Summary of the Session Target and Moderators: Design and Test

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In this session, the presentations were from three rather clearly distinguishable classes of neutron source:

i) The More or Less Established Sources IPNS, KENS and WNR: They are running at an average beam power in the region of 10 kW. Their contributions to this session and also their status reports gave evidence of a trend to make contributions mainly on instrumentation.

ii) The Source(s) under Construction SNS: It is designed for higher average beam power (above 100 kW). Very special technical problems have to be solved at this stage; they are down to the basic level of "nuts and bolts".

iii) The Sources in the Design Stage SIN, SNQ: They have the ambition to deal with a high average beam power (beyond 1 MW). These projects are at the level of Mock-up experiments and technical design.

A particularly interesting result was reported by K. Inoue. Grooved cold moderators have given a 2.0 to 2.5 times higher neutron current in the 1 to 10 meV energy region than a corresponding flat moderator. Similar effects for thermal neutrons have been presented at previous meetings. Time-dependent measurements showed that the higher flux is mainly due to an increase of pulse width rather than to increased pulse height. These results have revived the discussions on Grooved moderators.

This example shows how the design of high power sources may still be influenced by basic data provided by the established sources. Decisions on large D_2-sources for the "modulated" SNQ and the "continuous" SIN-facilities should possibly be reconsidered in view of these results.

Evidence of the impressive progress of SNS has been presented by A. Carne and his colleagues. The engineering and build-up of the shielding, as well as the peripheral equipment such as control system, remote handling, drainage- and ventilating-systems, and described by B. Poulten, cover at this stage a considerable part of their activity. What could we learn from their presentations? My own (obviously biased) conclusions are the following:

1) At a rather late stage in the project, new technical insight may be obtained, demanding a high flexibility, even during the realisation phase. The SNS uranium target is an example: The cooling mechanism turned out to be more efficient than expected. Hence, thicker target plates may be used which leads to a higher target efficiency.

2) Components have to be built in spite of incertainties about some basic physical parameters. This became evident in the presentation on "Cold Moderator Design" by B. Diplock. Lack of precise knowledge of e.g. energy deposition by neutrons and gamma rays can become quite embarrassing: this even more so since the walls of cold moderators are "neither flat nor massless"!

There were several reports from the project groups of future high power sources. It seems that at the power level of several megawatts a stationary target is no longer practical. At SIN, a liquid metal target, using natural convection as cooling mechanism, has been chosen. In the paper by Y. Takeda (presented by Ch. Tschalär), results of calculations in thermo-fluid dynamics gave evidence of the feasibility of the concept. Further investigations are still necessary to establish the reconciliation of neutronic and thermo-fluid dynamic requirements. With this target concept, investigations concerning the (stationary) beam window need special care. Therefore, irradiation tests of window material at a realistic beam power density are prepared at LAMPF. The target concept of SNQ for a beam power of 5 MW is a rotating wheel. Further details about the design was presented by J. Stelzer. Water cooled Pb-rods encased in $AlMg_3$ lead to a solution with mechanical stresses well below conventional limits. An advantage of this concept is the "moving window"; for a 5 MW beam power probably a necessity. On the neutronic side, flux distributions for thermal neutrons in a D_2O tank have been measured by the KFA/SIN-collaboration for a Pb-target, with and without a Be-sleeve. The results indicate that there is practically no gain in source strength from the (n,2n) reactions in the beryllium. This is in contradiction to theoretical calculations using the experimental neutron spectrum from a bare target.

From the contents of this session, we may draw the following conclusions:

i) The running sources do not suffer too much from the absence of basic physical data - they run! They could, however, still provide this kind of data for the projects in the design stage.

ii) SNS has to go ahead with construction, in spite of uncertainties - an embarrassing situation, which presumably cannot be escaped by any project in the realisation phase.

iii) The high power sources may still adjust their final design to new data.

From these conclusions we send a message to the running sources: Please continue to deliver basic technical and physical data in order to support the design of the future sources.