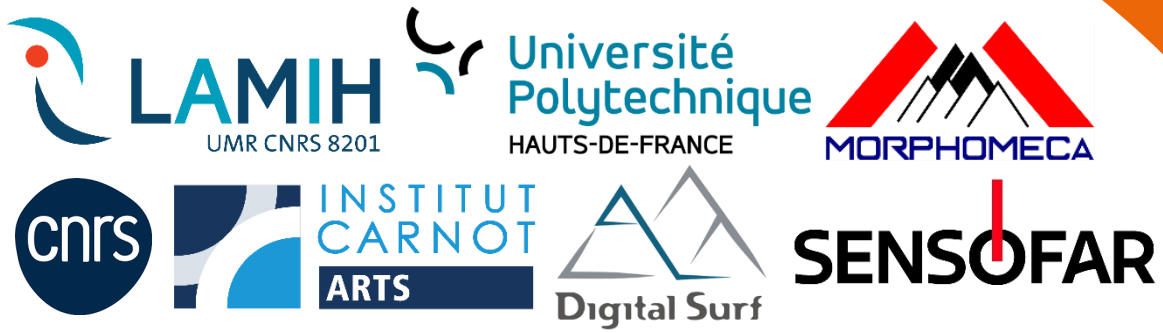




Inter-comparaison de technologies de mesure sur un profilomètre 3D multi-physique appliquée à des surfaces abrasées en TA6V

C. Moreau^{1,2}, M. Bigerelle¹, J. Lemesle^{3,4}, F. Blateyron²,
C.A. Brown⁵

1. LAMIH 2. Digital Surf 3. Valutec 4. UR Concept 5. Worcester Polytechnic Institute

cnrs **EDR** Groupement de recherche
Surf Topo - 2077
Topographie des Surfaces



*Présenté par :
Clément Moreau
clement.moreau@uphf.fr*

Introduction

Contexte Scientifique

Constat expérimental

Piste de réflexion

Surface étudiée

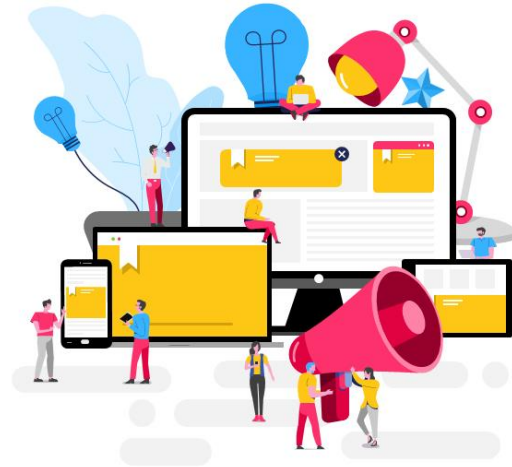
Problématique

Mesure

Méthode

Résultats et interprétation

Conclusions et perspectives



Sommaire

Introduction



INTRODUCTION

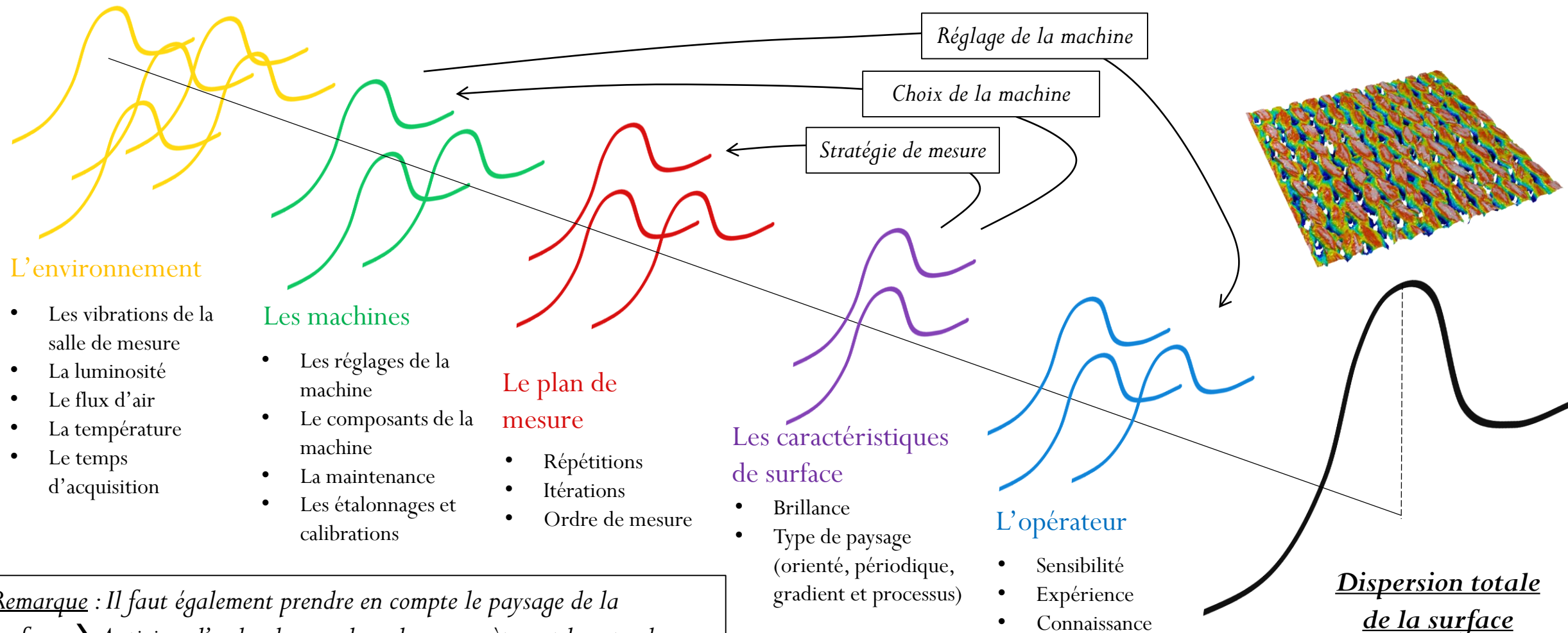
...wing pages are meant to revolutionize the way church
...done in America. The title of this book *Church Planting:
...a Manual* is designed to elicit curiosity from a reader
...looking for more than a checklist of the "how-to's" in
...planting.

In its essence this book is about faith, church planting, and
...how they intertwine to form a lifestyle. Church planting is more
...than just a one, two, or three step manual. For the church planter
...who has been able to establish a strong healthy church, it has been
...about a church planting lifestyle involving choices and decisions
...that ultimately lead a person back to God's call. Faith and church
...planting cannot and should not be separated.

I want the reader to get a glimpse into the life of my family
...whose exciting faith journey has highlighted church planting
...from virtually every angle. Pam and I, as well as our children Adam
...and Amy, have been engaged in establishing strong, healthy, repro-
...ducing churches in many parts of the country for over thirty years.

Contexte Scientifique

Dispersions élémentaires

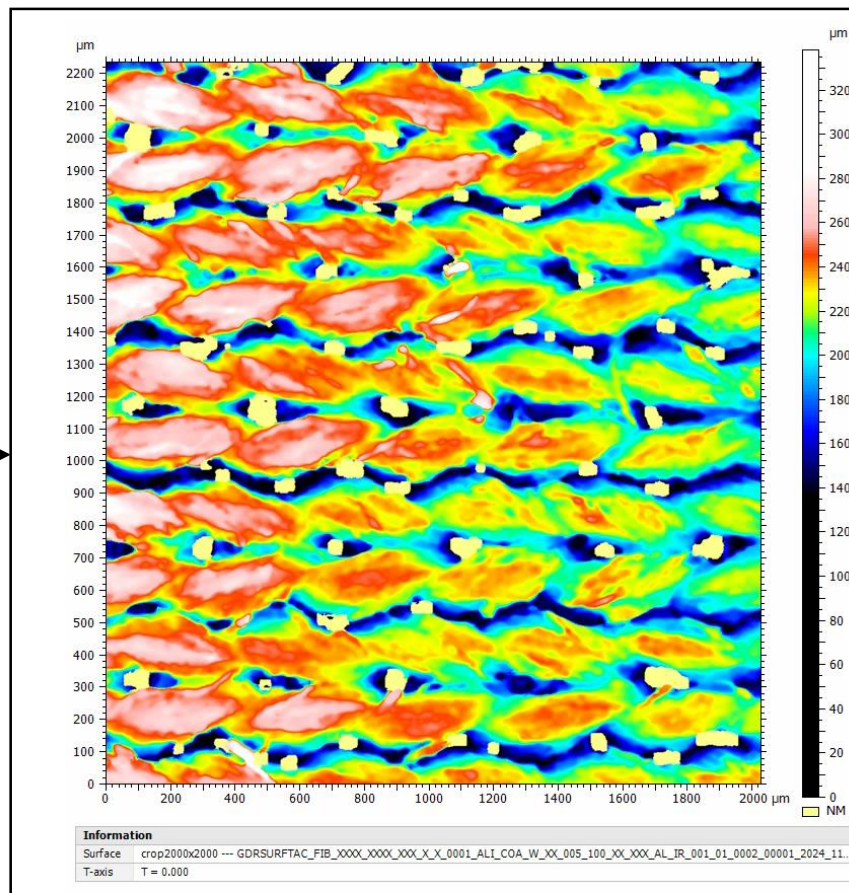


Constat expérimental

Mesure long terme : Observation

Surfaces
Elémentaires

Mesurer 100
fois la surface



Caractéristiques de la mesure

Machine : Alicona Infinite
focus G5

Lumière : Coaxiale

Objectif : X20

Résolution latéral : 0,66 μm

Nombre de mesures : 100

Plan de mesure

Mesure élémentaire : 2200 x
2000 μm

Aucun déplacement machine

Fréquence d'acquisition :
6 mesure/s

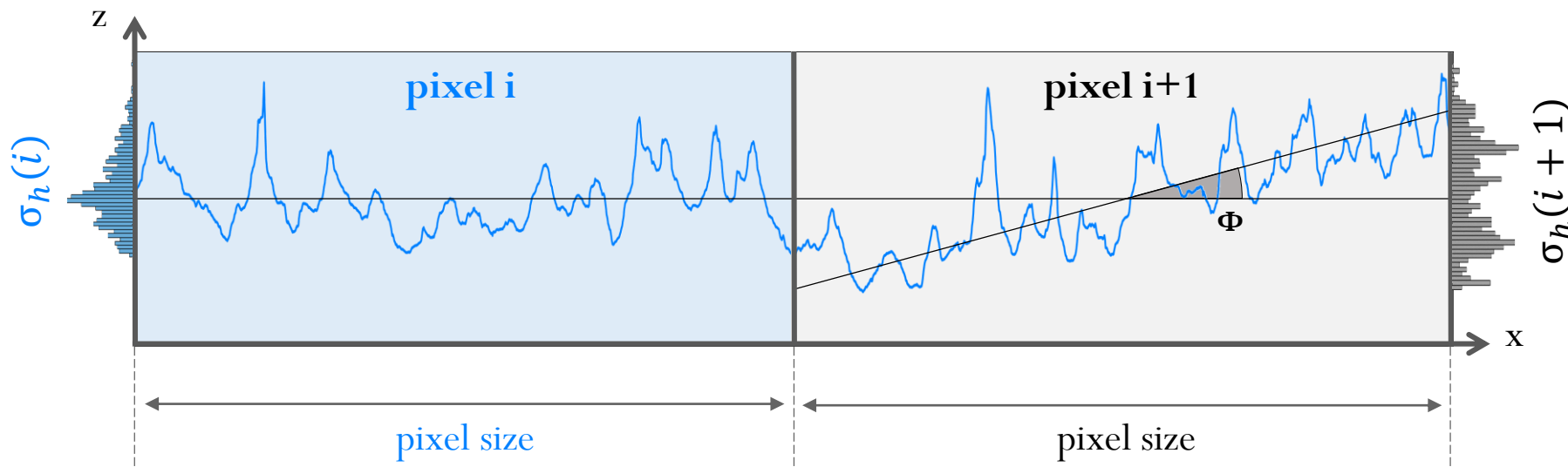
Mouvements
en X, Y et Z
de la surface

Data

Variation des
paramètres
de rugosité

Piste de réflexion ...

Pourquoi le



Conclusion

L'incertitude dépend de
la pente / du gradient
de la surface

$$\delta_z(i) \approx \sqrt{\frac{1}{2} \frac{\langle I \rangle}{I} \sigma_h^2(i)}$$

$$\delta_z(i+1) \approx \sqrt{\frac{1}{2} \frac{\langle I \rangle}{I} \left(\sigma_h^2(i+1) + \frac{1}{12} \left(\frac{\partial z}{\partial x} \Delta_x \right)^2 \right)}$$

Reference : Liu *et. al.*, Estimation of measurement uncertainty caused by surface gradient for a white light interferometer, Journal : Applied Optics, October 2015

Surface d'étude

En quelque mots :

SÉBUM

CAPILLARITÉ

INTERACTION AVEC L'HUMAIN

LUNETTES

PILOSITÉ



OPTIQUES

LIMITÉ L'ABRASION

CAPTATION DES PARTICULES

SMARTPHONE

CAPTEURS CCD

ECRAN

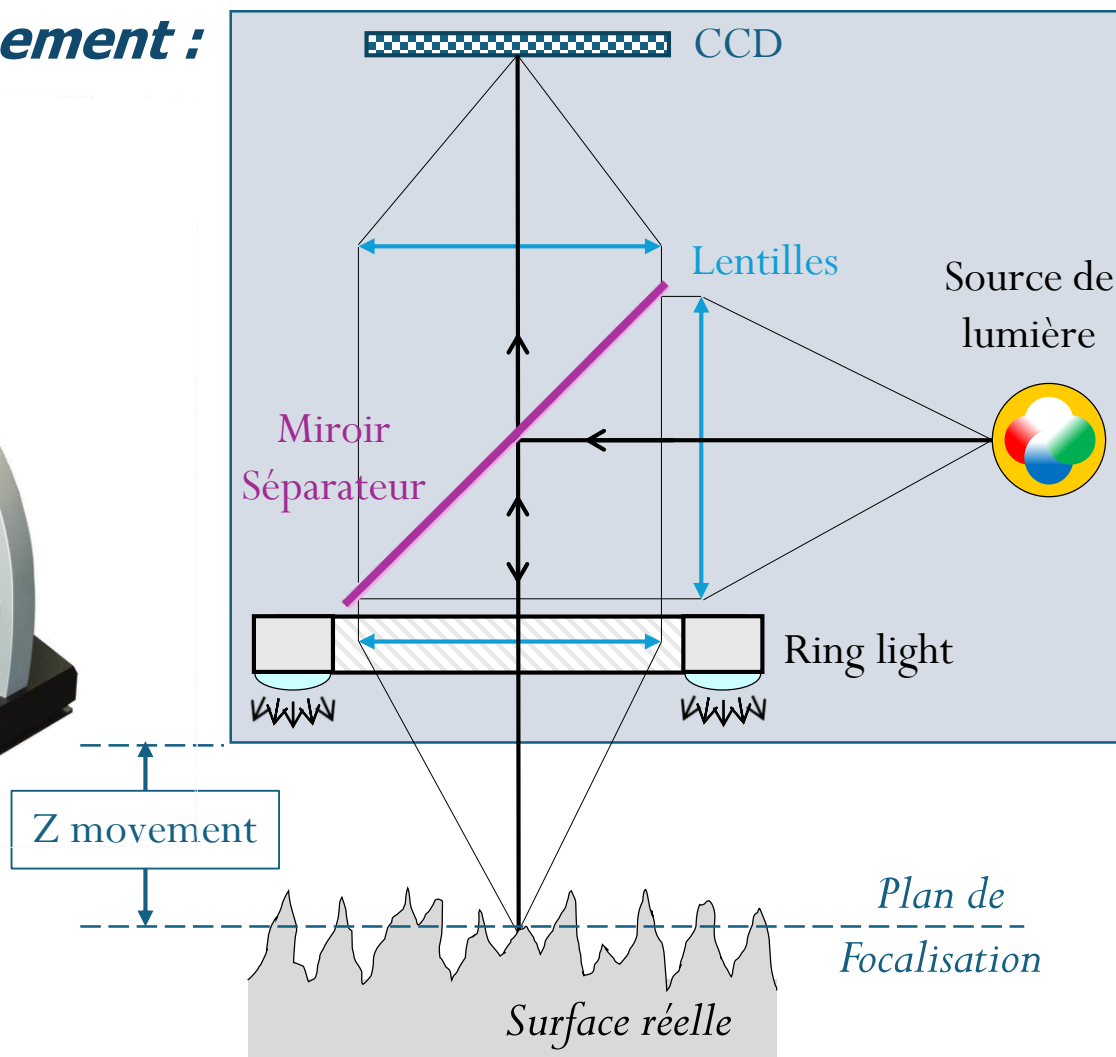
Comment déterminer l'aptitude à mesuré d'un profilomètre optique 3D?



Mesure

L'Alicona Infinite Focus G5

Principe de fonctionnement :



Conclusion

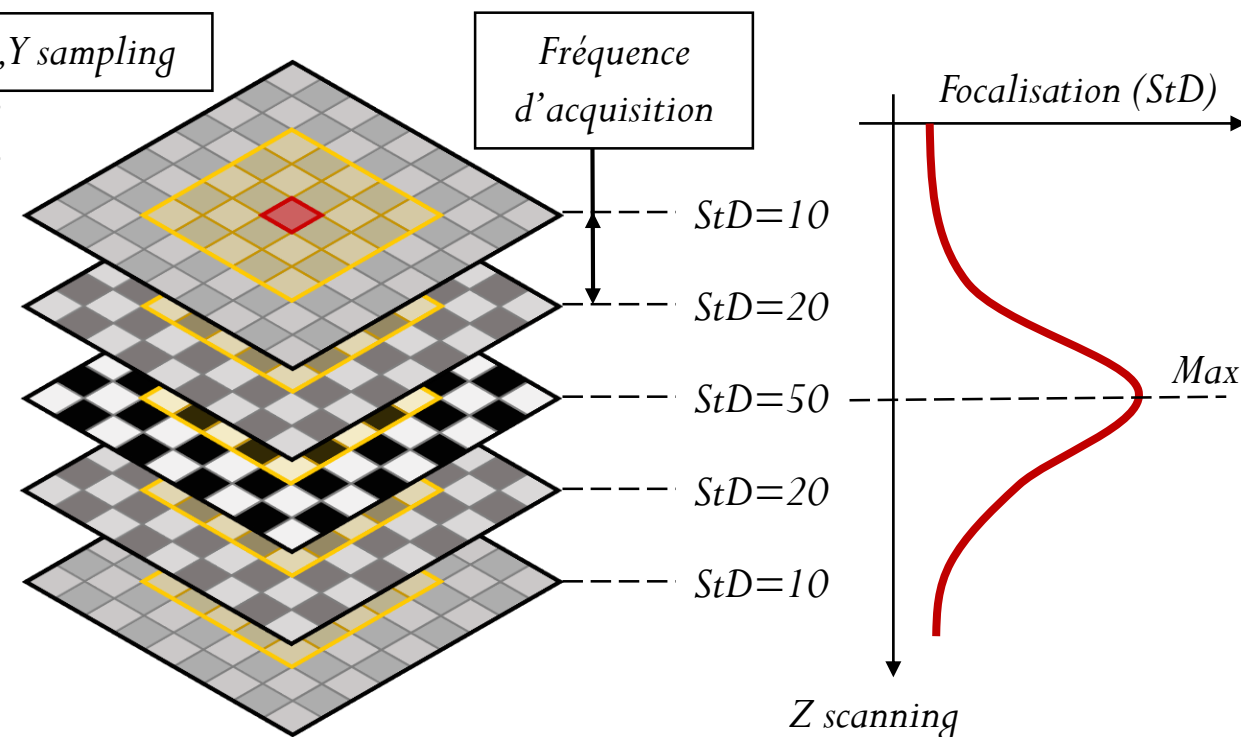
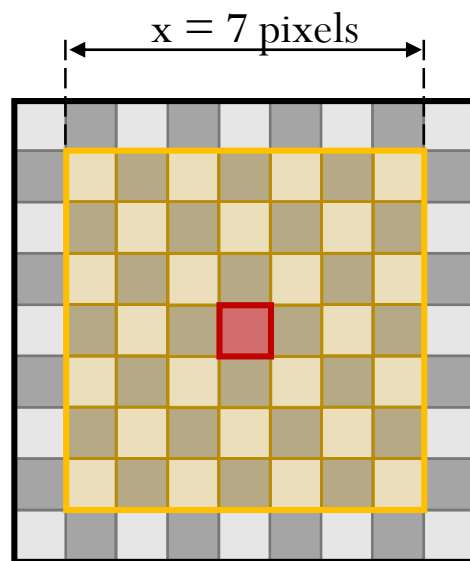
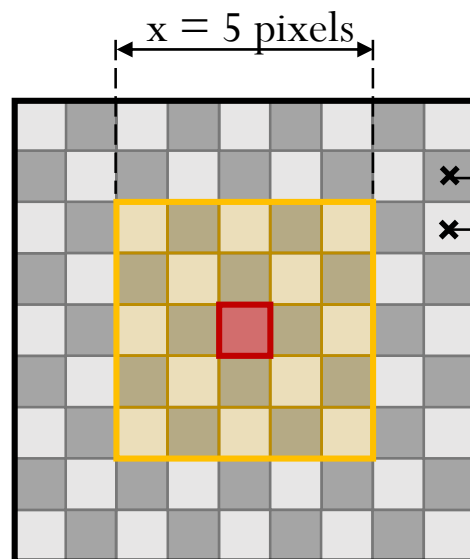
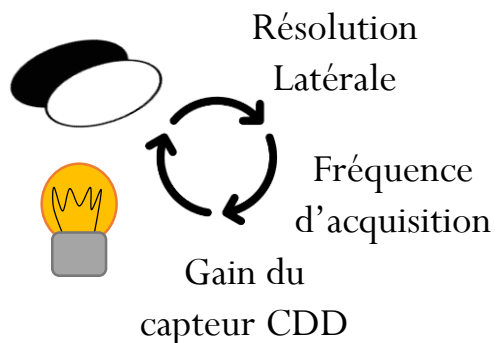
On mesure en tout point de la surface une nuance de gris ,et ce, pour chaque incrément en Z

Critère de focalisation

Mais encore ...



Les inputs



Légende

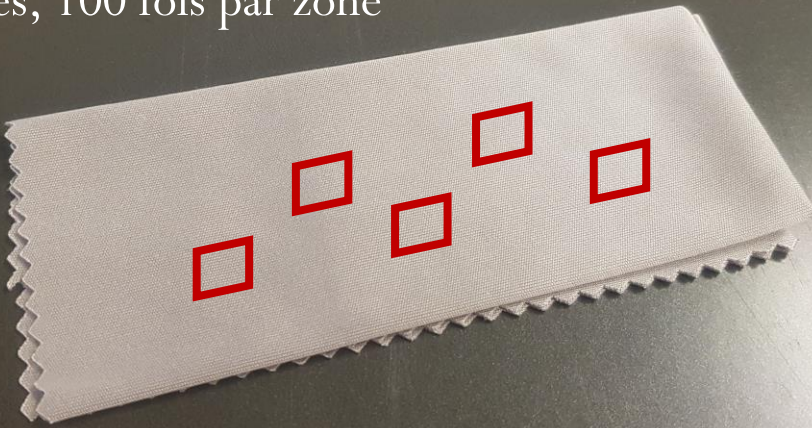
- Pixel mesuré
- Zone d'intérêt pour la mesure
- x: Résolution latérale (pixels)



Méthode

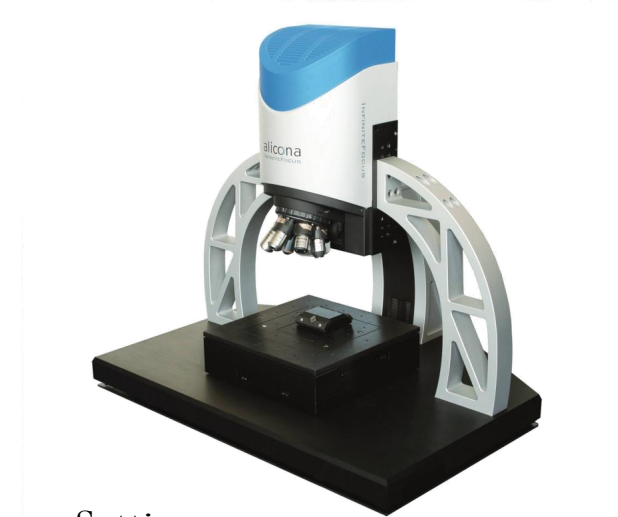
Plan de mesure

Mesure sur 5 zones
différentes, 100 fois par zone



Conclusion

Plan de mesure simple, rapide et facilement automatisable sur les instruments actuels



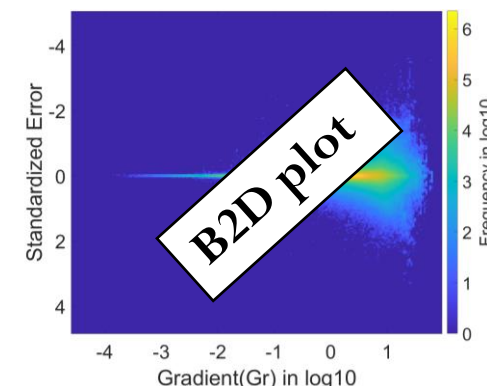
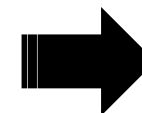
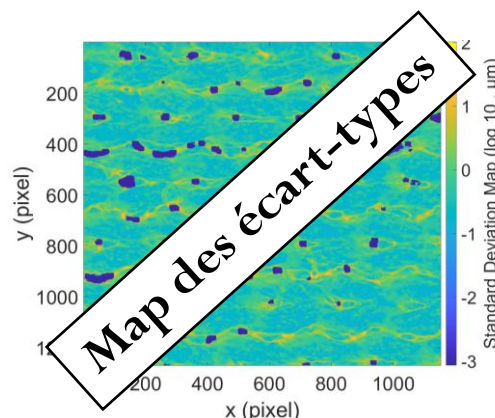
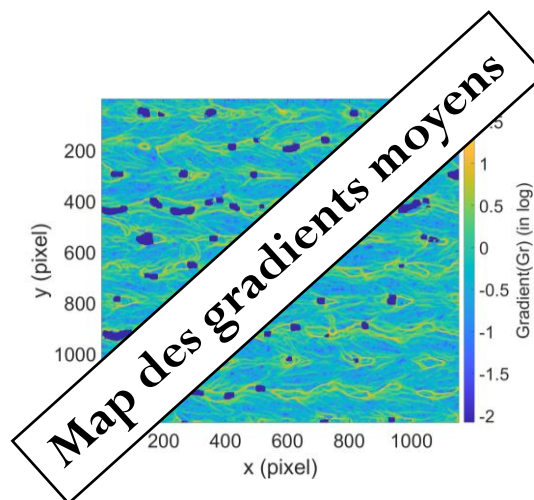
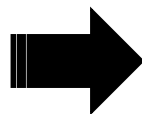
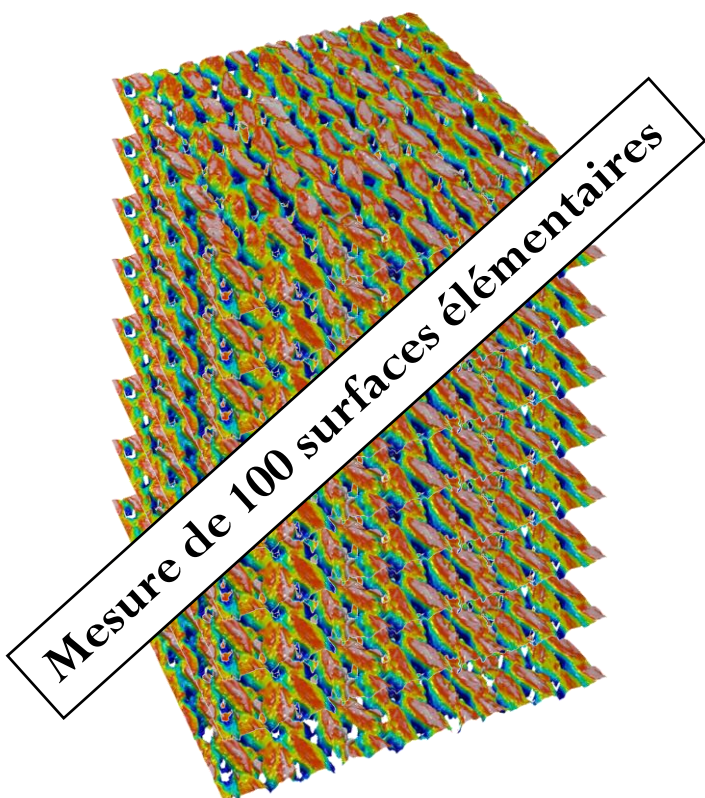
Settings :

Objectif 20X

Résolution latérale : $3\mu\text{m}$

Résolution Z : 50nm

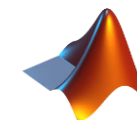
Calculs des maps de gradients et StD



Définition :

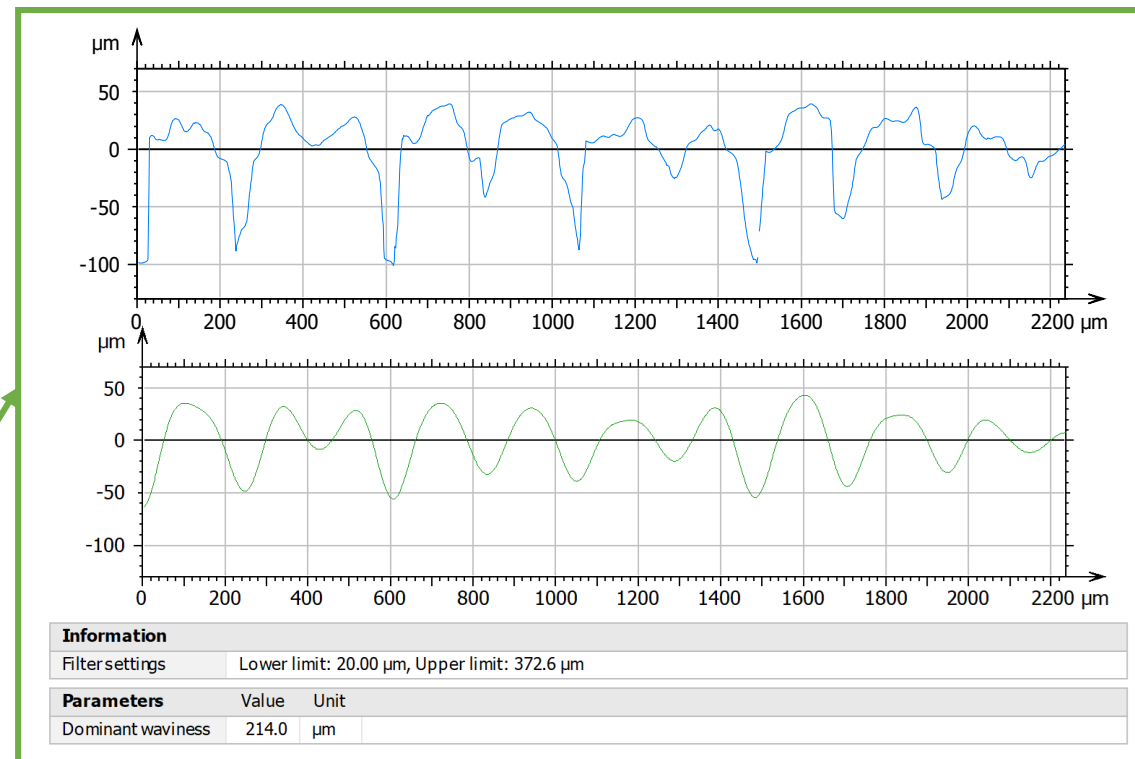
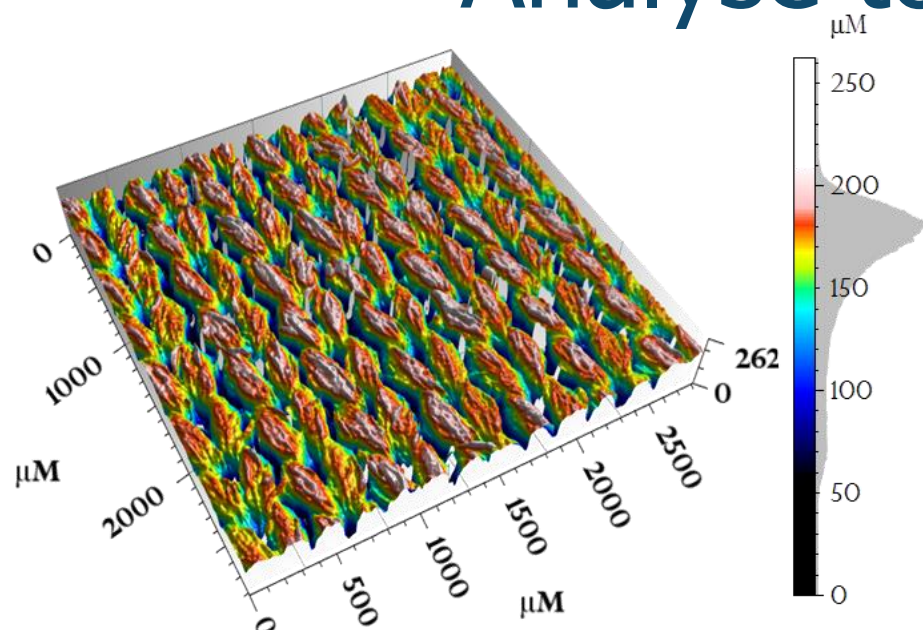
Outils permettant l'interaction Homme/Machine, mettant en avant la capacité d'une configuration d'un instrument à mesurer une surface donnée.

Développer sur Matlab



Résultats

Analyse topographique



ISO 25178 - Primary surface

S-filter(As): None

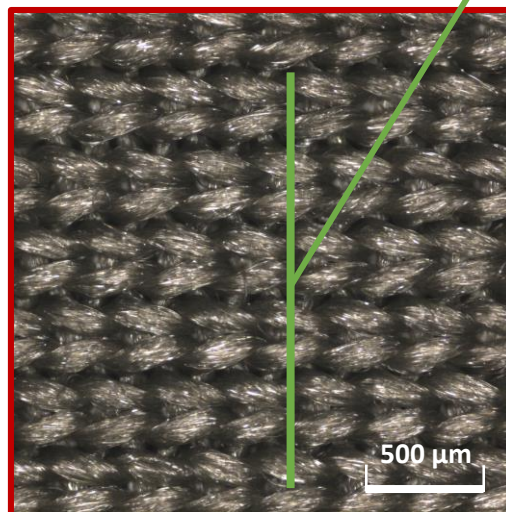
F:[Workflow]Formremoved (LS-poly3)

Height parameters

Sq	33.16	μm
Ssk	-1.356	
Sku	4.331	
Sp	98.77	μm
Sv	157.8	μm
Sz	256.6	μm
Sa	25.12	μm

Information

The studiable contains non-measured points. The results are cal...



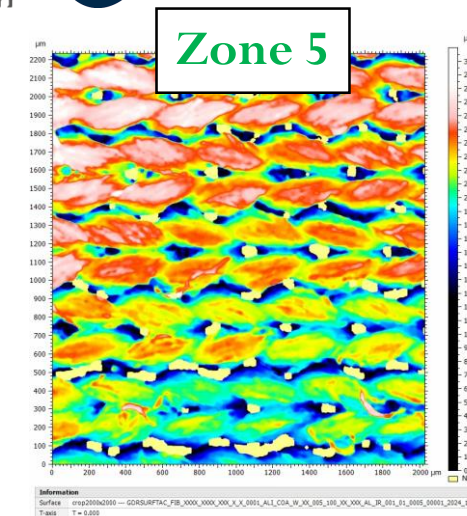
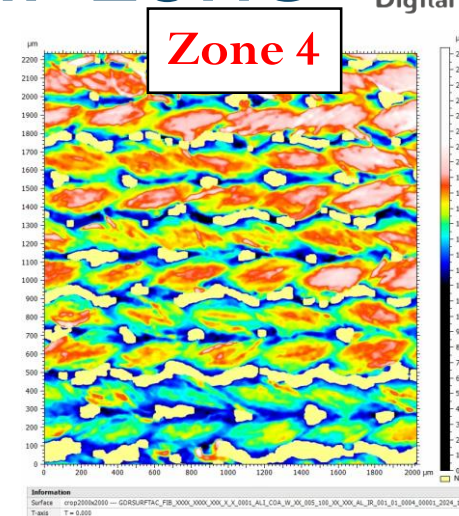
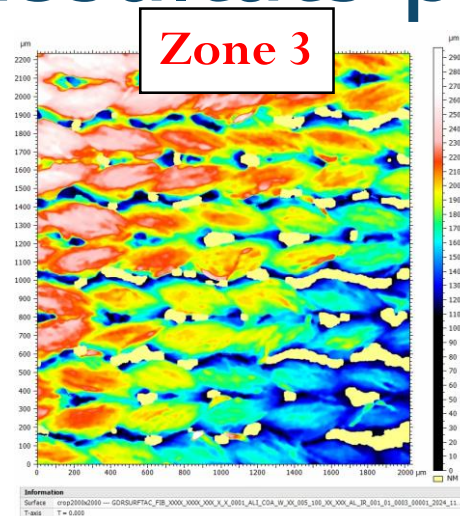
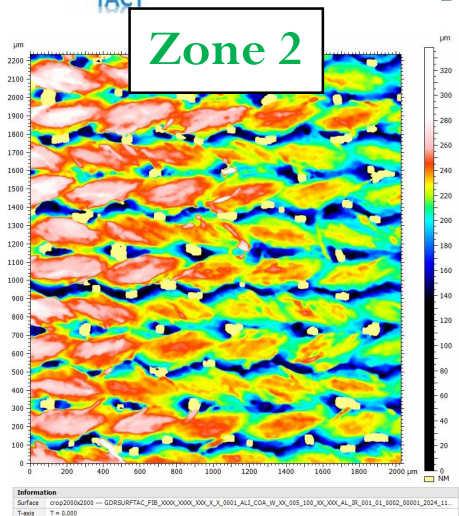
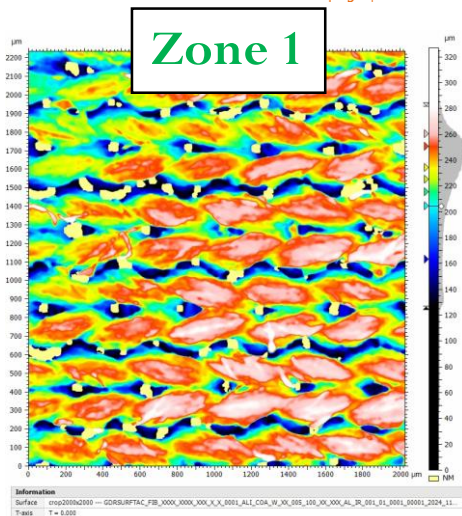
Conclusion

Tricot synthétique

Fibre de longueur infinie de diamètre entre 150 et 180 μm

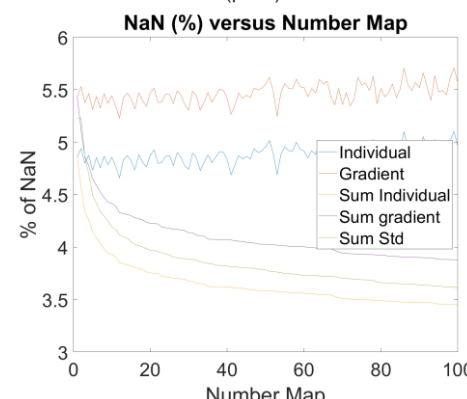
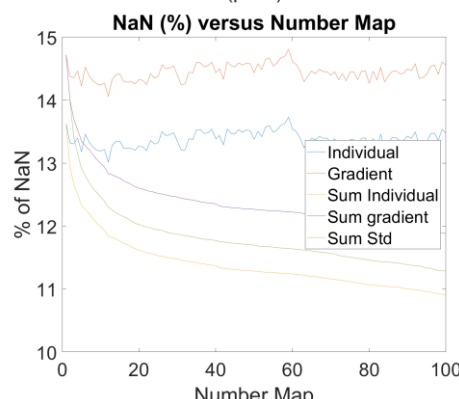
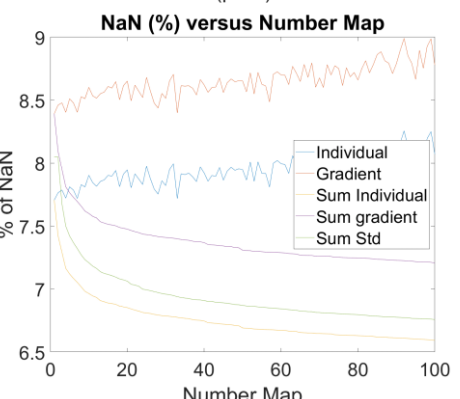
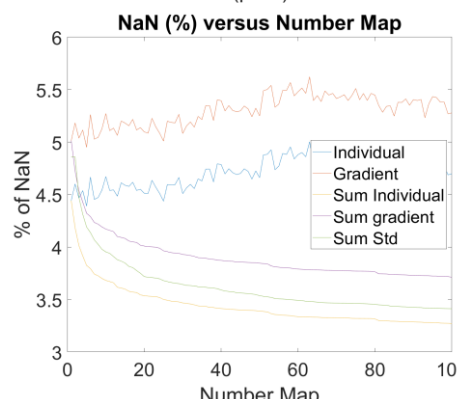
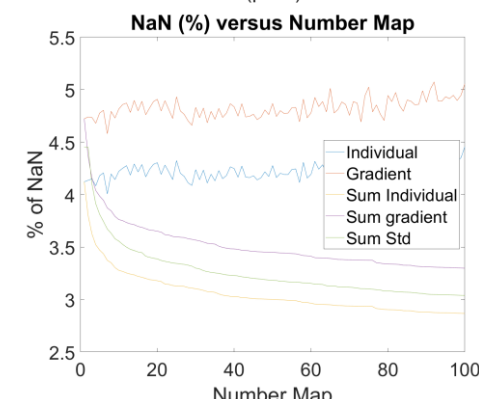
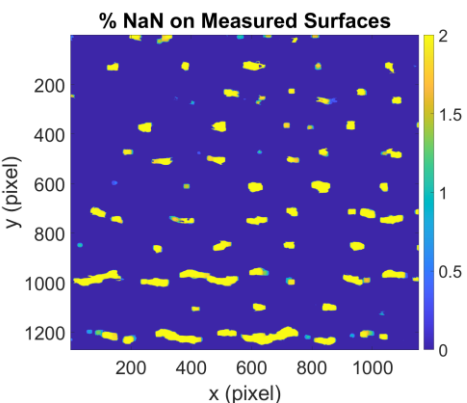
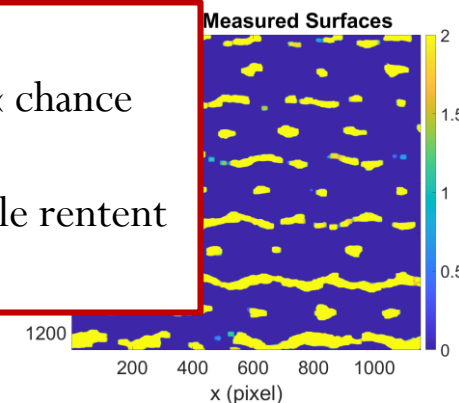
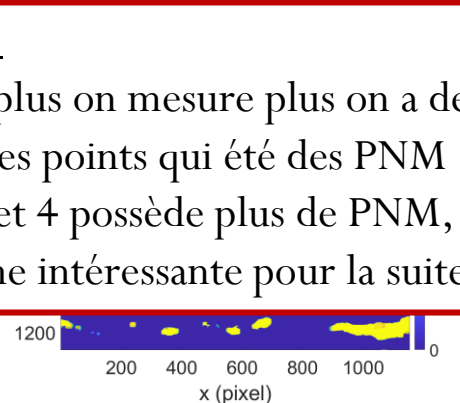
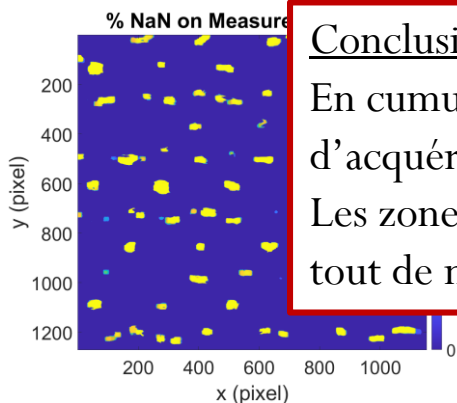
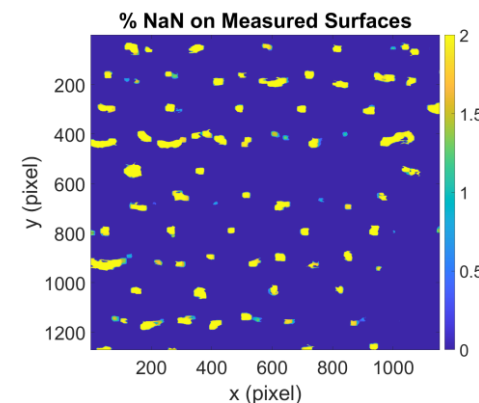
Pas de pilosité

Fibre entre Sa moyen de 22.3 sur les 5 zones



Conclusion :

En cumulé, plus on mesure plus on a de « chance d'acquérir des points qui été des PNM
Les zones 3 et 4 possède plus de PNM, elle rentent tout de même intéressante pour la suite



Zone 1

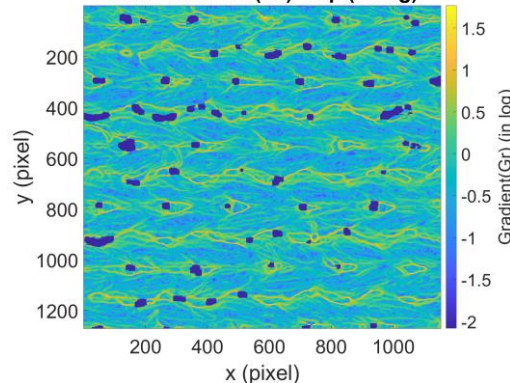
Zone 2

Zone 3

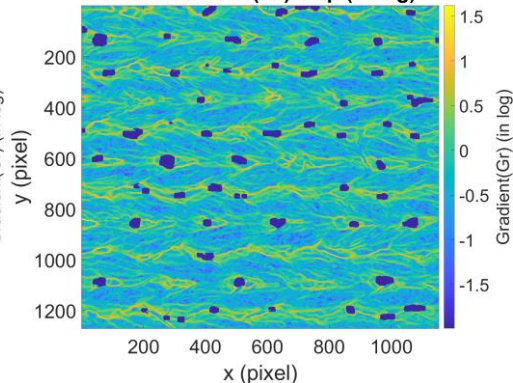
Zone 4

Zone 5

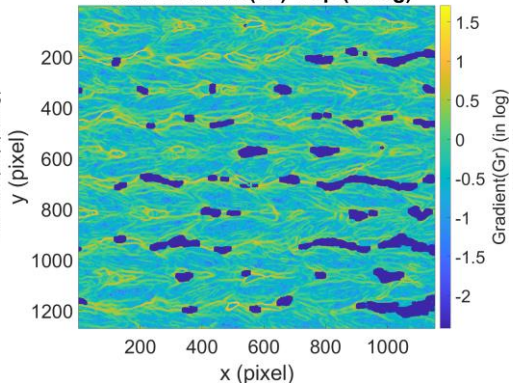
Mean Gradient(Gr) Map (in log)



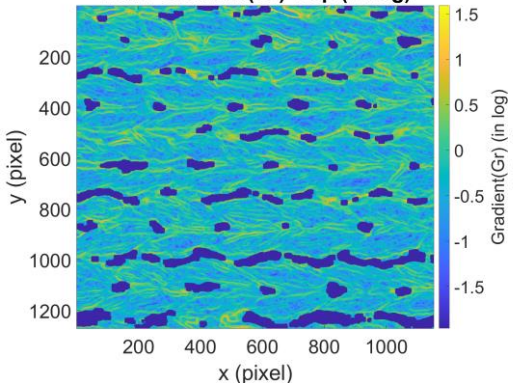
Mean Gradient(Gr) Map (in log)



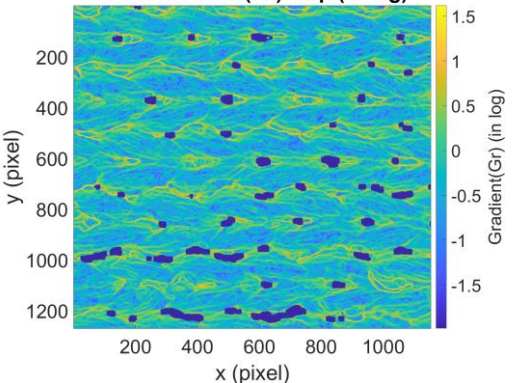
Mean Gradient(Gr) Map (in log)



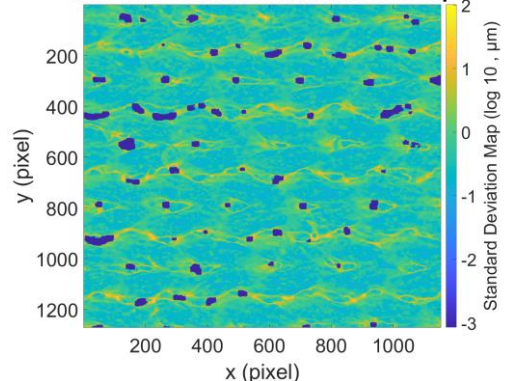
Mean Gradient(Gr) Map (in log)



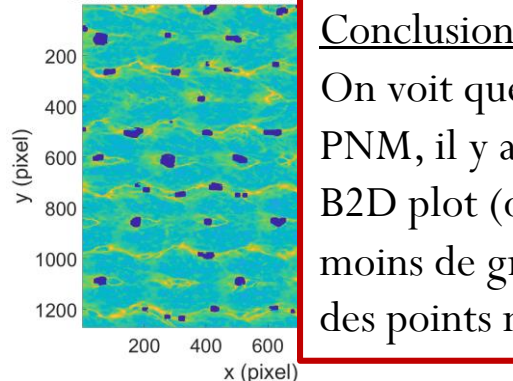
Mean Gradient(Gr) Map (in log)



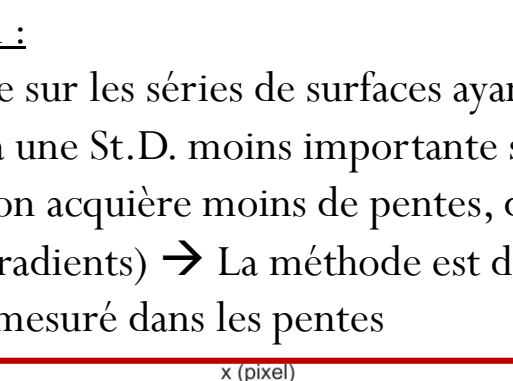
Standard Deviation Measurement Map



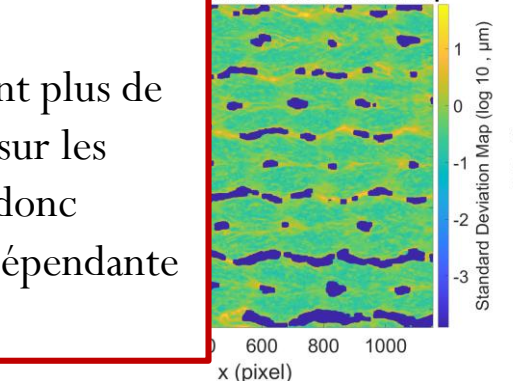
Standard Deviation Measurement Map



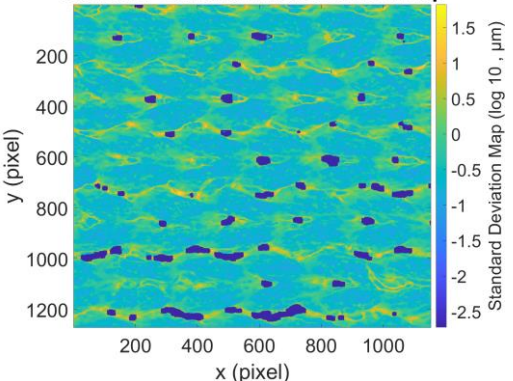
Standard Deviation Measurement Map



Standard Deviation Measurement Map



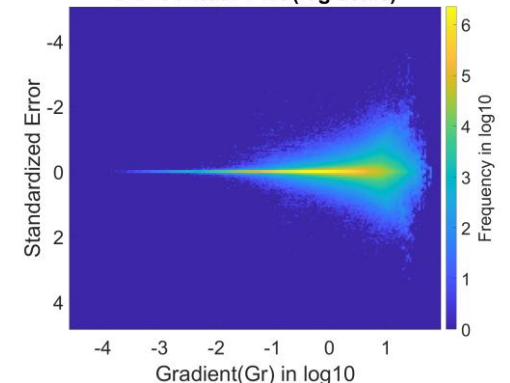
Standard Deviation Measurement Map



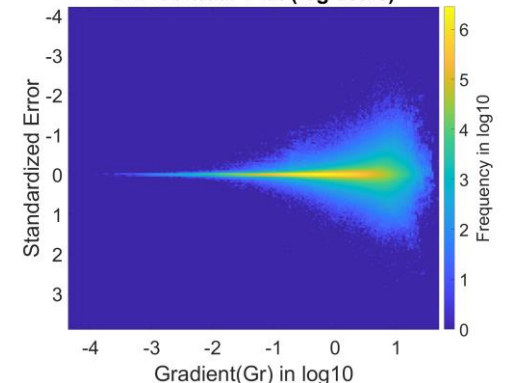
Conclusion :

On voit que sur les séries de surfaces ayant plus de PNM, il y a une St.D. moins importante sur les B2D plot (on acquière moins de pentes, donc moins de gradients) → La méthode est dépendante des points mesuré dans les pentes

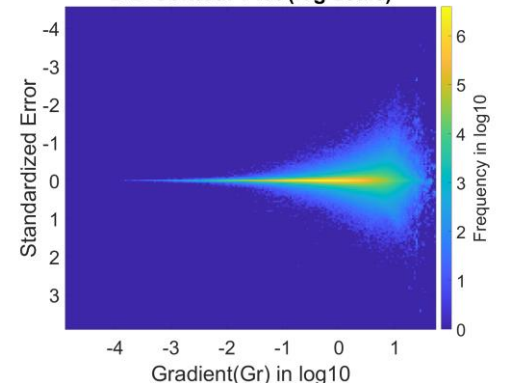
B²D Contour Plot (log scale)



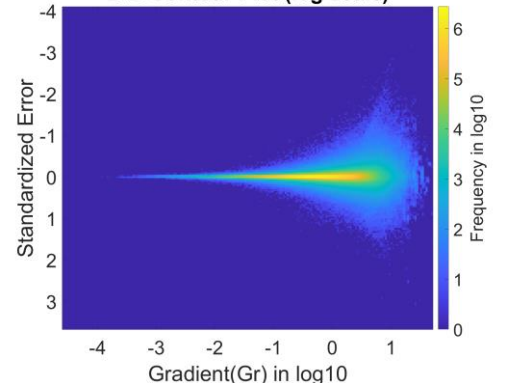
B²D Contour Plot (log scale)



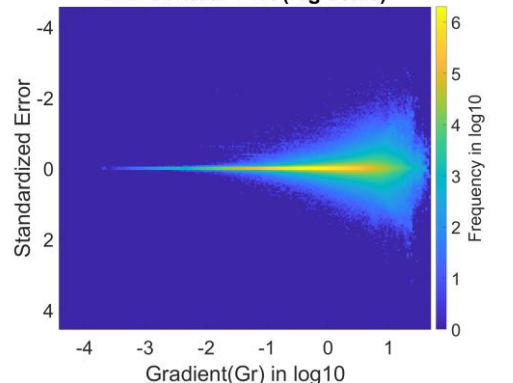
B²D Contour Plot (log scale)



B²D Contour Plot (log scale)

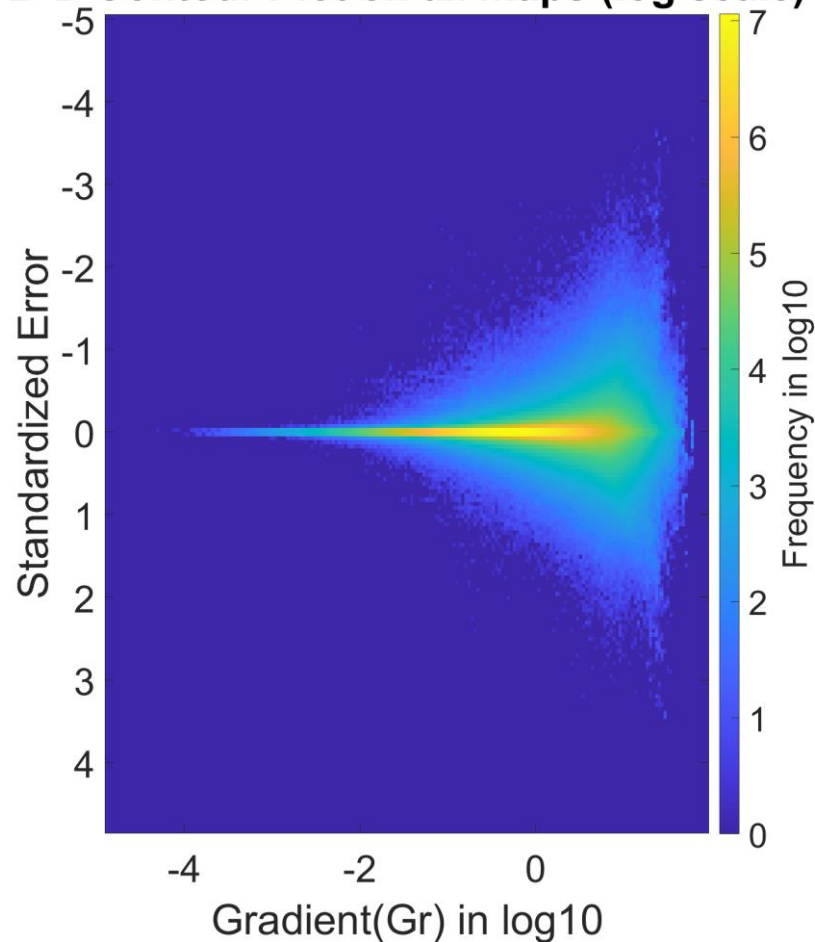


B²D Contour Plot (log scale)

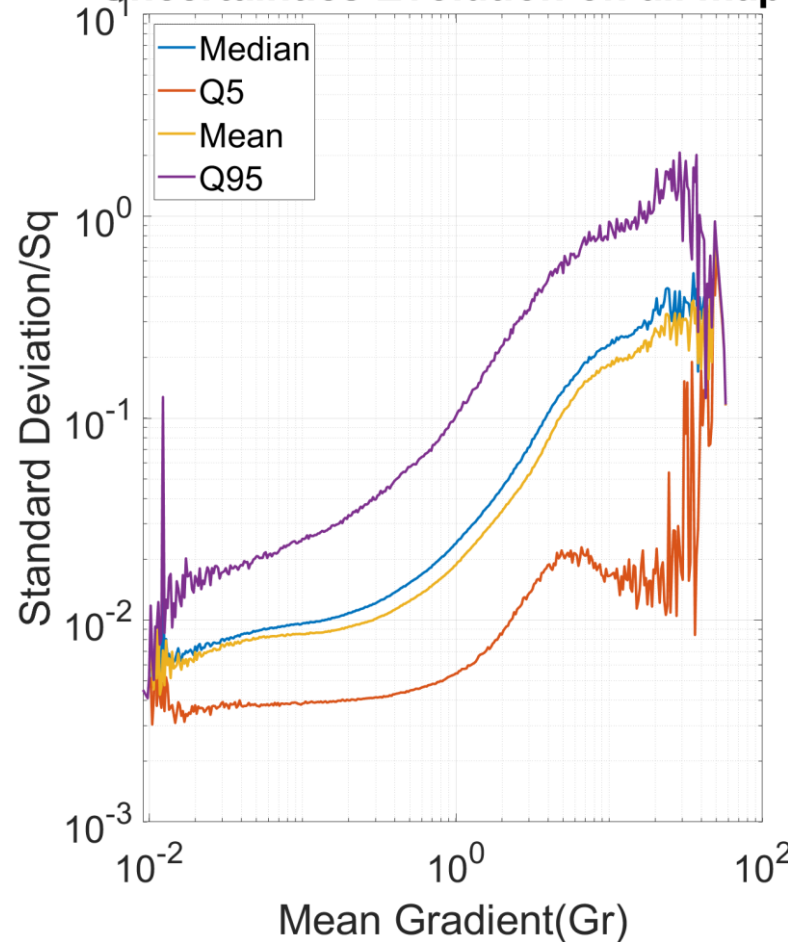


Résultats sur l'ensemble des surfaces

B²D Contour Plot on all maps (log scale)



Uncertainties Evolution on all maps



Conclusion :

Les datas peuvent être mutualisées (normalisé avec Sq) permettant d'observer les incertitudes en fonction du gradient sur l'ensemble des surfaces acquises

Conclusions

SCIENTIFIQUE

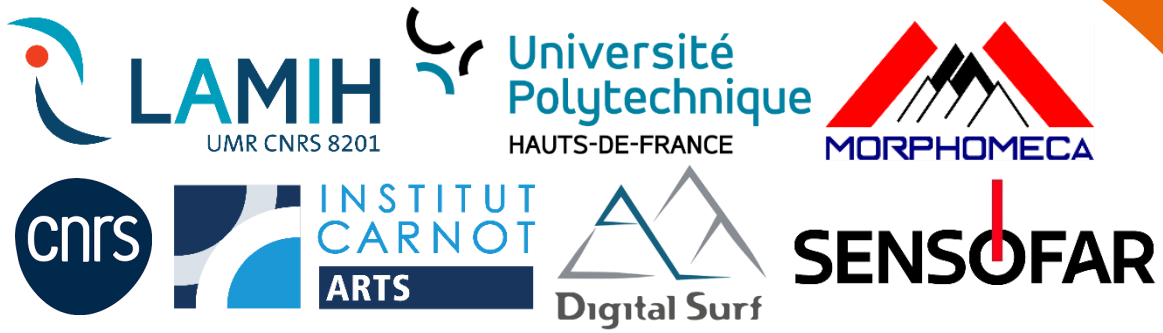
- Les incertitudes dépendent du gradient
- Les zones 3 et 4 sont moins bien acquises mais les points captés sont tout de même bons malgré un nombre de PNM plus important → /!\ le tissu est un matériau poreux

GENERAL

- Un outil de visualisation des incertitudes, implémentable pour tous les instruments de mesure est développé
- Cet outil est basé sur un plan de mesure simple, rapide et facilement automatisable
- La solution développée sur Matlab est donc implémentable directement sur le PC d'acquisition permettant l'adaptation des conditions de mesure en fonction du B2D plot

Perspectives

- Appliquer le B2D plot sur d'autres états de surface
- Implémentation dans le logiciel MountainsMap



Merci, avez-vous des questions ?



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clement.moreau@uphf.fr*