



# No tests of Locality via Bell's Inequality nor of Entanglement at Colliders.

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*Recently there has been an increased interest in possible tests of locality via Bell's inequality or tests of entanglement at colliders, in particular at the LHC. These have involved various physical processes, such as  $t\bar{t}$ -production,  $\tau^+\tau^-$ -production, or the decay of a Higgs boson to 2 vector bosons  $H \rightarrow VV$ . Meson anti-meson oscillations (e.g.  $B^0 - \bar{B}^0$ ) have also been reconsidered at Belle II. We first review Bell's original argument. Then discuss a response we formulated in 1991. We then argue here that **none** of these recent proposals constitute a test of locality via Bell's inequality or a test of quantum entanglement, including the Nature paper by ATLAS. The reason is quite simple. In all cases what is measured are the momenta of the final state particles and all components of momenta commute. It is straightforward to construct a local hidden variable theory (LHVT) which exactly reproduces the data. This LHVT satisfies Bell's inequality and is by construction **not** entangled. Thus a test of locality via Bell's inequality or a test of entanglement is inherently **not** possible.*

