`libamtrack` Manual

S. Greilich

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Chapter 1

Introduction

libamtrack is a library of computational routines for the prediction of solid state detector response and radiobiological effectiveness in proton and ion beams.

The libamtrack project has been started from the intention to provide open-source, freely available, and

Chapter 2

Installation

Als erstes musst Du den Nippel durch die Lasche ziehen. Haha.

Chapter 3

libamtrack methods

3.1 Introduction

'Methods' are the top-level routines in libamtrack. From the physical parameters describing a HCP field they compute the predicted RE or RBE. In order to do so, the user has to both chose

- method independent settings, such as the RDD, ER, gamma model to be used and
- method specific setting, e.g. the binning width to be used.

Methods are implemented in the `Amtrack.c` and make use of all other subordinate routines. At the moment, four methods are available:

- Grid summation method (GSM)
- Ion-gamma-kill method (IGK)
- Compound Poisson processes using successive convolution (CPP-SC)
- Compound Poisson processes using statistical sampling (CPP-SS)

3.2 The grid summation method

The most straight-forward approach of

Chapter 4

Physics routines

`libamtrack` contains a number of auxiliary routines handling the physics of ion beams needed. These routines can be used independently from the efficiency methods. They are implemented in `AT_PhysicsRoutines.c` and are described in detail in this.

4.1 `AT_beta_from_E`

Computes the relativistic speed $\beta = \frac{v}{c}$ from a particle's kinetic energy using

$$\beta = \sqrt{1 - \frac{1}{\frac{E}{1.0079 \cdot m_p}}} \tag{4.1}$$

Note that this relation is independent from the particle mass.

Single version:

`E_MeV_u`	the kinetic energy per nucleon (double)

Multi version:

`n`	array size (long integer)
`E_MeV_u`	the kinetic energy per nucleon (array of double, size `n`)
`beta`	array for results (array of double, size `n`)

4.2 AT_effective_charge_from_beta

Computes the effective charge of a travelling HCP as a function of its relativistic speed. Due to charge pick-up slower particle might not be fully stripped. Here, the Barkas (ref.?) equation is used:

$$Z_{eff} = Z \cdot (1 - e^{-125 \cdot \frac{\beta}{Z^{2/3}}}) \tag{4.2}$$

Single version:

`beta`	relativistic speed (double)
`Z`	charge (long integer)

Multi version:

`n`	array size (integer)
`beta`	relativistic speed (array of double, size `n`)
`Z`	charge (array of long integer, size `n`)
`effective_charge`	relativistic speed (array of double, size `n`)

Chapter 5

List of symbols

β	relativistic speed [1]
E	kinetic energy per nucleon [MeV/u]
T	total kinetic energy [MeV]
m_p	proton mass [938.272029 MeV/c^2]
Z	charge [elemental unit]
Z_{eff}	effective charge [elemental unit]