Pixel Fall-Back Options

M. Gilchriese July 26, 2000

Assumptions

- Fall-back options are needed in case of continued difficulties with the FE electronics or later difficulties with module production and assembly.
- Schedule(time) and funds(cost) are both concerns
- Attempt to maintain continuity of the design avoid or postpone to latest possible time radical changes in direction.
- Meet the apparent need to have an initial detector capable of "doing physics" ready by July 2005.
- But which might be completed, if necessary, 9-12 months later.
- "Real" LHC schedule likely not known until 2002.

Scope Possibilities

Possibility	No. of Modules	<u>%</u>
A. Current baseline	2146	100
B. 2 hits(Layer 2+eg. 2x2 disks+B-layer)	≥1254	≥ 58
C. Layer 2, 2x2 disks + "double" B-Layer	≥1618	≥75
D. "Double" B-layer only	≥650	≥ 30
E. Current B-layer only	286	13

- (B) Current B-layer(286 modules). "Fixed" part is 968 modules. May choose to keep 3 rather than 2 disks.
- (C)"Double" B-layer(guess total of 650 modules). "Fixed" part remains 968 modules. Roughly current B-layer + another barrel layer.. "Double" can be inserted from outside ID. This is roughly minimum, might be more.
- Of course, one can imagine other scenarios eg. start with (B) and replace with (C), or.....
- Approximate rapidity coverage of barrels/disks for z=0, +11, -11 cm on next pages.

Z=0

Rapidity Coverage(Z=0)



4

Z=+11 cm

Rapidity Coverage(Z=11 cm)



5



Rapidity Coverage(Z=-11 cm)



6

Performance

- The 2 vs 3 hit scenario was studied in 1997 with the layout(s) at that time see INDET-NO-188.
- See also e-mail from Dario.
- Critical question is additional simulation necessary BEFORE implementing a possible fall-back option?
 - Simulation requires considerable time(months)
 - Simulation including "double B-layer" requires layout of this...even more time.
 - Simulation of updated 2-hit layout could, in principle, start now.
 - Simulation with "double B-layer" or any major change, likely cannot start before October at earliest.
- Need decision about 2 vs 3 now. Default no new simulation results available for next pixel week.

FE- Electronics Options/Milestones

- Preliminary scenarios have been discussed with Kevin. Many unknowns. These are my guesses. Iteration needed!
- DMILL
 - Assuming FE-D2 run is not total failure, earliest decision point to continue or not with Temic could be December 2000(eg. at pixel week).
 - Must assume that additional iteration(FE-D3) required if continue
 - If lucky, the FE-D3 submission could be of preproduction quality/quantity, submitted in Spring 2001, evaluated thoroughly during summer(irradiation, modules, test beam) leading in Fall to Production Review(PR) with Temic, ATLAS PRR and production start by end 2001, first production wafers arriving March May, 2002
 - If not lucky, add at least 6 months for another engineering run, leading to compressed schedule for preproduction/PR/PRR, first production wafers arriving September November, 2002.
 - Total production fab time not yet clear. Temic asked on July 21, indicate 12-18 months possible, Temic will make formal response, obviously depends on total quantity.

More FE Electronics

- Honeywell
 - Cost not well known but starting to work on this.
 - Assuming FE-H1 is not a total failure, earliest decision point to continue with Honeywell or not is about July 2001. Complete FE-H1 evaluation by early Fall 2001
 - Must plan on FE-H2. Again, if very lucky, preproduction quality/quantity and submit in Fall 2001. Irradiate, modules, test beam, PR, PRR, begin production July - September 2002, first production wafers then November 2002 - January 2003.
 - If not lucky add 7-8 months(assuming cannot accelerate Honeywell fab time)
 - Total fab time unknown(capacity). Starting to work on this.

More FE Electronics

- 0.25 micron
 - Prototype FE-I1 wafers by Fall 2001 eg. October 2001. Evaluation difficult without test beam.
 - FE-I2 needed. Too optimistic to plan now to go from FE-I1 to preproduction. Wafers back Summer 2002, eg. June, test beam, modules, irradiate
 - FE-I3 is preproduction, wafers back early 2003, PR, PRR, start production late Spring 2003. First production wafers June - September 2003.
 - Total fab time not clear. Need to find out. Potentially short?

FE-Electronics

• Production does NOT include preproduction. Times are when production wafers ARRIVE. Submission is one quarter earlier.

1st Production Wafers	<u>Total Fab Time</u>
First quarter 2002	12-18 mo? To be
	confirmed.
Last quarter 2002	Unknown
Third quarter 2003	Unknown, 12 mo?
	<u>1st Production Wafers</u> First quarter 2002 Last quarter 2002 Third quarter 2003

- This ignores conflicts for IC design and testing resources!
- Two vendor scenario should be considered for schedule/cost reasons(in addition to technical eg. 300 micron pixel)
- Need ICs in 2001 to move module program forward how?

Module Production

• What is needed....

	Good	Years	Years	Years	Mod/week
Scenario	Modules	10/week	20/week	30/week	for one yr.
A. Baseline	2146	6.5	3.2	2.2	65
B. 2 hits	1254	3.8	1.9	1.3	38
C. Layer 2/4 disks+double B-layer	1618	4.9	2.4	1.6	49
D. Double B-layer only	650	2.0	1.0	0.7	20
E. Current B-layer only	286	0.9	0.4	0.3	9
Working weeks per year	44				
Yield factor	1.33				

- See notes from Norbert http://www.physik.uni-bonn.de/~wermes select ATLAS and then "descoping_00.ppt"
- My conclusion: should understand in detail what is required to realistically produce all modules(all steps) in 1.5 years.
- Use this to guide us on how many modules can be realistically produced in this time and use this to guide us in fall-back decisions. Need this info also by December pixel week.
- How to keep bumping vendors on board serious problem. Sensors? Much bigger
 12 dummy module program?

Mechanics Implications(My Guess)

- Some slowdown is inevitable.
- Revisiting recent decision about thermal barrier is likely in all cases but current baseline.
- Modified final assembly/installation sequence is required
 - No X-ray
 - Install while SCT in cryostat
 - Other?
- What is latest time to install B-layer/"double-B-layer"? Need more work on realistic access scenario.
- Be completely ready when first production modules arrive..minimize assembly time. What does this imply?
- Build ALL of the mechanics before starting full production of modules? Requires knowing the scope!

Fall-Back Options - Decision Points

- <u>First decision point December 2000</u> continue with Temic or not
 - If Temic not viable => implement fall-back option
 - Even if Temic looks viable, need much more detailed evaluation of module production duration - complete this evaluation by December. This may imply need for fall-back, even if Temic appears to be viable vendor.
- Second decision point about September 2001
 - If still Temic, is their production rate OK? Module production rate OK?
 - If not Temic, proceed with Honeywell or not? Is IBM work on track?
- <u>Third(last?) decision point mid-2002</u>
 - LHC schedule known?
 - IBM viability known
 - Last chance!