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Chapter 1

The CMS experiment at LHC

1.1 The Large Hadron Collider

The Large Hadron Collider, or LHC, is a machine thataccelerates and collides protons and heavy ions. This machine is the biggest particle collider nowdays with a circunference of 27 km. It also achieves the greatest energy by collider up to present, planned to be 14 TeV at the center of mass of the collision. It's located in French-Swiss border near to Geneva. The tunnel for the machine was carved around 100 m under the ground, 45 m under the Jura mountains and 170 m under the Léman lake with an inclination of around 1.4%, sloping downtowards the lake .

$$f'(x) = 1 - 2x$$

$$\beta(x) \leq \cos(x)$$

$$\sqrt{\frac{1}{2}} = \frac{\sqrt{(2)}}{2}$$

$$\forall x \in \mathbb{R}, f'(x) = f(x) \tag{1.1}$$

$$\lim_{x \to 0} \frac{\sin(x)}{x} = 1 \tag{1.2}$$

$$\int_0^\infty \frac{\ln(x)}{f(x)} = \pi^2 \tag{1.3}$$

$$\left\| 2^{\Gamma(x)} \right\|^2 = \underbrace{f(a) + f(b)}_{\leq 1} + \dot{y}$$

Chapter 2

The Standard Model

Chapter 3

Vector Like Quarks: Generic model

Chapter 4

Understanding theory predictions via Monte-Carlo event generation

Chapter 5

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