

9th May, 1961.

NI/61/9

NATIONAL INSTITUTE FOR RESEARCH IN NUCLEAR SCIENCE

GOVERNING BOARD

4 GeV Electron Synchrotron

Note by T. G. Pickavance

1. At their last meeting, the Board asked for a further review of the estimated cost of the proposed 4 GeV electron synchrotron laboratory. This review has now been carried out, and has led to increases in the estimates of both capital and operating costs, as follows:-

	<u>Estimate in paper NI/61/2</u>	<u>Present estimate</u>
Capital - Machine	<u>£1,000,000</u>	<u>£1,360,000</u>
Capital - Site and buildings	<u>£1,000,000</u>	<u>£1,400,000</u>
	<u>£2,000,000</u>	<u>£2,760,000</u>
Annual cost after completion -		
Capital -	<u>£250,000</u>	<u>£ 330,000</u>
Non-capital	<u>£400,000</u>	<u>£ 800,000</u>
Total	<u>£650,000</u>	<u>£1,130,000</u>

Details of the revised estimate are given in the attached draft amendments.

The review took into account the comments of Dr. J. B. Adams, received after the last Governing Board meeting, a copy of which is attached. It also took account of the latest information and cost estimates from the Hamburg project, as regards the machine and the buildings directly associated with it. Provision, not previously included, has now been made for certain general laboratory buildings such as canteen and library.

The estimates of staff numbers have been reviewed, and increased, and the estimates of recurrent expenditure have been revised on the basis of the staff numbers, and of costs per man at the Rutherford Laboratory.

2. As a result of the review, the following amendments to paper NI/61/2 are proposed:-

Page 4. In Table 1 Machine Parameters

Radius of curvature of magnet sections, for 19 metres read 16 to 18 metres.

Injection Energy for 20 MeV read 40 MeV.

Page 4. Delete Table 2 and substitute:-

Table 2 - Machine Cost Estimates - Page 2.

Table 2 - Machine Cost Estimates

	£
Magnet	400,000
Power supply	400,000
Injector	250,000
R. F. System	130,000
Vacuum system	80,000
Regulation and controls	100,000
	<u>1,360,000</u>

Page 5. Delete Table 3 and substitute:-

Table 3 - Site and Building Cost Estimates

	£
Ground investigation	10,000
Opening up site	100,000
Laboratory and office block, including library and colloquium rooms	280,000
Magnet building	350,000
Generator House	50,000
Experimental halls (including cranes and shielding)	250,000
Ancillary buildings	80,000
Mechanical and electrical site services (including sub-stations)	200,000
Roads, Car park	50,000
Canteen	30,000

Total £ 1, 400,000

Page 5. Para 4.3 Delete the last sentence ("The capital costs £250,000 per annum") and substitute:-

"Provision for a computer has however been included. The capital costs of new research equipment, spares etc., are estimated to level off at £330,000 per annum.

Page 6. (Last words of para 4.4) ~~For~~ "£400,000 per annum" read "£800,000 per annum" .

Page 6. (second line of para 4.5) for "£2,000,000" read "£2,760,000"

Page 6. Delete Table 4 and substitute:-

Table 4

Estimated costs by years, in £1,000's

Year	1961/2	1962/3	1963/4	1964/5	1965/6	1966/7 and subsequently
Recurrent expenses	150	400	700	800	800	800
Capital expenses						
Minor capital items needed for design and development	35	40	50	60	70	80
<u>Machine construction</u>						
Buildings	50	300	500	350	200	0
Plant	25	160	400	500	275	0
<u>Modifications and improvements</u>						
Buildings	-	-	-	-	-	20
Plant	-	-	-	-	-	30
<u>External electron beams</u>						
Buildings						100
Plant						50
						Note 1
Nuclear Research equipment	-	-	50	200	200	200
Computer	-	-	-	-	200	200 Note 2
Hostel and flats for visitors	-	-	25	50	25	0
Total capital	105	500	1025	1160	970	680 Note 3
Grand Total (Recurrent and capital)	255	900	1725	1960	1770	1480 Note 3

NOTE 1 A non-recurring item the total cost of which is estimated at £300,000. Not typical of subsequent years. No doubt, however, there will be other special non-recurring items, for example a computer (Note 2).

NOTE 2 A non-recurring item the total cost of which is estimated at £400,000.

NOTE 3 Not typical of subsequent years because the expenditure on the external electron beam and computer is included. By deducting these, the following estimate of "normal" expenditure in subsequent years is obtained

Total capital	£330,000
Grand total	£ 1,130,000

Page 6 Delete the entries in Table 5 and substitute:-

1961/2	1962/3	1963/4	1964/5	1965/6
15	40	70	80	80

Copy of a letter dated 24th March 1961 from Dr. J.B.Adams to the Secretary.

"I have the following comments on the financial estimates contained in Paper NI/61/2.

The capital cost of the machine is given as £1m. and the building costs as another £1m. From CERN experience the total cost of the machine, including staff and general expenses during construction, will then be £3m. The C.P.S. cost £10m. and is about four times the size of this new machine. A total cost of £3m. for the new machine is therefore quite reasonable.

The total cost of the new laboratory, including the machine, is likely to be twice the machine total cost (again from CERN experience), assuming that the new laboratory is self-contained and receives no assistance from other laboratories. The total laboratory cost includes, apart from the machine, such items as an adequate library, restaurant, lecture hall, liquid gas facilities, computer facilities and experimental equipment, site services, etc. All these are necessary in a self-contained laboratory sooner or later, and at CERN, in 1959, at the time the C.P.S. worked, we had spent an equal amount on such items as we had spent on the machine itself. It can be argued that a smaller machine will demand similar facilities to the C.P.S. and not proportionately less, as I have assumed, but in any case the cost of the whole laboratory is unlikely to be less than twice the total machine cost.

Again from experience, the running cost of the laboratory per annum once the machine is finished, will be about twice the machine capital cost, in this case 2 x £1m. The figure of £0.65m. quoted in the report seems very small therefore.

I am therefore suggesting that the total cost of the whole laboratory should be looked at carefully and that it may be about £6m. The running costs per annum should also be reconsidered, and I suggest that £2m./annum is a likely figure. My suggestions apply to a self-contained laboratory providing complete working facilities for nuclear physics research on the site, but this seems to me to be essential.

Although I could not attend the Board meeting of the 9th March when this matter was on the agenda, I hope that my comments can be made known in some way.

(signed) John Adams."

P.S. The relevant CERN figures are:-

C.P.S. Machine capital	£4m
Building capital.. ..	£3m
Staff and general expenses	£3m
Total ..	£10m
CERN laboratory total cost (up to end 1959)	£20m
Annual budget covering total cost of laboratory ..	£6m

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Circulation to Members of the Governing Board.