

Laboratoire de Géologie de Lyon
Terre Planètes Environnement



Procédure de correction de dérive lors de séries 3D en FIB

B. Van De Moortèle^a, H. Yuan^b, T. Epicier^b, J.C. Ménard^c

^a Université de Lyon, École Normale Supérieure de Lyon, Lab. de Géologie de Lyon UMR CNRS 5570, 15, Parvis René Descartes, 69342 Lyon cedex 07, FRANCE

^b Université de Lyon, INSA de Lyon, MATEIS UMR CNRS 5510, Bât. B. Pascal, 69621 Villeurbanne Cedex, FRANCE

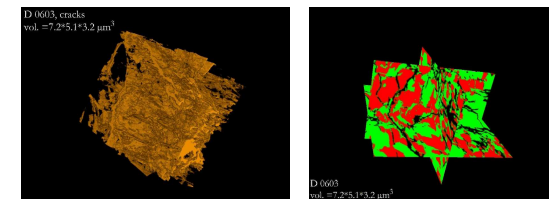
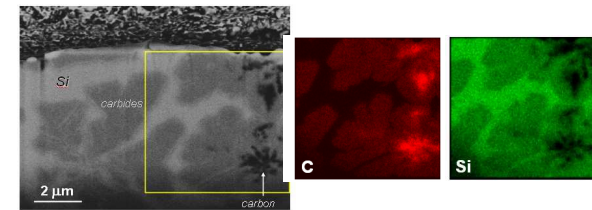
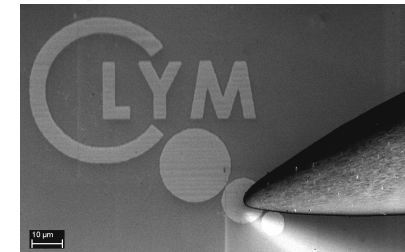
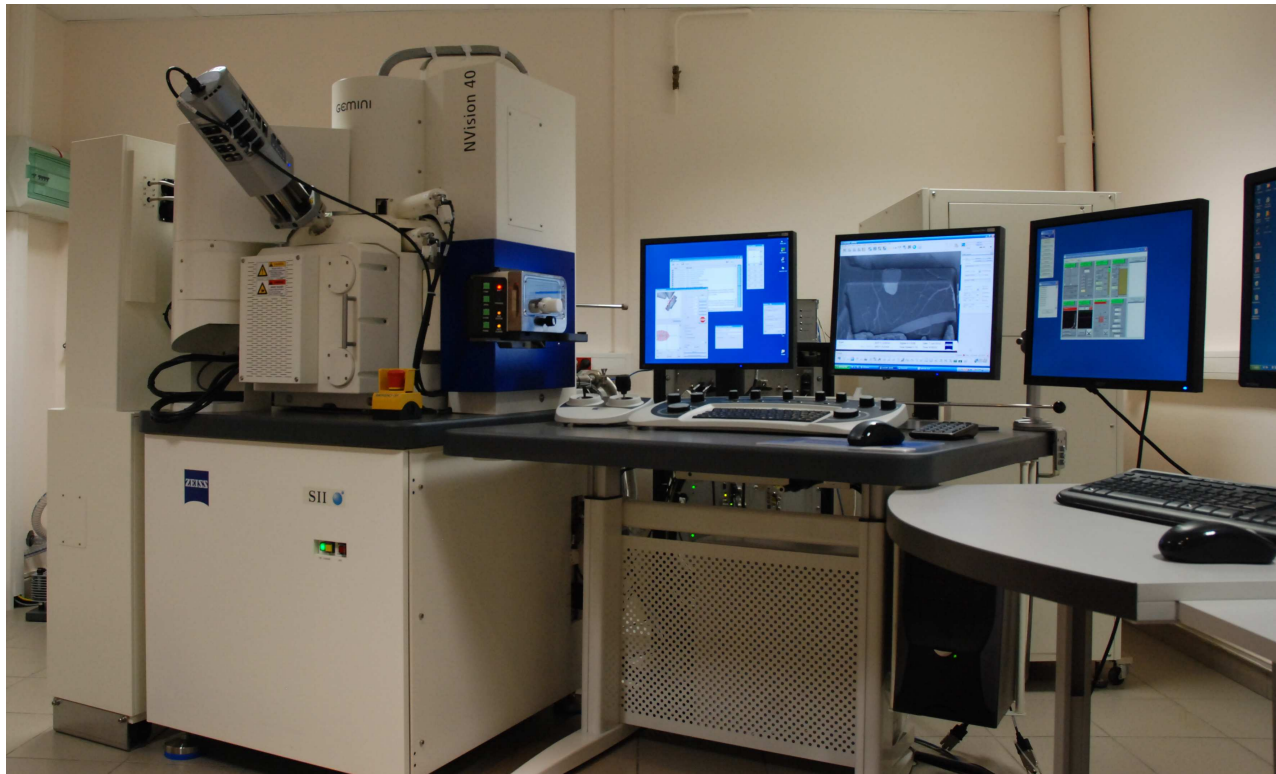
^c Carl ZEISS microscopie, 27 rue des Peupliers, 82752 Nanterre



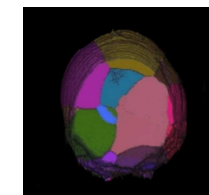
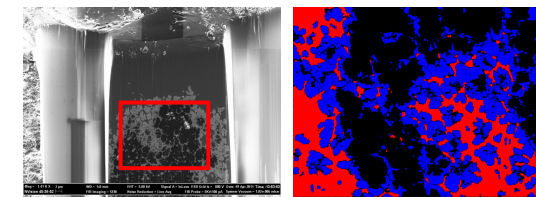
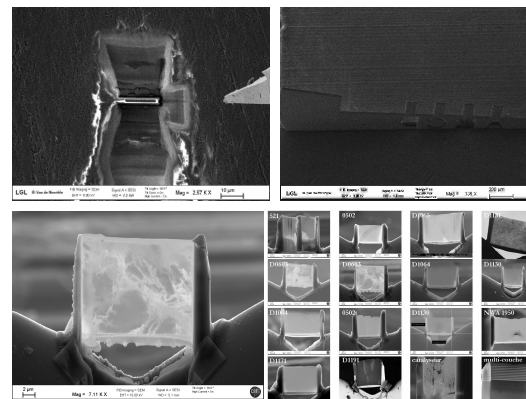
CARL ZEISS SMT

Le FIB : un outil de préparation, mais pas que...

A. Descamps, N. Blanchard, T. Douillard, T. Epicier et B. Van de Moortèle



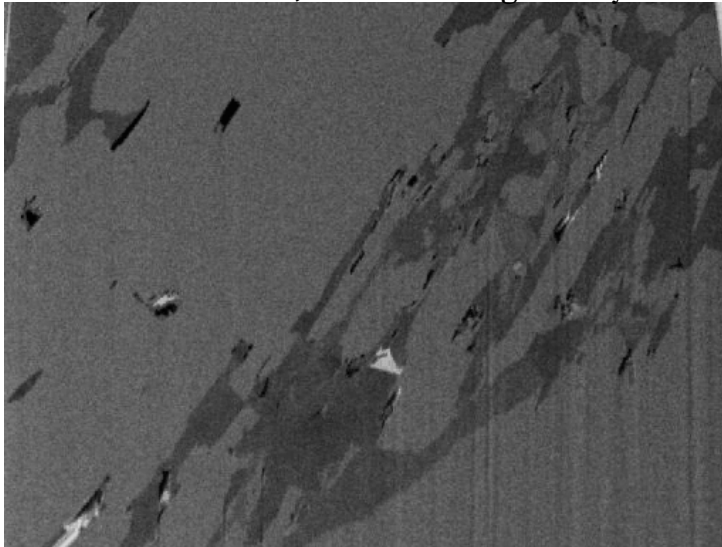
Détecteurs : SESI, BSE, InLens, EsB, STEM
µmanipulateurs : 2 KlockeNanotechnik
Analytique : EDX SDD 50mm² Oxford
 EBSD, camera Nordlys F⁺
Buse multi-injection : W, SiO_x, C, H₂O, XeF₂
Système de compensation de charge



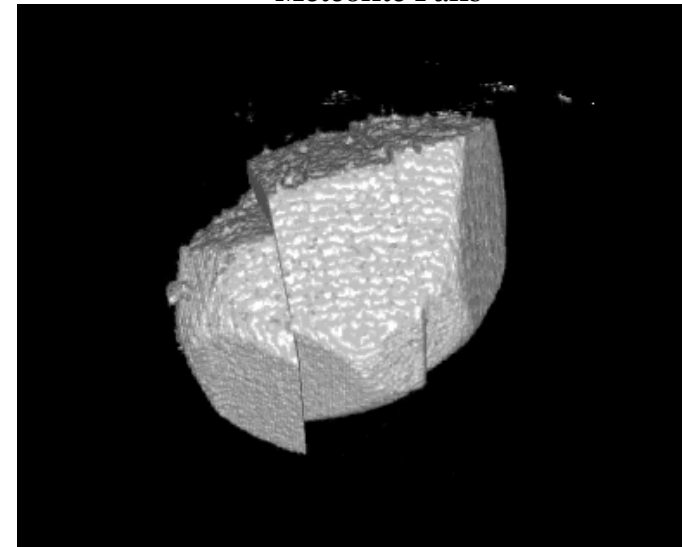
Nous remercions le CLYM pour l'accès au FIB Nvision40

B. Van de Moortèle, LGL, GNMEBA, décembre 2011

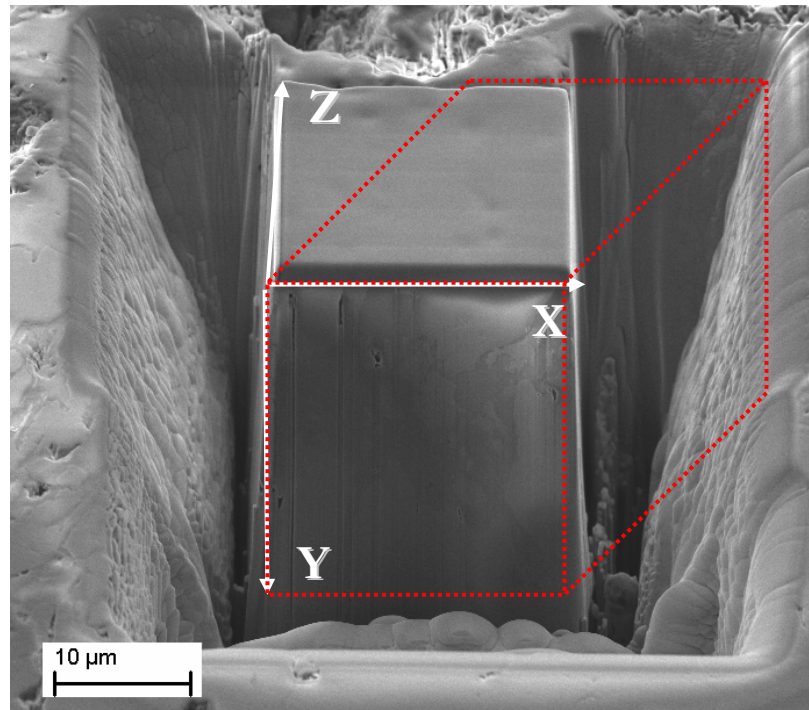
éch. M. Andreani, Lab. de Géologie de Lyon



Météorite Paris



4 μm



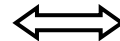
INSIGHTS ON THE THERMAL HISTORY OF THE PARIS CM CHONDRITE BASED ON THE PHASE RELATIONS OF ITS OPAQUE ASSEMBLAGES.

C. Caillet Komorowski¹, O. Boudouma², B. Reynard³, B. Van de Moortèle³, and A. El Goresy⁴. ¹Muséum National d'Histoire Naturelle, LMCM, UMR CNRS 7202, Paris, France. E-mail: ccaillet@mnhn.fr. ²UPMC-ISTEP, Paris. ³ENS - Laboratoire de Géologie de Lyon, UMR CNRS 5276. ⁴Bayerisches Geoinstitut, Universität Bayreuth, Germany.

We studied the characteristic features of FeNi metals and sulfides in matrix, around clasts and in chondrules of the primitive Paris CM chondrite [1] to explore its thermal history. Two pol-



AP_BEAMSHIFT_X, Y	Beam Shift
AP_BEAM_OFFSET_X, Y	Beam Offset
AP_BRIGHTNESS	Brightness
AP_CONTRAST	Contrast
AP_MAG	Magnification
AP_WD	Working Distance
AP_SPOT	Spot Signal
AP_PIXEL_SIZE	Pixel Size
AP_SCM	Specimen Current
AP_SPOTSIZE	Relative Spot Size
AP_IProbe	Probe Current
AP_STIG_X, Y	Stigmation
AP_AUTO_BRIGHT	Auto Brightness Target
AP_AUTO_CONTRAST	Auto Contrast Target
AP_ZOOM_FACTOR	Zoom Factor
AP_TILT_ANGLE	Tilt Angle



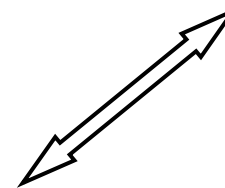
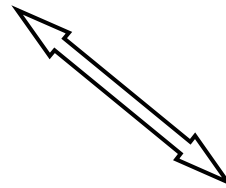
d'après SmartSEM Programmation API.pdf

Form1

Beam shift X actuel (%) -0.1202 Beam shift Y actuel (%) 0.3511

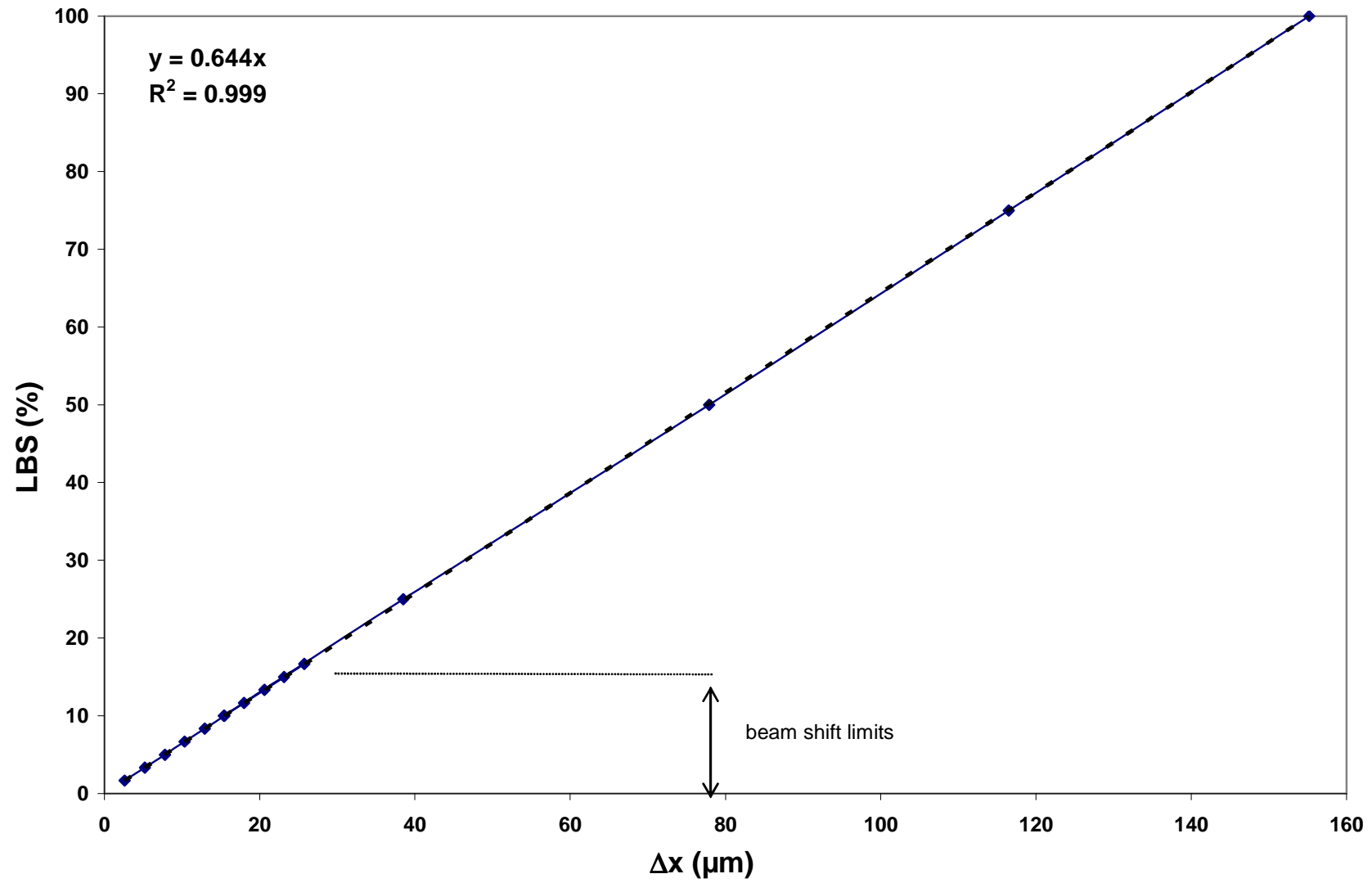
AJOUTER Beam shift X (%) 0 AJOUTER Beam shift Y (%) 0

Forcer le mode "large beam shift" VRAI X (%) -0.1202 vrai Y 0.3511



Fiji Is Just ImageJ

<http://pacific.mpi-cbg.de/wiki/index.php/Fiji>



```

Alignt11_allimages.jm
File Edit Language Templates Run Tools Help

Alignt11_allimages.jm
1 Dialog.create("parameters");
2 Dialog.addMessage("Define the SEM-FIB acquire conditions");
3 Dialog.addNumber(" SEM resolution (nm/pi) ", 10);
4 //Dialog.addNumber("scaling >=1", 4);
5 Dialog.addChoice(" scaling >=1 ", newArray("0", "1", "2", "4", "8"));
6 Dialog.addHelp("File:///C:/Program20Files/Fiji.app/help/micro-bvdm.txt");
7 Dialog.addNumber(" slope-DX-vs-BS% ", 0.046);
8 Dialog.addNumber(" Max image number ", 1000);
9 Dialog.addNumber("start align at image number", 0);
10 Dialog.addNumber("align all n images", 30);
11 //Dialog.addSlider("Max image Number", 1, 3000, 1000);
12 Dialog.show();
13 ps =Dialog.getNumber();
14 //print(ps);
15 a =Dialog.getChoice();
16 //print(a);
17 DBS =Dialog.getNumber();
18 //print(DBS);
19 sb=Dialog.getNumber();
20 //print(sb);
21 s=Dialog.getNumber();
22 x=Dialog.getNumber();
23 x=x+1;
24 //print(x);
25 sb=s+1;
26 path1=getDirectory("choisir le dossier où les images seront enregistrées");
27 path2=Path("TBP");
28 path3=Path("TR");
29 File.makeDirectory(path3);
30 File.makeDirectory(path3);
31 path3=path3+"TR";
32 path3=path3+"BS";
33 //
34 //choose of scale parameter : more precise more time-consuming...
35 s=1/a;
36 //choose of scale parameter : more precise more time-consuming...
37 //si l'alignement fait partie de l'alignement
38 //Dialog.create("continue?");
    
```

parameters

Define the SEM-FIB acquire conditions

SEM resolution (nm/pi)

scaling >=1:

slope-DX-vs-BS%

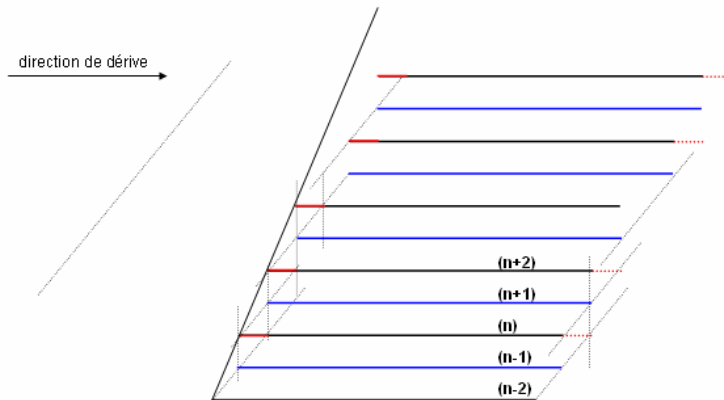
Max image number

start align at image number

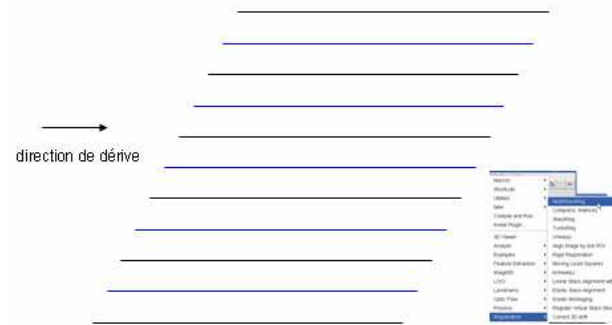
align all n images number

OK Cancel Help

1) correction d'une image sur l'autre



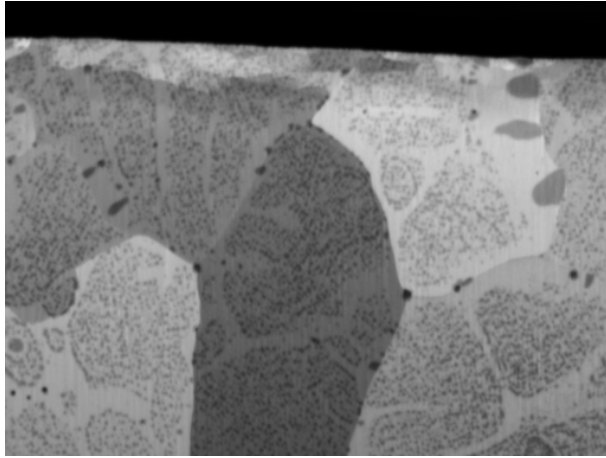
2) correction toutes les n images



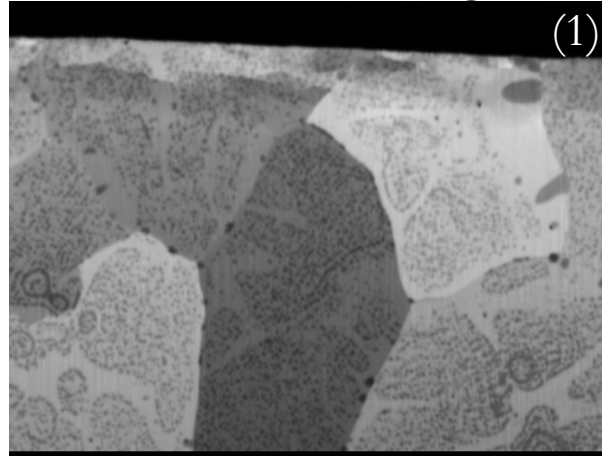
Si $\gamma_{n-1 \rightarrow n} = (0;0)$ et $\gamma_{n-2 \rightarrow n-1} = (\delta x; \delta y) \rightarrow \gamma_{n \rightarrow n+1} = (\delta x; \delta y)$

- 1-calcul de la dérive de proche en proche de l'image i à i+n
- 2-application d'un décalage de faisceau (ou platine) à l'image i+n+1
- 3-l'image i+n est la nouvelle référence

im. 122

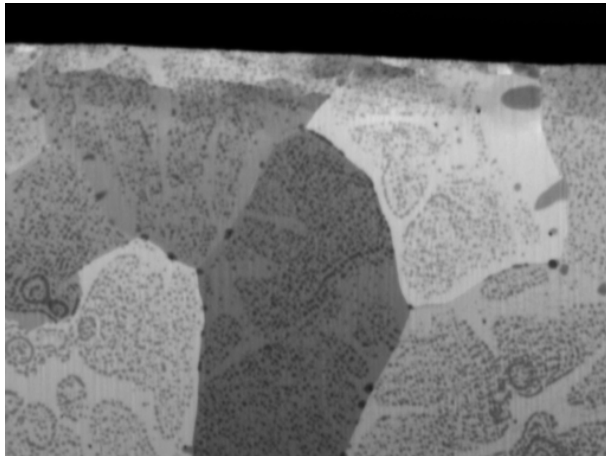


rec. toutes les images

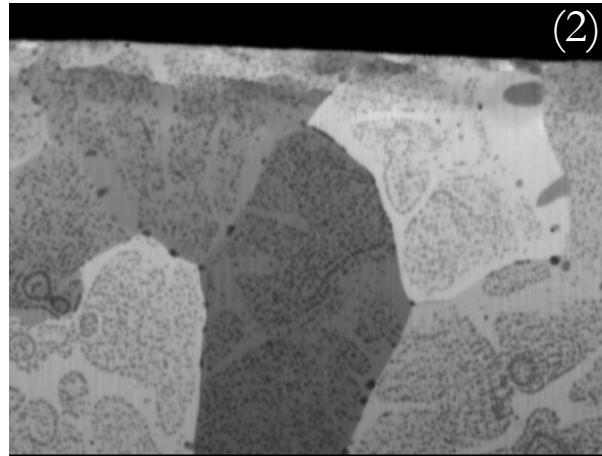


(1)

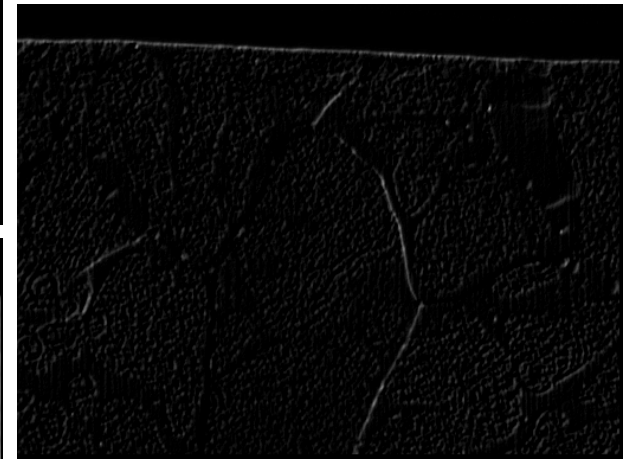
im. 142



recalage direct



(2)

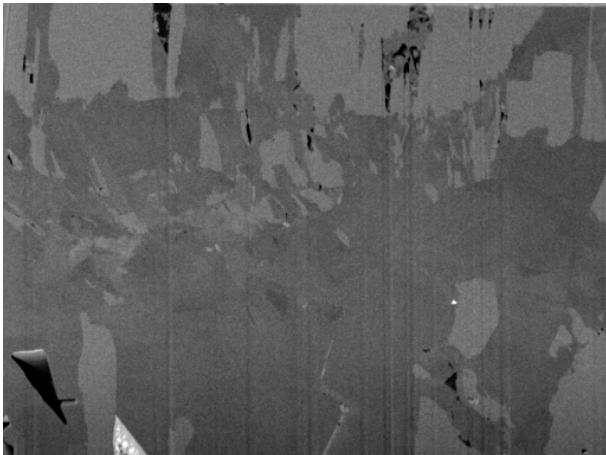
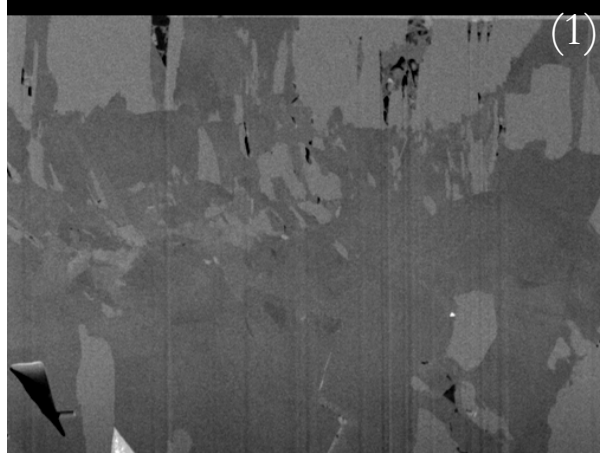


im (1) - im (2)

im. 020

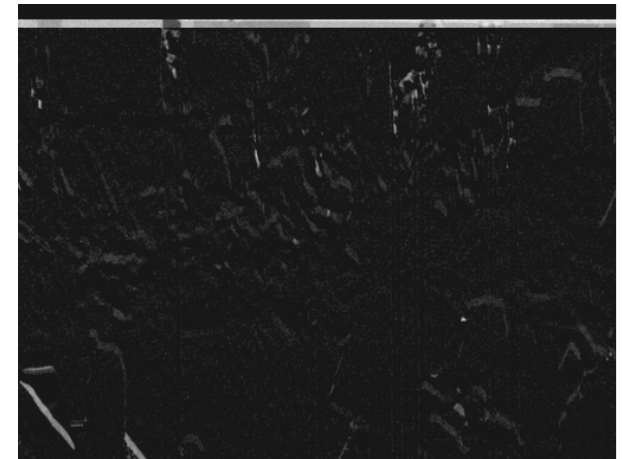
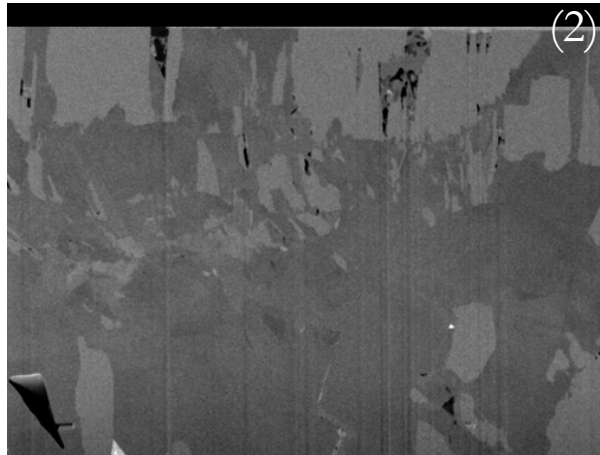


rec. toutes les images



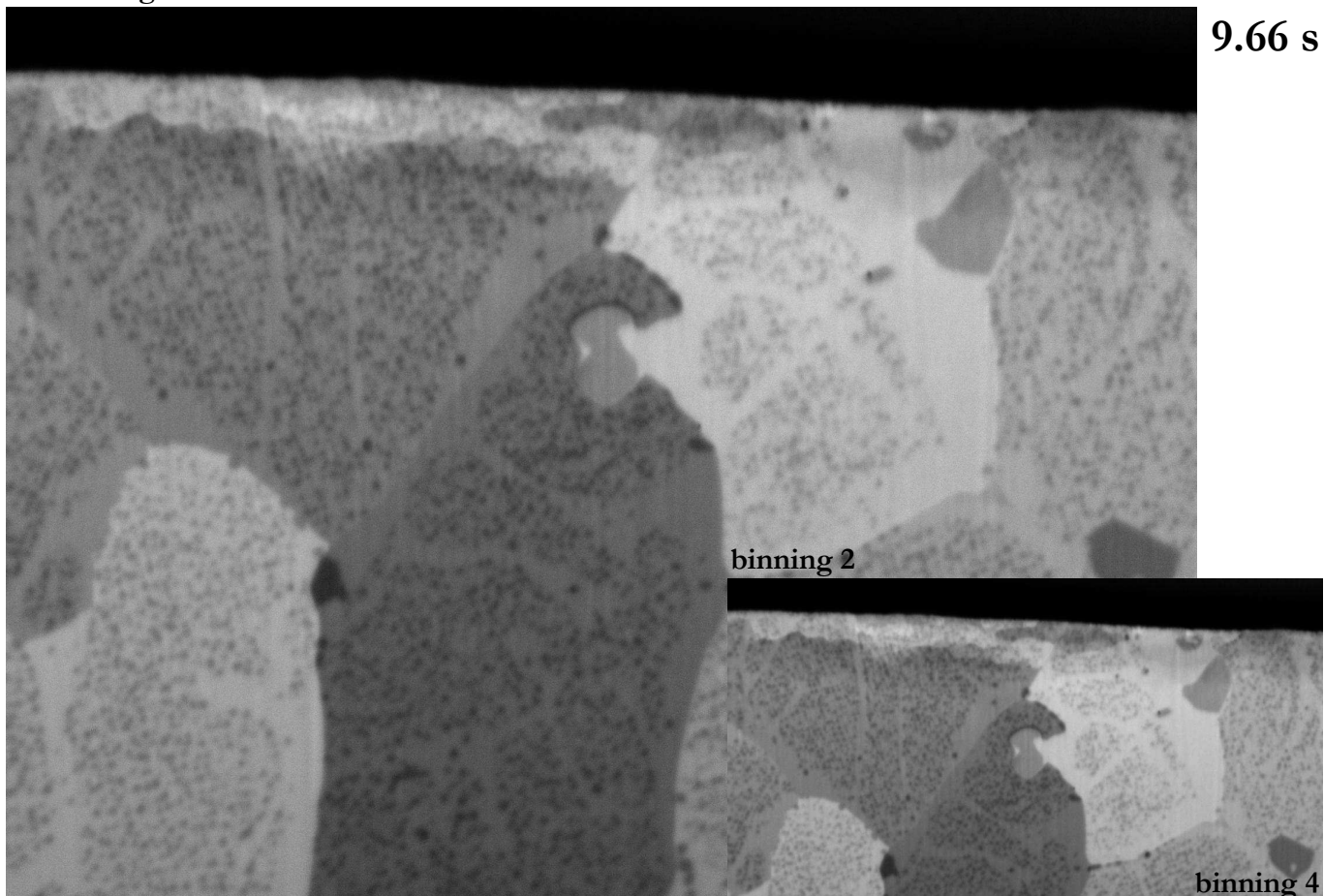
im. 040

recalage direct

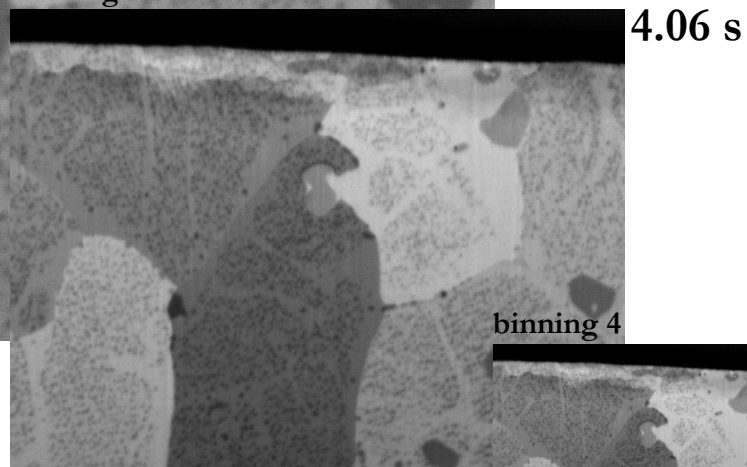


im (1) - im (2)

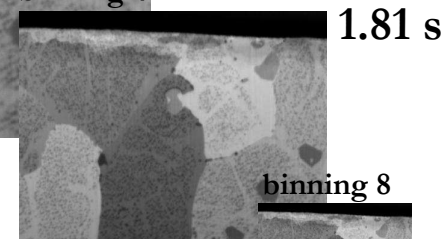
no-binning



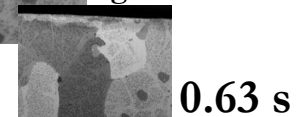
binning 2

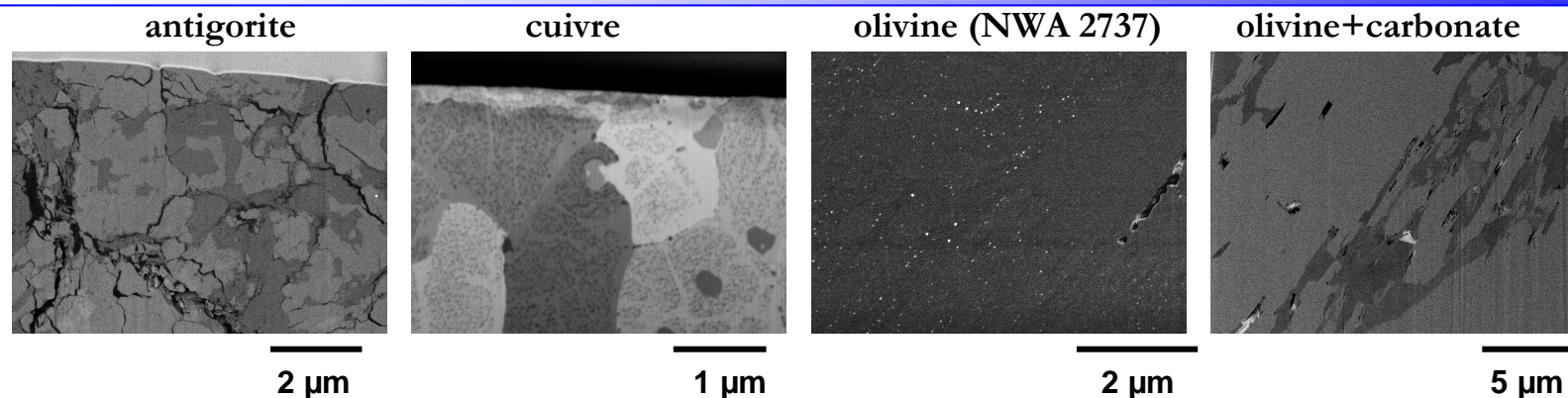


binning 4



binning 8

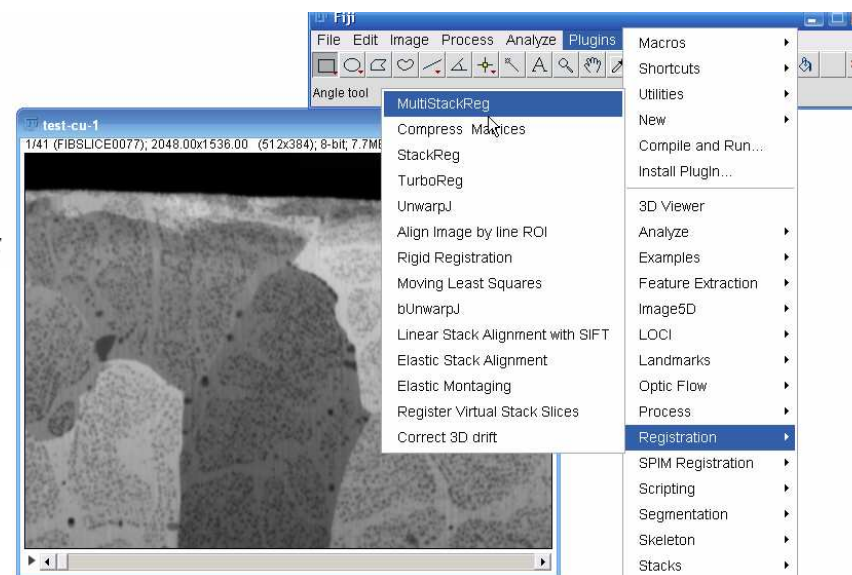




	D0603		Cu		NWA2737		FritDun	
bin1	1013.876	785.087	1052.809	698.677	1022.308	763.445	1019.291	755.225
	1024	768	1024	768	1024	768	1024	768
bin 2	506.944	392.540	526.404	349.340	511.163	381.718	509.656	377.587
	512	384	512	384	512	384	512	384
bin 4	253.484	196.264	263.201	174.671	255.551	190.849	254.841	188.765
	256	192	256	192	256	192	256	192
bin 8	126.741	98.128	131.593	87.340	127.775	95.402	127.441	94.345
	128	96	128	96	128	96	128	96
bin 1	10.124	-17.087	-28.809	69.323	1.692	4.555	4.709	12.775
bin 2	10.113	-17.080	-28.809	69.321	1.674	4.564	4.689	12.825
bin 4	10.065	-17.054	-28.805	69.315	1.797	4.606	4.635	12.939
bin 8	10.075	-17.023	-28.743	69.279	1.802	4.785	4.476	13.243
ecart-type	0.0285	0.0291	0.0324	0.0206	0.0678	0.1074	0.1056	0.2100

A Pyramid Approach to Subpixel Registration Based on Intensity

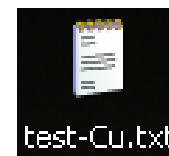
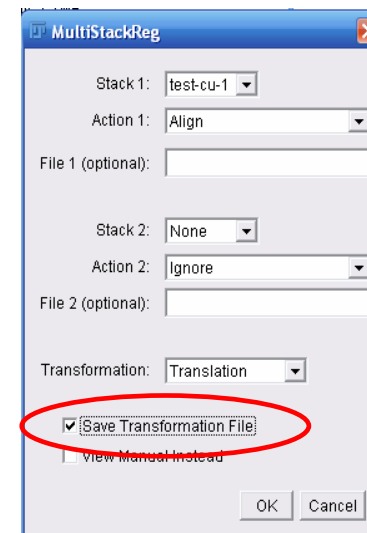
Philippe Thévenaz, Urs E. Ruttimann, and Michael Unser, *Senior Member, IEEE*

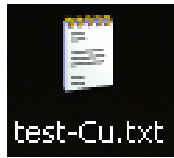



Brad Lee Busse

MultiStackReg v1.45 - Just drag/drop into your plugins folder - Prior to Array Tomography, our lab had been using **Stackreg** as an excellent and reliable alignment tool for ImageJ. As we began to image the same tissue repeatedly, we needed to be able to save and load the alignment parameters to ensure that images taken in different sessions were aligned the same way. MultiStackReg is just a slight alteration to Stackreg to allow for save/load functionality.

<http://www.stanford.edu/~bbusse/work/downloads.html>



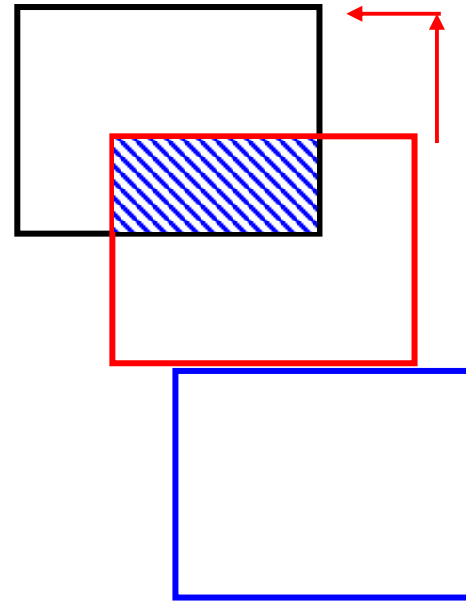


 Zone utile pour la reconstruction 3D

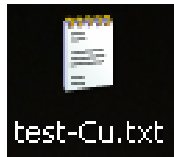
```

1 MultiStackReg Transformation File
2 File Version 1.0
3 0
4 TRANSLATION
5 Source img: 2 Target img: 1
6 256.2512531525796      193.71586479949374
7 0.0      0.0
8 0.0      0.0
9
10 256.0      192.0
11 0.0      0.0
12 0.0      0.0
13
14 TRANSLATION
15 Source img: 3 Target img: 1
16 255.84738369041096    195.10069072576823
17 0.0      0.0
18 0.0      0.0
19
20 256.0      192.0
21 0.0      0.0
22 0.0      0.0
23
24 TRANSLATION
25 Source img: 4 Target img: 1
26 261.8568165560044    185.7520806373666
27 0.0      0.0
28 0.0      0.0
29

```



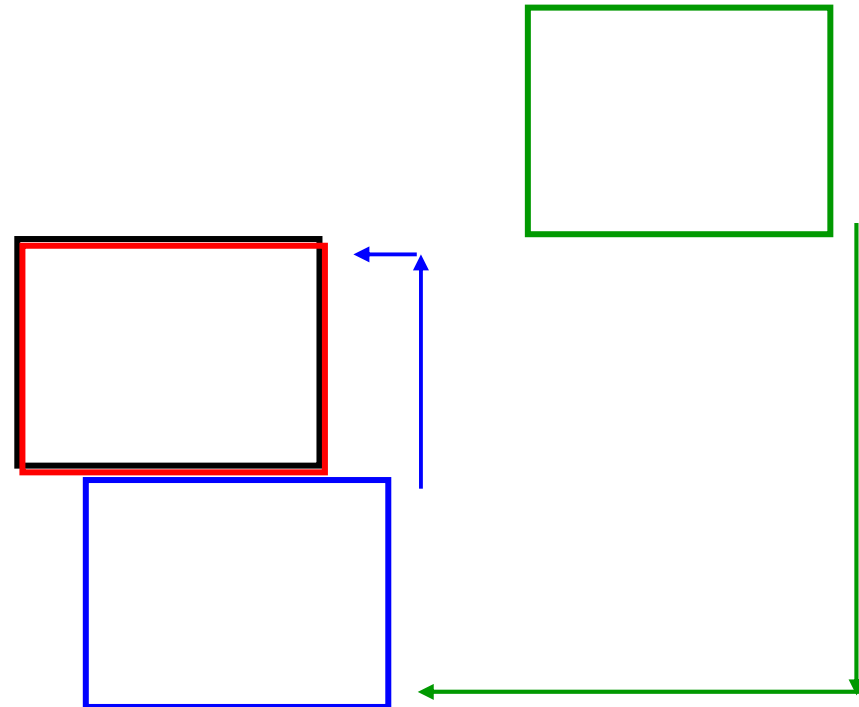
- 1-une image est caractérisée par la position de son centre → Image 512/384
- 2-l'image de référence pour recaler une image est toujours l'image précédente



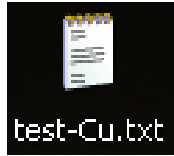
```

1 MultiStackReg Transformation File
2 File Version 1.0
3 0
4 TRANSLATION
5 Source img: 2 Target img: 1
6 256.2512531525796 193.71586479949374
7 0.0 0.0
8 0.0 0.0
9
10 256.0 192.0
11 0.0 0.0
12 0.0 0.0
13
14 TRANSLATION
15 Source img: 3 Target img: 1
16 255.84738369041096 195.10069072576823
17 0.0 0.0
18 0.0 0.0
19
20 256.0 192.0
21 0.0 0.0
22 0.0 0.0
23
24 TRANSLATION
25 Source img: 4 Target img: 1
26 261.8568165560044 185.7520806373666
27 0.0 0.0
28 0.0 0.0
29

```



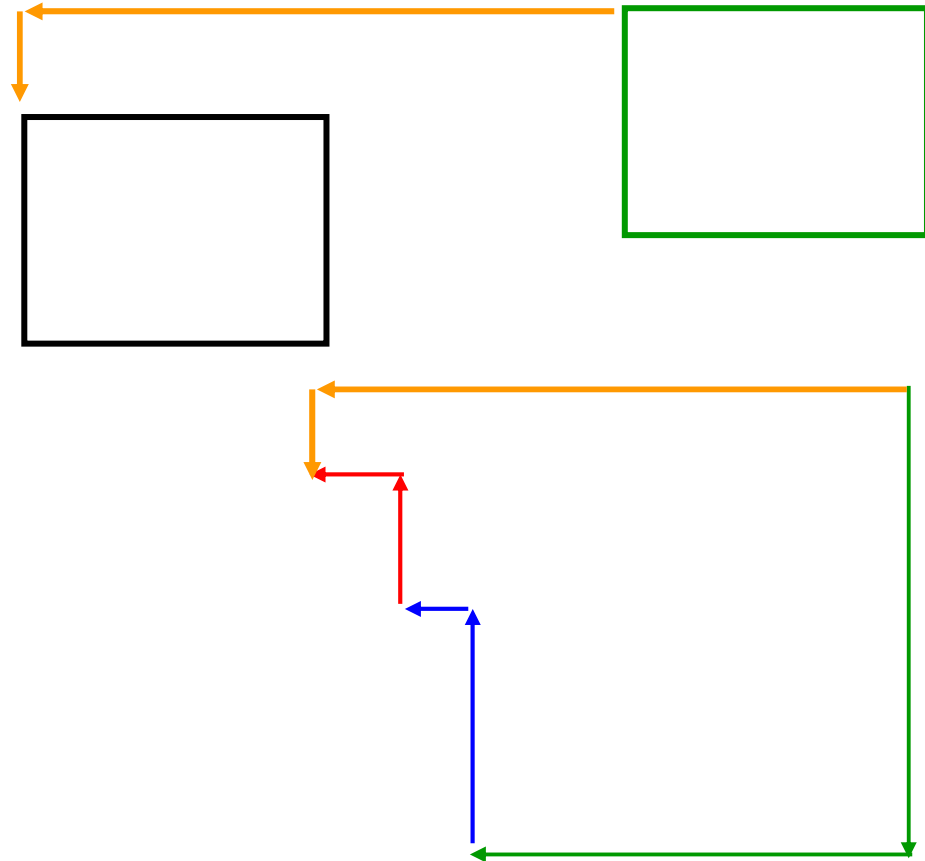
- 1-une image est caractérisée par la position de son centre → Image 512/384
- 2-l'image de référence pour recaler une image est toujours l'image précédente



```

1 MultiStackReg Transformation File
2 File Version 1.0
3 0
4 TRANSLATION
5 Source img: 2 Target img: 1
6 256.2512531525796 193.71586479949374
7 0.0 0.0
8 0.0 0.0
9
10 256.0 192.0
11 0.0 0.0
12 0.0 0.0
13
14 TRANSLATION
15 Source img: 3 Target img: 1
16 255.84738369041096 195.10069072576823
17 0.0 0.0
18 0.0 0.0
19
20 256.0 192.0
21 0.0 0.0
22 0.0 0.0
23
24 TRANSLATION
25 Source img: 4 Target img: 1
26 261.8568165560044 185.7520806373666
27 0.0 0.0
28 0.0 0.0
29

```



- 1-une image est caractérisée par la position de son centre → Image 512/384
- 2-l'image de référence pour recaler une image est toujours l'image précédente
- 3-le décalage entre l'image n et l'image n+10 est la somme des décalages des images de n à n+10 prises deux à deux



parameters

Define the SEM-FIB acquire conditions

SEM resolution (nm/pi) 10

scaling >=1: 4

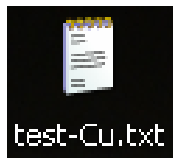
slope-DX-vs-BS% 0.046

Max image number 1000

start align at image number 0

align all n images number 30

OK Cancel Help



TRANSLATION

Source img: 11 Target img: 1

```

255.420264 188.676982
  0         0 0.579736221 3.323018217
  0         0
256        192
  0         0
  0         0
    
```

	shift X (pi)	shift Y (pi)
Total	6.0582052	10.2787509

décalage en pi

Fichiers générés par notre Macro Fiji



-0.0450 } valeurs de Beam Shift à injecter
-0.0571 }
128 }
96 } valeurs de contrôle
1280.8681 }
961.1009 }
-9222.9445 }
-6920.8073 }

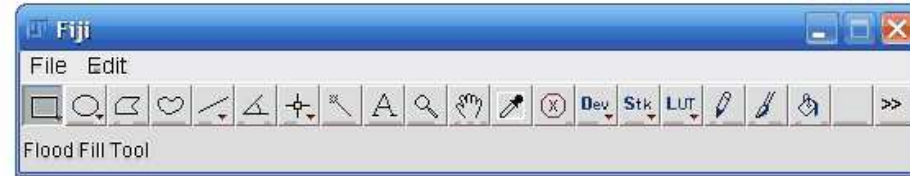
Form1

Beam shift X actuel (%) -0.1202 Beam shift Y actuel (%) 0.3511 Refresh

AJOUTER Beam shift X (%) 0 AJOUTER Beam shift Y (%) 0 Beamshift

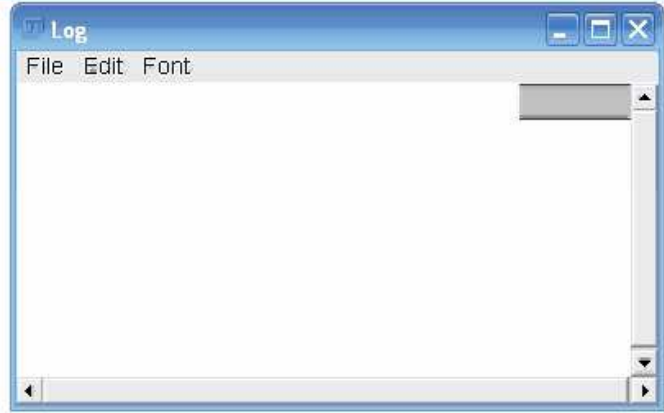
Forcer le mode "large beam shift" VRAI X (%) -0.1202 vrai Y 0.3511

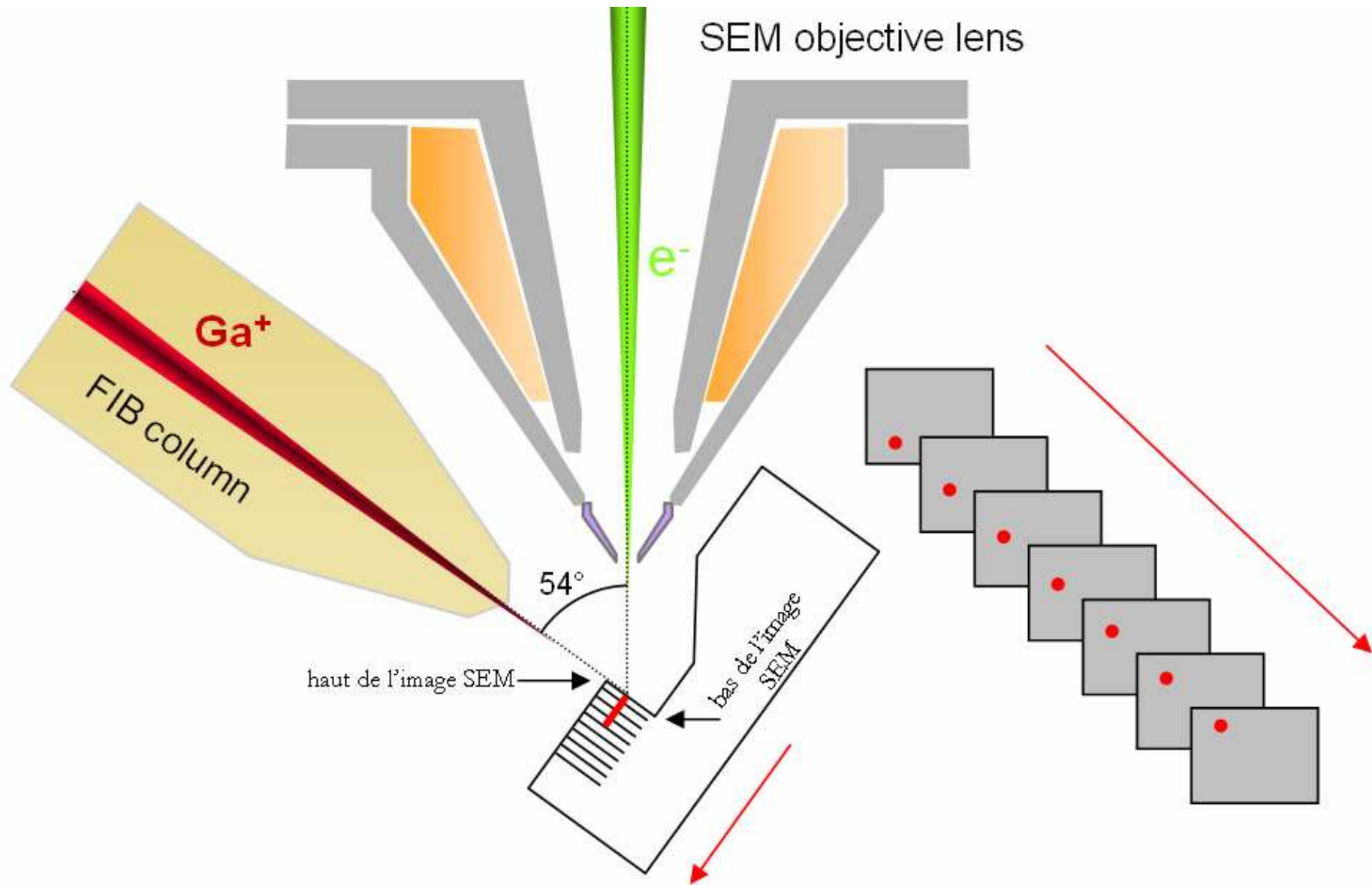




```
Align11_all-n-images-1.0.1.ijm
File Edit Language Templates Run Tools Tabs
Align11_all-n-images-1.0.1.ijm
1 Dialog.create("parameters");
2 Dialog.addMessage("Define the SEM-FIB acquire conditions");
3 Dialog.addNumber(" SEM resolution (nm/pi) ", 10);
4 //Dialog.addNumber("scaling >=1", 4);

Run Show Output Clear
java.lang.ThreadDeath: null
    at java.lang.Thread.stop(Thread.java:758)
    at fiji scripting TextEditors$Executer.obliterate(TextEditor.java:...
```





sans correction de dérive

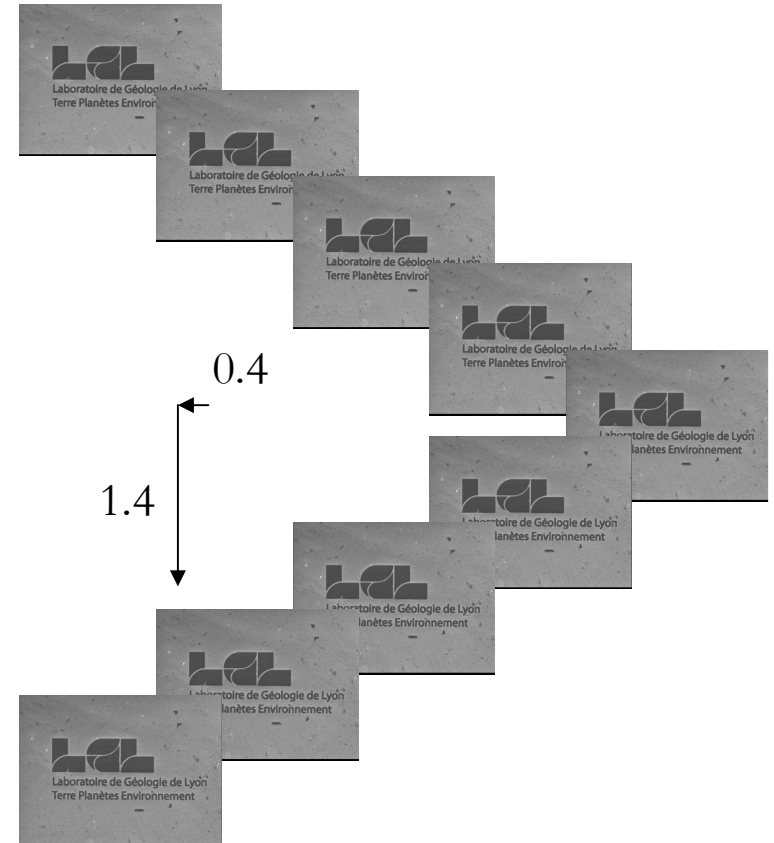
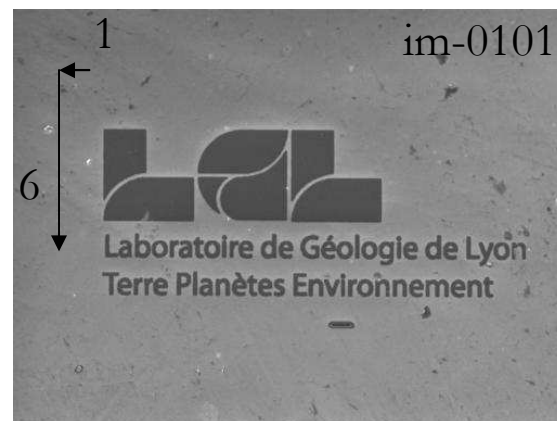
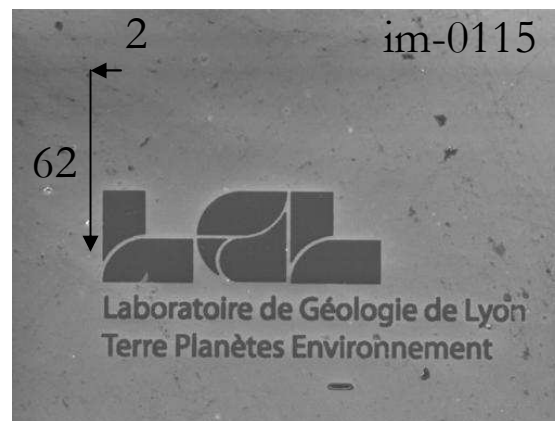
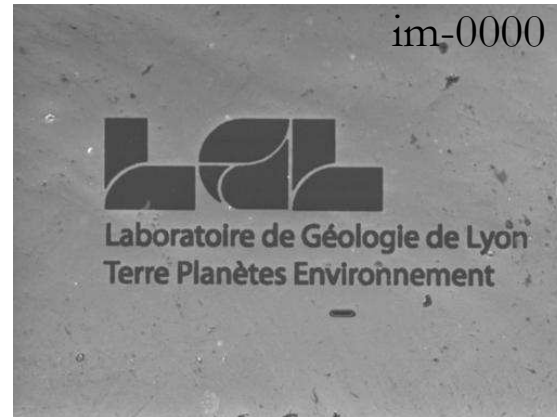


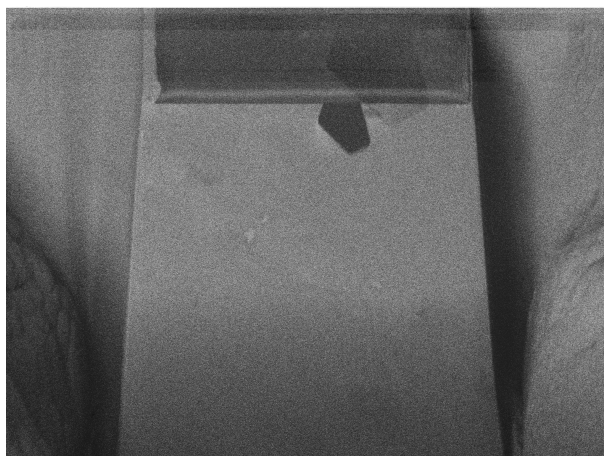
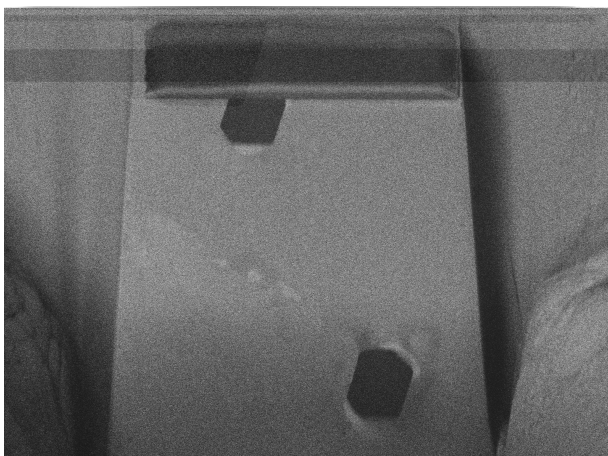
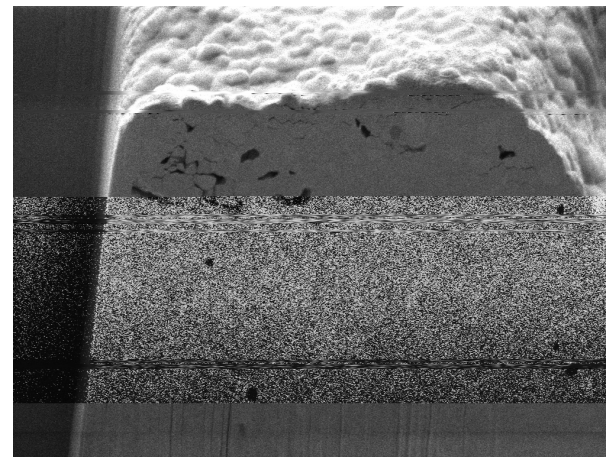
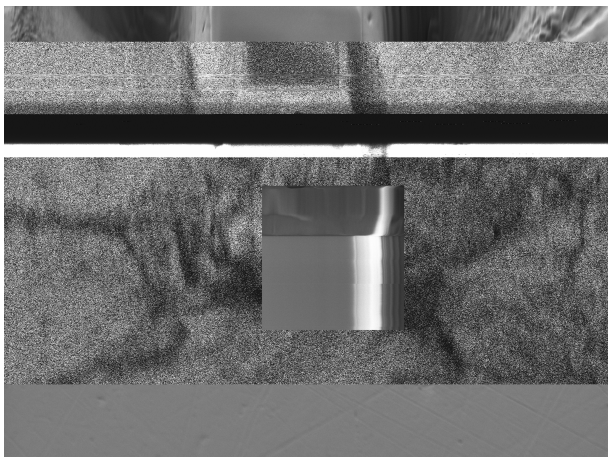
avec correction de dérive



images non recalées

images recalées



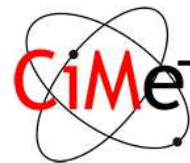




1ère réunion CaZaC en juillet 2010 à Lyon

Journées CaZaC 2012

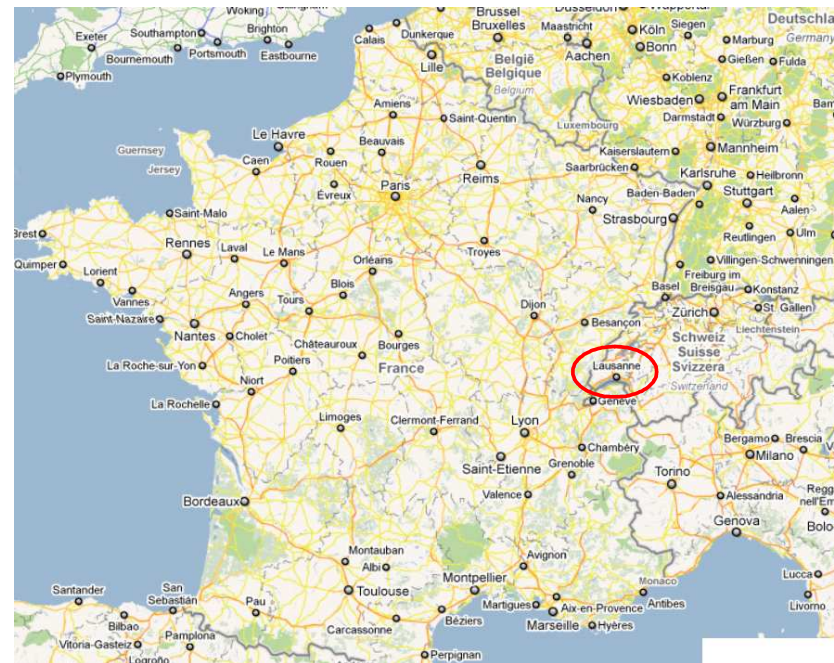
Carl Zeiss application Community



Centre
Interdisciplinaire
de Microscopie
Électronique



ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE



13 et 14 juin 2012