Future Plan of the Experimental Program on Synthesizing the Heaviest Element at RIKEN

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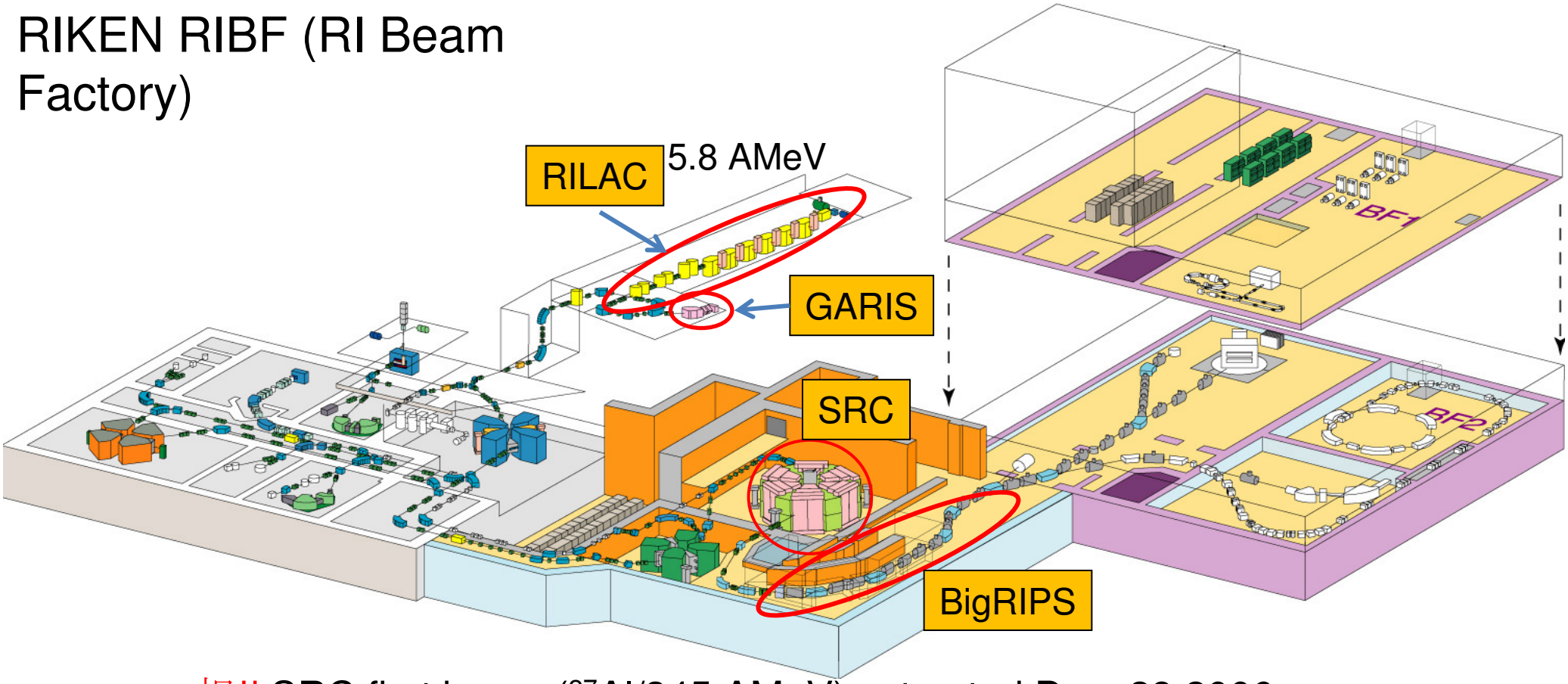
RIKEN RIBF (RI Beam Factory)



祝!! SRC first beam (^{27}Al/345 AMeV) extracted Dec. 28 2006
祝!! SRC ^{238}U/345 AMeV beam extracted Mar. 23 2007
祝!! New Isotope ^{125}Pd extracted from BigRIPS May 2007 ^{238}U beam

Now RILAC: Injector for RRC, SRC

New Injector (prototype) for RRC, SRC will be installed (2009).

→ RILAC: for SHE research

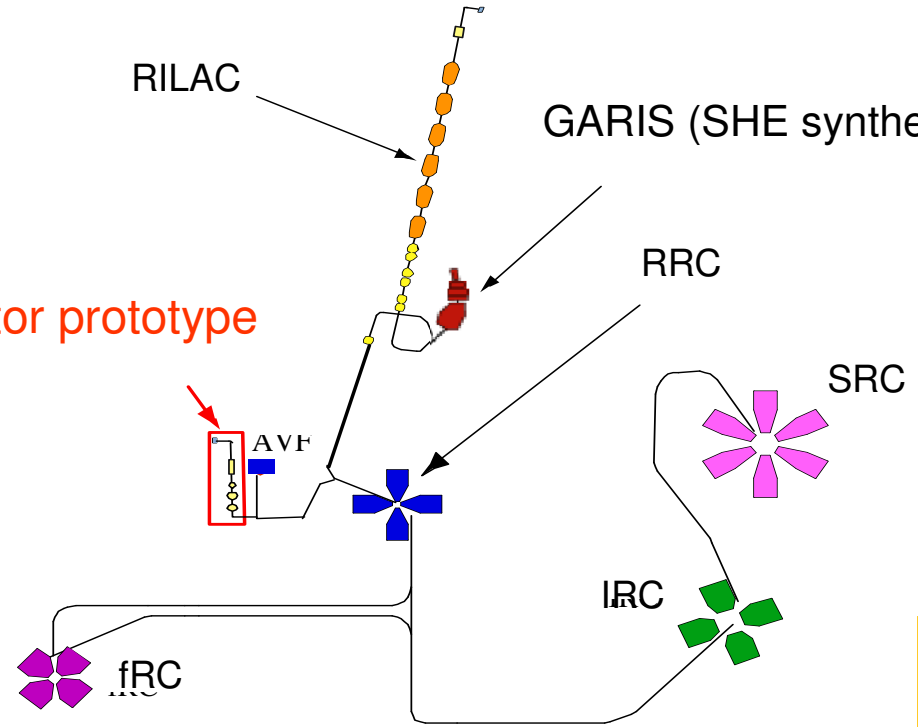
Upgrade of U beam intensity

R&D for a new injector system has started:

- to produce high-intensity U beams so as to allow us to obtain the intensity of 1 pμA at 345 MeV/u, and

- to make it possible to conduct both experiments at RIBF and experiments for super-heavy-element synthesis simultaneously.

New injector prototype



from Dr. Goto/ Director of Accelerator Development G.

Configuration of New Injector Prototype

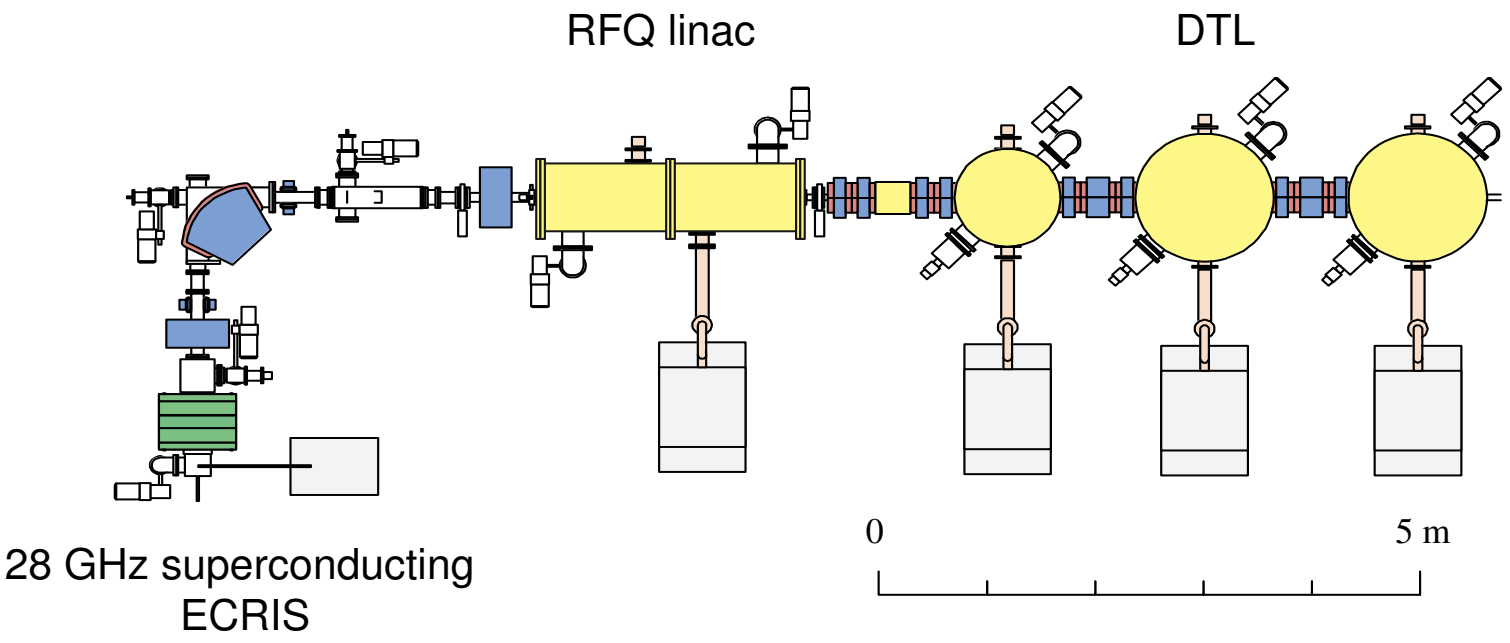
- 28 GHz superconducting ECRIS

  Intensity of U ions is to be increased by two orders.

  Scheduled to be completed in the summer of 2008.

- RFQ linac + DTL

- **The whole system is scheduled to be completed in the spring of 2009.**



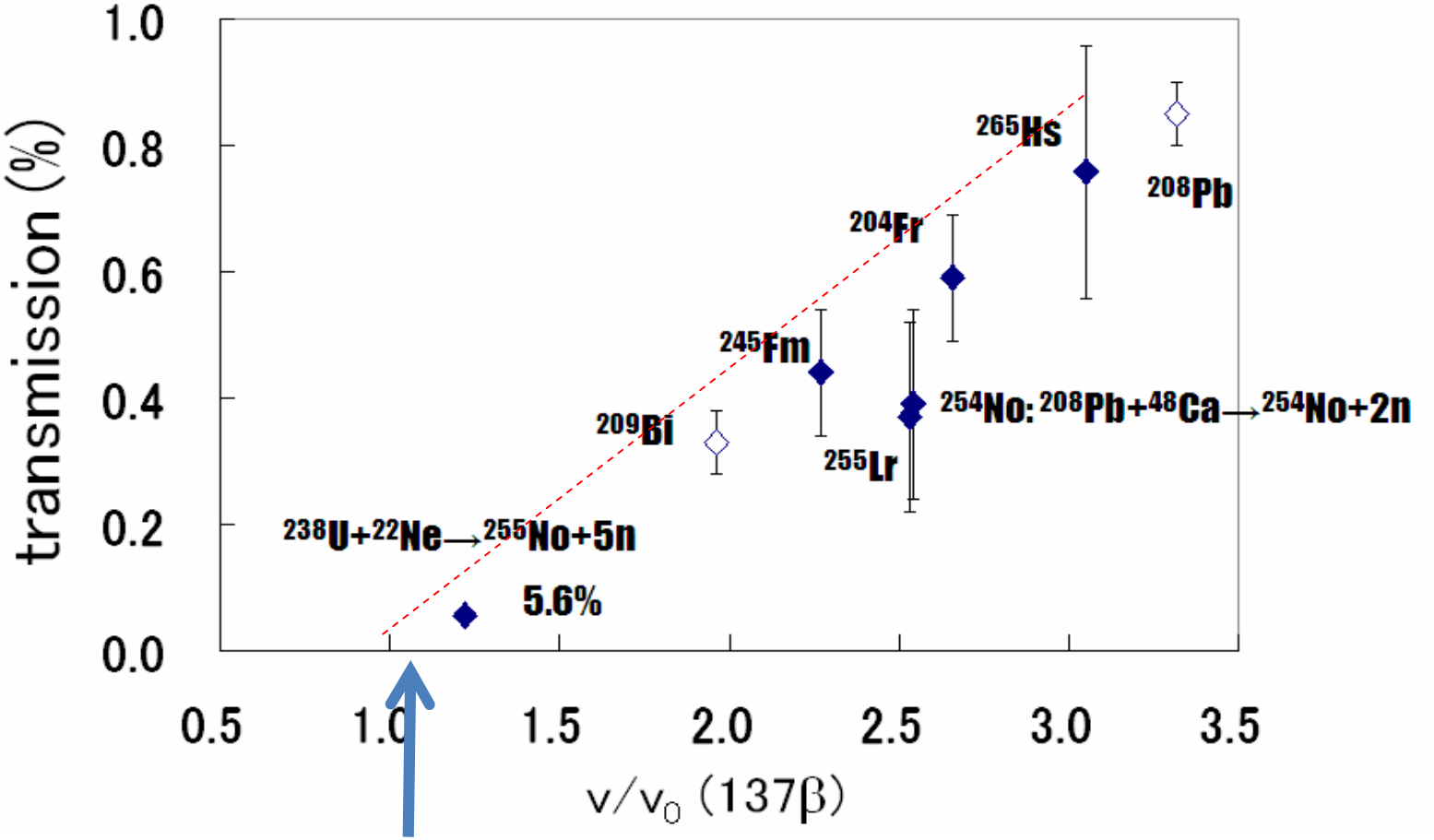
Scientific Subjects

I. Search for the heaviest elements
II. Spectroscopy of the heavy nuclei
III. Chemistry of the superheavy elements

Technical development

I. Increase of a beam intensity
II. Target for high intensity beam
III. Installation of a new recoil separator
IV. Detector for A and/or Z identification
V. Apparatus for chemistry experiment
VI. ^{248}Cm target
VII. γ-/X-ray detector at the focal plane of GARIS

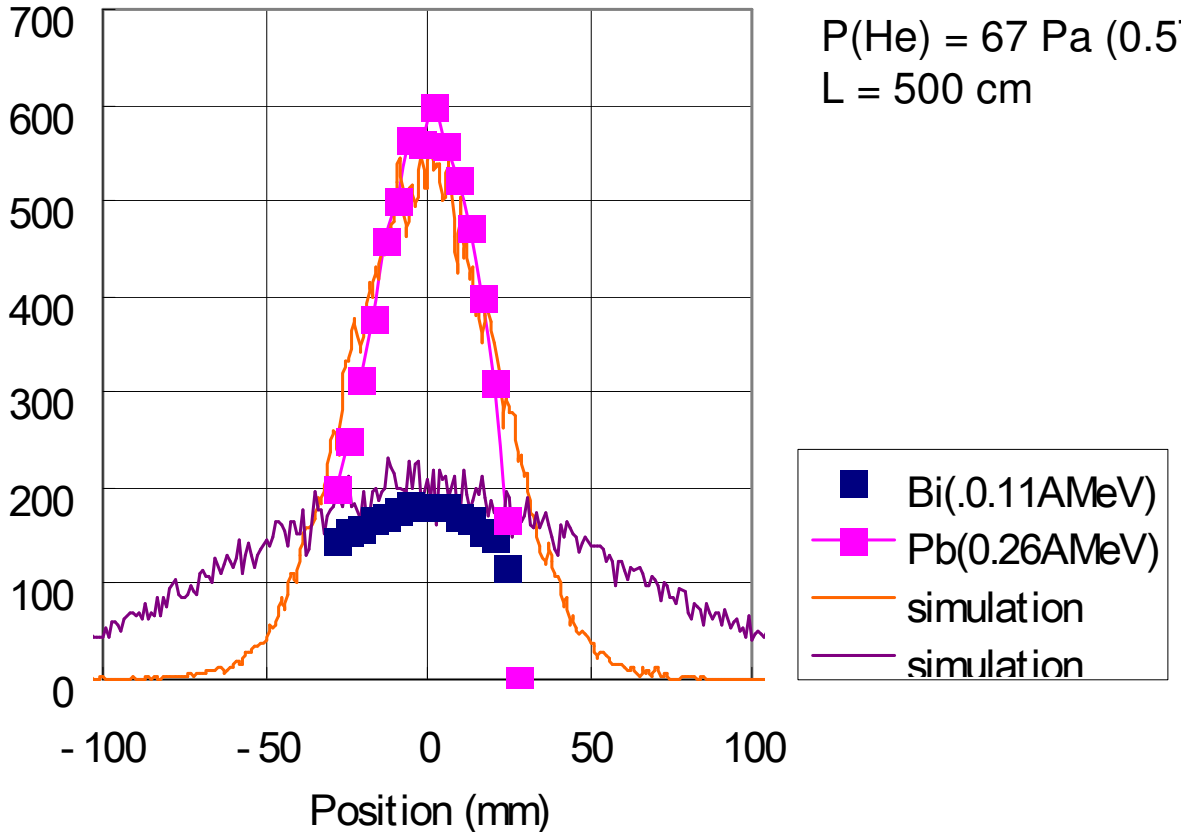
Transmission (efficiency) of GARIS



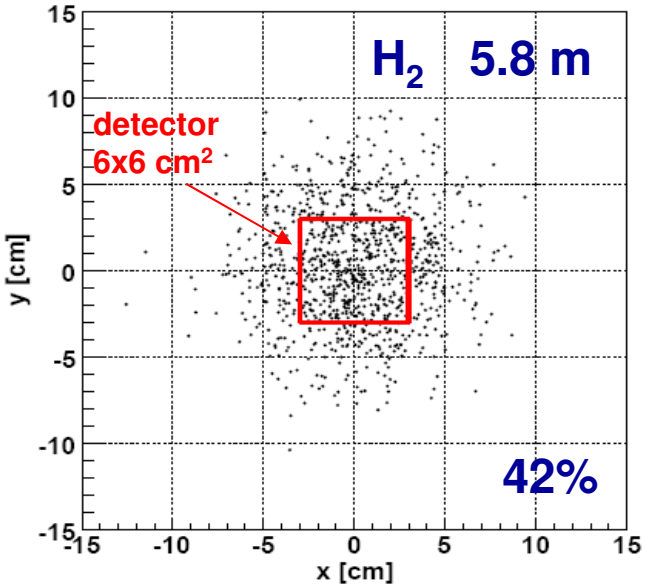
Small efficiency because of slowness of the ion

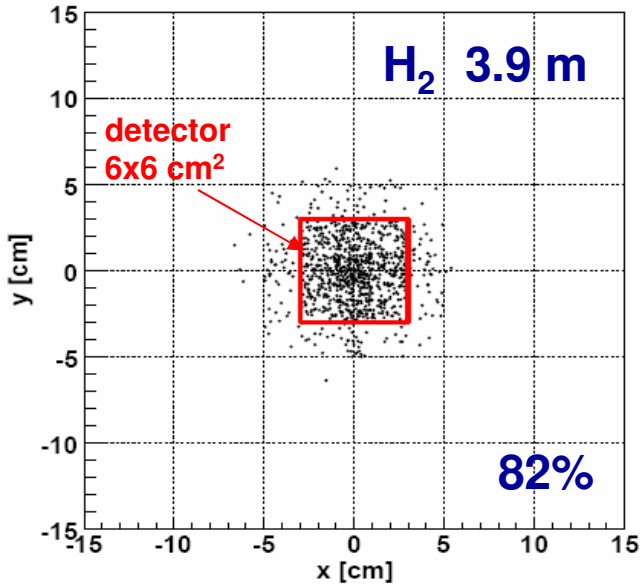
multiple scattering with target atoms	～ 30%
multiple scattering with buffer gas atoms	～ 17%

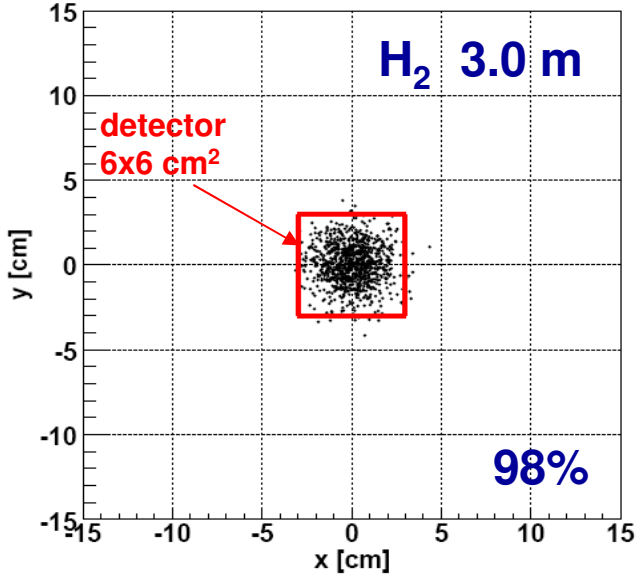
Positional Distribution at Focal Plane

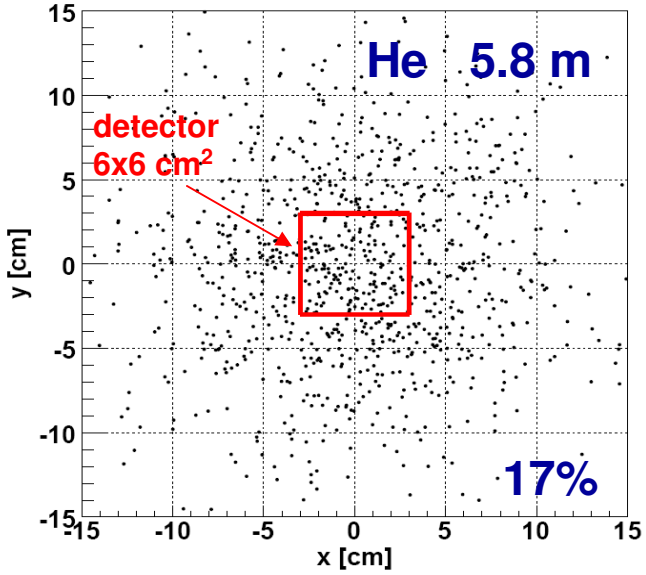


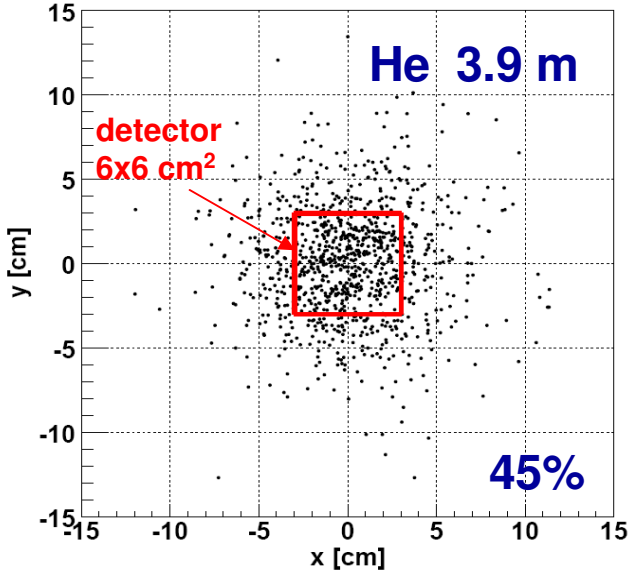
Positional distribution of ^{238}U ions (0.037 MeV/u), v/v_0=1.22 at focal plane

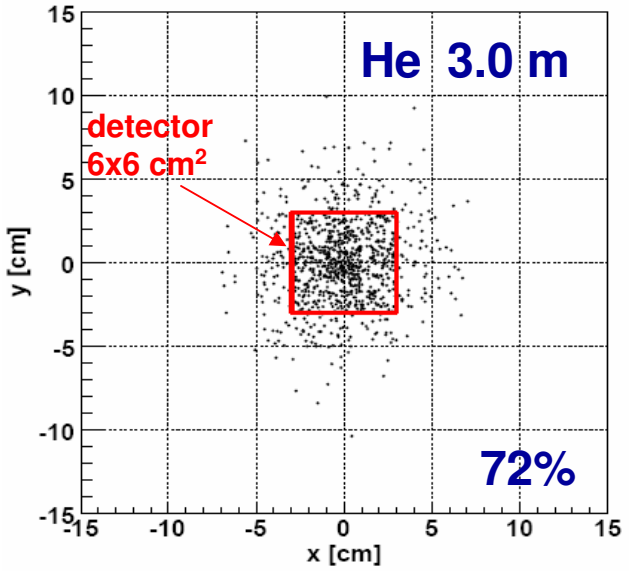












calculated by SRIM code (Monte-Carlo simulation) URL: http://www.srim.org/

New Recoil Separator Design Concept

High efficiency for slow ($v/v_0 \sim 1.2$) heavy ions

- Large angular acceptance $\sim$ 20 msr
- Shorter length $\sim <$ 4 m
- possibility of use of H_2 gas as a buffer gas

Low background at the Focal Plane

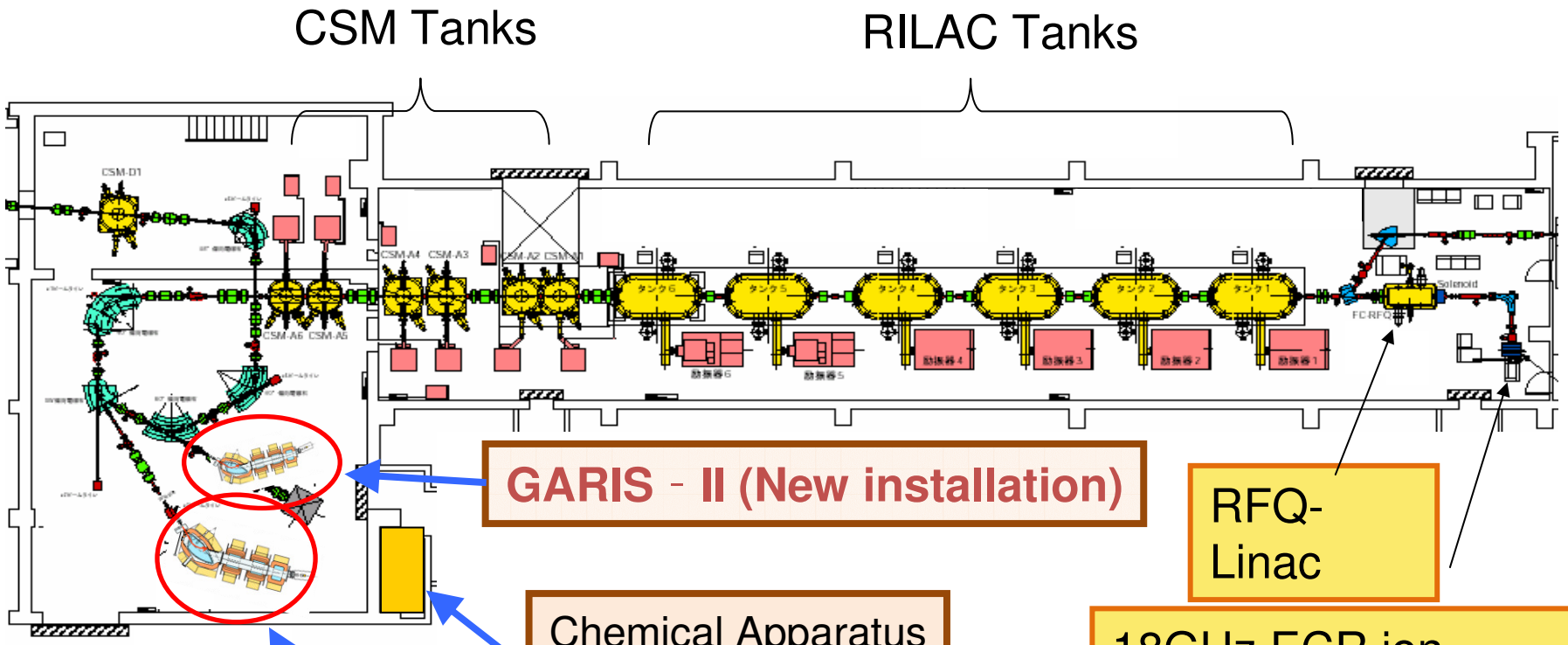
- special design of beam stopper
- second dipole

Limitation

- money, space, time

Preparation of devices

RILAC Facility



GARIS - II (New installation)

RFQ-Linac

Chemical Apparatus

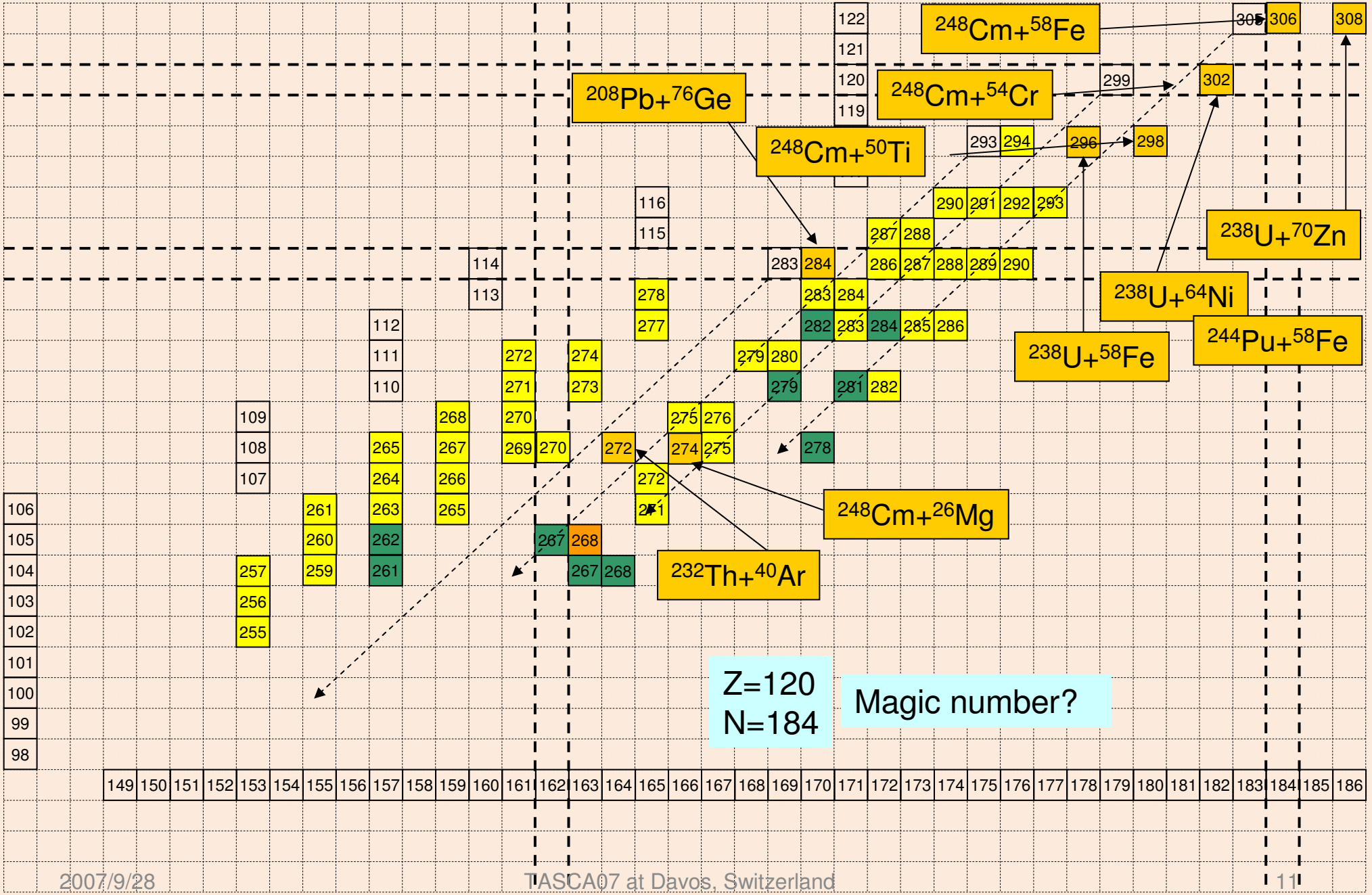
room for chemistry

18GHz ECR ion Source

Ion Source – RFQ beamline upgrade

GARIS（Search for new element）

Target for high intensity beam


248Cm+58Fe
208Pb+76Ge
248Cm+54Cr
248Cm+50Ti
238U+70Zn
238U+64Ni
238U+58Fe
244Pu+58Fe
248Cm+26Mg
232Th+40Ar
Z=120
N=184
Magic number?