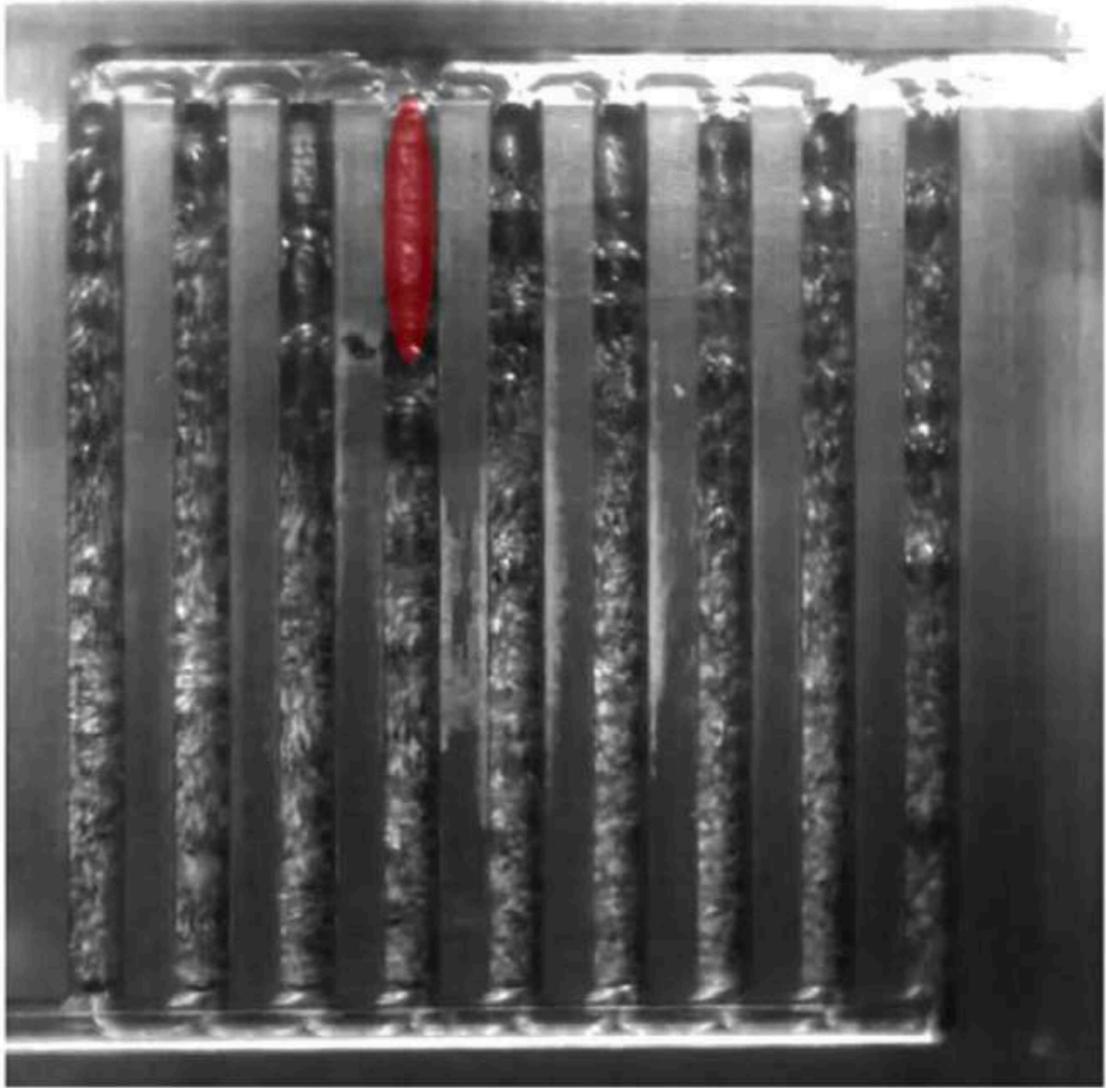
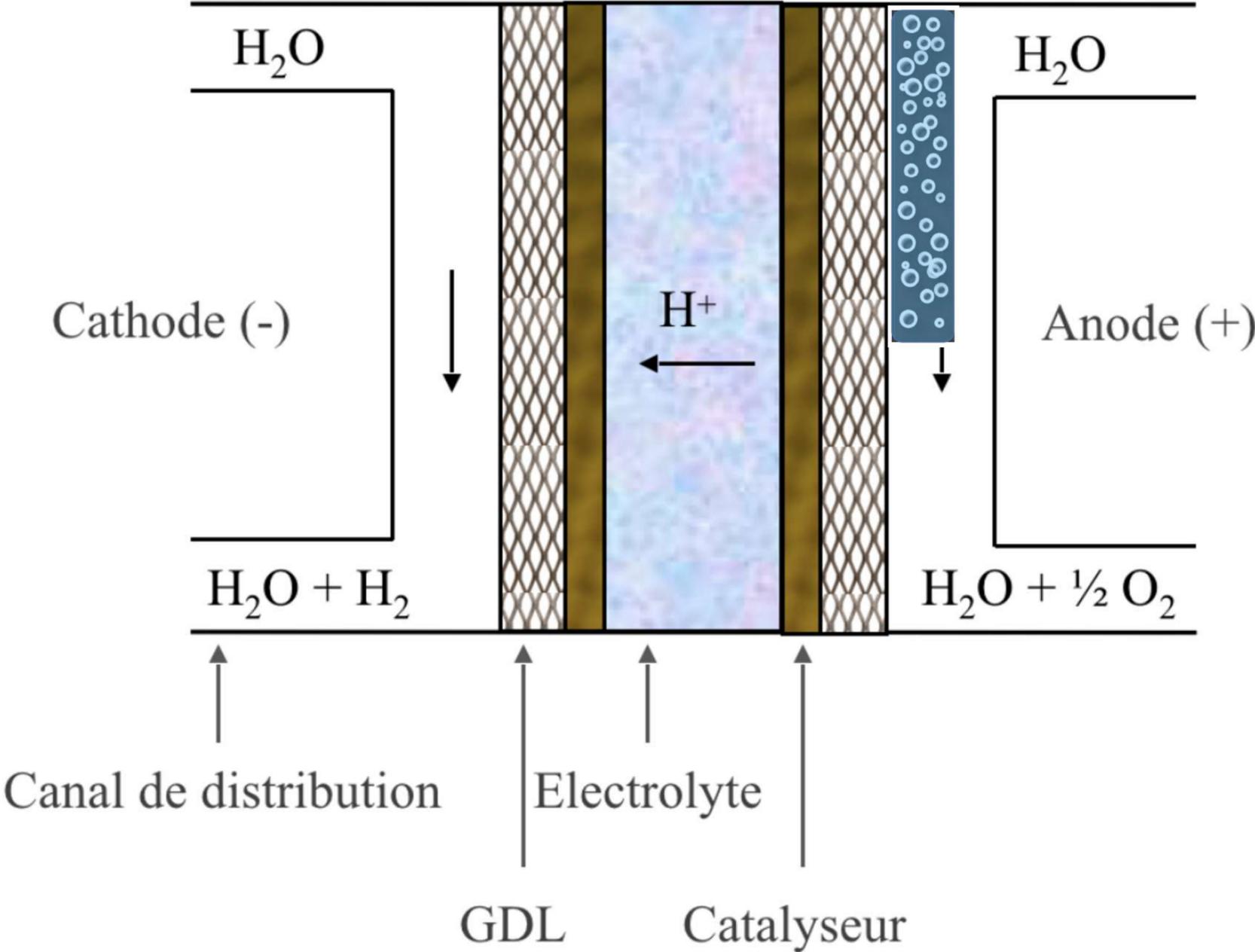


Étude du comportement des bulles d'oxygène à l'anode d'une PEMWE basée sur de l'apprentissage profond.

Idriss Sinapan, Christophe Lin-Kwong-Chon, Cédric Damour, Jean-Jacques Kadjo, Michel Benne

Jeudi 25 mai 2023
3ème Réunion plénières
Saint Gilles Les Bains - La Réunion

Schéma du principe de fonctionnement d'un électrolyseur PEM (PEMWE)



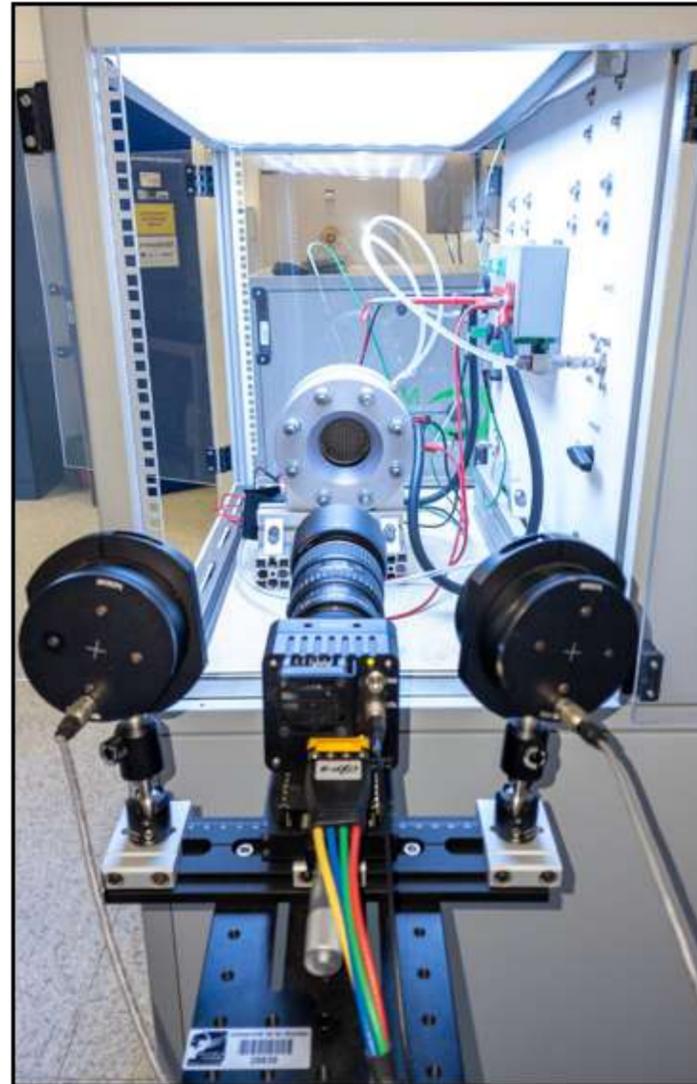
Maier et al., (2020)

Objectif : Comprendre le comportement des bulles

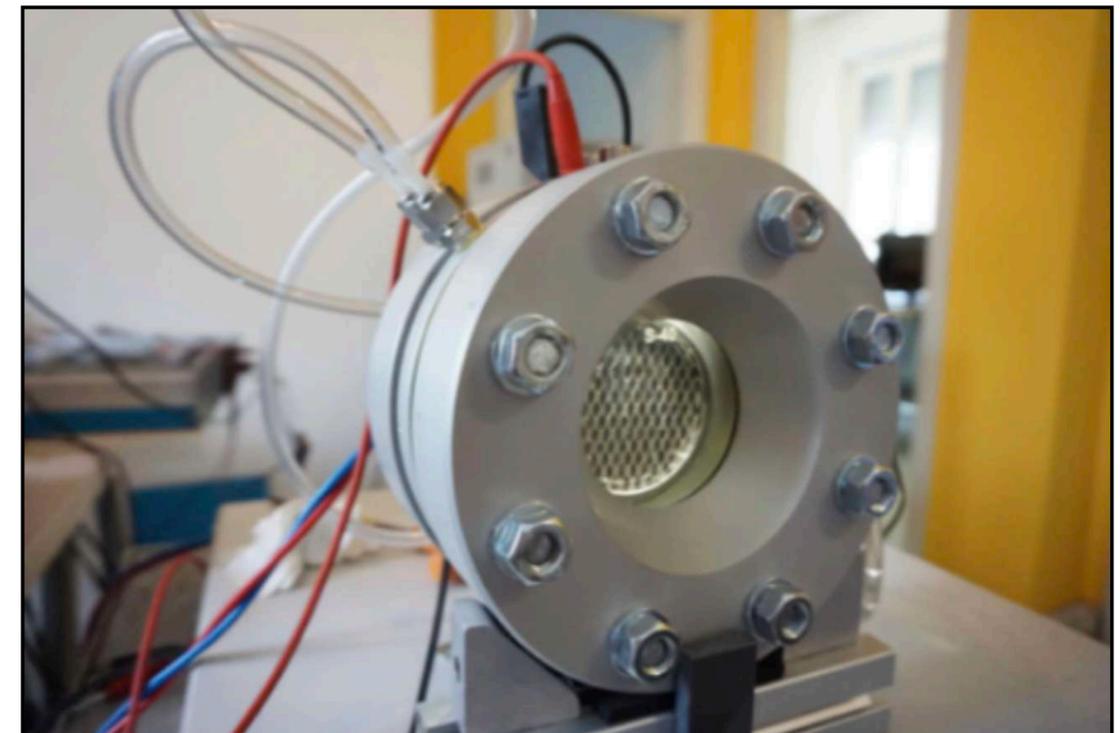
Dispositif expérimental du laboratoire Energy-Lab



Banc de test PEMWE vue de face

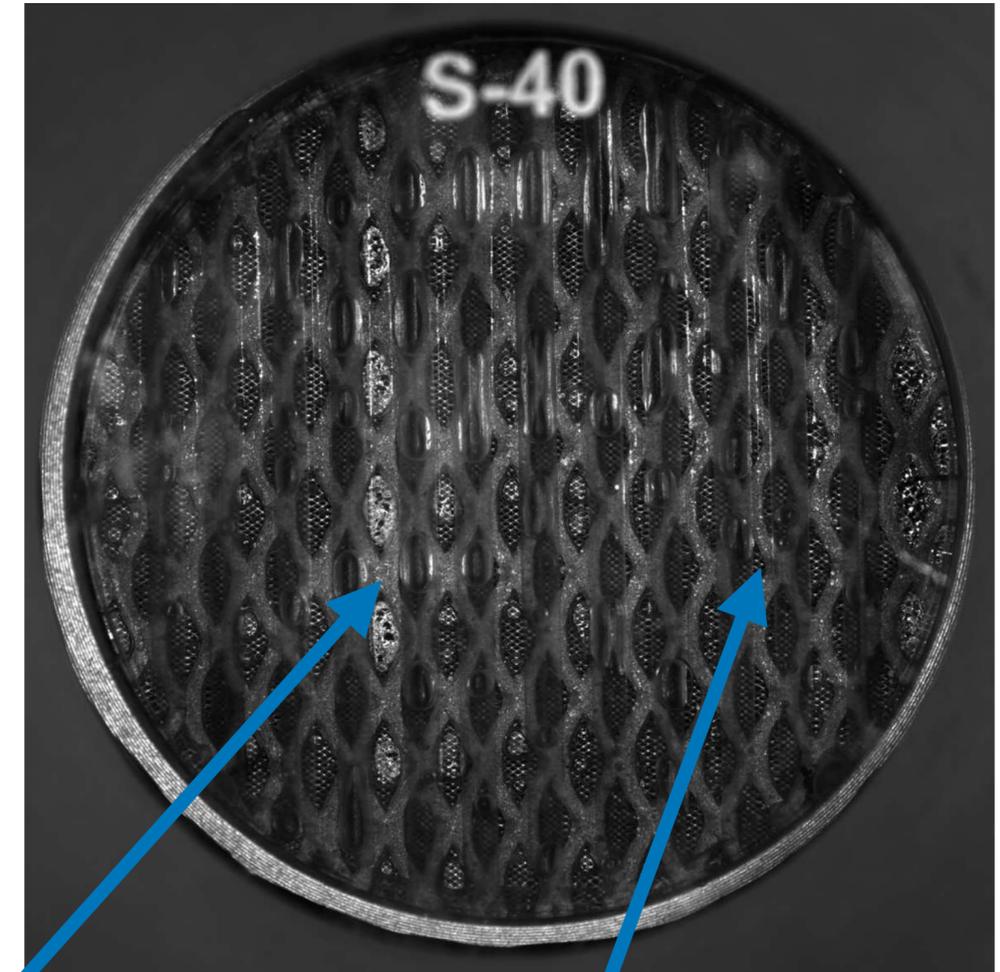
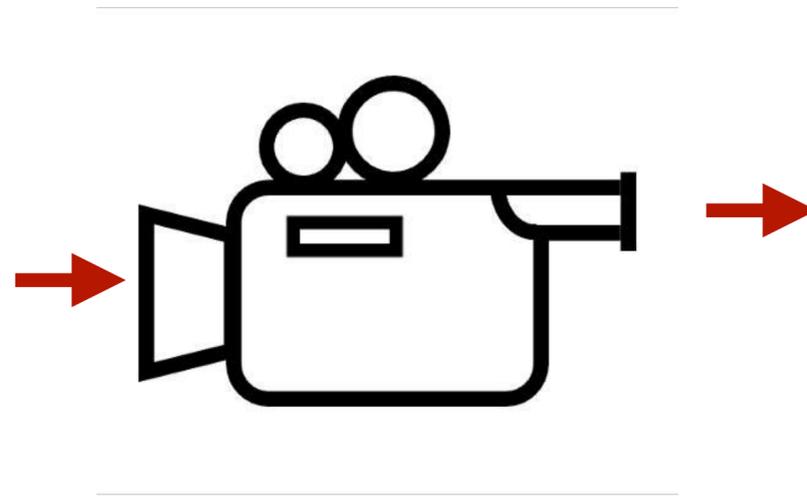
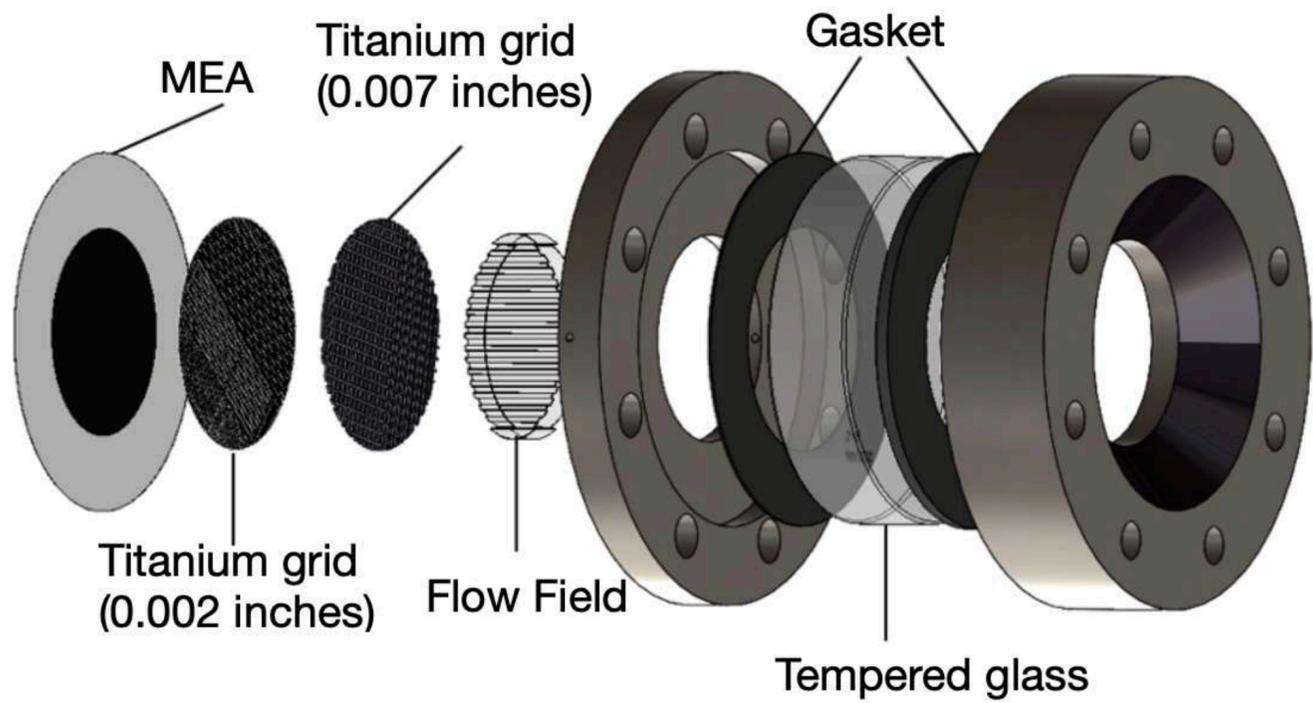


Banc de test PEMWE vue caméra

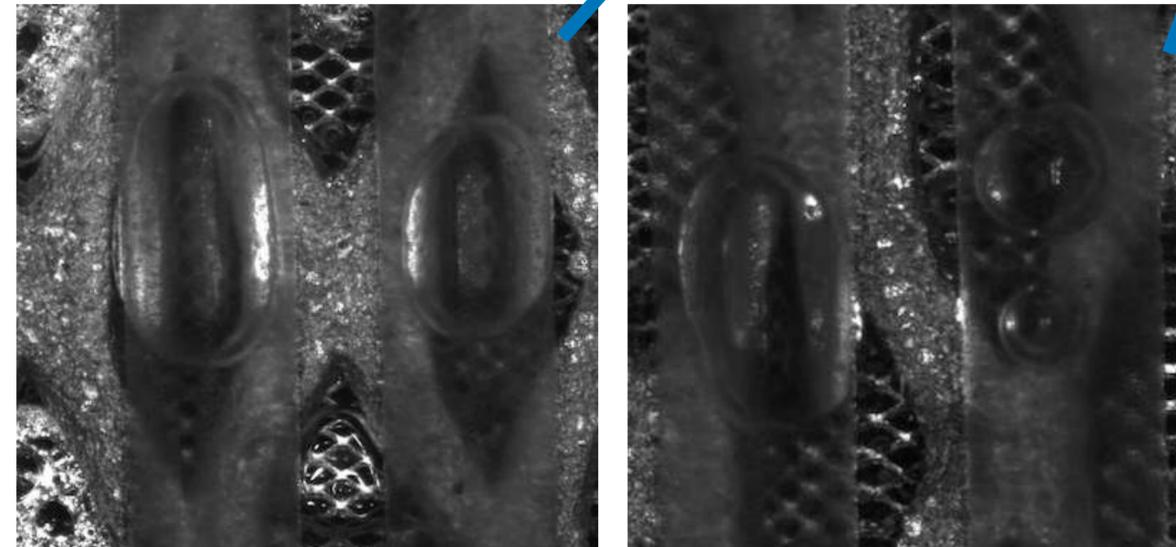


PEMWE avec fenêtre de visualisation
partie anodique

Visualisation

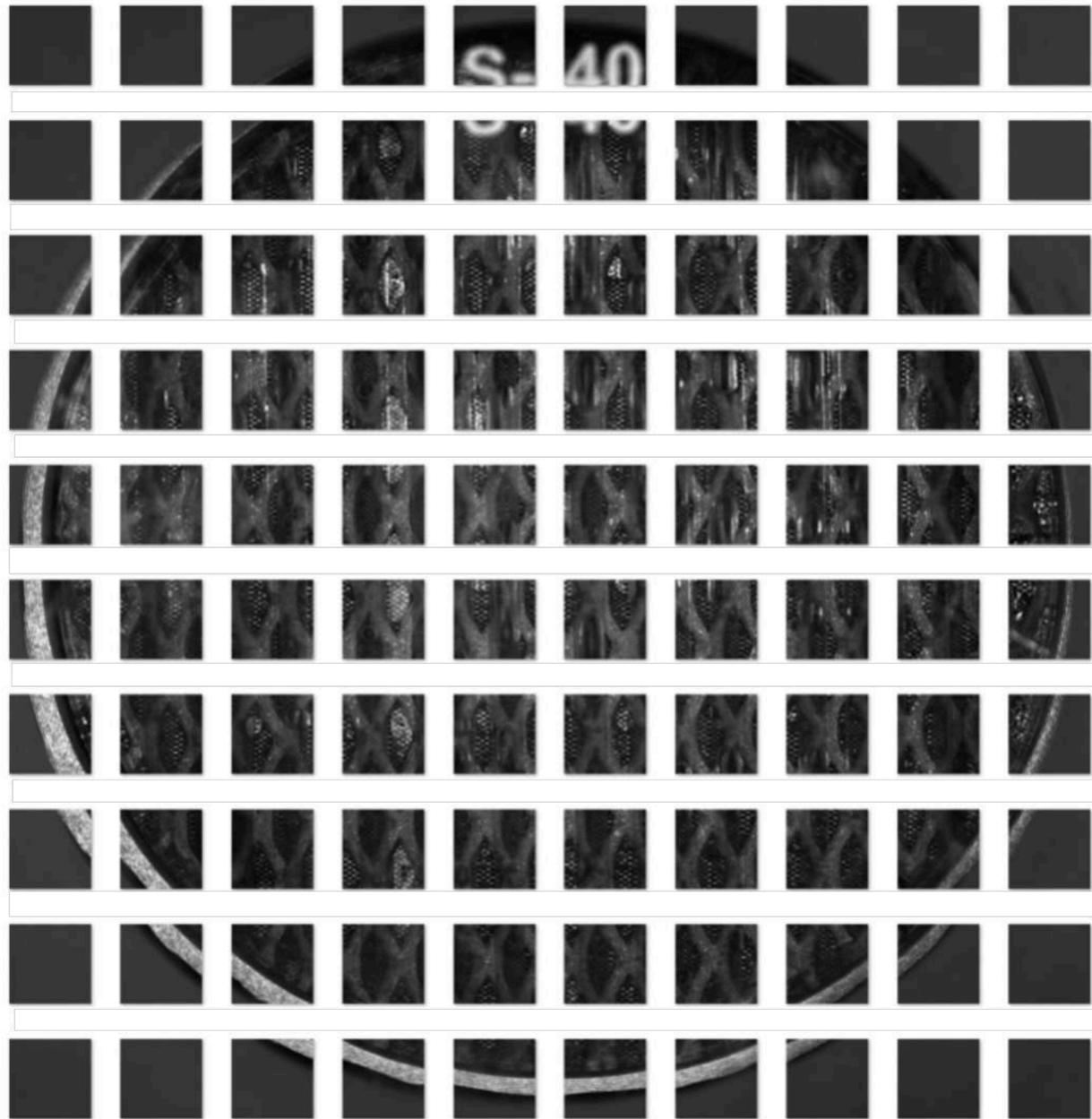


Objectif : Détection des bulles d'oxygène

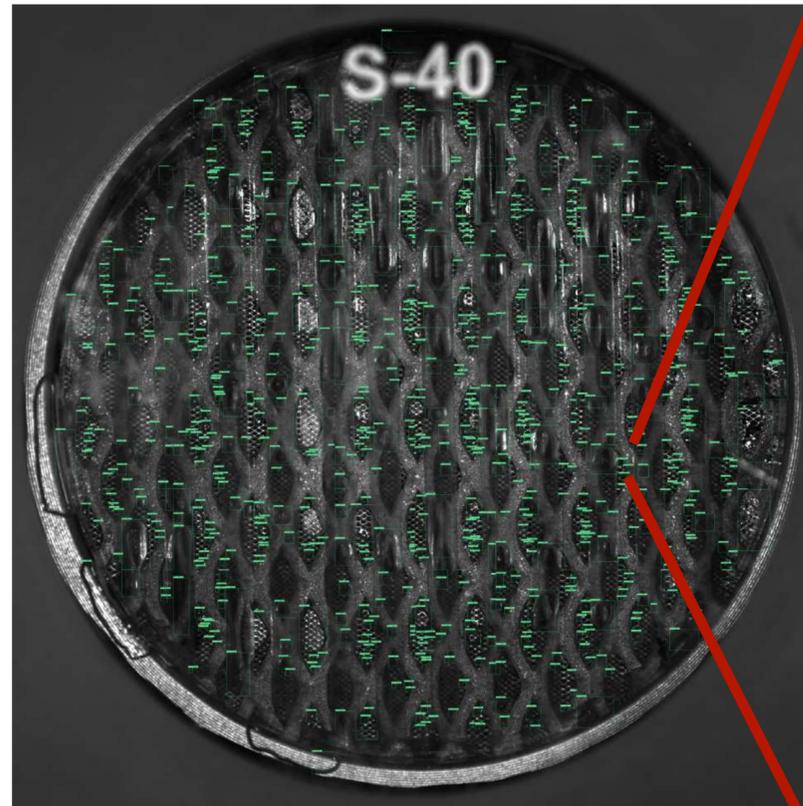


Classe unique : Bulle

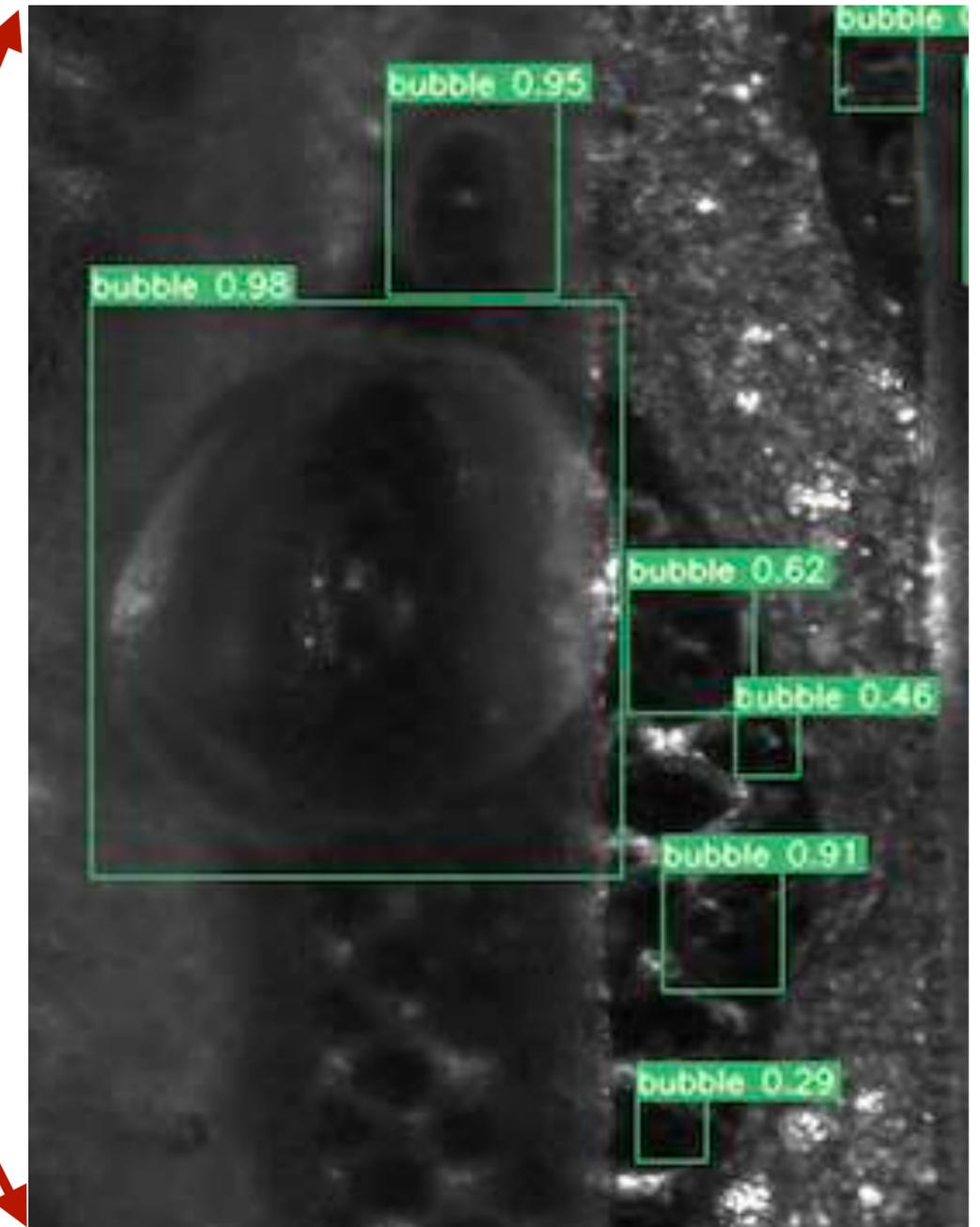
- Yolo V5 -> Yolo V7 (Wang et al, (2022))
- Architecture, entraînement, détection

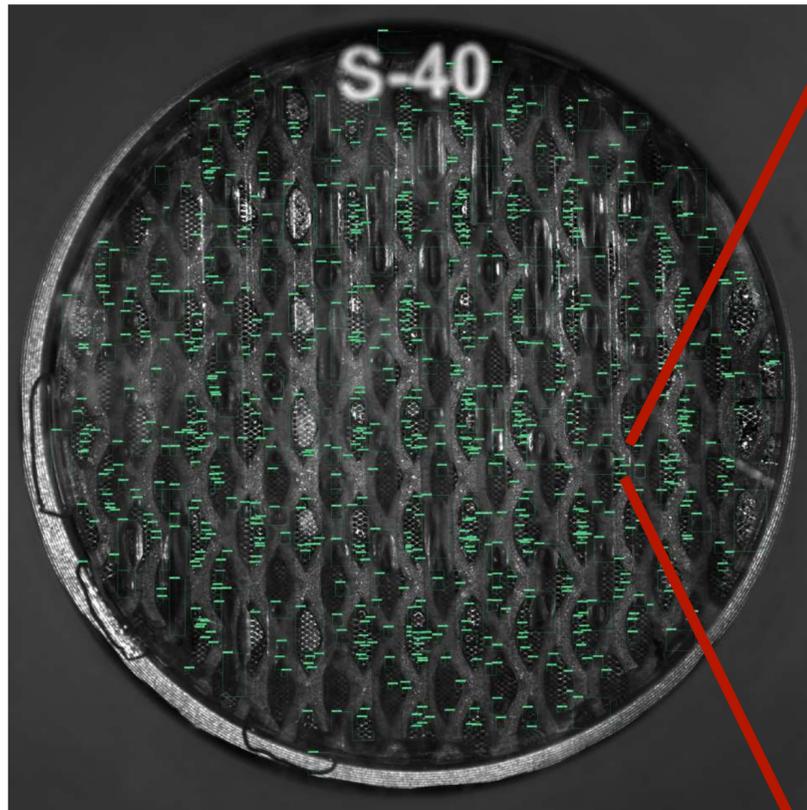


Slicing

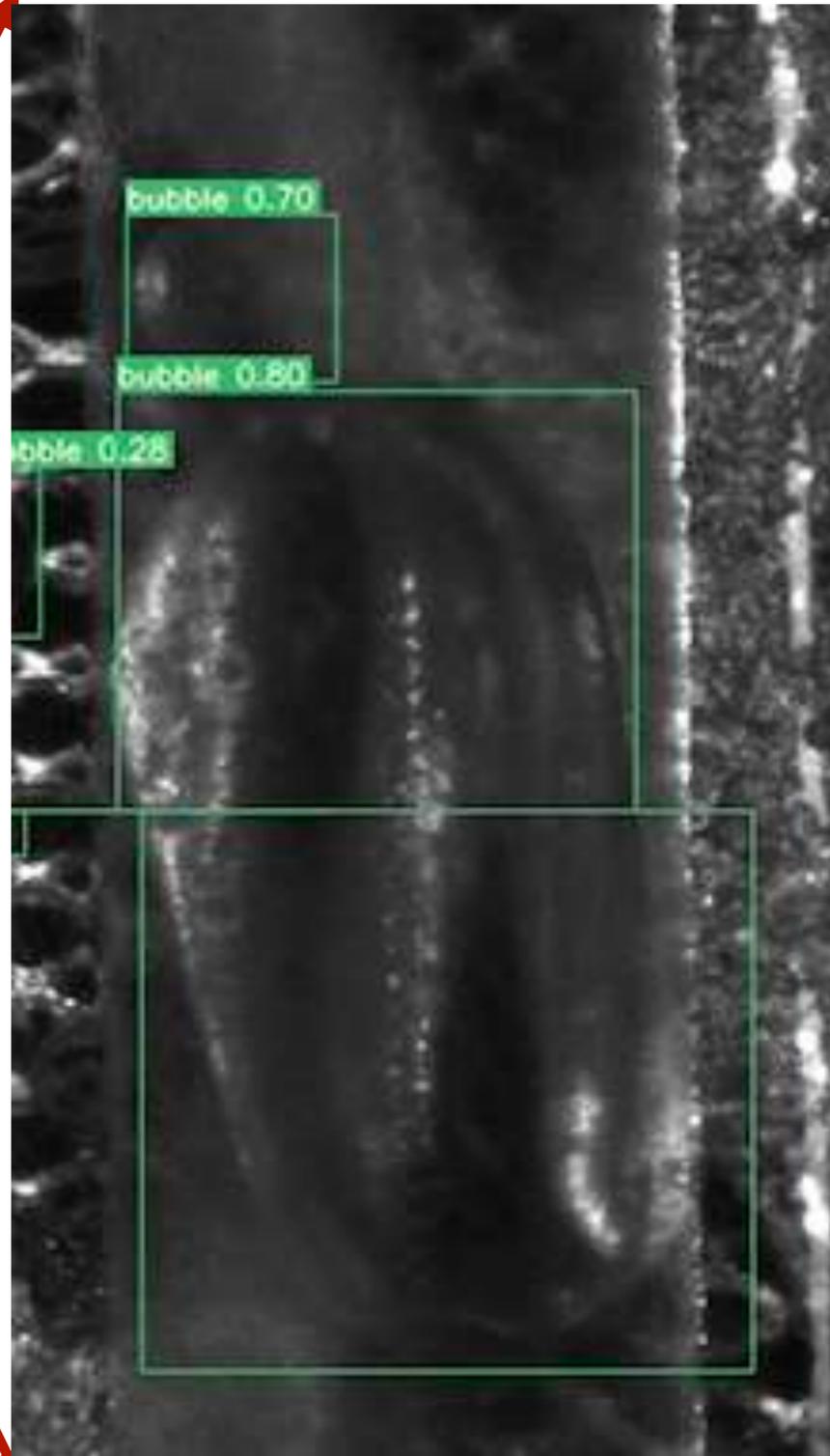


Détections et fusion





Détections et fusion



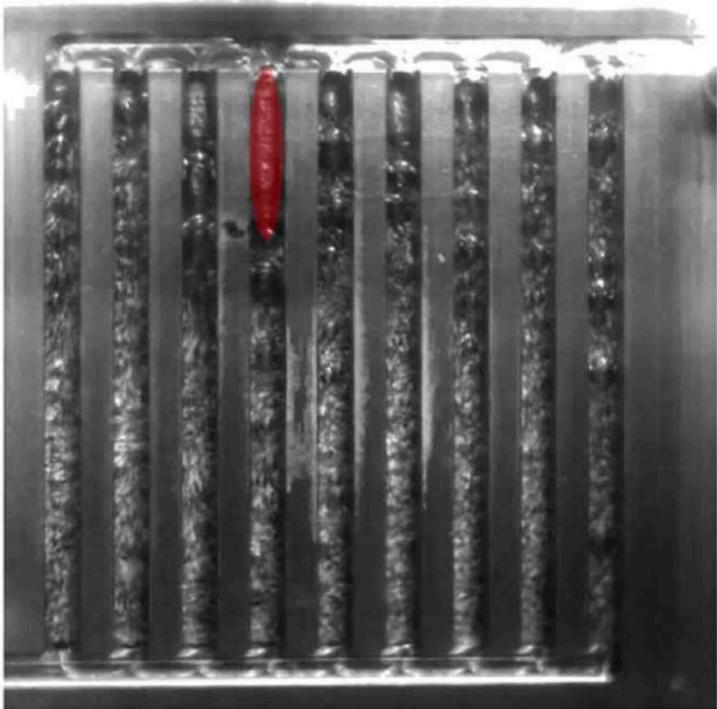
- Nombre de bulles
- Surface moyenne des bulles
- Phénomène de coalescence

1ère piste d'amélioration

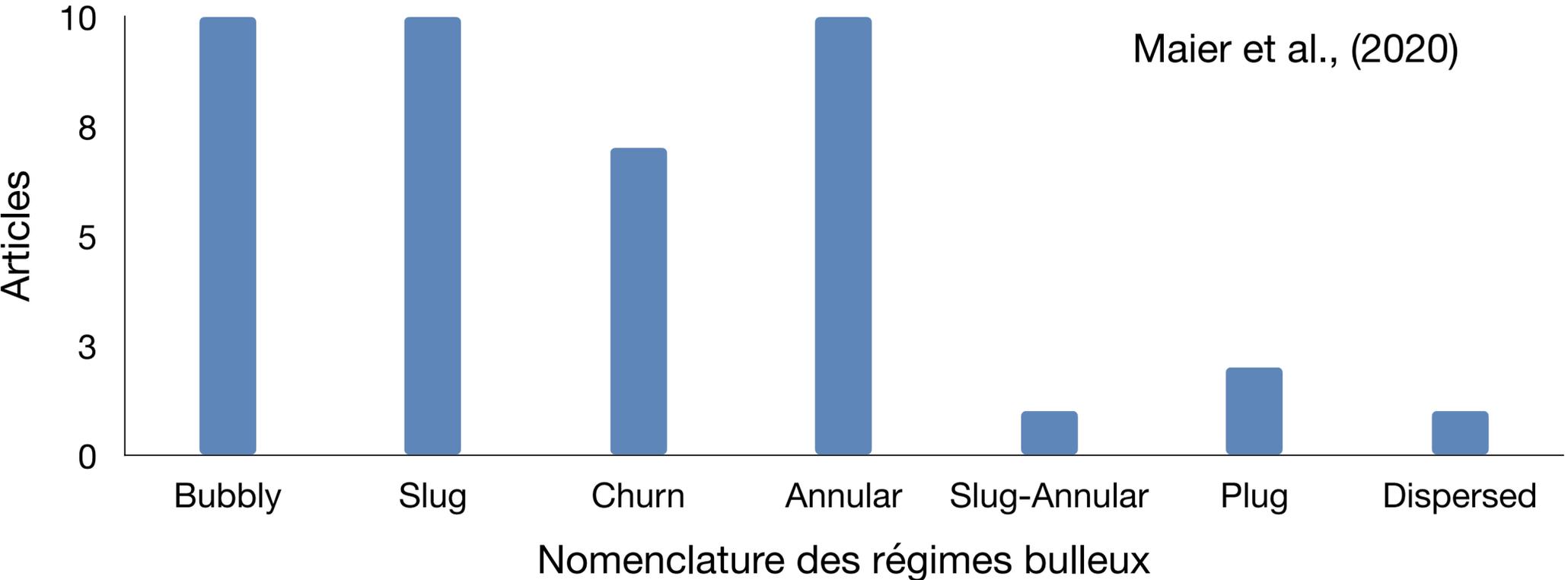
Chen et al., (2006)

Table 2
Classification and description of flow patterns

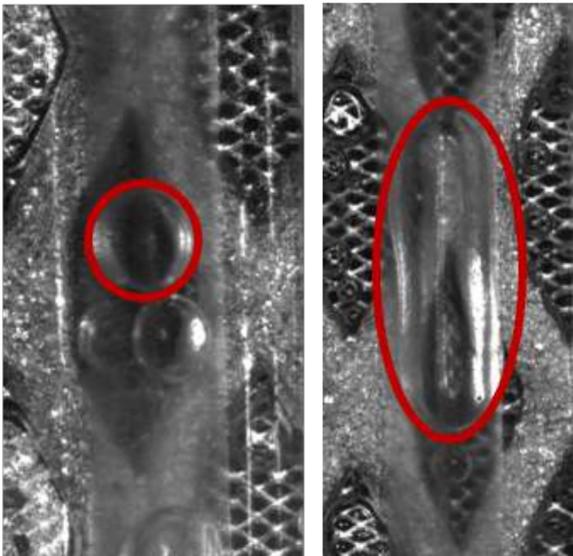
Main class	Subclass for normal tubes	Subclass for small tubes
Stratified flow	Stratified smooth	Stratified wavy
	Stratified wavy	
Bubble flow	Bubbly	Bubbly
	Dispersed bubble	Dispersed bubble
Intermittent flow	Plug	Plug (confined bubble or elongated bubble)
	Slug (Taylor bubble)	Slug (Taylor bubble)
	Churn	Churn
		Pseudo-slug (wavy annular)
Annular flow	Annular	Annular
	Mist	Mist
	Wispy annular	



Maier et al., (2020)

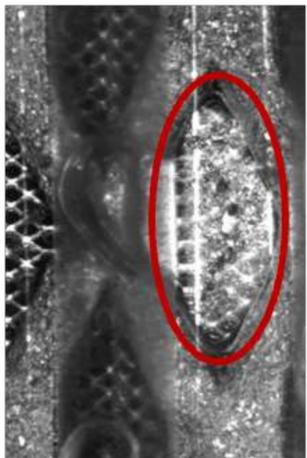


YOLO V7



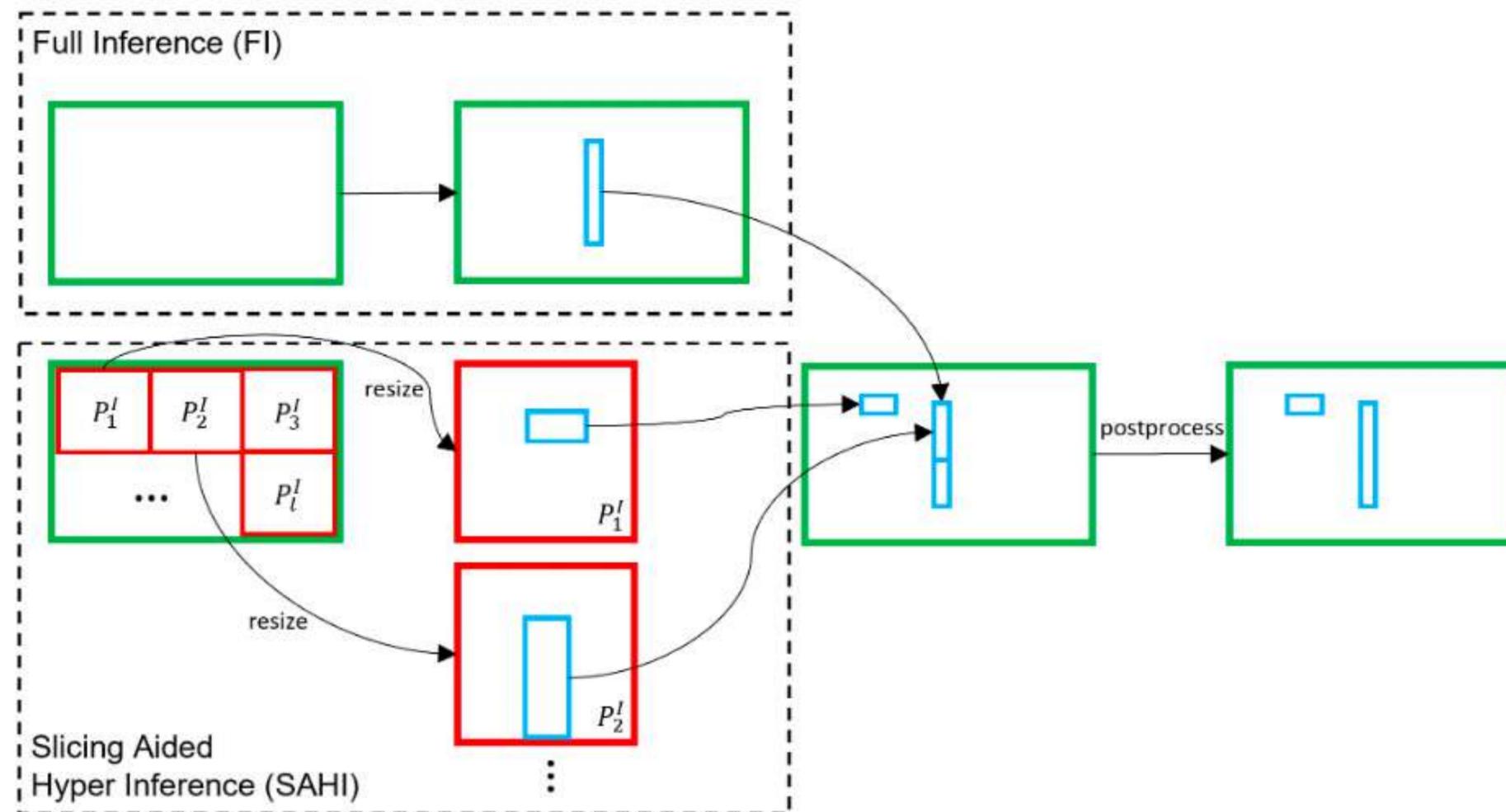
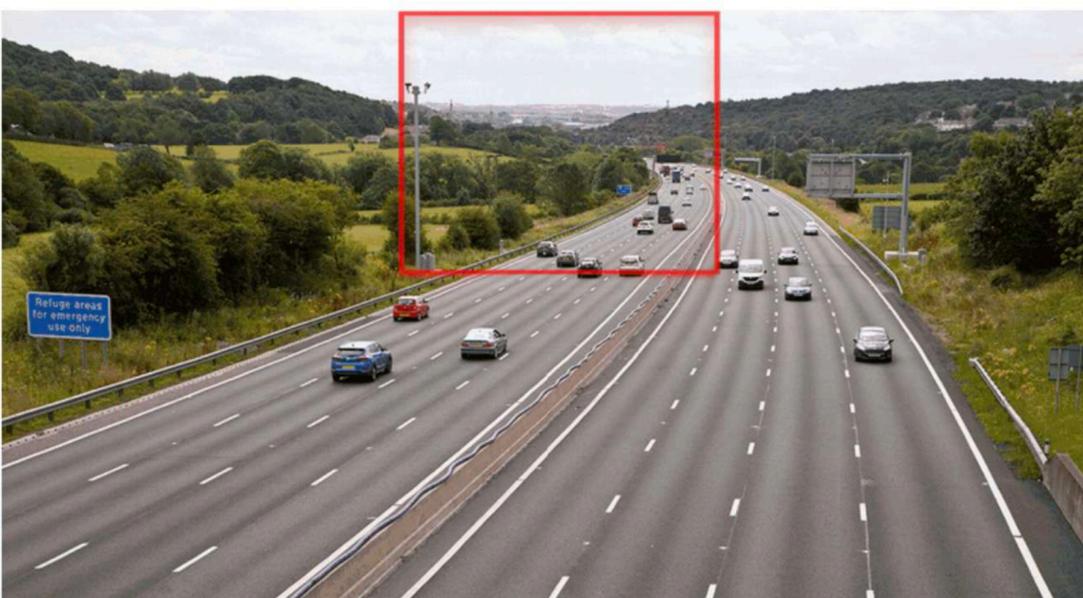
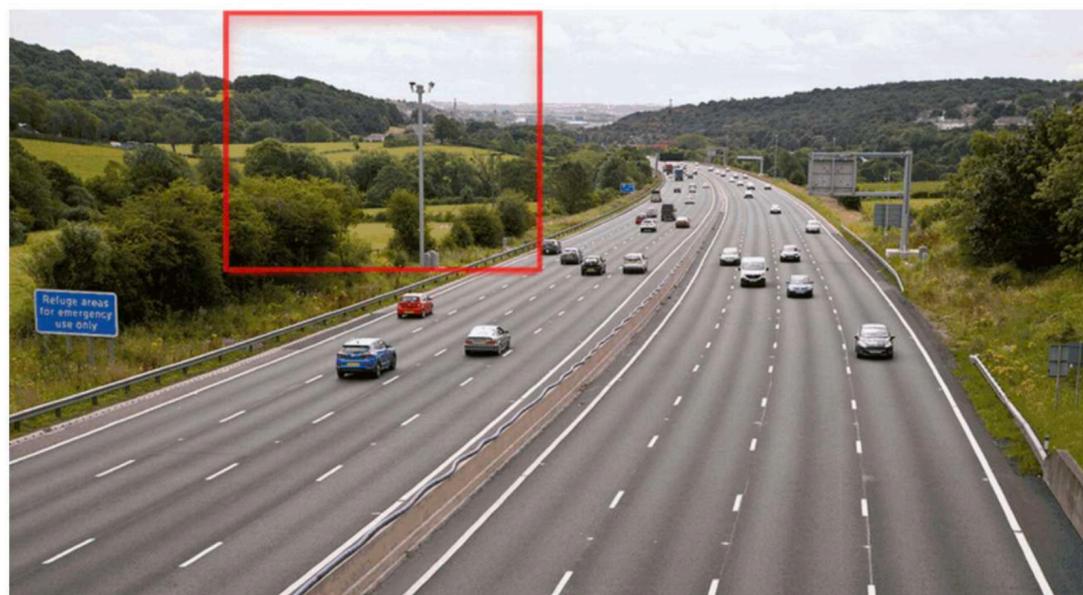
Bubbly

Slug



Stagnated

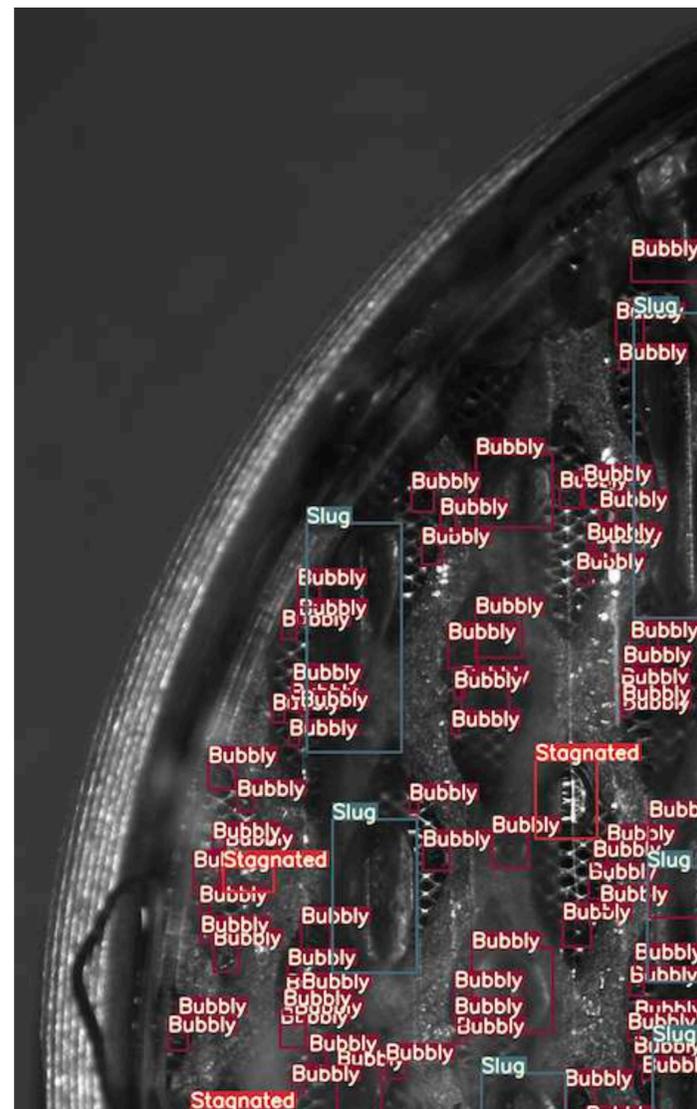
SAHI : Slicing Aided Hyper Inference (Akyon et al, (2022))



Code de post-traitement



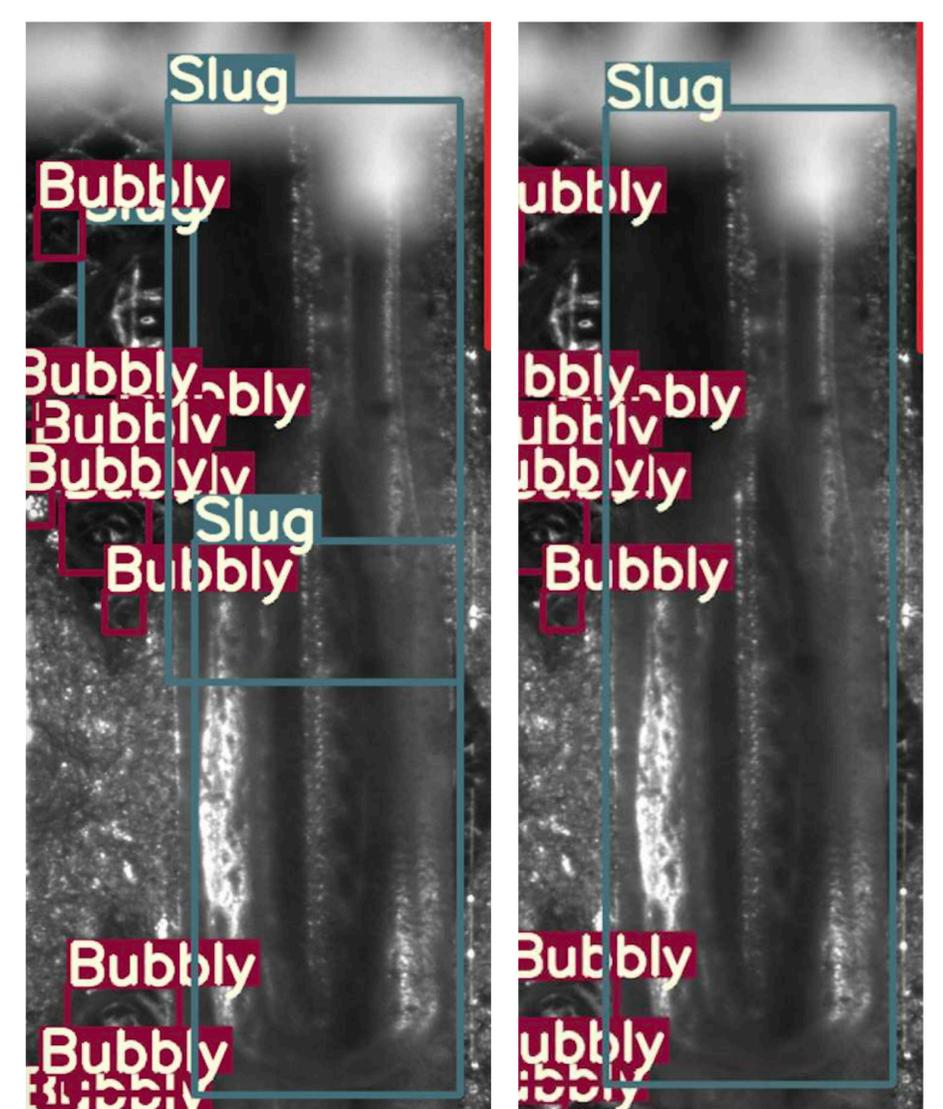
Masque sur les bords



Bubbly et Slug aberrantes

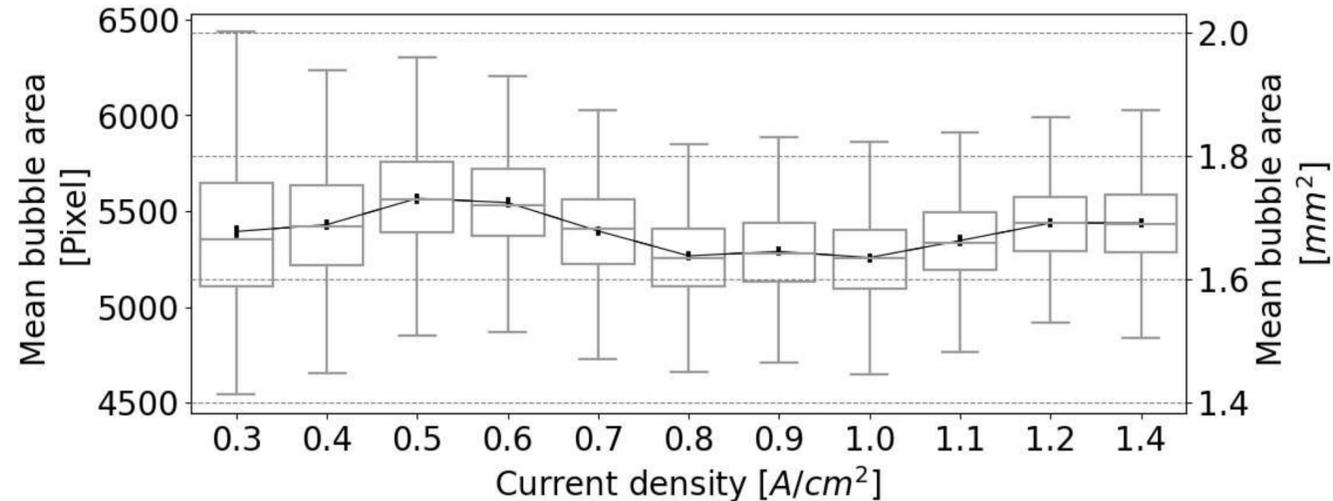
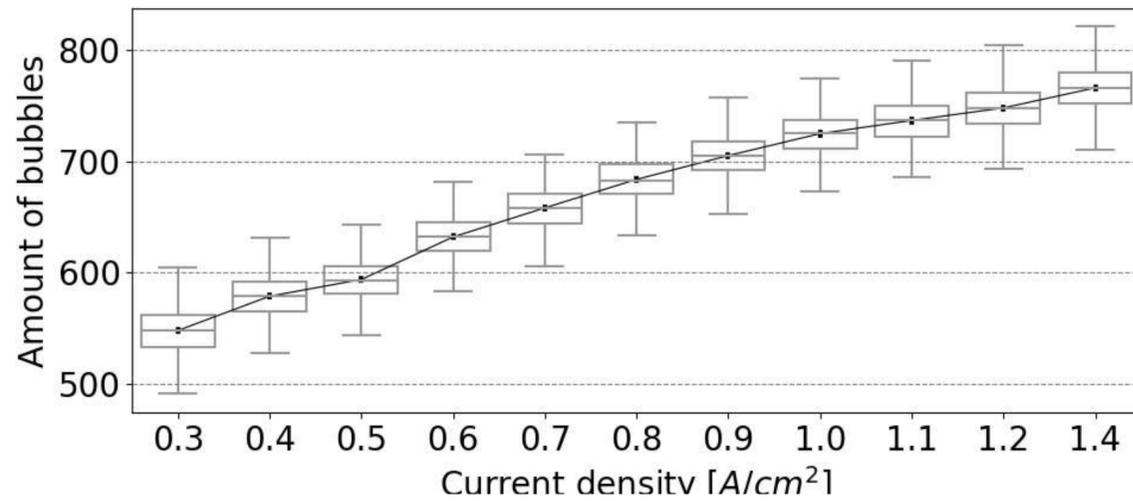
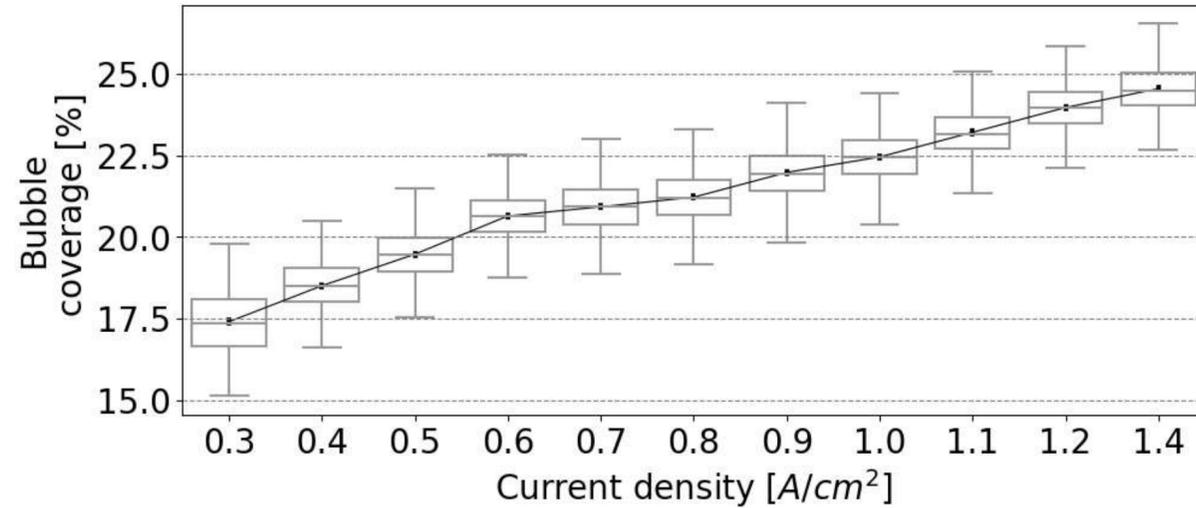


Fusion des multiples détections

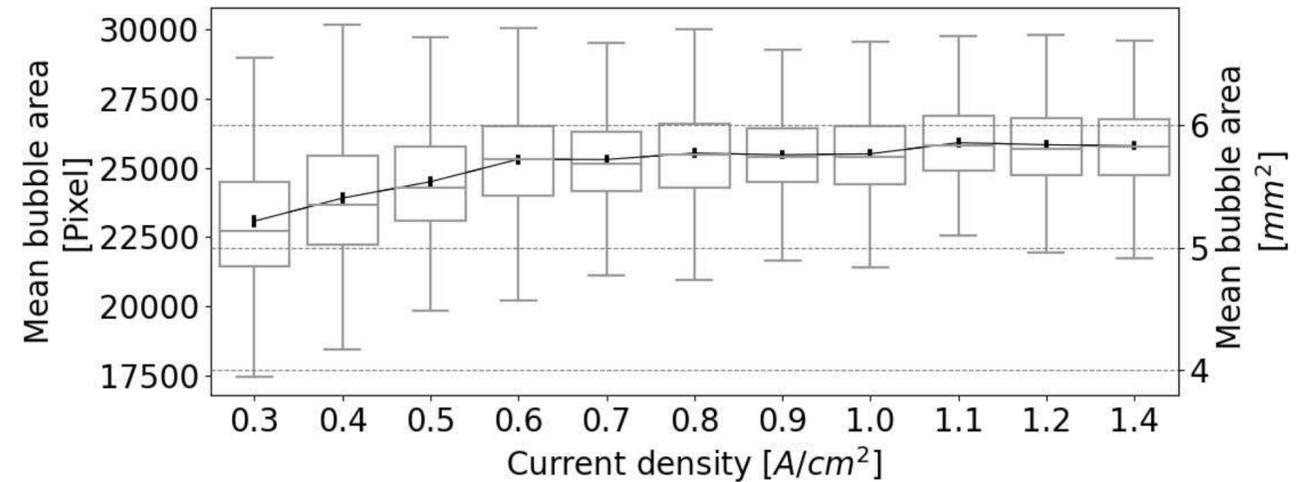
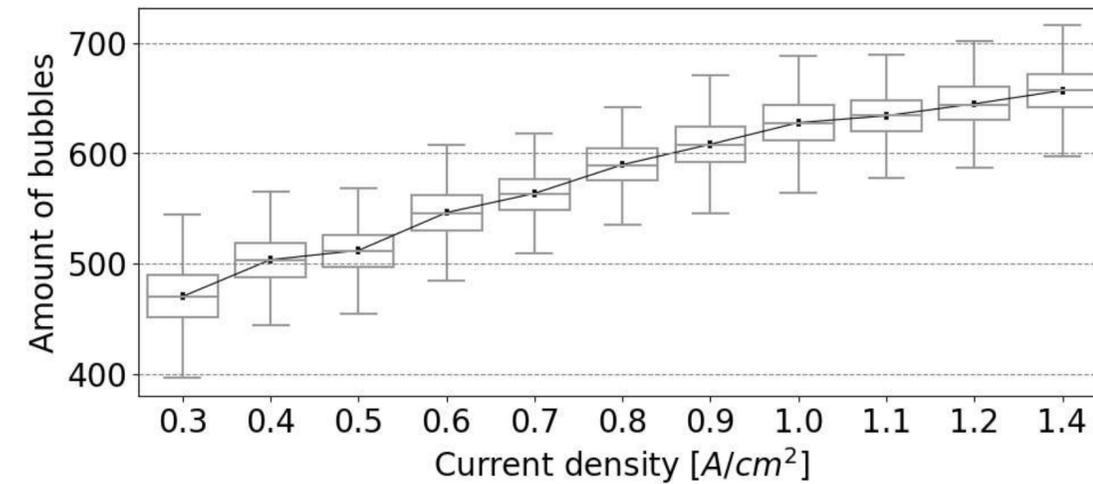
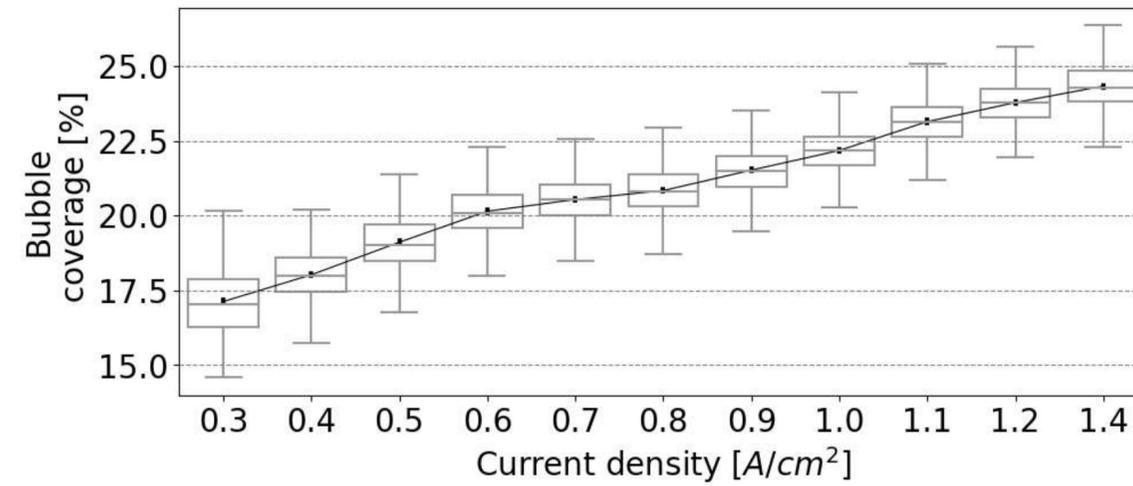


Comparaison une classe : Variation de courant

YoloV7



YoloV7 + SAHI + Post-traitement

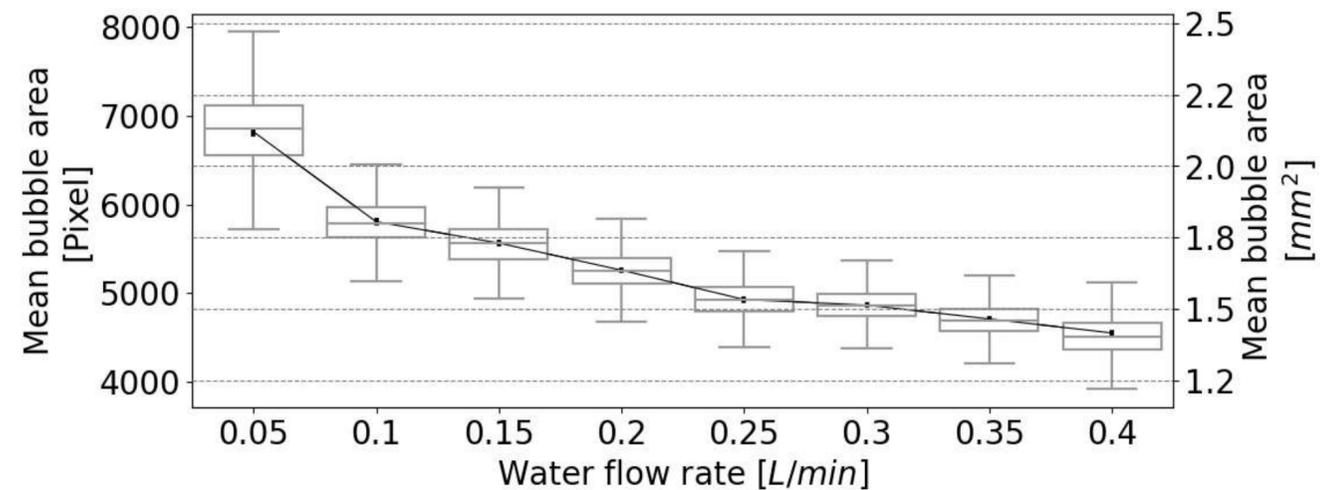
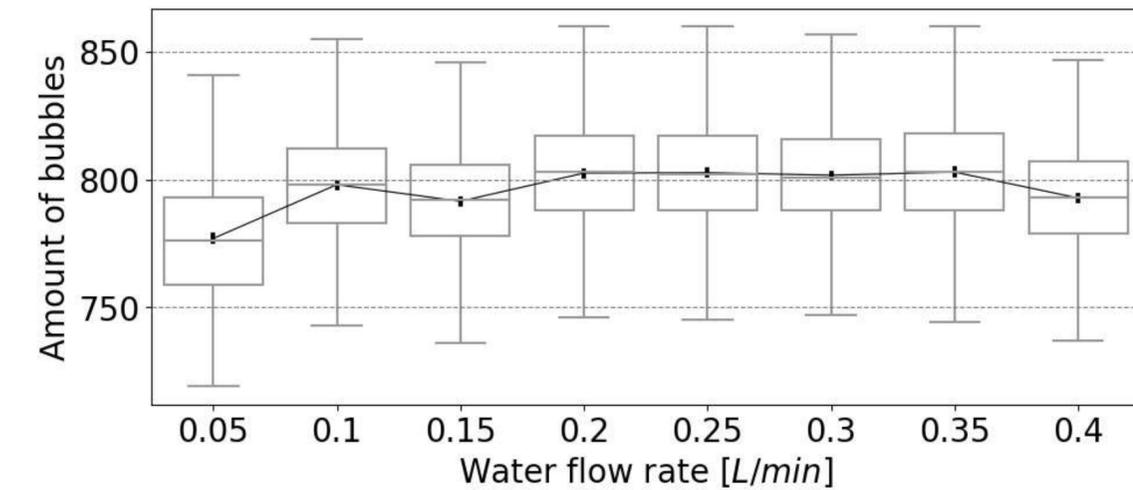
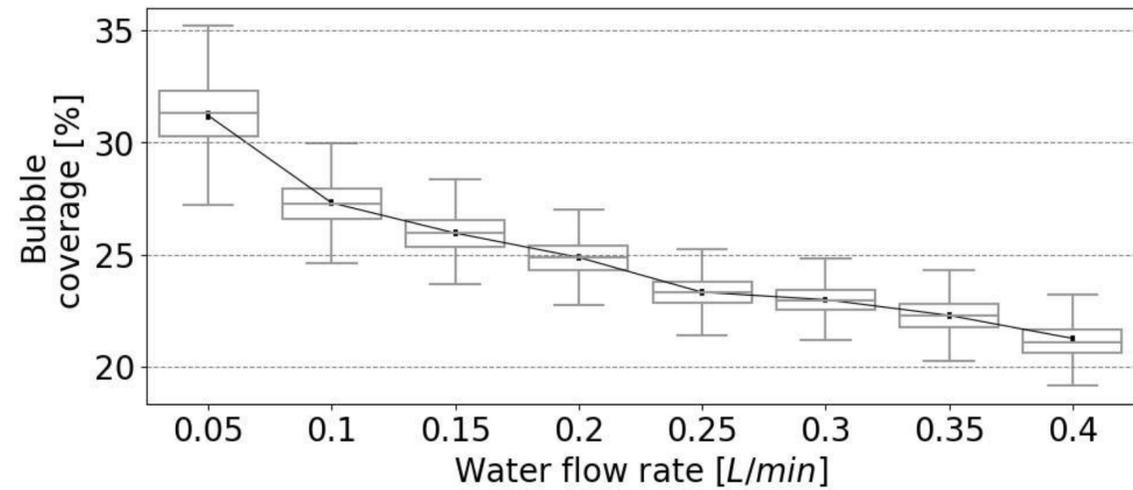


- Li et al, (2021)
- Su et al, (2022)
- Visual

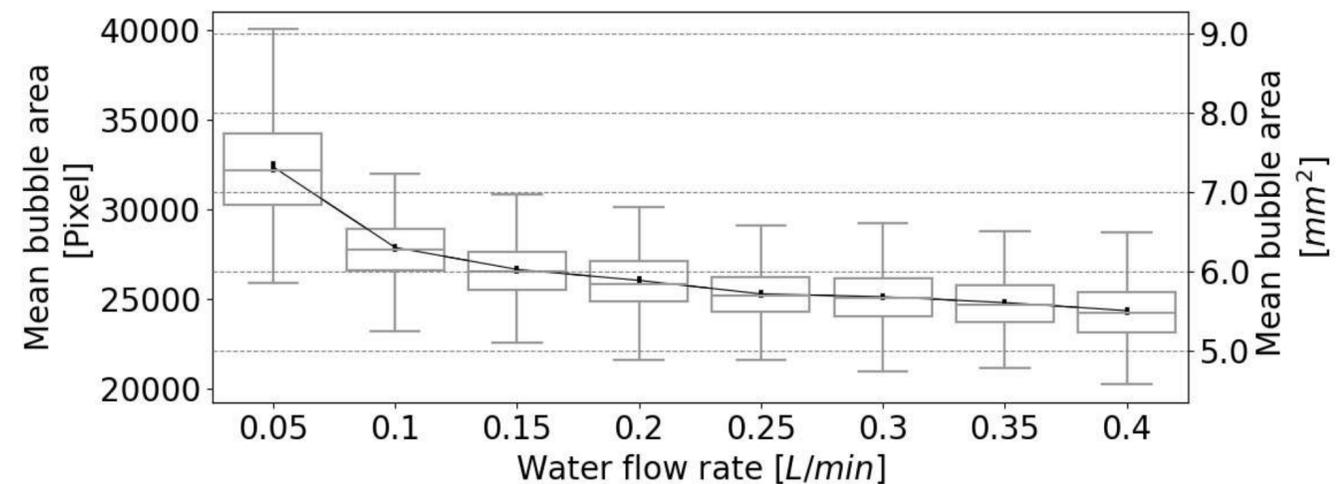
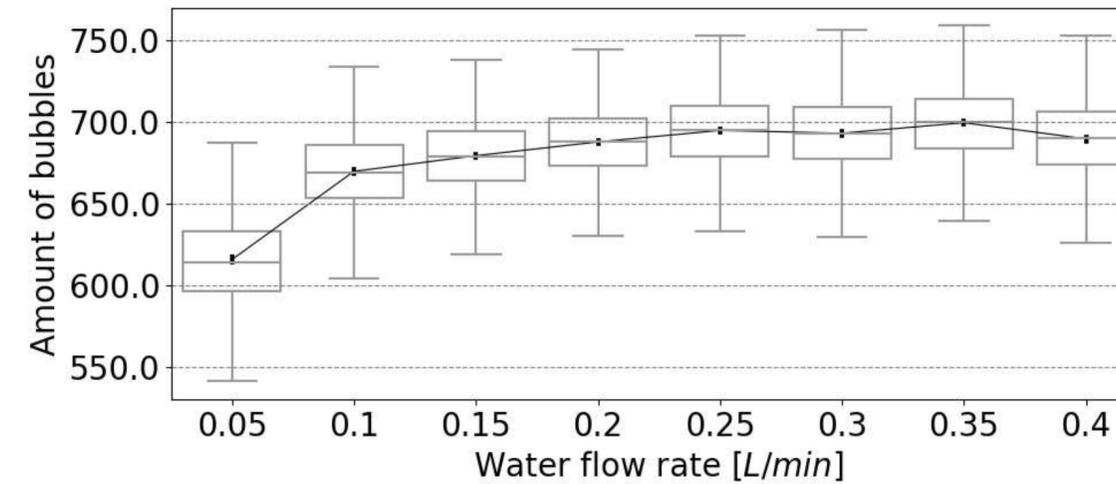
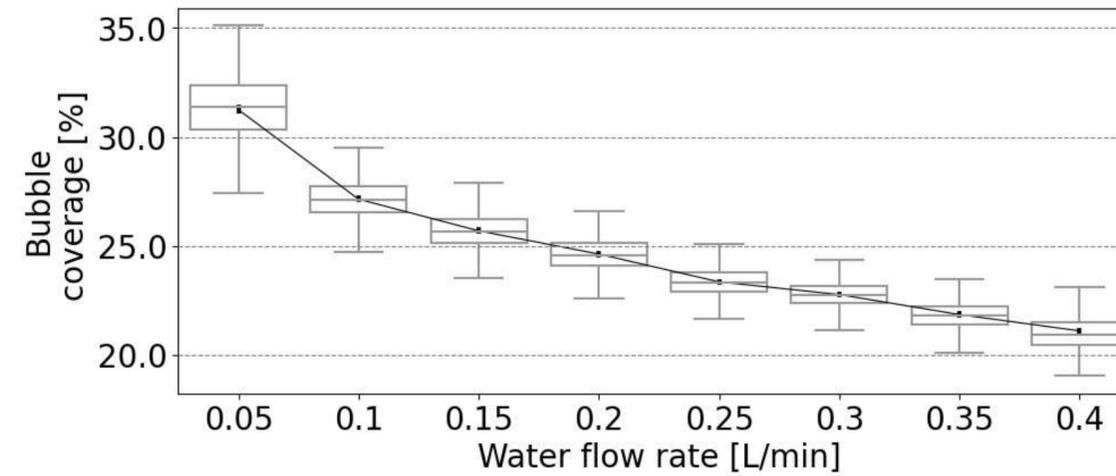
- Li et al, (2021)
- Su et al, (2022)

Comparaison une classe : Variation de débit anodique

YoloV7



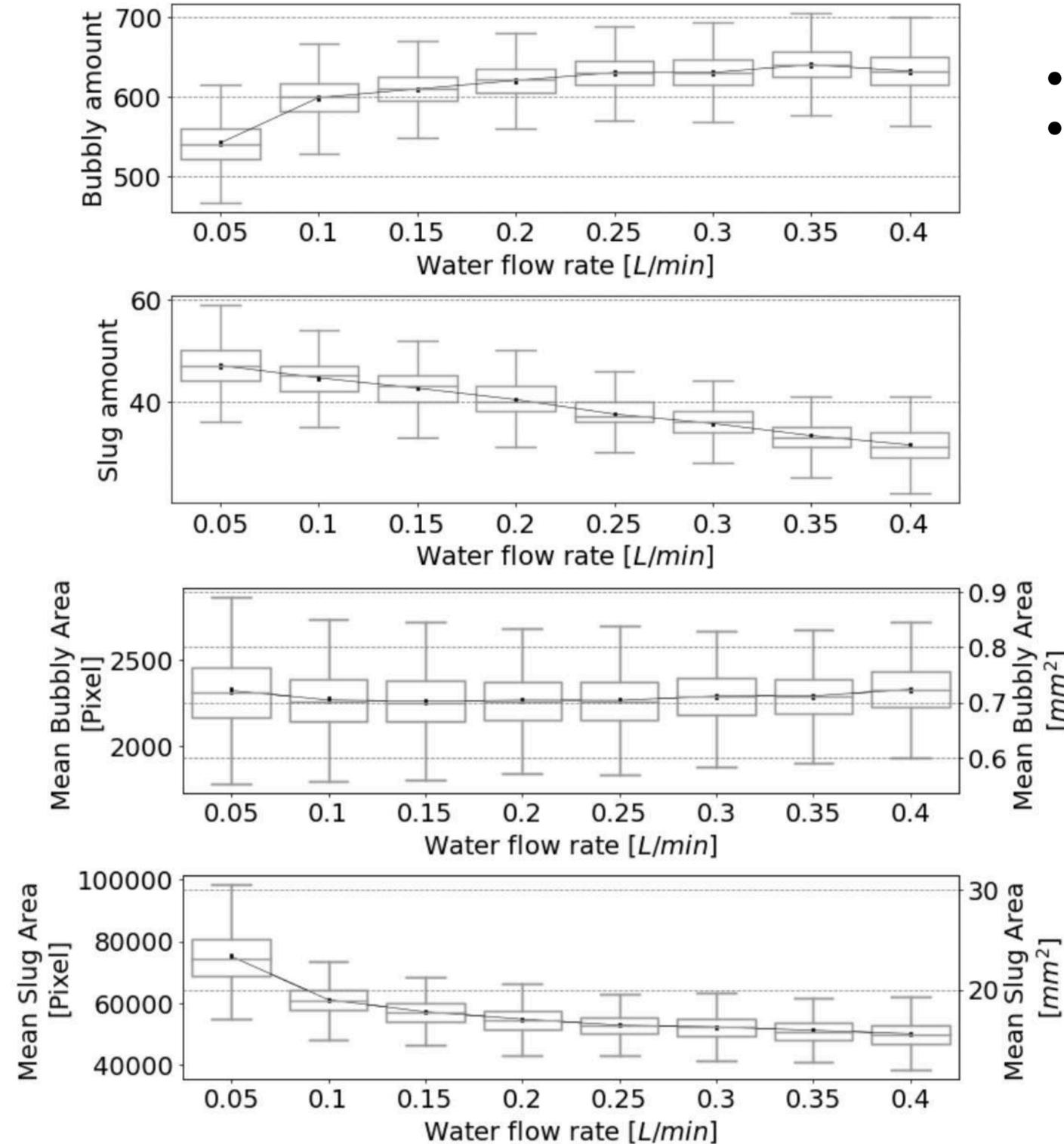
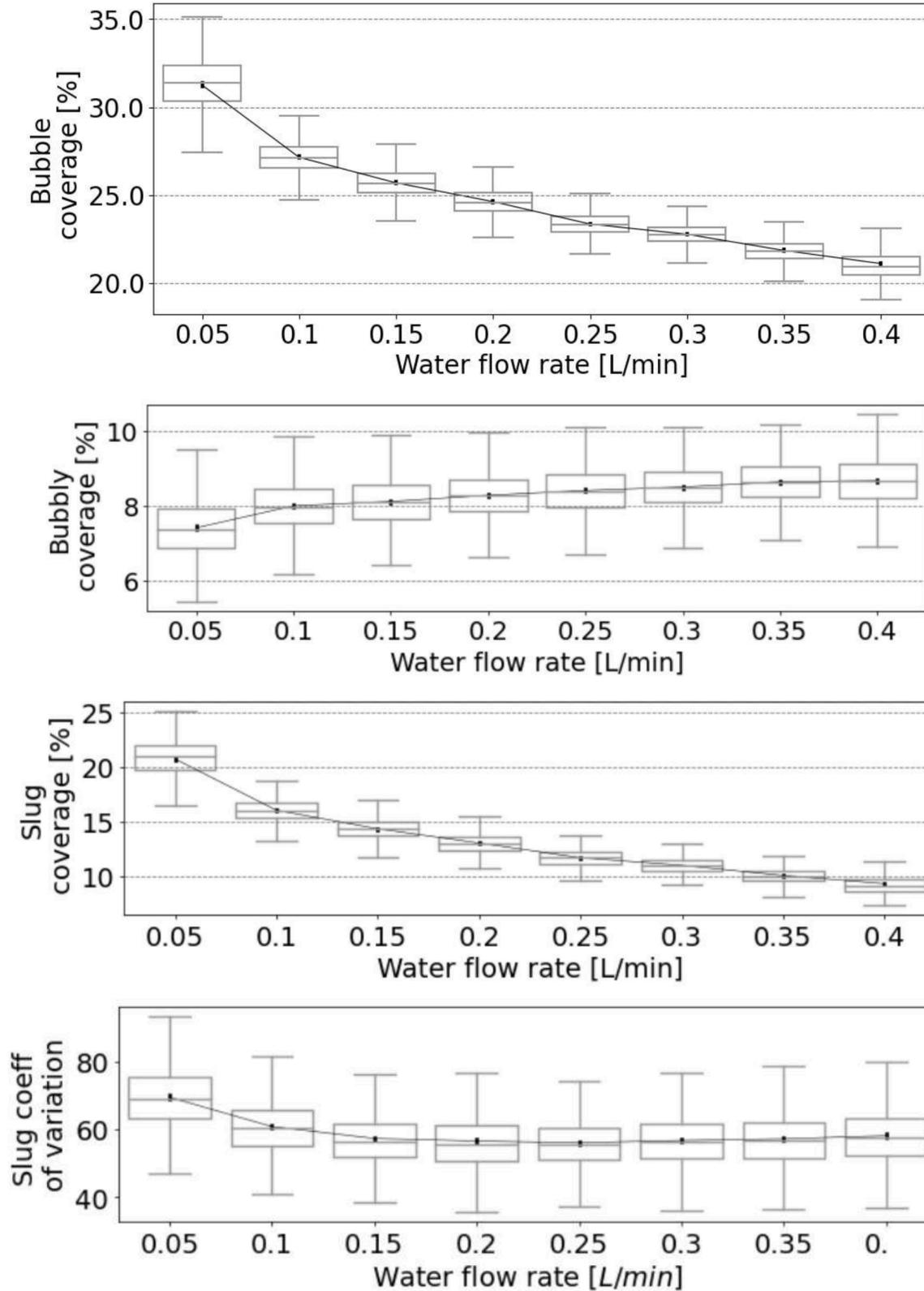
YoloV7 + SAHI + Post-traitement



- Su et al, (2022)

- Su et al, (2022)
- Dedigama, (2014)
- Li et al, (2021)

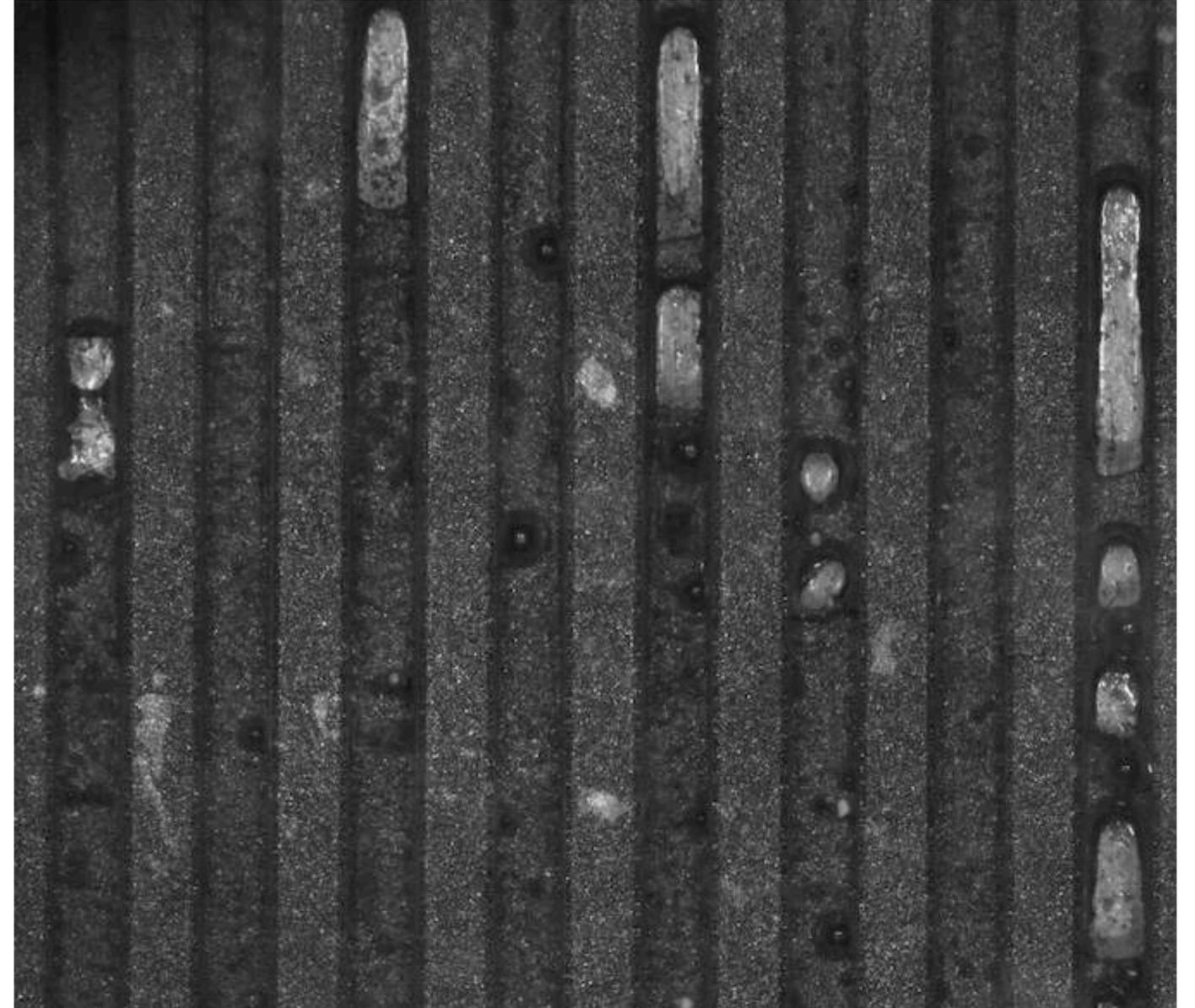
Analyse : 3 classes Variation de débit



- Su et al, (2022)
- Li et al, (2021)

- Garcia et al, (2019)

- Suppression de la grille
- Autres motifs de canaux
- Suivie des bulles



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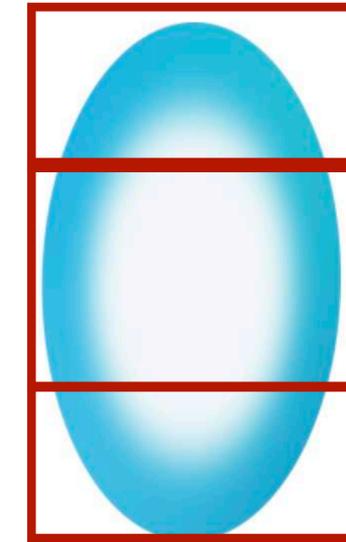
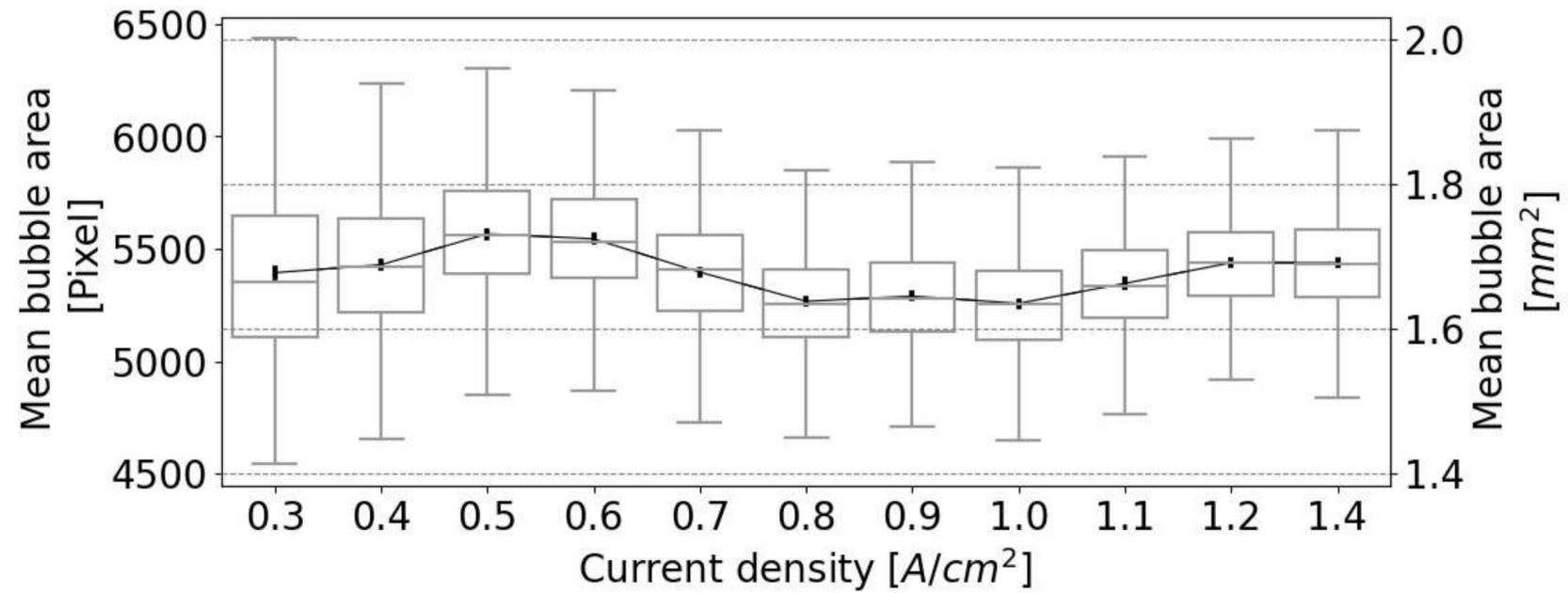
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