

Neutrons: A Powerful Tool

Research reactors provide a source of neutrons through the fission process. Within the core of the CNF, the neutrons will be used to test materials to ensure they will perform reliably in CANDU power reactors. In addition, small beams of neutrons extracted from the reactor will tell researchers where the atoms are in a material and how they move.

Neutron Beam Research

Beams of neutrons are guided to experimental stations outside the reactor core, where they are used as powerful probes. This technique—pioneered in Canada by Canadian Nobel Laureate Bertram Brockhouse in the 1950s and now used all over the world—is called neutron scattering. Neutrons can be used to probe materials on length scales ranging from a tenth of the size of an atom up to the large biological molecules or polymers. Neutrons can also

observe atomic movements on a very short time scale.

A device in the reactor, called a cold-neutron source, is used to cool the neutrons to low energy to provide the specialized beams needed for advanced applications. This will be the first time cold neutrons are available in Canada.

CNF Facilities for Advanced Materials Research

- 6 thermal beam tubes in the reactor hall
- 1 cold source feeding seven neutron guides
- 1 thermal source feeding two neutron guides
- 1 new spectrometer directly viewing the cold source
- 5 instruments relocated from NRU
- 5 new instruments in the Guide Hall
- Provision for 23 instrument stations

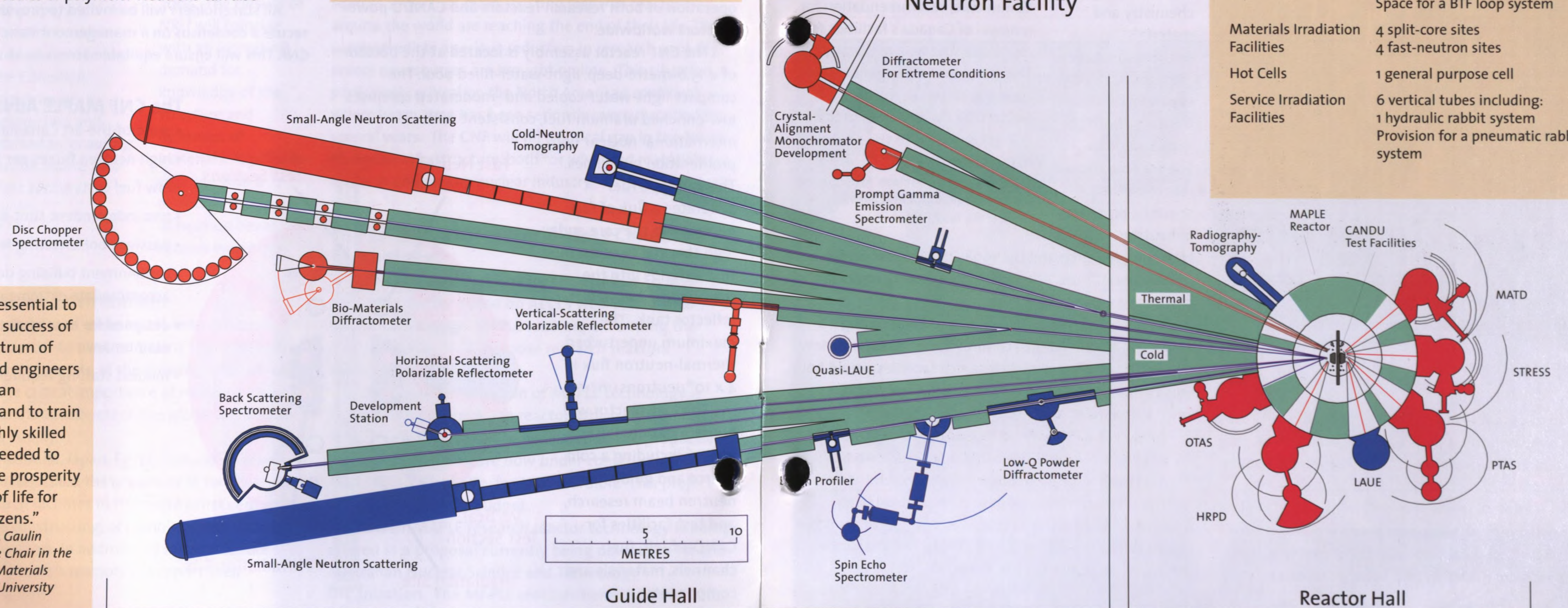
In-core Research

The neutrons in the reactor core are used to irradiate materials and components in special test sections or “loops” that reproduce a nuclear power reactor’s operating environment. The materials and components are then examined and tested in shielded “hot cells” to obtain information on their performance under power reactor conditions. Irradiation research has been an essential element in ensuring a successful CANDU nuclear industry.

CNF Facilities for CANDU Research and Product Development

Horizontal Fuel-Test Facilities	3 test sections, each with up to 3 CANDU bundles, connected to 2 loops Bottom test section replaceable with a high-integrity section for future severe fuel damage (BTF) tests CANTHERM advanced fuel channel capability
Vertical Fuel-Test Facilities	1 test loop with 2 test sections for multi-element partial fuel bundles Space to connect one test section to a second loop Space for a BTF loop system
Materials Irradiation Facilities	4 split-core sites 4 fast-neutron sites
Hot Cells	1 general purpose cell
Service Irradiation Facilities	6 vertical tubes including: 1 hydraulic rabbit system Provision for a pneumatic rabbit system

Canadian Neutron Facility



“The CNF is essential to the research success of a broad spectrum of scientists and engineers from Canadian universities, and to train the new, highly skilled innovators needed to ensure future prosperity and quality of life for Canada’s citizens.”

*Dr. Bruce D. Gaulin
Brockhouse Chair in the
Physics of Materials
McMaster University*