Physics at the high luminosity LHC using the upgraded CMS detector
Higgs boson measurements and search for a vector-like top quark partner

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HIGH LUMINOSITY LHC PHYSICS GOALS

- Precision measurement of Higgs boson properties (-100 M Higgs boson produced)
- Extend the LHC discovery reach
- Precision measurement of Standard Model

PHYSICS OBJECT PERFORMANCE

Identification of jets forms an important component of most physics analyses:
- b-tagging of jets originating from b quarks.
- Jet substructure to identify highly Lorentz-boosted W, Z, and Higgs bosons and top quarks W→qaq', H→bb-, t→qqt.b.

- Pileup is removed using PUPPI (Pile Up Per Particle Identification) (arXiv:1407.6013).
- The soft drop algorithm is used for the W jet mass and anti-k_t algorithm, with distance parameter 0.8, is used for the jet reclustering.

PHYSICS HIGHLIGHTS

H→γγ
- Precise timing measurement of high energy photons with HGCal (High Granularity Calorimeter in endcap with increased longitudinal and transverse segmentation).

Di-Higgs production
- SM HH (non resonant):
  - Four projections:
    - HH → γγbb
    - HH → ττbb
    - HH → VVbb
    - HH → 4b
  - Stransverse mass (M_T) distribution of $t_t$ events having two jets tagged as b-jets.

Vector-like quark T→tH
- Vector-like top quarks offer a solution to the low mass of the Higgs boson (Hierarchy problem).
- Single production dominates at high mass. The presence of a forward (high n) jet distinctive signature. Upgraded CMS calorimeter and tracker to improve forward jet identification at high pileup.