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NATIONAL INSTITUTE FOR RESEARCH IN NUCLEAR SCIENCE

GENERAL PURPOSES COMMITTEE

Development of the "parasitic" area at Nimrod

Submitted by T. G. Pickavance

The attached note details a proposal for taking full advantage, in the light of developments since the layout of Nimrod was planned, of the subsidiary experimental area known as the "parasitic area". The so-called "parasitic" type of experiment is no longer of such great importance, but the need for a second, independently-shielded experimental area is greater than ever. The area has the further advantage, for certain types of experiment, of being designed for a thin, dense shielding wall, so that the total distance from the accelerator to the experimental apparatus can be minimised.

The question of additional beam transport equipment must be considered in relation to this area. In the first place, the requirement for two independent experimental areas is so strong that there would be a good case for asking approval for this scheme now even if there were a risk that no more than the first £1 million worth of beam transport equipment would be authorised for some time. Even that first equipment and the experiments linked with it could be more fully used if disposed in two areas rather than in one. However, it has always been made clear that additional beam transport equipment will be needed on a continuing basis, and of course if it is to be fully used the developed parasitic area will require its share of the additional equipment. It is proposed to submit a scheme for this at a later date when further details are available both of this scheme and of the £1 million scheme already approved, but it is thought right to state the approximate cost involved now.

Approval is requested for the extension of the "parasitic area" as a second experimental area at Nimrod. Approval to proceed with the shielding, building extension, crane and services is sought now at a cost estimated at £200,000 including £20,000 contingencies. Approval for beam transport equipment provisionally estimated to cost £334,000 would be sought later. All this expenditure would be within the scope of forecast estimates already submitted.

Rutherford High Energy Laboratory,
Harwell

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Development of Parasitic Area at Nimrod

Note prepared by W. Galbraith

A development of the "parasitic area" at Nimrod is proposed in the light of discussions at the Rutherford Laboratory with members of the Nuclear Equipment Project Committee and with the Nimrod Study Group (Chairman Dr. P. T. Matthews, Imperial College, London). The scheme is endorsed by these groups.

Case for development

In order to use any accelerating machine to the highest efficiency and to quicken the research programme by keeping it as flexible as possible, there is a real need to have, at least, two independent experimental areas well shielded from each other. The advantage of two such areas at Nimrod can be readily seen, since it is clear that one group cannot be setting up an experiment in the main experimental area, while another experiment, requiring the extracted proton beam, is running there.

In addition, it is clear from the considerable interest and enthusiasm shewn by the Universities in using Nimrod facilities that the space available for experimental arrangements in the main area will soon become overcrowded. One can foresee a bottleneck developing in the experimental programmes of the various groups, unless more experimental area is made available early in the life of Nimrod by the end of 1963 or early 1964.

To meet these demands the only space around the machine which would, after a moderate amount of development, give an independent area for full-scale experiments is the parasitic area.

When this area was first planned (1956) it was usual practice at the Bevatron to run more than one experiment on the machine simultaneously. For example, a fraction of the circulating proton beam was used to provide a beam from an internal target for a bubble chamber, while the remainder of the beam struck another target for a second or parasitic experiment.* In a similar manner, at Nimrod the target for the main experiment might be located in the vacuum chamber at a position appropriate to the main experimental area, while the parasitic target would be adjacent to the parasitic area. In the parasitic area one would then have one or more relatively simple beam transport systems to provide beams for experiments, and in addition, have facilities for testing experimental apparatus.

*It is necessary to distinguish this mode of "parasitic" operation from that in which two experiments use the same target, one experiment being a parasite to the other.

Since 1957, however, beam transport techniques have undergone very rapid changes and the original concepts of parasitic experiments have also had to change. With the introduction of particle separators, bubble chamber beams no longer use only a fraction of the circulating proton beam in the machine, and, in general, even for the simpler experiments, the equipment of a beam transport channel has become more complex. In its existing form, the parasitic area is not as useful as it might be, but it can be developed to supply alternate experimental facilities to those which will be available in the main experimental area.

An advantage of this area is that one can get reasonably close to internal targets in the machine. With the addition of suitable shielding, this area could provide particle beams similar to those available in the main area, including beams of the highest intensity slow K-mesons. Because of their great interest in nuclear physics, the slow K meson beams will be in considerable demand at Nimrod.

Nature of Development

To convert the existing parasitic area into a second experimental area of comparable quality to the main area (though much smaller), we require to add shielding at the wall of the magnet hall, and to extend the present building, adding a crane and other services in the extension. We will also ultimately require additional beam handling equipment for this area.

(a) Additional Shielding at Wall of Magnet Hall

The existing shielding wall is not as thick here as in the main experimental area and additional shielding (approximately 10 feet thickness of steel) will be required to give comparable shielding to the main area. Since we are interested in the development of K meson beams, it is particularly advantageous to use material of high density for the shielding wall, in order to get as close as possible to the machine.

(b) Extension of Building

At present the total distance from an internal Nimrod target to the outer wall of the parasitic area is 75 feet, and within the area itself the available space (allowing for additional shielding on the outside of the existing wall) is only 35 feet. This is much too restrictive on experimental arrangements and the extension of the building for a further 70 feet over the existing hard standing is essential if we wish to set up experiments under a permanent roof. The additional area would be approximately 5000 sq. feet.

(c) Installation of Crane

There is no crane in the parasitic area and the lifting facilities there consist of chain and pulley tackle of 2 tons capacity. The extension building should be of an adequate height to permit the installation of a crane with a lifting capacity of 15 tons and a hook height of 25 feet above the ground.

(d) Beam Transport Equipment

The quantity of beam transport equipment for which a budget will be required is based on a limit of three beams into this area, the limit being set by the available holes in the wall of the magnet hall. It is suggested that of these beams, two might be of high purity and of momentum up to 1 GeV/c, and the third an unseparated beam of high momentum particles. A provisional estimate of the budget required for the equipment to set up these beams is given in the estimates below.

(e) D.C. Power Supplies

Present supplies give 4 MW of power for beam transport equipment and 4 MW for bubble chamber magnets. For the future demands of experiments, a further 8 MW is considered a reasonable total power, again approximately half being for beam transport and half for bubble chambers. These power supplies should ultimately be accommodated in a separate power building, and this building will be part of a later submission in connexion with long term development at Nimrod. On the short term view, however, the additional power supplies required for experiments in the parasitic area (about 2.5 MW) could be located in the building itself at the cost of much inconvenience.

Estimates

	£
(a) Shielding for Magnet Hall Wall (including up to 2000 tons steel)	120,000 ?
(b) (i) Building Extension (5000 sq.feet)	35,000
(ii) Crane (15 ton capacity)	10,000
(iii) Services	15,000
(c) Contingencies on (a) and (b)	20,000

Provisional Beam Transport Budget

Power Supplies	75,000
Quadrupoles	96,000
Bending Magnets	63,000
Separators	30,000
H.V. Supplies	20,000
Cabling, cooling etc.	20,000
Vacuum plant	30,000
	<u>£ 334,000</u>

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