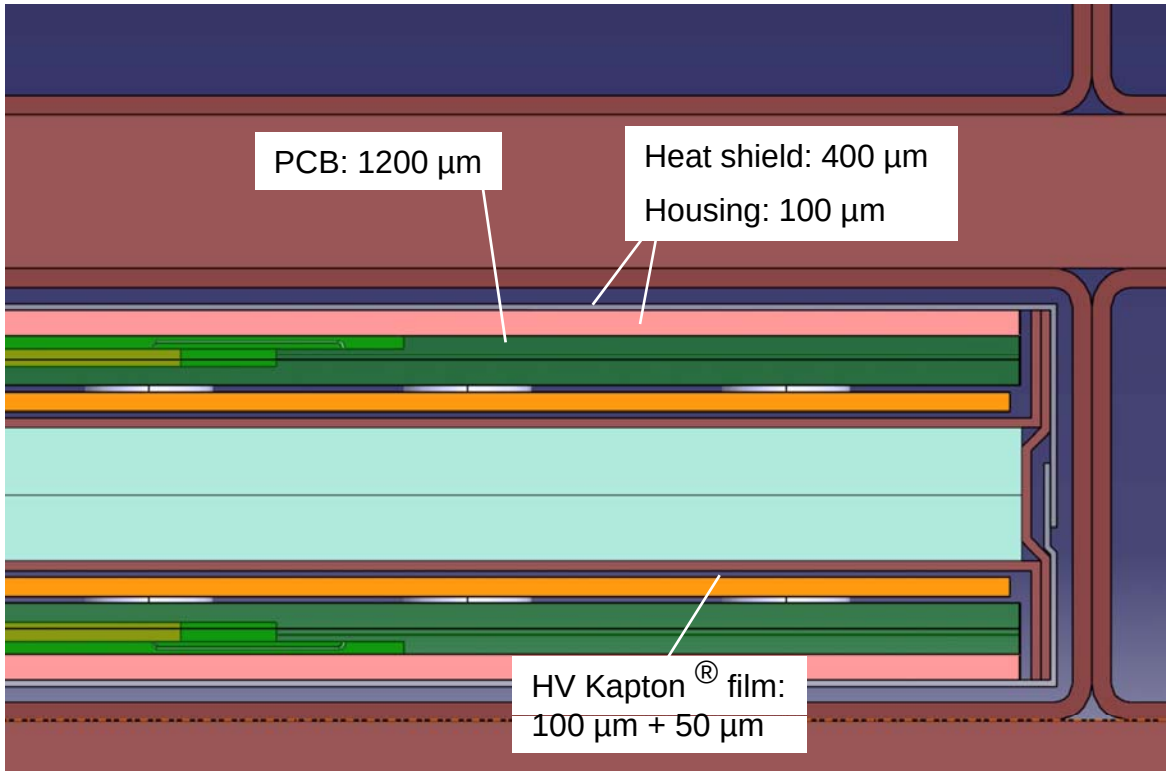
SLAB Integration & Thermal Measurements

CALICE Meeting/ Manchester Sept 2008

Detector SLAB Integration

- Thickness budget & Tolerances
- Integration Cradle & H structure Fastening
- HV Kapton & ASU insertion + interconnection
- Copper Shield & Housing installation
- DIF plugging with possible clamping to Cu shield
- SLAB Link to Cooling device & Electronic Setup
- SLAB ready to Electronic Qualification Tests at operating temperature (inside alveolar sector)

Thickness Budget (SLAB cross section)



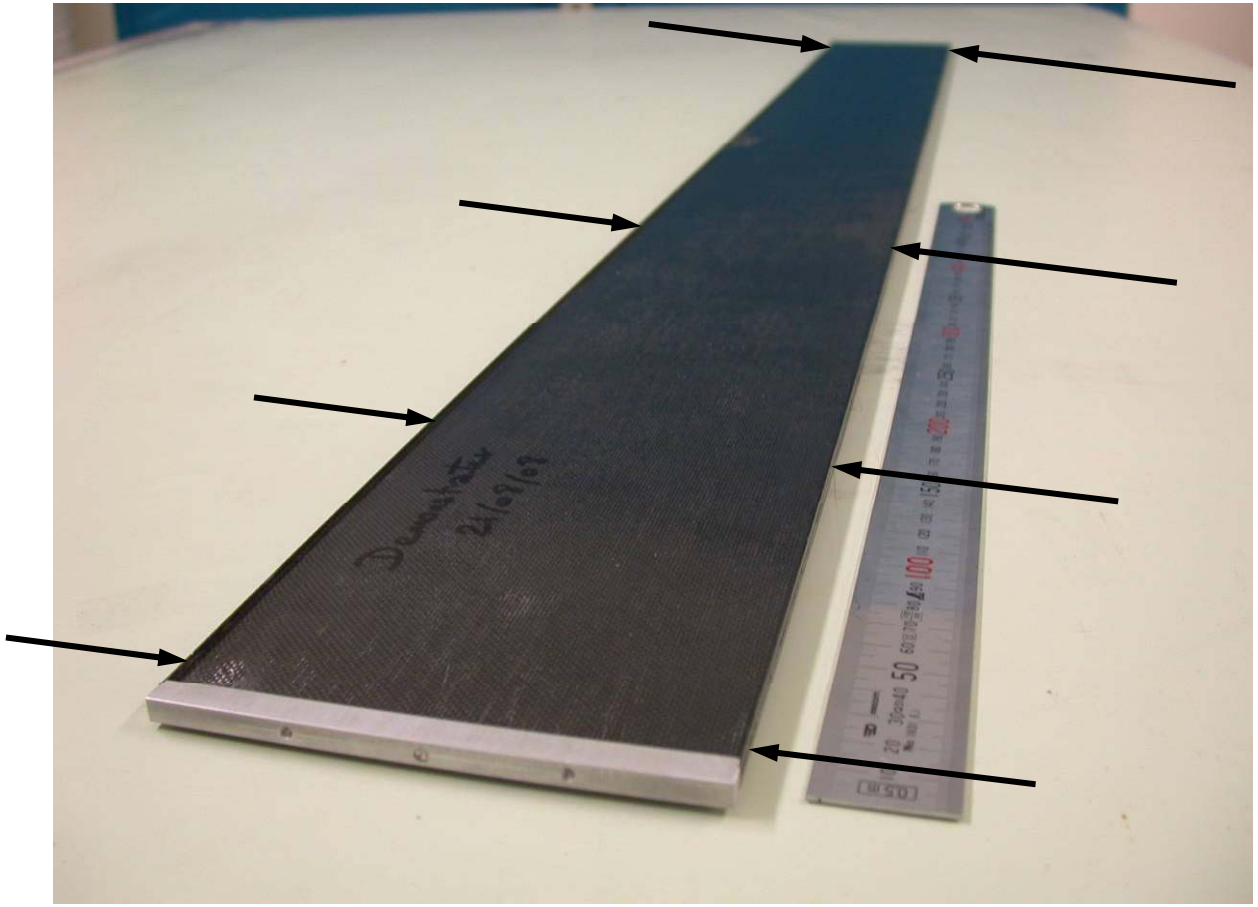
1. Copper housing: 100 µm
2. Copper heat shield: 400 µm
3. PCB & chips: 1200 µm
4. Thermal grease: 0 µm {in the Cu holes covering chips wire bonding} could balance final tolerances result
5. Si Wafer + glue ~= 400 µm
6. HV Kapton feeding + contact interface ~= 150 µm
7. Sub total ~= 2250 µm

Integration Cradle & H Structure Fastening

⇨ Aluminum Rectangular Frame : fully adapted to H structure with free access to detector sensitive components {HV feeding, ASU + Terminal Boards} & Copper shielding parts.

1. Lateral fastening of H structure to integration cradle {adequate screws + rubber ends on few locations along opposite H edges}
2. Adjustment of the straight alignment between H structure and integration cradle line {giving common reference of slab components & proximity parts (cooling device, external supports etc...}
3. Connection of 2 stable bearings to integration cradle ends {allowing 180° up side down tilt of the assembly}

Integration Cradle & H Structure Fastening
Locations along 2 opposite H edges



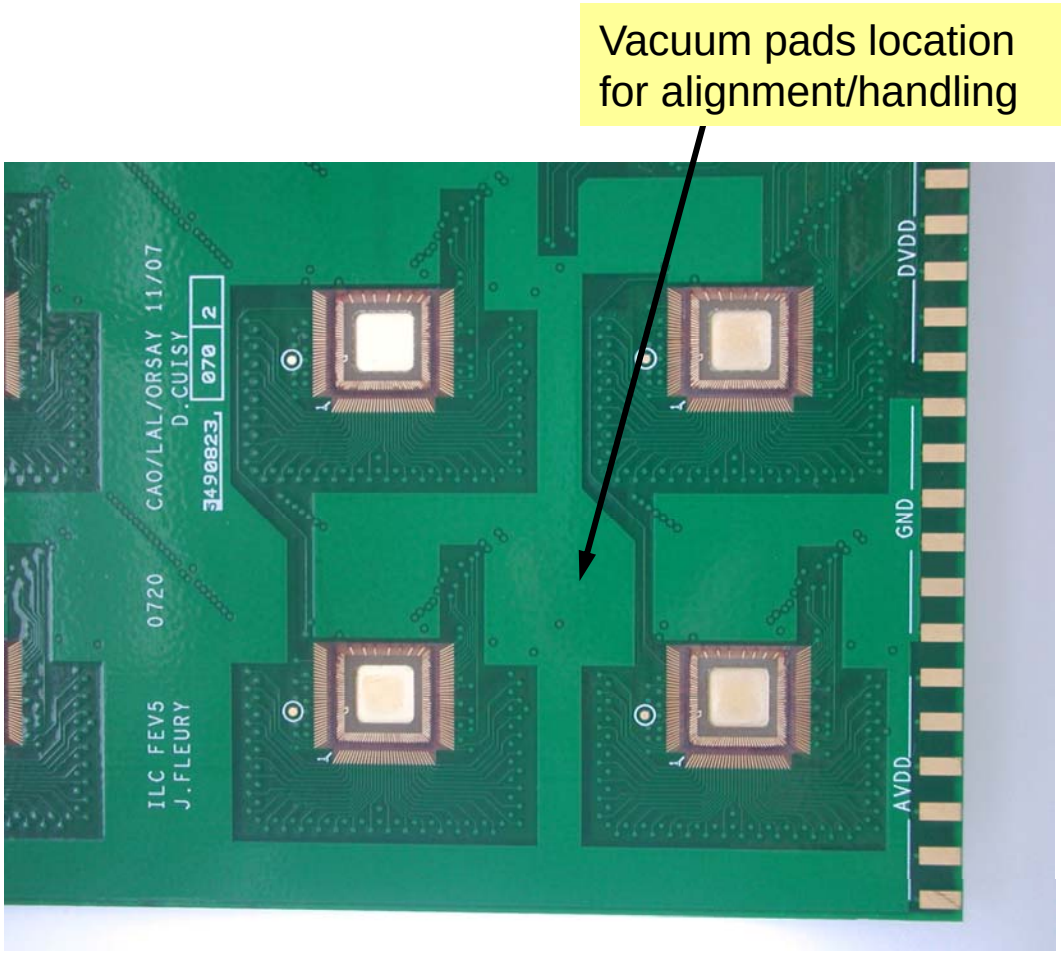
HV kapton feeding & ASU insertion + interconnection

1. Insertion of HV kapton feeding into H structure {straight alignment, one end clamping to integration cradle + few glue drops to H edges}
2. unit-1 A.S.U insertion & HV connection {connection/disconnection 'spring' process to be studied}
3. unit-2 A.S.U insertion & HV connection
4. unit-1 to unit-2 interconnection {bridge soldering technique under study to answer major specifications}
5. Electrical continuity test & unit-3, unit-4... insertion, interconnection
6. Qualification test of all ASU + terminal boards, PCB 'soft gluing to H
7. *After Cu Shield + housing installation, 180° up side down tilt, then same procedure for 'inner' slab insertion & interconnection {HV kapton, ASU, qualification tests}*

ASU insertion + interconnection
Vacuum pads location {4 non sensitive spots}

After ASU alignment along H edges, these vacuum pads should stabilize 2 ASU each other during bridge soldering.

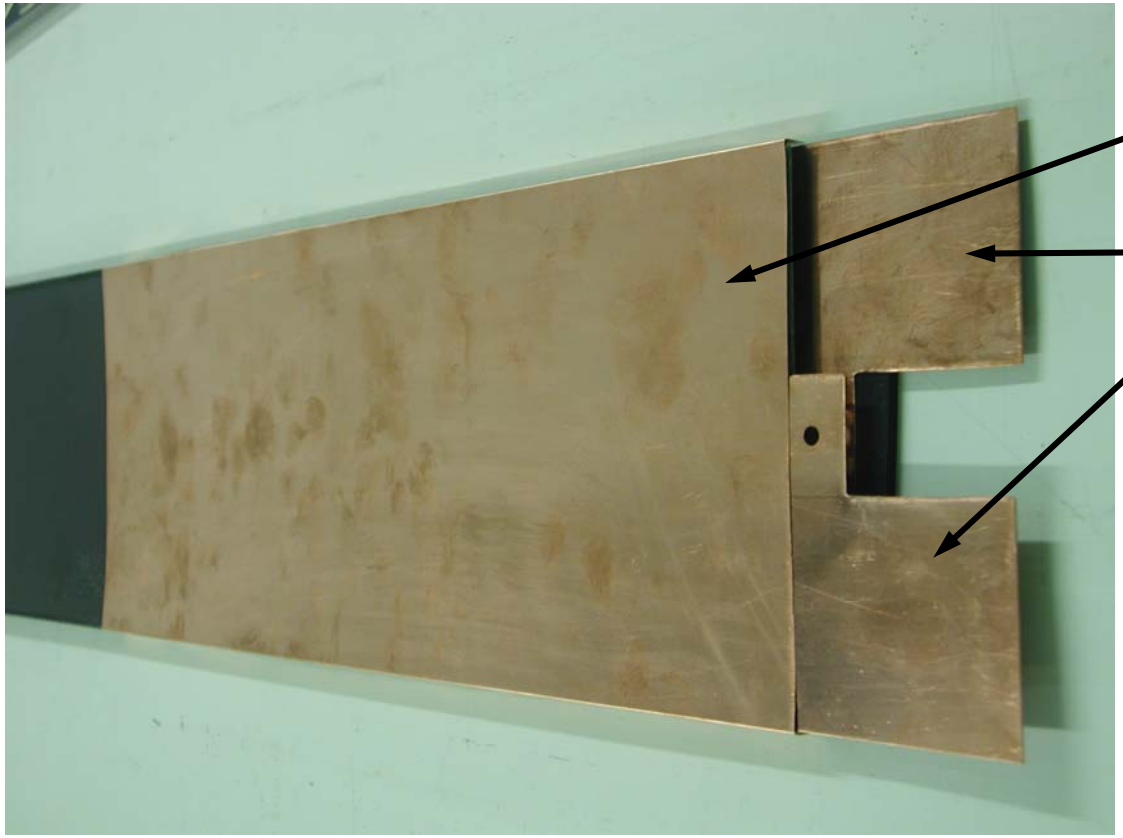
At Si wafers side, if the temperature rising is critical, temporary cold thermo conductive foam could be placed in-between HV kapton & ASU (soft contact with Si wafers).



Copper Shield & Housing installation {Thermo conductive Grease}

1. Copper shield alignment & installation on the slab by vacuum pads handling {DIF board is not plugged in yet}
2. Filing Cu shield square holes with thermo conductive grease {thermo contact between Cu shielding & PCB could improve cooling process}
3. Secure link of Copper Shield to H structure with few glue drops
4. Cu housing insertion & clamping to H edges by vacuum pads handling {some thermo conductive grease could balance thickness tolerances}
5. 180° up side down tilt, then identical procedure at inner slab side
6. Final thickness control with matrix template using H structure & calibrated shims as solid stoppers
7. Detector slab ready to be inserted into alveolar sector

Copper Shield & Housing installation



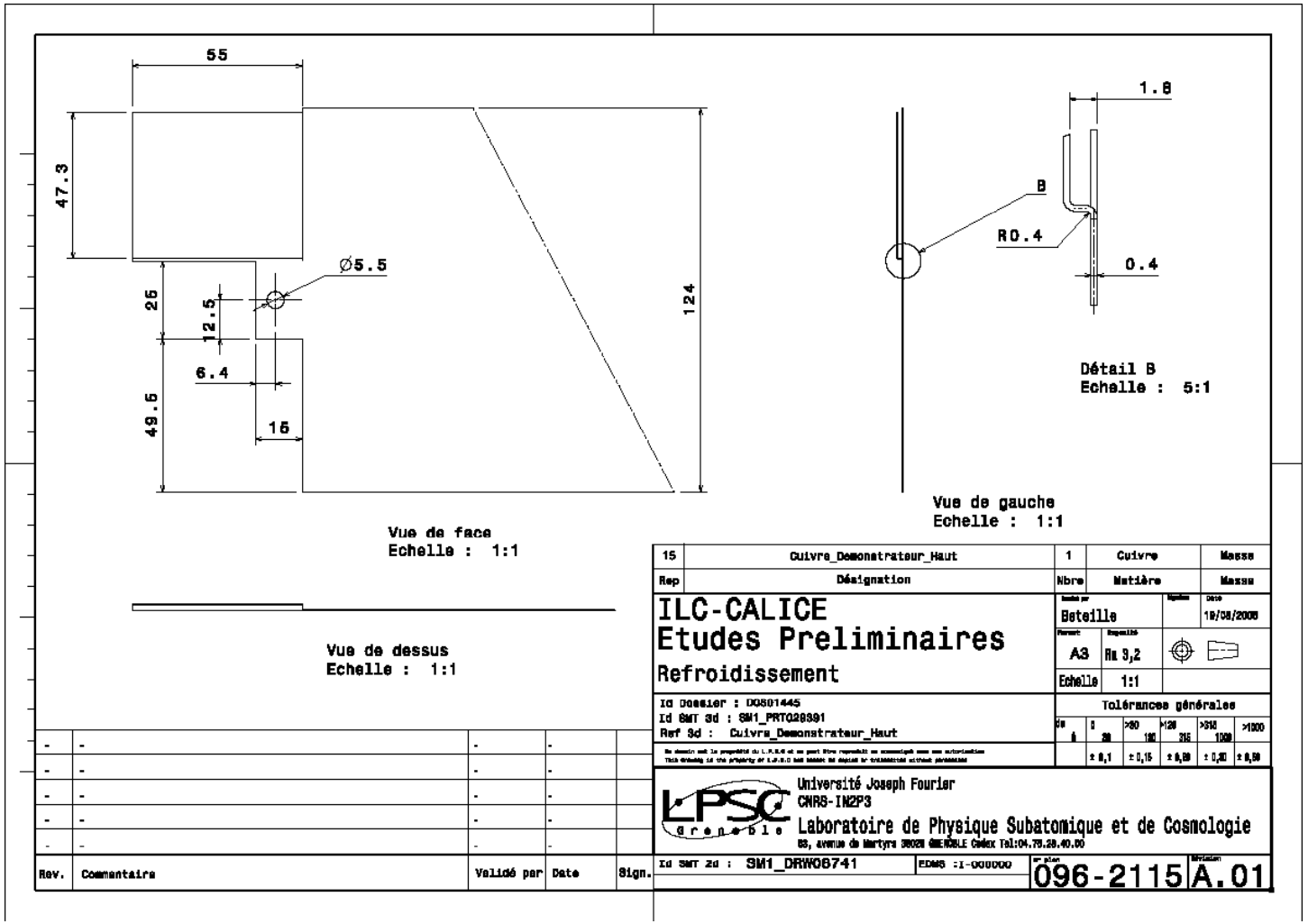
Housing 100 micron Cu plate clamped to H edges

Cu shielding inner & outer slab sides (400 micron)

DIF area should be modified according to next slide LPSC specification drawing (096-2115 of 19.08.2008)

To improve thermal contact with DIF active components, clamping technique need to be studied.

DIF area on the Copper Shield



Open Questions

SLAB integration & thermal measurements

1. To improve thermal contact & mechanical stability as well, Should we fasten DIF board to copper shield ?
2. To prevent damage & maintain constant electrical contact, is clamping of proximity cables/services to mechanical support needed ?
3. From disassembly issues, electrical contact between Si wafers & HV kapton feeding is given by direct pressure, what is its origin ?
4. What is power dissipation range of DIF & adaptor board ?
5. Should we operate with single contact FPGA/Cu shield ?

Conclusion/ Next Items

SLAB integration & thermal measurements

1. Production of one 'simplified' integration cradle + vacuum pads frame to be used with thermal demonstrator
2. Preparation of few Cu shield units with square holes to thermal demonstrator {L=9x(124.5+0.5)+40+55=1220, W=124.5mm, t=400micron} + few Cu housing units {L=1320, W=125.6, t=100micron}
3. Preparation/ordering of PCB, resistors, T°C sensors, cables etc... & thermal demonstrator integration
4. Correlation between cooling studies (FEM calculation) & operating measurements
5. Selection of thermo conductive grease