TECHNISCHE UNIVERSITÄT MÜNCHEN

ZWE FRM-II

The FRM-II Hot and Cold Neutron Sources

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Overview

1. Introduction
2. Cold Neutron Source
   function / operation
   measurements
3. Hot Neutrons Source
   function / operation
   measurements

Introduction

Installation of the cold and hot neutron source in the year 2001 / 2002

Cold Commissioning in the year 2003

Nuclear Commissioning in the year 2004

The Cold Neutron Source

Liquid Deuterium Moderator

volume moderator vessel	25 liters
volume of liquid D_2	~ 13 liters
temperature	25 K

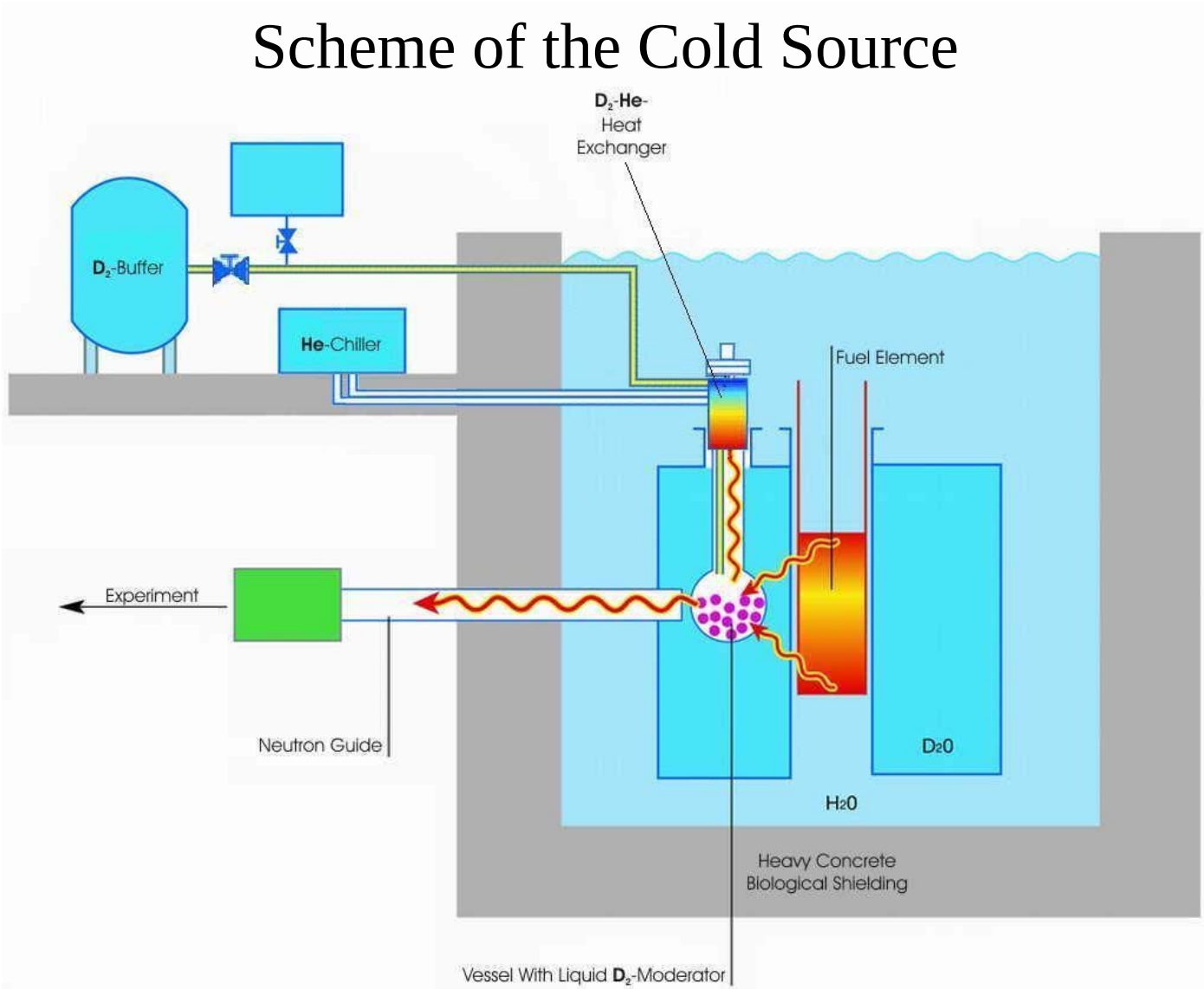
3 Beam Tubes

for cold neutron experiments

1 vertical Beam Tube

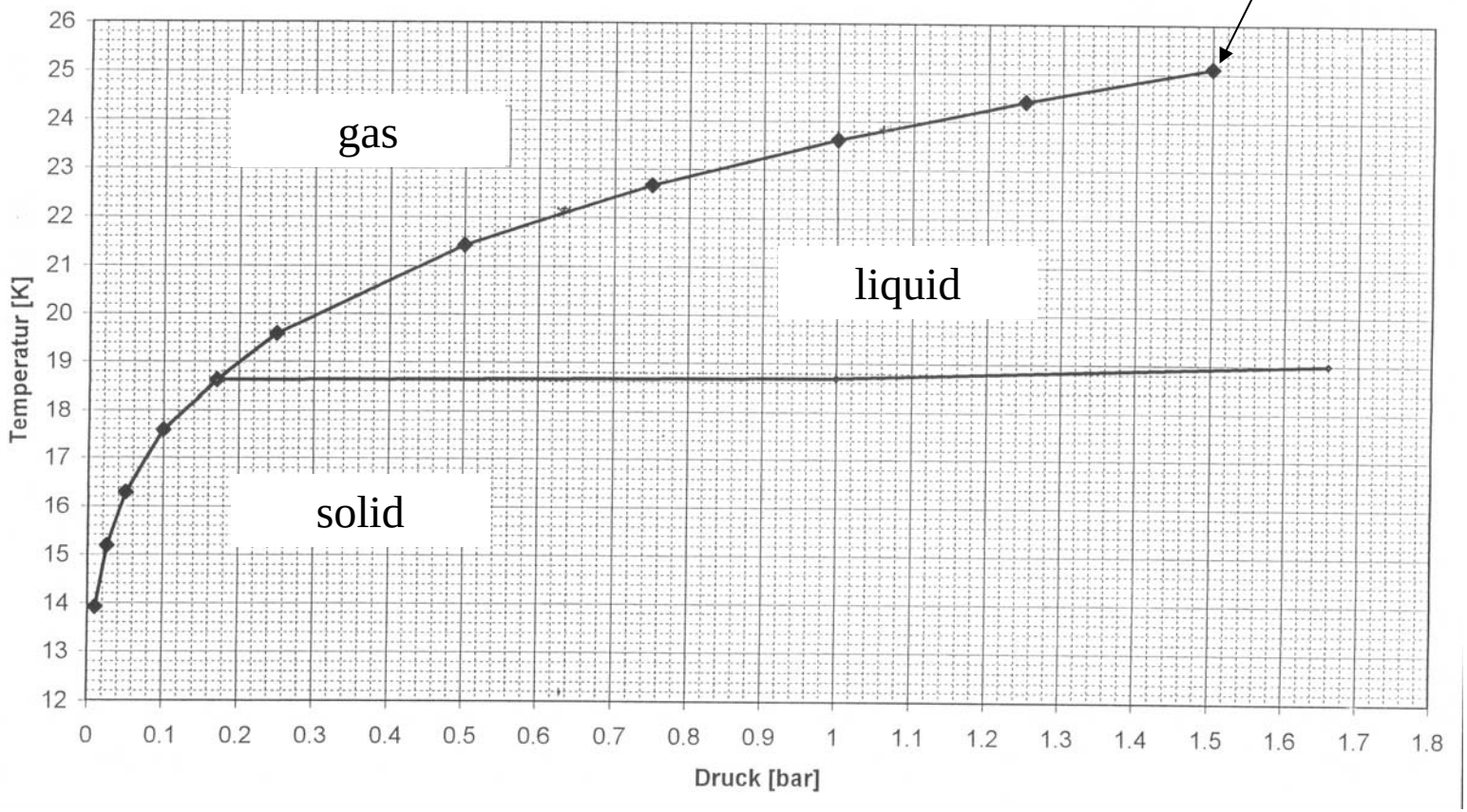
is not in use

Scheme of the Cold Source

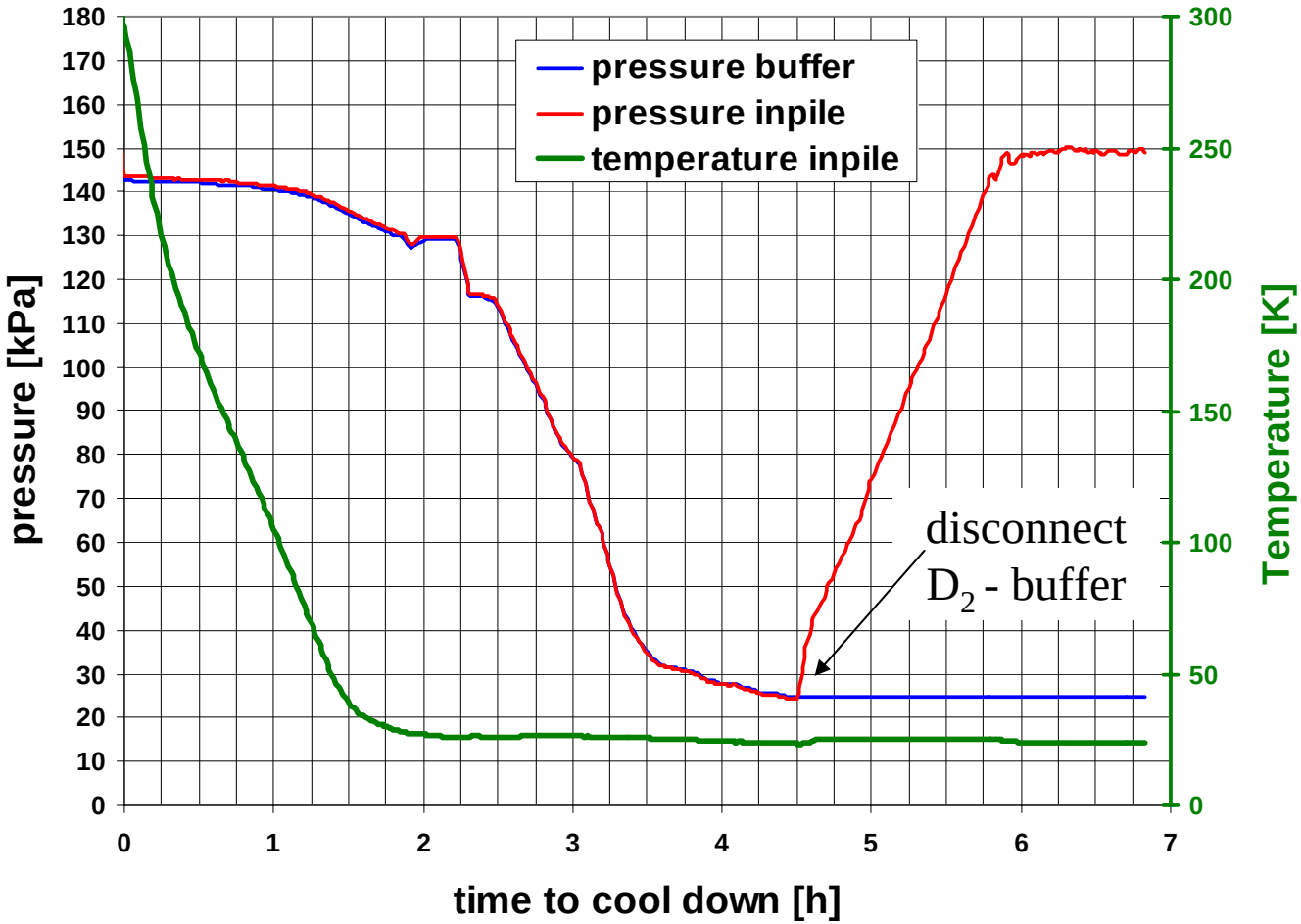


Deuterium Diagram

working on boiling point
at **150 kPa / 25 K**



Preparing the Cold Source



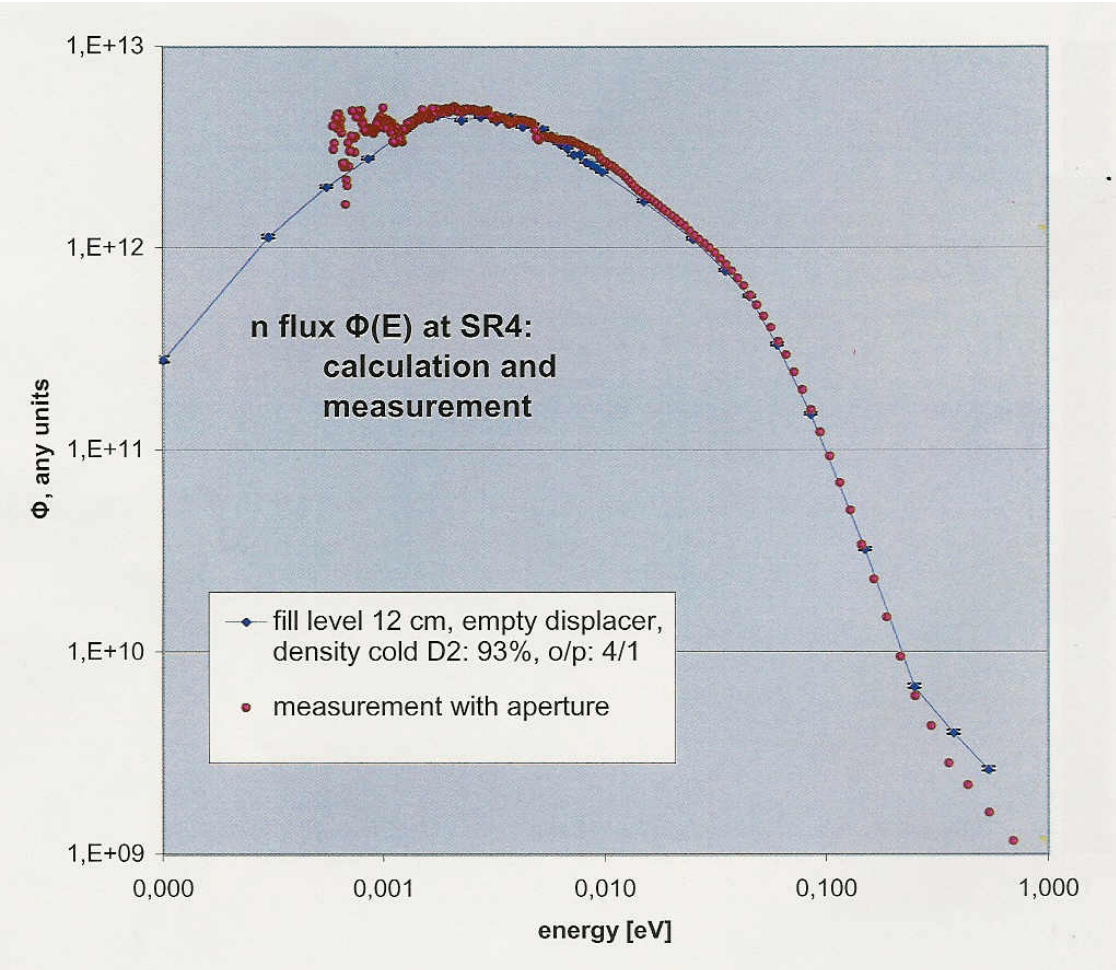
Benefits:

- low pressures
- smaller amount of Deuterium needed
- smaller amount of Tritium (waste)

Disadvantage:

- the regulation of the refrigerator has to be very precise

Measurement of the Cold Neutron Spectral Flux at 20 MW



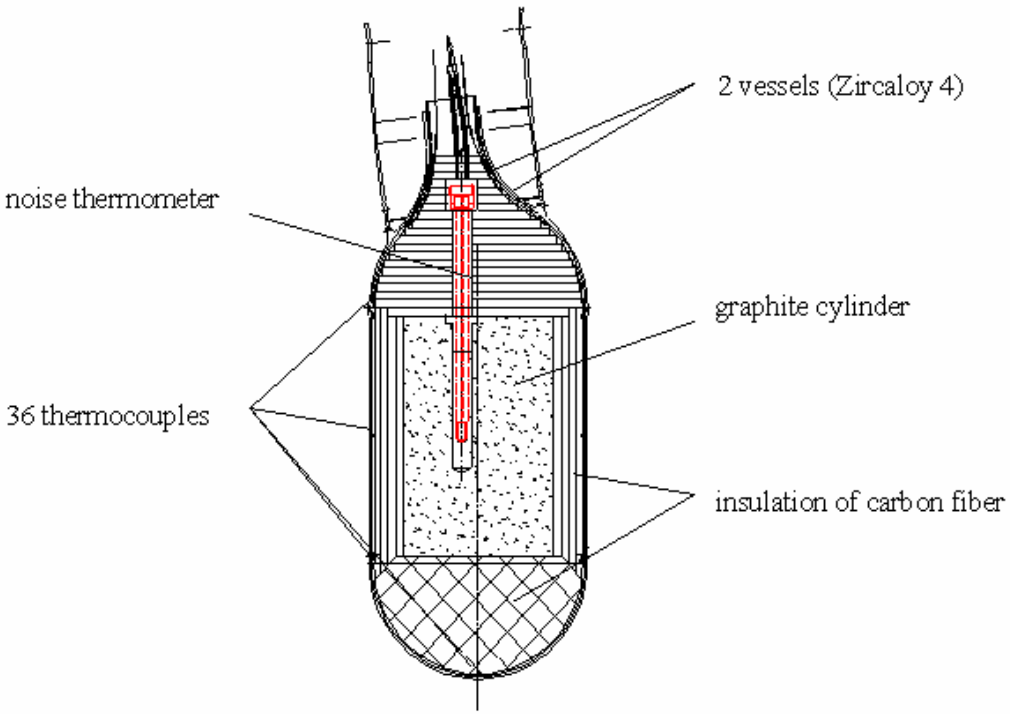
Hot Neutron Source

Hot Graphite Moderator
heated by gamma radiation

distance from center source
to center of core 42 cm

1 Beam Tube
with neutron energies 0.1 – 1 eV

Graphite Moderator



Characteristic Data:

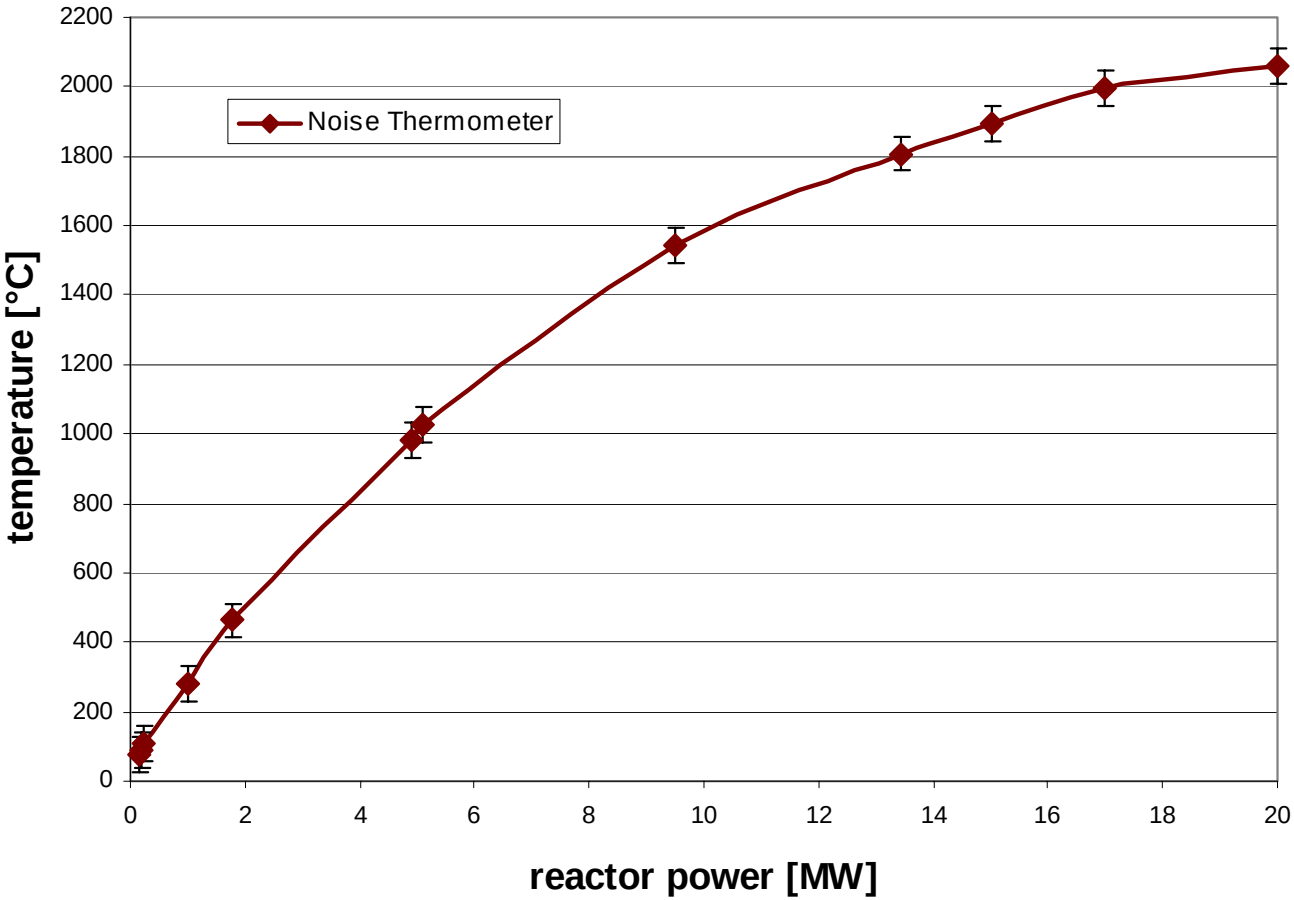
Moderator

- Graphite cylinder
- 200 mm in diameter, 300 mm high
- about 15 kg
- surrounded carbon fiber
- double wall of zircaloy 4

Instrumentation:

- 1 noise thermometer
- 36 thermocouples (type K)

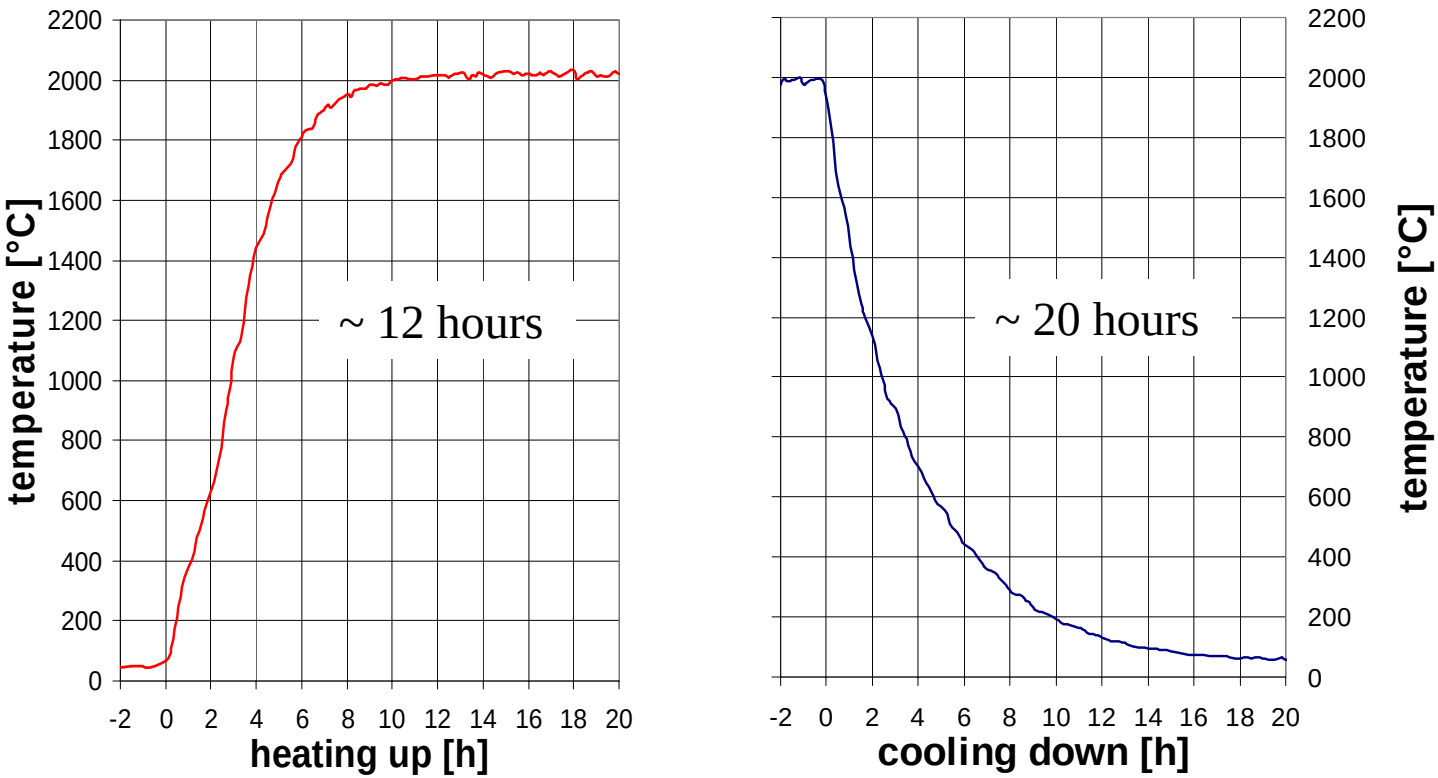
Graphite Temperature at Commissioning



temperature at
20 MW reactor power

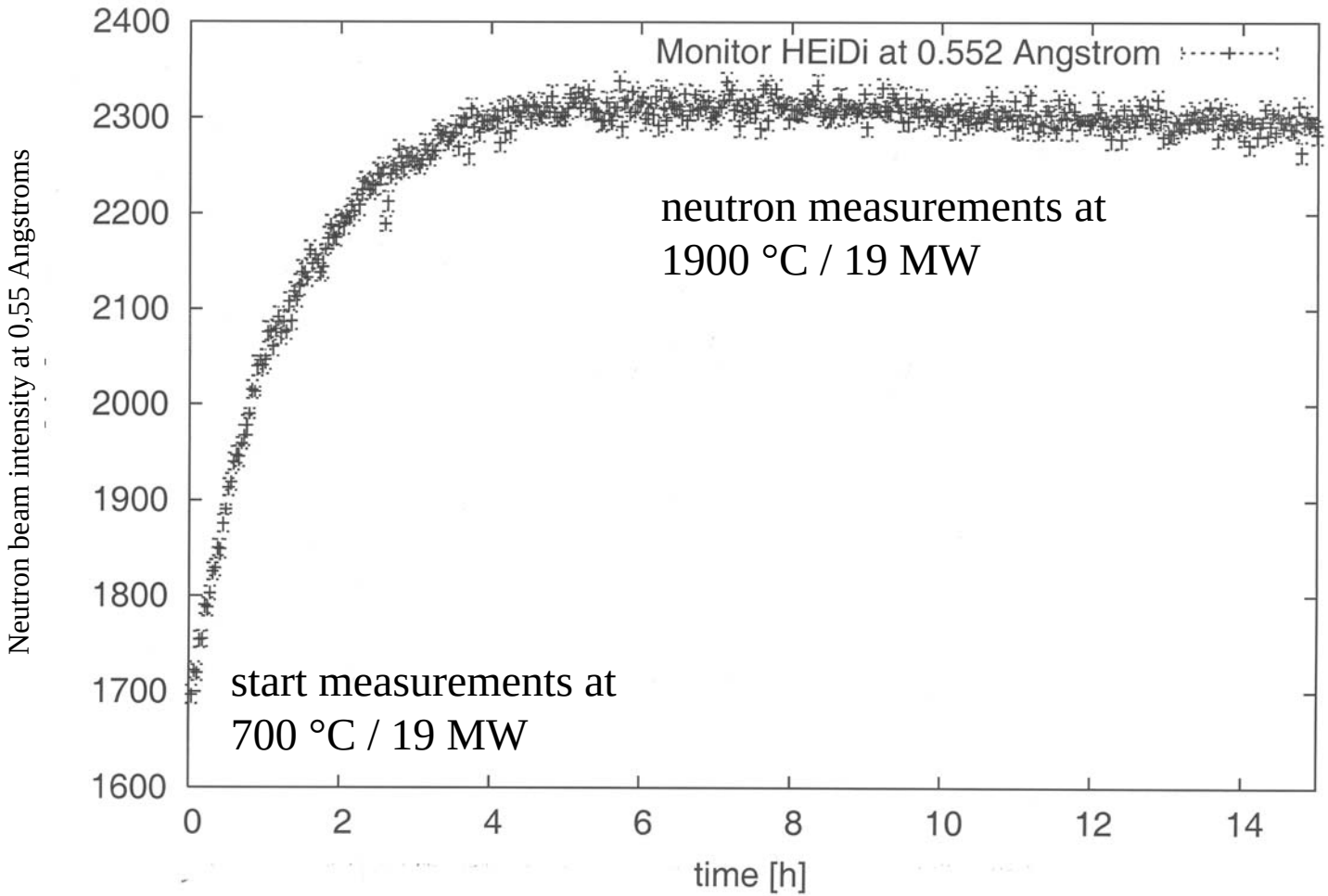
2030°C (3690 °F)

Temperature Gradient of the Hot Graphite Moderator



measured by the noise thermometer - reactor power 20 MW

Heat-Up Effect of Hot Neutron Source at 19MW Reactor Power



Literature -Links

IGORR Proceedings

http://www-igorr.cea.fr/proceedings

Neutron Research Facility - FRM-II

http://wwwnew.frm2.tum.de