

CMS RE 1/1 PRODUCTION

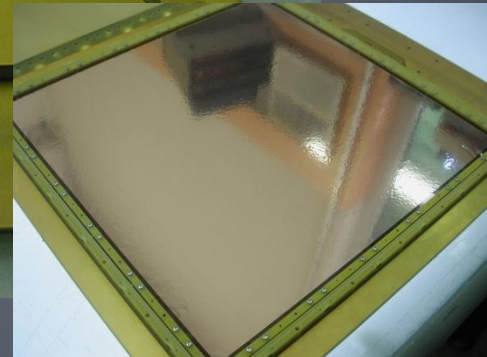
Rui De Oliveira

20/04/2012

82 detectors NS2 Type 1mx 0.45m



30 cm x 30 cm example



What we need?

- ▣ Components
 - 82 x 3 GEMs (1m x 0.45m) → 246 GEMs
 - 82 drift boards
 - 82 Read/out boards
 - Spare parts for NS2
- ▣ Assembly
 - Clean room
 - tooling
- ▣ Qc
- ▣ QA

GEM

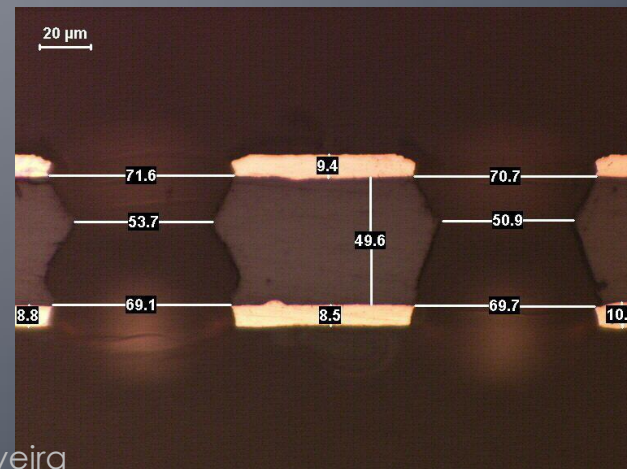
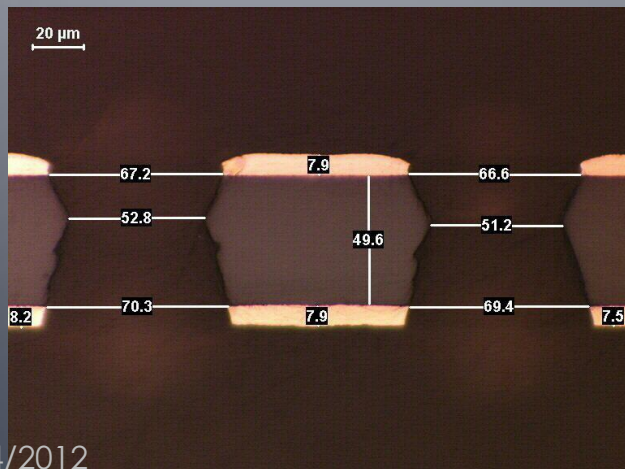
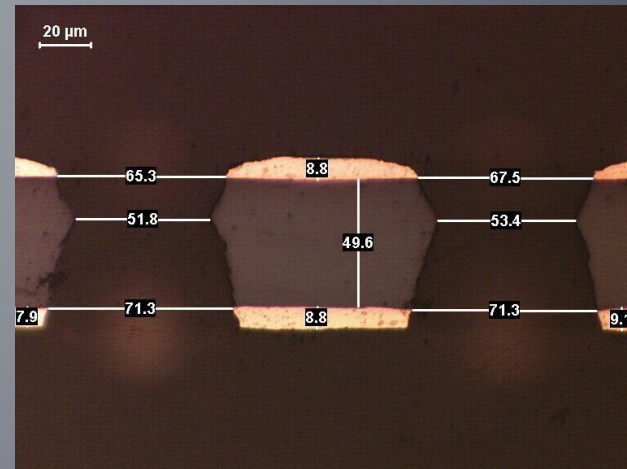
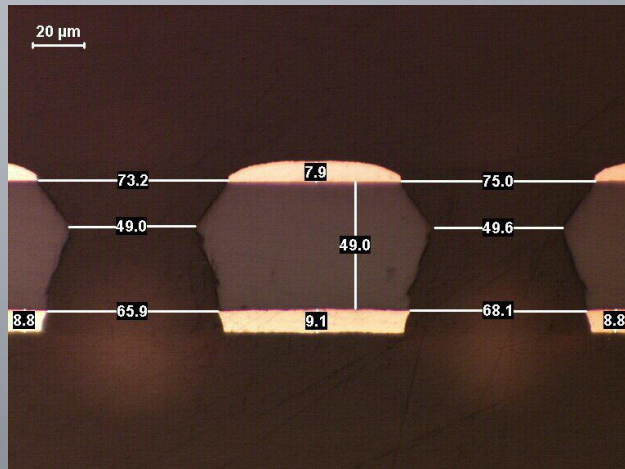


1m x 45cm active area
1.2m x 0.6m raw material
Apical NP 50um
Copper 2 x 5um
Passivated
Raw material on stock

GEM single mask process



cross section pictures



GEM production

- ▣ Present rate : 10 to 12 GEM / month/technician
- ▣ With new equipment → 20 GEM/month/technician



- ▣ around 1 year to produce all the GEMs
- ▣ 1.5 Men/year extra load in TE/MPE workshop

Drift and R/O board

- ▣ Subcontracted
 - Drift board → single sided board (Cope with industry Standards)
 - R/O → under study , Multilayer board (Cope with industry Standards)
- ▣ Less than 6 months to produce 82+82 Boards

Remaining parts

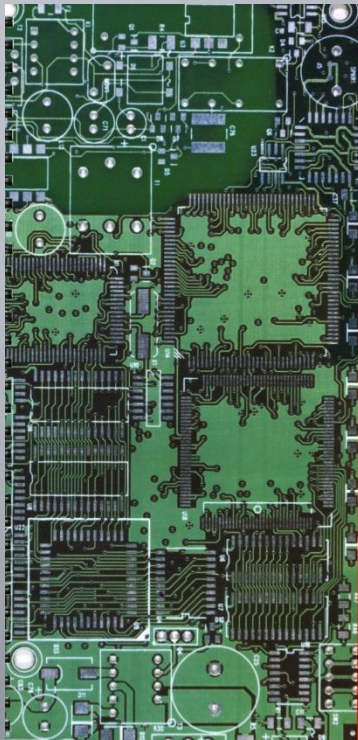
- ▣ NS2 frames
 - Subcontracted
 - Simple machining
 - All parts in less than 3 months
- ▣ Screws, O-rings, Gas plug etc
 - Standard
 - Available
- ▣ HV divider
 - Std thick film Hybrid (high laser trimming precision)
 - Fast production (1000 in 2 months)

Assembly

- ▣ Will be done at CERN in TE/MPE workshop
 - Expected rate : 1 detector per day
 - 0.5 men/year extra load in TE/MPE workshop
 - Process nearly finalized
 - ▣ Minor adjustments of NS2 technique to simplify the assembly
 - ▣ Accelerated life time tests to verify the stability of the NS2 stretching (100 cycles 10 deg to 40 deg)
 - ▣ Accelerated life time test results under radiation (verify all the material used)
 - Clean room in Building 102 and future building 107



- ▣ On GEM
 - Measure physical parameters (holes diameter and uniformity)
 - Measure leakage current at define voltage in Air
 - Check sparking voltage (following Pashen curve)
- ▣ On Drift and R/O boards
 - Follow IPC A 600 Standards
 - Measure leakage current at high voltage on the Drift board
- ▣ On NS2 frames
 - Measure physical parameters
- ▣ On assembled detector
 - Measure gas leaks
 - Measure HV divider voltages
 - Measure HV polarization currents
 - Check Connection integrity and leakage current to GND
 - Check response uniformity under real operation (X ray scan and current measurement)



IPC-A-600

Revision G
July 2004
Supersedes Revision F
November 1999

Acceptability of Printed Boards

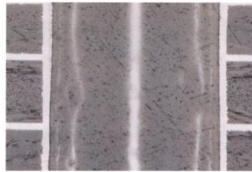
Developed by



IPC A 600

3.3 PLATED-THROUGH HOLES - GENERAL

3.3.3 Foil Crack - (Internal Foil) "C" Crack

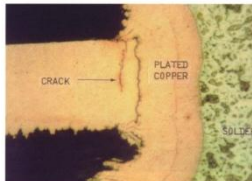


Target Condition - Class 1, 2, 3

- No cracks in foil.

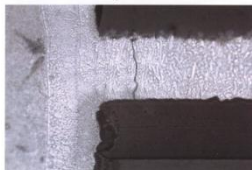
Acceptable - Class 2, 3

- No evidence of cracks in foil.



Acceptable - Class 1

- Allowed on one side of hole only and **shall not** extend through foil thickness.



Nonconforming - Class 1, 2, 3

- Defects either do not meet or exceed above criteria.

Visual observations made on cross-sections only.

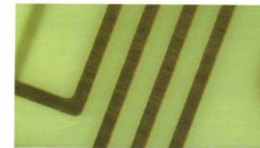
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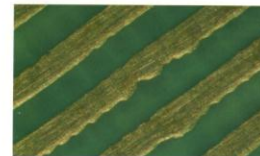
2.10 PATTERN DEFINITION - DIMENSIONAL

2.10.1.2 Conductor Spacing



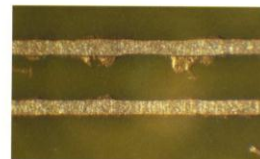
Target Condition - Class 1, 2, 3

- Conductor spacing meets dimensional requirements of the procurement documentation.



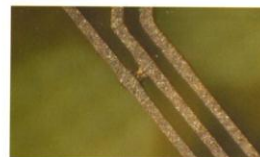
Acceptable - Class 3

- Any combination of edge roughness, copper spikes, etc., that does not reduce the specified minimum conductor spacing by more than 20% in isolated areas.



Acceptable - Class 1, 2

- Any combination of edge roughness, copper spikes, etc., that does not reduce the specified minimum conductor spacing by more than 30% in isolated areas.



Nonconforming - Class 1, 2, 3

- Defects either do not meet or exceed above criteria.

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QA documents

- ▣ Delivered with each GEM
 - Description files
 - Detailed process
 - Measurement sheet for each GEM (holes diameter , uniformity)
 - Production sheet (when, who, yield, base material)
- ▣ Delivered with Drift and R/O
 - Description files
 - Detailed specification
 - QA report from suppliers
- ▣ Delivered with NS2 frames
 - Description files
 - Measurement sheet (physical parameters: size)
- ▣ Delivered with each assembled detector
 - Detailed assembly process
 - Measurement sheet (leaks , HV values , X ray uniformity)
 - Production sheet (when, who, yield, parts lot number)

QA example

| FICHE SUIVEUSE PIXEL BUS | | | |
|--------------------------|----------------|--------------|-----------|
| CLIENT | Nom | Division | Téléphone |
| Recept de la command | | | |
| DATES | | Lancement | Livraison |
| QUANTITÉ DEMANDÉE | Numero circuit | | |
| DIRECTOIRE | | | |
| Date | Embarquement | Observations | |
| Lancement | 13/7/06 | SF | |
| Preparation matiere | 13/7/06 | SF | |
| Etape K1 | 20/7/06 | SF | |
| Etape A1 + Controle | 31/7/06 | SF | |
| Etape K2 + Controle | 18/8/06 | SF | |
| Etape A2 + Controle | 23/8/06 | SF | |
| Etape K3 + Controle | 15/9/06 | 4 | |
| Etape L3 + Controle | 20/9/06 | 11 | |
| Etape K3 + Controle | 26/9/06 | 11 | |
| Etape via 3-4 + Controle | 25/9/06 | SF/EB | |
| Etape croissance depot | 30/9/06 | Lum p1/SF | |
| Etape L4 + Controle | 11/10/06 | EB | |
| Etape K4 + Controle | 12/10/06 | SF/EB | |
| Etape via 4-5 Controle | 13/10/06 | SF/EB | |
| Etape croissance depot | 16/10/06 | SF | |
| Etape K4 + Controle | 18/10/06 | SF/EB | |
| Etape L5 + Controle | 23/10/06 | EB/SF | |
| Etape solder mask | 24/10/06 | EB | |
| Etape NiAu | 26/10/06 | EB | |
| Etape detourage | 27/10/06 | EB | |

Livré le 27/10/06 n° { P36-1-R21
P36-2-R22
P36-3-R23
P36-4-R24 } P36-C-R26

Test BUS ALU

Sens de la planche : repérage avec les mires

| N. circuit | mires | mires |
|------------|-------|-------|
| 1 | + | + |
| 2 | + | + |
| 3 | + | + |
| 4 | + | + |
| 5 | + | + |
| 6 | + | + |

Date: 10/06

Numero planches: 1 06

| Nom fichier | N. ticket | Resultat | Visu erreurs | Resultat |
|-------------|------------|----------|--------------|----------|
| T. A18 | 1007 | OK | OK | OK |
| T. A19 | Ashley Bop | OK | OK | OK |
| T. A20 | A op | OK | OK | OK |
| T. A21 | OK | OK | OK | OK |
| T. A22 | OK | OK | OK | OK |
| T. A23 | OK | OK | OK | OK |

Eda00332-14has



PERSEE LERMP

Montbéliard le 03/10/2006

Certificat de conformité CERN n° CC006-012

Nos ref: CP/FB/06.121

Yos ref: DAI

Référence de la gamme de traitement: PVD-CERN-DM01

Date de réalisation du traitement: 30/09/2006

Détermination du profil d'épaisseur déposé:

| Numéro de la plaque | | | | |
|---------------------|------|------|------|------|
| 93 | 95 | 98 | 91 | 96 |
| 13.7 | 13.8 | 14 | 13.9 | 13.5 |
| 12.1 | 11.7 | 12.2 | 12.1 | 11.9 |
| 13.1 | 13.2 | 13.2 | 13.4 | 13 |
| 13 | 13.2 | 12.8 | 13 | 12.5 |
| 10.8 | 10.5 | 10.6 | 10.4 | 10.8 |
| 12.1 | 12.4 | 12 | 11.7 | 12.4 |

Commentaires éventuels: Valeurs corrigées (-2µm)

Signature du responsable de production
D. MERCS

Conclusion

- ▣ We need 2 persons during 2 years to build the 82 detectors.
- ▣ We need to be informed at least 6 month before the start of the project to train these technicians.
- ▣ For QC we still need to develop a X-Ray scanning system (in close collaboration with CMS) to do basic checks at the production level (uniformity).
- ▣ 1 room in building 107 can be dedicated to assembly and test.