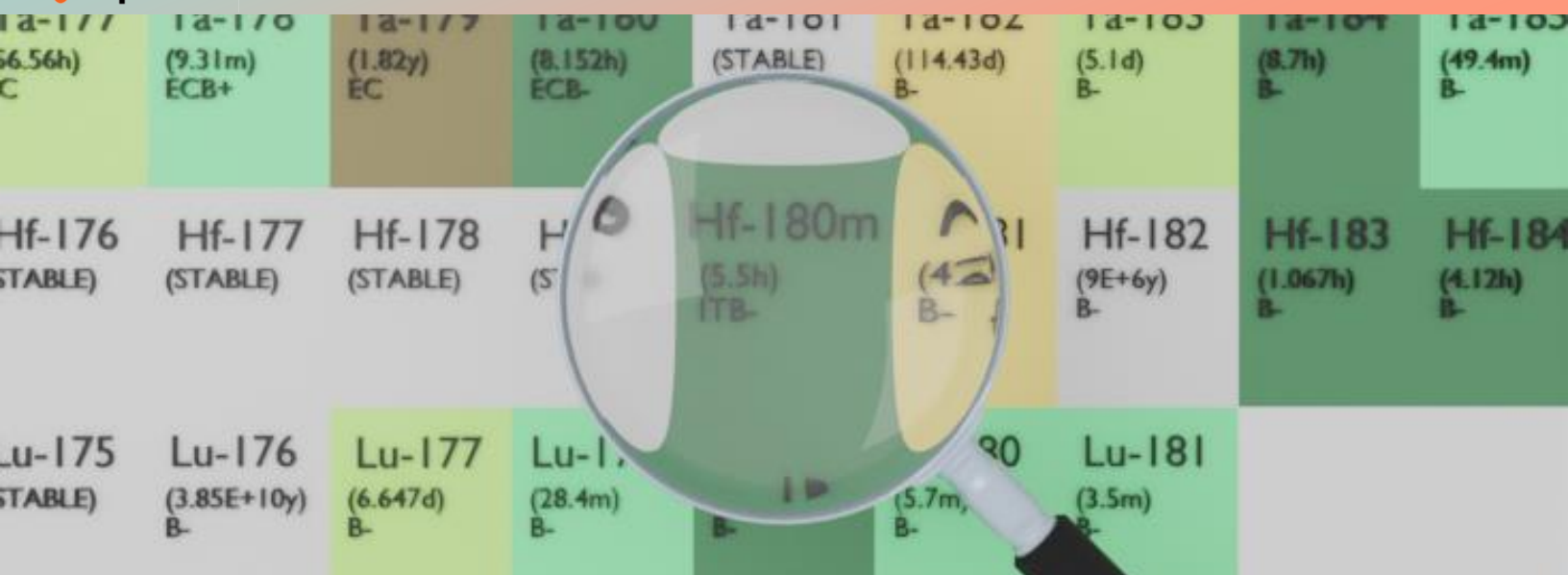




HAFNIUM-180M

SUMMARY DATA

GENERAL

CLASSIFICATION

Isotope: Hf-180m
Atomic number (Z): 72
Mass number (A): 180
Neutron number (N): 108

RADIOACTIVE DECAY

Decay modes: β^- , Internal transition
Half-life: 5.5 [h]
Decay constant: 3.5007×10^{-5} [1/s]
Daughters: Hf-180 (99.7%), Ta-180m (0.3%)
Radioactive daughters: None

DOSIMETRIC CONSTANTS

Mean alpha energy: 0.0 [MeV]
Mean electron energy: 0.14374 [MeV]
Mean photon energy: 0.98839 [MeV]
Air kerma rate constant, Γ_{10} : 3.768×10^{-17} [Gy $\cdot$ m²/Bq $\cdot$ s]
Air kerma coefficient, K_{air} : 3.768×10^{-17} [Gy $\cdot$ m²/Bq $\cdot$ s]
Equilibrium dose constant for weakly-penetrating radiations (α and/or electrons), Δ_{wp} : 2.303×10^{-14} [Gy $\cdot$ kg/Bq $\cdot$ s]
Equilibrium dose constant for alphas, Δ_{α} : 0.000e+00 [Gy $\cdot$ kg/Bq $\cdot$ s]

Equilibrium dose constant for betas/electrons, $\Delta_{\beta, \beta^+, e^-}$: 2.303×10^{-14} [Gy·kg/Bq·s]

Equilibrium dose constant for photons, Δ_p : 1.584×10^{-13} [Gy·kg/Bq·s]

DOSE POINT KERNELS (PLOT)

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

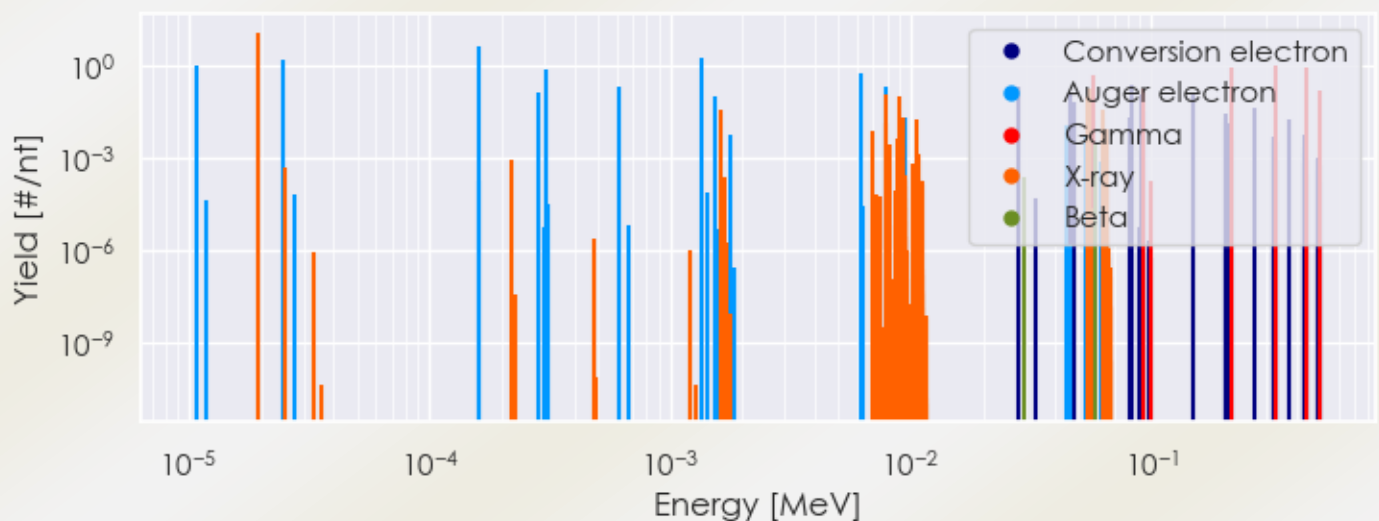
Note: Bins are spaced every 0.1 mm until a radius of 10 cm, and every 1 mm until a radius of 2 m.



Download tabulated dose point kernel file here: www.mirdsoft.org/products/MIRDspecs/Hf-180m DPK.csv

SUMMARY SPECTRA (PLOT)

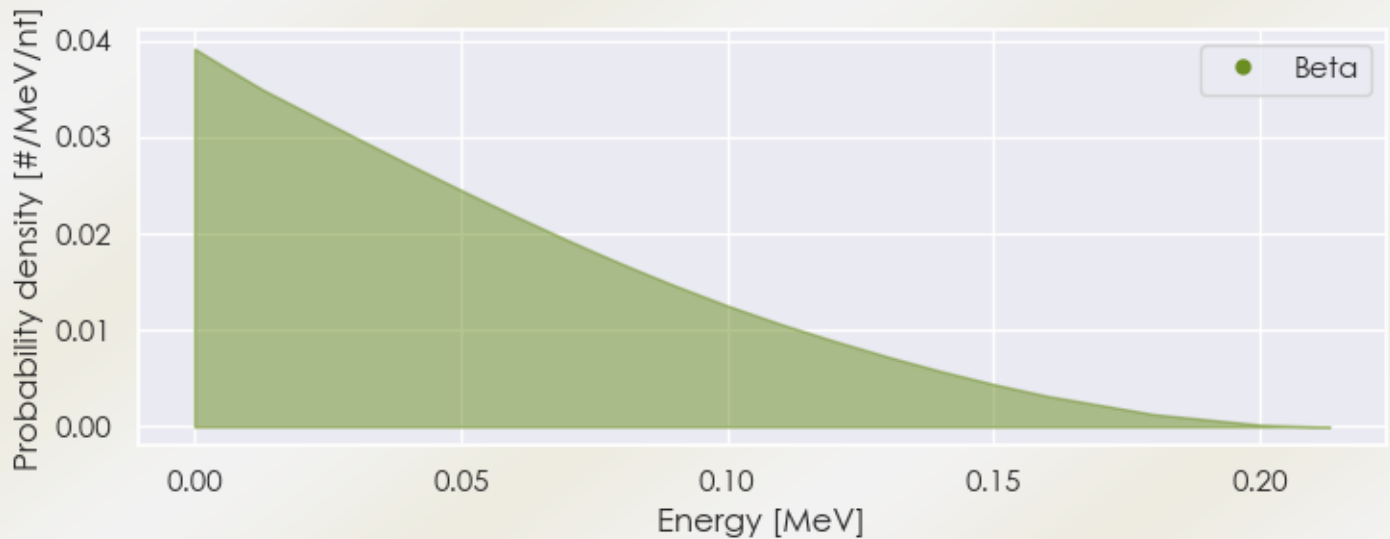
Spectra source: **ICRP Publication 107: Nuclear Decay Data for Dosimetric Calculations. Ann. ICRP 2008, 38 (3).**



Download tabulated summary spectra file here: www.mirdsoft.org/products/MIRDspecs/Hf-180m 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/Hf-180m 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/Hf-180m Summary Spectrum.csv

Energy [MeV]	Yield [# / nt] if > 0.01	Radiation type
1.94075e-05	1.179e+01	X-ray
1.63889e-03	3.552e-02	X-ray
7.83281e-03	1.296e-02	X-ray
7.88959e-03	1.144e-01	X-ray
9.03751e-03	9.805e-02	X-ray
9.34358e-03	1.988e-02	X-ray
1.05374e-02	1.784e-02	X-ray
5.47191e-02	9.898e-02	X-ray
5.59237e-02	1.732e-01	X-ray

5.75470e-02	4.800e-01	Gamma
6.31238e-02	1.844e-02	X-ray
6.33831e-02	3.563e-02	X-ray
9.33250e-02	1.713e-01	Gamma
2.15426e-01	8.132e-01	Gamma
3.32275e-01	9.412e-01	Gamma
4.43163e-01	8.188e-01	Gamma
5.00697e-01	1.431e-01	Gamma
1.07809e-05	1.029e+00	Auger electron
2.44612e-05	1.456e+00	Auger electron
1.59901e-04	4.106e+00	Auger electron
2.83497e-04	1.304e-01	Auger electron
3.04443e-04	7.033e-01	Auger electron
6.17881e-04	1.878e-01	Auger electron
1.36558e-03	1.780e+00	Auger electron
1.54511e-03	9.386e-02	Auger electron
6.20983e-03	5.678e-01	Auger electron
7.83238e-03	2.110e-01	Auger electron
9.48612e-03	1.976e-02	Auger electron
2.78430e-02	1.875e-01	Conversion electron
4.45280e-02	1.098e-02	Auger electron
4.63020e-02	1.219e-01	Conversion electron
4.67840e-02	5.408e-02	Conversion electron
4.79887e-02	6.653e-02	Conversion electron
5.54480e-02	5.524e-02	Conversion electron
5.75470e-02	1.517e-02	Conversion electron
8.20800e-02	1.909e-02	Conversion electron
8.25620e-02	2.340e-01	Conversion electron
8.37667e-02	2.201e-01	Conversion electron
9.12260e-02	1.185e-01	Conversion electron
9.33250e-02	3.210e-02	Conversion electron
1.49944e-01	1.103e-01	Conversion electron
2.04181e-01	1.261e-02	Conversion electron
2.04663e-01	2.566e-02	Conversion electron
2.05868e-01	1.780e-02	Conversion electron
2.13327e-01	1.375e-02	Conversion electron
2.66793e-01	3.955e-02	Conversion electron
3.77681e-01	1.651e-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/SNMML-MAIN/iCore/Store/StoreLayouts/Item_Detail.aspx?iProductCode=0-932004-80-6