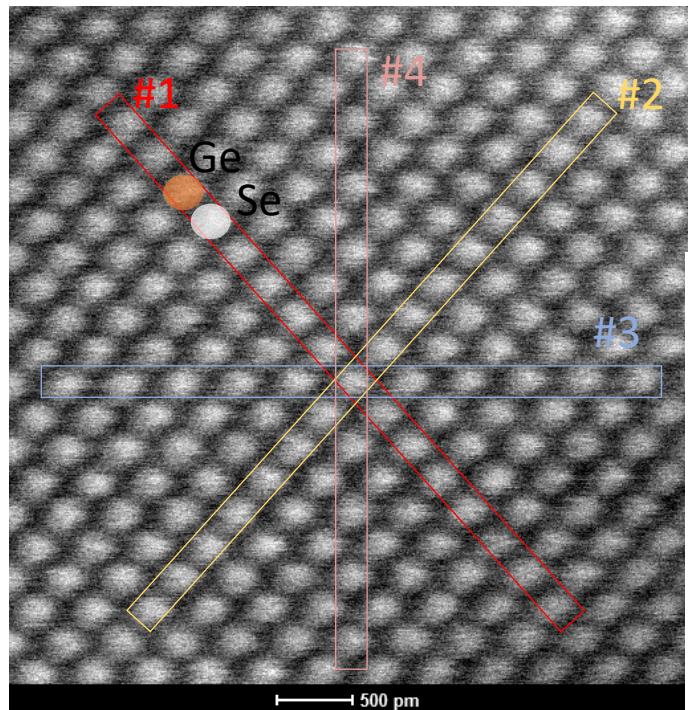


Supplementary information

The Effect on Plasmon Peaks in Quasi Two-Dimensional GeSe by Variation in Thickness & Phases

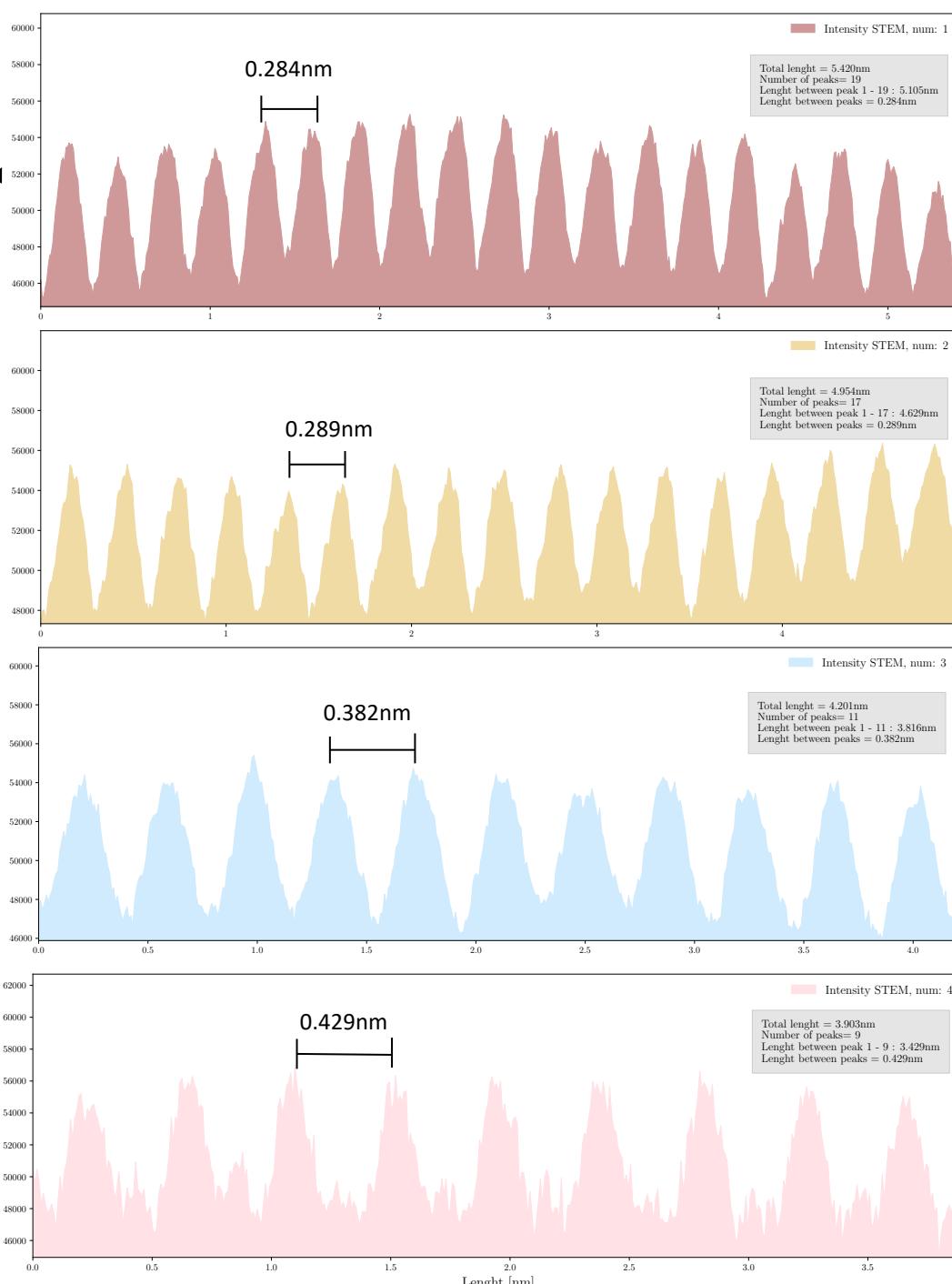
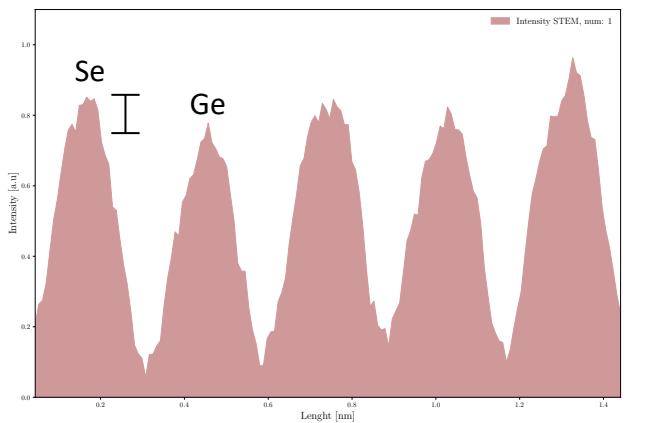
Line Profile of GeSe_flake_ROI_2 along four direction

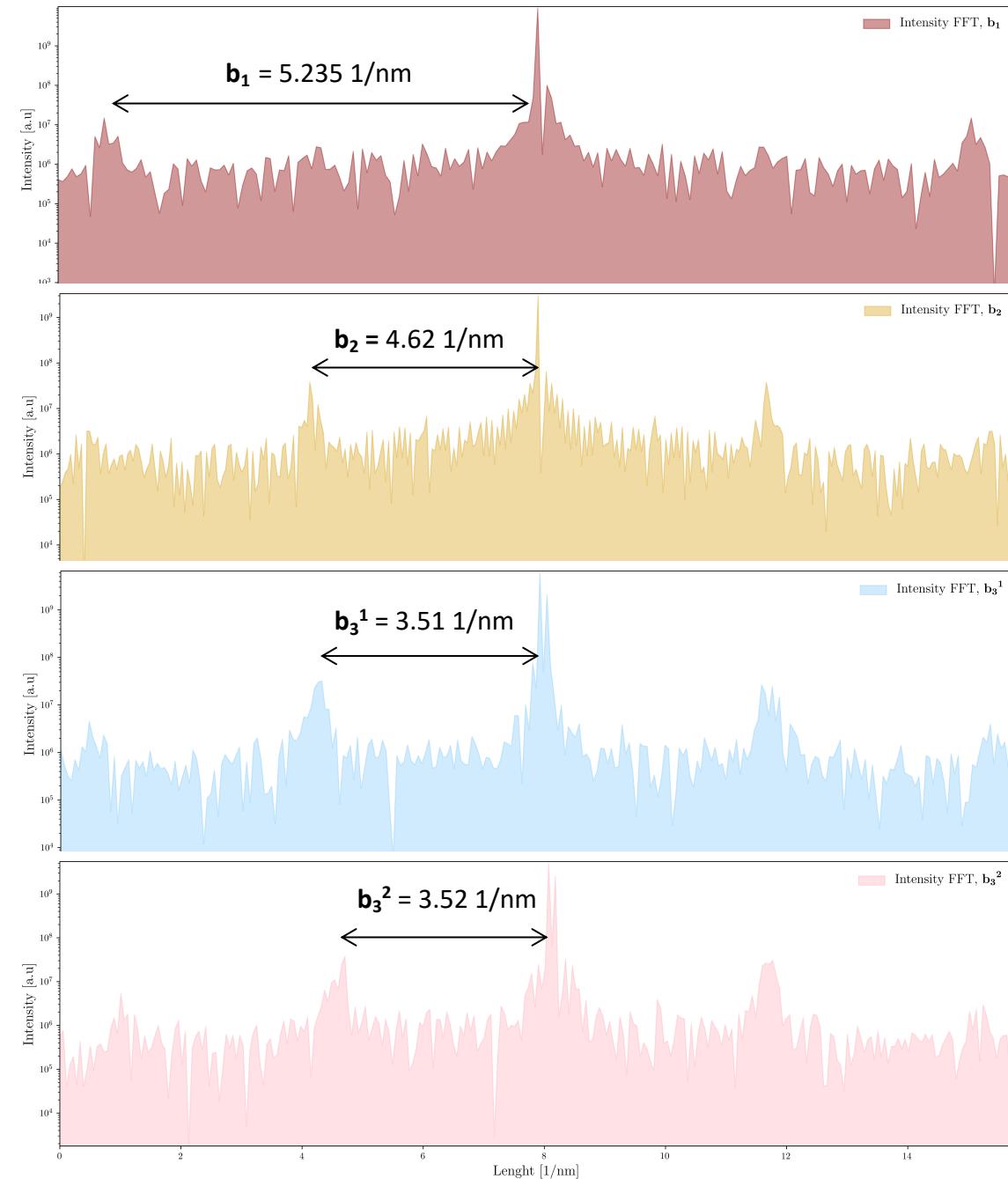
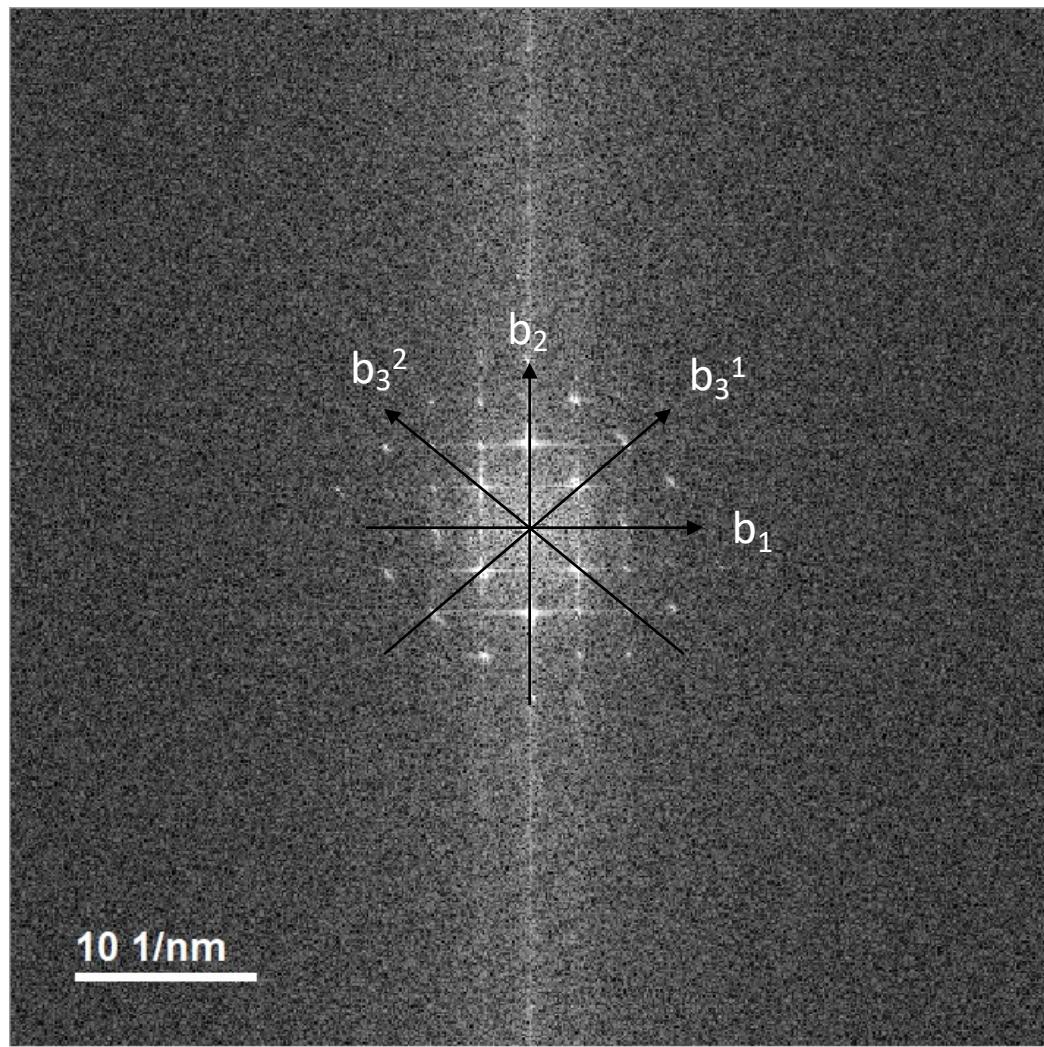
- High resolution STEM image of GeSe_flake_ROI_2
- The measures of lattice spacing coincides with litterature.
- The #4 line profile matches the plane of (001) with 0.429nm spacing, and #3 matches that of (010) plane with 0.382 [2]
- Furthermore, line profile #1 may be ascribed to (111) plane, with 0.284n, and #2 matches that of (011) plane. [1]



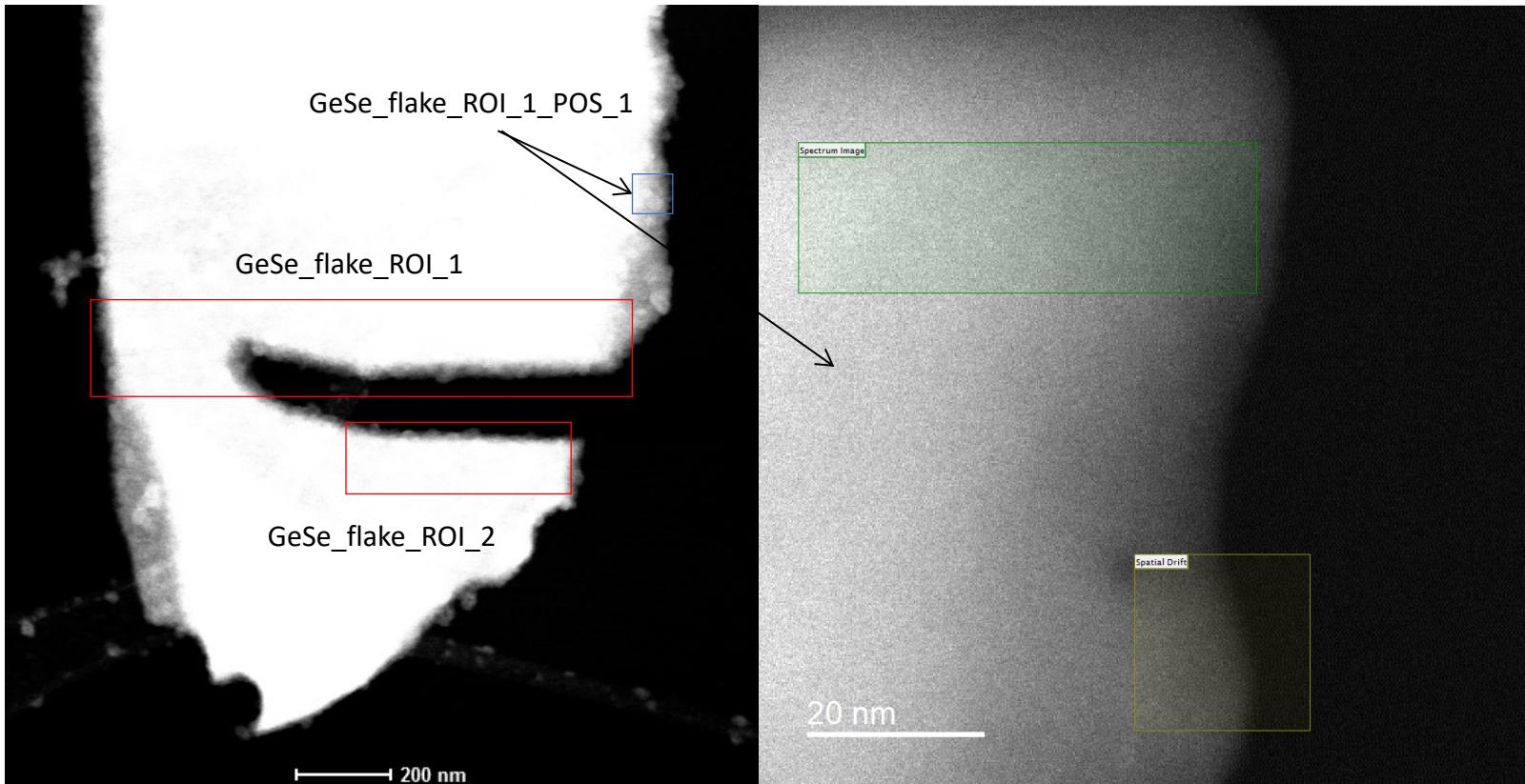
Line profiles:

- #1 – 0.284nm
- #2 – 0.289nm
- #3 – 0.382nm
- #4 – 0.429nm



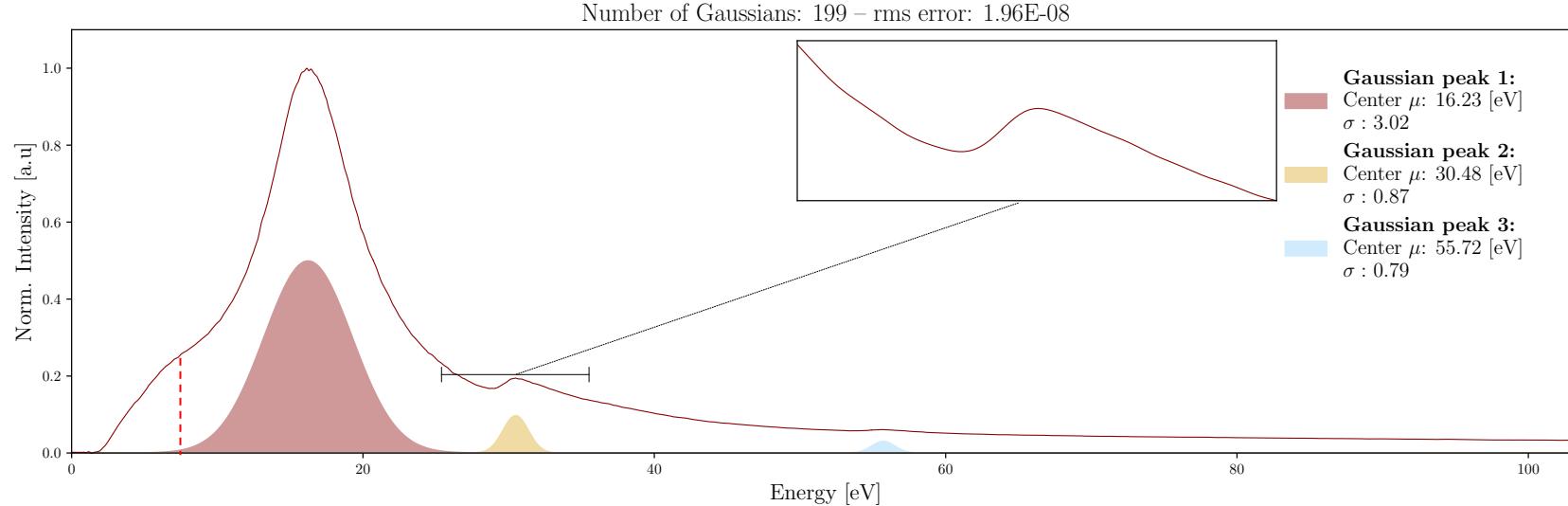
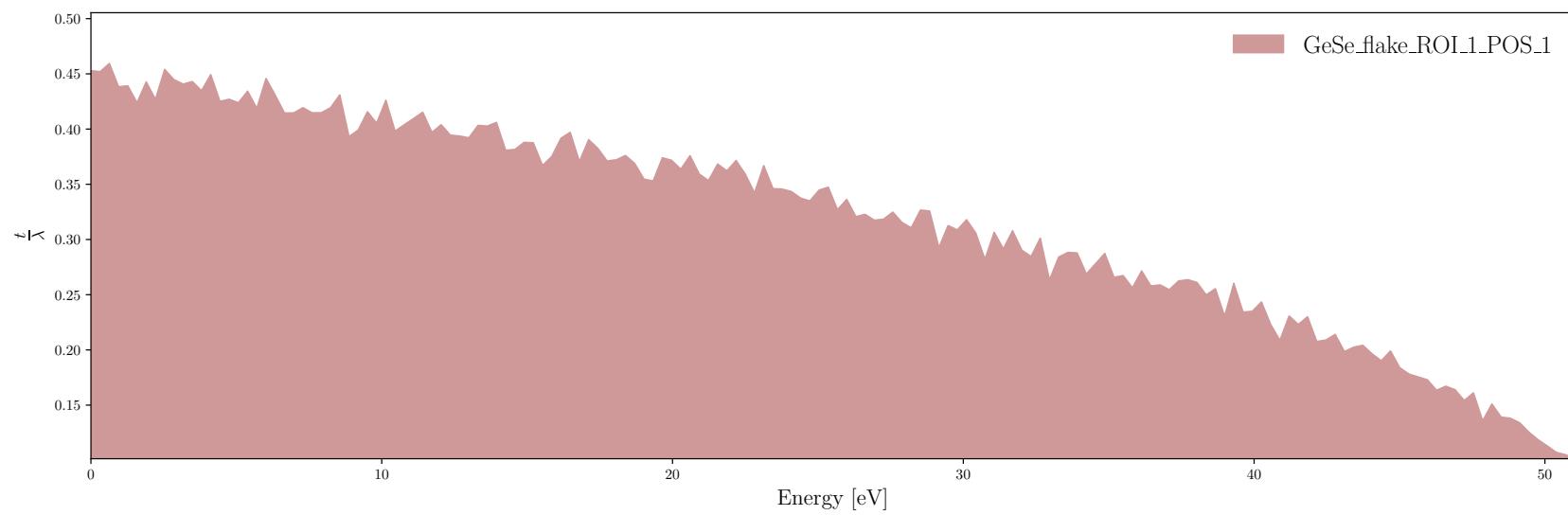
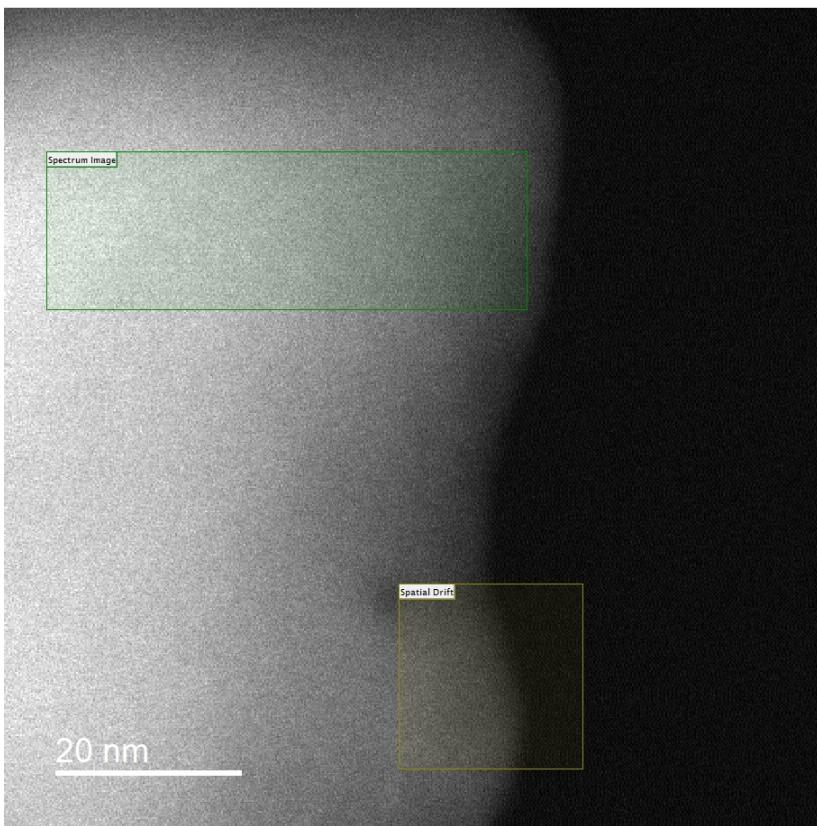


ADF – GeSe_flake ROI_1 POS_1

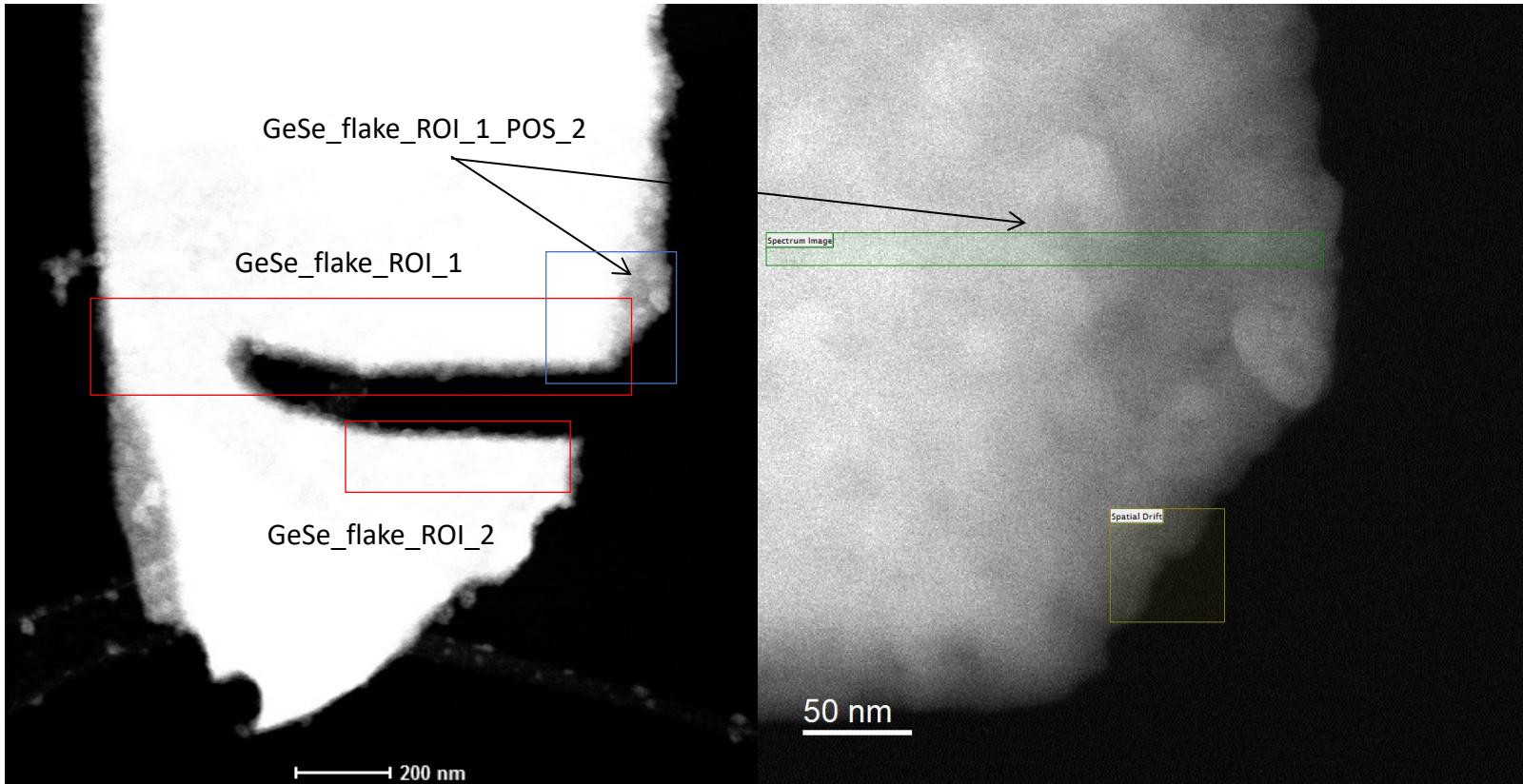


Thickness profile and High loss spectrum – GeSe_flake ROI_1 POS_1

- High loss spectrum collected from entire region
- Plot from real data
- Inset from estimated function
- Gaussian peaks estimated through peak-finding algorithm

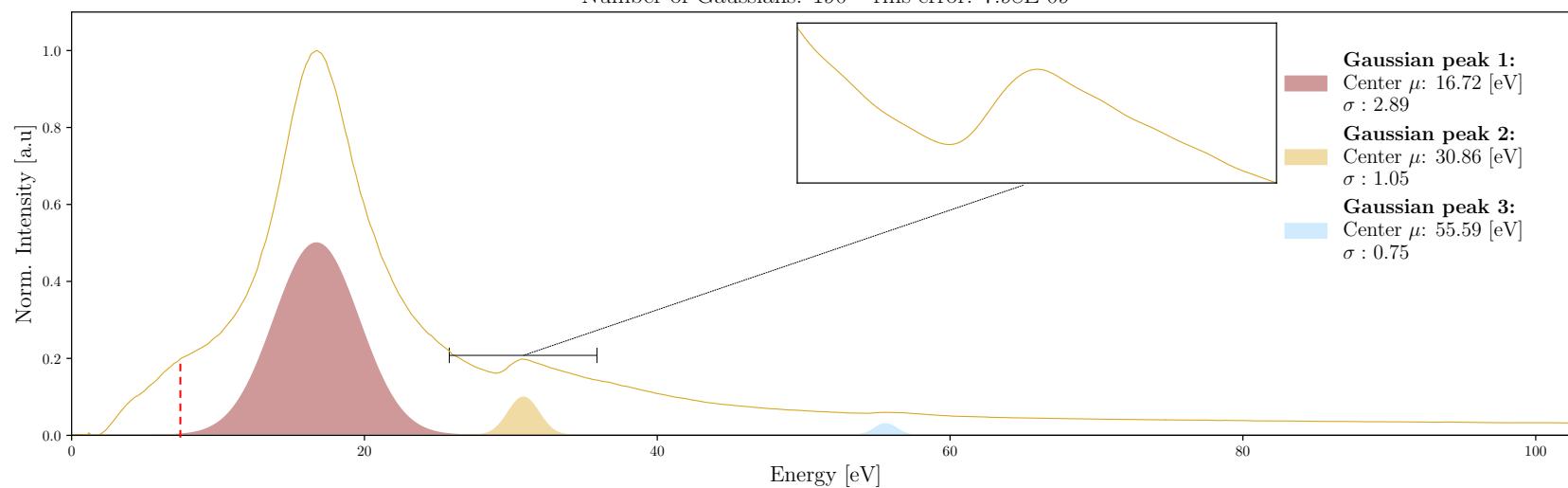
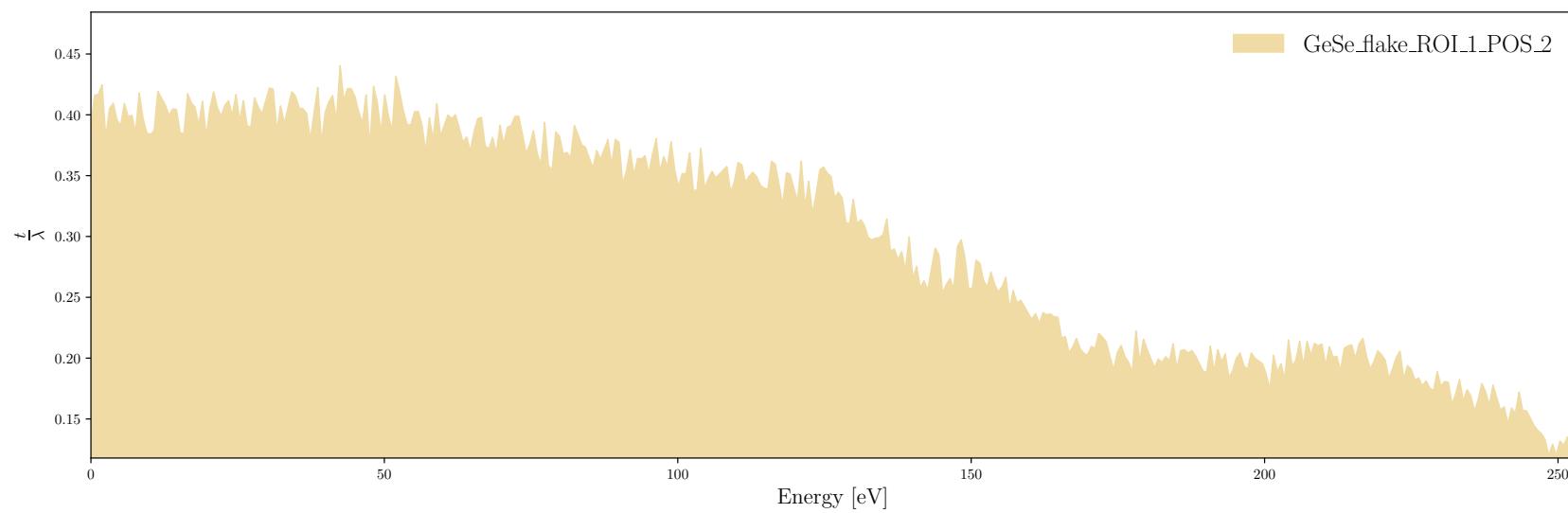
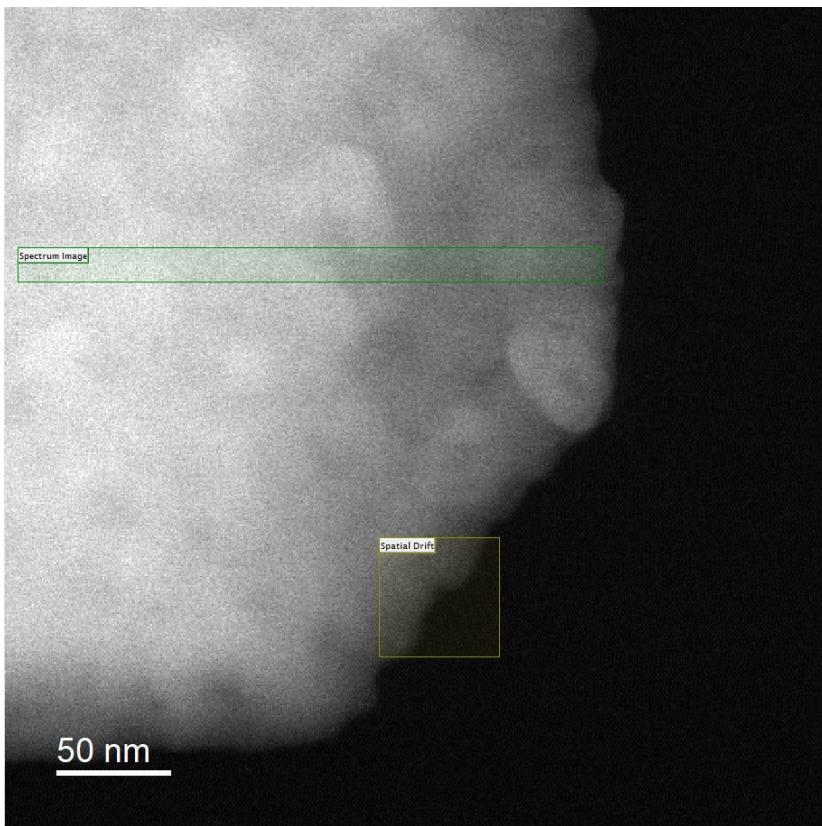


ADF – GeSe_flake ROI_1 POS_2

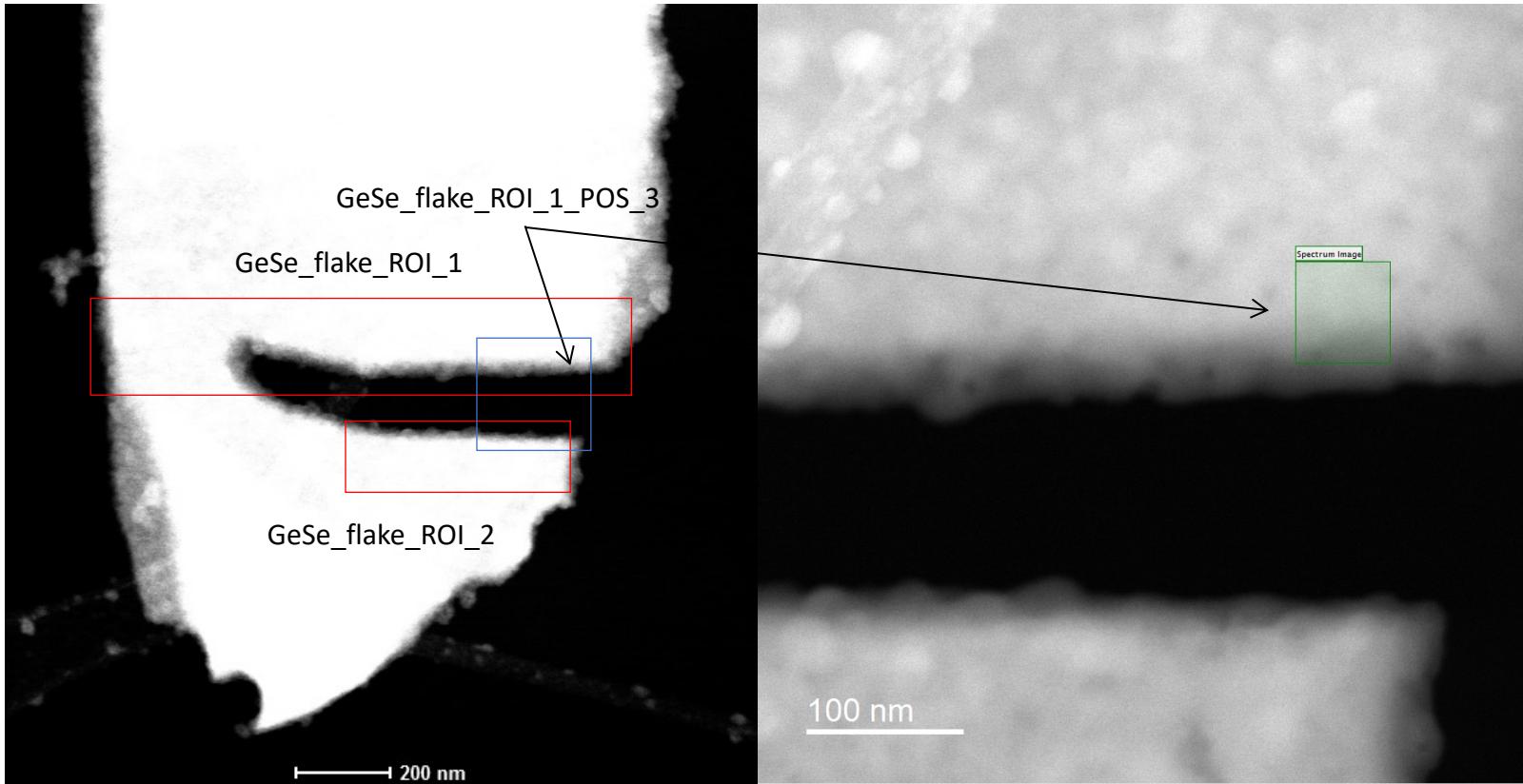


Thickness profile and High loss spectrum – GeSe_flake ROI_1 POS_2

- High loss spectrum collected from entire region
- Plot from real data
- Inset from estimated function
- Gaussian peaks estimated through peak-finding algorithm

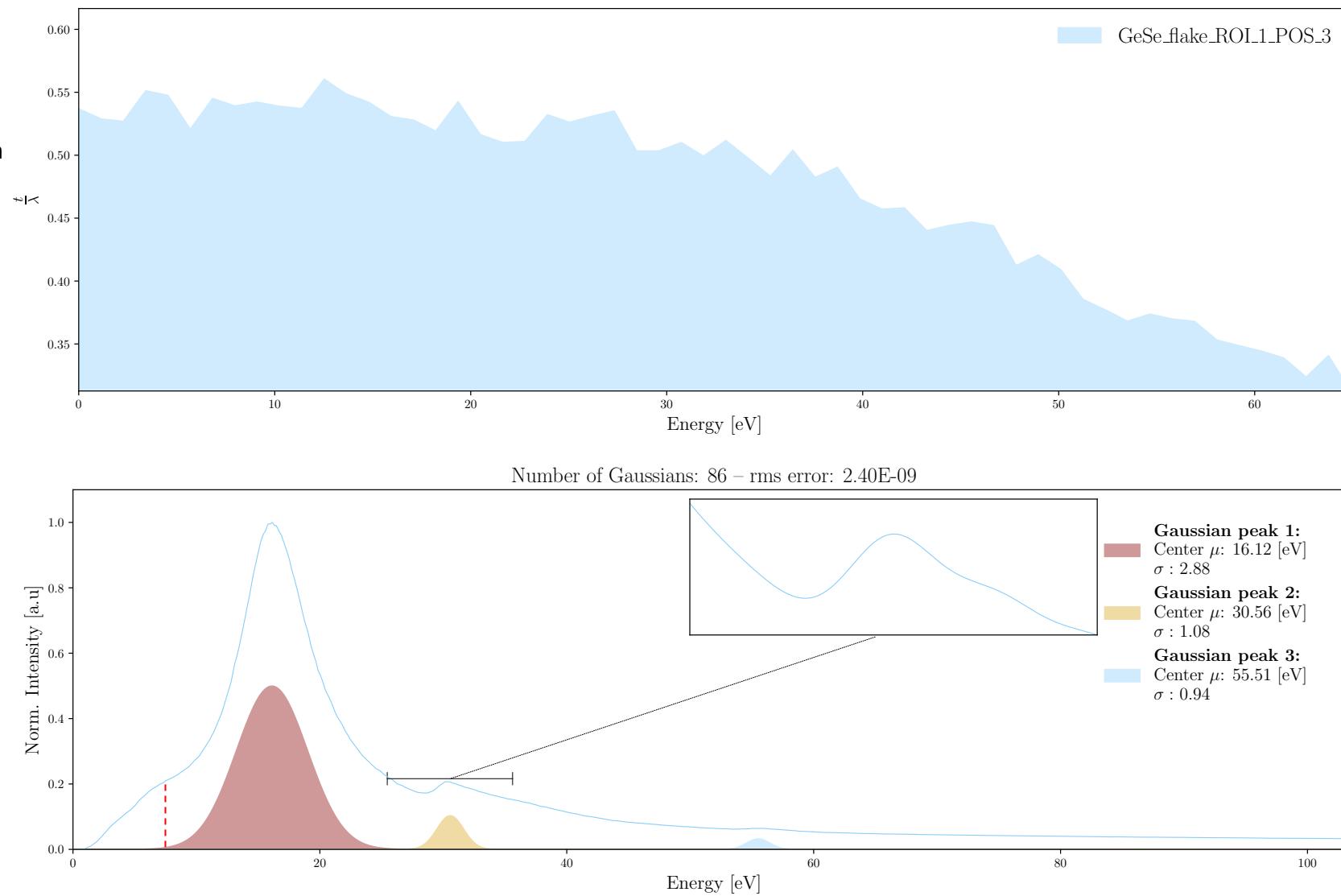
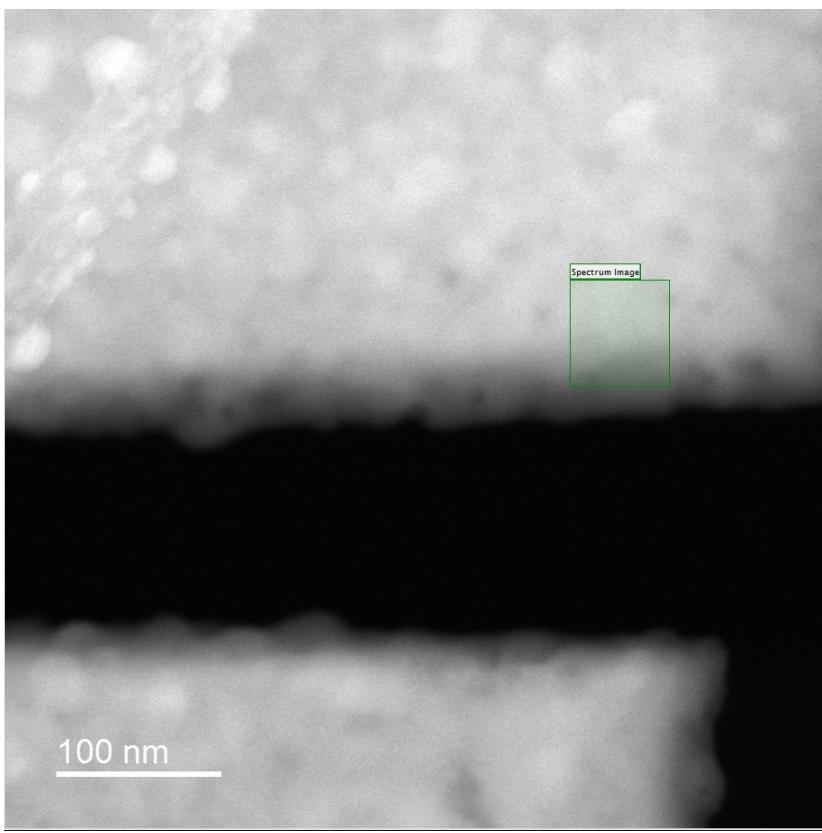


ADF – GeSe_flake ROI_1 POS_3

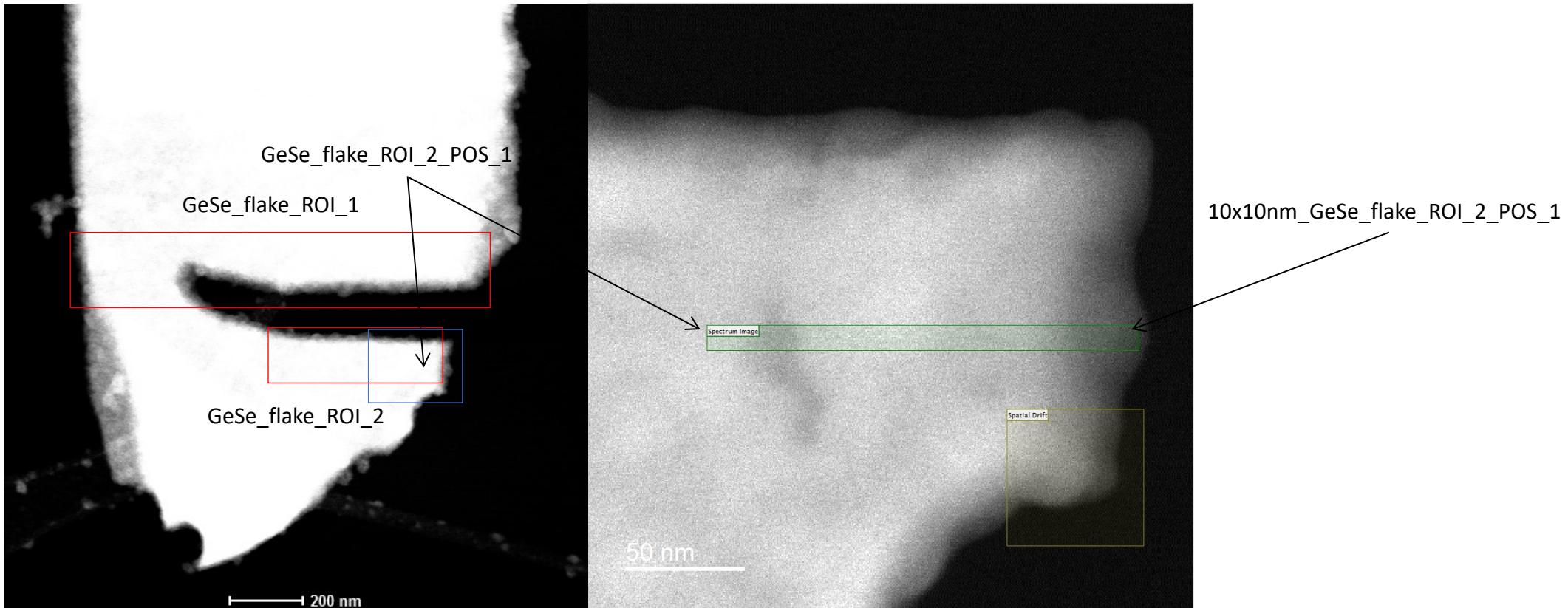


Thickness profile and High loss spectrum – GeSe_flake ROI_1 POS_3

- High loss spectrum collected from entire region
- Plot from real data
- Inset from estimated function
- Gaussian peaks estimated through peak-finding algorithm

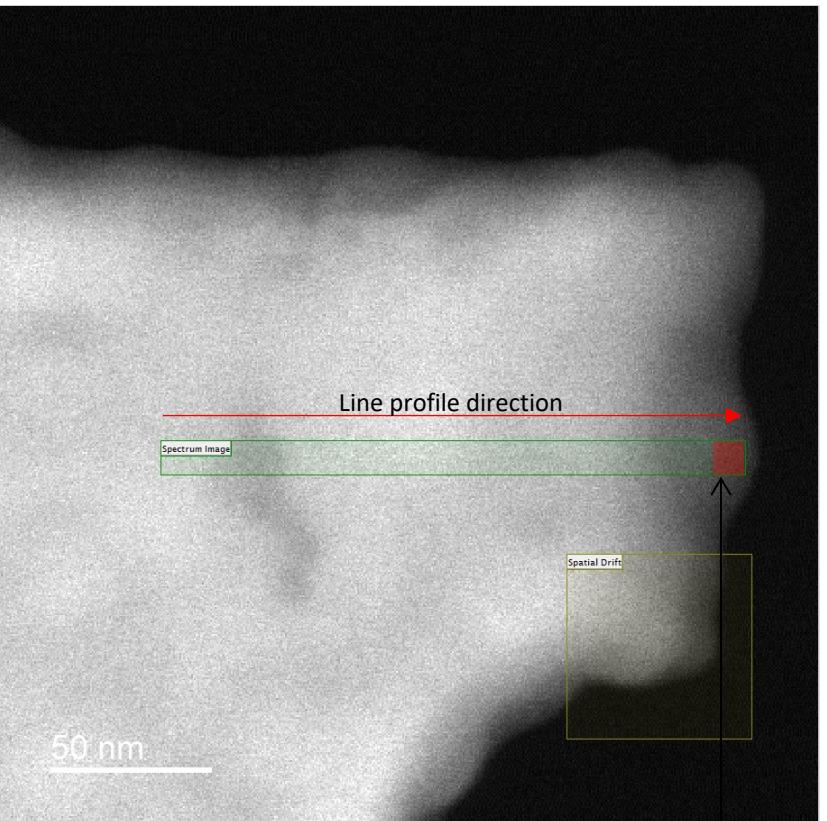


ADF – GeSe_flake ROI_2 POS_1

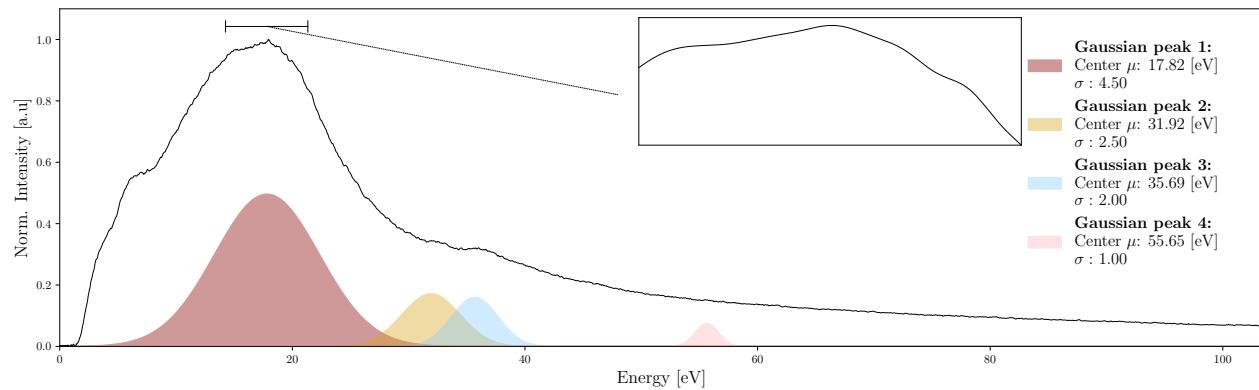
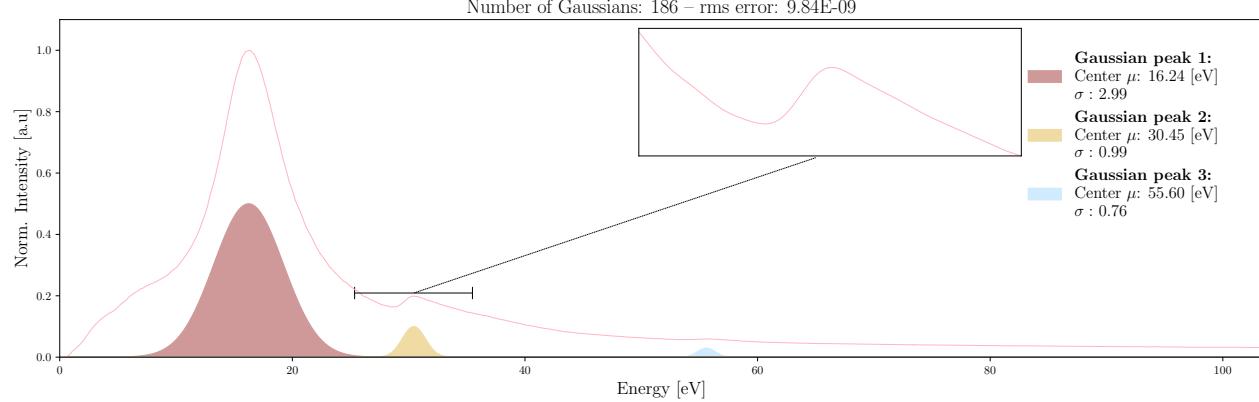
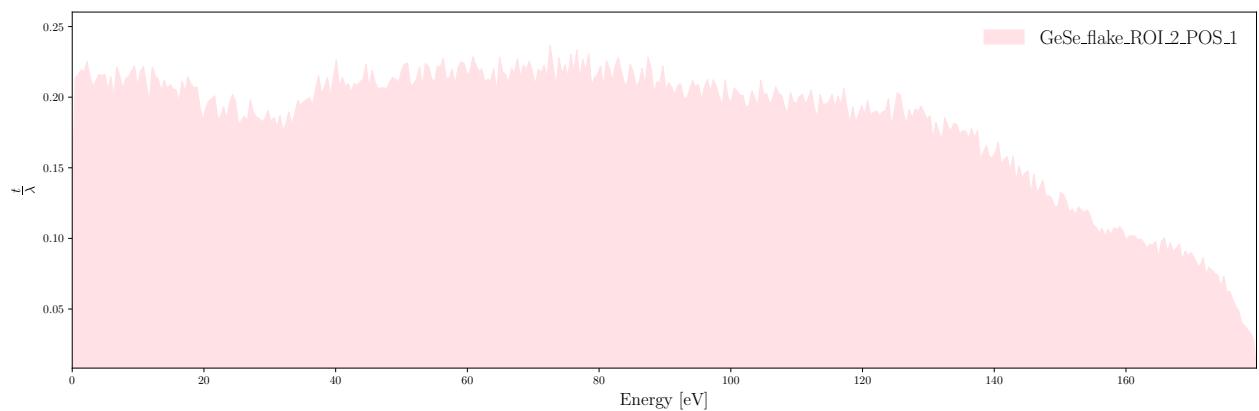


Thickness profile and High loss spectrum – GeSe_flake ROI_2 POS_1

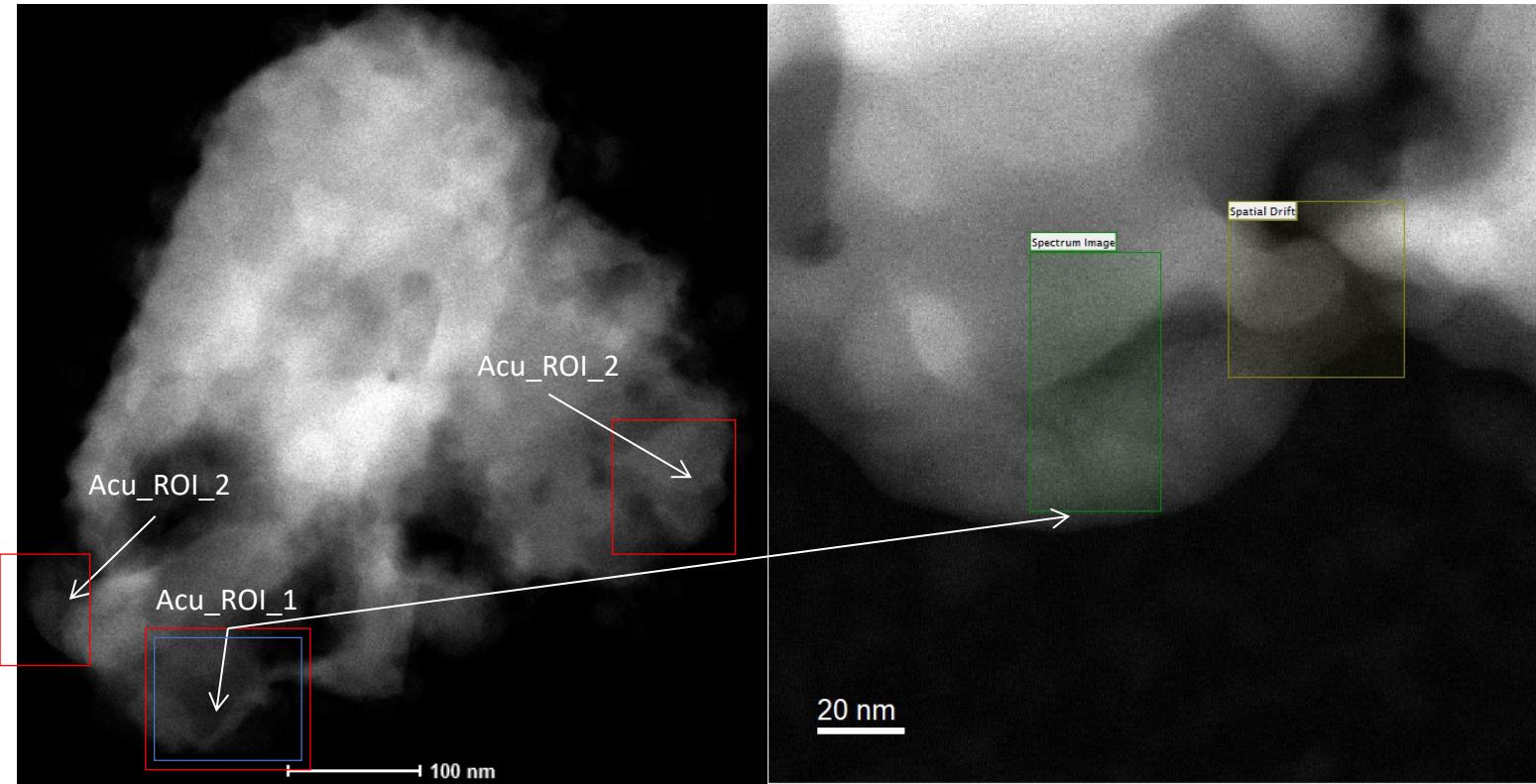
- High loss spectrum collected from entire region
- Plot from real data
- Inset from estimated function
- Gaussian peaks estimated through peak-finding algorithm



10x10nm_GeSe_flake_ROI_2_POS_1

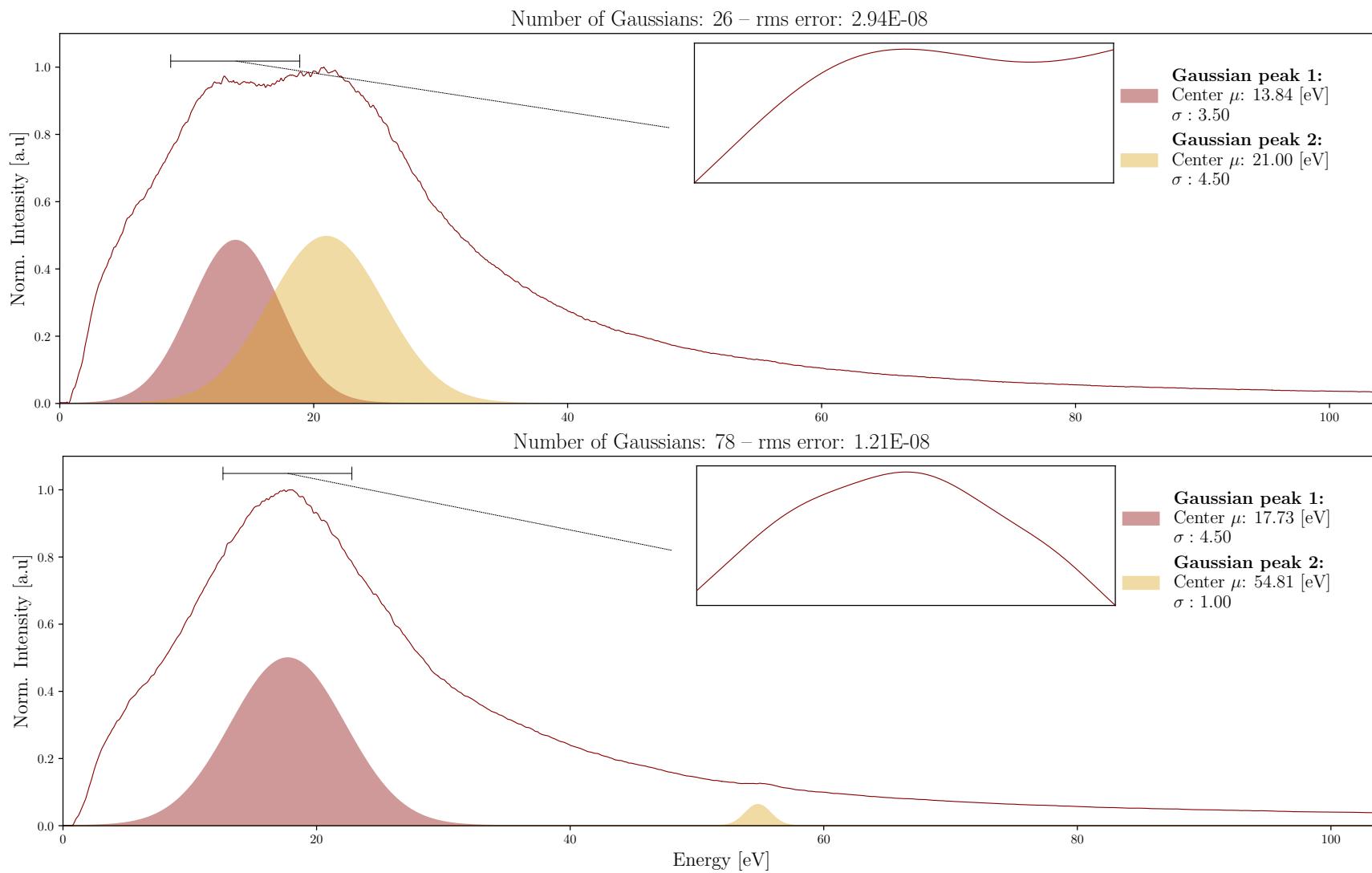
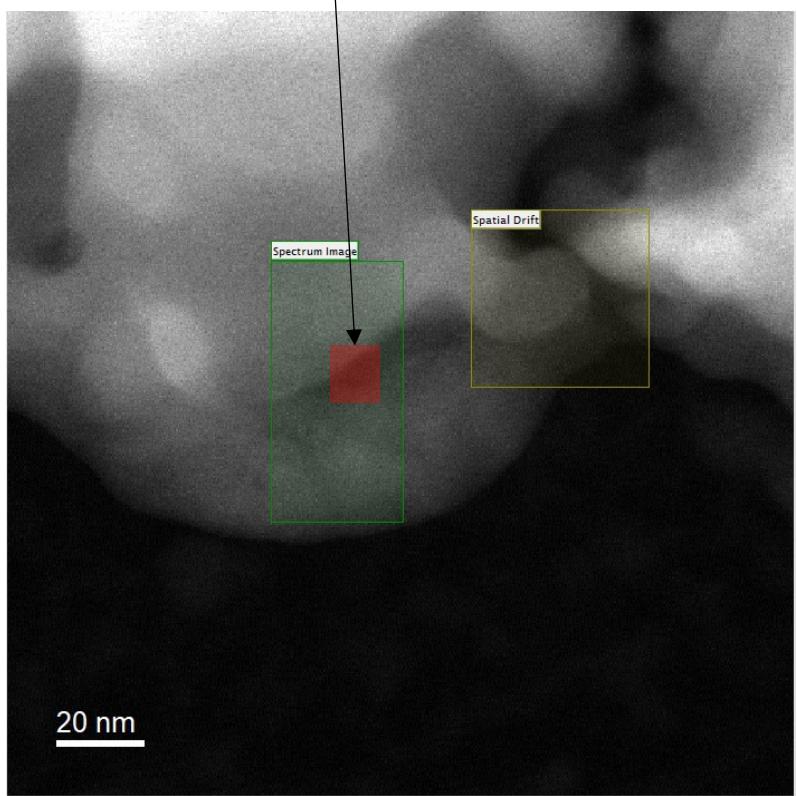


ADF – GeSe_Accumulation_ROI_1

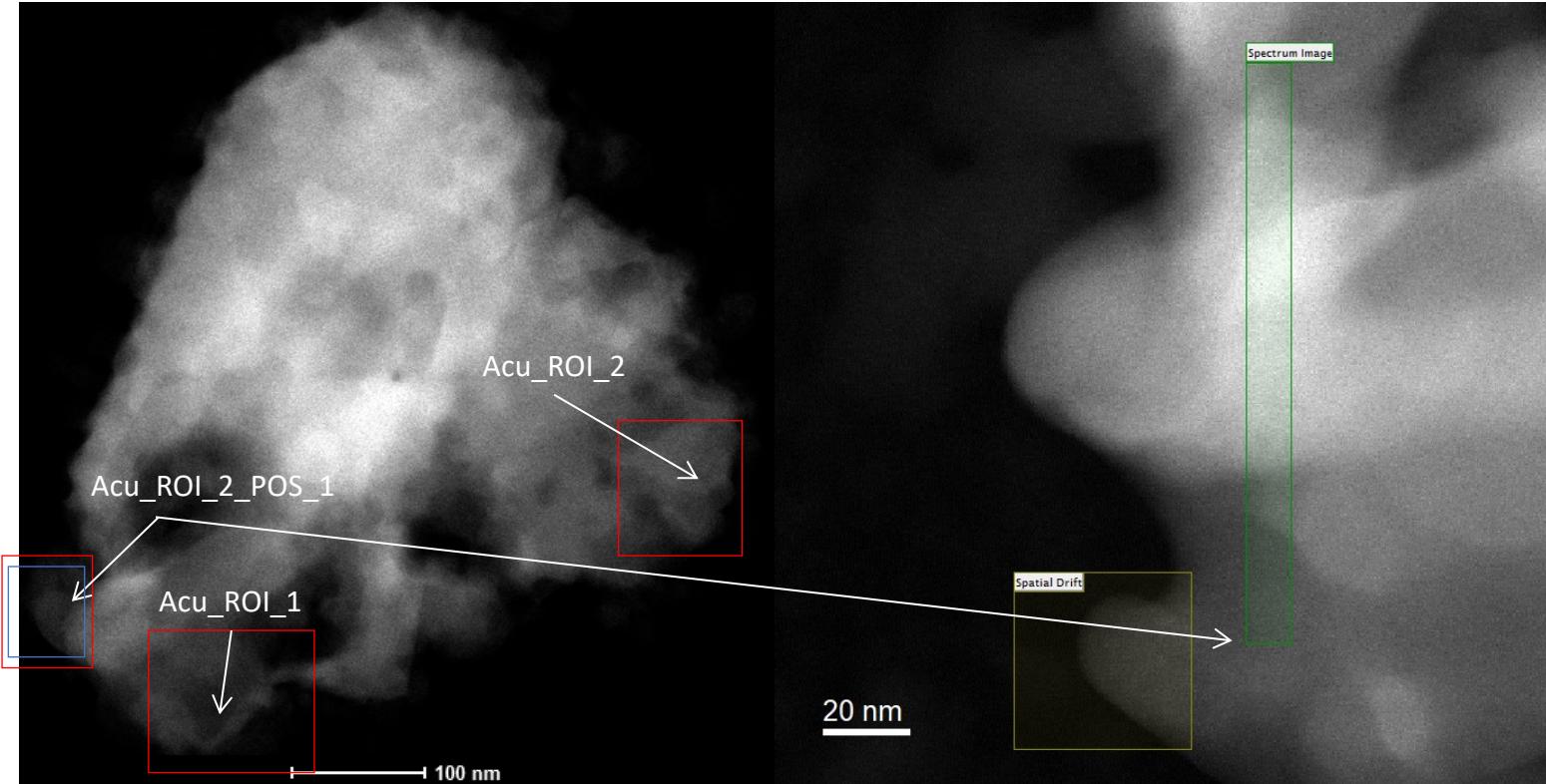


High loss spectrum – GeSe_Accumulation_ROI_1

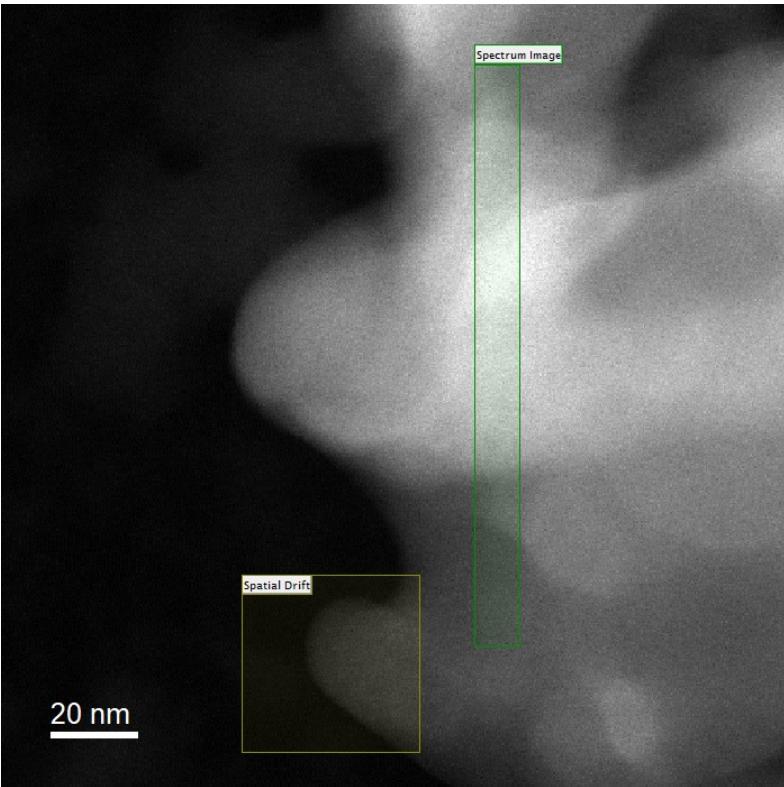
10x10nm_GeSe_Accumulation_ROI_1



ADF – GeSe_Accumulation_ROI_2 POS_1

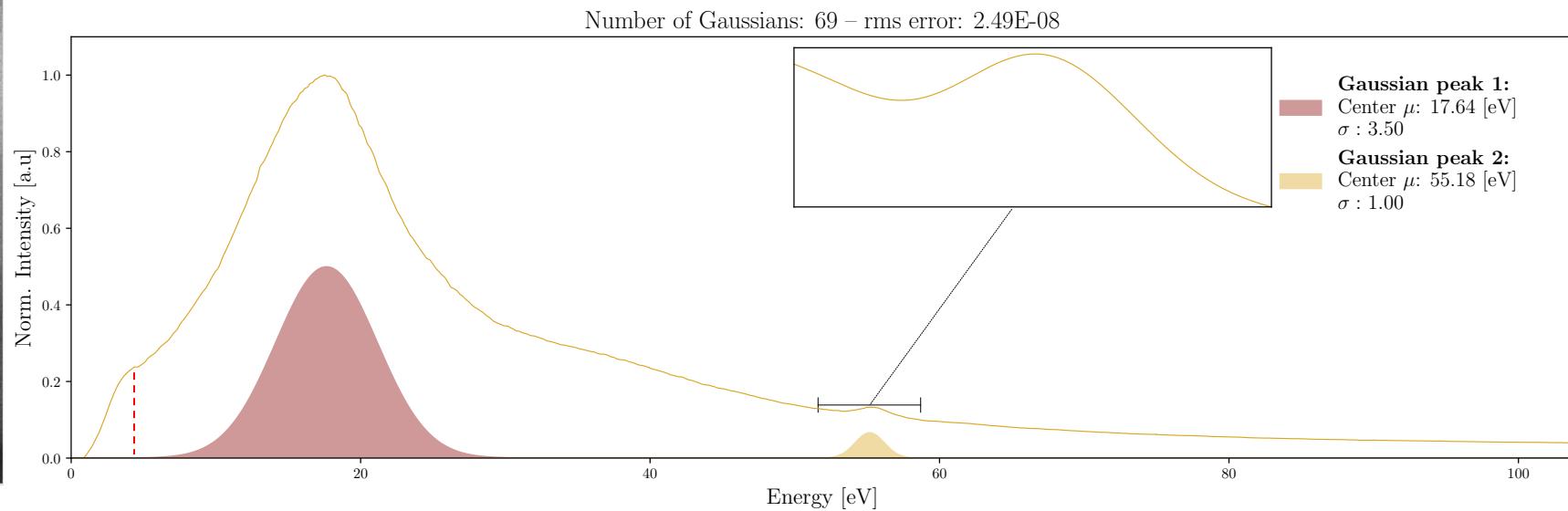


High loss spectrum – GeSe_Accumulation_ROI_2_POS_1

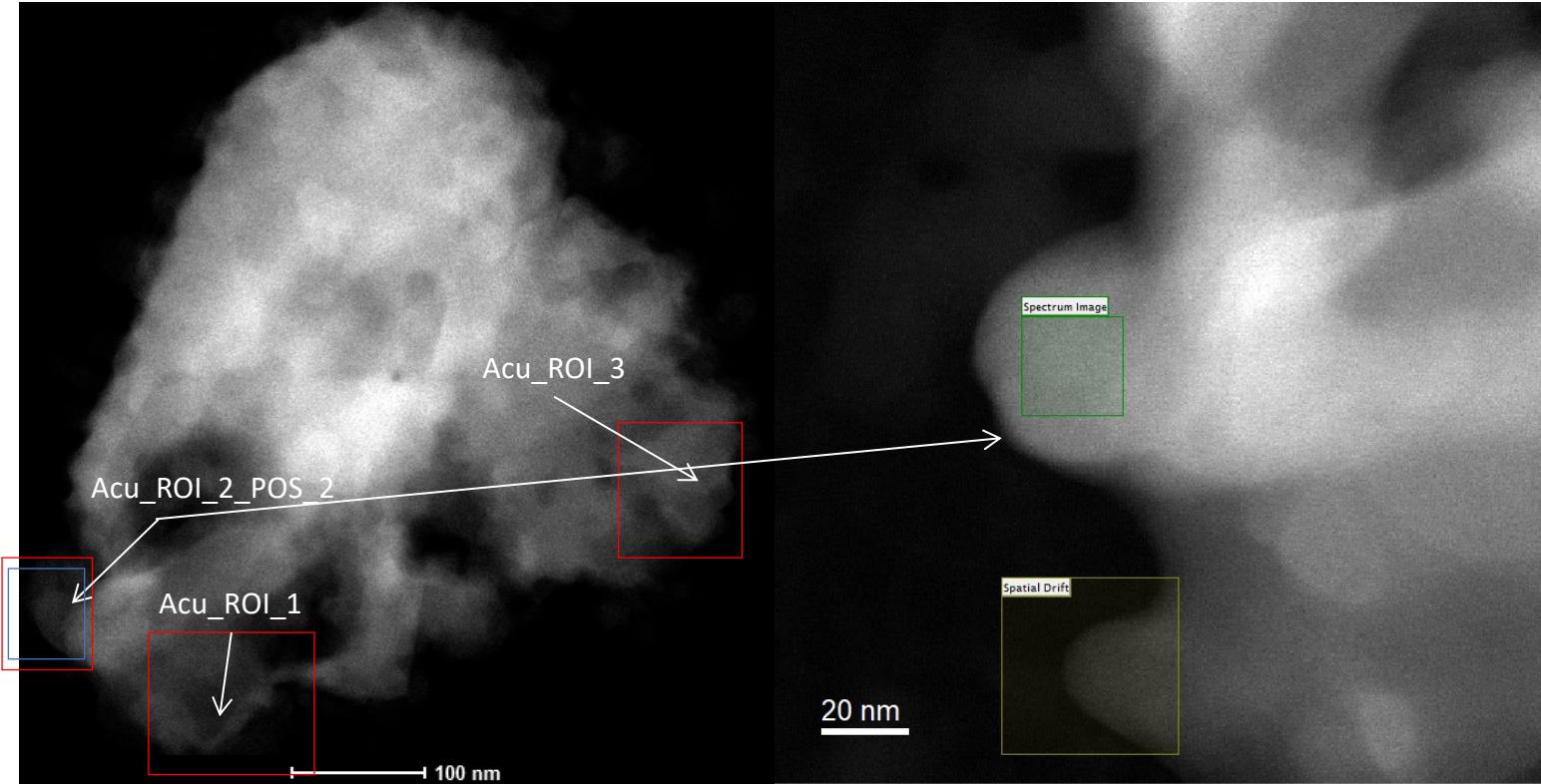


Main peak features:

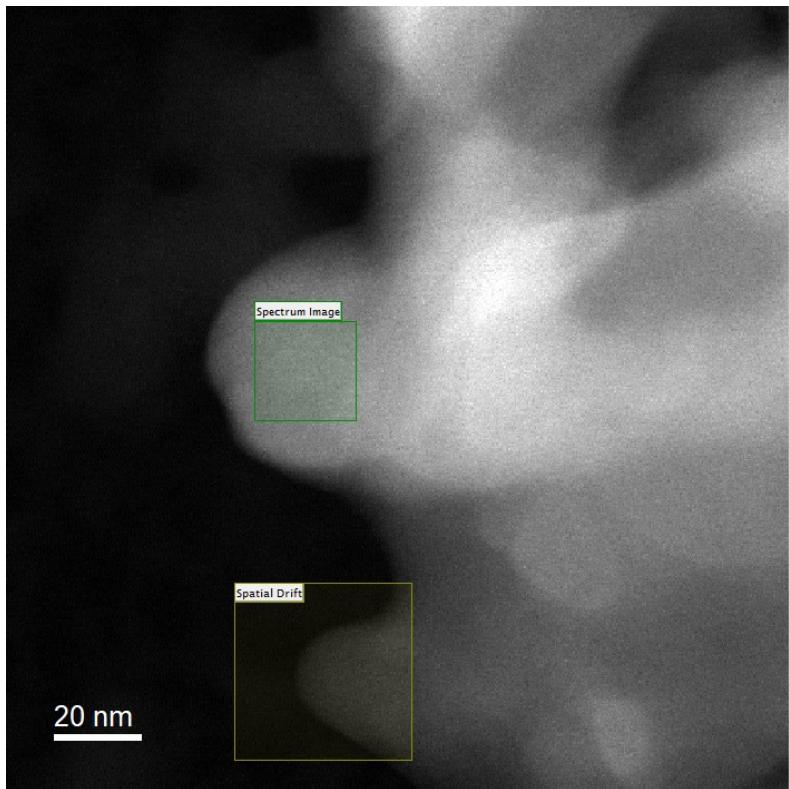
- Gaussian peak 1 (Plasmon peak):
 - Centered at 17.59eV
- Gaussian peak 2:
 - Centered at 55.28eV



ADF – GeSe_Accumulation_ROI_2_POS_2

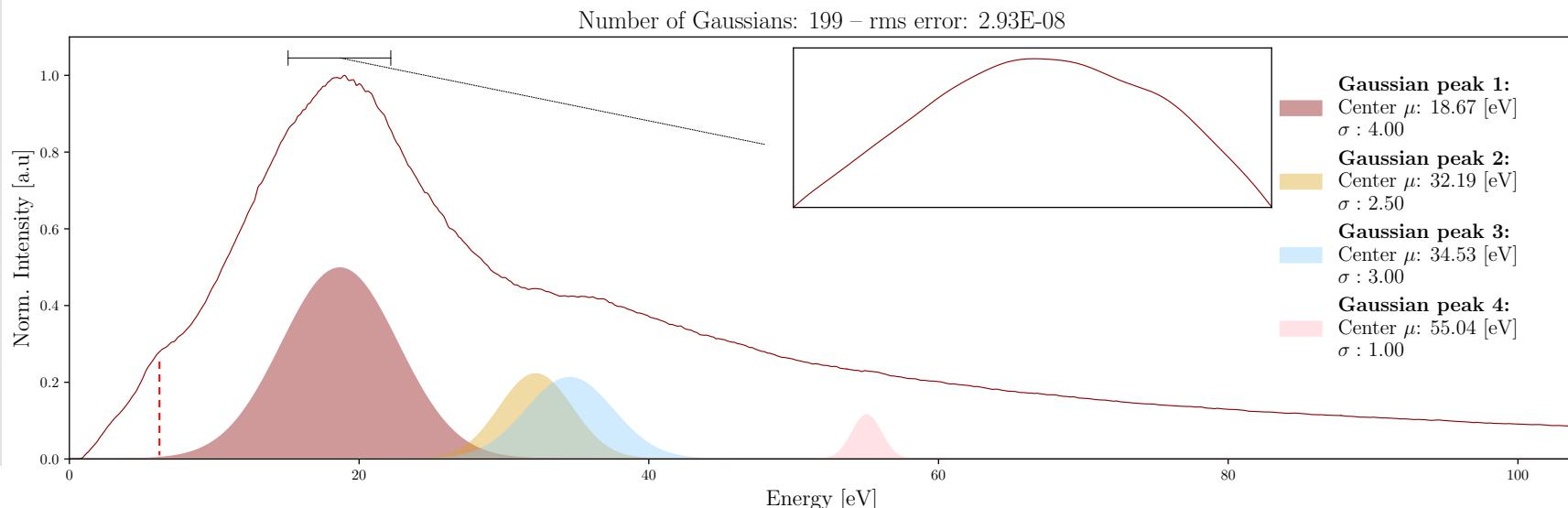


High loss spectrum – GeSe_Accumulation_ROI_2_POS_2

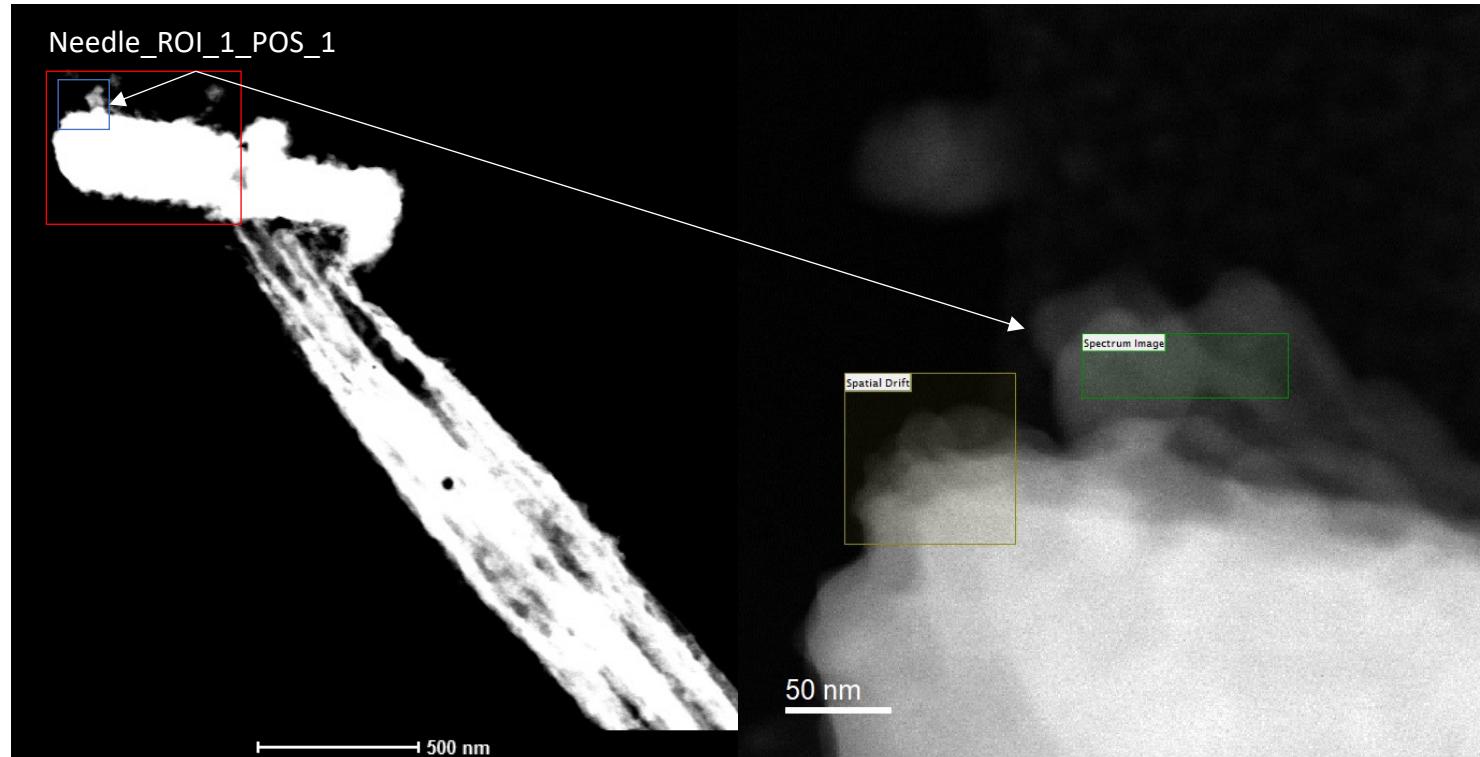


Main peak features:

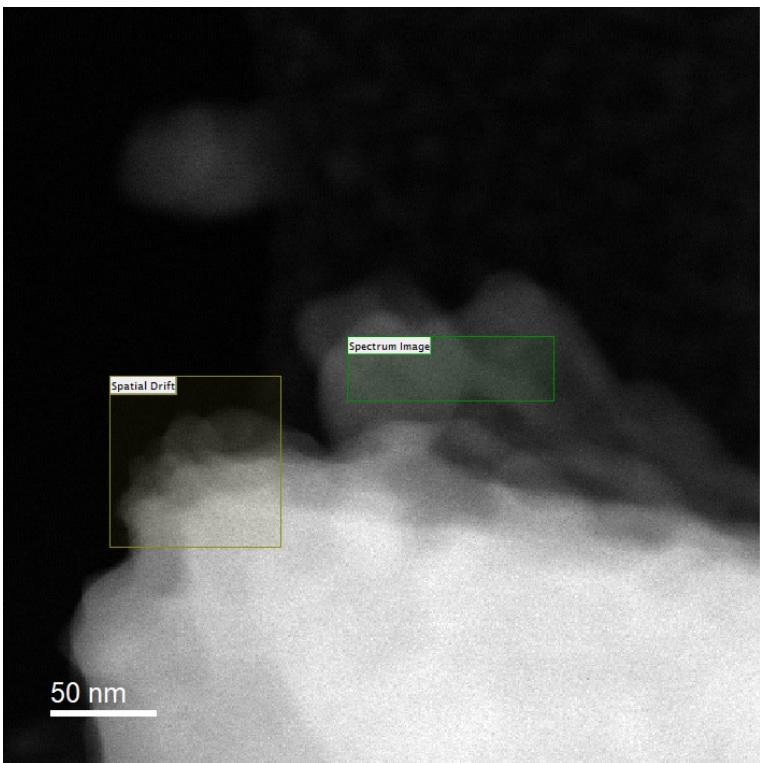
- Gaussian peak 1 (Plasmon peak):
 - Centered at 18.67eV
- Gaussian peak 3:
 - Centered at 34.53eV
- Gaussian peak 2:
 - Centered at 32.19eV
- Gaussian peak 4:
 - Centered at 55.04eV



ADF – GeSe_Needle_ROI_1_POS_1

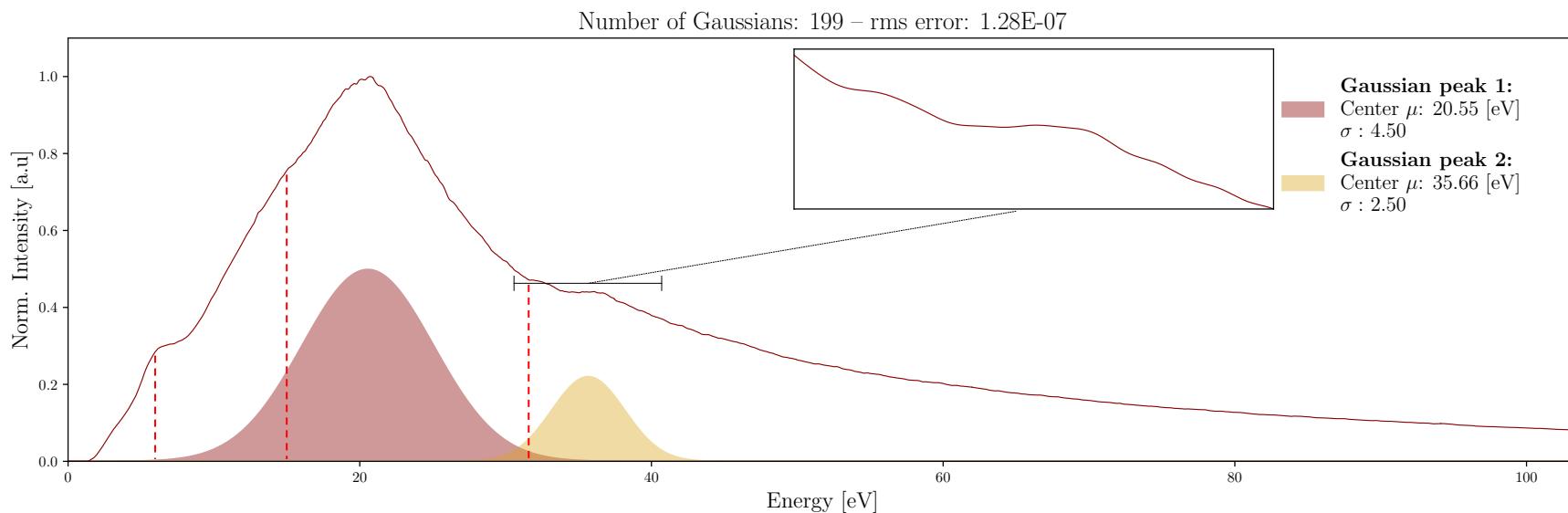


High loss spectrum – GeSe_Needle_ROI_1_POS_1

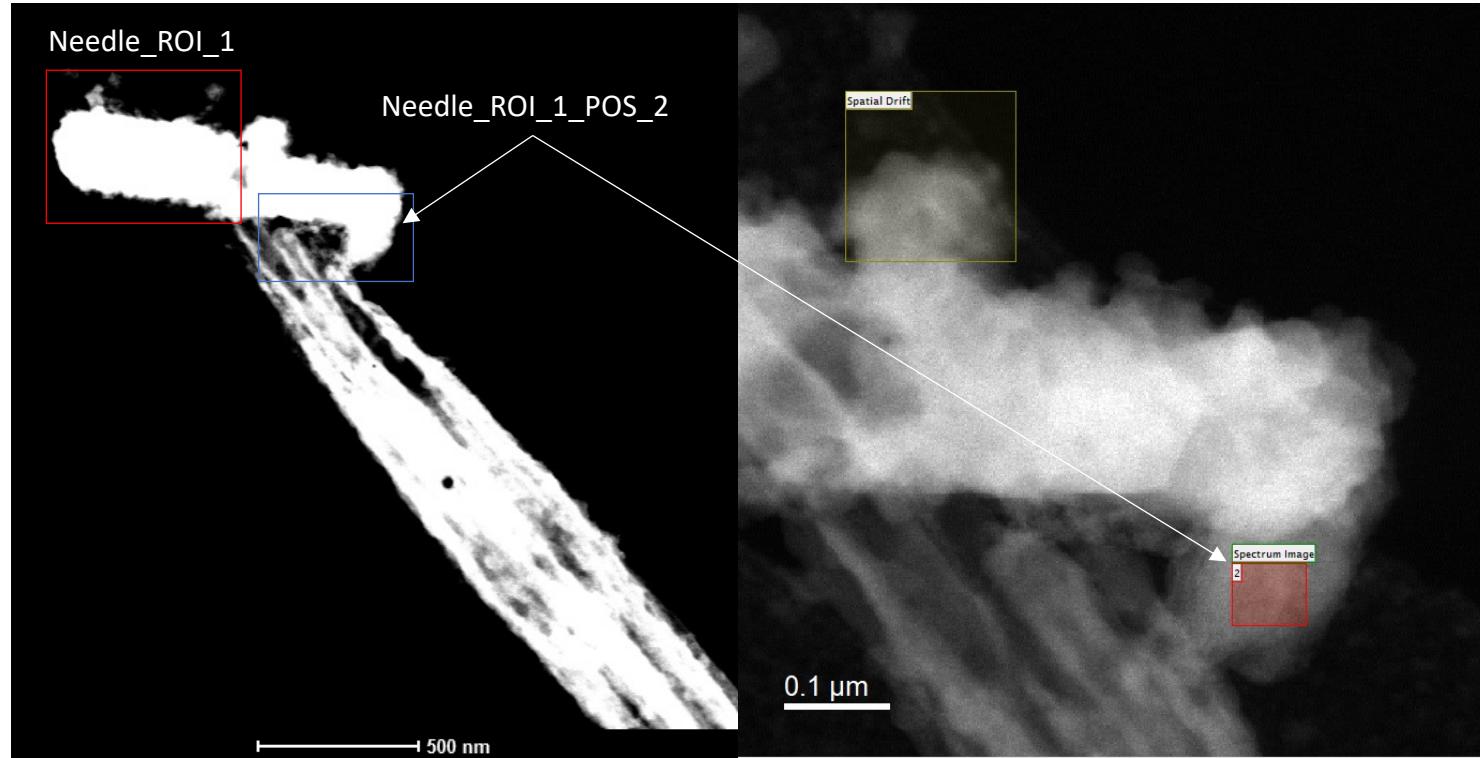


Main peak features:

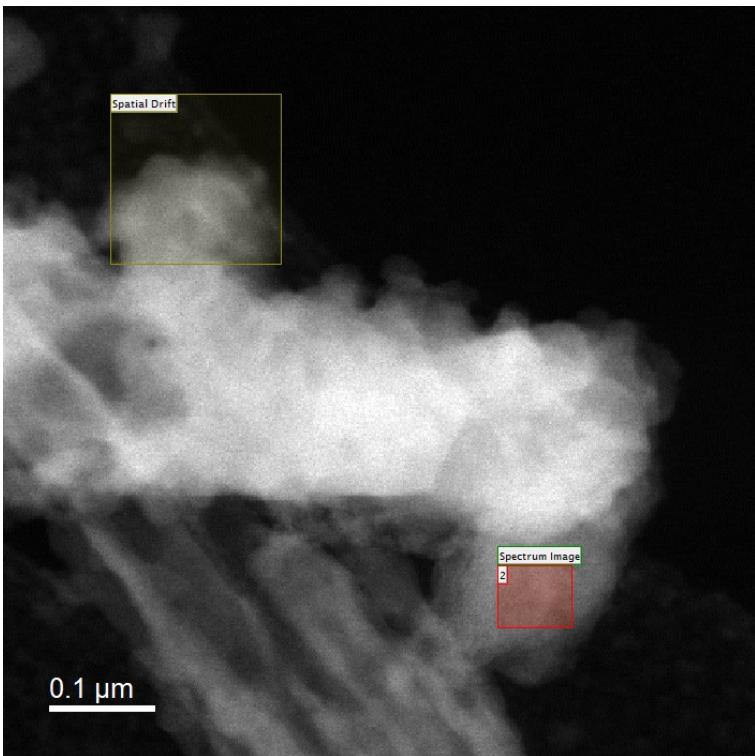
- Gaussian peak 1 (Plasmon peak):
 - Centered at 20.55eV
- Potentially many other peaks in hidden shoulders



ADF – GeSe_Needle_ROI_1 POS_2

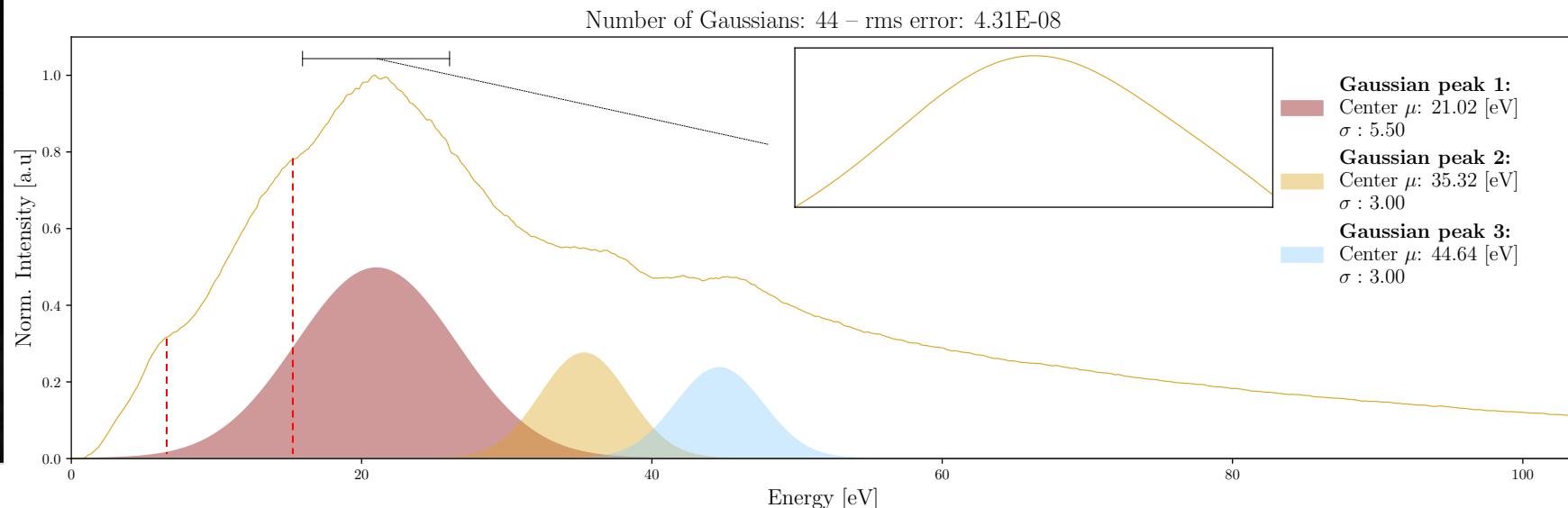


High loss spectrum – GeSe_Needle_ROI_1_POS_2

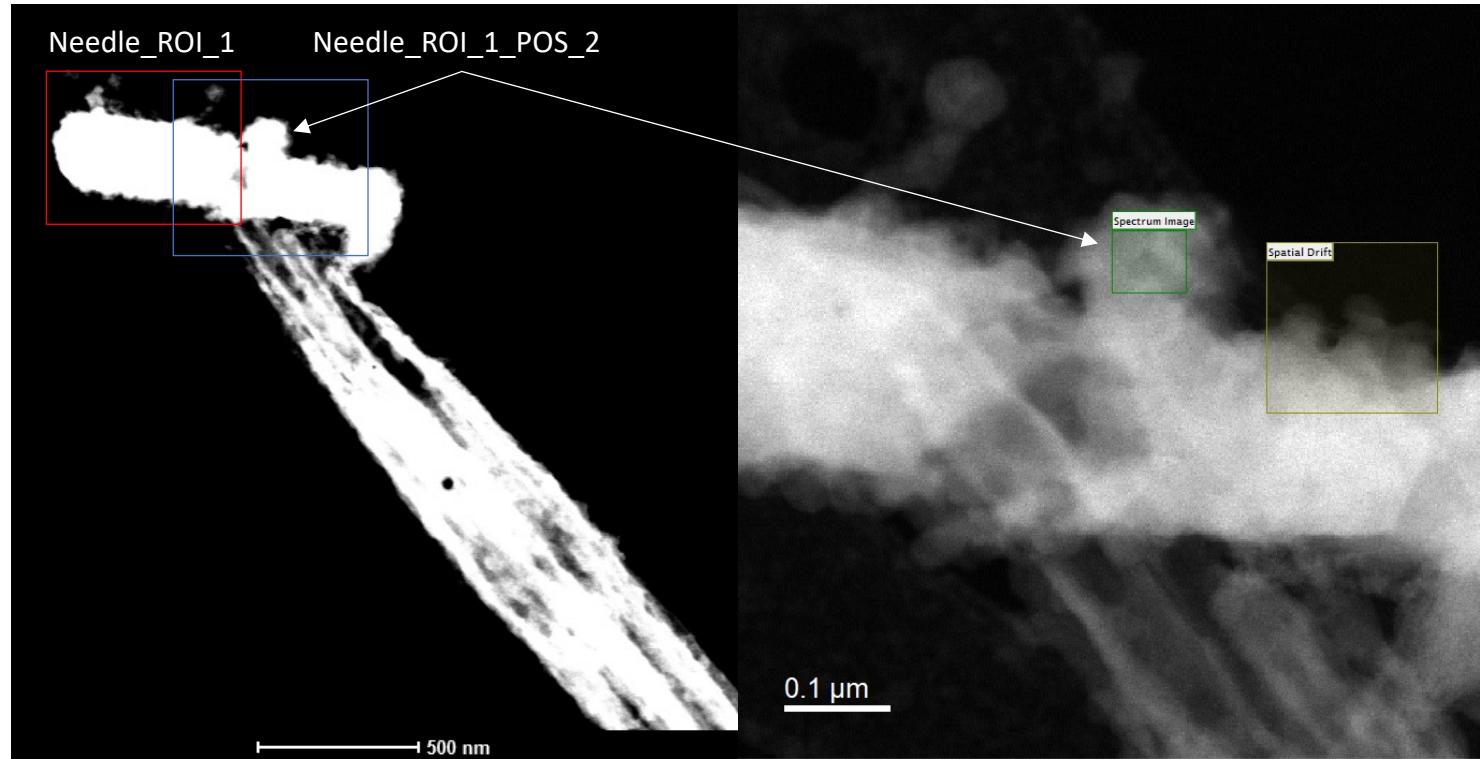


Main peak features:

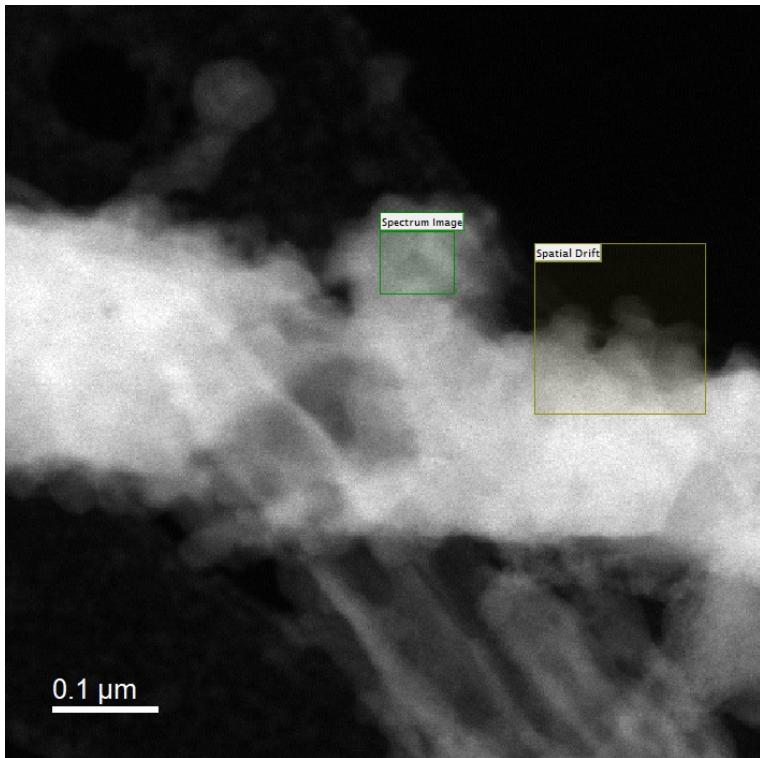
- Gaussian peak 1 (Plasmon peak):
 - Centered at 21.02eV
- Gaussian peak 3:
 - Centered at 44.57eV
- Gaussian peak 2:
 - Centered at 35.27eV



ADF – GeSe_Needle_ROI_1 POS_3

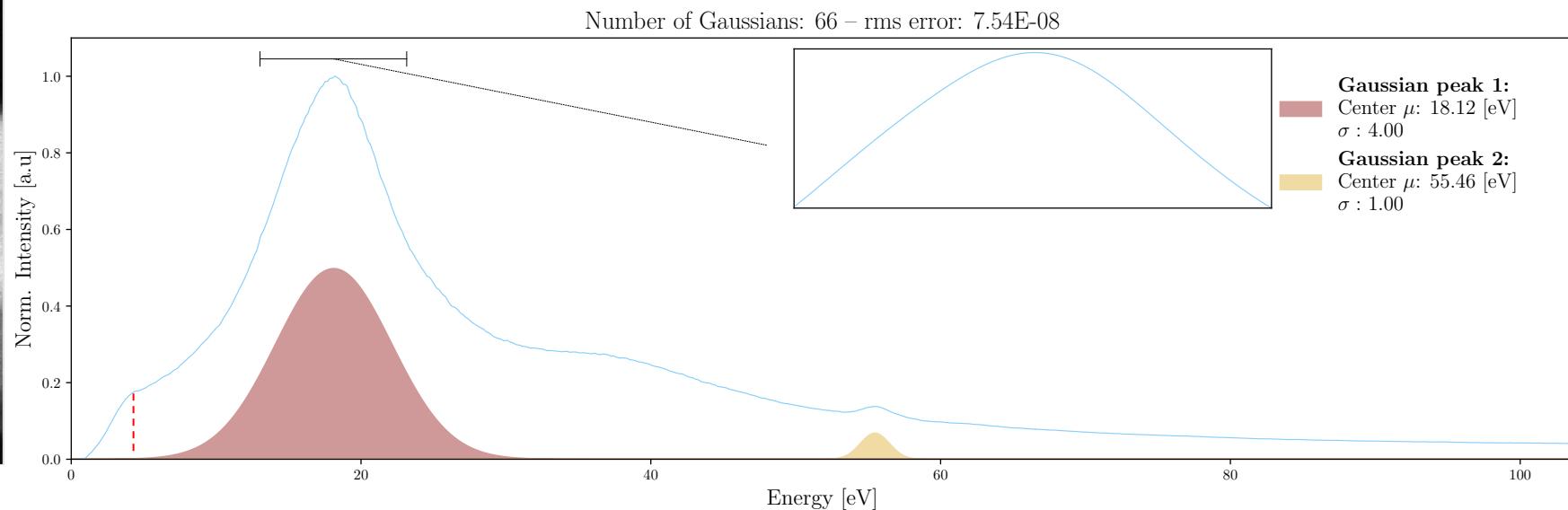


High loss spectrum – GeSe_Needle_ROI_1_POS_3

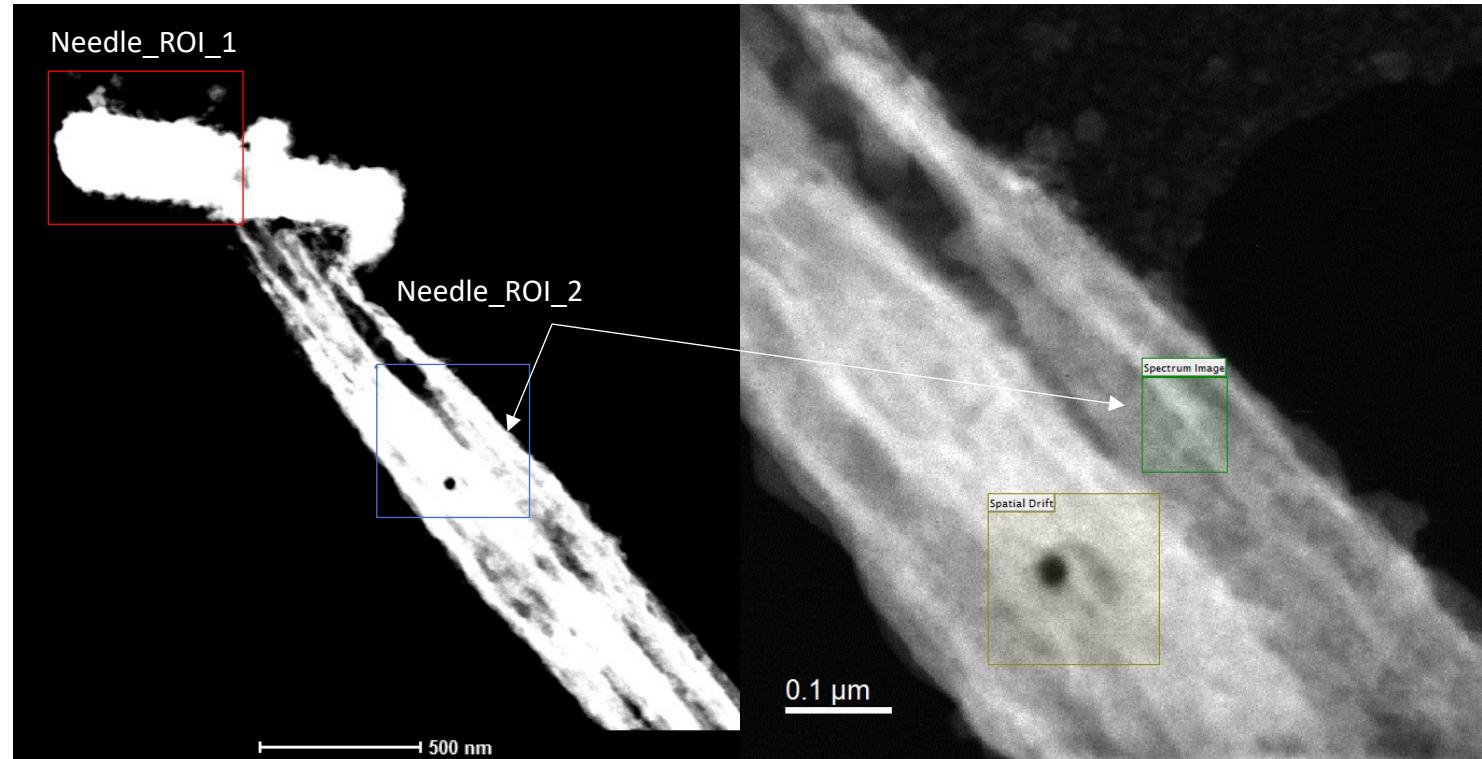


Main peak features:

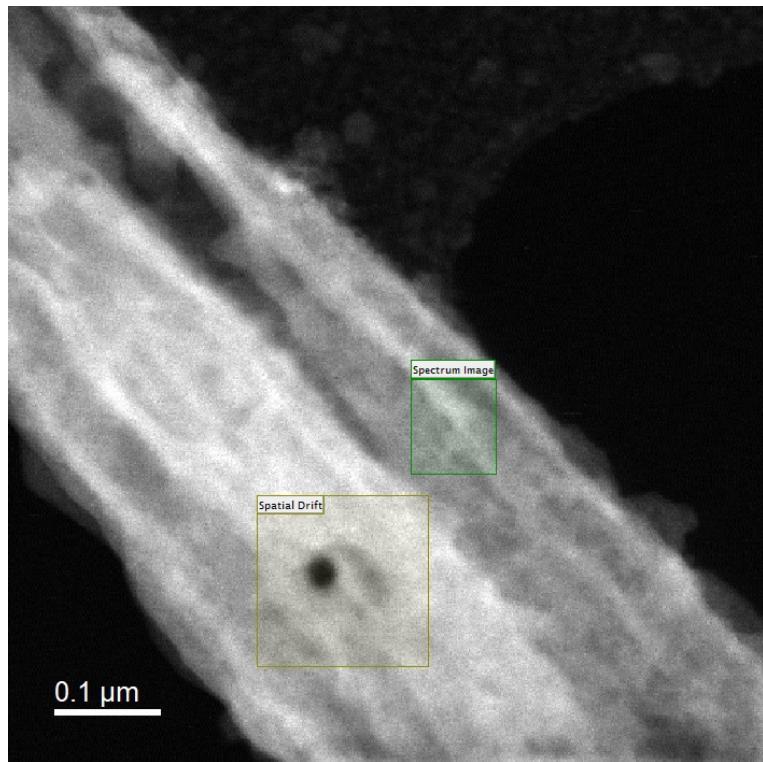
- Gaussian peak 1 (Plasmon peak):
 - Centered at 18.12eV
- Gaussian peak 2:
 - Centered at 55.46eV



ADF – GeSe_Needle_ROI_2



High loss spectrum – GeSe_Needle_ROI_2



Main peak features:

- Gaussian peak 1:
 - Centered at 6.22eV
- Gaussian peak 3:
 - Centered at 17.14eV
- Gaussian peak 2 (Plasmon peak):
 - Centered at 14.18eV

