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Summary Report on the LANL Meeting on Cold Neutron Sources

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The first meeting devoted to cold-neutron sources was held at the Los Alamos National Laboratory on March 5-8, 1990. Cosponsored by Los Alamos and Oak Ridge National Laboratories, the meeting was organized as an International Workshop on Cold Neutron Sources and brought together experts in the field of cold-neutron-source design for reactors and spallation sources. Eighty-four people from seven countries attended (see photograph). Because the meeting was the first of its kind in over forty years, much time was spent acquainting participants with past and planned activities at reactor and spallation facilities worldwide. As a result, the meeting had more of a conference flavor than one of a workshop.

As part of the workshop strategy, a list of questions to be addressed were sent to the participants prior to the meeting. The general topics covered at the workshop included:

- Cold source design criteria
- Neutronic predictions and performance
- Energy deposition and removal
- Engineering design, fabrication, and operation
- Material properties
- Radiation damage
- Instrumentation
- Safety
- Existing cold sources
- Future cold sources

As can be seen, a wide range of topics, from cold-moderator neutron physics to engineering and operation of cold-neutron sources were discussed.

The meeting began with review presentations on existing cold neutron sources, including design criteria, current design, and source performance. Calculational techniques for neutronic performance and available measurements on the neutronic performance of various sources were also covered on the first day. Design considerations for cold-neutron sources, including optimization, heating rates and heat removal, materials properties, radiation damage and safety, were covered on the second day. The third

day was devoted to proposals for new cold-neutron sources at both reactor and spallation facilities; this day also included a poster session and a tour of the LANSCE facility. The morning of the last day was devoted to summaries.

Here are some highlights of the items discussed at the meeting. Liquid deuterium and supercritical hydrogen appeared to be the favored choices for new cold-neutron sources at reactors. Minimizing energy deposition in the walls of reactor cold-source containers could be an improvement that could affect the engineering design of cold-neutron sources. Most attendees generally felt that neutronic gains at reactor cold sources will most likely come from more efficient coupling of the neutron source to the neutron-beam transport system rather than from improvements in cold source performance. The ability to change the moderating material viewed by a particular neutron spectrometer may be useful in some future applications. For reactors, an increase in neutron flux is always desirable if heat loads in the cold source are tolerable.

There are two types of spallation sources: steady-state and pulsed. Design problems with cold neutron sources for spallation sources are analogous to those for steady-state reactors. Heat loads are similar, but the distribution between gamma-ray and neutron heating is different. Because of inherent lower average heating rates in pulsed spallation sources, the possibility of using materials other than liquid hydrogen, such as liquid and solid methane, can be envisaged. To date, solid methane has only been used with proton currents of a few tens of microamperes, thus making it troublesome to employ as a cold moderator at proton currents in the hundreds of microampere range. Also, because target-moderator-reflector systems for pulsed spallation sources tend to be undermoderated, substantial gains in neutronic performance may result by using composite and coupled cold moderators.

A general consensus reached at the meeting was that an important design feature for both reactor and spallation cold-neutron sources is to get neutrons as cold as possible. Also, there is a real need for better data on materials properties and the effects of radiation damage at cryogenic temperatures, which could be used to improve the design of cold-neutron sources.

The meeting was deemed successful by all involved, and a follow-up meeting was proposed with the date and location to be decided later. The proceedings of the meeting will be published as a Los Alamos

National Laboratory report. A fairly extensive bibliography of work on cold-neutron sources over the past 40 years will be included.

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Q(B.S.Brown): Is there any program to get the much needed radiation damage information on the cryogenic materials?

A(G.J.Russell): Unfortunately not. Everyone recognizes the problems, but no one has the financial resources to do anything about it at this time.

Q(Utsuro): Do you try to consider the effects of another decrease of the total cross-section of p-H_2 in meV region?

A(G.J.Russell): Yes, we have recognized this additional decrease in the total cross-section of para-hydrogen cross-section. We are presently incorporating this effect into the Los Alamos para-hydrogen scattering kernel.