Layout Sensitivity Study

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What I Was Asked to

- Check the impact on layout of a potential increase of:
  - Min distance stayout zone - flex surface
  - total thickness of flex module

Input Data: Table From Gil (21/7/99 Last Update)

Goal represents minimum value. Uncertainty is possible amount for growth.						
All dimensions in mm						
Item	Goal	Uncertainty	Comments			
Adhesive	0.0500	0.0500				
Insulator	0.0000	0.0250	Kapton if backside ground needed			
Copper	0.0000	0.0070	Copper connection for backside ground			
Adhesive	0.0250	0.0250				
FE IC	0.1500	0.1500	Uncertainty in thinning			
Bumps	0.0050	0.0150				
Sensors	0.2500	0.0100				
Adhesive	0.0500	0.0250				
Flex hybrid:	0.0460	0.0050				
Bottom cover layer/adhesive	0.0120	.0.05				
Substrate	0.0250	0.0000				
Metal	0.0090	0.0050				
Top cover layer/adhesive	n/a	n/a	Components mounted on metal			
Subtotal	0.5760	0.3120		Subtotal envelop		**0.8880**
The MCC, optical and passive components require 3D analysis						
MCC	0.1500	0.1500				
MCC adhesive	0.0250	0.0250				
MCC wire bonds/encapsulant	0.5000	0.5000				
Subtotal MCC	0.6750	0.6750		Subtotal envelop		1.3500
Optical components, max	1.5000	0.5000	Is this correct?			2.0000
Passive components, max	1.6000	0.2000	Is this correct?			1.8000
0402	0.5000	0.0500	Not published			
0603	**0.8000**	0.0800	Not published			
1206	1.1500	.0.115	Not published			
EIA-A	1.6000	0.2000				

Module thickness:

~0.9

-0.1 (glue layer already included in Prague layout study)

= 0.8 (**+0.2** with respect to what assumed in Prague layout)

+0.3 on min distance of stay-out zone from module

Layout Implications

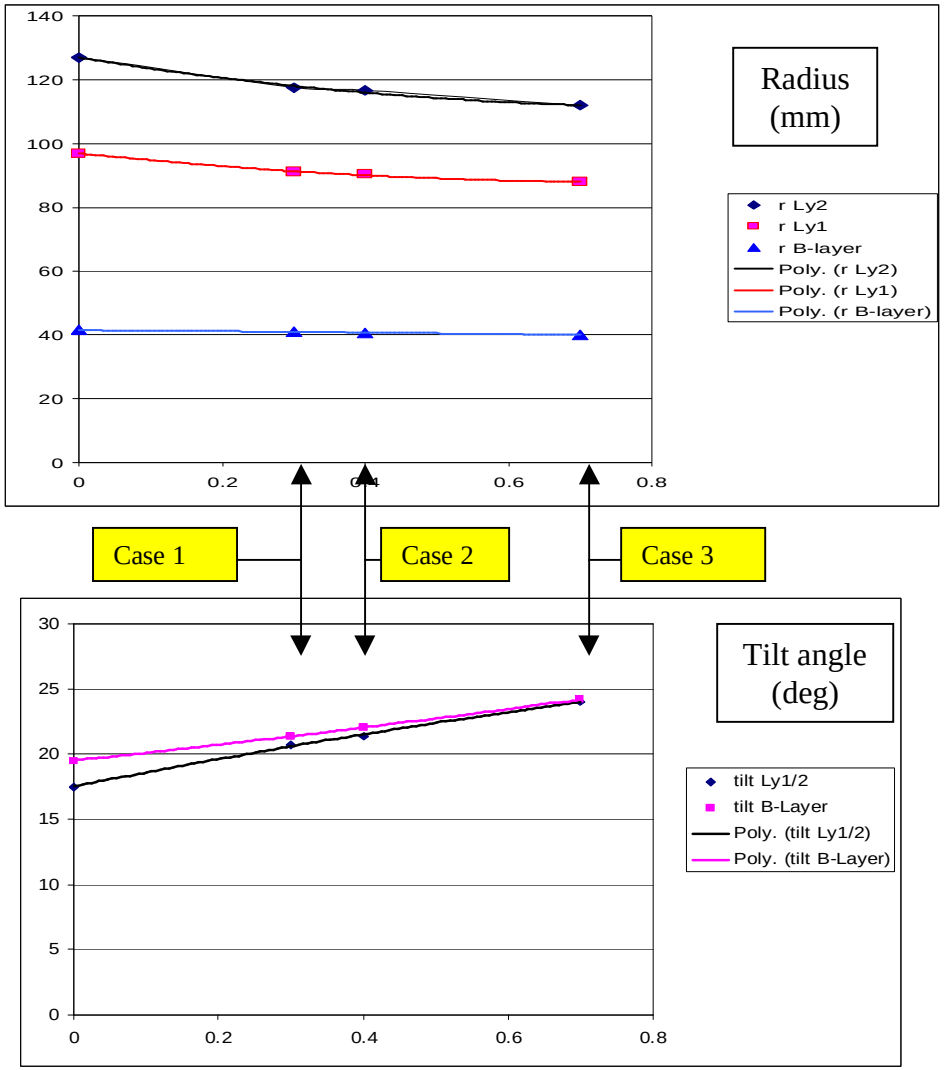
- +0.2 on module thickness means +0.4 impact on layout (additional +0.2 coming from stave central step thickness increase due to z overlap constraints)
- Both increments (module thickness and stayout zone min clearance) can be assumed as equivalent to an increase of the min clearance between staves
- The sensitivity has been performed evaluating the impact of each increment and of their combination

Results

CASE 1: + 0,3 mm min stayout zone clearance				
	Layer radius [mm]		tilt angle [°]	
	Prague	New	Prague	New
LAYER 2	127	117.5	17.5	20.7
LAYER 1	97	91	17.5	20.7
B-LAYER	41.5	41	19.5	21.4

CASE 2: + 0.2 on module thickness				
	Layer radius [mm]		tilt angle [°]	
	Prague	New	Prague	New
LAYER 2	127	116.5	17.5	21.4
LAYER 1	97	90.5	17.5	21.4
B-LAYER	41.5	40.8	19.5	22

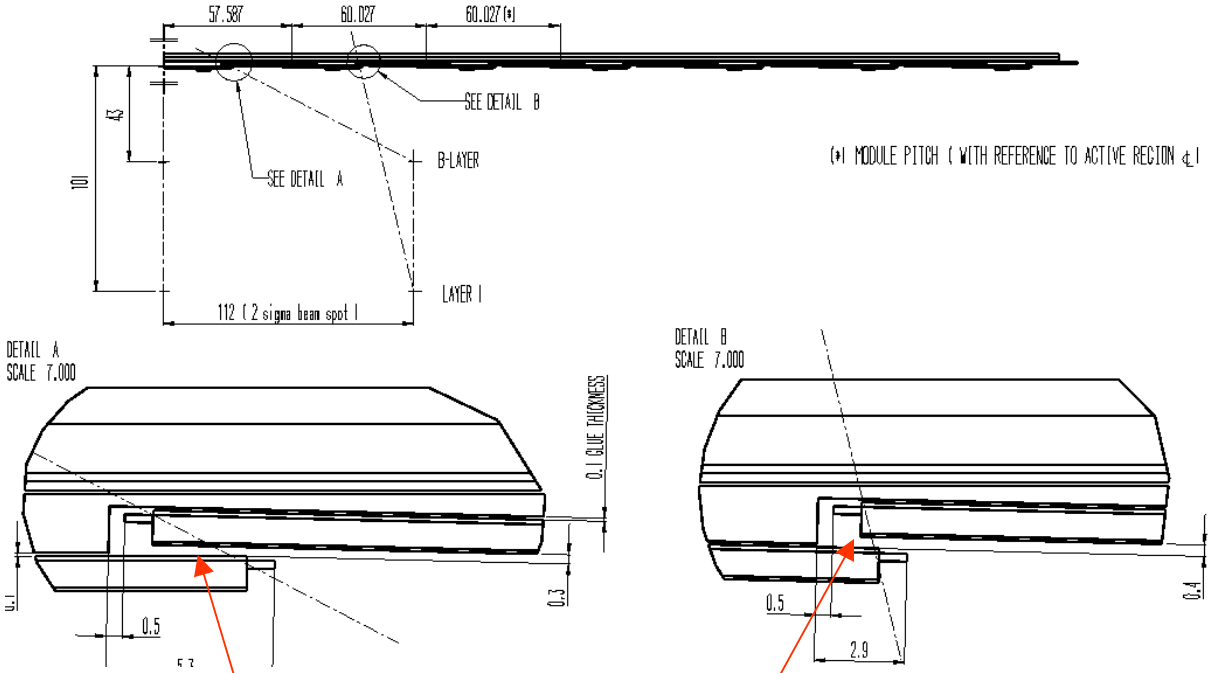
CASE 3 = CASE 1 +CASE 2				
	Layer radius [mm]		tilt angle [°]	
	Prague	New	Prague	New
LAYER 2	127	112	17.5	24
LAYER 1	97	88	17.5	24
B-LAYER	41.5	40	19.5	24.2



A few comments

- The results of the study are self-commenting
- we are at the edge of the abyss
- even the smallest increase in clearance or thickness has a relevant impact on layer radii (10 mm lost on layer 1 for only +0.3 clearance!)
- how to address the problem:
  - no way to accommodate the request of increase the stayout zone min clearance (heavy impact on layout unavoidable)
  - there is a viable solution to cancel the impact of module thickness increase but we have to pay for that

Possible solution to overcome the impact of an increase in thickness of the flex module



If the central module is overlapped as the other shingled ones:
- the modules can come closer together
- the thickness of the central step (the constraining one in ϕ layout) of the stave can be reduced

Consequences:

- the layout in ϕ does not change

but:

- the B-layer stave has to be different (otherwise too high losses in z overlap regions of the central module)
- layer 1 will have an additional coverage loss of about 0.2 %

Conclusions?

- The pressure to optimize the layout of the components on the flex to fit with Prague stayout zone constraints is now increased
- possible accommodation of increase in module thickness up to +0.2 without any impact on the layout, but assuming to have:
  - a different stave design for the B-Layer
  - additional 0.2 % coverage losses in layer 1
- the same check on MCM-D module (with the contribution of Karl Heinz) shows that it fits with Prague layout even taking into account all contingencies on thickness (+0.3) as for the flex with not too binding constraints on the passive components locations