\( V_{\text{Doppler}} = V(t) \times \cos(\theta) \)

\( V(t) \) is the velocity of the radar bearing robot during the panoramic acquisition. Let us denote the robot’s velocity profile \( V(t) \) with a polynomial function of the time \( t \):

\[
V(t) = X(1) \times t^m + X(2) \times t^{m-1} + \ldots + X(m + 1)
\]

\[
\begin{bmatrix}
V_{\text{Doppler} 1} \\
\vdots \\
V_{\text{Doppler} n}
\end{bmatrix} = ([t^m \ldots 1] X) \circ 
\begin{bmatrix}
\cos(\theta_1) \\
\vdots \\
\cos(\theta_n)
\end{bmatrix}
\]

(9)

where \( \circ \) is the Hadamard product function.

Median Least Square algorithm [22] is applied to estimate the parameters of \( X \) of the function \( V(t) \) based on Doppler estimates for each radar beam. This principle is illustrated in Fig. 4.

![Fig. 4 Doppler velocity profile estimation during the acquisition.](image)

Each measurement of Doppler velocity \( V_{\text{Doppler} i} \) has an uncertainty \( \sigma_{\text{Doppler}} \). As a result, parameters of \( X \) of the function \( V(t) \) are estimated with their own uncertainty. Vehicle’s own velocity profile \( V(t) \) and uncertainty \( \sigma_{V(t)} \) can be known during the radar acquisition.

6 Search of non coherent entities

A Doppler image representing the Doppler effect created by the vehicle is obtained based on the previous estimated robot’s velocity profile and (9). This result is presented in Fig. 5.

If no mobile object is present in the scan, no difference of velocity should be detected. In order to correct radar images, each power spectrum \( S_{\text{up}} \) and \( S_{\text{dw}} \) of the up and down acquisitions is modified based on the expected Doppler effect \( \Delta f_i \) in the observed direction \( \theta_i \) to obtain the corrected data \( S_{\text{up}} \) and \( S_{\text{dw}} \).

\[
\begin{cases}
S_{\text{up}}(f_c) = S_{\text{up}}(f - \Delta f_i) \\
S_{\text{dw}}(f_c) = S_{\text{dw}}(f - \Delta f_i)
\end{cases}
\]