Can place-specific cochlear dispersion be represented by auditory steady-state responses?

The present study investigated to what extent properties of local cochlear dispersion can be objectively assessed through auditory steady-state responses (ASSR). The hypothesis was that stimuli compensating for the phase response at a particular cochlear location generate a maximally modulated basilar membrane (BM) response at that BM position, due to the large "within-channel" synchrony of activity. This would lead, in turn, to a larger ASSR amplitude than other stimuli of corresponding intensity and bandwidth. Two stimulus types were chosen: 1] Harmonic tone complexes consisting of equal-amplitude tones with a starting phase following an algorithm developed by Schroeder [IEEE Trans. Inf. Theory 16, 85-89 (1970)] that have earlier been considered in behavioral studies to estimate human auditory filter phase responses; and 2] simulations of auditory-filter impulse responses (IR). In both cases, also the temporally reversed versions of the stimuli were considered. The ASSRs obtained with the Schroeder tone complexes were found to be dominated by "across-channel" synchrony and, thus, do not reflect local place-specific information. In the case of the more frequency-specific stimuli, no significant differences were found between the responses to the IR and its temporally reversed counterpart. Thus, whereas ASSRs to narrowband stimuli have been used as an objective indicator of frequency-specific hearing sensitivity, the method does not seem to be sensitive enough to reflect local cochlear dispersion.