Solid State Gamma Irradiation Facility

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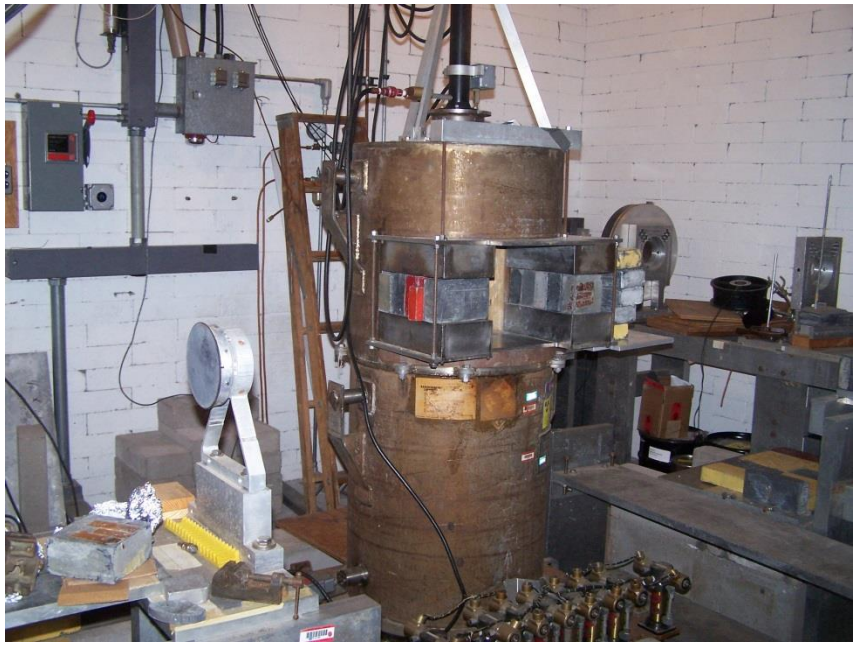
Irradiation Chamber of Gamma Facility



Partial List of Recent Radiation Campaigns

Institution/Detector	Components	Month/year of campaign
Argonne National Laboratory Tile Calorimeter	Optical modulators	January 2013
	Power modules	March 2013
	Optical modulators	May 2013
	Regulators, laser (modulator)	July 2013
	Test boards	March 2014
Brookhaven National Laboratory Liquid Argon Calorimeter	DC-DC Converters	January 2013
	LTC 2945 monitor	April 2013
	Micropod, PPod, ADCs	August 2013
	ADCs	September 2013
	ADCs, LHC 4913 Regulator	October 2013
	Clock oscillators	May 2014
	Analog to Digital Converters	October– November 2014
	Dc-DC Converters	March 2015
	Dc-DC Converters	May 2015
Brookhaven National Laboratory Silicon Tracker	AO6404 MOSFETs	June-July 2013
	Silicon Detectors	November-January 2014
	Gaskets/Adhesives	March 2014
	Gasket Materials	June 2014
	Silicon Mini Detectors	August-September 2014
Southern Methodist University Liquid Argon Calorimeter	Test board	January 2013
	Test chips	February 2014
University of Michigan New Small Wheel	DC-DC converters	September 2013
	DC-DC converters	February-March 2014
	DC-DC converters	March 2015
	Clock/Signal Repeaters	May 2015
	FPGA	August 2015
University of Pennsylvania (Various)	Test boards	March 2013
	Test boards	August 2013
	Test boards	October 2013
	Test boards	November 2013
	Test boards	February-March 2014
	Test boards	September-October 2014
	Power Converters	October 2014
	Test boards	November-December 2014
	TRT Boards	February 2015
	W0601, W0953 boards	March 2015

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- Source at this time is ~ 700 Curies of ^{60}Co.
- Emits 2 gammas at 1.17 and 1.33 MeV
- Range of dose rates outside the collimator ranges from about 10^4 rad/hr to 100 rad/hr
- Dose rates up to 6 x 10^4 rad/hr available for small volumes
- What makes this a good facility for ionizing radiation exposures and testing?
- ^{60}Co gammas have desirable characteristics compared to x-rays (Z dependent) or protons (displacement damage)
- Source is contained inside a shield in a walk-in room allowing for detailed setups.
- Irradiations can be run 24/7 allowing for long continuous exposures
- Support electronics can be configured close to the target electronics in shielded volumes
- Control and monitoring systems can be placed in an accessible location about 15 meters away.

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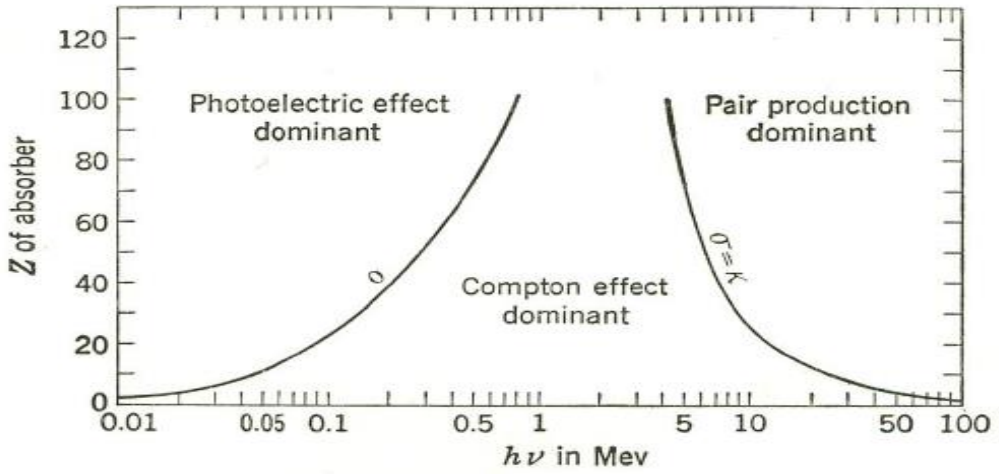
- Three types of gamma interactions are photoelectric effect, Compton scattering (electron) and pair production
- Shown is a plot of Z versus photon energy. The curves show where the interaction probability is equal
- As seen, at the 1.25 MeV (average) energy of ^{60}Co the interaction is strongly dominated by Compton scattering.
- To a rough first order the number of electrons/gram is independent of Z.
- This implies that the number of Compton (electron) scatters (amount of deposited energy) /gram is independent of Z
- This means that the total ionizing dose is independent of the composition



Plot of photon interaction versus photon energy. The two lines are where the interaction is equal

R. D Evans, The Atomic Nucleus ,1955, p. 712

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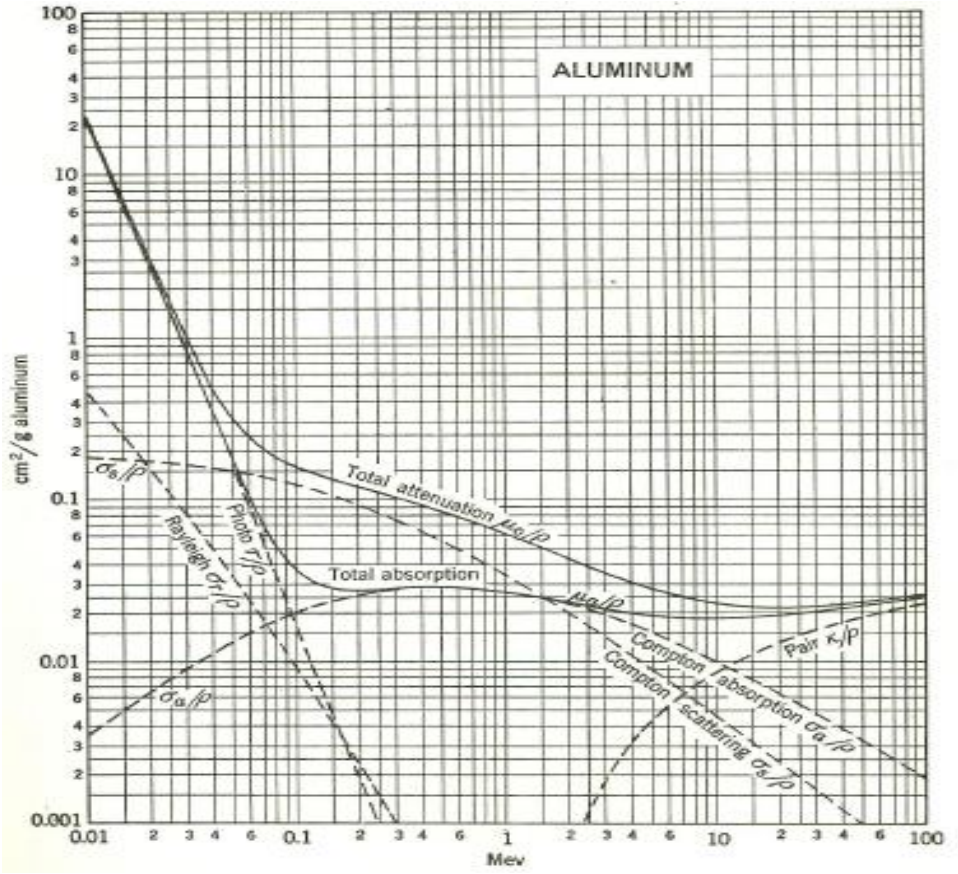
- Shown are the mass attenuation coefficients for Al as a function of photon energy.
- In the region of ^{60}Co gammas the total attenuation is significantly lower than at x-ray energies (< 100 keV)
- This implies that modest amounts of blocking materials (particularly low Z) can be tolerated without affecting the overall dose compared to lower energy gammas or x-rays



Mass Attenuation Coefficients for Al

R. D Evans, The Atomic Nucleus ,1955, p. 715

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Or go to website

http://www.inst.bnl.gov/facilities/ssif/