V. Epshteyn, P. Shatalov (ITEP) ATLAS-FCAL beam tests 2003 Note 6, 2004-Feb-16
Updates: 2004-Feb-11, 2004-June-22, with P. Gorbunov (Univ. of Toronto & ITEP)

The analysis status report

1. Introduction

In this note the results published in our previous report [Ref.1] are updated, taking the gain calibration into account. We refer to [Ref.1] for details of the analysis and term definitions.

2. The gain calibration

In each event, the signals are corrected for gain variations by dividing their reconstructed amplitudes [Ref. 1] by factors *norm_h* or *norm_m* (depending on the gain range used for a given channel). These factors are computed for every individual calorimeter channel. The resulting amplitudes are expressed in "average high gain" units. Two slightly different definitions of these factors are employed in this note:

- Definition 1 (V1):

$$norm\_h = \frac{cal\_h}{\langle cal\_h \rangle_{nCh,\ \ FEB\#}}, \quad norm\_m = \frac{cal\_m}{cal\_h}$$

- Definition 2 (V2):

$$norm\_h \text{ – same as in V1}, \quad norm\_m = \frac{cal\_m}{\langle cal\_h \rangle_{Ch,\ \ FEB}}$$

where

$$cal\_h\{m\} = \left\langle \frac{A(DAC, h\{m\})}{DAC} \right\rangle_{DAC} \quad ;$$

A(DAC, h{m}) – the amplitude measured in calibration runs for given gain range (high or medium, respectively) and the DAC value. See [Ref.2] for further details on the calibration data processing;

$\langle\rangle_{DAC}$ – the average over the DAC values;

$\langle\rangle_{Ch,\ FEB}$ – the global average over channels and FEBs.

For an illustration, Fig. 1 shows distributions of *norm_h* and *norm_m* for both definitions.

3. Electrons

The response and the resolution are quoted for a cylinder with the radius *r_core* = 8 cm. Fig. 2 shows the linearity plot for the 4H position.[1]

[1] In this and all other plots, the value 200 GeV (rather than 191.3 GeV) is attributed to the beam energy of "200 GeV" points. — *PG*

Table 1: the fit parameters of the linearity and the resolution plots, for electrons at 4L, with and without the gain correction

4L: resolution

	a, %	*b, %·√GeV/c,*	*c, %·GeV/c*	
no correction	*3.74±0.19*	*25.2±1.97*	*143±3.6*	*(for P≤100GeV/c)*
with corr. (V1)	*3.84±0.08*	*23.8±1.18*	*146.5±2.2*	
with corr. (V2)	*3.76±0.06*	*24.5±0.84*	*145.5±1.6*	

4H: resolution

	a, %	*b, %·√GeV/c,*	*c, %·GeV/c*	
no correction	*3.73±0.4*	*22.1±5.7*	*176±7.7*	*(for P≤120GeV/c)*
with corr. (V1)	*3.79±0.25*	*22.8±3.9*	*178±5.7*	
with corr. (V2)	*3.76±0.26*	*23.1±4.0*	*177±6.1*	

Table 2: The response and resolution for electrons in the 4L position, measured with the FCAL1 area cut *r core* = 8 cm.

P, GeV/c	5	10	20	40	60	80	100	150	200
response, ADC counts	51.1	110.8	228	467	696	932	1166	1744	2273
resolution σ, %	34.6	16.9	9.85	6.51	5.53	4.93	4.68	4.40	4.21

Position 4L ─ Figures 2 and 4. With the gain correction applied, the "anomalies" at 150 and 200 GeV, seen in the earlier analysis [Ref. 1], disappear. The data seem to be insensitive to the gain correction option (V1 or V2). The parameters of the fits are listed in Table 1. Table 2 gives the numerical values of the measured response and resolution for the 4L beam position and the definition V2 of the gain correction factors.

Position 4H ─ Figure 3. The same remarks, as for 4H, are applicable.

4. Pions

The gain calibration has no visible effect on the pion data.

References

1. V.Epshteyn, P.Shatalov and P.Gorbunov, *The analysis status report*, ATLAS-FCAL internal **Note 4**, 2003-10-30, http://cern.ch/atlas-fcaltb/Memos (the "Analysis" section).
2. V.Epshteyn, P.Gorbunov, *A study of non-linear effects in FCAL pulser calibration data,* ATLAS-FCAL internal **Note 5** 2004-1-25, http://cern.ch/atlas-fcaltb/Memos (the "Analysis" section).

Figures

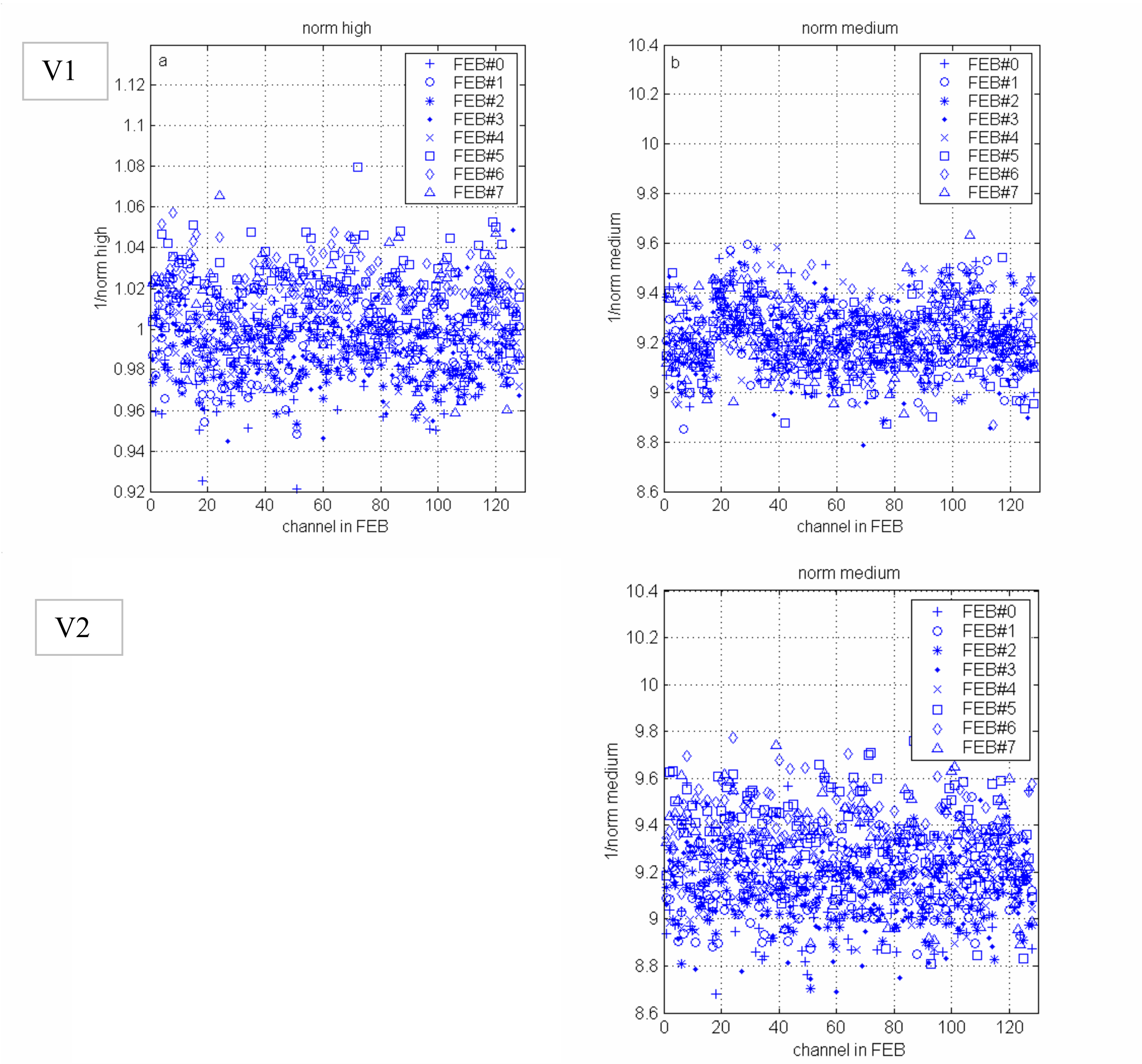
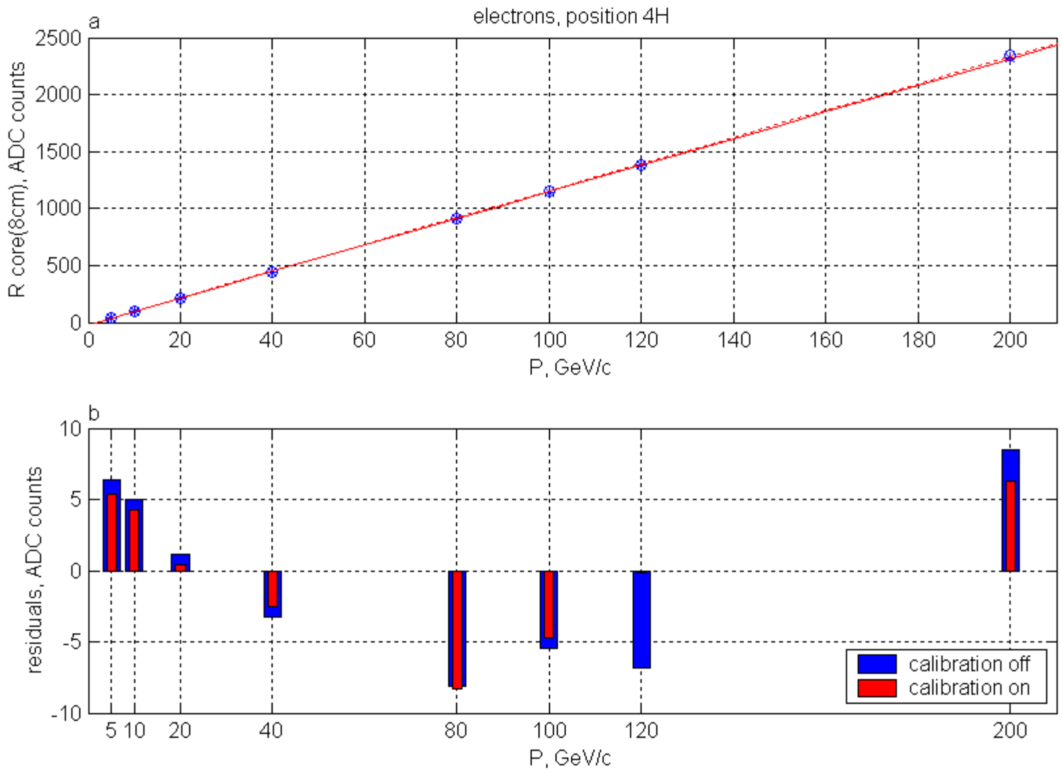


Figure 1: Values of the correction coefficients *norm_h* (a) and *norm_m* (b), for two definitions V1 and V2, as discussed in the text.



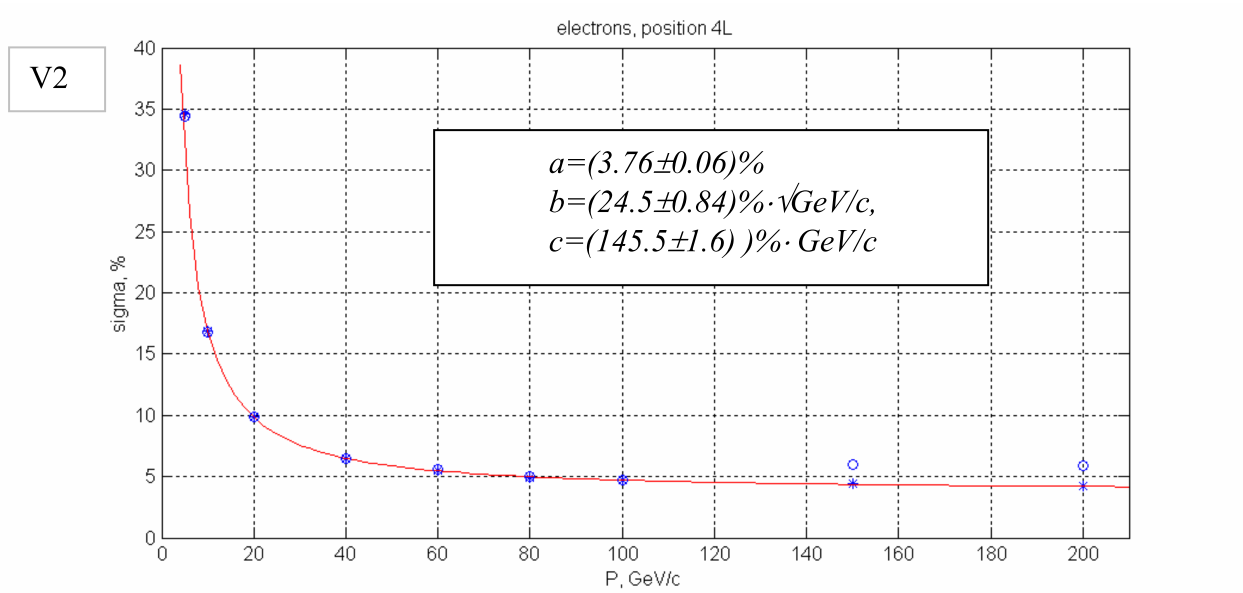


Figure 3: FCAL1 energy resolution for electrons in position 4L, with *r_core*=8cm, for the definition V2 of *norm_m*. The points are: o — calibration off, * — calibration on. The line shows the fit with the function $\sigma = a \oplus \frac{b}{\sqrt{P}} \oplus \frac{c}{P}$ (*P* in *GeV/c*). With the alternative definition V1, the data points and the fit are indistinguishable from V2.

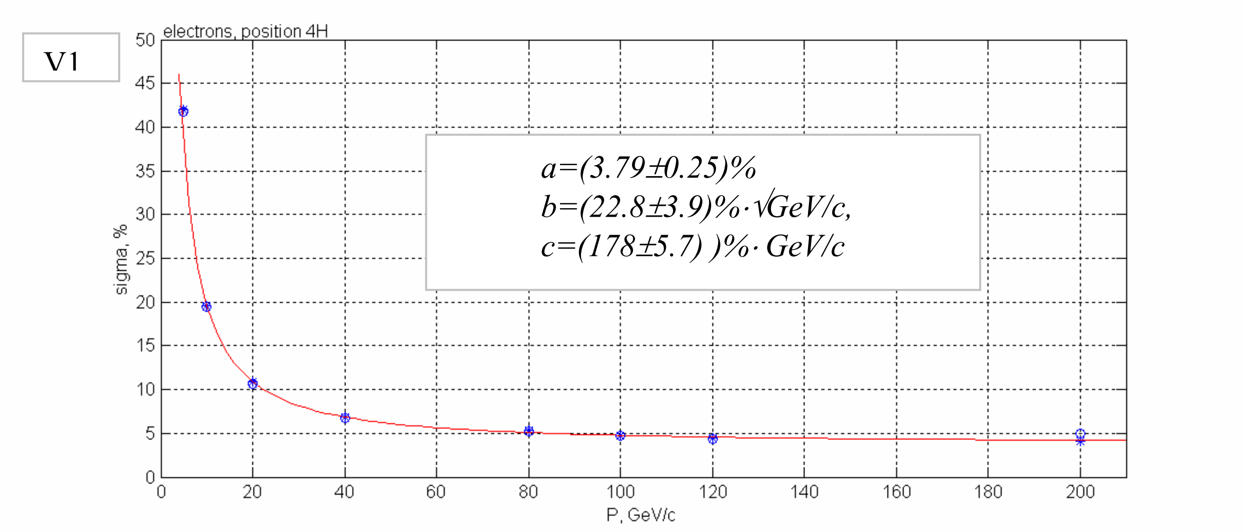


Figure 4: Same as in Fig. 3, for the beam position 4H.

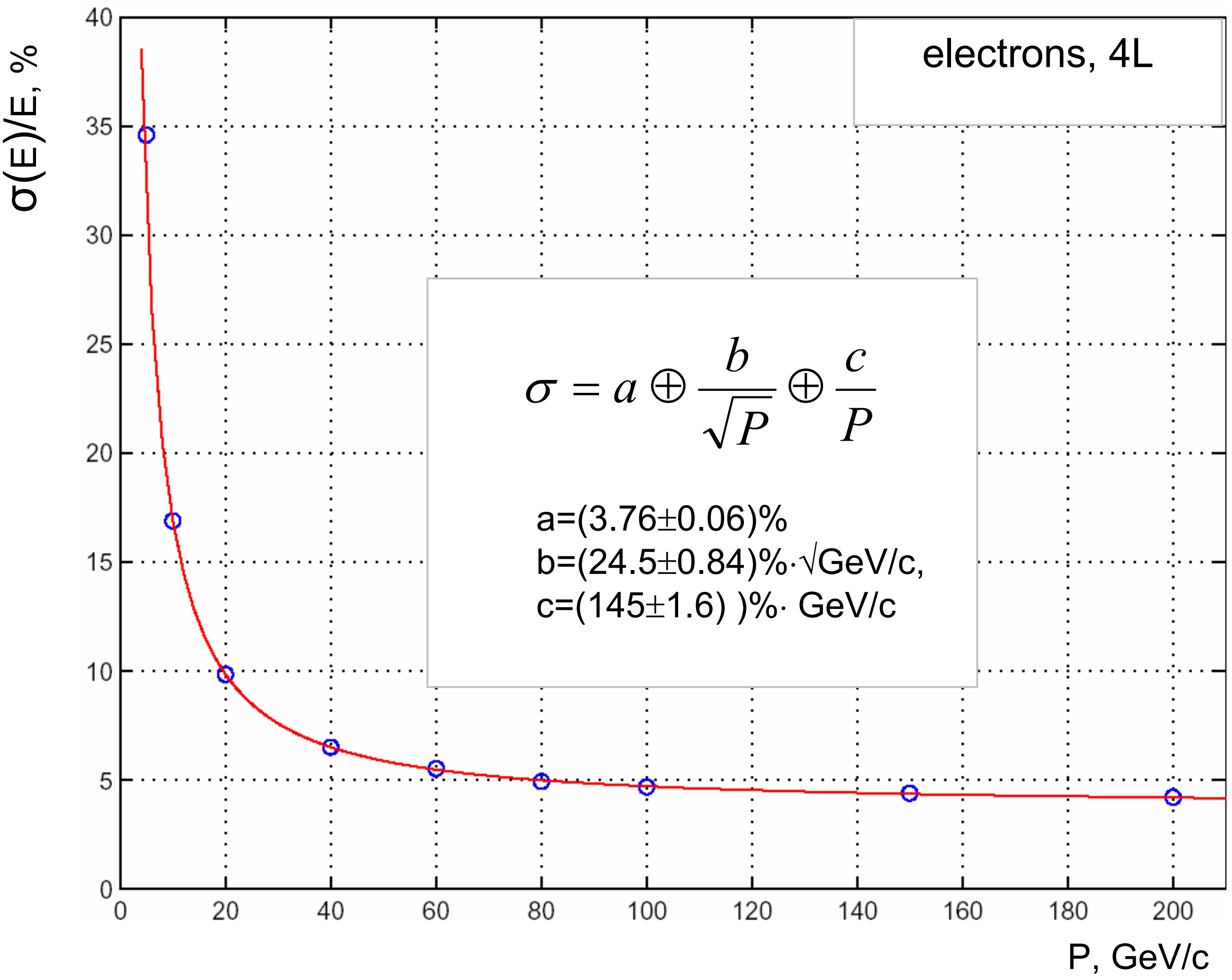


Figure 5: The "export" version of Fig. 3.

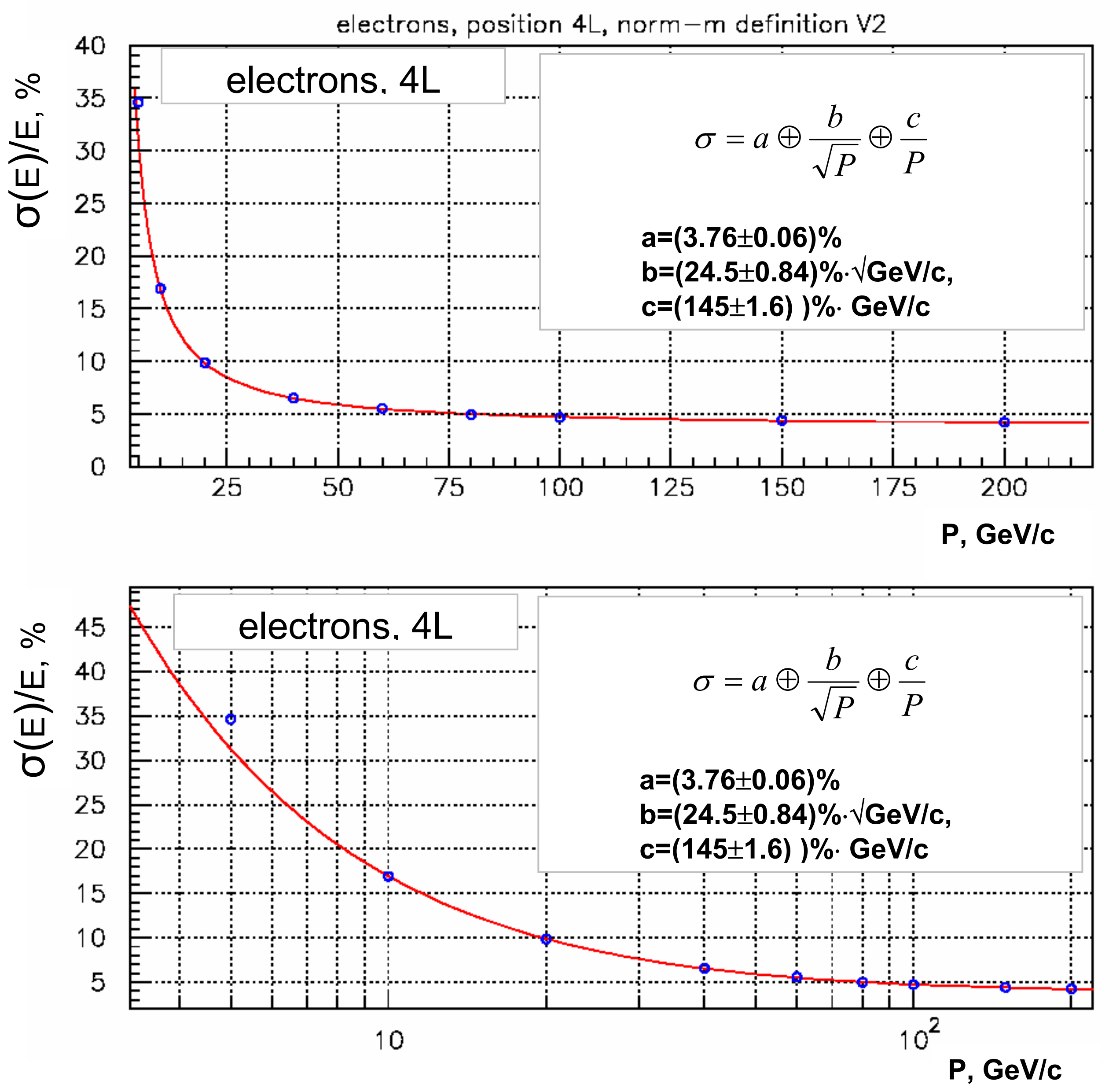


Figure 6: Yet another "export" version of Fig. 3.