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Interner Bericht

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Quantameter Calibration 1966

Completions and Corrections to the

Calibration Report DESY 65/12

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Hamburg, August 12, 1966

INTERNAL REPORT

QUANTAMETER CALIBRATION 1966

Completions and Corrections to the Calibration Report DESY 65/12

By repeating the calibration measurements for the quantameters done in 1965, the following questions were investigated:

1) Dependence of the calibration constant for the secondary emission quantameter from the position of the beam spot on the quantameter entrance surface.

2) Any change of the calibration constant of the gas-filled quantameters originating in systematic errors or variations with time.

The measurements with the secondary emission quantameters have confirmed the measurements of 1965: The quantameter current in the center of the quantameter is about 8 per cent lower than in the region 3 cm to 10 cm away from the center (see Fig. 1). The reason for this behaviour is not yet known. We expect that the angle-dependence of the secondary electron production in the correction slits of the quantameter or a possible change in the thickness of the gold plating may cause this effect. A new secondary emission quantameter is under construction, without gold-plating and without correction slits necessary for the gas-filled quantameters.

The measurements with the gas-filled quantameters have brought up a systematic error of about 5 per cent for the calibration constant, originating in recombination effects. The new calibration constants are:

Quantameter No. 1 (copper surfaces) $K = 4.38 \cdot 10^{18} \frac{\text{MeV}}{\text{Asec}}$

Quantameter No. 2,3,4,5 (gold surfaces) $K = 3.35 \cdot 10^{18} \frac{\text{MeV}}{\text{Asec}}$

The errors of $\pm$ 3 per cent are given by the errors arising from the energy measurements, from the calibration of the secondary emission monitors, from the extrapolation of the quantameter constant to zero beam intensity, to correct for the recombination, and from the small differences in gas-filling.

The measurements in 1965 have not shown a systematic variation of the quantameter-constant with beam intensity, mainly caused by spill-out variation with time and by only choosing a small range of intensities. This year the intensity was varied by a factor of about 10^3, yielding a good extrapolation curve to zero beam intensity and zero recombination (see Fig. 2). From this data we have to conclude that the maximum beam intensity - for recombination lower than about 1 per cent - should be choosen a factor of 10 smaller than given in Fig. 23 of the DESY-report 65/12.

For higher beam intensities the experimentator is in a somewhat unpleasant situation at this time. For an unstable and not good defined spill-out the quantameter constant may not be deducible from the experiment. For a stable and well defined spill-out the quantameter constant for the taken beam intensity may be extracted from the data by varying the beam intensity and constructing an extrapolation curve to zero beam intensity. At this point the above given quantameter-constant is valid.

For the future we hope to calibrate a new secondary emission quantameter after the shut-down in autumn.

A further possibility for high beam intensities is to use the gas-filled quantameter with a gas-filling of 90 per cent Helium and 10 per cent Nitrogen like CEA (M. Fotino and I. de Payter CEAL 1022). This will bring up the intensity limit by a factor of about 6 to 10.

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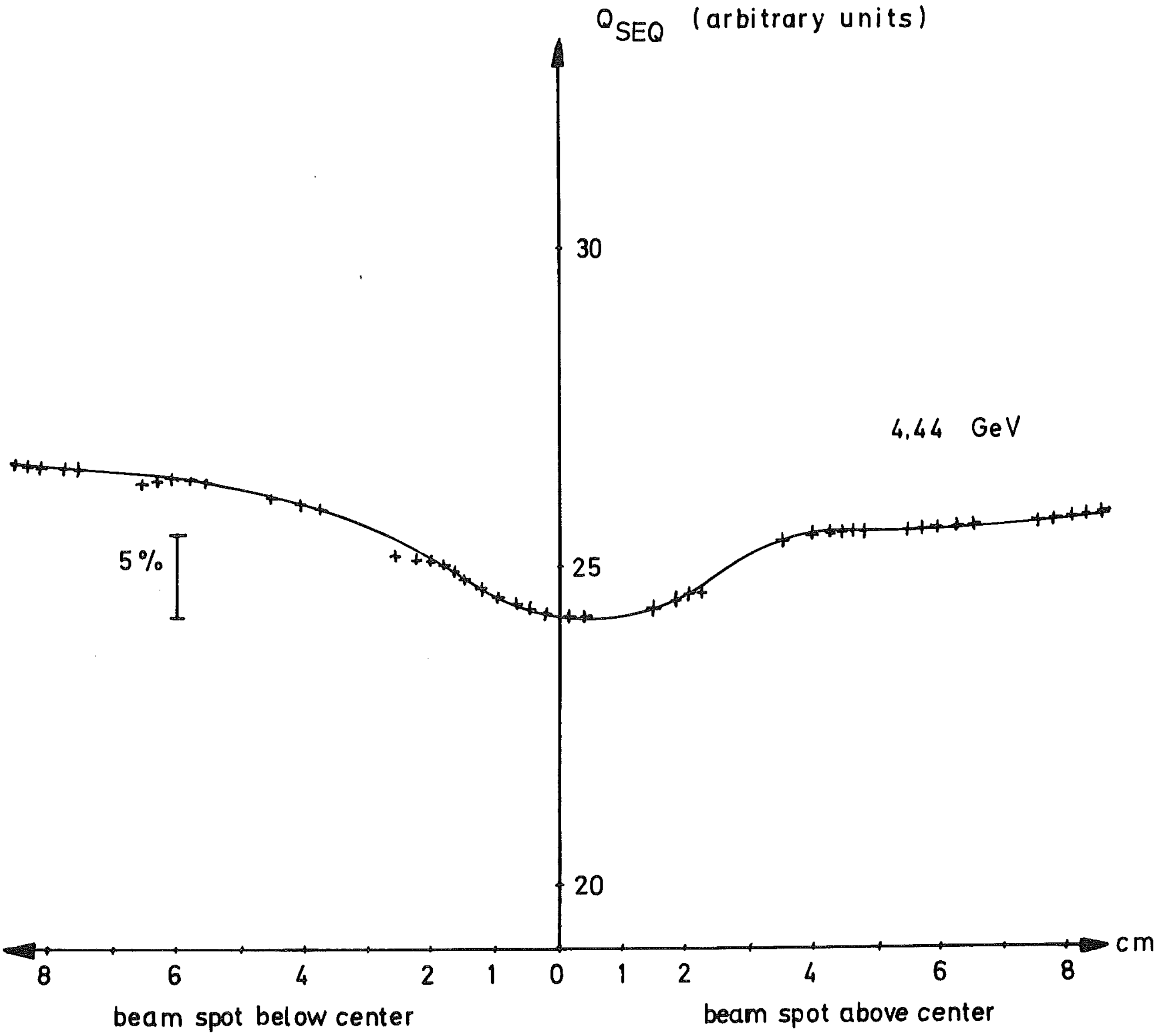

Fig. 1 Dependence of efficieny of the secondary emission quantameter from the position of the beam spot on the entrance surface.

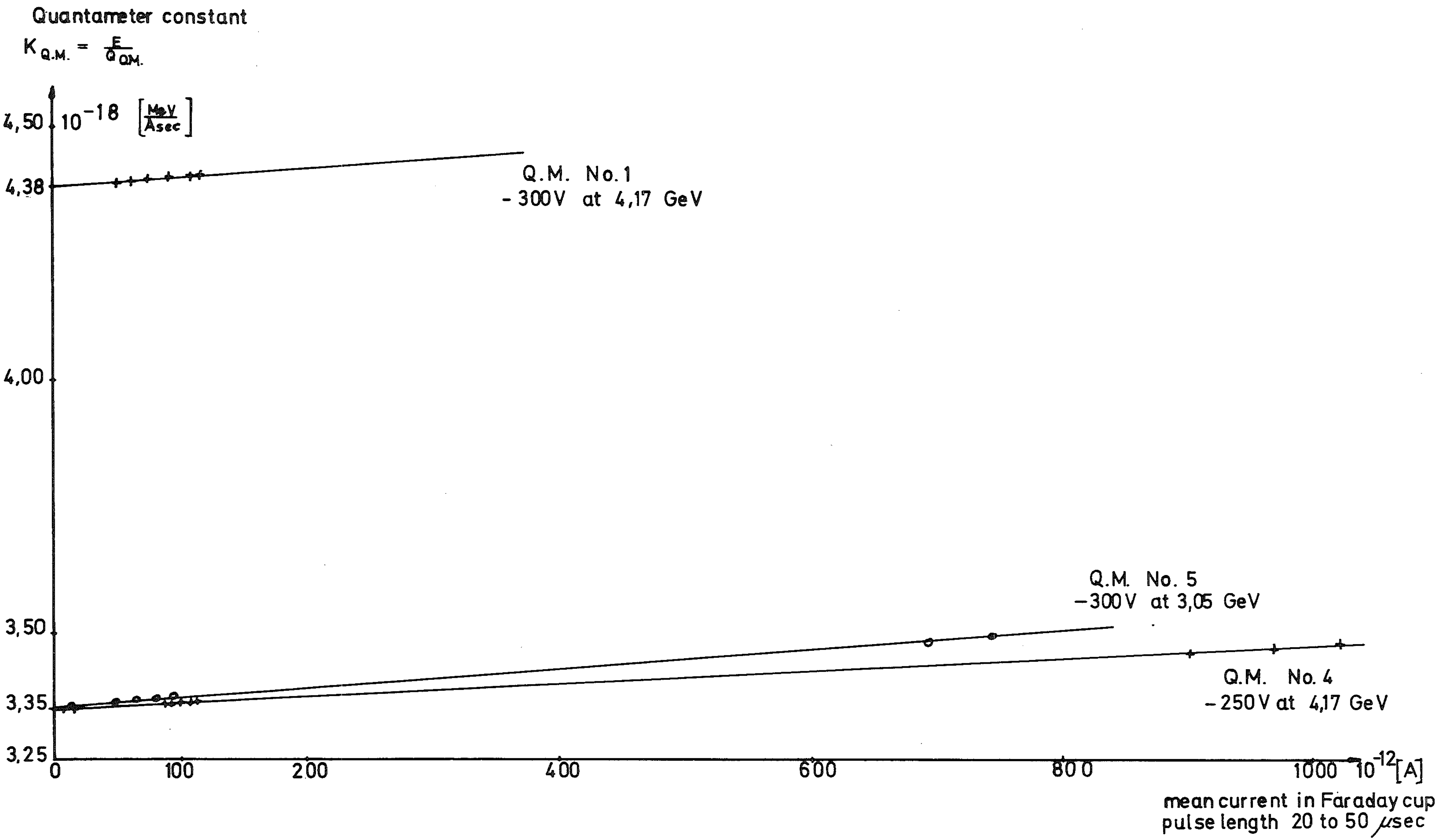

Fig. 2 Dependence of quantameter constant for the gasfilled quantameter (760 Torr A + 40 Torr CO_2) from beam intensity.