Non-Local Measurement

Consider two spin ½ particles for which two parties, Alice and Bob separated by a distance *d*, each have a single particle at their disposal. Suppose that it is possible for Alice and Bob to perform arbitrary measurements on the two particles. An interesting question is whether or not it is possible for Alice and Bob to make a non-local measurement of these particles, faster than would allow the speed of light to propagate between the two parties, i.e., faster than d/c. It is shown in [672, p. 197] that the majority of non-local measurements are impossible to make without violating causality, which is consistent with a result established in 1931 by Landau and Peierls [676]. On the other hand, Aharonov et al. [672, p. 198], assuming the measurement-system unitary coupling formalism considered by von Neumann [13, pp. 441-445], found a loophole for which it may be possible to measure a particular state faster than d/c --that being a bipartite superposition with precisely equal coefficients:

$$\frac{1}{\sqrt{2}}(|\uparrow\rangle|\uparrow\rangle + |\downarrow\rangle|\downarrow\rangle).$$