Wire Bond Testing in AMS
Topics

- AMS-2 SSD ladders
- Bonding process issues
- ASI’s acceptance criteria
- Strategy of G & A Engineering
- QA
- Traceability
- Results and conclusions
AMS-2 SSD ladders

- The AMS-2 silicon tracker counts about 250 (incl. spares) ladders of various lengths
- AMS-2 silicon sensors are 2-sided, with 192x641 strips to connect
- A typical ladder with 12 Si sensors needs more than 12000 bonds
- G & A Engineering is manufacturing on Oricola plant 125 ladders with lengths between 12 and 15 sensors – involve over 1500000 bonds
Bonding process issues

- SSD’s are connected to each other and to readout hybrids by means of a Upilex® cable
- Bond types (as substrate stiffness):
  - Wire - Silicon
  - Wire - Upilex
  - Wire - Capacitor
- Bond pad shape and repairs
### Bond acceptance criteria

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Limit</th>
<th>Value</th>
<th>Unit</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Upilex-Silicon bonding</strong></td>
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<tr>
<td>missing bonds</td>
<td>&lt;</td>
<td>0.1%</td>
<td>max</td>
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<tr>
<td>bonds in short with adjacent ch’s</td>
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<tr>
<td>bonding strength</td>
<td>&gt;</td>
<td>5 gf</td>
<td>min value during bonding on test structures (bond loop angle 30 degrees)</td>
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<td><strong>Upilex-hybrid bonding</strong></td>
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*385 bonds*

*644(n-1) = 9016 bonds max*
Strategy of G & A Engineering

- Avoiding the failed bonds by adapting the bond process parameters to the substrate properties and variability
- Optical inspection of pads before bonding
QA

- 100% inspection of incoming parts
- Customized bonder software and fixtures for auto-adjusting bond parameters to variability of materials
- Destructive pull test on wafer cutoffs
- Non-destructive daily pull tests
Traceability

- Online documentation of assembly process
Conclusions

- Analysis of bonding incidents on a sample of 76 ladders manufactured by G&A Engineering:
  - 74 ladders with no failed bond
  - 1 ladder with 1 missing bond
  - 1 ladder with 3 missing bonds
- Conclusion: 76 ladders present 4 missing bonds only, compared to >900 allowed by acceptance criteria