Eclipse™ Cyclotrons

The Eclipse family of PET cyclotrons is Siemens comprehensive solution for radioisotope production. The Eclipse cyclotron is an 11 MeV, negative ion, single particle accelerator designed for clinical and commercial production and distribution of ^{18}F radiotracers. The Eclipse product line is composed of the Eclipse RD and HP.

Accelerator design
The Eclipse's unique sector design, with a valley-to-hill gap ratio of 27:1, enables high quality beam focusing. This means improved beam transmission, greater production yields, and greatly reduced internal activation.

Magnet design
The Eclipse uses a patented single-coil magnet that dramatically reduces the system's power consumption. High efficiency guarantees high production capabilities coupled with low operating costs.

RD target carousel
The automated target carousel holds up to eight targets, enabling both rapid and remote target changes.

HP target carousel
Four position automated target carousel can be installed on either of two beamlines. Targets are easily changeable within either carousel. Optional configurations include HP/HP, RD/RD and HP/RD.

Self-shielding
The Eclipse's self-shielded system substantially reduces radiation levels without the expense and space required for a vault. Dose at room boundary (24' x 23' x 14' height) is <2.0 mR/hour.

Small volume targets
Using advanced technology, Eclipse targetry offers efficient production of PET isotopes with minimal use of enriched starting materials such as ^{18}O water.

Ease of serviceability
Vertical mounting of the ion source and extraction mechanism provides easy access and reduced maintenance time. The extraction carousel's multiple, long-lived stripping foils enable extended operation before service is required.

Automated system control
All major systems on the Eclipse are automatically controlled through a PC-compatible workstation. The control software incorporates an easy-to-use interface.

Powerful, Flexible, Easy

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Typical System Performance

Product	Chemical Form	Irradiation Time (min)	HP Typical Single Target Product Yield at 60 µA on Target*	RD Typical Single Target Product Yield at 40 µA on Target*
^{18}F	F^-	60	2200 mCi (82 GBq)[a]	1400 mCi (52 GBq)[a]
	F^-	120	3500 mCi (131 GBq)[a]	2400 mCi (90 GBq)[a]
	F_2	60	750 mCi (28 GBq)[a]	500 mCi (18 GBq)[a]
^{15}O	O_2	10	3000 mCi (111 GBq)[a]	2000 mCi (74 GBq)[a]
	CO_2	10	900 mCi (33 GBq)[b]	600 mCi (22 GBq)[b]
	CO	10	1200 mCi (44 GBq)[b]	800 mCi (30 GBq)[b]
	H_2O	10	1175 mCi (42 GBq)[b, d]	750 mCi (28 GBq)[b,d]
^{13}N	NH_3	10	200 mCi (7.5 GBq)[a]	100 mCi (4 GBq)[a]
^{11}C	CO_2	50	2000 mCi (75 GBq)[a, c]	1500 mCi (56 GBq)[a, c]
	CO	50	1300 mCi (48 GBq)[b]	975 mCi (36 GBq)[b]

a. End of bombardment (EOB)
b. End of synthesis, decay corrected to EOB
c. Specific activity >25 Ci/µmole
d. Computer controlled target purging enables repetitive delivery of 20-25 mCi doses for <$4/dose
** See acceptance test for specified minimum yields.*

System Specifications

Energy	11 MeV
Magnet: 4-sector azimuthally varying field, single strip coil	
Power	3kW
Mean field	1.2 Tesla
Valley-to-hill gap ratio	27:1
Magnetic Field at room boundary	<1 Gauss
RF System: Four Dees	
Fundamental mode	72 MHz
Max. amplifier power	10 kW
Ion Source: Penning Ion Gauge	
Max H- current	2mA
Beam Extraction: Carbon Foils	
# foils/carousel	3
Foil lifetime	10,000 µA-hr
Beam size (RD)	8 mm
Beam size (HP)	10 mm

Target Current	
Eclipse RD	40 µA single beam; 80 µA dual beam
Eclipse HP	60 µA single beam; 120 µA dual beam
Vacuum (in Torr)	
Base pressure (mm Hg)	$5x10^{-7}$
Operating pressure	$<1x10^{-5}$
Power Consumption	
Standby	<7 kW
Operating	35 kW
Heat Rejection	
Air	52,000 BTU/hr
Water	90,000 BTU/hr
Shielding	
Eclipse RD	2.0 mR/hr (20µSv/hr) total n+g @ 2x40µA at room boundary
Eclipse HP	2.0 mR/hr (20µSv/hr) total n+g @ 2x60µA at room boundary

Installation Options

- Self-shield – Movable shield for radiation safety.
- Shipping – System shipping dependent upon destination country.
- Installation & applications – Installation and on-site applications training dependent upon destination country.

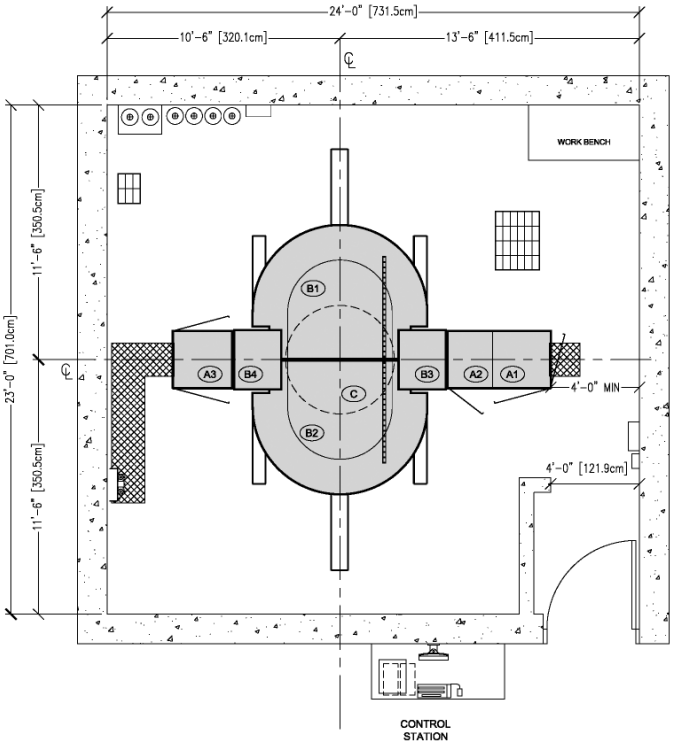
System Options

- Vacuum system – Isolation valves.
- Tantalum target – The new optional tantalum target body offers unparalleled uptime, and is the backbone of today's major FDG production facilities.
- Second target system – Second extraction port, including target water purge valve and either a four- or eight-position target carousel. Second extraction port allows two target carousels to be mounted to enable the simultaneous production of two different isotopes or the dual production of one isotope.
- Switching valve option – The switching valve is required if the system has more than one target. It enables unloading target to any one of four different locations.
- Targetry – Targetry can be expanded to accommodate other target systems in a modular format, including but not limited to, $^{11}C\text{-}CO_2$, $^{15}O\text{-}O_2$, and $^{13}N\text{-}NH_4^+$.
- Chemistry modules – Automated chemistry modules for the production of radiochemicals:
  - Explora AC – Acetate module
  - Explora CH_3 – Methylation module
  - Explora CN – Cyanide synthesis
  - Explora FDG_4 – Multirun FDG
  - Explora FM – Formulation module
  - Explora GN – General nucleophilic module
  - Explora GPC – Gas phase carbon module
  - Explora GPU – Gas processing unit
  - Explora H_2O – $^{15}O\text{-}H_2O$
  - Explora LC – Semi-prep HPLC purification module

Technical Data	HP/RD	
Cyclotron	10,000 (kg)	22,000 (lbs)
Width	150 (cm)	59 (in)
Depth	150 (cm)	59 (in)
Height	173 (cm)	68 (in)
Movable Shields	14,450 (kg)	31,800 (lbs)
Width	240 (cm)	95 (in)
Depth	184 (cm)	73 (in)
Height	230 (cm)	90 (in)
Stationary Shields	3,400 (kg)	7,400 (lbs)
Width	66 (cm)	26 (in)
Depth	83 (cm)	73 (in)
Height	230 (cm)	90 (in)
Control Cabinets (1 unit)	1,000 (kg)	2,200 (lbs)
Width	81 (cm)	32 (in)
Depth	142 (cm)	56 (in)
Height	210 (cm)	83 (in)
Heat Exchanger Cabinet	450 (kg)	1,000 (lbs)
Width	81 (cm)	32 (in)
Depth	81 (cm)	32 (in)
Height	210 (cm)	83 (in)

Physical, Environmental, and Power Data	
Power Requirements	
Europe	208 (±5%) VAC, 150A, 3 phase 50 Hz standard
U.S./Asia	208 (±5%) VAC, 150A, 3 phase 60 Hz standard (50 Hz optional), 380 (±5%) VAC, 150A, 3 phase 60 Hz (optional)

Environmental Requirements	
Normal operation requires an ambient temperature of 21°C (70°F) with relative humidity of 40 – 55%, noncondensing.	
Control Band	±1°C (3°F)



A1, A2: Control Cabinets (1 unit)
A3: Heat Exchanger Cabinet
B1, B2: Movable Shields (x2)
C: Cyclotron

The automated chemistry modules are delivered as laboratory equipment for the production of radiochemicals. No claim is made as to the suitability for human use of the products made with these modules. It is the exclusive responsibility of the user to determine if such products can be used for human subjects according to local and federal regulations, and Siemens disclaims all responsibility in this respect.

ISO 9001:2000 and ISO 13485 certified, meeting internationally recognized quality standards.

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