OPAL : Cold Neutron Source Commissioning Progress Update
CNS Progress to Date

- Preliminary Engineering
- Detailed Engineering
- Prototyping and Testing
- Fabrication
- Installation
- Pre-op
- Commissioning
The CNS Systems

1. In-pile Components (also combining a reflector plug)
   - Vacuum containment: Zircalloy (ZrNb2.5%)
   - Moderator chamber: Aluminium (AlMg5)
   - Sub-contracted: PNPI

2. Cryogenic Refrigeration System
   - He circuit, Brayton cycle, 19.8K at 5000W
   - Sub-contracted: Air Liquide

3. Moderator System
   - Liquid deuterium, ~ 24K

4. Vacuum System

5. Gas Blanketing System
CNS In-pile

- CNS Beam tube
- HNS Beam tube
- Vacuum containment
- Alignment pin
- Core
CNS In-pile
Cryo Refrigeration System

- RCS
- Compressors
- Oil Skid

Cold Box (containment)

Helium piping 70m
Cryo Refrigeration System
Cryo Refrigeration System
Vacuum & Moderator Systems
Installation
Installation

Compressors, oil skid, cold box delivered – Mar 05
Compressors, oil skid, cold box installed – June 05
Moderator system installed – June 2005
Vacuum system installed – June 2005

Vacuum containment fitted to reflector – Aug 2005
Cryo pipe installed - Aug 2005

In-pile assembly installation – Sept 2005
CNS Testing Schedule

- Thermosiphon prototype tests
- CNS-RCS acceptance tests
- On-site CNS-VS, CNS-MS, CNS-GBS tests
- CNS-RCS integration with in-pile assembly
- Liquefaction of deuterium
- On-site RCS tests
- Reactor facility stage C commissioning (sequential power increase)
In-pile Prototype Testing (PNPI)

AIM: To prove heat removal by thermosiphon

PROTOTYPE: Moderator chamber and thermosiphon. Two electric heaters modelled nuclear heating.

RESULTS:
Operation in normal cryogenic mode with 4300 W heat input.
Operation in warm stand-by mode with 2650 W heat input.
RCS Factory Acceptance Test (Air Liquid)
RCS Testing (Air Liquid)

TEST PROGRAM

CONCLUSIONS

• 5.6 kW heat removal capacity (during Normal Operation).
• Stand-by operation, and transition between modes successful.

LESSONS LEARNT

• Bypass loop, on the cryogenic helium lines
• Helium relief tank
• Clean helium system
On-Site CNS-RCS Testing

July 05

Cold box bypass fitted

Tuning of control loops to guarantee:

• required flow to the moderator cell
• prevent moderator chamber over-pressurisation

Loss of one compressor – no reactor trip

Containment isolation – no He relief
On-Site Testing

Transition from SO (warm) mode to NO (cryogenic) mode with simulated power
On-Site Testing

CNS trip due to failure of compressor A
On-Site CNS-RCS Testing
Operation

Normal Operating Mode (NO)
Stand-by Operating Mode (SO)
Halt Mode

Fast Warm-up – rapid deuterium vapour warm-up
Forced Evaporation – accelerated return to reactor power
Helium injection into the vacuum containment