

11th September, 1964

NI/64/14

NATIONAL INSTITUTE FOR RESEARCH IN NUCLEAR SCIENCE

GOVERNING BOARD

Forecast Expenditure of the Rutherford Laboratory 1964/65
and comparison with CERN 1964

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Paper NI/63/17 (J. B. Adams and J. M. Cassels) compared the forecast expenditure of the Rutherford Laboratory for 1963/64 with CERN 1963.

At that time the organisation and the financial system of the Rutherford Laboratory were largely determined by the construction of Nimrod, whereas the CERN arrangements were consistent with the major accelerator having been operational for some years. With Nimrod now operating and the experimental programme well under way, the organisation and financial system have been completely changed to meet the new requirements, and hence the information is much easier to abstract and to compare with CERN. The method of financial presentation, as can be seen from the form of the Estimate 1965/66 which includes the Forecast Out-turn 1964/65 from which this comparison is made (Paper NI/64/9), is to a marked extent functional, and the large general headings have been much reduced by allocating expenses to the new Divisions and new functions wherever possible and sensible.

The CERN financial information is derived from the Draft Budget 1964 (CERN/FC/651) which was issued in November 1963, whereas information on personnel is taken from the List of Staff Members, 1st August 1964. The major difficulty still exists in dividing the costs of Nuclear Physics Division between high energy physics on the Proton Synchrotron (CPS) and nuclear physics on the Synchro cyclotron (MSC). However, during the course of the year the Engineering Division has been broken up with most of its personnel and money being allocated to the CPS, and the Divisions of Directorate General, Finance and Administration have been reformed into the Directorate, Finance Division and a new Personnel Division. The cost of Site and Buildings Division is also difficult to allocate to functions. In recent discussions with CERN it emerged that they too are preparing information in a more functional manner, but for some time they will present draft budgets in the existing form so as to retain year by year continuity.

In November or December of this year CERN will issue the Draft Budget for 1965 which will include, as usual, an almost-final statement for 1964. At that time this comparison could be corrected (also with later Rutherford Laboratory information), and a further comparison can be done between the Rutherford Laboratory Estimate 1965/66 and the CERN Draft Budget 1965. For the present, it can only be said that the CERN Budget for 1965 will be about £M10.7 as compared with the Rutherford Laboratory Estimate of £M7.054, and that the figures for comparison will be about £M10.5 and £M6.57 respectively.

TABLE
Functional Comparison
(in units of £1,000)

<u>RUTHERFORD LABORATORY</u>			<u>CERN</u>		
Forecast out-turn 1964/65	Staff Forecast March.65	Breakdown	Budget 1964	Staff August 1964	Notes
3,623	447	<u>Nimrod</u> <u>Proton Synchrotron</u>	4,937	749	
2,097	323	(Operation and Development (Exploitation (Beams, etc.)	2,116	309	1.
576	42	Counter Physics	801	150	2.
679	47	Bubble Chamber Physics	1,264	159	3.
271	35	Theoretical Physics, track analysis equipment and computing	756	131	4.
491	117	<u>Proton Linear</u> <u>Synchro Cyclotron</u> <u>Accelerator</u>	589	122	
349	99	Operation and Development	397	79	5.
112	15	Nuclear Physics	192	43	6.
30	3	Nuclear and Radio Chemistry			
164	41	<u>Other Physics</u>	127	26	7.
45	15	Accelerator Research	127	26	
27	5	High Magnetic Fields			
22	6	V.E. Cyclotron			
70	15	Electrostatic Generator			
458	201	<u>Engineering</u> <u>Site & Buildings</u>	2,203	362	8.
77	36	Design			
370	160	Services			
11	5	Safety			
505	160	<u>Administration</u> <u>Administration</u>			
207	13	<u>Non Divisional</u> Directorate		114	9.
24	4	Staff	1,187	64	
33	9	Radiation Protection		82	
150		Money not allocated			
869		<u>General Lab.expenses</u>			
105		Travel & Subsistence			
699		Standing charges			
150		Research Reactors			
- 85		Deductible receipts			
6,317	989	Laboratory Totals	9,043	1,519	
5,884	925	Comparative Totals	8,843	1,479	10.

Notes on Table

1. Rutherford Laboratory figures are simply for Nimrod Division since it has the staff and money for all these functions. A final capital payment of £150,000 is included for Nimrod Construction. Electricity cost for Nimrod and all the experiments is included at £374,000. The Division probably provides more engineering services to the users than does the CERN CPS Division.

CERN figures are mainly CPS Division, but with allowances for beams equipment from Nuclear Physics Apparatus Division, separators from Accelerator Research Division, and electricity (£210,000) and some buildings from Site and Buildings Division.
2. Rutherford Laboratory figures are for the appropriate part of High Energy Physics Division. Included is £160,000 for University Agreements, and £139,000 of divisional budgets for visiting teams. The number of visitors engaged in counter experiments is about 65 and is rising. CERN figures are for the appropriate proportion of the Nuclear Physics Division, estimated much as in the 1963 comparison. There could be an appreciable error and there is no absolute check. Some allowance is made for design and engineering services supplied by MSC Division. The N.P. Division operates the "electronics" stores. The Division provides facilities for many visitors. Associated with the division (as a whole) are 20 CERN Fellows, 2 Ford visitors, and 108 visitors (31 being in visiting teams).
3. Rutherford Laboratory costs include £410,000 for construction of the heavy liquid and helium bubble chambers and for salaries, overheads and stores and materials for some 30 contract staff at the associated universities. Of the remaining money, about £100,000 represents the total cost of "operating" the National hydrogen bubble chamber at CERN. Although the Saclay hydrogen chamber is extensively supported from Saclay, the Rutherford Laboratory contribution is considerable. The CERN costs include at least £420,000 for construction of the 2m. hydrogen chamber. The CERN heavy liquid chamber is much committed in the neutrino field. There is extensive "provisioning" for 91 visitors of whom 64 belong to the three visiting bubble chamber teams.
4. The Rutherford Laboratory costs are for the appropriate parts of the Applied Physics Division.

The CERN figures incorporate the Data Handling Division and Theoretical Studies Division. The former includes development of track analysis equipment, computing services and a strong scientific information section. There are 116 staff, 2 CERN fellows, 3 Ford fellows and 10 visitors. The budget of the latter division is £65,000 which is almost entirely for staff expenditure. There are 15 Staff, 21 CERN fellows, 10 Ford fellows and 27 visitors.
5. The Rutherford Laboratory and CERN figures are directly comparable. The larger number of Rutherford Laboratory staff to some extent reflects the greater complexity of the proton linear accelerator.
6. The Rutherford Laboratory staff number is low since visiting users predominate. The CERN data is subject to the reservation already expressed in note 2.
7. Apart from the work on producing high magnetic fields the Rutherford Laboratory activities under this heading are not even indirectly associated with Nimrod or the P.L.A.

The CERN figures are for the Accelerator Research Division after extracting certain work relating to the CPS. The work on the

proposal for a very high energy proton synchrotron is now in a New Accelerator Division. This is completely excluded from the table. It is financed from an entirely separate supplementary budget of £316,000.

The whole of the work under this "Other Physics" heading, except for High Magnetic Fields, is deleted from the comparison.

8. The CERN figures are for Site and Buildings Division excluding only the costs of electricity and some new building work relating to the CPS. The costs of other CERN Divisions should be similarly augmented to compare with Rutherford Laboratory Divisions. Of the Building Programme of £925,000 at least £450,000 should be so allotted. The remainder is for general buildings and site work which would fall under the Rutherford Laboratory headings of Engineering and Administration. The remaining categories of Site and Buildings costs would fall under the following Rutherford Laboratory headings :-

Workshops and Machine Tools	- Mainly Engineering Division. Partly physics divisions.
Stores	- Administration and Engineering Divisions.
Services (except electricity)	- General Laboratory Expenses (AERE)
Transport Service	- General Laboratory Expenses (AERE and Administration Division)
Transport "vehicles"	- Administration and user divisions.

Detailed reconciliation would be an extremely lengthy process and subject to considerable error if done without a great deal of help from CERN. The functional data approach which is now being considered by CERN would resolve this problem.

9. The CERN data shows the actual strengths of the re-formed divisions, but only the total of the budgets of the old divisions. Some budget headings and the equivalent methods of accounting at the Rutherford Laboratory are as follows :-

Health Physics and Safety	- Non. Divisional and Engineering Division.
Medical	- General Laboratory Expenses (AERE).
Fellows and Visitors	- Mainly allocated to Divisions as University Agreements.
Director Generals Reserve	- Non. Divisional. Unallocated money.
Budgeting and Accounting	- Administration Division and General Laboratory Expenses (AEA).
Purchasing	- Standing Charges (cost of using AEA Contracts Office).
Personnel and recruitment	- Administration Division.
Cleaning and Security	- Mainly Administration Division.

10. The Rutherford Laboratory totals exclude £433,000 and 64 staff for

Nuclear and Radio Chemistry	}	with appropriate overhead charges in money and staff numbers.
Accelerator research		
V.E. Cyclotron		
Electrostatic Generator		
Research Reactors		

The CERN totals exclude £200,000 and 40 staff for Accelerator Research (including similar allowance for "overheads").

The Staff totals exclude all except permanent and fixed term staff at the Rutherford Laboratory, and staff with contracts of employment at CERN. The other categories of staff are as follows :-

Rutherford Laboratory

42 Part-time staff - "Scanners" for bubble chamber film and Domestic Assistants.

170 Contract staff - Mainly craftsmen and general workers distributed around the divisions and paid for out of divisional budgets.

CERN

264 Supernumerary staff - Staff to support experimental programmes. (Includes "Scanners"). Attributed to General expenditure.

132 Auxilliary staff - Similar to Rutherford Laboratory contract staff. Attributed to Capital expenditure.

69 Fellows

All CERN divisions except Theoretical Studies have staff in the first or second category (or both), and pay out of their divisional budgets. The major users are :-

Site and Buildings Division	137
Track Chamber Division	117
Nuclear Physics Division	49
Nuclear Physics Apparatus Division	28

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COMMENTS RELATING TO THIS AND THE PREVIOUS COMPARISON

1. Operating Costs of Nimrod and the CPS

The operating costs of the two large accelerators are still remarkably similar.

The cost for Nimrod in 1963/64, as extracted from the previous comparison, was £1,120,000, plus electricity cost, plus £1,000,000 of capital cost in Nimrod construction and £500,000 in Beams Equipment. The present figures show reasonable continuity.

There has been only a small increase in staff numbers.

2. High Energy Counter Physics

The cost of counter physics at the Rutherford Laboratory has fallen slightly. The number of research physicists is 18 although the total number of staff shown has fallen due to transfer of engineering support staff to Nimrod Division. The salaries of 23 university "staff" are paid through Experimental Agreements. The comparison with CERN sensibly reflects the less advanced state of using Nimrod.

3. Bubble Chamber Physics

Much of the increase at the Rutherford Laboratory is in capital expenditure on the heavy liquid and helium bubble chamber and the operation of the National chamber at CERN. The cost of using bubble chambers will build up over the next two years, and, unlike CERN, virtually the whole cost of operation and visitor participation will fall to the Rutherford Laboratory. Nevertheless, the reduction of capital costs should result in some overall reduction next year.

4. Theoretical Physics, track analysis equipment and computing

The domestic policy for the Rutherford Laboratory is that these activities shall be on a smaller scale than at CERN. However, there are some deficiencies in track analysis equipment and computing at the Rutherford Laboratory and enormous deficiencies at the university departments engaged in bubble chamber research who should now be largely supported under this heading. Particularly because of this latter requirement there should be substantial increases in subsequent years towards the CERN figure. Direct Grants to universities for track analysis equipment and computing involve £60,000, including salaries for 6 university "staff".

5. Operating costs of the PLA and the MSC

The almost exact equivalence continues although the marginal difference in cost has reversed. The earlier efforts to achieve reliability of the PLA are now reflected in lower operating costs.

6. Research with the PLA and the MSC

The Rutherford Laboratory cost is remarkably low. Contributing factors are that considerable support is provided by the operations group and that basic requirements for equipment, particularly electronics, were provisioned in previous years. The CERN cost seems to be more or less stationary.

7. Administration, Engineering and Site Services

The comparative totals (excluding the cost of Research Reactors) are :-

	<u>Staff</u>	<u>Expenditure</u>
Rutherford Laboratory	374	£1,682,000
CERN	622	£3,390,000

There are known inadequacies in Rutherford Laboratory Administration which must be corrected in future years, and the purchasing of AEA services of all kinds is to the equivalent of some 120 staff.

The CERN data is not strictly comparable because at least £500,000 should be allocated to other divisions. Other factors which contribute to the higher figures are that an international organisation demands more administration than a national laboratory, and that CERN have much more extensive internal manufacturing facilities.

8. Overall conclusion

The comparison is still inadequate in many ways but so far seems not to lead to obvious criticism of the Rutherford Laboratory except perhaps for the expenditure per staff member when salaries

are excluded.

	Average Salary	Expenditure per staff member	
		Including Salaries	Excluding Salaries
Rutherford Laboratory	£1,400	£6,400	£4,950
CERN	£2,000	£5,950	£4,000

However, the CERN supernumerary staff total of 400 is matched by about 220 at the Rutherford Laboratory and an equivalent of about 120 in AEA services. The effective expenditure per man becomes

Rutherford Laboratory	£3,570
CERN	£3,150

The exclusion of grants to universities or the inclusion of the university staff numbers involved would considerably reduce the Rutherford Laboratory figures. However, CERN too have their Fellows and provide much for the visitors. Other material factors are that CERN have considerably greater numbers of inexpensive people, particularly in administration and theoretical physics, they make a greater proportion of equipment within the laboratory and there is some evidence that industrial costs are lower. This last point is at least proveable when the Rutherford Laboratory purchases almost identical equipment from continental firms and the competition has taken into account the import duty of about 15%. CERN also enjoy certain privileges such as freedom from Swiss Federal Tax.

Better explanations await the routine production of more and better analysis from the two laboratories. In the meantime it is only worth saying that the staff at the Rutherford Laboratory are very hard pressed to meet the programme and considerable paid and unpaid overtime is worked.