The Fermi-edge of a single crystal TiTe$_2$ sample was measured at low temperature. The diode closest to the sample read 12 K. A sample temperature of 17 K was estimated. The data was taken with a PHOIBOS 150 CCD analyzer at 3 eV pass energy and with 0.2 mm slit width.

Fermi-edge of TiTe$_2$ at low temperatures. Data courtesy Chris Jozwiak and Alessandra Lanzara (University of California at Berkeley and Lawrence Berkeley National Laboratory).
The Fermi edge of a cold metallic solid is a good testing ground for the analyzer resolution. The Fermi-Dirac distribution gives the fractional distribution of levels at a finite temperature:

\[
F(E) = \frac{1}{e^{\frac{E-E_F}{kT}}+1}
\]

where \(E_F\) is the Fermi energy, \(T\) the temperature, and \(k\) is the Boltzmann constant (\(k=1/11600\) eV/K). According to the Fermi-Dirac statistics a width of \(\Delta E = 4k \cdot T = 6\) meV is expected at \(T = 17K\).

At \(E_p = 3\) eV with a 0.2 mm slit the contribution of the PHOIBOS analyzer \(\Delta E_A\) to the total line width of about 4 meV is calculated from:

\[
\Delta E_A = \left( \frac{s_1 + s_2}{4R_0} + \frac{\alpha^2}{4} \right)E_p
\]

\[
= \frac{s_1 + s_2}{2R_0}E_p = \frac{s_1}{R_0}E_p
\]

\[
= \frac{0.2\ mm}{150\ mm} \cdot 3\ eV
\]

\[
= 4\ meV
\]

is confirmed by the deconvolution \(7^2-6^2=4^2\) of the experimental data: 4 meV.

Here, \(S_1, S_2, R_0, \alpha\) and \(E_p\) are the width of the entrance slit, the width of the exit slit, the mean radius of the analyzer, and the pass energy, respectively.