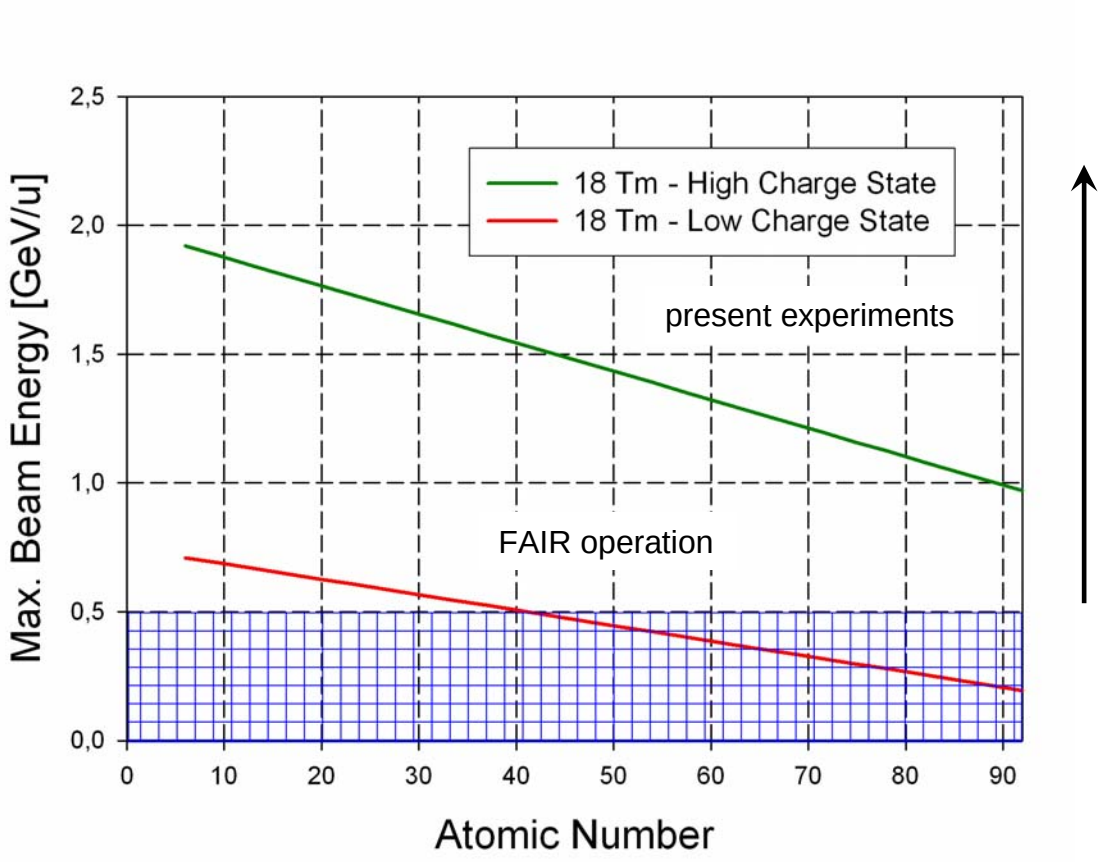
SIS18 and Accelerators

Peter Spiller

FRS user meeting

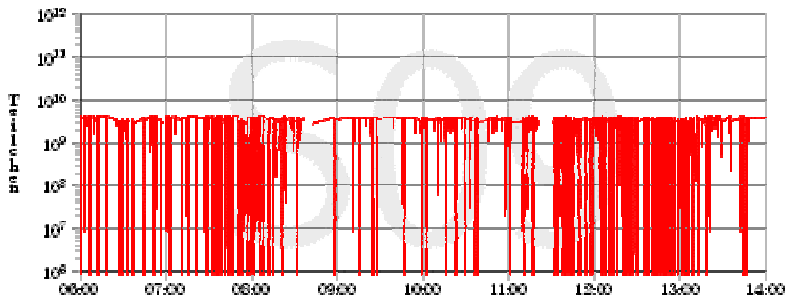
29.10.2009

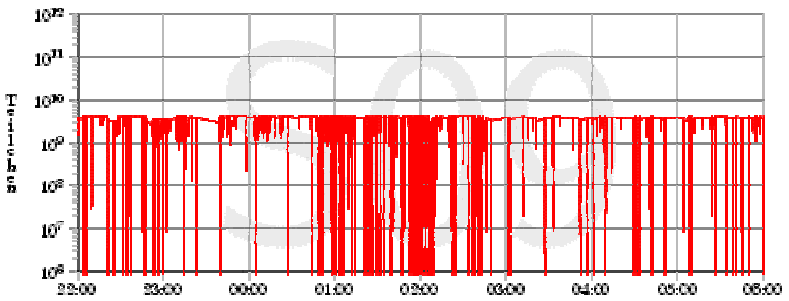
Beam Energy



Range for RIB production

Operation with U^{73+}





- Maximum injected: 4.5 x 10^9 ions / cycle (effective MTI stacking factor: 13)
- Typical extracted (on target): 2.5 x 10^9 ions / cycle

- Maximum Unilac current in TK9: ~1.5 mA
- MEVVA source current (U^{4+}): ~15 mA
- Very stable conditions for about one week during exclusive FRS operation
- Increased average intensity:
  Ramp rate 1.3 T/s > 4 T/s (New Power Grid Connection)
  Extraction time: 5 s > 0.5 s
  Cycle times: 7 s > 2.5 s
  Factor: ~4

Development Issues for Slow Extraction

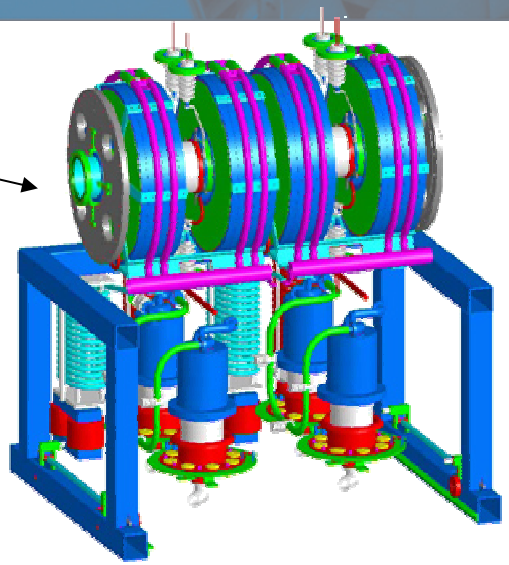
- Slow extraction at maximum rigidity (septum length, distance from axis, settings etc.)
- Slow extraction with space charge – debunched (instable) beams
  (impedances, simulations, approaching resonance from top etc.)
- Commissioning of KO extraction (hardware available, concentred work for half a year needed)
- Influence of eddy currents (field measurements ongoing, feed back system)
- Hardt condition, (extraction angle independend from momentum
  (set values, experiments ongoing)

- Slow extraction with intermediate charge states (FAIR)

Too little number of synchrotron experts and missing machine development time !

Fast Extraction and Compression

Amorphous MA Cores
Cobalt based



40 kV per Gap

P. Hülsmann, G. Hutter,
H. Klingbeil, W. Vinzenz,
R. Balz, U. Kopf u.a.

Low Duty Cycle System
> Air Cooling

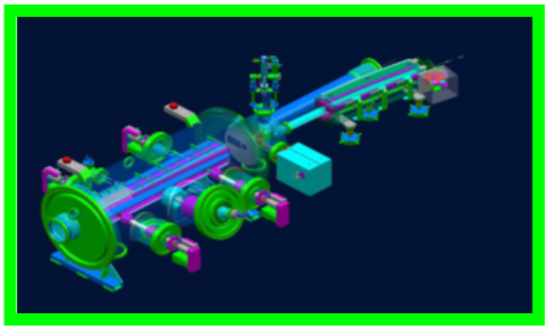
Original Goal: μQf = 6 GHz

Project completed - cavity installed

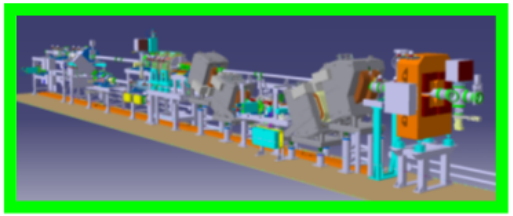
Link to the control system outstanding

Fixed frequency operation possible

SIS18upgrade Program

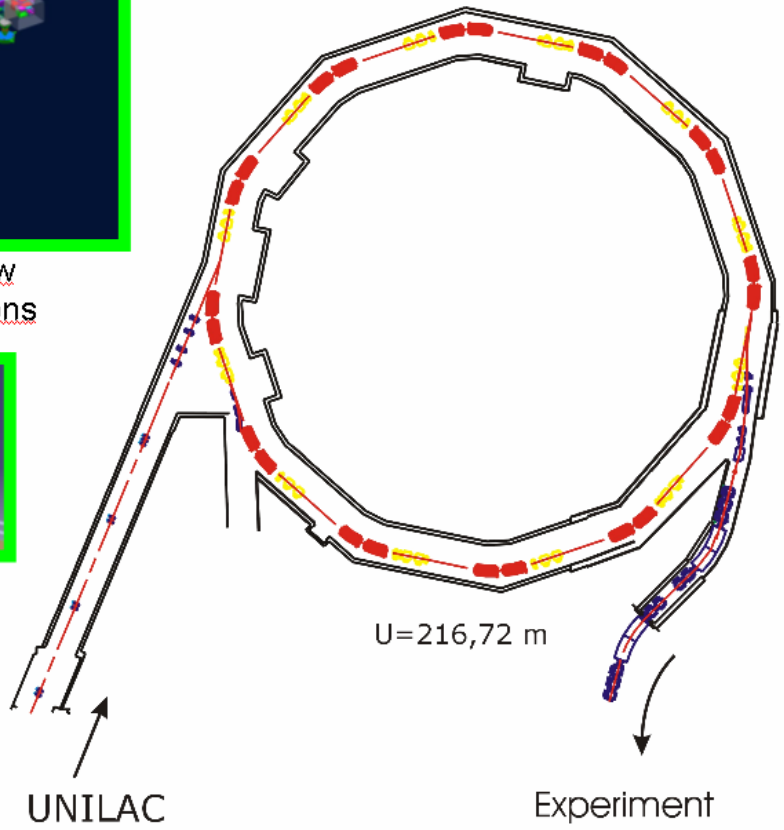


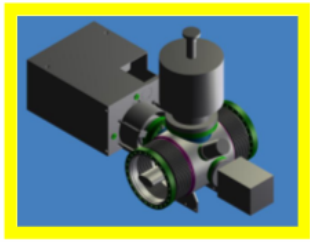
Injection system for low charged state heavy ions



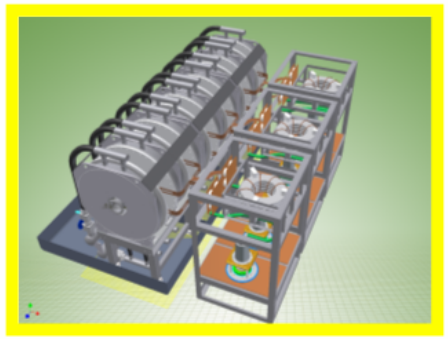
Charge separator for higher intensity and high quality beams

Power grid connection





Scrapers and NEG coating for pressure stabilization



h=2 acceleration cavity for faster ramping

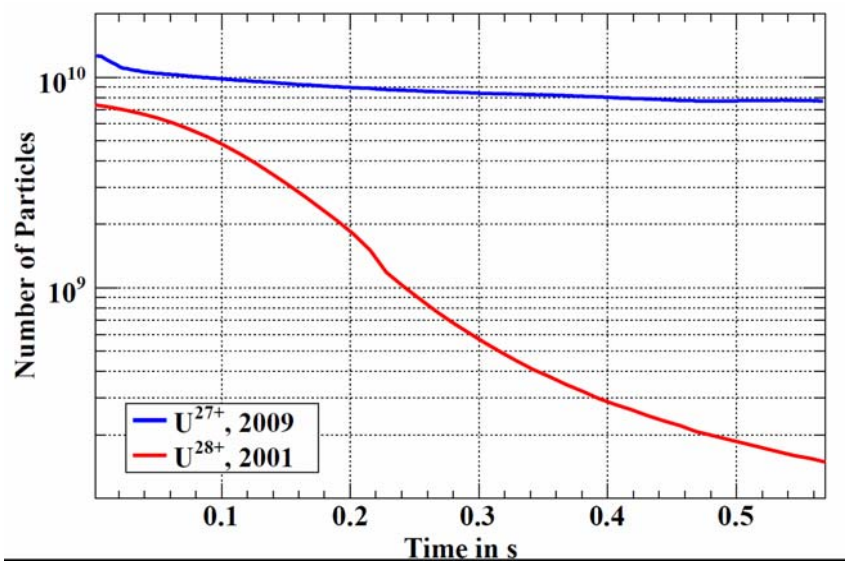
The SIS18upgrade program: Booster operation with intermediate charge state heavy ions

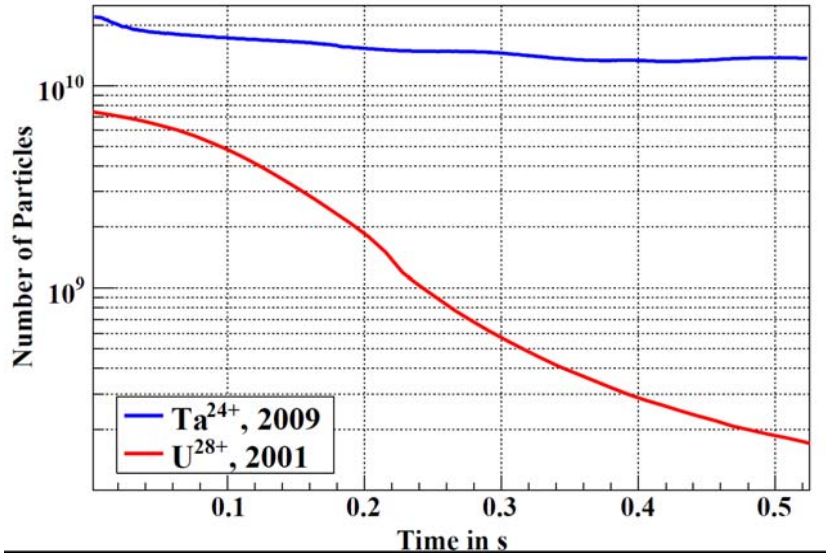
SIS18 upgrade program

Supported by EU Construction contract:

- **Task 1: RF System**
  New h=2 acceleration cavity and bunch compresion system for FAIR stage 0, 1
  (2012)
- **Task 2: UHV System**
  New, NEG coated dipol- and quadrupole chambers
  (2009)
- **Task 3: Insertions**
  Set-up of a „low-desorption“ scraper system
  (2009)
- **Task 4: Injection / Extraction Systems**
  New, large acceptance injection system plus HV power suppy
  (2008)
- **Task 5: Beam Diagnostics Systems**
  Fast residual gas profile monitor and high current transformer
  (2009)
- **Task 6: Injector**
  Set-up of a TK charge separator
  (2008)

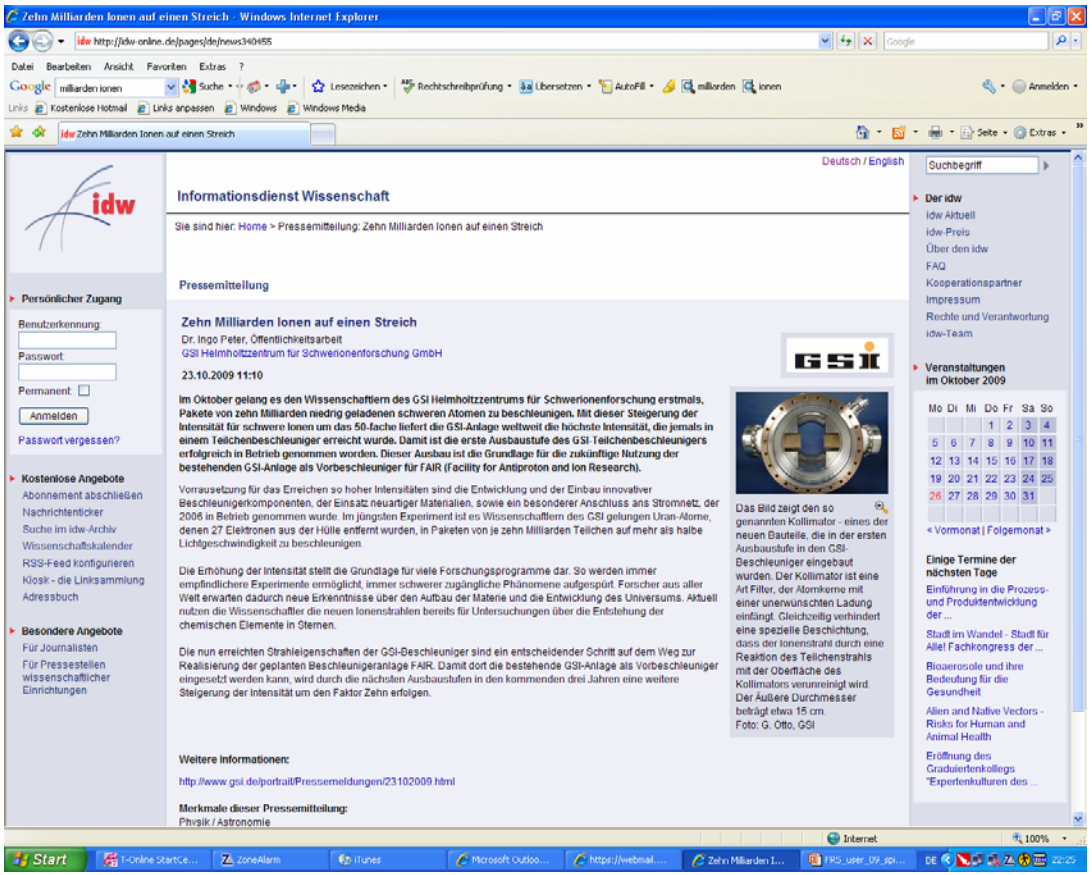
Acceleration of Intermediate Charge State Heavy Ions





- Significant progress with Ta^{24+} and U^{27+} ions due to the upgrade program in comparison with 2001
- Maximum beam energy about 200 MeV/u

Press Release



GSI world wide leading in acceleration of intermediate charge state heavy ions