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Session A3: Beam Quality

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Sessions A1 and A 2 covered problems in the production of fast neutrons in spallation targets. Session A3 is concerned with the conversion of that primary spectrum to a neutron distribution suitable for scattering experiments. Aspects of proposed target-moderator-reflector decoupler assemblies were discussed, together with the measurement of the fast spectrum from the moderator and its relation to background problems. Recent scattering data from the new KENS facility were also presented by Watanabe.

Conrad and Drüke presented data from the SNQ study, taken at SATURNE and SIN. Time-of-flight measurements by Conrad at SATURNE showed a lead reflector to be marginally superior to a beryllium reflector for both uranium and lead targets. The lead reflector aslo produced a better time structure. The gain from grooving the moderator surface was confirmed and a softening in the spectral distribution observed. Using the continuous source of SIN, Drüke measured neutron distributions in a D_2O moderator for a variety of quasicontinuous spallation source configurations.

Russell and Taylor presented data from moderator, moderator poison studies and reflector optimizations done at the WNR. Taylor showed how Monte Carlo codes have been used to chose likely reflector materials and to examine their optimum yield and time structure. Carpenter outlined the target-moderator reflector assembly installed in IPNS-I; the core of the beryllium reflector is cooled to 100 K and all four moderators are cryogenic (two liquid methane, two liquid hydrogen). Cooling the beryllium suppresses upscattering thus reducing the dwell time in the reflector. This allows a decoupling energy as low as 0.1 eV (eg. gadolinium) to be employed.

Hino presented fast neutron measurements from moderators obtained by the FERDOR unfolding method. This method shows a significant imporvement over previous techniques and he concludes that, particularly in slab

geometry, an intense high energy componet exists.

Golub gave a new analytic approach to pulsed moderator problems, based on the diffusion approximation but treating collisions with hydrogen exactly. Although only applicable to simplified problems, this approach provides much more insight than the Monte Carlo techniques.

There is now a wealth of experimental data from working spallation sources (KENS, WNR, ZING-P') as well as the SNQ mock ups at SIN, CERN, and SATURNE. From such practical experience, a better understanding of many aspects of 'beam quality' have emerged. As an example, figure 1 illustrates the relative intensities of the fast component of the spectrum for slab and wing geometries. The three orders of magnitude increase in fast neutron background from slab geometry therefore greatly outweigh the 2-3 gain in epithermal flux.

At ICANS-IV it was believed that no new target-moderator reflector-development designs would emerge; factors of 2 were no longer in dispute, only factors of 20 percent. In this session, new concepts, resulting mainly from the impetus given by the SNQ study, have been presented and 'factors of 2' are being discussed again.

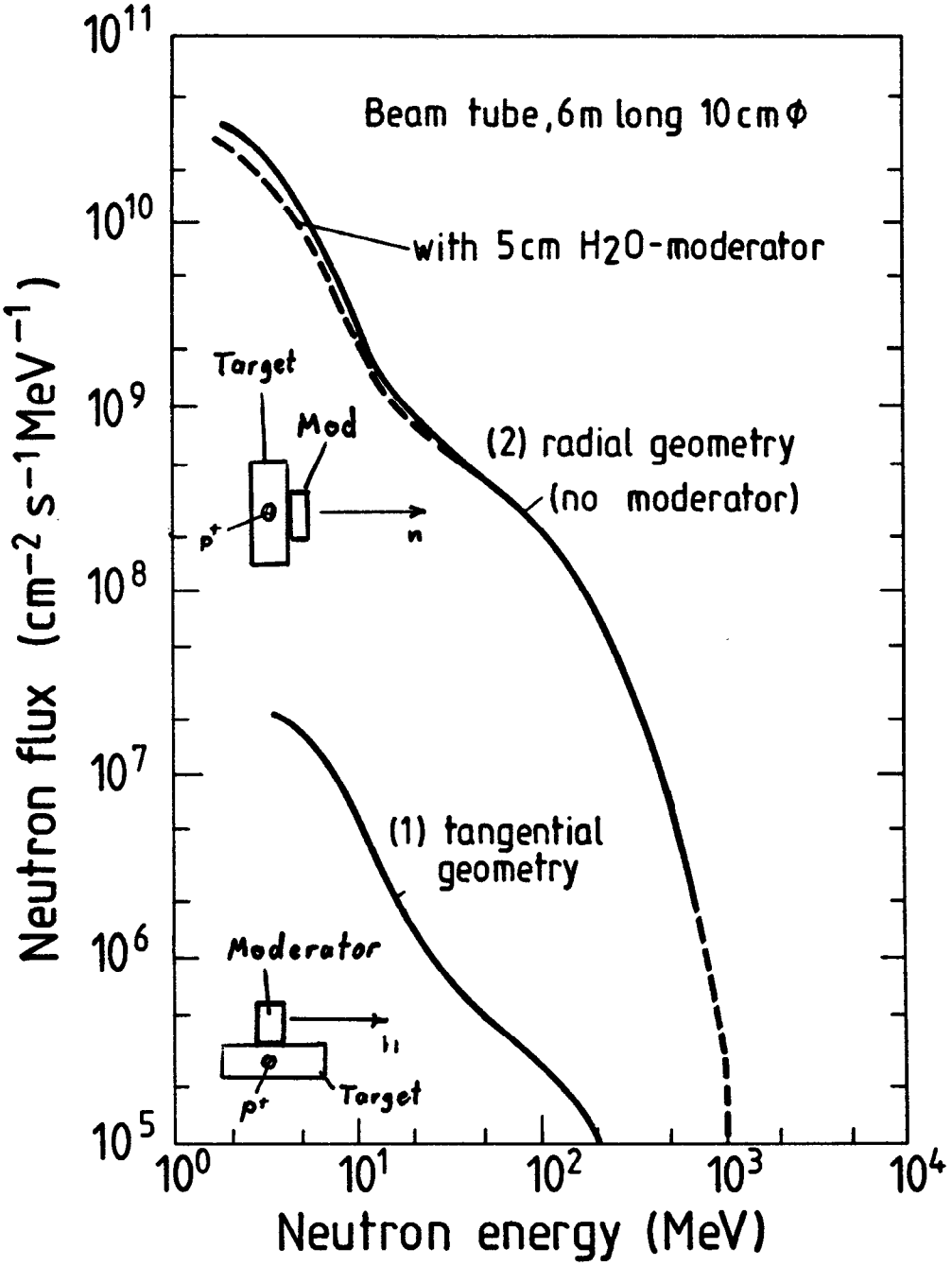

Figure 1 Fast Neutron flux from a slab (radial geometry) and wing (tangential geometry) moderators. (From the SNQ study)