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**Absolute target range and target range profile in separate
computational compartments: Synthetic aperture echolocation**

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Echolocating big brown bats emit wideband (20-100 kHz) FM sounds and perceive target range from echo delay with an accuracy determined by echo relative bandwidth (Q). They distinguish among target shapes by echo spectra, but they perceive shape in terms of distances to different parts (glints), or the target's range profile. Shape resolution based on glint delay differences extracted from target interference spectra is in fractions of millimeters. The bat's flight velocity is about 5 m/s, so that echo delay changes continuously during production of broadcasts and then again during reception of echoes, smearing and displacing delay estimates for target ranging by several hundred microseconds. Previous workers have identified a particular distance at which smearing is minimal, but it is not known whether this "distance of focus" has significance for the bat. However, perception of target shape is based on a spectral representation that is only slightly distorted by the bat's motion, and it is kept in separate computational path from absolute delay until after absolute delay is determined, whereupon it is attached to absolute delay to place the target's image in an approximate spatial position. The bat's system achieves synthetic aperture imaging of shape while avoiding motion-related blurring.