Abstract Submitted
for the APR16 Meeting of
The American Physical Society

Development of Radiation-Tolerant, Low Mass, High Bandwidth Flexible Printed Circuit Cables for Particle Detection Applications NEIL MCFADDEN, University of New Mexico — Design options for meter long flexible printed circuit cables required for low mass ultra-high speed signal transmission in the high radiation environment at the High Luminosity run of the Large Hadron Collider (LHC) are described. Two dielectric materials were considered in this study, Kapton and a Kapton/Teflon mixture. The design geometry is a differential embedded microstrip with nominal 100 Ω impedance. Minimal mass and maximal radiation hardness are pre-eminent considerations. The long flexible printed circuit cables are characterized in bit error rate tests (BERT), attenuation versus frequency, mechanical response to stress and temperature change, and RLC decomposition. These tests are performed before and after irradiation with 1 MeV neutrons to $2\text{x}10^{16}/\text{cm}^2$ and 800 MeV protons to $2\text{x}10^{16}$ 1 MeV-neq/cm^2. A 1.0 m Kapton cable, with bandwidth of 6.22 gigabits per second, 0.03% of a radiation length, and no radiation induced mechanical or electrical degradation is obtained.

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Date submitted: 22 Dec 2015 Electronic form version 1.4