Operation And Experiments At GSI

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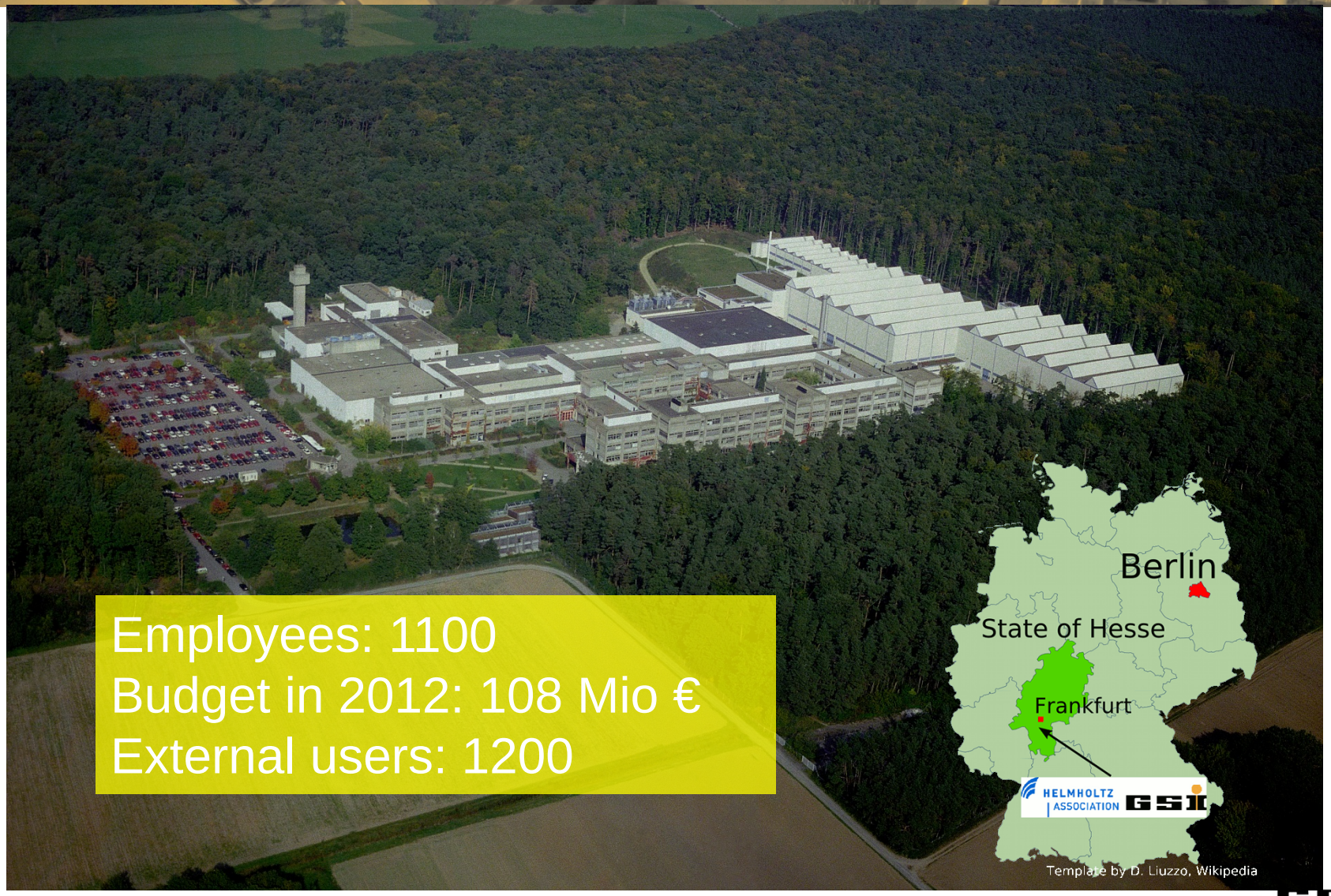
Operation And Experiments At GSI

Topics:

1. Overview of the laboratory
2. Parts of the accelerator facility
3. Operation possibilities and beam parameters
4. Experimental installations
5. Outlook

Operation And Experiments At GSI

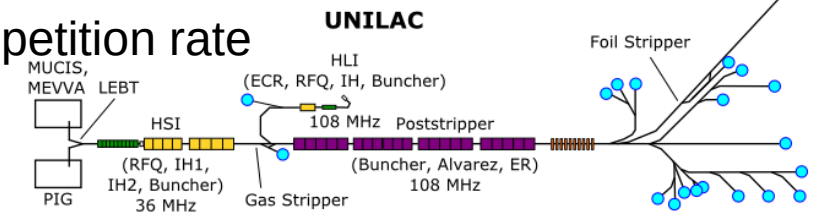


Accelerator facility

3. GSI accelerators:

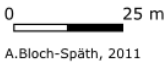
UNILAC

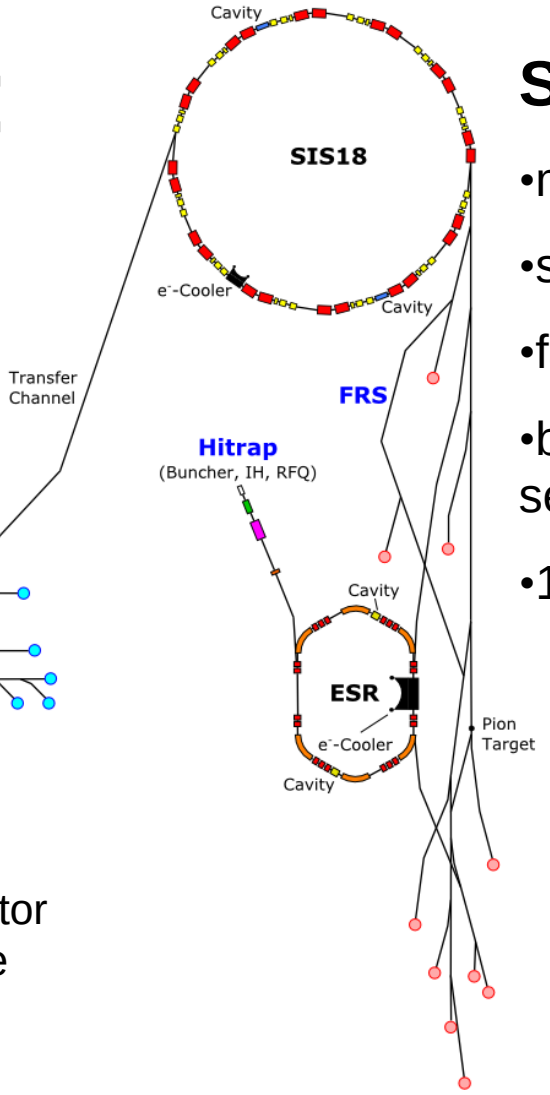
- 3 ion sources
- 4 branches/16 experimental caves
- 50 Hz repetition rate



Time sharing operation:

-different time base for each accelerator
-change the setup from pulse to pulse





SIS18

- max. rigidity 18Tm
- slow extraction
- fast extraction
- beam pulse 1µs-10 sec.
- 10 experimental caves

ESR

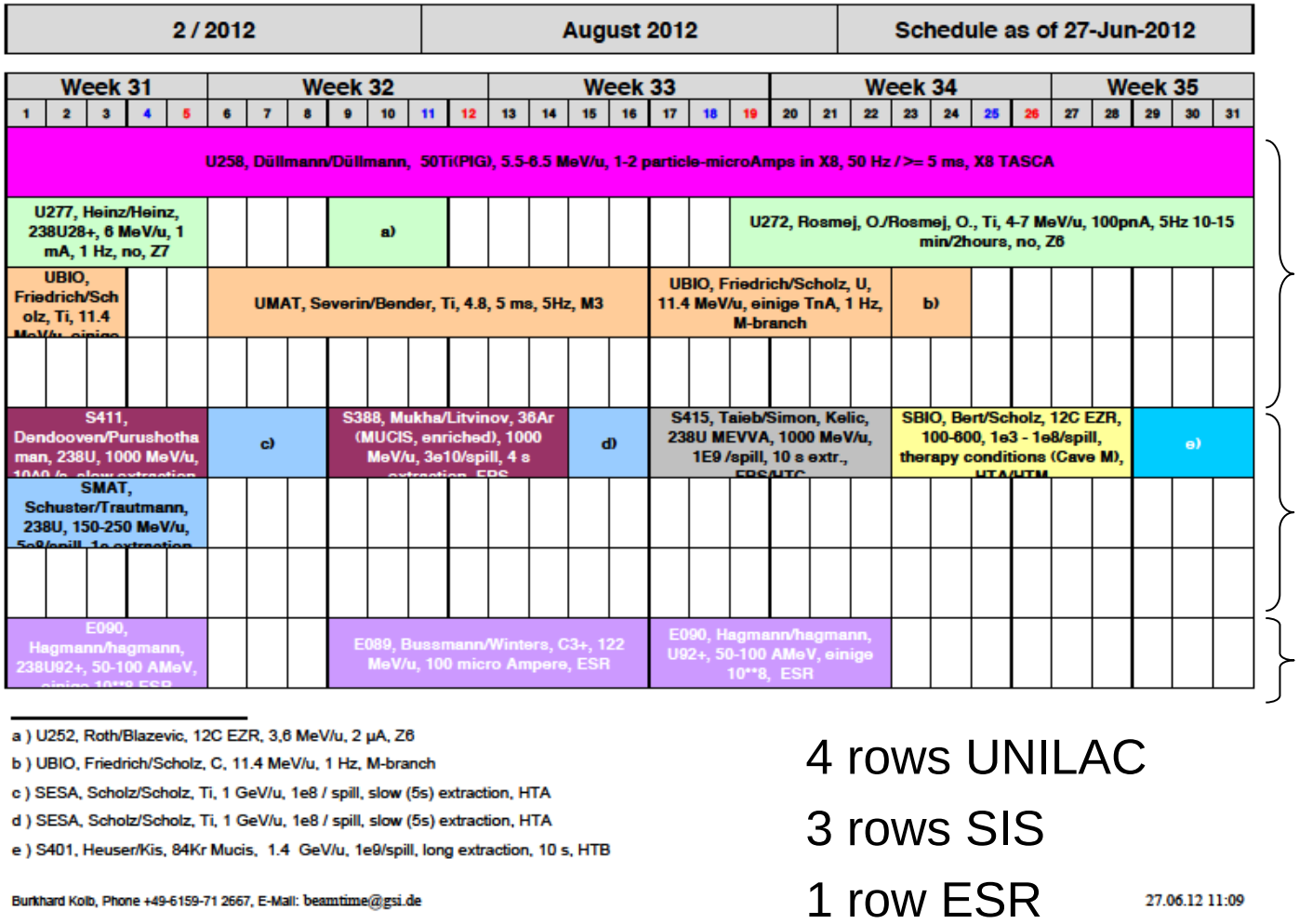
- beam pulse from a few seconds up to 30 minutes

Beam time schedule

-details of August last year

-contains the sequence of approved beam requests of the experiments

-daily meeting for discussing and organizing details



4 rows UNILAC

3 rows SIS

1 row ESR

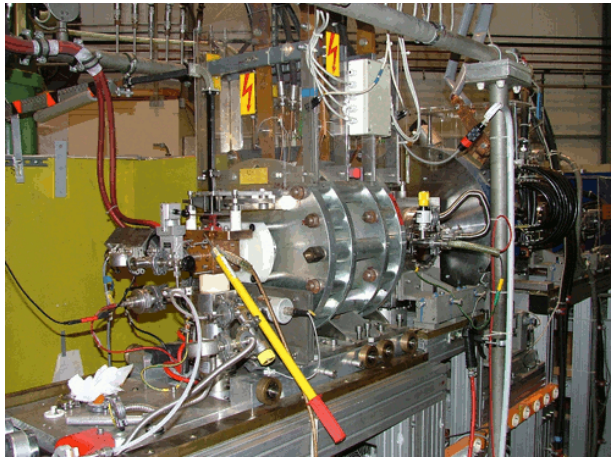
UNILAC beam parameters

iso-tope	ele-ment	ion source	energy [MeV/u]	duty cycle [%]	charge state [exp.]	intensity [eμA]	intensity [pps]
12	C	ECR	5.9	26	2	21	$1.7*10^{12}$
50	Ti	PIG	6.1	25	10	50	$7.8*10^{12}$
64	Ni	ECR	5.5	27	9	30	$5.6*10^{12}$
136	Xe	ECR	11.4	10	17	5	$1.8*10^{11}$
197	Au	PIG	4.8	15	24	18	$7.0*10^{11}$

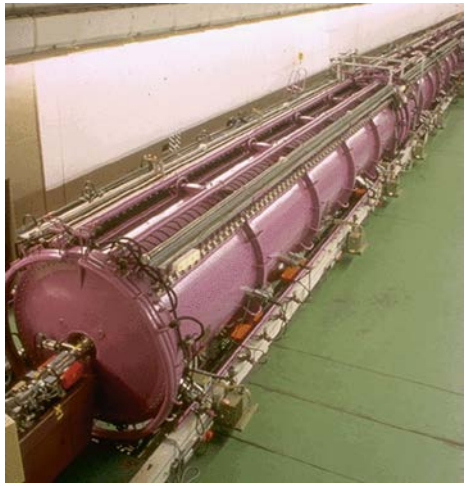
-duty cycle up to about 27% , depending on the rf- power

-energy from 3.6-12 MeV/u

-intensity depends on source and operation conditions



ECR-source



Alvarez-section

single gap resonators

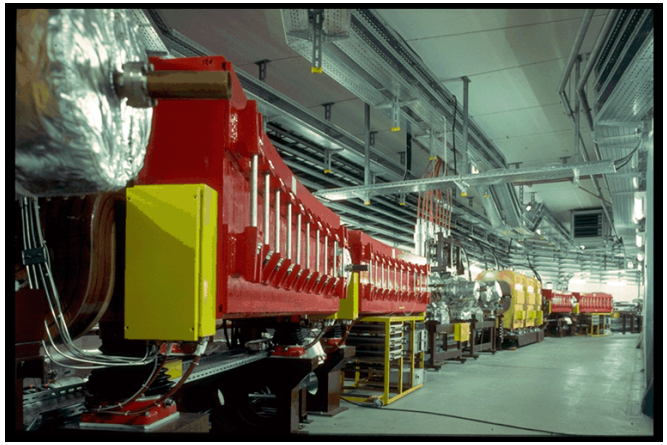
SIS beam parameters

-high pulse current from UNILAC requested

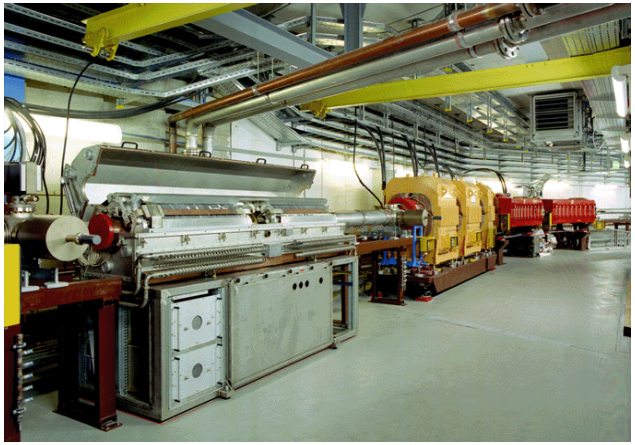
-extraction energy from 50keV/u to 2GeV/u

-beam cooling to increase pulse intensity

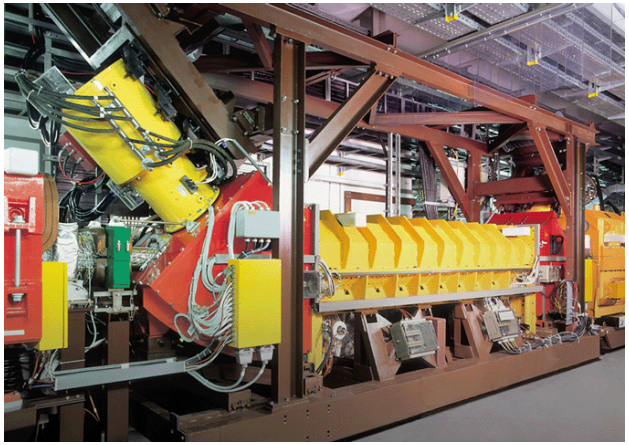
isotope	element	ion source	charge state (SIS)	extraction energy [MeV/u]	intensity [ppp]	max. energy [MeV/u]
2	D	MUCIS	1	1250	$2.3*10^{10}$	2000
86	Kr	MUCIS	33	730	$1.5*10^{10}$	1400
107	Ag	MEVVA	43	750	$1.3*10^{9}$	1500
208	Bi	MEVVA	68	600	$2.1*10^{9}$	1100
238	U	MEVVA	73	600	$3.0*10^{9}$	1000



one SIS section



rf-cavity



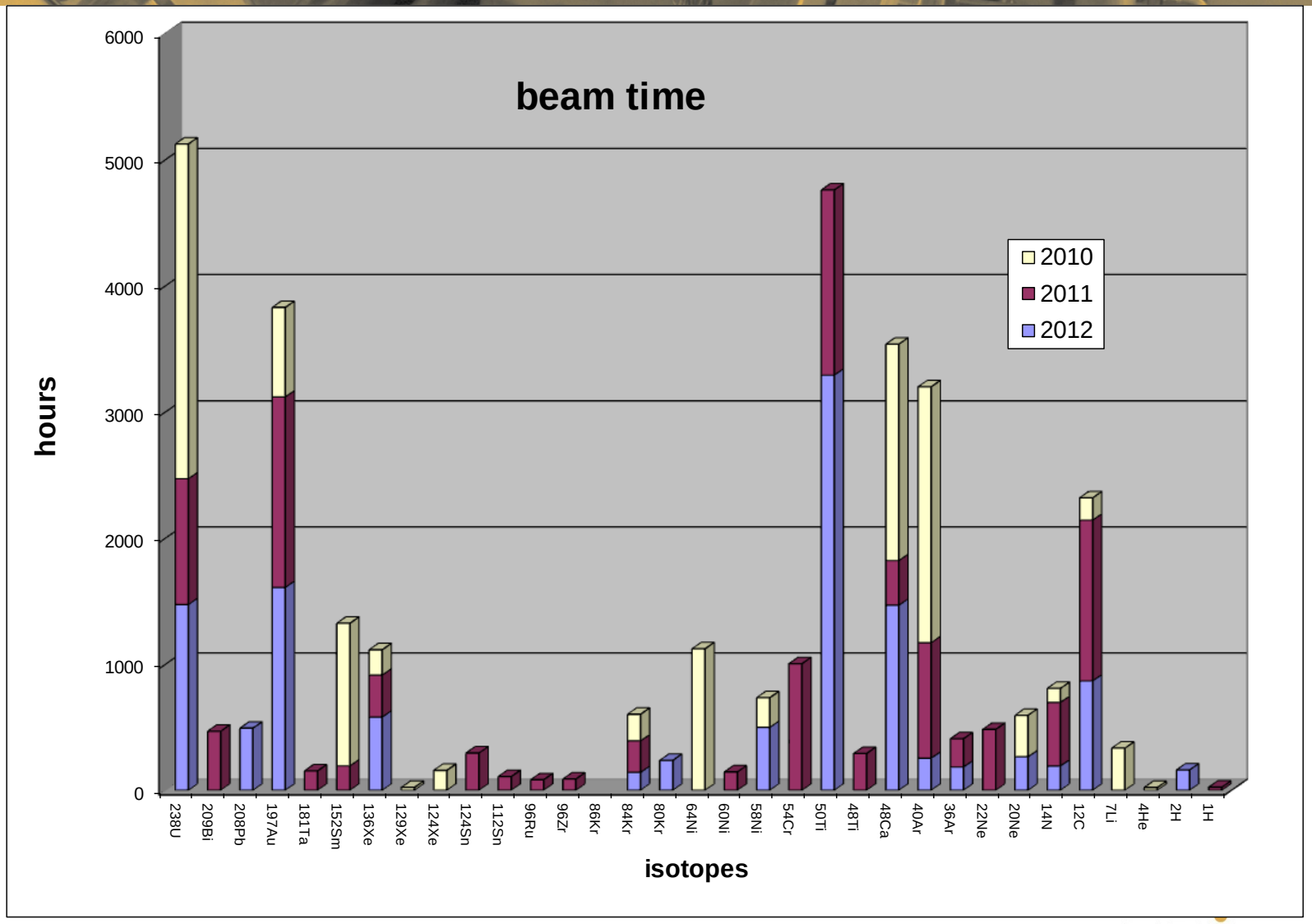
electron cooler

Accelerated isotopes

-uranium was often requested by many users

-medium heavy isotopes for superheavy production

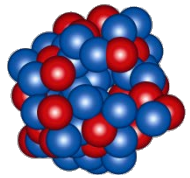
-carbon for biological irradiations and the ESA program

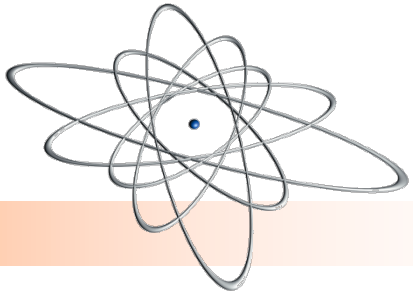


Experimental program

Nuclear Physics

- Nuclear reactions up to highest energies
- Superheavy elements
- Hot dense nuclear matter





Atomic Physics

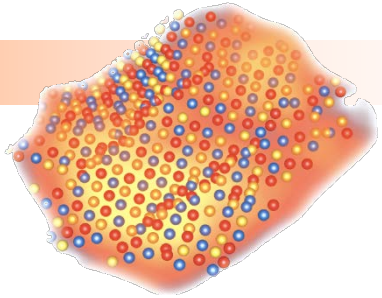
- Atomic Reactions
- Precision spectroscopy of highly charged ions

Biophysics and radiation medicine

- Radiobiological effect of ions
- Cancer therapy with ion beams

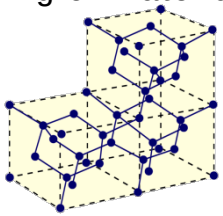
Plasma Physics (5%)

- Hot dense plasma
- Ion-plasma-interaction



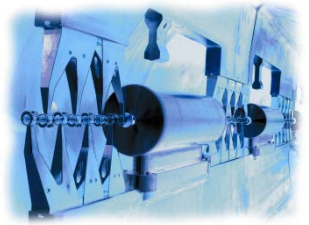
Materials Research

- Ion-Solid-Interactions
- Structuring of materials with ion beams

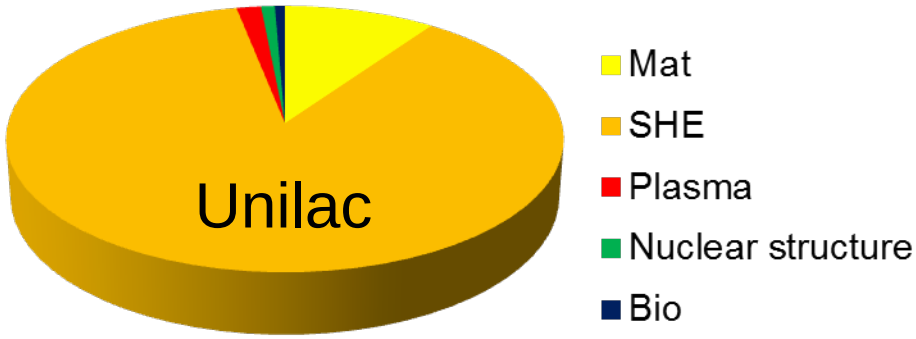


Accelerator Technology

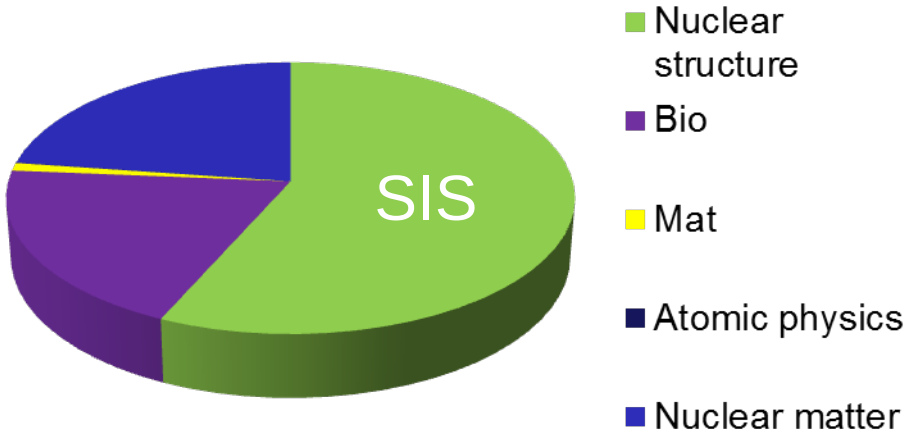
- Linear accelerator
- Synchrotrons and storage rings



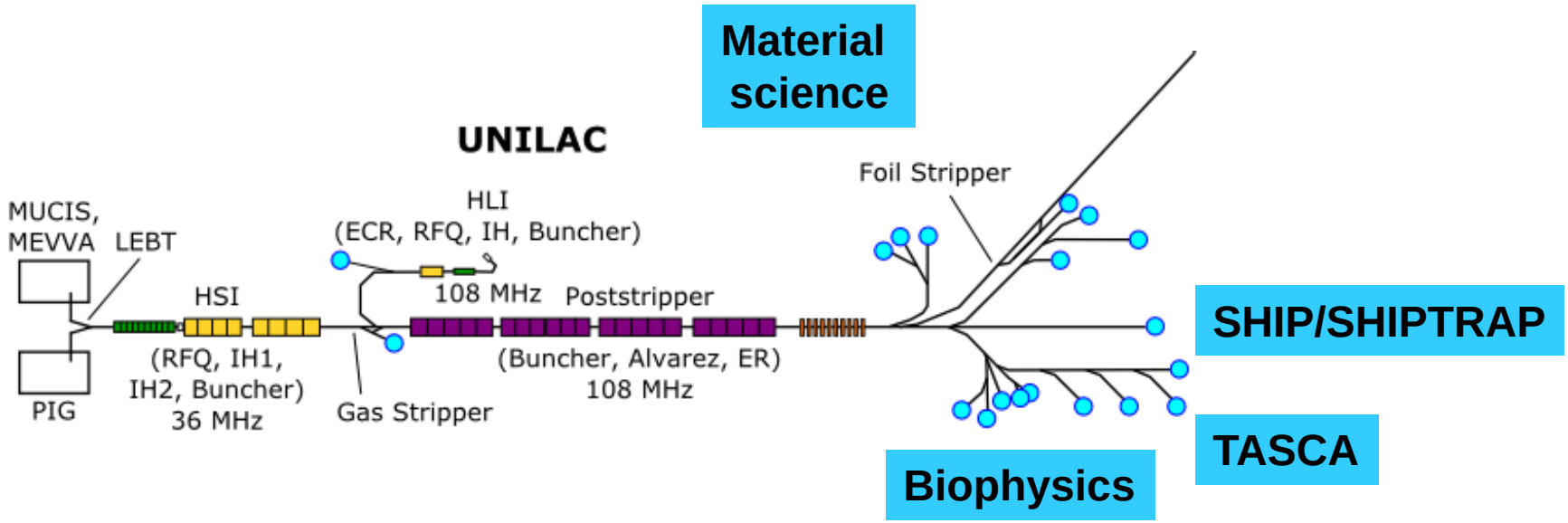
Beam time distribution



Total beam time 2012 (hours)	
Unilac	4180
ESR	1810
SIS	2570

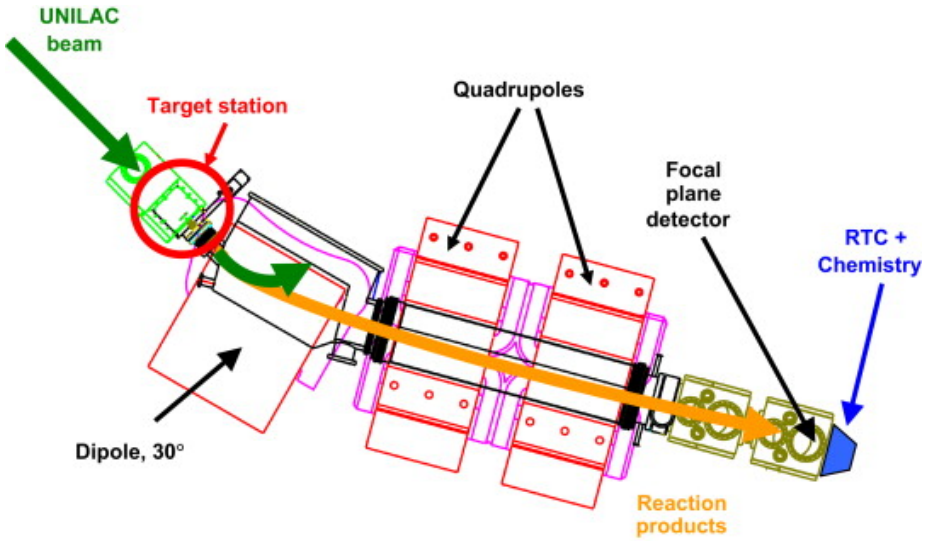


Experimental sides - Unilac



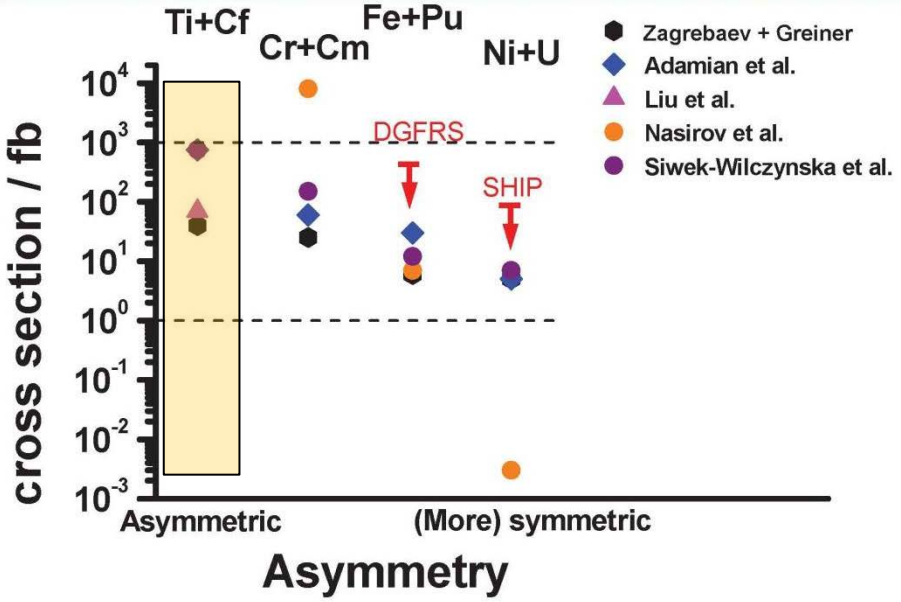
TASCA

TrAnsactinide Separator and Chemistry Apparatus

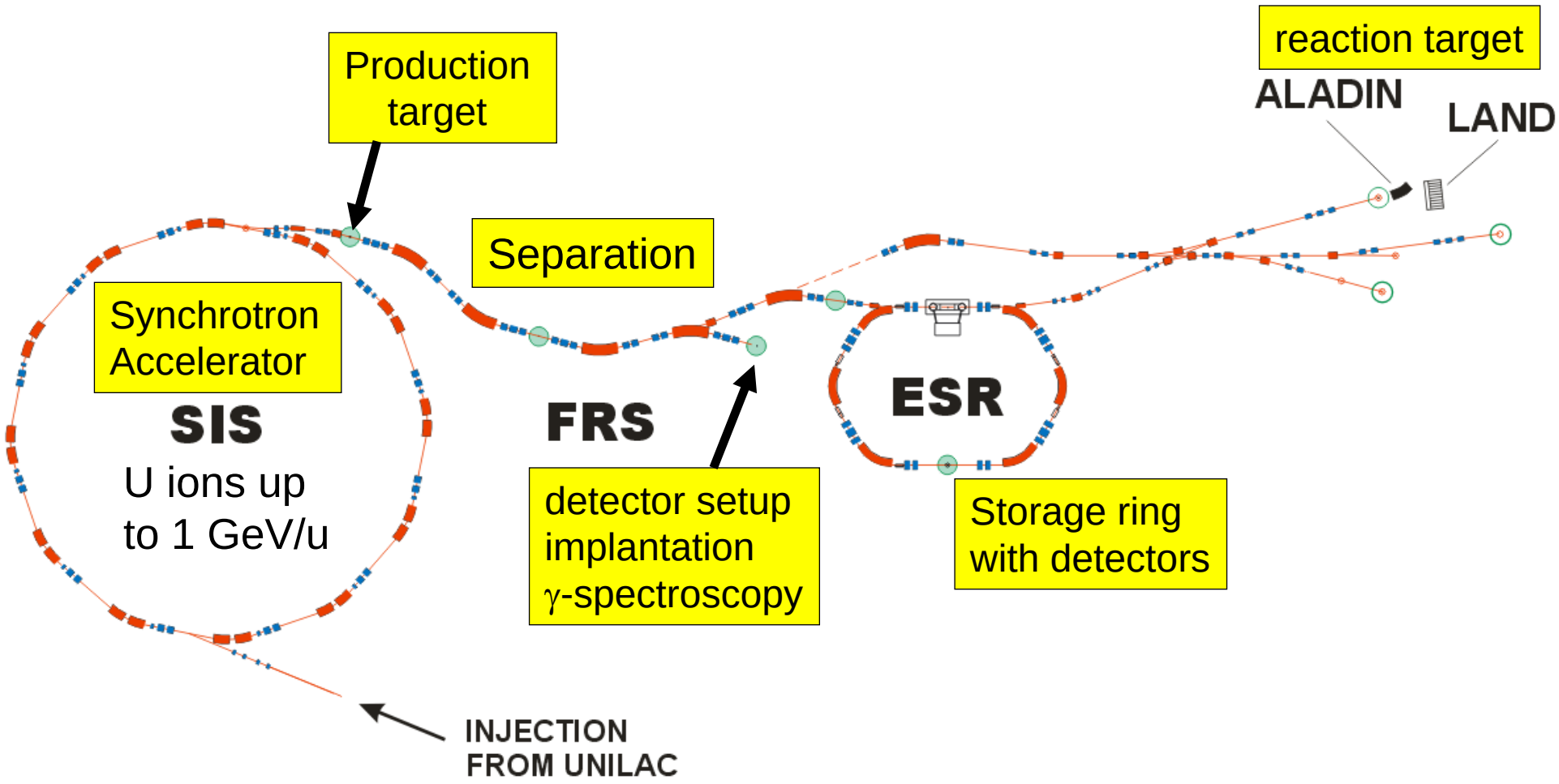


Gas filled separator for transactinides (Z>104)
J. Even et al., Nucl. Instrum. Meth. A638, 157-164 (2011)

- Synthesis of SHE
- Preseparated SHE for chemical studies

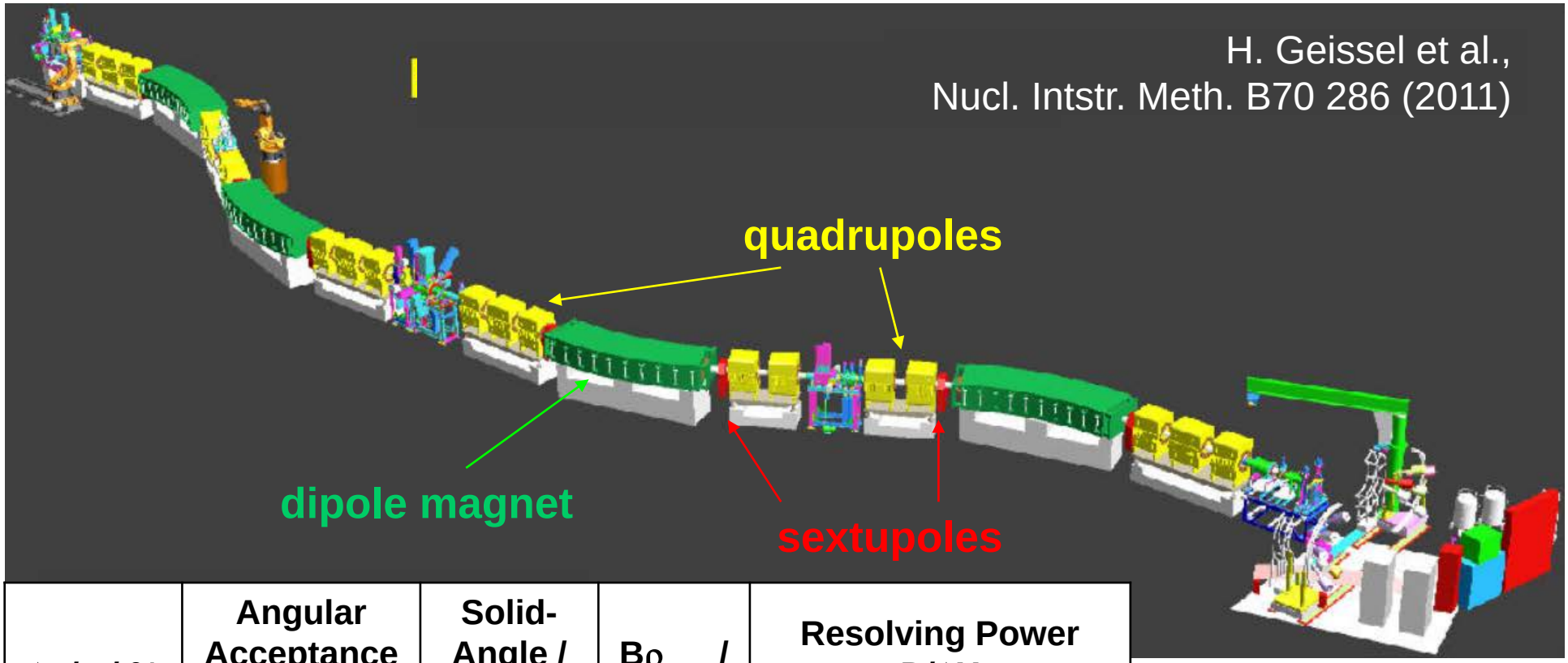


Experimental sides - SIS



FRS

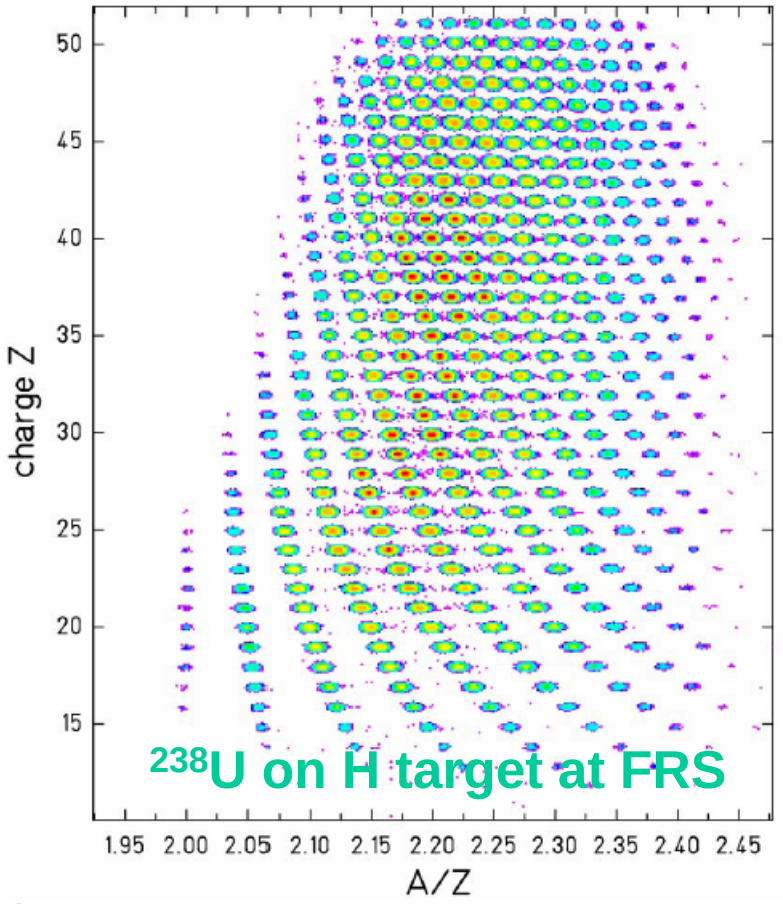
Fragmentseparator



Δp/p / %	Angular Acceptance (φ_x,φ_y) /mread	Solid-Angle / msr	$B\rho_{max}$ / Tm	Resolving Power D/ΔX 2x0 = 1mm
2	30, 30	0.9	18	3131 ($2x_0$=2,7mm)

Fragment separator

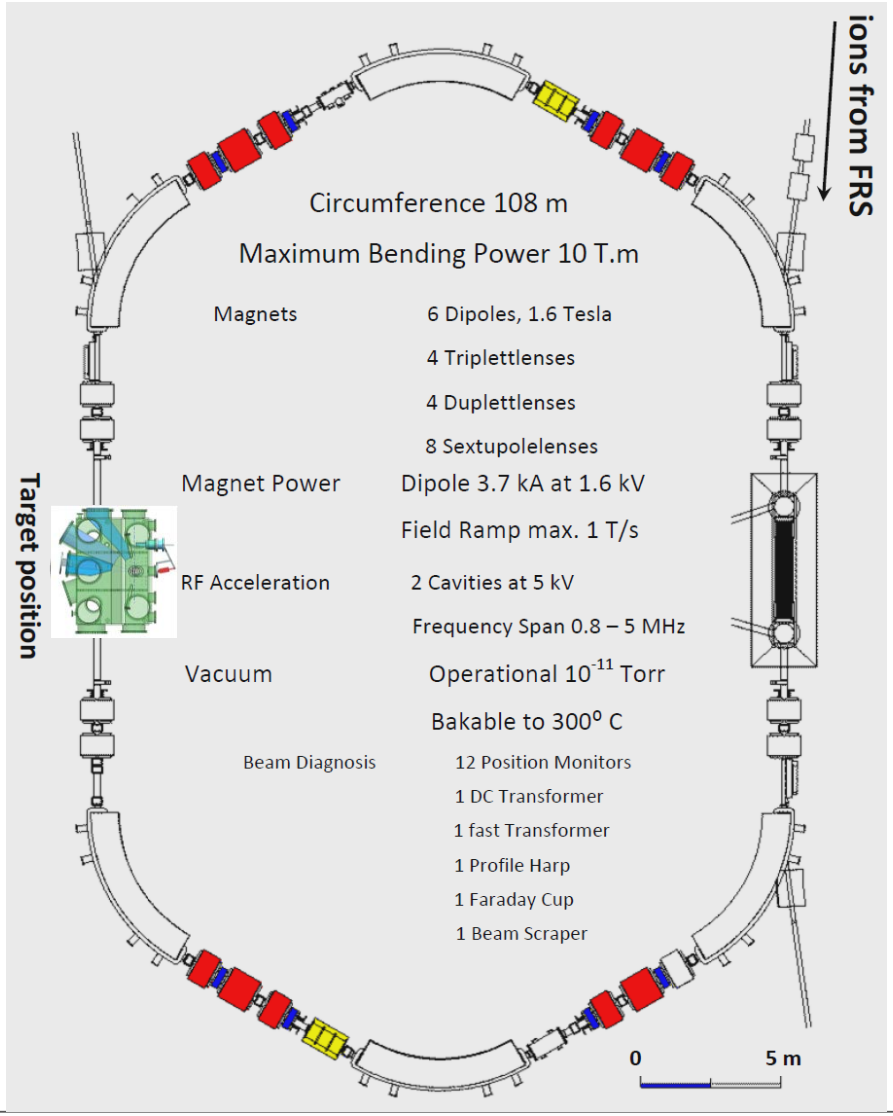
Separator	Δp/p	Angular Acceptance (φ_x,φ_y)	Solid-Angle	$B\rho_{max}$	Resolving Power D/ΔX
	%	mrad	msr	Tm	($2x_0$=1 mm)
FRS	2	30, 30	0.9	18	3131 ($2x_0$=2,7mm)
Big-RIPS	6	80, 100	8.0	9	1st stage 1290 2nd stage 3300 ($2x_0$=1mm)
A1900	5		8.0	6	2900
RIPS	6	80, 80	5.0	5.8	1500
Super-FRS	5	40, 20	3.2	20	3076



+ RIBLL 1+2, LISE-3, ALPHA, COMBAS, ACCULINA, EN, Triμp, CRIB, …

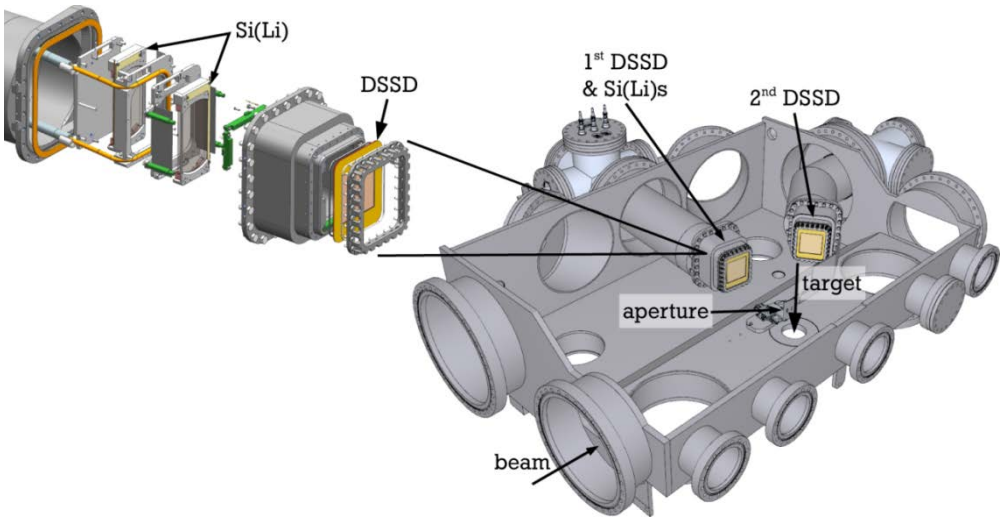
ESR/EXL

Exotic Nuclei studied in Light ion induced reactions



- ^{58}Ni(p,p) and ^{58}Ni(α,α`): feasibility studies and proof of principles
  ⇒ UHV capability of detector setup, background conditions at ESR target
- ^{56}Ni(p,p): doubly magic nucleus ^{56}Ni: of high interest for structure and astrophysics
- EXL@NESR at FAIR

P. Egelhof et al.

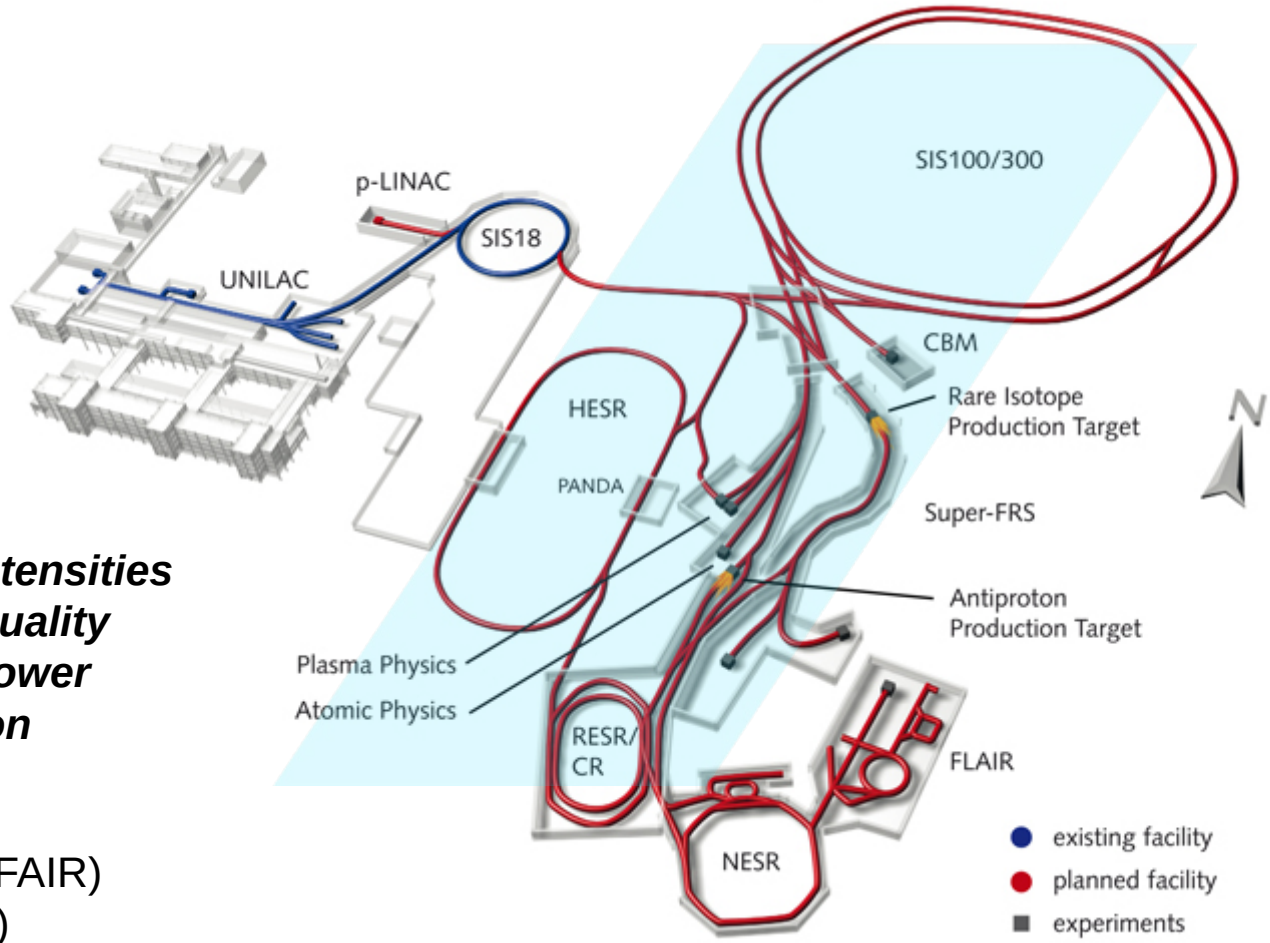


Outlook

FAIR facility:

center for antiproton and ion research:

-p-linac
-100Tm synchrotron
-Super FRS
-Anti proton target
-Collector ring
-High energy storage ring

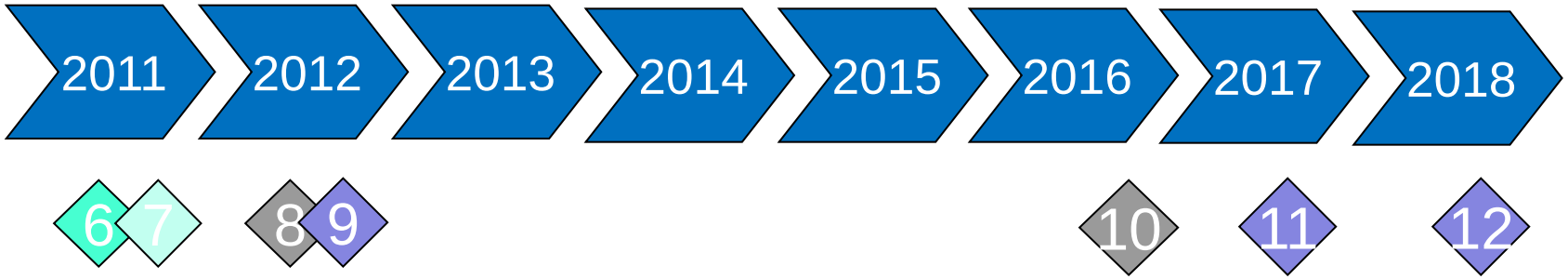


Highest Beam Intensities
Brilliant Beam Quality
Highest Beam Power
Parallel Operation

GSI upgrade:

-link existing facility (connection to FAIR)
-high energy linac (FAIR intensities)
-cw demonstrator/linac (R&D, UNILAC Hall)

Timeline start version



- 6 Submission building permits
- 7 Site preparation
- 8 Civil construction contracts
- 9 Building of accelerator & detector components
- 10 Completion of basic civil construction work
- 11 Installation & commissioning of accelerators and detectors
- 12 Data taking

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Thank you for your attention

and a bright future for ALTO!

Further information:

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