

“Experimental Data Processing”

Laboratory work 13

Joint assimilation of navigation data

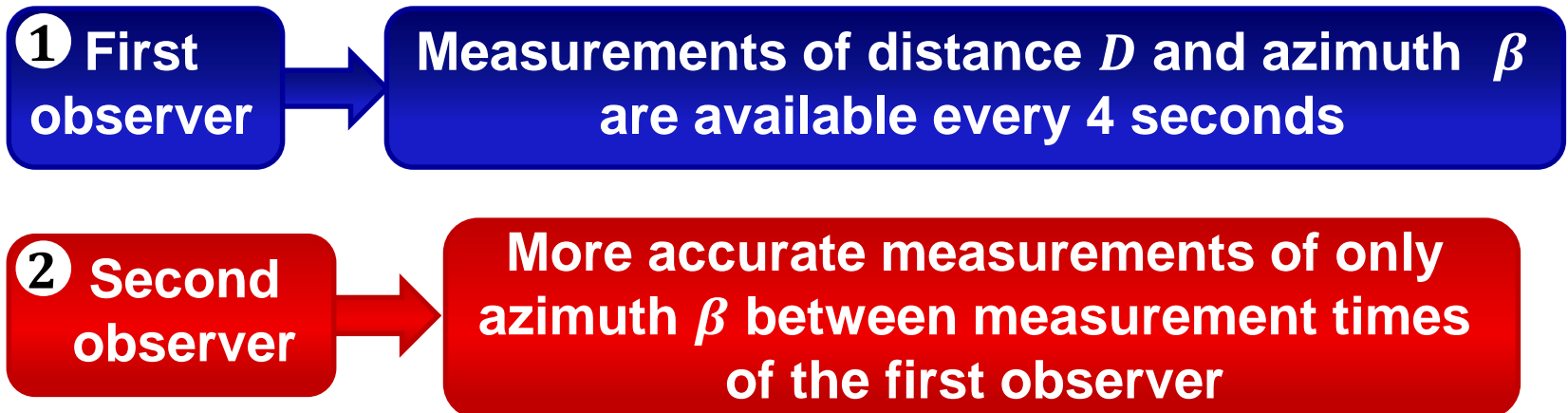
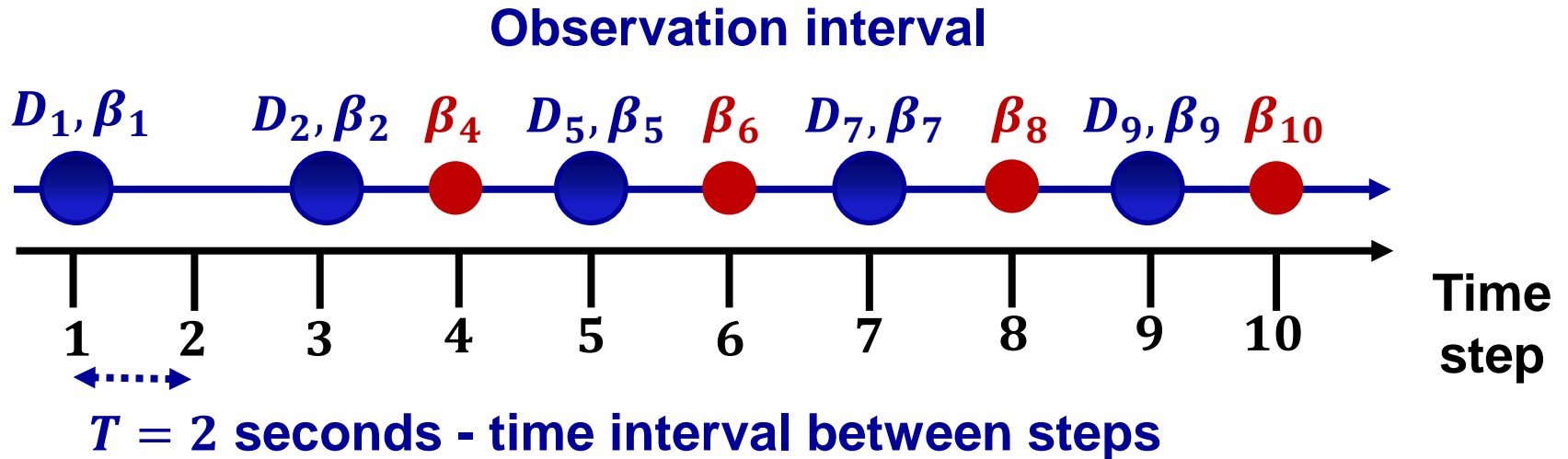
coming from different sources

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Term 1B, October 2017

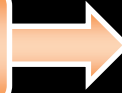
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Navigation data coming from different sources



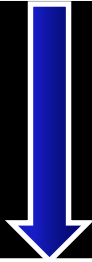
Measurement equation for the first observer

Measurement equation



$$z_i = h(X_i) + \eta_i$$

Measurement
vector z_i



$$z_i = \begin{bmatrix} D_i^m \\ \beta_i^m \end{bmatrix}$$

Nonlinear
function $h(X_i)$



$$h(X_i) = \begin{bmatrix} \sqrt{x_i^2 + y_i^2} \\ \arctg\left(\frac{x_i}{y_i}\right) \end{bmatrix}$$

Observation function for the first observer

Nonlinear function $h(X_i)$ \Rightarrow

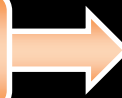
$$h(X_i) = \begin{bmatrix} \sqrt{x_i^2 + y_i^2} \\ \arctg\left(\frac{x}{y}\right) \end{bmatrix}$$

Derivative with respect
to X_{i+1} at point $\hat{X}_{i+1,i}$

$$\frac{dh(\hat{X}_{i+1,i})}{dX_{i+1}} = \begin{bmatrix} \frac{x_{i+1,i}}{\sqrt{x_{i+1,i}^2 + y_{i+1,i}^2}} & 0 & \frac{y_{i+1,i}}{\sqrt{x_{i+1,i}^2 + y_{i+1,i}^2}} & 0 \\ \frac{y_{i+1,i}}{x_{i+1,i}^2 + y_{i+1,i}^2} & 0 & -\frac{x_{i+1,i}}{x_{i+1,i}^2 + y_{i+1,i}^2} & 0 \end{bmatrix}$$

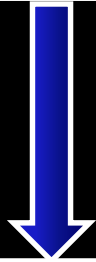
Measurement equation for the second observer

Measurement equation



$$z_i = h(X_i) + \eta_i$$

Measurement
vector z_i



$$z_i = |\beta_i^m|$$

Nonlinear
function $h(X_i)$



$$h(X_i) = \left| \arctg \left(\frac{x_i}{y_i} \right) \right|$$

Observation function for the second observer

Nonlinear
function $h(X_i)$



$$h(X_i) = \left| \arctg \left(\frac{x_i}{y_i} \right) \right|$$

Derivative with respect
to X_{i+1} at point $\hat{X}_{i+1,i}$



$$\frac{dh(\hat{X}_{i+1,i})}{dX_{i+1}} = \left| \begin{array}{cc} \frac{y_{i+1,i}}{x_{i+1,i}^2 + y_{i+1,i}^2} & 0 \\ -\frac{x_{i+1,i}}{x_{i+1,i}^2 + y_{i+1,i}^2} & 0 \end{array} \right|$$