

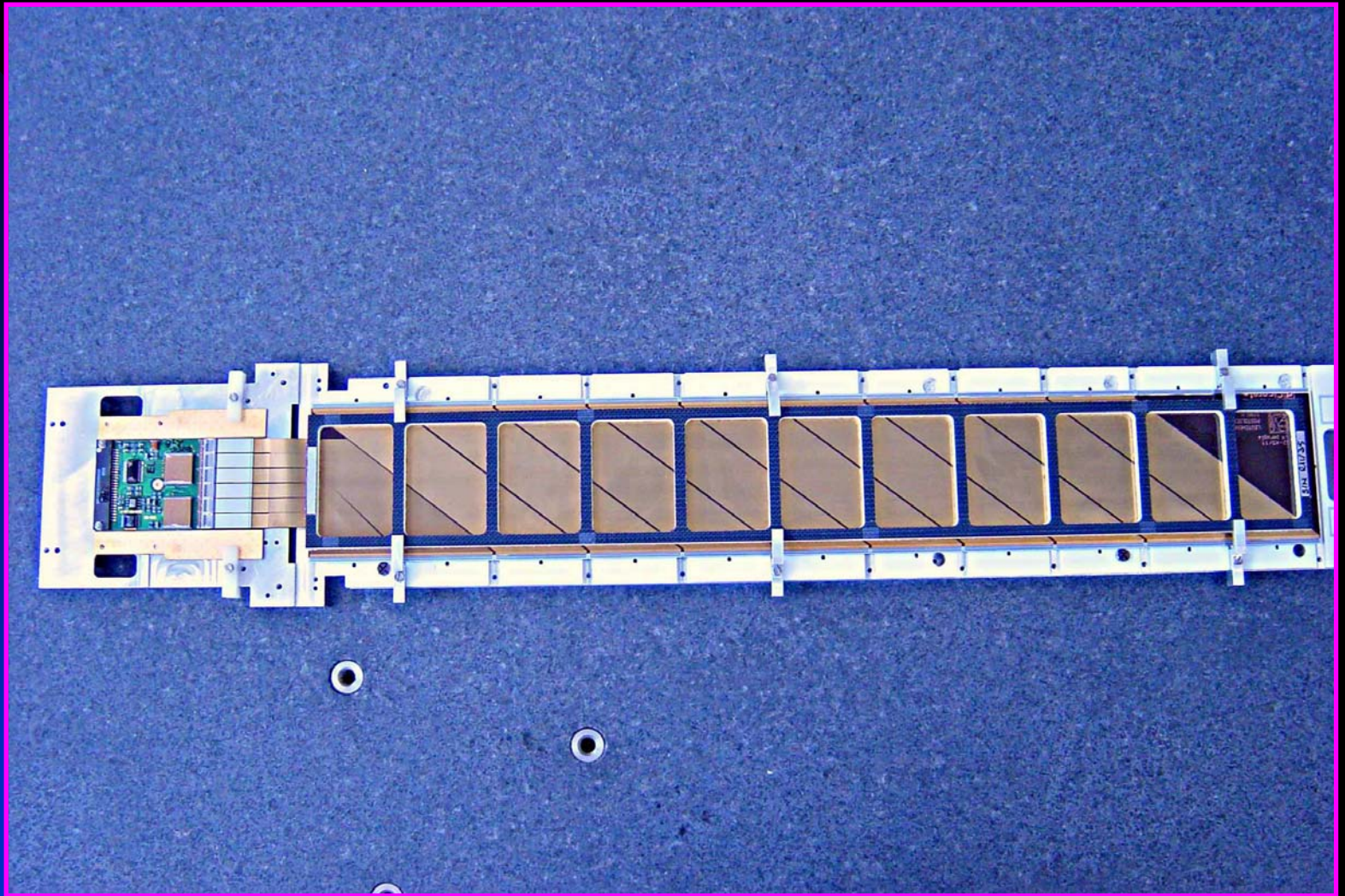
Wire Bond Testing in AMS

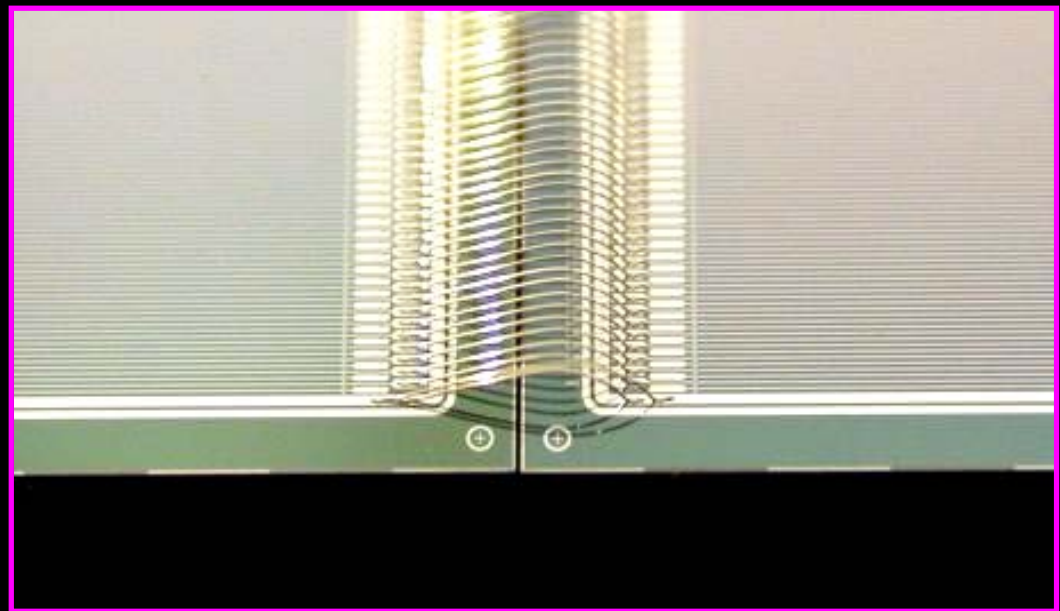
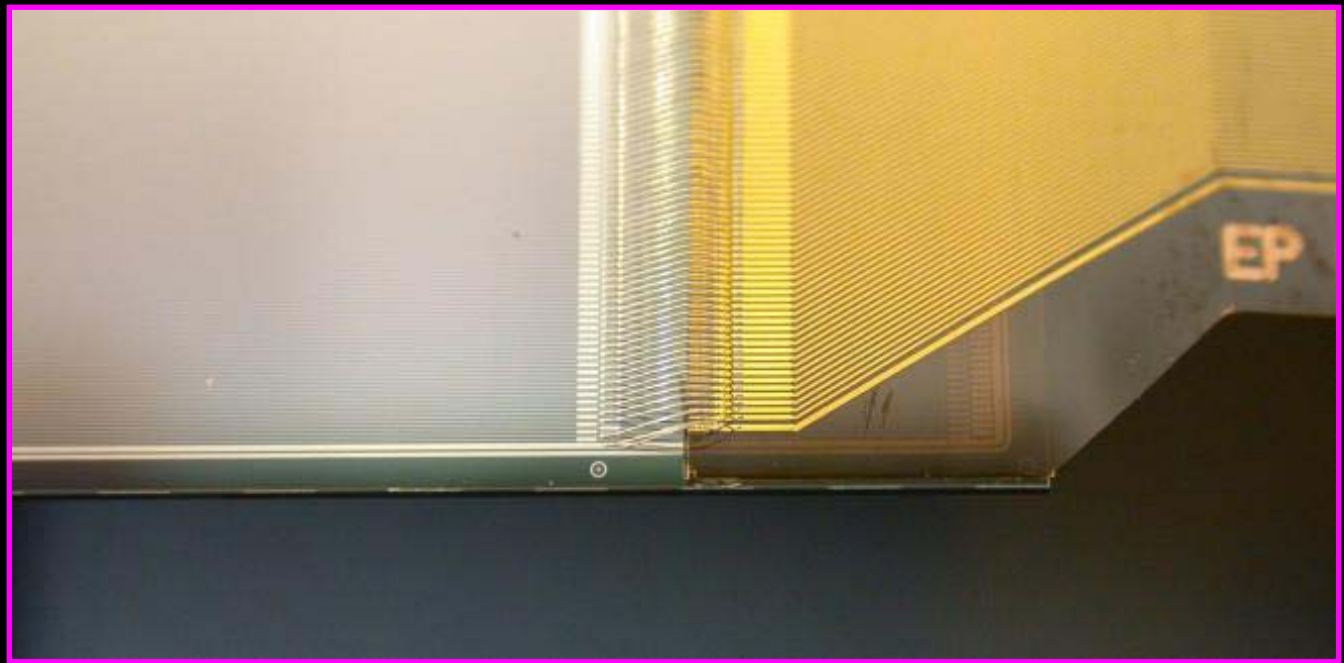
Topics

- 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

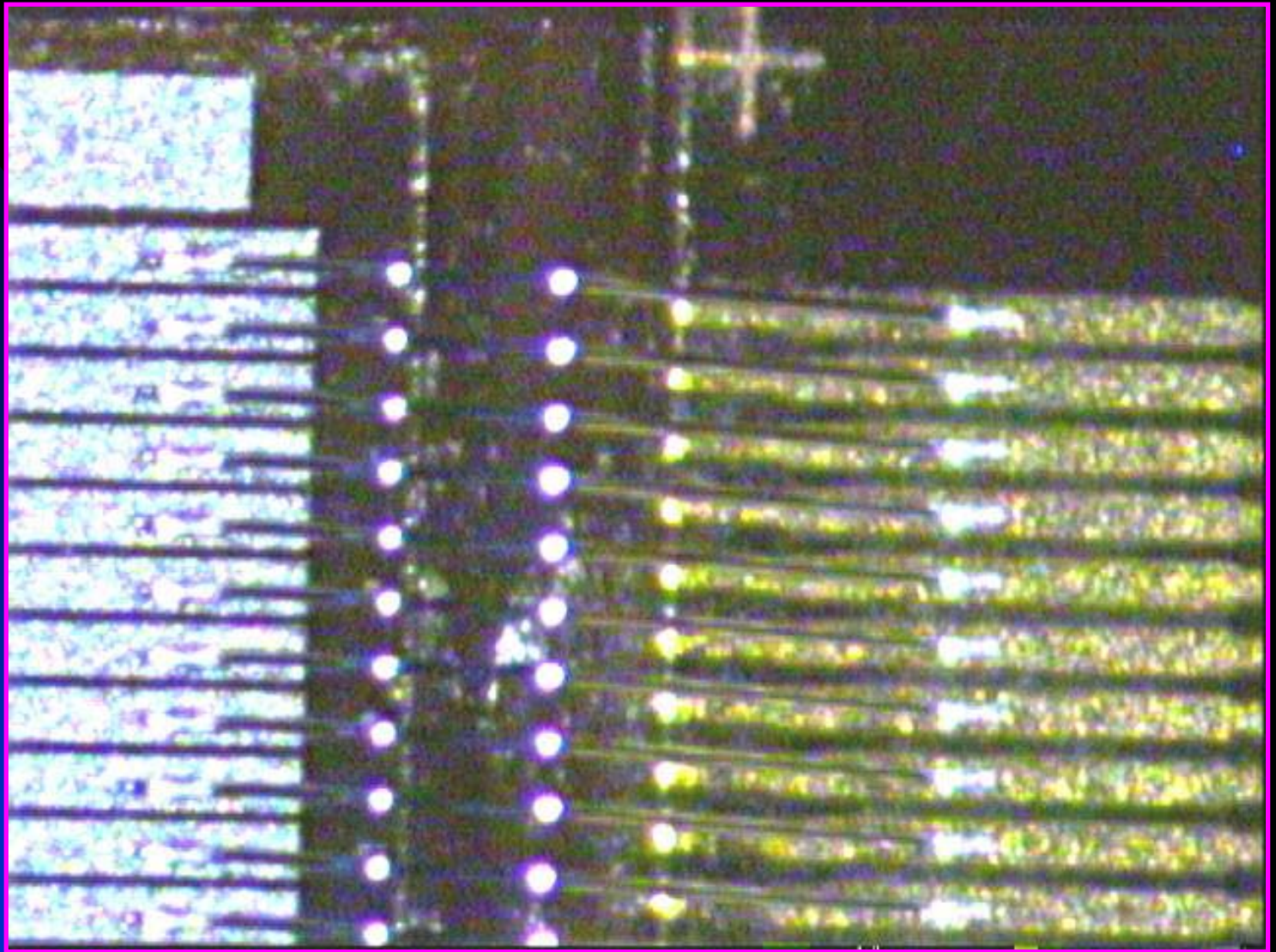
- The AMS-2 silicon tracker counts about 250 (incl. spares) ladders of various lengths
- AMS-2 silicon sensors are 2-sided, with 192x641 strips to connect
- A typical ladder with 12 Si sensors needs more than 12000 bonds
- G & A Engineering is manufacturing on Oricola plant 125 ladders with lengths between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

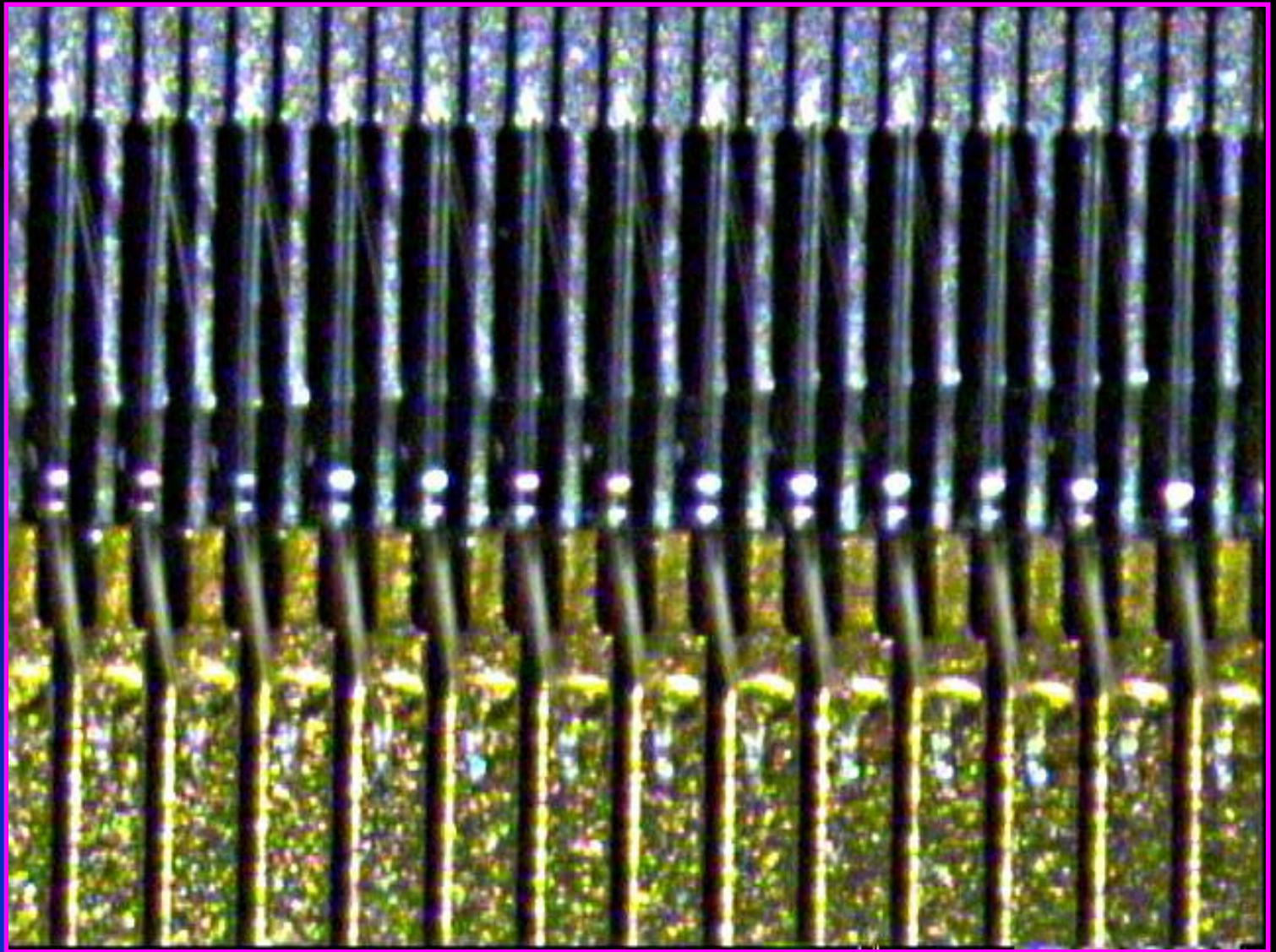


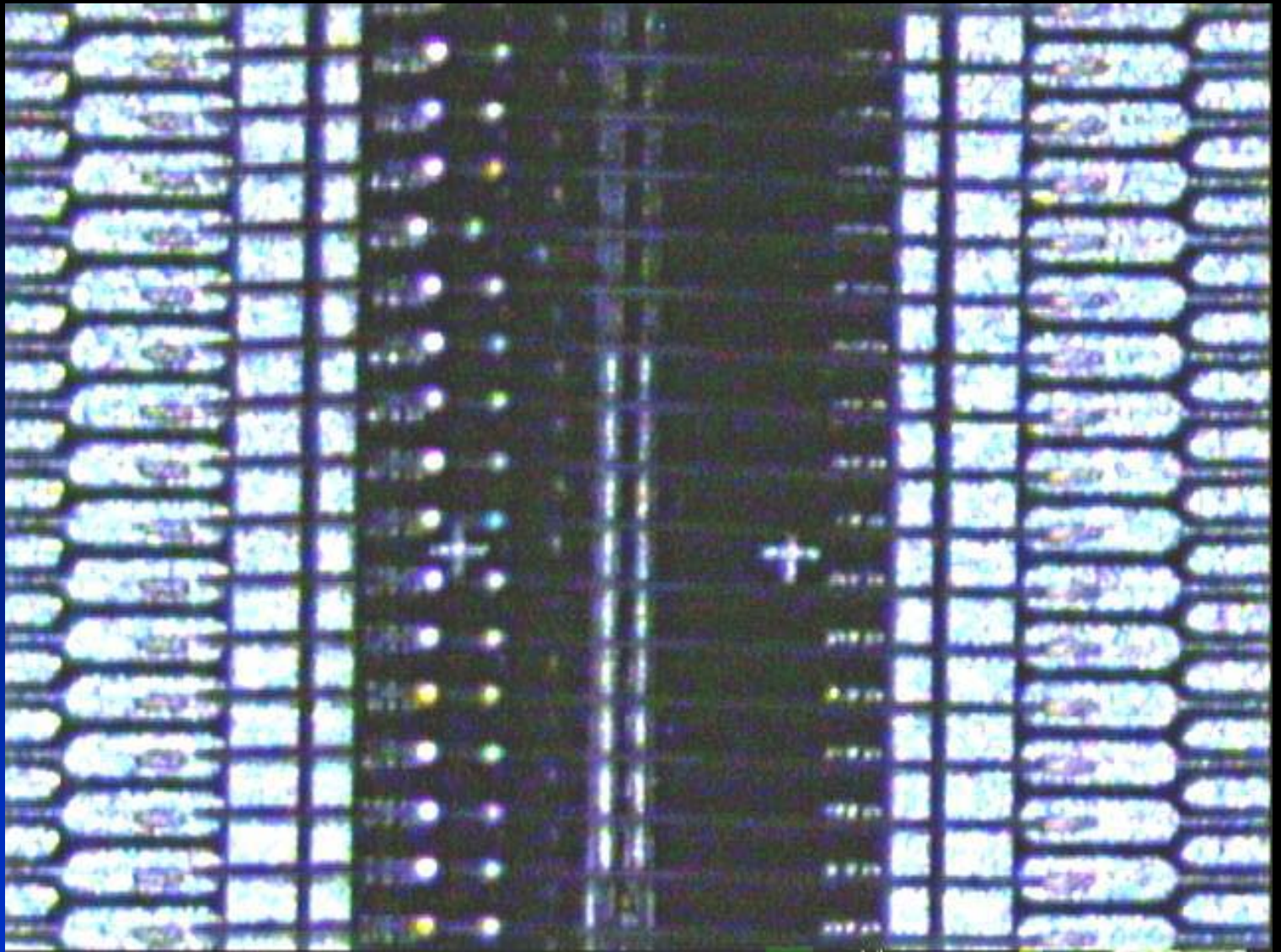


Bonding process issues

- 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







ASI's acceptance criteria

Microsoft Excel - NewAcCrit.xls

File Edit View Insert Format Tools Data Window Help

D19 =

Bond acceptance criteria					
Quantity	lim.	value	unit	remarks	
Upilex-Silicon bonding					
missing bonds	<	0.1	%	max value	
bonds in short with adjacent ch's	<	0.1	%	max value	
bonding strength	>	5	gf	min value during bonding on test structures (bond loop angle 30 degrees)	
bonding strength	>	9	gf	average value during bonding on test structures (bond loop angle 30 degrees)	
Upilex-hybrid bonding					
<i>385 bonds</i>					
missing bonds	<	1	%	max value	
bonds in short with adjacent ch's	<	1	%	max value	
bonding strength	>	5	gf	min value during bonding on test structures (bond loop angle 30 degrees)	
bonding strength	>	9	gf	average value during bonding on test structures (bond loop angle 30 degrees)	
Silicon-Silicon bonding					
<i>644*(n-1) = 9016 bonds max</i>					
missing bonds	<	0.1	%	max value	
bonds in short with adjacent ch's	<	0.1	%	max value	
bonding strength	>	5	gf	min value during bonding on test structures (bond loop angle 30 degrees)	
bonding strength	>	9	gf	average value during bonding on test structures (bond loop angle 30 degrees)	

Sheet1

Ready

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