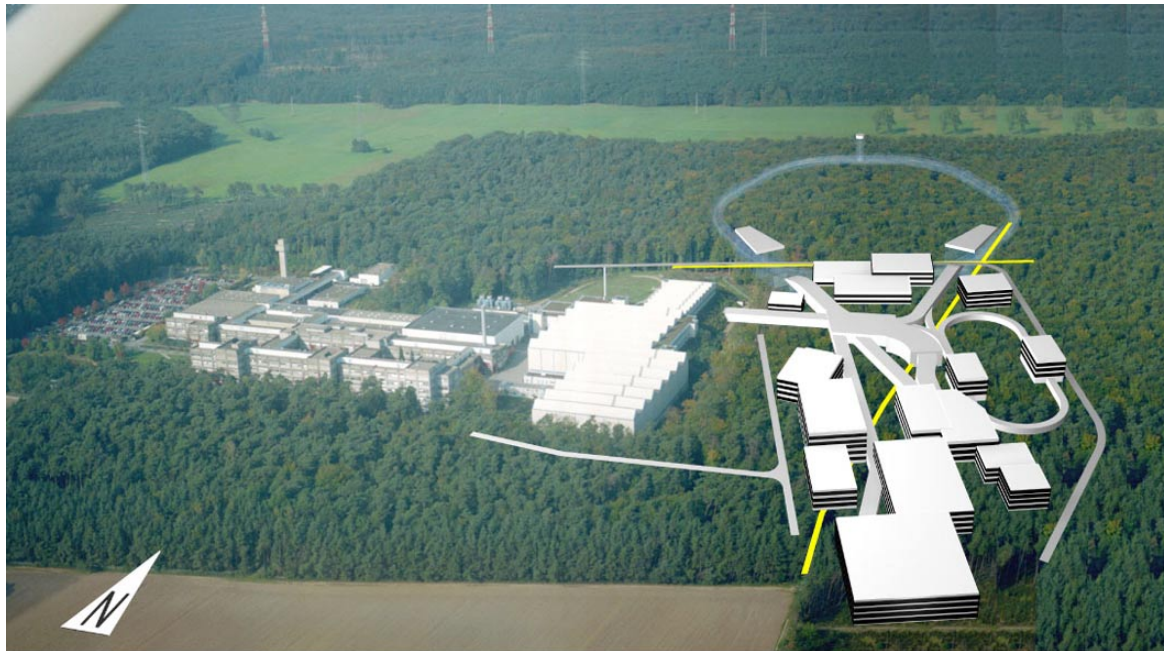


# **The New Accelerator Complex for Ions and Antiprotons**

**Petra Schütt**

FRS Users' Meeting

February 12-14 2003



## 5 Research areas:

- Radioactive Ion Beams
- Antiproton Physics
- High Energy Nuclear Collisions
- Plasma Physics
- Atomic Physics

## Gain Factors

- Primary beam intensity: Factor 100 – 1000
- Secondary beam intensities for radioactive nuclei: up to factor 10,000
- Beam energy: Factor 15

## Special Properties

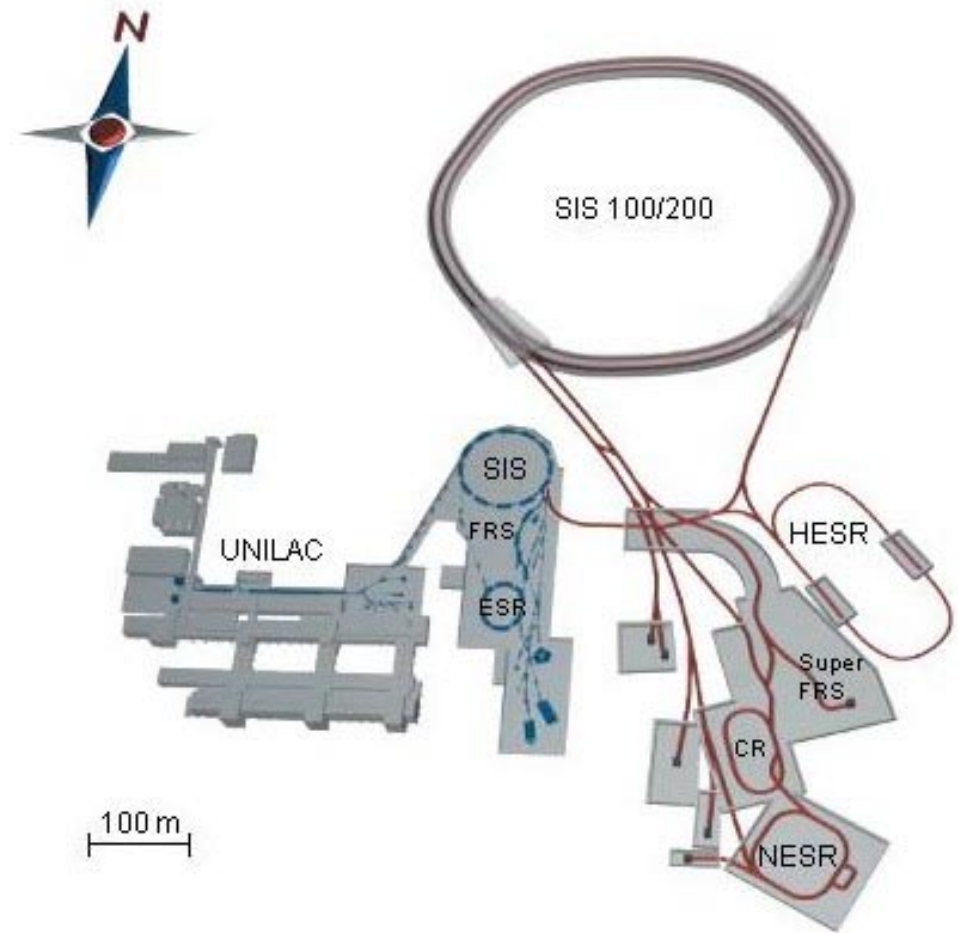
- Intense, fast cooled energetic beams of exotic nuclei
- Cooled antiproton beams up to 15 GeV
- Internal targets for high-luminosity in-ring experiments

# Tasks of the New Facility



GSI Future Project

- **SIS100 (Synchrotron 100 Tm):**
  - „work horse“
  - accelerates heavy ions/protons
  - fast extraction to SIS 200 or RIB/Antiproton targets
- **SIS200 (Synchrotron 200 Tm):**
  - stretcher ring
  - accelerates heavy ions to high energies
  - slow extraction
- **SuperFRS (Fragment Separator):**
  - analyses and separates secondary beams
- **CR (Collector Ring Complex):**
  - collects secondary beams
  - storage of antiprotons
  - stochastic precooling of ions and antiprotons
  - Fast deceleration of RIBs
- **NESR (New Experimental Storage Ring):**
  - electron cooling
  - in-beam experiments with RIB and primary ions
  - e-A-collision experiments
- ● **HESR (High Energy Storage Ring):**
  - experiments with antiprotons

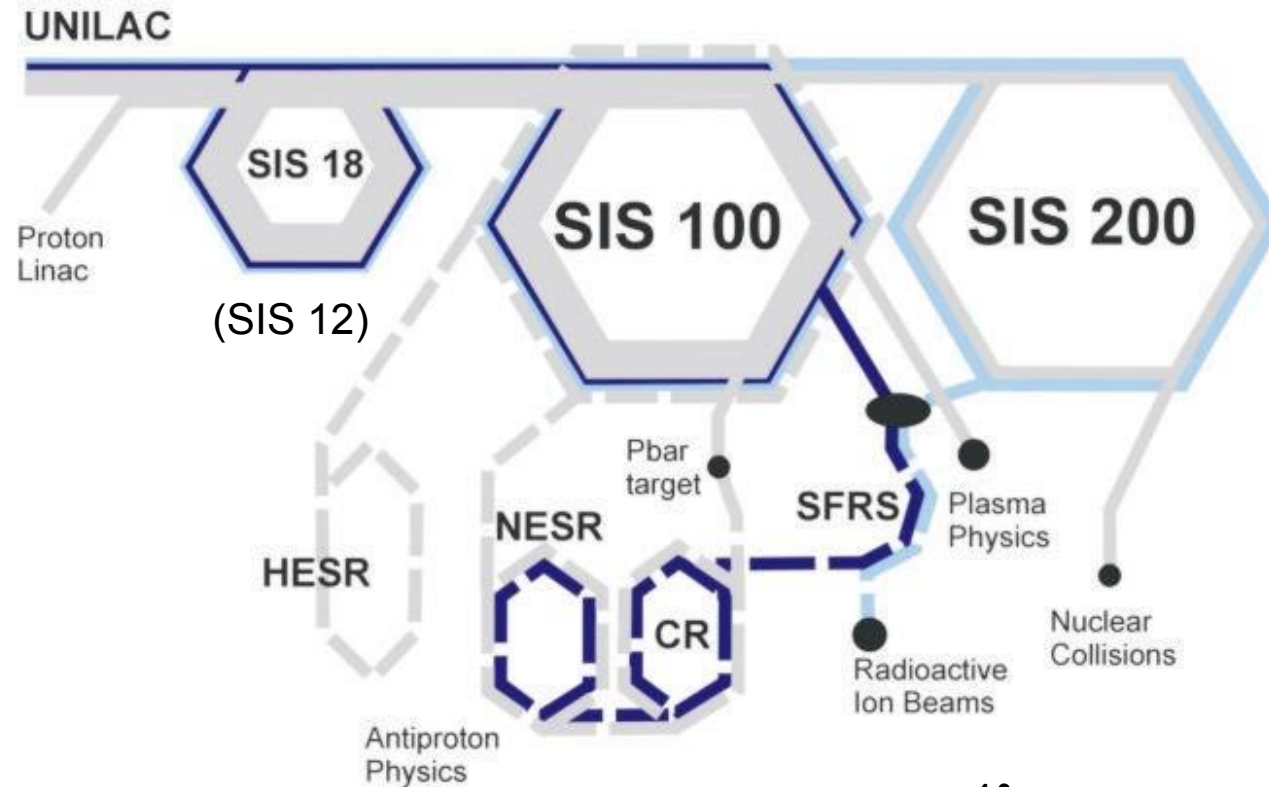


Existing facilities

Proposed upgrade

# Radioactive Ion Beams

GSI Future Project

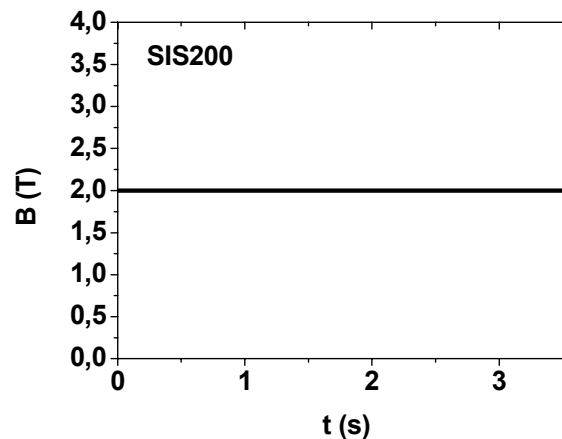
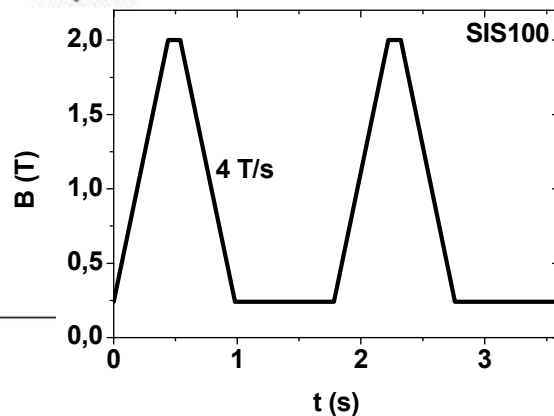


For storage ring experiments:

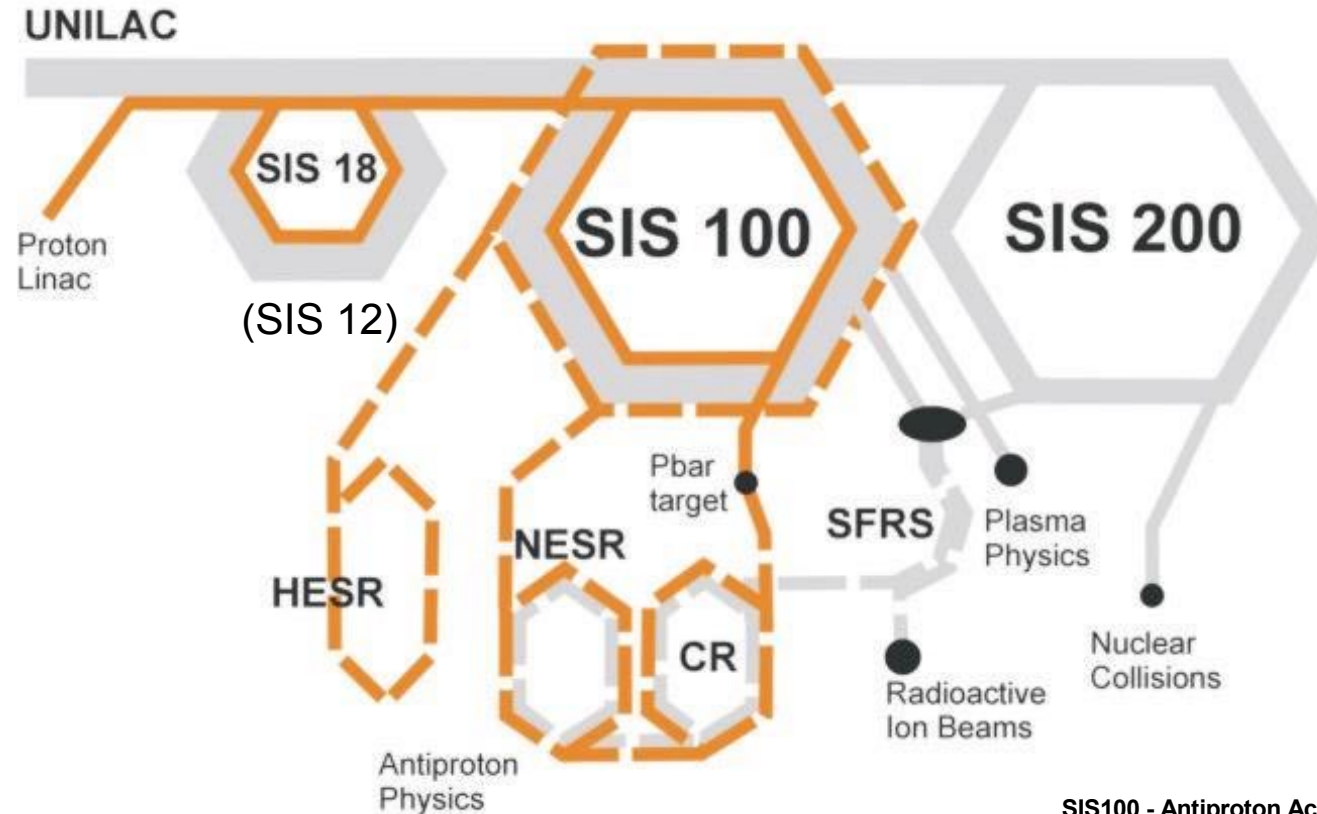
- $10^{12}$  ions in 50 ns pulse

For fixed target experiments:

- $10^{12}$  ions/sec
- Duty factor near 100%

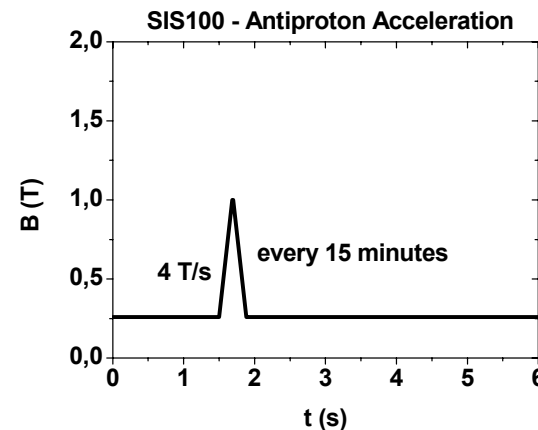
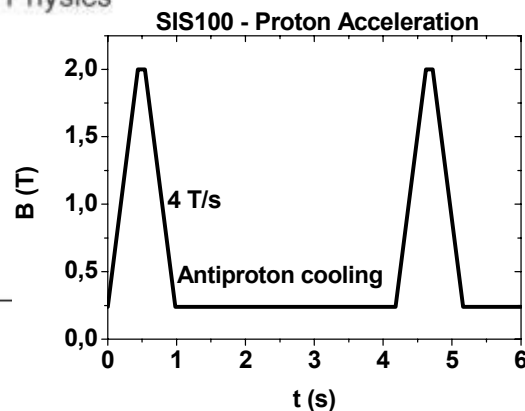






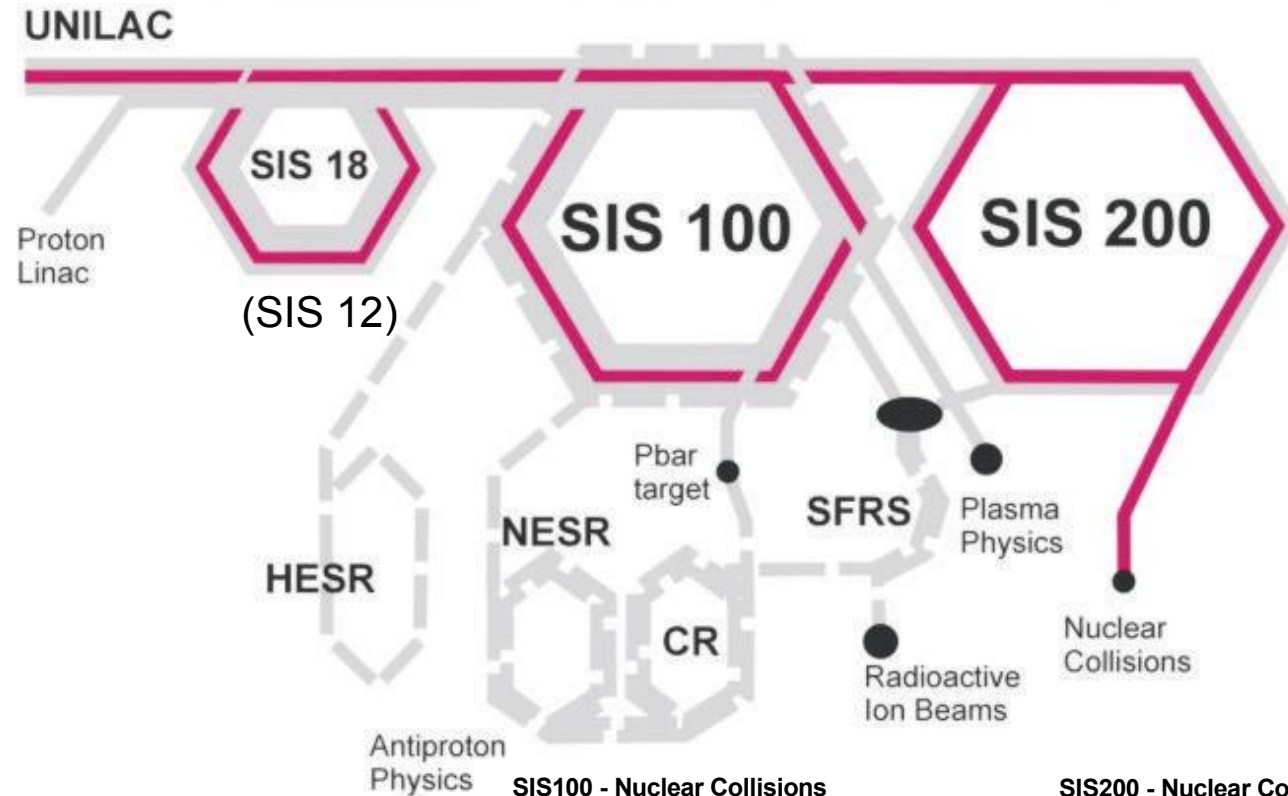
- Primary proton beam:
  - $2.5 \times 10^{13}$  protons in 50 ns pulse
- Proton-antiproton experiments in HESR:
  - Luminosity  $2 \times 10^{32} \text{ cm}^{-2} \text{ s}^{-1}$
  - Antiproton production rate  $2 \times 10^7 \text{ s}^{-1}$

Antiproton Physics



# High Energy Nuclear Collisions

GSI Future Project



## ■ High Energy

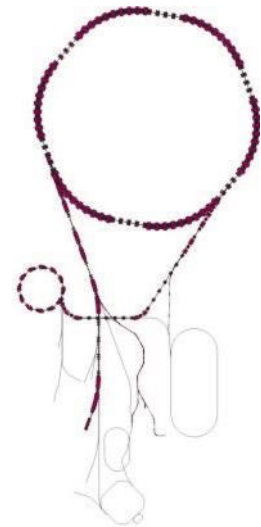
- $U^{92+}$  22.3 GeV/u
- $Xe^{54+}$  23.8 GeV/u
- $Ne^{10+}$  29.1 GeV/u

## ■ Moderate Intensity

- $<1 \times 10^9$  ions /s

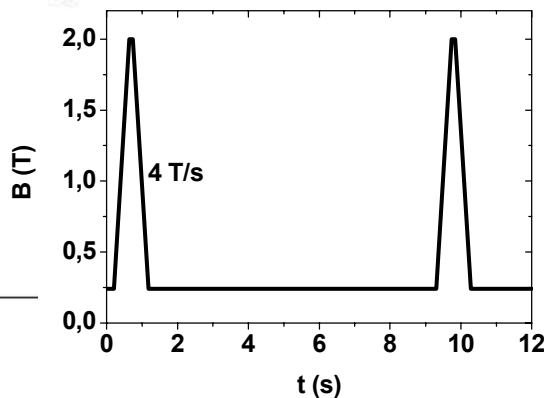
## ■ High Duty Factor

- $>80\%$

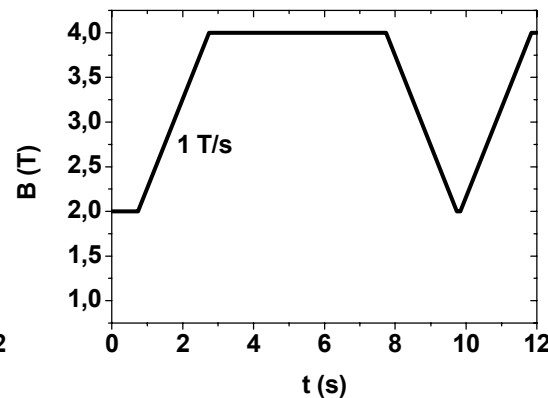


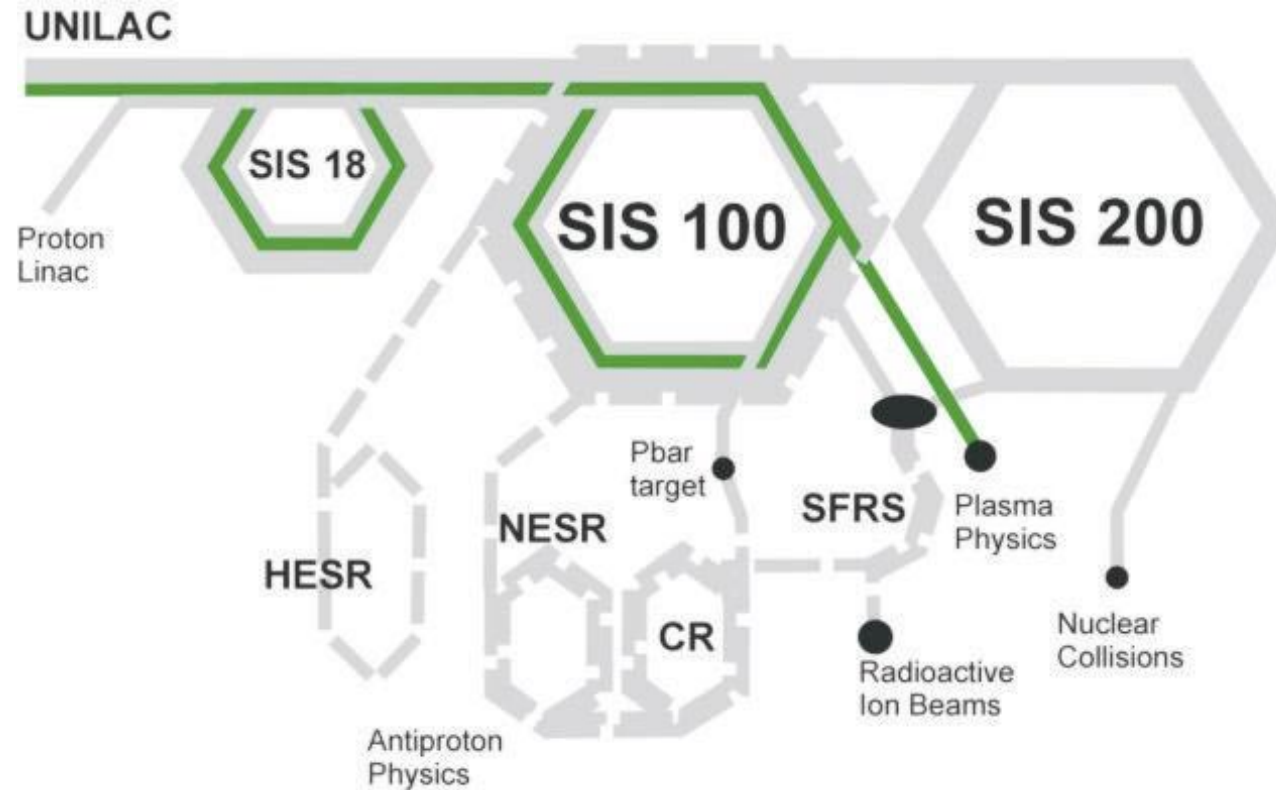
Antiproton  
Physics

SIS100 - Nuclear Collisions



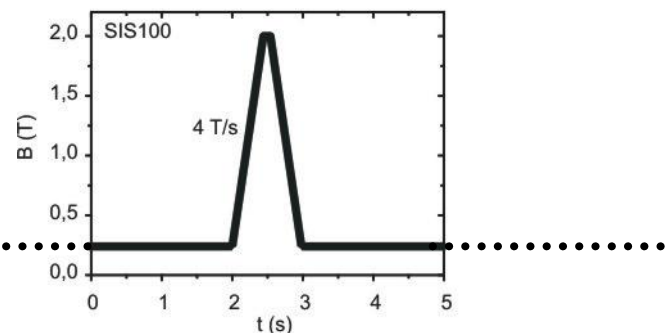
SIS200 - Nuclear Collisions





Plasma production in target:

- $1-2 \times 10^{12}$  ions in short pulse every 15 minutes
- Energy range 400 MeV/u .. 2.7 GeV/u
- Pulse length 100 ns .... 20 ns



## SIS 200 as Stretcher Ring

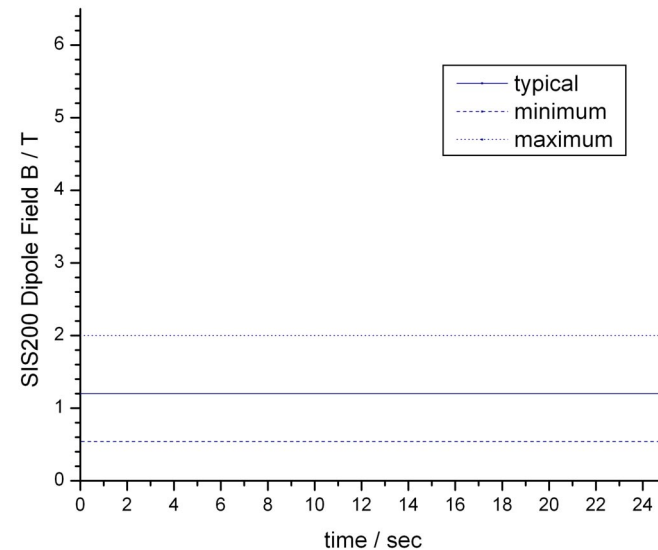
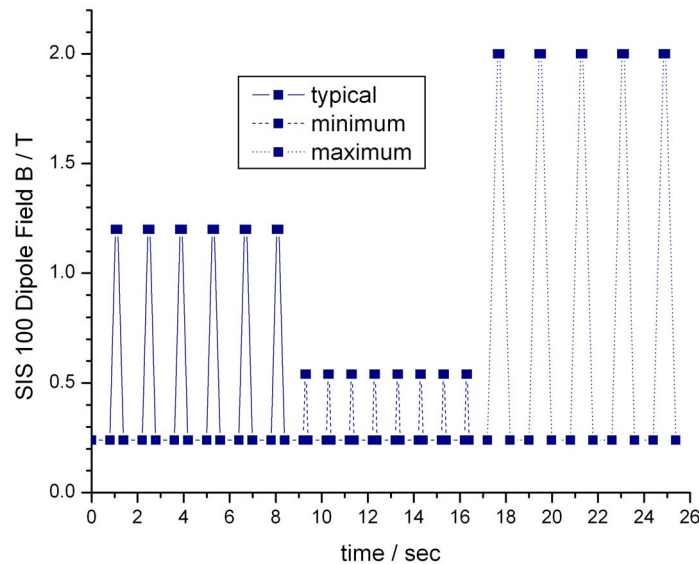
### Beam Parameter:

- $U^{28+}$
- 400 – 2700 MeV/u
- Typically 1500 MeV/u
- $10^{12}$  ions per pulse in SIS100

### Pulse repetition in SIS100

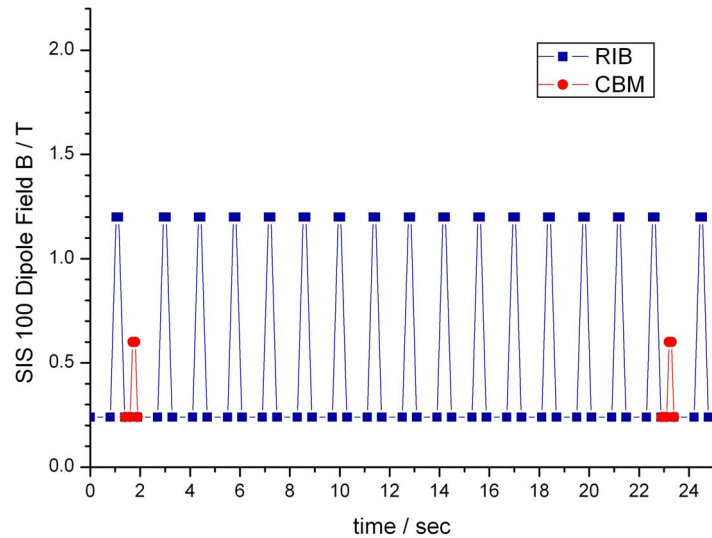
- 1.0 sec for 400 MeV/u
- 1.4 sec for 1500 MeV/u
- 1.8 sec for 2700 MeV/u

### Duty cycle near 100%

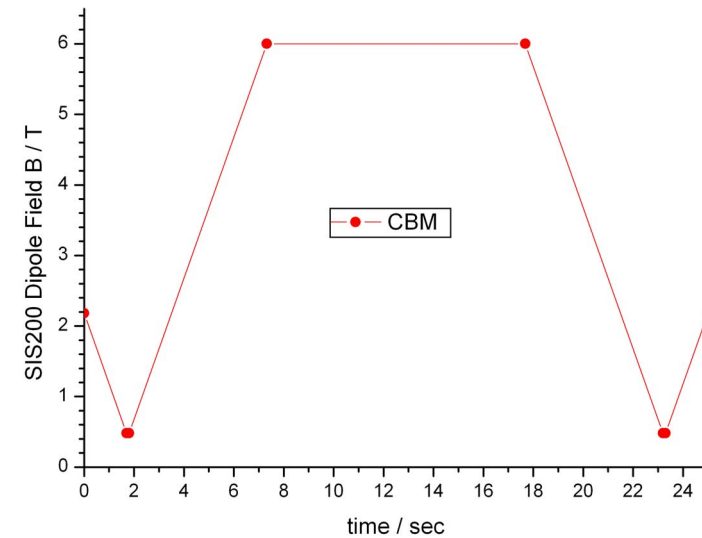




## Fast Extraction from SIS100



## Parallel Operation with CBM possible



# Online Experiments without SIS200

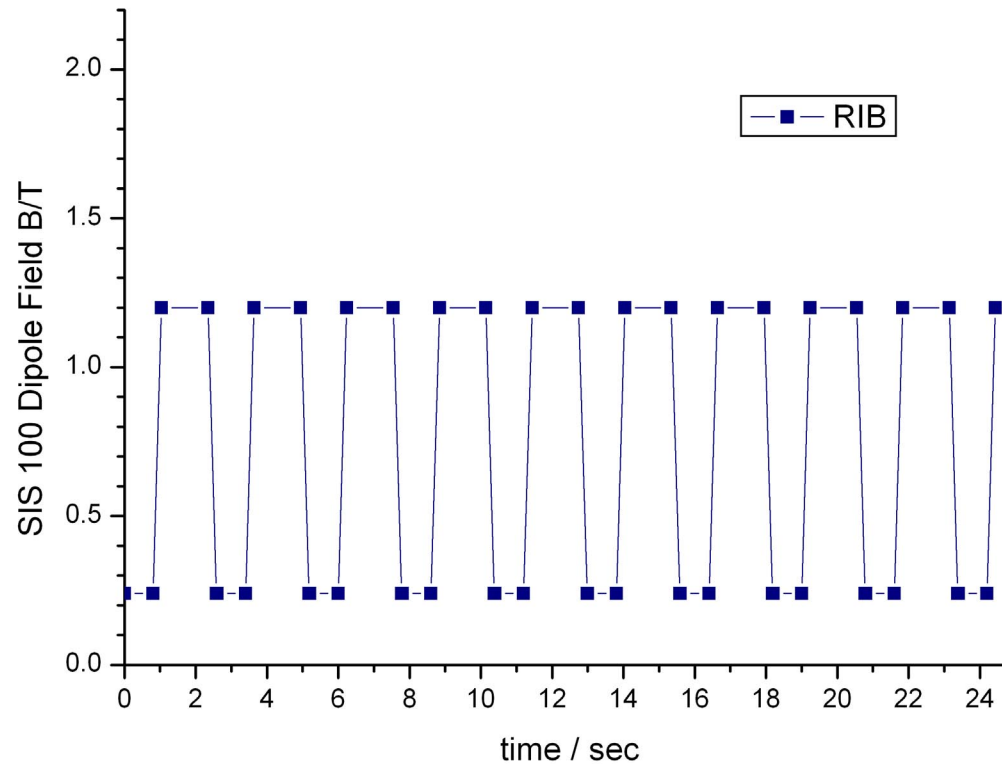


GSI Future Project

● Slow extraction from SIS100

● Duty cycle 50%

● Cycle length 2.6 sec



# Antiproton Operation

- SuperFRS as 2nd priority experiment in cooling pauses.

- Approx. 50% of design intensity

