

Gamma Technology

Irradiation Systems Applied to Precision Dose Applications

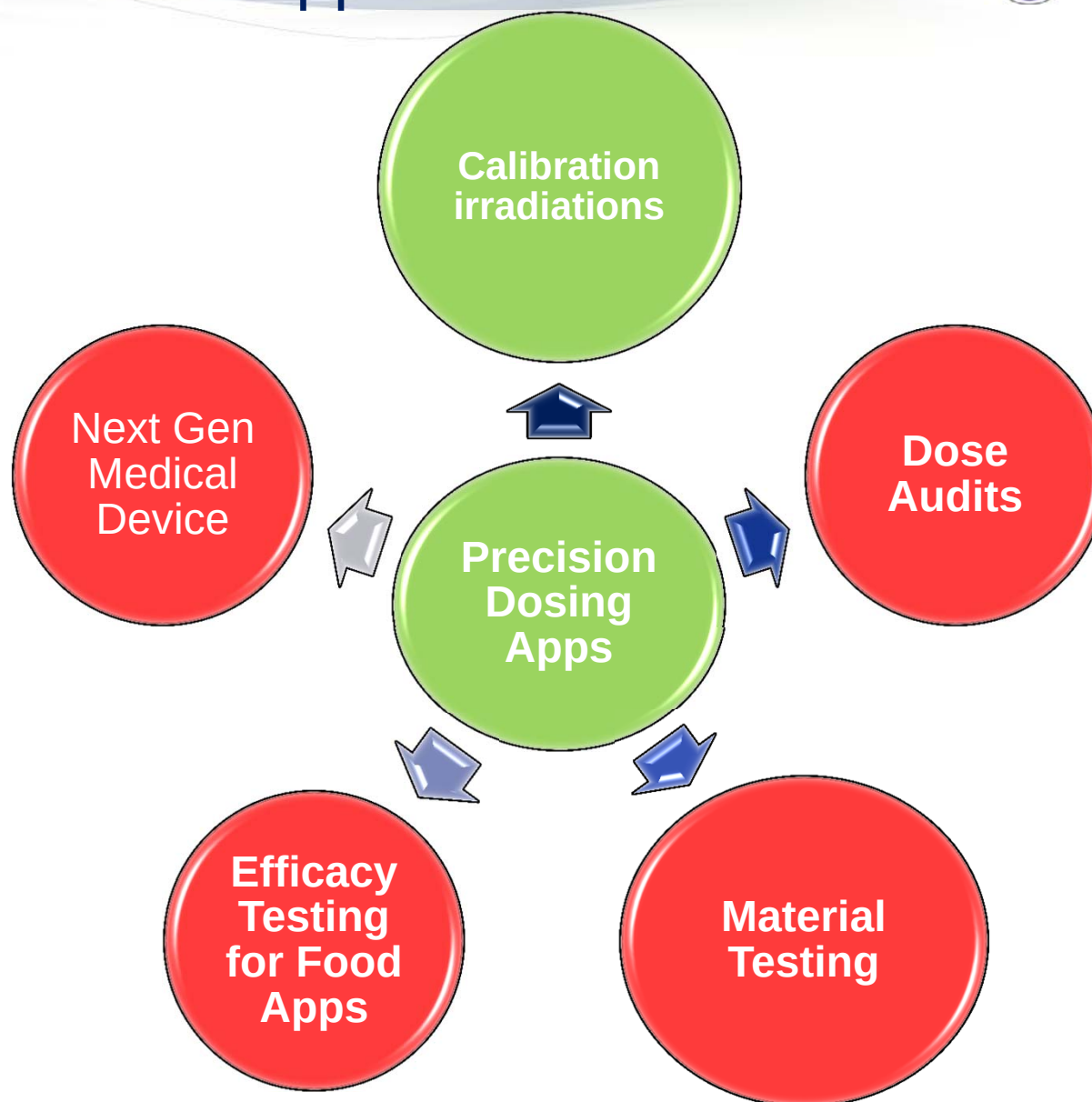
Kevin P.J. O'Hara
October, 2012

Objectives

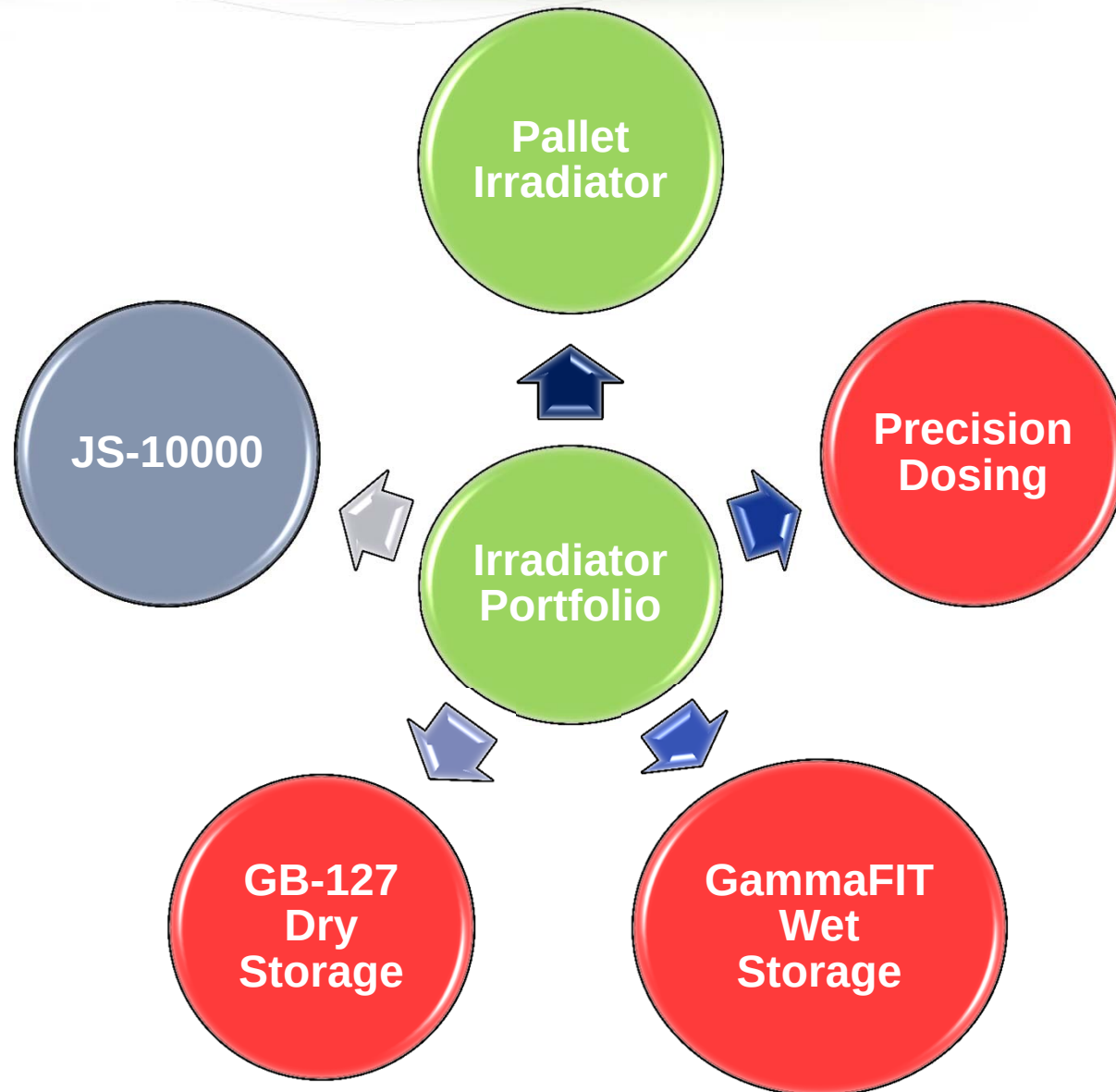


- Precision Dose Applications
 - Dosimeter Calibration irradiations
 - Dose Audits
 - Material Testing
 - Efficacy Testing for Food Applications
 - Next Generation Medical Devices
- Discussion

Precision Dose Applications



Nordion's Irradiator Portfolio

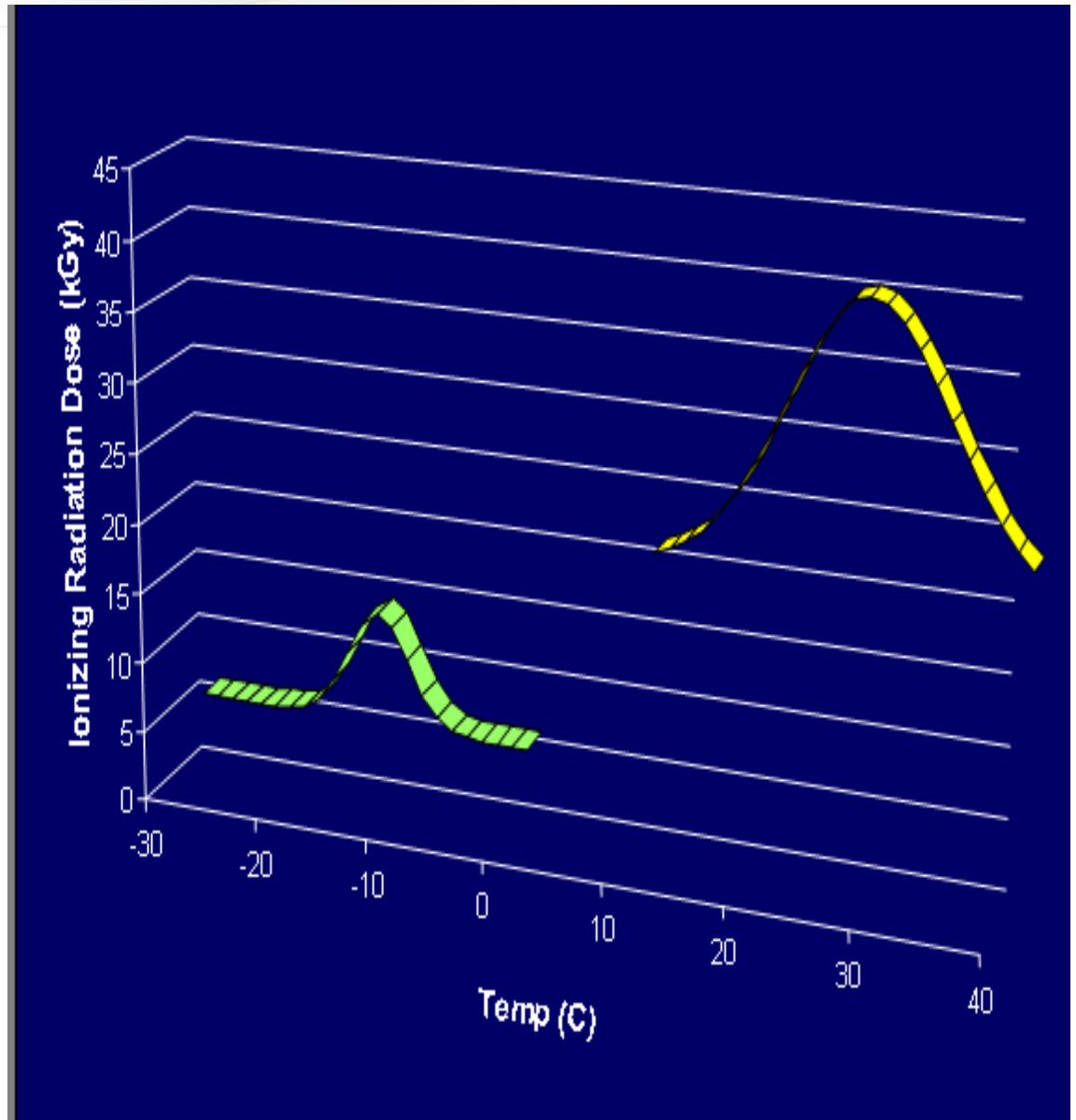


Next Generation of Medical Devices

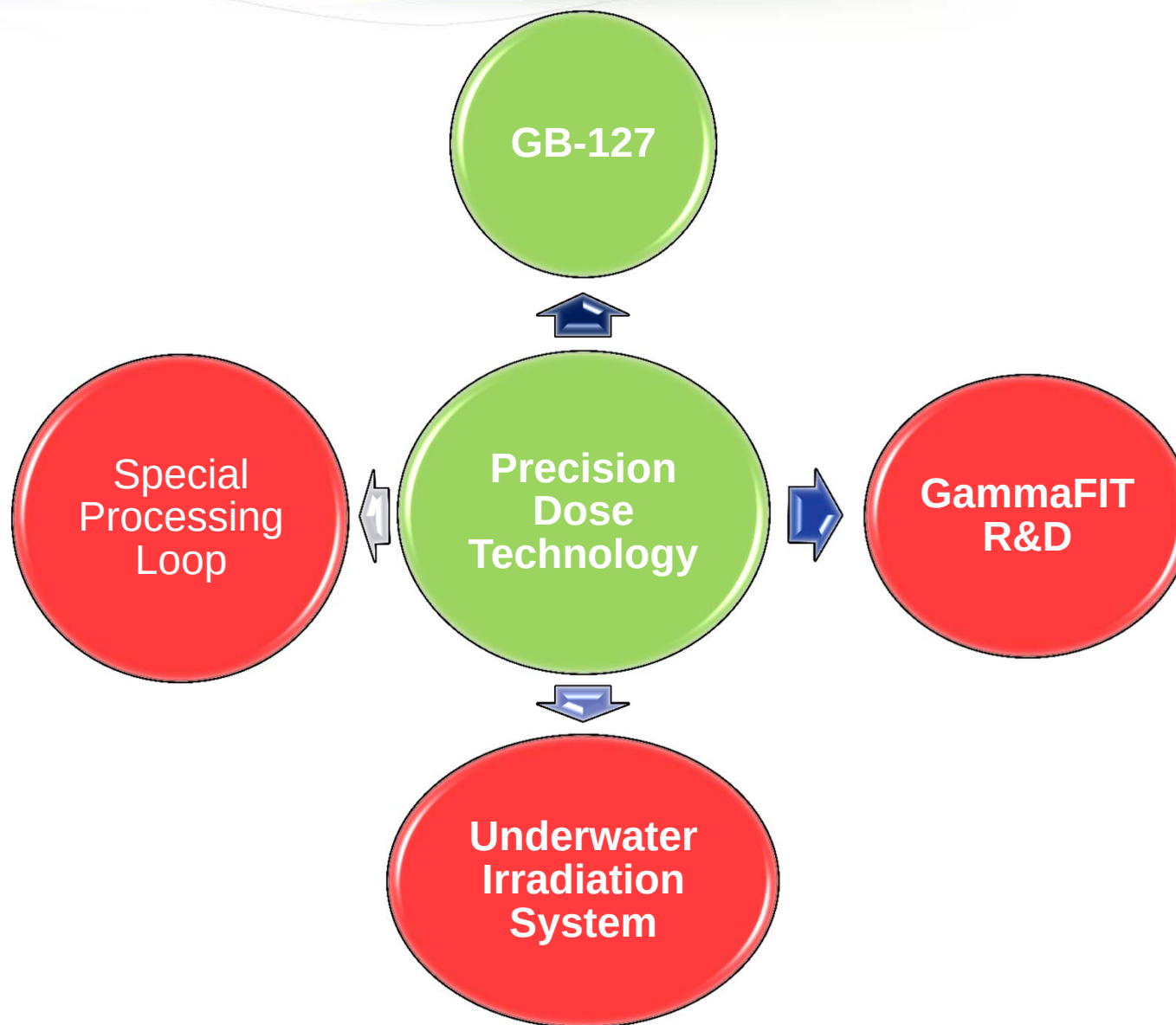


- Bio-absorbable materials less tolerant than metallic counterparts
- For bio-actives, low doses generally required, and the range of applied dose will be narrower
- LT environment help protect biologic (migration of radiation induced free radical mitigated)

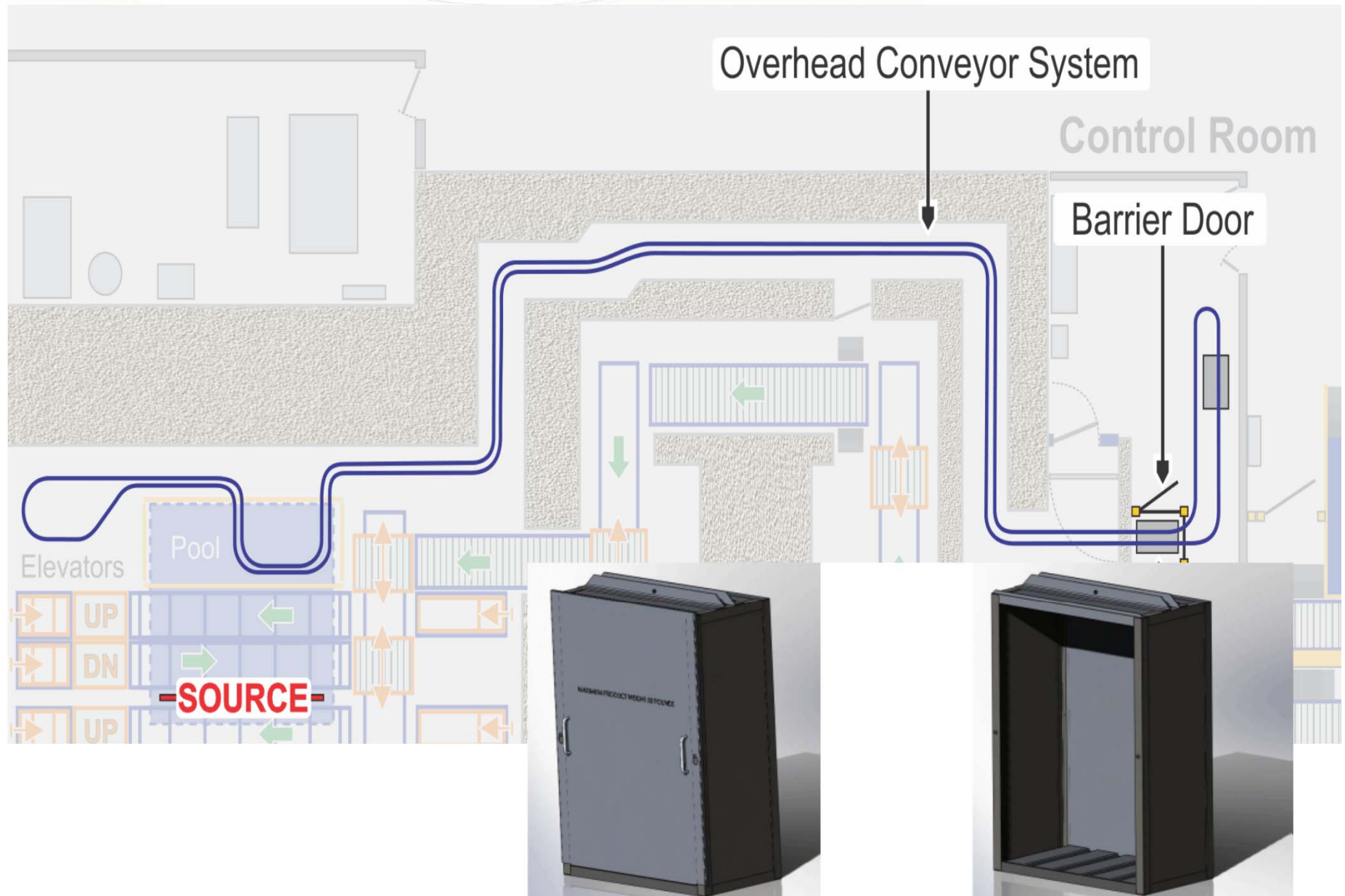
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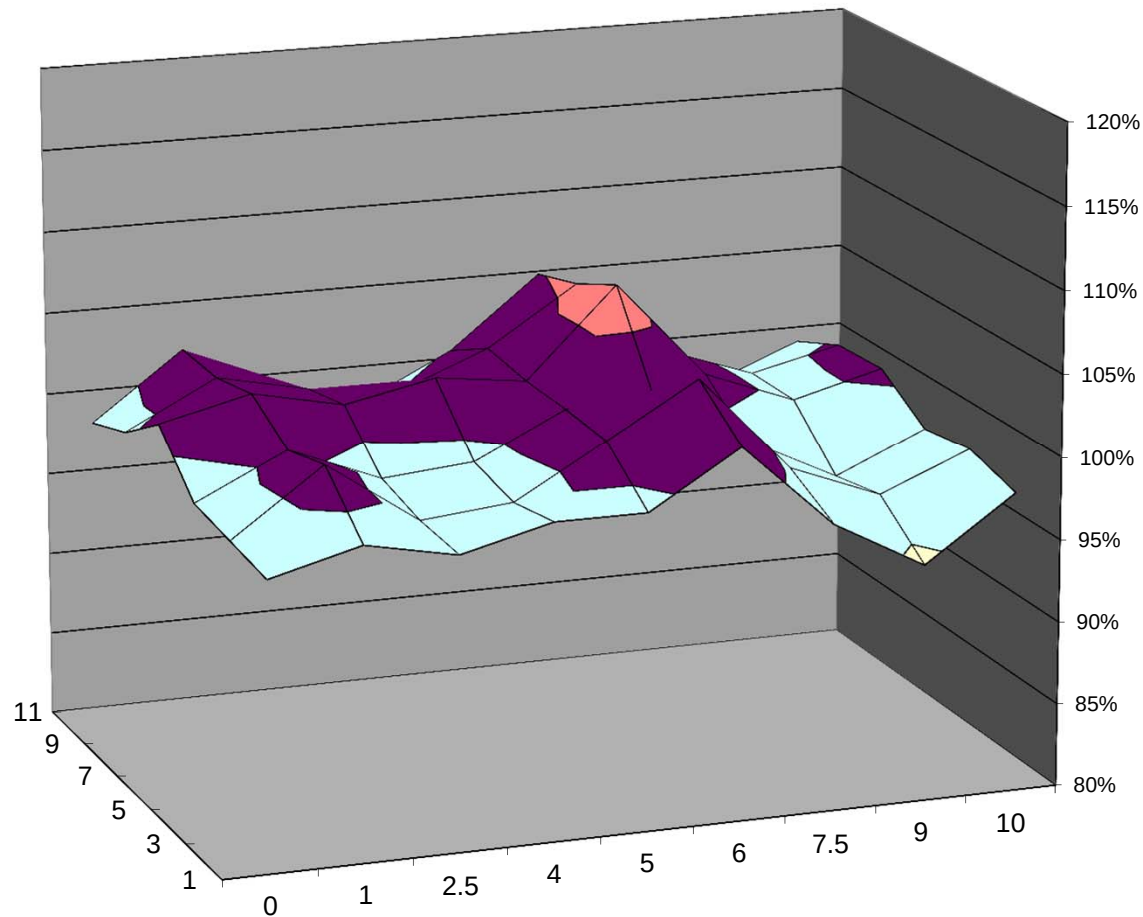
Precision Dose Technology



Special Processing Loop

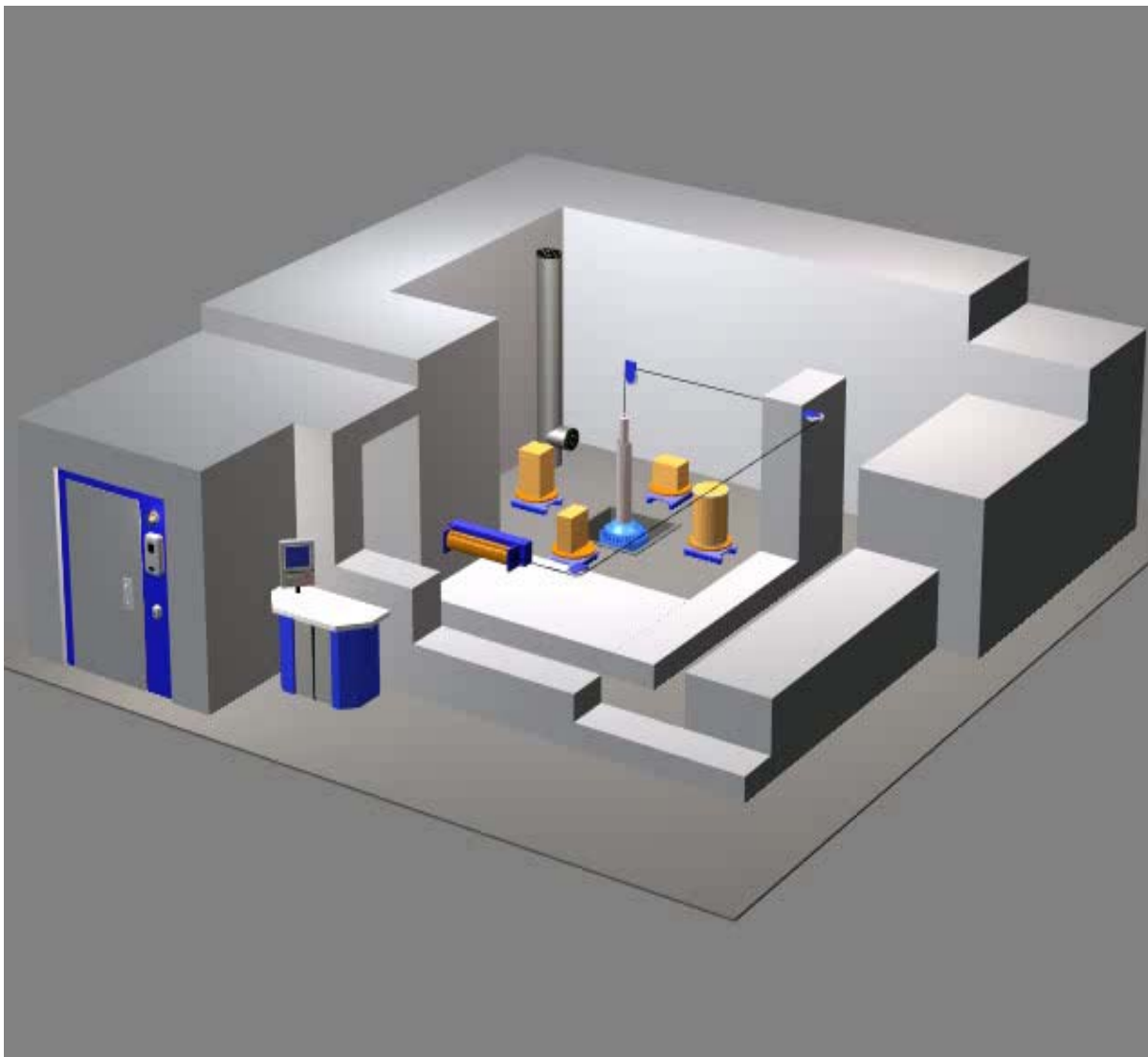


Processing Loop - Dose Distribution



GB-127

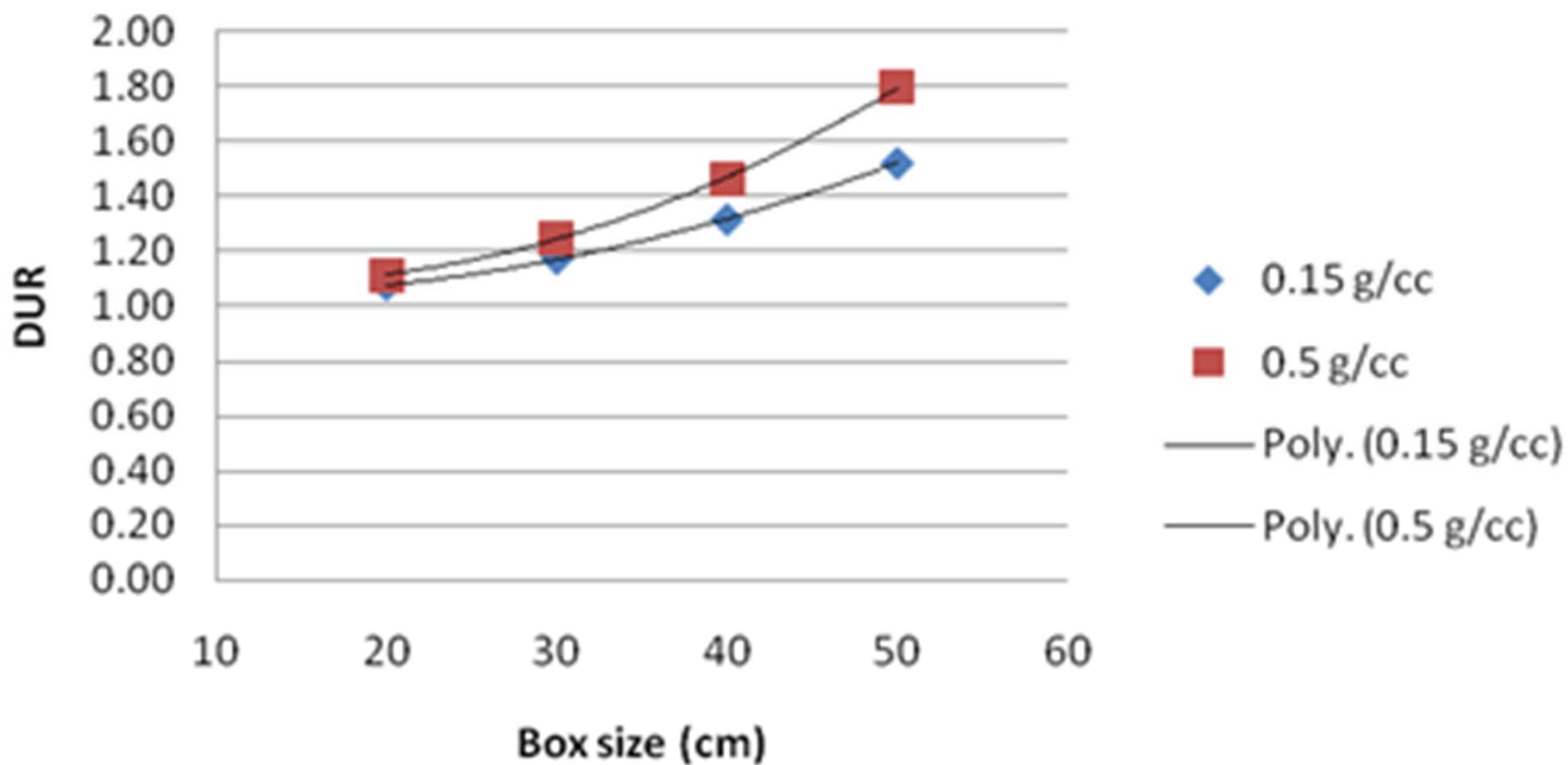
(Dry Storage - R&D Irradiator)



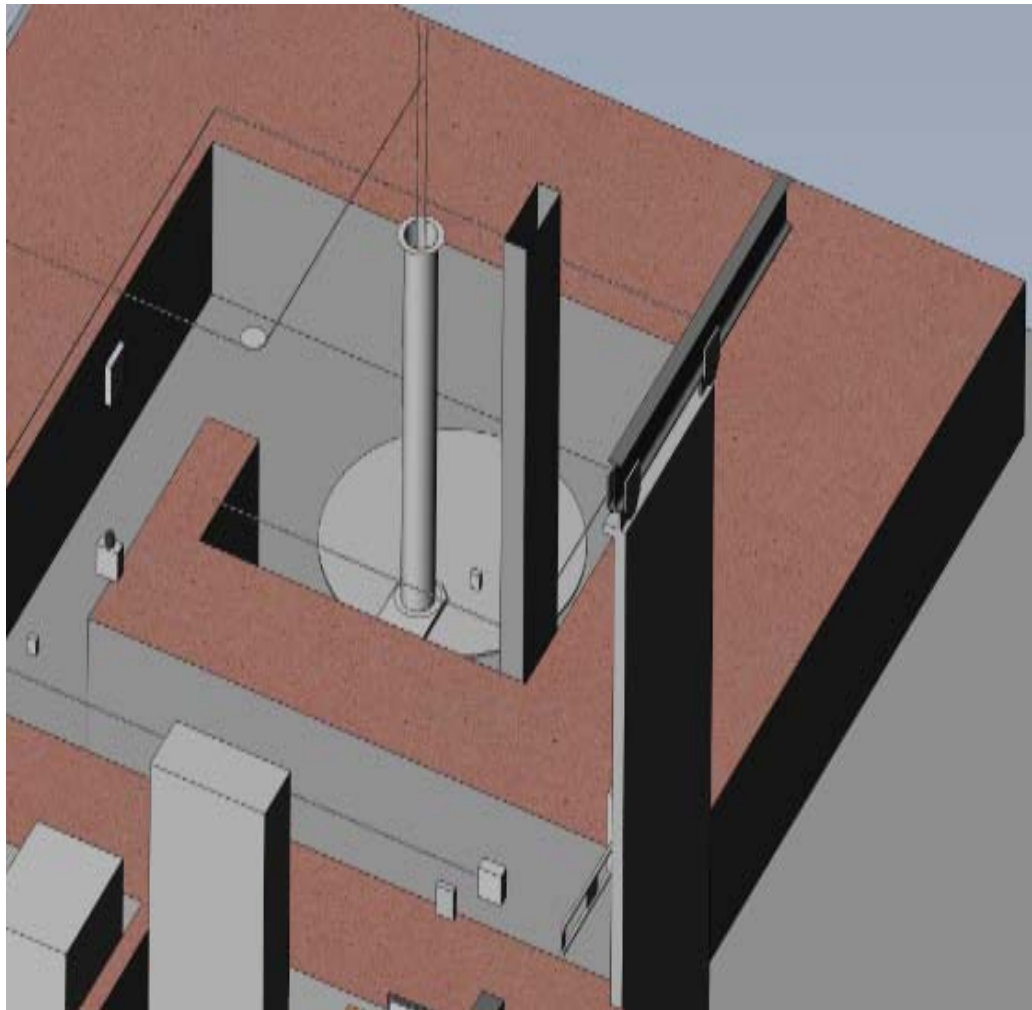
- 60 kCi (2.22 PBq) maximum capacity – dry source storage
- Interlocked turntables for dependable product rotation
- Small volume product irradiations and R&D applications

GB-127 Dose Uniformity

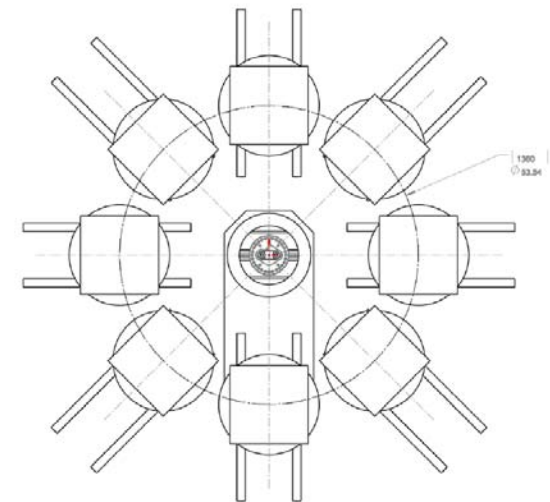
DUR vs Box Size at 1m



GammaFIT R&D Irradiator

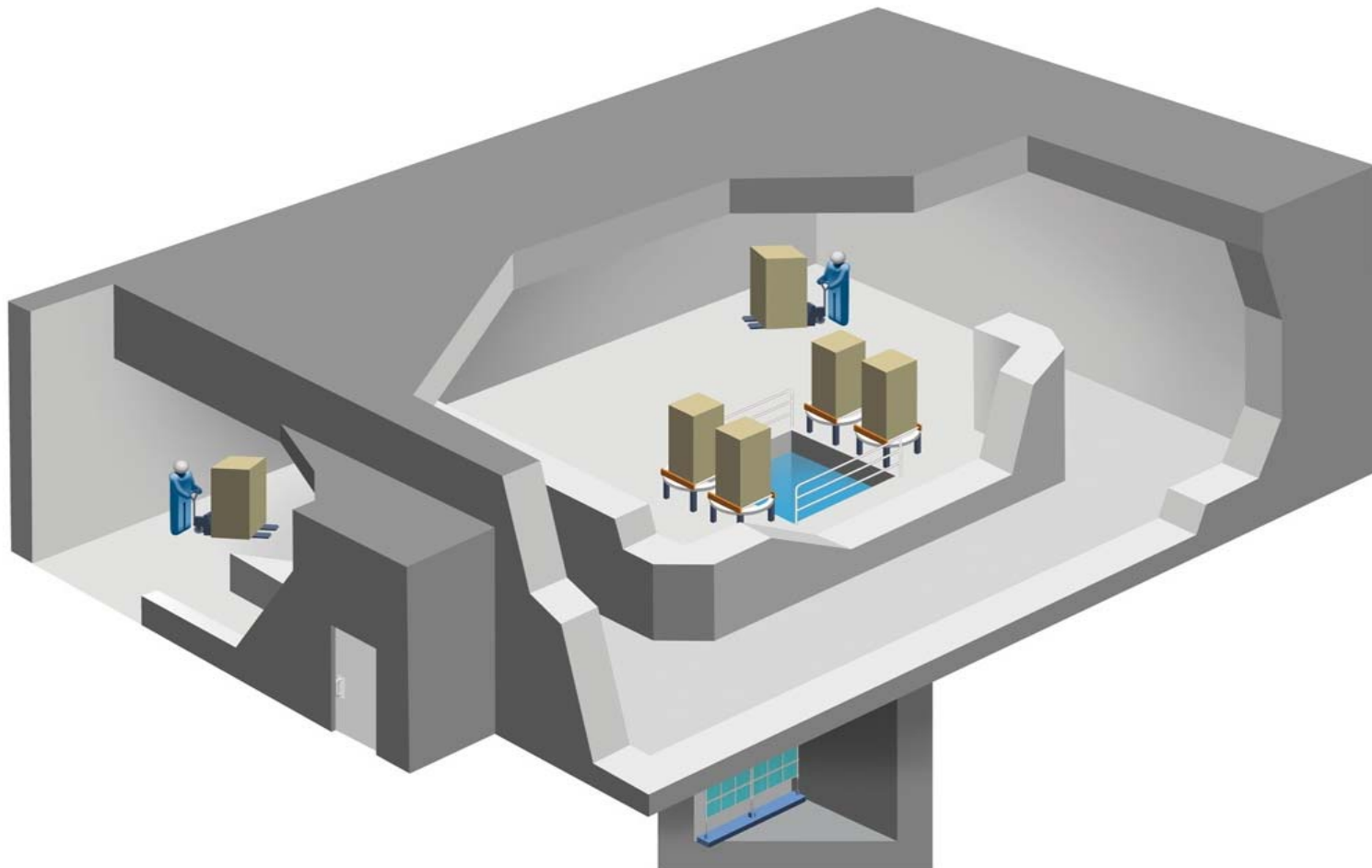


- Product turntables at defined positions
- Rotational or static irradiations

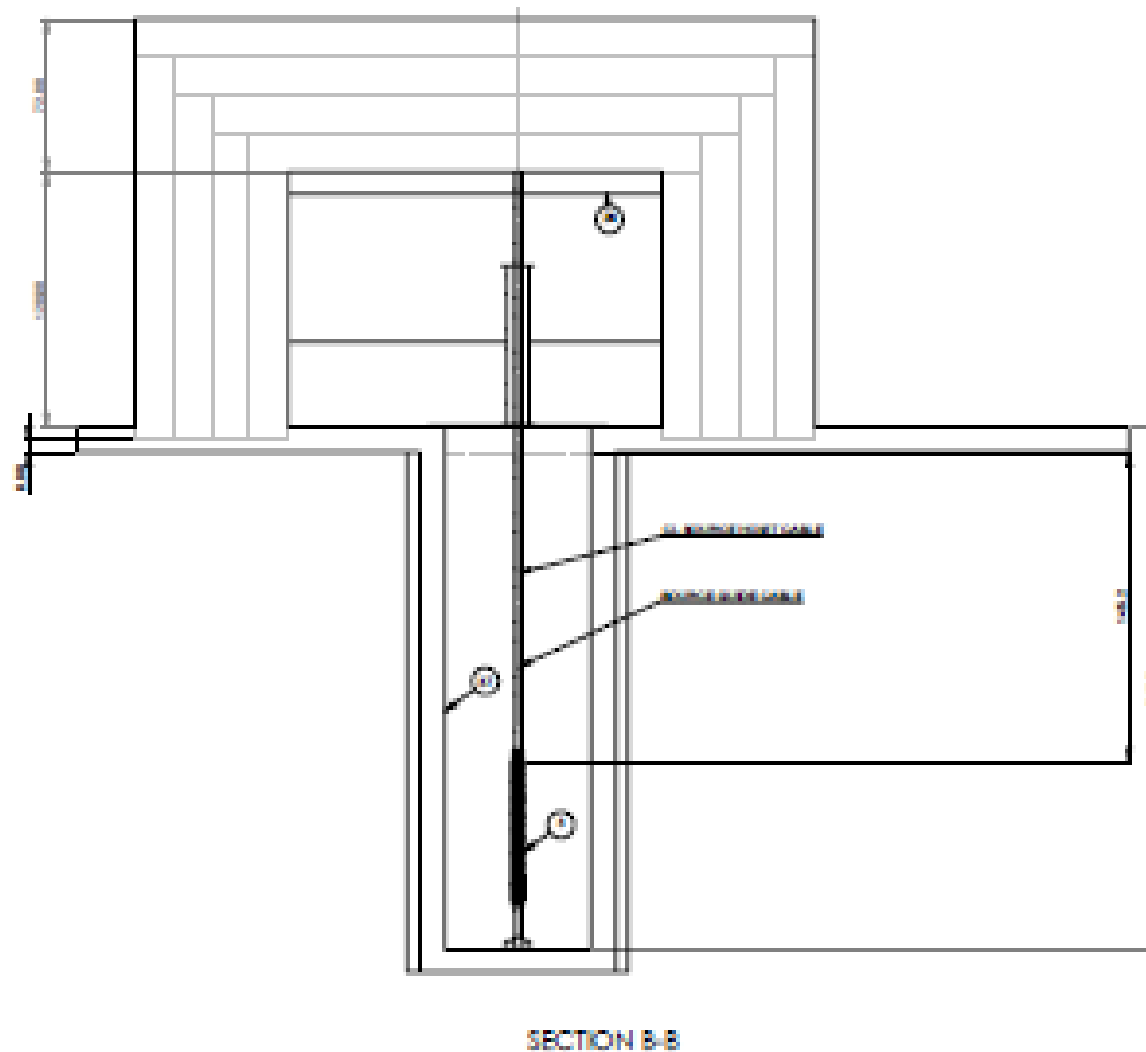


Product on Turntables
Circular Array around radiation source

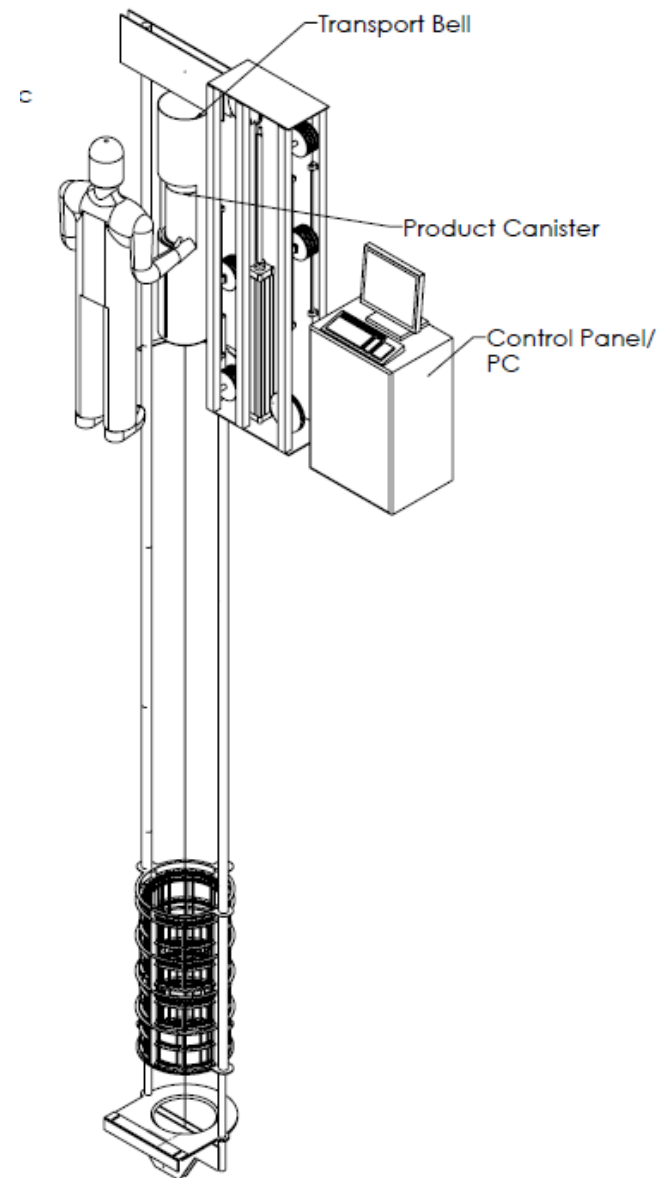
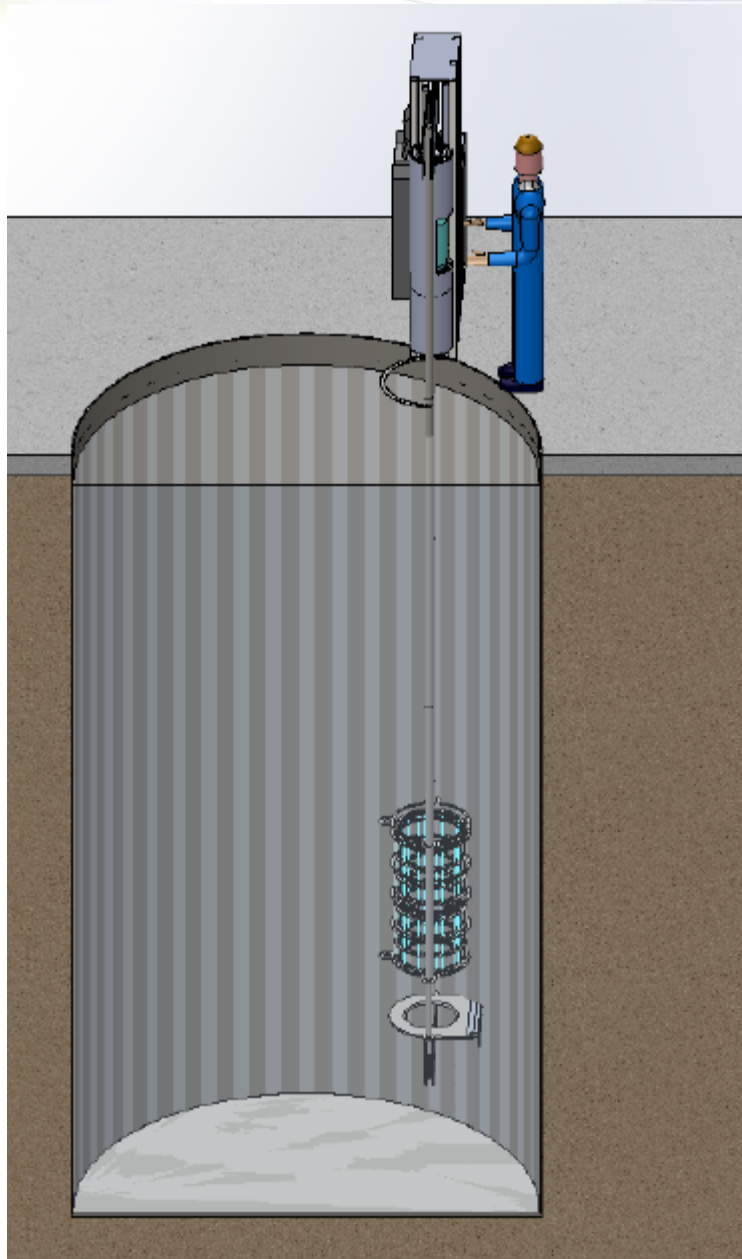
GammaFIT R&D Irradiator



GammaFIT R&D Irradiator

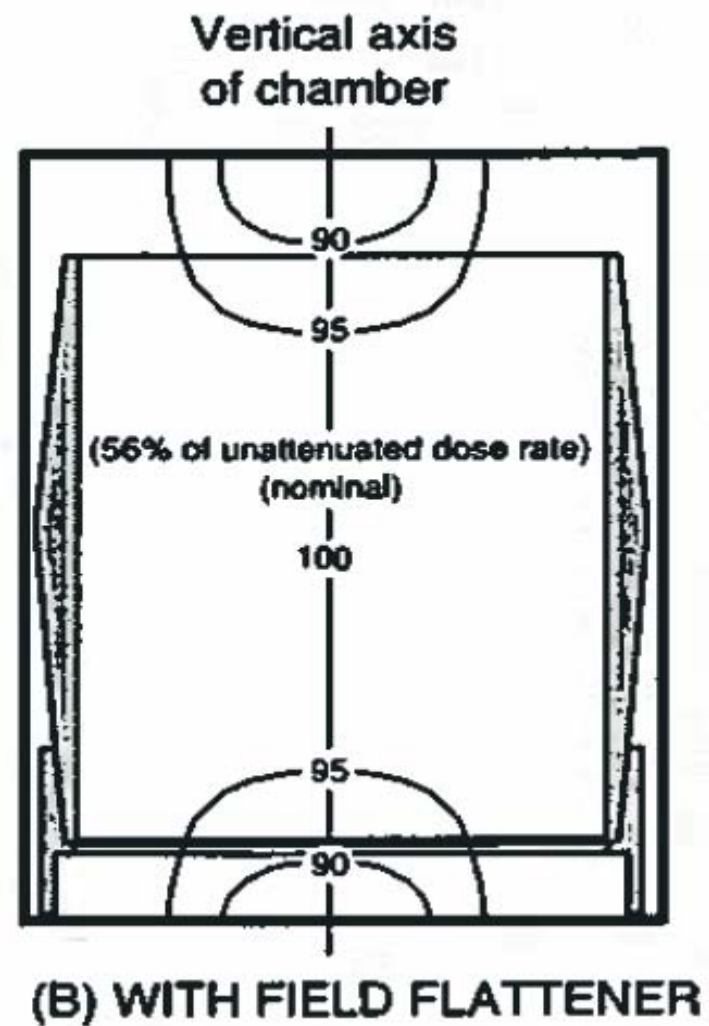
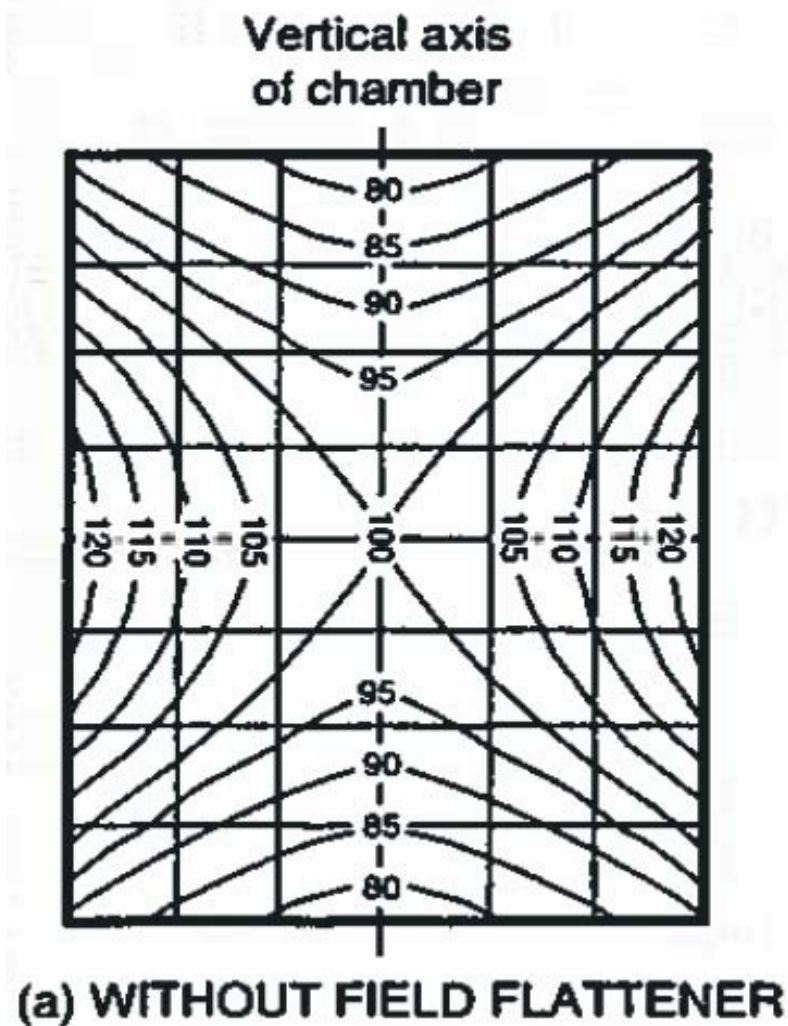


Underwater Irradiator



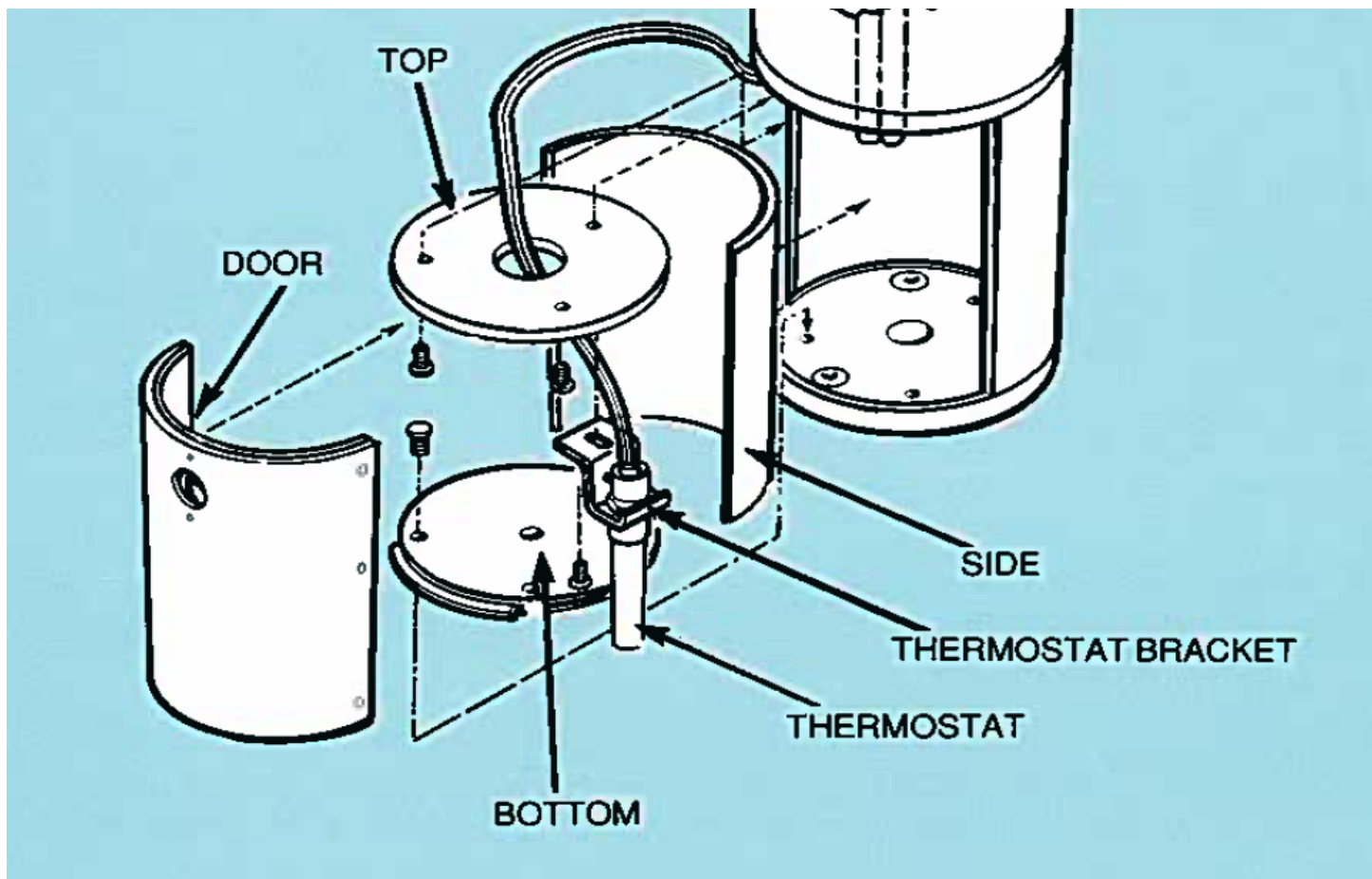
Field Flattening

Field Uniformity improved from $\pm 35\%$ to $\pm 10\%$



Spectrum Modification

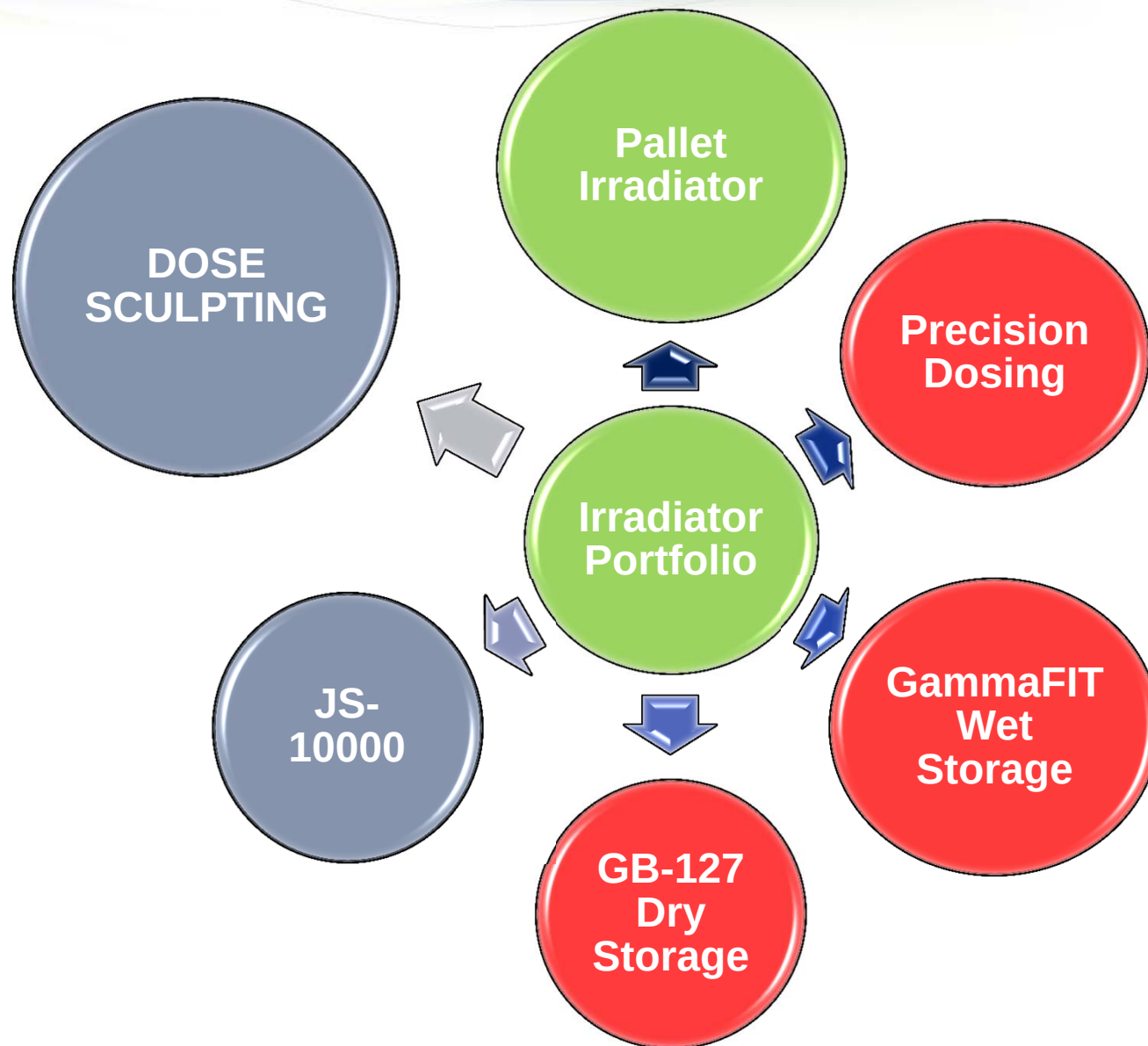
Removal of Low-energy field to reduce dose enhancement effects in Si devices

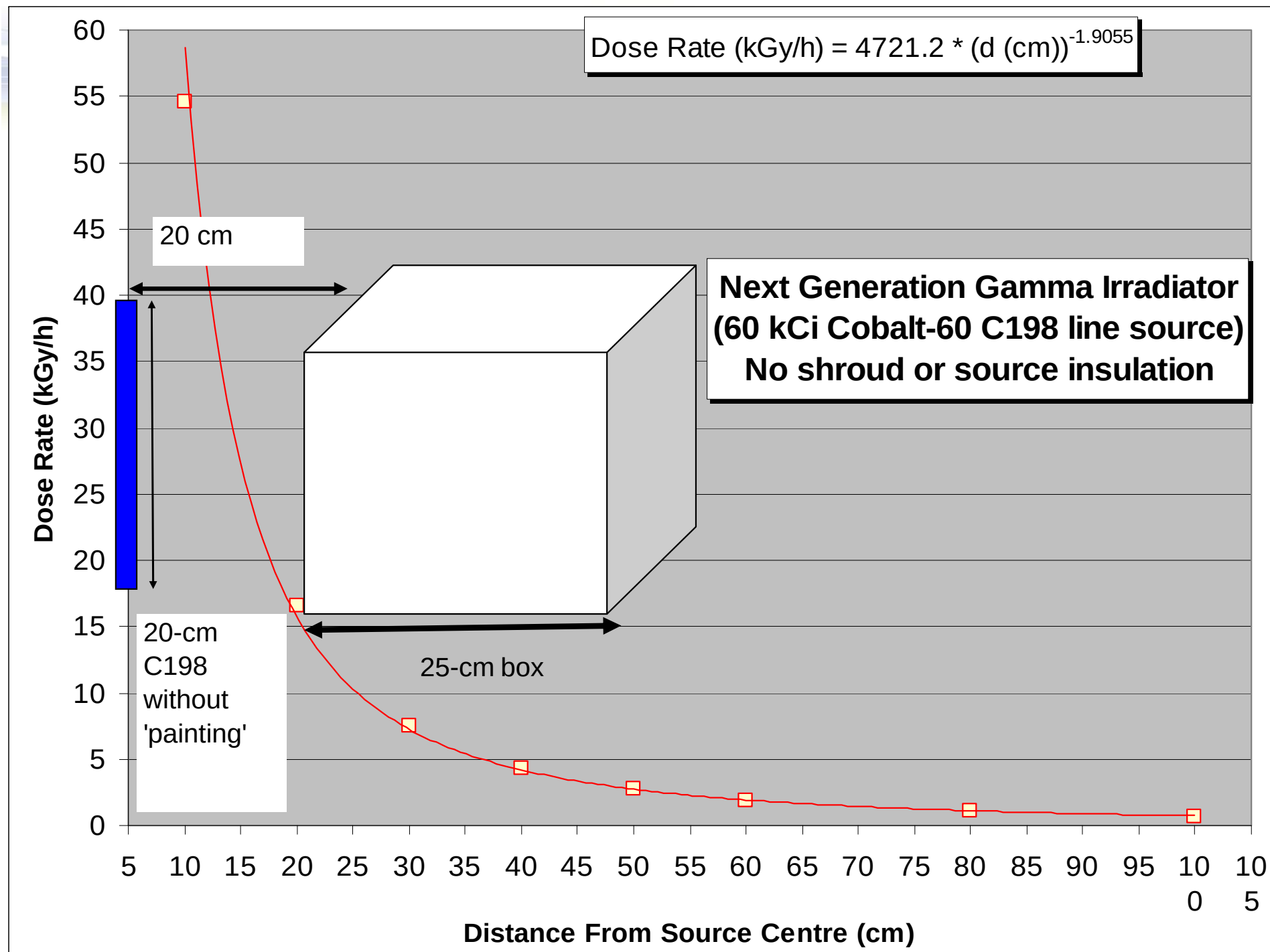


Temperature controlled filter.

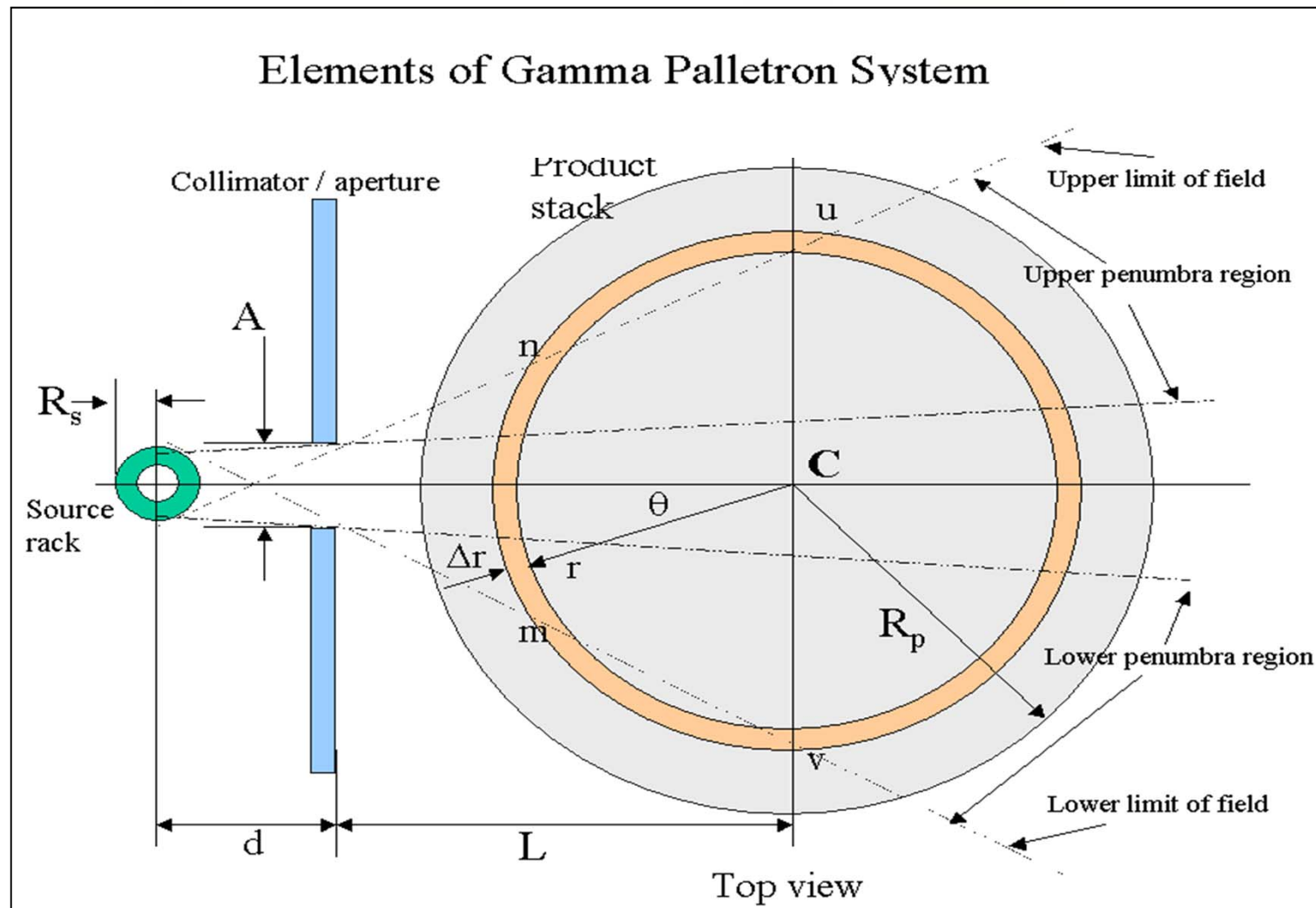
1.5-mm Pb sandwiched between 3-mm and 0.75-mm Al

Precision Dose Technology





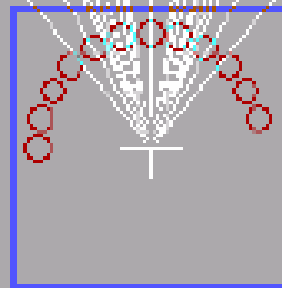
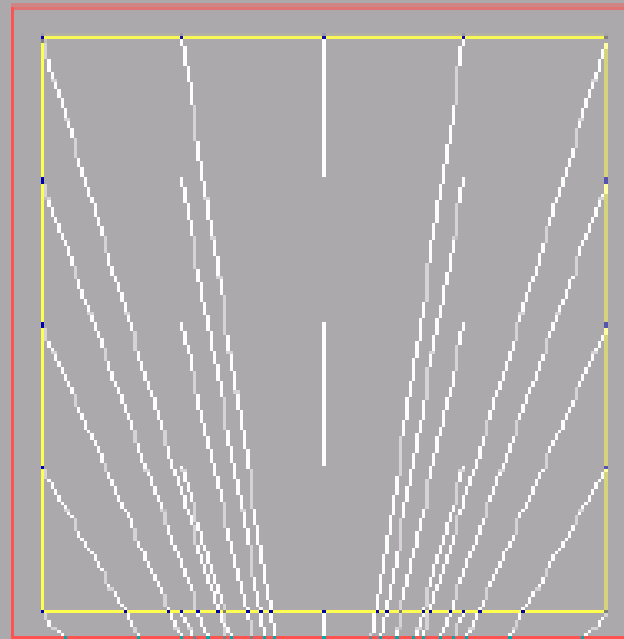
Patented Dose Delivery System



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(1) New Gen (100-nm 10-nm Ap, 137.5 nm s

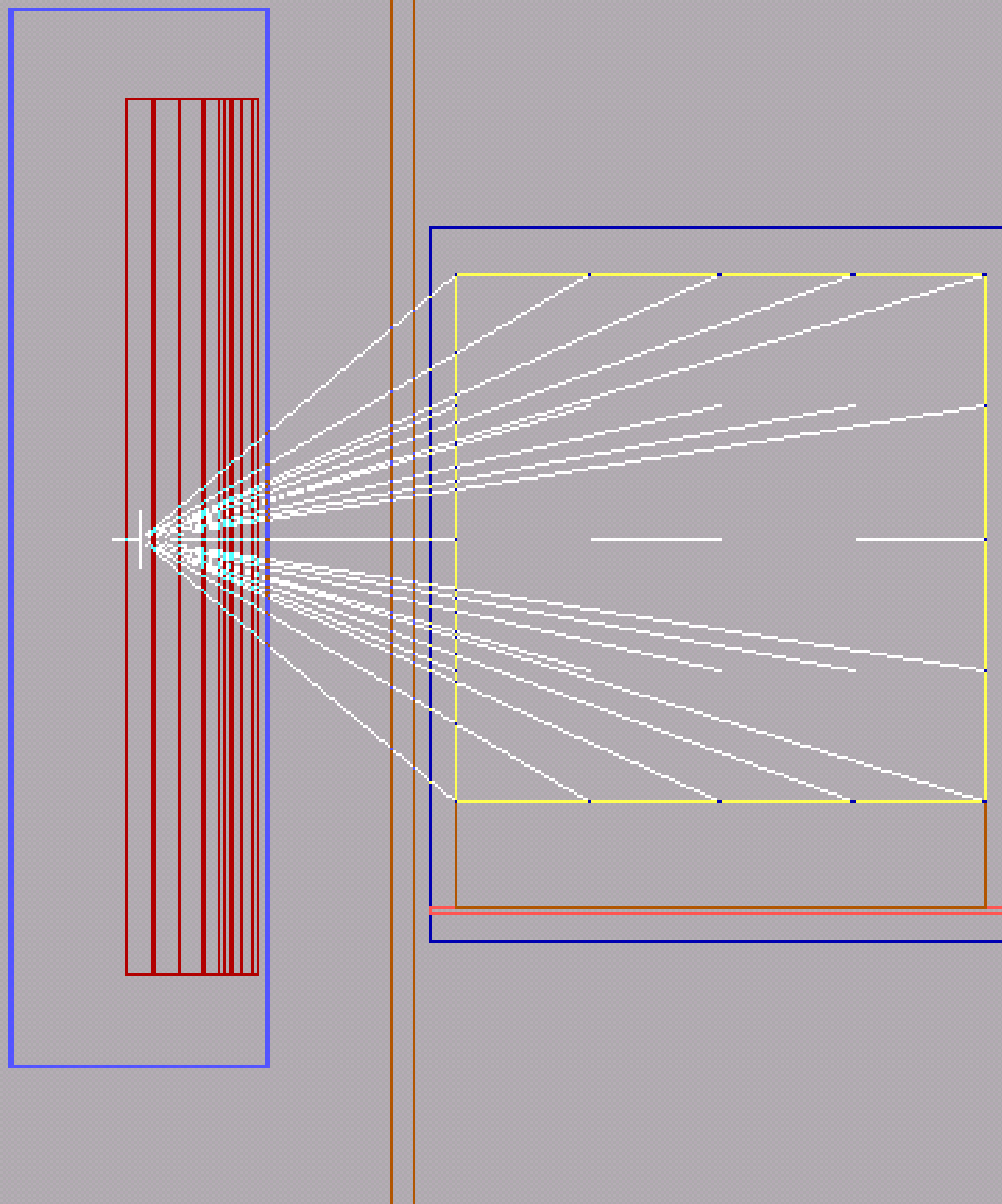
0 0 0



Use: Arrow keys=cursor movement C=coarse movement F=fine movement Q=Quit

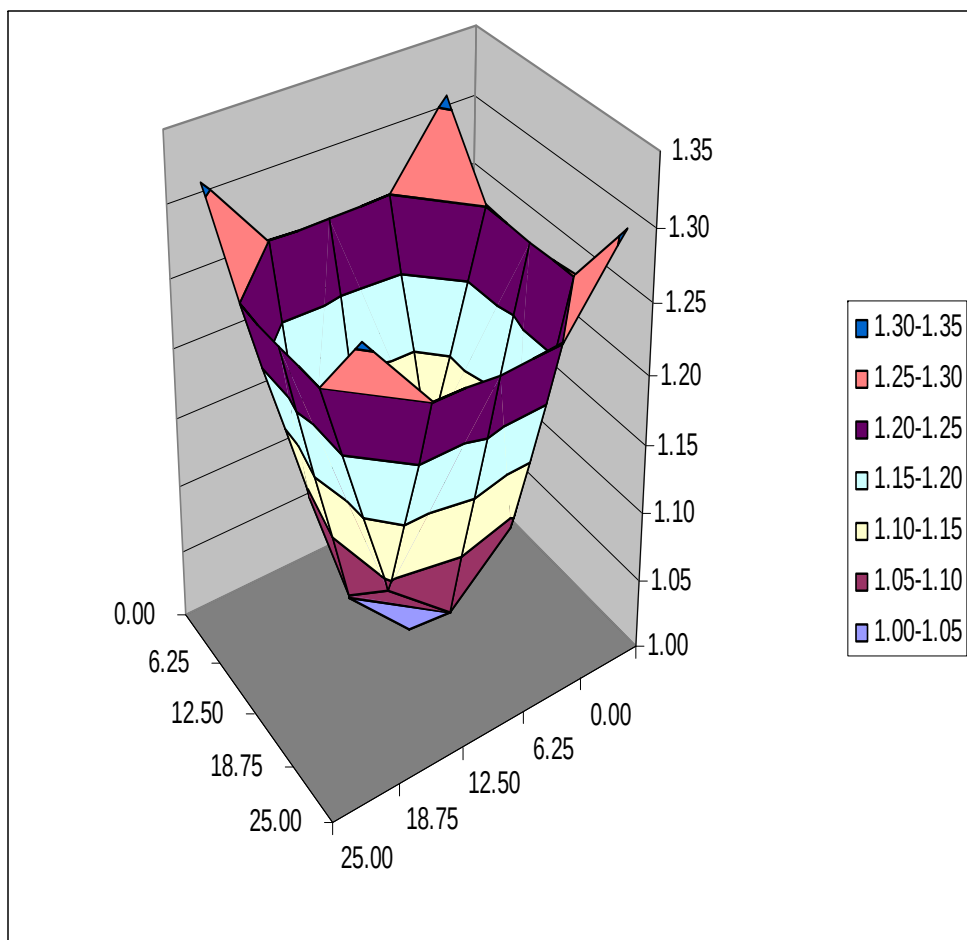
(1) New Gen (100-mm 10-mm Ap, 137.5 mm s

0 0 0



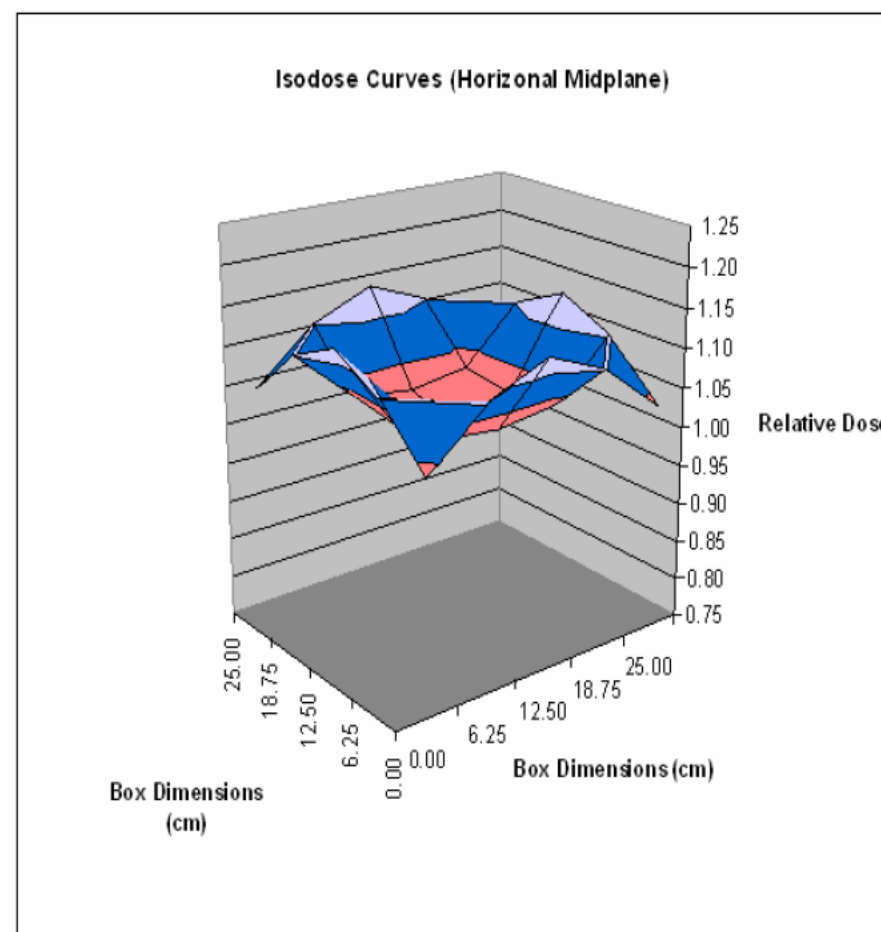
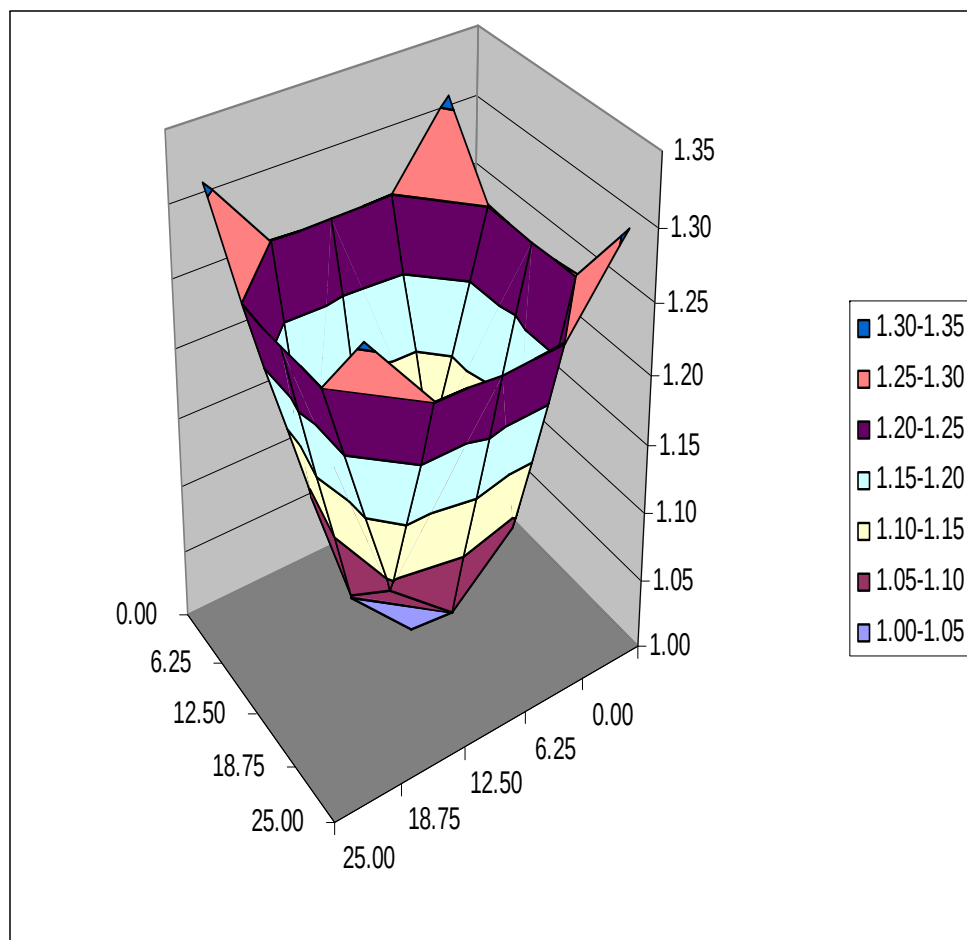
Use: Arrow keys-cursor movement C-coarse movement F-fine movement Q-Quit

Dose Sculpting



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Dose Sculpting

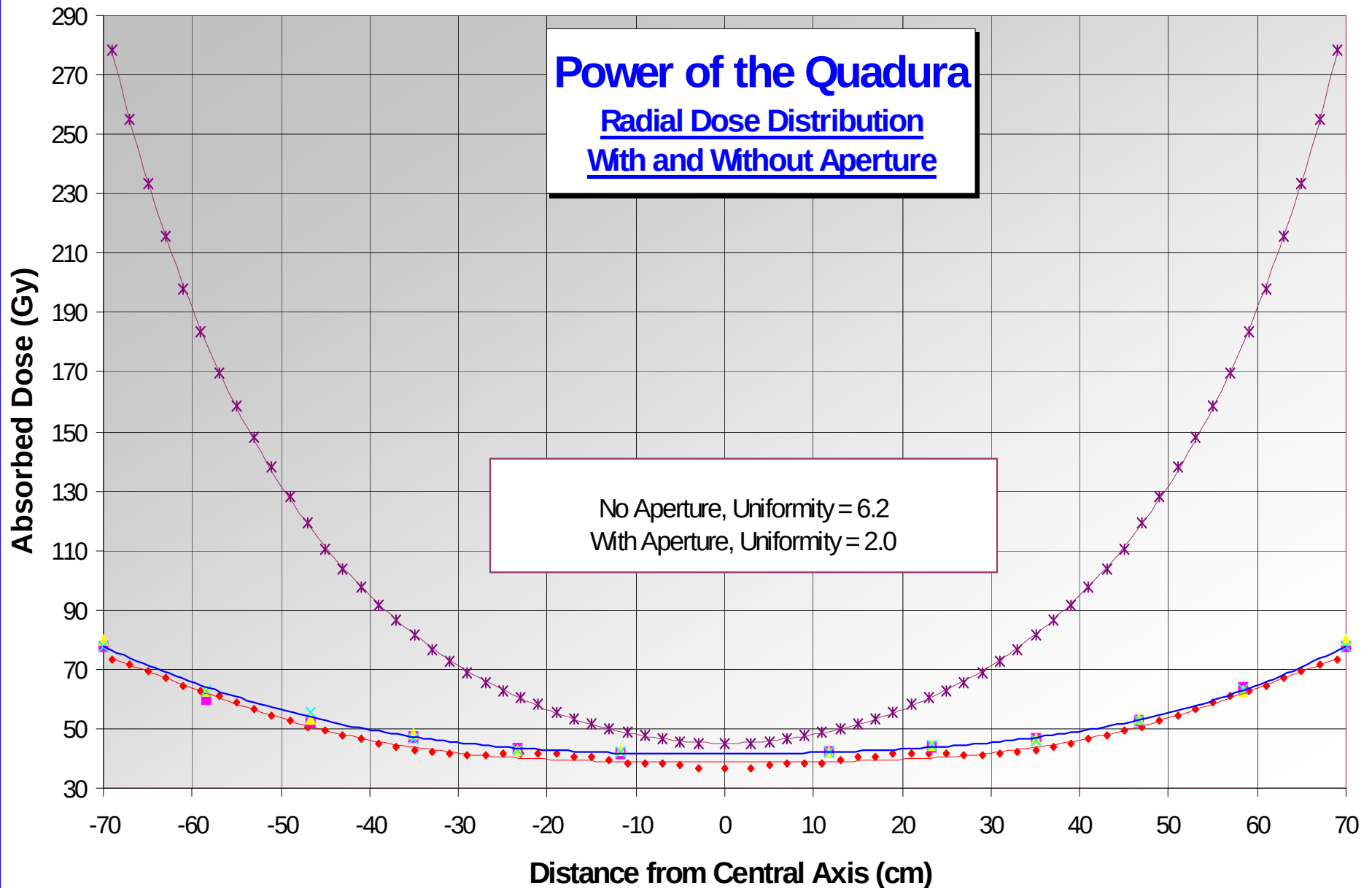


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Uniformity Improvement (fixed aperture, dynamic rotation)

Power of the Quadra Radial Dose Distribution With and Without Aperture

No Aperture, Uniformity = 6.2
With Aperture, Uniformity = 2.0



Summary

Input	GammaFIT R&D	GB-127 R&D	Underwater Irradiation System
Ability to process small volumes, R&D	√	√	√
Processing Flexibility (product size, environmental)	√	√	√
Capacity	3 MCi	60 kCi	500 kCi
+/- 10% dose uniformity or better	√	√	√

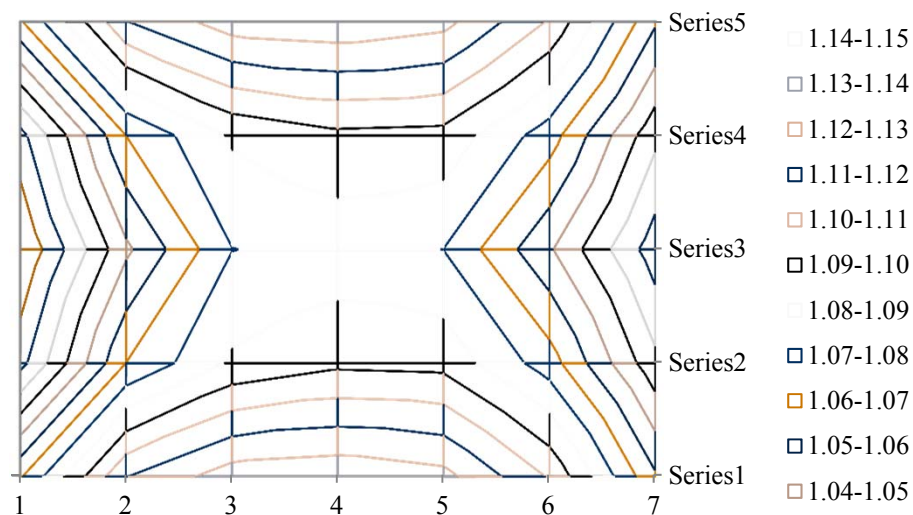
Low Temperature R&D



- Large scale precision irradiations at GCE with dry ice
- Smaller scale precision irradiations at controlled low temperatures
 - In-house self-contained irradiator
 - Fitted with cold chamber
 - Small sample irradiations
 - Accepts samples up to 3" tall by 3" in diameter
 - Temperature range from -100°C to 0°C
 - PID loop controlled
 - Independent control and monitoring temperature measurements within the chamber

Preliminary Test Results

- **Temperature profile**
 - Temperature control stable to within $\pm 1^{\circ}\text{C}$ of target
 - Temperature distribution under steady state conditions
 - $\pm 0.5^{\circ}\text{C}$ at -10°C setpoint
 - $\pm 1.5^{\circ}\text{C}$ at -100°C setpoint
- **Dose mapping**
 - Cold chamber sample area isodose curves (DUR over sample area 1.14)



Discussion



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