The Munich Fission Fragment Accelerator

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For the new Munich high flux reactor FRM-II we are designing a fission fragment accelerator [1], which will deliver intense mass-separated beams of very neutron-rich radioactive isotopes at and beyond the Coulomb barrier. The physics of this facility and a similar one called PIAFE [2] at the reactor in Grenoble has been addressed in detail in a workshop on "Research with Fission Fragments", held at Benediktbeuern during 28-30 Oct. 1996 [3].

The central issue is the fission fragment ion source. In the Munich design the fission fragment ion source will be located in a horizontal beam tube of the reactor at a distance of 70 cm from the centre of the reactor core. It is optimized for the maximum yield of fission fragments and reaches high flexibility in source handling with the through-going beam tube. The source is placed at the maximum neutron flux of $1.5{\cdot}10^{14}/(\mathrm{cm}^2\mathrm{s})$. The neutron flux is very constant over a region of more than 30 cm, allowing for extended sources.

The burnup of the fissionable material ^{235}U in the ion source during one reactor cycle (51 days) causes changes of the source heating induced by the fission rate. Different techniques will be explored to compensate the resulting temperature change: (i) active control by cooling the target with He gas, (ii) adding ^{234}U to the source to compensate the burnup by breeding of ^{235}U, (iii) using ^{232}Th in the source to breed ^{233}U.

It is planned to use an ion source system based on the design of the ANUBIS at OSIRIS [4], which produces a broad spectrum of elements. For a more selective ion source of simpler structure surface ionization is considered for the production of alkali elements such as Rb.

A general overview of the complete accelerator facility is presented in fig. 1. More information about the set-up in the accelerator hall is given in ref. [5]. Detailed views of the central part, the target-ion source in the reactor, are shown in figs. 2 and 3. The inner diameter of the beam tube at the ion source position is 155 mm and widens in a distance of about 60 cm at the extraction side to 255 mm. This allows the placement of the ion optical extraction elements shown in fig. 1 of ref. [6].

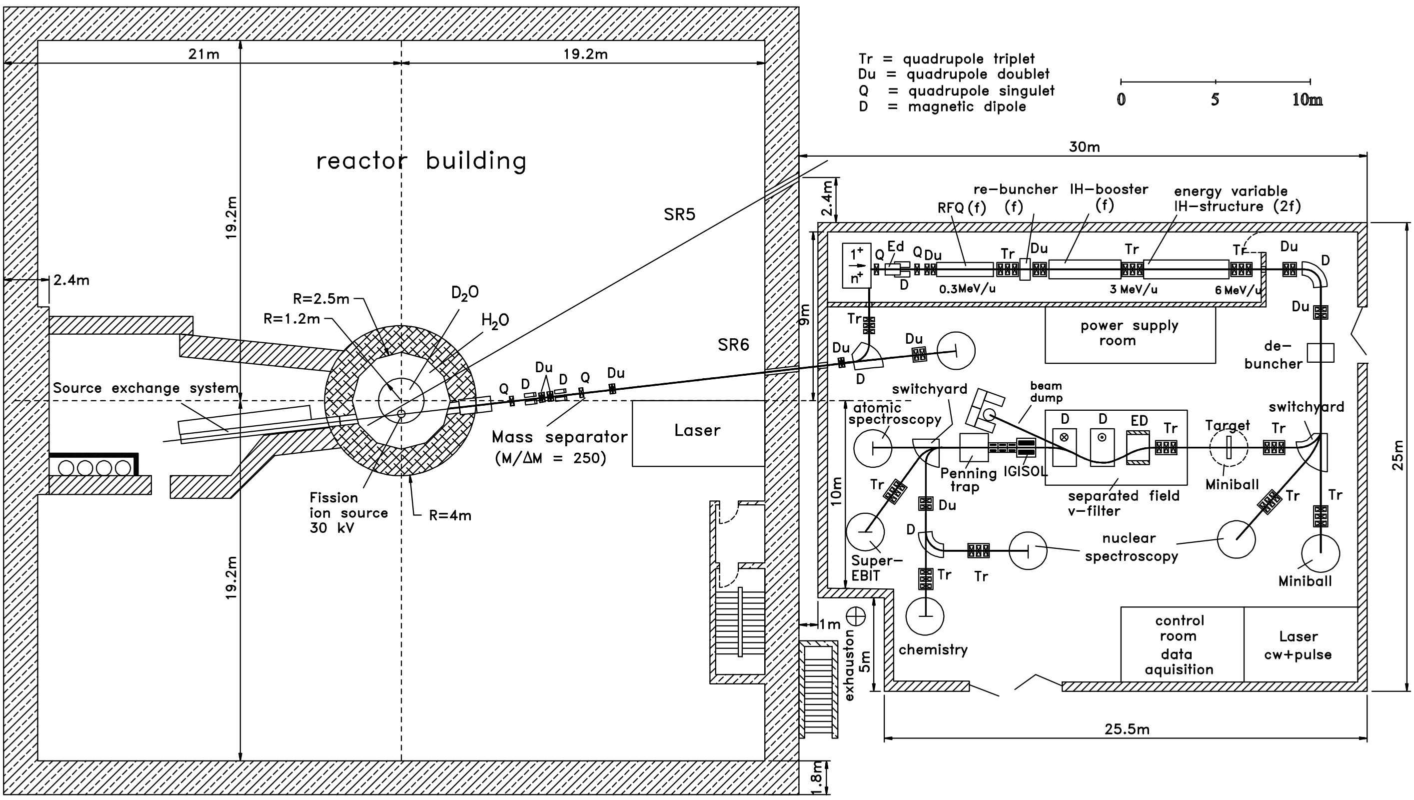

Fig. 1: Overview of the reactor building and accelerator hall for the Munich fission fragment accelerator.