Overview of the RIBF accelerators

The 3rd PAC meeting for
Nuclear Physics Experiments at RIBF

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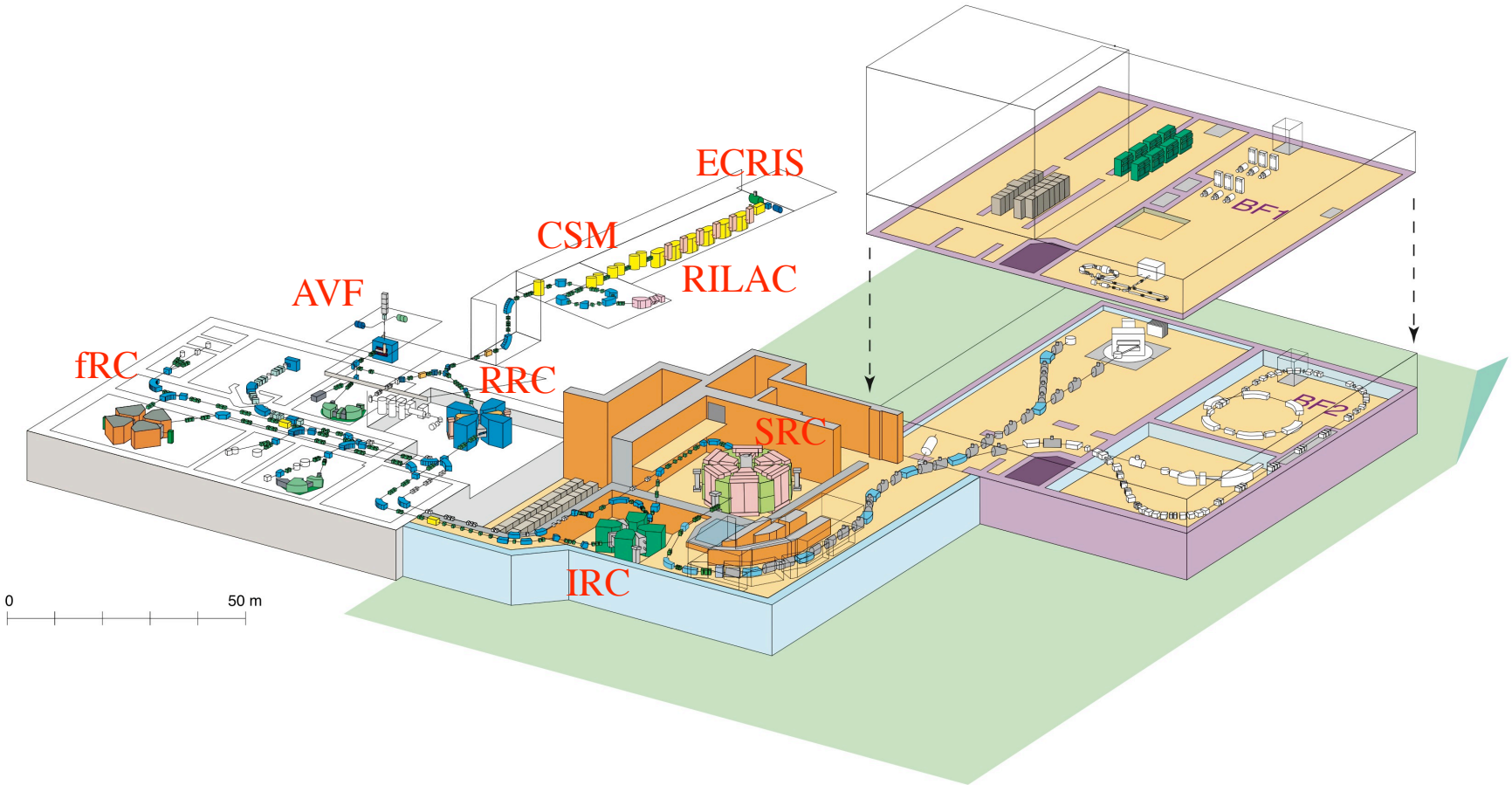
Expected intensities of 345 MeV/nucleon beams at RIBF

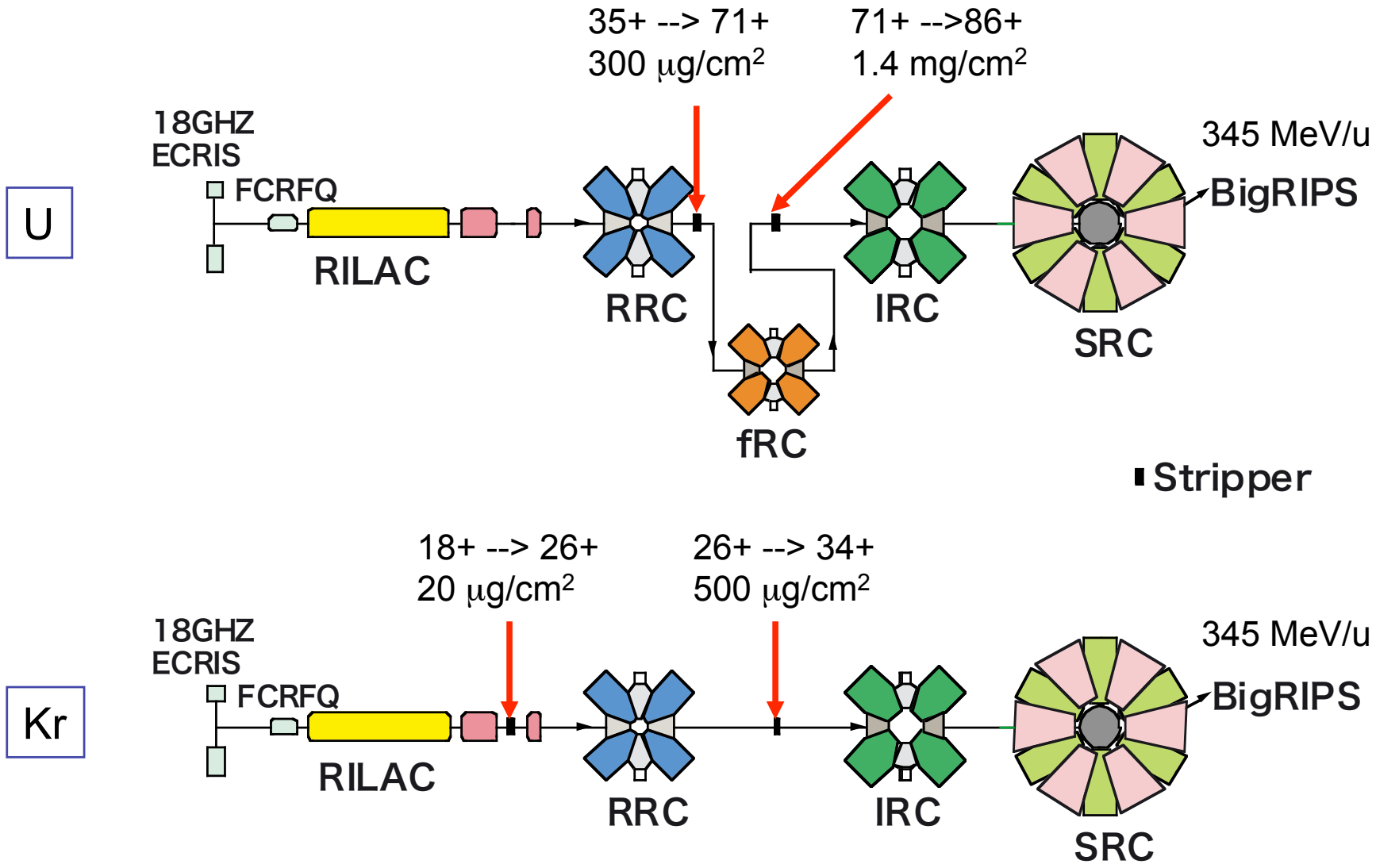
pnA

	^{48}Ca	Kr	Xe	^{238}U
April~November 2008	30~50	30~50	5~10	0.3~0.5
April 2009	200	100	20	5

RIKEN RI Beam Factory



U and Kr acceleration schemes



RIBF machine studies performed since September 2007

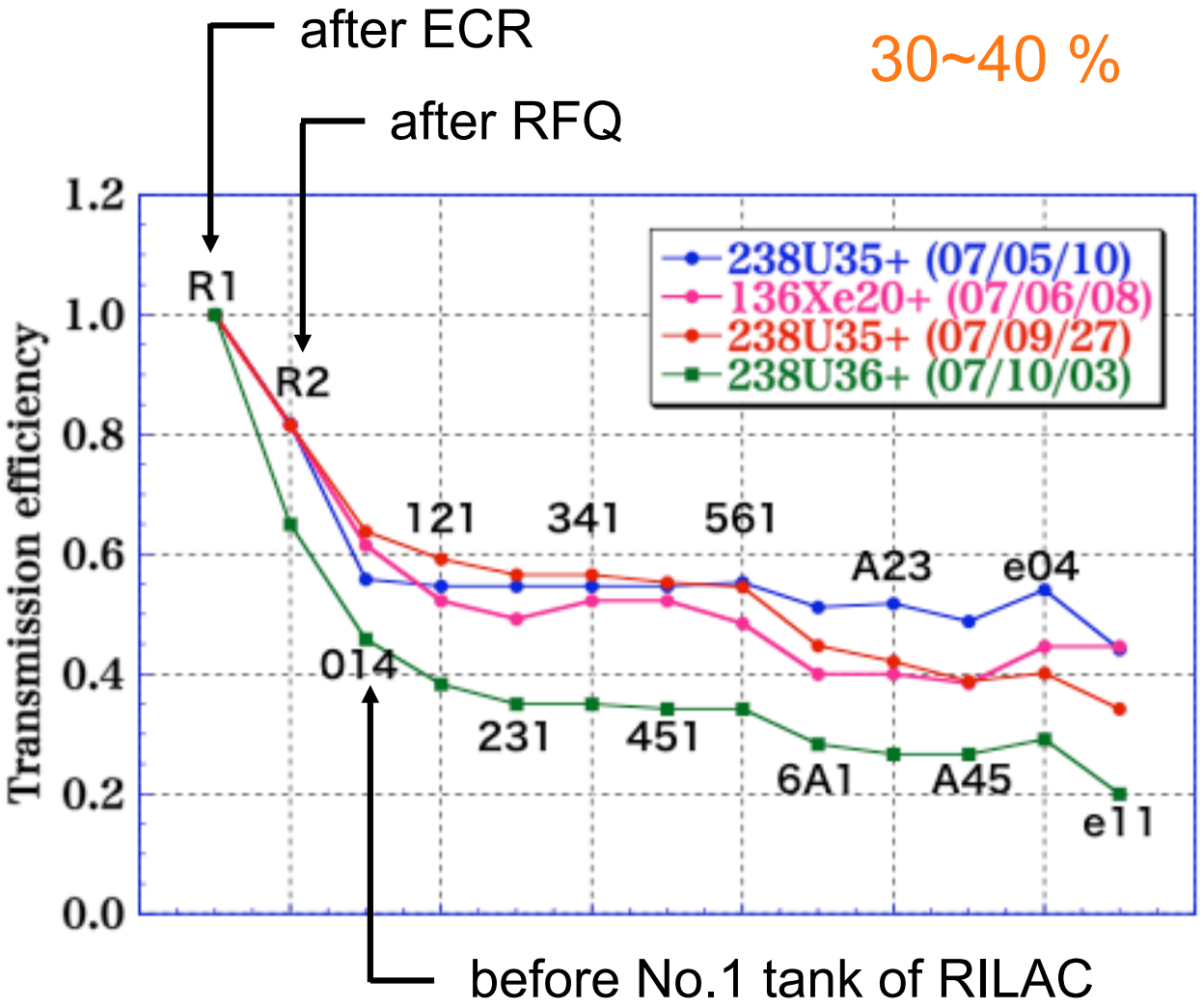
- U acceleration (RILAC+RRC): Sept. 22 ~ Oct. 4, 2007

  - Calibrated the voltages of No. 5 and 6 of RILAC
  - Calibrated the voltage of the beam rebuncher
  - Measured the stability of RILAC & RRC
  - Tested charge strippers
  - Tested new Faraday cups

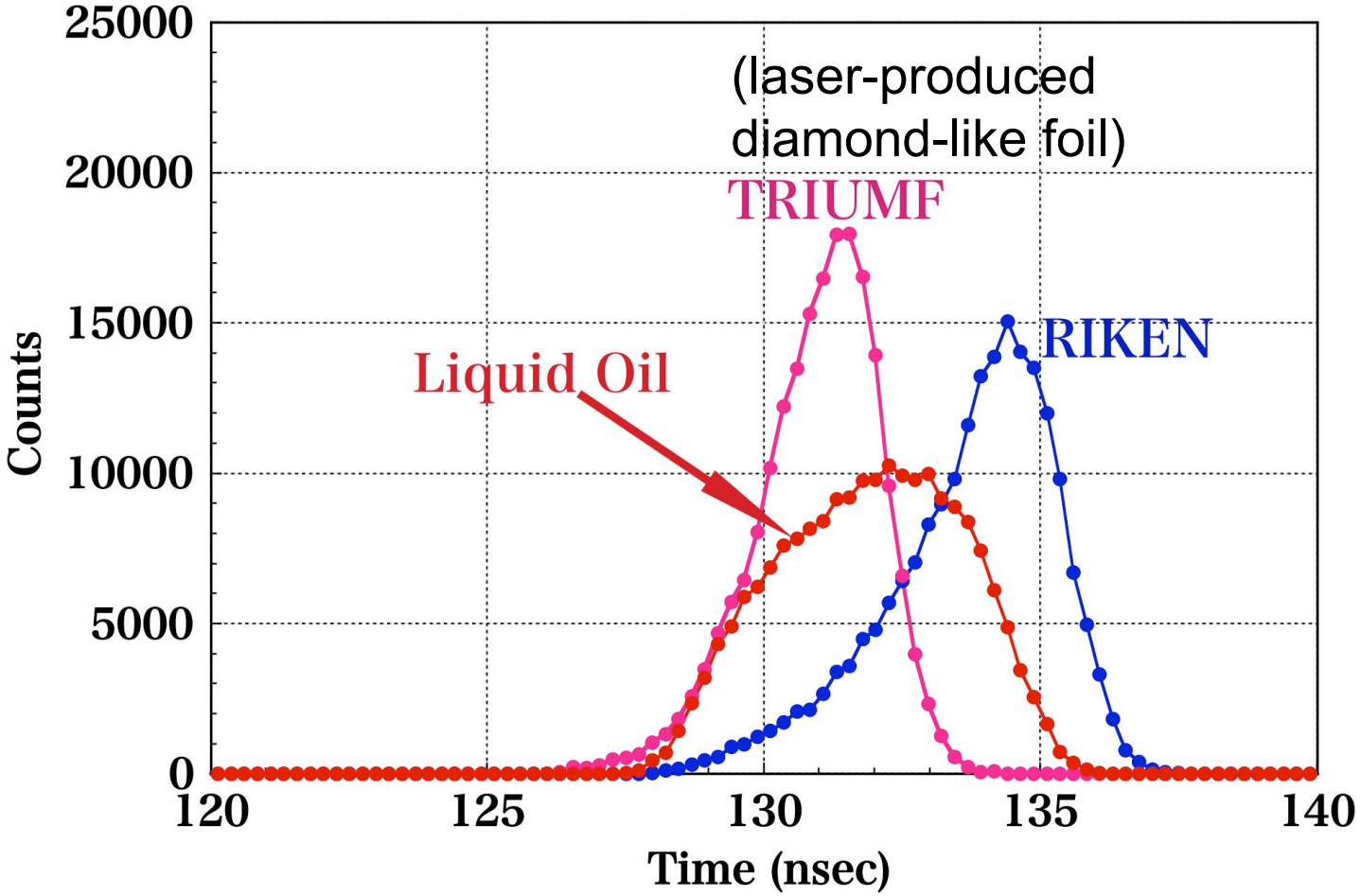
- Kr acceleration (RILAC+RRC+IRC+SRC): Nov. 3 ~ 10, 2007

  - Used the four RF resonators of SRC
  - Used the flattop resonators of both IRC and SRC
  - Improved the beam transmission through IRC by use of the flattop resonator up to 82 % (c.f. 45 % for SRC due to lack of tuning time)
  - Achieved 30 pnA at the exit of SRC (though we limited the time to as short as 1 min.)

Transmission through RILAC



Time structure of the uranium beam after stripping (measured at downstream of RRC)



Main developments performed since September 2007

- Introduced new Faraday cups that allowed us to measure beam intensities accurately
- Built a system monitoring the stabilities of beam phases, RF voltages and RF phases by use of lock-in amplifiers
- Doubled the intensity of U ions from the existing 18 GHz ECR ion source by improving the sputtering method

Machine studies scheduled for April to November 2008

- Beginning of April : Renovation of the low-energy beam transport line of ECR ion source
- April 20 - 30 : U acceleration (for ZDS commissioning)
- May 29 - June 4 : U acceleration (for new isotopes search)
- June 25 - 30 : ^{48}Ca and/or ^{86}Kr acceleration

- October (one week) : ^{48}Ca, ^{86}Kr or ^{136}Xe acceleration
- November (one week) : ^{48}Ca, ^{86}Kr or ^{136}Xe acceleration

Key issues to be improved for higher intensities

- To increase beam intensities from ECR ion source

  - The intensity of U^{35+} ions from the existing 18 GHz ECR ion source has already increased by 2 times.

  - The beam intensities is expected to increase owing to the renovation of the low-energy beam transport line.

  - A 28 GHz superconducting ECR ion source is being constructed for completion by the end of 2008; the performance for U^{35+} ions will be improved by two orders.

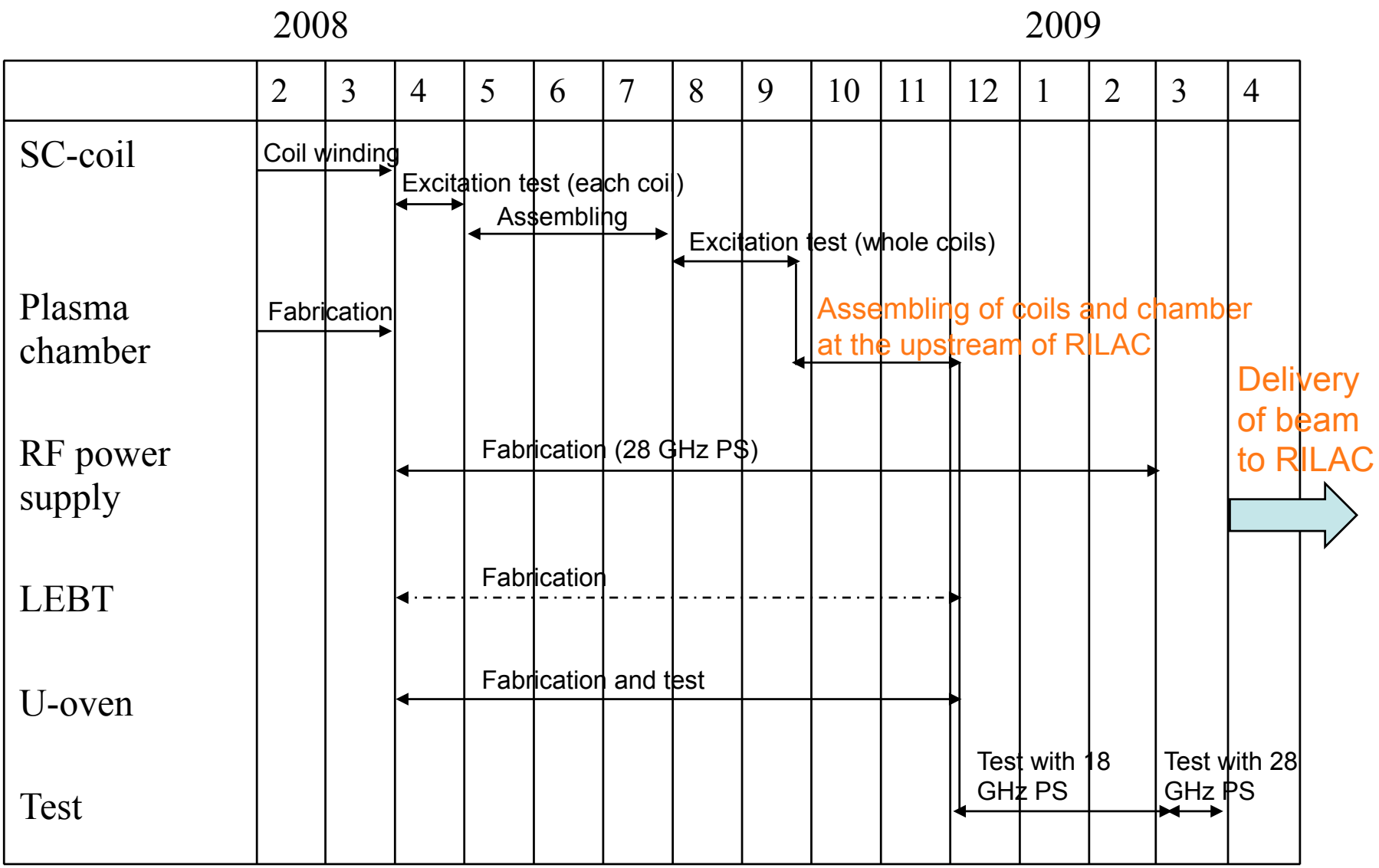
- To improve the beam transmission through the accelerators

  - The transmission of U ions through IRC and SRC is expected to increase by 2.5 to 3 times by use of their flattop resonators.

  - The transmission up to IRC is expected to increase by 2 times by careful tuning.

→ The beam intensity of 345 MeV/u U ions is expected to increase this April by more than 10 times.

Construction schedule of 28 GHz SC-ECR



Key issues to be improved for higher intensities (cont'd)

- To improve the beam transmission through the accelerators (cont'd)

  - Transmission especially through the SRC should be improved for high-intensity beams; it should be more than 80 % for 100 pnA 345 MeV/u Kr beam, for example, while it was 45 % in the acceleration test.

- To make charge strippers with long lifetimes

  - A rotating carbon foil is expected to have remarkably longer lifetimes for a U beam than fixed foils ever used; a slowly moving foil is also expected to have long lifetimes for a Kr beam.

    Lifetimes of fixed foils ever used

    300 $\mu g/cm^2$ foil after RRC : 6 ~ 12 hours @ 0.02 pnA (SRC) U

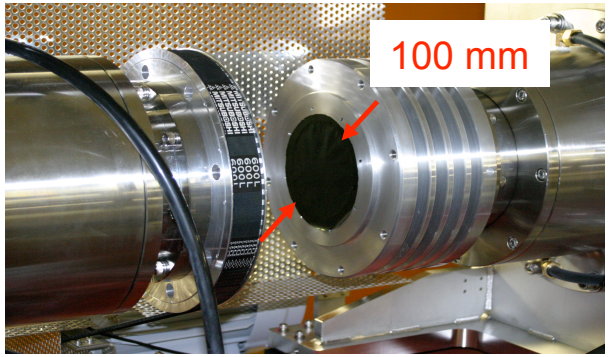
    20 $\mu g/cm^2$ foil after RILAC : 2 days @ 3 pnA (SRC) Kr

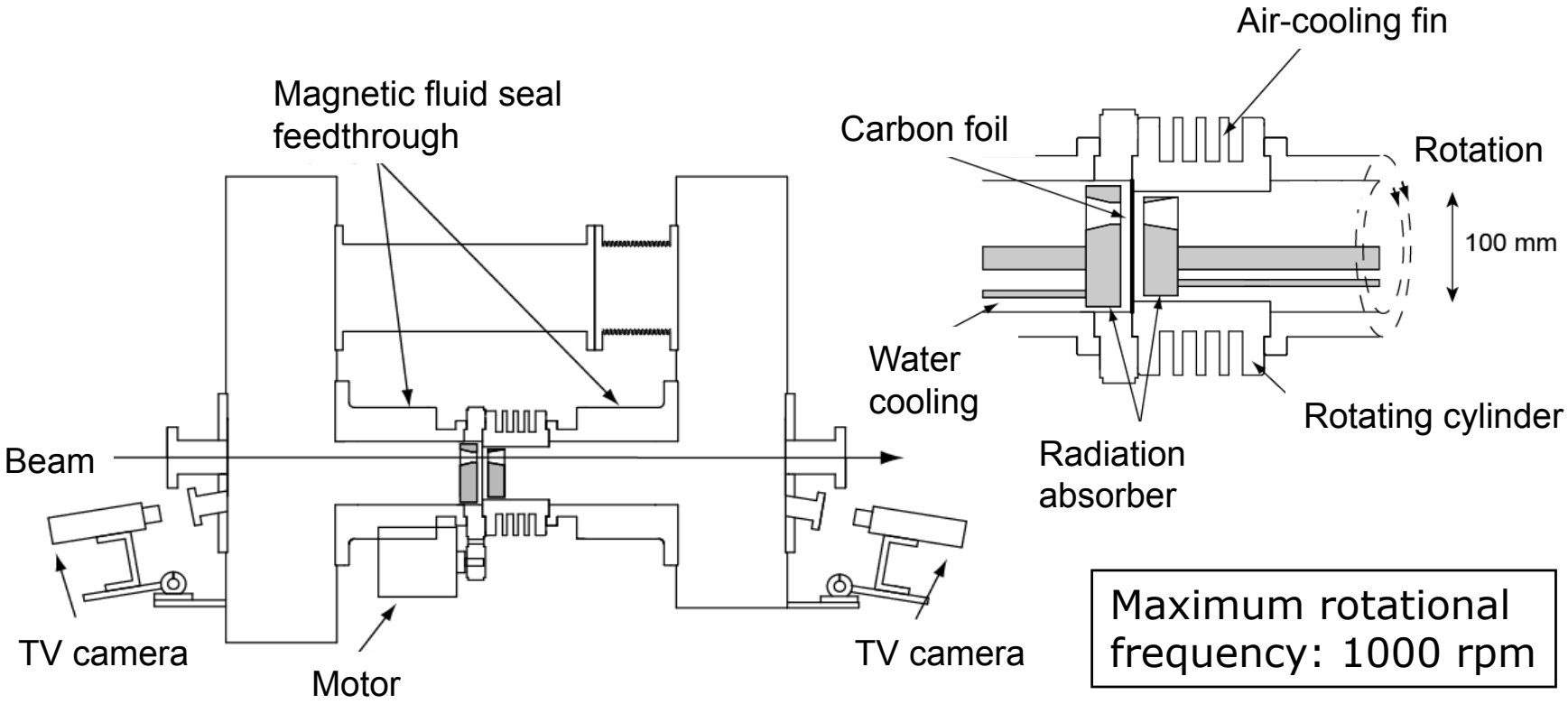
  - Gas stripper is planned to be tested in the near future.

  - Liquid stripper

Rotating carbon foil

This rotating carbon foil for a U beam will be tested this April.





Maximum rotational frequency: 1000 rpm

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Acceleration of deuteron, ^{14}N, ^{16}O ions, etc. using AVF-RRC-SRC mode

The bypass beam line from RRC to SRC is scheduled to be complete for the SHARAQ commissioning in March 2009.