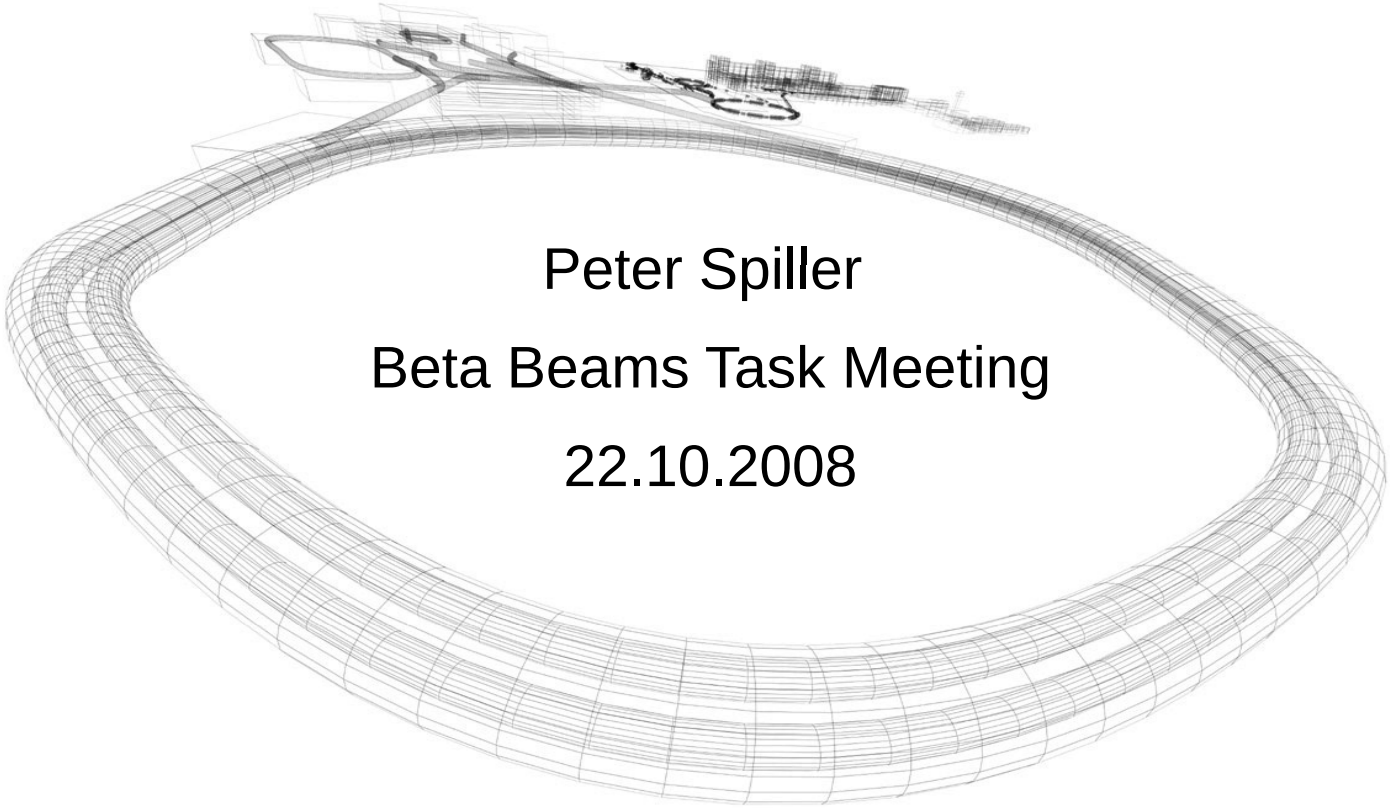
Extensions of STRAHLSIM



Peter Spiller

Beta Beams Task Meeting

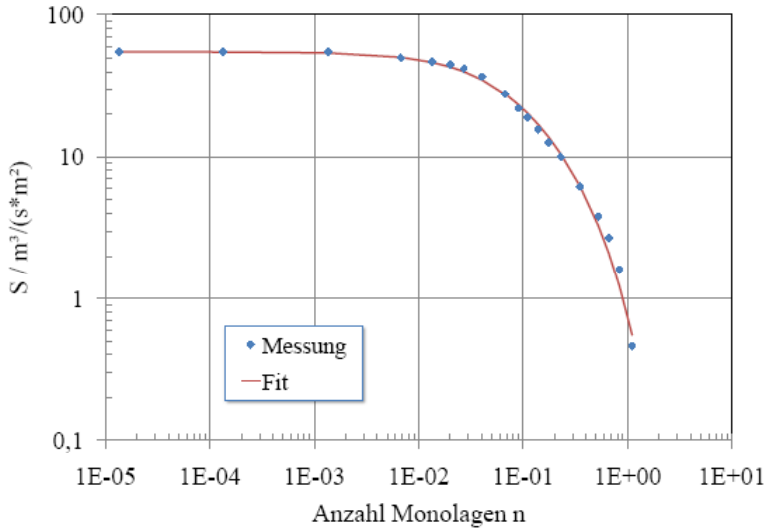
22.10.2008

Saturation of NEG Pumps and Scrubbing

Reduction of Pumping Speed of NEG Surfaces

$$S_{Red} := \frac{1}{\alpha + (1-\alpha) \cdot e^{n_{NEG} \cdot \beta}}, \tag{1}$$

wobei n_{NEG} die Anzahl der adsorbierten Monolagen auf der NEG-Oberfläche, $\alpha = -3{,}768$ und $\beta = 2{,}785$ an die Messwerte gefittete Konstanten sind.

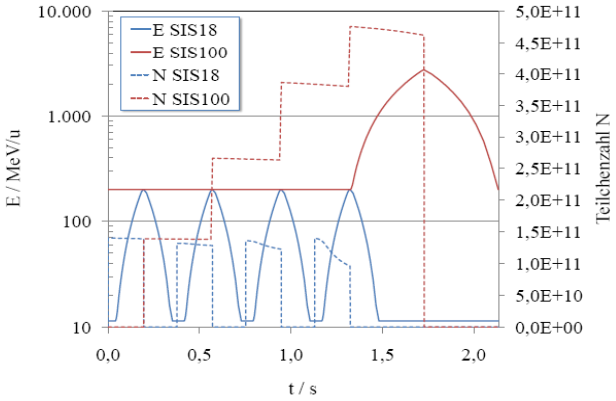


Reduktion of Desorption Yield (Scrubbing)

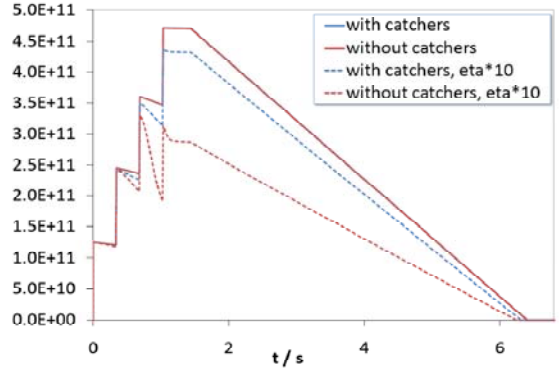
$$\eta(t) = \eta_0 \cdot \frac{1}{n_{normal}(t)},$$

Ionization Beam Loss and Dynamics of Pressure

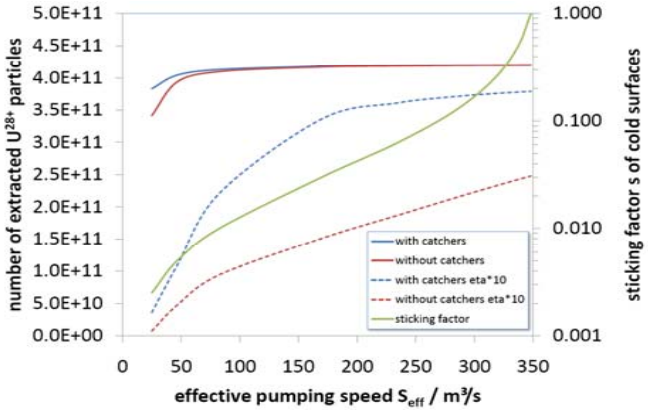
Short Term Studies (Cycles)



Ionization loss during stacking and acceleration in SIS18 and SIS100

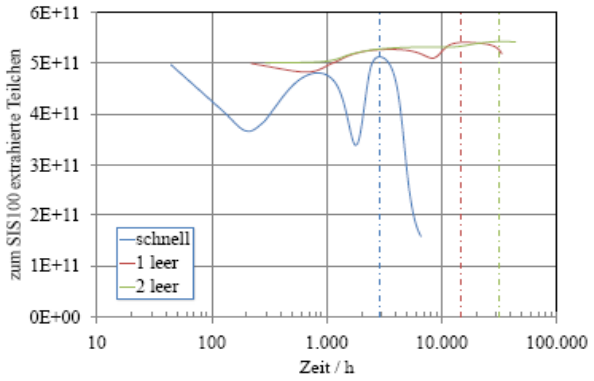


Safety studies for beam survival in SIS100

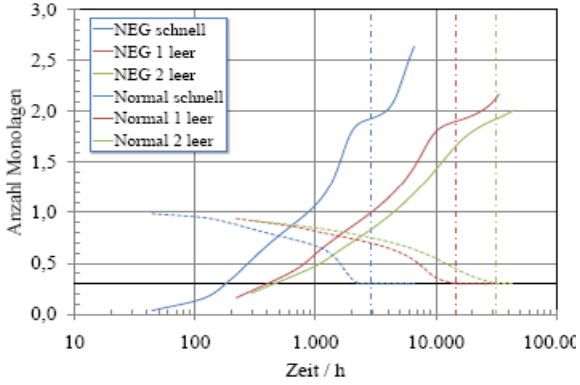


Extracted ions versus pumping speed of cryogenic surfaces

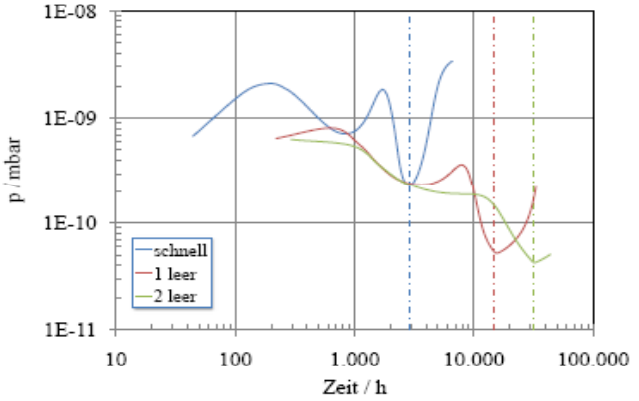
Long Term Studies



Extracted ions over months



Number of monolayers over months



Pressure over months

Life Time of NEG Pumps in SIS18

Tabelle 1: Berechnete Sättigungsdauern des NEG.

Fall	t / h	t / d	t / M	Lebensdauer / a
schnell	2 900	120	4,0	10
1 leer	14 716	613	20,1	50
2 leer	31 083	1 295	42,4	106

Cryo-Pumping

CRYOPUMPING OF HYDROGEN AND HELIUM*

BNL, 1981

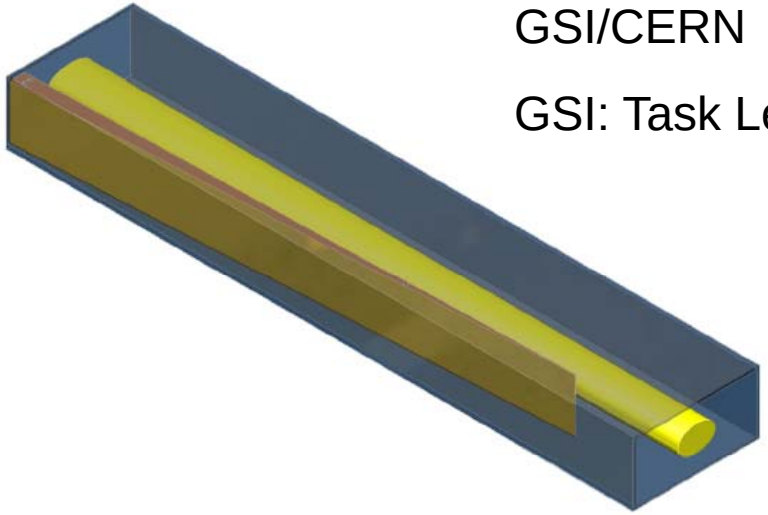
H. J. Halama, H. C. Hseuh and T. S. Chou

Accelerator Department
Brookhaven National Laboratory
Upton, New York 11973

Results

1. The Pumping Speed. The measured pumping speeds of the LHe cooled surface for H_2, D_2 and T_2 are about 11, 8 and 6.5 $\ell \cdot s^{-1} \cdot cm^{-2}$ respectively, for typical chevrons with a molecular transmission coefficiency of ~25%. These pumping speeds correspond to an effective sticking coefficiency almost unity. Within 10% accuracy the pumping speeds for H_2 and D_2 are independent of surface coverage up to at least 45 Torr $\cdot \ell \cdot cm^{-2}$ (1.5×10^{21} molecules $\cdot cm^{-2}$ or 2×10^6 monolayers or 0.56 mm thick condensed film). The pumping speed is also independent of the input gas flux up to 3×10^{-3} Torr $\cdot \ell \cdot s^{-1} \cdot cm^{-2}$.

EU FP7 Project Cryo-Collimator Project

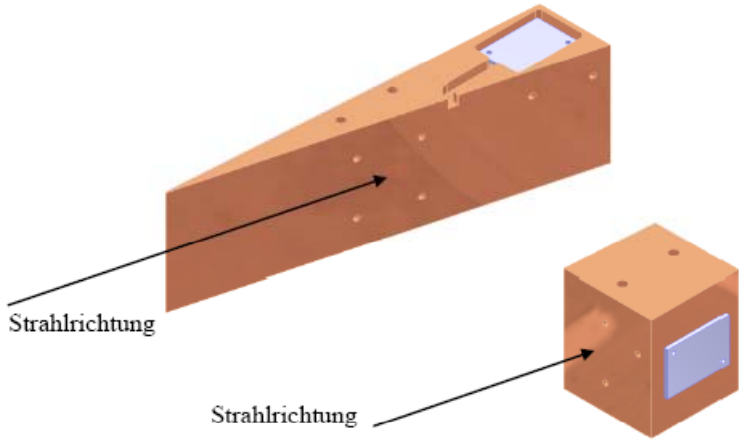


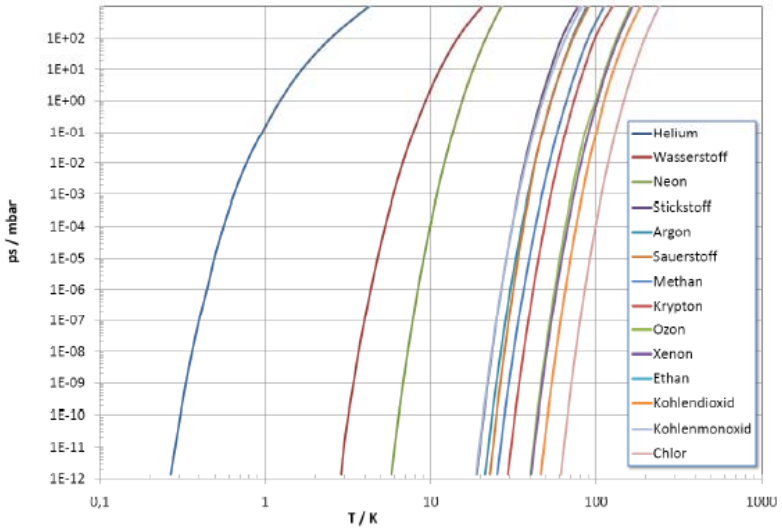
GSI/CERN

GSI: Task Leader

[82].

Molekül	$T_{Schmelz}$ / K	T_{Siede} / K	ρ / kg/m³
He	0,95	4,2	179
H_2	13,4	20,4	90
Ne	24,6	27,1	900
N_2	63,2	77,3	1.030
CO	68,1	81,7	950
Ar	83,8	87,3	1.784
O_2	54,4	90,2	1.429
CH_4	90,1	111,7	717
Kr	116	120	3.708
Cl_2	171,6	239,11	2.030
Xe	161,4	165	3.780
C_2H_6	89,89	184,6	1.630
CO_2	194,6	216,5	
NH_3	195,4	239,8	719
H_2O	273,15	373,15	1.000
J_2	386,8	456,2	4.940





Consequences for Beta Beams:

- Recalculation of the long term behaviour of the dynamic vacuum taking into account the "scrubbing effect" in PS and SPS possible (no NEG coating in the existing PS and SPS in use)

- Recalculation for the long term behaviour of the dynamic vacuum in the Decay Ring taking into account the "monolayer effected pumping speed" of the cold surfaces