Dark current measurement at KEK

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Experimental setup

Accelerating structure (T18)

Magnet

Spectrometer

FC-UP

FC-Mid

FC-DN

Experimental setup

Varian IP

VAC

PM

IP

Load

Q-suka

Load

AM

FC

FC-Mid

FC-DN

FC-UP

75cm

75cm

195cm

Courtesy of T. Higo
Field enhancement factor measurement

\[ \frac{d \left( \log_{10} \left( \frac{I}{E^{2.5}} \right) \right)}{d \left( \frac{1}{E} \right)} = -2.84 \times 10^5 \beta^{1.5} \]

\( \beta \) upstream = 33
\( \beta \) downstream = 29
\( \beta \) end of line = 35
pA fluctuations

Data manually recorded during a very stable running period at \((64.0 \pm 0.3)\) MW

Input power fluctuation < 0.5 %
Sampling rate \(\approx 1.2\) Hz
Dark current spectra measurement
Pulse length : 252 ns

Horizontal error bars : spectrometer resolution ($\Delta$slit/$\rho$)
Vertical error bars : pA-meter fluctuations
Dark current spectra measurement
Pulse length : 252 ns

- Always the same low-energy cut off (≈3.5 MeV) \( \Rightarrow \) low energy e\(^-\) lost in the pipe?
- Spectrum maximum around 5 MeV
- Often exhibits a double peak structure that tends to smooth while decreasing the gradient (\( \Rightarrow \) dark current originating mainly from 2 cells at high power ?).
T18_VG2.4_Disk_#2

Dark current spectra measured 18 June 2009

Dependence on power

Dependence on width
Conclusion

• Nice test bench, very stable running which makes the measurements easy.

• An automation of the pA-meter read-out would make the measurement even easier and more precise.

• Change in the spectra shape since March to be investigated.

• Possible measurement of the dark current spectrum upstream ?
La réserve du chef
Dark current spectra measurement
Pulse length : 252 ns

Slit opening : 33 mm

Faraday cup current (pA)

Energy (MeV)

- 108.7 MV/m (2/03)
- 95.5 MV/m (2/03)
- 85.4 MV/m (3/03)
- 108.7 MV/m (3/03)
- ?????????

???
Experimental setup

Accelerating structure (T18)

Acoustic sensors (1 / cell)

Magnet

Spectrometer

FC-UP

FC-Mid

FC-DN

Experimental setup

FC-UP

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75cm

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195cm