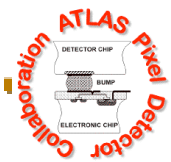


Valencia Workshop on ATLAS Tracker Upgrade

Genova, 20 December 2007

G. Darbo - INFN / Genova

Valencia Workshop

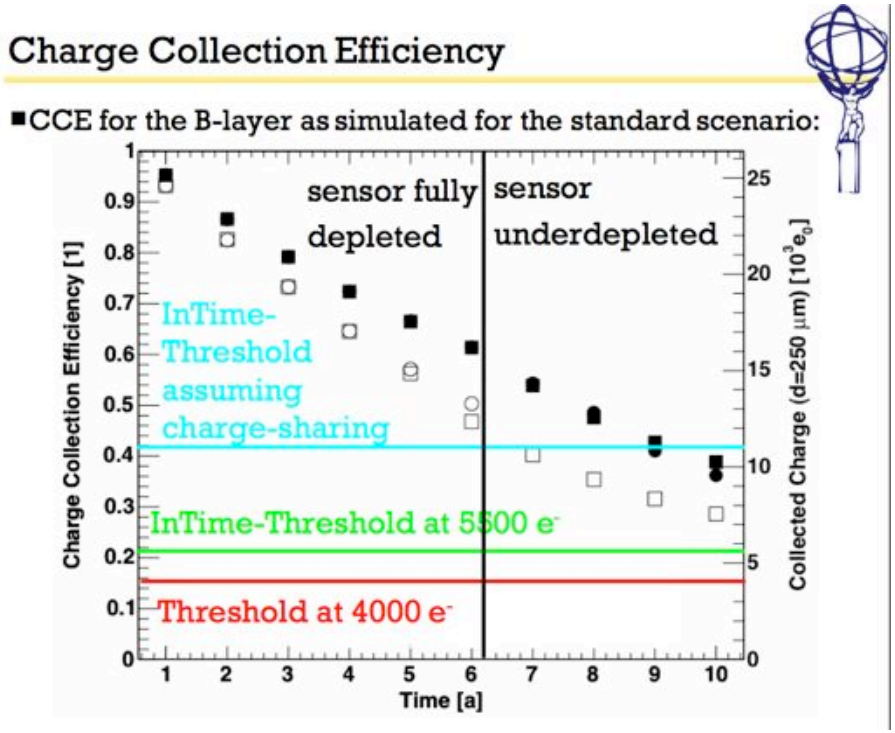
WS Highligts

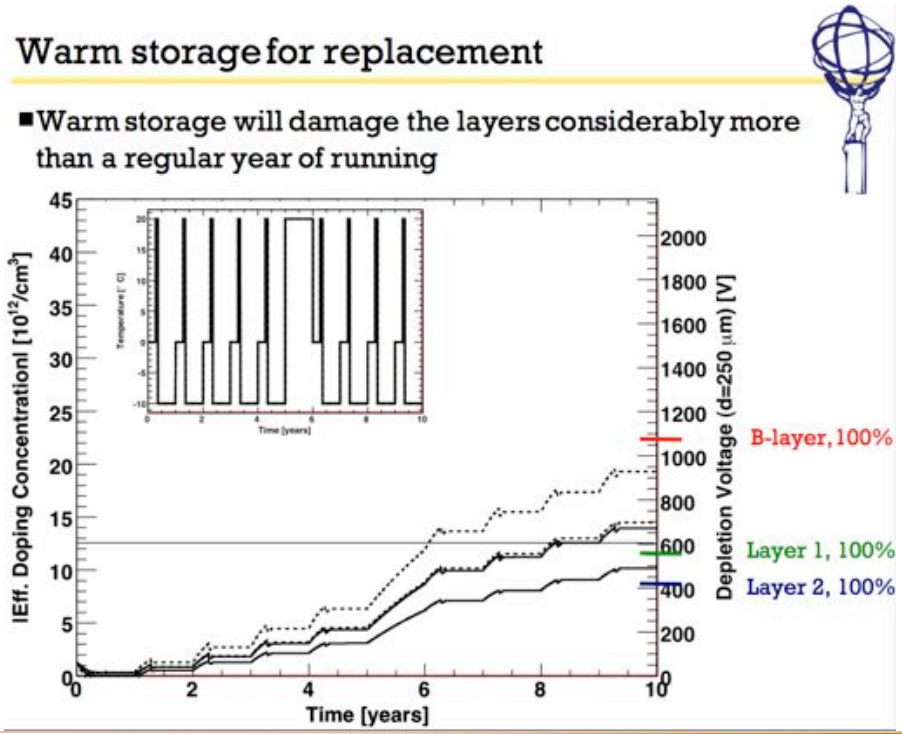
- *Not much news from Pixel side:*
  - We had the B-layer Workshop 2 months before;
  - Little activities from pixel's folk;
  - No clear direction for B-layer replacement.

- *Nevertheless:*
  - Some update on n-on-n sensors dose life
  - Some on additional simulation of Physics and b-tagging both at LHC (BL replacement) and at SLHC
  - Some update in the new chip design FE-I4.

Update since BL WS: Sensors

- *Some simulation made by D. Muenstermann.*
  - Sensors aqre degraded with higher temperature. Mainly the depletion voltage affected. Charge collection is less sensitive to temperature.
- *The real story is that we do not know how the whole detector will behave after life dose… we may do some irradiation to 50, 75, 100 Mrad and then test beam.*





B-L Replacement

- *Sasha and Vadim simulated inserted scenario (see table at the bottom) and a 2 layer scenario:*
  - Improvement of inserted for light higgs.

- *Many discussions… results to be digested…*

4 Pixel Layer- Inserted at 3.7 cm

WH → bb (120 GeV Higgs)

Type, ε_b	Standard 3-layers	4-layers, b-layer R=3.7cm	F(4L/3L)
2D 60%	62 ± 2	78 ± 4	1.26
2D 70%	20 ± 1	26 ± 1	1.30
3D 60%	112 ± 6	160± 10	1.42
3D 70%	31 ± 1	43 ± 1	1.38
SV1 60%	261 ± 20	501 ± 56	1.92
SV1 70%	61 ± 2	90 ± 4	1.48
SV2 60%	256 ± 19	508 ± 57	1.98
SV2 70%	57 ± 2	89 ± 4	1.56

WH → bb (400 GeV Higgs)

Type, ε_b	Standard 3-layers	4-layers, b-layer R=3.7cm	F(4L/3L)
2D 60%	61 ± 2	52 ± 2	0.85
2D 70%	21 ± 1	20 ± 1	0.95
3D 60%	99 ± 3	81± 3	0.82
3D 70%	31 ± 1	29 ± 1	0.93
SV1 60%	314 ± 21	230 ± 15	0.74
SV1 70%	88 ± 3	77 ± 3	0.88
SV2 60%	297 ± 20	226 ± 14	0.76
SV2 70%	84 ± 3	71 ± 3	0.85

Simpla 2 Layer Scenario

- *Also a simple Pixel detector with only 2 layers simulated…*

2 Pixel Layer- Inserted at 3.7 cm, L1 = 8 cm

WH → bb (120 GeV Higgs)

Type, ε_b	Standard 3-layers	2-layers, b-layer R=3.7cm	F(2L/3L)
2D 60%	62 ± 2	110 ± 5	1.8
2D 70%	20 ± 1	38 ± 1	1.9
3D 60%	112 ± 6	233± 17	2.1
3D 70%	31 ± 1	58 ± 2	1.9
SV1 60%	261 ± 20	655 ± 80	2.5
SV1 70%	61 ± 2	146 ± 9	2.4
SV2 60%	256 ± 19	564 ± 64	2.2
SV2 70%	57 ± 2	135 ± 8	2.4

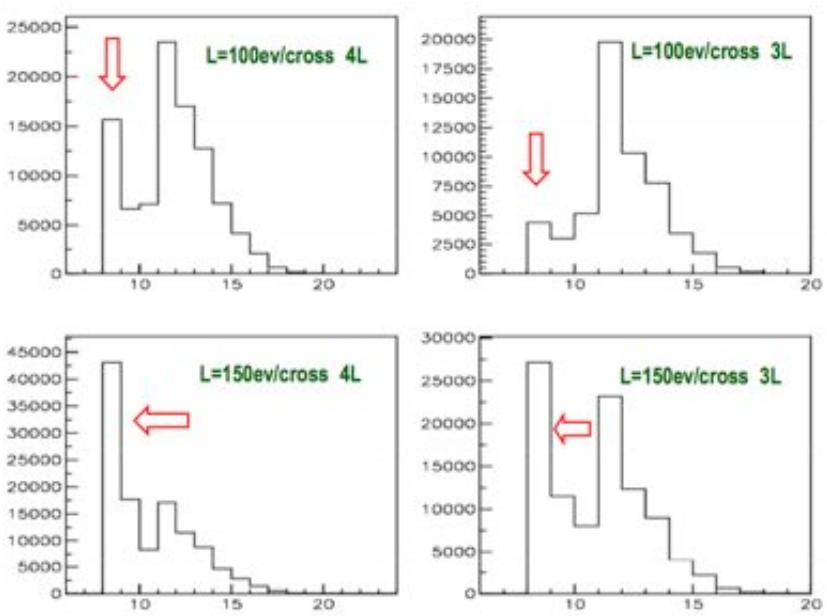
WH → bb (400 GeV Higgs)

Type, ε_b	Standard 3-layers	2-layers, b-layer R=3.7cm	F(2L/3L)
2D 60%	61 ± 2	60 ± 2	1.0
2D 70%	21 ± 1	20 ± 1	1.0
3D 60%	99 ± 3	104± 4	1.1
3D 70%	31 ± 1	32 ± 1	1.0
SV1 60%	314 ± 21	353 ± 26	1.1
SV1 70%	88 ± 3	107 ± 4	1.2
SV2 60%	297 ± 20	338 ± 24	1.1
SV2 70%	84 ± 3	99 ± 4	1.2

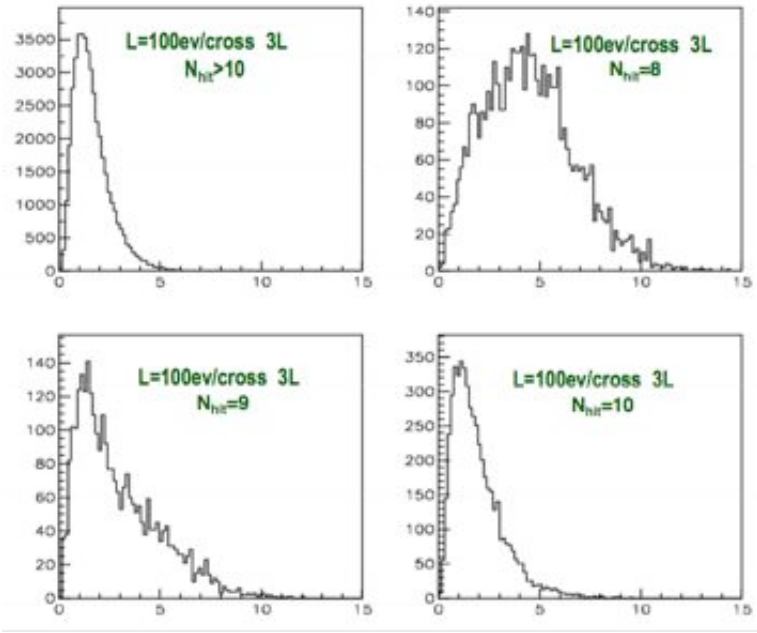
Tracking at SLHC

- *With tested Pixel+SCT layout tracking starts to produce significant amount fakes at L=100ev/cross and this amount grows quite rapidly with further increase of luminosity.*
- *Even at L=200ev/cross primary vertex is reconstructable although with significant degradation of precision (much bigger than at L=100ev/cross)*
- *B-tagging performance is strongly degraded already at L=100ev/cross with extremely strong degradation of secondary vertex part.*
  - Naively extrapolating these results to L=400ev/cross one may conclude that B-tagging most probably will be unusable
  - Primary vertex may still be reconstructable but with bad quality

Amount of silicon hits (Pixel+SCT) for all tracks



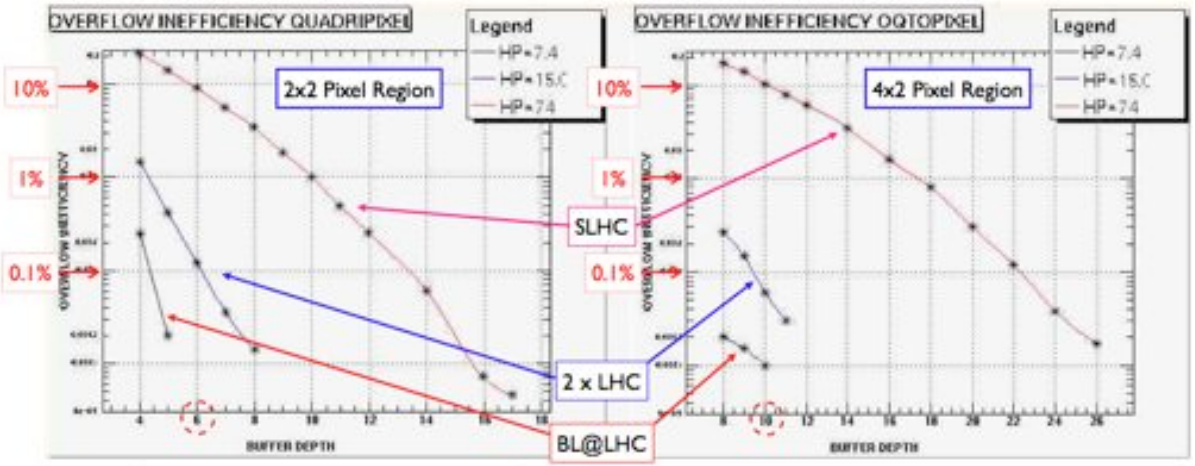
Based on the shape of χ2 one may conclude that trackswithsmall tracks with small amount of silicon hits are bad

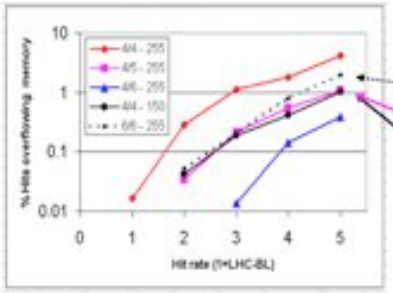


FE-I4

- *A new R/O architecture based on local region storage.*
  - Simulation presented…
  - Status of blocks and submission of test chip in 0.13 μm by end of January

Local Buffer depth effects





- Inefficiency as function of Local Buffer Depth.

Larger region

More Buffers

Faster Erase

Simulation work is critical in order to understand correct scaling of most available parameters.

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What to do Next - ATLAS Task Force

- *An ATLAS task force will be nominated with the mandate to review the situation and present to the collaboration an updated plan for the B-layer and Pixel system evolution in ATLAS (in a 6 months timescale). The task force will be established at EB level and reports at TMB/EB level - and also as appropriate in ID, Pixel and Upgrade meetings. (→ See **D. Lissauer's talk**)*

- *The task force should consider the following points:*
  - The expected lifetime of the PIXEL system and critical components that might change the lifetime
  - Machine upgrade plans and expected luminosity profiles
  - Time estimates, risks, procedures for, and activity levels related to changing/adding layers for the Pixel system. This included compatibility with INB regulations and concerns both work in situ and on the surface.
  - Simulations studies for extra layers or changed layouts
  - Interfaces to and compatibility with a complete ID upgrade
  - Time scales and costs
  - Possible changes to the central beampipe
  - Key issues to study during initial running (physics, operational issues) that can provide guidance for future upgrades of the Pixels.
  - Other points as deemed necessary

Task Force (2)

- *Several options must be considered, and their feasibilities studies, keeping in mind the points above for each of them:*
  - Replacing the current B-layer with a similar layer (current baseline)
  - Adding a new layer inside the current system
  - Replacing the entire PIXEL system with a new system as ambitious as possible
  - Keeping several options open but defining a plan (in time and identifying key issues) that can guide us towards a decision in the coming years.
  - Permutations/derivations/ developments of the above.

- *Practical constraints:*
  - Basic R&D for the Pixel upgrade must be encouraged to continue during this process and as part of the revised plan.
  - The b-layer replacement budget line in M&O must be kept open, in all scenarios there is a well-defined inner layer that will be a focus for development and early change.
  - The PIXEL upgrade community must be kept together working on a common framework as a result of any new plan.
  - In absence of a replacement plan we have no flexibility in the vertexing system (B-layer is a kind of unique layer in the B-tagging). On the other way CMS has simple mechanical replacement. The unbalance situation of the two experiment has to be corrected.

Santiago Calatrava…

- *…also worths a trip to Valencia !*