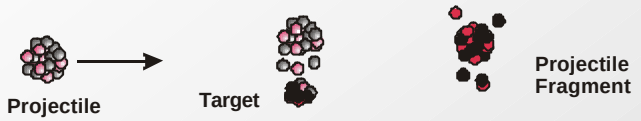
Super-FRS Facility Overview

Martin Winkler
for the Super-FRS working group
GSI, 14.2.2003

- Design goals of the Super-FRS
- Layout of the separator
- Separation performance of the 2-stage separator
- The Super-FRS and its branches
- Special: High-power production target

Projectile Fragmentation and Projectile Fission

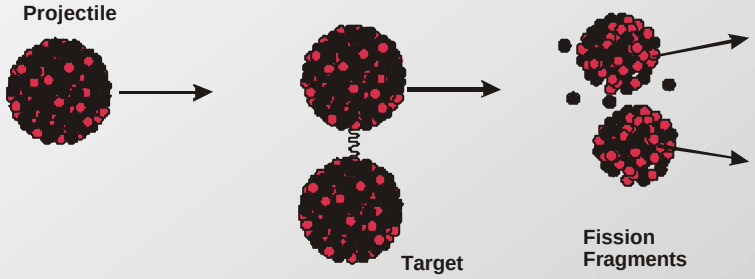
Projectile Fragmentation



Nucleon-Nucleon-Collissions (Abrasion Ablation)

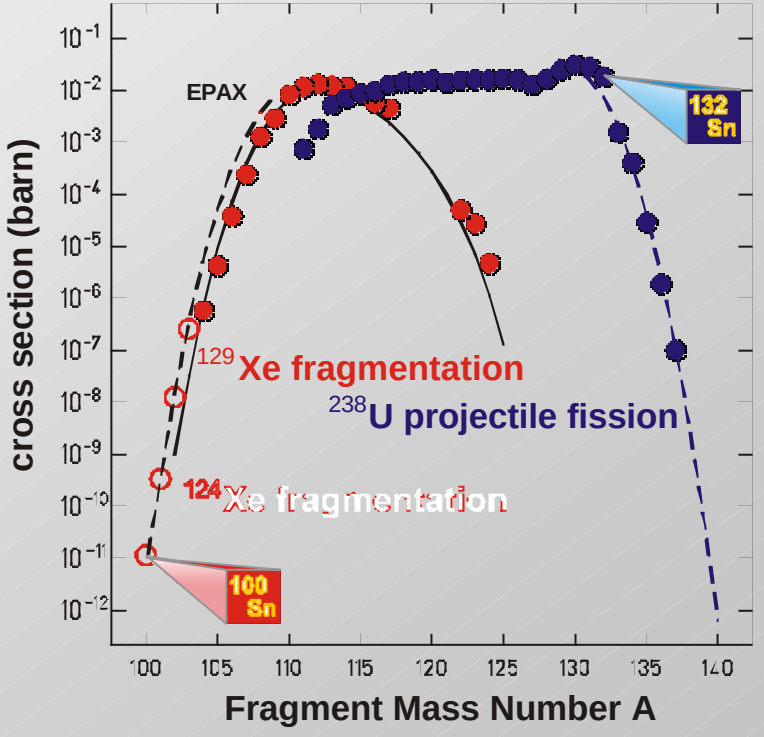
$$\vec{V}_f \approx \vec{V}_p$$

Projectile Fission



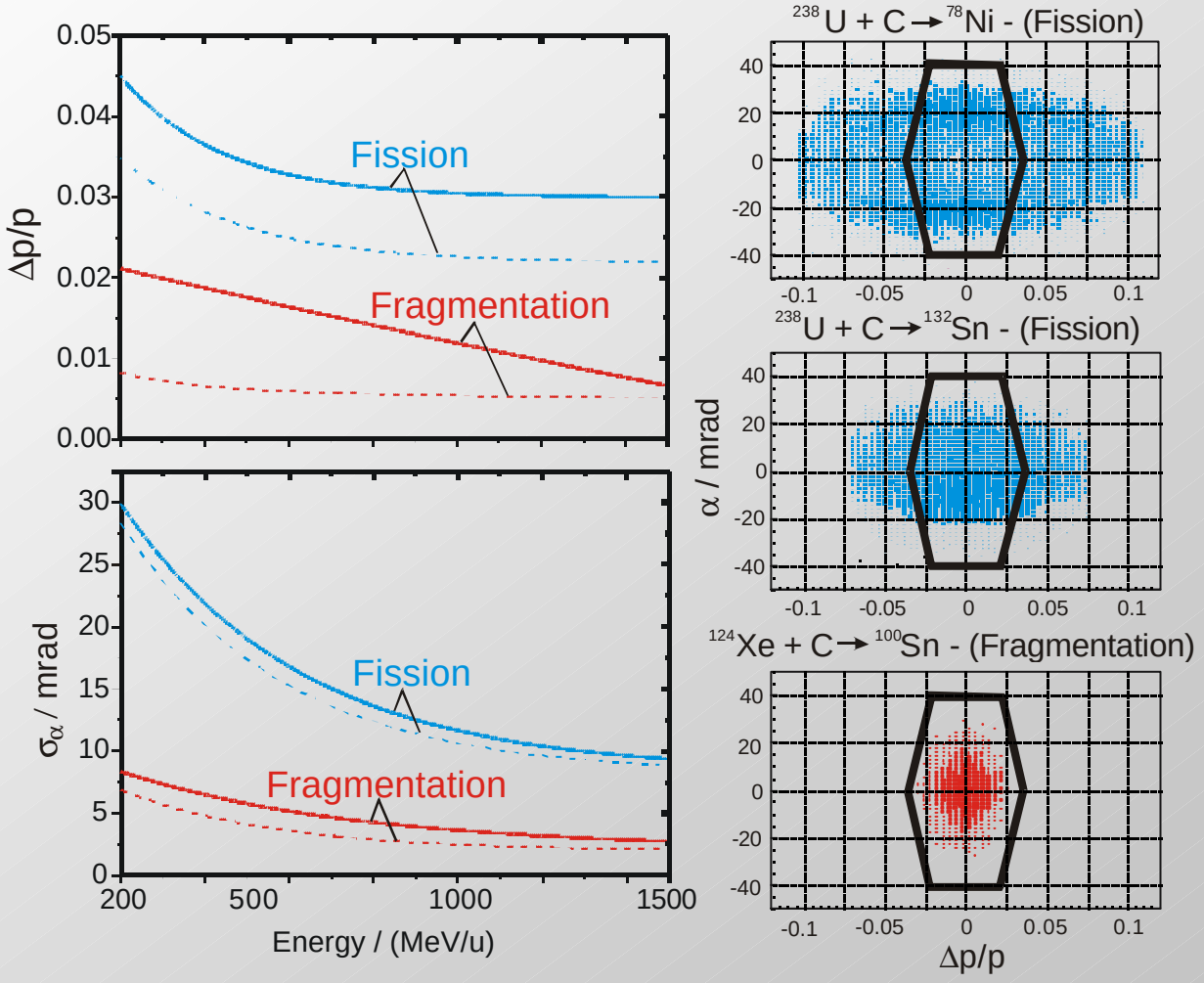
Coulomb Excitation in Peripheral Collisions

$$\dot{V}_f \approx \dot{V}_p + \dot{V}_{fission}$$

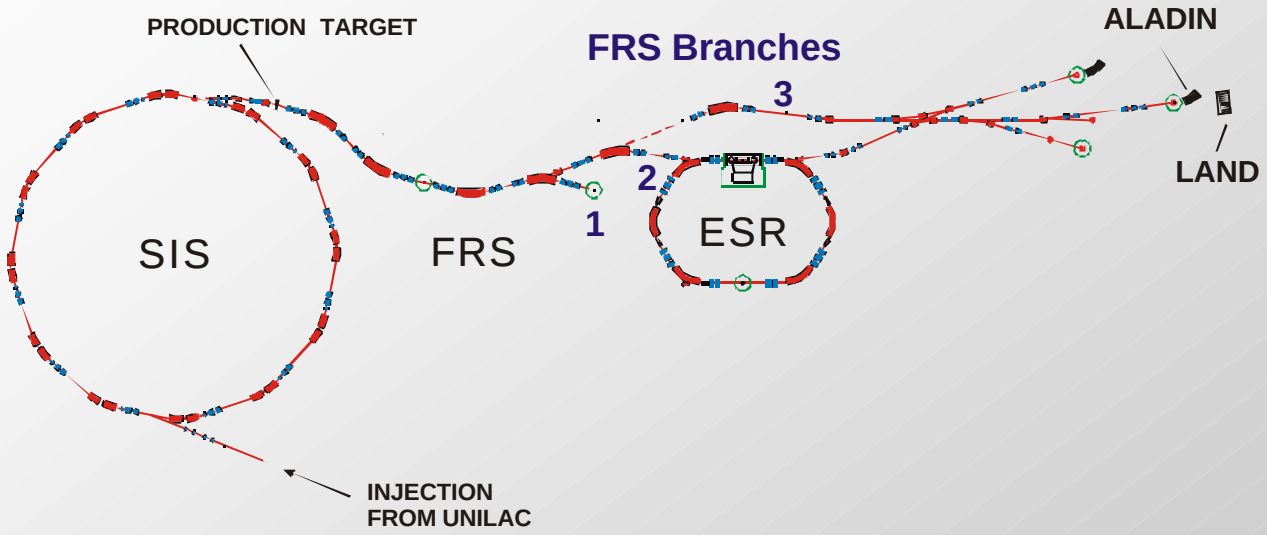


K.Sümmerer

Kinematics of Exotic Nuclei produced in Projectile Fragmentation and Projectile Fission



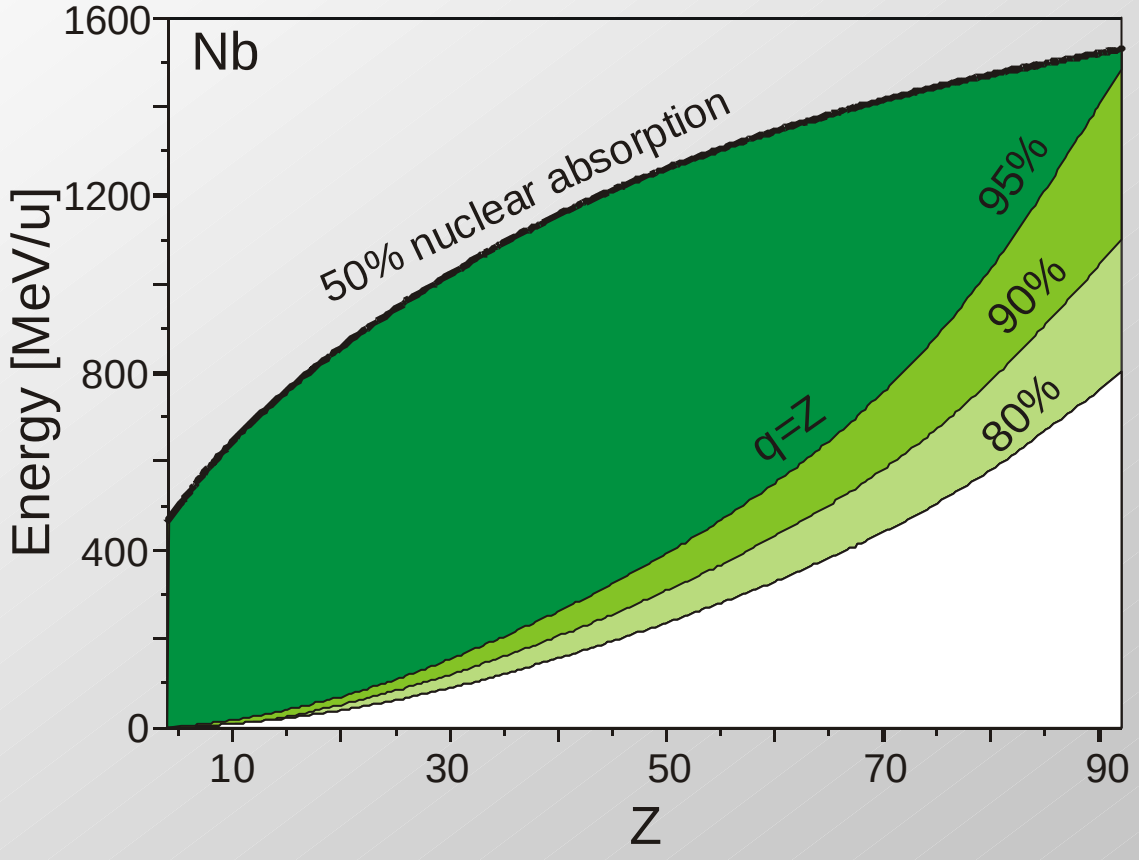
The Present Secondary Beam Facility at GSI



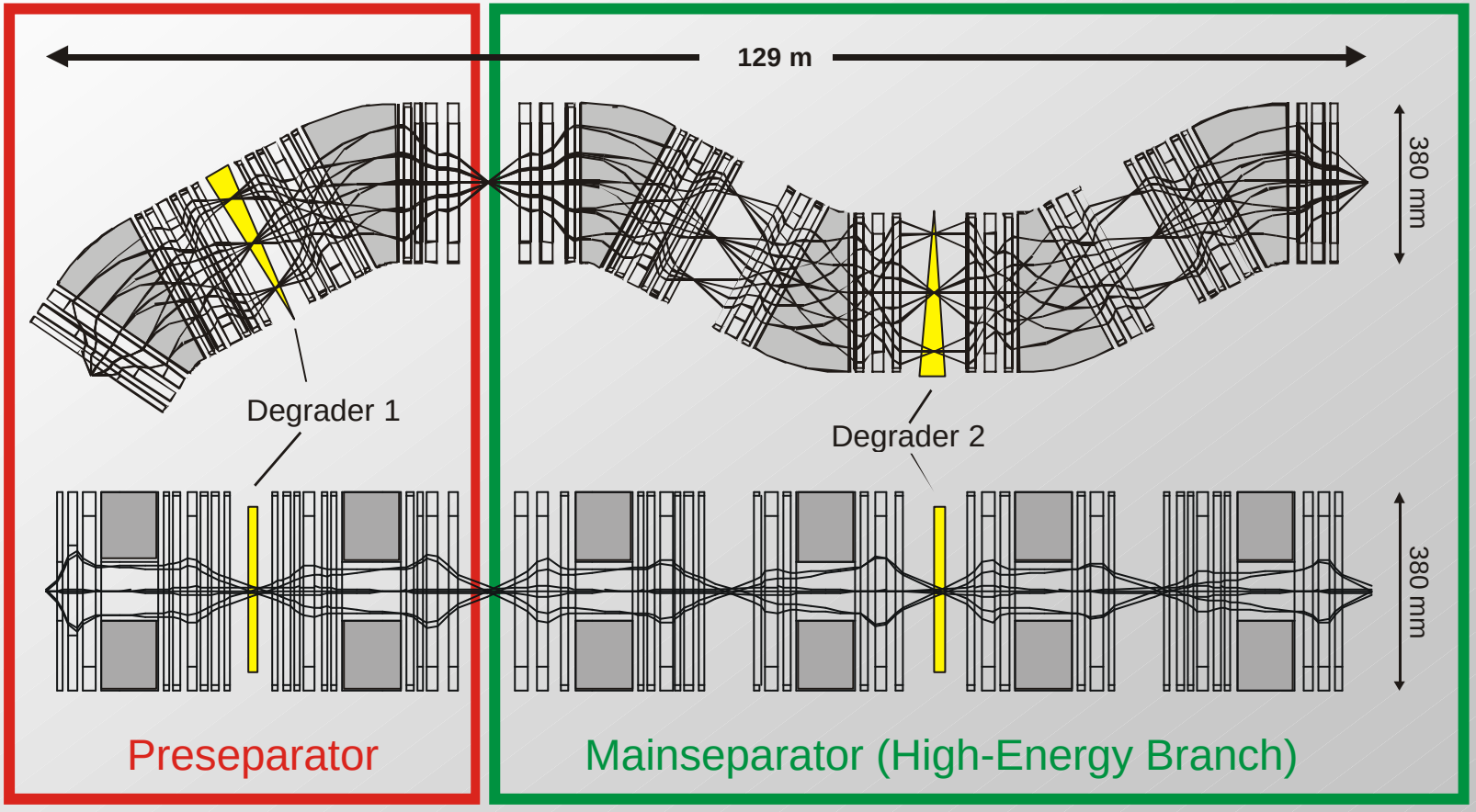
Limitations of the facility:

- Low primary beam intensity (e.g. 10^9 ^{238}U /s)
- Low transmission for projectile fission fragments (4-10% at the FRS)
- Low transmission for fragments into the storage ring and to the experimental areas
- Limited maximum magnetic rigidity

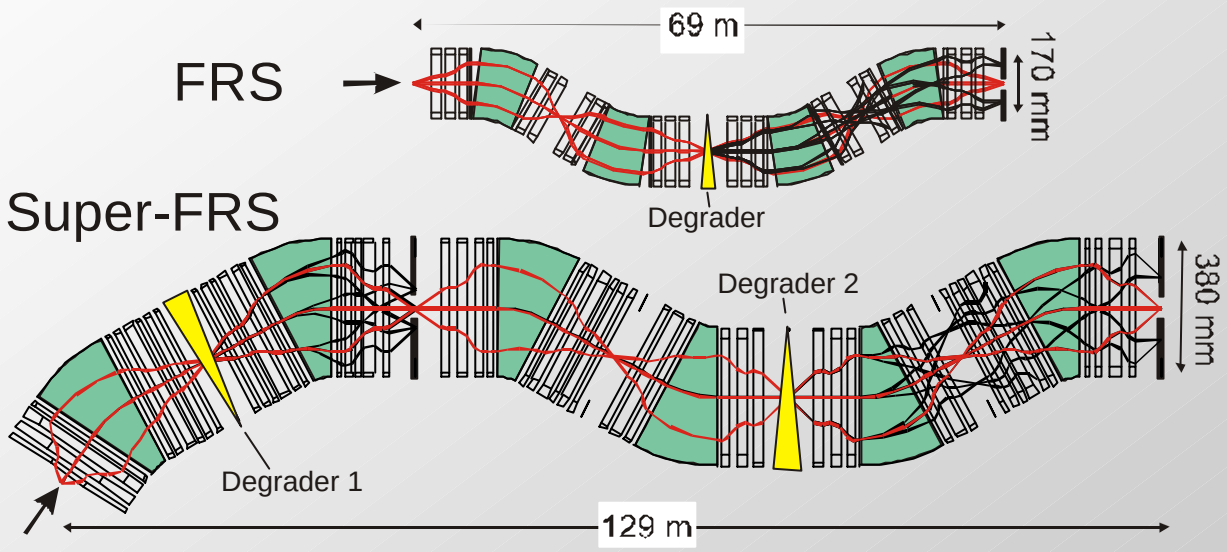
The Energy-Z Operating Domain for In-Flight Separation



Ion-Optical Design of the High-Energy Branch

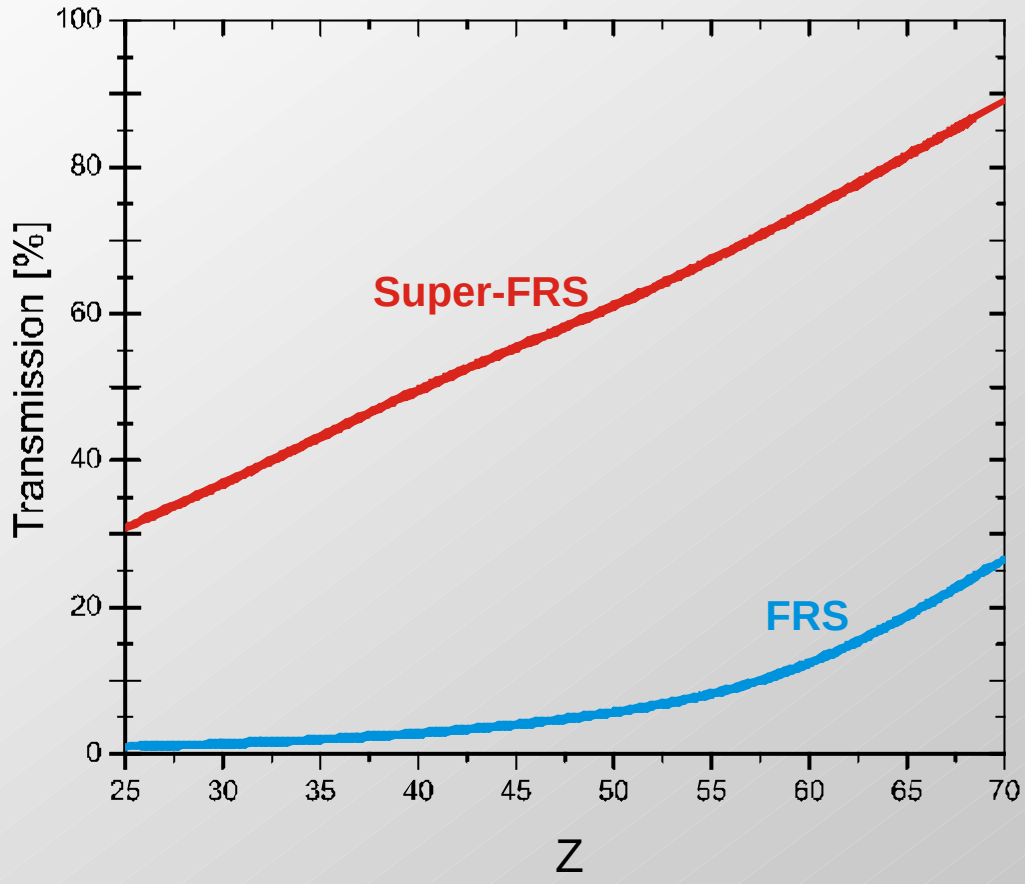


Comparison of the FRS and the Super-FRS

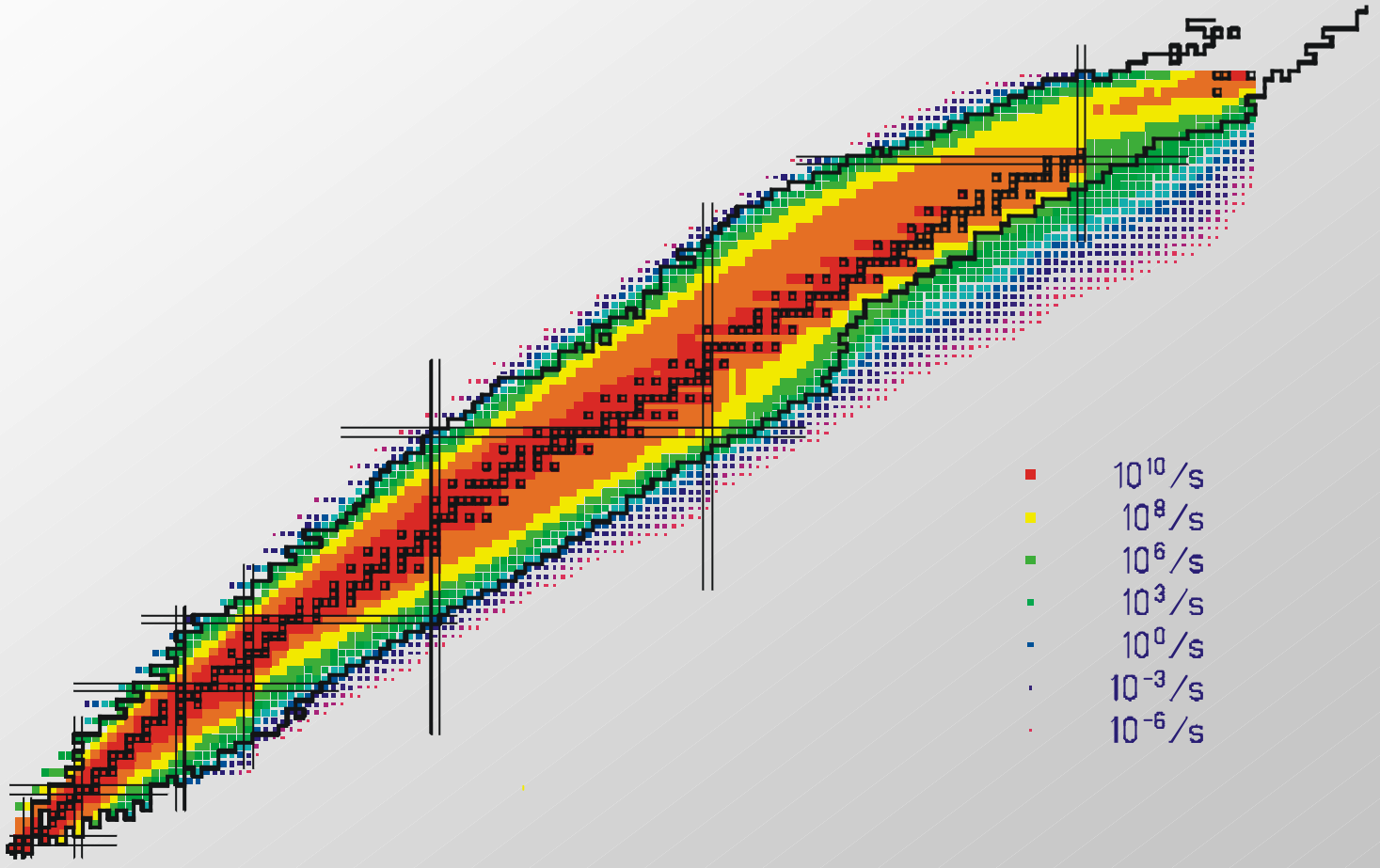


	$B\rho_{max}$	$\Delta p/p$	$\Delta\Phi_x$	$\Delta\Phi_y$	resolving power
FRS	18 Tm	1.0 %	± 13 mrad	±13 mrad	1500
Super-FRS	**20 Tm**	**2.5 %**	**±40 mrad**	**±20 mrad**	**1500**

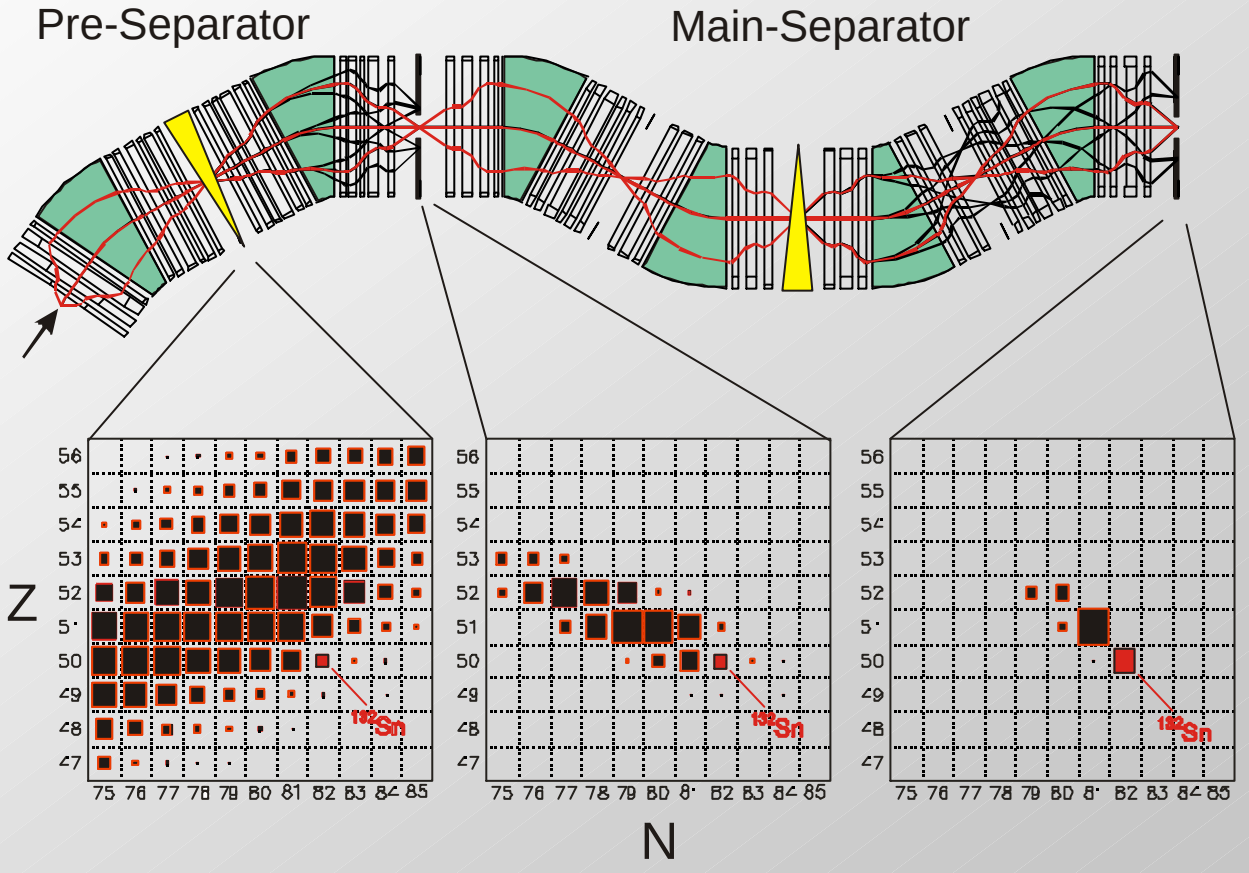
Transmission Gain for Fission Products



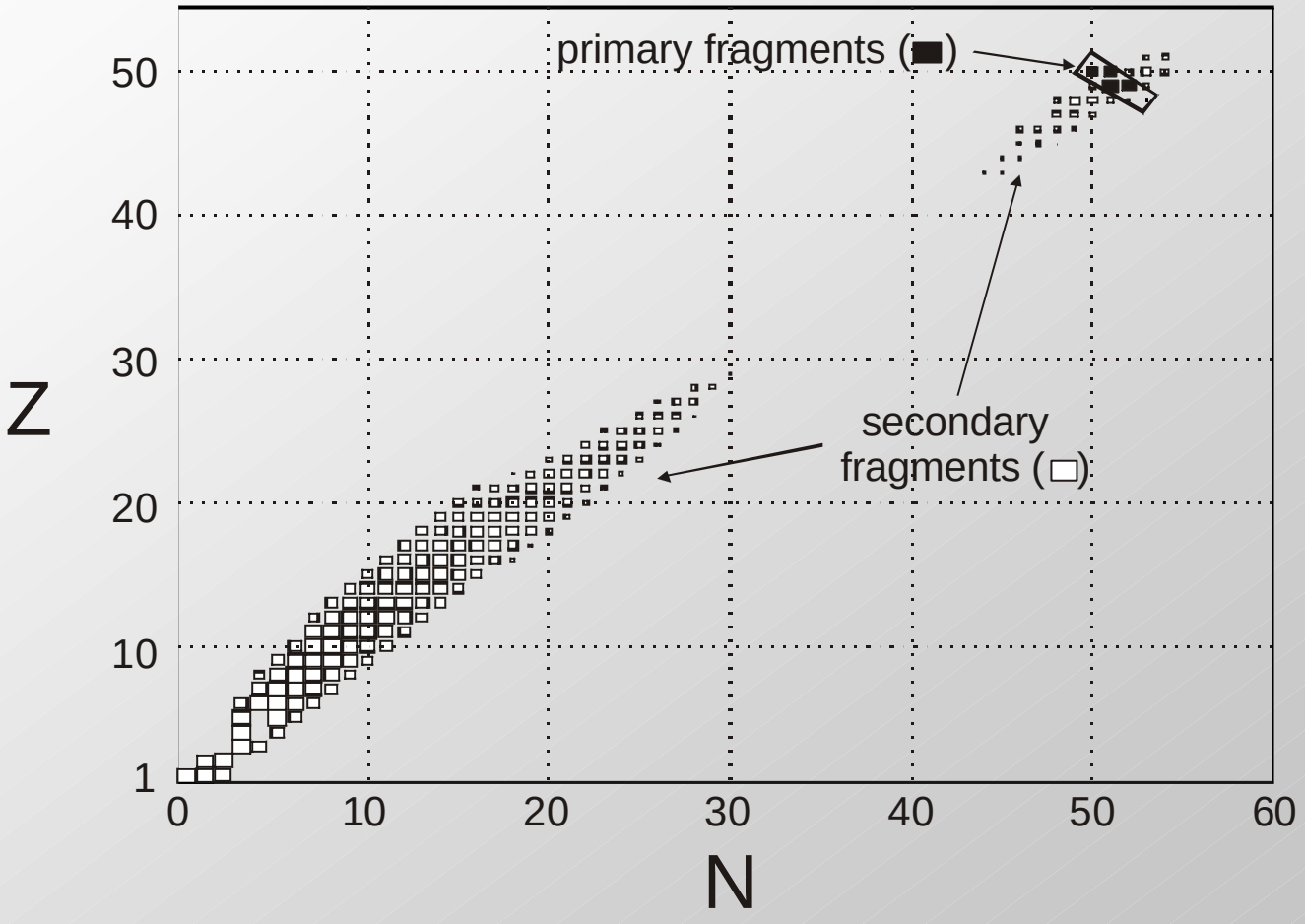
Rates for Exotic Nuclei at the Super-FRS



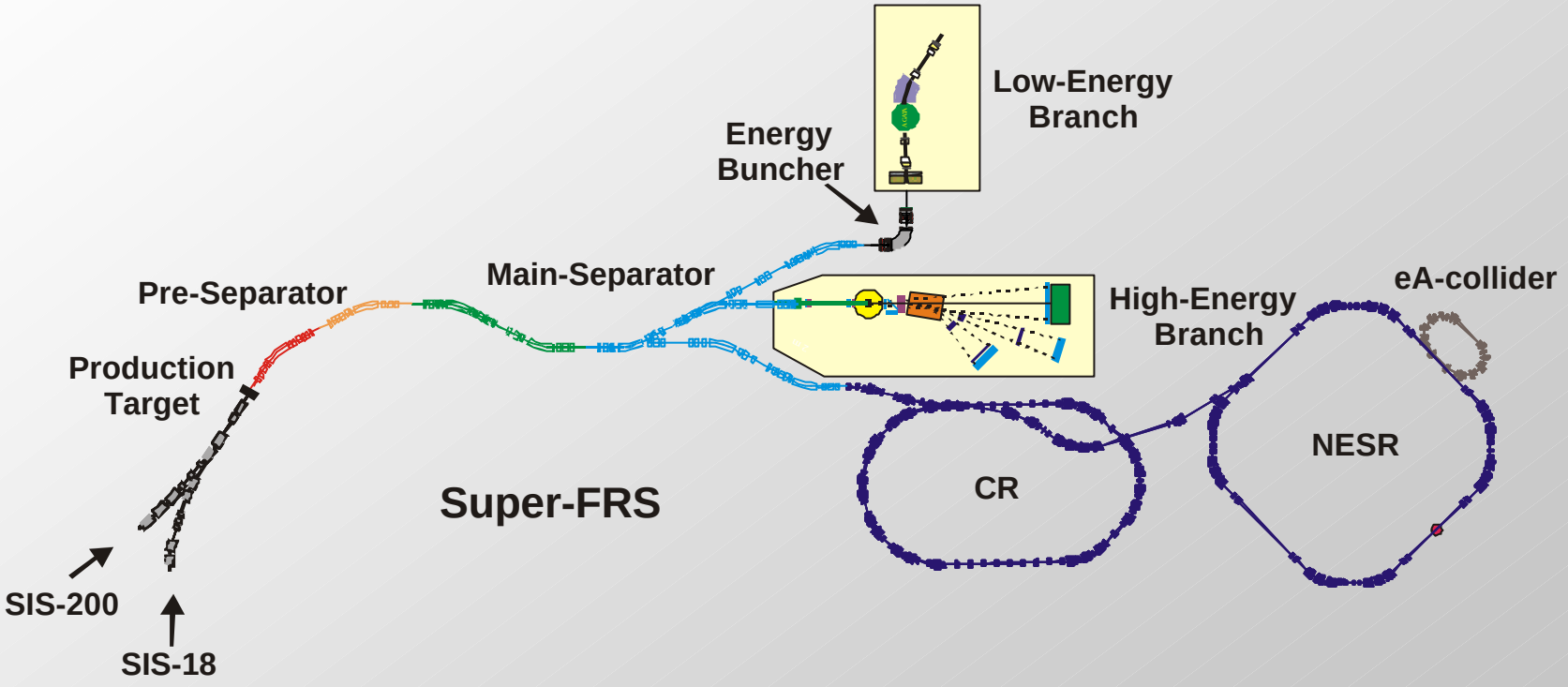
Separation performance using two degrader stages



Separation Characteristics for ^{100}Sn with 1 and 2 Degrader Stages



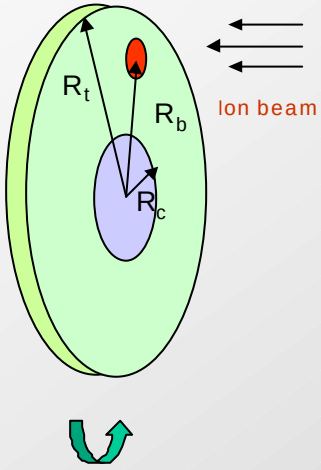
The Super-FRS and its Facilities

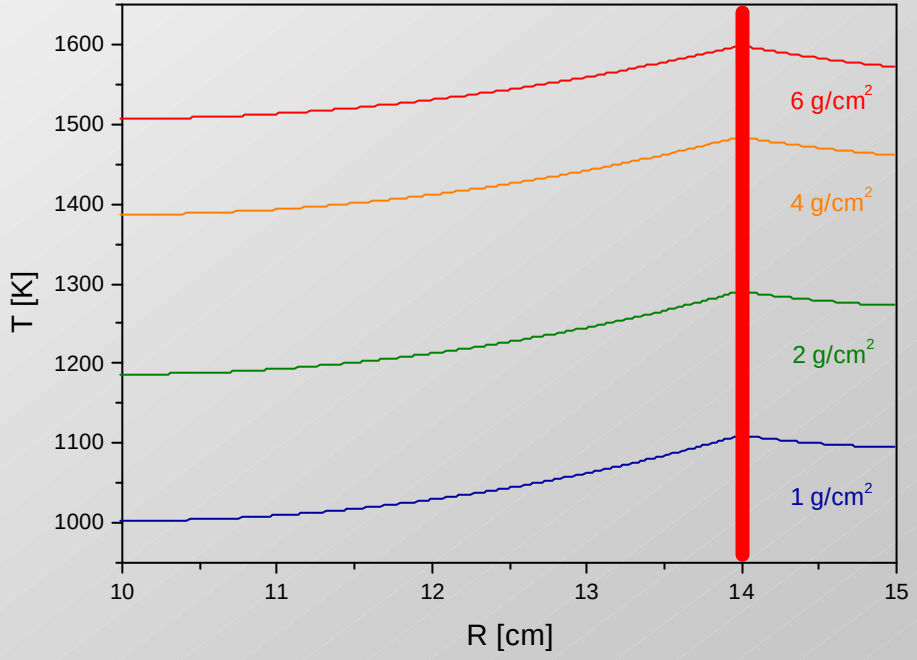


Primary Beam Parameters

	Slow-Extraction Mode	Fast-Extraction Mode
Intensity	10^{12} /s	10^{12}/spill
Spill Length	DC	50 ns
Max. Energy ($^{238}U^{28+}$)	1500 MeV/u	1500 MeV/u
Emittance (ε_x, ε_y)	(13, 5) π mm mrad	(26, 10) π mm mrad
Beam Spot (x, y)	(1, 2) mm	(1, 2) mm
Momentum Spread	$\pm$0.07 %	$\pm$1 %

Temperature Distribution on a Rotating Target Wheel





Temperature Distribution for Fast-Extracted Beams using an Elliptical Beam Spot on Target