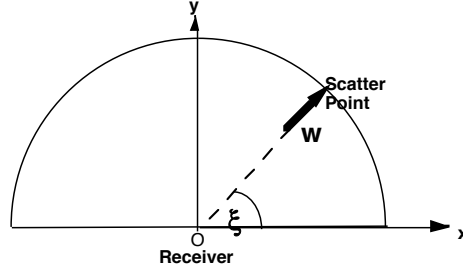


## UNCERTAINTIES IN TOTAL VELOCITIES

We define a rectangular grid covering the joint coverage area with cell size typically 1.5 x 1.5 km for a 25 Mhz radar. In practice, all radial components that fall within a combining circle of defined radius (typically 2km) are combined to form a single total current vector at the grid point. We define these  $m$  components as having magnitudes  $w_i$ , variances

$\langle \Delta w_i^2 \rangle$  and inclinations  $\xi_i^i$  for  $i=1, 2, \dots, m$ , if the component is produced by backscatter, it is normal to the circular range cell (see Fig).



We define a total velocity vector with components  $U$  and  $V$  along the  $x, y$  axes, which are determined by minimizing the sum of deviations given by:

$$S = \sum_{i=1}^m [w_i - U \cos(\xi_i) - V \sin(\xi_i)]^2 \quad (1)$$

The solutions for  $U, V$  resulting from this minimization are given by:

$$U = \sum_{i=1}^m e_i w_i \quad V = \sum_{i=1}^m d_i w_i \quad (2)$$

where the coefficients  $e_i, d_i$  are given by

$$e_i = \frac{\cos(\xi_i) \sum_{i=1}^m \sin^2(\xi_i) - \sin(\xi_i) \sum_{i=1}^m \sin(\xi_i) \cos(\xi_i)}{\sum_{i=1}^m \cos^2(\xi_i) \sum_{i=1}^m \sin^2(\xi_i) - \left[ \sum_{i=1}^m \sin(\xi_i) \cos(\xi_i) \right]^2} \quad (3)$$

$$d_i = \frac{\sin(\xi_i) \sum_{i=1}^m \cos^2(\xi_i) - \cos(\xi_i) \sum_{i=1}^m \sin(\xi_i) \cos(\xi_i)}{\sum_{i=1}^m \cos^2(\xi_i) \sum_{i=1}^m \sin^2(\xi_i) - \left[ \sum_{i=1}^m \sin(\xi_i) \cos(\xi_i) \right]^2} \quad (4)$$

with the corresponding variances obtained from linear error propagation (see for example Brandt: 'Statistical and Computational Methods in Data Analysis').

$$\langle \Delta U^2 \rangle = \sum_{i=1}^m e_i^2 \langle \Delta w_i^2 \rangle \quad \langle \Delta V^2 \rangle = \sum_{i=1}^m d_i^2 \langle \Delta w_i^2 \rangle \quad (5)$$

By definition, the standard deviations in  $U, V$  are the square roots of the variances.