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JÜLICH FORSCHUNGSZENTRUM

Chopper Development for 3rd Generation Spallation Source ESS

Critical Instrument Components: Disc-, Fermi-, T0-Choppers*)

Disc Choppers, e.g. :
ILL/France; 6 disks; 20,000 rpm
PSI/Switzerland; 5 disks; 21,000 rpm
NIST/USA; 2 disks, 18,000 rpm
SNS/USA; 4 disks; 3,600 rpm

Chopper requirements for an expected beam power of 5 MW:

Chopper systems: evaluation of the development status, determination of the potential for new and further development.

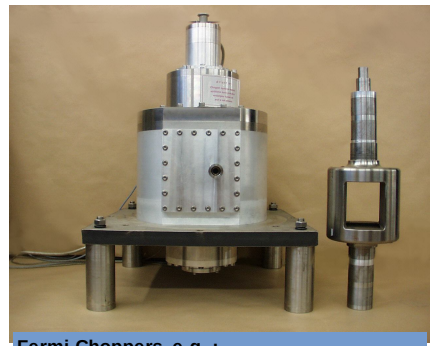
Development of Fermi chopper systems and disc chopper systems with concepts for low-maintenance bearing and drive units with long lifetimes suitable for the high radiation exposure, and concepts for the use of rotor materials and coatings.

Development of fastening elements for Fermi packages in novel chopper concepts; positioning of Fermi chopper systems to minimize kinetic energy and to make the opening function more flexible; consideration of rotordynamic effects.

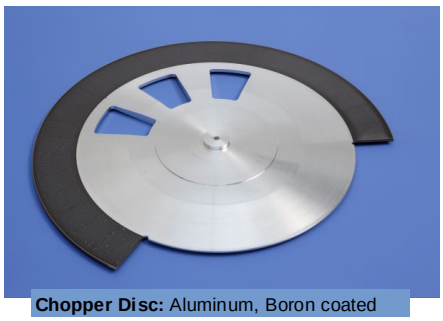
Equipping the rotors with absorber material for high rotational velocities and very high radiation exposure. Options and methods for integrating absorber materials in non-metallic coposites and for the coating of metallic materials.

Analysis of interaction between external magnetic fields and chopper operation, temperature development, and cooling.

Repetition rate multiplication chopper: evaluation of the development status, determination of the potential for new and further development.



Fermi Choppers, e.g. :
FZJ/Germany; 28 kg; 15,000 rpm
ILL/France; 1.5 kg; 15,000 rpm
ILL/France; 2 kg; 15.000 rpm
ISIS/UK; 7 kg; 36,000 rpm



Chopper Disc: Aluminum, Boron coated

Typical characteristics of Jülich chopper systems, made by ZAT:

- **well established permanent magnetic bearings (PMB) for high-speed chopper applications**
- **drive with nanosecond phase stability**
- **self- centering of the rotor by permanent magnet induced restoring forces**
- **minimum electronics for stabilization control**
- **low power consumption of the bearing, independent of the rotor mass**
- **friction-less, high-speed chopper operation in vacuum**
- **safe operation in ceramic back-up bearings**
- **maintainance free**
- **no forced cooling at room temperature**
- **advantage of inherent simplicity, reliability, and safety**

*) The chopper development is a co-operation of Forschungszentrum Jülich, Technische Universität München (TUM Munich), and Helmholtz-Zentrum Berlin (HZB, Berlin), financed by the federal German government and individual German laboratories of the German Helmholtz Association.