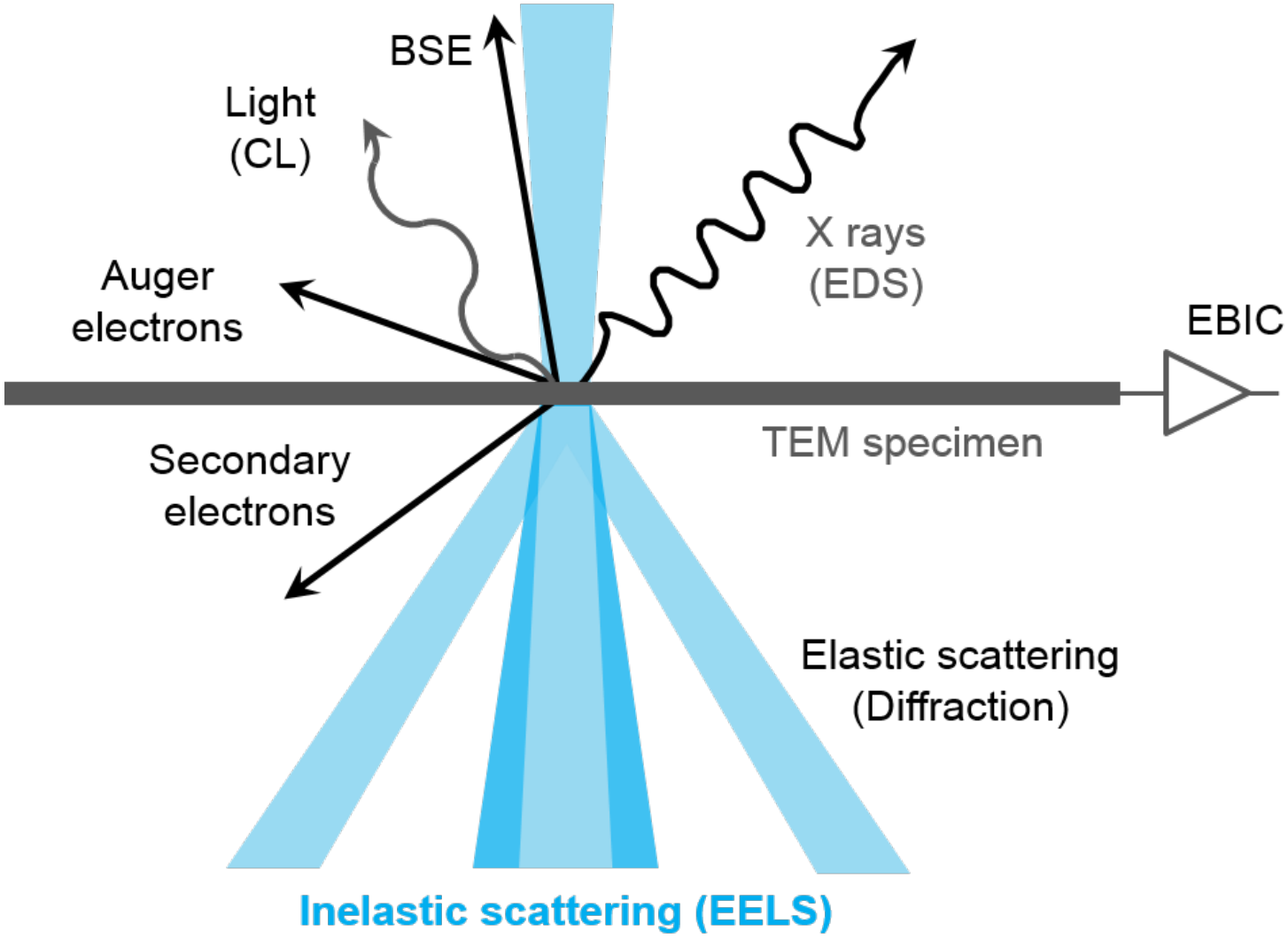
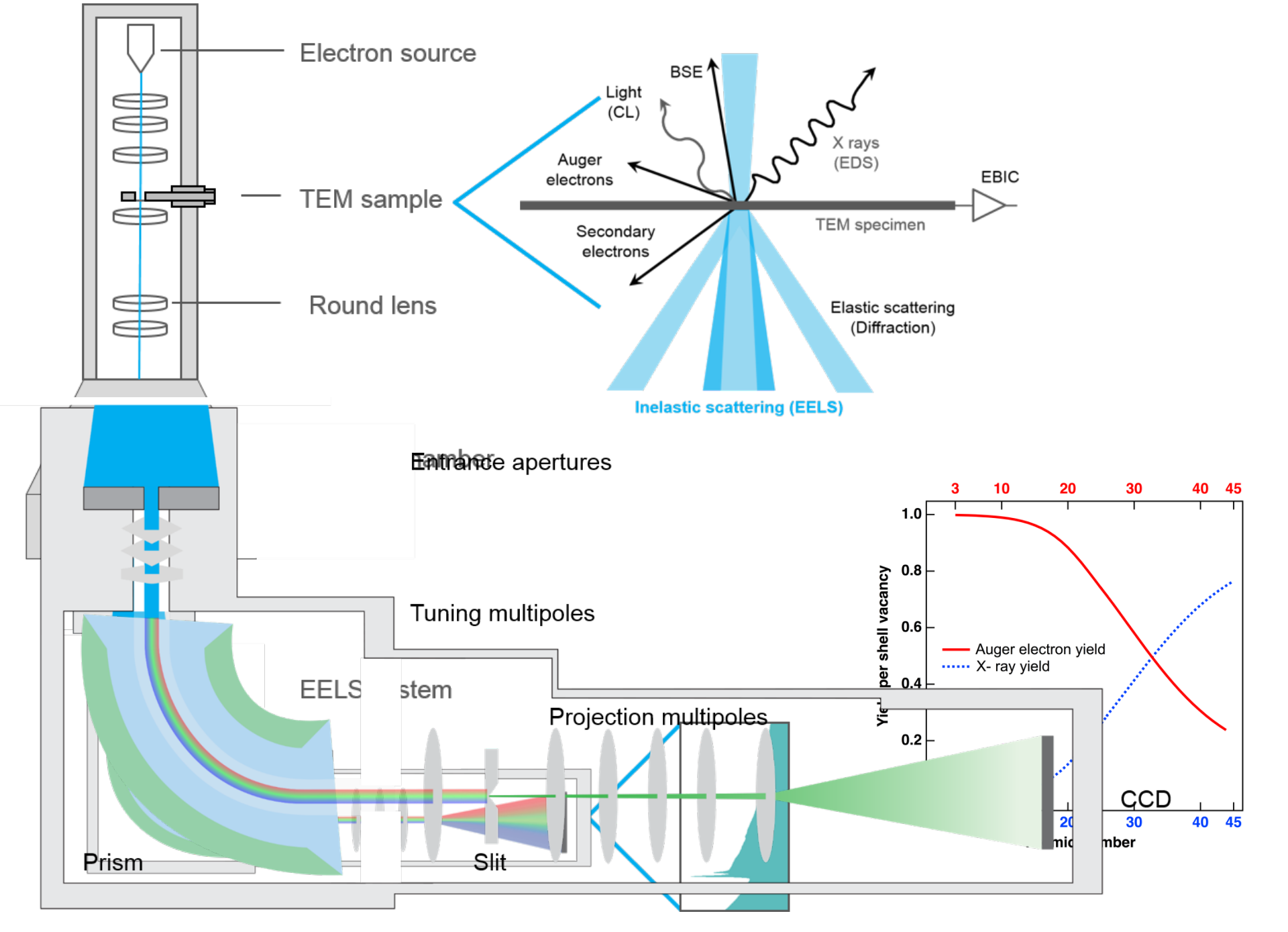
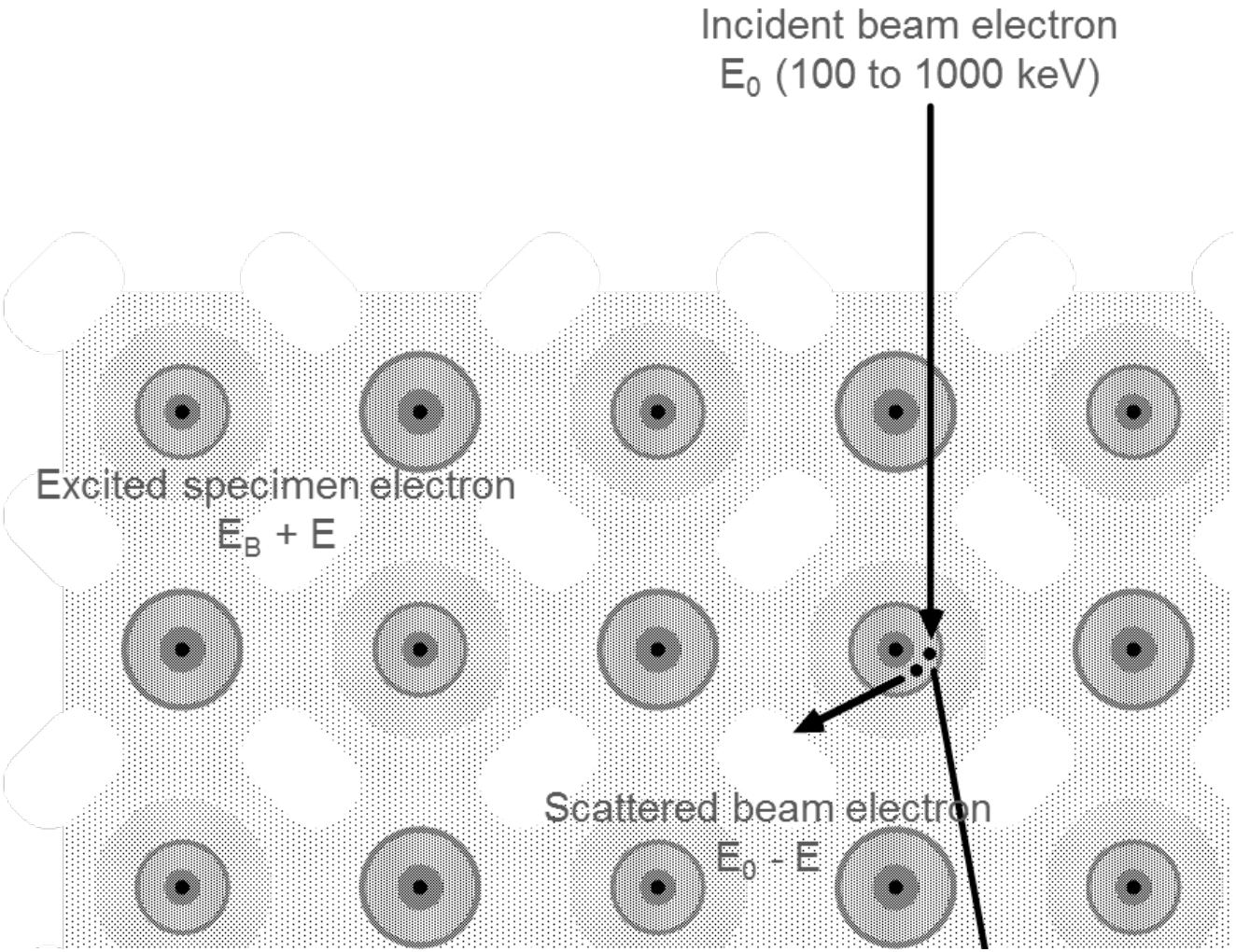
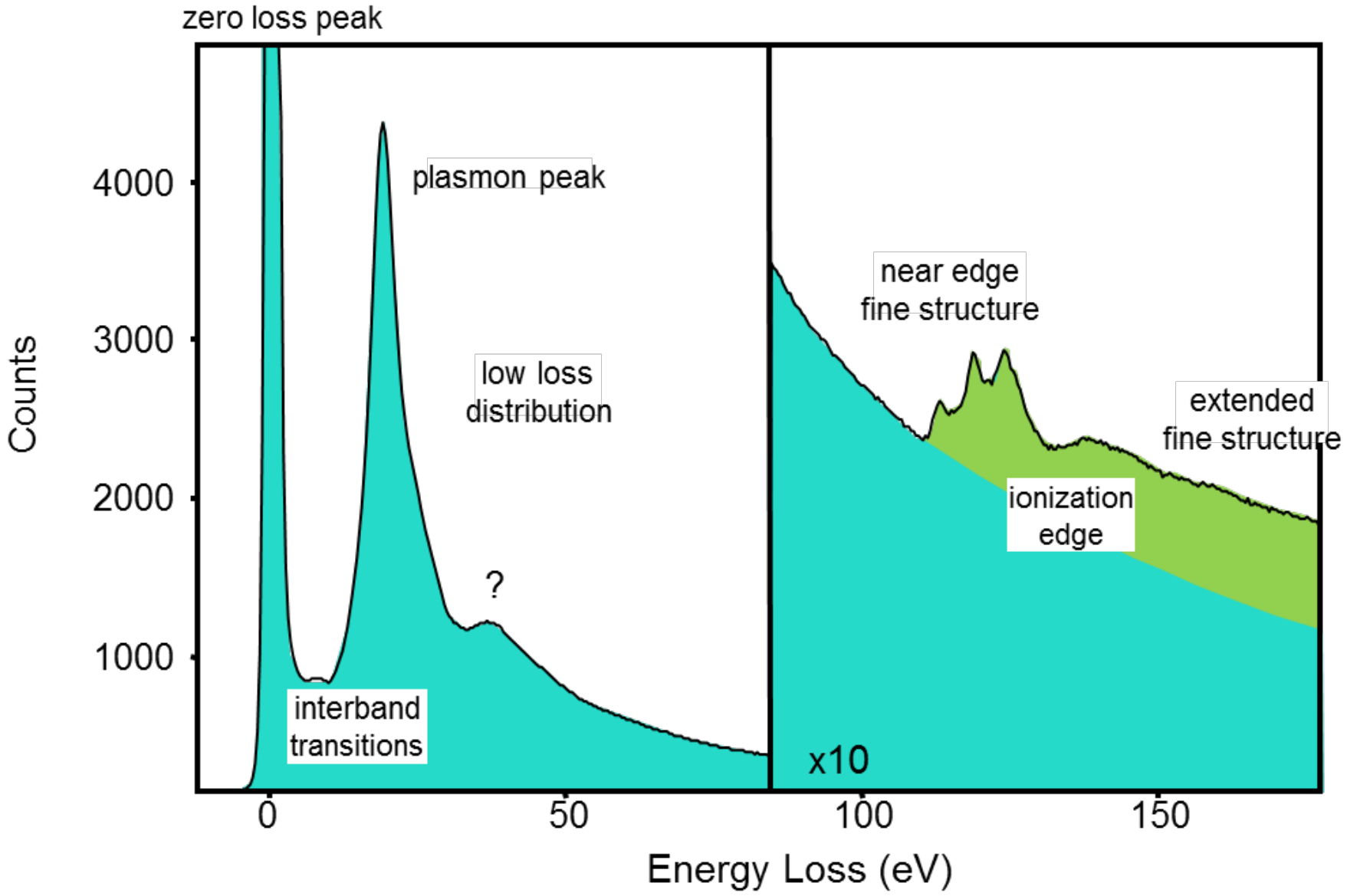
Elementaufgelöste und chemische Analytik in TEM

Elektronenwechselwirkung im TEM



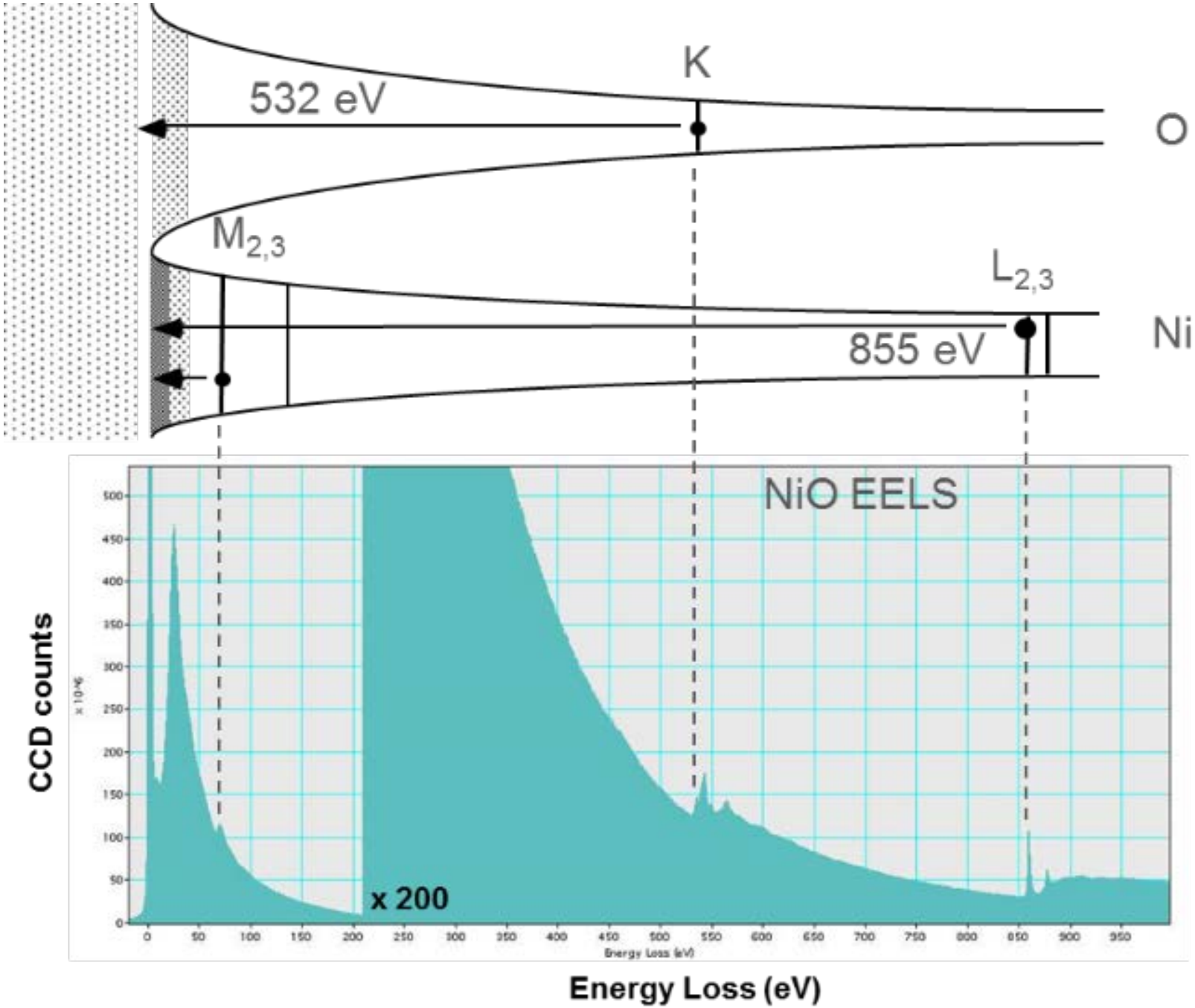

Electron source
TEM sample
Round lens
BSE
Light
(CL)
X rays
(EDS)
Auger
electrons
EBIC
TEM specimen
Secondary
electrons
Elastic scattering
(Diffraction)
Inelastic scattering (EELS)
Entrance apertures
Tuning multipoles
Projection multipoles
Prism
Slit
CCD
Auger electron yield
X- ray yield
3
10
20
30
40
45
1.0
0.8
0.6
0.4
0.2


Incident beam electron
E_0 (100 to 1000 keV)
Excited specimen electron
E_B + E
Scattered beam electron
E_0 - E

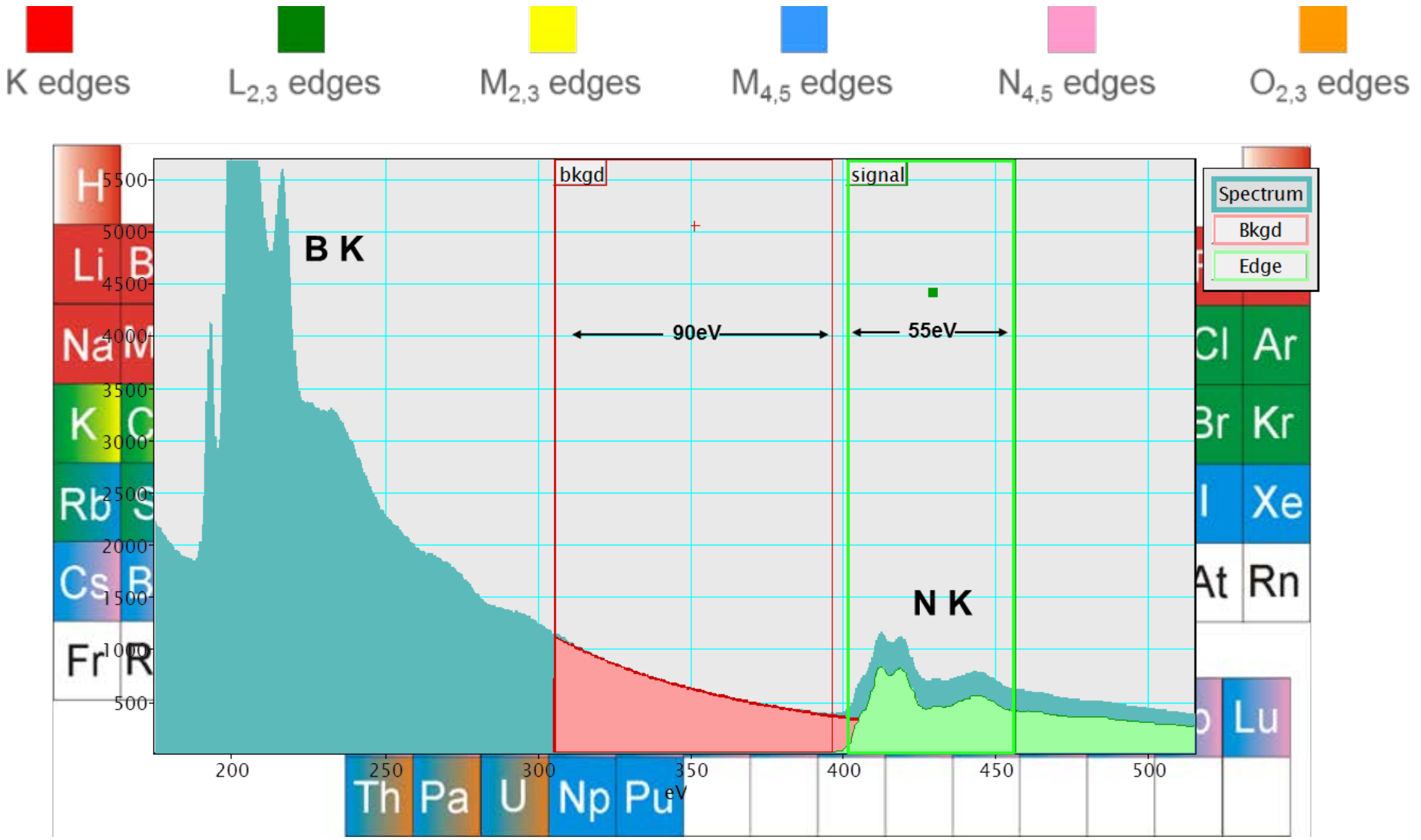


- Probendicke (zero loss)
- Elektronendichte (Plasmon)
- Interband/Intraband Übergänge

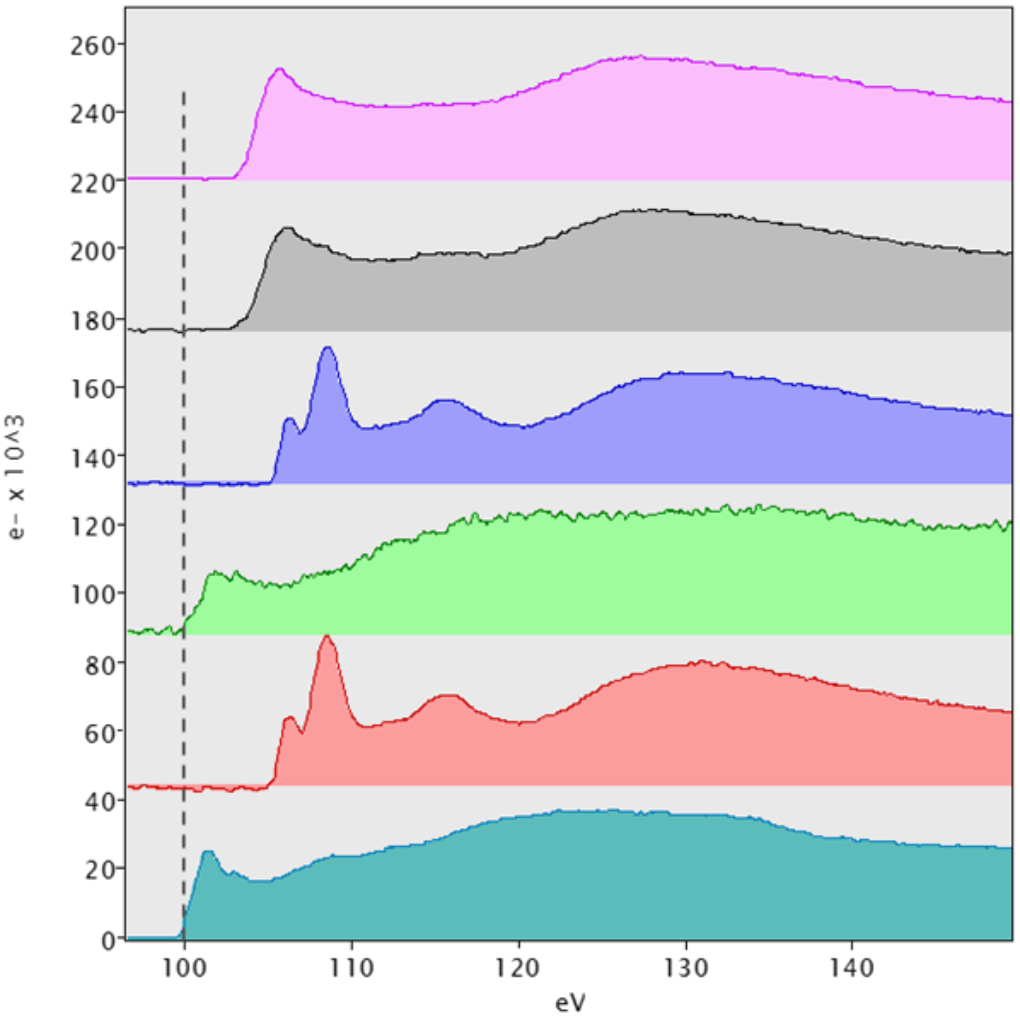
- Elementanalytik
- Bindung
- Radiale Verteilungsfunktion


K
532 eV
O
$M_{2,3}$
$L_{2,3}$
855 eV
Ni
NiO EELS
CCD counts
x 200
Energy Loss (eV)

Elementspezifizität (quantitativ)



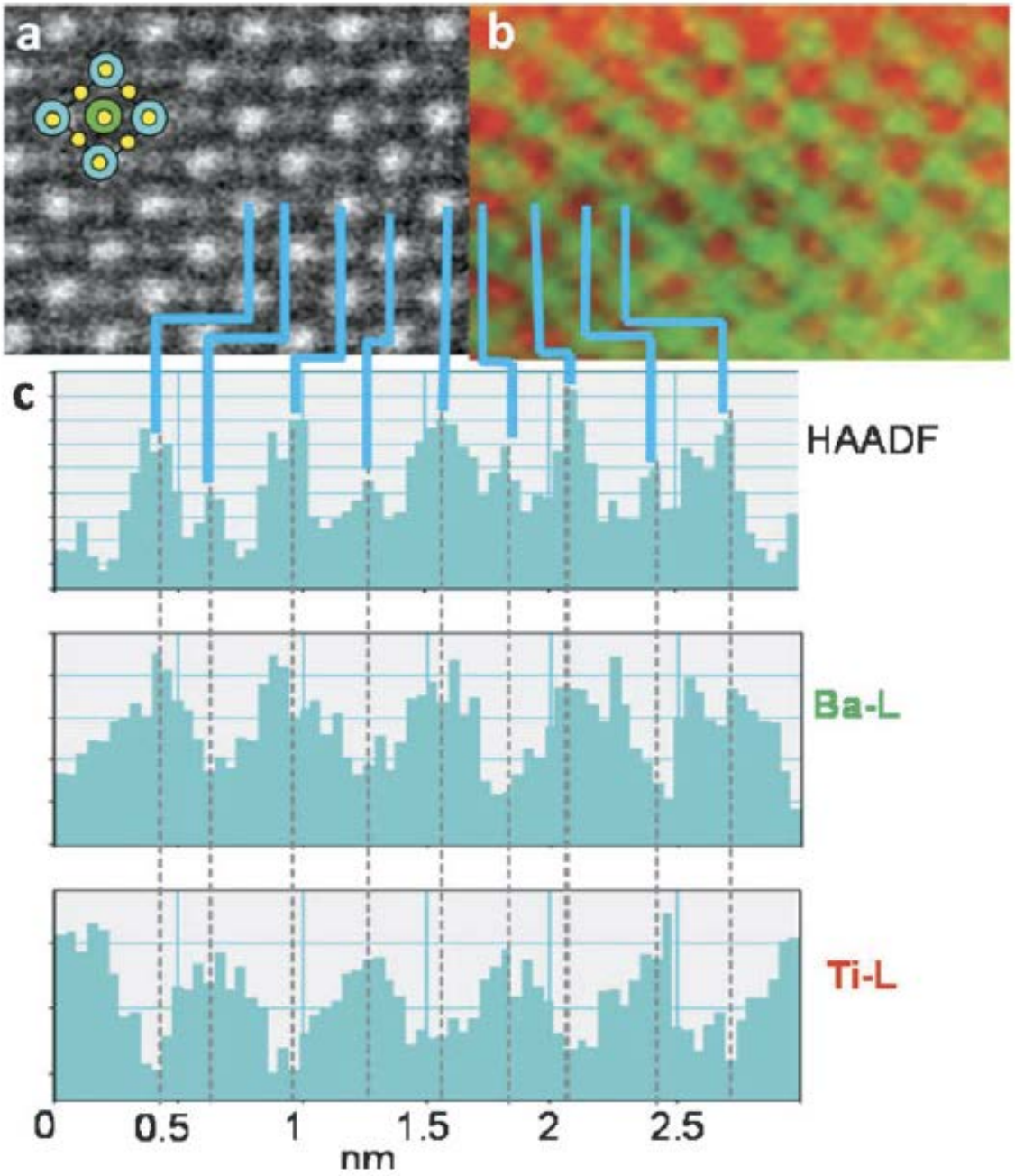
Chemische Spezifizität



Phase	E_k (eV)	ΔE_k (eV)
SiN	103.79±0.10	3.88±0.10
SiO_xN_y	104.07±0.10	4.16±0.10
SiO_x	105.32±0.07	5.41±0.07
WSi	100.37±0.48	0.46±0.48
SiO_{therm}	105.29±0.08	5.38±0.08
Si	99.91±0.06	0.00±0.06

Atomar auflösende Spektromikroskopie

BaTiO3



Energiedispersive Röntgenfluoreszenz (EDS, EDX)