ATLAS ITk Pixel detector

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Cluster&Seed plots IDTR-2016-011
Luminous region scenario IDTR-2016-012
Vertexing at high $\mu$: IDTR-2016-014
**ITk Pixel timeline: close future**

- In the last two years focus on finalizing the layout for the TDRs.
  - It is important also to have the community behind it.

2012 LoI

2015 Q4

Step 1.0

2016 Q2

Step 1.5

2016 Q4

Step 1.6

2017 Q1

Step 2.0

Step 3.0

3 layouts under study different in pixel barrel and eta coverage

**Strip TDR**

**Pixel TDR**

**Layout decision**

Layout for the TDR: 
- \( \eta \) coverage, optimize (reduce) endcap, fix innermost layer radius, supports and material description.
ITK Layouts under study

Strip layout and Pixel end-cap all the same. Changes only in the Pixel barrel.
The layouts have:

- Pixel volume up to 345 mm radius; then strip to the edge of the solenoid
- 4 Strip Barrel layers + 2x6 EC disks
- 5 Pixel Barrel and 4 (or 3) Rings layers, surface ~14 m²
- η coverage up to 4.0 (or 3.2) with at least 9 space points
- Pixel innermost detector replaceable.
Step 1.5: Material description
Step 1.5: Pixel Occupancies

Pixel occupancies for a minimum bias event with a pile up of 200
Channel occupancy higher in extended (as expected)

*Note the different scales on the two plots*
Step 1.5: Before we get to the results

- Intrinsic resolution
  - pessimistic scenario
digital clustering: done
(simplistic error assumption)

  - optimistic scenario
  In practice the results would not be realizable
idealistic clustering: done
idealistic cluster-merging: done
idealistic $\theta$ measurement: implemented/used, needs to be checked by experts
include $\phi$ measurement: implemented, but not used yet
(adapted errors)

- Material dependence
  - extended: ok for next step

  - inclined: amount ok, local positioning needs to be checked

The results presented here are indicative but not yet final. All of the tools are in
Step 1.5 : Preliminary results

- Impact parameter resolution
  - pessimistic scenario
digital clustering

- optimistic scenario
  - idealistic clustering
  - idealistic cluster-merging
  - idealistic $\theta$ measurement
    (adapted errors)
Step 1.5: Preliminary results

Comparison of performance results (extended vs inclined) for single 1GeV muons

See 3 very nice talks in ITk week (Plenary, Thursday am 11:30 – 13:15)
https://indico.cern.ch/event/562672/
Beyond the TF, towards the Pixel TDR (1)

✓ Step 1.6

• **Time:** weeks

• **Scope:** finalize the layout recommendation!
  - Extra material in the inclined modules
    → Anything else???? We must to be sure everybody agrees on the input conditions!
  - One layout optimized in the barrel region for 28.5 cm BP envelope
    → Extended@4.0@33 → similar overlaps as in the Extended@4.0

• **Layouts:**
  - Extended@4.0@33 → BP studies
  - FullyInclined for better material comparison
Layout Task Force. What Happens Next?  
3 Steps each with different “owners”

1. The ITk Layout Task Force will produce a set of recommendations in a written report [20-30 pages] by the end of November. This report will be circulated to the ITk through CDS who will then be invited to comment.

2. Those recommendations will be reviewed by a joint ITk/USC committee on 5\textsuperscript{th} and 19\textsuperscript{th} December. First meeting to review the document and its conclusions and a second meeting to clear up any outstanding issues that arise in the first meeting and cannot be resolved on the spot.

3. The findings of this committee will be presented to the USC/EB for approval.
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Beyond the TF, towards the Pixel TDR (2)

✓ **Step 2.0**

- **Time:** end of year

- **Scope:** recommended layout so far
  - Input on the min radius if in time
  - Optimization of the EC
  - Optimization of extended and inclined layouts at to eta 4 in material description and realism

- **Layouts:**
  - Two flavors: Extended, Inclined
Beyond the TF, towards the Pixel TDR (3)

✓ Step 3.0

• **Time**: early-mid Q2, in time for the pixel TDR

• **Scope**: support the pixel TDR
  • Keep updating the material description and progress in realism.
  • The layout recommendation may bring the engineers in a further optimization or new ideas of the pixel local supports.
  • Pixel size, sensor/electronics thicknesses may change towards the TDR
  • Also for the strip, the recommendation may bring new effort in the barrel/end-cap transition.

• **Layouts**:  
  • Hopefully ONE!