

Computation of space charge effect in Allison scanner and its application to the measurement of emittance

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Outline

- SNS LEBT emittance measurements
- Demonstration of the problem
- Method of solution of the problem
- Conclusions and future problems



SNS Accelerator Complex



SNS LEBT and parameters of the beam



Allison emittance scanner



Parameters for imulation	Name	Value
1	Length between two slits	120.95 mm
\a	Entrance slit width	0.5 mm
Vp	Exit slit width	0.5 mm
	Current of the beam	50 mA
2	Energy of the beam	65 keV
R _t	rms radius of the beam	2 mm
, t	Twiss parameter of the beam	-1
t	Normalized rms emittance	0.2π mm·mrad

Measurements of rms emittance and Twiss parameters

Distribution of current in

Scanner parameters

Ion beam parameters

Front slit

Exit slit

-5



The distribution of the current density just before the front slit

6 Managed by UT-Battelle for the Department of Energy The distribution of transverse emittance just before the front slit





Simulation of emittance distribution measurements



for the Department of Energy

Calculated dependence of emittance change



9 Managed by UT-Battelle for the Department of Energy

Algorithm of reconstruction of the true emittance



Conclusions

- It is shown that space charge effect can yield error up to few dozens percents in transverse emittance measurements of low energy H- beam by Allison Scanner
- -We developed a new method for analysis of emittance data that allows to take into account space charge and estimate the error of measurements

Future problems

- It is necessary to develop or extend the method of analysis of emittance data of any distribution
- It is also necessary to confirm the effect of space charge experimentally by measuring the emittance as the function of the slit width

