Evaluating e/h and e/μ from April 1998 Testbeam Data

Matt Dobbs
Michel Lefebvre
Dugan O'Neil

University of Victoria
Victoria, B.C.

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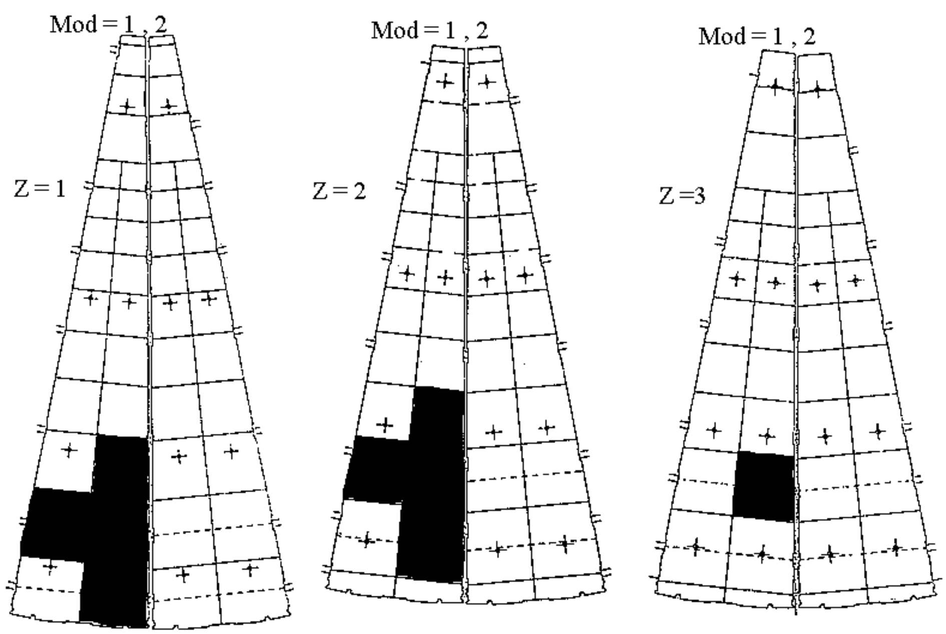
- Electron results (9 cells)
- e/μ
- e/h
- Conclusions

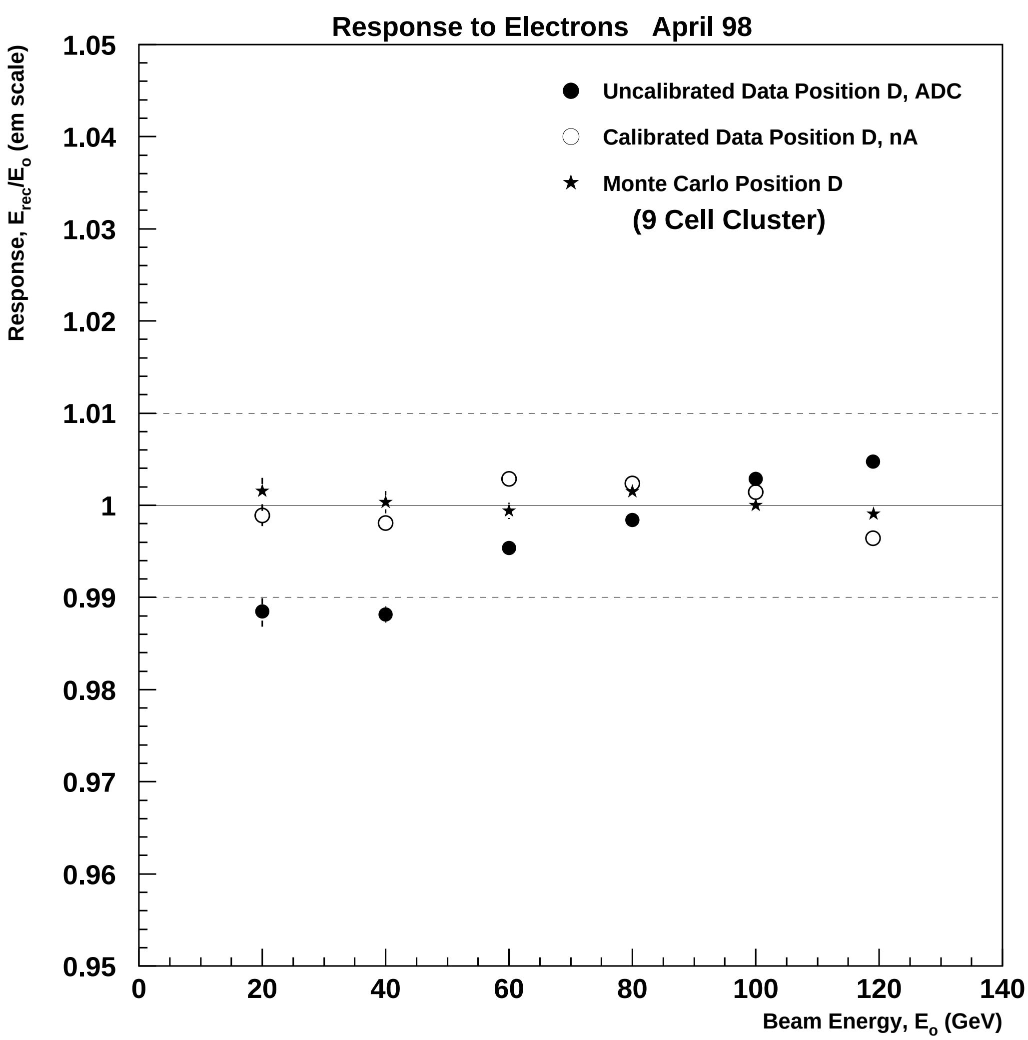
Electron Analysis

- Electron data were analyzed using 9 cell electron clusters to achieve full containment. (3 cell cluster was used previously)



Electron Analysis

- Response for this cluster is flat within ±0.5%. New calibration (May 6, 1999) was tried but had no effect.



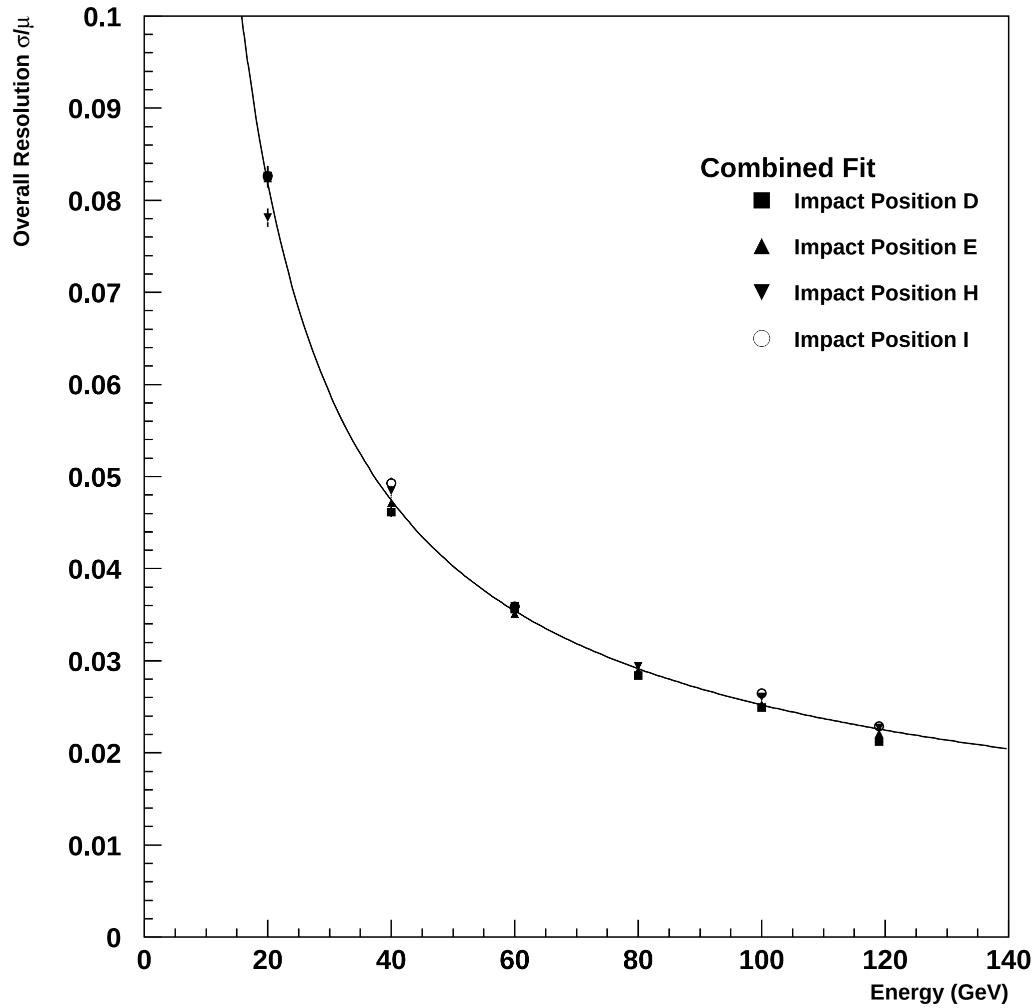
Electron Analysis

- Electron response was taken as average at each impact position, error is rms

Impact Position	Calibrated α_{em}	Uncalibrated α_{em}
Module 1		
D	$3.211 \pm 0.008 \frac{GeV}{\mu A}$	$0.1058 \pm 0.0007 \frac{GeV}{ADC}$
H	$3.194 \pm 0.011 \frac{GeV}{\mu A}$	$0.1045 \pm 0.0008 \frac{GeV}{ADC}$
Module 2		
E	$3.171 \pm 0.008 \frac{GeV}{\mu A}$	$0.1041 \pm 0.0007 \frac{GeV}{ADC}$
I	$3.211 \pm 0.008 \frac{GeV}{\mu A}$	$0.1042 \pm 0.0007 \frac{GeV}{ADC}$

Electron Analysis

- Resolution also agrees with previous results



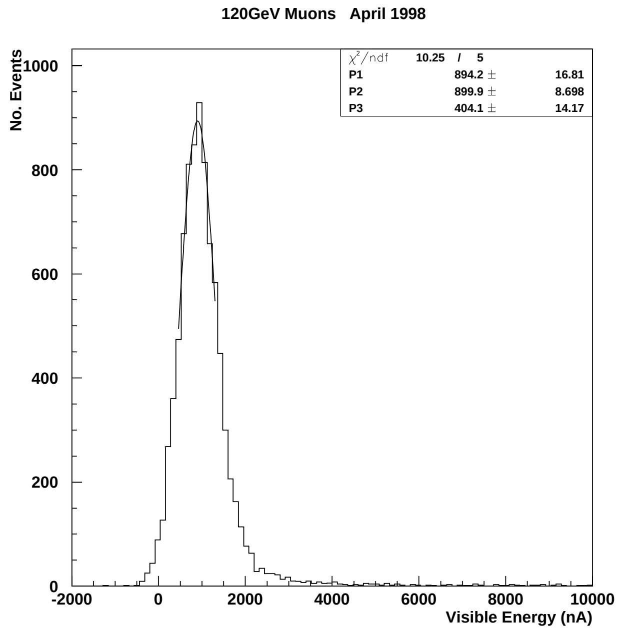
- Combined fit:

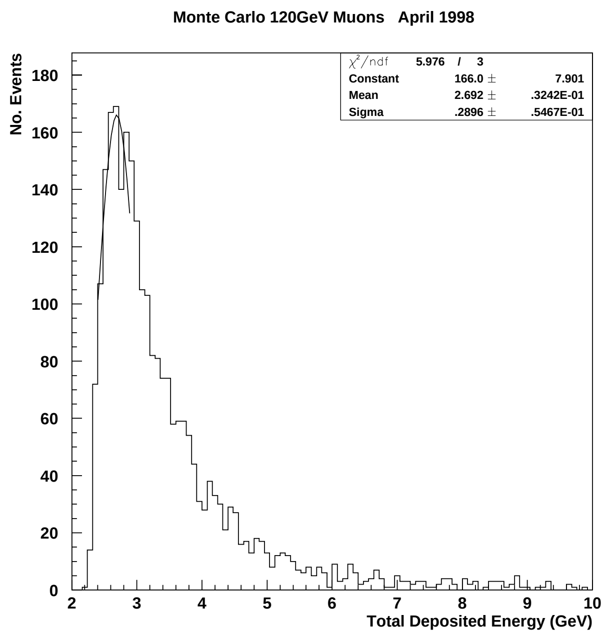
$$\frac{\sigma}{E} = \frac{21.4\%}{\sqrt{E_o}} \oplus 0 \oplus \frac{1.33\ \mathrm{GeV}}{E}$$

e/μ Analysis

- 120 GeV muon data at 4 impact positions
- use 6 cell muon cluster (straight line through calorimeter)
- use "most probable" energy rather than mean energy
- total deposited energy must be taken from Monte Carlo

e/μ Analysis





e/μ Analysis

- depth weights of 1,1,2 are used, except for HV correction in module 2. In second wheel of this module 8 sub-gaps are disconnected and 8 are only at 1200V. Correction factor

$$\frac{16 \times 4}{8 \times 3 + (8 \times 3 + 8 \times \frac{195}{225})} \simeq 1.165$$

  195/225 corrects for reduced voltage in 8 gaps.

- results are obtained using full HV correction or ignoring low voltage subgaps

Impact Position	$\frac{e}{\mu}$ (Corrected)	$\frac{e}{\mu}$ (Partially Corrected)
Module 1		
D	0.932 ± 0.014	–
H	0.923 ± 0.022	–
Module 2		
E	0.954 ± 0.025	0.997 ± 0.03
I	0.933 ± 0.022	0.969 ± 0.03

e/h Analysis

- 9 cell electron and 39 cell pion clusters are used
- e/π response is fit using

$$\frac{e}{\pi} = \frac{\frac{e}{h}}{1 - (1 - \frac{e}{h}) f_{\pi_o}(E)}$$

where f_{π_o} is either Wigmans'

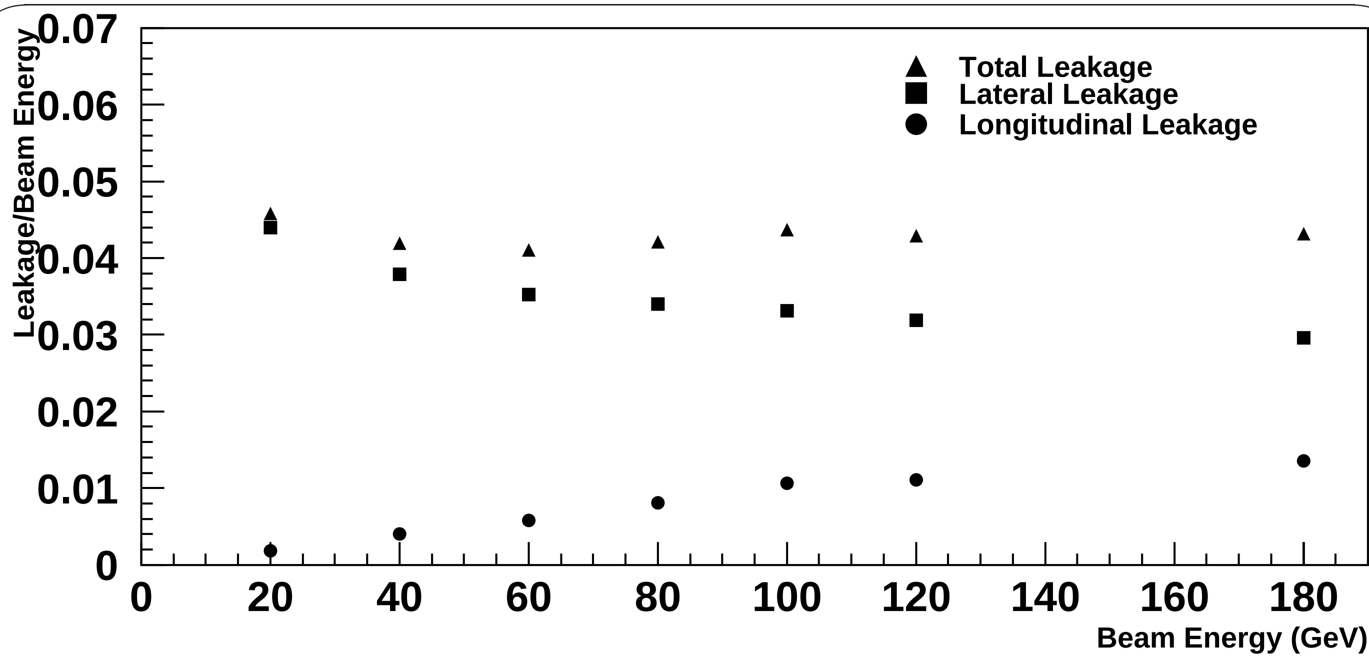
$$f_{\pi_o} = k \ln(E/E_o)$$

or Groom's

$$f_{\pi_o} = 1 - (E/E_o)^{m-1}$$

and $E_o = 1$ GeV.

e/h Analysis



- MC leakage correction is used. Leakage is mostly lateral and overall leakage is almost flat as a function of energy.
- MC data exists for 2 impact positions, use average leakage for the other 2 positions
- cells distant from the impact position are compared for data and MC to estimate error on leakage correction. $\pm 15\%$ is assumed.

e/h Analysis

- Three values of m are used for Groom parameterization, 0.83 is Groom's average. The two modules are fit separately.

		Module 1		Module 2	
		e/h	χ^2/ndf	e/h	χ^2/ndf
Groom	m=0.80	1.84±0.02	1.8	1.74±0.02	1.4
	m=0.83	1.67±0.01	1.1	1.60±0.01	0.77
	m=0.85	1.59±0.01	0.74	1.52±0.01	0.47
Wigmans	k=0.11	1.58±0.01	2.4	1.52±0.01	1.8

- Module 1 has generally higher e/π than module 2 at all energies. This is reflected in e/h.
- Groom parameterization fits data slightly better than Wigmans. If m is allowed to be 0.85 they agree.

e/h Analysis

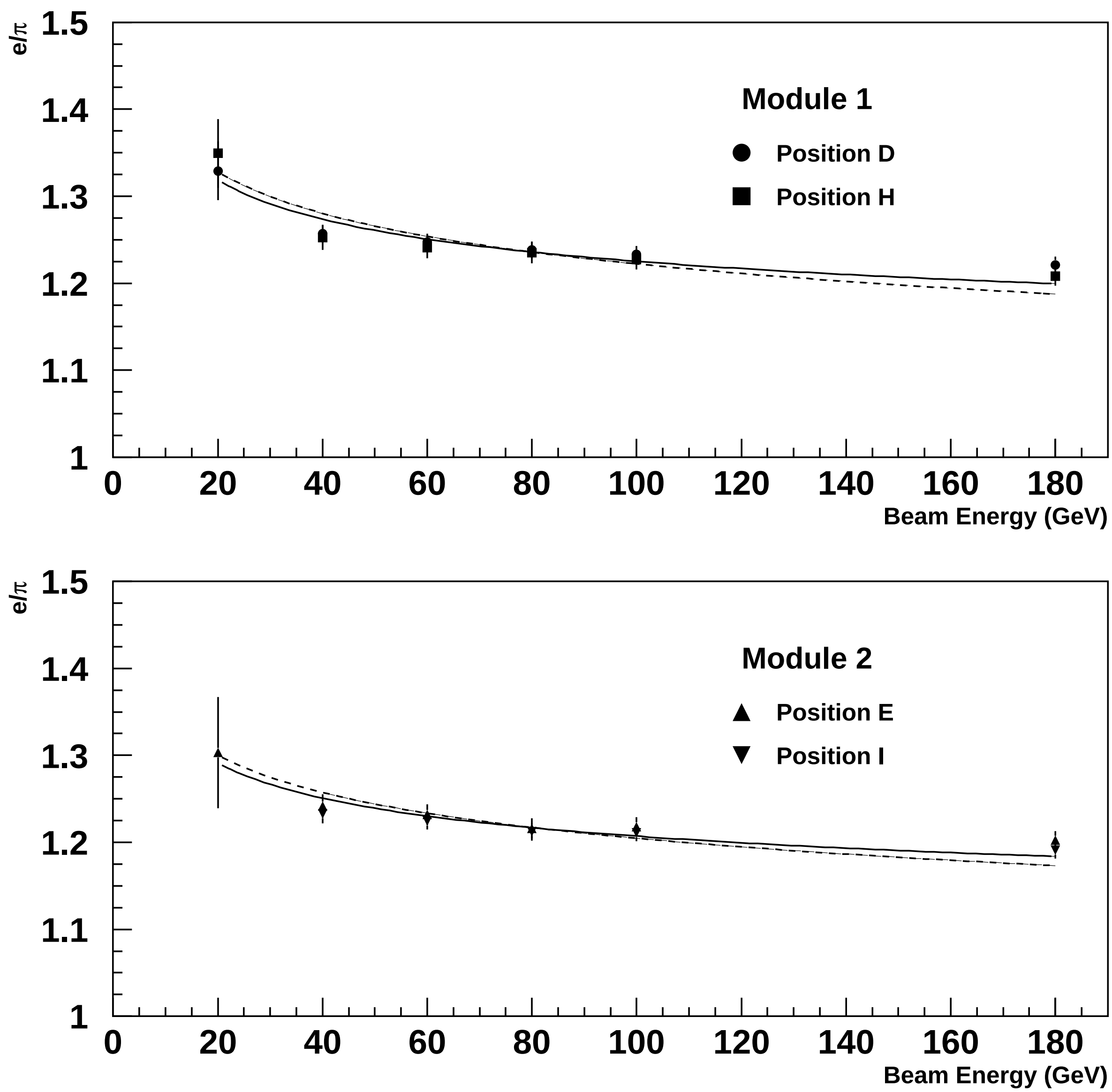


Figure 1: e/h fits after Monte Carlo correction. Solid lines are Groom parameterization with m=0.83, dashed lines are Wigmans' with k=0.11. Error bars are dominated by the uncertainty on the MC leakage correction.

Conclusions

- 9 cell electron cluster is used, resolution results unchanged.
- e/μ analysis must take into account lower voltage in last 8 gaps. After correction results are:

Impact Position	$\frac{e}{\mu}$ (Corrected)
Module 1	
D	0.932 ± 0.014
H	0.923 ± 0.022
Module 2	
E	0.954 ± 0.025
I	0.933 ± 0.022

- e/π response fits theoretical shape:

		Module 1		Module 2	
		e/h	χ^2/ndf	e/h	χ^2/ndf
Groom	m=0.83	1.67±0.01	1.1	1.60±0.01	0.77
Wigmans	k=0.11	1.58±0.01	2.4	1.52±0.01	1.8

Measured e/π and e/h are slightly higher for module 1. Combining results gives e/h $\approx 1.6 \pm 0.1$.