



Readout System Enhancements for ATLAS ITk Project

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Agenda

**Introduction
HL-LHC & ITk**

**Our Progress
Acknowledgements**

Introduction

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Our Progress

Acknowledgements



ATLAS & the Inner Detector



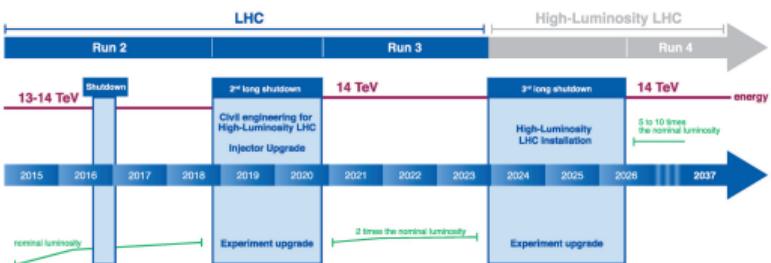
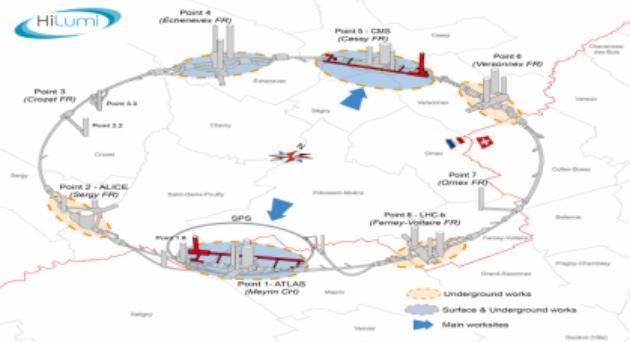
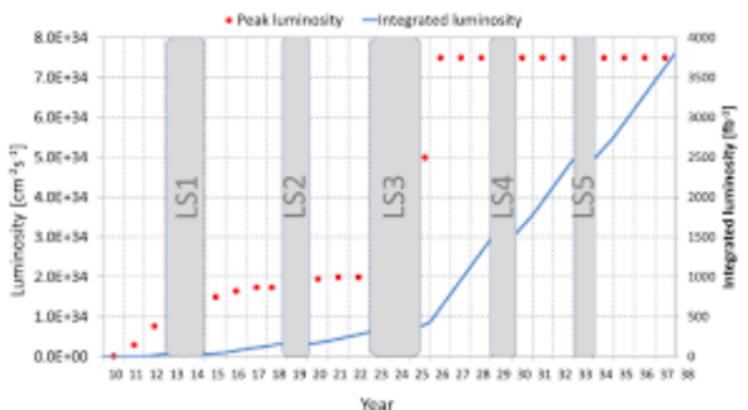
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Our Progress Acknowledgements

High Luminosity LHC & ITk Upgrades

x10 increase in instantaneous luminosity!

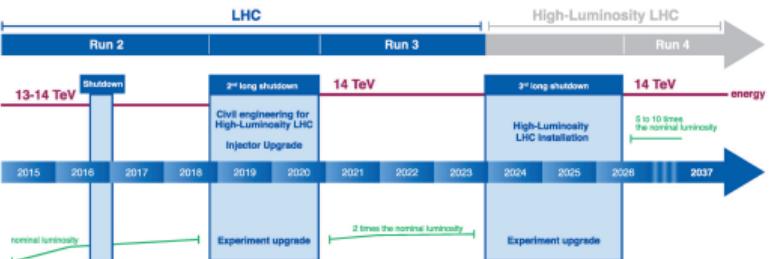
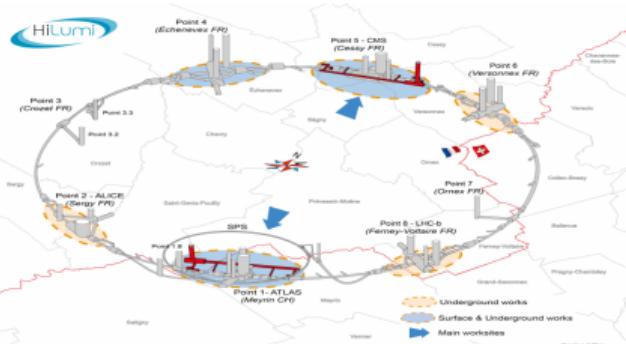
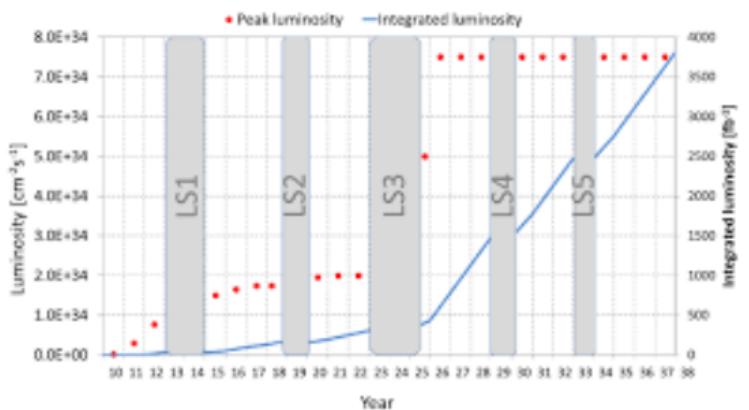
$$\blacktriangleright L = 1\text{e}73 \text{ fb}^{-1} \text{ s}^{-1} \rightarrow L = 1\text{e}74 \text{ fb}^{-1} \text{ s}^{-1}$$



High Luminosity LHC & ITk Upgrades

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- $L = 1\text{e}73 \text{ fb}^{-1} \text{ s}^{-1} \rightarrow L = 1\text{e}74 \text{ fb}^{-1} \text{ s}^{-1}$
- More particles, more problems



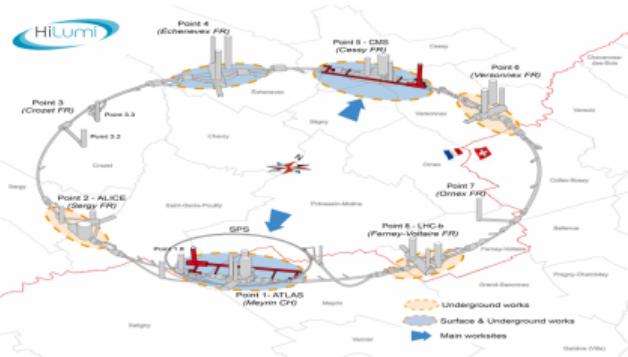
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The inner detector has insufficient:

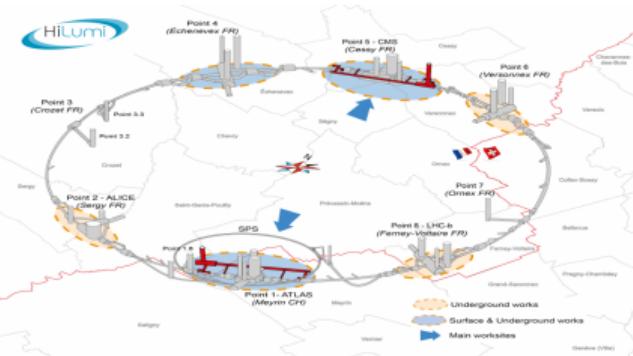
- radiation hardness
- granularity
- readout bandwidth
- trigger readout speed/storage



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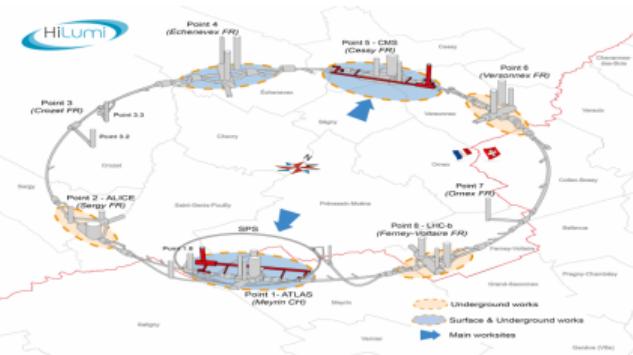
The inner detector has insufficient:

- ▶ radiation hardness: HL-LHC will deliver 4000 fb^{-1} fluence. ID PIX is designed for 400 fb^{-1} , ID SCT for 700 fb^{-1} , IBL for 800 fb^{-1}

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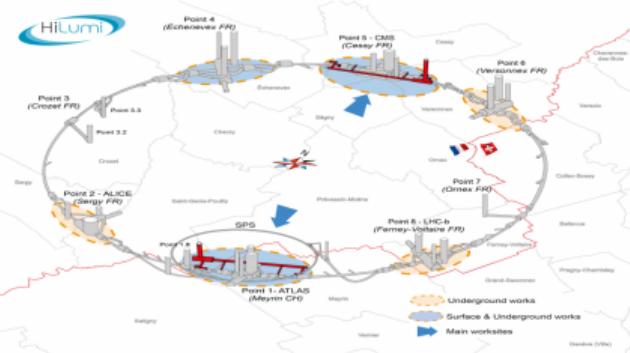
The inner detector has insufficient:

- granularity: Increasing fluence means higher granularity is needed to maintain performance; compensate for intrinsic dead time

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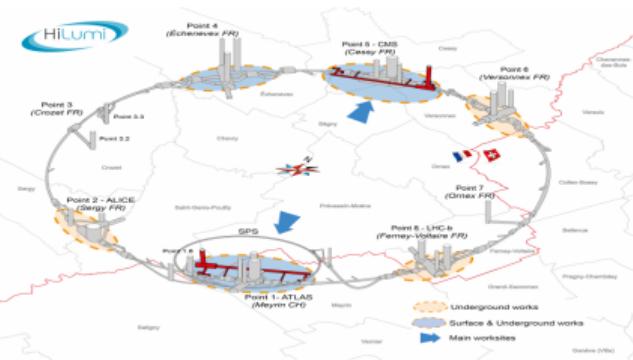
The inner detector has insufficient:

- ▶ readout bandwidth: HL-LHC will roughly quadruple ID designed bandwidth saturation

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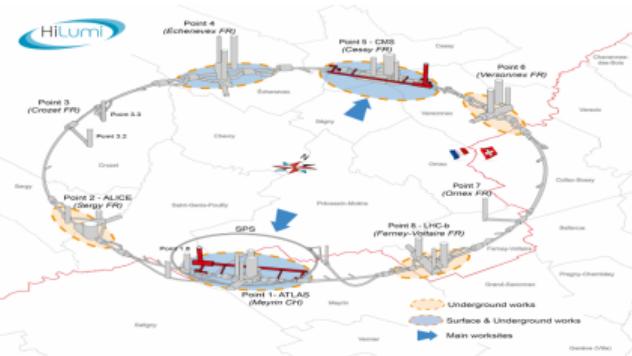
The inner detector has insufficient:

- ▶ trigger readout speed/storage: readout chain must accomodate much higher hardware (level 1) trigger rate

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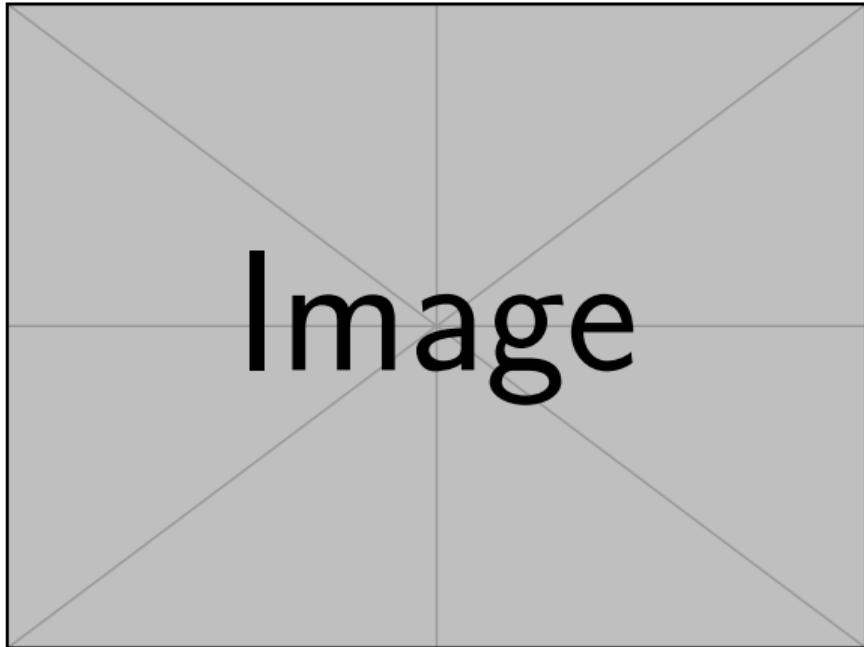
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Goal of ITk:

Same or better performance than ID in harsh environment of HL-LHC

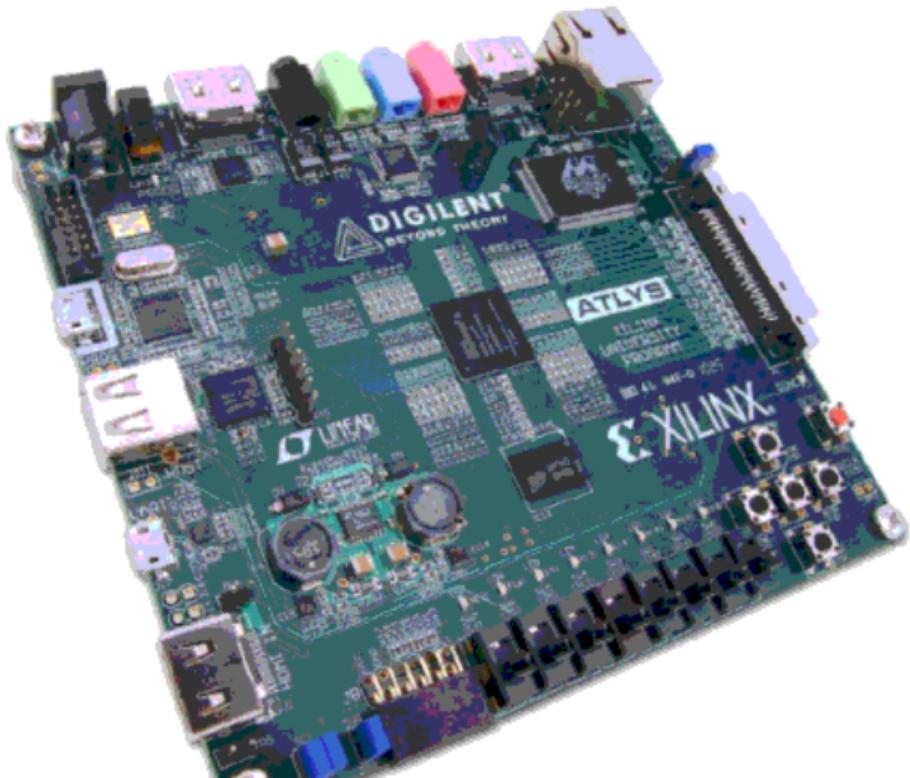
ITk design



Introduction
HL-LHC & ITk

Our Progress
Acknowledgements

ATLYS Board



Obstacles

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**Introduction
HL-LHC & ITk**

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Acknowledgements

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