

amU



INSTITUT  
de MATHÉMATIQUES  
de MARSEILLE



Centrale  
Méditerranée



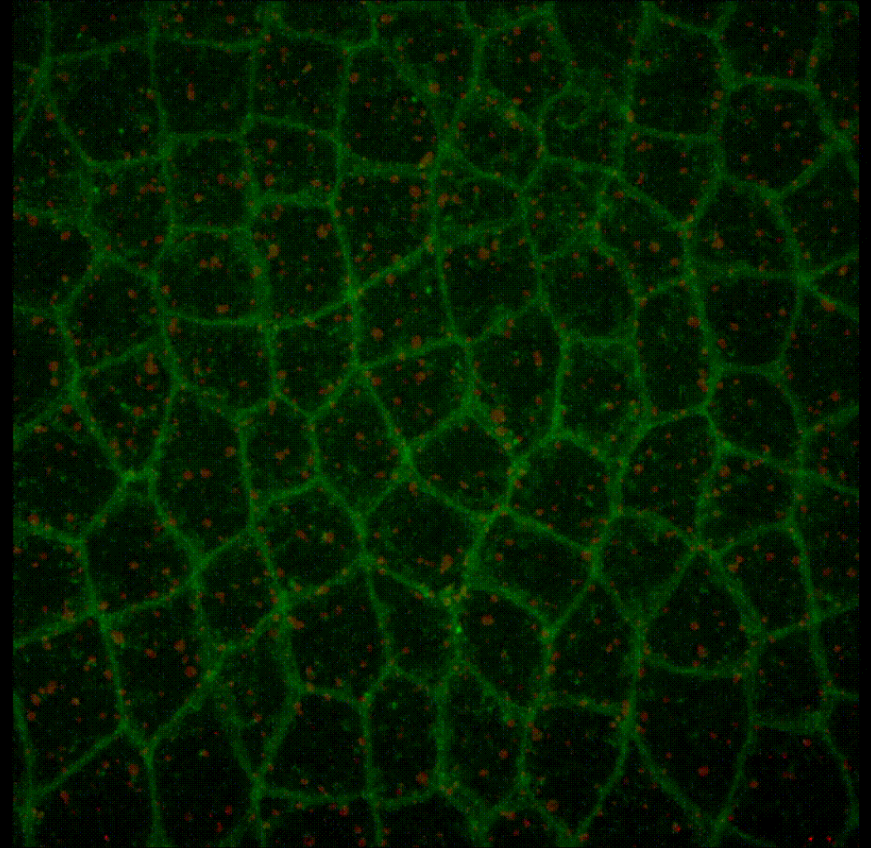
CENTURI  
TURING CENTRE  
FOR LIVING SYSTEMS

# Suivi des particules à l'échelle nanométrique

Piyush MISHRA  
Sup: Philippe ROUDOT

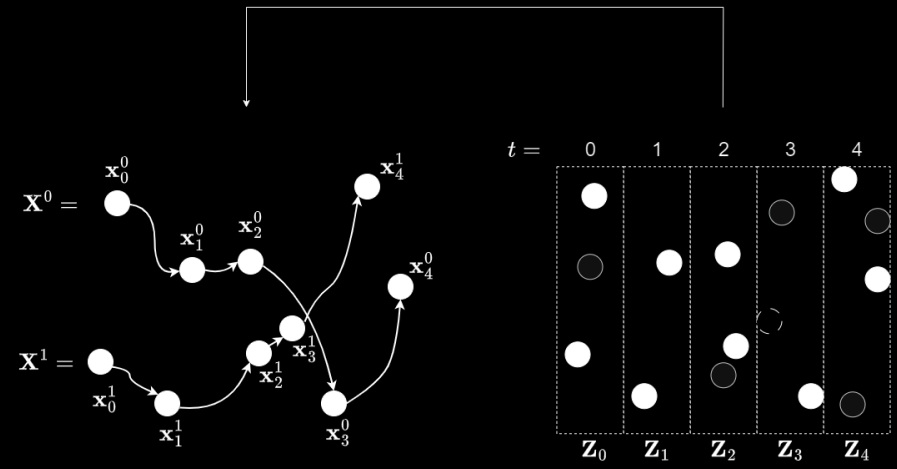
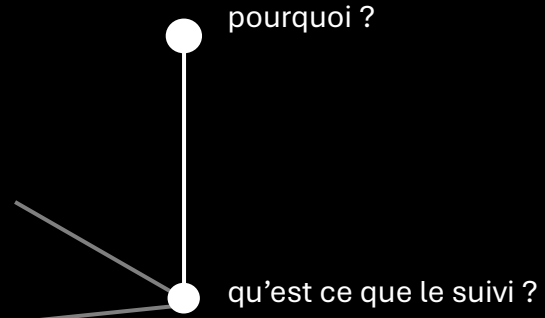
Inst. de Mathématiques de Marseille &  
Inst. Fresnel  
(ED 184)

● pourquoi ?



problème inverse

éxplosion  
combinatoire



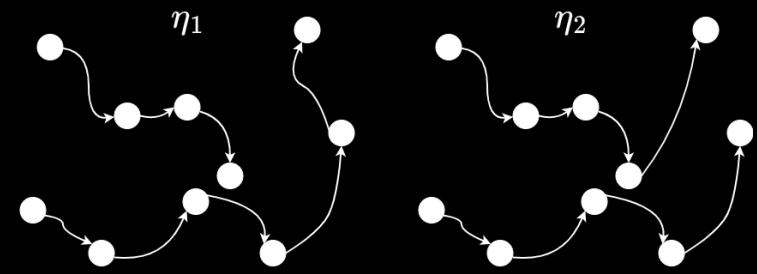
$$\mathbf{X} = \{\mathbf{X}^p\}_{p=0:N-1}$$

states

$$\mathbf{Z} = \{\mathbf{Z}_t\}_{t=0:T-1}$$

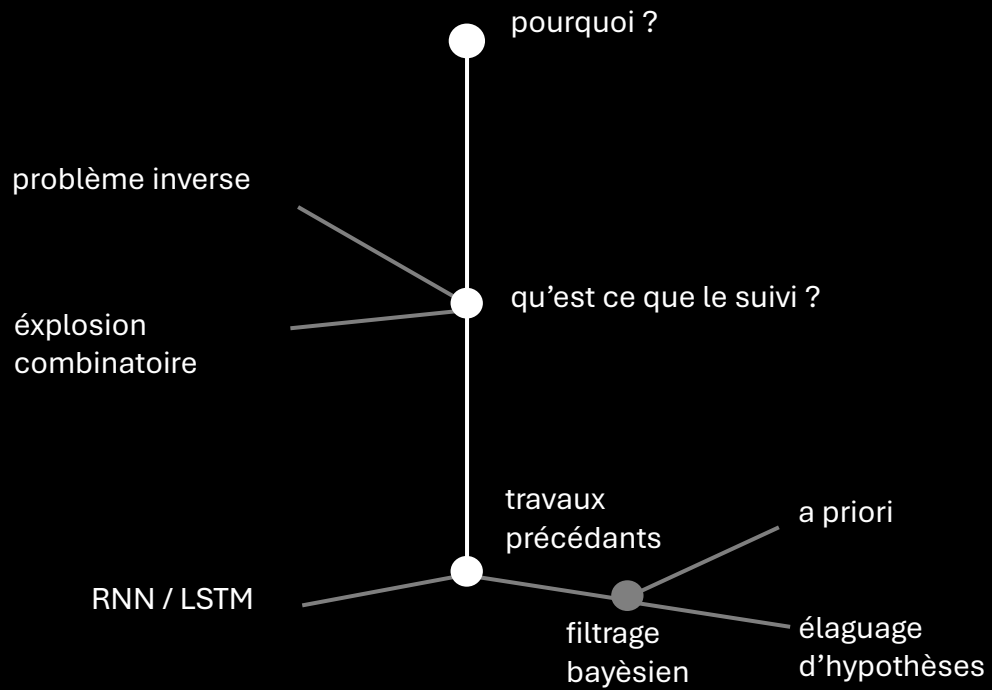
measurements

$$\mathbf{Z} = \mathbf{\Lambda} \cdot \mathbf{X} + \epsilon$$

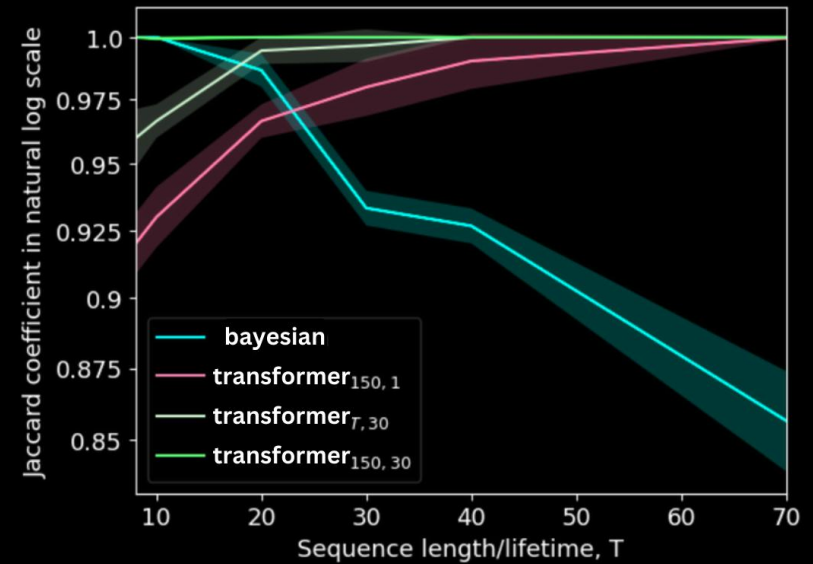
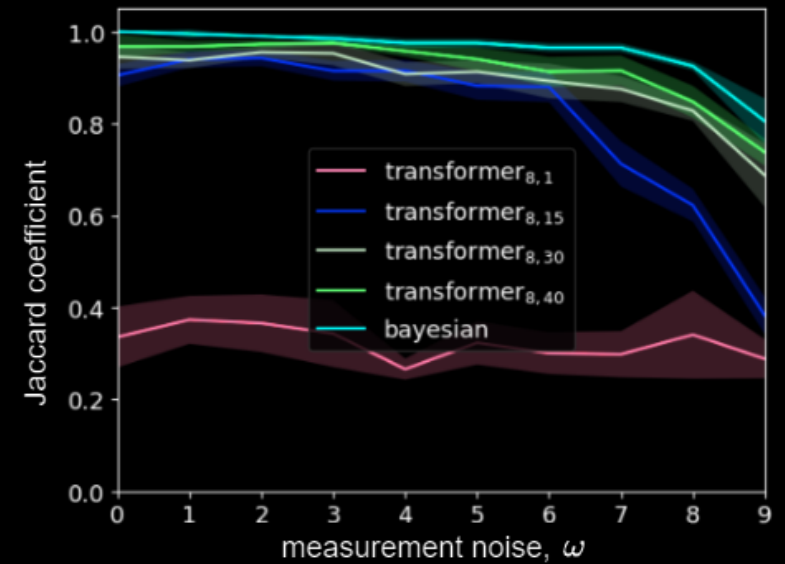
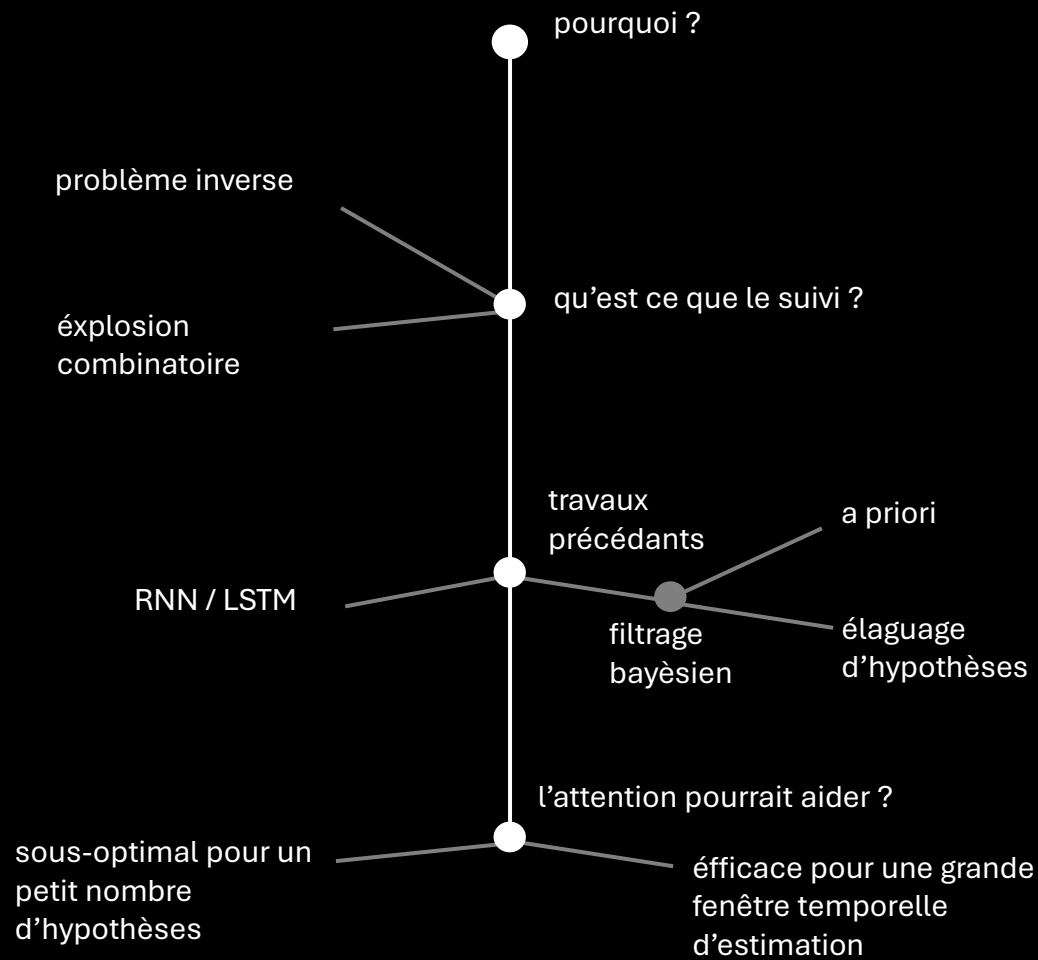


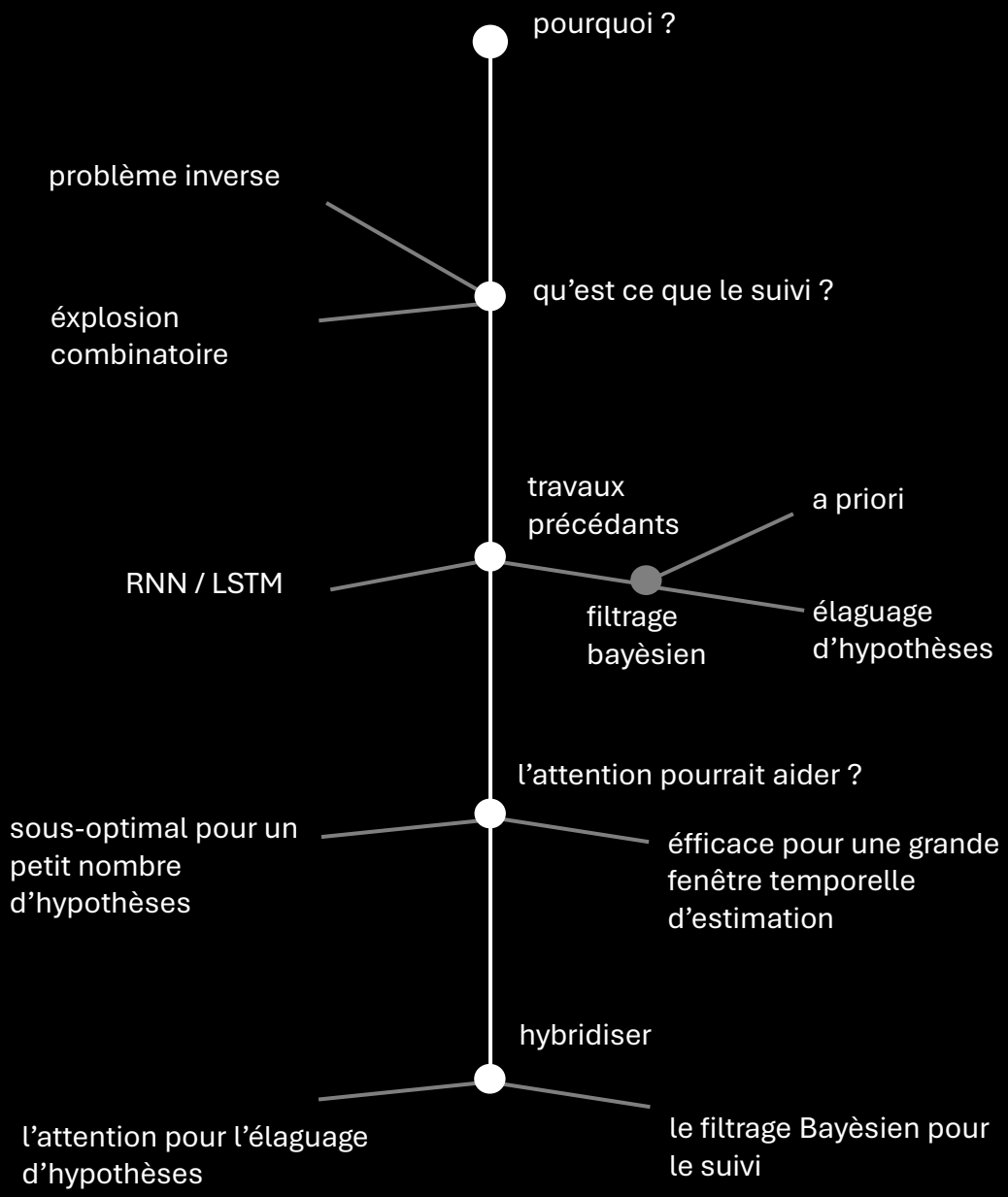
$$|\eta_i| \propto N!^t$$

hypotheses



$$\begin{aligned}
 p(\mathbf{X}_t | \mathbf{Z}_{1:t}) &= \underbrace{p(\mathbf{Z}_t | \mathbf{X}_t)}_{\text{association}} \int \underbrace{p(\mathbf{X}_t | \mathbf{X}_{t-1})}_{\text{prediction}} \underbrace{p(\mathbf{X}_{t-1} | \mathbf{Z}_{1:t-1})}_{\text{a priori}} d\mathbf{X} \\
 &= \sum_{\boldsymbol{\eta}_p^t \in \mathbf{H}_t'} p(\mathbf{Z}_t | \mathbf{X}_t, \boldsymbol{\eta}_p^t) p(\boldsymbol{\eta}_p^t | \mathbf{X}_t) \int p(\mathbf{X}_t | \mathbf{X}_{t-1}) p(\mathbf{X}_{t-1} | \mathbf{Z}_{1:t-1}) d\mathbf{X}
 \end{aligned}$$





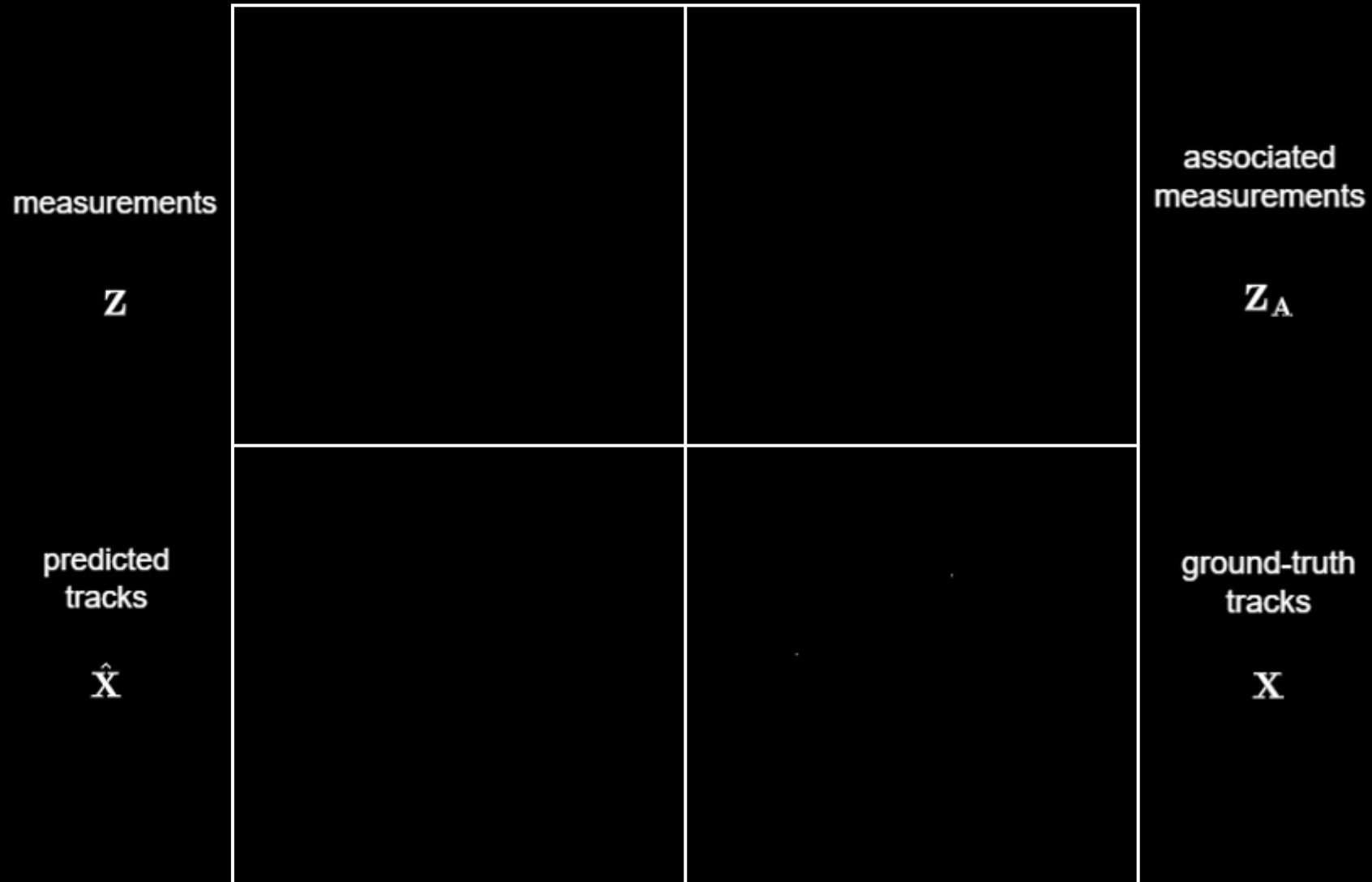
association basée sur l'attention



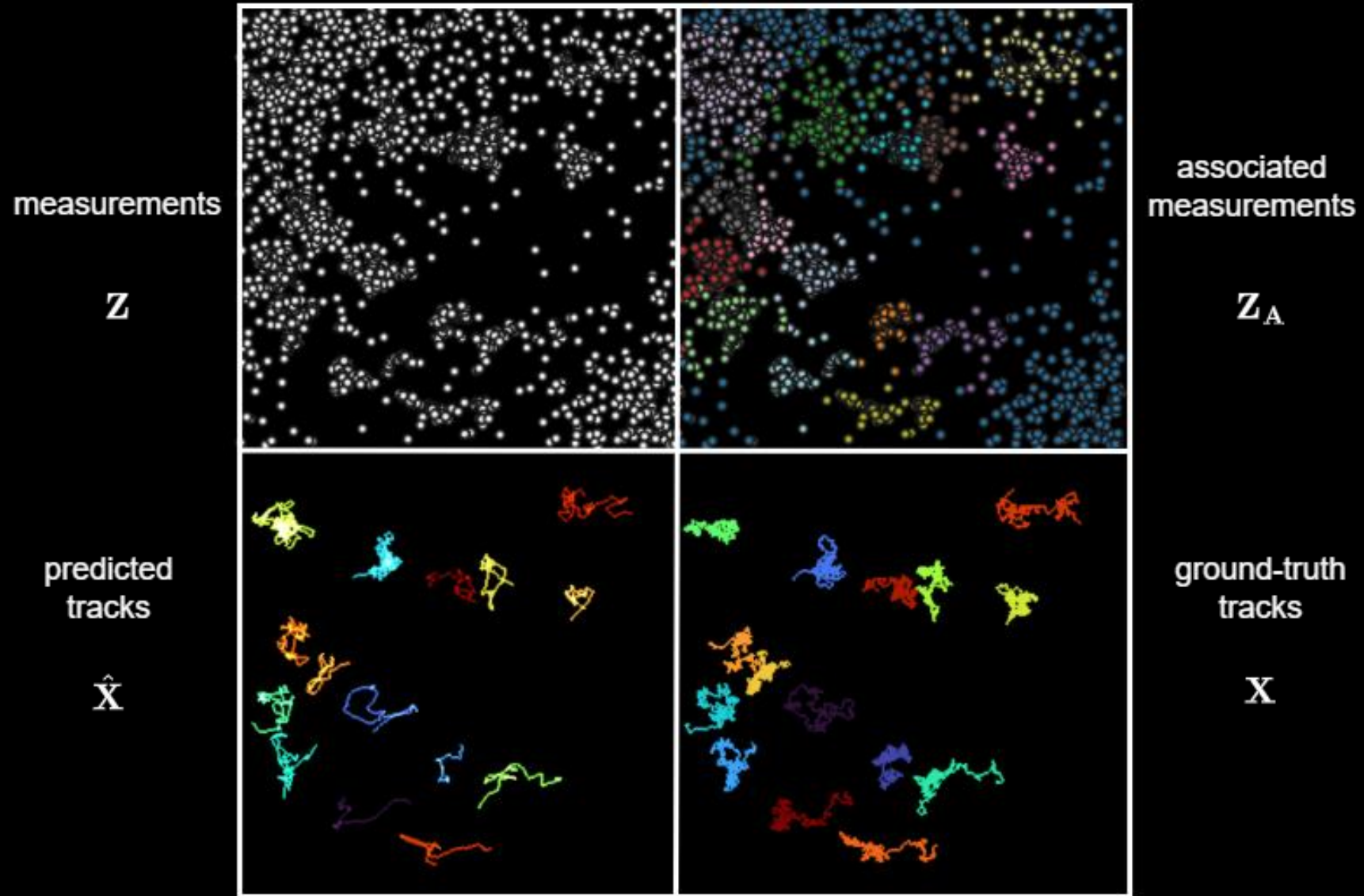
suivi Bayésien



# Applications : le suivi des particules admettant un mouvement Brownien

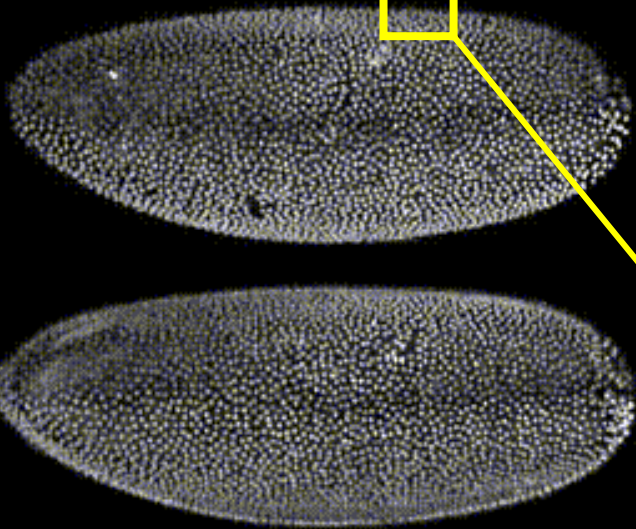


# Applications : le suivi des particules admettant un mouvement Brownien

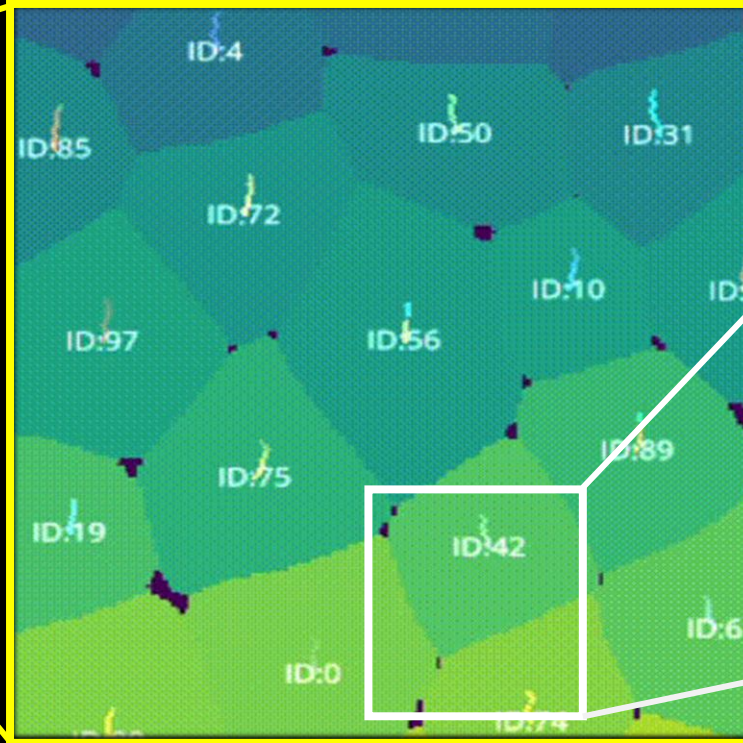




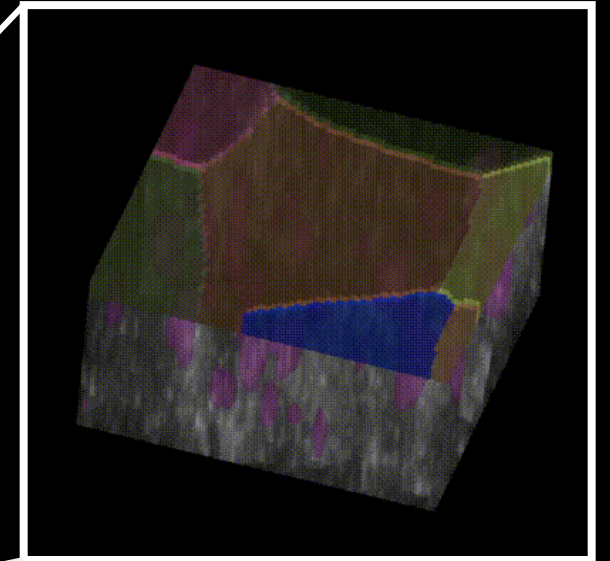
## Applications : zoomer sur une cellule qui bouge



Images microscopiques des  
embryons des mouches,  
C. Collinet, IBDM



Suivi des cellules  
avec la stratégie hybride  
Attention-Bayésienne



Région d'intérêt stabilisée,  
Team Endotrack,  
Centuri Hackathon, 2024

amU



INSTITUT  
de MATHÉMATIQUES  
de MARSEILLE



Centrale  
Méditerranée



CENTURI  
TURING CENTRE  
FOR LIVING SYSTEMS

**Merci de votre attention 😊**

[piyushmishra12.github.io](https://piyushmishra12.github.io)