



PETtrace™ 800 cyclotron series

Data sheet

Overview

The GE Healthcare PETtrace 800 cyclotron series is a compact, automated, dual-particle cyclotron system designed for fast, easy and efficient production of PET tracers. It offers the efficiency required to facilitate your clinical schedules, flexibility for research protocols and the performance necessary to meet regional distribution demands.

The PETtrace 800 is built around a compact negative ion cyclotron with a vertical mid-plane of proven design, featuring both protons and deuterons allowing maximum flexibility and low-cost isotope production. You can configure the system with various targets and process systems to produce commonly used PET radioisotopes.

The PET isotopes that can be produced by PETtrace 800 include oxygen-15, nitrogen-13, carbon-11, fluorine-18 as well as a number of solid target isotopes. The isotopes are automatically transferred to the chemistry processing systems for efficient conversion into finished PET tracers and precursors.

Primary benefits

Reliability and production capacity

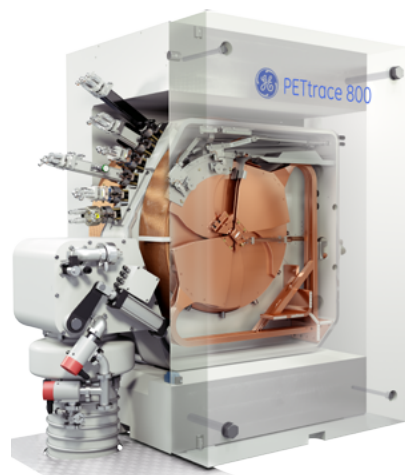
The most significant characteristic of the PETtrace 800 series is the high demonstrated reliability. This, together with high production capacity, has made it one of the most preferred cyclotrons in the world.

User-friendly

The entire sequence of producing the PET isotope and tracer is fully automated. The operator will only select the isotope and the amount of activity needed. The control system automatically prepares the cyclotron and the targets, tunes the beam and manages the target irradiation.

Lower dose to personnel

The innovative vertical cyclotron mid-plane design and quick-release components have made it possible to reduce the radiation dose to the maintenance personnel.



PETtrace 800 cyclotron

Flexibility

The PETtrace 800 can be configured in a number of different ways to meet your needs. You can select different options including protons, deuterons, radiation shield, Beam Line, numerous target systems, including solid target, and chemistry modules.

Upgradeability and performance enhancement

At GE Healthcare we are committed to forming long lasting relationships with our customers. A continuous upgrade path is available to keep your PETtrace 800 cyclotron up-to-date. With this solution, you will always be able to adapt to your changing facility needs, increase your production capacity, and update your cyclotron with the latest technology – making the PETtrace 800 an investment for the future.

Contact your local GE representative to learn more about our product upgrades and TYLER, GE's 10-year-life extension-and-refurbishment program for cyclotrons.

Configuration

The different PETtrace 800 versions are based on the customer's demand for proton beam current.

Four proton beam options are available:

- S9120ND, PETtrace 840, 60 μA
- S9120NE, PETtrace 860, 100 μA
- S9120NF, PETtrace 880, 130 μA
- S9120NG, PETtrace 890, 160 μA

For the PETtrace 800 series, a 60 μA deuteron option is available.

A number of different target and other options can be added to each system. For more details, see "Product options".

System components

Magnet

The design of the PETtrace 800 cyclotron magnet offers simple and robust operation. The coils are made of hollow-core copper conductors that are fiberglass insulated and cast in epoxy.

The magnet is water-cooled. Each conductor layer is equipped with a thermo-switch for overheat protection. Hardware interlocks continuously monitor the cooling water flow.

Radio frequency (RF) system

The RF system consists of two resonators and an RF Power Generator (RFPG) applying RF power to the two resonators within the vacuum chamber, that accelerate the particles. Operation is automatically regulated by the cyclotron control system.

Ion source

The ion source for the PETtrace 800 cyclotron is mounted internally in a fixed position. The design is of the Penning Ion Gauge (PIG) discharge type with cathodes heated by the discharge. The ion source is capable of generating both proton and deuteron beams.

Beam extraction

The PETtrace 800 has a beam extraction efficiency above 99.9%. Two carousels, equipped with six carbon foils each, are used to extract the beam. The extraction system can operate in single or dual mode. Dual mode allows simultaneous irradiation of two targets.

Beam diagnostics

The beam current is continuously monitored and regulated by the beam diagnostic system. One part of the diagnostic system provides a remotely actuated internal beam probe to aid in adjusting and tuning the beam. Another part continuously monitors the extraction foil carousel, collimators and targets to allow fully automated start-up, tuning and operation.

Vacuum system

The PETtrace 800 vacuum system consists of one high vacuum oil diffusion pump and one mechanical roughing pump. A dedicated vacuum system controller performs pressure monitoring, vacuum pump sequencing and system operation. The aluminum vacuum chamber is O-ring sealed against the magnet poles.

Control system

The PETtrace 800 control system is equipped with an accelerator control unit, a chemistry control unit and a PC workstation. The control units carry out all the automated closed-loop and logical control tasks, while the workstation is used for operator inputs and database handling. A complete software package for fully automated cyclotron and process system operation is provided.

Control system functions include:

- System start-up, including warm-up periods (<5 min from a cold start) and component monitoring.
- Initiation of production parameters, including selection of irradiation, duration of irradiation and beam current.
- Beam tuning capability to optimize system operation and efficiency.
- Continuous monitoring of system operating parameters, with appropriate protection interlocks and warnings.
- Batch data logging with printout possibilities.
- Data logging of operational parameters for trend analysis.
- Remote connectivity for monitoring and support by GE Online Center.

Target mounting and support

Six fixed target ports are located along the cyclotron vacuum chamber.

Target media, cooling water and helium cooling are supplied to the target through a single manifold attached to the rear of each target with a quick-connector. The design of the PETtrace 800 mounting flange and targets permits rapid and convenient installation and removal of the targets to minimize dose exposure.



PETtrace 800 user interface

Product options

P5220JG, PETtrace 800 basic cyclotron

The PETtrace 800 series cyclotron consists of

- a core system with magnet, ion source, beam extraction, beam diagnostics, vacuum and radiofrequency systems
- a control system that includes control units and a workstation.

Additional workstations are optional. The system ensures robust system control and data recording during routine operation.

- electronics, power supply systems and support equipment required for cyclotron operation

P5220JD, PETtrace 800 proton option

Proton acceleration capability. Providing a proton beam with an energy of 16.5 MeV on target.

P5220JB, PETtrace 800 deuteron option

Deuteron acceleration capability. Providing a deuteron beam with an energy of 8.4 MeV on target.

P5220JC, PETtrace 800 dual extraction

The dual extraction option enables simultaneous irradiation of two targets with the same particle. The dual extraction system option will allow irradiation of targets in position 1 to 6 in single mode. It also allows dual irradiation of a target in position 1 to 3 in combination with a target in position 4 to 6.

P5220JS, PETtrace 800 installation stand

The PETtrace 800 installation stand makes it possible to install an unshielded PETtrace 800 into a bunker without a floor pit for the vacuum system.

P5260QL, PETtrace 800 client station

Additional workstation that allows the user to operate and monitor the cyclotron system from other locations than the Master station. Requires PETtrace 800 PC Lynx control system.

P5260MJ, PETtrace 800 external proton target interface

Interface to connect a non-GE target to the cyclotron.

PETtrace 800 radiation shield options

Refer to separate data sheet for radiation shield options.

PETtrace 800 target and process system options

Refer to separate data sheets for the different target and process system options.

PETtrace 800 Beam Line options

Refer to separate data sheet for Beam Line options.

System performance

PETtrace 800 cyclotron series performance

PETtrace 800	Proton beam current*	¹⁸ F[F] capacity / 2hr run GBq / Ci (# of FDG doses)
PETtrace 840	60 µA	240 / 6.5 (45–80)
PETtrace 860	100 µA	403 / 10.9 (75–160)
PETtrace 880	130 µA**	524 / 14.2 (100–200)
PETtrace 890	160 µA**	648 / 17.5 (120–240)

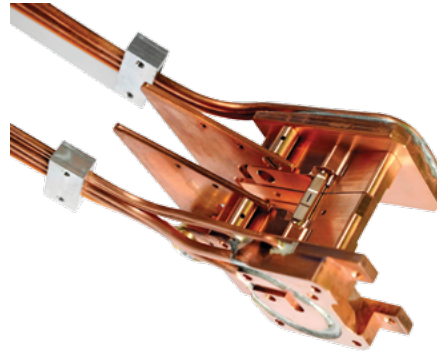
*Total beam current on any target or target combination.

**Intended for dual beam. Maximum 100 µA on one beam port.

Tracer production yields and specifications

See separate data sheets for:

- Radiation shield options
- Target and process system options
- Beam Line option



PETtrace 800 ion source

Site planning requirements

GE Healthcare will assist the customer in site planning and give suggestions how to design the facility.

For detailed site preparation requirements, refer to *PETtrace 800 series Site Planning Guide* (dir. 2102960-100).

System dimensions

Cyclotron	
Length	1330 mm (52 in)
Width	1200 mm (48 in)
Height	1910 mm (75 in)
Weight	20 000 kg (44 000 lbs)*

*Equally distributed over 1000 mm × 1200 mm (41 in × 47 in)

Magnet Power Supply, PSMC	
Width	600 mm (24 in)
Depth	800 mm (32 in)
Height	1800 mm (71 in)
Weight	700 kg (1540 lbs)

Radio Frequency Power Generator, RFIG	
Width	1180 mm (47 in)
Depth	800 mm (32 in)
Height	1800 mm (71 in)
Weight	750 kg (1640 lbs)

Control electronics CAB 3

Width	600 mm (24 in)
Depth	800 mm (32 in)
Height	1800 mm (71 in)
Weight	250 kg (550 lbs)

Cooling water system

Width	1300 mm (51 in)
Depth	600 mm (24 in)
Height	1500 mm (59 in)
Weight	415 kg (915 lbs)

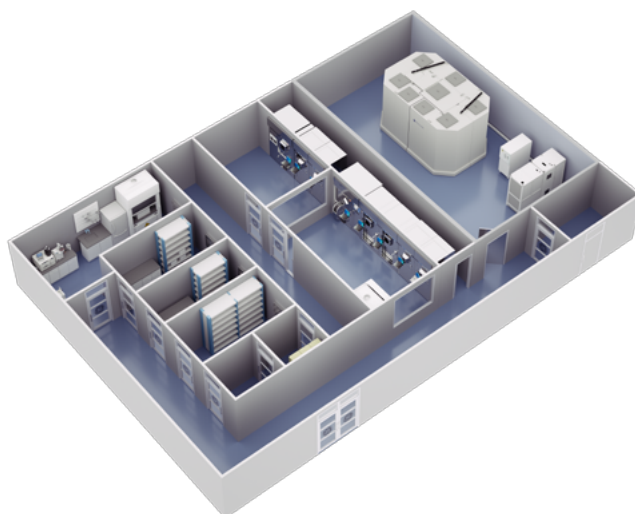
System requirements

Cyclotron cooling system

Flow	120-160 l/min (32-42 US Gallon/min)
Inlet temperature to secondary cooling system	10-15 °C (50-59 °F)
Max system pressure	~ 0.13 Mpa
Connection	DN32
Capacity	Minimum 80 kW

Total power consumption

Operation mode (max)	75 kW
Standby mode	4 kW



Example of facility layout

Imagination at work

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