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Lightning charge transfer before and after terrestrial gamma ray flash generation

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Many and perhaps all terrestrial gamma ray flashes (TGFs) are produced in association with an upward propagating negative polarity in-cloud lightning leaders. This suggests that electric field enhancement produced by the leader plays a role in generating the high amplitude, large scale electric fields needed to produce the relativistic runaway electron avalanche process. Consequently, measurements of the lightning charge moment change in this lightning leader at the time of TGF production may provide valuable quantitative insight into how TGFs are produced. We analyze here several TGFs measured by Fermi GBM for which we have high quality multi-site and multi-band magnetic field measurements from the lightning leader in order to estimate this crucial quantity.