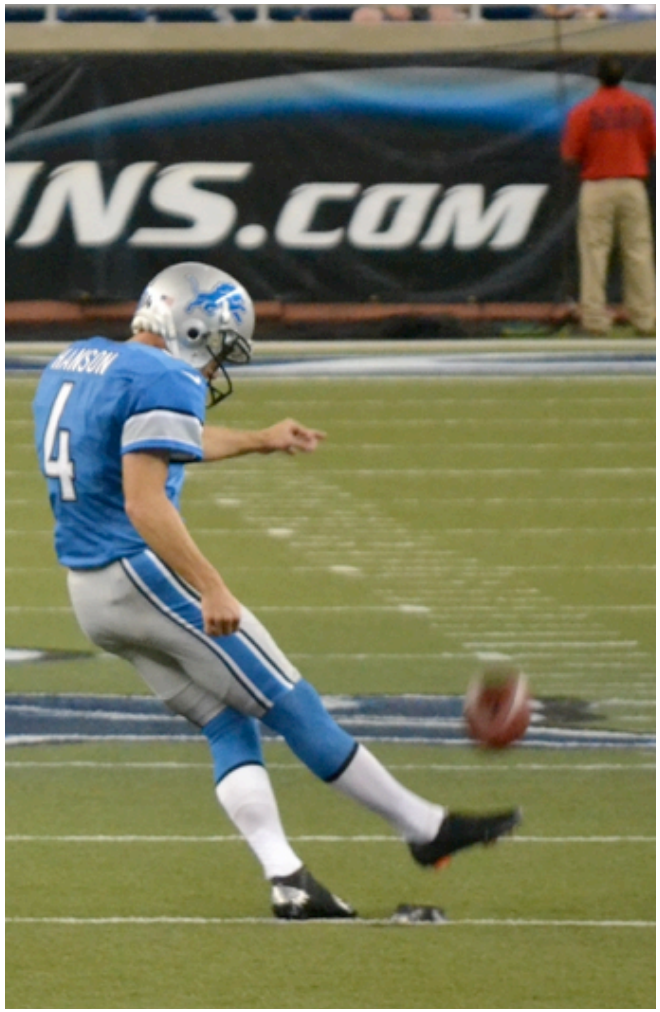
WP3 Low Mass System Design



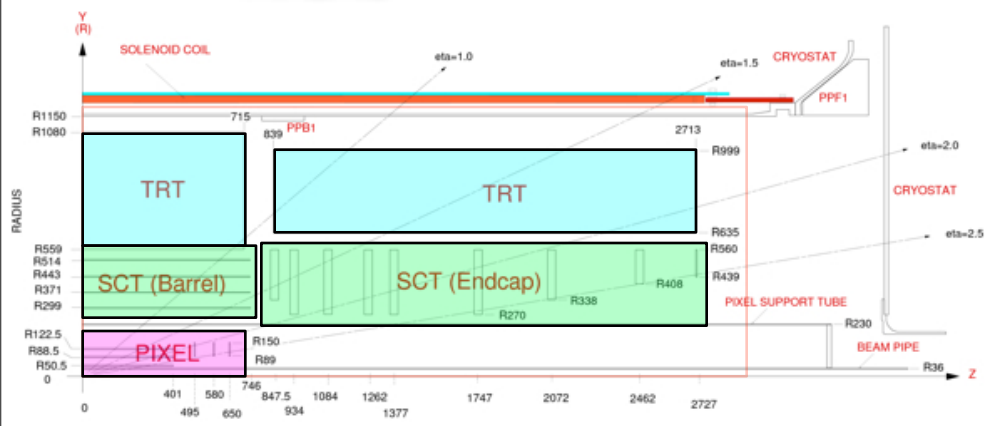
Ingrid-Maria Gregor, Andreas Mussgiller

Kick-Off Meeting ‚Enabling Technologies for Silicon Microstrip Tracking Detectors at the HL−LHC‘
01/03/2013

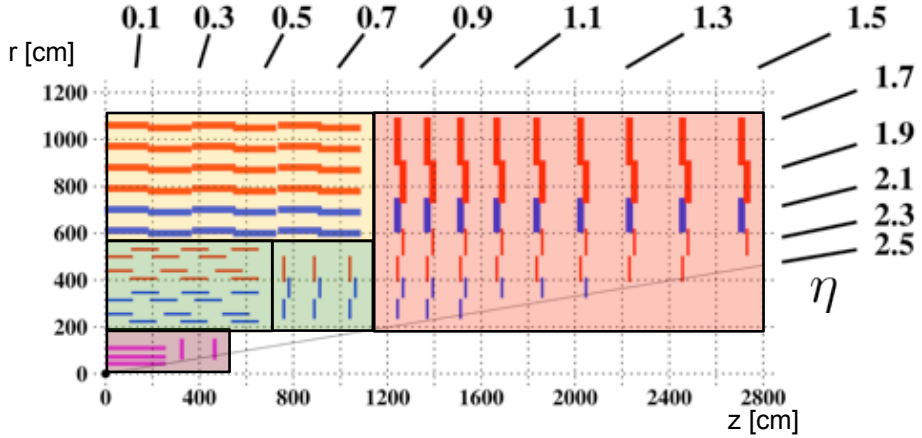
DESY

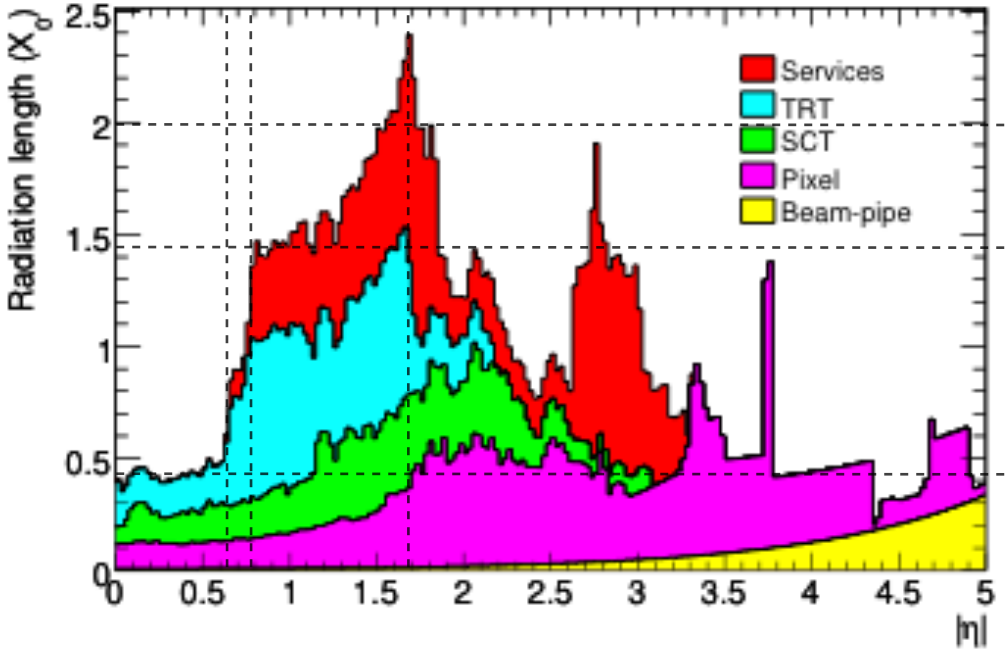
The Current Trackers

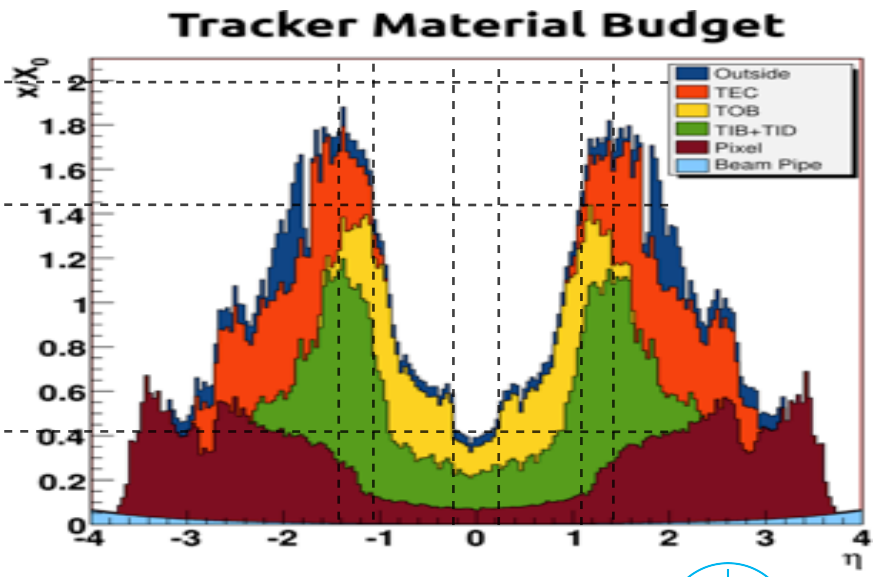
ATLAS



CMS

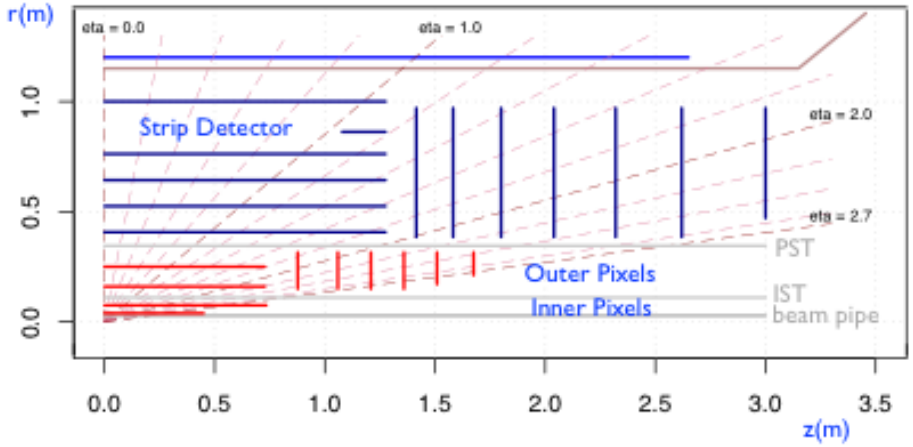


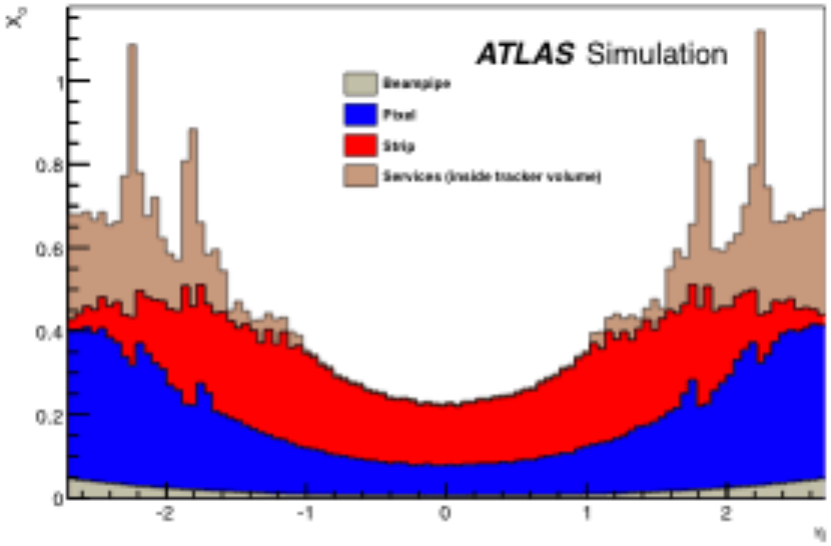




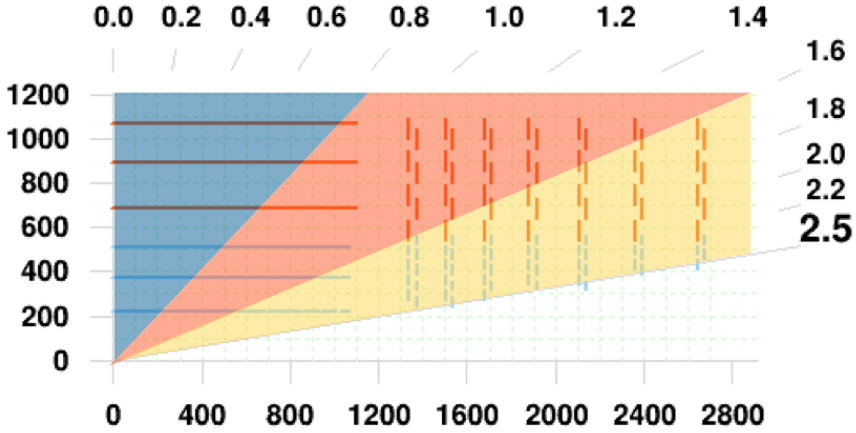
The possible future Trackers

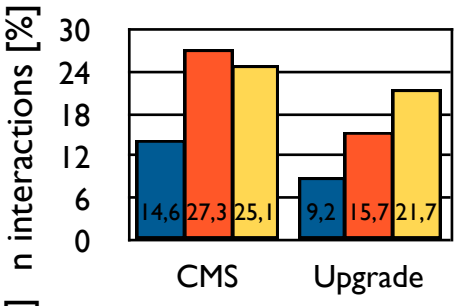
ATLAS LOI layout

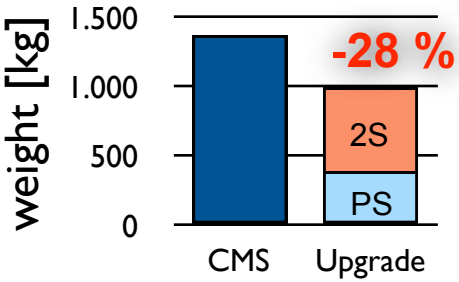


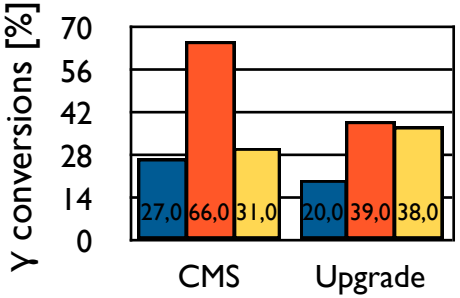


CMS layout under study









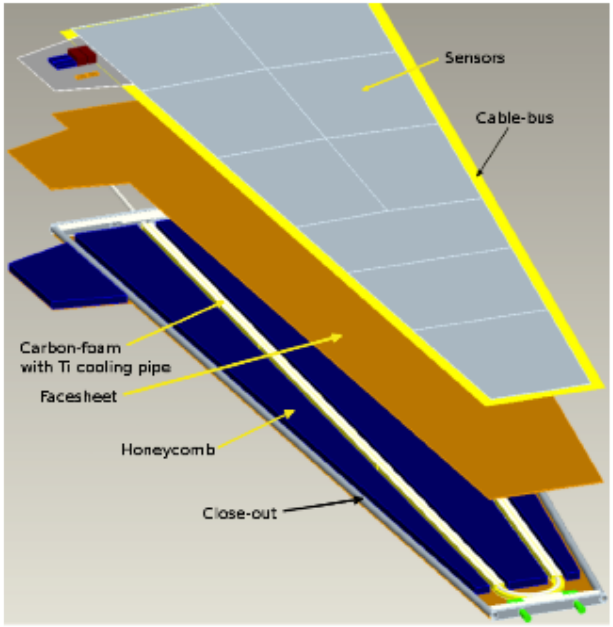
Low Mass System Design in an HL-LHC Environment

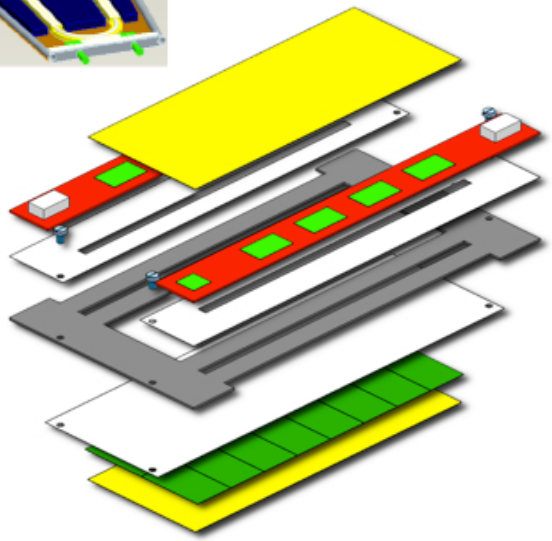
- future ATLAS and CMS follow different concepts
  - CMS: pt discrimination on module level ➟ tracker provides information for L1
  - ATLAS: L1 uses tracker information based on ROI provided by L0
- direct comparison is probably a bit unfair
- ATLAS and CMS need a ‚Low Mass System Design‘
  - we wouldn‘t be at this meeting if this wasn‘t the case
- ‚Low Mass System Design‘ goes beyond plain structural properties of materials
  - sensors operated at -20°C
    requires designs and materials that allow efficient cooling with a CTE matched to that of Si
    structural integrity must be maintained over 10+ years and several temperature cycles
  - 3000 fb^{-1} of integrated luminosity
    all materials - not just the sensor - need to be radiation hard ➟ WP5
  - CMS: pt discrimination on module level
    design must allow precision assembly (of >30000 modules) ➟ WP4
  - what about the end-users (not physics analyses, rather DPG)
    e.g. alignment ➟ what position precision is actually needed and at what cost (mass)
- we need a holistic view at things

DESY

Materials we know, we need or we might want to consider

- composite materials
  - CFRP (with high modulus fibres)
  - Carbon-Carbon
  - Carbon fibre reinforced Aluminium
- thermal management
  - pyrolytic graphite
    TPG, PGS, FGS
- fillers
  - foams
    Poco, Airex, CVD-Foam
  - honeycomb
    e.g. Carbon (Ultracore)
- glues
  - resin systems with low moisture uptake
  - alternatives to silicone based glues
  - nano-modified glues for improved thermal conductivity
    e.g. aligned carbon nano tubes
  - low temperature curing glue with low viscosity
- PCB substrates
  - something that matches the CTE of Silicon
- what else
  - ceramics
  - carbon screws





- ELITE
  Enab**LI**ng **TE**chnology
- ENMITy
  ENabling **MI**crostrip **T**racking
- TErMITe
  TEchnology **MI**crostrip **T**racking
- TOMCaT
  Techn**O**logy **MiC**rostrip **T**racking

Forum on Tracking Detector Mechanics 2013

Topics:
- Deflection, stability and precision of tracker structures
- Thermal expansion
- Vibration
- Fast discharge of magnet coils
- Materials
- Mass and radiation lengths
- Radiation and mechanics
- Cooling inside tracker volume and transfer pipework
- Environment (humidity and temperature)
- Tracker support systems
- Tracker to beam-pipe interfaces
- Service management
- Tracker alignment
- Failure management
- Transport
- Maintenance

University of Oxford
June 19th-21st, 2013

http://www.physics.ox.ac.uk/forum2013/
email: forum2013@physics.ox.ac.uk

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