

Ce-134 (97m) ECB+	Ce-135 (3.16d) EC	Ce-136 (17.7h) ECB+	Ce-137 (STABLE)	Ce-138 (9.0h) (STABLE)	Ce-139 (137.641d) EC	Ce-140 (STABLE)	Ce-141 (32.508d) B-	
La-132 (1.8h) ECB+	La-133 (3.912h) ECB+	La-134 (6.45m) ECB+	La-135 (1.1h) ECB+	La-136 (9.87m) ECB+	La-137 (6.48d) ECB-	La-138 (1.02E+11y) ECB-	La-139 (STABLE)	La-140 (1.6781d) B-
Ba-131 (1.50d) C	Ba-132 (STABLE)	Ba-133 (10.52y) EC	Ba-134 (STABLE)	Ba-135 (STABLE)	Ba-136 (STABLE)	Ba-137 (STABLE)	Ba-138 (STABLE)	Ba-139 (83.06m) B-

LANTHANUM-136

SUMMARY DATA

GENERAL

CLASSIFICATION

Isotope: La-136
Atomic number (Z): 57
Mass number (A): 136
Neutron number (N): 79

RADIOACTIVE DECAY

Decay modes: β^+ , Electron capture
Half-life: 9.87 [m]
Decay constant: 1.1705e-03 [1/s]
Daughters: Ba-136 (100.0%)
Radioactive daughters: None

DOSIMETRIC CONSTANTS

Mean alpha energy: 0.0 [MeV]
Mean electron energy: 0.29406 [MeV]
Mean photon energy: 0.40703 [MeV]
Air kerma rate constant, Γ_{10} : 3.511e-18 [Gy·m²/Bq·s]
Air kerma coefficient, K_{air} : 1.718e-17 [Gy·m²/Bq·s]
Equilibrium dose constant for weakly-penetrating radiations (α and/or electrons), Δ_{wp} : 4.711e-14 [Gy·kg/Bq·s]
Equilibrium dose constant for alphas, Δ_{α} : 0.000e+00 [Gy·kg/Bq·s]

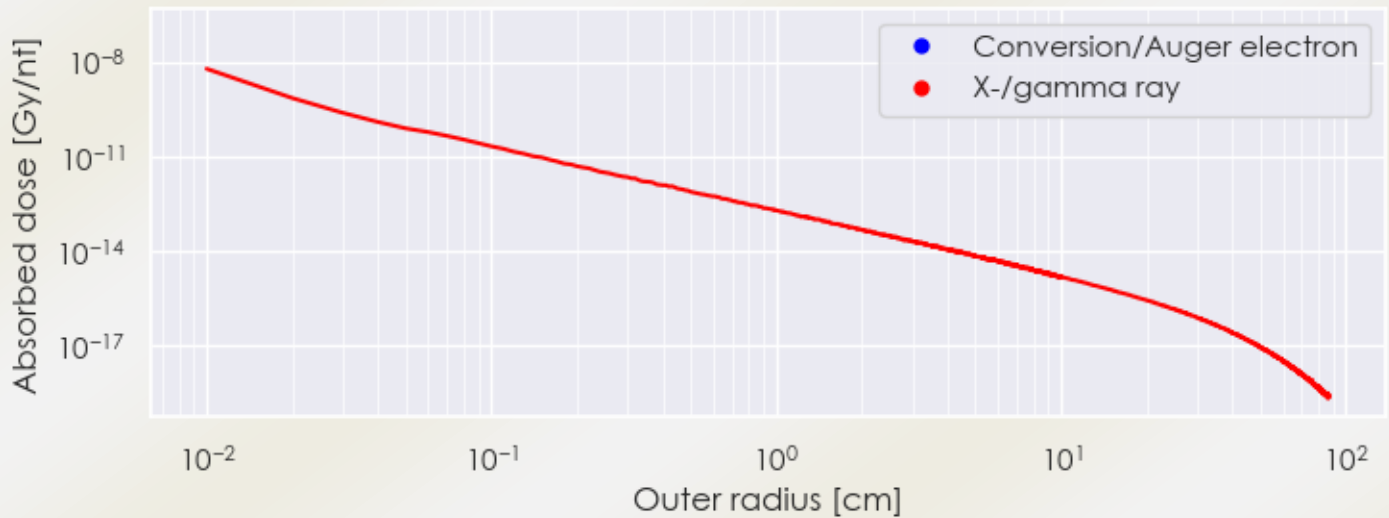
Equilibrium dose constant for betas/electrons, $\Delta_{\beta, \beta^+, e^-}$: 4.711×10^{-14} [Gy·kg/Bq·s]

Equilibrium dose constant for photons, Δ_p : 6.521×10^{-14} [Gy·kg/Bq·s]

DOSE POINT KERNELS (PLOT)

Dose point kernel source: **Graves, et al. Medical Physics. 2019 Nov.; 46(11):5284-5293.**

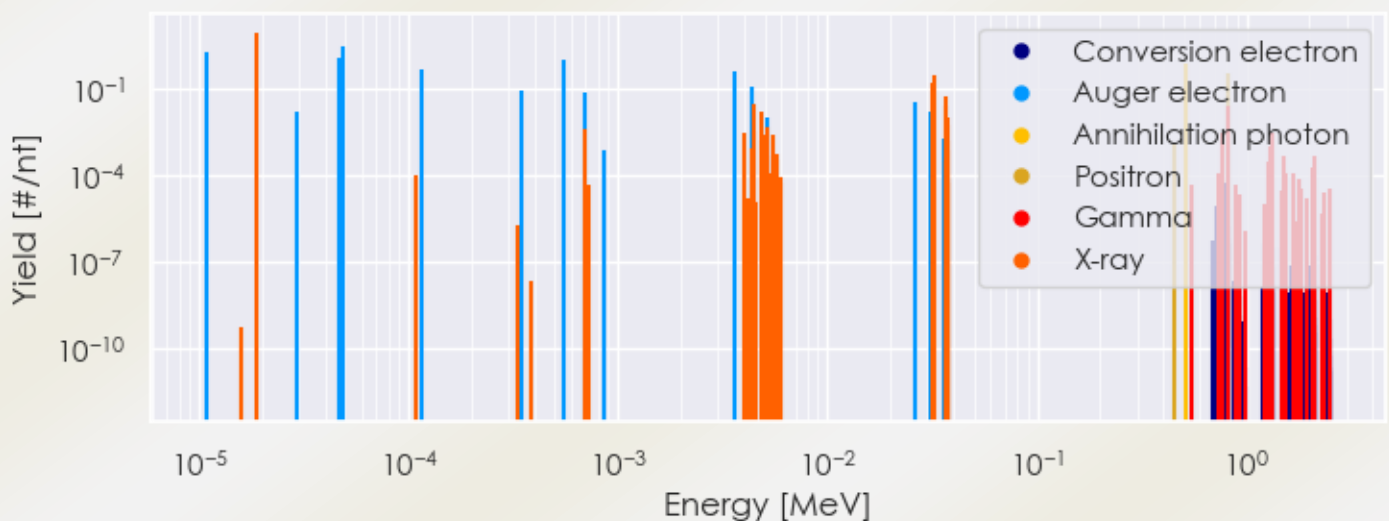
Note: Bins are spaced every 0.1 mm until a radius of 10 cm, and every 1 mm until a radius of 2 m.



Download tabulated dose point kernel file here: www.mirdsoft.org/products/MIRDspecs/La-136 DPK.csv

SUMMARY SPECTRA (PLOT)

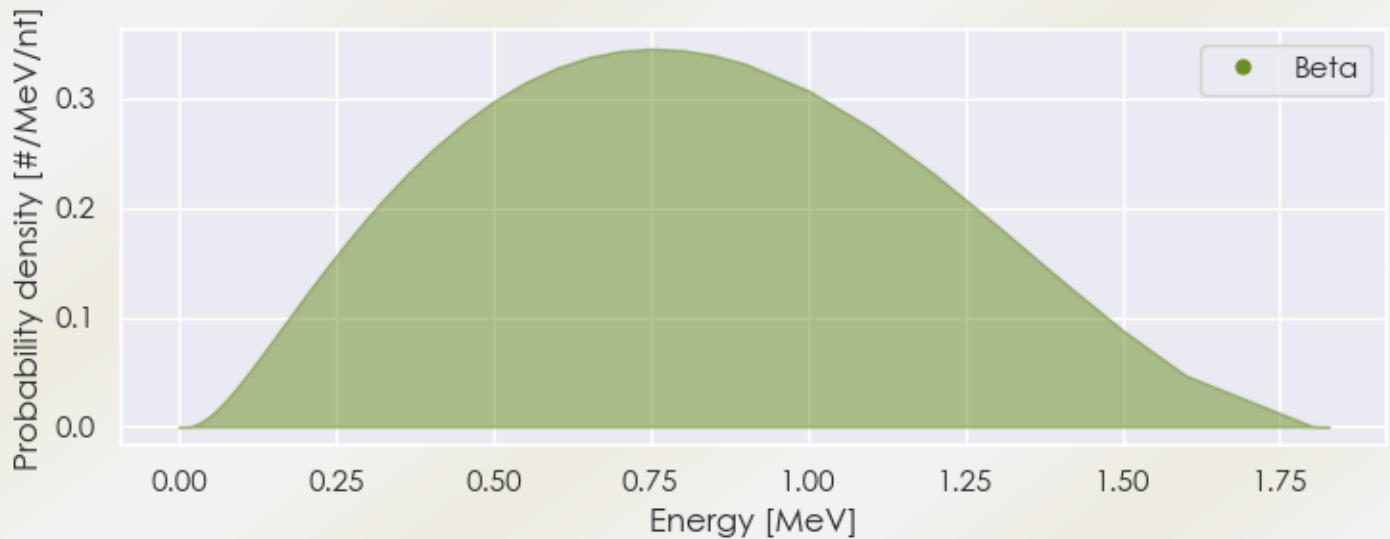
Spectra source: **ICRP Publication 107: Nuclear Decay Data for Dosimetric Calculations. Ann. ICRP 2008, 38 (3).**



Download tabulated summary spectra file here: www.mirdsoft.org/products/MIRDspecs/La-136 Summary Spectrum.csv

BETA SPECTRA (PLOT)

Spectra source: **ICRP Publication 107: Nuclear Decay Data for Dosimetric Calculations. Ann. ICRP 2008, 38 (3).**



Download tabulated beta spectra file here: www.mirdsoft.org/products/MIRDspecs/La-136 Beta Spectrum.csv

TABULATED DATA

SUMMARY SPECTRA (TABLE)

Spectra source: **ICRP Publication 107: Nuclear Decay Data for Dosimetric Calculations. Ann. ICRP 2008, 38 (3).**

Note: Radiations with yield < 0.01 are excluded from the table, but are available in the linked *.csv data.

Download tabulated summary spectra file here: www.mirdsoft.org/products/MIRDspecs/La-136 Summary Spectrum.csv

Energy [MeV]	Yield [# / nt] if > 0.01	Radiation type
1.86002e-05	8.653e+00	X-ray
4.45292e-03	2.726e-02	X-ray
4.82366e-03	1.604e-02	X-ray
3.18187e-02	1.427e-01	X-ray
3.22056e-02	2.628e-01	X-ray
3.63167e-02	2.511e-02	X-ray
3.63920e-02	4.866e-02	X-ray
3.72607e-02	1.034e-02	X-ray
5.11000e-01	7.064e-01	Annihilation photon
8.18510e-01	2.300e-02	Gamma

8.21545e-01	3.520e-01	Positron
1.08630e-05	1.846e+00	Auger electron
2.91100e-05	1.530e-02	Auger electron
4.69849e-05	1.072e+00	Auger electron
4.88206e-05	2.928e+00	Auger electron
1.14462e-04	4.236e-01	Auger electron
3.42556e-04	8.611e-02	Auger electron
5.52294e-04	9.559e-01	Auger electron
6.90671e-04	7.040e-02	Auger electron
3.56936e-03	3.750e-01	Auger electron
4.33590e-03	1.198e-01	Auger electron
2.63448e-02	3.499e-02	Auger electron
3.09583e-02	1.614e-02	Auger electron

USEFUL LINKS

Isotope decay characteristics are periodically updated as better measurements can be made - changes that may not be reflected on this page. Please see useful links:

National Nuclear Data Center (NNDC): <https://www.nndc.bnl.gov/nudat3/mird/>

International Atomic Energy Agency (IAEA) Livechart: <https://www-nds.iaea.org/relnsd/vcharthtml/VChartHTML.html>

REFERENCE LINKS

ICRP Report 107: <https://www.icrp.org/publication.asp?id=ICRP%20Publication%20107>

Graves et al. Dose Point Kernels: <https://doi.org/10.1002/mp.13789>

MIRD Decay Schemes 2nd Edition: https://sites.snmmi.org/SNMMI-MAIN/iCore/Store/StoreLayouts/Item_Detail.aspx?iProductCode=0-932004-80-6