

Settings

Elements

| | |
|--|---|
| H | He |
| Li Be | B C N O F Ne |
| Na Mg | Al Si P S Cl Ar |
| K Ca Sc Ti V Cr Mn Fe Co Ni Cu Zn Ga Ge As Se Br Kr | |
| Rb Sr Y Zr Nb Mo Tc Ru Rh Pd Ag Cd In Sn Sb Te I Xe | |
| Cs Ba La Hf Ta W Re Os Ir Pt Au Hg Tl Pb Bi Po At Rn | |
| Fr Ra Ac | Ce Pr Nd Pm Sm Eu Gd Tb Dy Ho Er Tm Yb Lu |
| | Th Pa U Np Pu Am Cm Bk Cf Es Fm Md No Lr |

Clear all

Auto ID

Element finder

| | | |
|----|-----|-------|
| In | LG5 | 3.816 |
| Sn | LB6 | 3.792 |
| Cs | LL | 3.801 |
| Pa | M30 | 3.820 |

Element overview list

Standards

Background settings SEM, Preset

Deconvolution settings Series fit

Quantification model P/B - ZAF

Additional settings 5.0 keV, 0°

High voltage [kV] 5.0 A

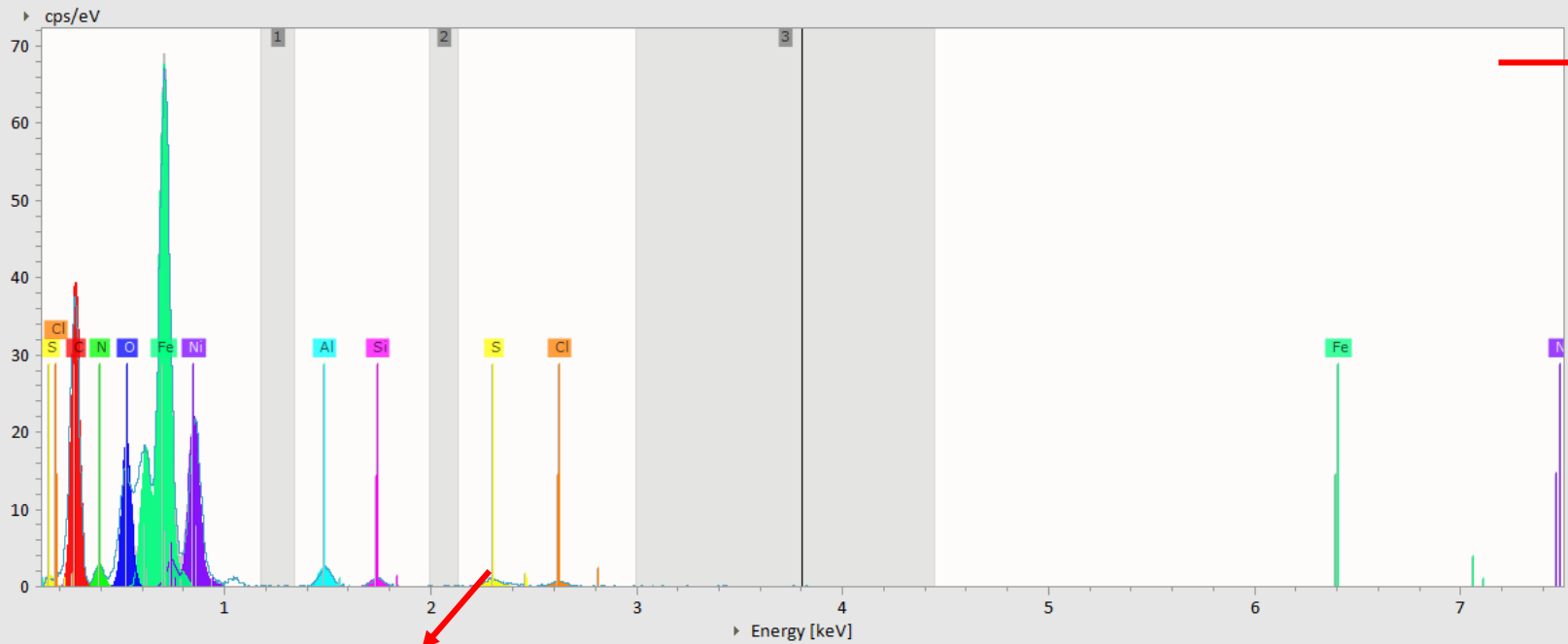
Sample tilt angle [°] 0 A

Fast quantification

Description

as set in spectrum (Linemarker), quantification with P/B-ZAF

Results



Background regions Element lines Dynamic lines

| Element | At. No. | Line s. | Netto | Mass [%] | Atom [%] | abs. error [%] (3 sigma) | rel. error [%] (3 sigma) |
|------------|---------|----------|--------|--------------|--------------|-----------------------------|-----------------------------|
| Carbon | 6 | K-Series | 164335 | 13.4 | 36.3 | 4.5 | 33.5 |
| Nitrogen | 7 | K-Series | 12895 | 1.4 | 3.3 | 0.7 | 45.8 |
| Oxygen | 8 | K-Series | 88611 | 6.4 | 13.0 | 2.3 | 35.2 |
| Aluminium | 13 | K-Series | 16441 | 1.1 | 1.3 | 0.2 | 21.4 |
| Silicon | 14 | K-Series | 7788 | 1.1 | 1.3 | 0.2 | 21.5 |
| Sulfur | 16 | K-Series | 7903 | 1.1 | 1.1 | 0.2 | 22.4 |
| Chlorine | 17 | K-Series | 5153 | 1.0 | 0.9 | 0.2 | 24.3 |
| Iron | 26 | L-Series | 452263 | 59.2 | 34.4 | 18.9 | 31.9 |
| Nickel | 28 | L-Series | 145181 | 15.2 | 8.4 | 5.1 | 33.6 |
| Sum | | | | 100.0 | 100.0 | | |

Density: 4.06 g/cm³
Electron interaction depth: 0.2 µm Radius: 0.1 µm

All

Orig.

Bkg.

C

N

O

Al

Si

S

Cl

Fe

Ni

Deconv.

Y axis

Logarithmic

Square root

Individual scaling

Automatic

Show negative data

Other options

Grid visible

Bar graphic

Show legend

X/Y cursor

Show cursor info

Load Save To project Apply

Add to standards OK Cancel

Settings

Elements

| | |
|--|---|
| H | He |
| Li Be | B C N O F Ne |
| Na Mg | Al Si P S Cl Ar |
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| | Th Pa U Np Pu Am Cm Bk Cf Es Fm Md No Lr |

Clear all

Auto ID

Element finder

Cs LL 3.801

Element overview list

Standards

Background settings

SEM, Preset

Deconvolution settings

Series fit

Quantification model

P/B - ZAF

Additional settings

5.0 keV, 0°

High voltage [kV]

5.0

A

Sample tilt angle [°]

0

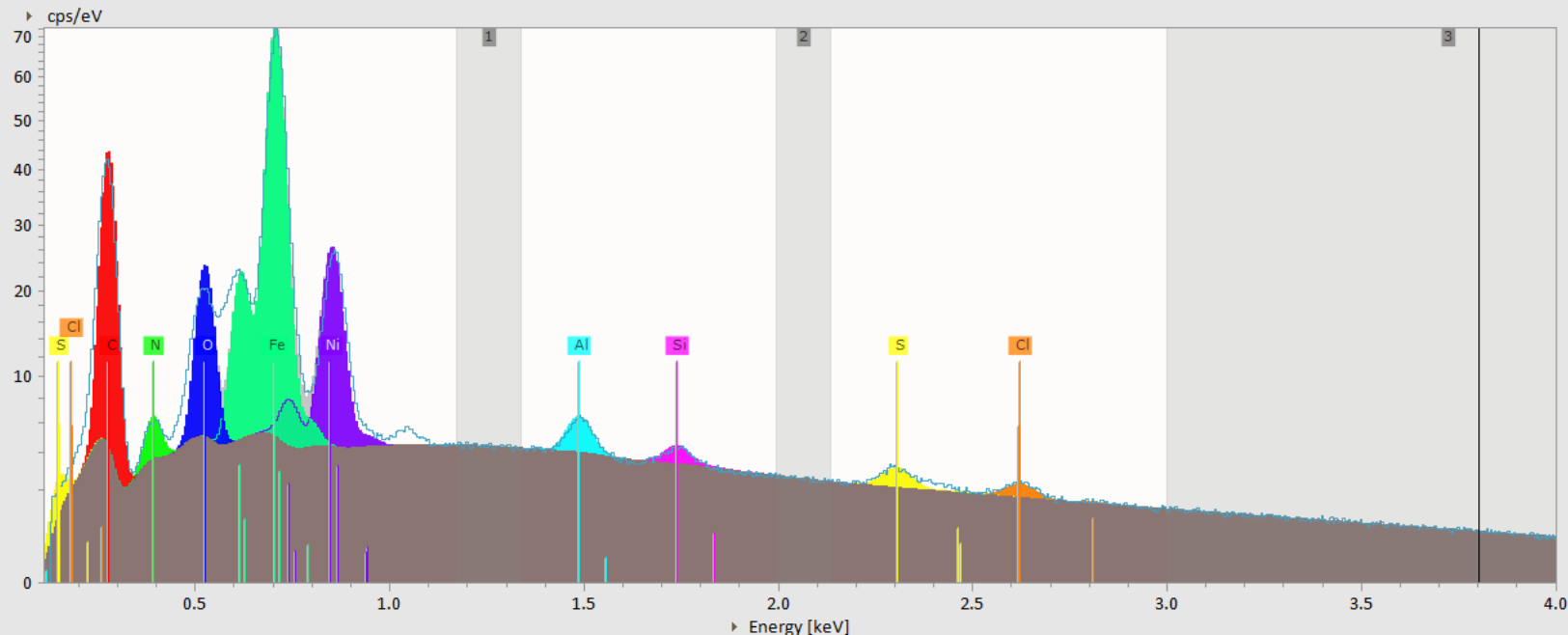
A

Fast quantification

Description

as set in spectrum (Linemarker), quantification with P/B-ZAF

Results



Show/hide method editor

- All
- Orig. ---
- Bkg. ---
- C ---
- N ---
- O ---
- Al ---
- Si ---
- S ---
- Cl ---
- Fe ---
- Ni ---
- Deconv. ---

- Background regions
- Element lines
- Dynamic lines

| Element | At. No. | Line s. | Netto | Mass [%] | Atom [%] | abs. error [%] (3 sigma) | rel. error [%] (3 sigma) |
|-----------|---------|----------|------------|--------------|--------------|-----------------------------|-----------------------------|
| Carbon | 6 | K-Series | 164335 | 13.4 | 36.3 | 4.5 | 33.5 |
| Nitrogen | 7 | K-Series | 12895 | 1.4 | 3.3 | 0.7 | 45.8 |
| Oxygen | 8 | K-Series | 88611 | 6.4 | 13.0 | 2.3 | 35.2 |
| Aluminium | 13 | K-Series | 16441 | 1.1 | 1.3 | 0.2 | 21.4 |
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| Sulfur | 16 | K-Series | 7903 | 1.1 | 1.1 | 0.2 | 22.4 |
| Chlorine | 17 | K-Series | 5153 | 1.0 | 0.9 | 0.2 | 24.3 |
| Iron | 26 | L-Series | 452263 | 59.2 | 34.4 | 18.9 | 31.9 |
| Nickel | 28 | L-Series | 145181 | 15.2 | 8.4 | 5.1 | 33.6 |
| | | | Sum | 100.0 | 100.0 | | |

Density: 4.06 g/cm³
Electron interaction depth: 0.2 µm Radius: 0.1 µm

Load

Save

To project

Apply

Add to standards

OK

Cancel

Settings

Elements

| | |
|--|---|
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| | Th Pa U Np Pu Am Cm Bk Cf Es Fm Md No Lr |

Clear all

Auto ID

Element finder

Cs LL 3.801

Element overview list

Standards

Background settings SEM, Preset

Deconvolution settings Series fit

Quantification model P/B - ZAF

Additional settings 5.0 keV, 0°

High voltage [kV] 5.0 A

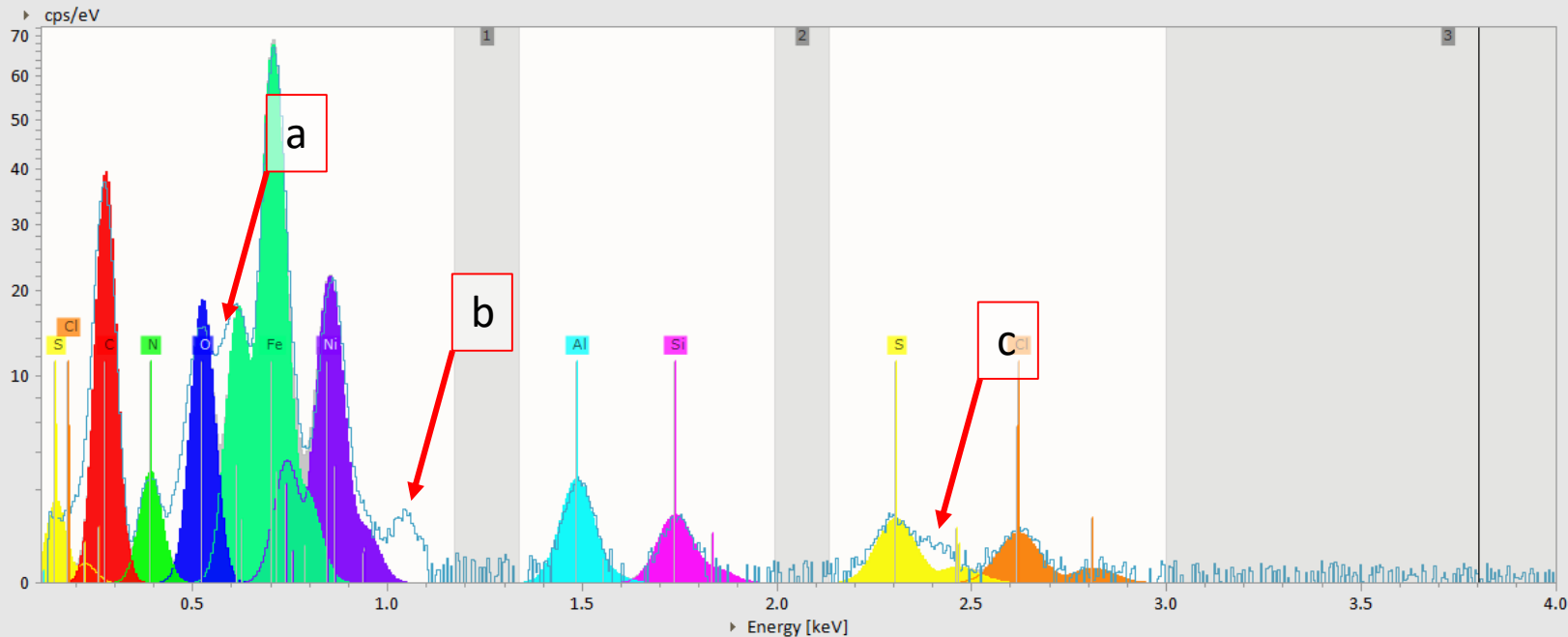
Sample tilt angle [°] 0 A

Fast quantification

Description

as set in spectrum (Linemarker), quantification with P/B-ZAF

Results



Background regions Element lines Dynamic lines

| Element | At. No. | Line s. | Netto | Mass [%] | Atom [%] | abs. error [%] (3 sigma) | rel. error [%] (3 sigma) |
|-----------|---------|----------|------------|--------------|--------------|-----------------------------|-----------------------------|
| Carbon | 6 | K-Series | 164335 | 13.4 | 36.3 | 4.5 | 33.5 |
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| Chlorine | 17 | K-Series | 5153 | 1.0 | 0.9 | 0.2 | 24.3 |
| Iron | 26 | L-Series | 452263 | 59.2 | 34.4 | 18.9 | 31.9 |
| Nickel | 28 | L-Series | 145181 | 15.2 | 8.4 | 5.1 | 33.6 |
| | | | Sum | 100.0 | 100.0 | | |

Density: 4.06 g/cm³
Electron interaction depth: 0.2 µm Radius: 0.1 µm

- All
- Orig.
- Bkg.
- C
- N
- O
- Al
- Si
- S
- Cl
- Fe
- Ni
- Deconv.

Load

Save

To project

Apply

Add to standards

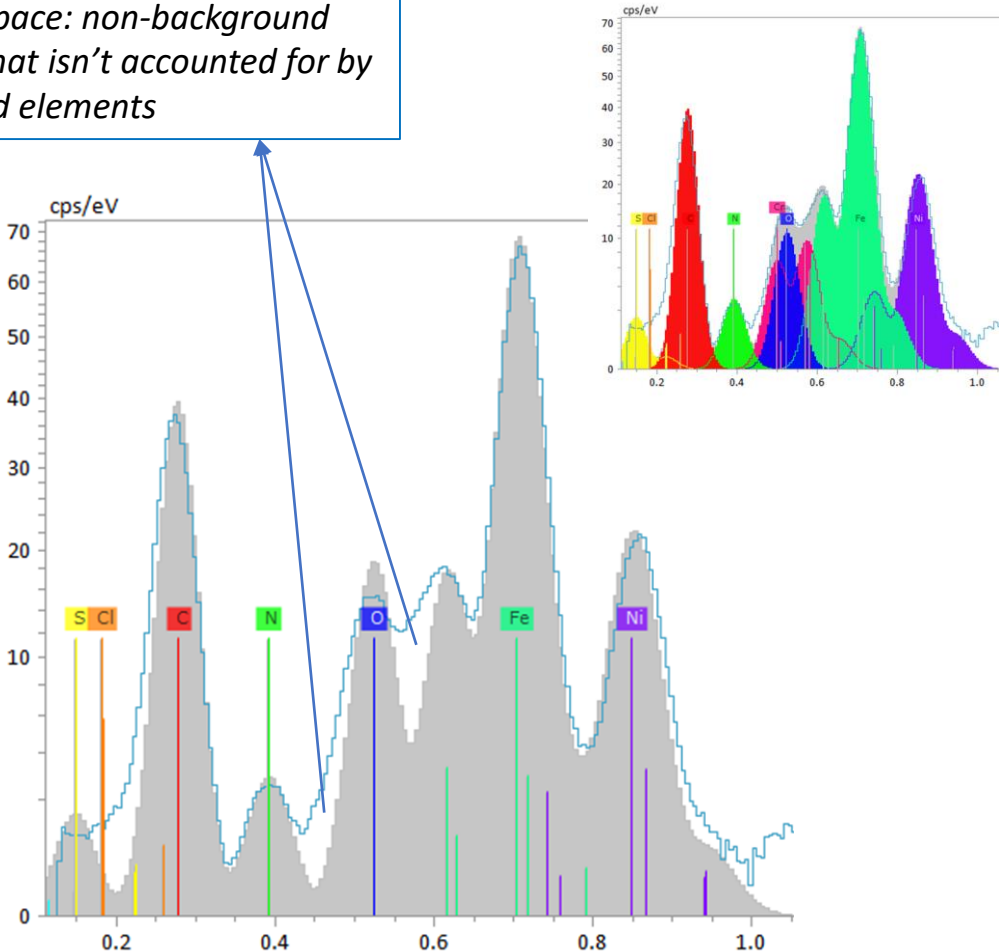
OK

Cancel

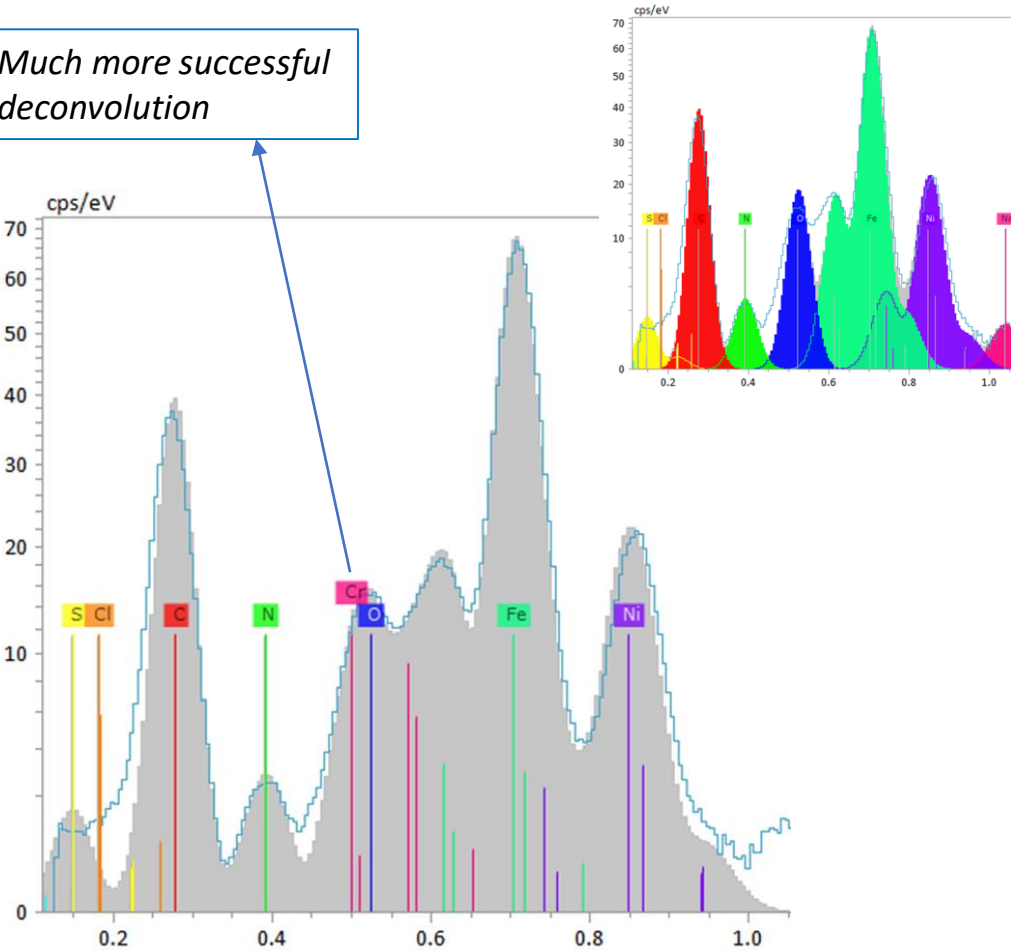
a. Possibly an additional element(s), or just something that's chalked up to this area being especially difficult to resolve well: the 0.5-1.0kV energy range generally has the greatest background signal, while also potentially containing signals from up to 23 elements. Low kV (reduces background level), low throughput (reduces peak widths), and high counts (improves statistics) all help this issue!

Try a few elements and see if any work well and make sense for your sample – in this case, Cr checks both boxes (steel substrate). If you want to be sure, you can test this by temporarily raising the voltage and seeing if any of the other peaks appear (for Cr, there should be a K peak at 5.4kV)

White space: non-background signal that isn't accounted for by assigned elements



Much more successful deconvolution

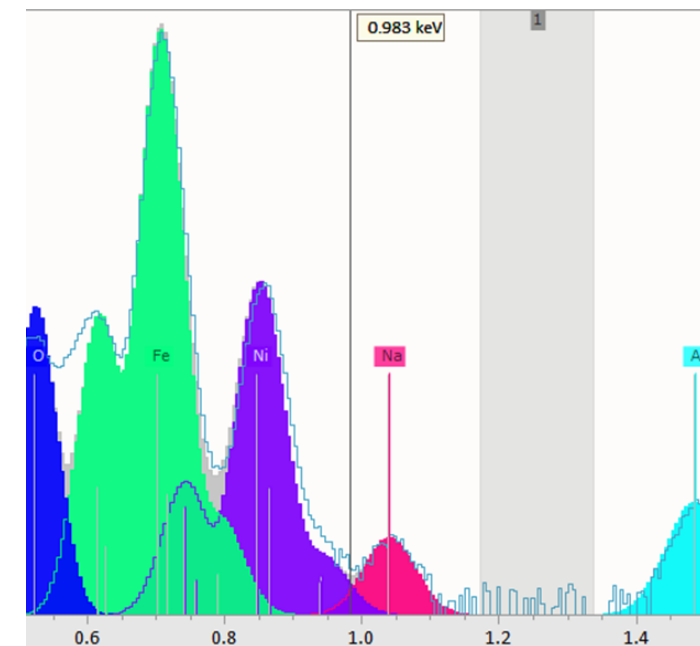
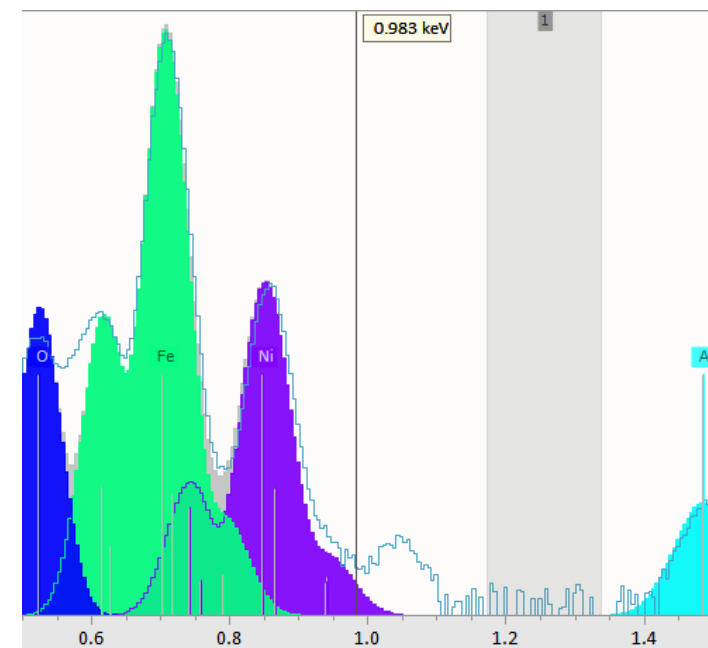


b. Most likely an unassigned peak, so first check to see if anything should be there. In this case, Na fits well and isn't unreasonable. If nothing does (or you're confident that element is *not* in your sample), check to see if it's an artifact peak. Esprit does a pretty good job getting rid of them as they pop up, but some slip by. A big clue would be if it had a weird (non-gaussian) shape, which would indicate Esprit has already been digging around that area.

The most likely artifact would be a **sum peak**. EDS works by measuring the energy of photons that hit the detector; if 2 photons hit at the "same" time, their energy is considered together and counted as a single feature. A sum peak will thus most likely occur for: 1. a high count rate relative to the throughput, and 2. the elements that contribute the greatest signal. So, if you had a count rate of 2kcps for a throughput of 30kcps, you could pretty safely rule it out. Here, there's 22kcps, so it wouldn't be unreasonable.

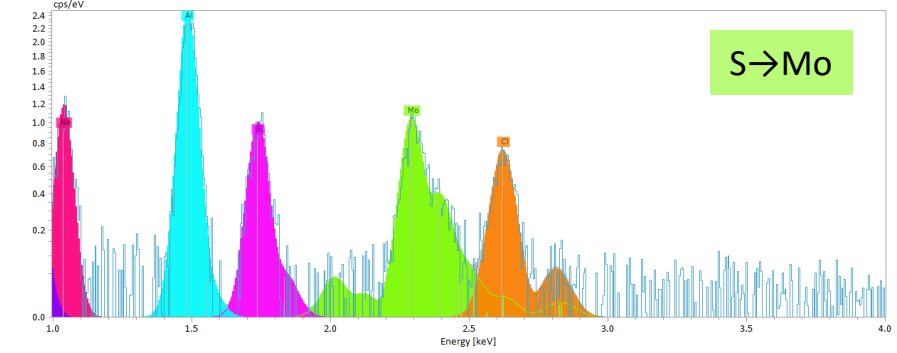
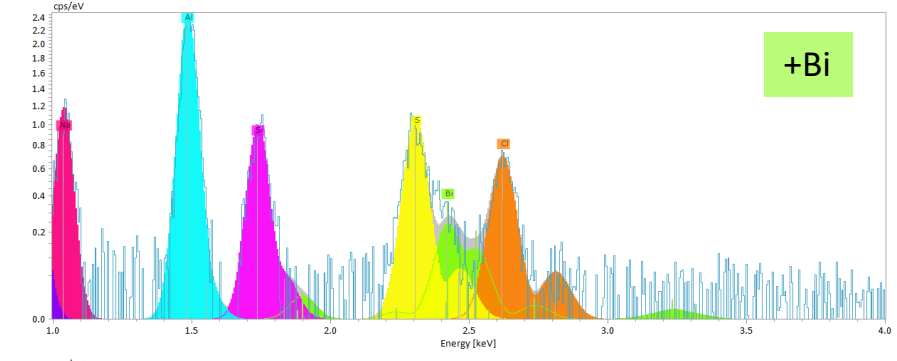
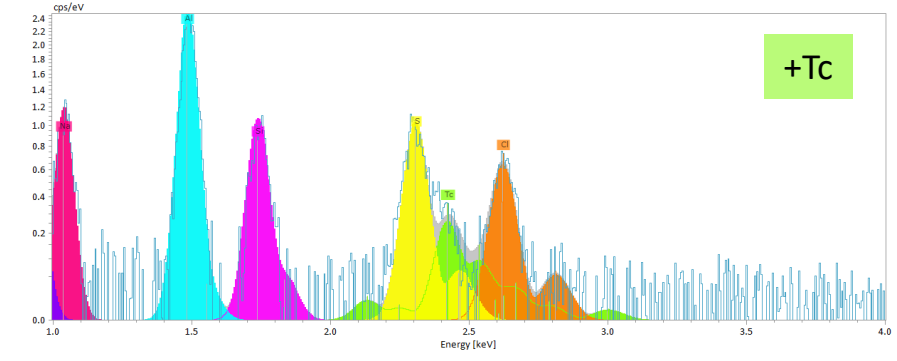
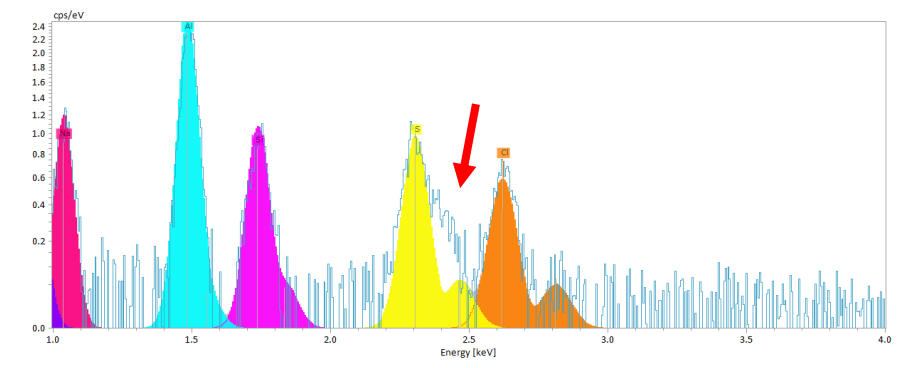
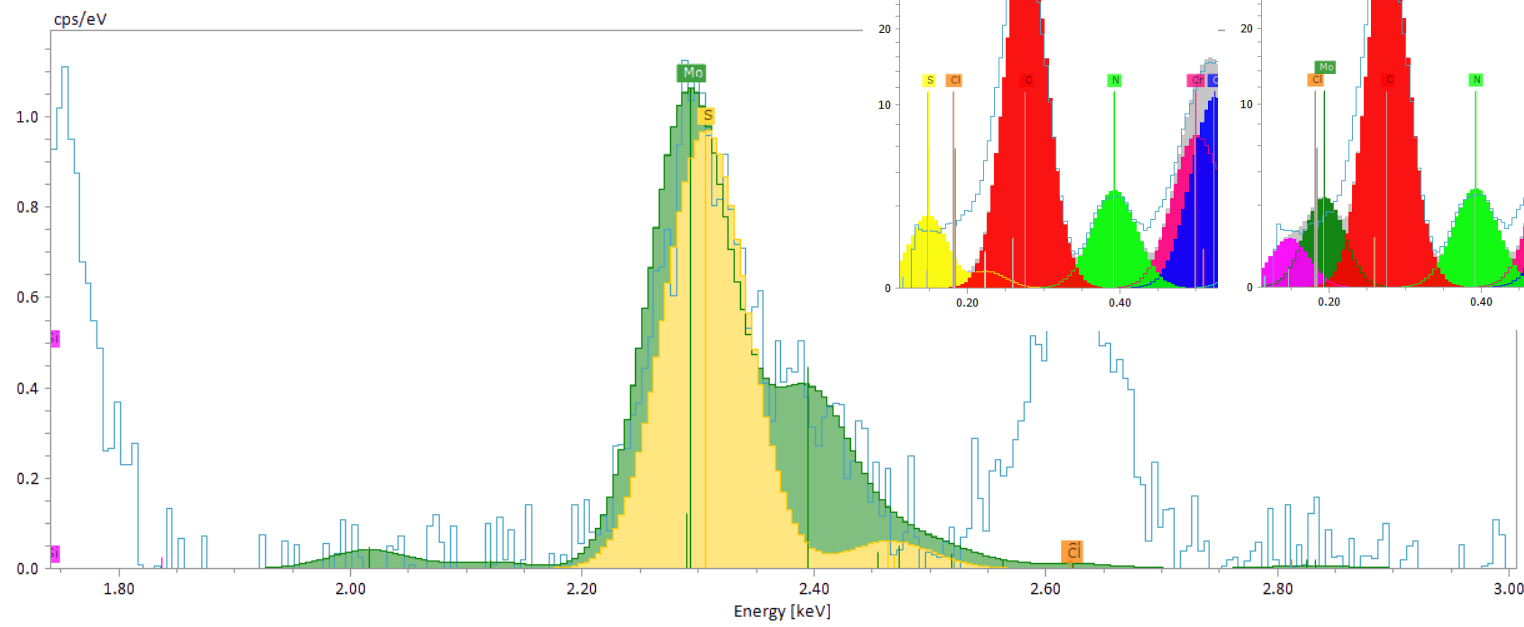
The unidentified peak here is at 1.049kV. Fe (0.710kV) and C (0.272kV) are the two highest peaks, so we could potentially have the following sum peaks. Fe+C is close, but far enough that we can pretty reasonably rule it out.

- Fe+Fe=1.420kV
- Fe+C=0.982kV
- C+C=0.544kV



c. There's unassigned counts at 2.4keV, near the S peak. Tc and Bi fit the data well, but are very unlikely candidates to randomly be found unless explicitly expected. It also seems very unlikely to be due to a sum peak.

Instead, the solution is that the peak assignment is probably incorrect: the L family of Mo fits the profile of the data much better than a S-K line. This is actually the 'classic' example of overlaps in EDS. So, while the peak positions themselves may not be able to get you all the way, your peak *shapes* give you another clue.



Settings

Elements

| | |
|--|---|
| H | He |
| Li Be | B C N O F Ne |
| Na Mg | Al Si P S Cl Ar |
| K Ca Sc Ti V Cr Mn Fe Co Ni Cu Zn Ga Ge As Se Br Kr | |
| Rb Sr Y Zr Nb Mo Tc Ru Rh Pd Ag Cd In Sn Sb Te I Xe | |
| Cs Ba La Hf Ta W Re Os Ir Pt Au Hg Tl Pb Bi Po At Rn | |
| Fr Ra Ac | Ce Pr Nd Pm Sm Eu Gd Tb Dy Ho Er Tm Yb Lu |
| | Th Pa U Np Pu Am Cm Bk Cf Es Fm Md No Lr |

Clear all

Auto ID

Element finder

| | | |
|----|-----|-------|
| Bi | MA2 | 2.417 |
| Nb | LG5 | 2.407 |
| Re | M2N | 2.408 |
| Au | MG | 2.408 |

Element overview list

Standards

Background settings

SEM, Preset

Deconvolution settings

Series fit

Quantification model

P/B - ZAF

Additional settings

5.0 keV, 0°

High voltage [kV]

5.0 A

Sample tilt angle [°]

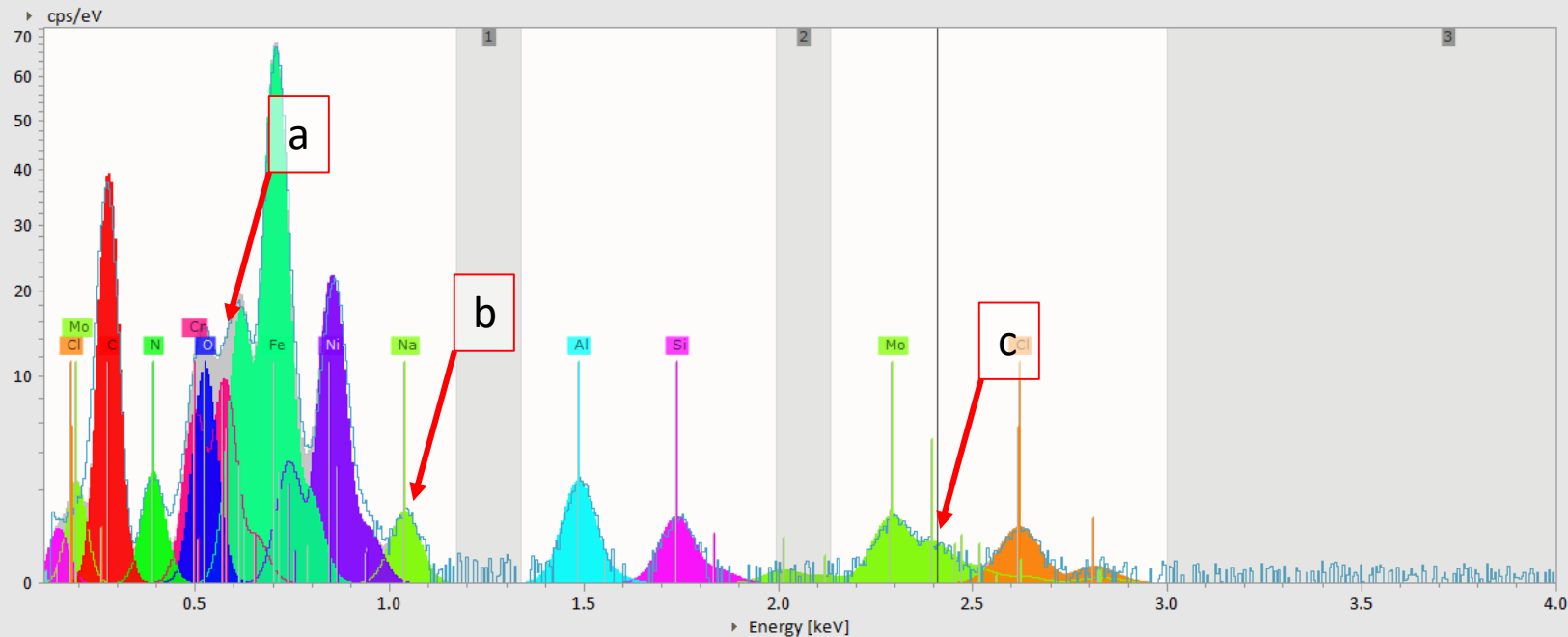
0 A

Fast quantification

Description

as set in spectrum (Linemarker), quantification with P/B-ZAF

Results



Background regions Element lines Dynamic lines

| Element | At. No. | Line s. | Netto | Mass [%] | Atom [%] | abs. error [% (3 sigma) | rel. error [% (3 sigma) |
|------------|---------|---------|--------|----------|----------|-------------------------|-------------------------|
| Carbon | 6 | K-Serie | 164261 | 11.1 | 33.6 | 3.7 | 33.6 |
| Nitrogen | 7 | K-Serie | 12833 | 1.2 | 3.1 | 0.6 | 47.0 |
| Oxygen | 8 | K-Serie | 51449 | 3.1 | 7.0 | 1.2 | 37.7 |
| Aluminium | 13 | K-Serie | 16095 | 0.8 | 1.1 | 0.2 | 23.7 |
| Silicon | 14 | K-Serie | 7227 | 0.8 | 1.0 | 0.2 | 24.4 |
| Chlorine | 17 | K-Serie | 6397 | 0.9 | 1.0 | 0.2 | 24.6 |
| Iron | 26 | L-Serie | 448106 | 52.8 | 34.3 | 16.9 | 31.9 |
| Nickel | 28 | L-Serie | 145893 | 12.9 | 8.0 | 4.4 | 33.7 |
| Chromium | 24 | L-Serie | 83210 | 13.7 | 9.6 | 4.8 | 34.7 |
| Sodium | 11 | K-Serie | 6932 | 0.3 | 0.5 | 0.1 | 39.6 |
| Molybdenum | 42 | L-Serie | 12222 | 2.2 | 0.0 | 0.4 | 18.5 |

Density: 4.77 g/cm³
Electron interaction depth: 0.2 µm Radius: 0.1 µm

- All
- Orig.
- Bkg.
- C
- N
- O
- Al
- Si
- Cl
- Fe
- Ni
- Cr
- Na
- Mo
- Deconv.

Load Save To project Apply

Add to standards OK Cancel

P/B-ZAF (Old element assignments)

| Element | At. No. | Line s. | Netto | Mass Norm. [%] | Atom [%] | abs. error [%] (3 sigma) | rel. error [%] (3 sigma) |
|-----------|---------|---------|------------|----------------|---------------|-----------------------------|-----------------------------|
| | | | Sum | 100.00 | 100.00 | | |
| Carbon | 6 | K-Serie | 164335 | 13.45 | 36.30 | 4.51 | 33.52 |
| Iron | 26 | L-Serie | 452262 | 59.23 | 34.38 | 18.90 | 31.91 |
| Oxygen | 8 | K-Serie | 88612 | 6.40 | 12.97 | 2.25 | 35.20 |
| Nickel | 28 | L-Serie | 145181 | 15.15 | 8.37 | 5.10 | 33.64 |
| Nitrogen | 7 | K-Serie | 12895 | 1.44 | 3.34 | 0.66 | 45.77 |
| Aluminium | 13 | K-Serie | 16532 | 1.13 | 1.36 | 0.24 | 21.33 |
| Silicon | 14 | K-Serie | 7724 | 1.11 | 1.28 | 0.24 | 21.55 |
| Sulfur | 16 | K-Serie | 7903 | 1.08 | 1.09 | 0.24 | 22.37 |
| Chlorine | 17 | K-Serie | 5153 | 1.01 | 0.92 | 0.24 | 24.33 |

P/B-ZAF (New element assignments)

| Element | At. No. | Line s. | Netto | Mass [%] | Atom [%] | abs. error [%] (3 sigma) | rel. error [%] (3 sigma) |
|------------|---------|---------|------------|--------------|--------------|-----------------------------|-----------------------------|
| | | | Sum | 100.0 | 100.0 | | |
| Iron | 26 | L-Serie | 448106 | 52.8 | 34.3 | 16.9 | 31.9 |
| Carbon | 6 | K-Serie | 164261 | 11.1 | 33.6 | 3.7 | 33.6 |
| Chromium | 24 | L-Serie | 83210 | 13.7 | 9.6 | 4.8 | 34.7 |
| Nickel | 28 | L-Serie | 145893 | 12.9 | 8.0 | 4.4 | 33.7 |
| Oxygen | 8 | K-Serie | 51449 | 3.1 | 7.0 | 1.2 | 37.7 |
| Nitrogen | 7 | K-Serie | 12833 | 1.2 | 3.1 | 0.6 | 47.0 |
| Aluminium | 13 | K-Serie | 16095 | 0.8 | 1.1 | 0.2 | 23.7 |
| Silicon | 14 | K-Serie | 7227 | 0.8 | 1.0 | 0.2 | 24.4 |
| Chlorine | 17 | K-Serie | 6397 | 0.9 | 1.0 | 0.2 | 24.6 |
| Molybdenum | 42 | L-Serie | 12333 | 2.3 | 0.9 | 0.4 | 18.5 |
| Sodium | 11 | K-Serie | 6932 | 0.3 | 0.5 | 0.1 | 39.6 |

Using phi(rho,z) (New element assignments)

| Element | At. No. | Line s. | Netto | Mass [%] | Atom [%] | abs. error [%] (3 sigma) | rel. error [%] (3 sigma) |
|------------|---------|---------|------------|--------------|--------------|-----------------------------|-----------------------------|
| | | | Sum | 100.0 | 100.0 | | |
| Iron | 26 | L-Serie | 448174 | 52.7 | 34.0 | 4.4 | 8.4 |
| Carbon | 6 | K-Serie | 164290 | 11.2 | 33.7 | 1.2 | 11.0 |
| Chromium | 24 | L-Serie | 83222 | 13.8 | 9.6 | 1.2 | 8.7 |
| Nickel | 28 | L-Serie | 145867 | 12.8 | 7.9 | 1.3 | 9.8 |
| Oxygen | 8 | K-Serie | 51418 | 3.1 | 7.0 | 0.3 | 10.7 |
| Nitrogen | 7 | K-Serie | 12831 | 1.2 | 3.1 | 0.2 | 15.7 |
| Aluminium | 13 | K-Serie | 16083 | 1.0 | 1.4 | 0.2 | 15.0 |
| Chlorine | 17 | K-Serie | 6373 | 1.2 | 1.2 | 0.2 | 13.8 |
| Molybdenum | 42 | L-Serie | 12302 | 2.0 | 0.7 | 0.2 | 11.3 |
| Silicon | 14 | K-Serie | 7309 | 0.6 | 0.7 | 0.1 | 21.2 |
| Sodium | 11 | K-Serie | 6892 | 0.4 | 0.6 | 0.1 | 27.4 |