

	Nb-87 (2.11m) ECB+	Nb-88 (14.5m) ECB+	Nb-90 (14.60h) ECB+	Nb-91 (6.8E+6y) EC	Nb-92 (3.47E+7y) EC	Nb-93 (STABLE)	Nb-94 (2.03E+4y) B-
Zr-85 (7.86m) CB+	Zr-86 (16.5h) ECB+	Zr-87 (1.60h) ECB+	Zr-88 (83.4d) EC	Zr-90 (STABLE)	Zr-91 (STABLE)	Zr-92 (STABLE)	Zr-93 (1.53E+6y) B-

NIOBIUM-90

SUMMARY DATA

GENERAL

CLASSIFICATION

Isotope: Nb-90

Atomic number (Z): 41

Mass number (A): 90

Neutron number (N): 49

RADIOACTIVE DECAY

Decay modes: β^+ , Electron capture

Half-life: 14.6 [h]

Decay constant: 1.3188e-05 [1/s]

Daughters: Zr-90 (100.0%)

Radioactive daughters: None

DOSIMETRIC CONSTANTS

Mean alpha energy: 0.0 [MeV]

Mean electron energy: 0.40318 [MeV]

Mean photon energy: 4.21354 [MeV]

Air kerma rate constant, Γ_{10} : 1.237e-16 [Gy·m²/Bq·s]

Air kerma coefficient, K_{air} : $1.445\text{e-}16$ [$\text{Gy} \cdot \text{m}^2/\text{Bq} \cdot \text{s}$]

Equilibrium dose constant for weakly-penetrating radiations (α and/or electrons), Δ_{wp} : 6.460e-14 [Gy·kg/Bq·s]

Equilibrium dose constant for alphas, Δ_a : 0.000e+00 [Gy·kg/Bq·s]

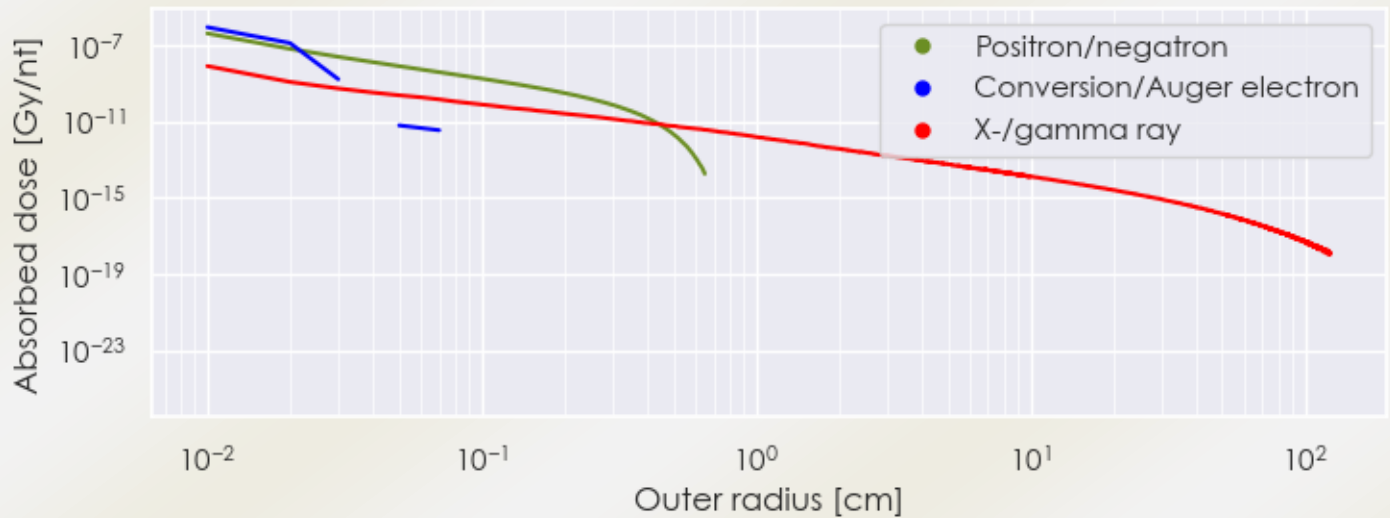
Equilibrium dose constant for betas/electrons, $\Delta_{\beta,\beta^+,e^-}$: 6.460×10^{-14} [Gy·kg/Bq·s]

Equilibrium dose constant for photons, Δ_p : 6.751×10^{-13} [Gy·kg/Bq·s]

DOSE POINT KERNELS (PLOT)

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

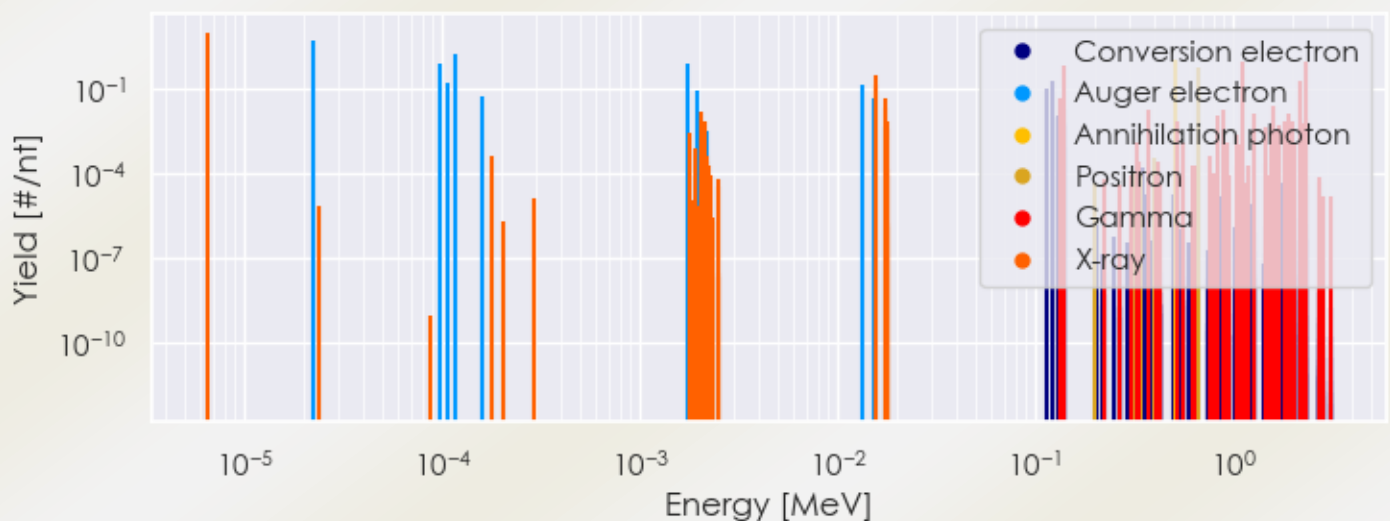
Note: Bins are spaced every 0.1 mm until a radius of 10 cm, and every 1 mm until a radius of 2 m.



Download tabulated dose point kernel file here: www.mirdsoft.org/products/MIRDspecs/Nb-90 DPK.csv

SUMMARY SPECTRA (PLOT)

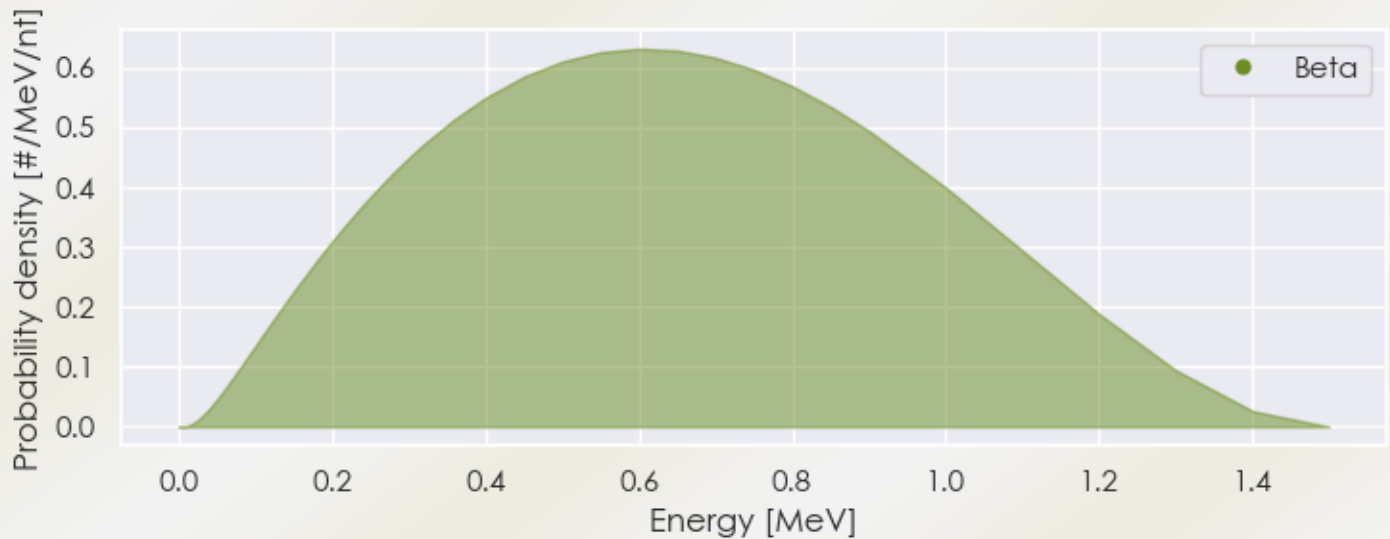
Spectra source: **ICRP Publication 107: Nuclear Decay Data for Dosimetric Calculations. Ann. ICRP 2008, 38 (3).**



Download tabulated summary spectra file here: www.mirdsoft.org/products/MIRDspecs/Nb-90 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/Nb-90 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/Nb-90 Summary Spectrum.csv

Energy [MeV]	Yield [# / nt] if > 0.01	Radiation type
6.52415e-06	9.577e+00	X-ray
2.03430e-03	1.438e-02	X-ray
1.56498e-02	1.433e-01	X-ray
1.57372e-02	2.742e-01	X-ray
1.76171e-02	2.162e-02	X-ray
1.76312e-02	4.210e-02	X-ray
1.32716e-01	4.134e-02	Gamma
1.41178e-01	6.677e-01	Gamma
3.71307e-01	1.805e-02	Gamma
5.11000e-01	1.075e+00	Annihilation photon

8.27740e-01	1.107e-02	Gamma
8.90640e-01	1.805e-02	Gamma
1.12922e+00	9.269e-01	Gamma
1.27040e+00	1.296e-02	Gamma
1.61176e+00	2.379e-02	Gamma
1.91319e+00	1.280e-02	Gamma
2.18624e+00	1.796e-01	Gamma
2.31896e+00	8.203e-01	Gamma
6.62140e-01	5.367e-01	Positron
2.22377e-05	5.077e+00	Auger electron
9.84963e-05	7.607e-01	Auger electron
1.05573e-04	1.539e-01	Auger electron
1.17869e-04	1.739e+00	Auger electron
1.58123e-04	5.134e-02	Auger electron
1.75393e-03	7.233e-01	Auger electron
1.94461e-03	8.107e-02	Auger electron
1.33271e-02	1.331e-01	Auger electron
1.53342e-02	4.739e-02	Auger electron
1.14754e-01	9.233e-02	Conversion electron
1.23216e-01	1.801e-01	Conversion electron
1.30491e-01	1.017e-02	Conversion electron
1.38663e-01	1.728e-02	Conversion 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