Report for

NRDC Meeting 2019

Nuclear Reaction Data Group at ATOMKI

S. Takács

09-12 April, 2019, Vienna, Austria

Institute and Staff

Institute

Institute for Nuclear Research, Hungarian Academy of Sciences, (ATOMKI) (going to be changed)

Nuclear Data Group at ATOMKI

Main tasks

Measurements of activation cross section of charged particle induced reactions (p, d, ^{3}He, α)

Application of cross section data in different fields (isotope production, TLA, CPAA)

EXFOR compilation

Evaluation of experimental data for articles and CRP

Staff

The research team consists of physicists, radiochemist and technical persons.

- experimental physicists: 4
- radiochemist : 1
- technical staff member: 1

Experimental work

Continue the systematic investigations of charged particle induced reactions by p, d, ^{3}He and α particle induced reactions on

Al, Ti, Ni, Se, Rb, Y, Zr, Ru, Ag, Cd, Tb, Tm, Yb, W, Bi targets.

Collaborations

- VUB, Cyclotron laboratory of Free University Brussels, Belgium,
- Nishina Center for Accelerator-Based Science, RIKEN, Wako, Saitama, Japan,
- Faculty of Science, Hokkaido University, Sapporo, Japan,
- Molecular Imaging Center, NIRS, Chiba, Japan
- Institute of Physics and Power Engineering (IPPE), Obninsk, Russia.
- Cyclotron Facility, Nuclear Research Centre, Atomic Energy Authority, Cairo, Egypt,
- Austrian Competence Center for Tribology, AC^{2}T Wiener Neustadt, Austria

Applications

- Thin Layer Activation (TLA) technique with free handling activity level
- Isotope production for tracing, process development and other industrial applications
- Tracer experiments for investigating water transport of plants

EXFOR compilation

Our responsibility to compile experimental data of charged particle induced nuclear reactions reported from Hungary (Atomki) and VUB, Brussels, Belgium.

All newly published data were compiled in EXFOR

Participations in nuclear data related CRPs

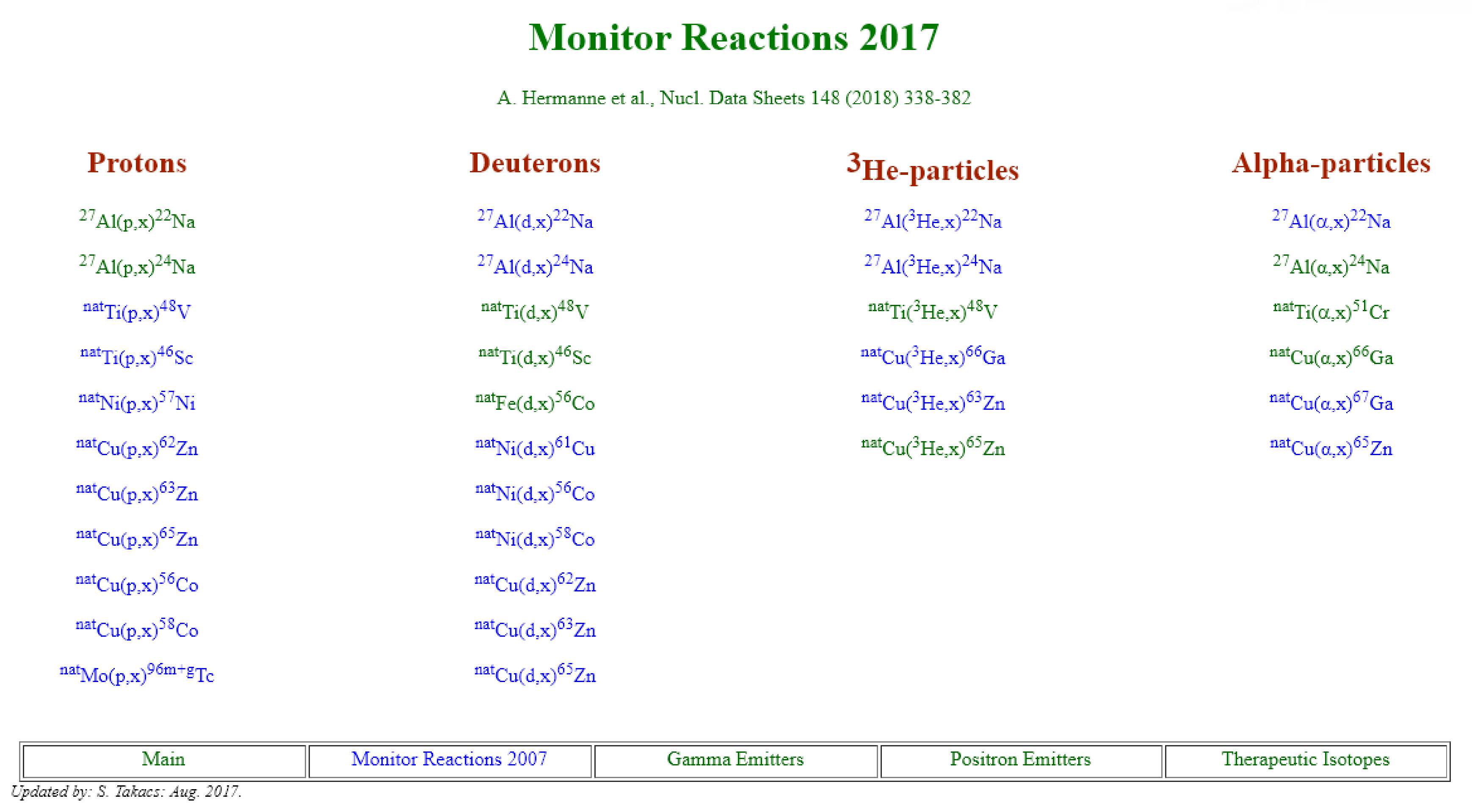
Nuclear Data for Charged-particle Monitor Reactions and Medical Isotope Production (2012–2017)

The main part of the work of this CRP is completed. The selected reactions were evaluated, new recommended datasets were determined. Results for monitor reactions, gamma emitters, positron emitters and therapeutic reactions were published in:

Nuclear Data Sheets 148 (2018) 338–382 (34 monitor reactions)
J. Radioanal. Nucl. Chem. (2019) 319, 487-531 (35 gamma emitter reactions)
J. Radioanal. Nucl. Chem. (2019) 319, 533-666 (75 positron emitter reactions)
Nuclear Data Sheets 155 (2019) 56-74 (47 therapeutic reactions)

Web version of the results were implemented.

Most (95+ %) of the cross section data are from EXFOR https://www-nds.iaea.org/medical/monitor_reactions.html



Monitor Reactions 2017

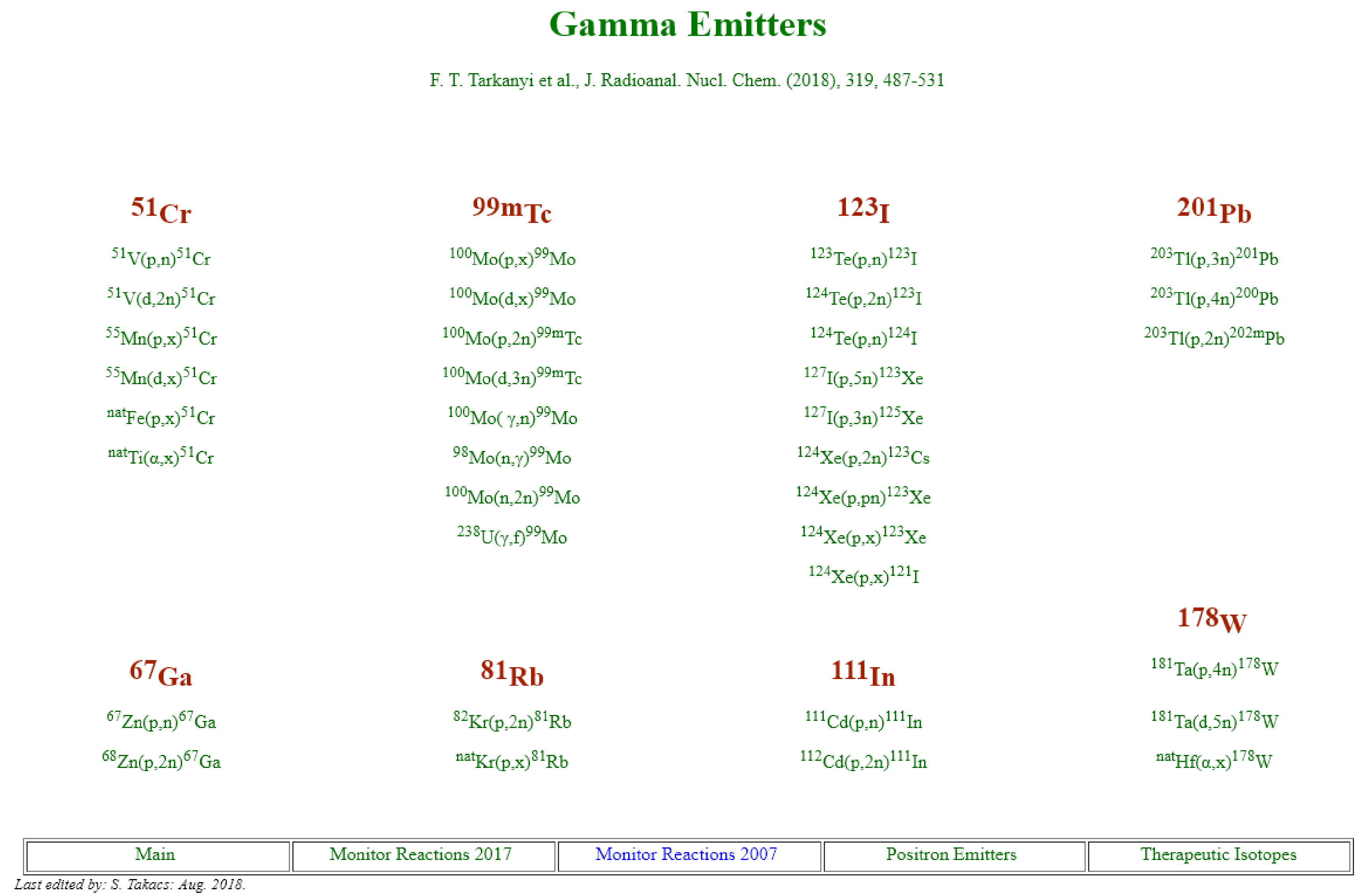
A. Hermanne et al., Nucl. Data Sheets 148 (2018) 338-382

Protons	Deuterons	^{3}He-particles	Alpha-particles
^{27}Al(p,x)^{22}Na	^{27}Al(d,x)^{22}Na	^{27}Al(^{3}He,x)^{22}Na	^{27}Al(α,x)^{22}Na
^{27}Al(p,x)^{24}Na	^{27}Al(d,x)^{24}Na	^{27}Al(^{3}He,x)^{24}Na	^{27}Al(α,x)^{24}Na
^{nat}Ti(p,x)^{48}V	^{nat}Ti(d,x)^{48}V	^{nat}Ti(^{3}He,x)^{48}V	^{nat}Ti(α,x)^{51}Cr
^{nat}Ti(p,x)^{46}Sc	^{nat}Ti(d,x)^{46}Sc	^{nat}Cu(^{3}He,x)^{66}Ga	^{nat}Cu(α,x)^{66}Ga
^{nat}Ni(p,x)^{57}Ni	^{nat}Fe(d,x)^{56}Co	^{nat}Cu(^{3}He,x)^{63}Zn	^{nat}Cu(α,x)^{67}Ga
^{nat}Cu(p,x)^{62}Zn	^{nat}Ni(d,x)^{61}Cu	^{nat}Cu(^{3}He,x)^{65}Zn	^{nat}Cu(α,x)^{65}Zn
^{nat}Cu(p,x)^{63}Zn	^{nat}Ni(d,x)^{56}Co		
^{nat}Cu(p,x)^{65}Zn	^{nat}Ni(d,x)^{58}Co		
^{nat}Cu(p,x)^{56}Co	^{nat}Cu(d,x)^{62}Zn		
^{nat}Cu(p,x)^{58}Co	^{nat}Cu(d,x)^{63}Zn		
^{nat}Mo(p,x)$^{96m+g}$Tc	^{nat}Cu(d,x)^{65}Zn		

Main	Monitor Reactions 2007	Gamma Emitters	Positron Emitters	Therapeutic Isotopes

Updated by: S. Takacs: Aug. 2017.

https://www-nds.iaea.org/medical/gamma_emitters.html



Gamma Emitters

F. T. Tarkanyi et al., J. Radioanal. Nucl. Chem. (2018), 319, 487-531

^{51}Cr

^{51}V(p,n)^{51}Cr

^{51}V(d,2n)^{51}Cr

^{55}Mn(p,x)^{51}Cr

^{55}Mn(d,x)^{51}Cr

^{nat}Fe(p,x)^{51}Cr

^{nat}Ti(α,x)^{51}Cr

^{99m}Tc

^{100}Mo(p,x)^{99}Mo

^{100}Mo(d,x)^{99}Mo

^{100}Mo(p,2n)^{99m}Tc

^{100}Mo(d,3n)^{99m}Tc

^{100}Mo(γ,n)^{99}Mo

^{98}Mo(n,γ)^{99}Mo

^{100}Mo(n,2n)^{99}Mo

^{238}U(γ,f)^{99}Mo

^{123}I

^{123}Te(p,n)^{123}I

^{124}Te(p,2n)^{123}I

^{124}Te(p,n)^{124}I

^{127}I(p,5n)^{123}Xe

^{127}I(p,3n)^{125}Xe

^{124}Xe(p,2n)^{123}Cs

^{124}Xe(p,pn)^{123}Xe

^{124}Xe(p,x)^{123}Xe

^{124}Xe(p,x)^{121}I

^{201}Pb

^{203}Tl(p,3n)^{201}Pb

^{203}Tl(p,4n)^{200}Pb

^{203}Tl(p,2n)^{202m}Pb

^{67}Ga

^{67}Zn(p,n)^{67}Ga

^{68}Zn(p,2n)^{67}Ga

^{81}Rb

^{82}Kr(p,2n)^{81}Rb

^{nat}Kr(p,x)^{81}Rb

^{111}In

^{111}Cd(p,n)^{111}In

^{112}Cd(p,2n)^{111}In

^{178}W

^{181}Ta(p,4n)^{178}W

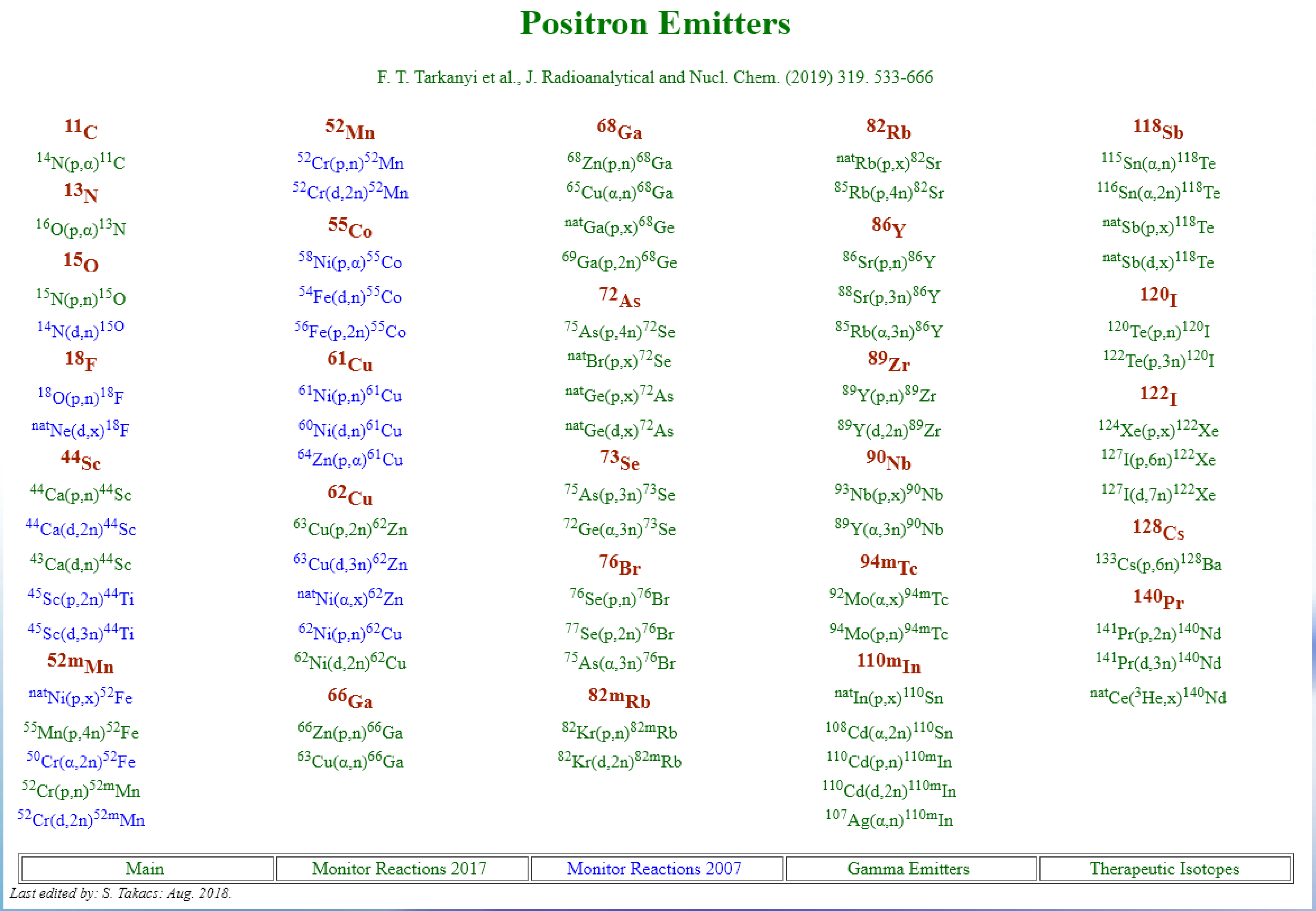
^{181}Ta(d,5n)^{178}W

^{nat}Hf(α,x)^{178}W

Main	Monitor Reactions 2017	Monitor Reactions 2007	Positron Emitters	Therapeutic Isotopes

Last edited by: S. Takacs: Aug. 2018.

https://www-nds.iaea.org/medical/positron_emitters.html



Positron Emitters

F. T. Tarkanyi et al., J. Radioanalytical and Nucl. Chem. (2019) 319. 533-666

^{11}C

^{14}N(p,α)^{11}C

^{13}N

^{16}O(p,α)^{13}N

^{15}O

^{15}N(p,n)^{15}O

^{14}N(d,n)^{15}O

^{18}F

^{18}O(p,n)^{18}F

^{nat}Ne(d,x)^{18}F

^{44}Sc

^{44}Ca(p,n)^{44}Sc

^{44}Ca(d,2n)^{44}Sc

^{43}Ca(d,n)^{44}Sc

^{45}Sc(p,2n)^{44}Ti

^{45}Sc(d,3n)^{44}Ti

^{52m}Mn

^{nat}Ni(p,x)^{52}Fe

^{55}Mn(p,4n)^{52}Fe

^{50}Cr(α,2n)^{52}Fe

^{52}Cr(p,n)^{52m}Mn

^{52}Cr(d,2n)^{52m}Mn

^{52}Mn

^{52}Cr(p,n)^{52}Mn

^{52}Cr(d,2n)^{52}Mn

^{55}Co

^{58}Ni(p,α)^{55}Co

^{54}Fe(d,n)^{55}Co

^{56}Fe(p,2n)^{55}Co

^{61}Cu

^{61}Ni(p,n)^{61}Cu

^{60}Ni(d,n)^{61}Cu

^{64}Zn(p,α)^{61}Cu

^{62}Cu

^{63}Cu(p,2n)^{62}Zn

^{63}Cu(d,3n)^{62}Zn

^{nat}Ni(α,x)^{62}Zn

^{62}Ni(p,n)^{62}Cu

^{62}Ni(d,2n)^{62}Cu

^{66}Ga

^{66}Zn(p,n)^{66}Ga

^{63}Cu(α,n)^{66}Ga

^{68}Ga

^{68}Zn(p,n)^{68}Ga

^{65}Cu(α,n)^{68}Ga

^{nat}Ga(p,x)^{68}Ge

^{69}Ga(p,2n)^{68}Ge

^{72}As

^{75}As(p,4n)^{72}Se

^{nat}Br(p,x)^{72}Se

^{nat}Ge(p,x)^{72}As

^{nat}Ge(d,x)^{72}As

^{73}Se

^{75}As(p,3n)^{73}Se

^{72}Ge(α,3n)^{73}Se

^{76}Br

^{76}Se(p,n)^{76}Br

^{77}Se(p,2n)^{76}Br

^{75}As(α,3n)^{76}Br

^{82m}Rb

^{82}Kr(p,n)^{82m}Rb

^{82}Kr(d,2n)^{82m}Rb

^{82}Rb

^{nat}Rb(p,x)^{82}Sr

^{85}Rb(p,4n)^{82}Sr

^{86}Y

^{86}Sr(p,n)^{86}Y

^{88}Sr(p,3n)^{86}Y

^{85}Rb(α,3n)^{86}Y

^{89}Zr

^{89}Y(p,n)^{89}Zr

^{89}Y(d,2n)^{89}Zr

^{90}Nb

^{93}Nb(p,x)^{90}Nb

^{89}Y(α,3n)^{90}Nb

^{94m}Tc

^{92}Mo(α,x)^{94m}Tc

^{94}Mo(p,n)^{94m}Tc

^{110m}In

^{nat}In(p,x)^{110}Sn

^{108}Cd(α,2n)^{110}Sn

^{110}Cd(p,n)^{110m}In

^{110}Cd(d,2n)^{110m}In

^{107}Ag(α,n)^{110m}In

^{118}Sb

^{115}Sn(α,n)^{118}Te

^{116}Sn(α,2n)^{118}Te

^{nat}Sb(p,x)^{118}Te

^{nat}Sb(d,x)^{118}Te

^{120}I

^{120}Te(p,n)^{120}I

^{122}Te(p,3n)^{120}I

^{122}I

^{124}Xe(p,x)^{122}Xe

^{127}I(p,6n)^{122}Xe

^{127}I(d,7n)^{122}Xe

^{128}Cs

^{133}Cs(p,6n)^{128}Ba

^{140}Pr

^{141}Pr(p,2n)^{140}Nd

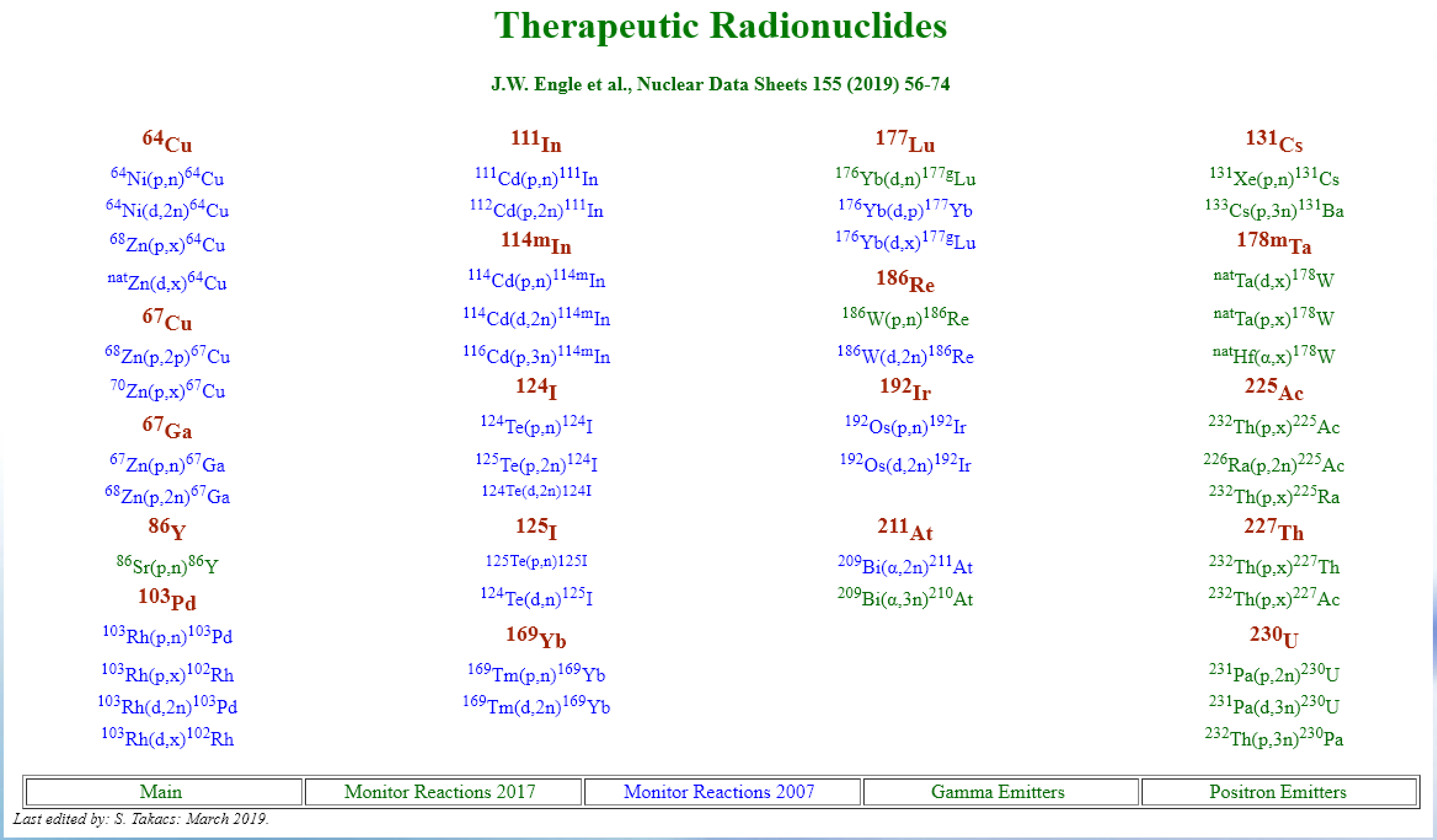
^{141}Pr(d,3n)^{140}Nd

^{nat}Ce(^{3}He,x)^{140}Nd

Main	Monitor Reactions 2017	Monitor Reactions 2007	Gamma Emitters	Therapeutic Isotopes

Last edited by: S. Takacs: Aug. 2018.

https://www-nds.iaea.org/medical/therapeutic.html



Therapeutic Radionuclides

J.W. Engle et al., Nuclear Data Sheets 155 (2019) 56-74

^{64}Cu

^{64}Ni(p,n)^{64}Cu

^{64}Ni(d,2n)^{64}Cu

^{68}Zn(p,x)^{64}Cu

^{nat}Zn(d,x)^{64}Cu

^{67}Cu

^{68}Zn(p,2p)^{67}Cu

^{70}Zn(p,x)^{67}Cu

^{67}Ga

^{67}Zn(p,n)^{67}Ga

^{68}Zn(p,2n)^{67}Ga

^{86}Y

^{86}Sr(p,n)^{86}Y

^{103}Pd

^{103}Rh(p,n)^{103}Pd

^{103}Rh(p,x)^{102}Rh

^{103}Rh(d,2n)^{103}Pd

^{103}Rh(d,x)^{102}Rh

^{111}In

^{111}Cd(p,n)^{111}In

^{112}Cd(p,2n)^{111}In

^{114m}In

^{114}Cd(p,n)^{114m}In

^{114}Cd(d,2n)^{114m}In

^{116}Cd(p,3n)^{114m}In

^{124}I

^{124}Te(p,n)^{124}I

^{125}Te(p,2n)^{124}I

124Te(d,2n)124I

^{125}I

125Te(p,n)125I

^{124}Te(d,n)^{125}I

^{169}Yb

^{169}Tm(p,n)^{169}Yb

^{169}Tm(d,2n)^{169}Yb

^{177}Lu

^{176}Yb(d,n)^{177g}Lu

^{176}Yb(d,p)^{177}Yb

^{176}Yb(d,x)^{177g}Lu

^{186}Re

^{186}W(p,n)^{186}Re

^{186}W(d,2n)^{186}Re

^{192}Ir

^{192}Os(p,n)^{192}Ir

^{192}Os(d,2n)^{192}Ir

^{211}At

^{209}Bi(α,2n)^{211}At

^{209}Bi(α,3n)^{210}At

^{131}Cs

^{131}Xe(p,n)^{131}Cs

^{133}Cs(p,3n)^{131}Ba

^{178m}Ta

^{nat}Ta(d,x)^{178}W

^{nat}Ta(p,x)^{178}W

^{nat}Hf(α,x)^{178}W

^{225}Ac

^{232}Th(p,x)^{225}Ac

^{226}Ra(p,2n)^{225}Ac

^{232}Th(p,x)^{225}Ra

^{227}Th

^{232}Th(p,x)^{227}Th

^{232}Th(p,x)^{227}Ac

^{230}U

^{231}Pa(p,2n)^{230}U

^{231}Pa(d,3n)^{230}U

^{232}Th(p,3n)^{230}Pa

Main	Monitor Reactions 2017	Monitor Reactions 2007	Gamma Emitters	Positron Emitters

Last edited by: S. Takacs: March 2019.

Therapeutic Radiopharmaceuticals Labeled with New Emerging Radionuclides (^{67}Cu, ^{186}Re, ^{47}Sc)

2016-2019

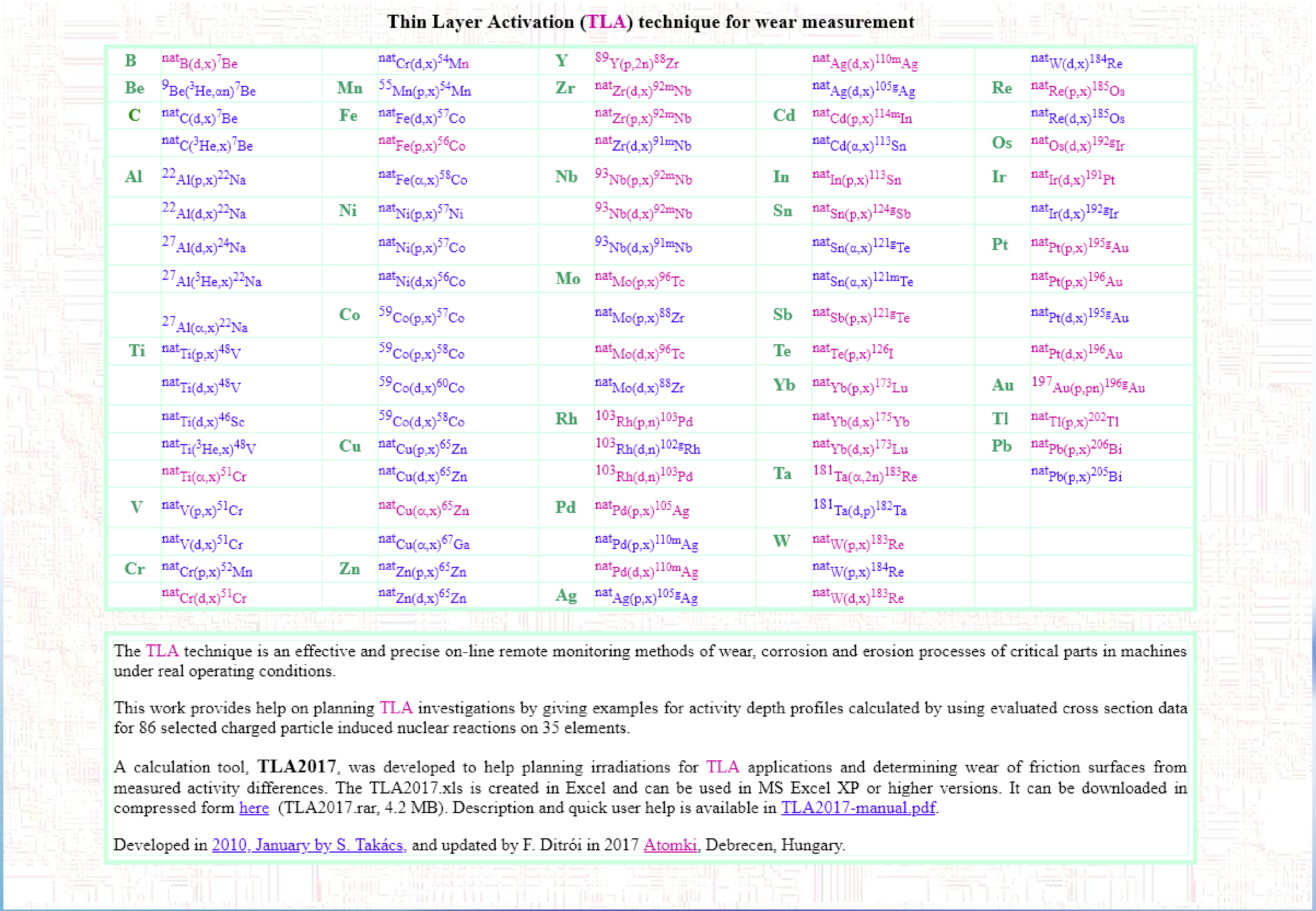
All possible accelerator production routes for the three selected radionuclides were collected and evaluated regarding the possible yields, radionuclidic purity, chemical purity, specific activity. Based on the reaction network analysis the "best" accelerator production routes were selected for the ^{67}Cu, ^{186}Re and ^{47}Sc medically important radioisotopes.

Imaging Technologies for Process Investigation and Components Testing

2017 - 2021

The objective of the CRP is to facilitate further advancement and implementation of imaging nuclear technologies in industries and to develop a synergetic approach to imaging technologies coming from different fields.

https://www-nds.iaea.org/tla/index.html



Thin Layer Activation (TLA) technique for wear measurement

B	$^{\mathrm{nat}}\mathrm{B(d,x)}^{7}\mathrm{Be}$		$^{\mathrm{nat}}\mathrm{Cr(d,x)}^{54}\mathrm{Mn}$	**Y**	$^{89}\mathrm{Y(p,2n)}^{88}\mathrm{Zr}$		$^{\mathrm{nat}}\mathrm{Ag(d,x)}^{110m}\mathrm{Ag}$		$^{\mathrm{nat}}\mathrm{W(d,x)}^{184}\mathrm{Re}$
Be	$^{9}\mathrm{Be}(^{3}\mathrm{He},\alpha n)^{7}\mathrm{Be}$	**Mn**	$^{55}\mathrm{Mn(p,x)}^{54}\mathrm{Mn}$	**Zr**	$^{\mathrm{nat}}\mathrm{Zr(d,x)}^{92m}\mathrm{Nb}$		$^{\mathrm{nat}}\mathrm{Ag(d,x)}^{105g}\mathrm{Ag}$	**Re**	$^{\mathrm{nat}}\mathrm{Re(p,x)}^{185}\mathrm{Os}$
C	$^{\mathrm{nat}}\mathrm{C(d,x)}^{7}\mathrm{Be}$	**Fe**	$^{\mathrm{nat}}\mathrm{Fe(d,x)}^{57}\mathrm{Co}$		$^{\mathrm{nat}}\mathrm{Zr(p,x)}^{92m}\mathrm{Nb}$	**Cd**	$^{\mathrm{nat}}\mathrm{Cd(p,x)}^{114m}\mathrm{In}$		$^{\mathrm{nat}}\mathrm{Re(d,x)}^{185}\mathrm{Os}$
	$^{\mathrm{nat}}\mathrm{C}(^{3}\mathrm{He,x})^{7}\mathrm{Be}$		$^{\mathrm{nat}}\mathrm{Fe(p,x)}^{56}\mathrm{Co}$		$^{\mathrm{nat}}\mathrm{Zr(d,x)}^{91m}\mathrm{Nb}$		$^{\mathrm{nat}}\mathrm{Cd}(\alpha,\mathrm{x})^{113}\mathrm{Sn}$	**Os**	$^{\mathrm{nat}}\mathrm{Os(d,x)}^{192g}\mathrm{Ir}$
Al	$^{22}\mathrm{Al(p,x)}^{22}\mathrm{Na}$		$^{\mathrm{nat}}\mathrm{Fe}(\alpha,\mathrm{x})^{58}\mathrm{Co}$	**Nb**	$^{93}\mathrm{Nb(p,x)}^{92m}\mathrm{Nb}$	**In**	$^{\mathrm{nat}}\mathrm{In(p,x)}^{113}\mathrm{Sn}$	**Ir**	$^{\mathrm{nat}}\mathrm{Ir(d,x)}^{191}\mathrm{Pt}$
	$^{22}\mathrm{Al(d,x)}^{22}\mathrm{Na}$	**Ni**	$^{\mathrm{nat}}\mathrm{Ni(p,x)}^{57}\mathrm{Ni}$		$^{93}\mathrm{Nb(d,x)}^{92m}\mathrm{Nb}$	**Sn**	$^{\mathrm{nat}}\mathrm{Sn(p,x)}^{124g}\mathrm{Sb}$		$^{\mathrm{nat}}\mathrm{Ir(d,x)}^{192g}\mathrm{Ir}$
	$^{27}\mathrm{Al(d,x)}^{24}\mathrm{Na}$		$^{\mathrm{nat}}\mathrm{Ni(p,x)}^{57}\mathrm{Co}$		$^{93}\mathrm{Nb(d,x)}^{91m}\mathrm{Nb}$		$^{\mathrm{nat}}\mathrm{Sn}(\alpha,\mathrm{x})^{121g}\mathrm{Te}$	**Pt**	$^{\mathrm{nat}}\mathrm{Pt(p,x)}^{195g}\mathrm{Au}$
	$^{27}\mathrm{Al}(^{3}\mathrm{He,x})^{22}\mathrm{Na}$		$^{\mathrm{nat}}\mathrm{Ni(d,x)}^{56}\mathrm{Co}$	**Mo**	$^{\mathrm{nat}}\mathrm{Mo(p,x)}^{96}\mathrm{Tc}$		$^{\mathrm{nat}}\mathrm{Sn}(\alpha,\mathrm{x})^{121m}\mathrm{Te}$		$^{\mathrm{nat}}\mathrm{Pt(p,x)}^{196}\mathrm{Au}$
	$^{27}\mathrm{Al}(\alpha,\mathrm{x})^{22}\mathrm{Na}$	**Co**	$^{59}\mathrm{Co(p,x)}^{57}\mathrm{Co}$		$^{\mathrm{nat}}\mathrm{Mo(p,x)}^{88}\mathrm{Zr}$	**Sb**	$^{\mathrm{nat}}\mathrm{Sb(p,x)}^{121g}\mathrm{Te}$		$^{\mathrm{nat}}\mathrm{Pt(d,x)}^{195g}\mathrm{Au}$
Ti	$^{\mathrm{nat}}\mathrm{Ti(p,x)}^{48}\mathrm{V}$		$^{59}\mathrm{Co(p,x)}^{58}\mathrm{Co}$		$^{\mathrm{nat}}\mathrm{Mo(d,x)}^{96}\mathrm{Tc}$	**Te**	$^{\mathrm{nat}}\mathrm{Te(p,x)}^{126}\mathrm{I}$		$^{\mathrm{nat}}\mathrm{Pt(d,x)}^{196}\mathrm{Au}$
	$^{\mathrm{nat}}\mathrm{Ti(d,x)}^{48}\mathrm{V}$		$^{59}\mathrm{Co(d,x)}^{60}\mathrm{Co}$		$^{\mathrm{nat}}\mathrm{Mo(d,x)}^{88}\mathrm{Zr}$	**Yb**	$^{\mathrm{nat}}\mathrm{Yb(p,x)}^{173}\mathrm{Lu}$	**Au**	$^{197}\mathrm{Au(p,pn)}^{196g}\mathrm{Au}$
	$^{\mathrm{nat}}\mathrm{Ti(d,x)}^{46}\mathrm{Sc}$		$^{59}\mathrm{Co(d,x)}^{58}\mathrm{Co}$	**Rh**	$^{103}\mathrm{Rh(p,n)}^{103}\mathrm{Pd}$		$^{\mathrm{nat}}\mathrm{Yb(d,x)}^{175}\mathrm{Yb}$	**Tl**	$^{\mathrm{nat}}\mathrm{Tl(p,x)}^{202}\mathrm{Tl}$
	$^{\mathrm{nat}}\mathrm{Ti}(^{3}\mathrm{He,x})^{48}\mathrm{V}$	**Cu**	$^{\mathrm{nat}}\mathrm{Cu(p,x)}^{65}\mathrm{Zn}$		$^{103}\mathrm{Rh(d,n)}^{102g}\mathrm{Rh}$		$^{\mathrm{nat}}\mathrm{Yb(d,x)}^{173}\mathrm{Lu}$	**Pb**	$^{\mathrm{nat}}\mathrm{Pb(p,x)}^{206}\mathrm{Bi}$
	$^{\mathrm{nat}}\mathrm{Ti}(\alpha,\mathrm{x})^{51}\mathrm{Cr}$		$^{\mathrm{nat}}\mathrm{Cu(d,x)}^{65}\mathrm{Zn}$		$^{103}\mathrm{Rh(d,n)}^{103}\mathrm{Pd}$	**Ta**	$^{181}\mathrm{Ta}(\alpha,\mathrm{2n})^{183}\mathrm{Re}$		$^{\mathrm{nat}}\mathrm{Pb(p,x)}^{205}\mathrm{Bi}$
V	$^{\mathrm{nat}}\mathrm{V(p,x)}^{51}\mathrm{Cr}$		$^{\mathrm{nat}}\mathrm{Cu}(\alpha,\mathrm{x})^{65}\mathrm{Zn}$	**Pd**	$^{\mathrm{nat}}\mathrm{Pd(p,x)}^{105}\mathrm{Ag}$		$^{181}\mathrm{Ta(d,p)}^{182}\mathrm{Ta}$		
	$^{\mathrm{nat}}\mathrm{V(d,x)}^{51}\mathrm{Cr}$		$^{\mathrm{nat}}\mathrm{Cu}(\alpha,\mathrm{x})^{67}\mathrm{Ga}$		$^{\mathrm{nat}}\mathrm{Pd(p,x)}^{110m}\mathrm{Ag}$	**W**	$^{\mathrm{nat}}\mathrm{W(p,x)}^{183}\mathrm{Re}$		
Cr	$^{\mathrm{nat}}\mathrm{Cr(p,x)}^{52}\mathrm{Mn}$	**Zn**	$^{\mathrm{nat}}\mathrm{Zn(p,x)}^{65}\mathrm{Zn}$		$^{\mathrm{nat}}\mathrm{Pd(d,x)}^{110m}\mathrm{Ag}$		$^{\mathrm{nat}}\mathrm{W(p,x)}^{184}\mathrm{Re}$		
	$^{\mathrm{nat}}\mathrm{Cr(d,x)}^{51}\mathrm{Cr}$		$^{\mathrm{nat}}\mathrm{Zn(d,x)}^{65}\mathrm{Zn}$	**Ag**	$^{\mathrm{nat}}\mathrm{Ag(p,x)}^{105g}\mathrm{Ag}$		$^{\mathrm{nat}}\mathrm{W(d,x)}^{183}\mathrm{Re}$		

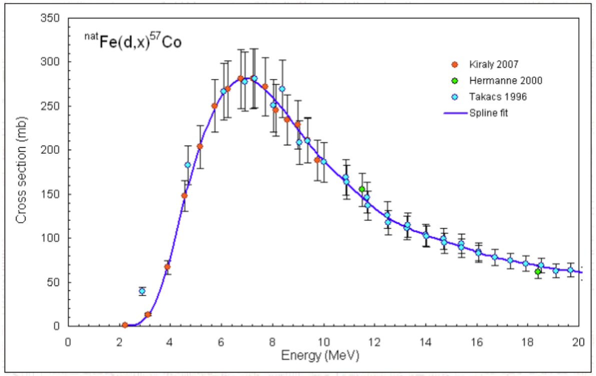
The TLA technique is an effective and precise on-line remote monitoring methods of wear, corrosion and erosion processes of critical parts in machines under real operating conditions.

This work provides help on planning TLA investigations by giving examples for activity depth profiles calculated by using evaluated cross section data for 86 selected charged particle induced nuclear reactions on 35 elements.

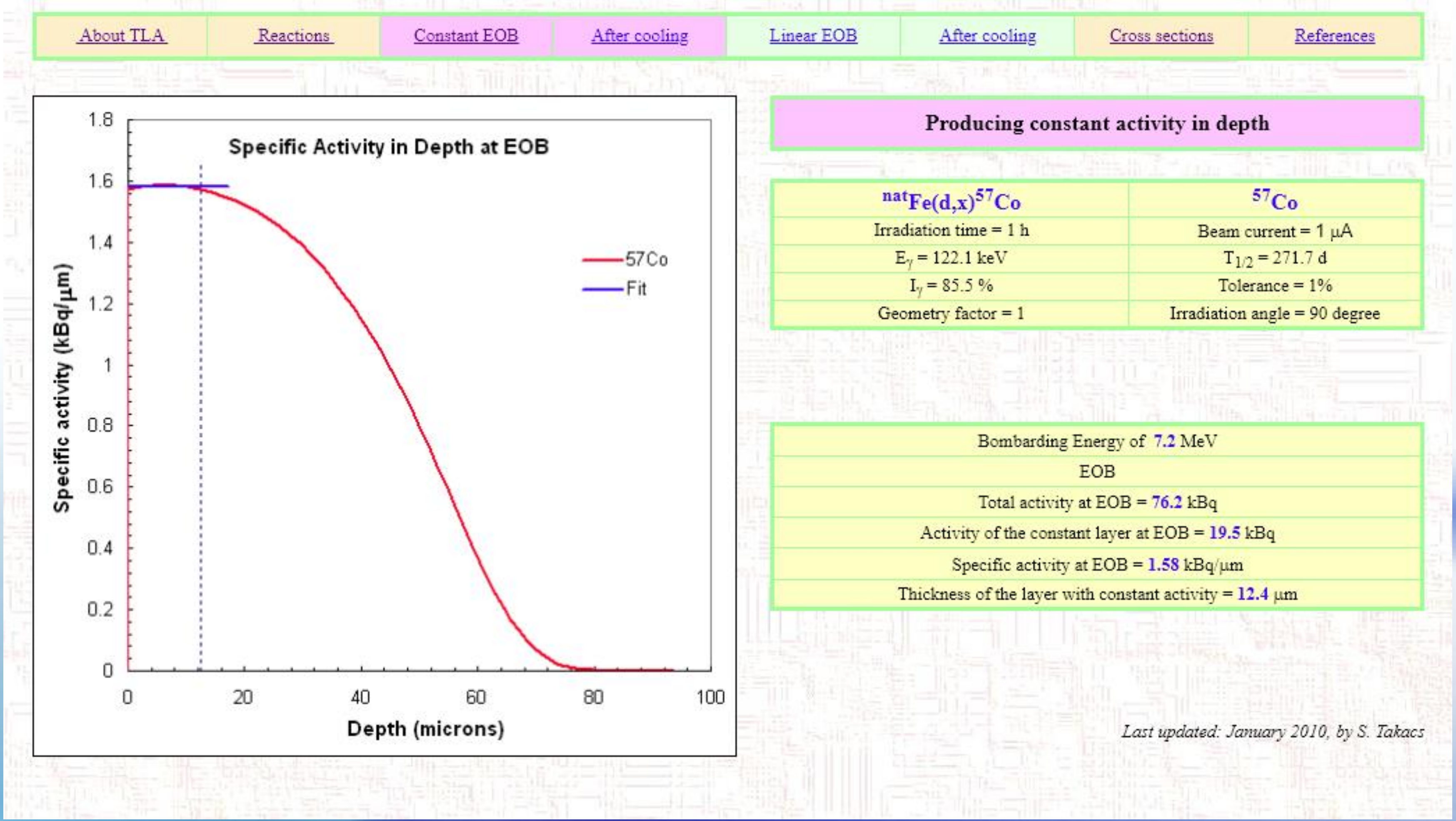
A calculation tool, **TLA2017**, was developed to help planning irradiations for TLA applications and determining wear of friction surfaces from measured activity differences. The TLA2017.xls is created in Excel and can be used in MS Excel XP or higher versions. It can be downloaded in compressed form here (TLA2017.rar, 4.2 MB). Description and quick user help is available in TLA2017-manual.pdf.

Developed in 2010, January by S. Takács, and updated by F. Ditrói in 2017 Atomki, Debrecen, Hungary.

$^{nat}Fe(d,x)^{57}Co$



https://www-nds.iaea.org/tla/fed57co7.html



Producing constant activity in depth

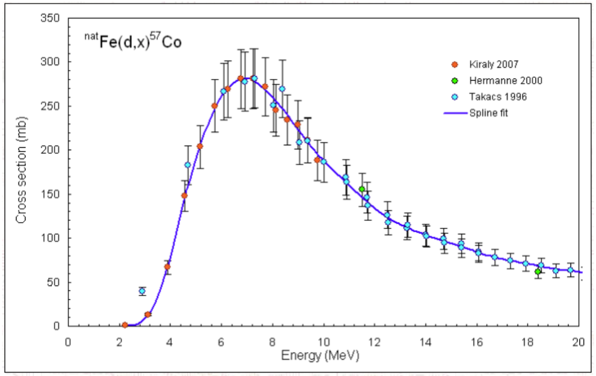
$^{nat}Fe(d,x)^{57}Co$	^{57}Co
Irradiation time = 1 h	Beam current = 1 μA
E_γ = 122.1 keV	$T_{1/2}$ = 271.7 d
I_γ = 85.5 %	Tolerance = 1%
Geometry factor = 1	Irradiation angle = 90 degree

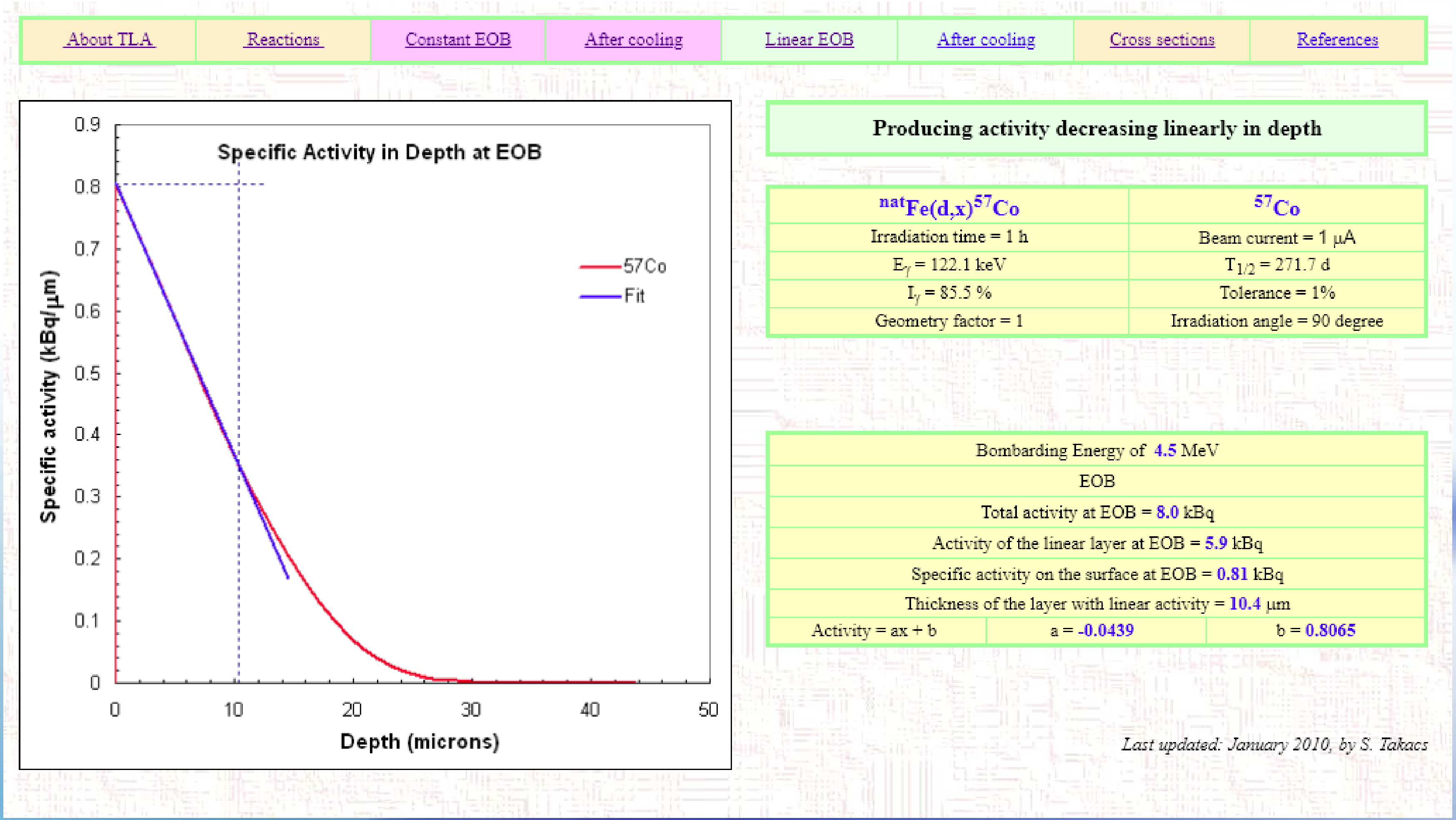
Bombarding Energy of 7.2 MeV
EOB
Total activity at EOB = 76.2 kBq
Activity of the constant layer at EOB = 19.5 kBq
Specific activity at EOB = 1.58 kBq/μm
Thickness of the layer with constant activity = 12.4 μm

Last updated: January 2010, by S. Takacs

$^{nat}Fe(d,x)^{57}Co$

https://www-nds.iaea.org/tla/fed57co7.html





About TLA	Reactions	Constant EOB	After cooling	Linear EOB	After cooling	Cross sections	References

Producing activity decreasing linearly in depth

$^{nat}Fe(d,x)^{57}Co$	^{57}Co
Irradiation time = 1 h	Beam current = 1 μA
E_γ = 122.1 keV	$T_{1/2}$ = 271.7 d
I_γ = 85.5 %	Tolerance = 1%
Geometry factor = 1	Irradiation angle = 90 degree

Bombarding Energy of 4.5 MeV		
EOB		
Total activity at EOB = 8.0 kBq		
Activity of the linear layer at EOB = 5.9 kBq		
Specific activity on the surface at EOB = 0.81 kBq		
Thickness of the layer with linear activity = 10.4 μm		
Activity = ax + b	a = -0.0439	b = 0.8065

Last updated: January 2010, by S. Takacs

Publications in 2018-2019

Number of publications: 25+

All the EXFOR relevant data were compiled in EXFOR.

Thank you