International Conference on Science and Technology for FAIR in Europe

Poster Prize

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CAEN Tools for Discovery

A New Way of Cooling Technique for the Super-FRS Slit System

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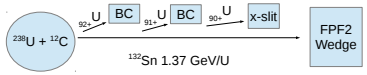
GSI FAIR

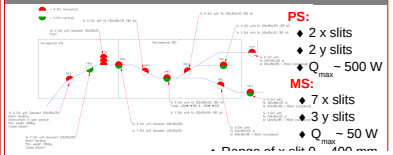
Introduction

♦ The slit systems for x and y positions will be used as collimator for stopping the unwanted charge states of primary beam and fragments produced at the reaction target of the in-flight Superconducting Fragment Separator (Super-FRS) at the FAIR facility, Darmstadt.



BC – Beam catcher

Details of the x and y slits



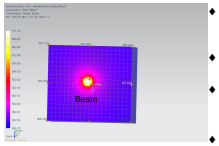
PS:
- ♦ 2 x slits
- ♦ 2 y slits
- ♦ Q_{max} ~ 500 W

MS:
- ♦ 7 x slits
- ♦ 3 y slits
- ♦ Q_{max} ~ 50 W

Overview of the Super-FR slit system

Thermal simulations on x-slit system

♦ Proposed Material: Densimet (97% W, 2% Ni and 1% Fe)
♦ Heat Dissipation: Radiation

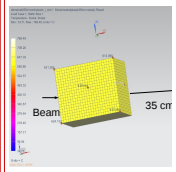


- ♦ Q = 500 W is applied on the front surface
- ♦ Steady-state simulations
- ♦ T_{max} = 700 °C at the heat load point
- ♦ T_{avg} = 550 °C on the block

Surface emissivity effect on the densimet temperature

Emissivity of densimet	0.07(pure)	0.5	0.8
Temp. at the heat load point in °C	700	407	354

Effect of temperatu by



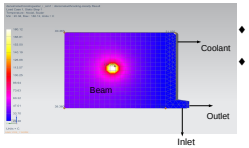
♦ 40 hours are required to r for an applied power of 50

♦ With an initial temperature 100 hours to cool down to

Densimet cooling by water as a coolant

♦ Applied Q = 500 W on the front surface of the densimet block

♦ T_{max} ~ 180 °C at the heat load point with water cooling



- ♦ Water is a coolant
- ♦ Water flow is 1 lit/min

Problems: 1. Radioactive water preservation.

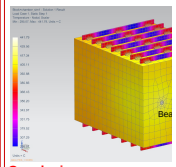
2. Difficulties in handling water leaks and/or a broken pipe during experiments.

Densimet cooling by as

♦ Applied Q = 500 W on the

♦ Surface emissivity of SS i

♦ T_{max} ~ 450 °C at the heat

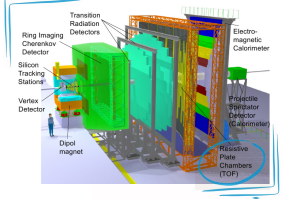


Conclusion:
♦ No active cooling is neede
♦ A new way of passive coo the temperature of the blo

Detector Development for the CBM Time-of-Flight Wall in Heidelberg

I. Deppner†, Prof. N. Herrmann, P.A. Loizeau, C. Simon, V. Zinyuk

The CBM detector



Multi-gap RPC characteristics

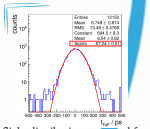
- **Time resolution < 50 ps**
  This ⟼ is the distance light travels within 50ps!
- **Efficiency > 97 %**
- **Rate capability ~ 1kHz/cm²**
- Gap size: 220 μm
- Active area: 53 x 52 cm²
- Spatial resolution ~ 5 mm

Setup in the lab @ Heidelberg

Activities at PI Heidelberg:

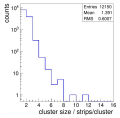
- Development of:
  - Multi-gap Resistive Plate Chambers (MRPCs) *(Hardware)*
  - Simulation framework for the TOF detector *(Software)*
  - More realistic simulation tools to simulate the RPC response in the CbmRoot framework *(Software)*
- Electronics chain implementation for RPCs *(Hardware/Software)*
- Design of the CBM TOF wall

Results of the Prototype Testing:



Time-of-flight distribution measured for the RPC system. $\sigma = (67.2 \pm 0.5)$ ps

Cluster size distribution of the prototype HDMRPC-P3



Results obtained with cosmic rays:

Applied high voltage	±10.2 kV	±11.0 kV
Efficiency	(94.4 ± 0.2) %	(98.5 ± 0.1) %
RPC time resolution	(43.5 ± 1.2) ps	(39.0 ± 1.0) ps
Mean cluster size	1.24	1.39
Mean cluster multiplicity	1.26	1.26

Testbeam Setup at GSI

Future Projects

- In beam evaluation of the full electric read-out chain.
- Closed-loop gas system for MRPCs .
- Particle identification in high rate experiments without trigger .
  - Reconstruction of anti-protons below production threshold .

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CBM ToF

Charge states distribution for the Au^{26+} ions after a plasma stripper

G. Xu, J. Jacoby, Y. Zhao, G. Xiao, G. Loisch, T. Rienecker, A. Fedjuschenko, K. Cistakov, A. Blazevic, K. Weyrich, O. Rosmej, R. Cheng, J. Ren, A. Schönlein, J. Wiechula, T. Manegold, A. Kutschireiter, S. Zähter, R. Maeder, O. Haas, M .Iberler

Motivation

The interaction of heavy ions with plasma is important for research in a field like warm dense matter (WDM), laboratory astrophysics and inertial confinement fusion (ICF), where the high repetition rate of ion-beam pulses are of an advantage as a driver. Also applications like using the plasma as an efficient beam-stripper are of importance with respect for the future Facility for Antiproton and Ion Research (FAIR).

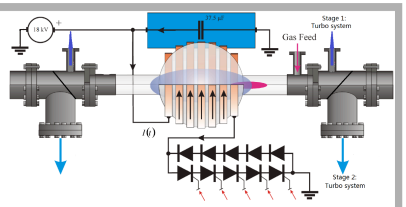


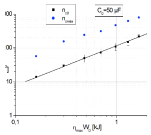
Fig. 1 Schematic of the experimental setup as a plasma stripper

ion beams is assumed to be $Q_0 = 4$; ven in units of cm^{-3}.

	λ cm	λ cm
	$N_e = 10^{17}$	$N_e = 10^{18}$
	230	23
	800	80
	2200	220

s with a plasma stripper cell

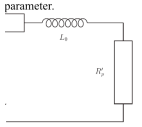
l H2 gas and H plasma.



: electron density n_{max} as a function of arge $\eta_{max}W_0$ for the 34 μF (left plot)

/sics of Plasmas 19, 033505 (2012).

end on the free electron density nergy transfer into the plasma for erminate, the energy transfer parameter.



for the plasma stripper

Plasma shape

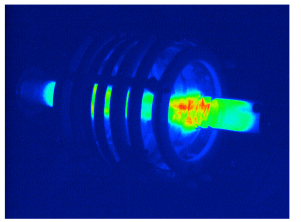


Fig. 4 Fast camera picture of the plasma in the target chamber

Charge states distribution

Projectile: 3.6MeV/u Au^{26+}
Plasma target: Hydrogen plasma ~10^{16} cm^{-3}

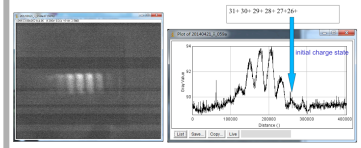


Fig. 5 Charge states distribution of the gold beams after the plasma stripper

Outlook

Upgrade the device to obtain the electron density above 10^{17} cm^{-3}:

1. Increase the operation voltage from 18 kV to 25 kV;

2. Enlarge the proportion of the reflected plasma resistance R_p.

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Ingo Deppner - Heidelberg
The Time-of-Flight System of the CBM-Experiment
Ge Xu - Frankfurt
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after a plasma stripper

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