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Chapter 1

Introduction

The long awaited upgrade of Belle [2], which is referred to as sBelle \(^1\) in this note, has become increasingly realistic and is very likely to happen in the near future. We have proposed a set of detectors in the Letter of Intent (LoI) [3] in 2003, which should work in the harsh beam background environment of the upgraded KEKB collider. Since the LoI, we have continued the R&D studies mainly in hardware in order to realize such a detector. As the design becomes more realistic and more concrete, we found several open questions concerning the parameters of the detector design.

Indeed, there will be several possible parameters such as geometry, structure materials, fundamental performance of sensors; and there is room to improve the overall performance by finding the best set of parameters. When the best set is not feasible either technologically or financially, we may need to compromise to some extent. In such a case, we must understand what will result. Finally, we require that the minimal performance of the new detector be at least as good as that of Belle, which is not very conservative because of the extremely harsh beam background.

In May 2007, a task force was formed to lead such discussions in a scientific way, and make proposals for the detector parameters from the viewpoint of physics analysis. The task force was asked to prepare a report of its studies in one year, which is the present report. Since we do not have an integrated simulation software tool for sBelle (one is under development based on Geant 4 and will require some more time to be ready), we began by preparing the simulation environments. One powerful tool is the Belle Geant 3 based full simulator (gsim) in which the parameters such as sensor configurations, material densities, and background immunities are modified to represent the sBelle detector. Another tool is a fast simulator called fsim6, which gives detector responses based on a priori probability density functions; where the PDFs are retuned for sBelle. In addition, there are standalone Geant 4 simulators for certain sub-detectors, and a simple track simulator named trackerr. Using those tools we simulated events of various complexity, from simple single tracks to full \(B\bar{B}\) and \(\tau^+\tau^-\) events in which the real background data obtained from Belle can be overlaid to simulate the level of expected conditions at sBelle.

Benchmark physics modes in this report are selected mainly because of their importance in the sBelle era and sensitivity to the detector parameters to be examined, but also because analysis code and the person in charge were available. In spite of very limited manpower, we

\(^1\)The name of the new collaboration/detector has not been determined as we write this document. 'sBelle' is not an authorized name, but will be used for simplicity in this report.
included the following important modes in this report: and $B \to \rho \gamma$. Studies of other decay modes that are underway will be compiled in a special report.

Update from 2009: The name of the collaboration is now known, it’s Belle II. The logo can be seen in Fig.1.1.

END OF EXAMPLE TEXT

1.1 Physics Motivation

1.1.1 General Motivation

(4 pages)

1.1.2 Example measurements

(examples with emphasize on improved sensitivities expected from the upgrade; 6 - 10 pages)

1.1.3 Expected sensitivities on various observables

(2 pages)
1.2 The proposed upgrade overview

References


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SuperKEKB
Chapter 3

IR design

3.1 Accelerator parameters
3.1.1 Layout of the IR magnet
3.1.2 IR assembly

3.2 Beam Background
3.2.1 Beam Background
3.2.2 Possible BG sources
3.2.3 Evaluation of the BG
   Simulation study (Strategy)
   Extrapolation from the Belle experience

3.3 IP-chamber design

(Strategy to design the IP chamber, and current design)
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Pixel Detector (PXD)

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4.9 Mechanical Support and Cooling
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5.1.3 Approach

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5.3 Sensors

5.3.1 Barrel

5.3.2 Forward

5.3.3 Radiation

5.3.4 Quality Assurance

5.4 Mechanics

5.4.1 Overview (maybe just inline text, not section)

5.4.2 Ladder Design

Origami Chip-on-Sensor Concept

Implementation

Materials and Properties

5.4.3 End Rings

5.4.4 Cooling

5.4.5 Assembly

Procedure

Testing

5.4.6 Installation

5.5 Electronics

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Particle Identification - Barrel

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7.4 Options
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Chapter 8

Particle Identification: End-cap

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  8.2.1 Aerogel Radiator
  8.2.2 Photon Detector
  8.2.3 Read-Out System
8.3 (Mechanical Design?)
8.4 R&D Results
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9.3 Endcap
9.4 Electronics
9.5 Expected Performance
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10.2 Barrel KLM

10.2.1 Resistive Plate Chambers
10.2.2 Background study
10.2.3 Capability to operate at SuperKEKB luminosity

10.3 Endcap KLM

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10.3.2 Scintillator strips
Geometrical specification
Material specification
Wavelength shifting fibers
Light yield tests
10.3.3 Photodetectors
10.3.4 Front end electronics and slow control
10.3.5 Test at KEKB tunnel
Radiation hardness
Measurement of the beam background
10.3.6 Production
Manufacturing of strips
Assembly of strips
Assembly of layer
Quality control
Mechanical supports
10.3.7 Mounting at KEK
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Iron structure and Solenoidal magnet

11.1 Iron structure

11.1.1 Review of the current system

11.1.2 Possible modifications for Belle-II

*Location with respect to the beam line
  *Pole piece modification
  *Reinforcement of radiation shield

11.1.3 Basic concept of the support for the inner detectors

11.2 Solenoidal Magnet

11.2.1 Review of the current system

11.2.2 Possible modification for Belle-II

*Power supply upgrade
  *Cryogenic system renovation
  *Control and monitors
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Data Acquisition System and Trigger

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12.2 Design overview
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  12.2.3 global design
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12.6 COPPER
12.7 Event Builder
  12.7.1 Readout PC
  12.7.2 Event builder
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12.10 Slow control
12.11 Data quality monitor
12.12 PXD integration
Chapter 13

Software, Computing

13.1 Introduction (Overview)
T.Kuhr+T.Hara

13.2 Computing Model
T.Kuhr

13.3 Distributed Computing and Data Handling
: M.Sevior [1]

13.4 Offline Software
A.Moll+K. Prothmann

13.5 Schedule
T.Hara+T.Kuhr

References

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Organization

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Conclusion