



ADVANCED TR-FLEX CYCLOTRON SOLUTIONS

The **TR-FLEX** cyclotron's design is based on the industry-proven TR-24 platform. The extended energy range of the TR-FLEX allows the user to tailor the extracted energy to optimize radionuclidic purity and production yields for PET and SPECT radioisotopes. While capable of producing the widest range of medical radioisotopes, the TR-FLEX cyclotron features a smaller footprint and requires a lower capital investment compared to other high energy cyclotrons.

CUSTOMIZABLE

With maximum extraction energy ranging from 24 MeV to 30 MeV, the TR-FLEX cyclotron can be fully customized to the specific customer's needs. In addition to the adjustable energy range, the high beam current capabilities allows for full scale commercial production of SPECT isotopes: ^{99m}Tc, ²⁰¹Tl, ¹¹¹In, ¹²³I, ⁶⁷Ga, etc. In order to provide optimal conditions for both PET and SPECT radioisotope production, the TR-FLEX beam profile and output is optimized at ~18 MeV and ~29 MeV for the low and high energy ranges.

PRODUCTION YIELDS

The table below shows production yields, normalized to 30 MeV, for some of the most important medical isotopes for the 24 MeV to 30 MeV energy range:

RELIABILITY

The high reliability of the TR family of cyclotrons has been proven over the past 25 years of service. They have become the accelerators of choice for the largest commercial producers of medical isotopes in the world. Over 90% of the ²⁰¹Tl, ¹¹¹In, ¹²³I and ⁶⁷Ga supplied in North America is produced on TR cyclotrons.

CONFIGURATIONS

The standard configuration for the TR-FLEX is with two external beam ports. Each beam port allows installation of a beamline or a target selector depending on the customer requirements. Different beamline configurations are available for the TR-FLEX. Up to 6 beamlines can be mounted on the TR-FLEX cyclotron.

| Isotope | 24 MeV | 25 MeV | 26 MeV | 27 MeV | 28 MeV | 29 MeV | 30 MeV |
|-------------------|--------|--------|--------|--------|--------------|--------------|-------------|
| ¹²³ I | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9* | 1.0 |
| ⁶⁸ Ge | 0.67 | 0.75 | 0.81 | 0.87 | 0.9 | 0.96 | 1.0* |
| ⁶⁷ Ga | 0.63 | 0.7 | 0.78 | 0.84 | 0.9 | 0.96* | 1.0 |
| ¹¹¹ In | 0.7 | 0.78 | 0.84 | 0.89 | 0.94 | 0.97* | 1.0 |
| ²⁰¹ Tl | - | 0.005 | 0.17 | 0.36 | 0.72* | 0.79* | 1.0 |
| ⁹⁹ Mo | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0* |

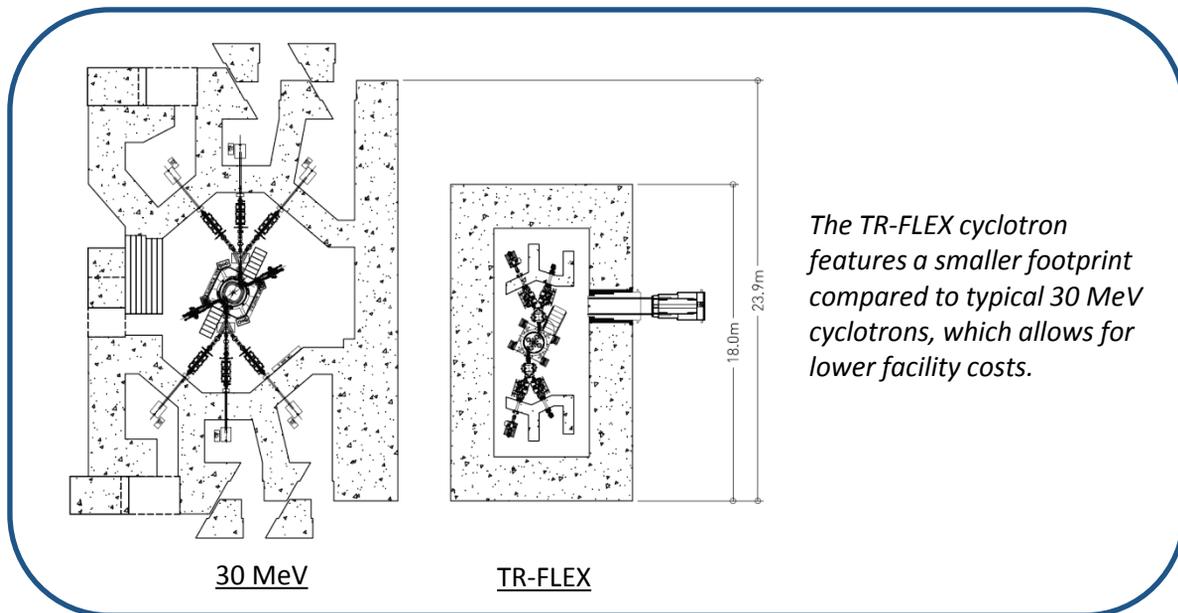
* Recommended production energy

The TR-FLEX at a glance:

| TR-FLEX | |
|----------------------------|--|
| Accelerated Ions | H ⁻ |
| Extracted Ions | H ⁺ |
| Extraction Method | Carbon foils |
| Max Extracted Energy | 24 MeV to 30 MeV, depending on configuration |
| Extracted Beam Current | Up to 750 μA |
| Acceleration Plane | Horizontal |
| Operating Vacuum | ~5x10 ⁻⁷ Torr |
| Extraction Ports | 2 |
| Standard Extraction Probes | Single carbon foil per side |
| Optional Extraction Probes | Carousel type, 4 foils per carousel |
| Cyclotron Vault (internal) | Without beamlines: 5.0 m x 4.5 m x 3.0 m (H) With one external beamline: 6.0 m x 8.5 m x 3.0 m (H) With two external beamlines: 6.0 m x 12 m x 3.0 m (H) |

LOWER COST, HIGH PRODUCTION

The energy range and beam current capabilities of the TR-FLEX allow production of large quantities of PET and SPECT isotopes, without the higher cost of a traditional commercial SPECT production facility.



The following targets and target stations can be mounted at the end of the beam lines:

- High Current Solid Target Station (SPECT) – For large solid targets
- ¹²³I Gas Target (SPECT) – For enriched ¹²⁴Xe targets
- Target Selector (PET) – For multiple liquid, solid, and gas targets
- Fixed Port Single Target (PET) – For one liquid, solid, or gas target

