Goodbye Malvern and The Lees

Bernard became SO in January 1950 and SSO in January 1951, which was to become his last promotion until 1960.

Lost in the detail of work is the birth of his first child, David, in February 1950. At this time they had moved into 2 Michael Crescent, and then in August 1950 a move on to Marchwood.

The work of the next few years seems to focus on waveguide systems used for the injector systems of accelerators.

The exact timeline of research over the next few years to 1953 is hazy. Undated, about this time, is "Waveguides for linear accelerators with laminated dialectric loading Part II Experimental", Harvie and Mullett. This appears to relate to the work regarding dialectric discs above. There is one reference to Mullett and Loach 1948.

Bernard has described his work in 1951 for his 1952 report as follows:

> *In control of a section working on the design and development of linear magnetron amplifiers for use with linear accelerators. Responsible for some theoretical work on the performance of these amplifiers and also for the design of suitable loaded waveguides, particularly of the slotted plate type. The possibility of the use of guides having negative phase velocities was also investigated both theoretically and practically.*
>
> *Publications include AERE 918, and "Practical aspects of feedback applied to linear acclerators "(to be published in Journal of IEE??) and joint originator of patent application no 29167/51"improvements in or relating to loaded waveguides*"

The first mention of corrugated rectangular waveguides was published in "Some properties of corrugated rectangular waveguides", Dain, 1951, R765. Photo 8995 dated November 1950 shows these?

There is an interesting catalogue produced by Hilger & Watts Ltd, dated 1951, showing their range of waveguide components. They are all cross referenced to those of TRE specifications. Included is a reference to the so called TRE "waveguide bench" system used for testing.

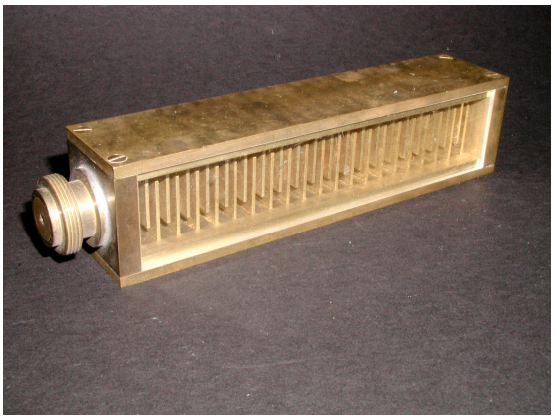
In 1951 various courses were being attended one more, including one on the theory of travelling wave magnetron amplifiers, and also rectangular waveguides.

In December 1951 the patent for “Improvements in or relating to loaded waveguides” was filed by Mullett, Loach and Adams, of “MOS, Shell Mex House, Strand, London”, but this matter will continue to be rolling on until well into the late 50’s before conclusion!

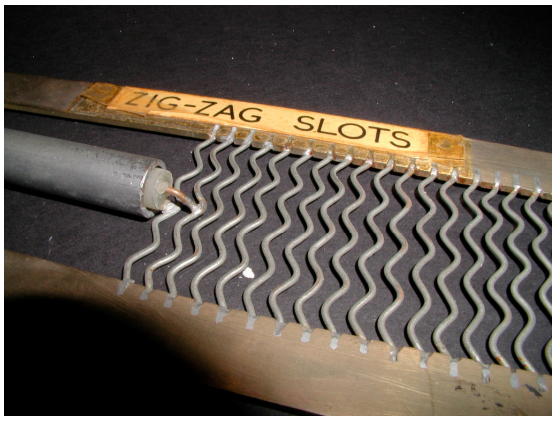
J Brentnall and Miss D S Simmons assisted with work at this time. There are references to “Construction and RF performance of a Rectangular Corrugated Guide Anode Block for a linear magnetron amplifier”, Loach and Dunn, which was to be published (was it?). Also “Approximate theory for a ridge loaded slotted plate waveguide”, Loach, to be published. The manuscript exists for this but not sure if it was published, - not listed in his personal list.

The next significant publication is “Waveguide systems with negative phase velocities”, Mullett and Loach, 1952, R918. There seems to be some interleaving of dates with various work here. This report appears in Nature June 14 1952. This makes the first mention of Adams, and the UK patent application for loaded waveguides. The references suggest the article was published in Nature before the report appeared anywhere else!

There is reference to the report “Measurements on waveguides with slotted plate loading”, Loach and Dunn, R974. This exists in the archive only as manuscript. This relates to work on a travelling wave linear magnetron amplifier. Corrugated waveguides are being tried out, rather like the artefact with the glass side? Also slotted plates. Zigzag plates (see artefacts). There are interesting details of how to construct such things. Perturbation is mentioned for the first time.



Dummy load with baffles?



Experimental ways to feed zigzags

In Nov 52 is published “A travelling wave magnetron amplifier operating in the cyclotron mode”, Dunn, AERE M166. Restricted at publication but unclassified in 1957. This work was to produce higher power for larger accelerators. A very mathematical concept. The author thanks the help of Clay, Harvie, Dain, Loach and Mullett.

In December 1952 the patent filed in 1951 surfaces again, maybe a repeat filing for reasons unknown?

There are some more photos dated for this time. One dated April 1952, shows an exhibit of this work so far, including loaded waveguides, and the accelerator downgraded to 3.5 MeV! Many of the artefacts are shown. Pictures of the accelerator look different, with more shielding. The caption on the stand says this is now at Harwell. This exhibit may be that mentioned in the personal file as the Physical Society exhibit.

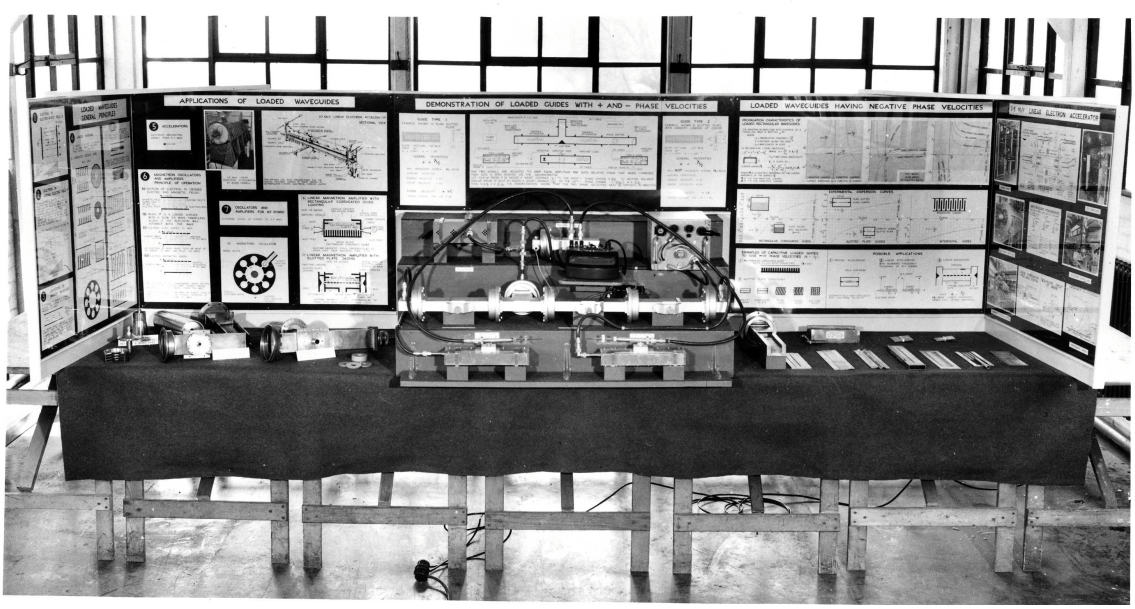


Exhibit for Physical Society Visit

The 4 MeV accelerator moved to Harwell?

Bernard describes the next years work 52-53, presumably for the 1953 personal report, thus:

Theoretical work on loaded waveguide structures for use with linear magnetrons (particularly the propagation characteristics of an assymetrical double rectangular corrugated waveguide.

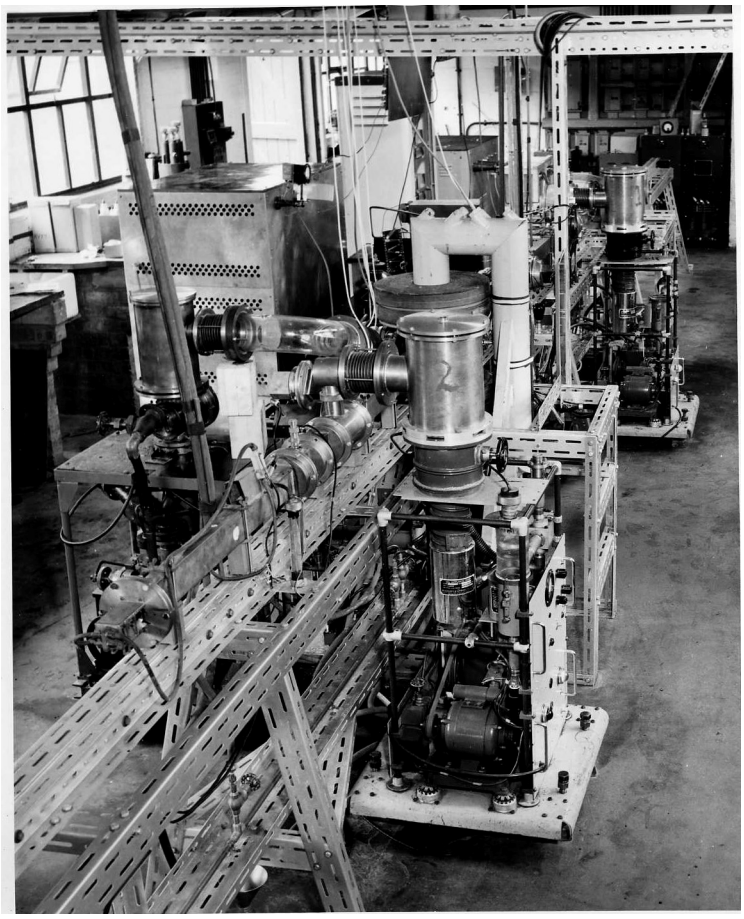
Partly responsible for the design and manufacture of equipment for testing the performance of a cyclotron mode linear magnetron amplifier.

Planning and interpretation of a large scale series of experiments to determine the propagation characteristics of slotted plate loaded waveguides.

Organisation of an exhibit on Negative Phase Velocity waveguides for the 1952 Physical society exhibit.

Publications quoted include 918 and 974.

One photo dated 1953, shows lots of dexion, waveguides and magnetrons. This is probably the above work?



Experimental work at The Lees

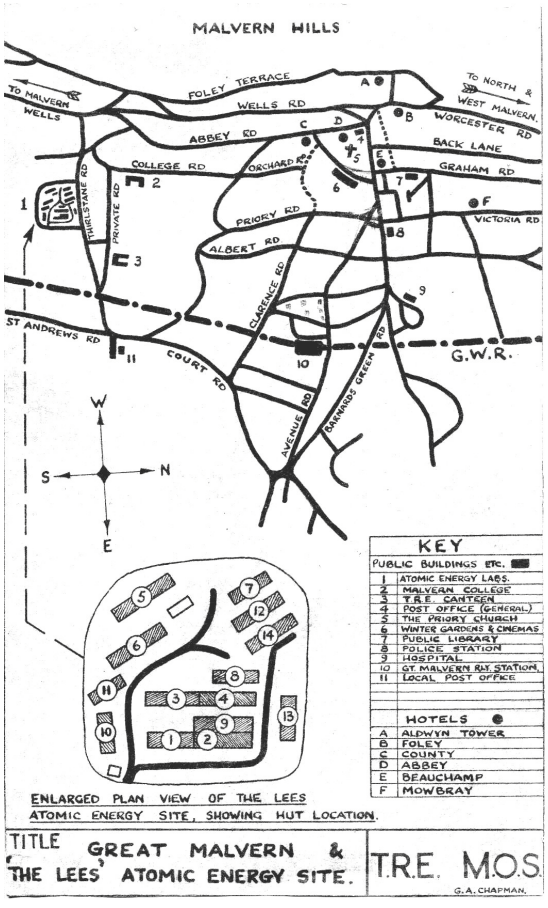
The idea of the Proton Linear Accelerator (PLA) is starting to appear. Report AERE M151, "Design study for a 600 MeV PLA, resume of progress up to January 1953 and the future programme", Mullett, April 1953. Loach is acknowledged in 2 publications, 918 and 974.

There is a report on a "Linear accelerator with a dialectric loaded waveguide", Hadden, July 1953, R1161.

"A review of experiments with a linear magnetron amplifier", Dain, Craston, Holmes, Weaver, R1227, August 1953, has only the usual reference to the Negative phase velocities report. The drawing looks as though it could be that apparatus in the 1953 photo mentioned above(?).

The report "Developments in the magnetron amplifier", Dain, August 1953, R1228, concludes that there is no advantage in the magnetron over the klystron at high powers.??

"A Circular waveguide magic tee and its application to high power microwave transmission" , Kingdon, is published in the Journal of British Inst of Radio Eng, May 1953. There is reference to Mullett and Loach, R391



Plan of The Lees, Accelerator in hut 9?

Another document appears dated July 1953 which may be yet another modification to the filing of the UK patent 29167/51 which has now acquired the number 19610/53. Mullett's name has been dropped from the application.

There is a plan of the layout of the huts at The Lees. Unfortunately they are only numbered, without any reference to their individual purpose. We do know that Bernard was contactable at Hut 3 in 1948 and Hut 12 in 1952. The vacuum system for the first accelerator was moved initially from house 7 to Hut 9.

Harvie wrote a note to Bernard in July 53 suggesting he was leaving. He wanted Bernard to write some notes on his work for him to take with him in case he was asked for opinion for promotions etc in the far future. He said he could recall what people were like personally but not their work!

At this point documentation from The Lees draws to an end.

Final items include a drawing of a 10MeV accelerator, which we assume is the one for the Hammersmith Hospital.

There is a letter marked secret from Harvie, copied to Loach, to Metropolitan Vickers (MV) regarding testing a new magnetron VX9128. Quite why MV seem to be testing a valve from AERE I cannot work out. There is also a data sheet for the VX4061 magnetron marked MOS DLRD(A)/TRE. There is also a broadsheet from MV Ltd for S Band Precision Test Equipment, of unknown date, but may actually be later.

Finally there are some cartoon bits of humour taken from the walls of TRE. One shows a toy shop window of the nuclear age. The other, a Punch cartoon of a complex experiment where all they need is an elastic band. Someone has annotated it "or a rubber ring". I guess this probably refers to the vacuum seal problems of waveguides. Another cartoon is of a weird machine where the inventor is advising the wife

" *It may completely destroy the universe, in which case my will etc is in the box under the bed*"

The conclusion of the Lees is best described by Bernard for his next ACR in 1954:

March 53 – Aug 53

Control of a section working on development of a cyclotron mode linear magnetron amplifier for possible use as a power source for a Proton Linear Acclerator. This includes some related theoretical work.

During the same period work was commenced on the development of high efficiency waveguide structures for the proton linear acclerator. This involved much careful perturbation measurement work (mainly on slotted plate loaded guides) and the planning of an elaborate series of experiments to be carried out by junior colleagues.

Sept 53.

In charge of the transfer of the AERE/TRE laboratories from Malvern to Harwell.

Oct 53 to Feb 54.

Took over responsibility (with a small section) for the design and construction of the first section (1/2 –10MeV) of the 600 MeV PLA.

It is interesting to note here that the copy of the 1952 directory in the artefacts, still has every amendment page kept showing all changes until No 15 in March 53.

During the 50's construction of home made electronics was continuing. In July 1950 he was making the RF receiver and microphone preamp for Rodrigo Puppet system, and also made the large wooden box to house it. More ambitiously, he made the console TV during 1950-51, which was to be used while in Malvern. On their move to Abingdon the fixed tuned Birmingham TV would be no use, so this was donated to his parents at The Laurels.

After only a short time in the flat at Homewood, they moved house to 59 Somers Park Avenue, Malvern Link, and by 1950 to 2 Michaels Crescent, Tanhouse Lane. By October that year they had moved again to Flat 3, Marchwood, Avenue Road. By June 1952 they were at Flat2, The Willows, Orchard Road until leaving for Abingdon.

The Lees Departing, the 5th person along the front row is Effie (Sylvia) Preston.