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This doc: ParkhomchukCooling.docx

**Parkhomchuk’s Friction Force due to Electron Cooling**

**[1].** Friction force :

 (1P)

where Coulomb logarithm  is

 (2P)

Here minimal impact parameter is defined as

, (3P)

maximal impact parameter is

 (4P)

with Larmor radius , plasma frequency , time of flight in the cooling section  and

 (5P)

where transverse velocity component  is defined by the drift motion in the crossed magnetic and space charge electric fields.

**[2].** Friction force :

 (1B)

where Coulomb logarithm  is

 (2B)

Here minimal impact parameter is defined as

, (3B)

maximal impact parameter is

 (4B)

with Larmor radius , plasma frequency , time of flight in the cooling section  and

 (5B)

where transverse velocity component  is defined by the drift motion in the crossed magnetic and space charge electric fields.

**[3].** Friction force :

 (1F)

where Coulomb logarithm  is

 (2F)

Maximal and minimal impact parameters are not defined, average Larmor radius is , and

 (5F)

where transverse velocity component  is defined by effective angles of variations in the magnetic field lines.

**[4].** Friction force :

 (1M)

where Coulomb logarithm  is

 (2M)

Here minimal impact parameter is defined as

, (3M)

maximal impact parameter is

 (4M)

with Larmor radius , plasma frequency , time of flight in the cooling section  and

 (5M)

where transverse velocity component  is defined by effective angles of variations in the magnetic field lines.

**[5].** Friction force (SI units):

 (1R)

where Coulomb logarithm  is

 (2R)

Here minimal impact parameter is defined as

, (3R)

maximal impact parameter is

 (4R)

with Larmor radius , plasma frequency , time of flight in the cooling section  and

 (5R)

where transverse velocity component  is defined by effective angles of variations in the magnetic field lines (term ) and the drift motion in the crossed magnetic and space charge electric fields (term ).

**[6].** Friction force :

 (1FB)

where Coulomb logarithm  is

 (2FB)

Here minimal impact parameter is defined as

, (3FB)

maximal impact parameter is

 (4FB)

with Larmor radius , plasma frequency , time of flight in the cooling section  and

 (5FB)

where transverse velocity component  is defined by effective angles of variations in the magnetic field lines and the drift motion in the crossed magnetic and space charge electric fields.

**[7]** uses the Parkhomchuk’s expression for friction force due to electron cooling to define the following system of coupled equations for time depending of transverse emittance  and energy deviation :

 (1K)

This report contents data for numerical simulation of friction force.

**[8]** content the experimental data for decreasing of the size beam due to electron cooling.

**Some results**

Following initial data were used [7,8]:



So, one has the following input data for simulation:



With these data the following result were found:

A close up of a person

Description generated with high confidence

A screenshot of a cell phone

Description generated with high confidence

A close up of a map

Description generated with high confidence

**References**

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