Summary of contribution to the ICANS-X panel discussion

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My role on this panel is to represent that group of users who wish to measure $S(\vec{Q}, \omega)$ at specified, pre-selected values of $\vec{Q}$ and ω. Until now this kind of measurement has always been reasonably easy to do with a triple axis crystal spectrometer (TACS) at a continuous source of neutrons, and rather more difficult to do with a time-of-flight (TOF) machine at a pulsed source. Only those physicists who were extraordinarily hard-working and persistent managed to get any useful specific $s(Q, \omega)$ data, using TOF methods. The lazy physicist (like me) simply emigrated to a place where triple axis spectrometers were located, or where he could build new ones. Well over 90% of all specific (Q, ω) research has been done the easy way during the past 30 years. Human nature being what it is, I suspect there will continue to be a group of physicists who want the spectrometer to do all the work for them, requiring little or no advance planning and presenting them with results that can be fully comprehended with essentially no data analysis. They can then devote all their attention to the physics of the problem at hand. This is the essence of the TACS: Long Live Bert Brockhouse!

It has not so far been feasible to use a conventional TACS at a pulsed neutron source because there is insufficient time-averaged intensity. The pulsed source user is obliged to use TOF methods, so naturally there has been much effort devoted to making it possible to do specific (Q, ω) measurements with a TOF spectrometer. One of the better examples along these lines is right here at Los Alamos–the Constant Q Spectrometer; PRISMA at ISIS is another excellent example. There are, however, significant limitations to the flexibility of these instruments, which I do not have space to discuss here. It seems likely that they will not be capable of supplanting the conventional TACS for a substantial body of fundamental research work. (Anyone who wants more details is welcome to contact me.)

I wonder whether it might be worthwhile, just for fun, to put a TACS at a spare beam port at LANSCE? Is the TACS that John Yarnell used to use at the Omega West reactor still available? One recalls the truly superb work he did, for example, on phonons in diamond. The only modification to a conventional TACS that would be nice to have would be a computer-controlled gating system for allowing the single detector to accept neutrons only for a suitably chosen 100-μs period, at a time after the machine pulse that would only allow the incident and then the scattered neutrons, at their calculated speeds, to travel the known distance from the source to the detector. This way one could easily suppress most of the background noise and all the order contamination problems, which can be quite a nuisance to TACS users at steady state neutron sources. Of course, for optimum results one should really use a different pulse structure at the spallation source: broad pulses (~200 to 300 μsec) at 50 to 100 Hz would be good enough for order elimination and background reduction, and would permit much better thermalization of the fast neutrons in the target. The time-averaged flux could be 20 times better than it is for a target-moderator system designed for sharp pulses. Is it too late now to redesign the Swiss SINQ so as to produce a suitable broad-pulse time structure without sacrificing any time-averaged intensity? This would surely make it a much better neutron source for TACS users! Is anyone prepared to give this idea a try?