POWERING of the HV-SOLENOIDS at the HESR ELECTRON COOLER

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Introduction

Many experiments at the planned High Energy Storage Ring (HESR) require magnetised electron cooling. One of the challenges in the future HESR electron cooler is the powering of HV-solenoids. The HV-solenoids are located on so called separation boxes and need a floating power supply. A concept currently under discussion is the use of cascaded cascade transformers. The individual cascade transformers should be powered by turbo generators. The cascade transformers will also be used to generate the potential difference between the individual separation boxes. This poster gives an overview about the turbo generator project.

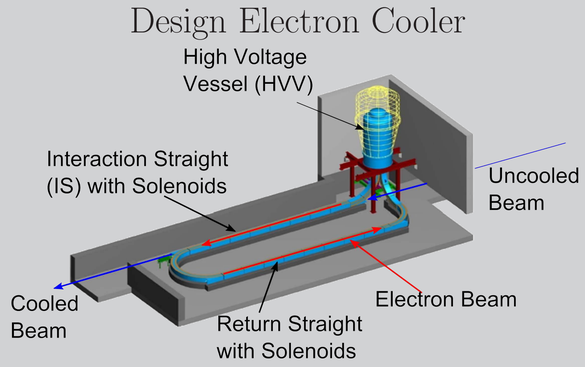
Experimental Demands for Antiproton Research

	High Luminosity	High Resolution
Momentum Range	$1.5 - 15\,\frac{\mathrm{GeV}}{\mathrm{c}}$	$1.5 - 9\,\frac{\mathrm{GeV}}{\mathrm{c}}$
Peak Luminositiy	$2 \cdot 10^{32}\,\frac{1}{\mathrm{cm^2 s}}$	$2 \cdot 10^{31}\,\frac{1}{\mathrm{cm^2 s}}$
Momentum Resolution	$\frac{\Delta \mathrm{p}}{\mathrm{p}} = 10^{-4}$	$\frac{\Delta \mathrm{p}}{\mathrm{p}} = 10^{-5}$

To meet this requirements for the high resolution mode, magnetised electron cooling is needed

HESR/ENC Electron Cooler

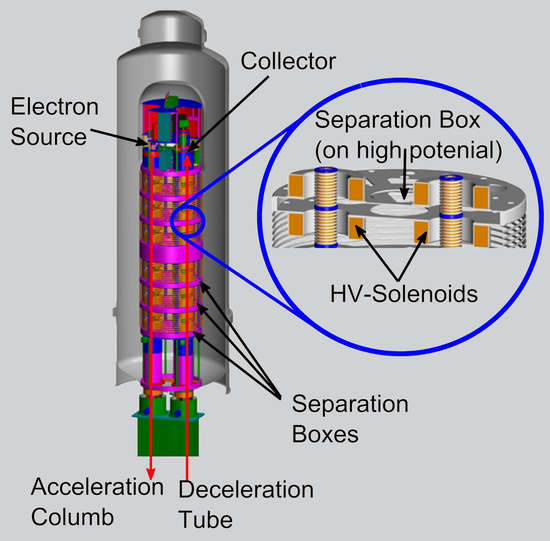
Design Electron Cooler



	HESR	ENC
Circumference	575 m	575 m
Interaction Straight	24 m	24 m
Energy	4.5 MeV	8.0 MeV
Current	1.0 A	3.0 A
Magnetic Field (IS)	0.2 T	0.2 T
Magnetic Field (HVV)	0.07 T	0.07 T

Challenging Component: Powering Solenoids at MV Potential

Interior of High Voltage Vessel

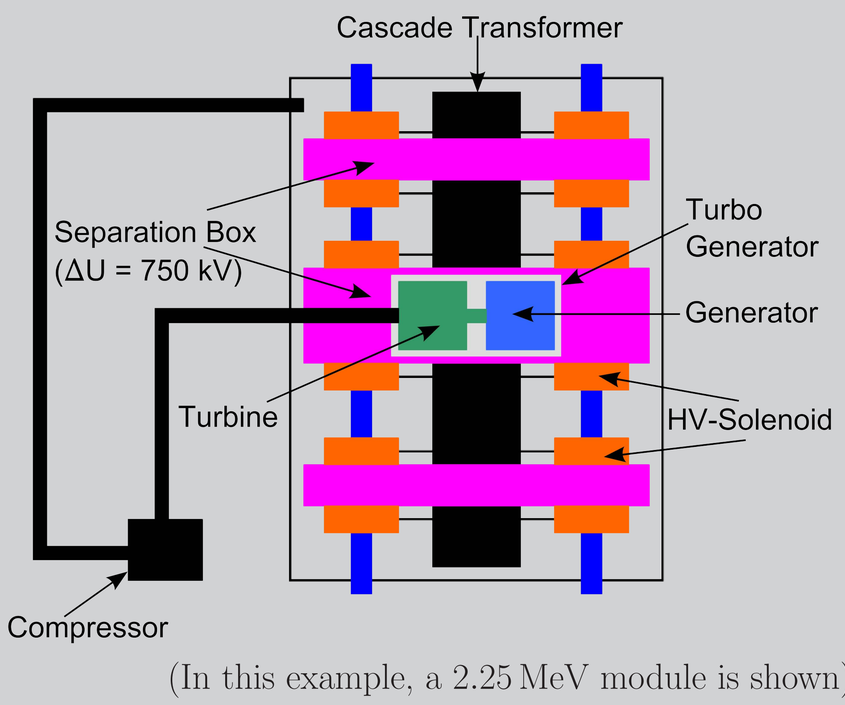


Power consumption (8 MeV) (including power supply losses)	
HV-Solenoids	100 kW
Gun & Collector	30 kW
Vacuum Control	5 kW
Diagnostics	5 kW
Miscellaneous	10 kW
Total Power	150 kW

- HV-solenoids on high potential
  ⇒ Floating power supply is needed
- Sulphur Hexafluoride environment
  ⇒ Components must be compatible with SF_6
- Maintenance only possible once a year
  ⇒ Power supply should run nine months without servicing
- Total energy consumption for all components is 150 kW
  ⇒ A high efficiency is necessary

Currently Discussed Concept (based on a proposal by the BINP)

Possible Design of a Power Supply Module

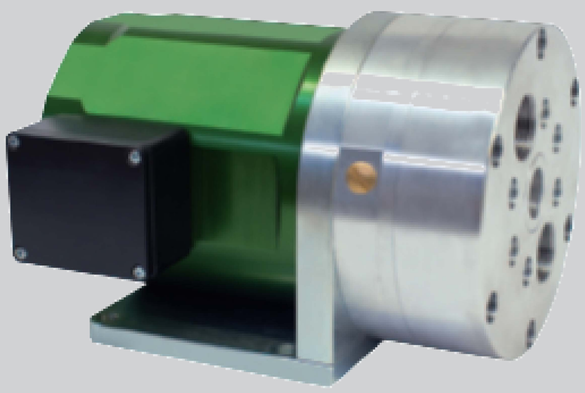


(In this example, a 2.25 MeV module is shown)

- Power supply should be build in a modular way
- The modules are cascaded in order to achieve the full energy (4.5 MeV or 8 MeV respectively)
- Each module consists of a cascade transformer powering the HV-solenoids
- Cascade transformers are powered by a turbo generator
- High pressure gas driving the turbo generator could be generated outside of the high voltage vessel

Further Road Map

Green Energy Turbine (GET)



(www.deprag.com)

Properties of GET	
Power	5 kW
Pressure (in)	4 bar
Gas Flow	$4\,\frac{\mathrm{m^3}}{\mathrm{min}}$
Mass	20 kg
Current (three phase)	7 A
Voltage	400 V
Frequency	600 Hz

- A test setup at HIM and BINP with a conventional turbo generator is in preparation
- Development of a proper turbo generator in collaboration e.g. with a technical university
- Using of waste heat in an Organic Rankine Cycle (ORC) like process to drive the turbo generator reduces operating costs