FPGA Development for the LHCb Vertex Locator Upgrade

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November 27, 2015

Abstract

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1.1 The Standard Model of Particle Physics

$$L_{GWL} = \sum_f (\bar{\Psi}_f (i\gamma^\mu \partial\mu - m_f)\Psi_f - eQ_f \bar{\Psi}_f \gamma^\mu \Psi_f A_\mu) + \frac{g}{\sqrt{2}} \sum_i (\bar{a}_L^i \gamma^\mu b_L^i W_\mu^+ + \bar{b}_L^i \gamma^\mu a_L^i W_\mu^-) + \frac{g}{2x_w} \sum_f \bar{\Psi}_f \gamma^\mu (I_f^3 -$$

(1)

1.2 The LHCb Experiment

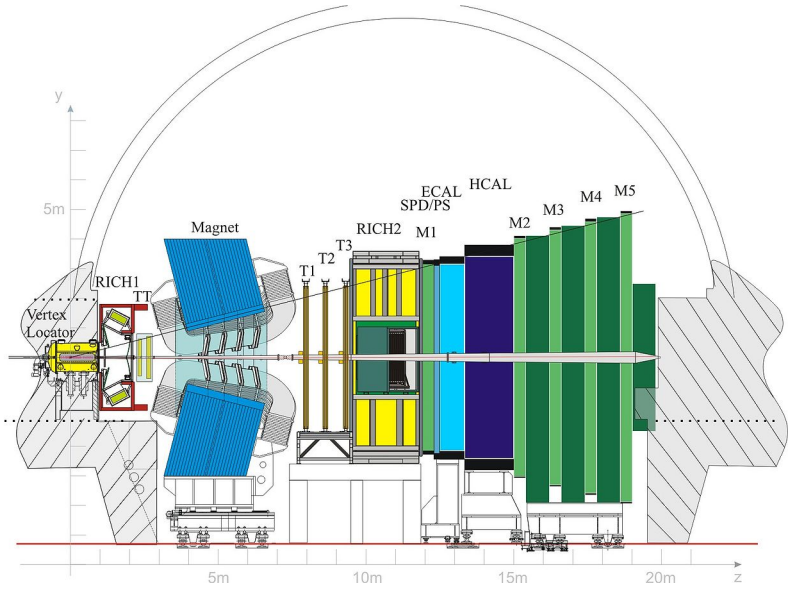

Figure 1: The LCHb Detector along the bending plane.

1.2.1 The Detector

1.2.2 Physics Studied at LHCb

$$\mathcal{L} = -\tfrac{1}{4}\mathbf{W}_{\mu\nu}\cdot\mathbf{W}^{\mu\nu} - \tfrac{1}{4}B_{\mu\nu}B^{\mu\nu}$$ — $\mathrm{W}^{\pm}, \mathrm{Z}, \gamma$ kinetic energies and self-interactions

$$+\bar{L}\gamma^{\mu}\left(i\partial_{\mu} - g\tfrac{1}{2}\tau\cdot\mathbf{W}_{\mu} - g'\tfrac{Y}{2}B_{\mu}\right)L$$
$$+\bar{R}\gamma^{\mu}\left(i\partial_{\mu} - g'\tfrac{Y}{2}B_{\mu}\right)R$$ — lepton and quark kinetic energies and their interactions with $\mathrm{W}^{\pm}, \mathrm{Z}, \gamma$

$$+\left|\left(i\partial_{\mu} - g\tfrac{1}{2}\tau\cdot\mathbf{W}_{\mu} - g'\tfrac{Y}{2}B_{\mu}\right)\phi\right|^2 - V(\phi)$$ — $\mathrm{W}^{\pm}, \mathrm{Z}, \gamma,$ and Higgs masses and couplings

$$-(G_1\bar{L}\phi R + G_2\bar{L}\phi_c R + \text{hermitian conjugate}).$$ — lepton and quark masses and coupling to Higgs

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Event Isosation

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Motivation

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Time Sorting

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Bubble Bubble Bubble

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Isolation Checking

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In Conclusion, Nick is Awesome

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This is future dev

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2020 upgrade

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fpga in velo

5 Conclusion

This is the Conclusion

6 Acknoledgments

I would like the Acknoledge Pablo Rodriguez and Marco Gersabeck for there continued support and supervision.