Title
PARTICLE ACCELERATORS I. BIBLIOGRAPHY II. LIST OF ACCELERATOR INSTABLLATIONS

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Gerald A. Behman

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PARTICLE ACCELERATORS

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ABSTRACT

References to accelerators and accelerator technology in the technical literature from July 1954 through June 1957 are listed in Section I, the bibliography. Most of the references are taken from Nuclear Science Abstracts, Chemical Abstracts, Physics Abstracts, and Electrical Engineering Abstracts.

In Section II, accelerator installations throughout the world are listed together with the types of particles accelerated and the energy and other characteristics of the machines.

PARTICLE ACCELERATORS

I. BIBLIOGRAPHY

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INTRODUCTION

This bibliography supplements the following compilations:

1. E. Thomas, P. Mittelman, and H. H. Goldsmith, Particle Accelerators; Bibliography and List of High-Energy Installations, BNL-L-101 and AECU-31 (July 1, 1948).

2. Bonnie E. Cushman, Bibliography of Particle Accelerators July 1948 to December 1950, UCRL-1238 (March 1951).

3. Sergey Shewchuck, Bibliography of Particle Accelerators January to December 1951, UCRL-1951 (September 1952).

4. F. E. Frost and J. M. Putnam, Particle Accelerators, I. Bibliography. II. List of High-Energy Installations, UCRL-2672 (November 16, 1954).

For this compilation, the literature searched includes Nuclear Science Abstracts, Chemical Abstracts, Physics Abstracts (Science Abstracts A), and Electrical Engineering Abstracts (Science Abstracts B) for the period from July 1954 through June 1957. Also included are certain articles and references not derived from the above abstracts. References are arranged in groups according to the accelerator classification and are arranged alphabetically within the accelerator group by author's surname. An author index listing all authors is provided, and each bibliography entry is numbered to facilitate searching for the work of individual authors with the aid of the author index. Articles by companies, societies, organizations, and institutions are arranged alphabetically by source in the author index.

The abbreviations used here include NSA for Nuclear Science Abstracts, CA for Chemical Abstracts, SA A for Physics Abstracts, and SA B for Electrical Engineering Abstracts. Typical examples of the notation system used in this report to describe entries in these publications are:

UCRL-8050 Notation	Explanation
NSA 8, 3873 (54)	This is Abstract 3873 of Volume 8 of Nuclear Science Abstracts issued in 1954.
CA 48, 9821e (54)	This Abstract is located in Section e of Column 9821 in Volume 48 of Chemical Abstracts for 1954.
SA A57, 6671 (54)	This is Abstract 6671 of Volume 57 of Physics Abstracts (Science Abstracts A) issued in 1954.
SA B57, 6671 (54)	This is Abstract 6671 of Volume 57 of Electrical Engineering Abstracts (Science Abstracts B) issued in 1954.
G. B.	This entry has been noted directly from the literature by the author of this bibliography.

In the preparation of this bibliography every effort has been made to include pertinent publications in the correct categories. Articles of a general nature in the accelerator field are grouped under the heading General. Those articles that discuss more than one type of machine are included in each of the appropriate accelerator groups. Publications that could not readily be classified in any of the aforementioned groups are listed under Miscellaneous.

The author will appreciate notification of duplications, omissions, or other shortcomings in this bibliography.

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PARTICLE ACCELERATORS
II. LIST OF ACCELERATOR INSTALLATIONS

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INTRODUCTION

This list is intended to include data on all accelerators throughout the world and supersedes similar lists by Bonnie E. Cushman in UCRL-1238 (March, 1951), by Sergey Shewchuck in UCRL-1951 (September, 1952), and by Frederick E. Frost and Jane M. Putnam in UCRL-2672 (November, 1954).

Data presented here have been acquired in most instances by direct response to a questionnaire sent by the author to the individual installations or, in the case of some foreign countries, to the scientific attachés of the various embassies. In a few cases, it was necessary to acquire the data indirectly through the technical literature or by reference to manufacturers' data.

Of the 411 questionnaires sent out, 224 went to installations in the United States, while 187 went to other countries. Replies were received from 89% of the installations polled in the United States, and from 74% of the foreign installations. Questionnaires submitted to Argentina, Brazil, Chile, China, Mexico, Rumania, and Turkey were not answered.

A time interval of ten months was arbitrarily set for response to the questionnaire. In some instances, not all of the desired information was furnished on the returned questionnaire; these cases are indicated in the list by n.a. (not available).

For rapid and ready reference, the information is classified, first, according to the type of accelerator and, second, according to the address of the installation. Each accelerator group is grossly separated into those machines located in the United States and those located elsewhere in the world.

The general types of accelerators included are direct-current (dc) machines, induction machines, and resonance accelerators. The dc machines comprise cascade rectifiers (Cockcroft-Walton), electrostatic generators (Van de Graaff), and certain transformer-rectifier combinations. The primary example of an accelerator operating on the principle of induction is the betatron. Resonance accelerators include both traveling- and standing-wave linear accelerators as well as magnetic accelerators of the cyclotron or synchrotron type. In this survey, the category cyclotron includes continuous-wave (CW) and frequency-modulated (FM) machines. The synchrotron group includes proton, electron, and fixed-field alternating-gradient (FFAG) machines.

For the convenience of the reader, the distribution of these machines throughout the world is summarized by type of accelerator and country in Table I. The distribution of types of establishments having accelerators in the United States is analyzed in Table II according to type of machine and primary activity of the organization.

Every effort has been made to avoid duplication or omission of information. The author will appreciate notification of such errors.

Table I

Distribution of Machines, by Type and Country

	D. C. Machines	Induction Machines	Resonance Machines		
				Magnetic Accelerators	
		Betatrons	Linear Accelerators	Cyclotrons	Synchrotrons
United States	133	38	32	38	15
Outside the United States	130	32	25	32	24
Argentina				1	
Australia				2	3
Belgium	7		3	1	
Brazil		1			
Canada	8	2	1	2	1
Denmark	3			1	
Formosa	1				
France	15	2	4	1	1
Germany	8	4		2	2
Great Britain	26	3	15	8	5
India	2				
Iran	1				
Israel	1			1	
Italy	5	2			1
Japan	17	11	1	5	6
Mexico	1				
Netherlands	5			1	1

Table I (cont.)

Distribution of Machines, by Type and Country

	D. C. Machines	Induction Machines	Resonance Machines		
				Magnetic Accelerators	
		Betatrons	Linear Accelerators	Cyclotrons	Synchrotrons
New Zealand		1			
Norway	6	1			
Poland	1				
Portugal	1				
Spain	2				
Sweden	7	2		3	1
Switzerland	5	2	1		2
Union of South Africa	1			1	
Union of Soviet Socialist Republics	3			2	1
Yugoslavia	4	1		1	

Table II

Distribution of establishments reporting accelerators in the United States according to type of machine and activity

Type of Machine	Type of Establishment					
	Colleges and Universities	Federal Government	Hospitals	Private Firms	Nonprofit Organizations	Total
D. C. Machines	31	11	9	33	4	88
Betatrons	9	7	5	14	0	35
Linear Accelerators	14	1	3	2	1	21
Cyclotrons	20	2	0	1	1	24
Synchrotrons	13	1	0	1	0	15
Total	87	22	17	51	6	183

Note: AEC contractors are classified according to the type of establishment holding the contract.

LIST OF ACCELERATOR INSTALLATIONS

I. Direct Current Machines

In the United States

Location	Type	Dimensions	Particles Accelerated	Energy (Mev)
[1] Argonne Cancer Research Hospital, University of Chicago, Chicago, Ill.	Van de Graaff	7-ft tank length	e	2
[1] Argonne National Laboratory, Lemont, Ill.	Van de Graaff	18-ft accelerating tube	p, d	3.6
	Van de Graaff	9-ft tank length	e	1.0
[1] Arkansas, University, Fayetteville, Ark.	High-voltage rectifier	~10-ft accelerating tube	p, d, α	0.4
[1] Atomics International, Canoga Park, Calif.	Van de Graaff	4-ft accelerating tube	e	1.6

*Under construction

[1]Information obtained from response to questionnaire.

[2]Information from High Voltage Engineering Company, Burlington, Massachusetts.

[3]Information from E. H. Krause, Particle Accelerators, in American Institute of Physics Handbook (McGraw-Hill, New York, 1957), p 8-184 to 8-201.

[4]Information from Allis-Chalmers Company, Milwaukee, Wisconsin.

[5]Information from Varian Associates, Palo Alto, California.

[6]Information from W. K. H. Panofsky, Some Comments on Soviet Physics Based on a Visit of 14-26 May, 1956. Internal Memorandum, High-Energy Physics Laboratory, Stanford University, Stanford, California, May 31, 1956.

[7]E. P. Rosenbaum, Physics in the U.S.S.R., Sci. American 195, No. 2, 29 (1956).

Location	Type	Dimensions	Particles Accelerated	Energy (Mev)
[2]Austenal, Inc., Chicago, Ill	Van de Graaff	n.a.	x-rays	1
[2]Babcock and Wilcox, Lynchburg, Va.	Van de Graaff	n.a.	x-rays	1
[2]Union Carbide and Carbon Corp., Bakelite Division, Bloomfield, N. J.	Van de Graaff	n.a.	e	2
[1]Bartol Research Foundation of the Franklin Institute, Swarthmore, Pa.	Cockcroft-Walton	4-ft accelerating tube	d	0.135
	Van de Graaff	21-ft accelerating tube	p	5.5
	Van de Graaff	6-ft accelerating tube	d	1.7
[2]Baylor University, College of Medicine, Houston, Tex.	Van de Graaff	n.a.	x-rays	2
[1, 2]Bell Telephone Laboratories, New York, N. Y.	Van de Graaff	n.a.	e	1
	*Van de Graaff	n.a.	e	1
[1, 2]Brookhaven National Laboratory, Upton, Long Island, N. Y.	Van de Graaff	8-ft accelerating tube	p, d, He^3, α	4
	Van de Graaff	3-ft accelerating tube	e	2
	Van de Graaff	3-ft accelerating tube	e	2
	Van de Graaff	12-ft accelerating tube	p	4
[1]California Institute of Technology, Pasadena, Calif.	Van de Graaff	2.25-ft accelerating tube	p, d, α, He^3	0.6
	Van de Graaff	8-ft accelerating tube	p, d, α, He^3	1.8
	Van de Graaff	9-ft accelerating tube	p, d, α, He^3	3.0
[2]California Research Corporation, Richmond, Calif.	Van de Graaff	n.a.	e	2

Location	Type	Dimensions	Particles Accelerated	Energy (Mev)
[1]California, University, Radiation Laboratory, Berkeley, Calif.	Cockcroft-Walton	4-ft accelerating tube	p	0.5
	Cockcroft-Walton	4-ft accelerating tube	gaseous ions	0.5
	Van de Graaff	27-ft tank length	p, d, α	4
[1]California, University, Radiation Laboratory, Livermore, Calif.	Van de Graaff	1.7-ft accelerating tube	p, d	1
	Cockcroft-Walton	6-ft accelerating tube	p, d, α	0.5
[1]Carnegie Institution of Washington, Washington, D. C.	Van de Graaff	n.a.	α	7
[2]Chicago Bridge and Iron Company, Birmingham, Ala.	Van de Graaff	n.a.	x-rays	2
	Van de Graaff	n.a.	x-rays	1
[1]Chicago, University, Chicago, Ill.	Cockcroft-Walton	7.5-ft accelerating tube	p, d	0.45
[3]College of Agriculture and Mechanics, Ames, Ia.	Cockcroft-Walton	5-ft accelerating tube	p, d, α	0.3
[1]Columbia University, Pupin Cyclotron Laboratories, New York, N. Y.	Van de Graaff	12-ft accelerating tube	p, d, α	6.5
[1]Connecticut, University, Storrs, Conn.	Cockcroft-Walton	3-ft accelerating tube	positive ions	0.25
[2]Cooper Alloy Corporation, Hillside, N. Y.	Van de Graaff	n.a.	x-rays	1
[2]Cornell University, Ithaca, N. Y.	Van de Graaff	n.a.	e	2
[1]Dow Chemical Company, Midland, Mich.	Van de Graaff	4.6-ft accelerating tube	p, d, e	2
	Van de Graaff	n.a.	e	2

Location	Type	Dimensions	Particles Accelerated	Energy (Mev)
[1]Dow Chemical Company, Western Division, Pittsburg, Calif.	Van de Graaff	n.a.	e	2.5
[1]Duke University, Durham, N. C.	Van de Graaff	25-ft tank length	p, d, α	4
[2]E. I. DuPont de Nemours, Inc., Wilmington, Del.	Van de Graaff	n.a.	e	2
	Van de Graaff	n.a.	e	3
[2]Eugene Talmadge Memorial Hospital, Augusta, Ga.	Van de Graaff	2.7-ft accelerating tube	x-rays	2
[1]Ethicon, Inc., Somerville, N. J.	Van de Graaff	n.a.	e	2.5
[1]Evans Signal Laboratory, Belmar, N. J.	Van de Graaff	n.a.	p, d, e	2
[1]Florida, University, Gainesville, Fla.	Van de Graaff	5-ft accelerating tube	p, d	1
[2]Florida State University, Tallahassee, Fla.	Van de Graaff (tandem)	n.a.	p, α	10
[1]Foster-Wheeler Corporation, Mountaintop, Pa	Van de Graaff	3.7-ft accelerating tube	x-rays	2
[1]General Electric Company, Hanford Laboratories, Richland, Wash.	Van de Graaff	5.3-ft tank length	e	2.0
	Van de Graaff	6.3-ft tank length	p, d	2.0
[1]General Electric Company, Aircraft Nuclear Propulsion Department, Cincinnati, O.	Van de Graaff	3.6-ft accelerating tube	e	2
[1]Arnold Greene, Inc., Cambridge, Mass.	Van de Graaff	n.a.	x-rays	1
[2]Gulf Research and Development Company, Pittsburgh, Pa.	Van de Graaff	n.a.	p, d, α, e	3

Location	Type	Dimensions	Particles Accelerated	Energy (Mev)
[1]Humble Oil and Refining Company, Houston, Tex.	Van de Graaff	3.25-ft accelerating tube	e	2
[1]Iowa State University, Iowa City, Ia.	Cockcroft-Walton	5-ft accelerating tube	p, d, α	0.5
	Van de Graaff	20-ft accelerating tube	p, d, α	4
[2]Johns Hopkins University, Baltimore, Md.	Van de Graaff	6-ft accelerating tube	p, d	3
[1]Kansas, University, Lawrence, Kan.	Van de Graaff	7-ft accelerating tube	p, d	3
[1]Kentucky, University, Lexington, Ky.	Van de Graaff	7.5-ft accelerating tube	p, d	2.2
	Cockcroft-Walton	2-ft accelerating tube	d	0.12
[1]Lemuel Shattuck Hospital for Chronic Diseases, Boston, Mass.	Van de Graaff	n.a.	x-rays	2
[1]Lockheed Aircraft Corporation, Missile Systems Division, Palo Alto, Calif.	Van de Graaff	3.5-ft accelerating tube	p, d, α	3
[1]Los Alamos Scientific Laboratory, Los Alamos, N. Mex.	Cockcroft-Walton	6.3-ft accelerating tube	p, d	0.50
	Cockcroft-Walton	3.3-ft accelerating tube	p, d	0.25
	Van de Graaff	20-ft accelerating tube	p, d, α	8
	Van de Graaff	5-ft accelerating tube	p, d, t, He^3, α	2.5
	Van de Graaff	5-ft accelerating tube	p, d, t, He^3, α	2.5
[2]Los Angeles Tumor Clinic, Los Angeles, Calif.	Van de Graaff	3-ft accelerating tube	x-rays	2

Location	Type	Dimensions	Particles Accelerated	Energy (Mev)
[1]Magnolia Petroleum Company, Dallas, Tex.	Van de Graaff	1.2-ft accelerating tube	p, d	0.5
	Van de Graaff	3-ft accelerating tube	p, d, He^3, α	2
[1]Massachusetts Institute of Technology, Laboratory for Nuclear Science, Cambridge, Mass.	Van de Graaff	18-ft accelerating tube	p, d, α	8.5
	Van de Graaff	9-ft accelerating tube	p, d	4
[2]Massachusetts General Hospital, Boston, Mass.	Van de Graaff	2.7-ft accelerating tube	x-rays	2.0
[2]Mellon Institute, Pittsburgh, Pa.	Van de Graaff	n.a.	e	3
[3]Minnesota, University, Minneapolis, Minn.	Van de Graaff	20-ft accelerating tube	p, d	3.5
[2]Monsanto Chemical Company, Dayton, O.	Van de Graaff	n.a.	e	2
[1, 2]National Bureau of Standards, Washington, D. C.	A-C Rectifier	2.25-ft each section	e	1.4
	Cockcroft-Walton	5-ft accelerating tube	p, d	0.25
	Van de Graaff	n.a.	p, d, α	2
[1]National Institutes of Health, Public Health Service, Bethesda, Md.	Van de Graaff	n.a.	e	2
	Van de Graaff	n.a.	e	2
	Van de Graaff	n.a.	e	3
[1]Nebraska, University, Lincoln, Neb.	Cockcroft-Walton	n.a.	positive ions	0.4
[1]Northwestern University, Evanston, Ill.	Van de Graaff	12-ft accelerating tube	p, α, e	5
[1]Notre Dame, University, Notre Dame, Ind.	Van de Graaff	12-ft accelerating tube	p, d, α, e	4

Location	Type	Dimensions	Particles Accelerated	Energy (Mev)
[1]Oak Ridge National Laboratory, Union Carbide Nuclear Company, Oak Ridge, Tenn.	Cascade	8.5-ft accelerating tube	p, d, α	0.6
	Cockcroft-Walton	3-ft accelerating tube	d	0.25
	Van de Graaff	12-ft accelerating tube	p, d, α	6.3
	Van de Graaff	4.7-ft accelerating tube	p, d	3
	Van de Graaff	2.7-ft accelerating tube	x-rays	2.0
[1]Pennsylvania, University, Philadelphia, Pa.	Van de Graaff	12-ft accelerating tube	p, d	3
[2]Pondville State Hospital, Wrentham, Mass.	Van de Graaff	n.a.	x-rays	2
[1]Princeton University, Princeton, N. J.	Van de Graaff	n.a.	p, d, α	3
[1]Radio Corporation of America, Princeton, N. J.	Van de Graaff	n.a.	e	1
[1]Redstone Arsenal, Huntsville, Ala.	Van de Graaff	22-ft tank length	p, d	2
[1, 2]Rensselaer Polytechnic Institute, Troy, N. Y.	Cockcroft-Walton	3.5-ft accelerating tube	p, d	0.25
	Van de Graaff	n.a.	p, d	1
[1]Rice Institute, Houston, Tex.	Cockcroft-Walton	2-ft accelerating tube	p, d	0.2
	Van de Graaff	18-ft accelerating tube	p, d, t, He^3, α	6
[1]Sandia Corporation, Albuquerque, N. Mex.	Van de Graaff	n.a.	p, d, e	2
[1]Shell Development Company, Houston, Tex.	Van de Graaff	n.a.	p, d	2

Location	Type	Dimensions	Particles Accelerated	Energy (Mev)
[1]Shell Development Company, Emeryville, Calif.	Van de Graaff	7-ft accelerating tube	e	3
[2]Socony-Vacuum Oil Company, Paulsboro, N. J.	Van de Graaff	n.a.	e	2
[1]Swedish Hospital, Seattle, Wash.	Van de Graaff	4-ft accelerating tube	x-rays, e	2
[1]Stanford Research Institute, Palo Alto, Calif.	Van de Graaff	n.a.	p, d	2
	Resonant Transformer	n.a.	e	1
[2]Texas Oil Company, New York, N. Y.	Van de Graaff	n.a.	p, d, α	3
[2]Texas Nuclear, Austin, Tex.	Van de Graaff	n.a.	p, d, α	2
[1]Texas, University, Austin, Tex.	Van de Graaff	10-ft accelerating tube	p, d, t, α	4
	Full-wave, four-tube rectifier	1.6-ft accelerating tube	d	0.1
[1]University Hospitals, Cleveland, O.	Van de Graaff	6.5-ft tank length	x-rays	2
[1]Upjohn Company, Kalamazoo, Mich.	Van de Graaff	n.a.	e	2
[1]U. S. Air Force, Air Material Command, Wright-Patterson Air Force Base, O.	Van de Graaff	n.a.	p	2
[1]U. S. Army Chemical Center, Chemical and Radiological Laboratory, Army Chemical Center, Md.	Van de Graaff	n.a.	e	0.3
[1, 2]U. S. Army Quartermaster Corps, Natick, Mass.	Van de Graaff	n.a.	p, d, α	1
[1]U. S. Naval Hospital, Bethesda, Md.	Van de Graaff	14-ft tank length	e	2

Location	Type	Dimensions	Particles Accelerated	Energy (Mev)
[1] U. S. Naval Postgraduate School, Monterey, Calif.	Van de Graaff	n.a.	p, d, α, e	2
[1] U. S. Naval Radiological Defense Laboratory, San Francisco, Calif.	Van de Graaff	n.a.	p, d, α, e	2
[1] U. S. Naval Research Laboratory, Washington, D. C.	Cockcroft-Walton	4.5-ft accelerating tube	p, d	0.50
	Cockcroft-Walton	3.3-ft accelerating tube	p, d	0.25
	Van de Graaff	2.5-ft accelerating tube	p, d, He^3, α	2.1
	Van de Graaff	3-ft accelerating tube	e, p	2.0
	Van de Graaff	4-ft accelerating tube	e	2.0
	Van de Graaff	15.5-ft accelerating tube	p, d, He^3, α	6.0
[2] Virginia, University, Charlottesville, Va.	Van de Graaff	3-ft accelerating tube	p, d, α	1.5
[1] Watertown Arsenal, Watertown, Mass.	Van de Graaff	n.a.	p, d	2
[1] Wells Surveys, Inc., Tulsa, Okla.	Van de Graaff	n.a.	p, d	0.65
[1] Westinghouse Electric Corporation, Commerical Atomic Power, Pittsburgh, Pa.	Van de Graaff	6-ft tank length	p, d, e	2
	Van de Graaff	6-ft tank length	p, d, e	2
	Van de Graaff	37-ft tank length	p, d, e	2
	Van de Graaff	22.5-ft tank length	p, d, e	6
[1, 2] Wisconsin, University, Madison, Wis.	Van de Graaff	n.a.	p, d, α	4.5
	Van de Graaff	n.a.	p, d, α	2
	Van de Graaff (tandem)	n.a.	p, α	10

Outside the United States

Location	Type	Dimensions	Particles Accelerated	Energy (Mev)
Australia				
[1]Australian National University, Canberra	Cockcroft-Walton	9-ft accelerating tube	p, d	0.5
	Cockcroft-Walton	14-ft accelerating tube	p, d, α	1.25
[1]Melbourne, University, Victoria	Van de Graaff	10-ft accelerating tube	p, d	1.0
	Van de Graaff	6.5-ft accelerating tube	e	0.7
Belgium				
[1]Centre de Physique Nucleaire, Ecole Royale Militaire, Bruxelles	Cockcroft-Walton	n.a.	p	1.4
[1]Centre de Physique Nucleaire, Louvain	Van de Graaff	3.5-m accelerating tube	p, d	1.8
[1]Institut Interuniversitaire des Sciences Nucleaire, Faculte Polytechnique, Mons	Cockcroft-Walton	6-m accelerating tube	p, d, α	1.3
[1]Laboratoire de Radioactivite et de Physique Nucleaire, Universite de Liège, Liège	Cockcroft-Walton	n.a.	p, d	1
	Van de Graaff	n.a.	p, d	2
	Electrostatic-charge transport by air-blown dust particles.		p, d	0.8
[1]Universite Libre de Bruxelles, Bruxelles	Cockcroft-Walton	n.a.	p, d	0.85
Canada				
[1]Atomic Energy of Canada, Ltd., Chalk River, Ontario	*Van de Graaff (tandem)	Two accelerators end-to-end	p, d, t, α	10
[1]British Columbia, University, Vancouver, B. C.	Van de Graaff	16-ft accelerating tube	p, d, α	2.25

Location	Type	Dimensions	Particles Accelerated	Energy (Mev)
Canada				
[2]Canadian Defense Research Board, Alberta	Van de Graaff	n.a.	p, d, α	2
[2]Canadian Department of Defense Production, Montreal	Van de Graaff	n.a.	e	3
[1]Montreal, University, Montreal	Cockcroft-Walton	4.5-ft tank length	p, d	0.5
[3]National Research Council, Ottawa	Van de Graaff	1.4-ft accelerating tube	e	0.6
	Van de Graaff	9-ft accelerating tube	p	4
[1]Ontario Cancer Institute, Toronto	Van de Graaff	n.a.	p, d, α	3
Denmark				
[1]Copenhagen, University, Copenhagen	Transformer-Rectifier	2.6-m accelerating tube	p, d	1
	Van de Graaff	4.4-m accelerating tube	p, d, α	4
	Van de Graaff	3.0-m accelerating tube	p, d, α	2.2
Formosa				
[2]National Tsing Hua University	Van de Graaff	n.a.	p, d, e	3
France				
[1]Centre d'Études Nucleaires, Grenoble, Isére	Van de Graaff	n.a.	p, e	0.6
	Van de Graaff	n.a.	e	0.6
	*Van de Graaff	n.a.	p, d, α, e	1.4

Location	Type	Dimensions	Particles Accelerated	Energy (Mev)
France				
[1] Centre d'Etudes Nucleaires de Saclay, Saclay	Van de Graaff	3.0-m accelerating tube	p, d	2
	Van de Graaff	7.0-m accelerating tube	p, d, α	5
[2, 3] Ecole Normal Superieure, Paris	Cockcroft-Walton	2.1-m accelerating tube	d	0.6
	Van de Graaff	2.1-m accelerating tube	p, d, e	2
[2] École Polytechnique, Paris	Van de Graaff	n.a.	p, d	2
[3] Institute Interuniversitaire des Sciences Nucleaire, Mons	Cockcroft-Walton	5-m accelerating tube	p, d	1.4
[1] Institute of Nuclear Research, University of Strasbourg, Strasbourg	Cockcroft-Walton	5-m accelerating tube	p, d, α	1.5
	*Van de Graaff	n.a.	p, d, α	6
[1] Laboratoire de Physique Atomique et Moleculaire, College de France, Paris	Van de Graaff	1.6-m accelerating tube	d→n	0.6
	Van de Graaff	1.25-m accelerating tube	d→n	0.15
[3] Laboratoire de Synthese Atomique, Ivry	Cockcroft-Walton	n.a.	d	0.9
[2] Lyons, University, Lyons	Van de Graaff	n.a.	p, d, α, e	2
Germany				
[1] Institut für Kernphysik der Universität Frankfurt am Main	Cockcroft-Walton	n.a.	p, d	1.5

Location	Type	Dimensions	Particles Accelerated	Energy (Mev)
Germany				
[1]Institut für Physik im Max-Planck-Institut für Med. Forschung, Heidelberg	Van de Graaff	3-m accelerating tube	p, d, α, e	1
[2]Institut für Strahlen und Kernphysik, University of Bonn, Bonn	Van de Graaff	n.a.	e	3
[1, 2]Max-Planck-Institut für Chemie, Mainz	*Van de Graaff	3.5-m accelerating tube	p, d, α, e	5
	Cockcroft-Walton	4.25-m accelerating tube	p, d	1.5
[3]Max-Planck-Institute for Physics of the Stratosphere, Hechingen	Van de Graaff	5.5-m accelerating tube	p, d, α, e	1.5
[1]Physikalisches Institut der Universitat Freiberg, Freiberg	Van de Graaff	n.a.	p, d	6
[1]Physical Institute, Free University Berlin-Dahlen	Van de Graaff	2-m accelerating tube	e	1
Great Britain				
[1]Associated Electrical Industries, Ltd., Aldermaston, England	Van de Graaff	9-ft accelerating tube	p, d	3.8
	Van de Graaff	4.5-ft accelerating tube	p, d	0.6
[1]Atomic Energy Research Establishment, Harwell, England	Cockcroft-Walton	n.a.	p, d, t	0.5
	*Van de Graaff (tandem)	14-ft accelerating tube	p, d, O^{16}	10
	Van de Graaff	13-ft accelerating tube	p, d, He^3, α	4.5
	Van de Graaff	4-ft accelerating tube	e	2.25

Location	Type	Dimensions	Particles Accelerated	Energy (Mev)
Great Britain				
[2]British Insulated Callender's Cables, Ltd., London, England	Van de Graaff	n.a.	e	2
[1, 3]Cambridge, University, Cambridge, England	Cockcroft-Walton	12-ft accelerating tube	p, d	1
	Cockcroft-Walton	16-ft accelerating tube	p, α	1.4
[1, 3]Clarendon Laboratory, Oxford University, Oxford, England	Cockcroft-Walton	12-ft accelerating tube	p, d, α	1.1
	Cockcroft-Walton	6-ft accelerating tube	p, d, α	0.5
[1, 3]Edinburgh, University, Edinburgh, Scotland	Cockcroft-Walton	12-ft accelerating tube	p, d, α	1.0
[1]Hammersmith Hospital, London, England	Van de Graaff	7.5-ft accelerating tube	d, e	2.0
[1]Liverpool, University, Mt. Pleasant, Liverpool, England	Cockcroft-Walton	n.a.	p, d	1
[3]London, University, London, England	Van de Graaff	n.a.	e	2
[1]Medical Research Council Radiobiological Research Unit, Harwell, England	Cockcroft-Walton	2-m accelerating tube	p, d	1
[2]National Physical Laboratory, Teddington, England	Van de Graaff	n.a.	x-rays	2
[1]Physical Laboratories, The University, Manchester, England	Van de Graaff	12.7-ft accelerating tube	p, d, t, He^3, α, He^4, ++	6
	Van de Graaff	6-ft accelerating tube	p, d, α	3
[1]Royal Cancer Hospital, London, England	Van de Graaff	4.5-ft accelerating tube	e	2

Location	Type	Accelerator Length	Particles Accelerated	Energy (Mev)
Great Britain				
[1] Hammersmith Hospital, London, England	n.a.	3 m	e	8
[1] Liverpool Radium Institute, Clatterbridge Hospital, Liverpool, England	n.a.	1.5 m	e	4
[1] Metropolitan-Vickers, Manchester, England	Traveling-wave	1 m	e	4
[1] Ministry of Supply, London, England	n.a.	1 m	e	5
[1] Mount Vernon Hospital, Northwood, London, England	Traveling-wave	100 cm	e	3.9
[1] Mullard Research Laboratories, Surrey, England	n.a.	1 m	e	4
[1] Newcastle General Hospital, Newcastle-upon-Tyne, England	Standing-wave	1 m	e	4.3
[1] St. Bartholomew's Hospital, London, England	n.a.	6 m	e	17
[1] Western General Hospital, Edinburgh, Scotland	n.a.	1 m	e	4
Japan				
[1] Central Research Laboratory, Hitachi Ltd., Tokyo	*n.a.	2 m	e	6
Switzerland				
[1] European Council for Nuclear Research, Geneva	*n.a.	n.a.	p	50
Union of Soviet Socialist Republics				
[6] Big Volga Laboratories, Bolshoya Volga	n.a.	n.a.	p	9
[6] Moscow Physical Institute, Moscow	n.a.	n.a.	p	40
[6] Ukrainian Technical Institute, Kharkov	n.a.	n.a.	p	21

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Location	Type	Dimensions	Particles Accelerated	Energy (Mev)
Italy				
[2]Bologna, University, Bologna	Van de Graaff	n.a.	x-rays	2.0
[1]Instituto di Fisica Universita Catania, Catania	Van de Graaff	n.a.	p, d	2.0
[3]CISE Laboratory, Milan	Cockcroft-Walton	1-m accelerating tube	d	0.4
[1]Instituto Superior di Sanita, Rome	Cockcroft-Walton	3-m accelerating tube	p, d	1.0
[2]Pirelli, Milan	Van de Graaff	n.a.	e	2.0
Japan				
[1]Central Research Laboratory, Hitachi, Ltd., Tokyo	Cockcroft-Walton	n.a.	n.a.	0.3
	Van de Graaff	n.a.	n.a.	1.5
[1]Electrotechnical Laboratory, Tokyo	Cockcroft-Walton	n.a.	n.a.	0.8
	Van de Graaff	n.a.	n.a.	3.0
[1, 2]Japan Atomic Energy Research Inst., (Ibaraki Pref.)	Van de Graaff	n.a.	p, d, α, e	2.0
[2]Japanese Chemical and Fiber Association, Osaka	Van de Graaff	n.a.	e	2.0
[1]Konan University, Kobe	Cockcroft-Walton	n.a.	p, d, t, α	0.4
[1]Kyoto University, Kyoto	Cockcroft-Walton	n.a.	p, d	0.6
[1]Kyushu University, Fukuoka	Van de Graaff	9-m tank length	p, d	5.0
[1]Osaka University, Osaka	Cockcroft-Walton	n.a.	p, d	0.6
	Van de Graaff	n.a.	n.a.	2.5

Location	Type	Dimensions	Particles Accelerated	Energy (Mev)
Japan				
[1] Rikkyo University, Tokyo	Cockcroft-Walton	n.a.	n.a.	0.2
[1] Scientific Research Institute, Tokyo	Van de Graaff	n.a.	n.a.	2.0
[1] Tohoku University, Sendai	Van de Graaff	7-m tank length	p, d	2.0
[1] Tokyo Institute of Technology, Tokyo	*Cockcroft-Walton	n.a.	d	0.44
[1] Tokyo Shibaura Electric Company, Ltd., Tokyo	Cockcroft-Walton	n.a.	n.a.	0.15
[1] Tokyo, University, Tokyo	Van de Graaff	n.a.	n.a.	1.6
Mexico				
[2, 3] National University of Mexico, Mexico 20, D. F.	Van de Graaff	4.2-ft accelerating tube	p, d, e	2.0
Netherlands				
[1] Delft Institute of Technology, Delft	Van de Graaff	n.a.	p, d	2.5
[1] Natuurkundig Laboratorium der Rijksuniversiteit, Gröningen	Cockcroft-Walton	3-m accelerating tube	d	0.6
	Cockcroft-Walton	1.6-m accelerating tube	p, d	0.6
[1] State University of Utrecht, Utrecht	Cockcroft-Walton	8-ft accelerating tube	p, d	0.7
	Van de Graaff	n.a.	p, d, α	3.0
Norway				
[1] Fysisk Institutt, Bergen University, Bergen	Van de Graaff	7-m accelerating tube	p, d, α	1.2

Location	Type	Dimensions	Particles Accelerated	Energy (Mev)
Norway				
[1, 3] Municipal Hospital, Bergen	Van de Graaff	n.a.	e	1.5
	Van de Graaff	n.a.	p	1.5
[1, 3] Norges Tehniske Hogskole, Trondheim	Van de Graaff	3.6-m accelerating tube	p, d	4.0
[1] Oslo, University, Blindern	Van de Graaff	3.6-m accelerating tube	p	2.0
	Van de Graaff	1.5-m accelerating tube	p	0.5
Poland				
[1] Danzig, University, Danzig	Van de Graaff	1.1-m accelerating tube	p, d	0.5
Portugal				
[2] Junta de Energia Nuclear, Lisbon	Van de Graaff	n.a.	p, d, e	2.0
Spain				
[1, 2] Junta de Energia Nuclear, Madrid	Cockcroft-Walton	n.a.	p, d	0.6
	Van de Graaff	n.a.	p, d, t, α, e	2.0
Sweden				
[2] A. B. Atomenergi, Stockholm	Van de Graaff	n.a.	p, d, α	3.0
[1] Chalmer's University of Technology Goteborg	Van de Graaff	4-m accelerating tube	p, d, t, α	4.0
[3] Forsvarets Forskningsanstalt, Stockholm	Van de Graaff	2.25-m accelerating tube	p, d, e	5.0
[3] Fysiska Institutionen, Lund	Van de Graaff	4.0-m accelerating tube	p, d	4.0
[1] Nobel Institute for Physics, Stockholm	Cockcroft-Walton	7-m accelerating tube	p, d, α	1.2

Location	Type	Dimensions	Particles Accelerated	Energy (Mev)
Sweden				
[1]Radiophysics Institute, Carolina Hospital, Stockholm	Cockcroft-Walton	3.5-m tank length	e→x-rays	1.2
[1]Uppsala, University, Uppsala	Van de Graaff	1.5-m accelerating tube	e	0.8
Switzerland				
[1]Physikalisches Institut der Eidg. Technischen Hochschule, Zurich	Cockcroft-Walton	n.a.	p, d, α	1.2
	Cockcroft-Walton	n.a.	p	2.0
[1]Physikalisches Institut der Universität Basel, Basel	Cockcroft-Walton	3-m accelerating tube	p, d	1.0
	Cockcroft-Walton	4-m accelerating tube	p, d, α	4.0
[1]Physikalisches Institut der Universität Zürich, Zürich	Van de Graaff	1.2-m accelerating tube	p, d, α	1.7
Union of South Africa				
[1]Diamond Research Laboratory, Johannesburg	Cockcroft-Walton	n.a.	p, d, α, e	2.0
Union of Soviet Socialist Republics				
[3]Physico-Technical Institute, USSR Academy of Sciences, Kharkov	Van de Graaff	n.a.	e	1.0
	Van de Graaff	n.a.	p, d, e	3.0
	Van de Graaff	n.a.	p, d, e, α	5.0
Yugoslavia				
[1]Institute "J. Stefan," Ljubljana	Van de Graaff	1.6-m accelerating tube	p	2.0
[1]Institute of Nuclear Sciences, Belgrade	Cockcroft-Walton	5-m accelerating tube	p, d	1.5
	Cockcroft-Walton	1-m accelerating tube	p, d	0.2
[1]Institute "Rudjer Boskovic," Zagreb	Cockcroft-Walton	n.a.	d	0.2

II. Induction Machines: Betatrons

In the United States

Location	Orbit Radius	Particles Accelerated	Energy (Mev)
[1, 4] Allis-Chalmers, Milwaukee, Wis.	8.20 in.	e	28
[1, 4] Anderson Hospital and Tumor Institute, University of Texas Houston, Tex.	9.5 in.	e	24
[1, 4] Baldwin-Lima-Hamilton Corporation, Lima, O.	8.22 in.	e→x-rays	24
[4] Birdsboro Steel Foundry, Birdsboro, Pa.	7.5 in.	e→x-rays	24
[4] Bonney-Floyd Steel Castings Company, Columbus, O.	7.5 in.	e→x-rays	24
[1] Case Institute of Technology, Cleveland, O.	17.25 cm	e	30
[3] Chicago, University, Chicago, Ill.	33 in.	e	100
[4] Continental Foundry and Machine Company, Coraopolis, Pa.	8.13 in.	e→x-rays	24
[4] Continental Foundry and Machine Company, East Chicago, Ind.	7.5 in.	e→x-rays	24
[1] Detroit Arsenal, Ordnance Corps, Center Line, Mich.	5.5 in.	e	15
[1, 3, 4] Electric Steel Foundry Company, Portland, Oreg.	8 in.	e→x-rays	22
	11.5 in.	e	50
	33 in.	e	100
[1] General Electric Research Laboratory, Schenectady, N. Y.	5.25 in.	e	11.7
[4] General Steel Castings Company, Eddystone, Pa.	7.5 in.	e	24
[4] General Steel Castings Company, Granite City, Ill.	7.5 in.	e	24

Location	Orbit Radius	Particles Accelerated	Energy (Mev)
[1, 4]Illinois, University, Urbana, Ill.	8 in.	e	24
	10 in.	e	80
	46 in.	e	340
[1, 4]Illinois, University, Medical School, Chicago, Ill.	20 in.	e	24
[1]Knolls Atomic Power Laboratory, General Electric Company, Schenectady, N. Y.	33 in.	e	100
[1, 4]Los Alamos Scientific Laboratory, Los Alamos, N. Mex.	19.3 cm	e	24
[1, 4]Madison Radiation Center, Madison, Wis.	8.5 in.	e	24
[1, 4]Memorial Center, New York, N. Y.	20 cm	e	24
[4]Mesta Machine Company, Homestead, Pa.	7.5 in.	e→x-rays	24
[4]Michigan, University, Ann Arbor, Mich.	7.5 in.	e→x-rays	24
[4]Mt. Sinai Hospital, New York, N. Y.	7.5 in.	e→x-rays	24
[3]National Bureau of Standards, Washington, D. C.	115 in.	e	50
[4]Ohio Steel Castings Company, Lima, O.	7.5 in.	e	24
[1, 4]Pennsylvania, University, Philadelphia, Pa.	19.1 cm	e	24
[1, 4]Picatinny Arsenal, Dover, N. J.	8 in.	e	24
[1, 4]Pittsburgh Steel Foundry Corporation, Glassport, Pa.	8.22 in.	e	24
[1, 4]Presbyterian Hospital, New York, N. Y.	7.5 in.	e→x-rays	25
[1]Rensselaer Polytechnic Institute, Troy, N. Y.	11.5 in.	e	31
[3]U. S. Naval Ordnance Laboratory, Silver Spring, Md.	5.2 in.	e	10

Location	Orbit Radius	Particles Accelerated	Energy (Mev)
[1, 4]U. S. Naval Research Laboratory, Washington, D. C.	7.3 in	e	21
[1, 4]U. S. Navy Electronics Laboratory, San Diego, Calif.	8.2 in.	e	26
[1, 4]Washington University, School of Medicine, St. Louis, Mo.	19 cm	e	24
[4]Watervliet Arsenal, Watervliet, N. Y.	7.5 in.	e	24
Outside the United States			
Brazil			
[4]Sao Paulo, University, Sao Paulo	7.5 in.	e	24
Canada			
[1, 4]Ontario Cancer Institute, Toronto	7.5 in.	e, γ	25
[1, 4]Saskatchewan, University, Saskatoon, Saskatchewan	20 cm	e	25
France			
[1]Institute Gustave Roussy, Paris	19 cm	e	22
[4]Ministry of Health, Paris	19 cm	e$\rightarrow\gamma$	24
Germany			
[1]Physikalisches Institut der Technischen Hochschule, Karlsruhe	24 cm	e	31
[1]Siemens-Reiniger-Werke, Erlangen	10 cm	e	15
	21 cm	e	35
[1]Universitat Frankfurt, Frankfurt	21 cm		35

Location	Orbit Radius	Particles Accelerated	Energy (Mev)
Germany			
Universitat Heidelberg, Heidelberg	19.2 cm	e	35
Universitat Würzburg, Würzburg	20 cm	e	35
Great Britain			
[1]Christie Hospital and Holt Radium Institute, Withington, Manchester, England	19 cm	e	20
[1]Metropolitan-Vickers, Manchester, England	20 cm	e	20
Italy			
[1]Clinica Medica, Universita Torino, Turin	26 cm	e	31
[1]Instituto Nazionale di Fisica Nucleare, Universita Torino, Turin	24.5 cm	e	31
Japan			
[1]Central Research Laboratory, Hitachi Ltd., Tokyo	7 cm	e	3.5
	22 cm	e	20
[1]Electrotechnical Laboratory, Tokyo	13.5 cm	e	10
[1]Osaka University, Osaka	8 cm	e	6
	19 cm	e	24
[1]Research Laboratory, Mitsubishi Electric Company, Amagasaki	18 cm	e	30
[1]Shimadzu Seisakusho, Ltd., Kyoto	8 cm	e	6
	12.5 cm	e	15
[1]Tokyo Shibaura Electric Company, Ltd., Mazda Research Laboratory, Kawasaki	10 cm	e	15

Location	Orbit Radius	Particles Accelerated	Energy (Mev)
Japan			
[1] Tokyo University of Education, Tokyo	8.5 cm	e	6
	29 cm	e	30
New Zealand			
[1, 4] Dunedin Hospital, Dunedin, New Zealand	19 cm	e	24
Norway			
[1] Bergen University, Bergen	40 cm	e	47
Sweden			
[1] Royal Institute of Technology, Stockholm	8 cm	e	5
[3] Institutionen for Fysikalisk Kemi, Stockholm	9.5 cm	e	5
Switzerland			
[1] Roentgeninstitut, Inselspital, Bern	25 cm	e	31
[1] Physikalisches Institut der Universitat Zurich, Zurich	30 cm	e	31
Union of Soviet Socialist Republics			
[6] Lebedev Institute, Moscow	n.a.	e	30
[6] Moscow State University, Moscow	n.a.	e	n.a.
[6] Tomsk	n.a.	e	100
[6] Tomsk	n.a.	e	20
Yugoslavia			
[1] Institute "J. Stefan," Ljubljana	25 cm	e	31

III. Resonance Machines

Linear Accelerators

In the United States

Location	Type	Accelerator Length	Particles Accelerated	Energy (Mev)
[1] Argonne Cancer Research Hospital, University of Chicago, Chicago, Ill.	Traveling-wave	16 ft	e	60
[1] Bartol Research Foundation of the Franklin Institute, Swarthmore, Pa.	n.a.	3 ft	e	1.4
[1] Brookhaven National Laboratory, Upton, Long Island, N. Y.	n.a.	110 ft	p	50
[1] Brown University, Providence, R. I.	n.a.	3 ft	p, d	0.2
[1] California, University, Radiation Laboratory, Berkeley, Calif.	Traveling-wave	3.3 ft	e	5
	Traveling-wave	3.3 ft	e	5
	Standing-wave	40 ft	p	32
	Standing-wave	18.2 ft	p	9.8
	Standing-wave	120 ft	heavy ions to Ne^{20}	10 Mev/ nucleon
[1, 5] California, University, Radiation Laboratory, Livermore, Calif.	*Traveling-wave	14 ft	e	16
	Traveling-wave	11 ft	p	3.75
	Traveling-wave	11 ft	d	7.5
	Traveling-wave	11 ft	α	15
[1] California, University, Radiation Laboratory, Site 300, Livermore, Calif.	Traveling-wave	6.7 ft	e	10
[4] Columbia University, New York, N. Y.	n.a.	9.5 ft	e	15

Location	Type	Accelerator Length	Particles Accelerated	Energy (Mev)
[1]Ethicon, Inc., Somerville, N. J.	Traveling-wave	10 ft	e	7
[1]General Atomic, Division of General Dynamics, San Diego, Calif.	*n.a.	12 ft	e	33
[1]Massachusetts Institute of Technology, Laboratory for Nuclear Science, Cambridge, Mass.	n.a.	21 ft	e	17
[1]Michael Reese Hospital, Chicago, Ill.	n.a.	10 ft	e	35
[1]Minnesota, University, Institute of Technology, Minneapolis, Minn.	n.a.	120 ft	p	68
[1]Montana State University, Missoula, Mont.	Traveling-wave	37.8 ft	e	7
[1]Purdue University, Lafayette, Ind.	n.a.	10 ft	e	5.5
	n.a.	2.5 ft	e	1.7
[1]Stanford Hospital, San Francisco, Calif.	Traveling-wave	6 ft	e→x-rays	5
[1]Stanford University, Stanford, Calif.	Traveling-wave	12 ft	e	38
	Traveling-wave	260 ft	e	700
	Traveling-wave	20 ft	e	75
[1]Stanford University, Microwave Laboratory, Stanford, Calif.	Traveling-wave	2 ft	e	6
[1]U. S. Army Ionizing Radiation Center, Lathrop, Calif.	*Traveling-wave	15 ft	e	24
[1]Virginia, University, Charlottesville, Va.	n.a.	1 ft	e	0.75
[1]Yale University, New Haven, Conn.	n.a.	20 ft	e	7
	n.a.	138 ft	heavy ions to A^{40}	10 Mev/ nucleon

Outside the United States

Location	Type	Accelerator Length	Particles Accelerated	Energy (Mev)
Belgium				
[1]Ecole Royale Militaire, Centre de Physique Nucleaire, Brussels	Helix	5 m	p	10
[1]Ghent, University, Ghent	n.a.	2 m	e	4
	*n.a.	n.a.	n.a.	15
Canada				
[1]McGill University, Montreal	*n.a.	10 ft	e	10
France				
[1]Centre d'Etudes Nucleaires de Saclay, Saclay	n.a.	6.30 m	e	28
[1]Centre Anticancereaux, Nancy	n.a.	2 m	e	4
[1]Curie Foundation, Paris	n.a.	3 m	e	4
[1]Paris, University, Laboratoire d' Electronique et de Radioelectricite, Paris	Traveling-wave	1 m	e	2
Great Britain				
[1]Associated Electrical Industries, Ltd., Aldermaston, England	Helix	1 m	p	4
[1]Atomic Energy Research Establishment, Harwell, England	Traveling-wave	6 m	e	15
	*n.a.	100 ft	p	50
	Traveling-wave	6 m	e	28
[1]Christie Hospital and Holt Radium Institute, Manchester, England	n.a.	1 m	e	4

Location	Type	Accelerator Length	Particles Accelerated	Energy (Mev)
Great Britain				
[1]Hammersmith Hospital, London, England	n.a.	3 m	e	8
[1]Liverpool Radium Institute, Clatterbridge Hospital, Liverpool, England	n.a.	1.5 m	e	4
[1]Metropolitan-Vickers, Manchester, England	Traveling-wave	1 m	e	4
	Traveling-wave	1 m	e	4
[1]Ministry of Supply, London, England	n.a.	1 m	e	5
[1]Mount Vernon Hospital, Northwood, London, England	Traveling-wave	100 cm	e	3.9
[1]Mullard Research Laboratories, Surrey, England	n.a.	1 m	e	4
[1]Newcastle General Hospital, Newcastle-upon-Tyne, England	Standing-wave	1 m	e	4.3
[1]St. Bartholomew's Hospital, London, England	n.a.	6 m	e	17
[1]Western General Hospital, Edinburgh, Scotland	n.a.	1 m	e	4
Japan				
[1]Central Research Laboratory, Hitachi Ltd., Tokyo	*n.a.	2 m	e	6
Switzerland				
[1]European Council for Nuclear Research, Geneva	*n.a.	n.a.	p	50
Union of Soviet Socialist Republics				
[6]Big Volga Laboratories, Bolshoya Volga	n.a.	n.a.	p	9
[6]Moscow Physical Institute, Moscow	n.a.	n.a.	p	40
[6]Ukrainian Technical Institute, Kharkov	n.a.	n.a.	p	21

Magnetic Accelerators: Cyclotrons

In the United States

Location	Type	Pole-piece Diameter	Particles Accelerated	Energy (Mev)
[1]Argonne National Laboratory, Lemont, Ill.	CW	62 in.	p	10.8
			d	21.6
			α	43.2
[1]Brookhaven National Laboratory, Upton, Long Island, N. Y.	n.a.	18 in.	p	3
			d	2
	n.a.	60 in.	p	11
			d	22
			α	44
[1]California, University, Radiation Laboratory, Berkeley, Calif.	CW	72 in.	p	10
			d	20
			α	40
	FM	184 in.	p	720
			d	430
			α	880
[1]California, University, Radiation Laboratory, Livermore, Calif.	CW (variable energy)	90 in.	p	14
			d	12
			α	24
[1]Carnegie Institute of Technology, Pittsburgh, Pa.	FM	70.8 in.	p	450
[1]Carnegie Institution of Washington, Washington, D. C.	CW	60 in.	p	8
			d	16
			α	32

Location	Type	Pole-piece Diameter	Particles Accelerated	Energy (Mev)
[1]Chicago, University, Enrico Fermi Institute for Nuclear Studies, Chicago, Ill.	FM	170 in.	p	450
[1]Columbia University, Pupin Cyclotron Laboratory, New York, N. Y.	CW	36 in.	p	15
			d	10
[1]Columbia University, Nevis Cyclotron Laboratories, Irvington-on-Hudson, N. Y.	FM	164 in.	p	400
[1]Harvard University, Cyclotron Laboratory, Cambridge, Mass.	FM	95 in.	p	160
[1]Illinois, University, Urbana, Ill.	n.a.	47 in.	p	6
			d	12
			α	24
[1]Indiana University, Bloomington, Ind.	CW	45 in.	d	11.4
			He^{++}	27.8
[1]Lewis Flight Propulsion Laboratory, National Advisory Committee for Aeronautics, Cleveland, O.	CW	60 in.	d	20
[1]Los Alamos Scientific Laboratory, Los Alamos, N. Mex.	CW (variable energy)	42 in.	p	9
			d	16
			α	32
[1]Massachusetts Institute of Technology, Laboratory for Nuclear Science, Cambridge, Mass.	n.a.	42 in.	p	7.5
			d	15
			α	30
[1]Michigan, University, Ann Arbor, Mich.	CW	42 in.	p, d, α	10
[1]Oak Ridge National Laboratory, Oak Ridge, Tenn.	CW	86 in.	p	25

(continued on page 143)

Location	Type	Pole-piece Diameter	Particles Accelerated	Energy (Mev)
[1]Oak Ridge National Laboratory, Oak Ridge, Tenn.	CW	63 in.	N^{3+}	27
	CW	44 in.	p	5
	CW	48 in.	N^{5+}	80
[1]Oregon State College, Corvallis, Oreg.	CW	37 in.	d	7.5
[1]Pittsburgh, University, Radiation Laboratory, Pittsburgh, Pa.	n.a.	47 in.	p	9.5
			d	19
			α	38
[1]Princeton University, Palmer Physical Laboratory, Princeton, N. J.	FM	35 in.	p	20
[1]Purdue University, Lafayette, Ind.	n.a.	37 in.	d	9.7
			α	19.4
[1]Rochester, University, Rochester, N. Y.	n.a.	27 in.	p	7
			d	4.3
			α	7
	FM	130 in.	p	240
[1]Stanford University, Stanford, Calif.	CW	27 in.	d	2.8
[1]U. S. Naval Research Laboratory, Washington, D. C.	n.a.	6 in.	e	1
	n.a.	6 in.	e	3
	n.a.	6 in.	e	3
	n.a.	6 in.	e	6
[1]Washington University, St. Louis, Mo.	CW	45 in.	p	5.1
			d	10.2
			α	20.4

Location	Type	Pole-piece Diameter	Particles Accelerated	Energy (Mev)
[1] Yale University, Sloane Physics Laboratory, New Haven, Conn.	CW	28 in.	d	4.2
			α	7.6
Outside the United States				
Argentina				
[3] n.a.	FM	n.a.	n.a.	n.a.
Australia				
[1] Australian National University, Canberra	n.a.	30 in.	p	8
[1] Melbourne, University, Melbourne	variable energy	40 in.	p	12.5
			d	6.25
			α	12.5
Belgium				
[1, 3] Centre de Physique Nucleaire, Louvain	CW	94 cm	d	13.35
Canada				
[1] McGill University, Montreal, Quebec	FM	82 in.	p	100
[1] Western Ontario, University, London, Ontario	n.a.	35 cm	e	4.5
Denmark				
[1] Copenhagen, University, Copenhagen	CW	90 cm	p	5.5
			d	11
			α	22
			also C, N, O	

Location	Type	Pole-piece Diameter	Particles Accelerated	Energy (Mev)
France				
[1] Centre d' Etudes Nucleaires de Saclay, Saclay	n.a.	160 cm	d	20
			α	45
			N^{6+}	120
			O^{6+}	120
Germany				
[1] Institut für Strahlen-Und Kernphysik, Universität Bonn, Bonn	FM	190 cm	d	35
			α	70
[1] Institut für Physik im Max-Planck-Institut für Med. Forschung, Heidelberg	CW	101 cm	d	13
[1] Universität Braunschweig, Braunschweig	n.a.	50 cm	e	5
[1] Universität Mainz, Mainz	n.a.	50 cm	e	10
Great Britain				
[1] Atomic Energy Research Establishment, Harwell, England	FM	110 in.	p	175
[1, 3] Birmingham, University, Birmingham, England	CW	61.5 in.	p	10
			d	20
			H_2^+	
			He^3	
			α	40
			C	
			N	
			O	

Location	Type	Pole-piece Diameter	Particles Accelerated	Energy (Mev)
Great Britain				
[1, 3]Cambridge, University, Cambridge, England	n.a.	35.5 in.	p	
			d	8
			α	
[1]Hammersmith Hospital, London, England	CW	50 in.	p	7.5
			d	15
			α	30
[1]Liverpool, University, Mt. Pleasant, Liverpool, England	CW	37 in.	p	4.5
			d	8.9
	FM	156 in.	p	410
[1]University College, London, England	n.a.	20 in.	e	4.5
	n.a.	80 in.	e	25
Israel				
[1]Hebrew University, Jerusalem	n.a.	n.a.	p	1
Japan				
[1]Kyoto University, Kyoto	n.a.	105 cm	d	16
[1]Osaka University, Osaka	n.a.	111.8 cm	d	12
[1]Scientific Research Institute, Tokyo	n.a.	66 cm	d	4
[1]Tokyo, University, Institute of Science and Technology, Tokyo	n.a.	40 cm	d	2
			p	4

Location	Type	Pole-piece Diameter	Particles Accelerated	Energy (Mev)
Japan				
[1] Tokyo, University, Institute for Nuclear Study, Tokyo	n.a.	160 cm	p	65 (FM)
			d	22 (CW_i)
			p	16 (CW)
Netherlands				
[1] Instituut voor Kernphysisch Onderzoek, Amsterdam	FM	180 cm	d	26
			α	52
Sweden				
[1] Nobel Institute for Physics, Stockholm	CW	80 cm	p	3.5
			d	7
			α	14
	CW	225 cm	p	11/Mev nucleon
			d	11/Mev nucleon
			α	11/Mev nucleon
			ions to Ne^{6+}	11/Mev nucleon
[1] Uppsala, University, Gustaf Werner Institute for Nuclear Chemistry, Uppsala	FM	230 cm	p	192
Switzerland				
[1] Physikalisches Institut der Universitat Zurich, Zurich	FFAG	33 in.	p	7.5
			d	10
			α	20

Location	Type	Pole-piece Diameter	Particles Accelerated	Energy (Mev)
Switzerland				
[1] European Council for Nuclear Research, Geneva	FM	50 cm	p	600
Union of South Africa				
[1] South African Council for Scientific and Industrial Research, Pretoria	CW	113 cm	d	15.5
Union of Soviet Socialist Republics				
[1, 6] Big Volga Laboratories, Bolshoya Volga	FM	6 m	n.a.	680
[6] Institute for Thermal Studies, Moscow	CW	1.5 m	n.a.	n.a.
[6] Moscow Physical Institute, Moscow	n.a.	1.5 m	n.a.	n.a.
[6] Peking	CW	n.a.	n.a.	25
[1] Radium Institute, USSR Academy of Sciences, Leningrad	n.a.	14 in.	d	1.8
Yugoslavia				
[1] Institute "Rudjer Boskovic," Zagreb	*n.a.	140 cm	p	8
			d	16
			heavy ions	

Magnetic Accelerators: Synchrotrons

In the United States

Location	Type	Orbit Radius	Particles Accelerated	Energy (Mev)
[1]Brookhaven National Laboratory, Upton, Long Island, N. Y.	proton	30 ft	p	3,000
	*proton	421.45 ft	p	30,000
[1]California, University, Medical Center, San Francisco, Calif.	electron	29 cm	e	70
[1]California, University, Radiation Laboratory, Berkeley, Calif.	electron	3.3 ft	e	340
	proton	50 ft	p	6,300
[1]California Institute of Technology, Pasadena, Calif.	electron	376 cm	e	1,200
[1]Cornell University, Laboratory of Nuclear Studies, Ithaca, N. Y.	electron	12.5 ft	e	1,000
[1]General Electric Company, Schenectady, N. Y.	electron	2 ft	e	300
[1]Iowa State College, Ames, Ia.	electron	1 ft	e	90
	electron	1 ft	e	90
[1]Massachusetts Institute of Technology, Cambridge, Mass.	electron	3.3 ft	e	350
[1]Michigan, University, Ann Arbor, Mich.	electron	3.3 ft	e	100
[1]Midwestern Universities Research Association, Madison, Wis.	FFAG	60 cm	e	0.4
	FFAG	60 cm	e	0.4
	FFAG	150 cm	e	40
[1]Purdue University, Lafayette, Ind.	electron	100 cm	e	340

Location	Type	Orbit Radius	Particles Accelerated	Energy (Mev)
[1]U. S. Naval Research Laboratory, Washington, D. C.	*electron	77 cm	e	100
[1]Virginia, University, Charlottesville, Va.	electron	30 cm	e	75
Outside the United States				
Australia				
[1]Australian National University, Canberra	*proton	480 cm	p	10,600
	electron	10 cm	e	33
[1]Melbourne, University, Melbourne	electron	10 cm	e	18
Canada				
[1]Queens University, Kingston, Ontario	electron	29.3 cm	e	70
France				
[1]Centre d'Etudes Nucleaires de Saclay, Saclay	proton	8.40 m	p	4,000
Germany				
[1]Physikalisches Institut, Freie Universitat, Berlin - Dahlem	electron	7.5 cm	e	12
[1]Physikalisches Institut der Universitat Bonn, Bonn	electron	170 cm	e	500
Great Britain				
[1]Birmingham, University, Birmingham England	proton	450 cm	p	1,000
[1]Cambridge, University, Cambridge, England	electron	10 cm	e	33
[1]Oxford University, Oxford, England	electron	46.7 cm	e	125

Location	Type	Orbit Radius	Particles Accelerated	Energy (Mev)
Great Britain				
[1]Glasgow, University, Glasgow, Scotland	electron	125 cm	e	340
[1]Royal Cancer Hospital, London England	electron	10 cm	e	30
Italy				
[1]Istituto Nazionale di Fisica Nucleare, Rome	electron	360 cm	e	1,000
Japan				
[1]Osaka Prefectural University, Osaka	electron	14 cm	e	30
[1]Tohoku University, Sendai	electron	25 cm	e	40
	electron	30 cm	e	60
[1]Tokyo, University, Faculty of Science, Tokyo	electron	100 cm	e	200
[1]Tokyo, University, Institute of Nuclear Study, Tokyo	electron	400 cm	e	1,000
[1]Tokyo Institute of Technology, Tokyo	electron	15 cm	e	25
Netherlands				
[1]Delft Institute of Technology, Delft	proton	3.25 m	p	1,000
Sweden				
[1]Institutionen for Electronik, Royal Institute of Technology, Stockholm	electron	3.65 m	e	1,200
Switzerland				
[1]European Council for Nuclear Research	proton	100 m	p	25,000
[1]Roentgeninstitut, Inselspital, Bern	electron	29 cm	e	100

Location	Type	Orbit Radius	Particles Accelerated	Energy (Mev)
Union of Soviet Socialist Republics				
[1, 6, 7] Big Volga Laboratories, Bolshoi Volga	proton	28 m	p	10,000
[6, 7] Leningrad	electron	n.a.	e	150
[6, 7] Lebedev Institute, Moscow	electron	n.a.	e	240
	electron	n.a.	e	600
[6] Moscow Physical Institute, Moscow	nonferrous, electron	n.a.	e	200

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