

Description of Open Data

Parameters (p_0, p_1)

The file `p0p1.txt` contains a set of semi-empirical parameters obtained from fitting the parametrized function for electronic stopping force (see below) to the experimental data for those ion-target combinations selected from the NDS database.

The data format is as follows

Projectile	Target	Z1	Z2	p0	p1
H	Si	1	14	0.774	1.004

Relative difference between models and experimental data

The relative difference between the experimental data and estimates from the models is defined as

$$\Delta = \frac{S_{exp} - S_{mod}}{S_{exp}}$$

The values for Δ calculated for the RADEF Stopping Code, SRIM and DPASS are presented in `Deltas.txt` for all stopping values used in the fitting of p_0 and p_1 .

The data format is as follows

Projectile	Target	Z1	Z2	E[MeV/u]	Delta_Model	Delta_SRIM	Delta_DPASS
H	Si	1	14	0.30	-0.11	-0.09	-0.03
...							

The average difference for all the datapoints can be calculated from

$$\langle \Delta \rangle = \frac{1}{N_{data}} \sum_i^{N_{data}} \Delta_i$$

and the standard deviation of the relative difference is given as

$$\Omega_{\Delta} = \sqrt{\frac{1}{N_{data}} \sum_i^{N_{data}} (\Delta_i - \langle \Delta \rangle)^2}$$

RADEF Stopping Code

Electronic stopping (in $MeV/mg/cm^2$) of ions (with atomic number of Z_1) in targets (Z_2 , and atomic mass of A_2) can be estimated with

$$S \equiv \frac{dE}{dx} = 3.0705 \cdot \frac{Z_1 \cdot Z_2}{A_2 \beta^2} \cdot L,$$

where

$$L = p_0 \cdot \ln \left(1 + p_1 C \frac{m_e c^2 \beta^3}{Z_1 I \alpha} \frac{1}{\sqrt{1 + \left(\frac{C \beta}{2 Z_1 \alpha} \right)^2}} \right)$$

where $I = Z_2 \cdot 10eV$ represents the mean ionization energy of the target atoms eV, $C = 2e^{-\gamma}$ with $\gamma = 0.5772$ as the Euler-Mascheroni constant, m_e the electron mass in eV and c the speed of light in ms^{-1} .