Table des matières

Introduction **1**

1 From the discovery of the electron to the high-energy physics **3**
1.1 The Standard Model . . . 3
1.1.1 Introduction . . . 3
1.1.2 Interactions in the Standard Model . . . 4
1.2 The Higgs physics . . . 4
1.2.1 Symmetry Breaking . . . 4
1.2.2 Higgs mechanism . . . 4
1.3 Basic physics analysis at the ILC . . . 4

2 The future of high-energy physics : the ILC **5**
2.1 The ILC machine . . . 5
2.2 The SiD . . . 5
2.3 The ILD . . . 5

3 Double-sided VXD : PLUME **7**
3.1 The ILD vertex detector specifications . . . 7
3.2 Integration of CMOS sensors . . . 7
3.3 A versatile mechanical structure . . . 7

4 Electrical Validation and laboratory testing **9**

5 Test beam analysis **11**
5.1 Experimental set-up . . . 11
5.2 Deformation studies . . . 11
5.3 Benefits of double-point measurements . . . 11

Conclusions **15**

Introduction

Chapitre 1

From the discovery of the electron to the high-energy physics

1.1 The Standard Model

1.1.1 Introduction

The Standard Model (SM) is a theory that describes the fundamental structure of matter. In this theory, the matter is made up of fermions (spin 1/2) which interact via bosons. Bosons are gauge field, they propagate the interaction and generate particles mass. They are two types of fermions : the leptons and the quarks. The leptons are made of six particles plus the six anti-particles associated. A quantum number describes those particles : L Leptons interact only via weak interaction.

The quarks are six plus six anti-quark. They are the components of neutron and protons. Lonely quarks were never observed in the nature. The quarks have a charge color : green, red, blue. The quarks are confined into "white color" objects call hadrons. The hadrons are subdivided into three categories : the mesons, the baryons and the anti-baryons. The mesons are made of a quark and a anti-quark are always of integer spin. The baryons (or anti-baryons) are made of three quarks, like the proton or neutron. A quantum number is associated to the quarks : the baryon number B which is conserved for every interaction and has the same properties as the L number.

Family	Particle	L	B	Q_e	Mass
1st	e	1	0	-1	511 keV
	ν_e	1	0	0	$<$ 2 ev
2nd	μ	1	0	-1	105.66 MeV
	ν_μ	1	0	0	$<$ 2 eV
3rd	τ	1	0	-1	1.78 GeV
	ν_τ	1	0	0	$<$ 2 eV

The Standard Model describes very well three forces out of four : the electromagnetic (E.M.) interaction, the weak interaction and the strong. The theory that explain the E.M. interaction is the Quantum Electrodynamics (QED). The vector of the interaction is the photon γ. The weak interaction is the only one that takes part on all particles. It intermediates via Z and $W^{\pm}$ bosons. The Quantum Chromodynamics (QCD) describes the strong interaction. The mediators of this interaction are the gluons to the number of eight. They can interact each other as well.

1.1.2 Interactions in the Standard Model

1.2 The Higgs physics

1.2.1 Symmetry Breaking

1.2.2 Higgs mechanism

1.3 Basic physics analysis at the ILC

Chapitre 2

The future of high-energy physics : the ILC

2.1 The ILC machine

2.2 The SiD

2.3 The ILD

Chapitre 3

Double-sided VXD : PLUME

3.1 The ILD vertex detector specifications

3.2 Integration of CMOS sensors

3.3 A versatile mechanical structure

Chapitre 4

Electrical Validation and laboratory testing

Chapitre 5

Test beam analysis

5.1 Experimental set-up

5.2 Deformation studies

5.3 Benefits of double-point measurements

Conclusions

Conclusions