

Rutherford High Energy Laboratory

The PLA years 1956 -1967



Bernard at PLAY with the PLA

These are still infancy days at RHEL and AERE. There was a restaurant at Harwell just inside the wire, where RHEL staff could get meals. Examples of prices are interesting.

Soup	4d
Roast Beef	11d
Milk puddings	4d
Bread	1/2d per slice

Or you could have lunch with waitress service for 3/6d

If you like going to work and back on time, there is a bus service from Abingdon for 1/7d a day. These bus services ran from all over the local area, there must have been 20 different buses and routes.

In 1956 the report “Vacuum equipment for the 4 MeV Linear electron accelerator”, written by Bernard in 1949, is published! Only 7 years later! It is noted that this is generally available for sale.

There is an interesting exchange of correspondence with RCA America concerning the suitability and supply of large power triodes delivering megawatt powers in the range 100-200 Mhz , for use in the PLA. RCA refer to their experiences of use in American UHF TV transmitters etc. Letters were exchanged in summer 1956.

It is not clear what was being built and when but it seems that by June 1957 the PLA had been run but although no beam was produced until 1958, an extension was proposed, see report “A proposed extension to the 50 MeV PLA”, in manuscript dated June 1957, Loach, published?.

Meanwhile a pile of photos is our only evidence of progress:

- MOW photos February 1954 show groundwork starting.
- In March a basement tunnel is appearing.
- By January 1955 the tunnel area is roofed inside a large skeletal building.
- By April there is a large pair of blast doors?
- By July the grid is down over the tunnel and the crane in place and its looking ready for occupation of the machine.
- By August the offices look nearly finished.
- The first picture of the PLA (injector?) is dated May 1956. Lots of dexion around the ends.
- There is a photo of another foundation of something starting in May 1958.

There is a set of undated AERE photos overlapping the above but continuing to show the construction of the EHT room and the positioning of the injector? or first tank. And a cubicle of equipment (RF source?)

Also here, three photos from MV Ltd (of?)

Remember the patents? Patent 755843 is filed August 6th 1954 and published Aug 29th 1956! US patent 2840788 , is filed 1952, and is published June 24th 1958!

The following should be read bearing in mind that there were proposals for an extension to the PLA as detailed above, dated 1957.

In May 1958 Bernard produces a document HAG/PLA/1 entitled “50 MeV PLA, Outline description of machine and general data”. No beam yet produced.

There is a list of dates forming a diary of events in late 1958:

- Beam first obtained 10 Nov 1958, 1.5 ma in, 3 microamp out
- Tuned to max, 10 microamp out

- After more adjustment, 2.5 ma in, 14.5 microamp out
- By 18 Nov 1958, 130 microamp out, 515KV on the injector.
- Lots more experiments during December but still 127 microamp by 17th.

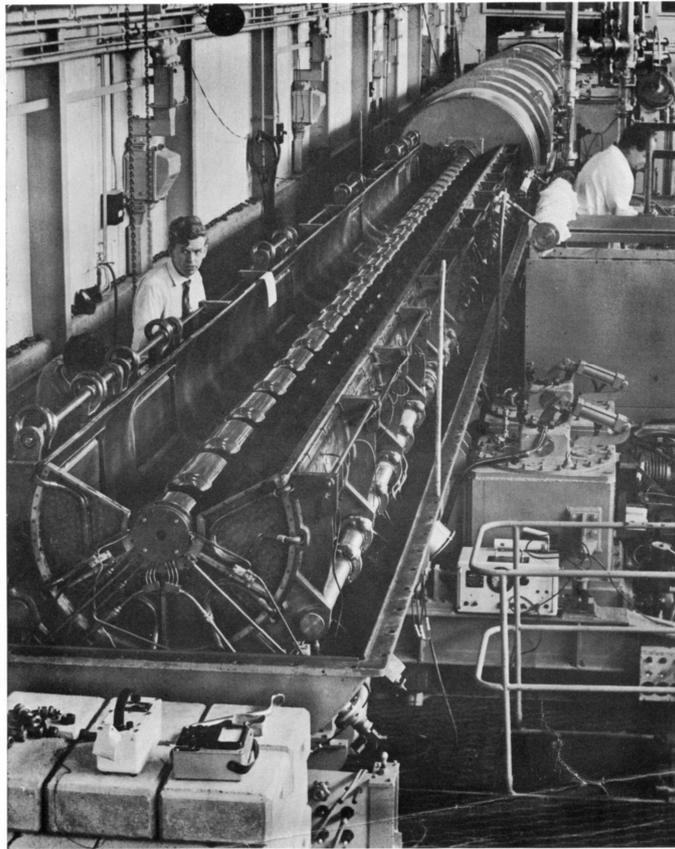
There is a document by Loach, entitled “PLA expected output beam characteristics”, dated April 1959.

There is a photo of an auto radiograph from mylar film, dated 28/2/59, produced by 100 microamp beam current.

Document HAG/PLA/3 , “Measurements carried out on the PLA in the period from 1st January to 10th October 1959 and an account of present and future plans to improve reliability of the machine”, Loach, December 1959. probably covers the work of 1959.

- A 30 MeV beam was first obtained 23rd May. 1959.
- A 50 MeV beam was first obtained 12th July .
- Xrays were found to be high from the Injector area towards the offices and more screening was needed.
- Reliability was still an issue
- Two documents are inserted summarising the measurements on tank 1 of the PLA during 5th August to 17th December 1958, by Batchelor.

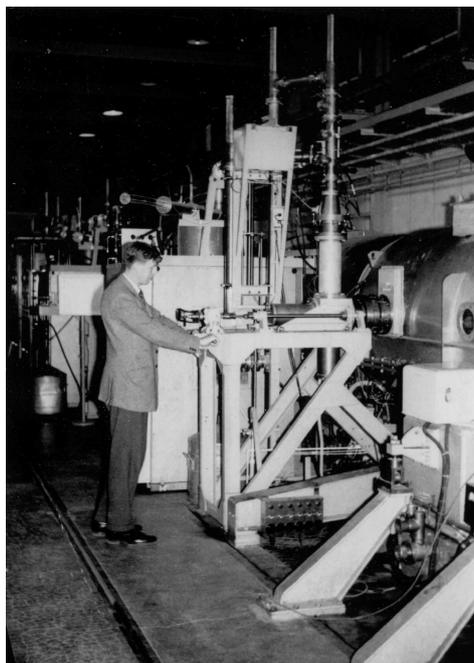
The Times supplement, the “Science Review” for Autumn 1959 reports the first beam on 12th July, with pictures, including one of Bernard peering into the tanks. Another photo shows him operating something looking like a drill (it probably isn't) on the side of the machine.



Science to provide facilities for nuclear physics research which would be available for common use by universities and similar institutions.

A general view of the 50 MeV proton linear accelerator from the output end, with the vacuum and lower lid off the third tank, showing the drift tubes.

Picture used in various press stories



What is he up to? Probably just a pose.

The ACR for 1960 has details as follows:

- Responsibility for setting up the required field law in the quadrupole focussing magnets and checking the optical alignment of the drift tubes.
- Other work included training of operators and the completion of a comprehensive “operators manual”. This is a mammoth binder of a size similar to A3. Marked “Copy 1”, dated January 1960, and appears to be the master copy, with handwritten amendments. I wonder how many there were? This one looks suspiciously unfinished and unpublished.
- A lecture was given to machine users on the theory of the PLA.
- The above publication HAG/PLA/3 is cited for the years work.

At this stage the building is still referred to as number 412 in Harwell. Publications are still cited as Harwell.

There is a Mullard brochure for microwave valves and magnetrons etc, dated January 1960. Also another for English Electric Excitrons undated, but contemporary, and also a catalogue of Evered waveguides and couplers.

There are a couple of Harwell prints undated, showing the PLA target area and wall mounted waveguides.

There is a batch of photos from AEI of some electrical components?

There is a note detailing what may be the PLA output on various dates from February – March 1960. Current rising to 350 microamps on 19 March 1960. “First reading of 13 microamps 10th November 1958”. Another note in the ACR file suggests a list of reasons for it taking 2 years slog to get the PLA working. Alignment, Q, Feed line, Valves and Vacuum were all problem areas.

There is a “staff in confidence” Accelerator Division personnel list dated 7th March 1960. L Mullett is division head. Bernard is shown as an SSO in the Accelerator Physics section. Others at the level include Banford, Batchelor, Gubbins and Warner(SO). There is no indication of grouping in this document.

On April 1st 1960 there was an explosion and fire in the PLA substation. The report on this incident refers to the Operating manual, correctly referring to the right section, thus suggesting it was indeed distributed and used. They decided emergency lighting might be useful! They also decided that the substation wall is not the best place to keep an emergency key!

The PLA was first officially scheduled for a nuclear physics experiment in late April 1960. Stafford's note recording this event suggests he is intending to call the machine "RAMROD". Suggested by J Dickson, Rectilinear Accelerating Machine Reaching Over the Downs. Probably not too serious.

In May Stafford issues a PLA Safety Procedure. Also, a number of documents start to appear concerning radiation hazards relating to the PLA.

Bernard becomes PSO on 1st July 1960.

The Nominal role for August 1st 1960 shows him as one of two PSOs heading the PLA Accelerator Physics group under Dr Stafford. (Along with J Dickson). Pickavance is director of RHEL. Mullett is assistant director.

For the first time NIMROD is mentioned, with its own set of groups.

One document is now referring to building R12 instead of 412. This is 5 years after the RHEL was created.

There is a document from Loach to Mullett, R1, dated September 1960, summarising the dates and problems developing the output of the PLA from 1958 to June 1960. My technical appreciation may be inadequate but I detect, even at this date, the PLA was still something of a disappointment in terms of reaching its planned performance. Did it ever?

A 1961 document infers that the writing was on the wall for the PLA in 1955, when a decision was made to limit the development of the PLA in favour of Nimrod. After all, a machine very similar to the PLA had also been built at CERN meaning this was no longer cutting edge research. In spite of this, another bigger PLA capable of CW operation was being dreamed about, and even had received a name – PLANET (PLA operating Near the Extreme Temperature). This would use super-conducting resonators to overcome power dissipation problems. Report NIRL/R/7, "The Feasibility of a super-conducting Proton Linear Accelerator", Banford and Stafford, refers. In this paper Bernard is acknowledged for information relating to disc loaded travelling waves. Orbit for July 1963 admits this was just a theory and there are no plans to build it yet.

NIRL/R/9 "An accurate determination of the PLA beam energy by a time of flight method", Batty and Warner, 1961, makes use of a reference to Bernard's report HAG/PLA/1.

There are examples of the famous cut away drawings depicting the PLA building and draft manuscript for the pocket sized PLA Handbook edited (and largely produced) by Bernard. This was presented in a small black plastic binder, the format of which was copied for the production of a RHEL site Visitors Handbook.

There is a photo dated October 1961, AERE Harwell HL 5413, showing a large box with Anode, Cathode and Grid metering etc, which looks to be a large RF source with cooling

facilities. The enclosure at the top of the cabinet looks as though it may contain a large electronic valve. The handbook confirms that this is the Grounded grid triode valve trolley for the PLA.

The PLA progress report for 1961, issued annually thereafter, contains a section entitled Quadrupole focussing for tank1, of which Bernard is author, along with DJ Warner.

The 1961 ACR outlines work as follows:

PLA work is described as commissioning improvement and testing, while also responsible for 3 items of documentation. The Operators manual, the PLA Visitors handbook, and the PLA Maintenance manual. Also investigated is the possibility of fitting AG quadruples for focussing in tank 1.

Nimrod appears in the workload for the first time. Coordination work was started for the controls for Nimrod, particularly the RF system. A review was carried out of the main control room layout and space requirements. This had accounted for 25% of the years time.

As this is a point where Nimrod work starts to really take off, this chapter will continue to focus on the finish of the PLA as a separate timeline to closure in 1967, although unfortunately the archives are thin for this remaining time.

The story of Nimrod will be continued under the appropriate chapter to follow, where it may be necessary to rewind time back to here.

In 1962 the PLA continued to claim 90% of time, with continuing responsibility for machine documentation. The main task was the maintenance handbook, editing, part authorship, organising line diagrams, photos, and supervising printing and production. 52 sections were planned, each the size of a bulky magazine. 13 were completed during the year and 18 were still to do. Also the Visitors handbook was completed.

This work is summarised in a chapter in the PLA report for 1962, along with reference to the work on a permanent display showing the PLA facility and its history.

In study of the PLA handbooks it is interesting if not refreshing to see the more or less exclusive use of valves for such high level scientific research. Few semiconductors have yet to appear. He used at least one photo of himself, in volume TK/2. There are drawings by Bernard in volume VC/2.

The 1962 nominal role continues to show him at the top of the group for Accelerator Physics. (PSO).

The ACR for 1963 shows most of the effort continues to produce more maintenance handbooks. 21 are now completed and 12 more are in various stages of production. Also referred to is the work in conjunction with AERE to produce exhibition display cases

showing aspects of theory, construction, performance and use of the PLA. The well known 12 page brochure on the PLA was also prepared.

Several weeks were spent editing the publication by Spinks, "Vacuum techniques" , NIRL/M/31. (Copy in archive) .

The rest of the time was used for continued involvement in the Nimrod controls, detailed in the next chapter.

In April 63 an issue of Orbit recorded the history of the PLA celebrating 3 years of experimental use. While Stafford records the actual history, Bernard writes a chapter on the machine itself.

There is yet another use of the image of Bernard at the PLA, in the reprint of the article from Image.

In May Bernard received a letter from Mullett asking him to serve as secretary to the Applied Physics Committee. He felt this post required someone from senior management. The minutes of the first meeting on 31st May are present. This meeting may have been due to the change of emphasis from PLA to Nimrod and whatever else RHEL was to do in future.

During July Bernard was giving lectures, concerning the PLA, to vacation students. It also appears that he was involved in a similar exercise in 1960 when lectures were being given to PLA staff. The theory covered in this material is highly complex and mathematical.

The 1963 PLA report contains a small contribution from him summarising the work done on documentation during the year. Also mentioned is the wall display and the brochure.

Around this time at home Bernard would have been constructing the microphone preamplifier to improve the performance of his microphone with the home built Truvox tape recorder. Construction of this item in a small cream tin box, carried out on the dining room table, is generally considered to be one of the earliest things I can remember which probably got me hooked on soldering and electronics for the rest of my life.

The 1964 ACR has transferred much of the emphasis to the NIMROD project. However there is mention of completing the outstanding handbooks.

In particular, there is mention of liaison with a film company making an RHEL film. This includes advice on script and film editing (*I recall seeing this film several times and need to trace it, BFI informed, but not able to trace it yet*)

There is a Technical leaflet on the PLA, written by Bernard, with original script present, released in early 1964.

There is a report detailing the PLA documentation project, undated but possibly late 1964. There is also an index.

The final chapter on the PLA starts at this time. Future ACRs show no further mention of PLA work by Bernard. Orbit for 1964 reports use is continuing as usual. The next item is a Rutherford Lab notice No 224, date June 1967, declaring the closure of the PLA, in October 69. The PLA division would cease to exist in October 1967.

RL bulletin 36/69, 13th October 1969 covers the PLA closure ceremony, carried out by Dr Stafford. Bulletin for January 1977 reports on the 25 year PLA party, with photos.



Bernard at the PLA party