Abstract for ND2004

Section:
Experimental Facilities and Methods:

Status of facilities producing nuclear data, measurement techniques, equipment, new approaches, modeling of facilities and detectors.

Invited Speakers: *V. Vlachoudis, P. Lisowski, K.-H. Schmidt, J. Blomgren*

**"Nuclear-data experimental programs at GSI"**

*Karl-Heinz Schmidt, GSI Darmstadt*

At GSI, Darmstadt, an extended series of measurements on nuclear-reaction products has been performed. The work is based on an innovative experimental approach, which exploits the unique technical installations of GSI: The accelerator complex provides heavy-ion beams with relativistic energies, which impinges on a reaction target, and a high-resolution magnetic spectrometer is used to identify the reaction products in-flight and to determine their kinematic properties. In addition, the storage ring provides a powerful tool for determining their ground-state masses.

The most important features of this experimental approach are
- full indentification in A and Z of the primary reaction products before their radioactive decay,
- complete coverage of the velocity distribution of each individual nuclide with no lower energy threshold, which allows reconstructing complete invariant-cross-section distributions,
- simultaneous identification of both fission fragments in Z,
- precision measurements of nuclear masses.

The major experimental results are:
- Systematic overview on the nuclide production in fragmentation-evaporation and fragmentation-fission reactions of several systems, ranging from 56Fe + 1H to 238U + Pb.
- Nuclide production in fission of 238U from excitation of the GDR.
- Systematic study of the evolution of fission channels as a function of Z and A of the fissioning system.
- Direct insight into transient effects in fission.
- Fingerprints of multifragmentation in invariant-cross-section distributions.
- Exploring the isospin degree of freedom in relavistic heavy-ion reactions.
- Precision velocity measurements in quasielastic and quasiinelastic peripheral collisions.
- Manifestation of nuclear structure in the condensation process of heated nuclear matter while cooling down in the evaporation process into the super-fluid phase.
- Information on the equation of state of nuclear matter from the response of the spectators to the participants blast.
- Systematic determination of nuclear masses on extended regions of the chart of the nuclides.

These results are relevant for nuclear technology. In addition, they provide an improved basic understanding of nuclear reactions and the properties of cold and heated nuclear matter.

The FAIR project will provide essentially enhanced experimental conditions for this kind of research.