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First ToF Backscattering at Spallation Sources

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The neutron backscattering technique first entered into my consciousness when I was attending a conference on hydrogen in metals in 1972 in Jülich. One of the names in hydrogen in metals at the time was Georg Alefeld and his brother Bert Alefeld was also attending the conference. I asked him about his backscattering spectrometer and we headed off in his VW Beetle to the Dido Reactor on the Jülich site and I saw for the first time the large silicon analyser he had set up on his spectrometer where he had measured hyperfine splitting in vanadium oxide. At that time I was completing my PhD on a 5 MW reactor at Aldermaston where I had built a rotating crystal spectrometer. Its resolution was of the order of 100 microelectronvolts and itself represented an improvement in resolution over what was available on ToF machines. I was impressed to find that there was a machine with a resolution 100 times better. A few years later having worked on the rotating crystal spectrometer at Ispra as an EU post doc I returned to the UK where plans to build what was later renamed as the ISIS spallation source were being put together. Discussions on the instrument suite for ISIS had not yet started and I was posted to the ILL in Grenoble as the UK link person. It was there that I received a telex one day from George Stirling asking me to provide an outline design for a high resolution spectrometer to be built on ISIS. I discussed this request with Julia Higgins and Reinhard Scherm who were in those days in the ILL's ToF group, and Reinhardt simply said why not put IN10 on the end of a long neutron guide. I had been thinking of a direct geometry time of flight machine but this idea was appealing and I began working on a design which ultimately resulted in the construction of the IRIS backscattering spectrometer at ISIS.

At that time the political wisdom was that spallation sources were for thermal and epithermal neutrons whereas reactors were for cold neutrons. The intensity of cold neutrons on ISIS could not compete. But was I supposed to spend 10 years of my life building an instrument that would be a pale imitation of IN5 and IN10. Accordingly I did everything that I could to enhance the delivery of cold neutrons to my instrument. That meant asking for a bulky liquid hydrogen moderator coupled to the reflector and a large area neutron guide. It was, along with HRPD, the first neutron guide to be installed on a spallation source. It caused the ISIS target station engineers sleepless nights. They were worried about the fast neutrons streaming out of this hole in the target station. It proved not to be the case and the neutron beam at the IRIS sample position could be stopped with half a millimeter of cadmium. However in order to arrive at an instrument that was competitive with the Instruments that were available at ILL a large number of challenges presented themselves, the gamma sensitivity of the detector, the thermal diffuse scattering coming from the graphite analyser and a number of other things. On reflection if these problems had been identified in advance it might well have been that the instrument would never even have been started. Fortunately this was not the situation and I will tell that story from a personal viewpoint at this 50th anniversary meeting.

Author: Dr CARLILE, Colin (Uppsala University)

Presenter: Dr CARLILE, Colin (Uppsala University)

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