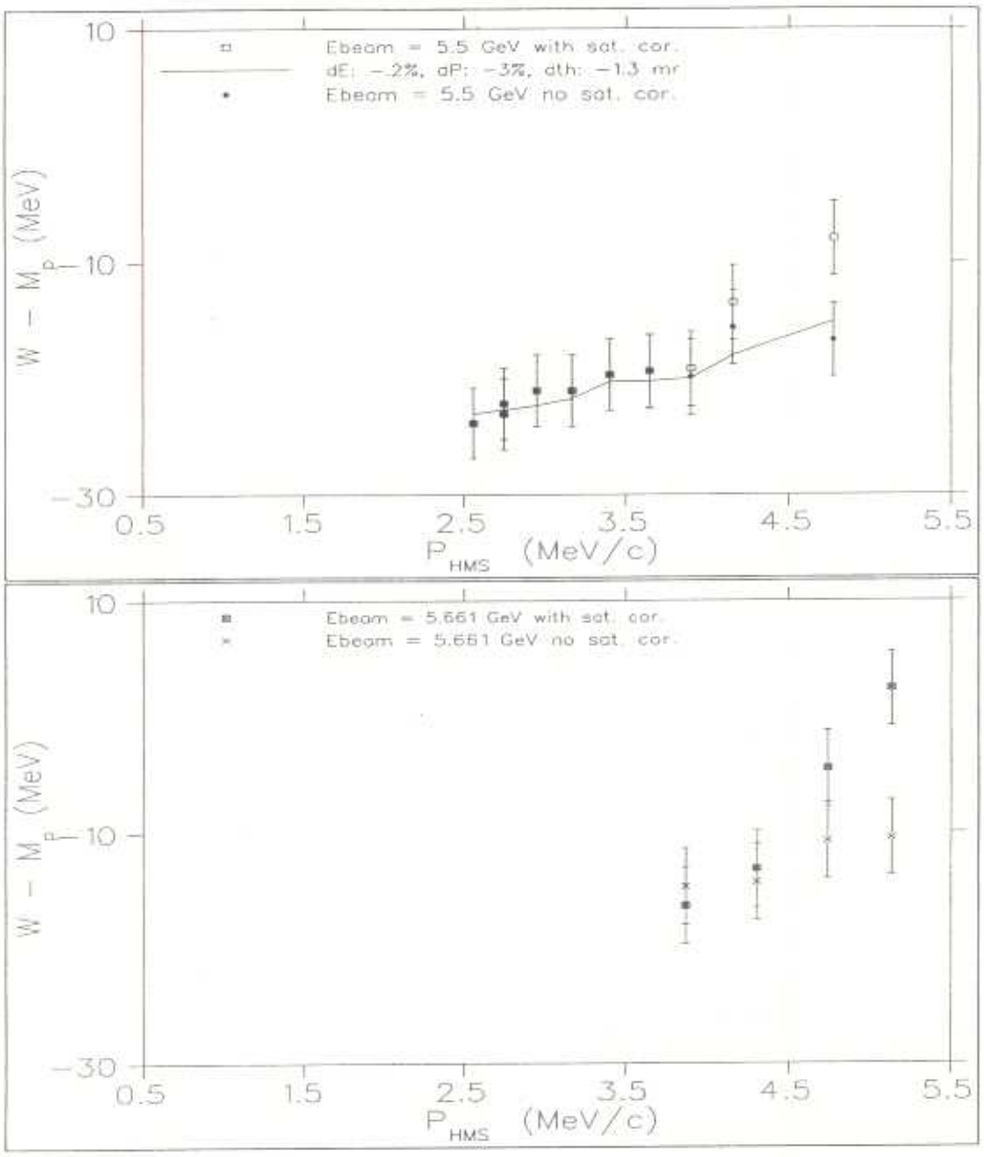
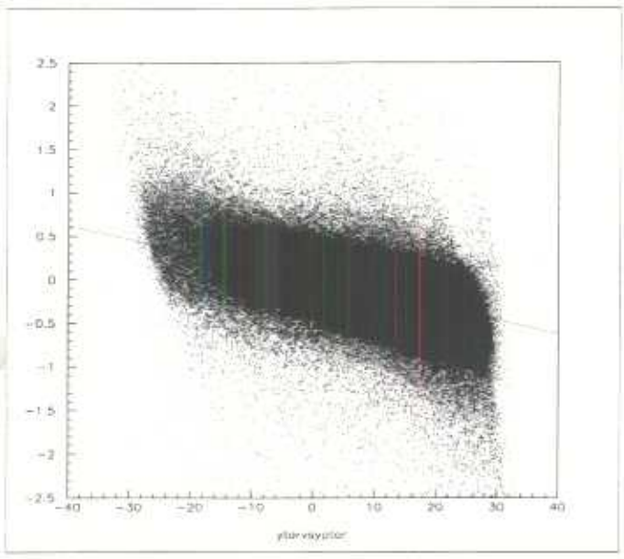
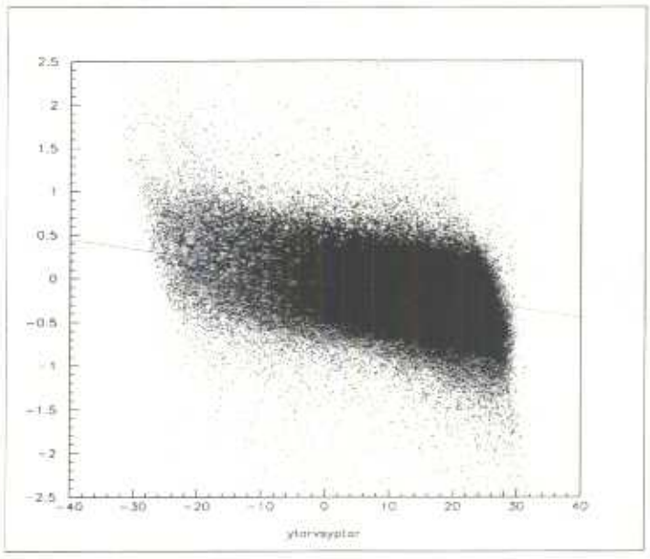


Figure 2: Measured values of W - Mp for beam energies of 5.5 GeV (top) and 5.661 GeV (bottom). The effect of removing the saturation correction intrinsic in Field99 is also shown.

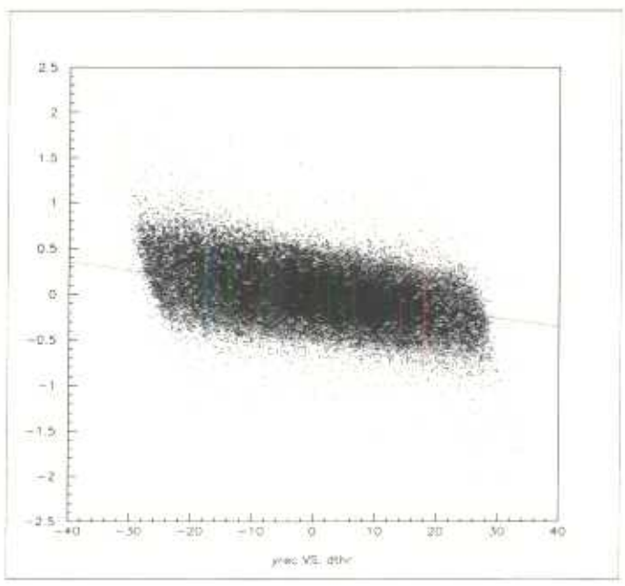
Large E' optics systematic

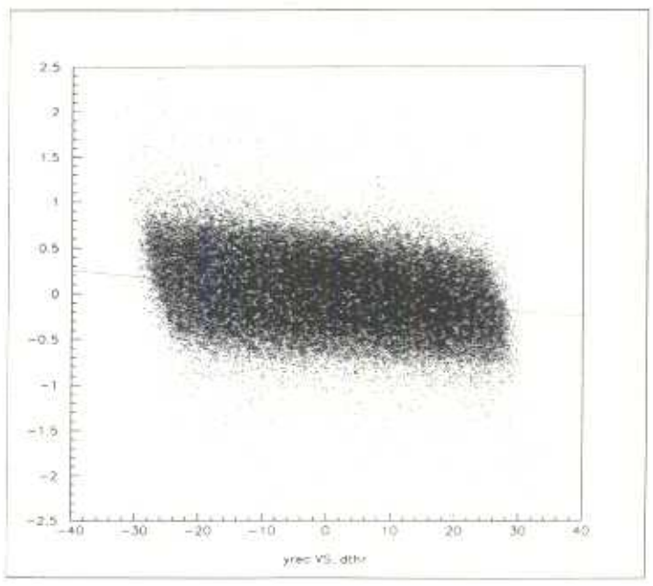
- Angle resolution is observed to be very poor for E' > 4 GeV
- Seen as a shift in the optical focal plane from the nominal position by an amount which scales with E'
- Results from a change in the field ratio of one or more magnets relative to the others





MC with Dipole saturation correction included

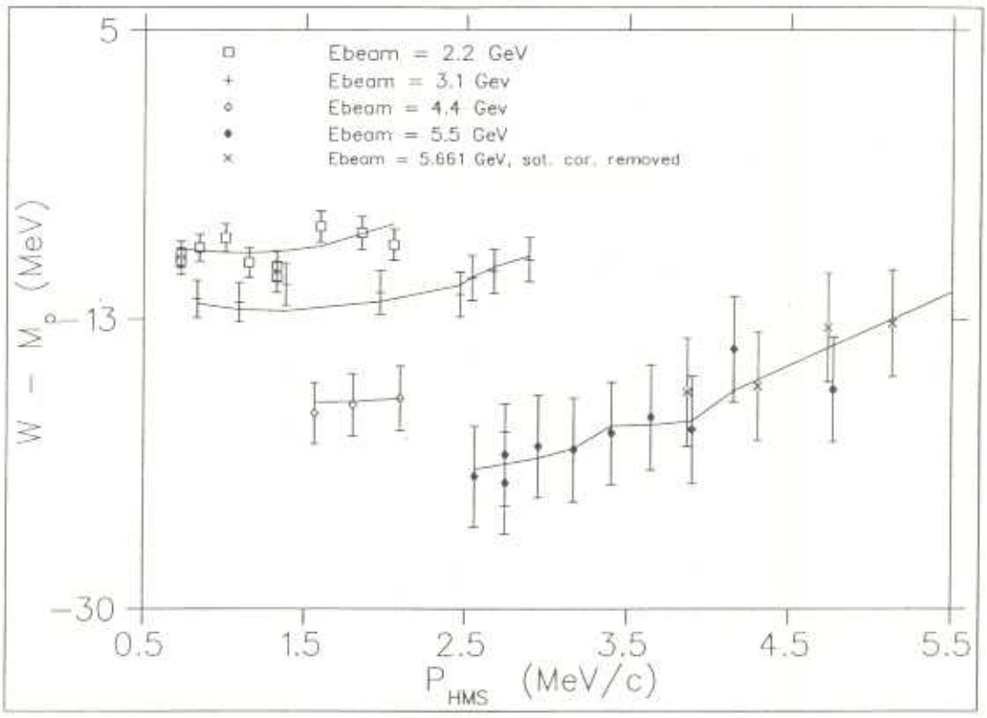




Kinematic Offsets from Single-Arm Elastics

$$W_{observed} - M_p = \left.\frac{\partial W}{\partial E}\right| \underline{\Delta E} + \left.\frac{\partial W}{\partial E'}\right| \underline{\Delta E'} + \left.\frac{\partial W}{\partial \theta}\right| \underline{\Delta \theta}$$

Best fit to determine ΔE, $\Delta E'$, $\Delta\theta$

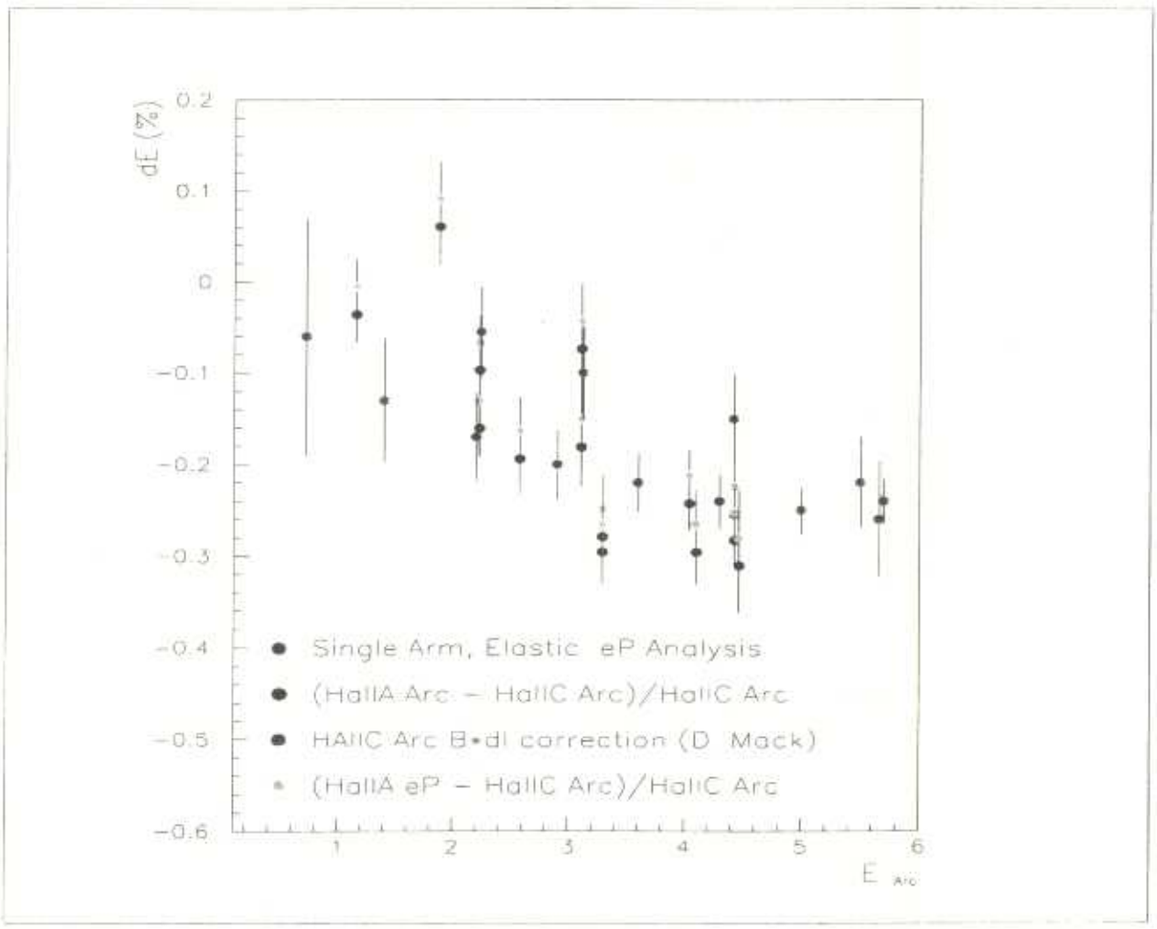


E (GeV)	δE (%)	$\Delta E'$ (%)	$\Delta\theta$ (mrad)
2.238	-0.055	-0.29	-1.2
3.119	-0.10	—	—
4.420	-0.15	—	—
5.506	-0.22	—	—
5.661	-0.26	—	—

Table 2: Final offsets for complete data set.

- Recent field mappings of a 'golden' ARC Magnet indicate B*dl diffent from that used in ARC energy measurements. (D. Mack

- Error in the previous ARC measurements scales with energy.



- Both studies indicate that the true beam energy is smaller than the HallC Arc measurement by an amount which scales with energy.