

ICANS IX

INTERNATIONAL COLLABORATION ON ADVANCED NEUTRON SOURCES

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COMMON PROBLEMS

A D Taylor

Rutherford Appleton Laboratory, Chilton, Didcot, Oxfordshire UK

INTRODUCTION

The ICANS collaboration has provided an excellent forum for the discussion of problems common to the development of spallation neutron sources for condensed matter research. The growth in the volume of each subsequent proceedings stands as a testimony to its usefulness for sharing information, much of which would be inappropriate to publish elsewhere. The ICANS meetings in particular provide an opportunity to discuss the neutronic and engineering aspects of target-moderator systems, source-instrument interactions, beam quality effects and novel neutron scattering instrumentation and techniques (especially those concepts unique to pulsed sources). The following summary of recent and potential problem areas may be regarded as a personal agenda for future ICANS meetings.

ACCELERATORS

The accelerators used are sufficiently different to make this the least common aspect. However, some problems are general, such as beam loss, activation of components, and the need for remote handling. Such problems will ultimately limit the performance of each accelerator.

TARGETS

The debate between non-fissile targets, fissile targets and ultimately boosted targets is far from reaching a consensus. It may be that fissile and boosted targets are appropriate only on low current sources. Non-fissile targets on present and projected sources are still a long way from their thermo-mechanical limit, although some limiting problems may soon be encountered in the design of the proton beam window. Fissile targets have been designed for 200 μ A operation, but the acceptability from an instrumental point of view of the contamination due to delayed neutrons has not yet been fully evaluated. It may be necessary to employ background-suppressing choppers buried deep in the bulk shield to minimise delayed neutron contamination. Booster concepts are in their infancy and metallurgical problems have been encountered even for low current (10 μ A) designs. It is probable that a fuel validation study would be required before a highly enriched, high power booster could be operated; some indications already exist from SNQ studies at LAMPF that the irradiation damage behaviour and embrittlement in proton beams is significantly different from that in high neutron fluxes.

MODERATORS

Ambient temperature water moderators and 100 K liquid methane moderators perform well physically and are well understood neutronically. The neutronic behaviour of liquid hydrogen moderators is not so well described and an experimental and computational programme to study their behaviour would be appropriate. Low temperature solid methane is a significantly better moderator than liquid hydrogen but, for radiation damage reasons, can only be used on low-power sources. The development of a good high hydrogen density, low temperature moderator for use on intense sources would be a major advance. The use of polyethylene or solid methane slurries suspended in flowing liquid hydrogen has been suggested, but feasibility studies of the cryogenic engineering have not been carried out.

INSTRUMENTS

The first generation of pulsed source spectrometers were in general analogues of existing reactor-based instruments. Several new and innovative designs have emerged but, as the SNQ study showed, there are many advanced concepts involving focusing and phase space transformations which remain to be evaluated. The need still remains for low-cost, low-noise, multipixel detectors. Data acquisition systems need to respond to the trend towards high data-rate multidetector arrays. Systems using 2 MBytes are currently in operation, but there is already a need for 20 MByte memories. With such large data arrays, sophisticated analysis 'on the fly' becomes almost essential. Sample environment development projects have traditionally been underfunded, and would probably yield a significant return on investment by opening up new areas of physics, particularly in the field of high pressure studies.

CONCLUSION

There are sufficient problems common to our various laboratories to guarantee the need for many future ICANS meetings !