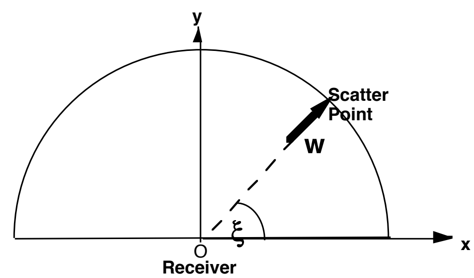
UNCERTAINTIES IN TOTAL VELOCITIES

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 ξ^i for i=1, 2, ...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:

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

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

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

where the coefficients e_i, d_i are given by

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

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

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

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

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