

## References for Neutron Disk and Fermi Choppers

MIRROTRON Ltd Company was founded by physicists and engineers of the former Central Research Institute for Physics (KFKI Budapest) in 1991. Its activities are centered on scientific instrumentation, primarily related to neutron scattering. The company has been in good position to take advantage of Hungary's rapid move to market economy and to draw on the experience as well as the achievements of the Hungarian school of neutron scattering. A good example is the installation of a new cold source and supermirror neutron guide system as well as a set of neutron beam experimental stations at the 10 MW Budapest Research Reactor (BRR) in the past few years.

At the moment, MIRROTRON is working with 30 full time employees and regularly helped by about the same number of scientific expert consultants (by case by case contracts). MR's personnel and associated partners have long experience in instrument development, since the Company was formed by those scientists at the Budapest Research Reactor (BRR) who had been involved in many important neutron instrumentation projects in Europe. Some of the Company's leading persons spent several years at various outstanding laboratories such as ILL Grenoble, HMI Berlin, LLB Saclay or FLNP Dubna. The successful reactor and neutron scattering instrumentation upgrading at BRR has been also partly lead by this team. MIRROTRON's scientists have had a dominant involvement in instrument construction for about 16-20 neutron scattering spectrometers at 6 different European laboratories. Concerning neutron guides, MR has delivered neutron optical components or entire guide systems to the following laboratories:

ANSTO - Australian Nuclear Science and Technology Organisation; SNS - Oak Ridge, US; Berlin Neutron Scattering Center; Budapest Neutron Centre; Frank Laboratory of Neutron Physics, Dubna; ISIS T2 Rutherford Appleton Laboratory; Instiut Laue Langevin, Grenoble; Laboratoire Léon Brillouin, Saclay; Los Alamos National Laboratory; Argonne National Laboratory; JAEA Japan; CARR Beijing; IPNC Mianyang.

### Development and production of neutron choppers:

Thanks to the economical changes and the open market system in Hungary since 1990 (MIRROTRON was founded in 1992) the highest quality components and services are now available, at still relatively moderate price. Moreover, with the Budapest Research Reactor (BRR) in operation, selectors and choppers can be developed and thoroughly tested. In 1998 the development and construction of a new type of a high rotation speed, high transmission (90%) selector was started for utilisation with extension to the short wavelength range (from 2 Å and below) and high resolution (down to 5%). The new model is commercially available since 2001.

MIRROTRON is committed in continuous research and development efforts in all device-related area such as large-disk and high-rotation-speed chopper systems, high strength fibre composite disks, and enhanced attenuation capabilities of disks.

In 2002 an agreement was made between the RMS Group and SKF Magnetic Bearings (Canada) for joint production of fast turning devices (e.g. choppers) in neutron scattering applications with supply of magnetic bearing and driving systems by SKF MB. Since then, more than 30 choppers are delivered or being delivered throughout the world.

### References for Neutron Choppers

In years 1991 - 2011 Mirrotron received awards for several large contracts for delivery of choppers or complete systems (these contracts have only a partial overlap and a suitable sequence with the current task/proposal), thus the company's capacity has been considerably extended.

Abbreviations:

*BWL – Bandwidth Limited Disk Chopper*

*DD – Dual/Double Disk Chopper*

*Fermi – Neutron Fermi Chopper*

*Fermi D – Dual Slit Package Fermi Neutron Chopper*



*Correlation Disk Chopper*

*BC – Beam Chopper*

*MB – Magnetic Bearing Levitated*

*TB – Traditional Mechanical Bearing*

For reference examples, the following are listed below:

Institute - Instrument	Type	Quantity	Year of Order	Reference person
SNS – CNCS 	BWL/120Hz MB	2	2002	Paul Sokol
HMI – EXED 	BWL/120Hz MB	4	2004	Judith Peters
HMI – EXED 	DD/250Hz MB	1	2004	Hans-Jürgen Bleif
HMI – EXED 	Fermi D/600Hz MB	1	2004	Hans-Jürgen Bleif
SNS – LR 	BWL/60Hz MB	3	2004	John F. Ankner
IPNS – GPPD 	BWL/30Hz MB	1	2004	James Richardson
Demokritos – TOF 	BWL/100Hz TB	1	2005	Georgios Apostolopoulos
SNS – VULCAN 	DD/60Hz MB	1	2005	Xun-Li Wang
SNS – SNAP 	BWL/60Hz MB	3	2005	Chris Tulk

Institute - Instrument	Type	Quantity	Year of Order	Reference person
SNS – POWGEN 	BWL/60Hz MB	3	2005	Jason Hodges
SNS – EQ-SANS 	BWL/60Hz MB	2	2005	Jinkui Zhao
IPNS – CHEX 	Corellation/250Hz MB	1	2005	Stephan Rosenkranz
SNS – CNCS 	Fermi D/300Hz MB	1	2005	Georg Ehlers
SNS – FnPB 	BWL/60Hz MB	3	2006	Geoffrey Greene
SNS – EQ-SANS 	DD/60Hz MB	1	2006	Jinkui Zhao
ISIS – LET 	BWL/150Hz MB	2	2006	Rob Bewley
SNS – TOPAZ 	BWL/60Hz MB	2	2006	Christina Hoffmann
INPC – TPNR 	BWL/50Hz TB	2	2007	Chen Bo
INPC – TPNR 	DD/50Hz TB	1	2007	Chen Bo
ICCAS/CIAE-SANS 	BC/50Hz TB	1	2008	Prof. Charles Han
SNS - HYSPEC 	BWL/60Hz MB	2	2008	Mark Hagen
SNS – HYSPEC 	Fermi/350Hz MB	1	2008	Mark Hagen
ANSTO – Pelican 	Fermi/400Hz MB	3	2008	Dehong Yu
BNC – TOF 	BWL/150Hz TB	1	2009	Gyorgy Kali

Total : 42 pcs Neutron Disk Chopper

6 pcs Neutron Fermi Chopper