Modeling Secondary Fluorescence with DTSA-II

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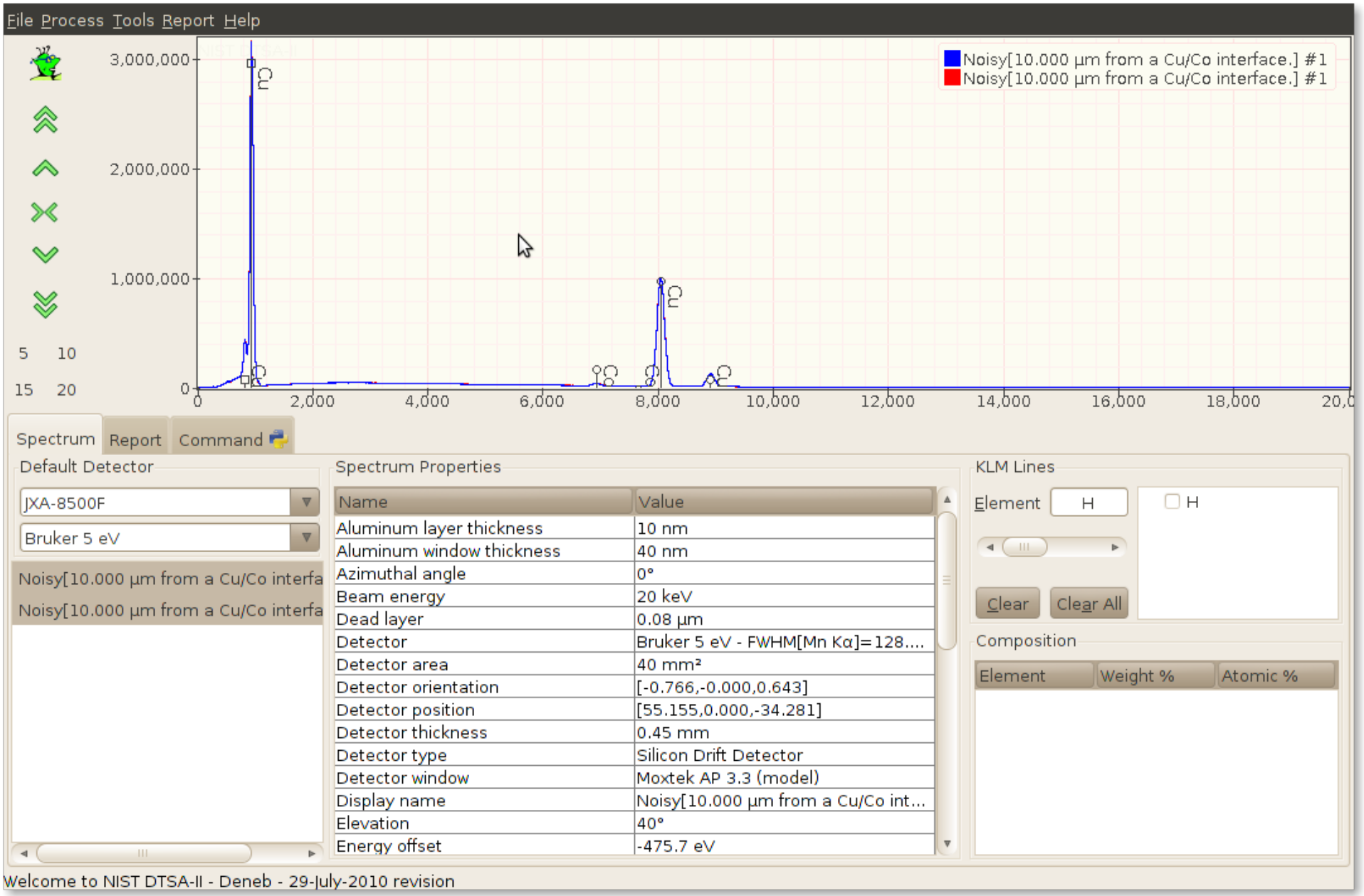
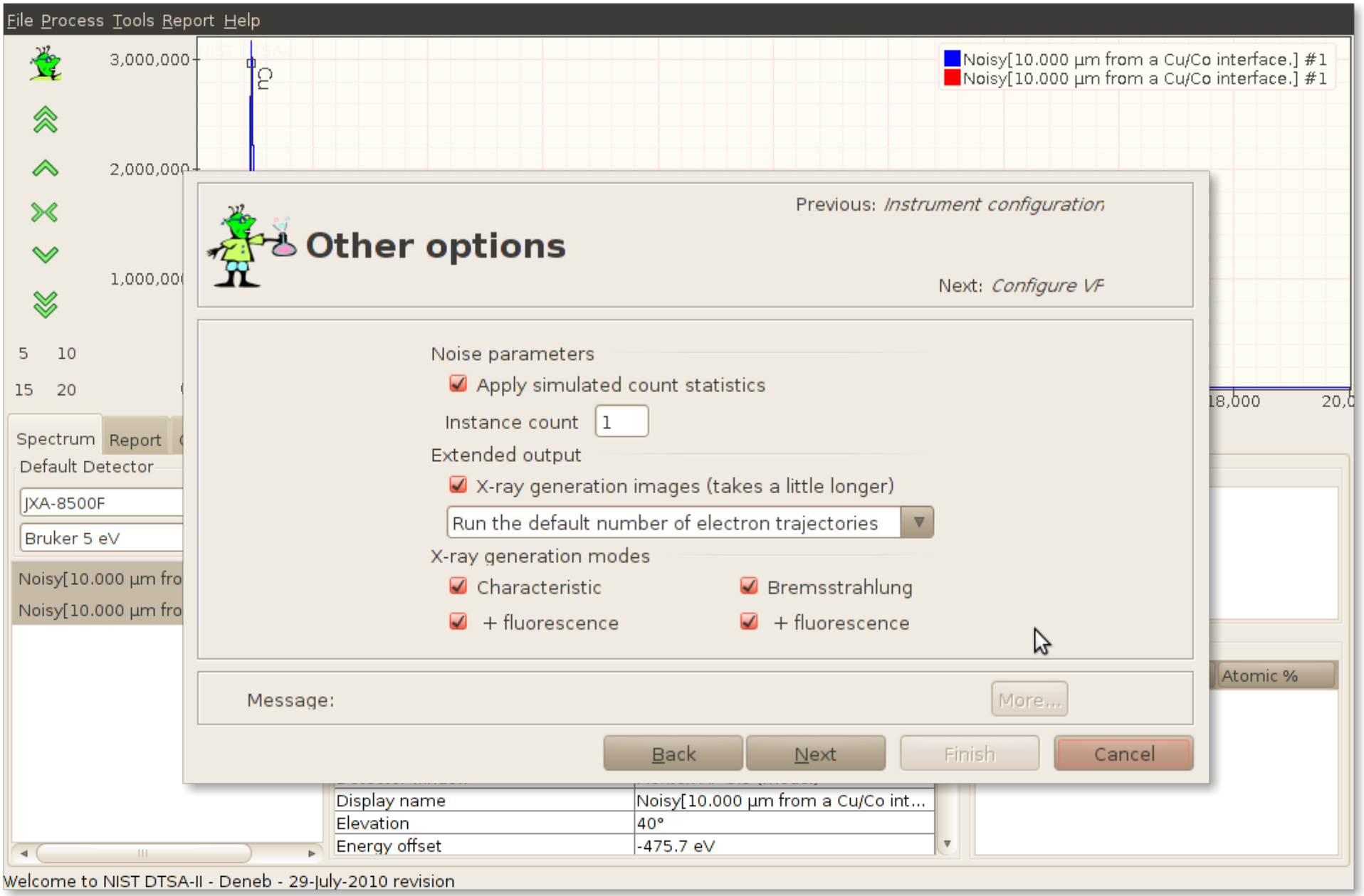
NIST
Advanced EPMA Workshop 2010
Eugene, OR



Windows (XP/Vista/7), Apple OS X, Linux, Unix, Solaris
Any platform running Java JRE 1.6+



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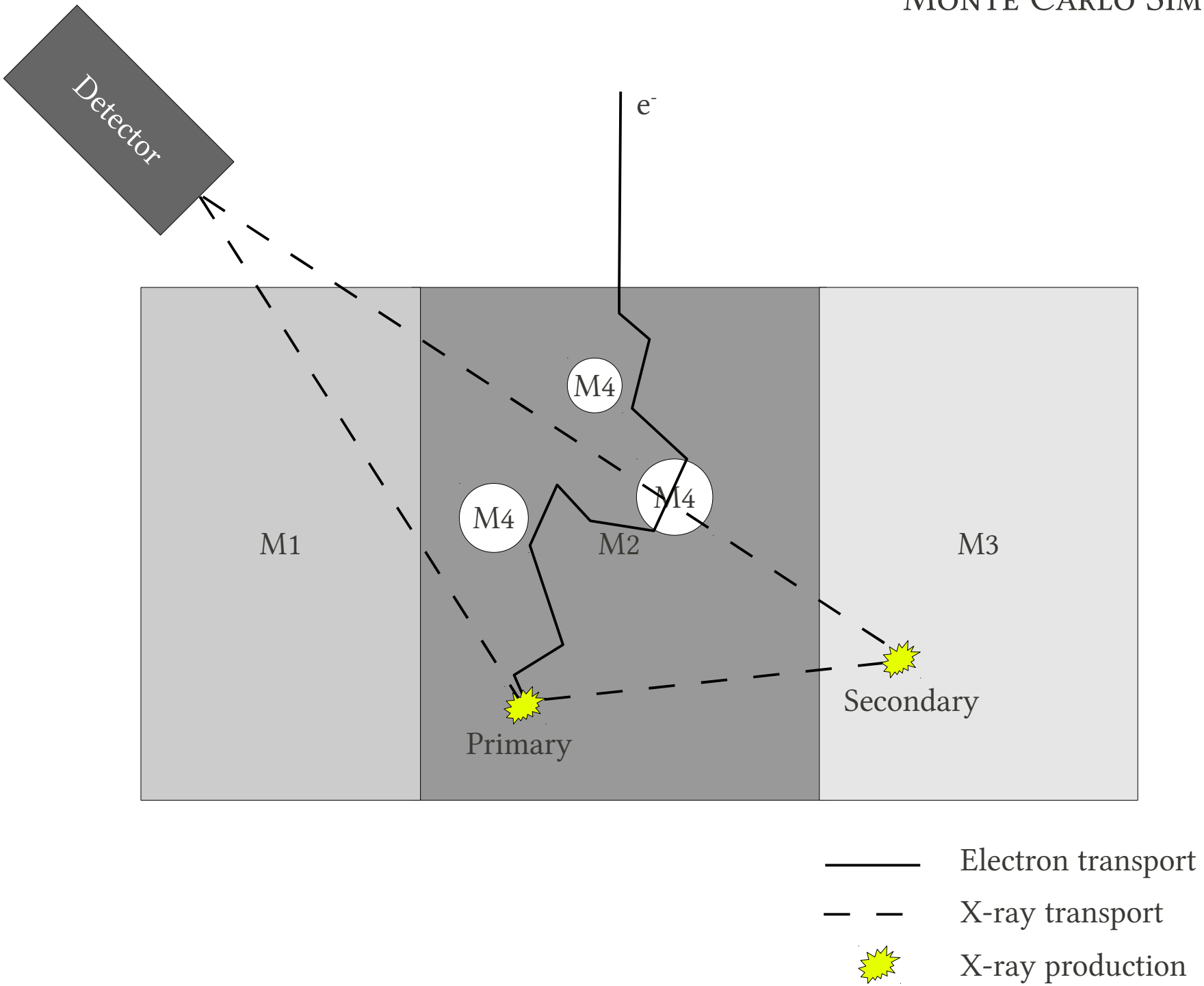
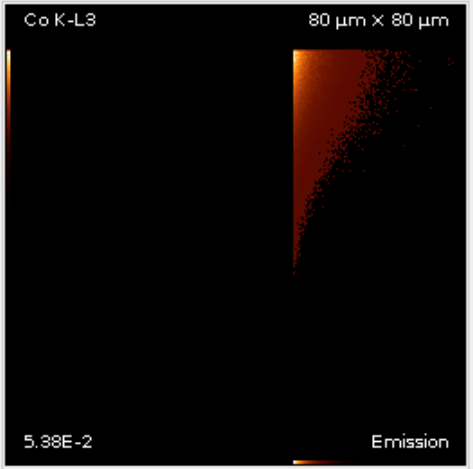
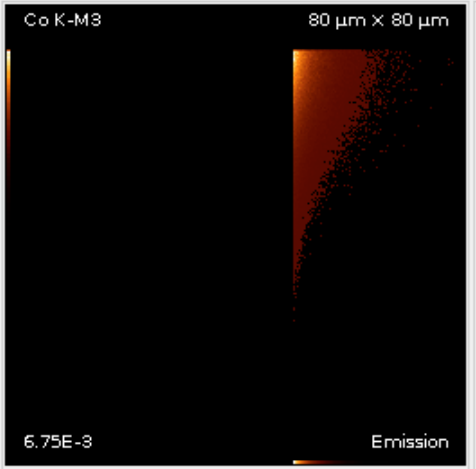

Detector
e-
M4
M4
M4
M1
M2
M3
Secondary
Primary
Electron transport
X-ray transport
X-ray production

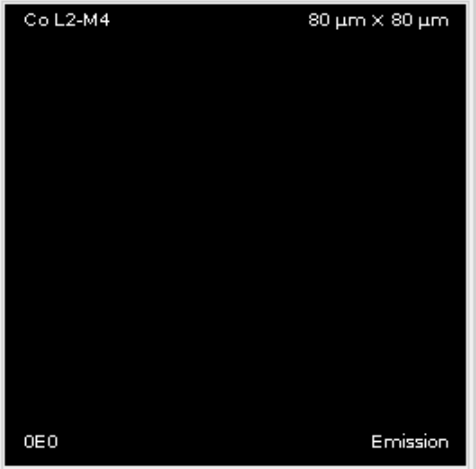
Simulation mode	Monte Carlo model of a junction between two materials
Secondary material	Co = [Co(100.00 wgt%),8.9 g/cc]
Primary Material	Cu = [Cu(100.00 wgt%),8.9 g/cc]
Distance from interface	10.000 µm
Beam energy	20.0 keV
Probe dose	10000.0 nA·s
Instrument	JXA-8500F
Detector	Bruker 5 eV
Calibration	FWHM[Mn Kα]=128.0 eV - initial
Overscan	false
Vacuum conditions	High vacuum
Replicas (with Poisson noise)	1
Result 1	Noisy[10.000 µm from a Cu/Co interface.] #1
Trajectory view	/home/nicholas/DTSA-II Reports/2010/August/6-Aug-2010/vrml67804024704252481 84.wrl



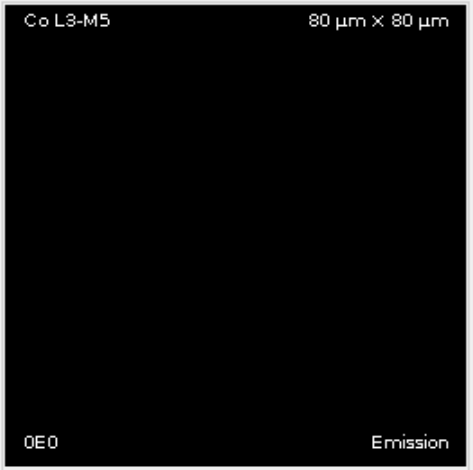
Co K-L3



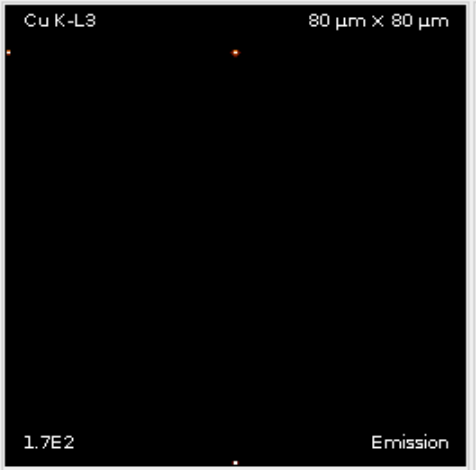
Co K-M3



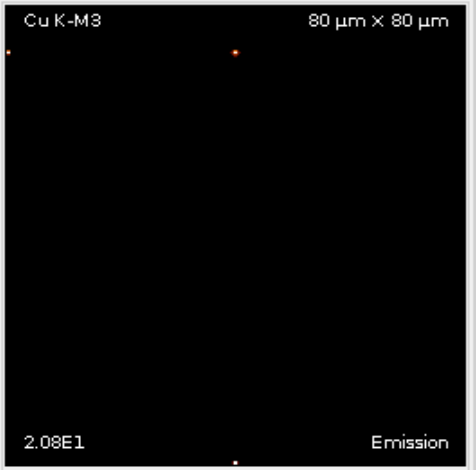
Co L2-M4



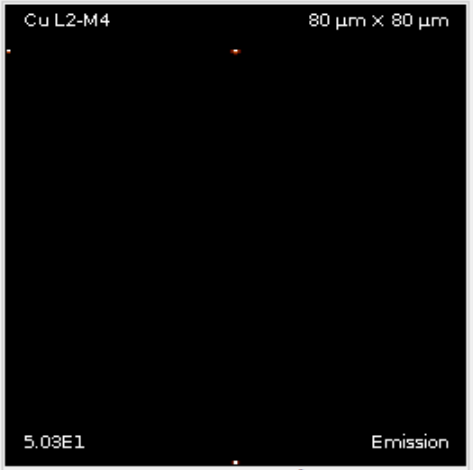
Co L3-M5



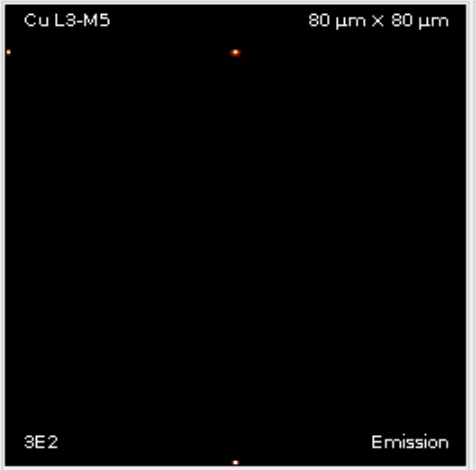
Cu K-L3



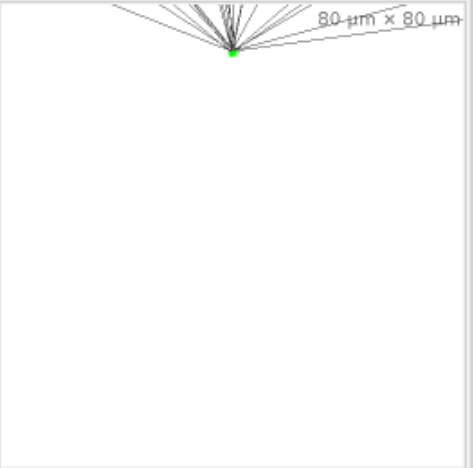
Cu K-M3



Cu L2-M4



Cu L3-M5



Trajectories

Characteristic

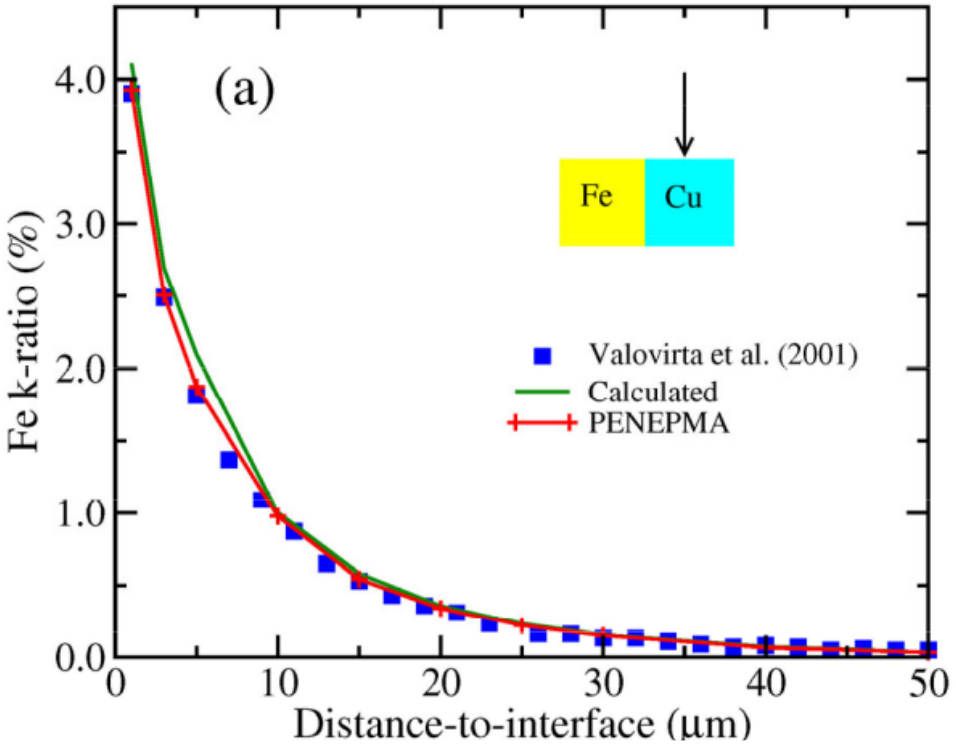
Transition	Generated 1/msR	Emitted 1/msR	Ratio (%)
Cu Kα	79,106,308.6	77,808,193.1	98.4%
Cu Kβ	9,608,569.5	9,488,602.4	98.8%
Cu Lβ	131,276,011.9	15,073,768.3	11.5%
Cu Lα	224,945,419.2	120,592,464.9	53.6%

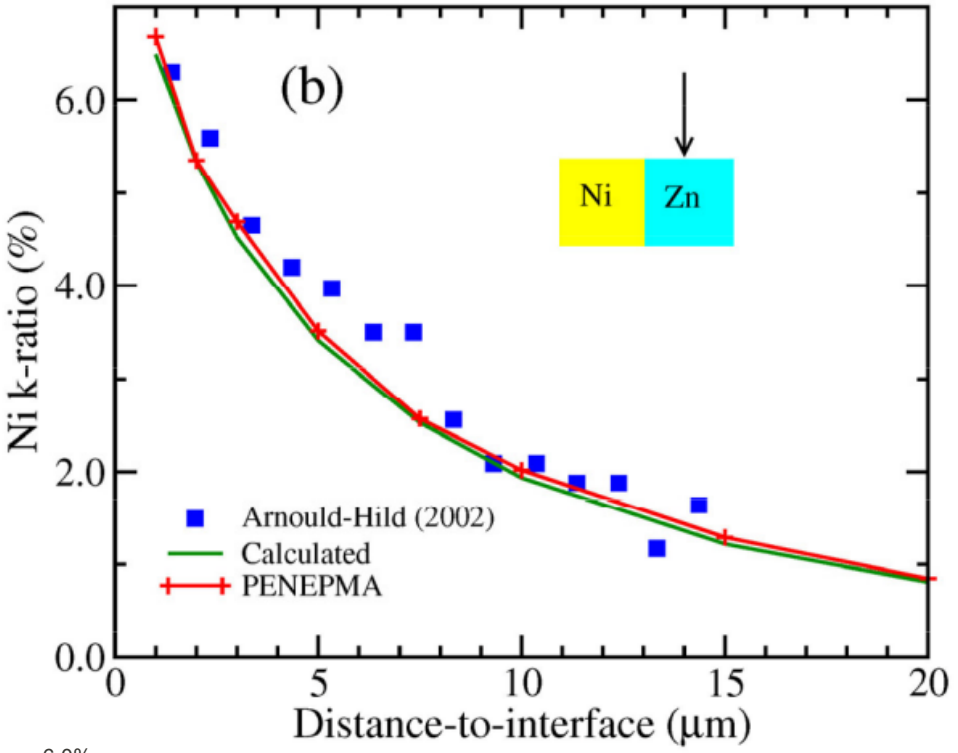
Characteristic Fluorescence

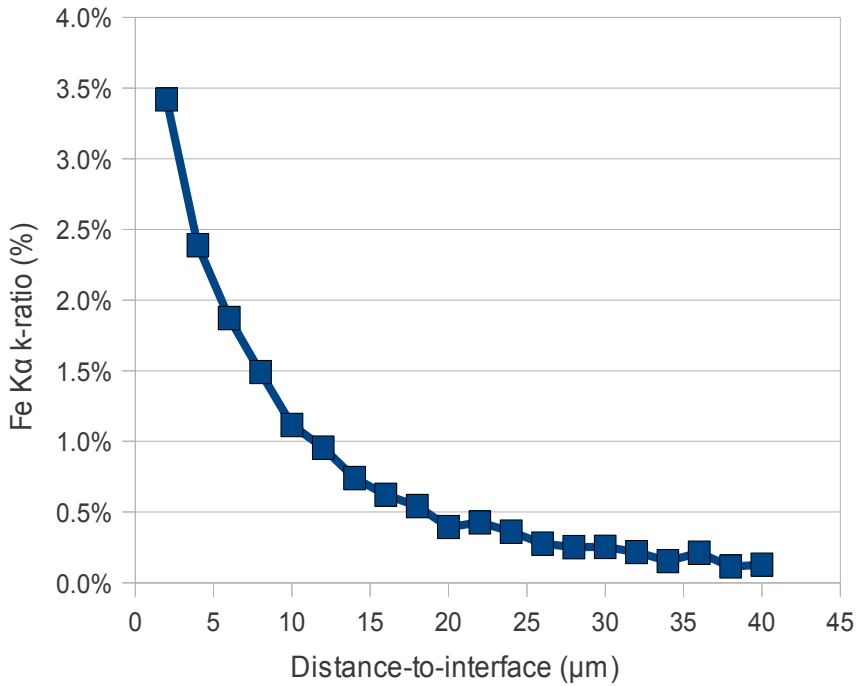
Transition	Generated 1/msR	Emitted 1/msR	Ratio (%)
Co Kα	2,480,354.6	1,344,712.9	54.2%
Co Kβ	301,960.5	184,136.1	61.0%
Cu Lβ	89,109.9	4,367.0	4.9%
Cu Lα	354,461.9	153,631.5	43.3%

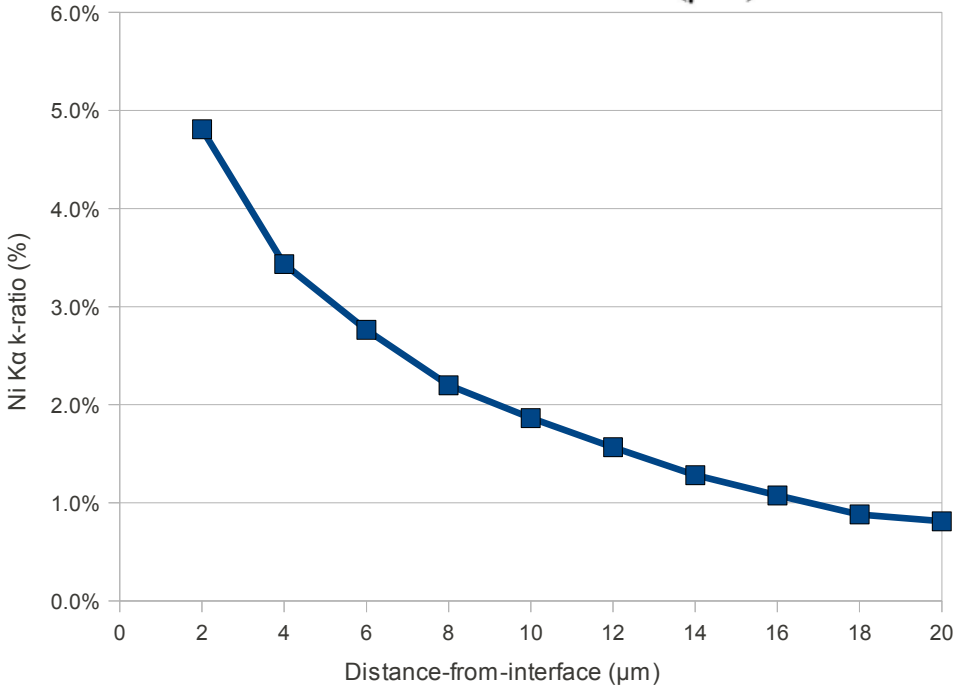
Bremsstrahlung Fluorescence

Transition	Generated 1/msR	Emitted 1/msR	Ratio (%)
Co Kα	591,208.4	300,589.9	50.8%
Co Kβ	71,974.2	41,467.7	57.6%
Co Lβ	1,496.1	6.5	0.4%
Co Lα	1,687.9	41.7	2.5%
Cu Kα	5,232,317.6	4,038,749.7	77.2%
Cu Kβ	635,538.3	511,211.6	80.4%
Cu Lβ	243,220.9	17,501.8	7.2%
Cu Lα	357,325.2	127,333.5	35.6%


(a)
Fe
Cu
Valovirta et al. (2001)
Calculated
PENEPMA
Fe k-ratio (%)
Distance-to-interface (µm)


(b)
Ni
Zn
Arnould-Hild (2002)
Calculated
PENEPMA
Ni k-ratio (%)
Distance-to-interface (µm)


Fe Kα k-ratio (%)
Distance-to-interface (µm)


Ni Kα k-ratio (%)
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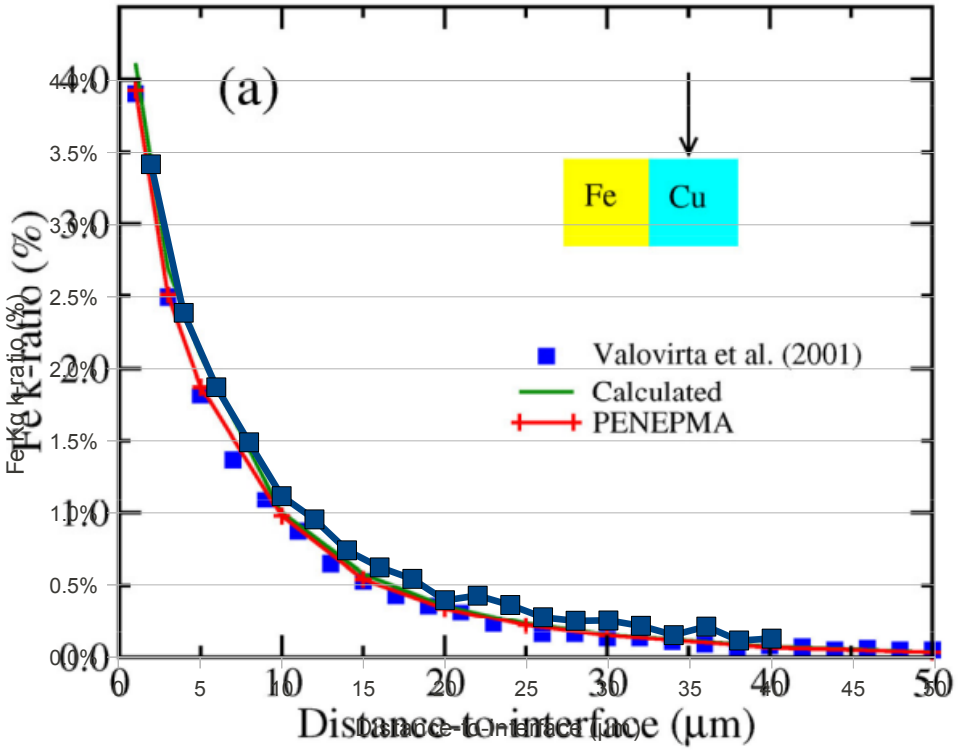
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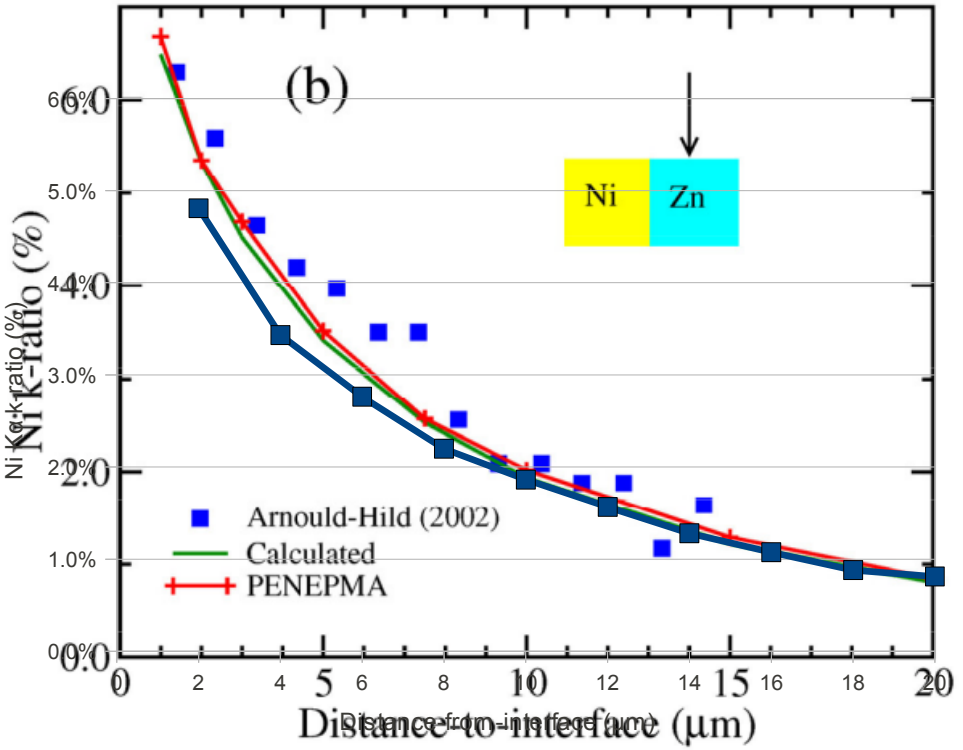
(b)
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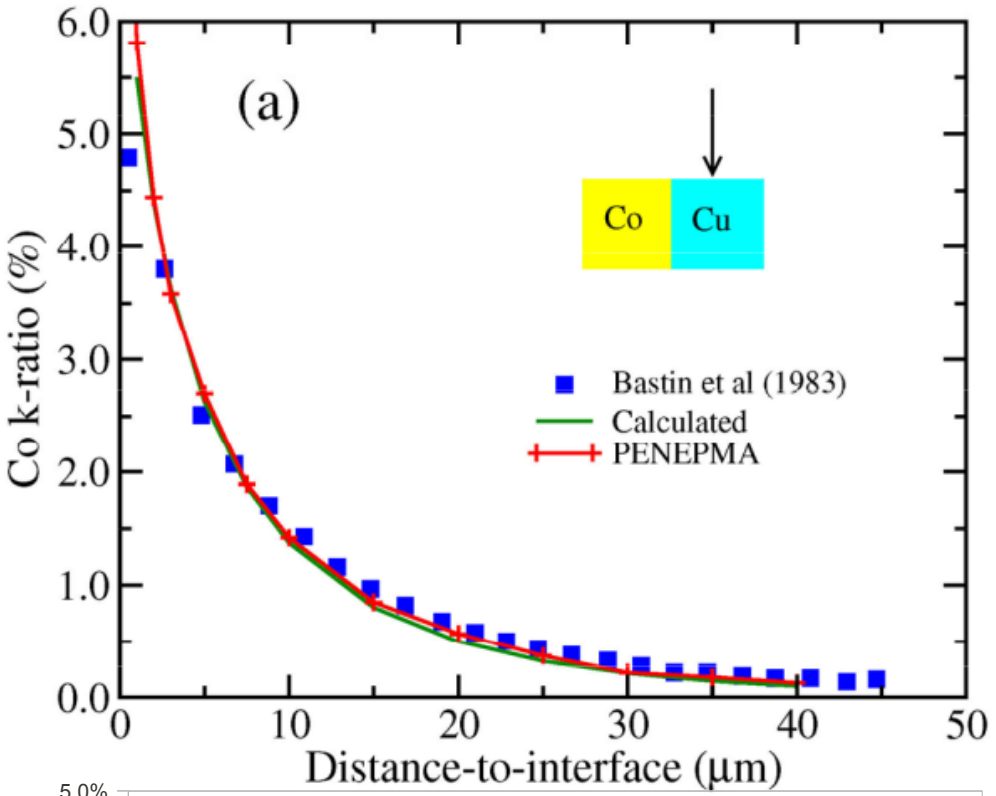
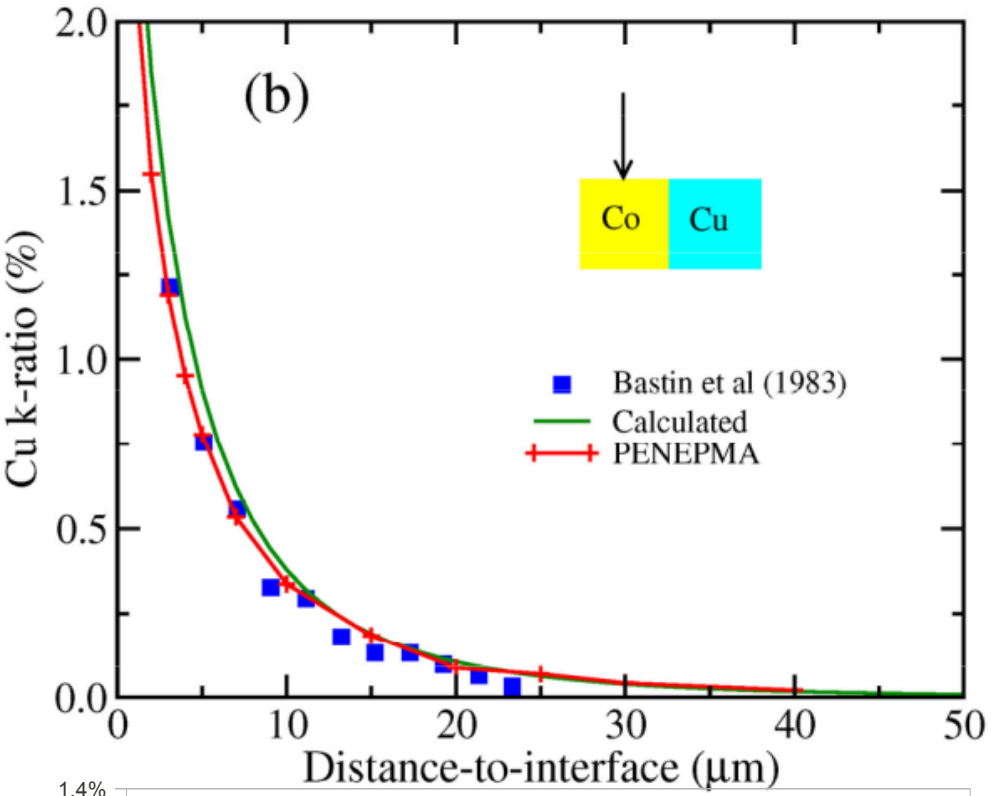
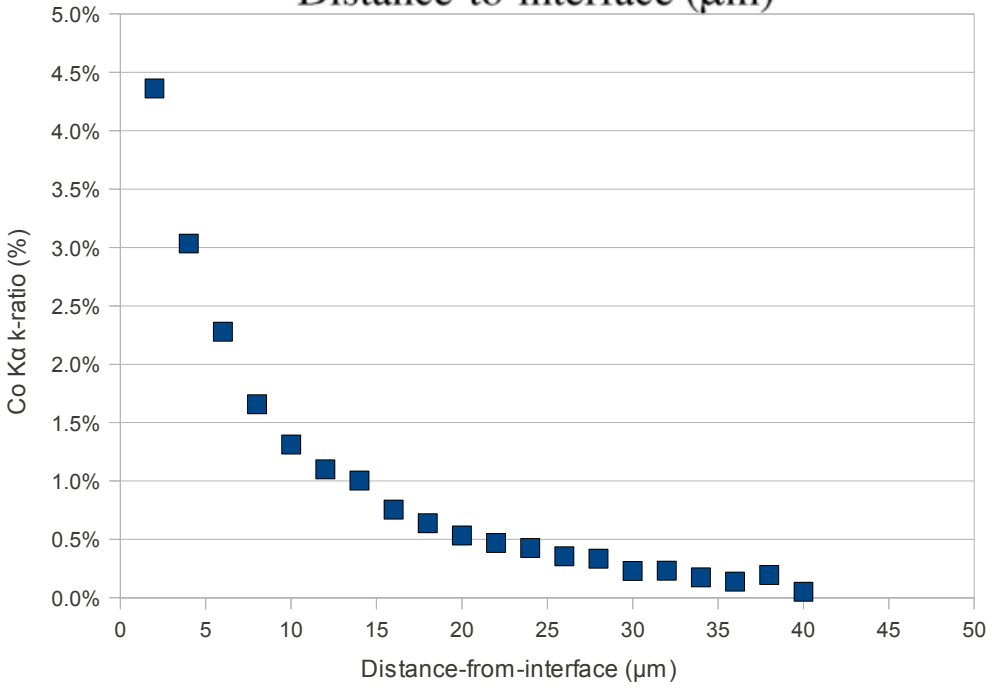
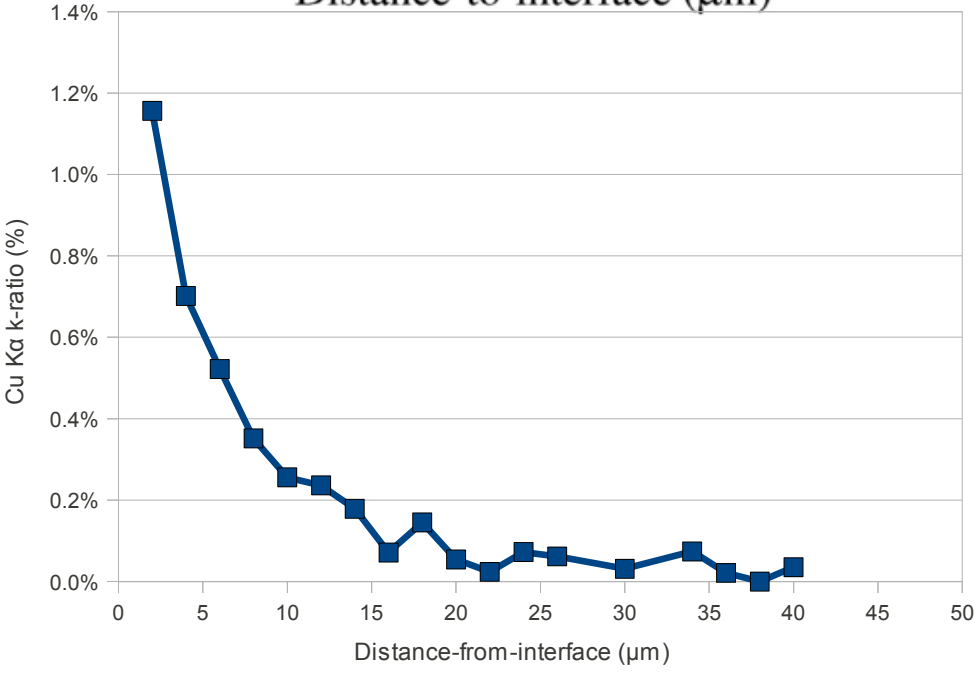
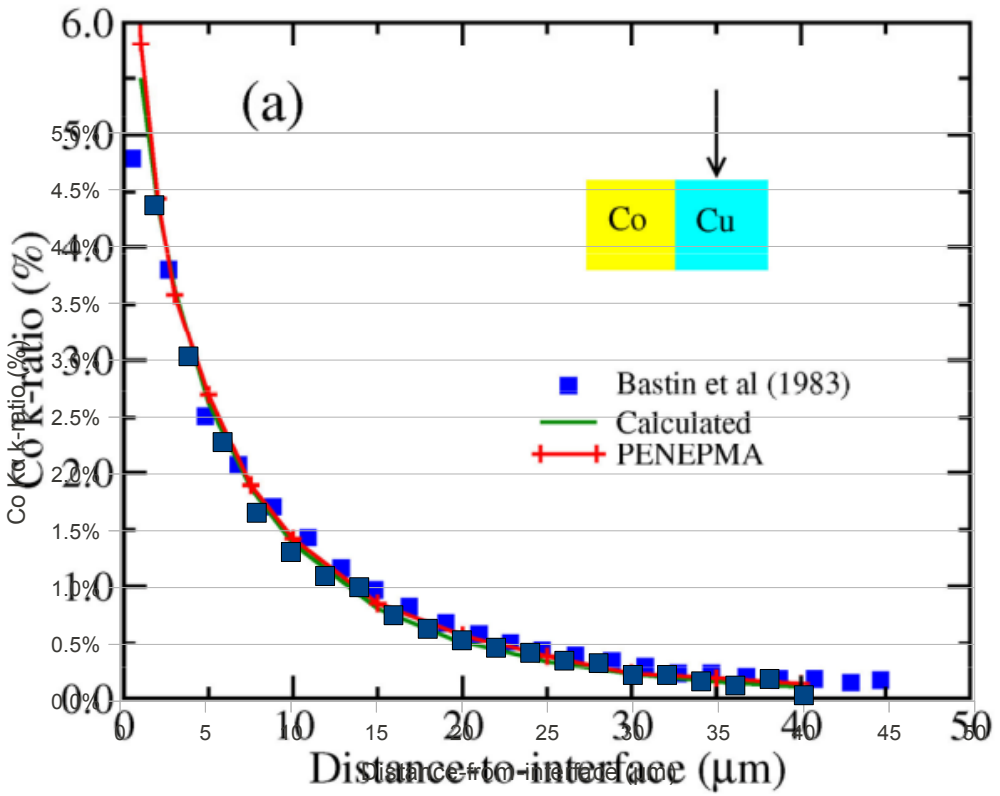
Ni Kα k-ratio (%)
Distance-to-interface (μm)


(a)
Co
Cu
Bastin et al (1983)
Calculated
PENEPMA
Co k-ratio (%)
Distance-to-interface (µm)


(b)
Co
Cu
Bastin et al (1983)
Calculated
PENEPMA
Cu k-ratio (%)
Distance-to-interface (µm)


Co Kα k-ratio (%)
Distance-from-interface (µm)


Cu Kα k-ratio (%)
Distance-from-interface (µm)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Bastin et al (1983)
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Co Kα k-ratio (%)
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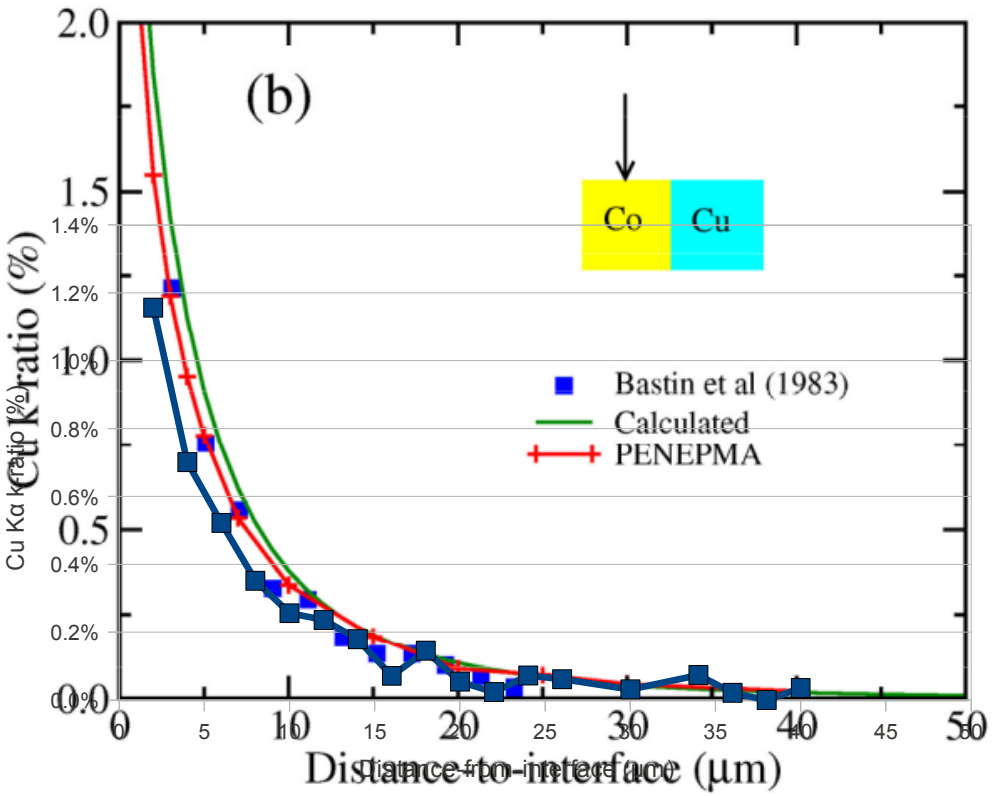
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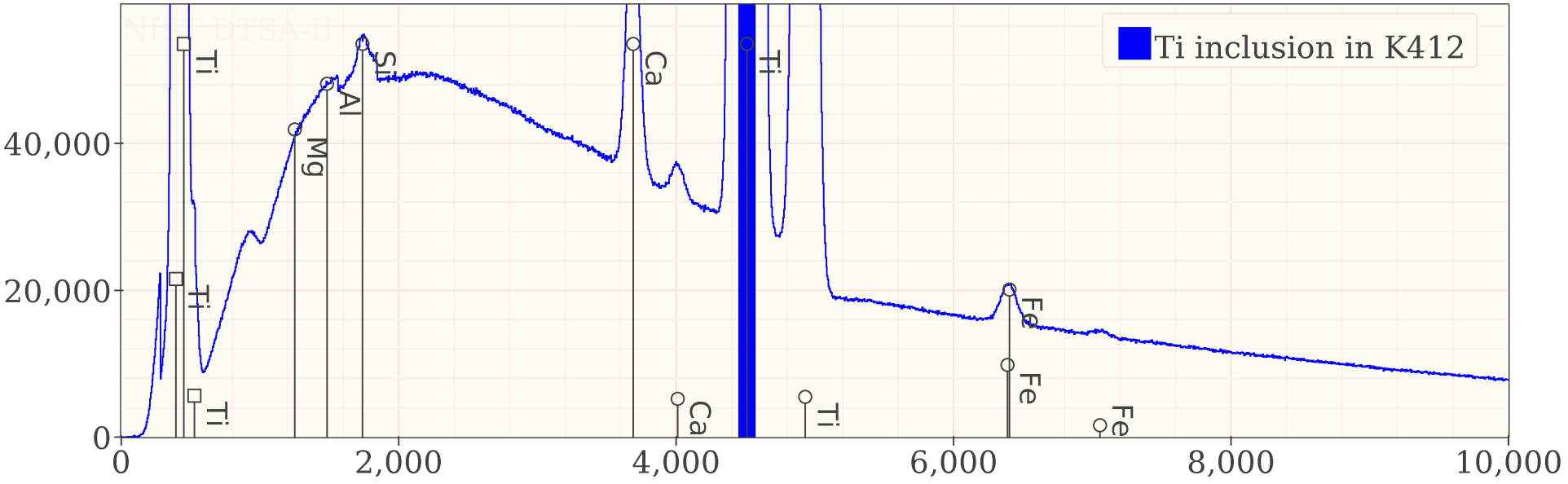

K412 = [O(42.76 wgt%),Mg(11.66 wgt%),Al(4.91 wgt%),Si(21.20 wgt%),Ca(10.90 wgt%),Fe(7.74 wgt%),Σ=99.16]