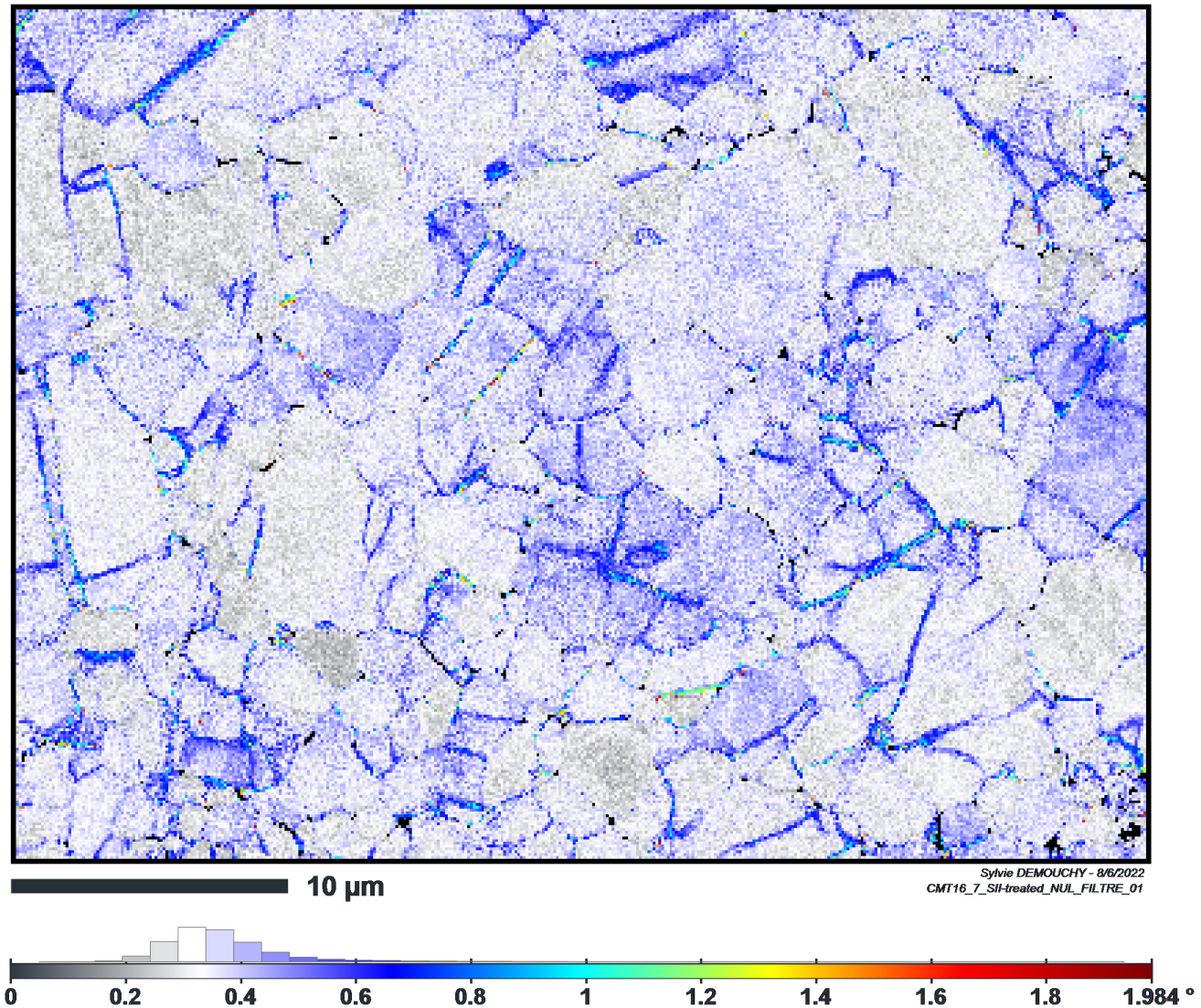
Dislocation and disclination densities in polycrystalline olivine experimentally deformed at high temperatures

Sylvie Demouchy*, Manuel Thieme, Fabrice Barou, Benoit Beausir,
Vincent Taupin & Patrick Cordier

Supplementary Figure S1: Example of MAD variation in the starting material, and compilation of the entrywise norm maps for all samples and the triplet θ_{13} θ_{23} and θ_{33} maps for all sample. See main text for details and see Table 2 for numerical values of α^c_{ij} and θ_{ij} densities. Grain boundaries are shown in green, subgrain boundaries in grey and non-indexed pixels in black.

Starting Material CMT-16-7-SII

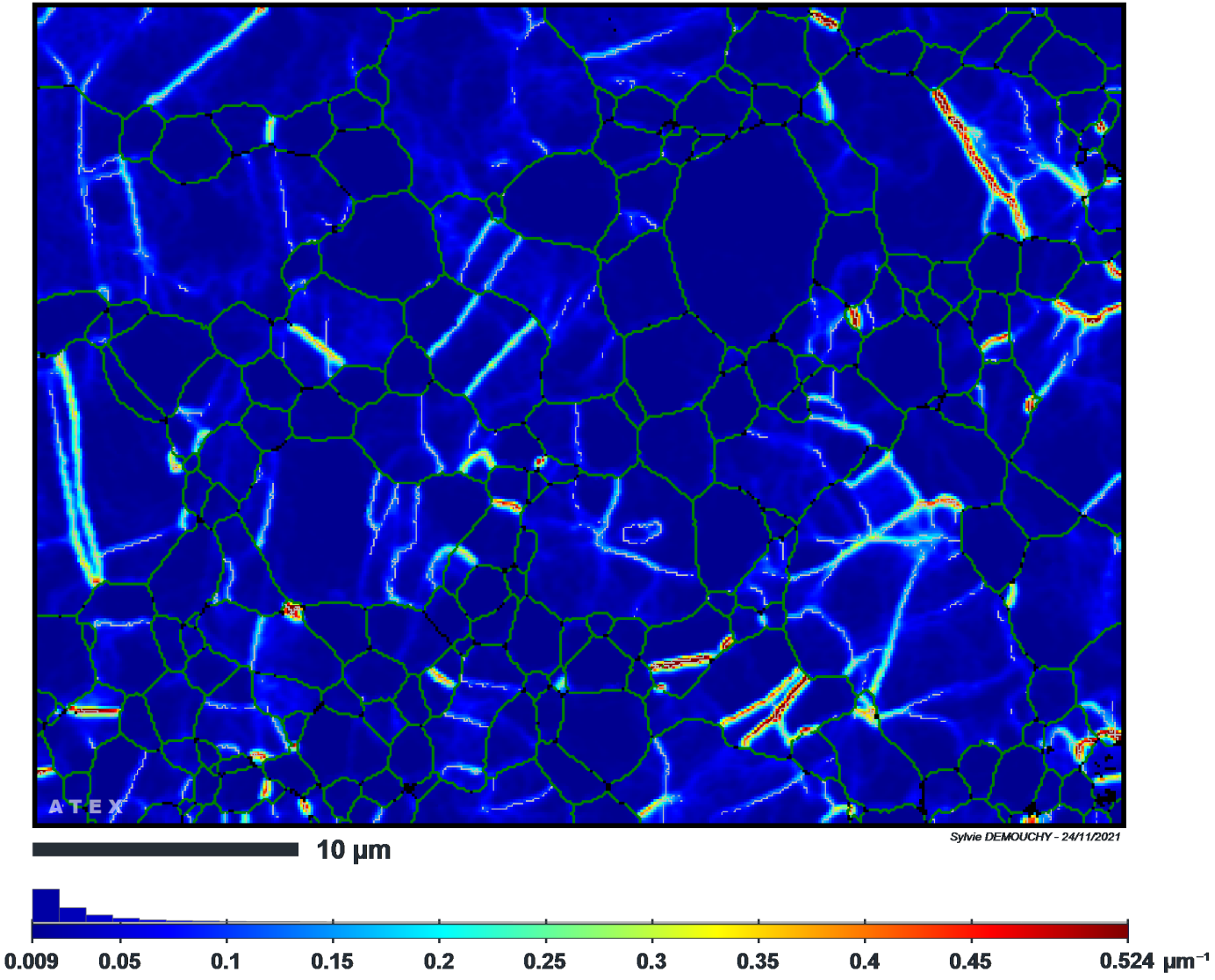
Misorientation Average Deviation



Step size: 0.1µm Resolution: 412x311 Index. Rate: 97% Magnification: x2500 Tension: 17kV
Minimum: 0 Maximum: 1.98 Average: 0.37 S. Dev: 0.12 Entropy: 2.017
Median: 0.35 Mode: 0

Starting Material CMT-16-7-SII

Entrywise Norm of the Nye Tensor

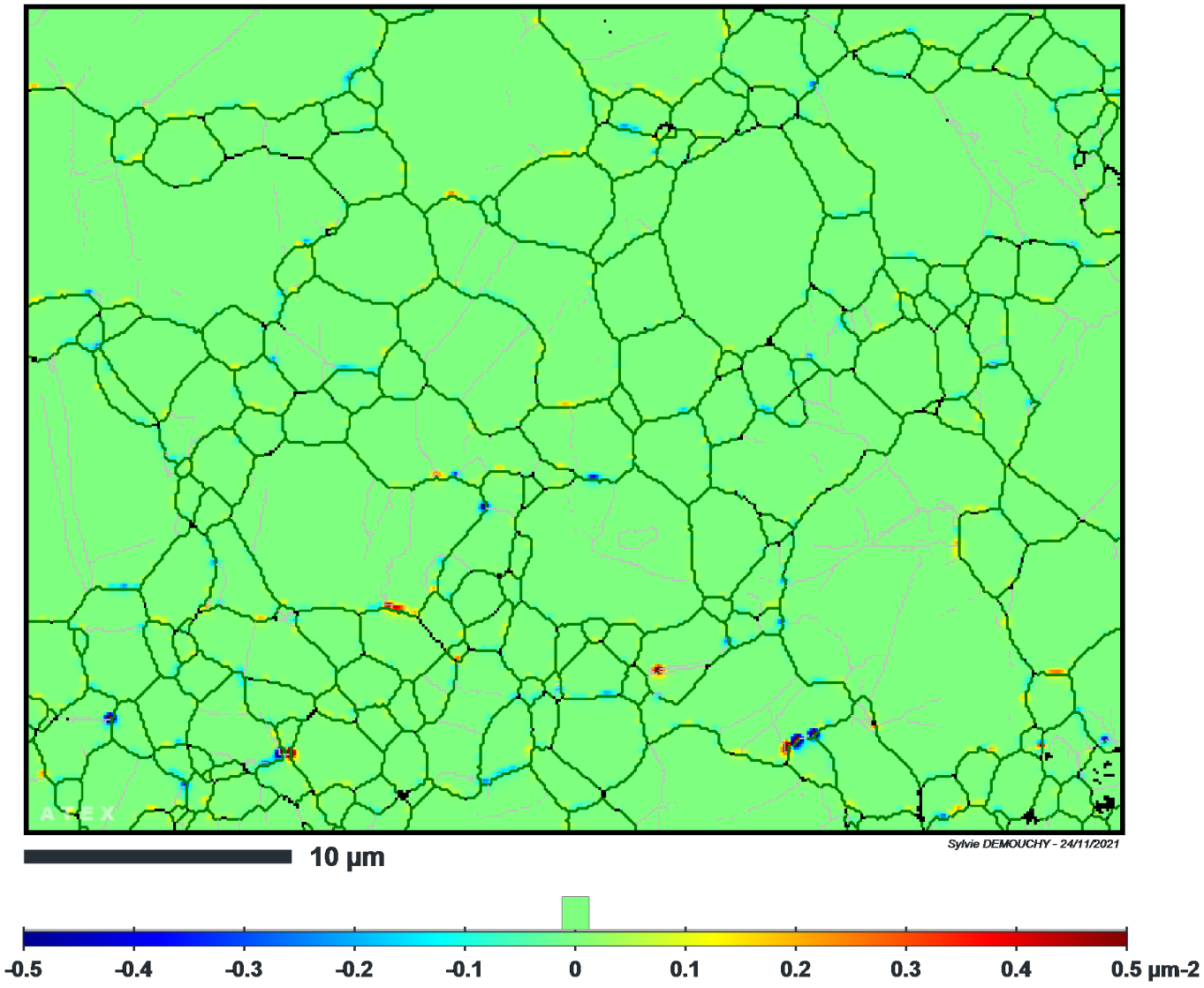


Step size: 0.1µm Resolution: 412x311 Index. Rate: 97%

Magnification: x2500 Tension: 17kV

Starting Material CMT-16-7-SII

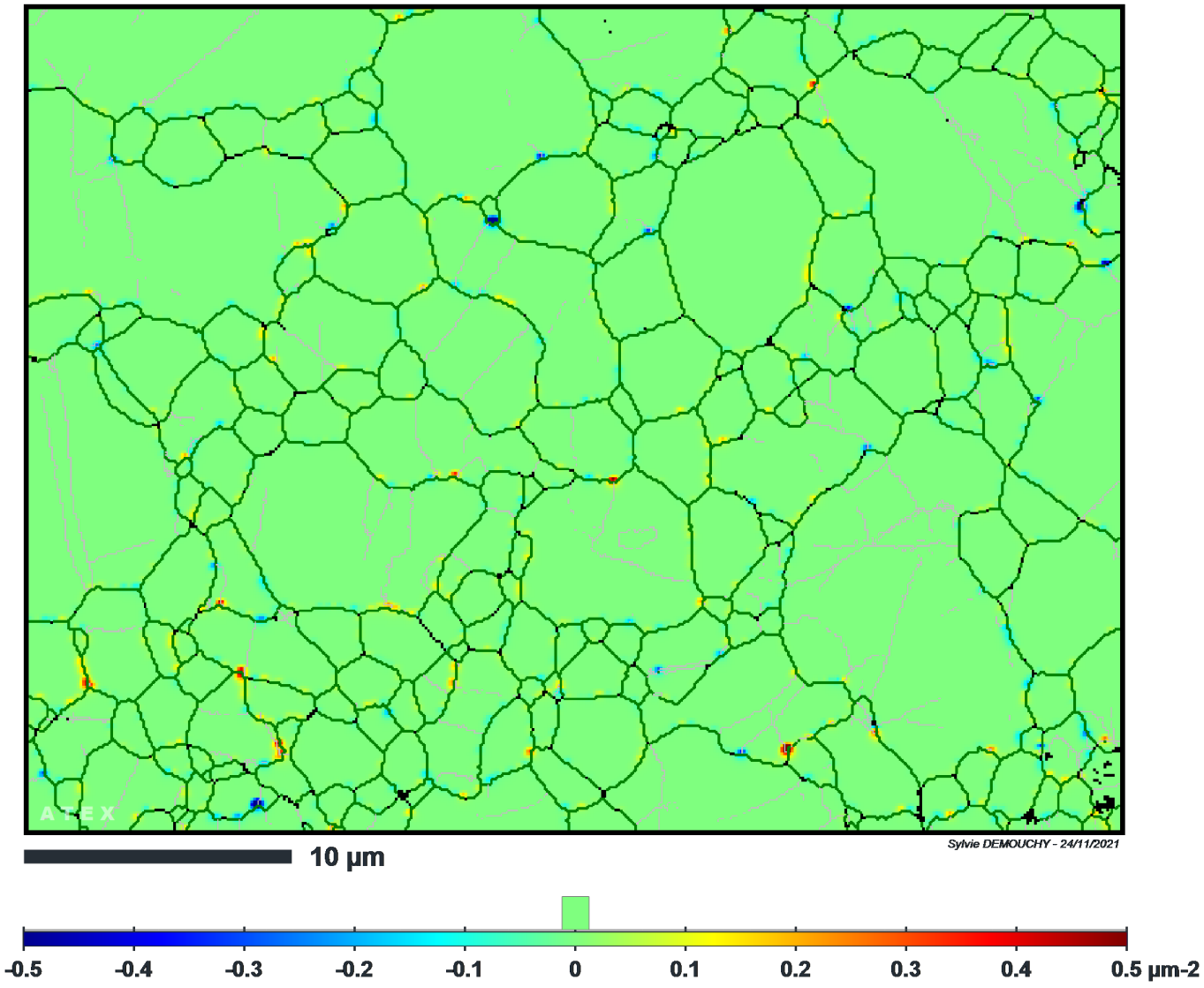
13 component Of Disclination Tensor



Step size: 0.1µm Resolution: 412x311 Index. Rate: 97%
Magnification: x2500 Tension: 17kV

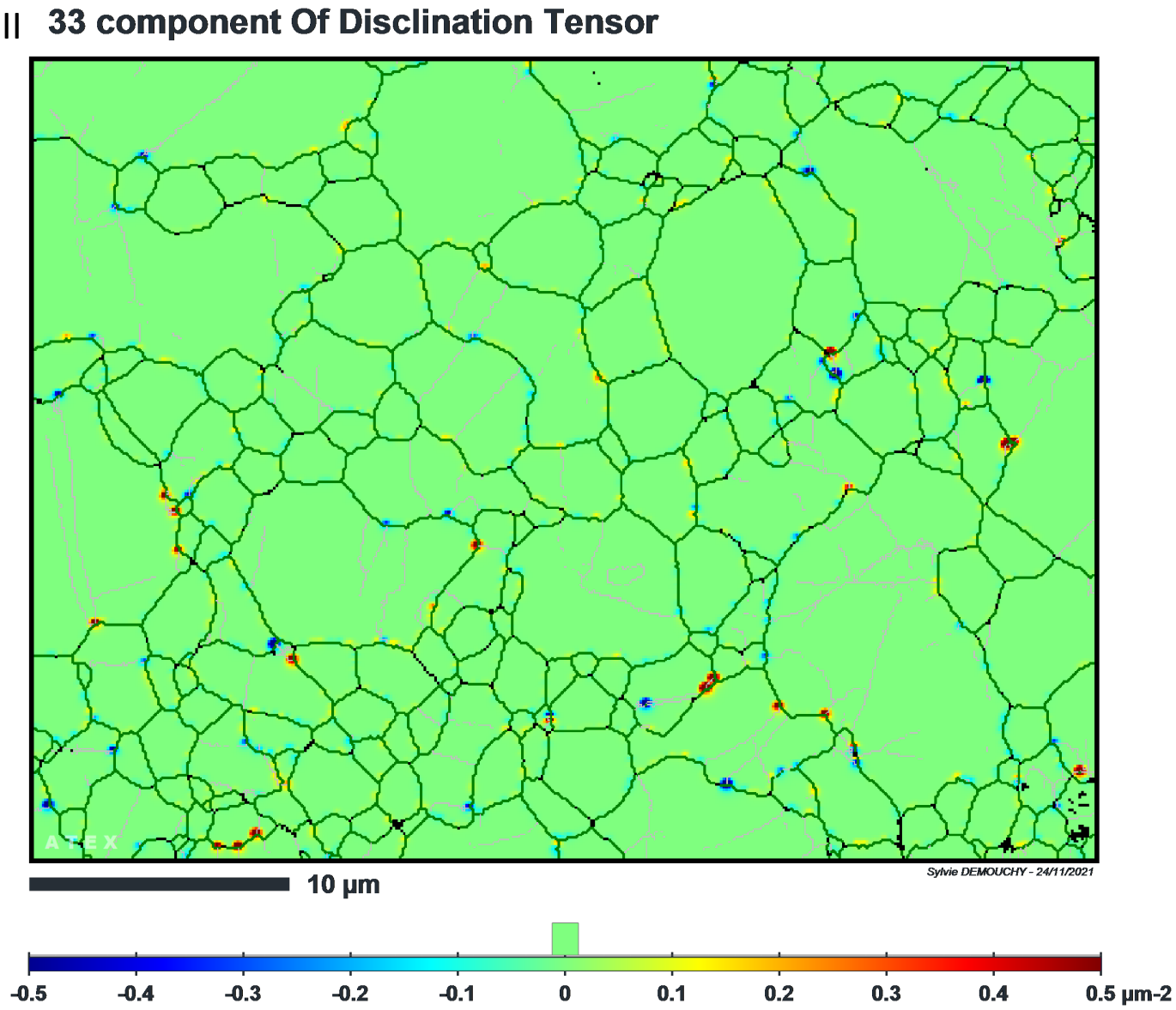
Starting Material CMT-16-7-SII

23 component Of Disclination Tensor



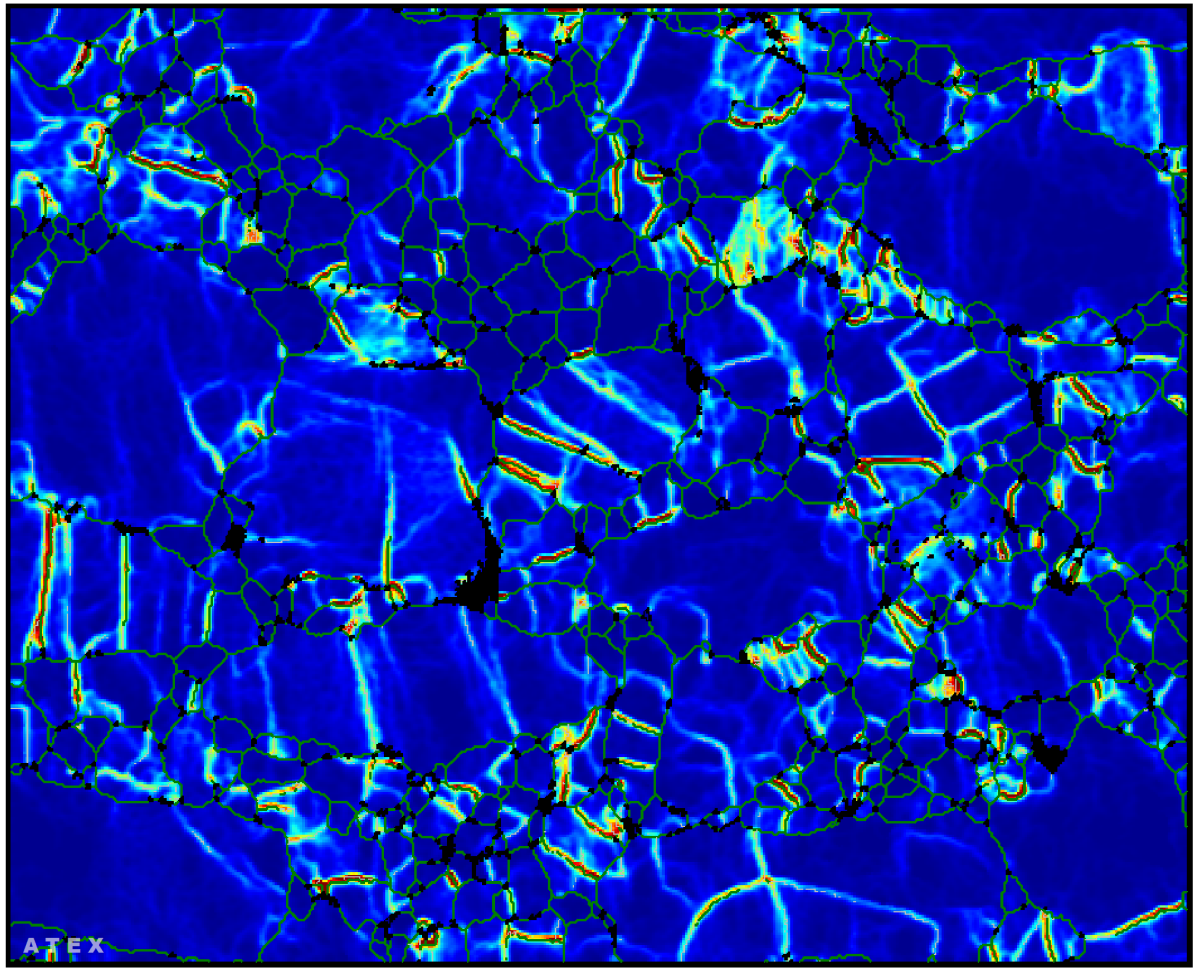
Step size: 0.1µm Resolution: 412x311 Index. Rate: 97%
Magnification: x2500 Tension: 17kV

Starting Material CMT-16-7-SII

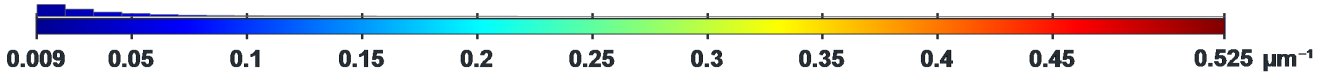


CMT-16-6-SIII

Entrywise Norm of the Nye Tensor



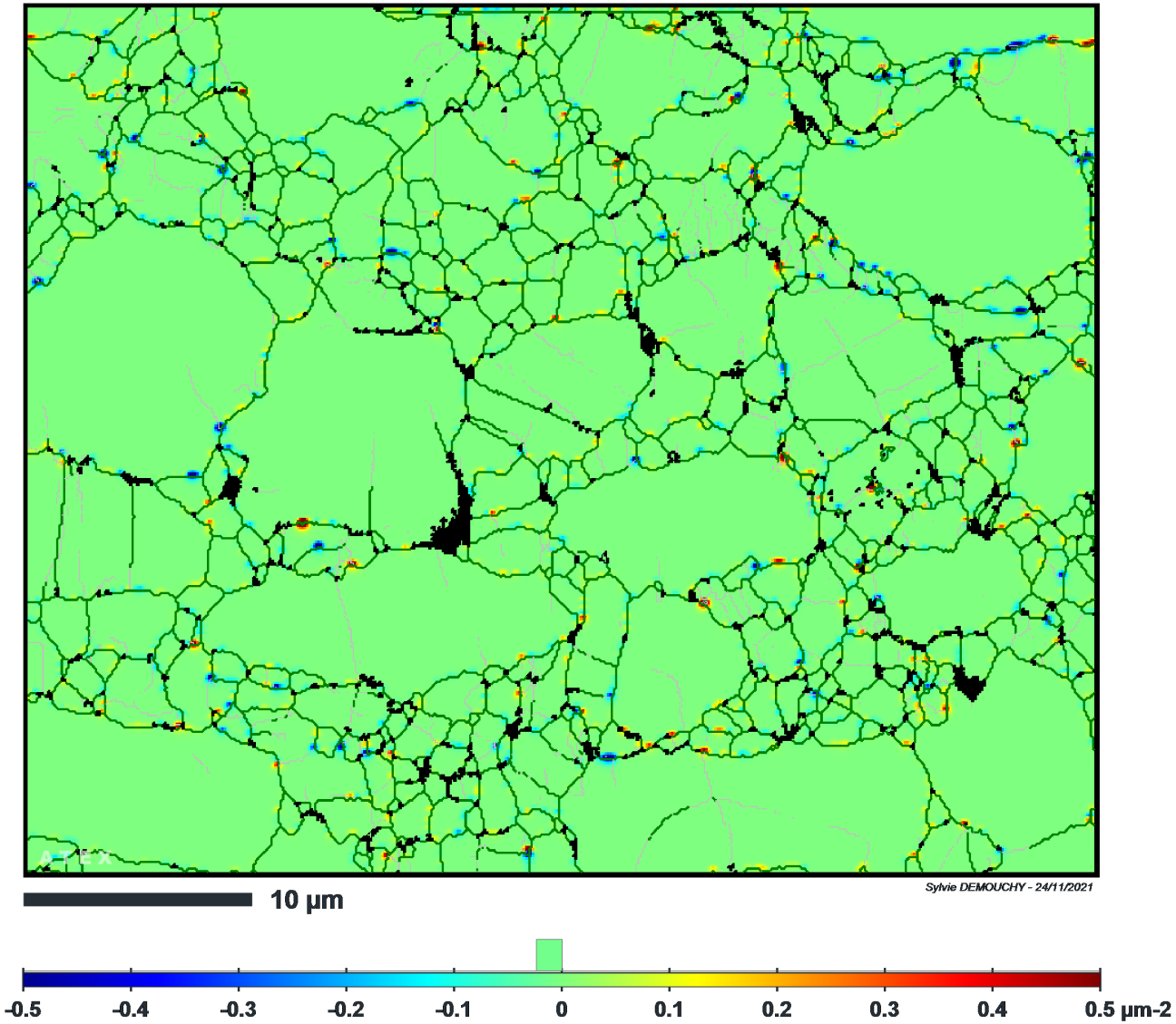
10 µm



Step size: 0.1µm Resolution: 472x384 Index. Rate: 96%
Magnification: x2000 Tension: 17kV

CMT-16-6-SIII

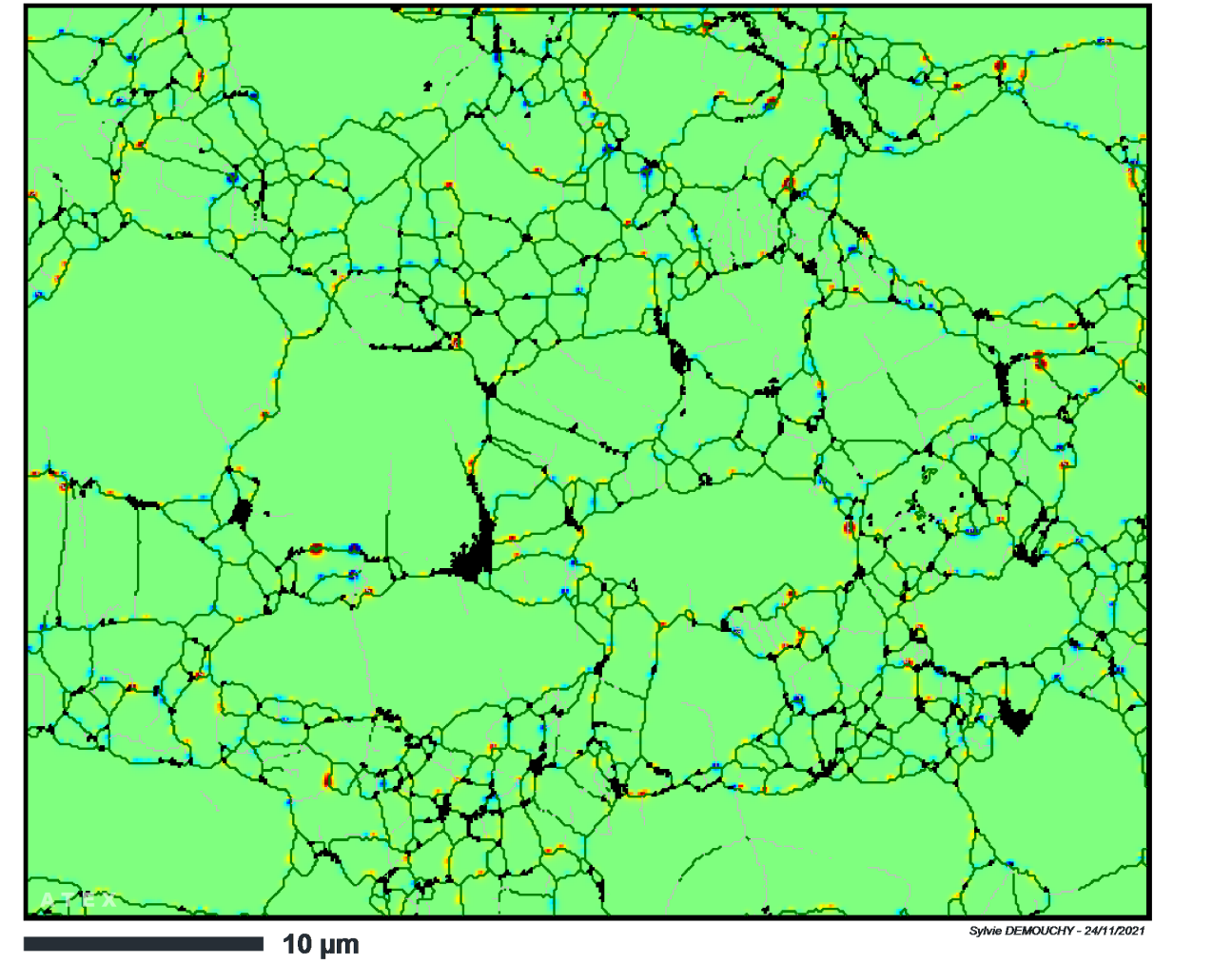
13 component Of Disclination Tensor

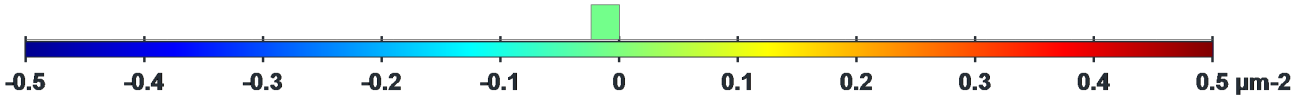


Step size: 0.1µm Resolution: 472x384 Index. Rate: 96%
Magnification: x2000 Tension: 17kV

CMT-16-6-SIII

23 component Of Disclination Tensor

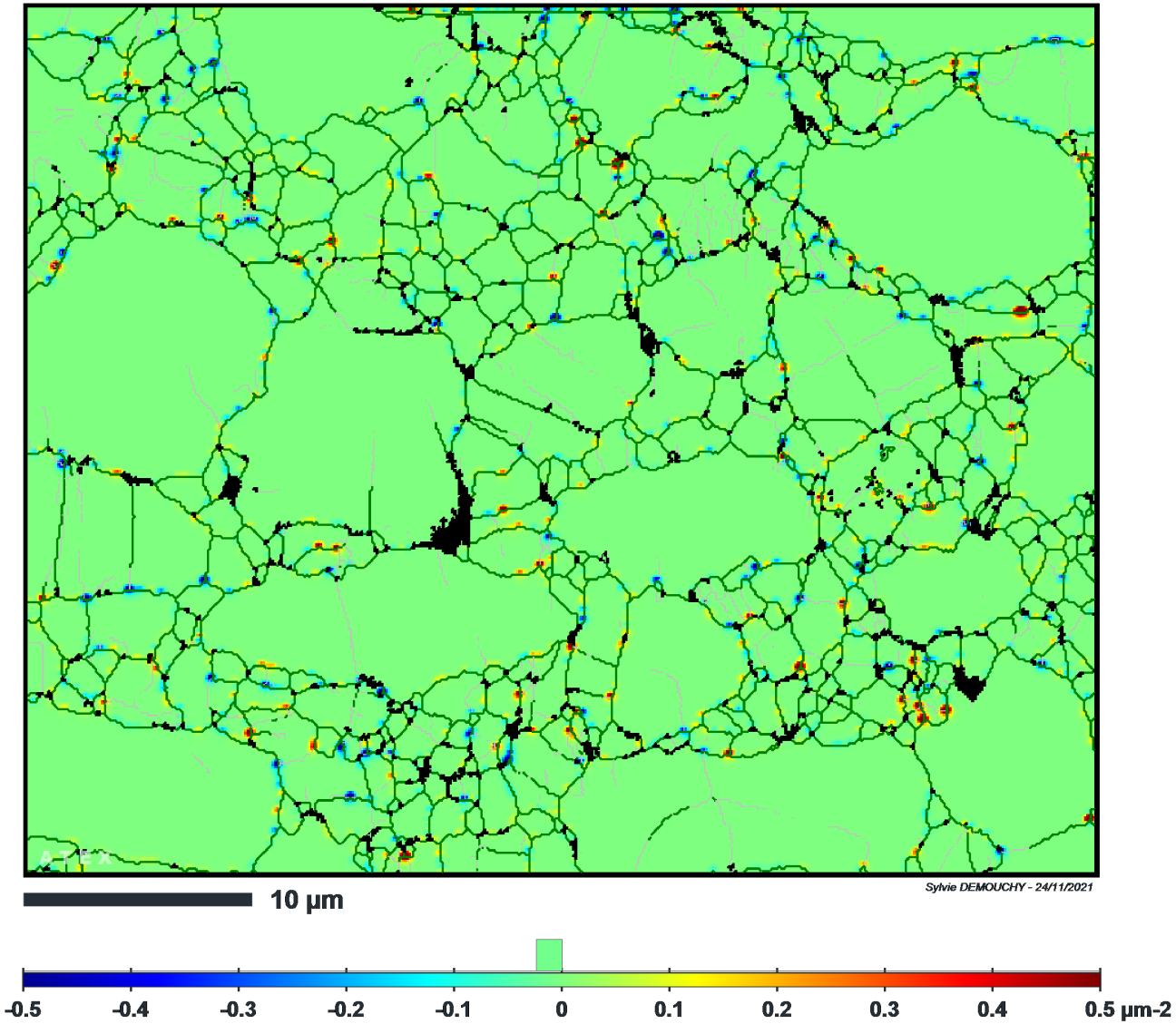




Step size: 0.1µm Resolution: 472x384 Index. Rate: 96%
Magnification: x2000 Tension: 17kV

CMT-16-6-SIII

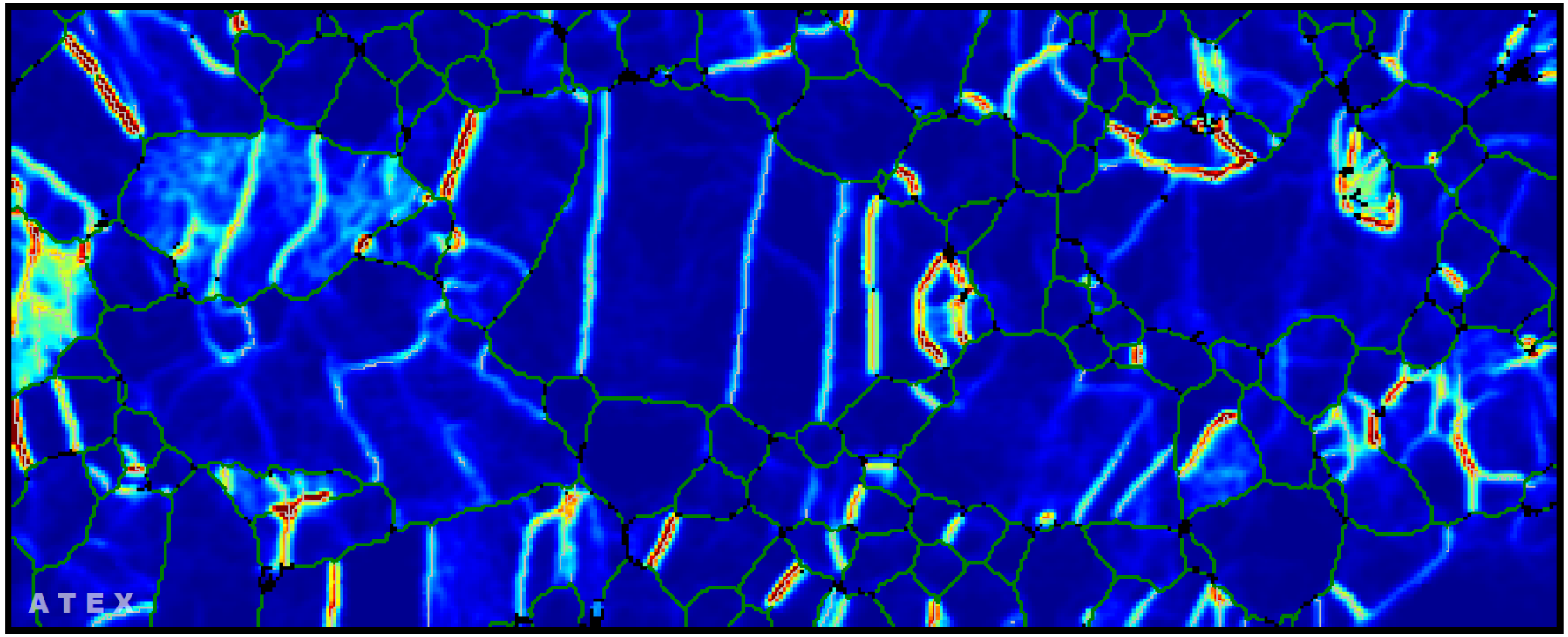
33 component Of Disclination Tensor



Step size: 0.1µm Resolution: 472x384 Index. Rate: 96%
Magnification: x2000 Tension: 17kV

CMT-16-8-SV

Entrywise Norm of the Nye Tensor



Sylvie DEMOUCHY - 24/11/2021

10 µm

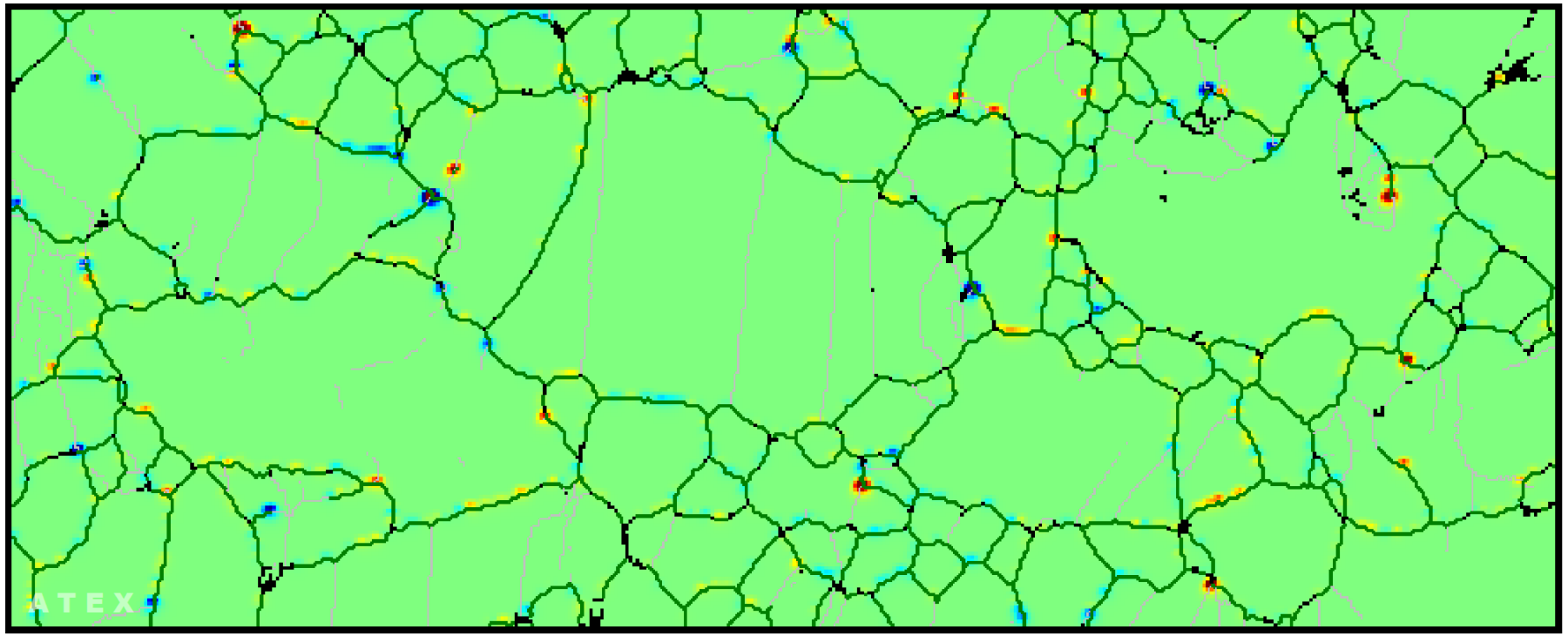
0.009 0.05 0.1 0.15 0.2 0.25 0.3 0.35 0.4 0.45 0.524 μm^{-1}

Step size: 0.1µm Resolution: 437x177 Index. Rate: 96%

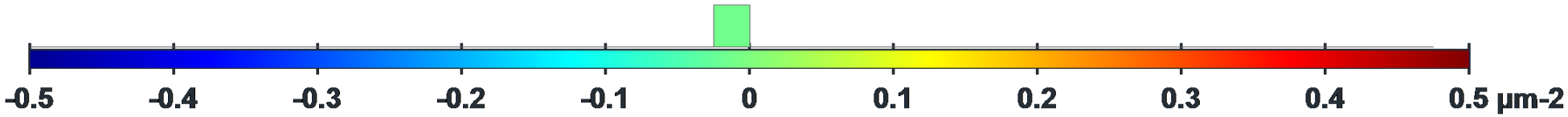
Magnification: x2500 Tension: 17kV

CMT-16-8-SV

13 component Of Disclination Tensor



10 µm

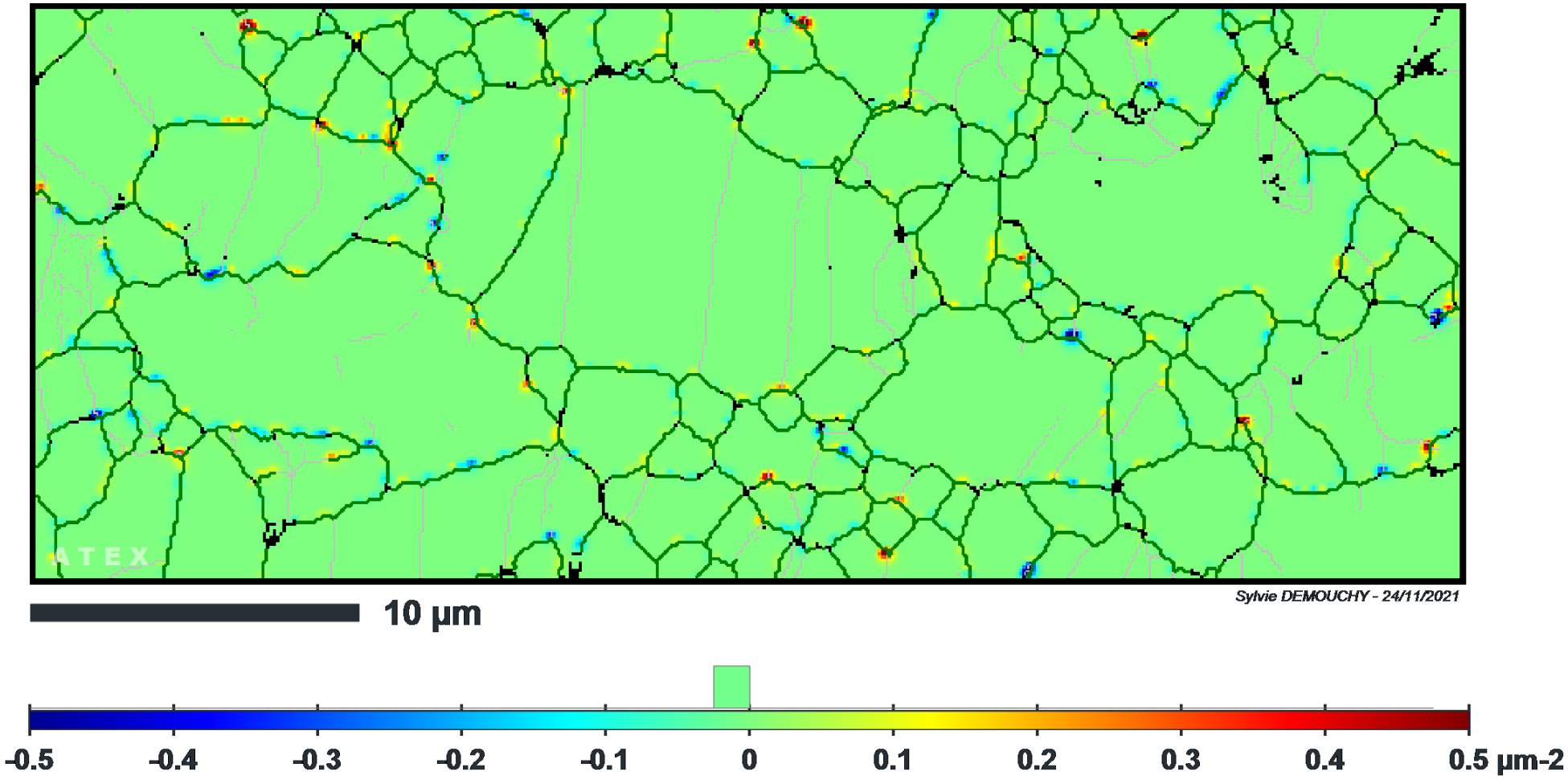


Step size: 0.1µm Resolution: 437x177 Index. Rate: 96%

Magnification: x2500 Tension: 17kV

CMT-16-8-SV

23 component Of Disclination Tensor

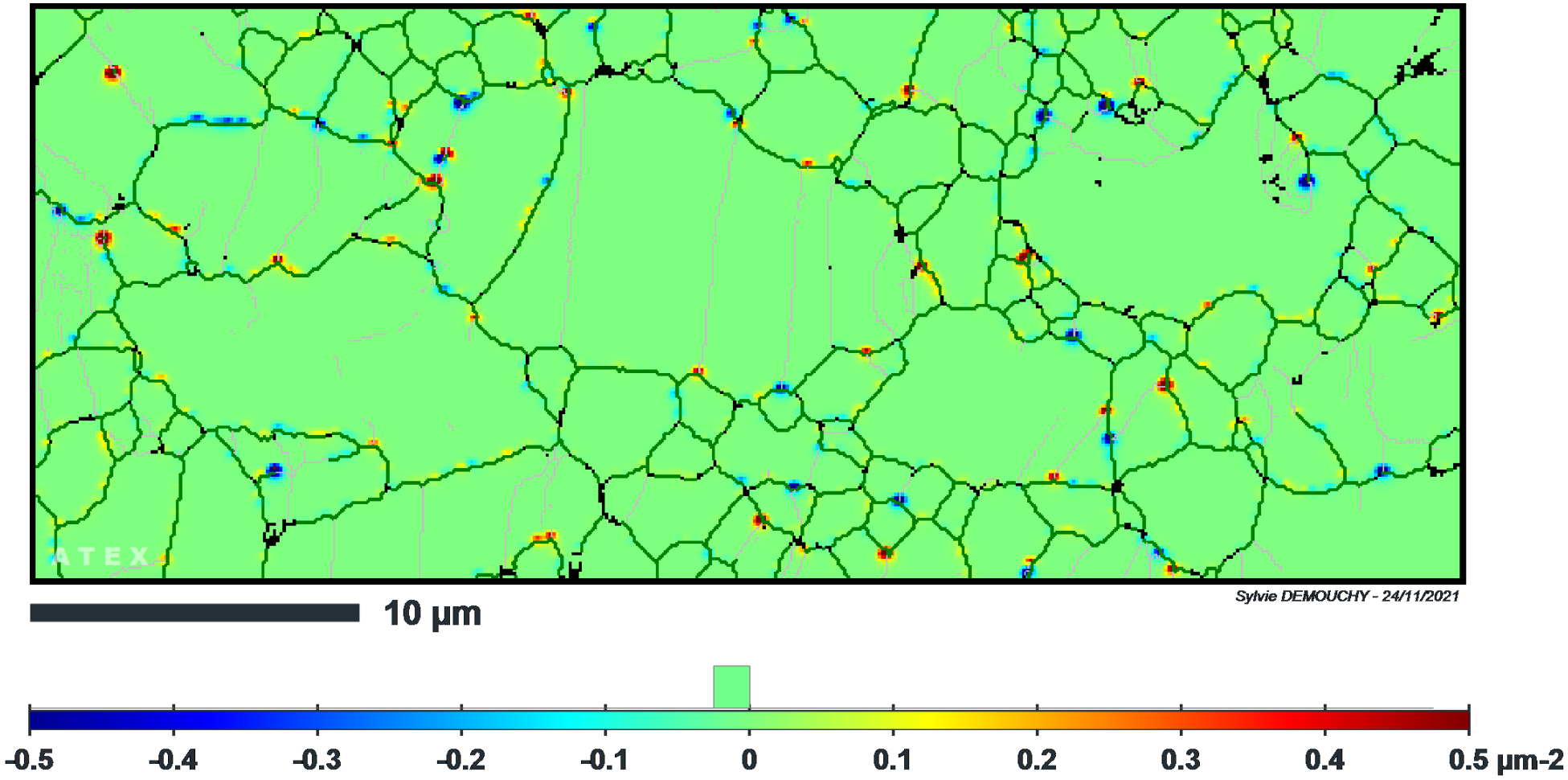


Step size: 0.1µm Resolution: 437x177 Index. Rate: 96%

Magnification: x2500 Tension: 17kV

CMT-16-8-SV

33 component Of Disclination Tensor

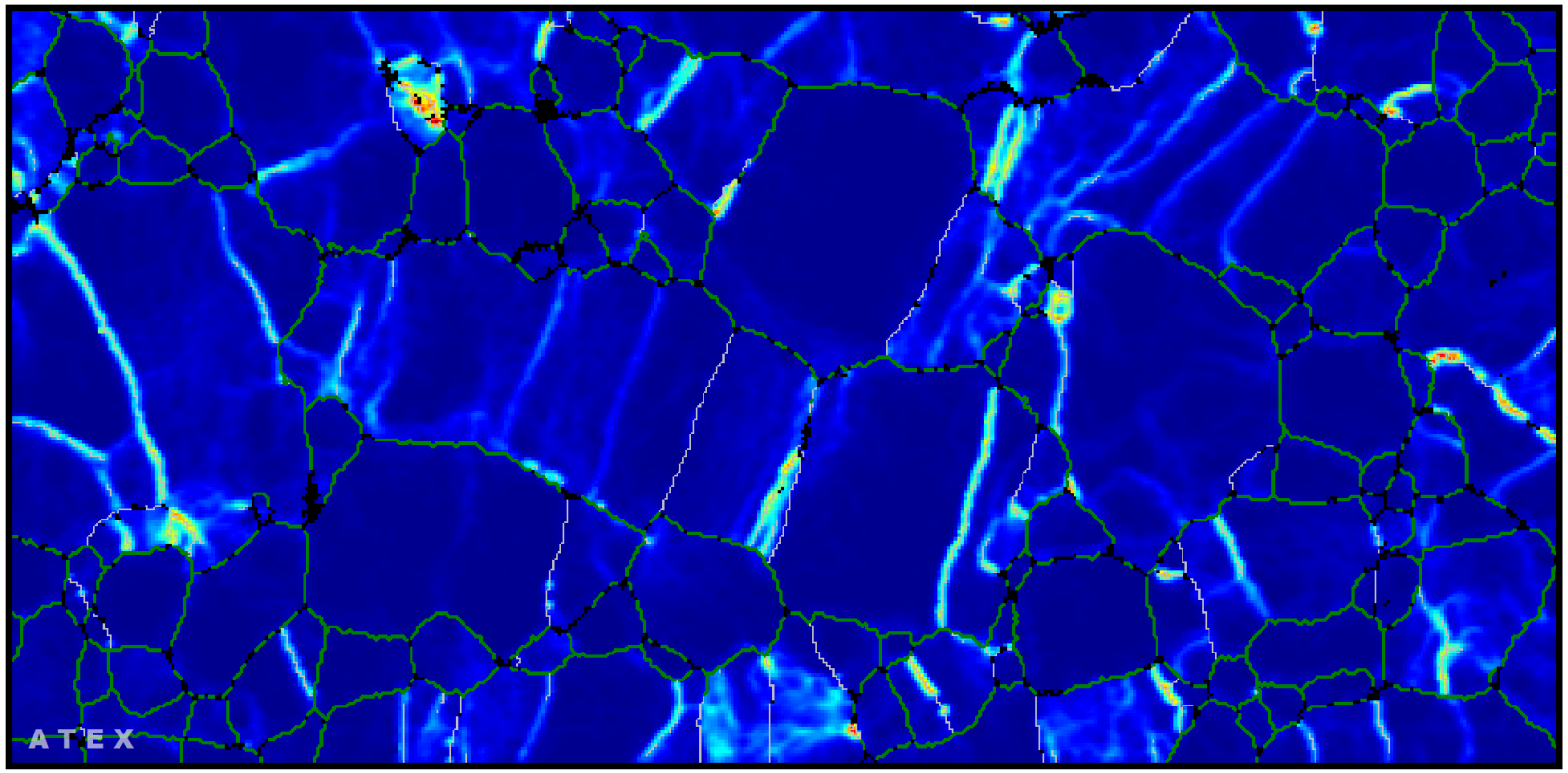


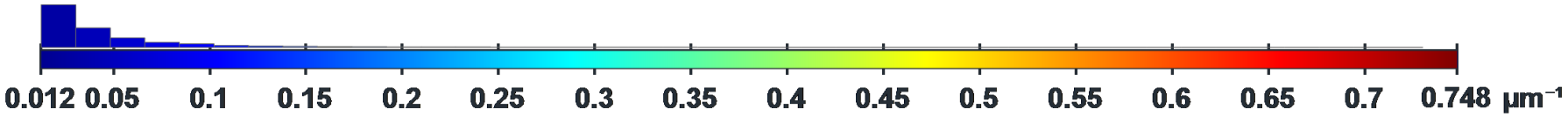
Step size: 0.1µm Resolution: 437x177 Index. Rate: 96%

Magnification: x2500 Tension: 17kV

CMT-16-8-SVI

Entrywise Norm of the Nye Tensor



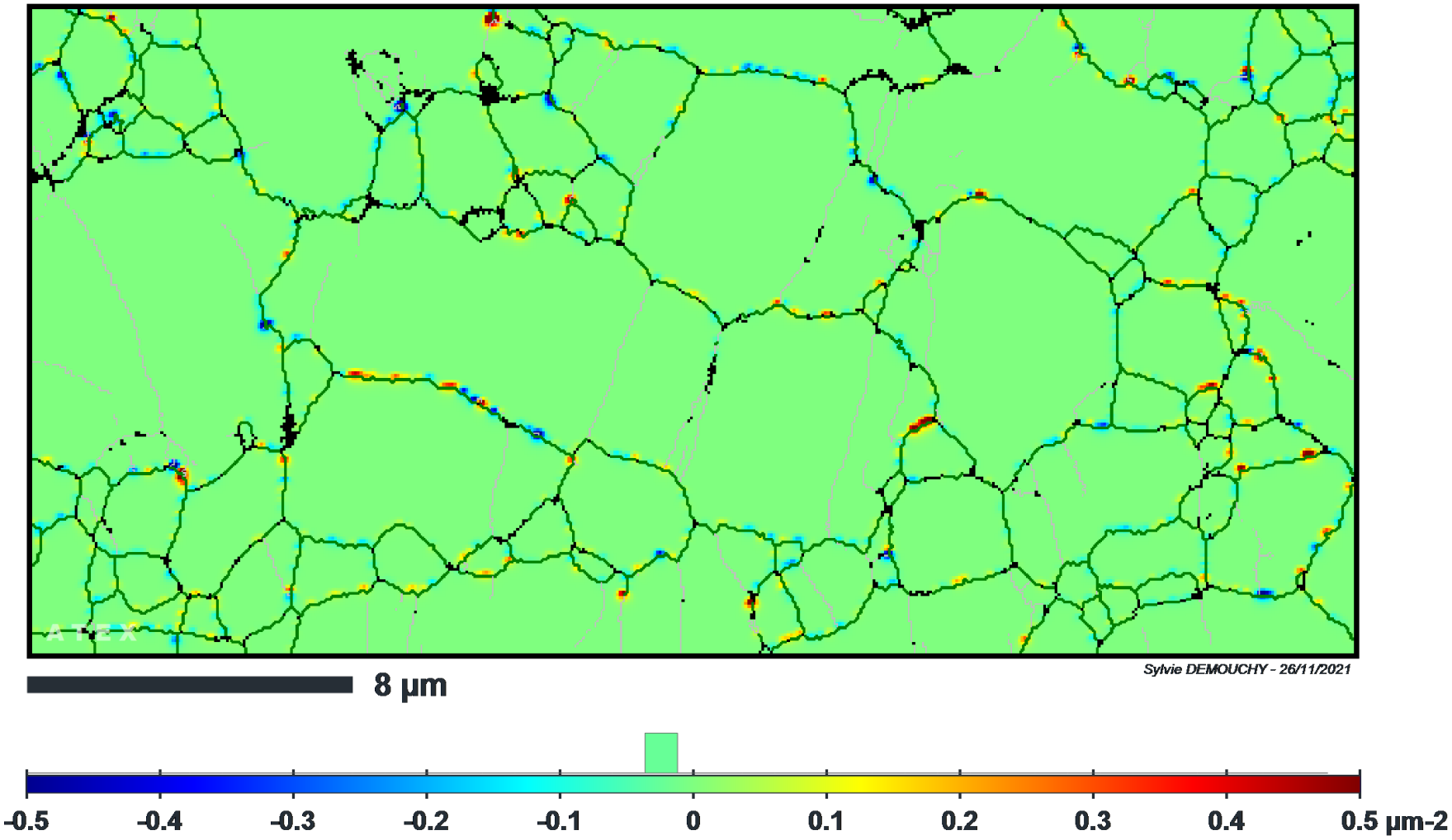


Step size: 0.07µm Resolution: 468x230 Index. Rate: 96% Magnification: x3000 Tension: 17kV

Minimum: 0.01 Maximum: 0.75 Average: 0.05 S. Dev: 0.11

CMT-16-8-SVI

13 component Of Disclination Tensor

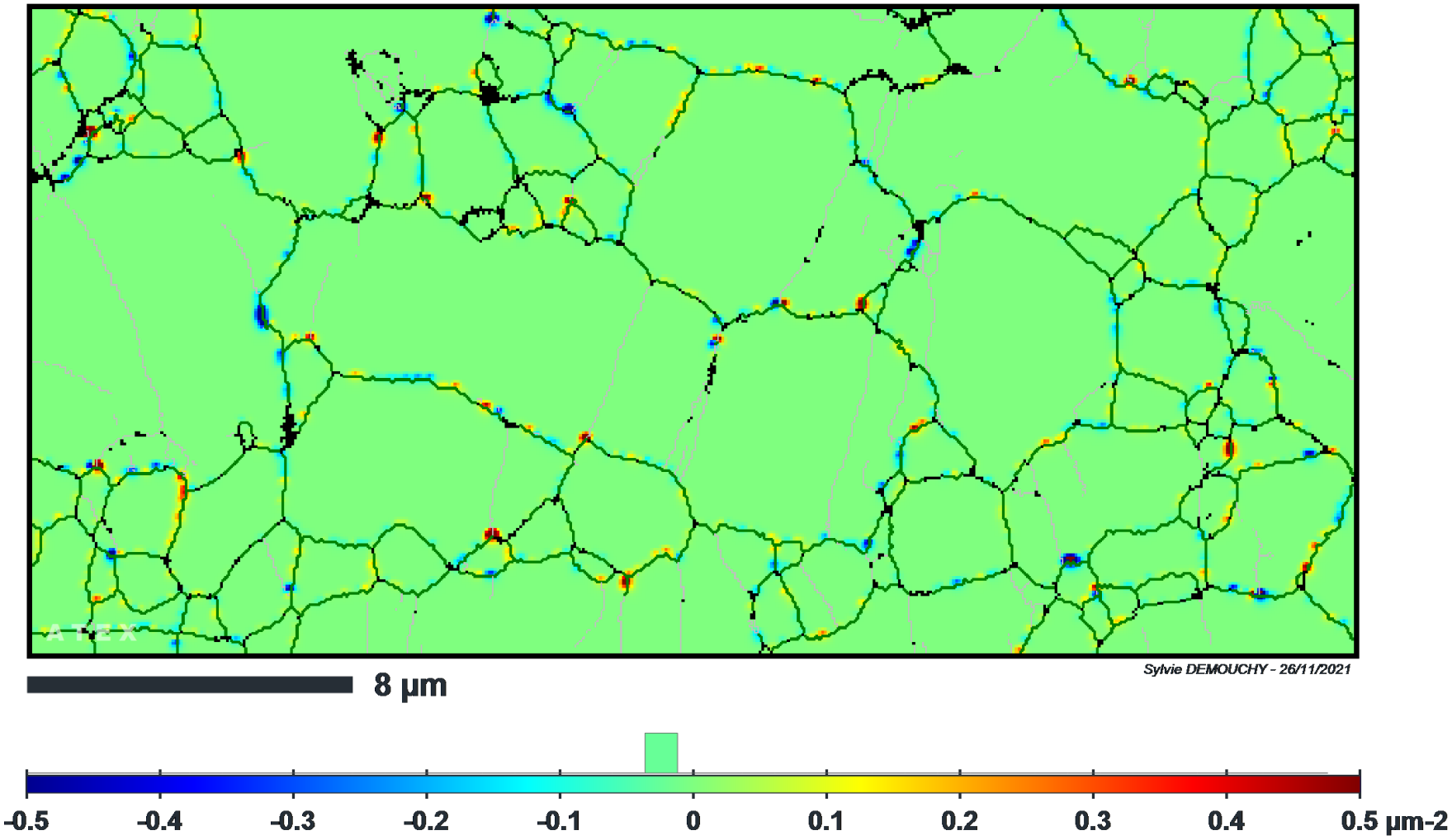


Step size: 0.07µm Resolution: 468x230 Index. Rate: 96% Magnification: x3000 Tension: 17kV

Minimum: -0.5 Maximum: 0.5 Average: 0 S. Dev: 0.2

CMT-16-8-SVI

23 component Of Disclination Tensor

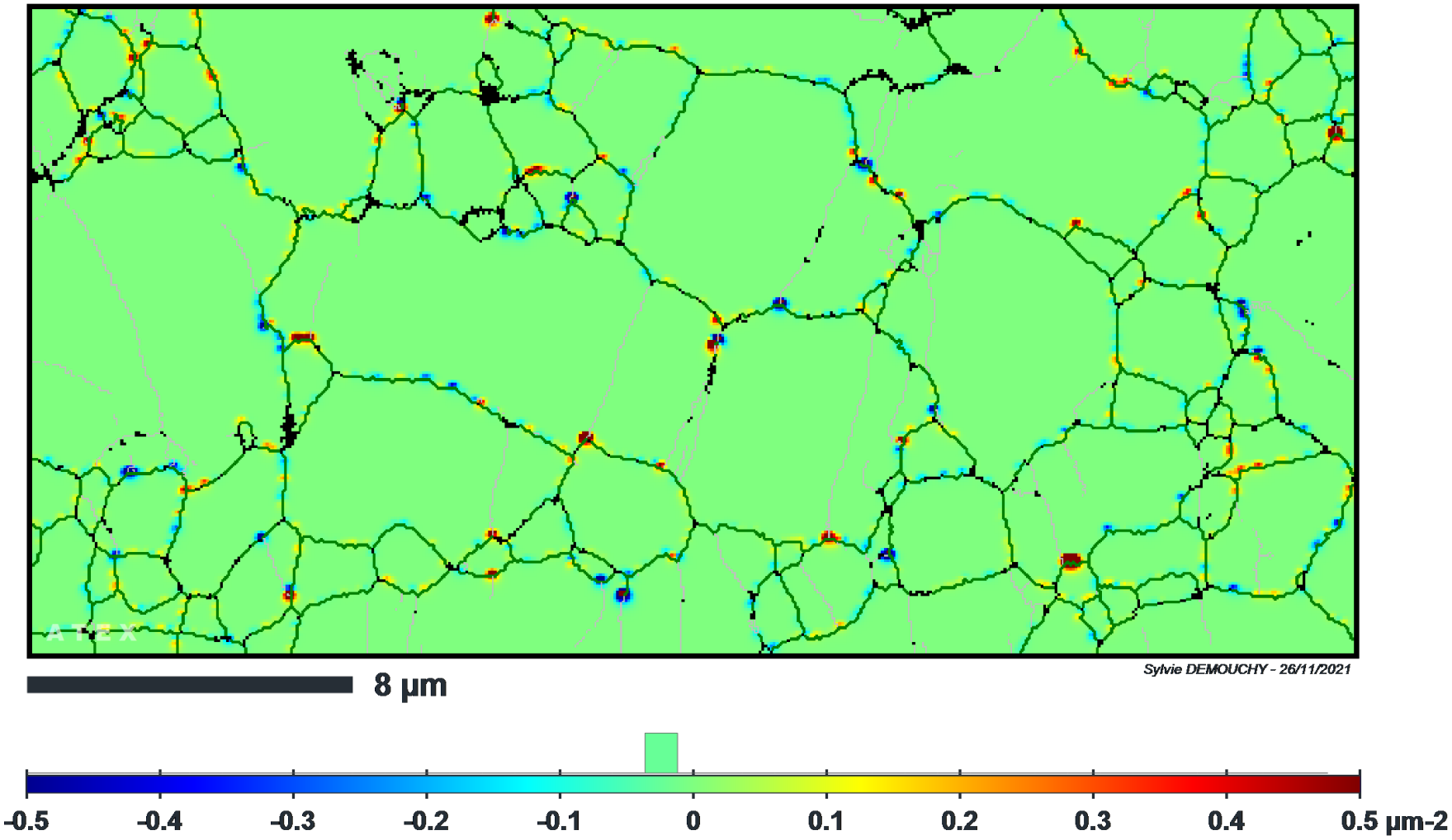


Step size: 0.07µm Resolution: 468x230 Index. Rate: 96% Magnification: x3000 Tension: 17kV

Minimum: -0.5 Maximum: 0.5 Average: 0 S. Dev: 0.23

CMT-16-8-SVI

33 component Of Disclination Tensor

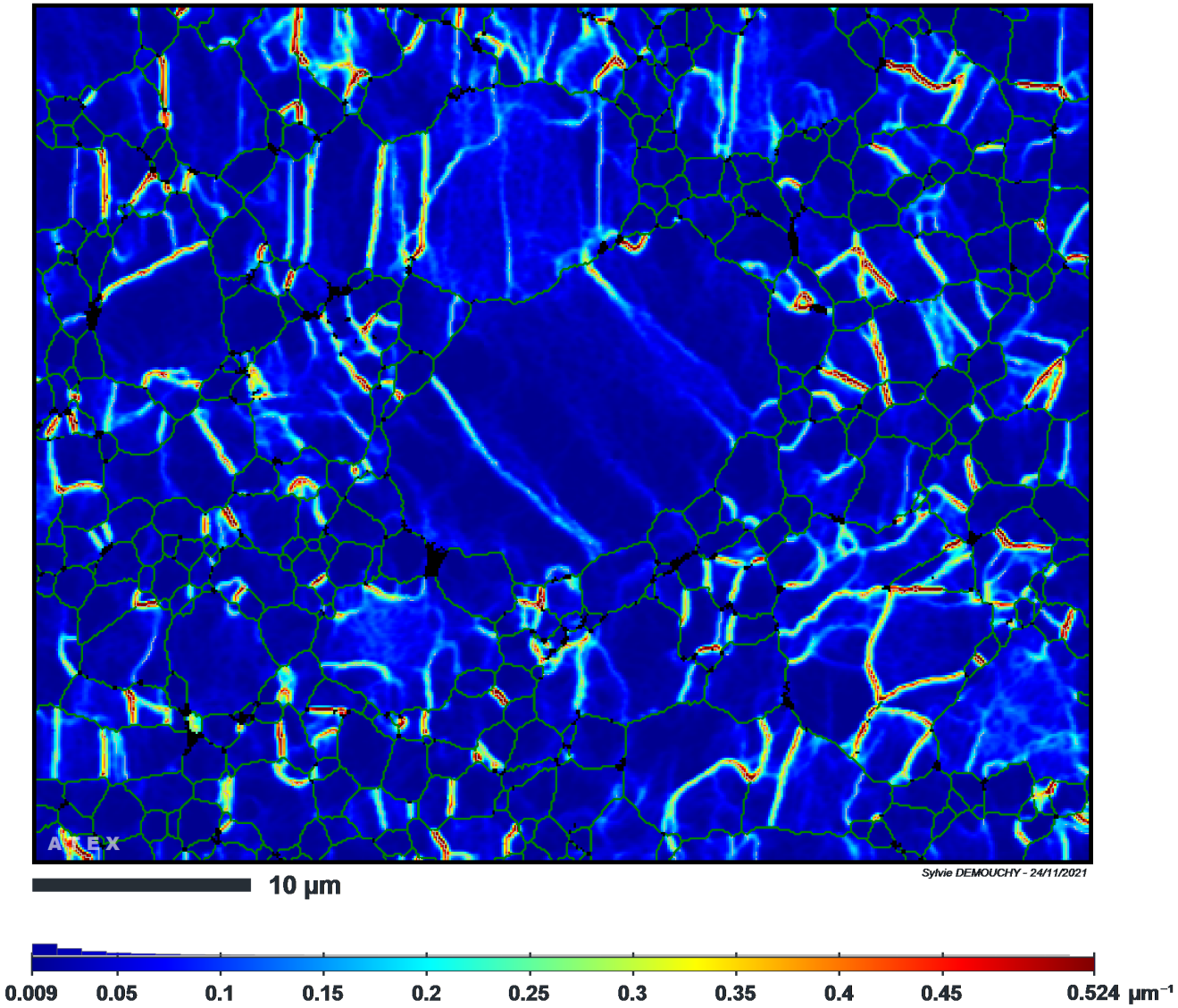


Step size: 0.07µm Resolution: 468x230 Index. Rate: 96% Magnification: x3000 Tension: 17kV

Minimum: -0.5 Maximum: 0.5 Average: 0 S. Dev: 0.31

CMT-16-9-SII

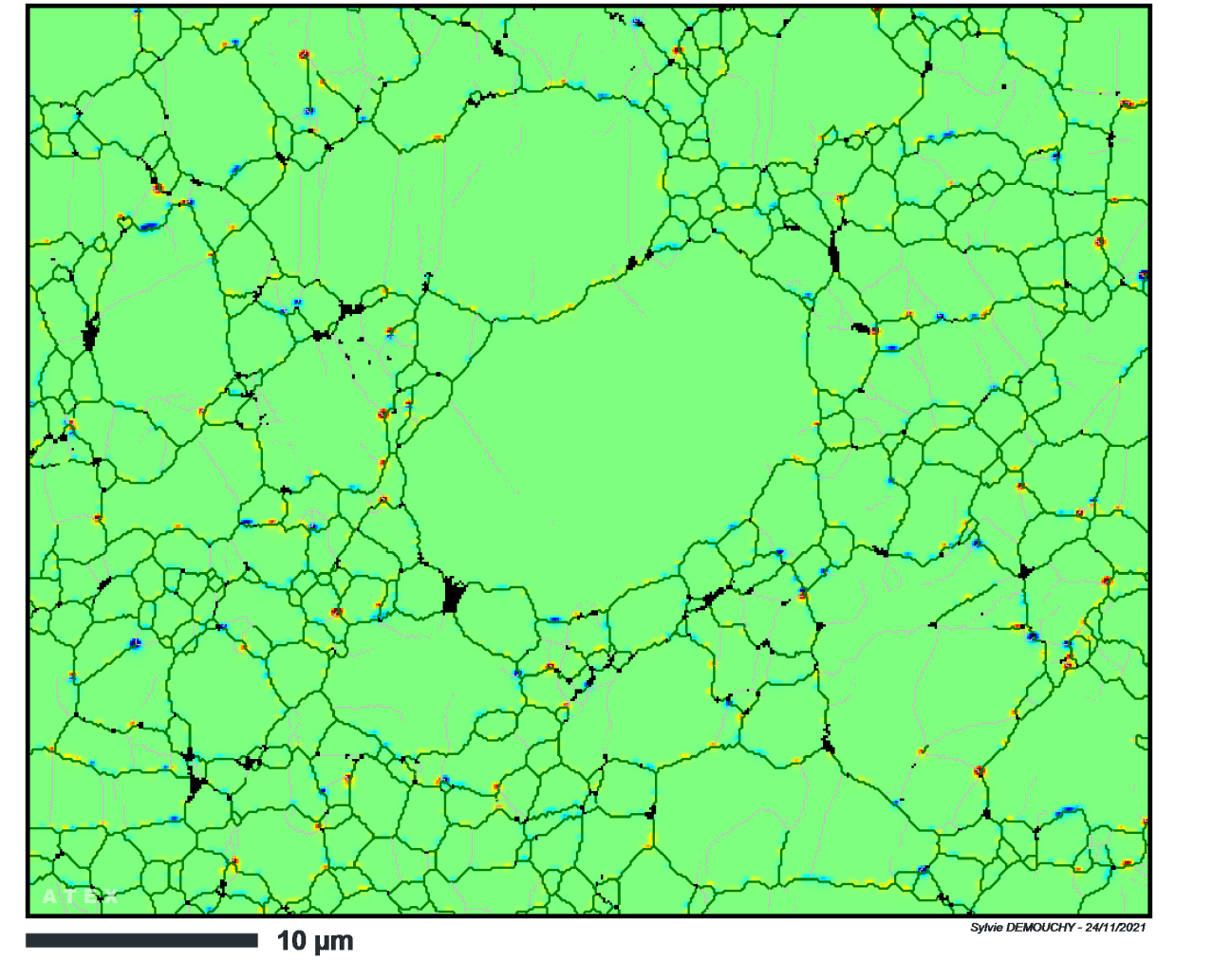
Entrywise Norm of the Nye Tensor



Step size: 0.1µm Resolution: 486x395 Index. Rate: 97%
Magnification: x2500 Tension: 17kV

CMT-16-9-SII

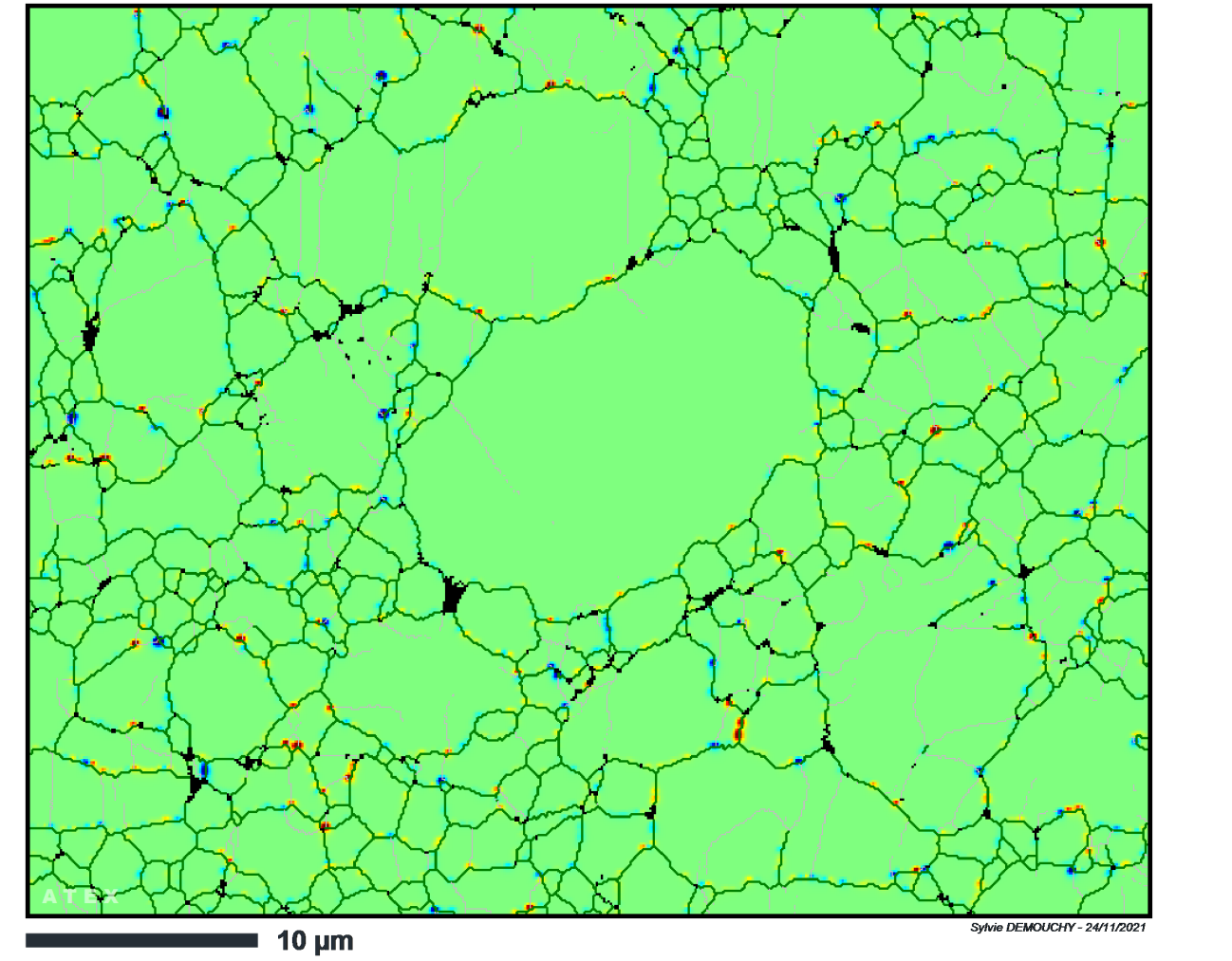
13 component Of Disclination Tensor

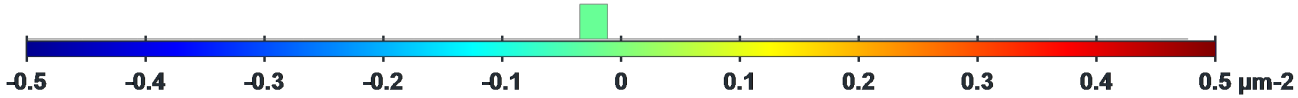


Step size: 0.1µm Resolution: 486x395 Index. Rate: 97%
Magnification: x2500 Tension: 17kV

CMT-16-9-SII

23 component Of Disclination Tensor

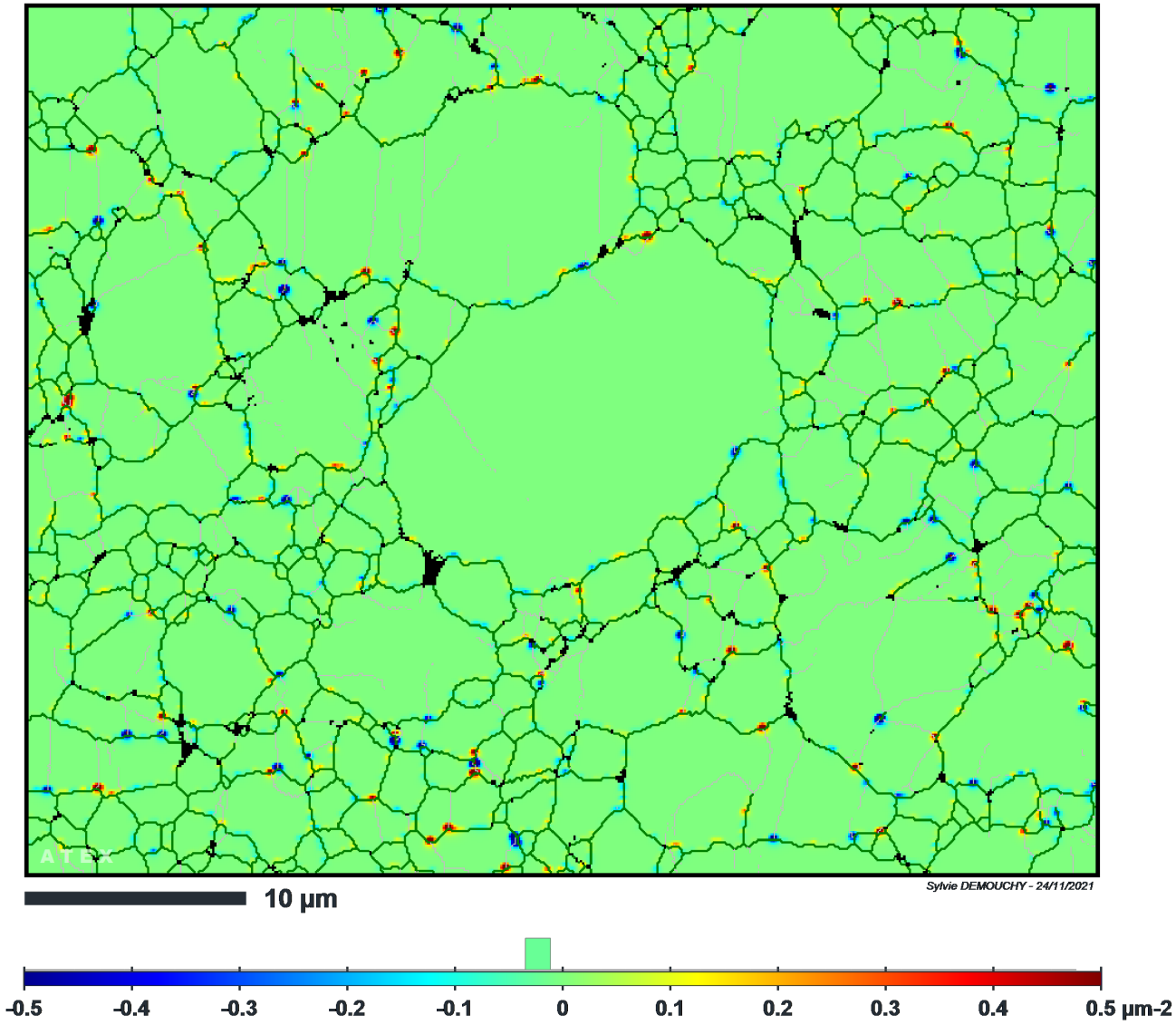




Step size: 0.1µm Resolution: 486x395 Index. Rate: 97%
Magnification: x2500 Tension: 17kV

CMT-16-9-SII

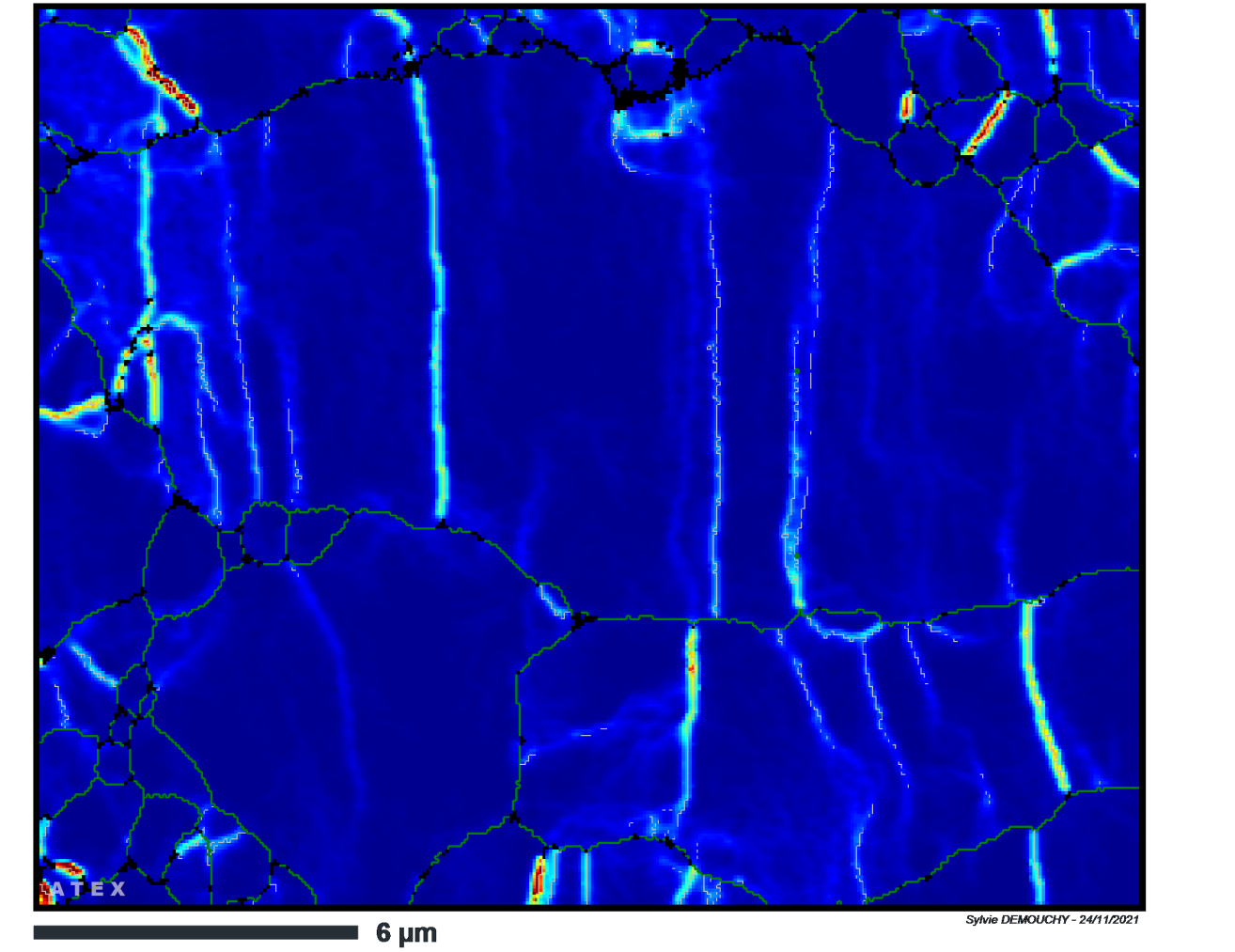
33 component Of Disclination Tensor



Step size: 0.1µm Resolution: 486x395 Index. Rate: 97%
Magnification: x2500 Tension: 17kV

CMT-16-12-SIII

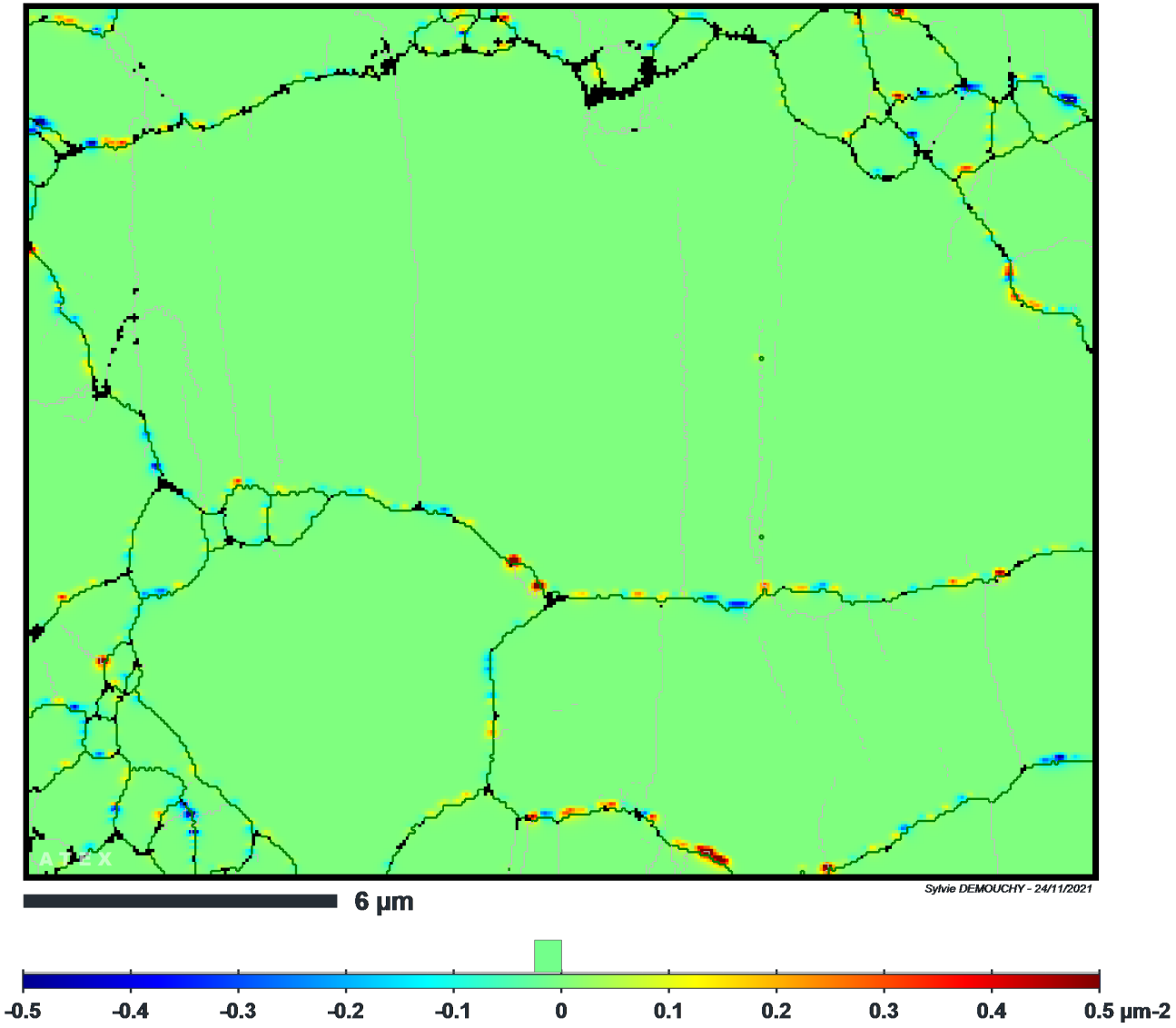
Entrywise Norm of the Nye Tensor



Step size: 0.06µm Resolution: 343x280 Index. Rate: 96%
Magnification: x3000 Tension: 17kV

CMT-16-12-SIII

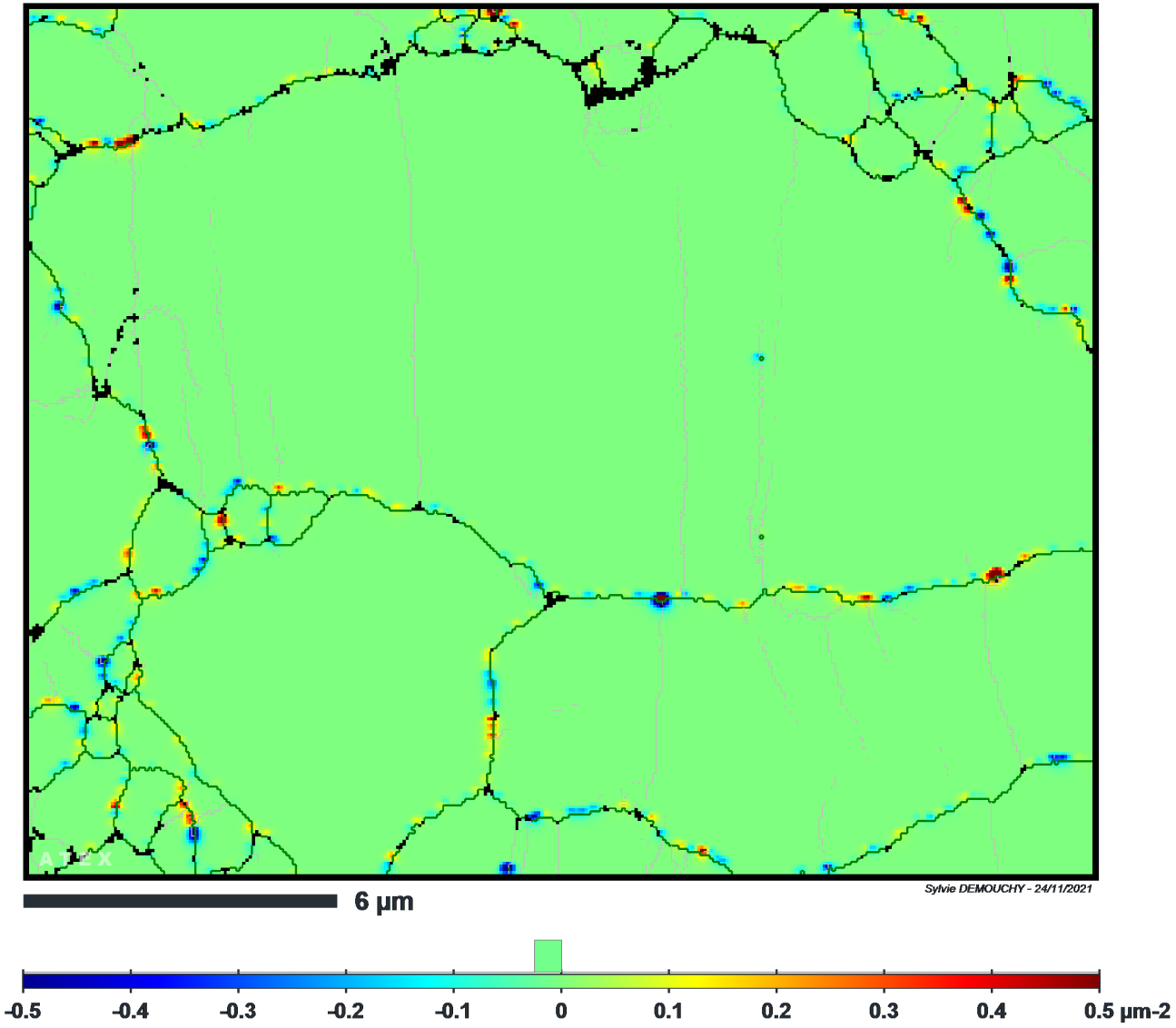
13 component Of Disclination Tensor



Step size: 0.06µm Resolution: 343x280 Index. Rate: 96%
Magnification: x3000 Tension: 17kV

CMT-16-12-SIII

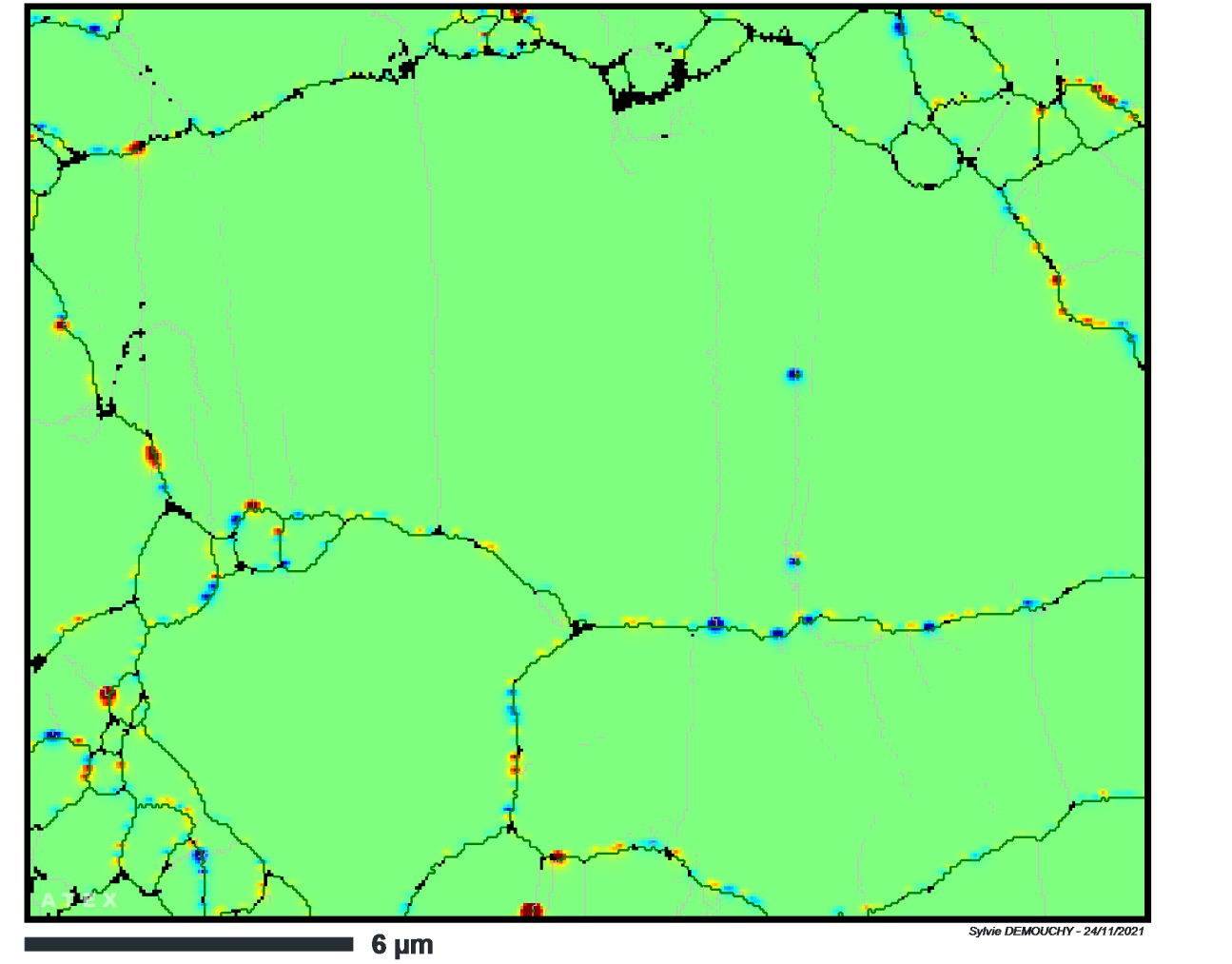
23 component Of Disclination Tensor

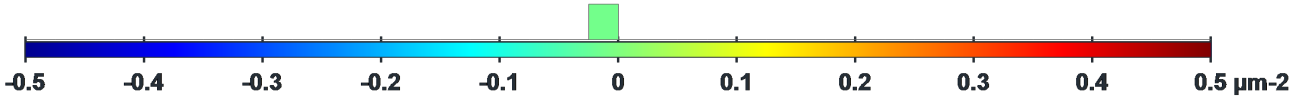


Step size: 0.06µm Resolution: 343x280 Index. Rate: 96%
Magnification: x3000 Tension: 17kV

CMT-16-12-SIII

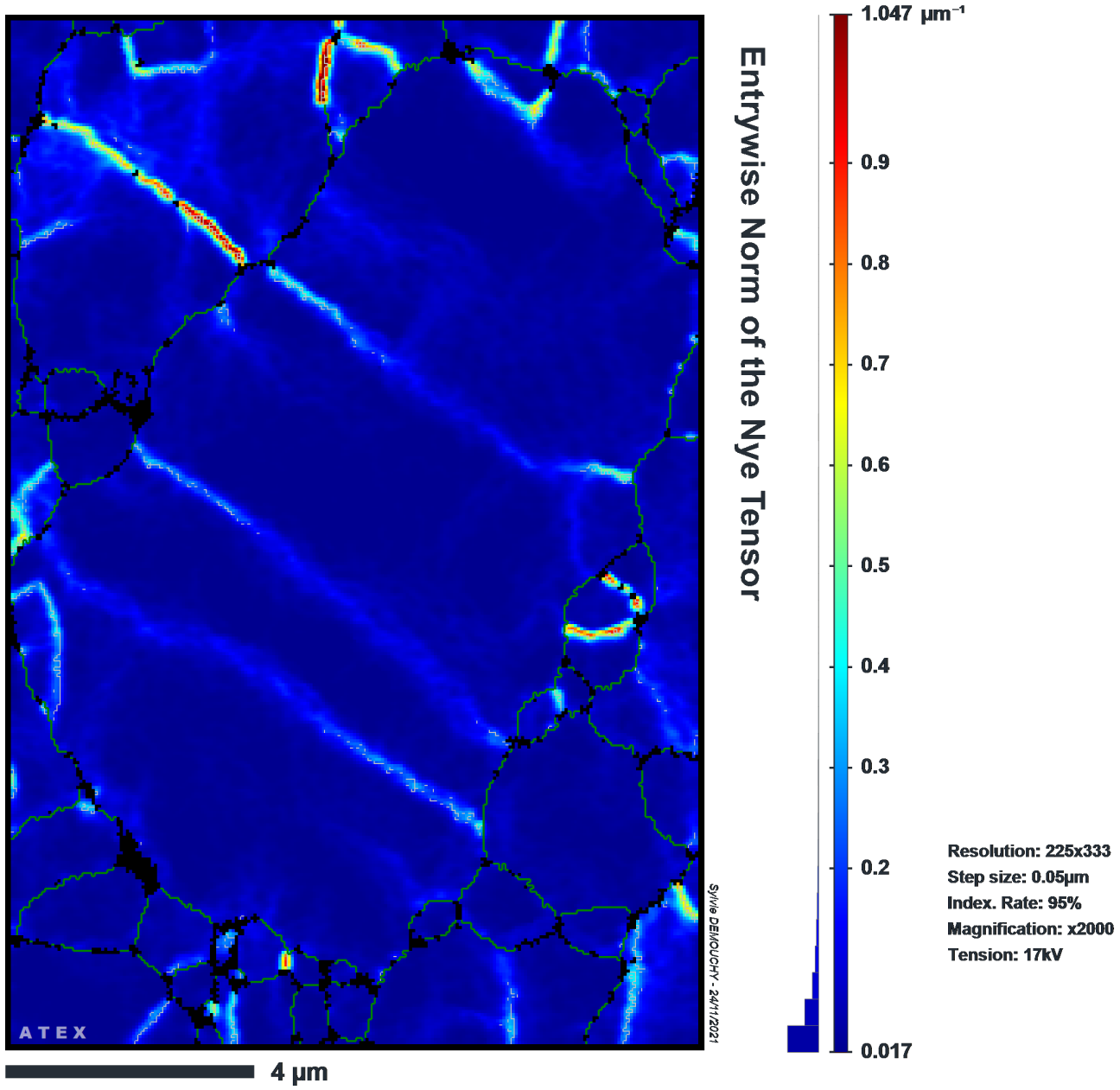
33 component Of Disclination Tensor



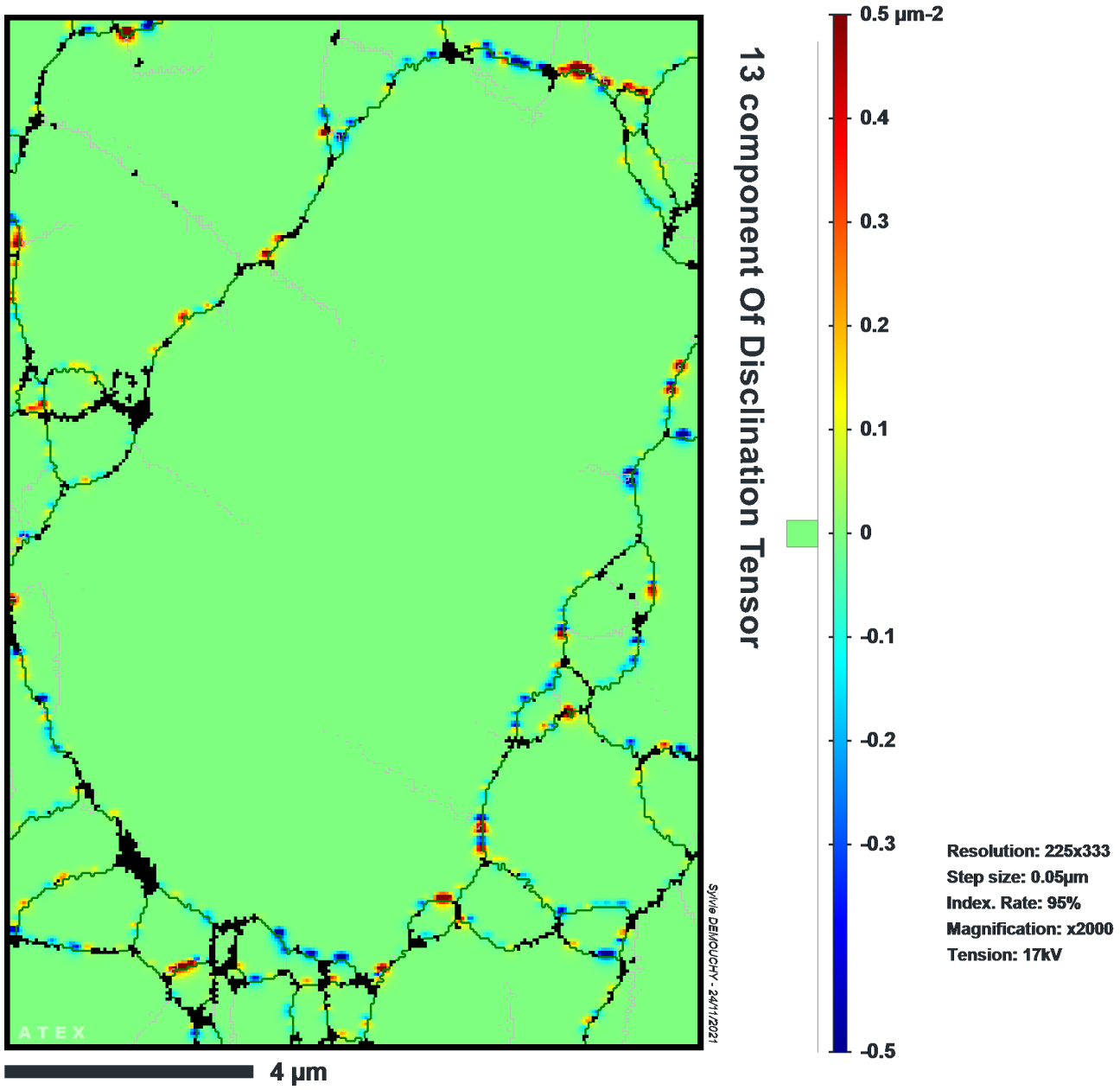


Step size: 0.06µm Resolution: 343x280 Index. Rate: 96%
Magnification: x3000 Tension: 17kV

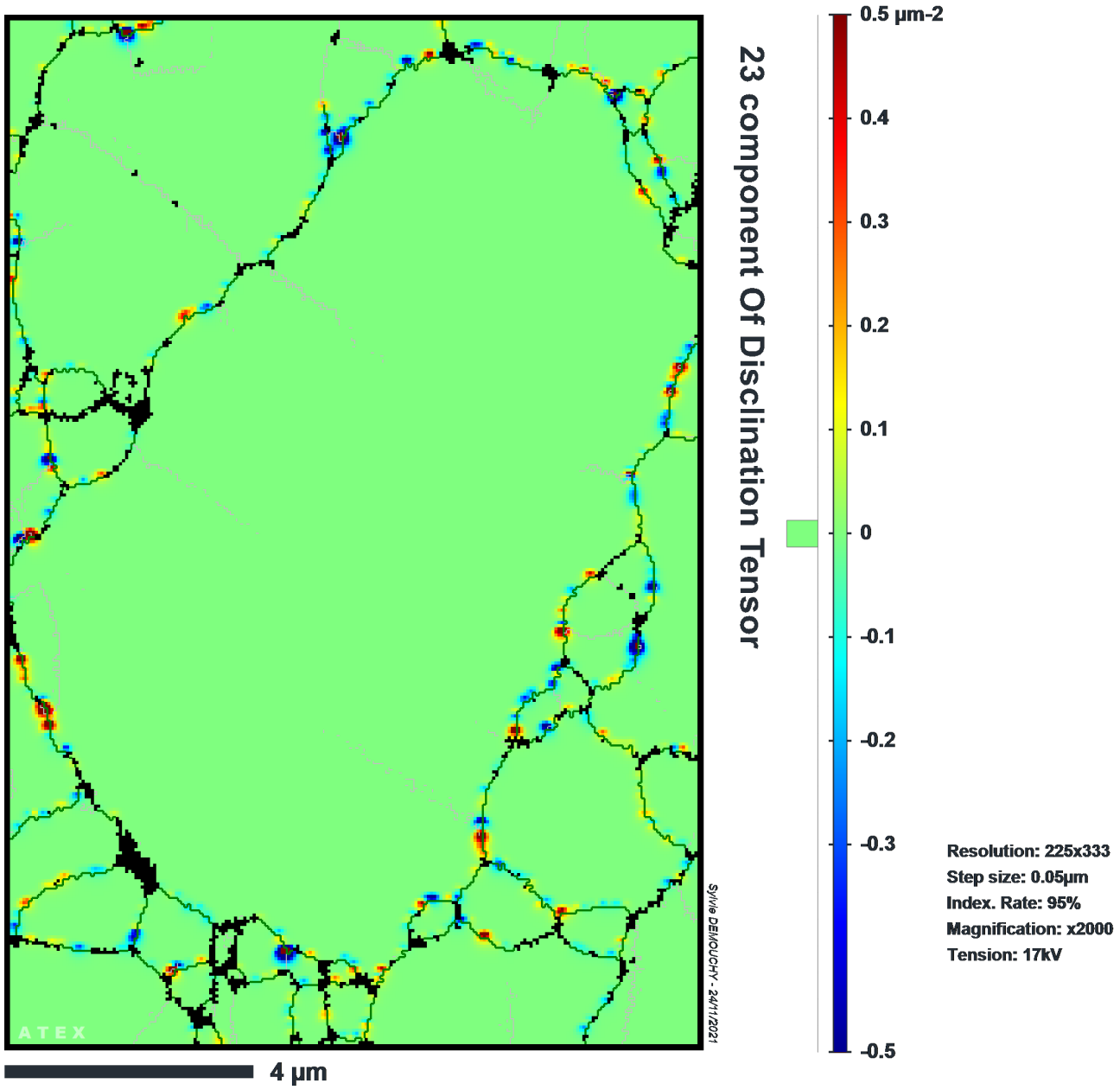
CMT-16-13-SII


ATEX
4 µm
Sylvie DELMOUCHY - 24/11/2021
Entrywise Norm of the Nye Tensor
1.047 µm⁻¹
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.017
Resolution: 225x333
Step size: 0.05µm
Index. Rate: 95%
Magnification: x2000
Tension: 17kV

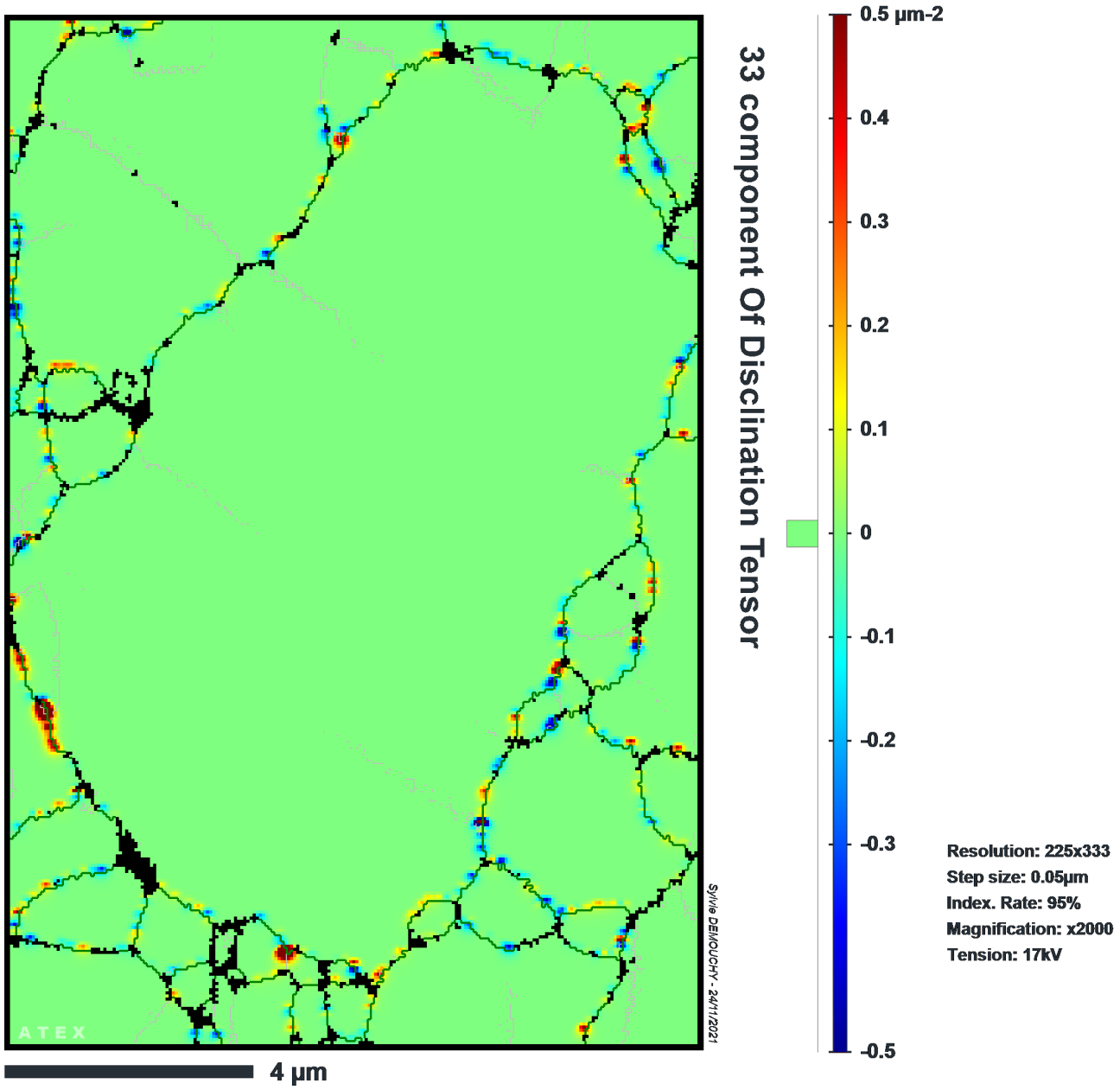
CMT-16-13-SII


13 component Of Disclination Tensor
0.5 µm-2
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.5
Resolution: 225x333
Step size: 0.05µm
Index. Rate: 95%
Magnification: x2000
Tension: 17kV
Sylvie DELMOUCHY - 24/11/2021
ATEX
4 µm

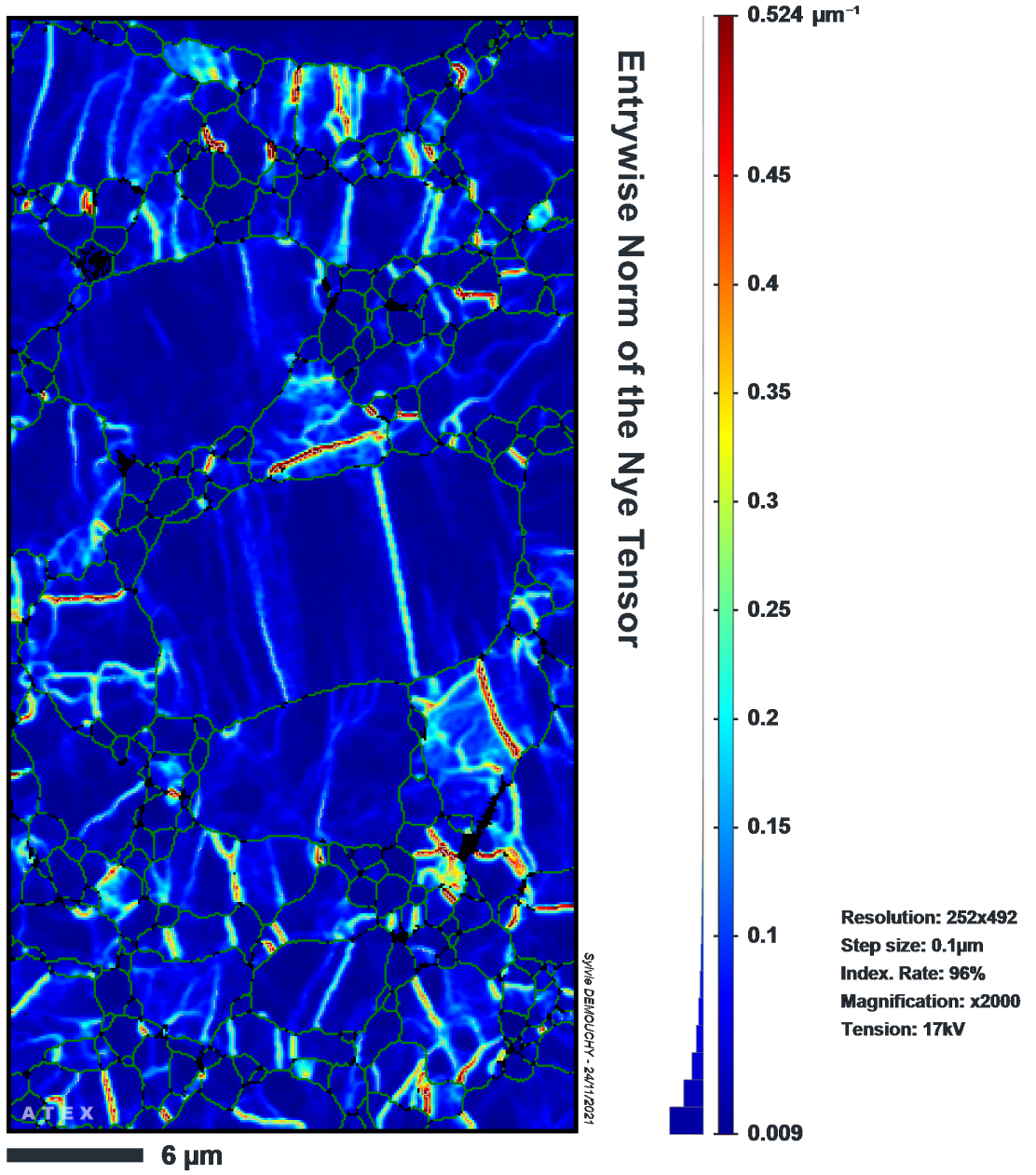
CMT-16-13-SII


23 component Of Disclination Tensor
0.5 µm-2
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.5
Resolution: 225x333
Step size: 0.05µm
Index. Rate: 95%
Magnification: x2000
Tension: 17kV
Sylvie DELMOUCHY - 24/11/2021
ATEX
4 µm

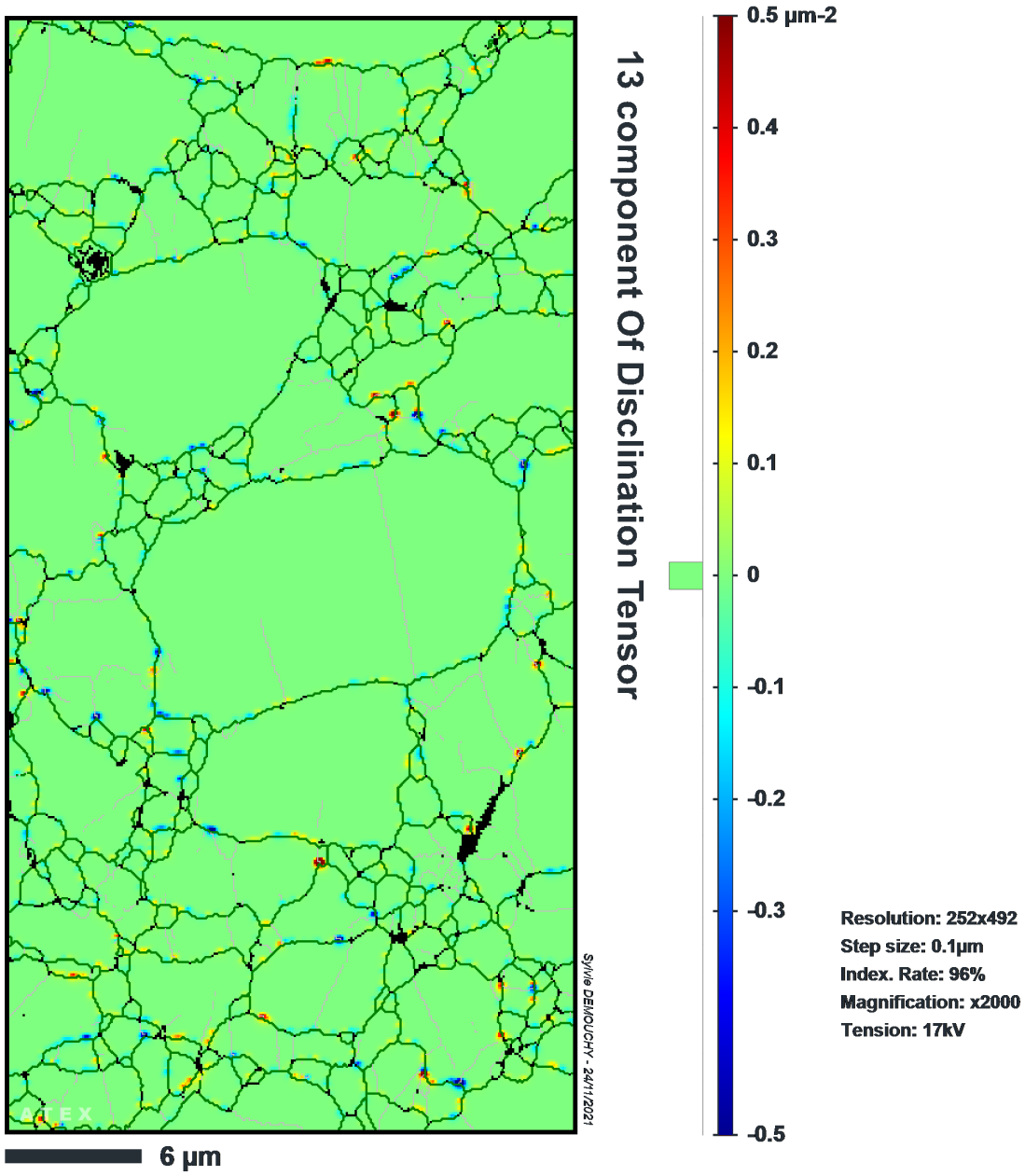
CMT-16-13-SII


33 component Of Disclination Tensor
0.5 µm-2
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.5
Resolution: 225x333
Step size: 0.05µm
Index. Rate: 95%
Magnification: x2000
Tension: 17kV
4 µm
ATEX
Sylvie DELMOUCHY - 24/11/2021

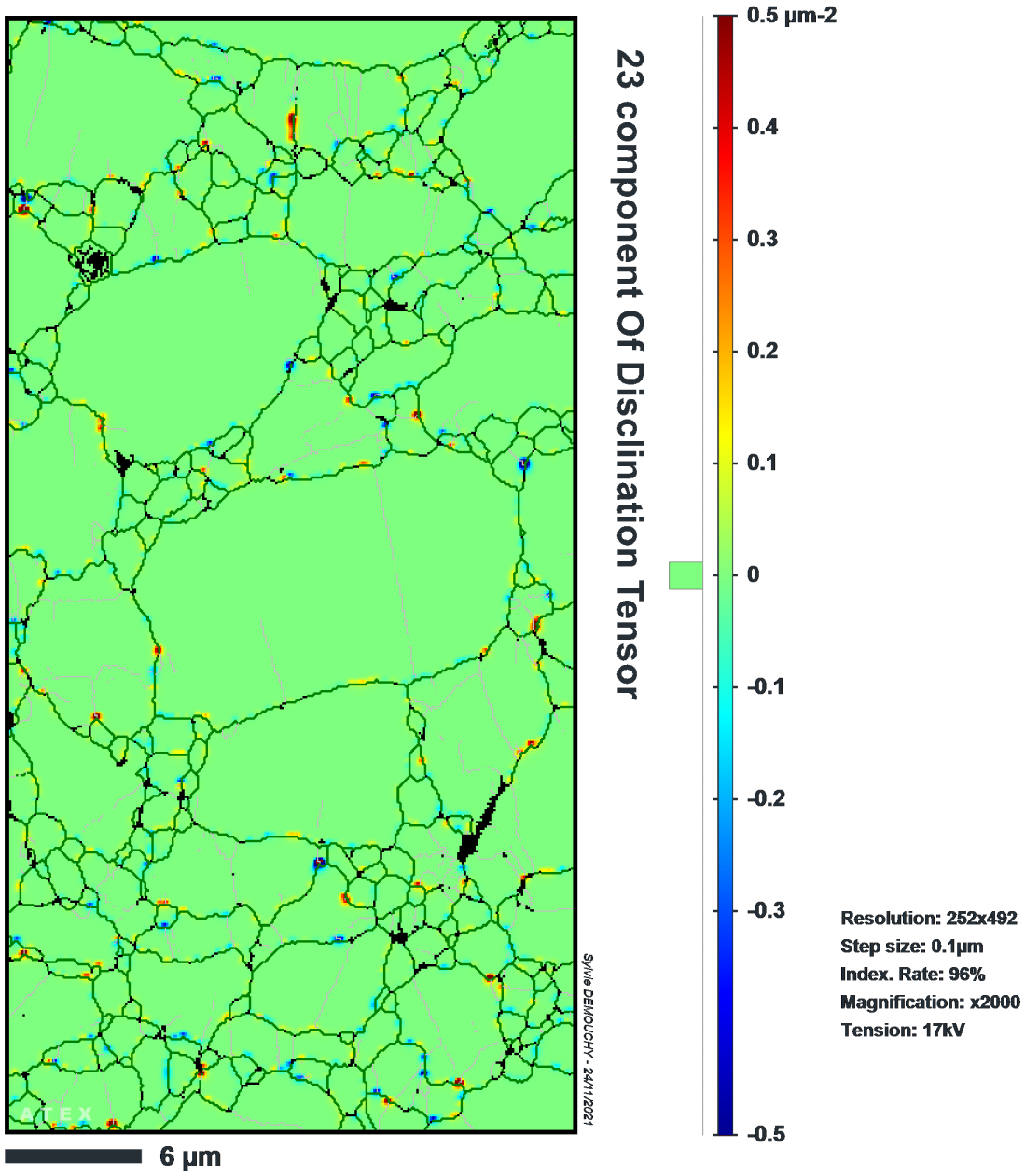
CMT-16-13-SIII



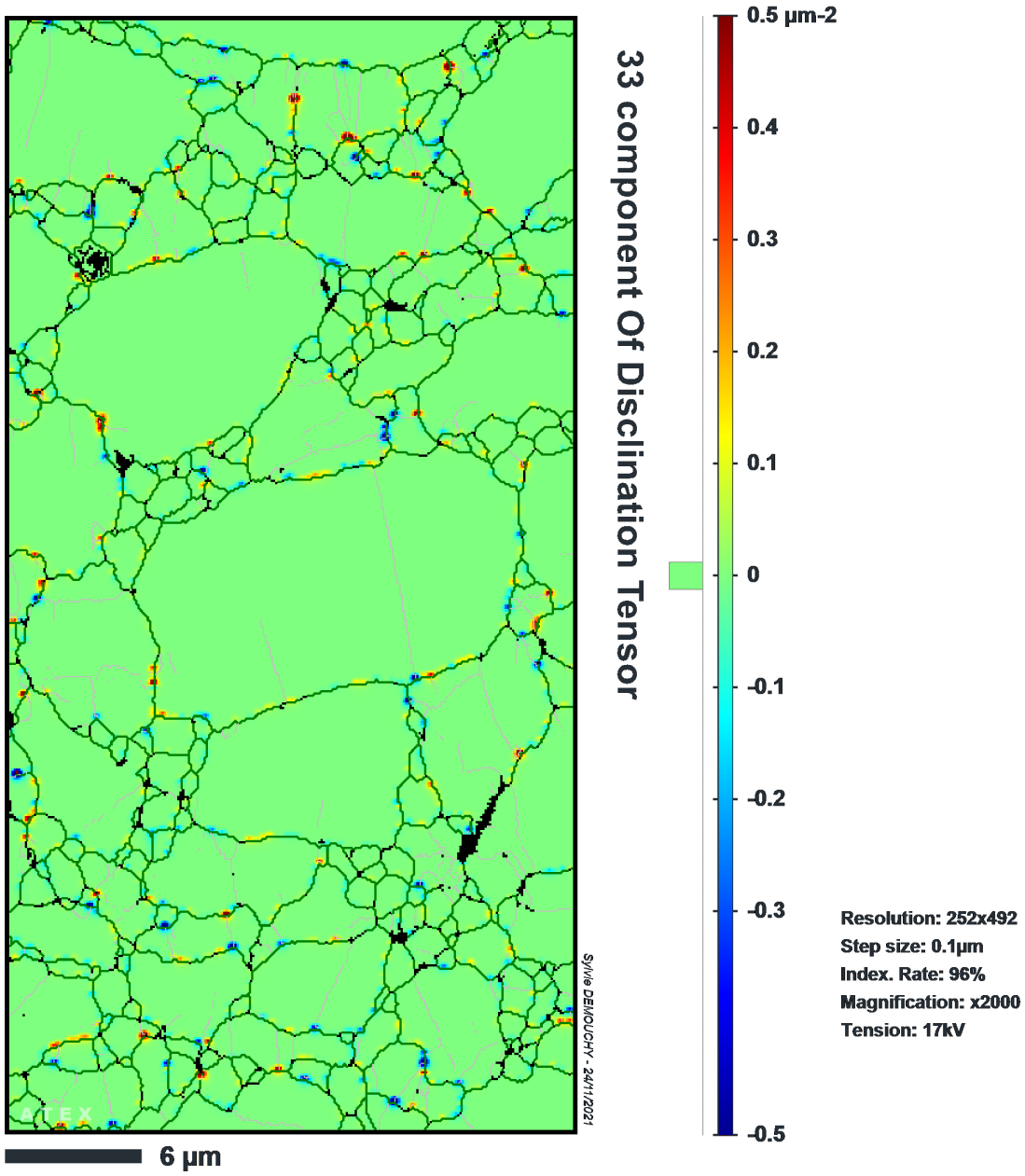
CMT-16-13-SIII



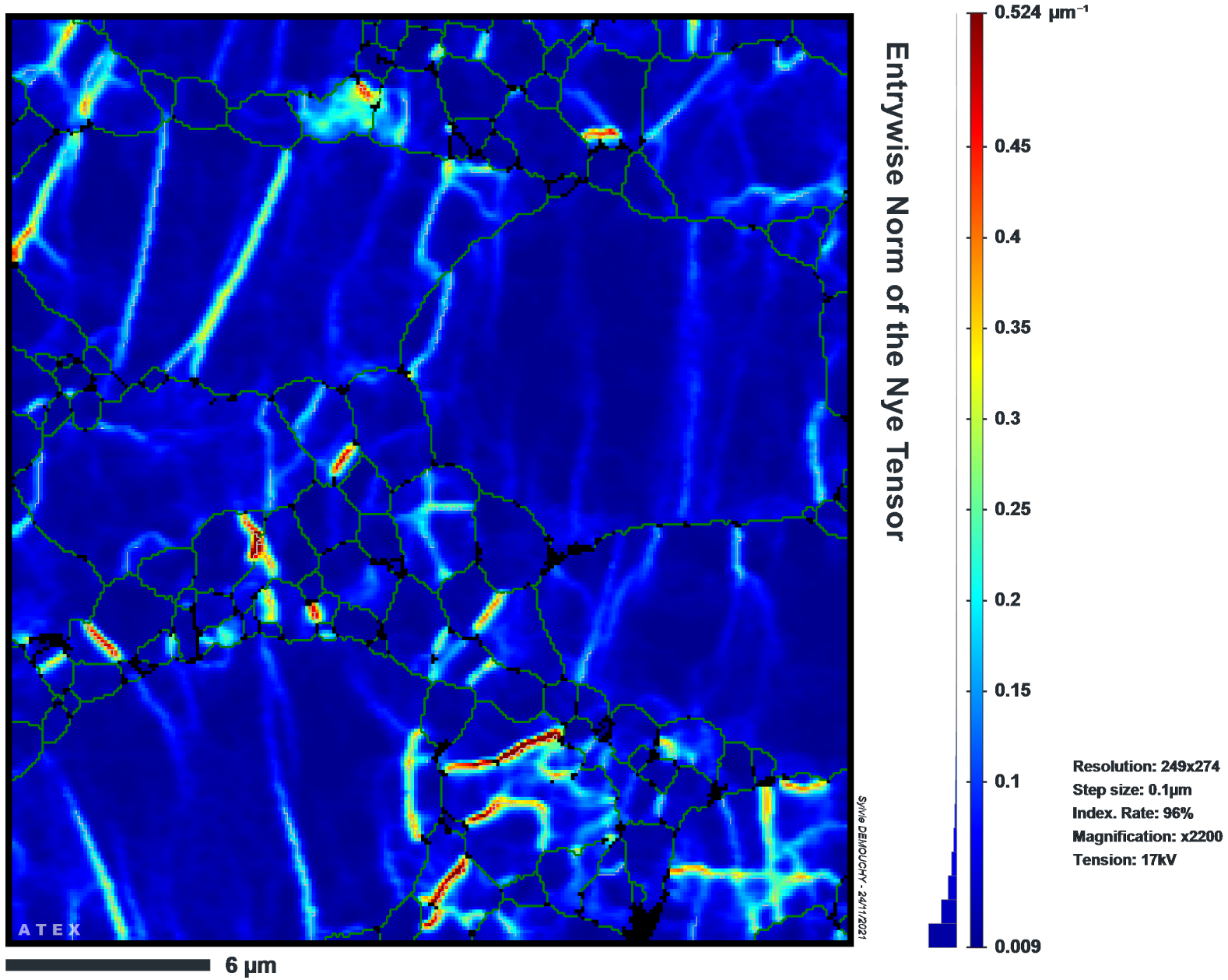
CMT-16-13-SIII



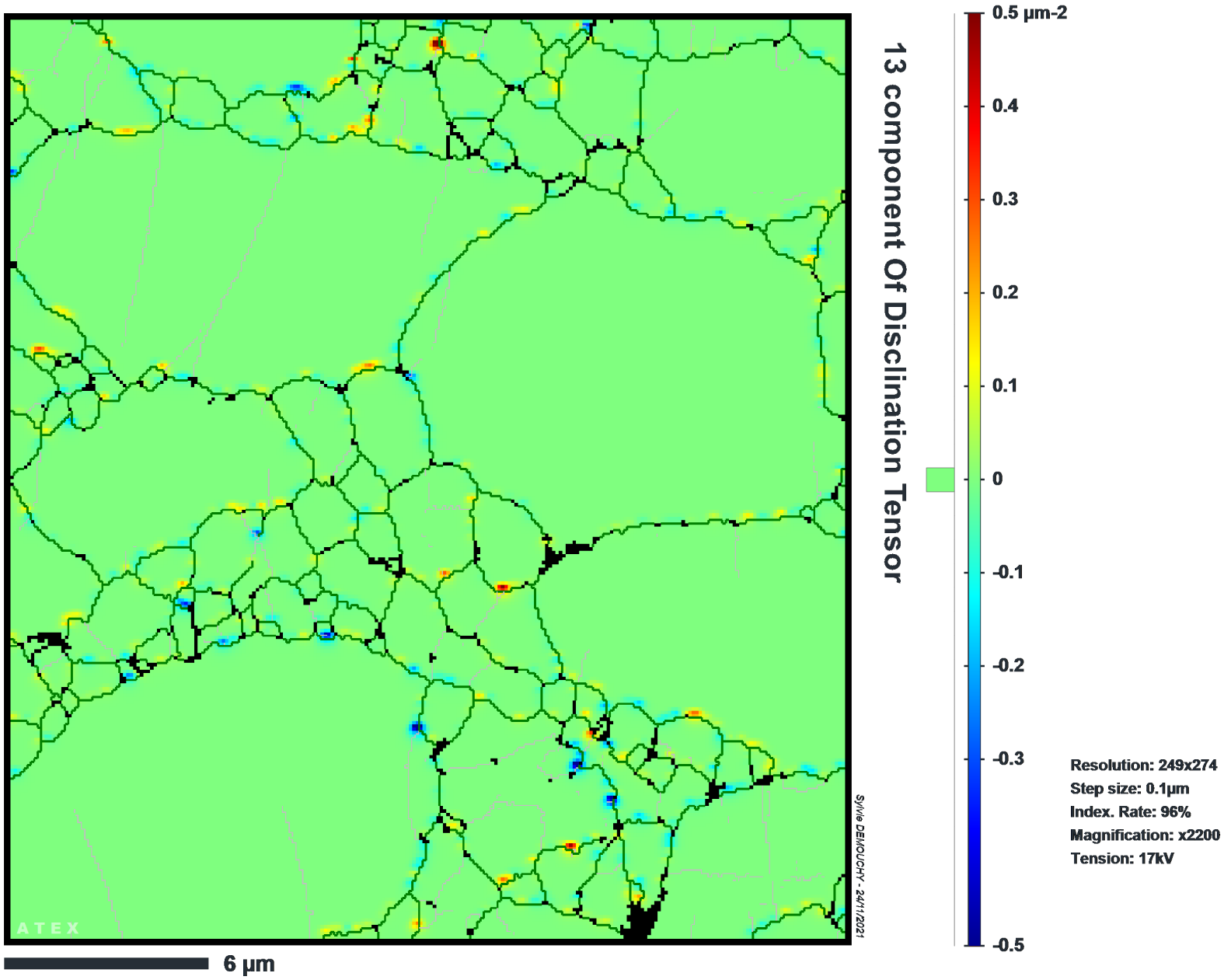
CMT-16-13-SIII



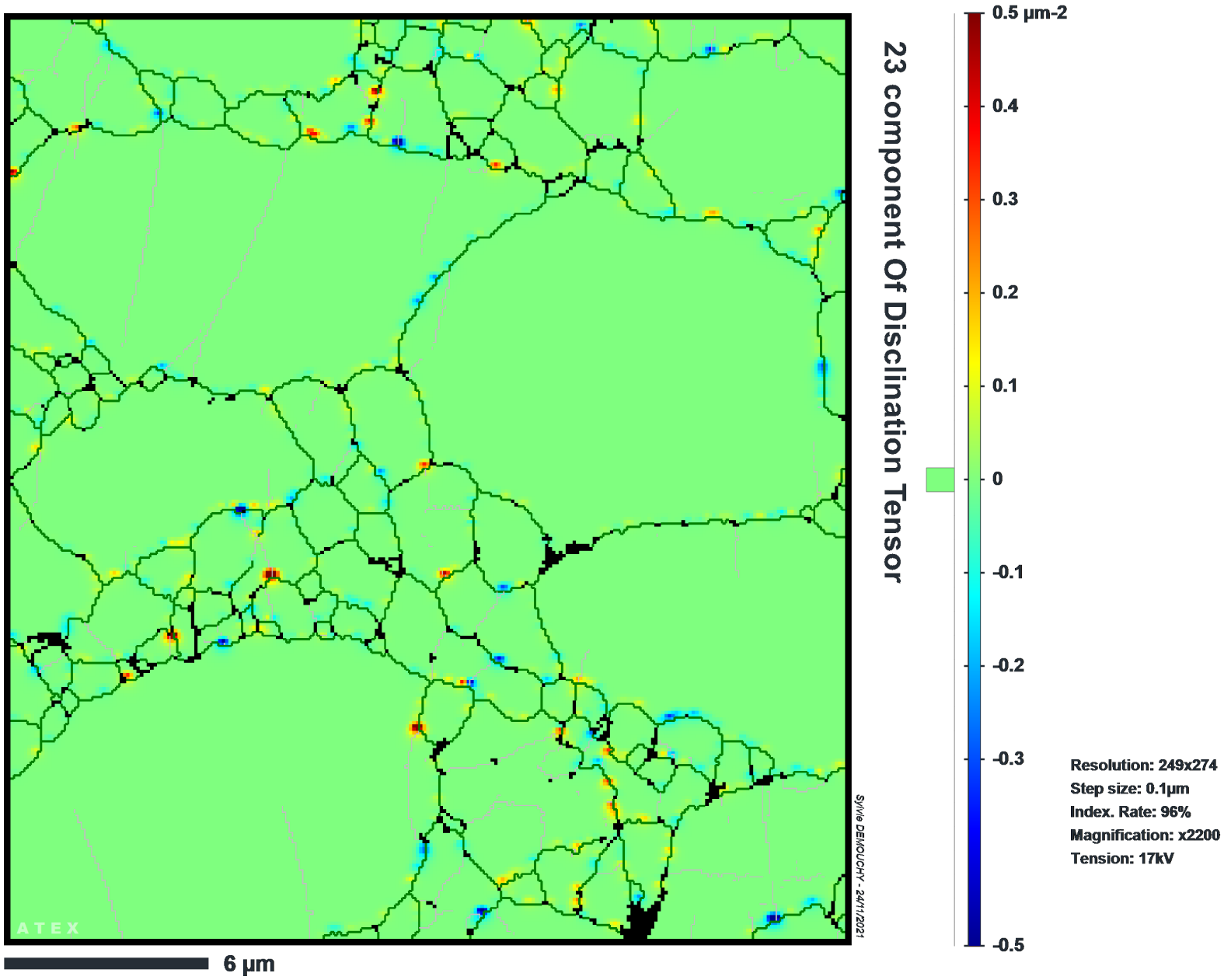
CMT-16-13-SIV


Entrywise Norm of the Nye Tensor
0.524 µm⁻¹
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.009
Resolution: 249x274
Step size: 0.1µm
Index. Rate: 96%
Magnification: x2200
Tension: 17kV
Sylvie DEMOUCHY - 24/11/2021
ATEX
6 µm

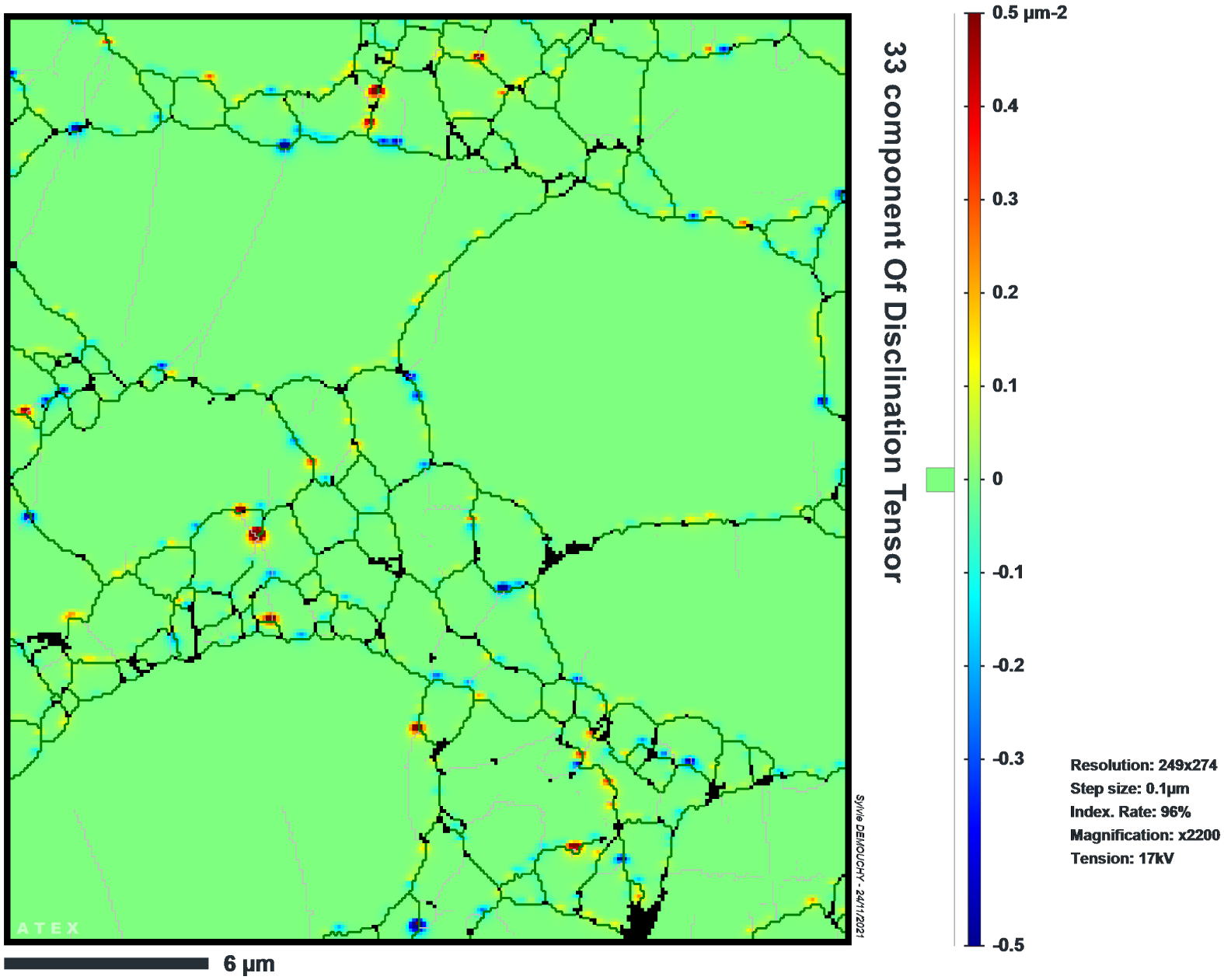
CMT-16-13-SIV


13 component Of Disclination Tensor
0.5 µm-2
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.5
Resolution: 249x274
Step size: 0.1µm
Index. Rate: 96%
Magnification: x2200
Tension: 17kV
Sylvie DELMOUCHY - 24/11/2021
ATEX
6 µm

CMT-16-13-SIV

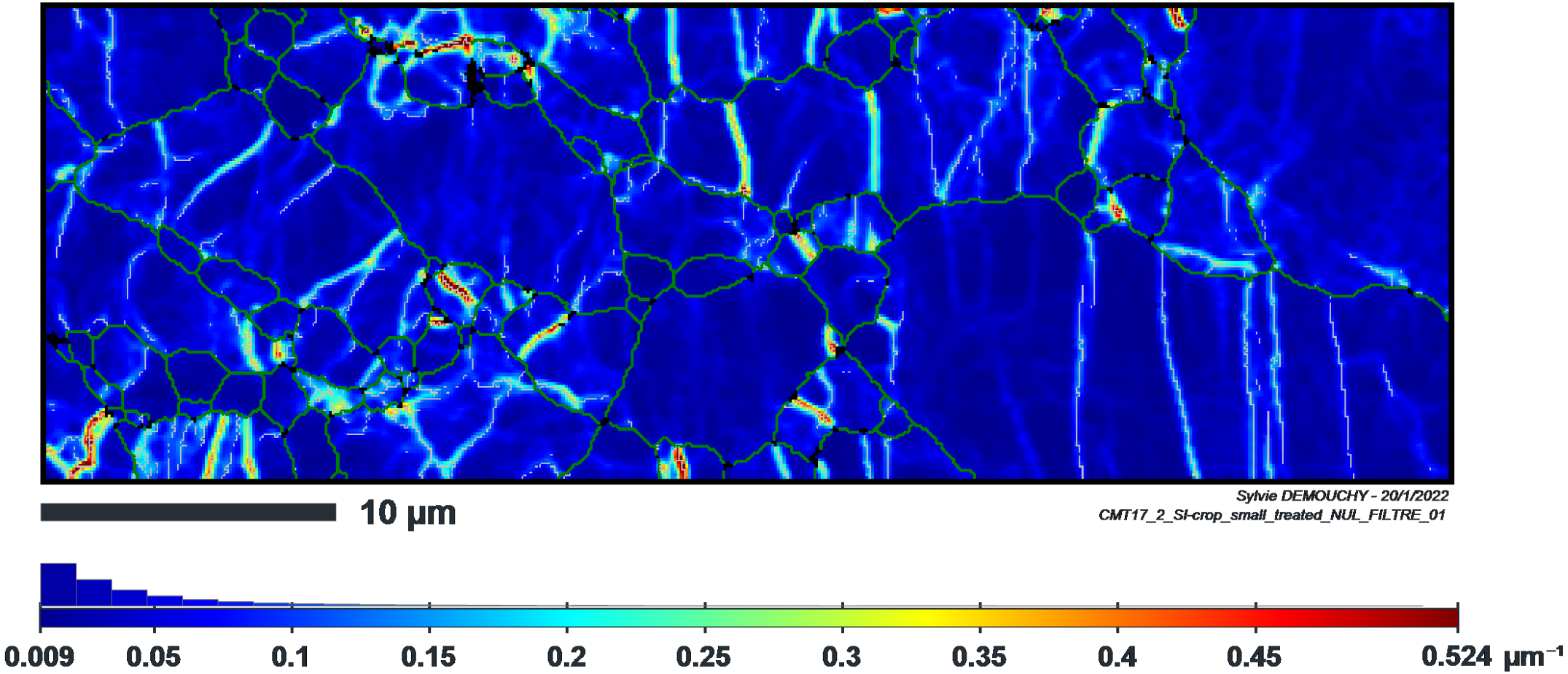

23 component Of Disclination Tensor
0.5 µm-2
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.5
Resolution: 249x274
Step size: 0.1µm
Index. Rate: 96%
Magnification: x2200
Tension: 17kV
Sylvie DELMOUCHY - 24/11/2021
ATEX
6 µm

CMT-16-13-SIV


33 component Of Disclination Tensor
0.5 µm-2
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.5
Resolution: 249x274
Step size: 0.1µm
Index. Rate: 96%
Magnification: x2200
Tension: 17kV
Sylvie DELMOUCHY - 24/11/2021
ATEX
6 µm

CMT-17-2-SII

Entrywise Norm of the Nye Tensor

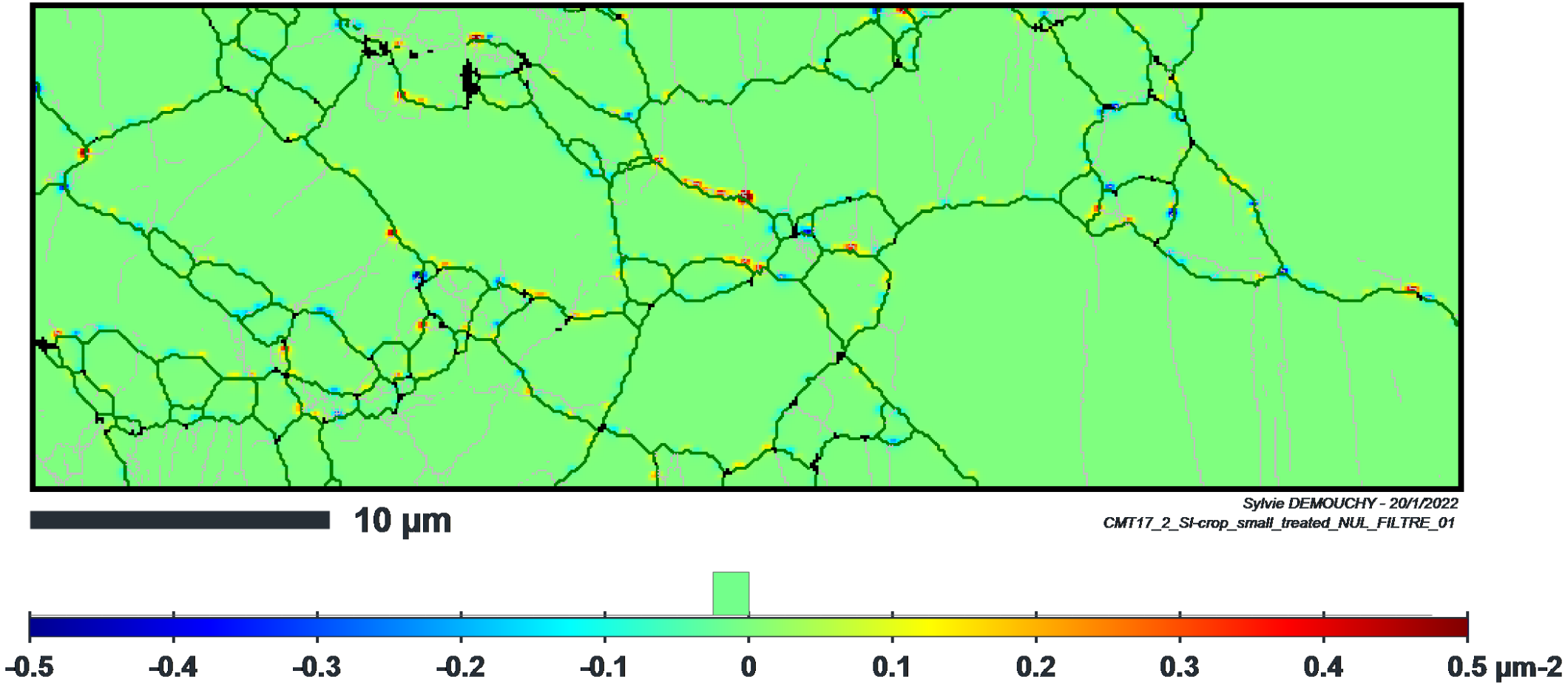


Step size: 0.1µm Resolution: 480x164 Index. Rate: 96% Magnification: x1500 Tension: 17kV

Minimum: 0 Maximum: 2.4 Average: 5.3×10^{-2} S. Dev: 1.1×10^{-1}

CMT-17-2-SII

13 component Of Disclination Tensor

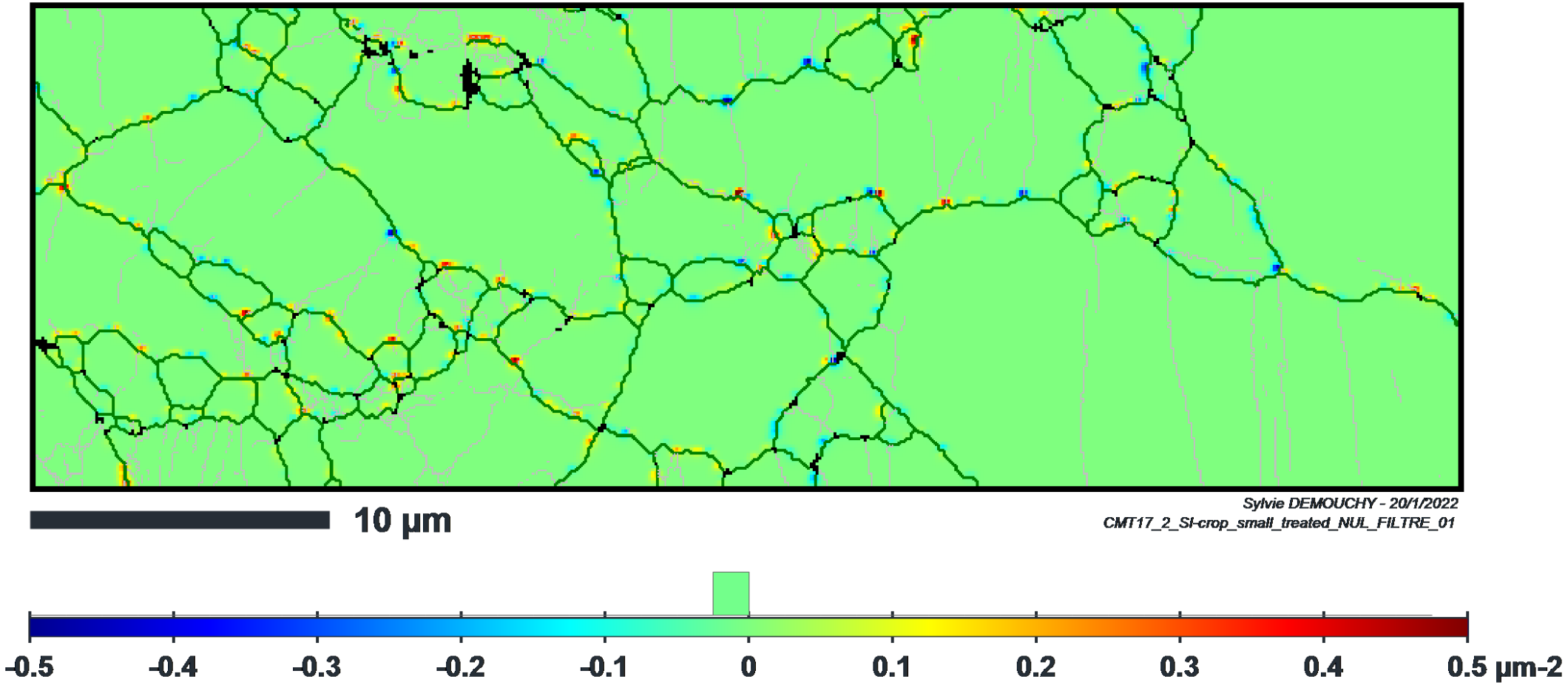


Step size: 0.1µm Resolution: 480x164 Index. Rate: 96% Magnification: x1500 Tension: 17kV

Minimum: -12.38 Maximum: 17.86 Average: 0 S. Dev: 0.14

CMT-17-2-SII

23 component Of Disclination Tensor

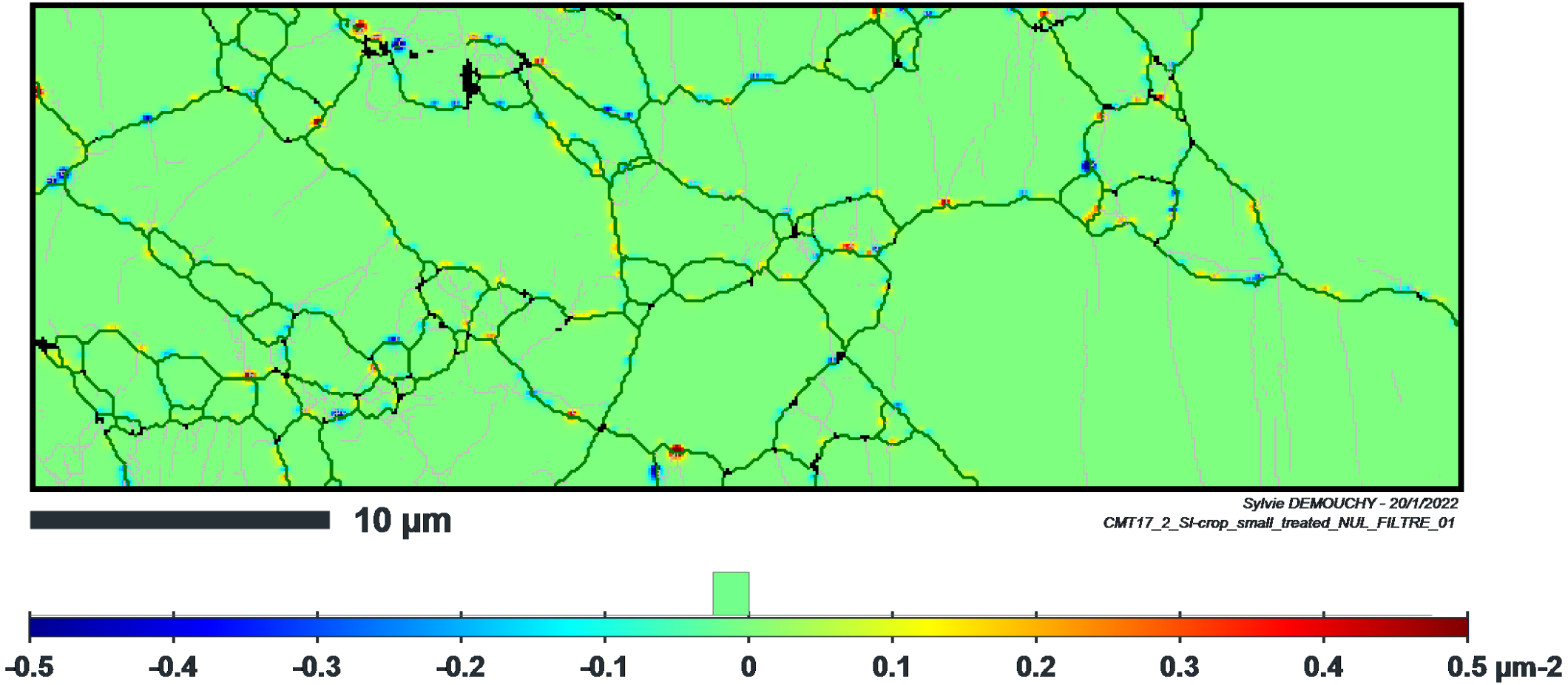


Step size: 0.1µm Resolution: 480x164 Index. Rate: 96% Magnification: x1500 Tension: 17kV

Minimum: -7.83 Maximum: 10.56 Average: 0 S. Dev: 0.14

CMT-17-2-SII

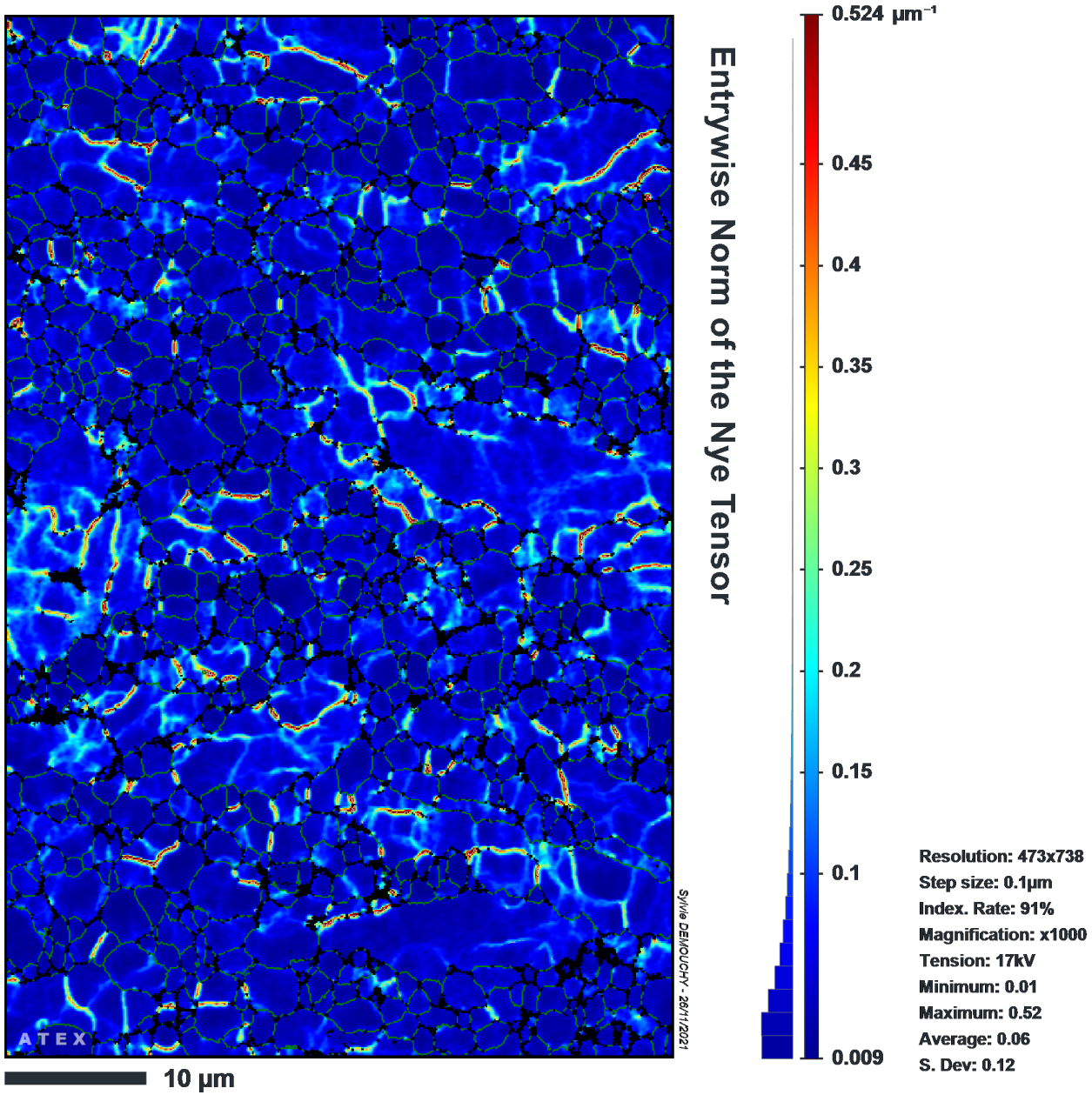
33 component Of Disclination Tensor



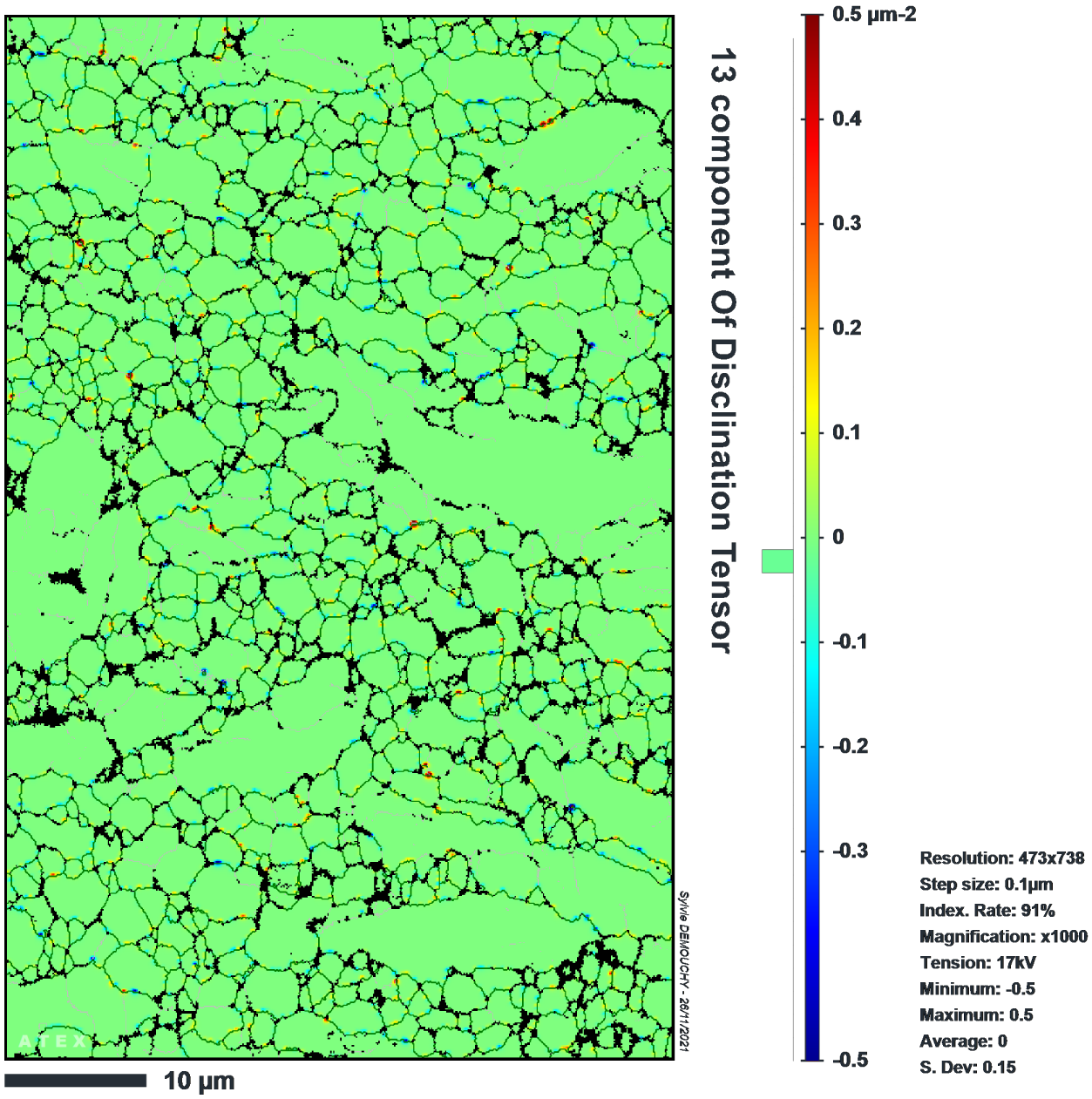
Step size: 0.1µm Resolution: 480x164 Index. Rate: 96% Magnification: x1500 Tension: 17kV

Minimum: -14.46 Maximum: 15.07 Average: 0 S. Dev: 0.16

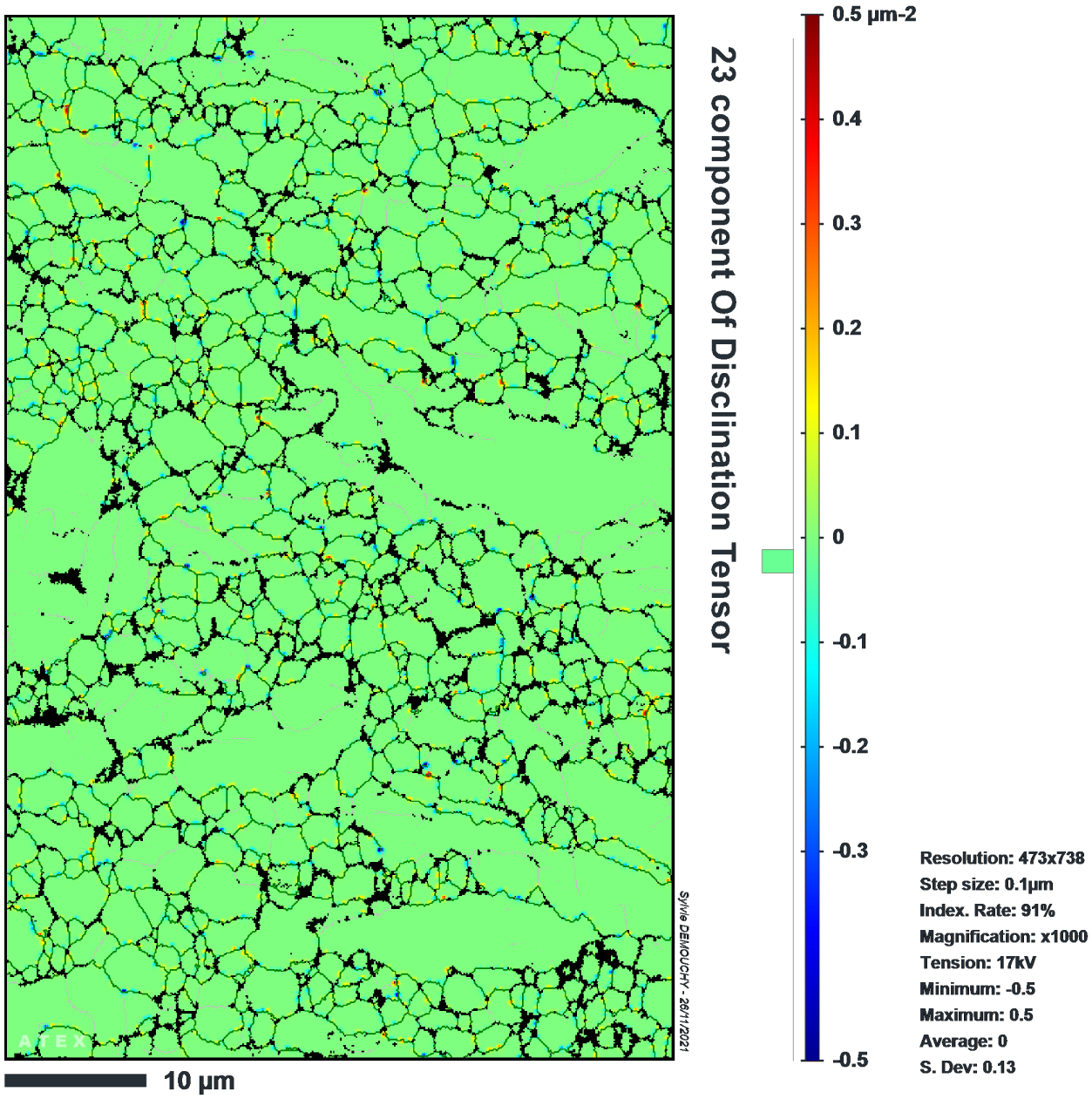
PI0546-III


Entrywise Norm of the Nye Tensor
0.524 µm⁻¹
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.009
Resolution: 473x738
Step size: 0.1µm
Index. Rate: 91%
Magnification: x1000
Tension: 17kV
Minimum: 0.01
Maximum: 0.52
Average: 0.06
S. Dev: 0.12
ATEX
Sylvie DEMOUCHY - 26/11/2021
10 µm

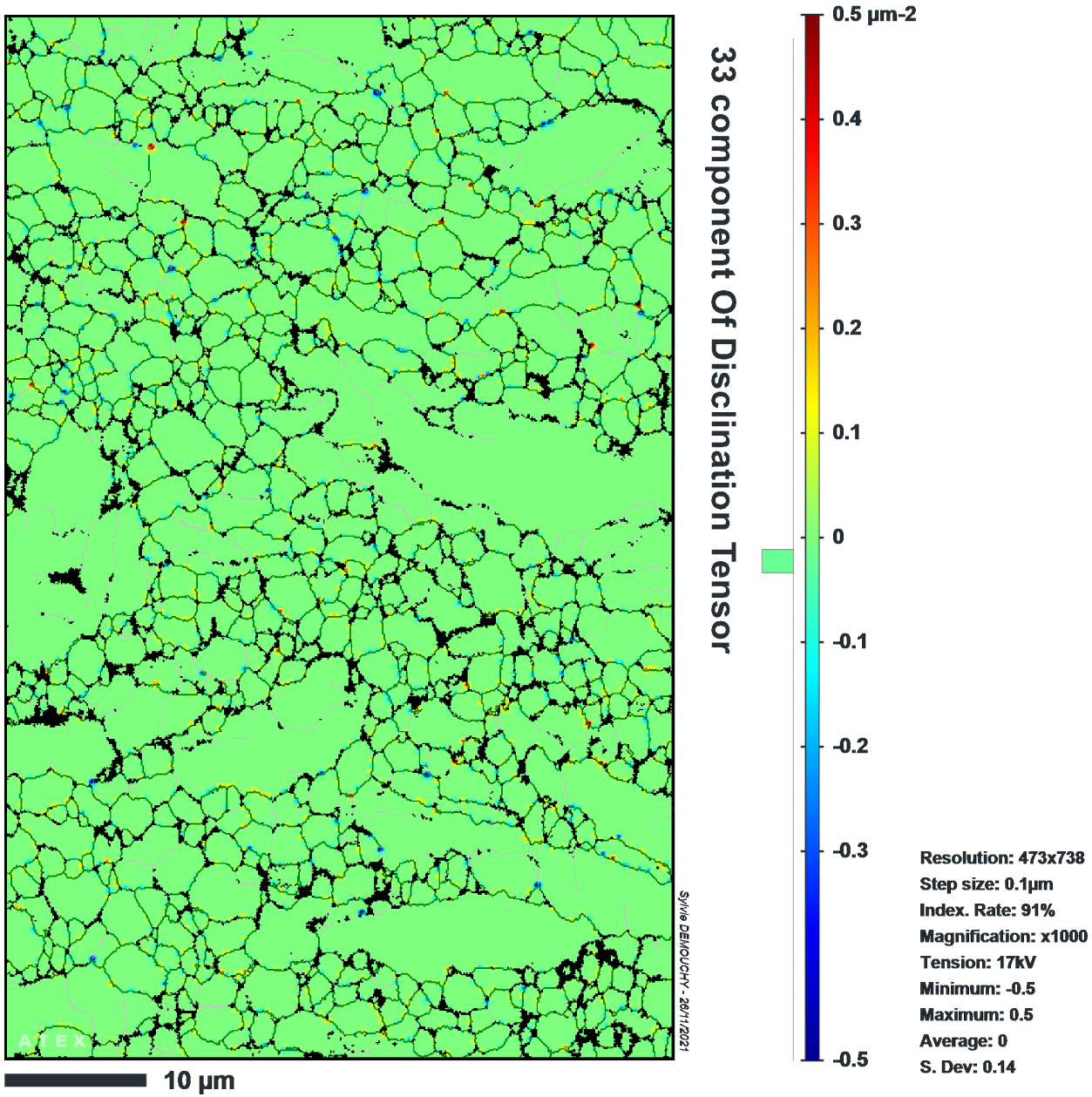
PI0546-III


13 component Of Disclination Tensor
0.5 µm-2
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.5
Resolution: 473x738
Step size: 0.1µm
Index. Rate: 91%
Magnification: x1000
Tension: 17kV
Minimum: -0.5
Maximum: 0.5
Average: 0
S. Dev: 0.15
10 µm
Sylvie DEMOUCHY - 26/11/2021
ATEX

PI0546-III

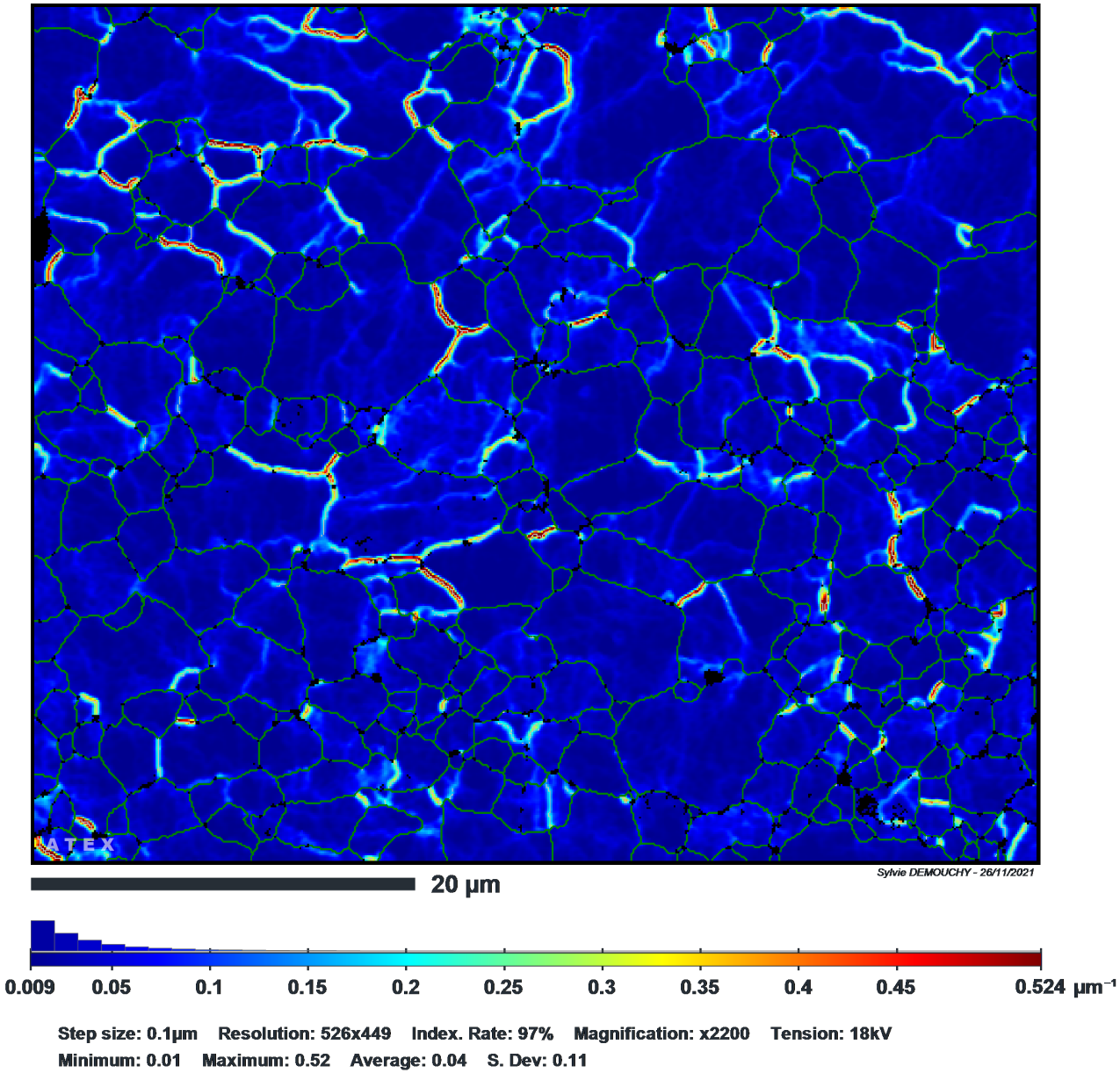

23 component Of Disclination Tensor
0.5 µm-2
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.5
Resolution: 473x738
Step size: 0.1µm
Index. Rate: 91%
Magnification: x1000
Tension: 17kV
Minimum: -0.5
Maximum: 0.5
Average: 0
S. Dev: 0.13
10 µm
Sylvie DEMOUCHY - 26/11/2021
ATEX

PI0546-III


33 component Of Disclination Tensor
0.5 µm-2
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.5
Resolution: 473x738
Step size: 0.1µm
Index. Rate: 91%
Magnification: x1000
Tension: 17kV
Minimum: -0.5
Maximum: 0.5
Average: 0
S. Dev: 0.14
10 µm
Sylvie DEMOUCHY - 26/11/2021

PI0546-IX

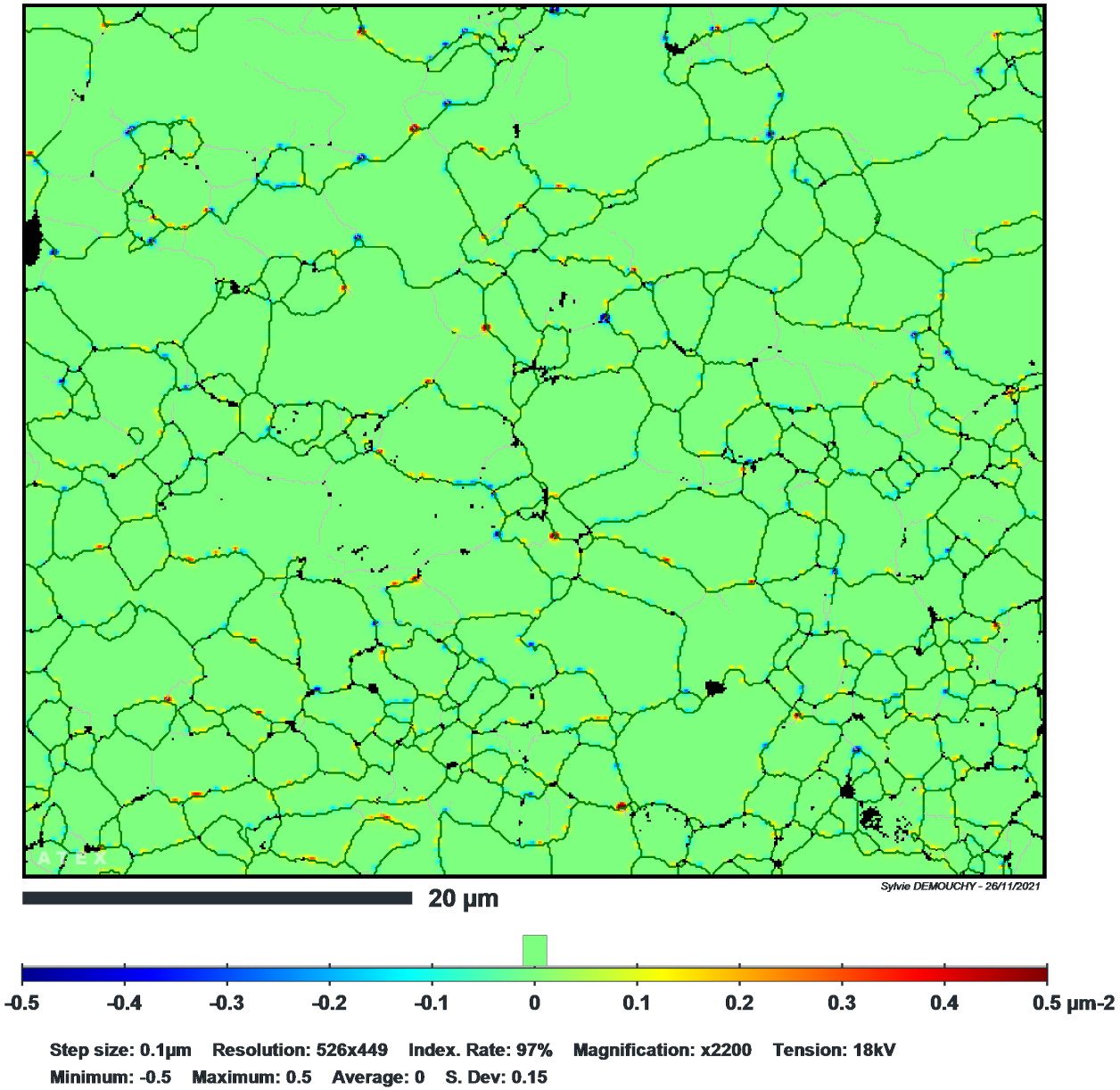
Entrywise Norm of the Nye Tensor



Step size: 0.1µm Resolution: 526x449 Index. Rate: 97% Magnification: x2200 Tension: 18kV
Minimum: 0.01 Maximum: 0.52 Average: 0.04 S. Dev: 0.11

PI0546-IX

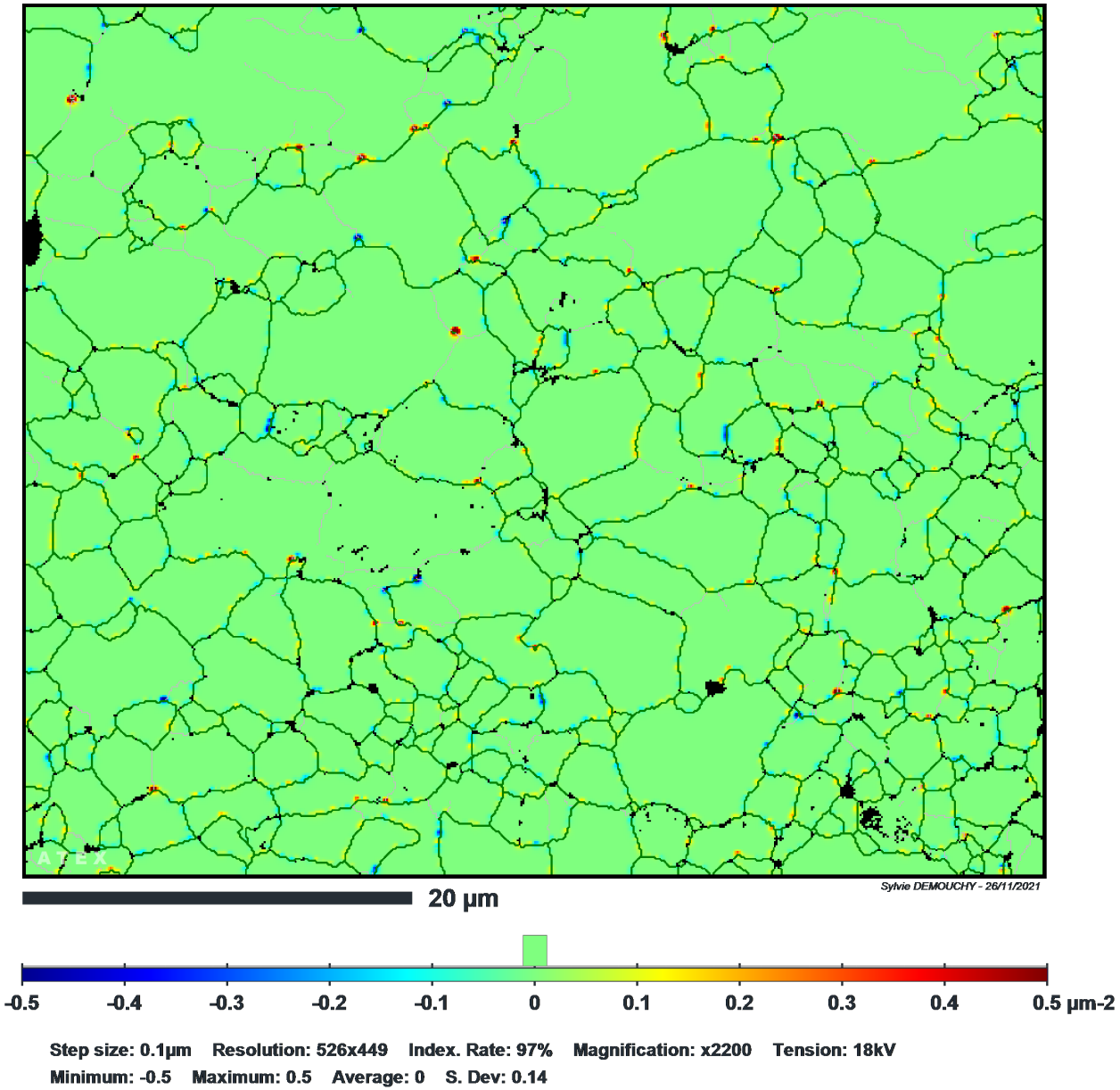
13 component Of Disclination Tensor



Step size: 0.1µm Resolution: 526x449 Index. Rate: 97% Magnification: x2200 Tension: 18kV
Minimum: -0.5 Maximum: 0.5 Average: 0 S. Dev: 0.15

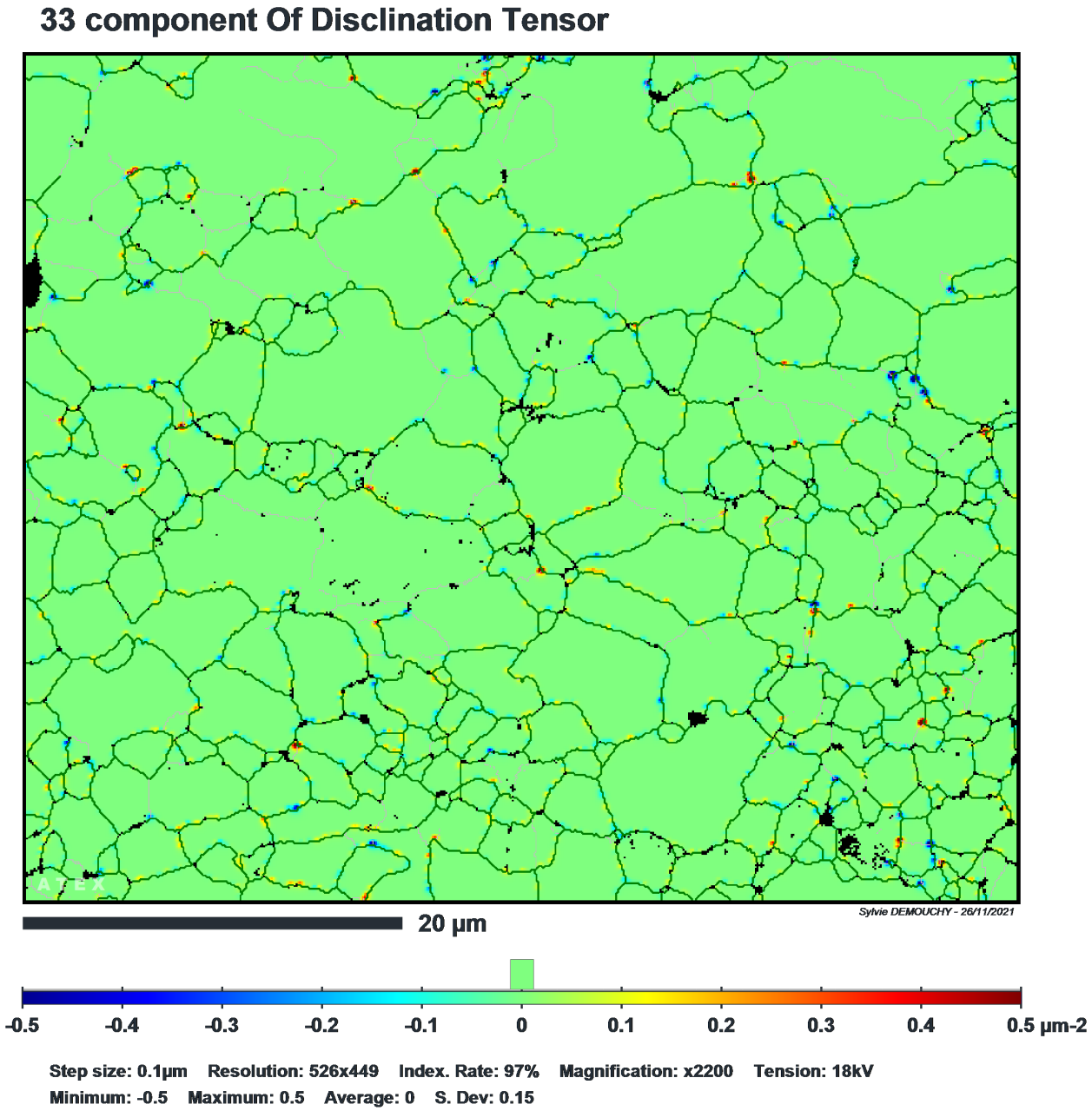
PI0546-IX

23 component Of Disclination Tensor



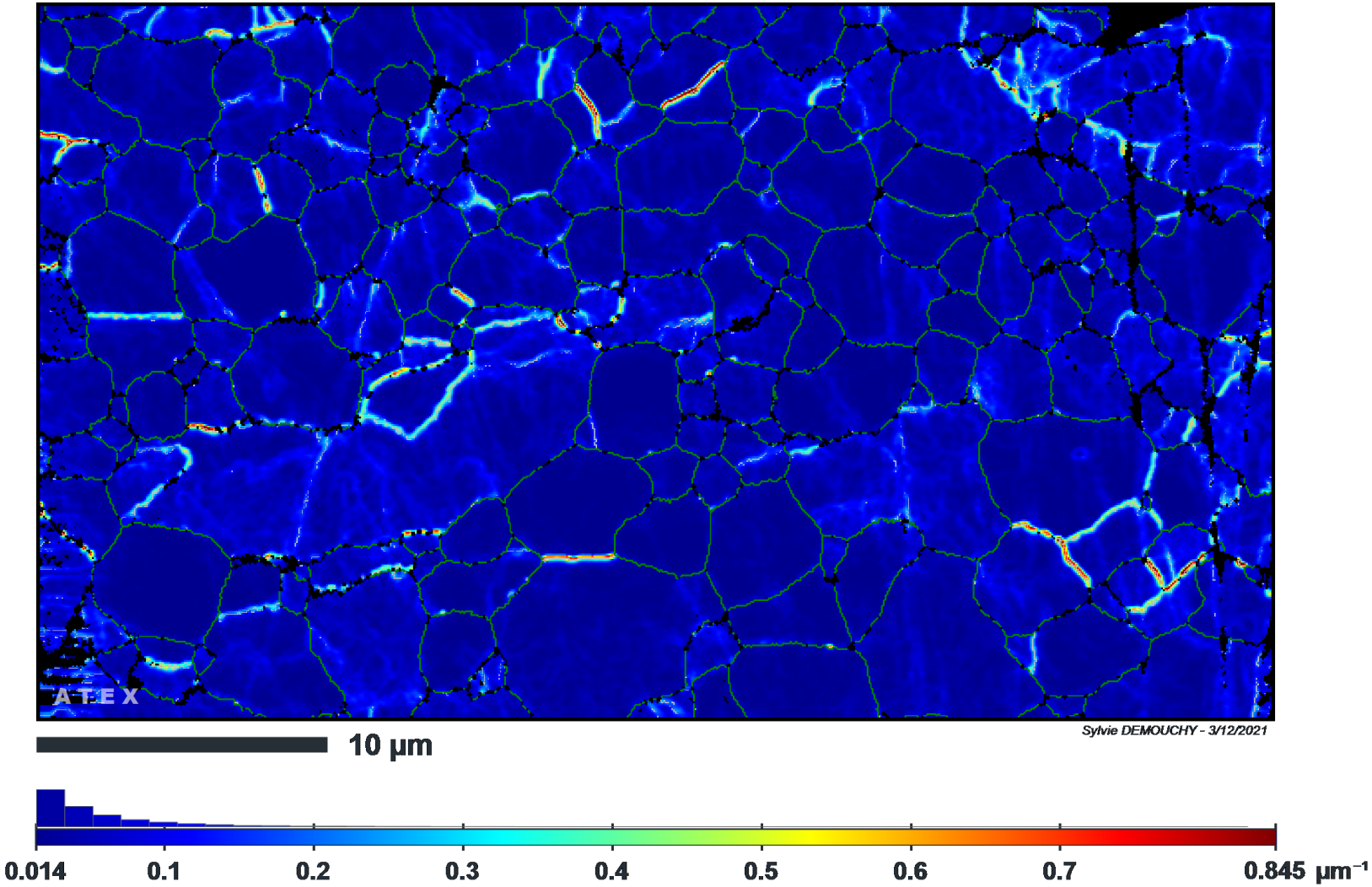
Step size: 0.1µm Resolution: 526x449 Index. Rate: 97% Magnification: x2200 Tension: 18kV
Minimum: -0.5 Maximum: 0.5 Average: 0 S. Dev: 0.14

PI0546-IX


33 component Of Disclination Tensor
Sylvie DEMOUCHY - 26/11/2021
20 µm
-0.5
-0.4
-0.3
-0.2
-0.1
0
0.1
0.2
0.3
0.4
0.5 µm-2
Step size: 0.1µm Resolution: 526x449 Index. Rate: 97% Magnification: x2200 Tension: 18kV
Minimum: -0.5 Maximum: 0.5 Average: 0 S. Dev: 0.15

PI0546-V

Entrywise Norm of the Nye Tensor

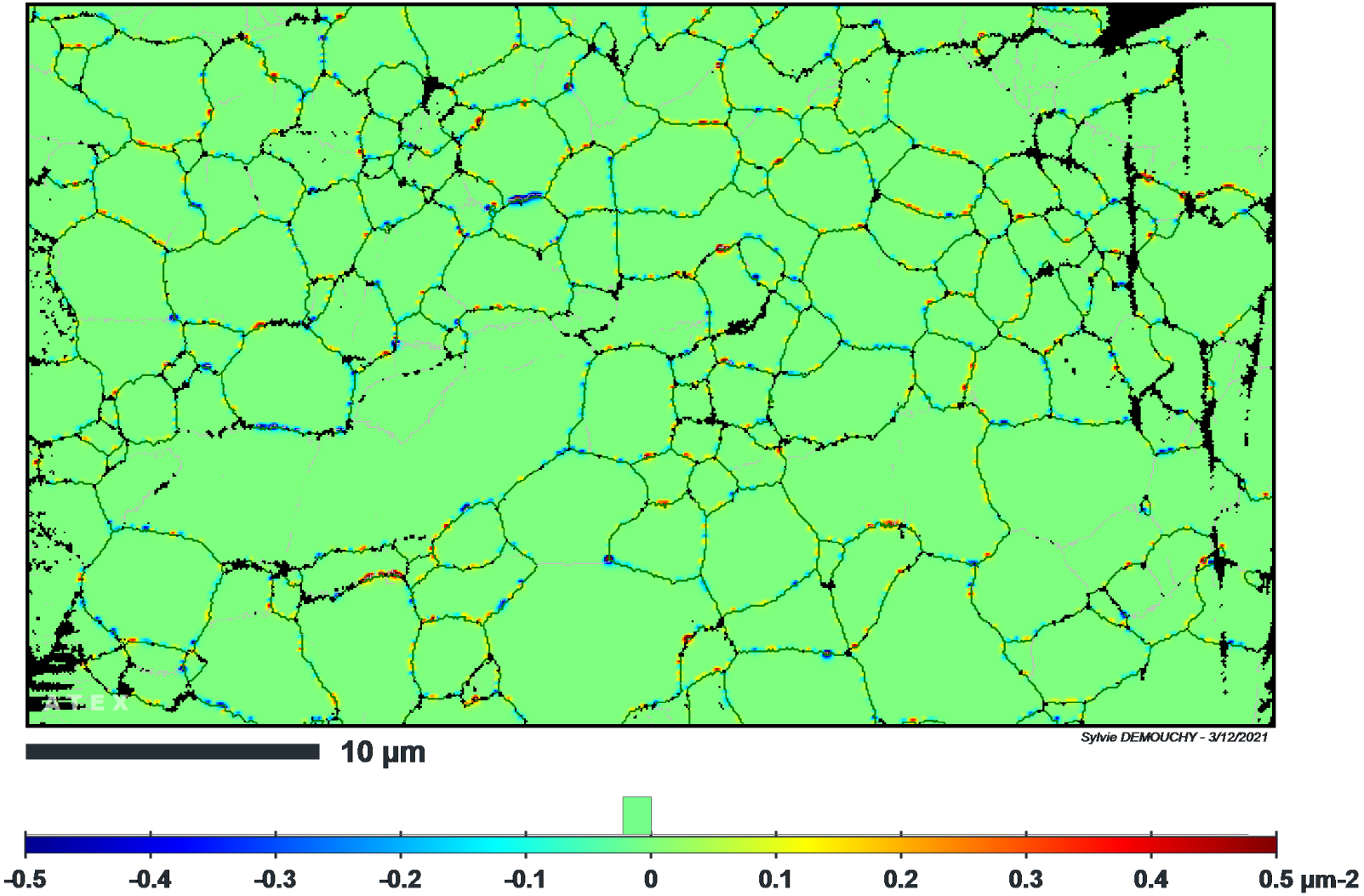


Step size: 0.062µm Resolution: 687x399 Index. Rate: 95% Magnification: x2500 Tension: 18kV

Minimum: 0.01 Maximum: 0.84 Average: 0.06 S. Dev: 0.12

PI0546-V

13 component Of Disclination Tensor

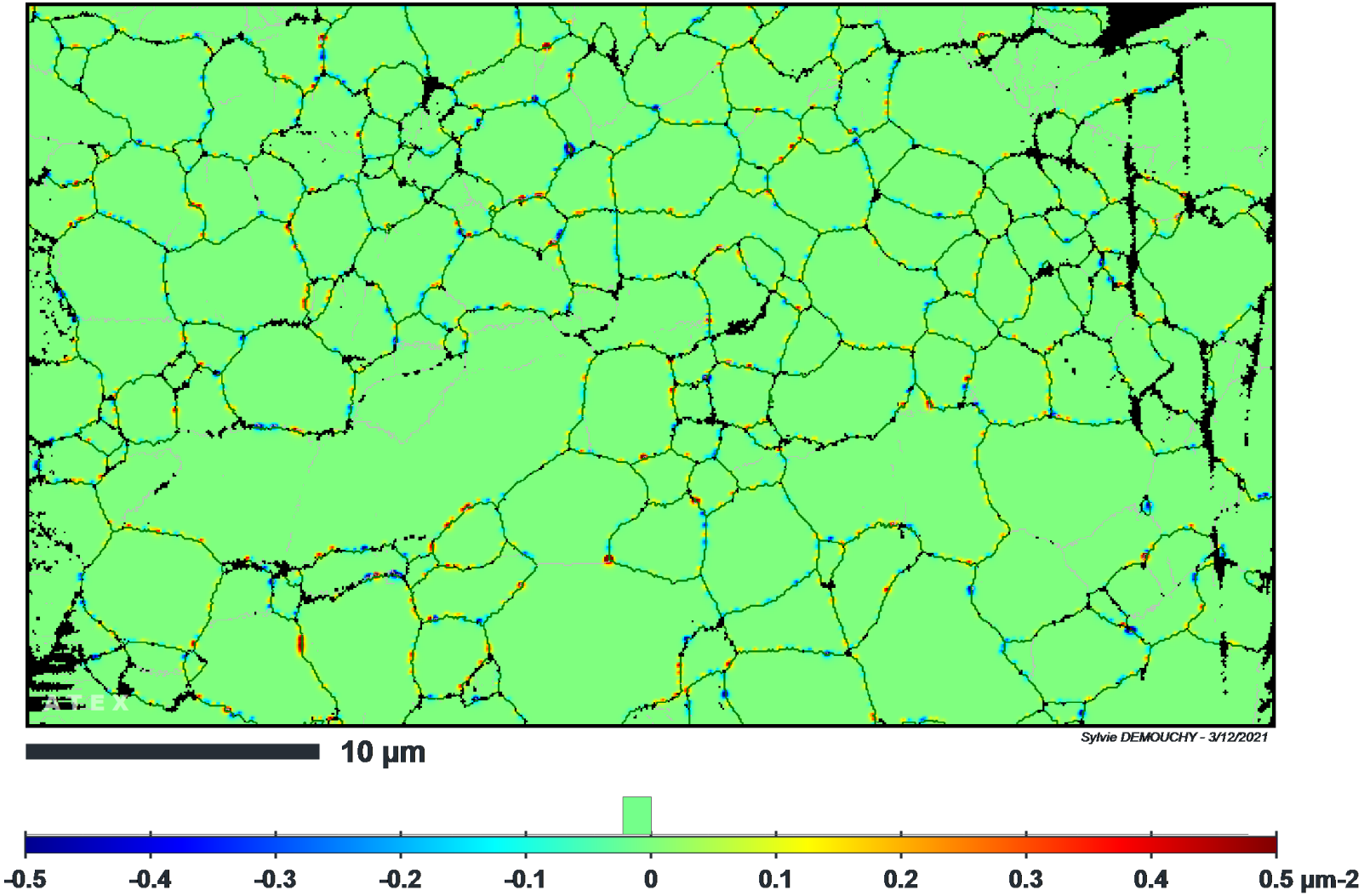


Step size: 0.062µm Resolution: 687x399 Index. Rate: 95% Magnification: x2500 Tension: 18kV

Minimum: -0.5 Maximum: 0.5 Average: 0 S. Dev: 0.22

PI0546-V

23 component Of Disclination Tensor

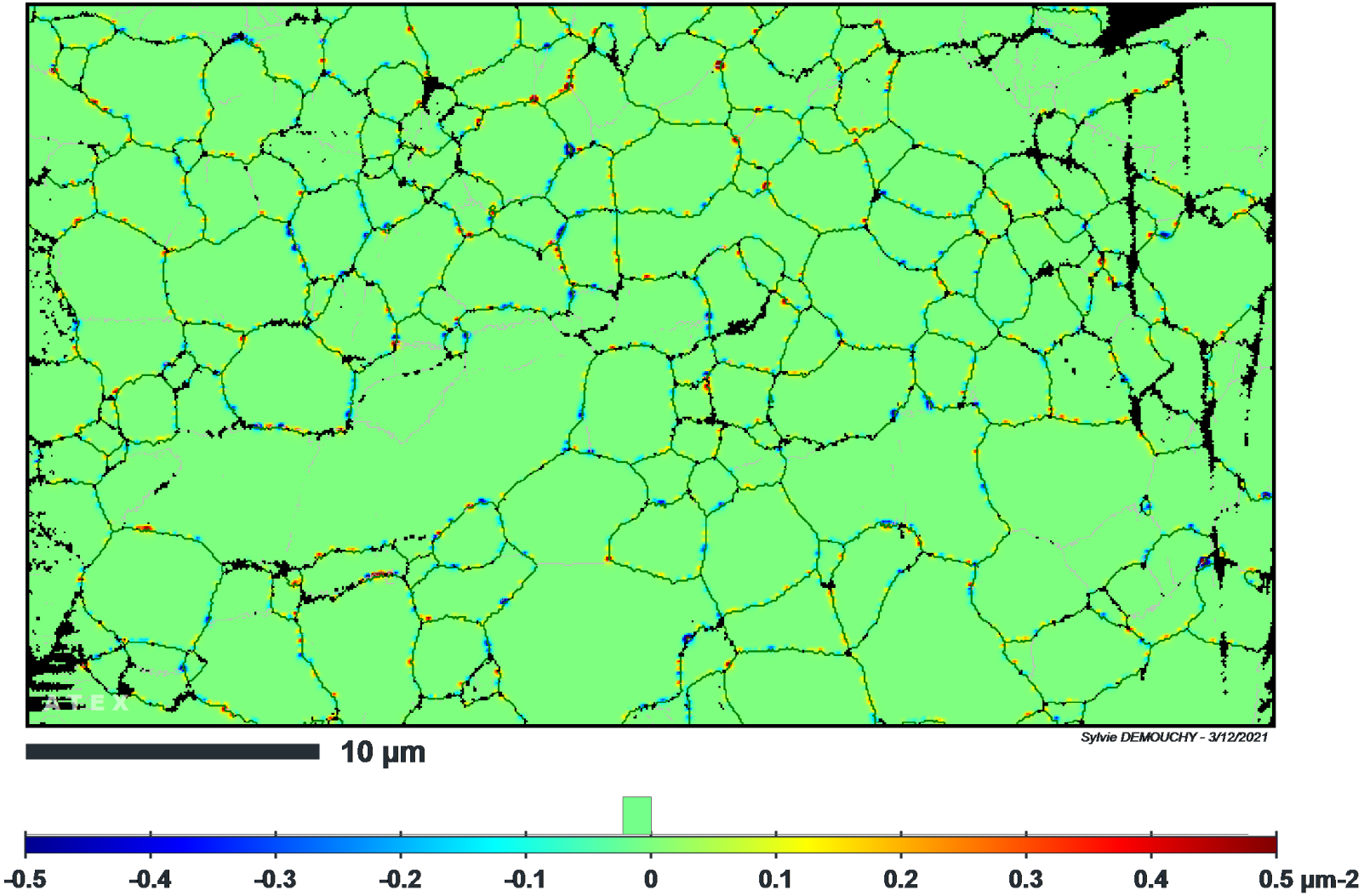


Step size: 0.062µm Resolution: 687x399 Index. Rate: 95% Magnification: x2500 Tension: 18kV

Minimum: -0.5 Maximum: 0.5 Average: 0 S. Dev: 0.22

PI0546-V

33 component Of Disclination Tensor

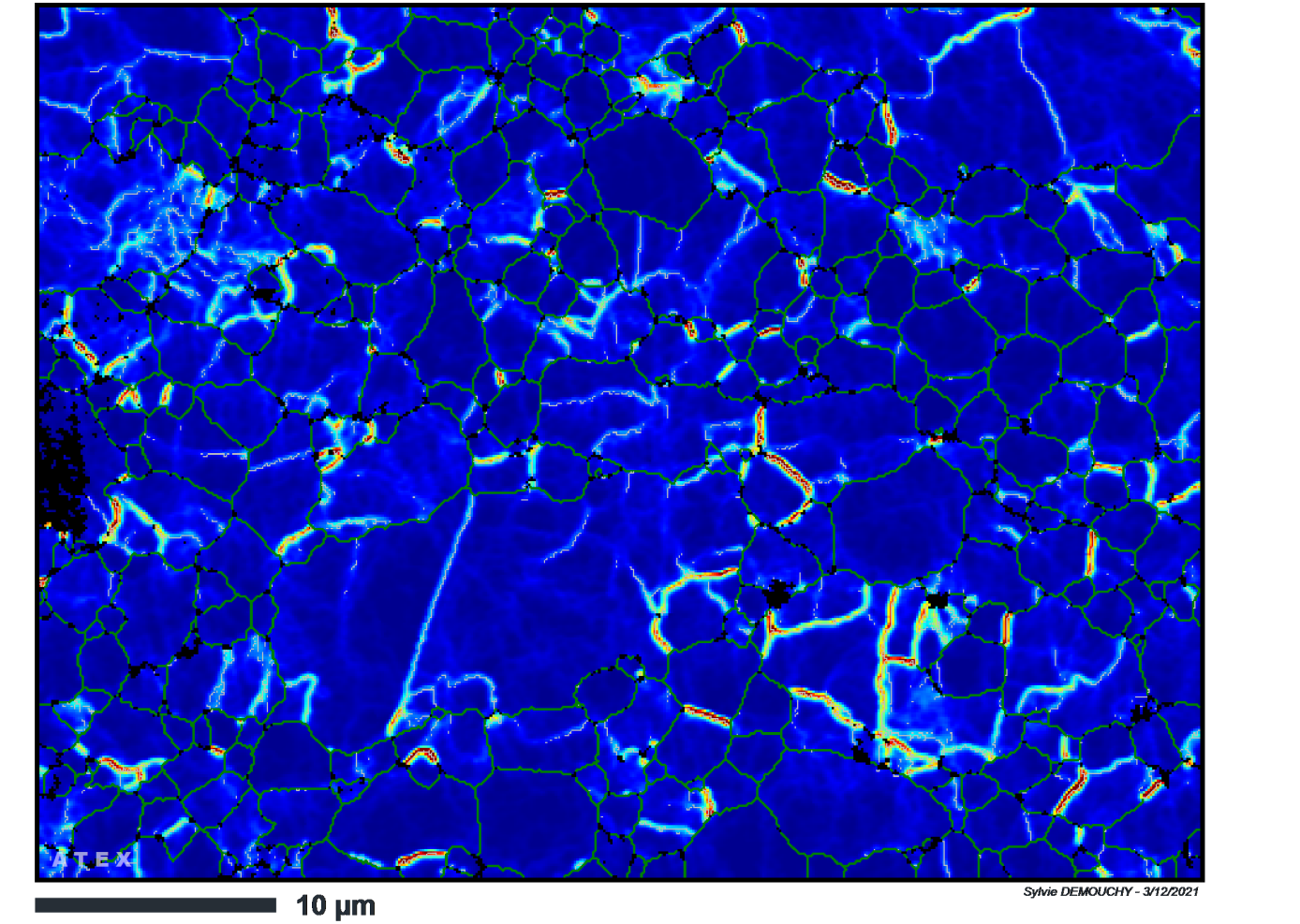


Step size: 0.062µm Resolution: 687x399 Index. Rate: 95% Magnification: x2500 Tension: 18kV

Minimum: -0.5 Maximum: 0.5 Average: 0 S. Dev: 0.23

PI0546-VII

Entrywise Norm of the Nye Tensor

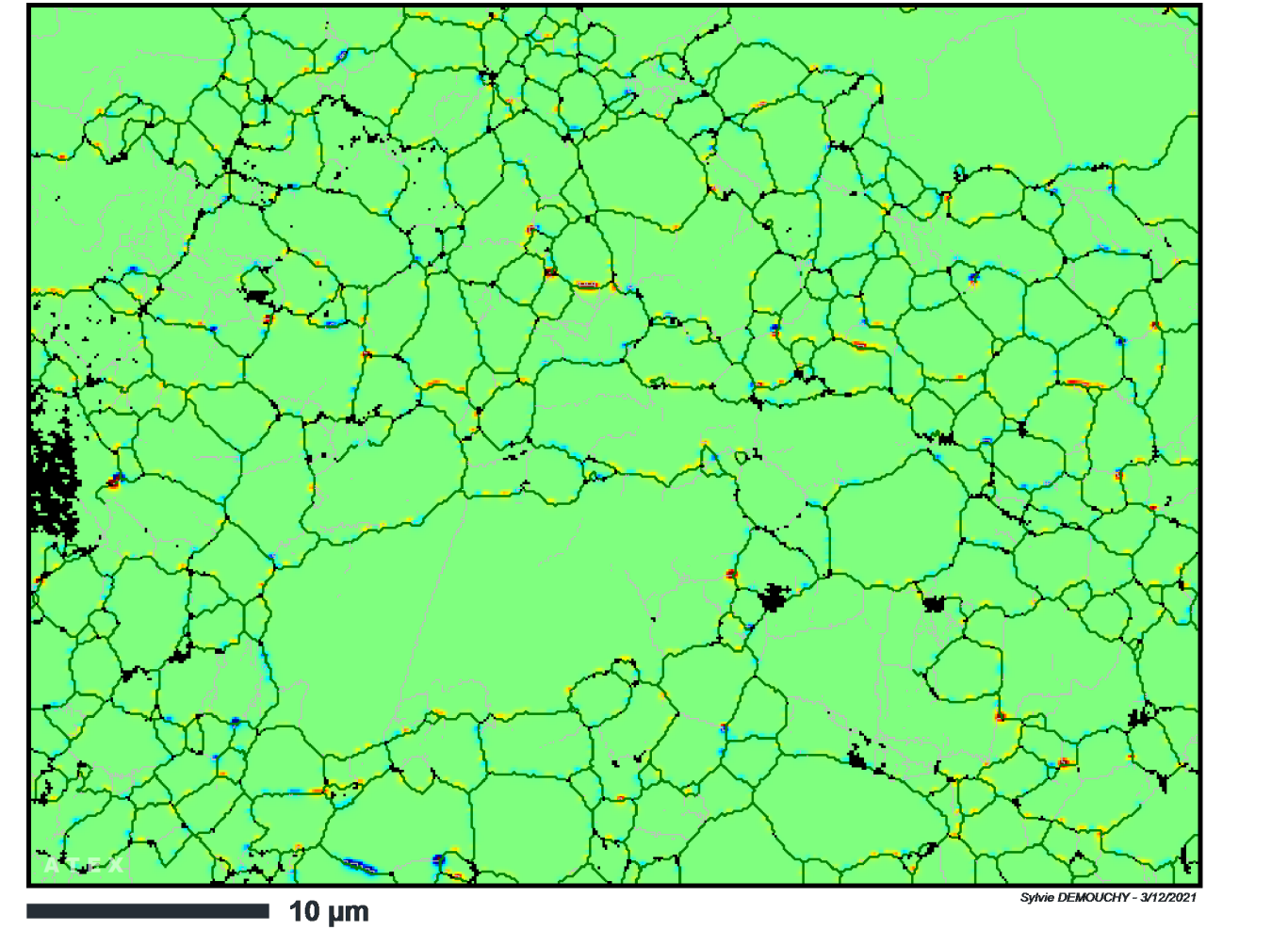


Step size: 0.1µm Resolution: 486x366 Index. Rate: 96% Magnification: x2500 Tension: 18kV

Minimum: 0.01 Maximum: 0.52 Average: 0.05 S. Dev: 0.12

PI0546-VII

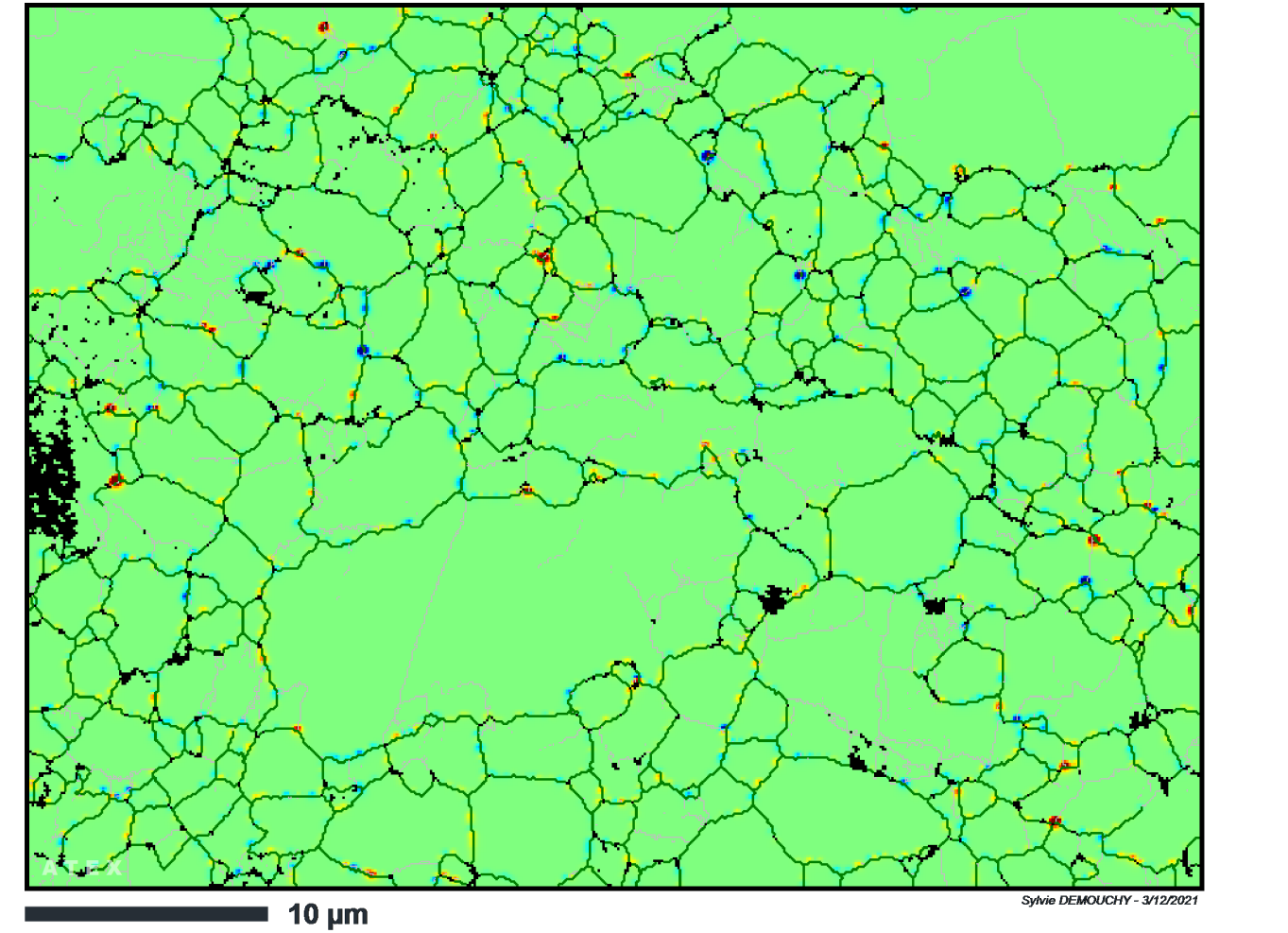
13 component Of Disclination Tensor



Step size: 0.1µm Resolution: 486x366 Index. Rate: 96% Magnification: x2500 Tension: 18kV
Minimum: -0.5 Maximum: 0.5 Average: 0 S. Dev: 0.18

PI0546-VII

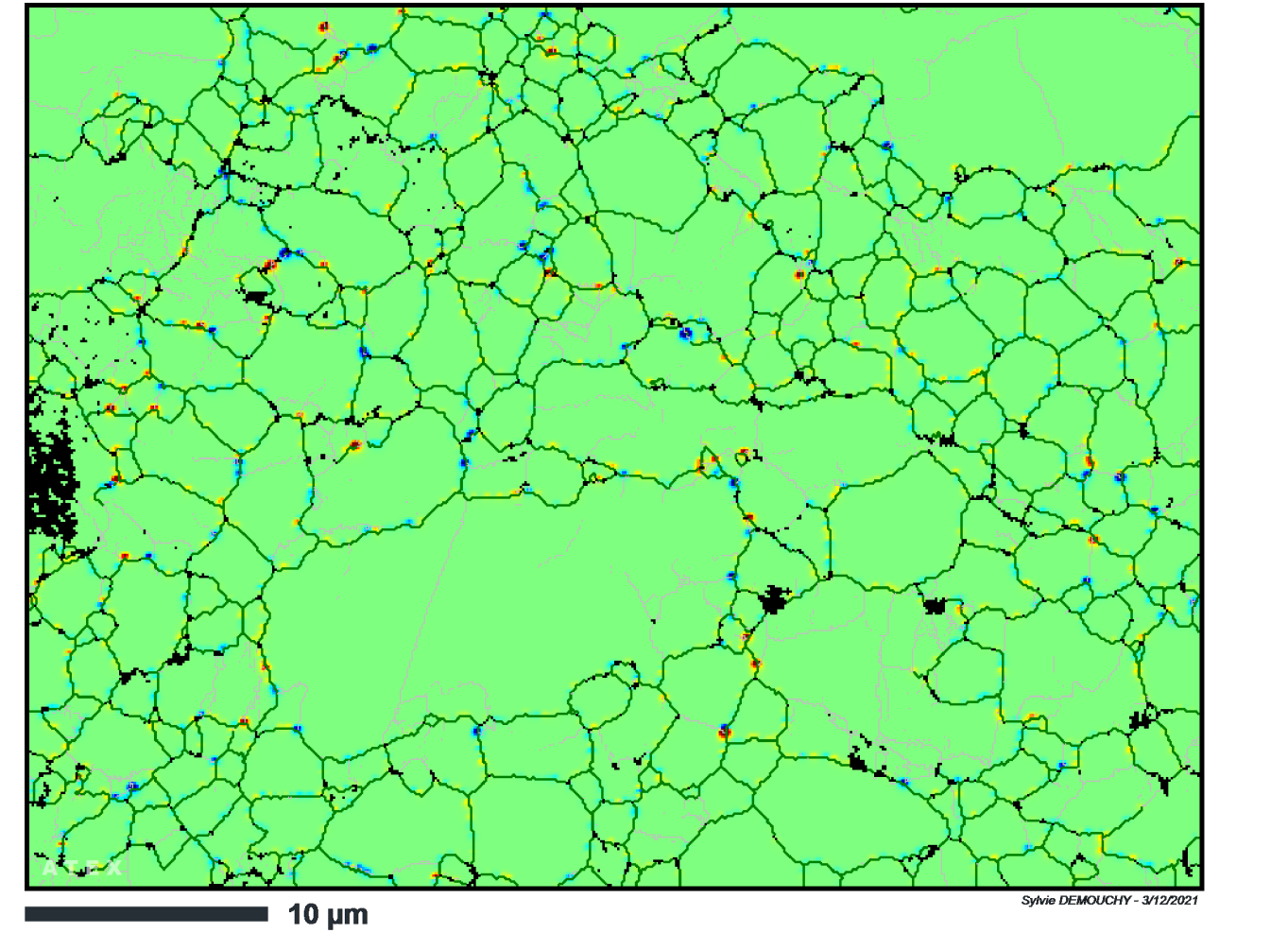
23 component Of Disclination Tensor



Step size: 0.1µm Resolution: 486x366 Index. Rate: 96% Magnification: x2500 Tension: 18kV
Minimum: -0.5 Maximum: 0.5 Average: 0 S. Dev: 0.18

PI0546-VII

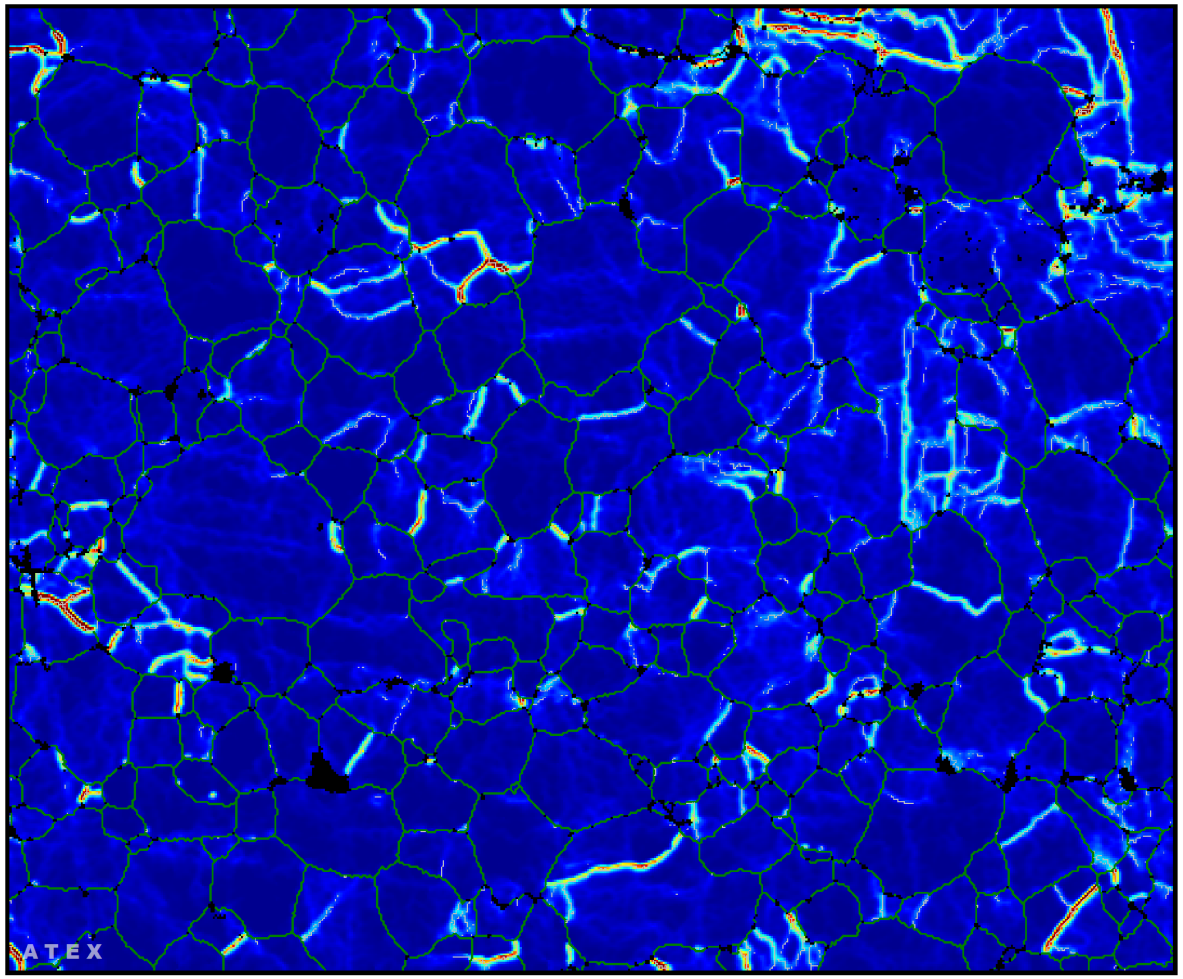
33 component Of Disclination Tensor

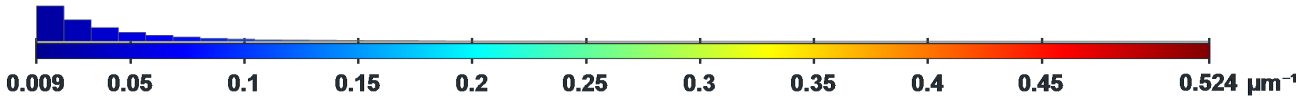


Step size: 0.1µm Resolution: 486x366 Index. Rate: 96% Magnification: x2500 Tension: 18kV
Minimum: -0.5 Maximum: 0.5 Average: 0 S. Dev: 0.18

PI0546-VIII

Entrywise Norm of the Nye Tensor

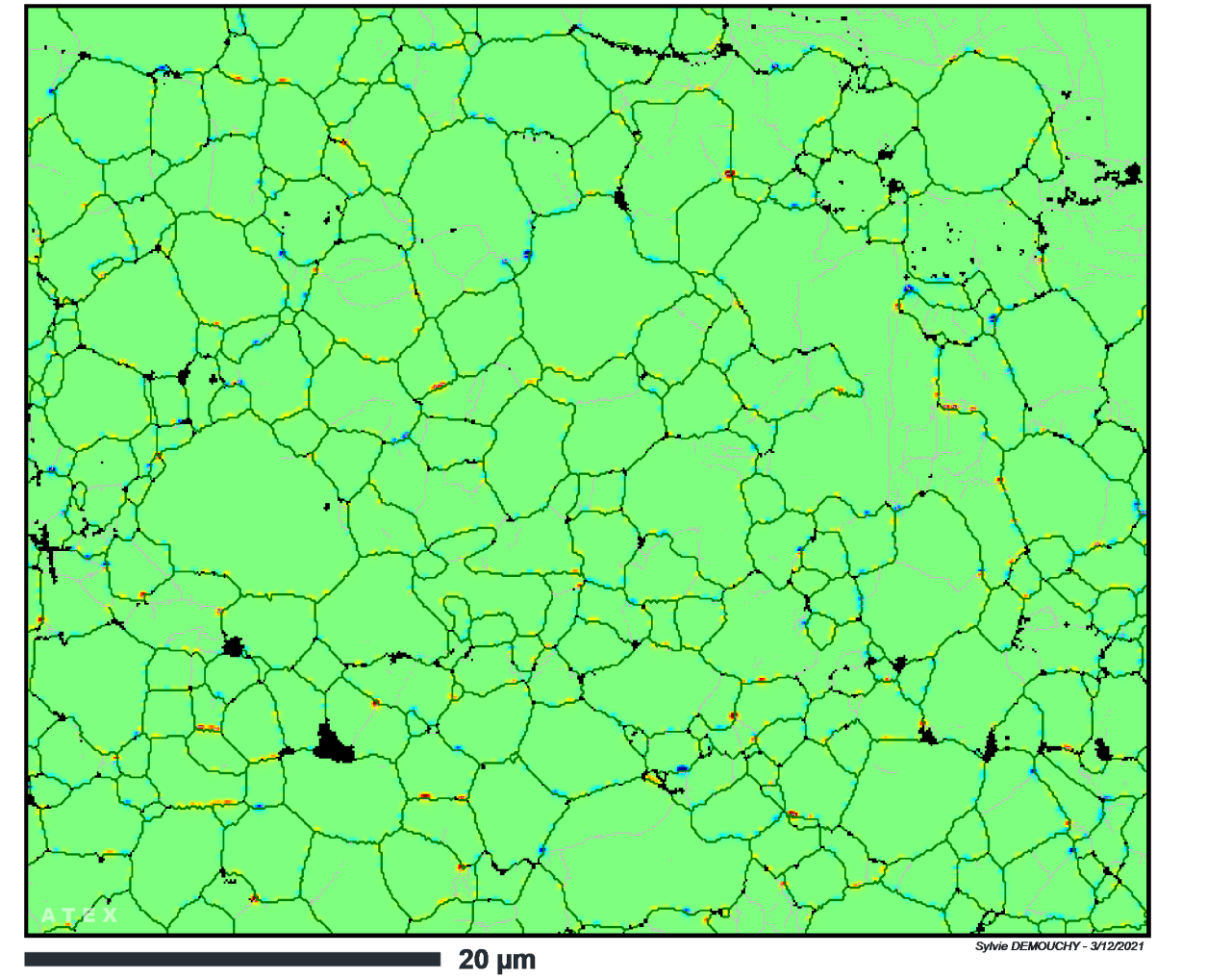




Step size: 0.1µm Resolution: 542x449 Index. Rate: 97% Magnification: x2200 Tension: 18kV
Minimum: 0.01 Maximum: 0.52 Average: 0.04 S. Dev: 0.1

PI0546-VIII

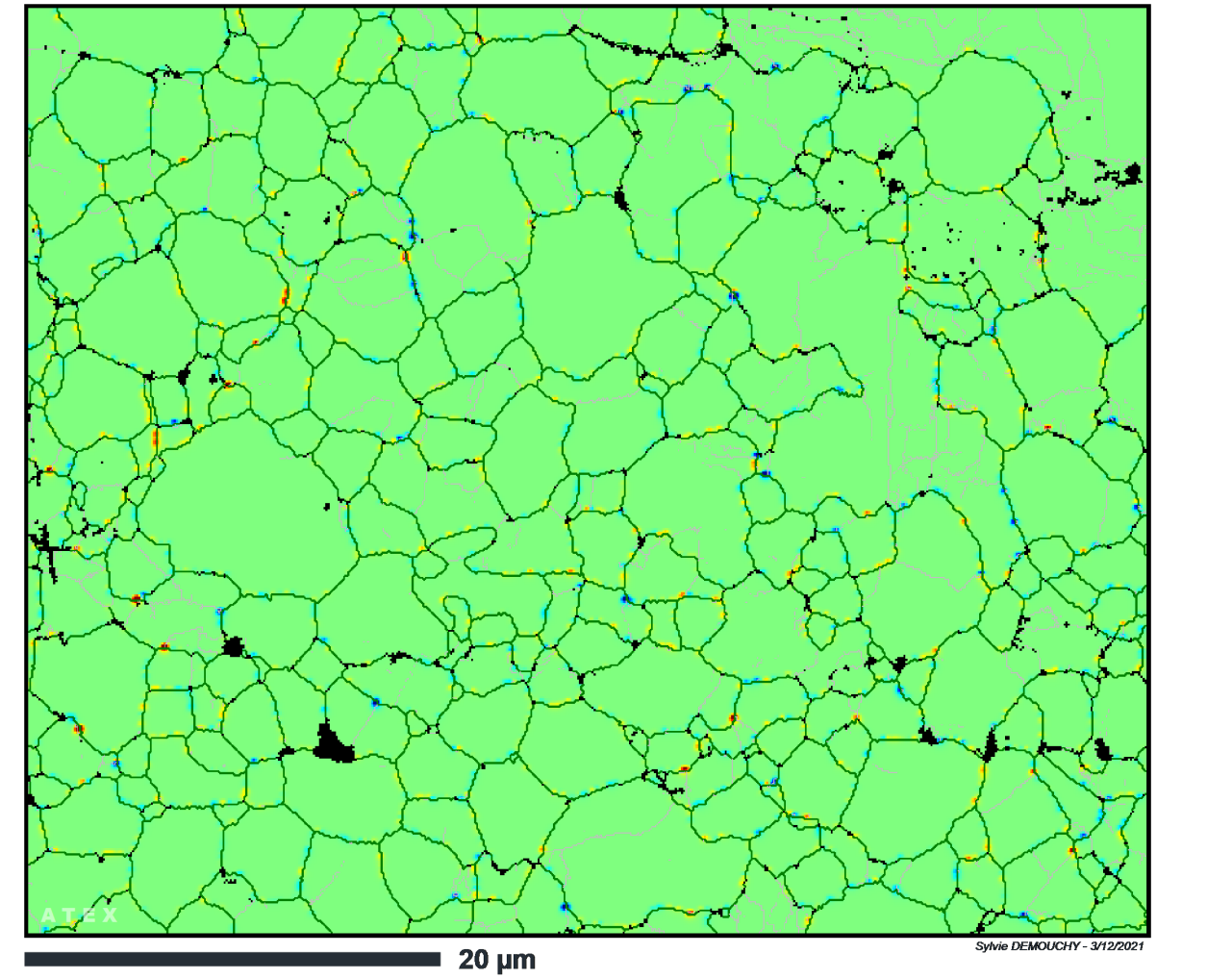
13 component Of Disclination Tensor



Step size: 0.1µm Resolution: 542x449 Index. Rate: 97% Magnification: x2200 Tension: 18kV
Minimum: -0.5 Maximum: 0.5 Average: 0 S. Dev: 0.13

PI0546-VIII

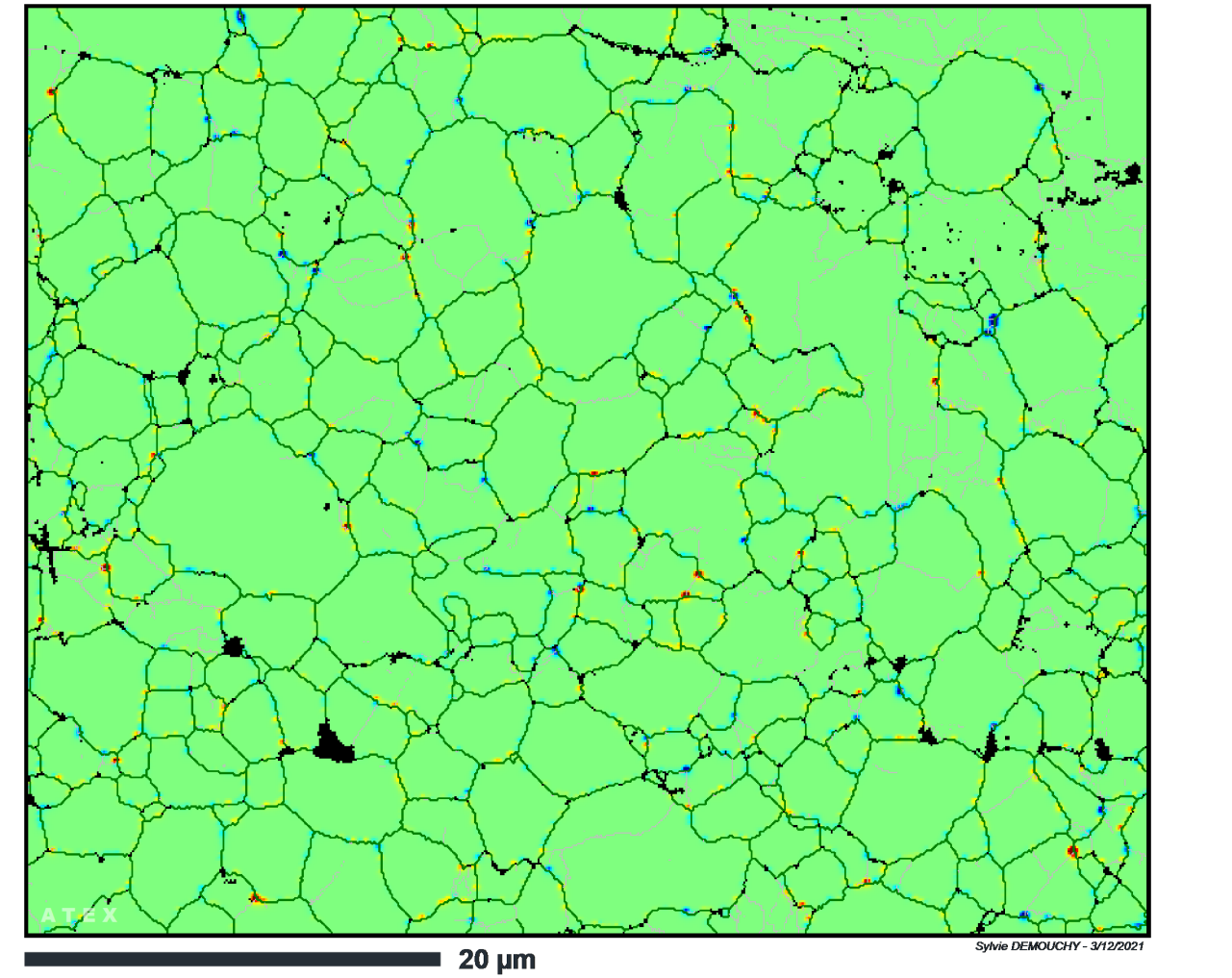
23 component Of Disclination Tensor



Step size: 0.1µm Resolution: 542x449 Index. Rate: 97% Magnification: x2200 Tension: 18kV
Minimum: -0.5 Maximum: 0.5 Average: 0 S. Dev: 0.13

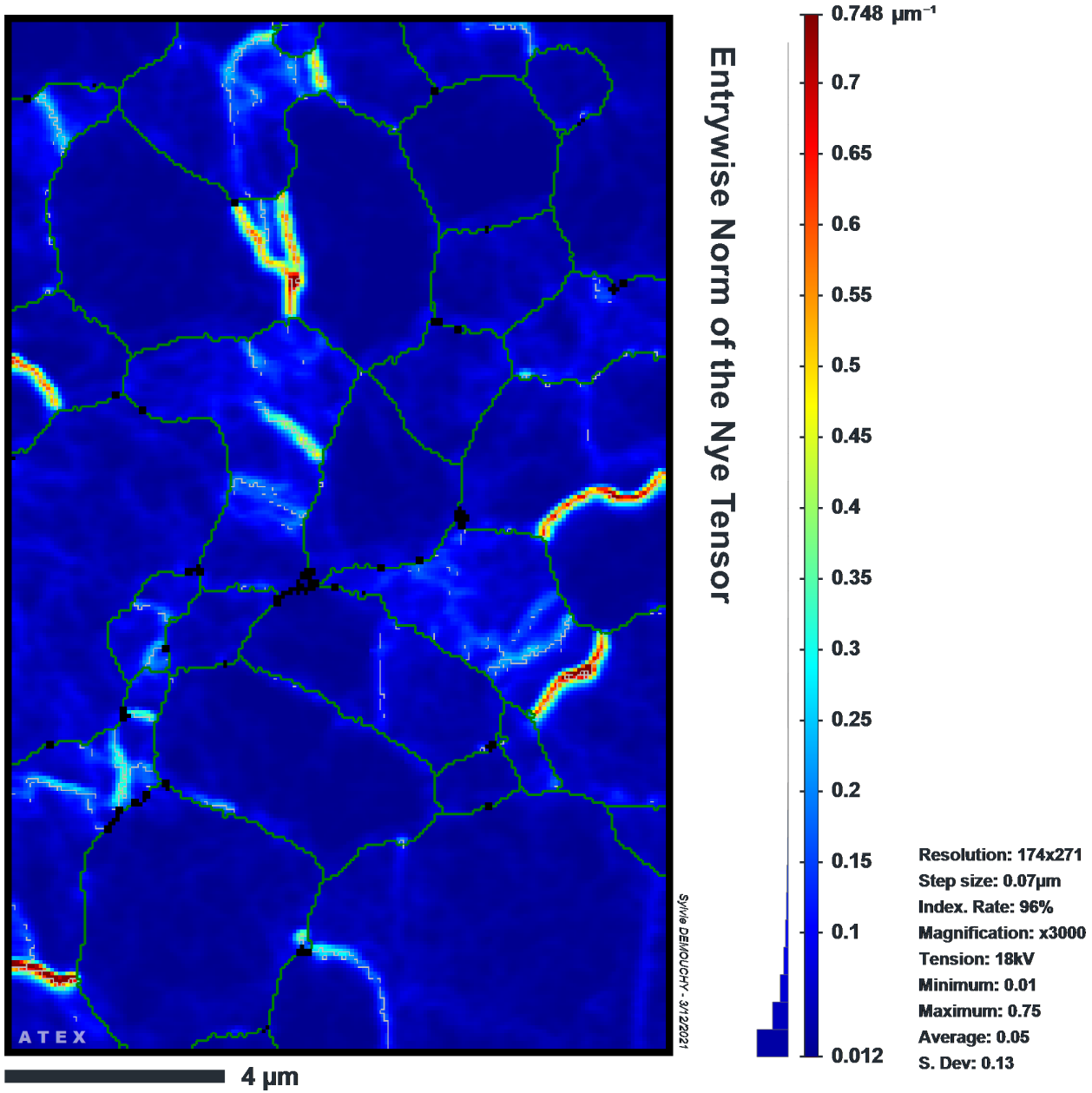
PI0546-VIII

33 component Of Disclination Tensor

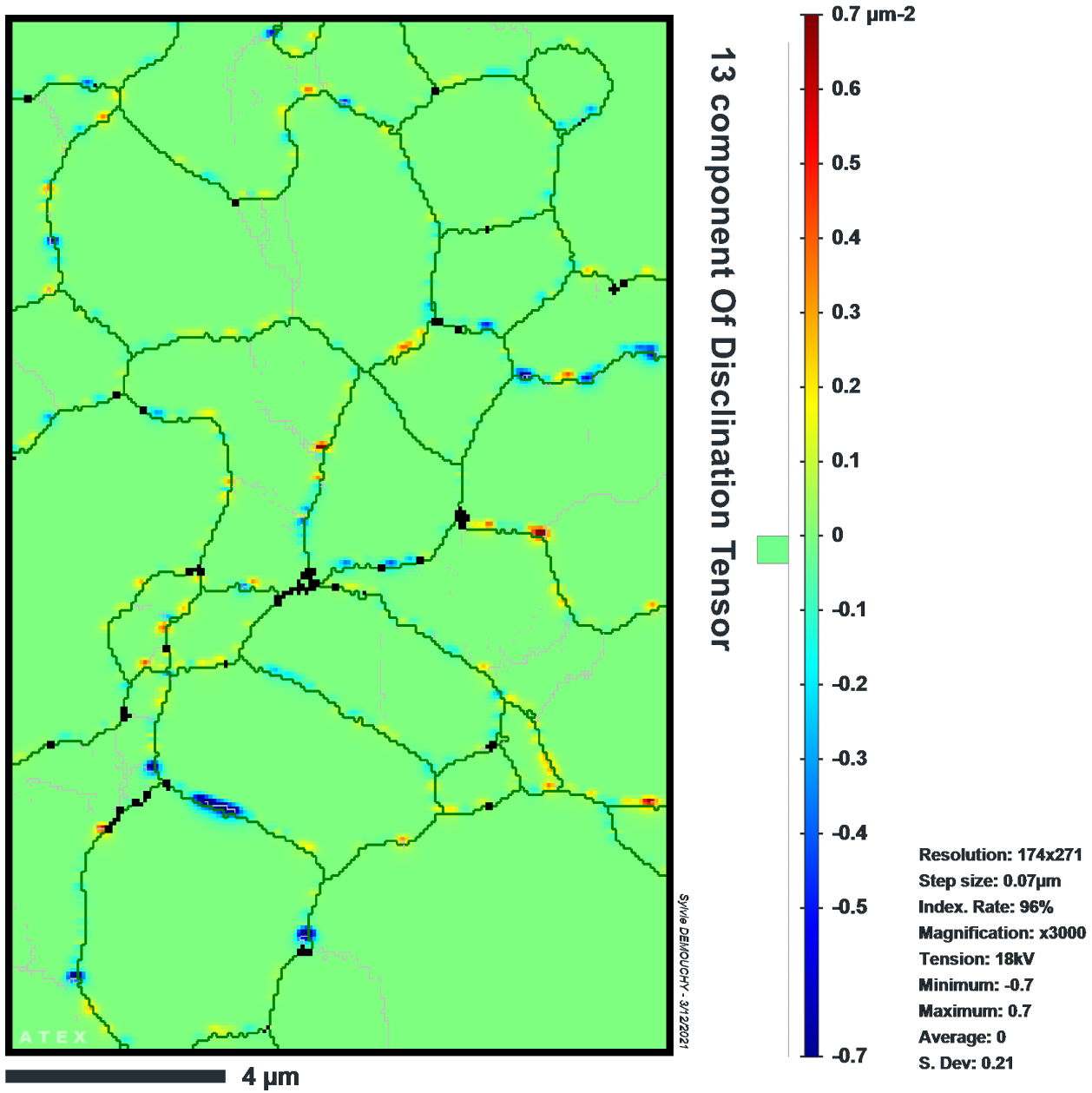


Step size: 0.1µm Resolution: 542x449 Index. Rate: 97% Magnification: x2200 Tension: 18kV
Minimum: -0.5 Maximum: 0.5 Average: 0 S. Dev: 0.14

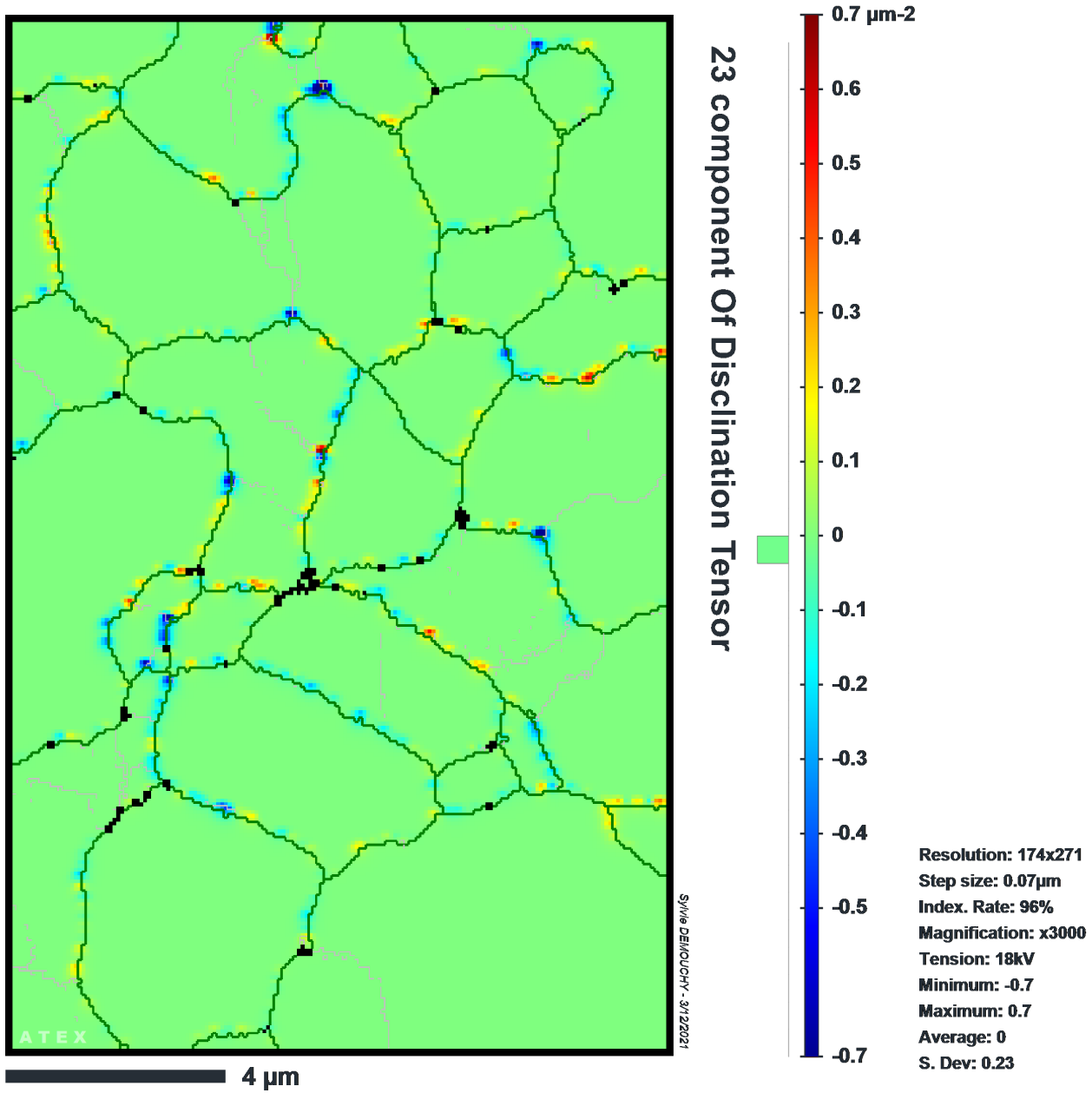
PI0546-XIV


Entrywise Norm of the Nye Tensor
0.748 µm⁻¹
0.7
0.65
0.6
0.55
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.012
Resolution: 174x271
Step size: 0.07µm
Index. Rate: 96%
Magnification: x3000
Tension: 18kV
Minimum: 0.01
Maximum: 0.75
Average: 0.05
S. Dev: 0.13
ATEX
Sylvie DEMOUCHY - 3/12/2021
4 µm

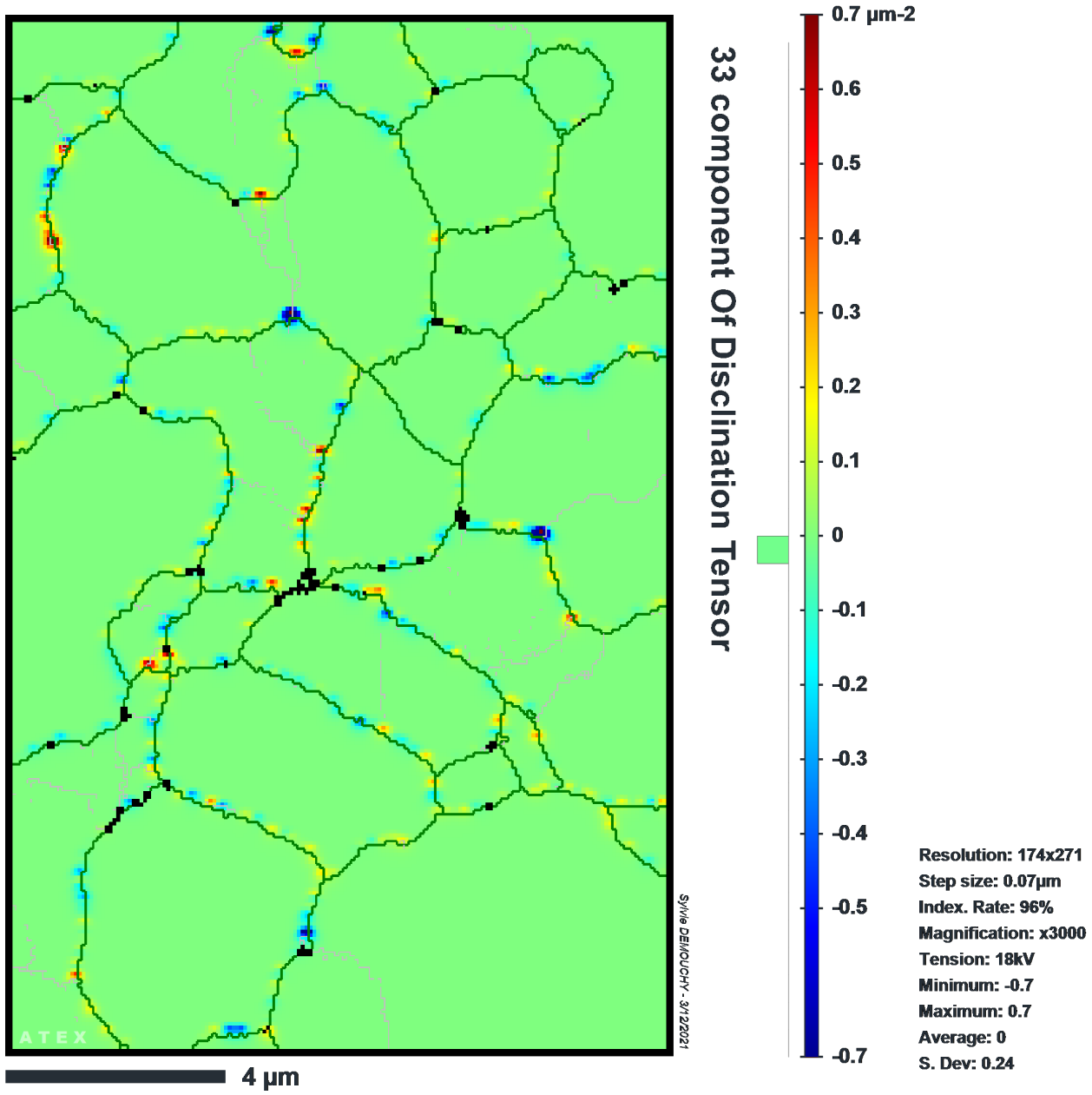
PI0546-XIV


13 component Of Disclination Tensor
0.7 µm-2
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.7
Resolution: 174x271
Step size: 0.07µm
Index. Rate: 96%
Magnification: x3000
Tension: 18kV
Minimum: -0.7
Maximum: 0.7
Average: 0
S. Dev: 0.21
ATEX
Sylvie DEMOUCHY - 3/12/2021
4 µm

PI0546-XIV

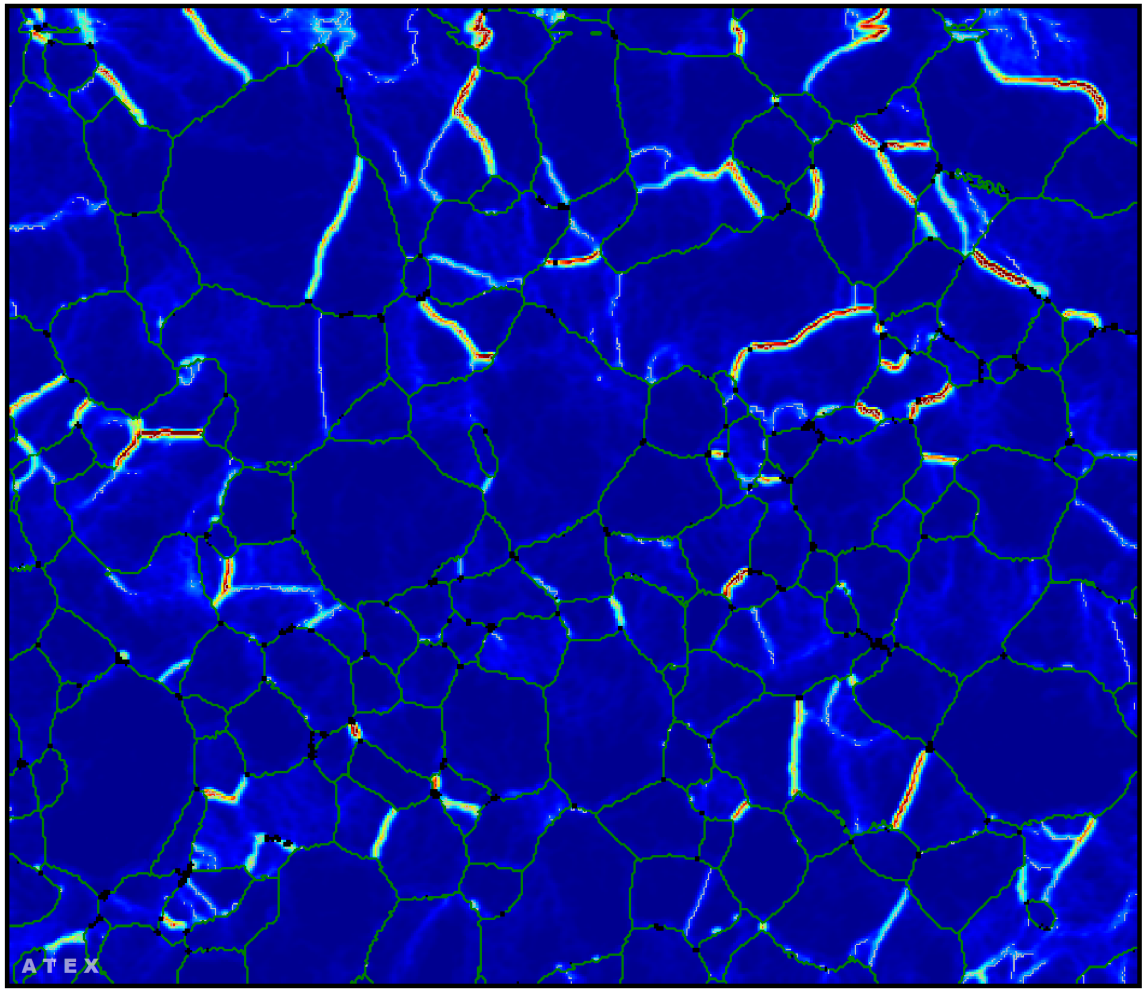

23 component Of Disclination Tensor
0.7 µm-2
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.7
Resolution: 174x271
Step size: 0.07µm
Index. Rate: 96%
Magnification: x3000
Tension: 18kV
Minimum: -0.7
Maximum: 0.7
Average: 0
S. Dev: 0.23
4 µm
ATEX
Sylvie DEMOUCHY - 3/12/2021

PI0546-XIV

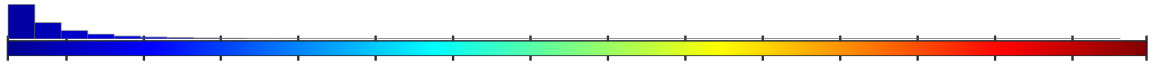

33 component Of Disclination Tensor
0.7 µm-2
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.7
Resolution: 174x271
Step size: 0.07µm
Index. Rate: 96%
Magnification: x3000
Tension: 18kV
Minimum: -0.7
Maximum: 0.7
Average: 0
S. Dev: 0.24
4 µm
ATEX
Sylvie DEMOUCHY - 3/12/2021

PI0546-XVI

Entrywise Norm of the Nye Tensor



8 µm

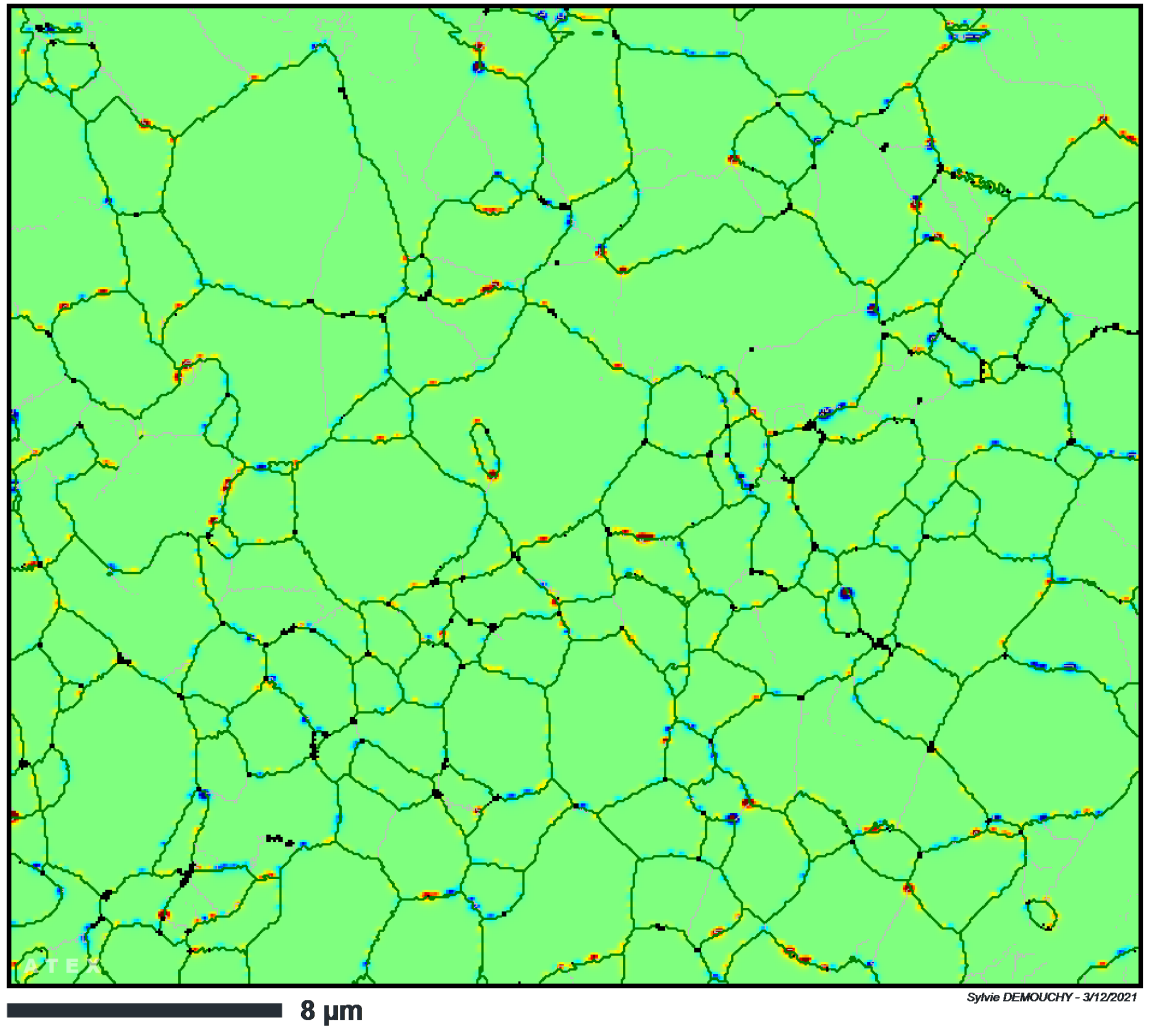


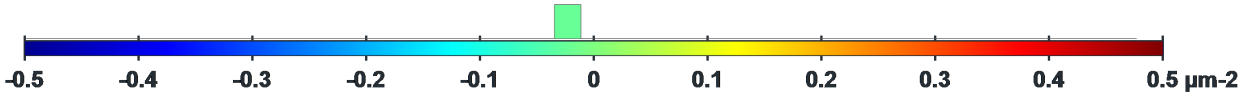
0.012 0.05 0.1 0.15 0.2 0.25 0.3 0.35 0.4 0.45 0.5 0.55 0.6 0.65 0.7 0.748 μm^{-1}

Step size: 0.07µm Resolution: 473x410 Index. Rate: 98% Magnification: x1500 Tension: 20.002kV
Minimum: 0.01 Maximum: 0.75 Average: 0.05 S. Dev: 0.15

PI0546-XVI

13 component Of Disclination Tensor

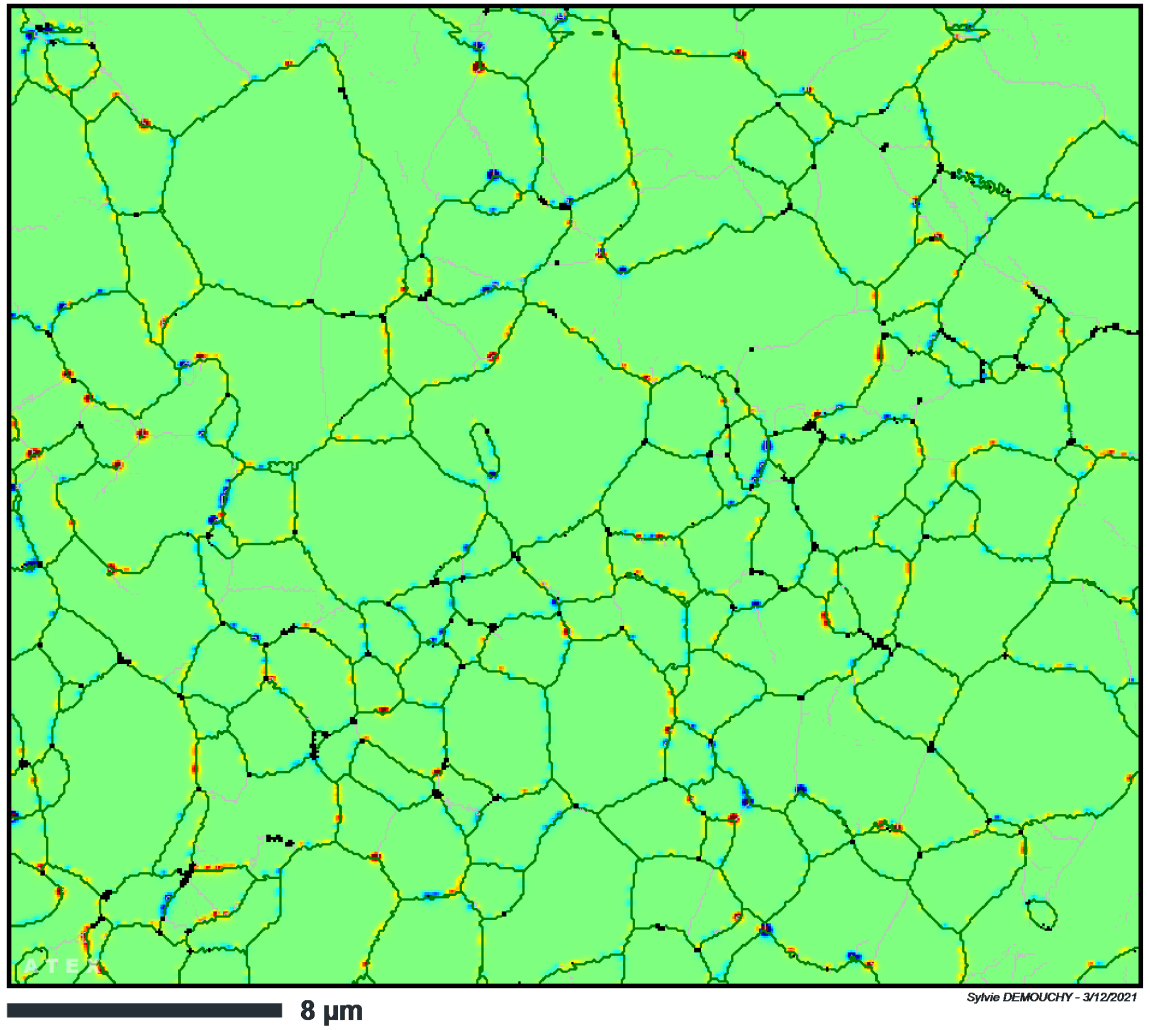


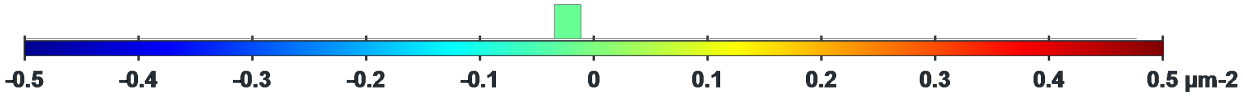


Step size: 0.07µm Resolution: 473x410 Index. Rate: 98% Magnification: x1500 Tension: 20.002kV
Minimum: -0.5 Maximum: 0.5 Average: 0 S. Dev: 0.27

PI0546-XVI

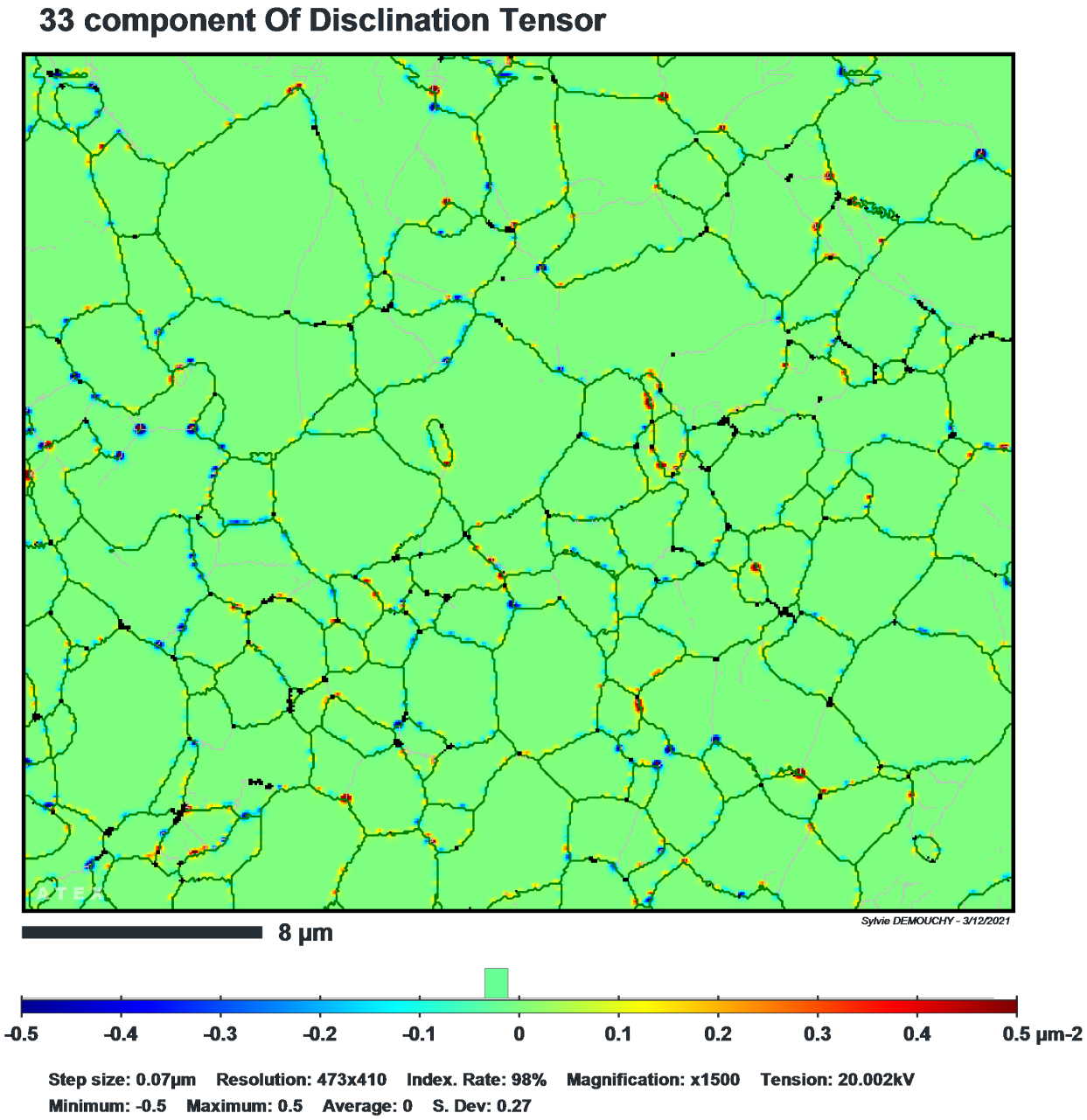
23 component Of Disclination Tensor



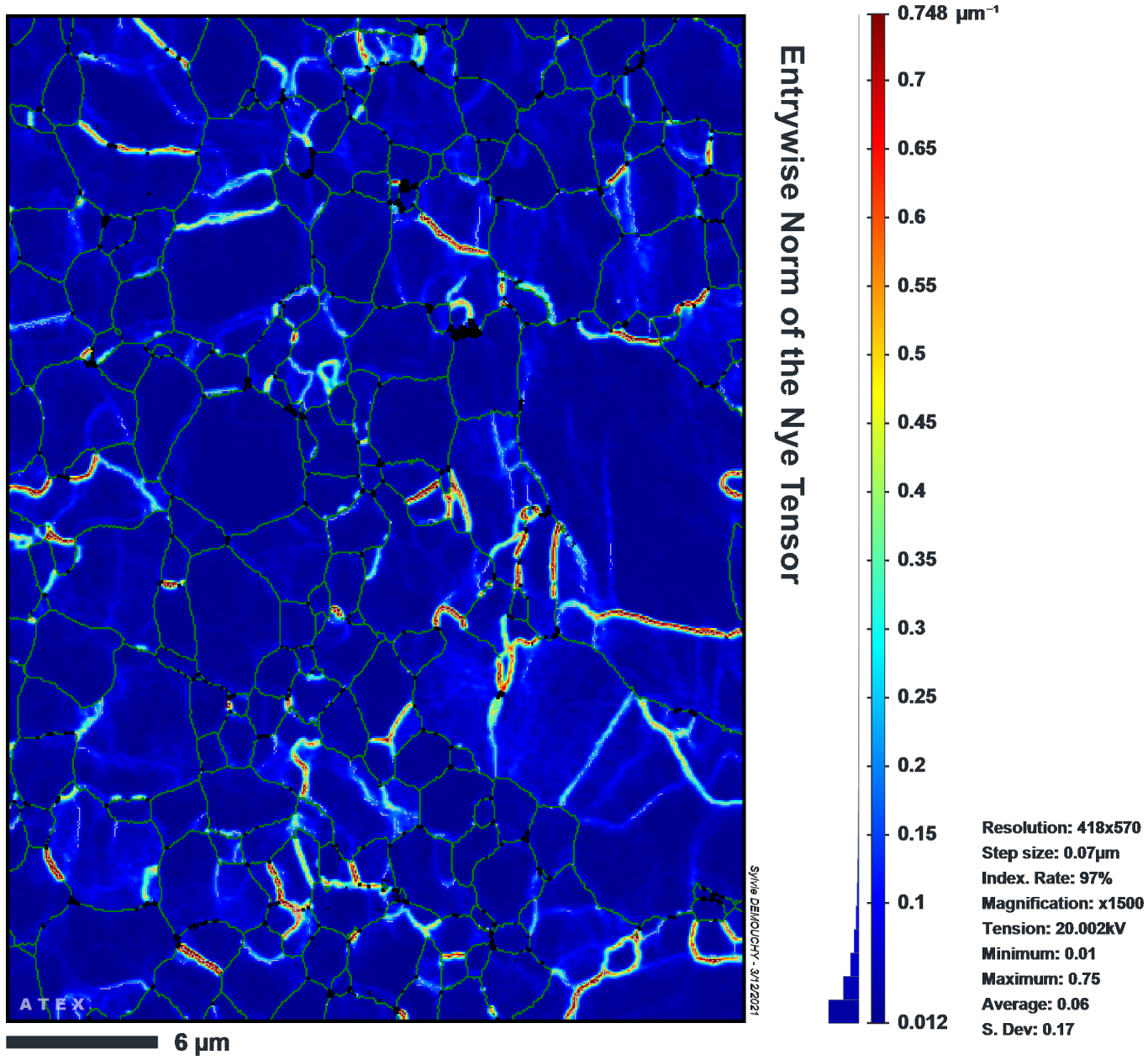


Step size: 0.07µm Resolution: 473x410 Index. Rate: 98% Magnification: x1500 Tension: 20.002kV
Minimum: -0.5 Maximum: 0.5 Average: 0 S. Dev: 0.25

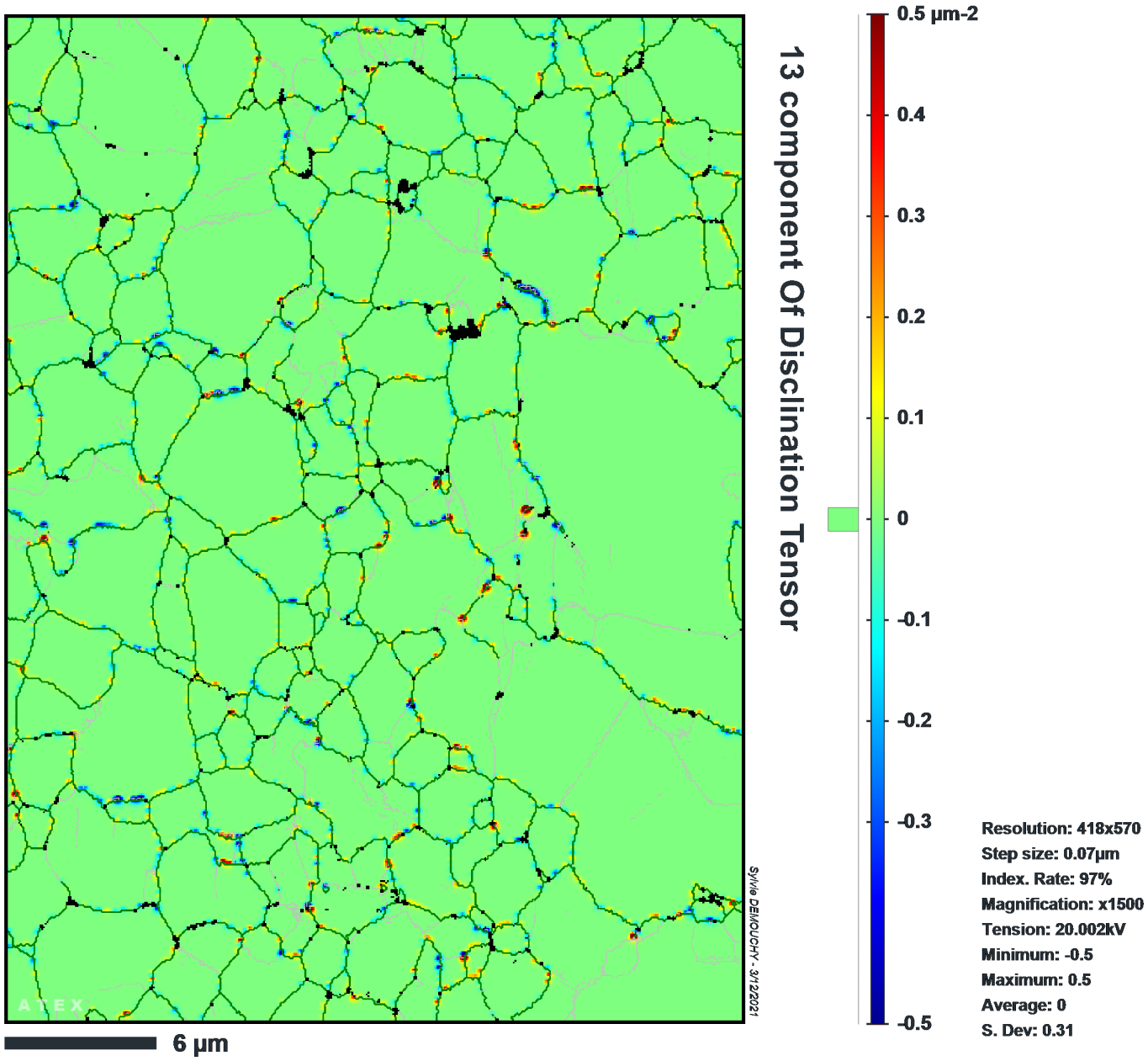
PI0546-XVI


33 component Of Disclination Tensor
Sylvie DEMOUCHY - 3/12/2021
8 µm
-0.5
-0.4
-0.3
-0.2
-0.1
0
0.1
0.2
0.3
0.4
0.5 µm-2
Step size: 0.07µm Resolution: 473x410 Index. Rate: 98% Magnification: x1500 Tension: 20.002kV
Minimum: -0.5 Maximum: 0.5 Average: 0 S. Dev: 0.27

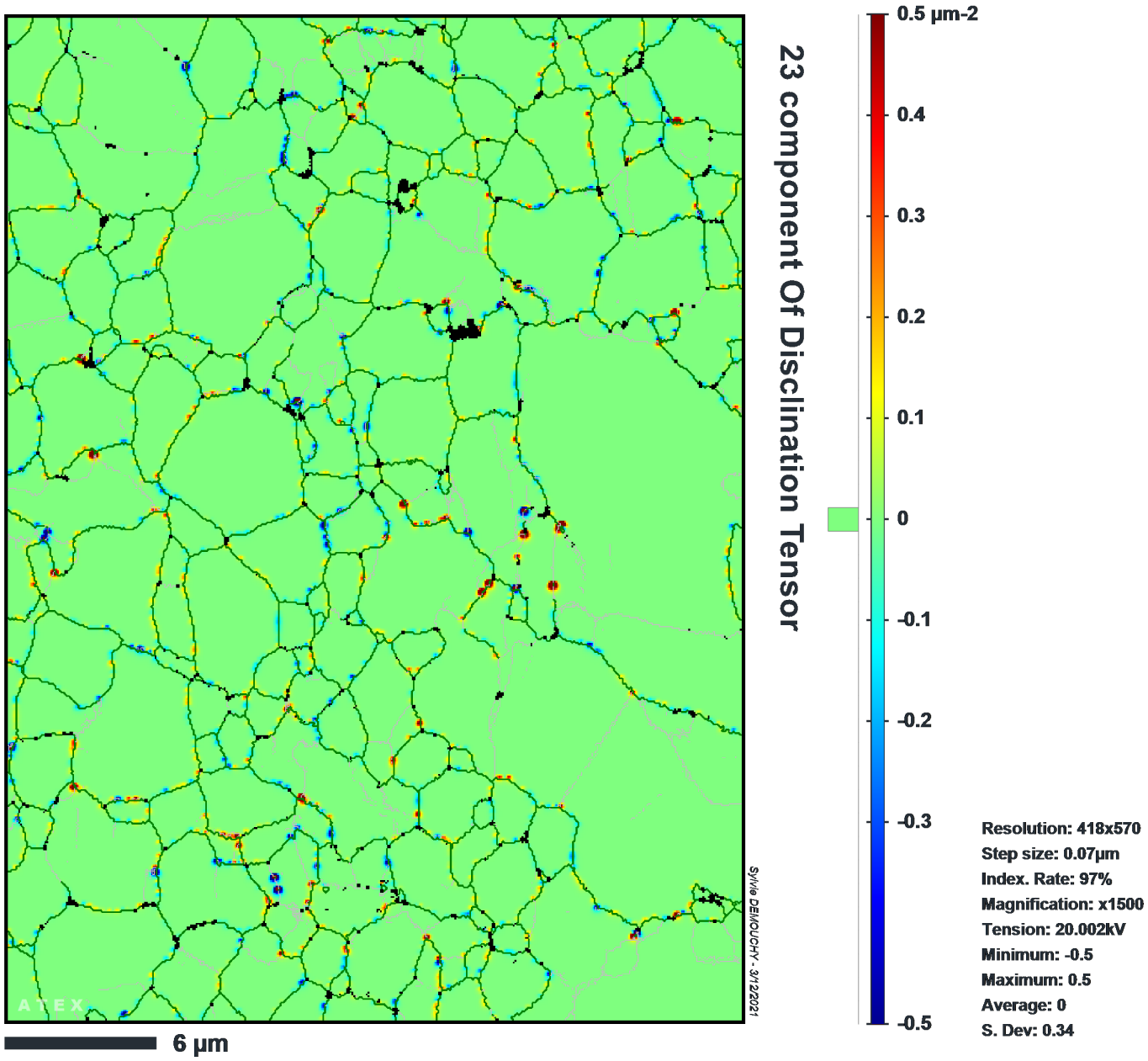
PI0546-XVII


Entrywise Norm of the Nye Tensor
0.748 µm⁻¹
0.7
0.65
0.6
0.55
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.012
Resolution: 418x570
Step size: 0.07µm
Index. Rate: 97%
Magnification: x1500
Tension: 20.002kV
Minimum: 0.01
Maximum: 0.75
Average: 0.06
S. Dev: 0.17
ATEX
Sylvie DEMOUCHY - 3/12/2021
6 µm

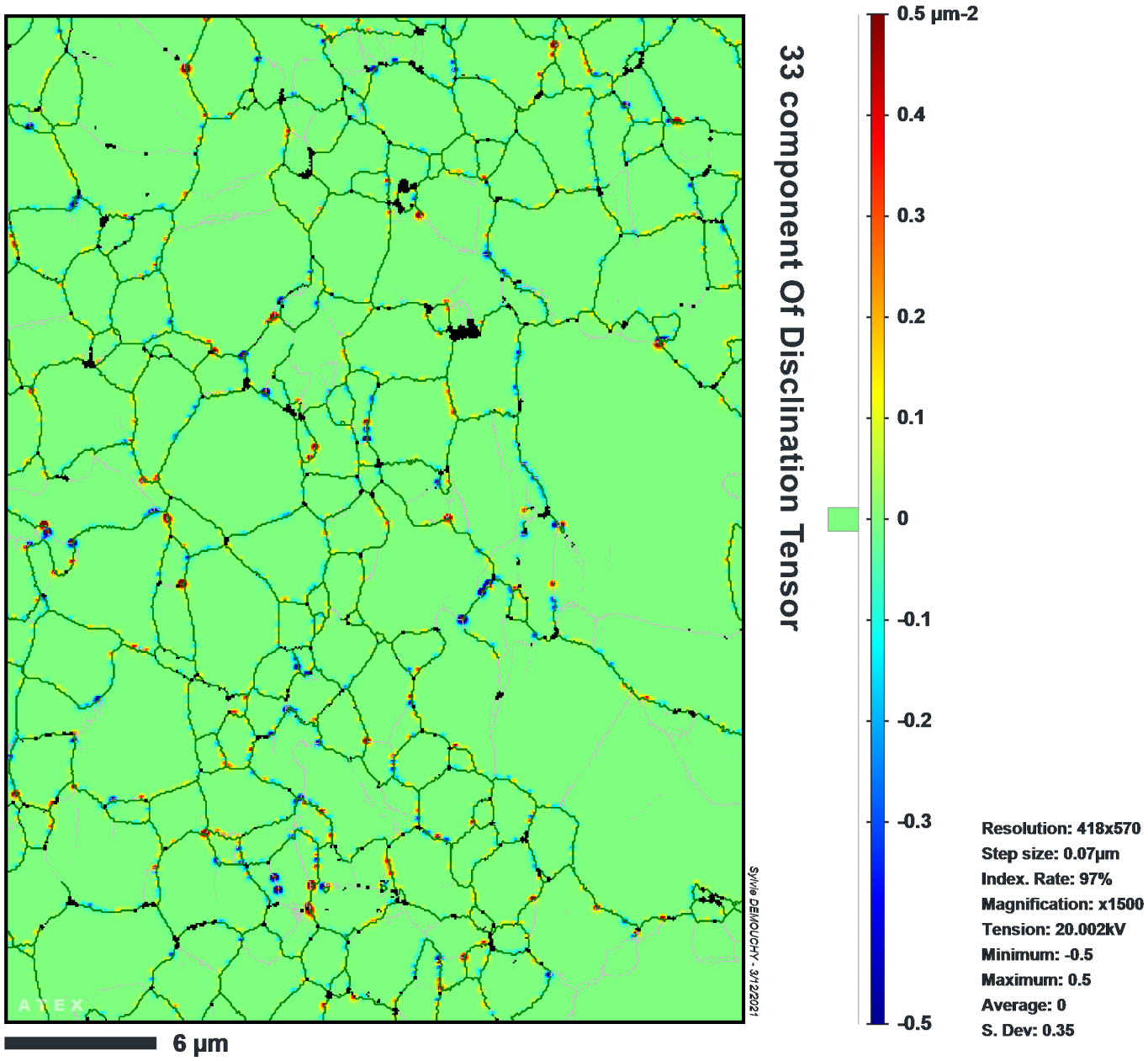
PI0546-XVII


13 component Of Disclination Tensor
0.5 µm-2
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.5
Resolution: 418x570
Step size: 0.07µm
Index. Rate: 97%
Magnification: x1500
Tension: 20.002kV
Minimum: -0.5
Maximum: 0.5
Average: 0
S. Dev: 0.31
Sylvie DEMOUCHY - 3/12/2021
6 µm

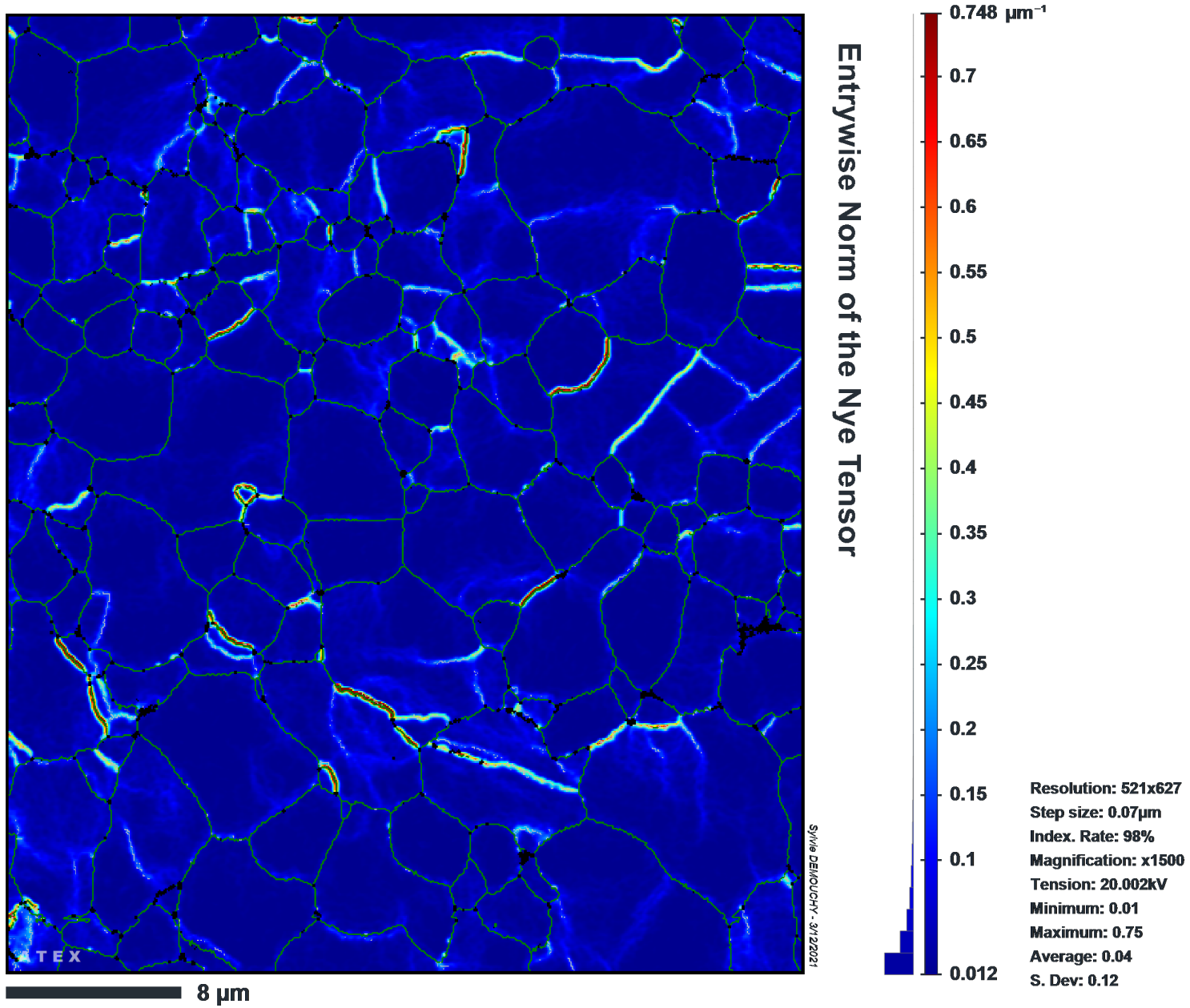
PI0546-XVII


23 component Of Disclination Tensor
0.5 µm-2
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.5
Resolution: 418x570
Step size: 0.07µm
Index. Rate: 97%
Magnification: x1500
Tension: 20.002kV
Minimum: -0.5
Maximum: 0.5
Average: 0
S. Dev: 0.34
6 µm
Sylvie DEMOUCHY - 3/12/2021
ATEX

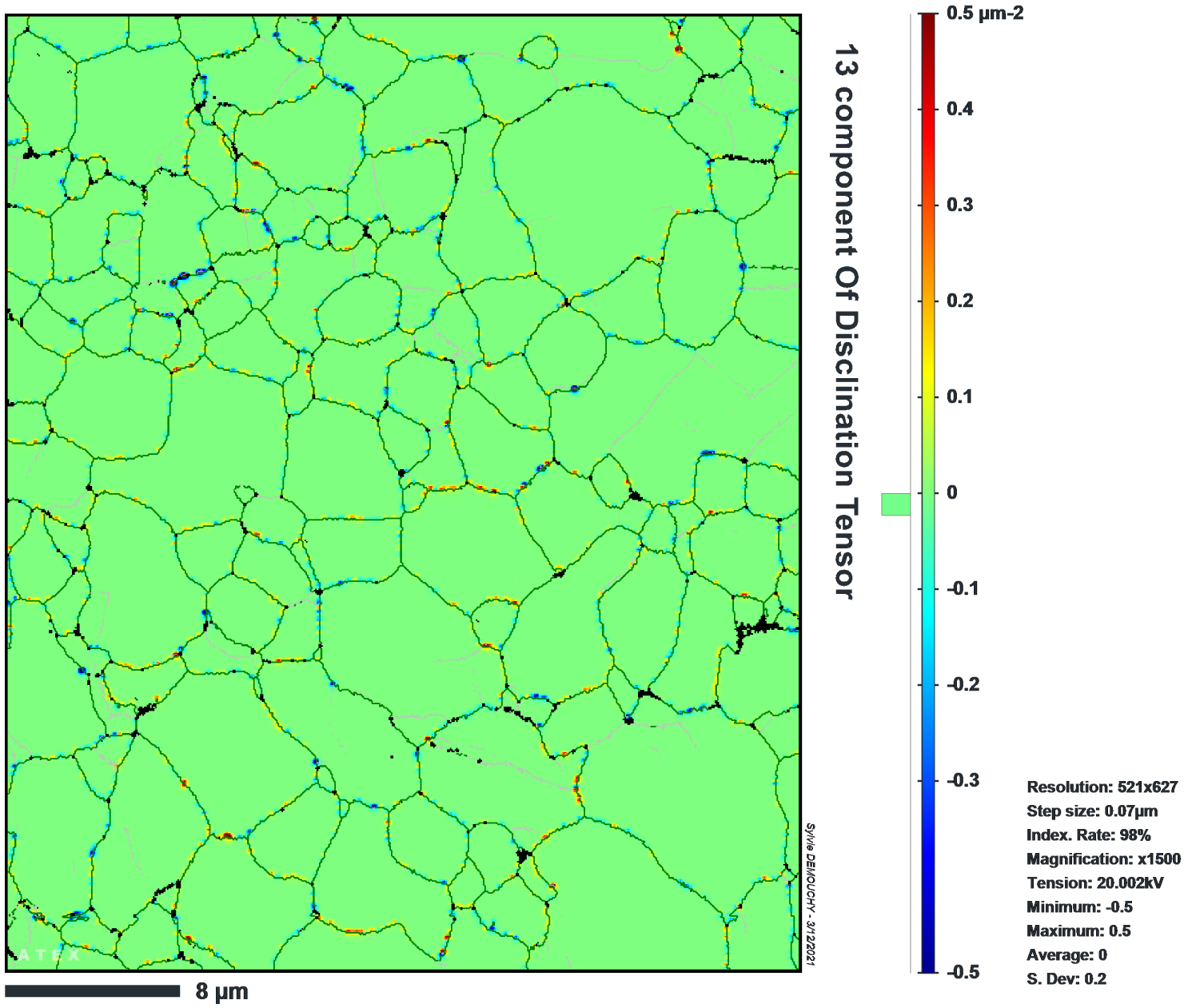
PI0546-XVII


33 component Of Disclination Tensor
0.5 µm-2
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.5
Resolution: 418x570
Step size: 0.07µm
Index. Rate: 97%
Magnification: x1500
Tension: 20.002kV
Minimum: -0.5
Maximum: 0.5
Average: 0
S. Dev: 0.35
6 µm
Sylvie DEMOUCHY - 3/12/2021
ATEX

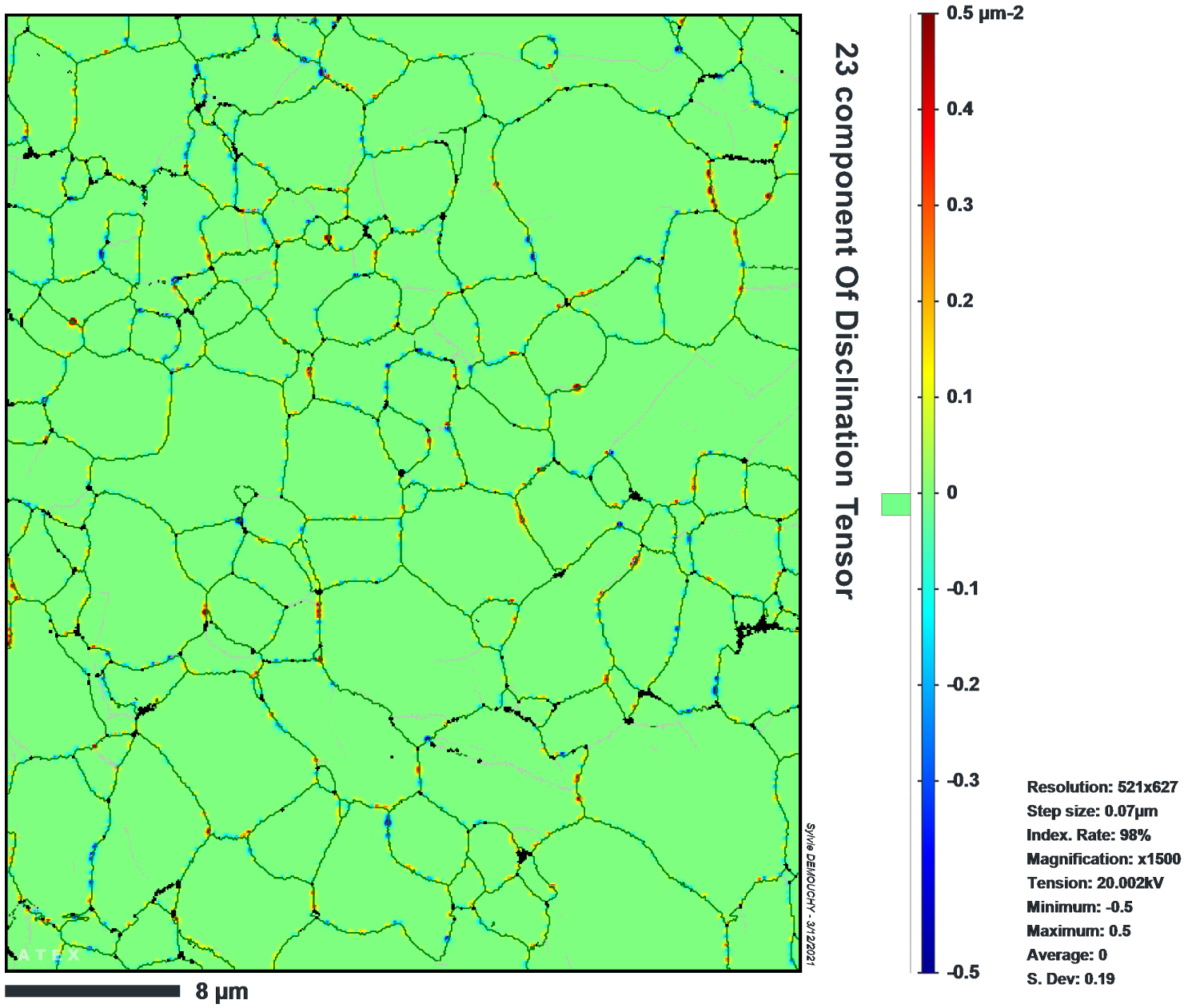
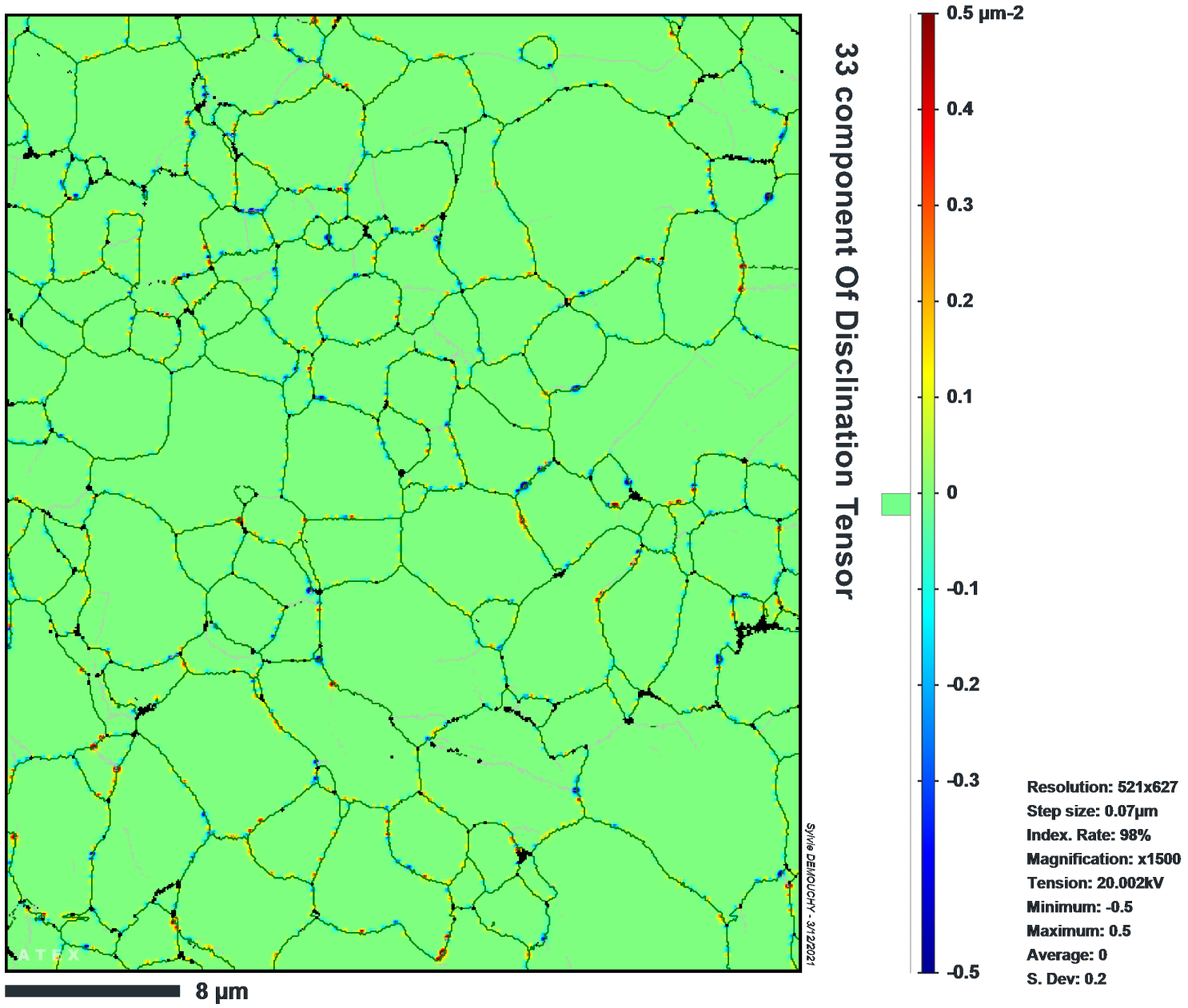
PI0546-XVIII



PI0546-XVIII



PI0546-XVIII



PI0546-XVIII