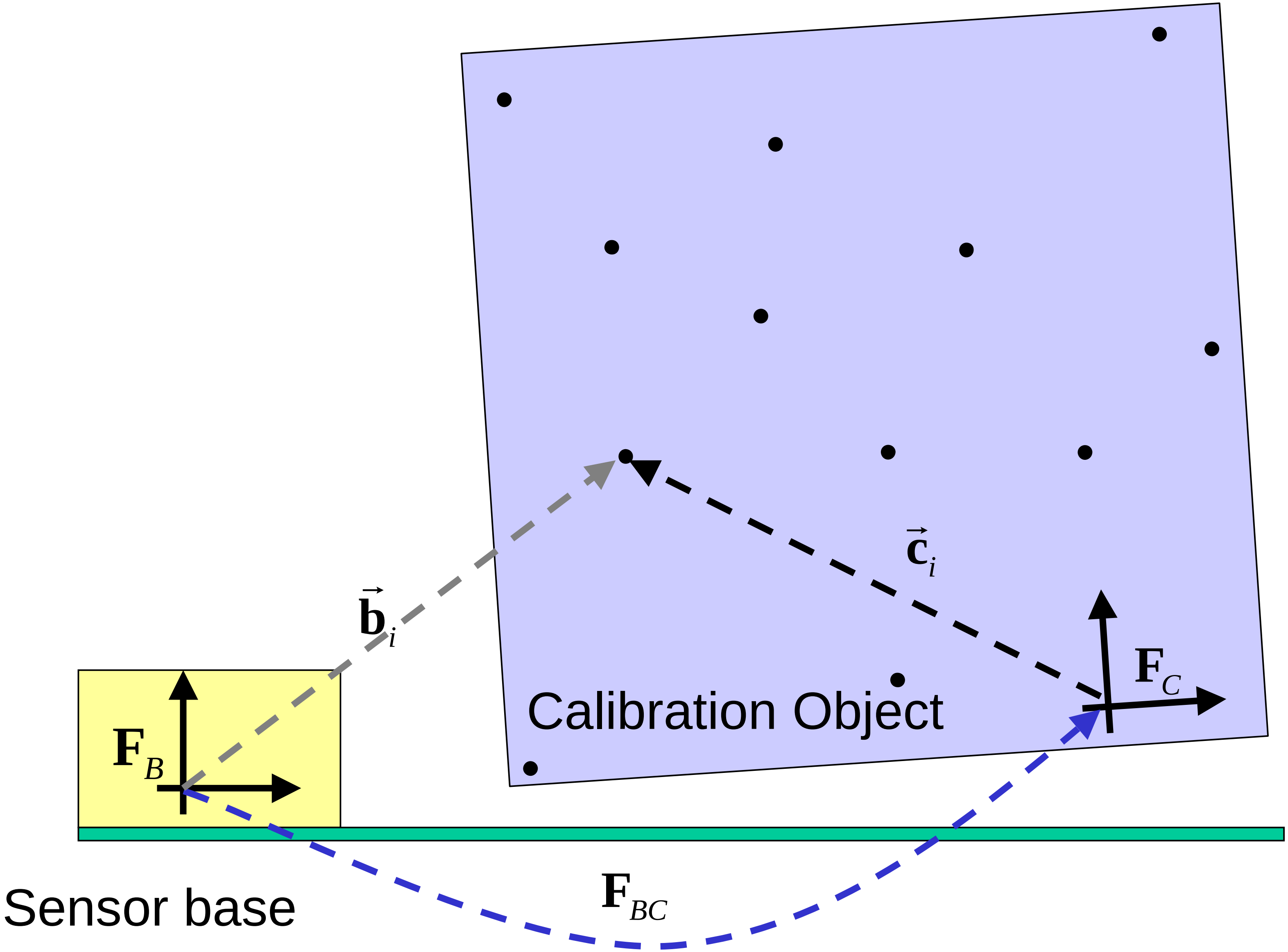
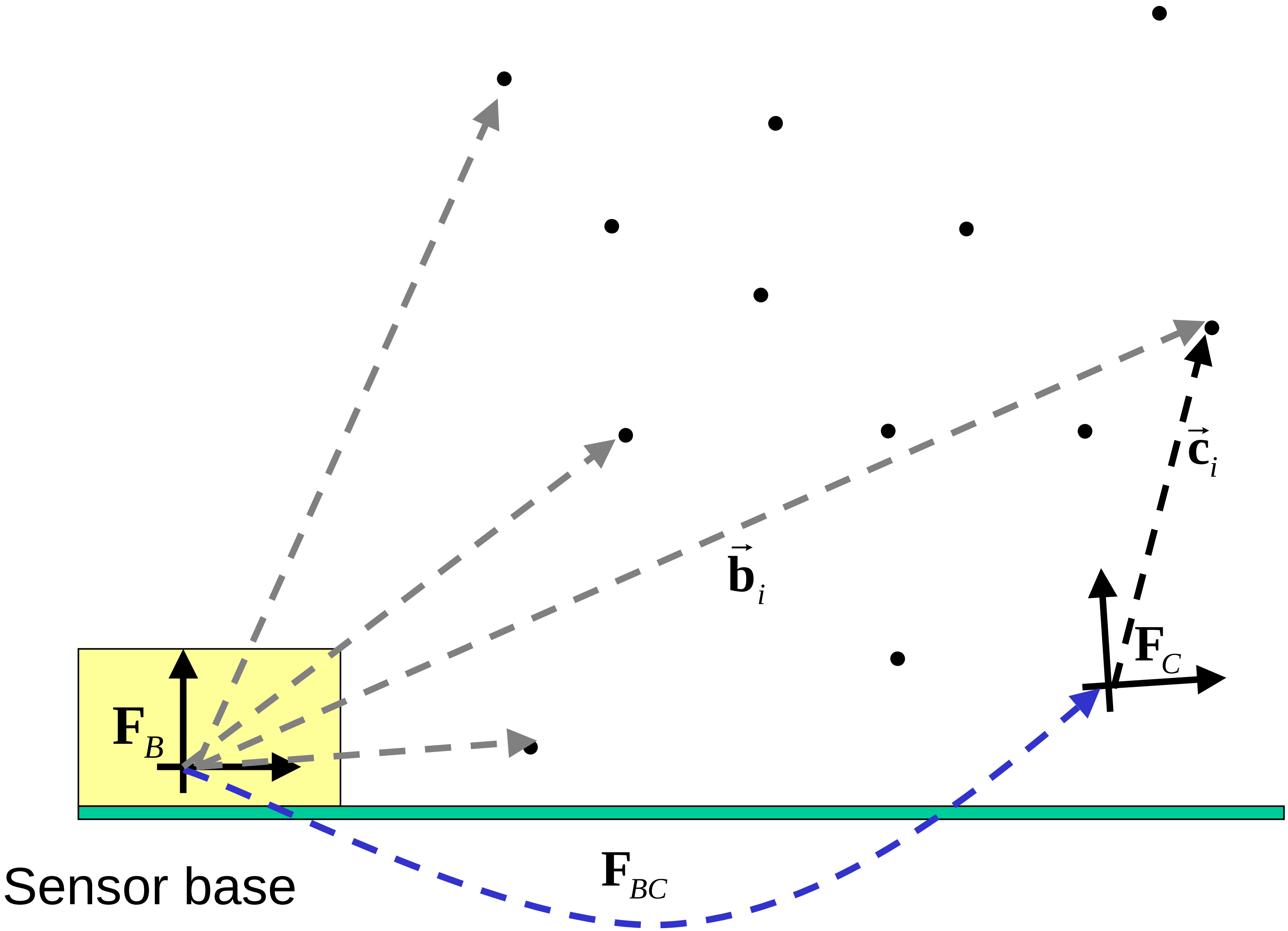
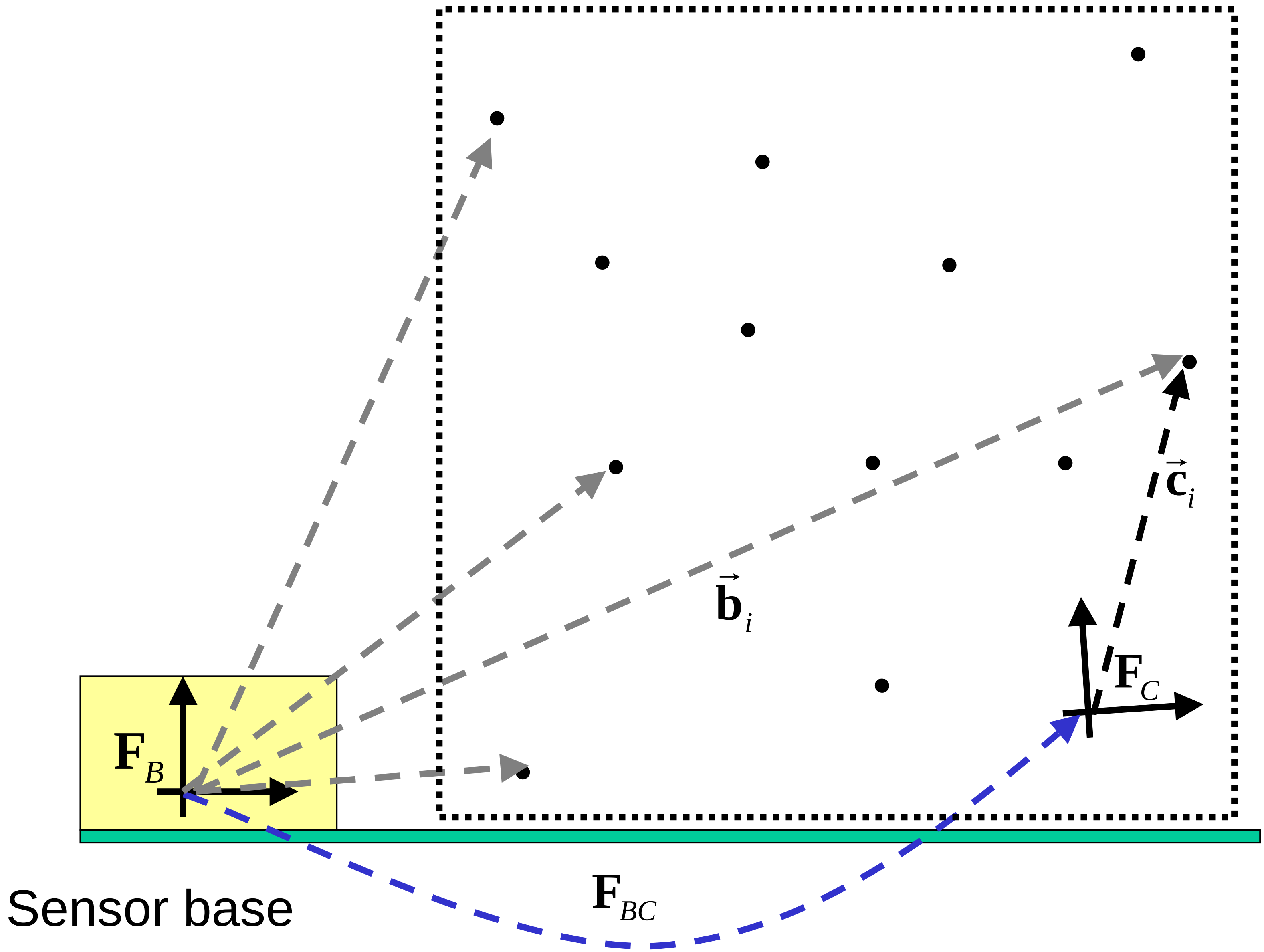

$\vec{\mathbf{b}}_i$
$\vec{\mathbf{c}}_i$
$\mathbf{F}_C$
Calibration Object
$\mathbf{F}_B$
$\mathbf{F}_{BC}$
Sensor base



$\vec{\mathbf{c}}_i$
$\vec{\mathbf{b}}_i$
$\mathbf{F}_C$
$\mathbf{F}_B$
$\mathbf{F}_{BC}$
Sensor base

Step 1: Find bounding box $(\vec{\mathbf{d}}_{LB}, \vec{\mathbf{d}}_{UB})$ of region of interest

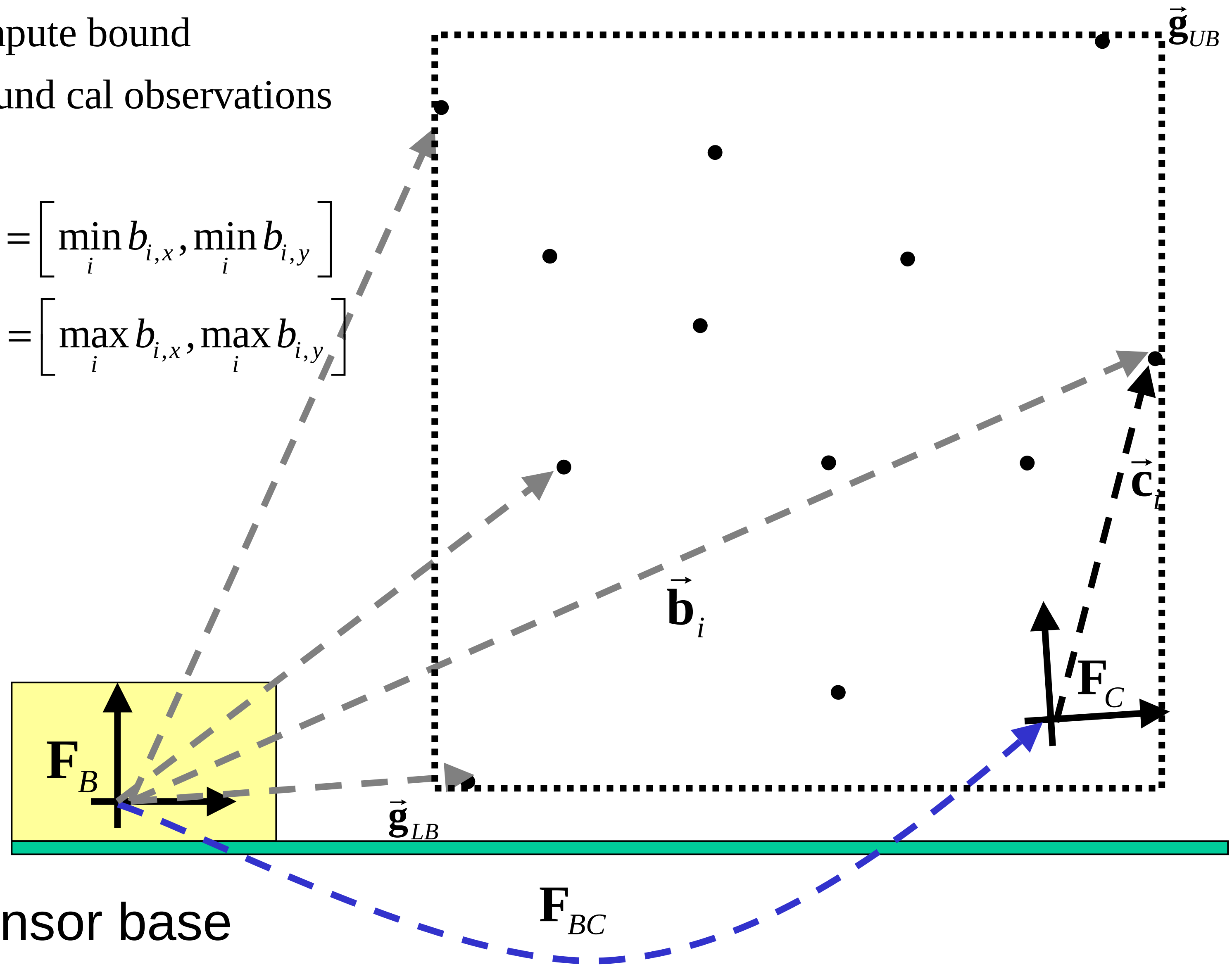


Step 1: Find bounding box ($\vec{\mathbf{d}}_{LB}, \vec{\mathbf{d}}_{UB}$) of region of interest

E.g., compute bound around cal observations

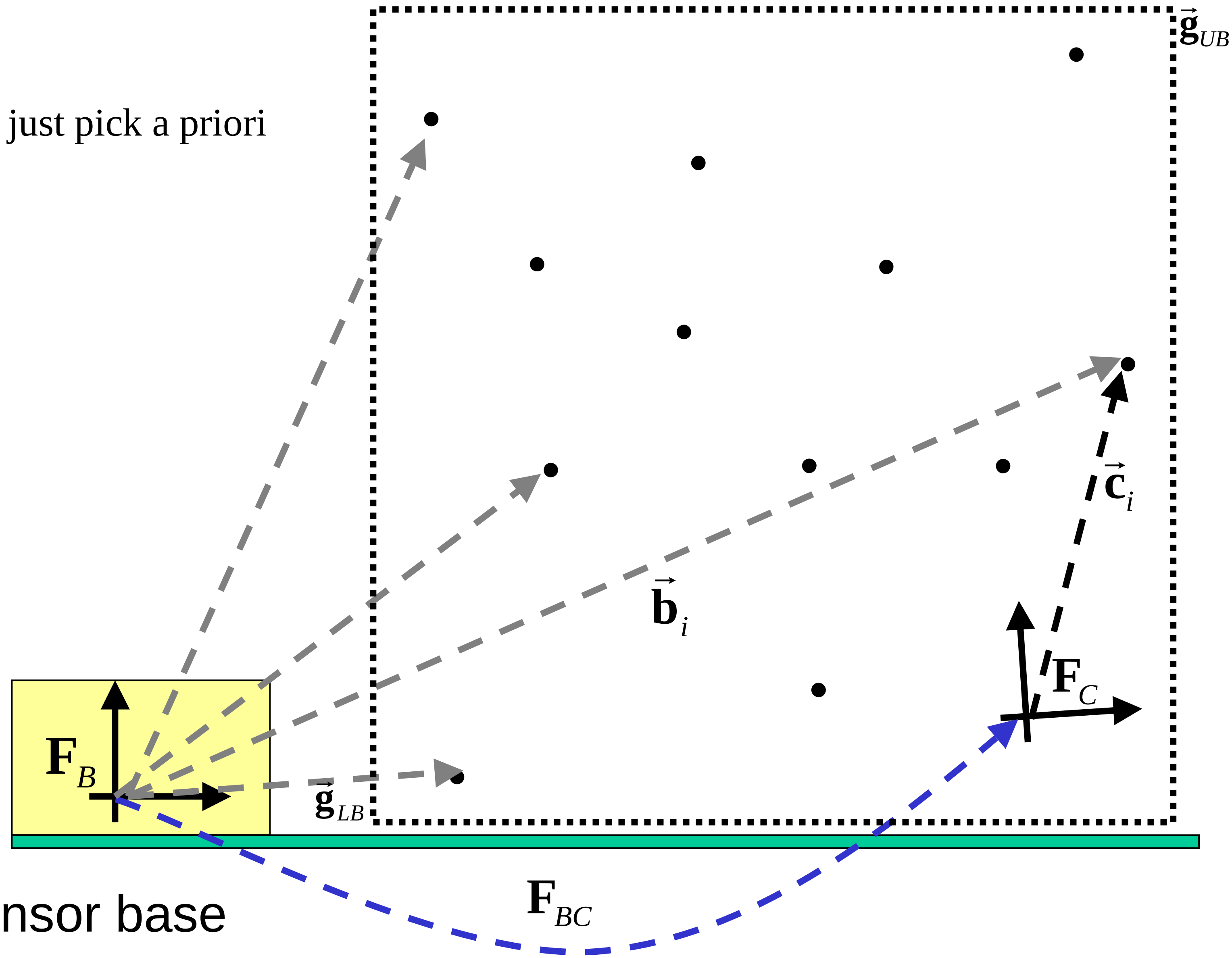
$$\vec{\mathbf{g}}_{LB} = \left[\min_i b_{i,x}, \min_i b_{i,y} \right]$$

$$\vec{\mathbf{g}}_{UB} = \left[\max_i b_{i,x}, \max_i b_{i,y} \right]$$



Step 1: Find bounding box ($\vec{\mathbf{d}}_{LB}, \vec{\mathbf{d}}_{UB}$) of region of interest

... or just pick a priori

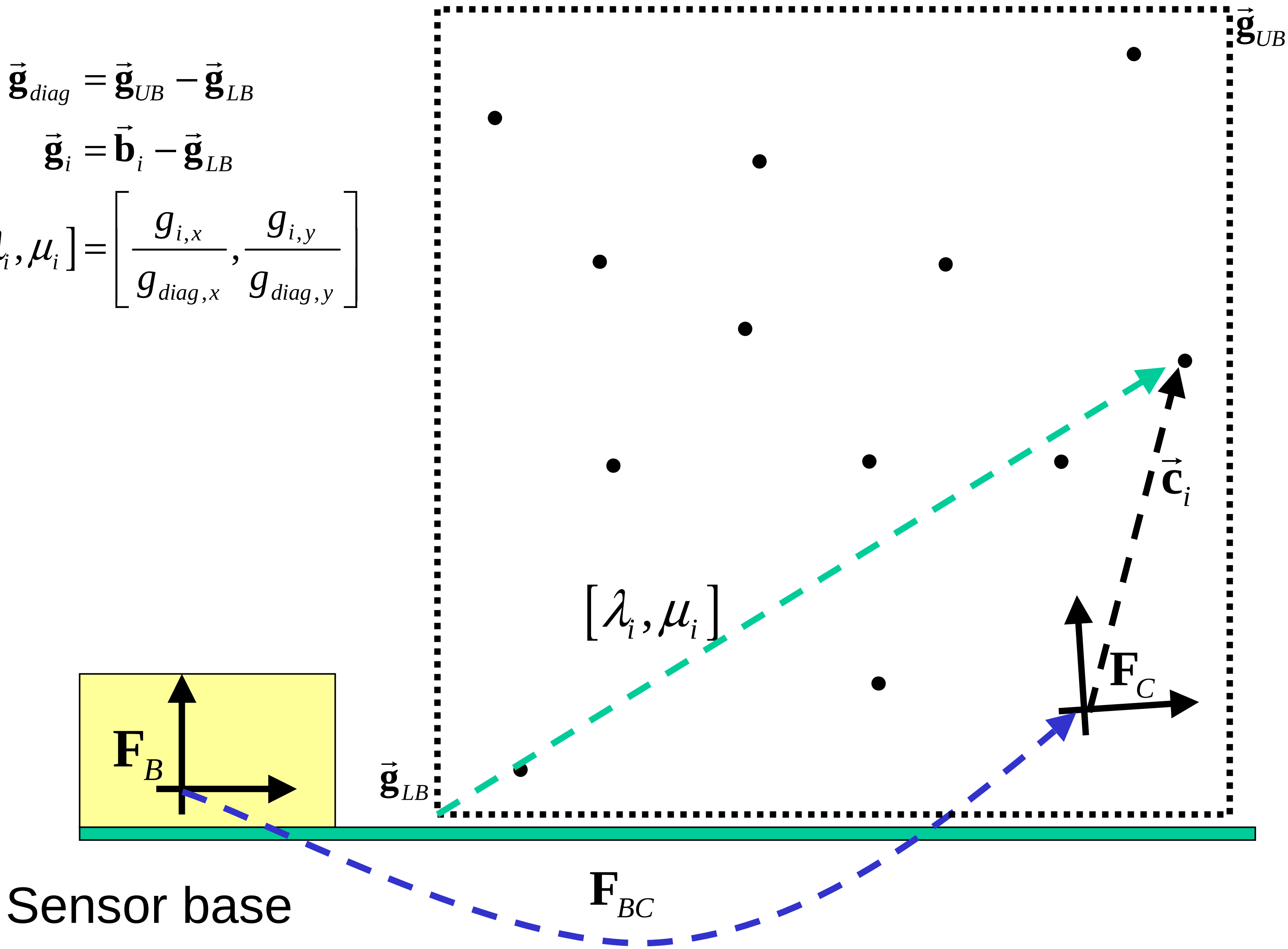


Step 2: Scale the $\vec{\mathbf{b}}_i$ to fractional range in ROI

$$\vec{\mathbf{g}}_{diag} = \vec{\mathbf{g}}_{UB} - \vec{\mathbf{g}}_{LB}$$

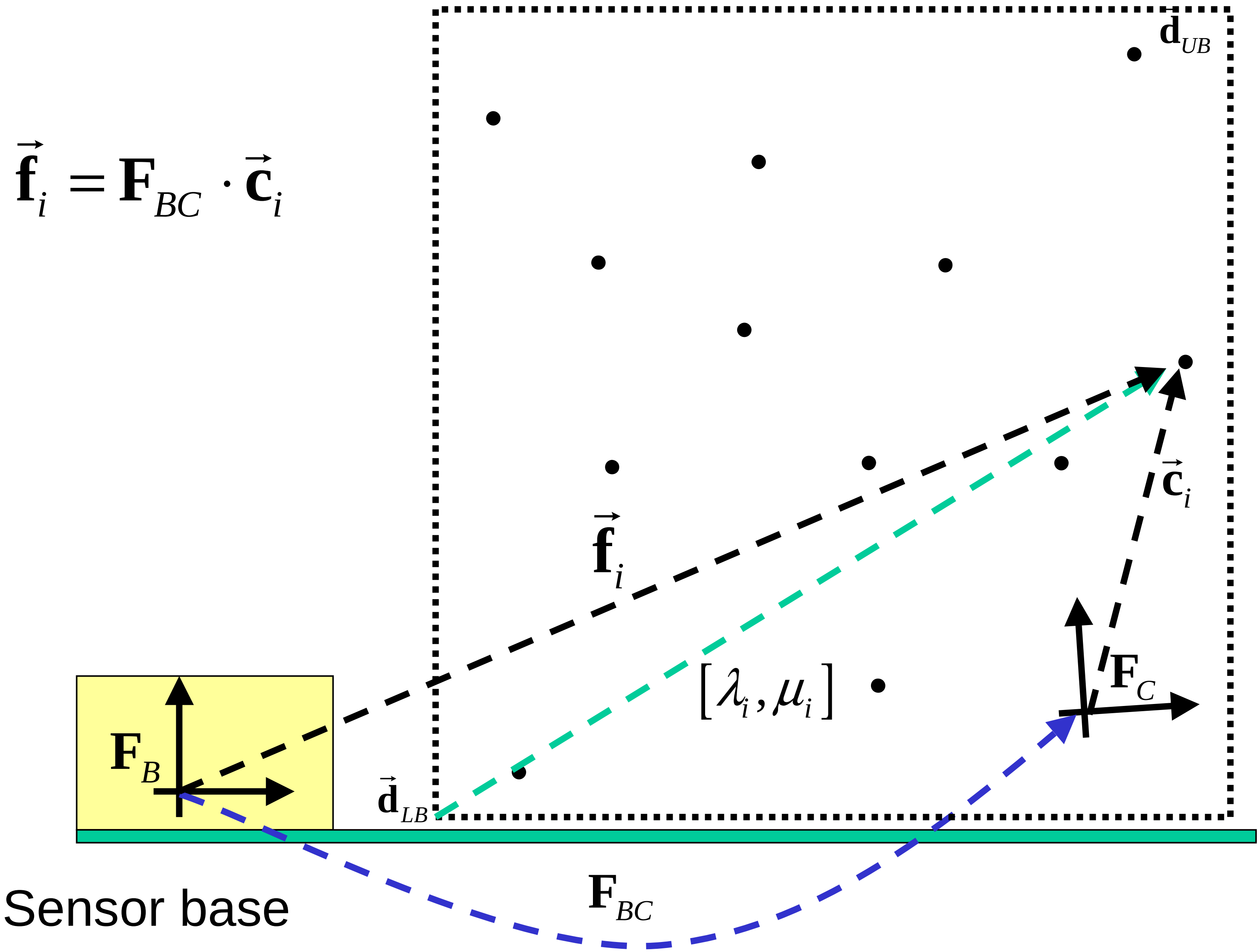
$$\vec{\mathbf{g}}_i = \vec{\mathbf{b}}_i - \vec{\mathbf{g}}_{LB}$$

$$[\lambda_i, \mu_i] = \left[\frac{g_{i,x}}{g_{diag,x}}, \frac{g_{i,y}}{g_{diag,y}} \right]$$



Step 3: Transform the $\vec{\mathbf{c}}_i$ to sensor coordinate system

$$\vec{\mathbf{f}}_i = \mathbf{F}_{BC} \cdot \vec{\mathbf{c}}_i$$



Step 4: find polynomial approximation

You will have a system like

$$\vec{\mathbf{f}}_k \approx \begin{bmatrix} \cdots & B_i^D(\lambda_k) & \cdots \end{bmatrix} \begin{bmatrix} \ddots & \vdots & \\ \cdots & \vec{\mathbf{h}}_{ij} & \cdots \\ & \vdots & \ddots \end{bmatrix} \begin{bmatrix} \vdots \\ B_j^D(\mu_k) \\ \vdots \end{bmatrix}$$

$$\vec{\mathbf{f}}_k \approx \sum_{0 \le i,j \le D} B_i^D(\lambda_k) B_j^D(\mu_k) \vec{\mathbf{h}}_{ij}$$

$$\left(\vec{\mathbf{f}}_k\right)_x \approx \sum_{i,j} B_i^D(\lambda_k) B_j^D(\mu_k) \left(\vec{\mathbf{h}}_{ij}\right)_x$$

$$\left(\vec{\mathbf{f}}_k\right)_y \approx \sum_{i,j} B_i^D(\lambda_k) B_j^D(\mu_k) \left(\vec{\mathbf{h}}_{ij}\right)_y$$

Use least squares to estimate the $\vec{\mathbf{h}}_{ij}$ from the known pairs $([\lambda_k, \mu_k], \vec{\mathbf{f}}_k)$.

Now, use this polynomial to un-distort sensor

Given $\vec{\mathbf{d}}_k$, compute corresponding $[\lambda_k, \mu_k]$

Then compute the undistorted value from

$$\sum_{0 \le i, j \le D} B_i^D(\lambda_k) B_j^D(\mu_k) \vec{\mathbf{h}}_{ij}$$