CMS SLHC Tracker Upgrade Workshop

Description: The agenda is being prepared, please check back later. Please contact Geoff Hall, Daniela Bortoletto, or Simon Kwan for more details.

Tuesday 27 November 2007

09:00 US-CMS SLHC R&D Program (20')
09:25 Possible Luminosity Upgrades to LHC and Their Integration with CMS (30')
10:00 Physics opportunities at the SLHC (25')
10:30 Coffee break
10:45 Planning a Tracker Upgrade (30')
11:20 Strawman CMS Tracker for the SLHC (25')
11:50 Current and future technologies for detector hybridization (25')
12:20 Lunch break

14:00->15:20 RD for SLHC: Other subdetector systems
14:00 HCAL (25')
14:30 Rad-Hard high density data links (20')
14:55 Muon (20')
15:20 Coffeebreak

15:40->17:40 Chip Development
15:40 Readout chip for the Strip Tracker (25')
16:10 DC-DC conversion (20')
16:35 Chip development for Serial Powering of future HEP experiments (20')
17:00 GBT: A readout, control and timing distribution architecture using high speed optical links (25')

Wednesday 28 November 2007

08:30->10:30 Reports from Tracker Working groups
08:30 Summary of the Readout WG (25')
09:00 Status Report of the Material Budget Working Group (25')
09:30 Summary of the Sensor Working Group (25')

http://indico.cern.ch/conferenceDisplay.py?confId=22827
10:00 Summary of the Simulation Working Group (25')
10:30 Coffeebreak
10:45 R&D on Trigger Upgrade (25')

11:15->12:15 CMS SLHC RD Proposals
11:15 CE Towards R&D on SCMS "Intermediate to large radii" (15')
11:35 An RD 50/CMS Silicon beam telescope for SLHC detector studies (15')
11:55 Possible replacement of Inner pixel layer (15')
12:30 lunch break

14:00->16:00 RD Plans
14:00 INFN toward an R&D Program for the SLHC (30')
14:35 New Technologies for Tracking Detector and Electronics (40')
15:15 General Discussion (45')
11/27/07
(Tue)
11/27/07 (Tue)

Daniela

Detectors to be installed in 2016

→

1st production in 2012

Design — flexible baseline

Eo I → March 2007

Tracker (more channels ⇒ more power) & Trigger

Lo I in 2008 and TDR in 2011-2012

5 yrs for R&D

8-10 yrs for full upgrade project

Simulation Group in Tracking Group

after LHC's startup
Peter Limon ... L upgrade
1st phase work at CERN will start soon using NbTi large appature dipole

Patrick Fox ... physics @ SLHC

Geoff Hall
- Tracker
  - Sensor
  - Simulation
  - Readout
  - Trigger
  - Power

Discuss in CMS week in December
  i) innermost 4 pixel layers
  ii) Outer layers as doublets
  iii) Endcap design (not yet)

Proposal deadline was end of December October '07
Still accept new proposals
Feedbacks @ CMS week (Dec '07)
Need to form Trigger WG and Power WG soon
Marcello \textit{Strawman Tracker}

LHC \quad L1 \rightarrow HLT (tracking)

SLHC \quad L1 \rightarrow HLT (tracking)

\[ \bar{\Sigma}_{L1} \quad \text{Occupancy} \]

\[ \bar{\Sigma}_{L1} \times \sim 10 \quad \text{Occupancy} \times \sim 10^{-2} \]

Require: Local \( P_T \geq \) Discriminator

\( P_T \geq 1 \text{ GeV?} \)

Zero Suppression

Local Reduction

\( \downarrow \)

20n40MHz

L1 trigger

\( \downarrow \)

Full readout

2 Hit-pairs per Super-layer

Match 2 pairs

by John Jones (\sim 2005)
5) Cont'd

a) Silicon Strip

\[ 80\,\mu m \sim 200\,\mu m \]

10 cm

\sim 20 cm

LHC

\Rightarrow

\Rightarrow

1 cm \sim 2 cm

SLHC (Short strip)

\downarrow

to reduce the occupancy by \( x \sim 10 \sim 20 \).

b) Pixel

LHC

\Rightarrow

SLHC (Long pixel)

2 kW/m²

125 W/m²

Each super-layer can find high-<sup>PT</sup> track segments

\{ 3 \text{ super layers} \}

radius (center \& super-layer)
[5-J (cont'd)]

i) Track quality
ii) Hit pair $P_T$ resolution ← mis-alignment effect
iii) Track stub $P_T$ resolution
iv) Fake rate & $E_{\text{tracking}}$

[6] Alan Huffman
Track "Simulation" Group

12/27/07 (Tue)

1) Run "Fast" simulation
2) Modify "Configuration" file (See Fig. 1)
3) Check "digi" on "Fast" simulation
   \[\text{\rightarrow understand how "digi" is carried out.}\]
4)...
   a) track quality
   b) hit pair $P_T$ resolution
   c) track stub $P_T$ resolution
   d) fake rate & $\varepsilon_{\text{track}}$

Harry: 2.5 wks @ CERN from Dec. 4th

NEXT meeting
1/30/07 (Fri)
12/3/07 (Mon)

Available Configuration (Barrel only)
Fig. 1

Configuration in Marcello's talk.
Fig. 2
11/28/07
(Wed)

Slow Control Arch.

TOTEM trigger Hardware

\[ L \rightarrow \text{Roman Pots (Silicon)} \]

\[ \bigcup \{ \text{T1, T2} \} \text{Silicon strips & wires} \]

\[ \text{GEM detector} \]

\[ \text{T1} \]

\[ \text{wire} \]

\[ \text{strip} \]


FE electronics

BE --> FEC, ... system

4/2/07 WG formed
9/12/07 1st meeting

Pixel detector
Outer tracker
Novel power scheme

- 3 WG meetings, so far
- Tracker digis ~ equiv. to FE electronics (output from Ken [Rossato] (Maryland) → Mike Weinberger (TAMU)
- Making muon digis
- Developing benchmarks
  \[
  \begin{cases}
  K^0 \\
  b \text{ tagging} \\
  \vdots \\
  \vdots \\
  \text{Combinatory issue}
  \end{cases}
  \]
- High-L MC samples with the present CMS detector

  Full simulation


RD 50 .... Radiation Hard Sensor
Tracker
Calorimeter
Muon
Architecture

LHC

\[ \text{\textasciitilde} 140 \text{ events/crossing} \quad \text{with L-leveling} \]

L1 Trig. & DAQ \rightarrow \quad 25 \text{ ns input}

3.2 \mu s latency

100 kHz = max. L1 rate

Tracking Tracker

for "e" \quad x10 reduction by track

for "\mu" \quad isolation from pixel

Cluster position in \text{\textasciitilde} 0.05 \@ trigger

\text{\textasciitilde} \frac{1}{2} \text{ of trig. tower}
LHC: TPG → RCT → GCT → GT

SLHC: TPG → Clustering → Correlator → Selector

Hardware: {High speed serial input}
{High performance FPGA} for processing