The Belle II Experiment

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on behalf of Belle II members
Introduction

Extremely successful Standard Model of particle physics
- no inconsistency in measurement (Belle/BaBar/LHCb...)
- no new particles discovered (ATLAS/CMS...)

The SM cannot create our Universe
- new phenomena (BSM or New Physics) should exist

Belle II is trying to find BSM through quantum effect appear in $B/\tau$ decay
SuperKEKB Accelerator

- 3km circumference, “Highest Luminosity” particle collider in the World
- \( \times 40 \) higher peak luminosity to the predecessor (KEKB)
  - 1/20, smaller beamsize, nano-beam scheme \( (\beta^* = 0.3 \text{ mm}, \sigma^* \sim 50-60 \text{ nm}) \)
  - \( \times 2 \) more beam current (3.6+2.5 A)
- \( 3.1 \times 10^{34} / \text{cm}^2 \text{s} \) achieved, keep improving
The Belle II Collaboration

- 659 members, 121 institutes, 26 countries/region (6.2010)
- In past,
  - Belle (2010) 379 members, 56 institutions, 14 countries
  - Belle II (2011) 405 members, 65 institutions, 19 countries
- Collaboration getting bigger

At 4th B2GM (2009)
The Belle II Detector

- 8m × 8m × 8m, 1500t
- Replaced all sub-detectors inside Calorimeter + Scintillator based KLM detector
- 1st layer of tracking detector as close as 14mm to collision point (was 20 mm @ Belle)
- Low material to avoid scattering for better particle tracking resolution
- Highly challenging imaging Čerenkov Particle ID detectors
  - Time-of-Propagation + Imaging Čerenkov in Barrel
  - Proximity focusing Aerogel RICH in Forward endcap
- Pipelined, deadtime free Trigger and Readout, Distributed computing
The Belle II Detector at Construction

- Detector Rotation (Feb. 2013)
- Forward KLM (Apr. 2014)
- Top (Feb. 2015)
- CDC (Oct. 2016)
- CDC (Oct. 2016)
- Roll-in (Apr. 2017)
- VXD (Nov. 2018)
- Forward Endcap (Dec. 2018)
- QCS insertion (Jan. 2019)
- Complete (Mar. 2019)
Start of Belle II Data taking

- Commissioning run started on March 2018 (Apr 26 1st Event)
- Physics Data taking started on March 2019
- Collected 213 /fb by Summer 2021
Belle II Detector is working well

“Re-discovery” of known Physics as detector performance benchmark

Belle II start producing Physics Results

5 papers, even with ~200 /fb (800/fb @ Belle)

improved detector, dedicated trigger, new analysis method
Future of the Belle II Experiment

- Belle II is collecting more data delivered by SuperKEKB collider
- Peak Luminosity is getting higher with higher beam current and smaller beam size
終わり