

Overview HESR

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HIC4FAIR

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HESR consortium members

(i) Forschungszentrum Jülich,



(ii) INCDIE ICPE-CA Bucharest,





(iii) ISYST Slovenia, (🍪)



lnstrumentation Lechnologies

(iv) GSI Darmstadt.









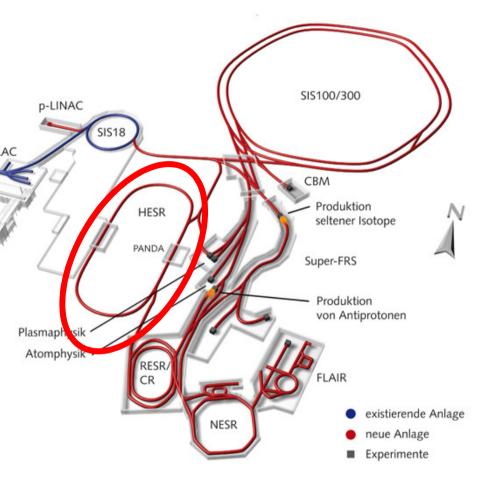
Outline

Basic Parameters of HESR

Modes of operation, for antiprotons

Modes of operation for ions

Status of technical components





Basic parameters of HESR

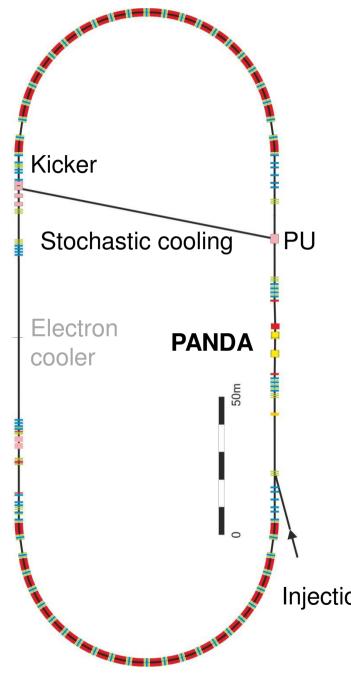
User collaborations interested in HESR FORSCHUNGSZENTRUM

• PANDA: Antiproton-proton interaction

• APPA: Stored Particles Atomic Physics Research Collaboration

• NUSTAR: Isomeric Beams, Lifetimes and Masses

With heavy ion and radioactive beams



Basic Data of HESR



- Circumference 574 m
 2 arcs of 155 m
 2 straight sections of 132 m
- ➤ Magnetic rigidity: 5 50 Tm
- ➤ Injection from CR at 13 Tm
- ➤ Maximum dipole field: 1.7 T
- ➤ Dipole field at injection: 0.4 T
- ➤ Dipole field ramp: 0.025 T/s

Injection from CR



Modes of operation for antiprotons

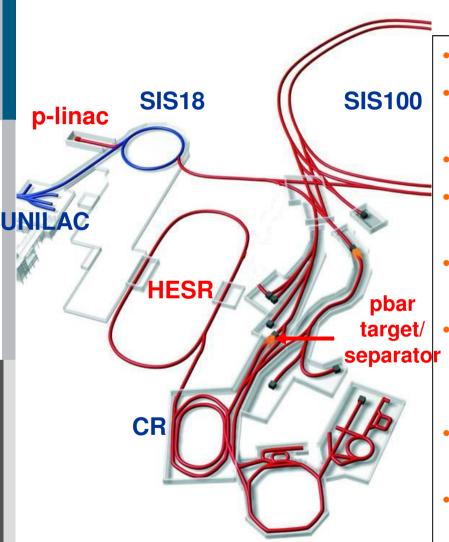
Modes of Operation with PANDA



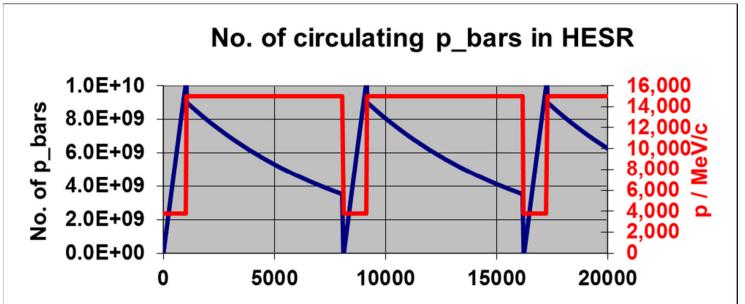
Experiment Mode	High Resolution Mode	High Luminosity Mode
Target	Hydrogen Pellet target with 4*10 ¹⁵ cm ²	
rms-emittance	1 mm mrad	
Momentum range	1.5 – 8.9 GeV/c	1.5 – 15.0 GeV/c
Intensity	1*10 ¹⁰	/1*10 ¹¹
Luminosity	2*10 ³¹ cm ⁻² s ⁻¹	2*10 ³² cm ⁻² s ⁻¹
rms-momentum resolution	5*10 ⁻⁵	1*10-4

Antiproton Chain (Modularised Start Version)

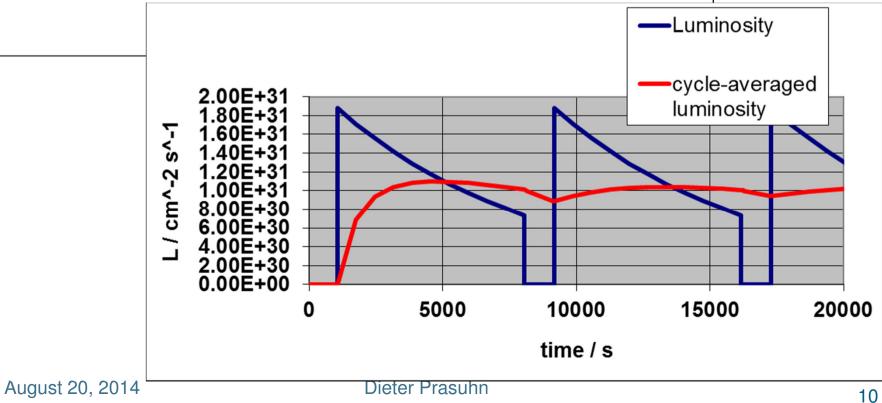




- acceleration in p-linac to 70 MeV
- multiturn injection into SIS18, acceleration to 4 GeV
- transfer of 4 SIS pulses to SIS100
- acceleration to 29 GeV and extraction of single bunch
- antiproton target and separator for 3 GeV antiprotons
- collection and 10 s pre-cooling of 10⁸ pbars in the Collector Ring CR
- Every 10 s transfer of 10⁸ p-bars at 3 GeV to HESR
- <u>accumulation</u> and storage of antiprotons in the HESR





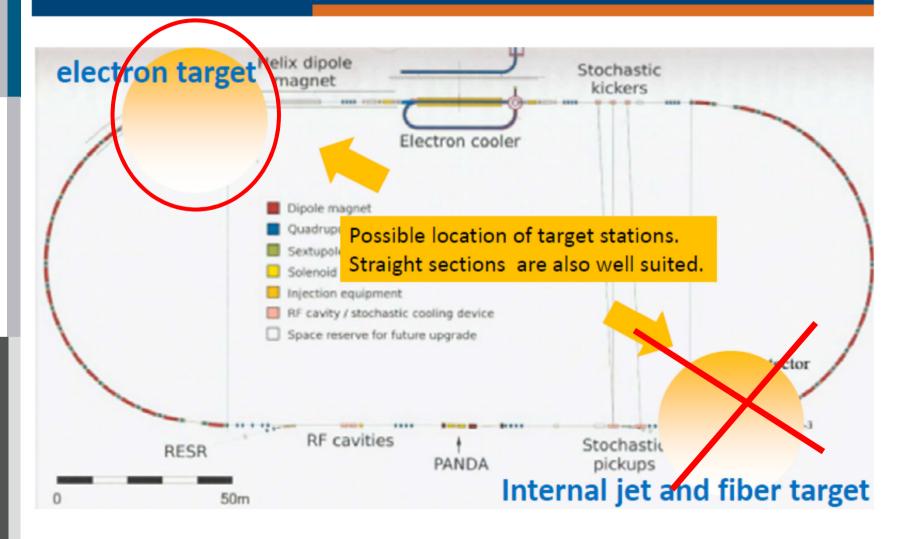




Modes of Operation for heavy ions



Experimental Conditions at the HESR





Data for Heavy Ions (238U92+)

Injection:

$$B^*\rho = 12 \text{ Tm } (740 \text{ MeV/u})$$

$$\beta = 0.83$$

Maximum magn. rigidity

$$B*\rho=50 \text{ Tm } (5 \text{ GeV/u})$$

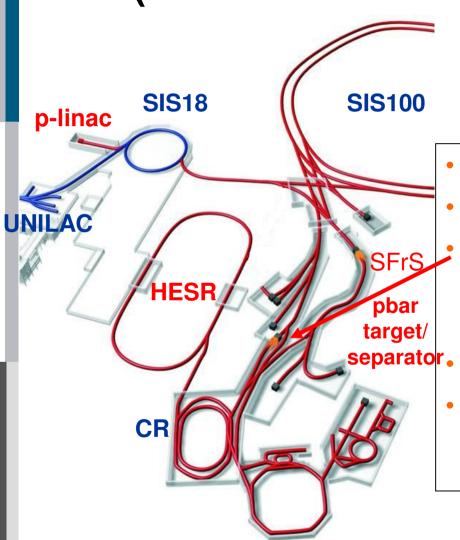
$$\beta = 0.98$$

Minimum magn. Rigidity

$$B^*\rho = 5 \text{ Tm } (170 \text{ MeV/u})$$

$$\beta = 0.53$$

Possible ways for ions into the HESR (Modularised Start Version)



- acceleration in UNILAC and SIS18
- Bypass the antiproton target
- collection and pre-cooling of ions in the Collector Ring CR
- transfer of ions at 12 Tm to HESR
- (accumulation and) storage, acceleration and cooling of ions in the HESR



Status of technical components

Magnets (Tendering by FAIR)



Dipoles:

May 2015: 1st dipole in Jülich



- 1st of its kind ready and measured in January 2015
- Series production released
- Dipole is reference magnet for all following dipoles
- 1st magnet arrived in Jülich middle of May this year
- Now 3 dipoles in Jülich
- Every 2 weeks one dipole is expected to be delivered
- Mounting of vacuum chambers in Jülich
- Storage until building is ready

Delivery of last dipole (46) expected for Q2/2017



Quadrupoles:



- 1st of its kind accepted
- Reference magnet for the next magnets
- 5 quadrupoles expected to arrive in Jülich this week
- In Jülich mounting of the complete units
 Sextupole – Quadrupole – Steerer planned

Delivery of last quadrupole (84) expected Q2/2017





Quadrupole power converters:

1st of its kind in house and accepted since Q3/2014 All Quad-PoCo have been delivered to Jülich in the middle of July 2015

Dipole test power converter:

Is delivered and used by the dipole manufacturer for the measurement of the dipoles

The HESR dipole PoCos:

are specified, but will be ordered matched to the CC schedule

RF and stochastic cooling

First amplifiers have arrived and been tested in Jülich

Tanks for stochastic cooling are under construction,

1st Pickup tank is expected to be ready Q3/2015,

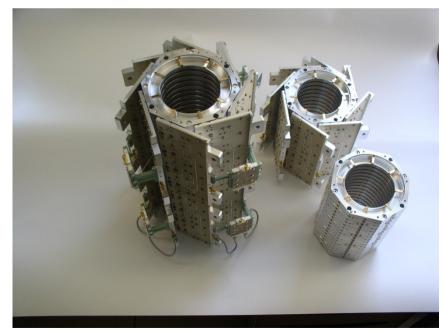
1st kicker tank Q4/2015.

They will be installed in COSY for tests

Barrier bucket prototype in use at COSY



First tank arrived in Jülich



hn 2-4 GHz PU-structures

Vacuum



- Design vacuum for HESR had been 10⁻⁹ mbar
- According to an early recommendation of MAC the vacuum system was upgraded to a bakeable system
- NEG-coating plus heating jackets are foreseen in the dipole sections from the beginning

Heating jackets for the dipole chambers on the test bench





Status:

Straight vacuum chambers for the whole HESR are in house

- Bent vacuum pipes for the dipoles are ordered
- 1st bent dipole vacuum chamber is NEG-coated by GSI

The detailled Specs for the slow control will be finished autumn 2015.



Injection

Injection kicker and supply:

Design of the manufacturer is accepted,

Kicker tank is under construction

First test expected Q3/2015



Diagnostics

Prototype BPM is under construction and will be tested end of this year.

Then series production will start.



Further In-Kind contributions:

Romania: Sextupoles and steerers:

Prototypes of each kind have arrived in Jülich in Q2/2015, series production has started.

Time schedule for delivery to Jülich is matched to the mounting schedule with quadrupoles

Power Converters:

Prototype is accepted, series production started

Material for the series production is ordered



In-Kind contribution from Slovenia

Diagnostics: Specifications are prepared

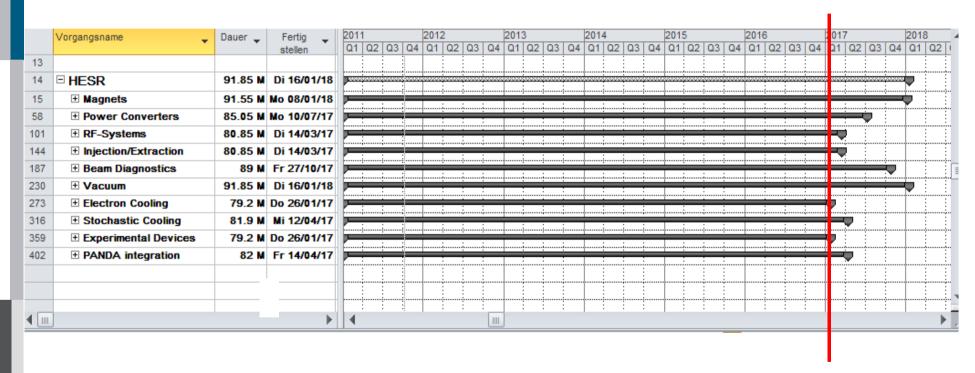
together with GSI

Slow control: Specifications for vacuum control are under discussion together with GSI

29/07/2015



HESR overall time schedule



All components of HESR are scheduled to be "ready to move into tunnel" 2017



