

Hopewell Designs, Inc.

GR440

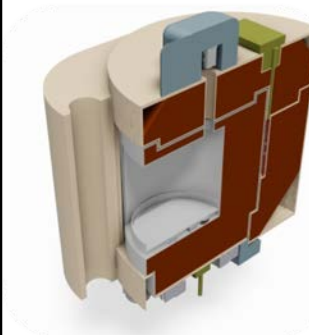
High Dose Rate Self-Contained Research Irradiator



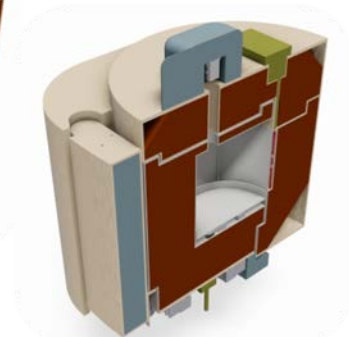
Several high dose rate applications require the use of a self-contained research irradiator for calibration, production and other supporting research & development activities. The Hopewell Designs, Inc. Model GR440 High Dose Rate Self-Contained Research Irradiator is a modern replacement for the legacy systems which are no longer supported. The GR440 combines the well-known and understood capabilities and features of legacy systems with numerous state-of-the-art design upgrades including larger chamber volume, a rotating chamber, higher precision timing/process control and greatly improved external (operator) dose rates. Hopewell Designs, Inc. provides unparalleled service, preventative maintenance, technical support and source reloading for its entire product line.

Specifications

- **Isotope** ^{60}Co
- **Maximum Activity** 888TBq (24,000 Ci)
- **Irradiation Chamber**
 - Diameter:** 27.94cm (11in)
 - Height:** 30.48cm (12in)
 - Volume:** 18,688 cm³ (1140 in³)
 - Door Opening:** 27.31cm (10.75 in)(Wide)
30.48cm (12 in) (Height)
- **Weight** 4036 kg (8900 lbs)
- **Primary Shielding** Depleted Uranium
- **Power Requirements** 120V/60Hz



Model GR440
Loading Position



Model GR440
Irradiation Position

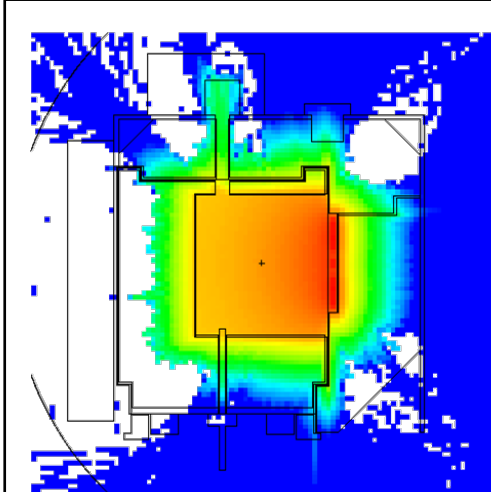


Features

- Large chamber size (3 times larger than legacy systems)
- Variable speed, rotating irradiation chamber
- Precision timing & process control
- External cable/tubing access to irradiation chamber
- Enhanced 10CFR Part 37 security features
- Irradiation chamber temperature control (Optional upgrade)
- Application-based fixturing (Optional upgrade)

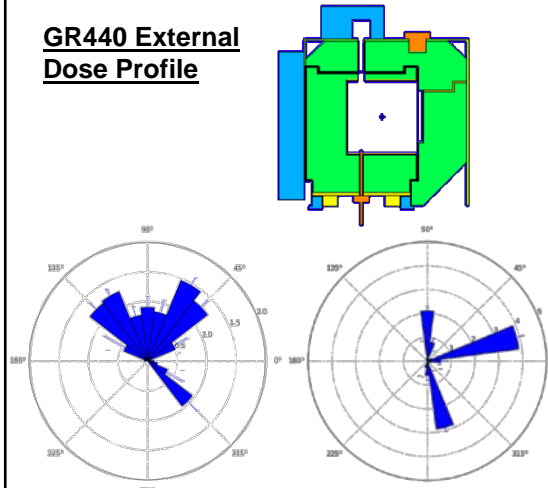
Hopewell Designs Model GR440 External Dose Performance

The GR440 large (28 cm diameter) irradiation chamber provides expanded capability, yet weight is kept under 4400 kg by utilizing a highly engineered depleted uranium primary shield. The dose to the operator and the transition dose to the sample are both reduced relative to the legacy system by using a horizontal loading technique which rotates the sample chamber into the irradiation position (once the external shield door closes).



GR440 Dose Mapping Cross Section. All blue areas represent areas with external radiation dose rates below 50 $\mu\text{Sv/hr}$ while all red areas represent the highest dose rate in the system.

GR440 External Dose Profile



Monte-Carlo Dose Profile of External Radiation Fields from 24 Measurement Points. (Left) around the circumference of the system and (Right) from the left side and over the top to the right side of the system [diagonal axis is dose rate at 5 cm in mrem/hr].

GR440 Monte-Carlo Predicted Performance
888TBq (24kCi) ^{60}Co

DUR
2.4

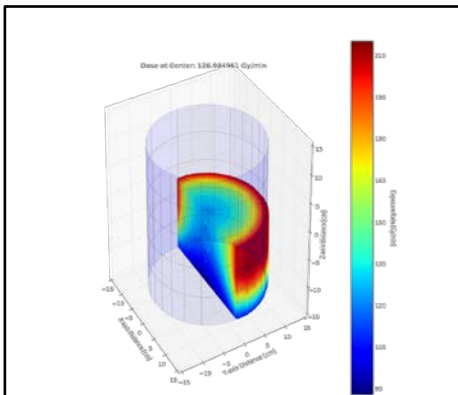
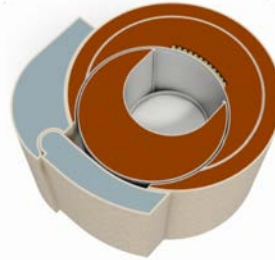
C_L Dose Rate
127 Gy/min

External Dose Rates
43 $\mu\text{Sv/hr}$
(Irradiation Position)

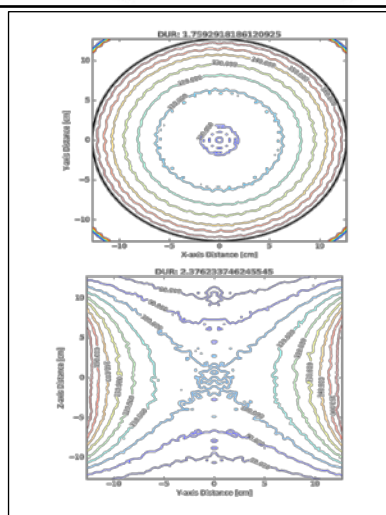
1.14 Dose Ratio
(Dose Transition Position to Dose Irradiation Position)

Model GR440 Internal Irradiation Performance

The GR440 is designed to obtain improved dose-uniformity ratio (DUR) by rotating the irradiation chamber in place (in the irradiation position).



GR440 3D Irradiation Chamber Dose Profiles. (Left) Within the irradiation chamber and (Top) the horizontal and (Right) vertical cross sections of the dose profiles.



Recent Model GR440 Publications

M.P. Shannon, G. S. Mickum, Z. Hope. "Optimization of Shielding Parameters for a High Dose Rate Research Irradiator Design Baseline." 49th Mid-Year Meeting of the Health Physics Society, Austin, TX, February 1-3, 2016.

M.P. Shannon, G. S. Mickum. "A New High Dose Rate Research Irradiator." Council on Ionizing Radiation Measurements and Standards (CIRMS) of the National Institute of Standards & Technology (NIST), April 18-20, 2016.

M.P. Shannon, G. S. Mickum, R. Howell, R. Rushton. "A Review of Gamma Cell 220 Research Irradiator External Dose Rates." 14th International Congress of the International Radiation Protection Association, Cape Town, South Africa, May 9-13, 2016.

M.P. Shannon, G. S. Mickum, Z. Hope. "Development of a High Dose Rate Research Irradiator Design." 61st Annual Meeting of the Health Physics Society, Spokane, WA, July 17-21, 2016 (Pending).