Progress of the Munich Accelerator for Fission Fragments (MAFF)

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The Munich fission fragment accelerator project itself has been described in detail already elsewhere [1–3], here we will only present its progress during the last year:

- The through-going zircaloy beam tube in the moderator vessel of the FRM-II has been designed in detail and is negotiated with potential manufacturers. We expect to place the order in the forthcoming weeks. The beam tube will be installed into the reactor in September 1999 in accordance with the general schedule of the FRM-II.
- The MAFF beam tube unit (SR-6) is until now the only one of the FRM-II which will be operated under vacuum. As this allows the occurrence of shockwaves in case of rupture of a major element of the beam tube unit, special attention has to be paid to quality assurance. The necessary reinforcements and quality improvements of all relevant parts — which essentially result in a first barrier that is dimensioned to remain intact even in case of an earthquake or airplace crash — have been decided and approved by the safety authorities (TÜV).
- The general technical concept of MAFF and its integration into the FRM-II is still being discussed with the safety authorities. An agreement, however, has been found for most items, and we expect the approval of the concept in the next few months. An approved concept will lead to a certificate of nonobjection to the construction of MAFF by the Bavarian ministry of environment.

MAFF is a complex installation, it can roughly be subdivided into the following elements:

1. in-pile parts (trolley, target, cryo pump) and source changing mechanism
2. ionization
3. extraction and pre-separation of the ion beam, that allows multi-beam operation
4. emittance improvement of the ion beam in a gas-filled RFQ ion guide
5. high-resolution mass separation
6. charge breeding
7. post-acceleration

Several test experiments have been set up or will be installed in the near future to address specific points of this list:

- A vacuum furnace has been set up, that allows continuous operation at temperatures of up to 2500° C for extended periods of time ($\geq$ 1000 h). By means of this device, the long-term behaviour of the target will be studied with special attention to the following questions: integrity of the target container, chemical reactions of the container material (Re) with C or U, recrystallization and grain growth, evaporation rate of Re, C, U, surface characteristics (emissivity) of the container.
- A test set-up of the "reactor part" of MAFF starts to be installed in the accelerator laboratory. This installation comprises everything between and including the target changing mechanism and the beam extraction, i. e. trolley, ion source, source changer, beam extraction system and the vacuum system including the cryo pump, which uses the He-liquefier of the Tritron. By means of this set-up we can gain operational experience of critical elements of the system and study the behaviour of the in-pile parts more closely than it would be possible in the reactor. This helps to detect eventual weak spots in the design in good time and thus improve reliability of the final design. Moreover, the performance of the cryo pump in the given geometry can be determined as well as the emittance of the ion source.
- An experiment to determine the maximum pressure values which may occur in case of a massive ingress of water into an evacuated beam tube has been set up. First results showed only surprisingly low peak pressures. The experiment has been modified in order to better reproduce the geometric conditions within the reactor. The new results will be available within the next few weeks.

Recent results concerning the emittance improvement of a low-energy ion beam in a gas-filled RFQ ion guide system [4], the charge breeding to highly charged ions in an electron beam (EB) or ECR ion source [5] or the design of a compact linac [5,6] for MAFF are presented in separate contributions.

The development of ion sources with special emphasis on laser ionisation is pursued at CERN-ISOLDE, a comprehensive overwiew is given in [7].

A non-technical but nevertheless important event was the foundation of the international MAFF collaboration in November 1998: Scientists from more than 40 universities and research institutes from all over Europe have declared their interest in joining this collaboration.

References

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