

# DPF-PHENO 2024

Contribution ID: 451

Type: **not specified**

## Toward a Measurement of the Z Boson Decaying to Four B-Quarks with the CMS Detector

*Wednesday 15 May 2024 16:30 (15 minutes)*

We propose an analysis to measure the branching fraction of the Z boson decaying to  $b\bar{b}b\bar{b}$  at the CMS detector. This quantity was previously measured by the LEP experiments to an uncertainty of about 36% but has not yet been measured at the LHC; such a measurement would be a high-precision test of QCD involving  $b$ -quarks. The rarity of this decay, about  $4 \times 10^{-4}$ , and the multiplicity of decay products make this measurement difficult. We show that the best prospect for this analysis selects events with a boosted Z boson which produces two jets, one of which contains multiple tagged  $b$ -quarks. Requiring this multi- $b$ -tagged jet strongly decreases the background events due to QCD interactions, though such events are still the largest background. We propose several ways in which these backgrounds can be further reduced, outline a proposed analysis strategy, and present expected sensitivities for pp collisions at  $\sqrt{s} = 13$  TeV using an integrated luminosity of  $138 \text{ fb}^{-1}$ .

### Mini Symposia (Invited Talks Only)

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**Session Classification:** Electroweak & Higgs Physics

**Track Classification:** Electroweak & Higgs Physics