Fan-in Tests

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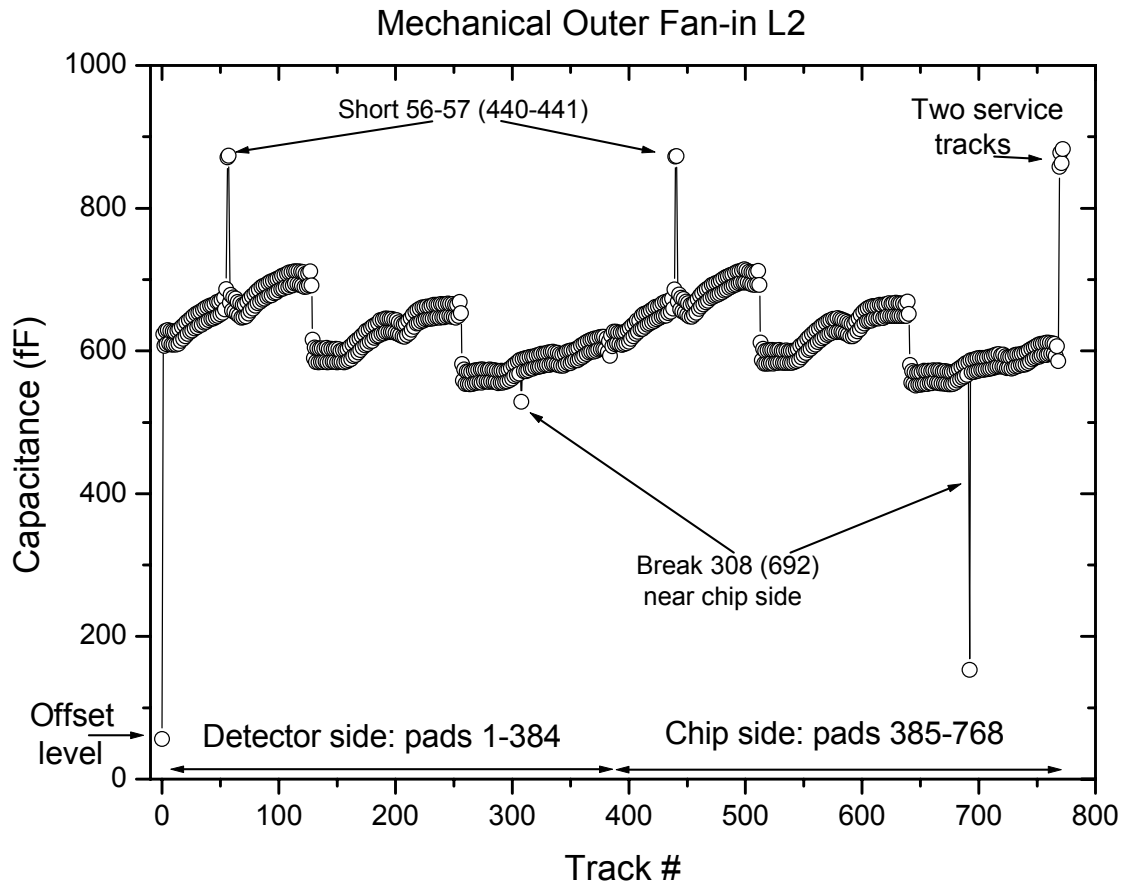
Lancaster University group has set a LabView program for scanning of the fan-ins. Six type of fan-ins: for Outer, Middle and Inner modules (left and right versions for each one) can be tested. In the scan the capacitance of each track relative to the fan-in backside placed on the chuck is measured from both detector and chip side. A short between tracks appears as an increase in the capacitance. A break leads to a drop in the capacitance, which for one of the two track measurements should be > 50%. The measurements are made at 100kHz frequency. A typical capacitance value is ~0.5pF and the relative measurement accuracy is several percent. Below is an example of the scan results performed for a mechanical fan-in.

At a steady state one person can test ~8 fan-ins (2 module sets) per day. The trial test of 30 good fan-ins revealed only 3 defects on two of the fan-ins. Two of these defects could be found by optical inspection. Since all the fan-ins pass the optical QA check at CNM (Barcelona) it was decided to perform the scans for only ~10% of the fan-ins. These should be either the samples looking suspicious at the visual input control at Manchester or just randomly selected fan-ins.

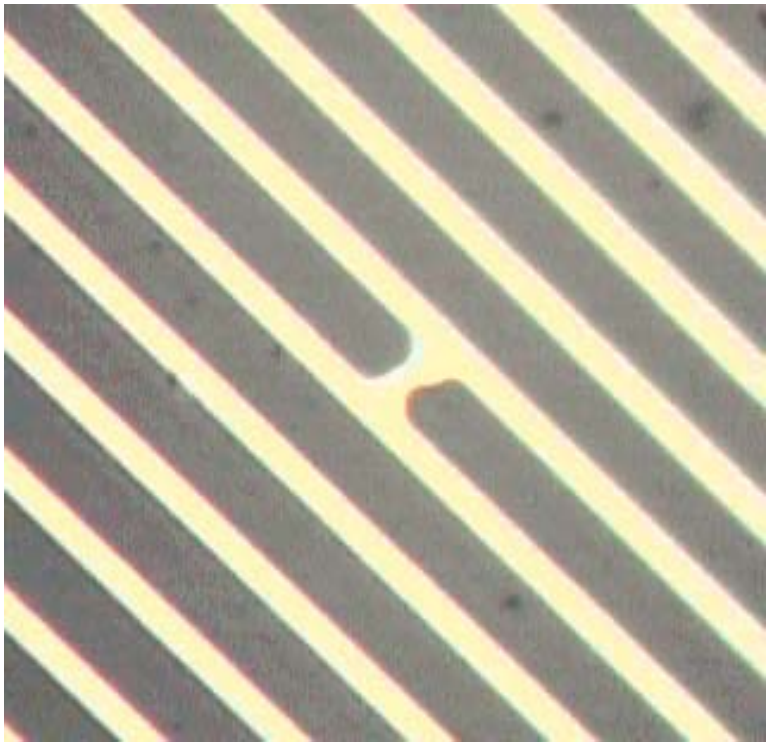


The fan-in is placed on the chuck and for each track its capacitance to the chuck is measured twice: at the detector side and at the chip side pads. Pad numbering is shown at the plot. The capacitance for two service tracks is also measured (pads 769-772). The offset C value is defined by positioning the probe needle outside the fan-in area (pad 0).

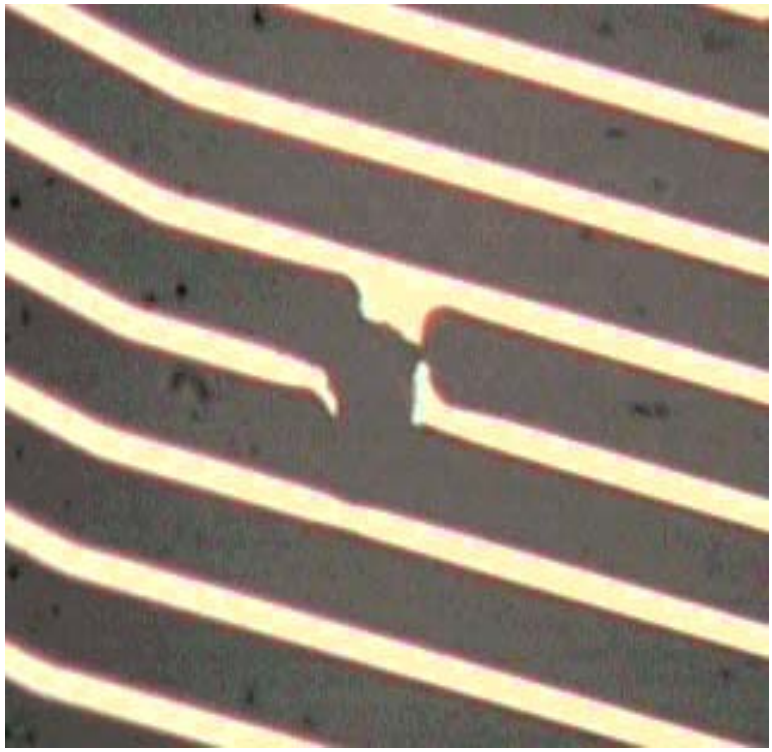
Shorts between tracks appear as an increased C for two adjacent pads at both sides. A break leads to a drop in C at both sides and at least for one side the drop is more than 50%.

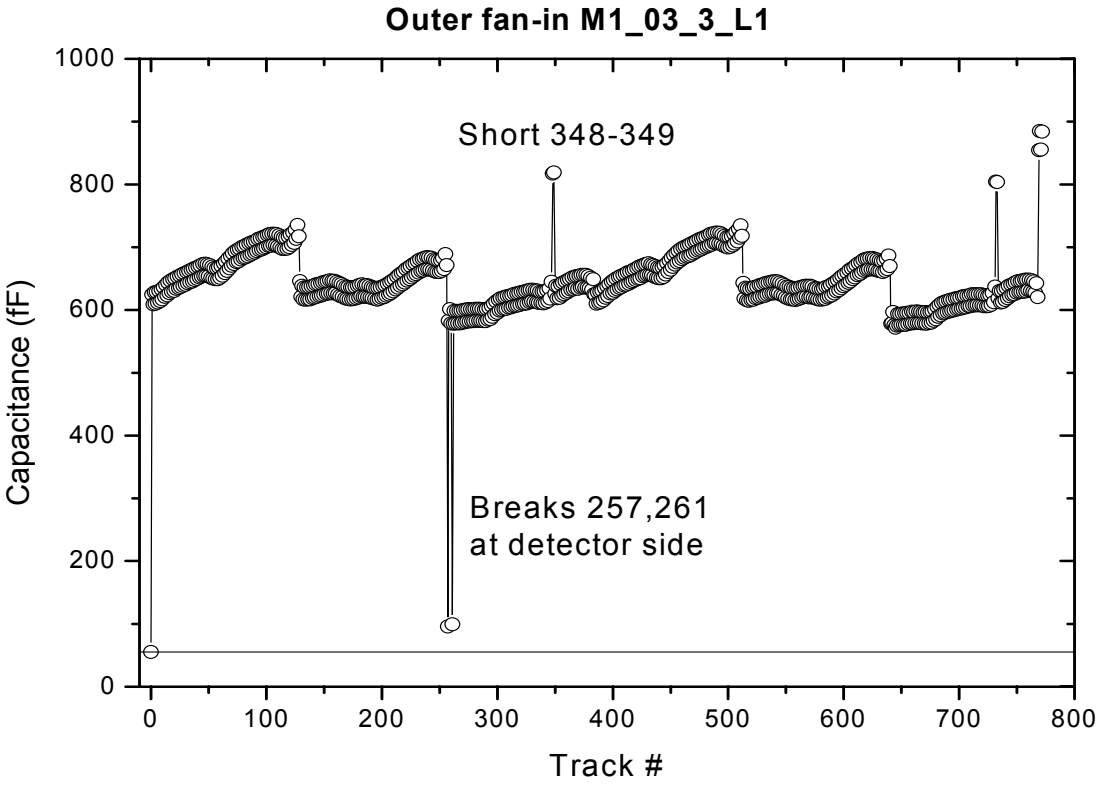
For this fan-in rejected previously by a visual inspection the sources of the break and the short were clearly identifiable visually (see below).

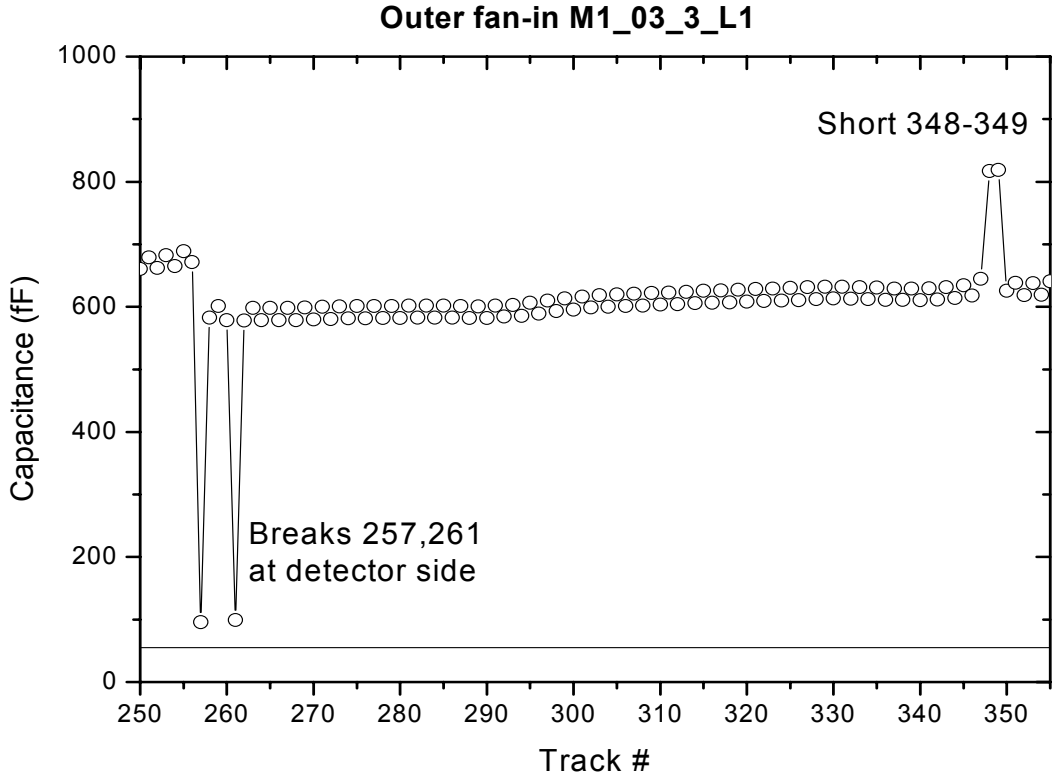
Mechanical fan-in L2: short between tracks 56-57

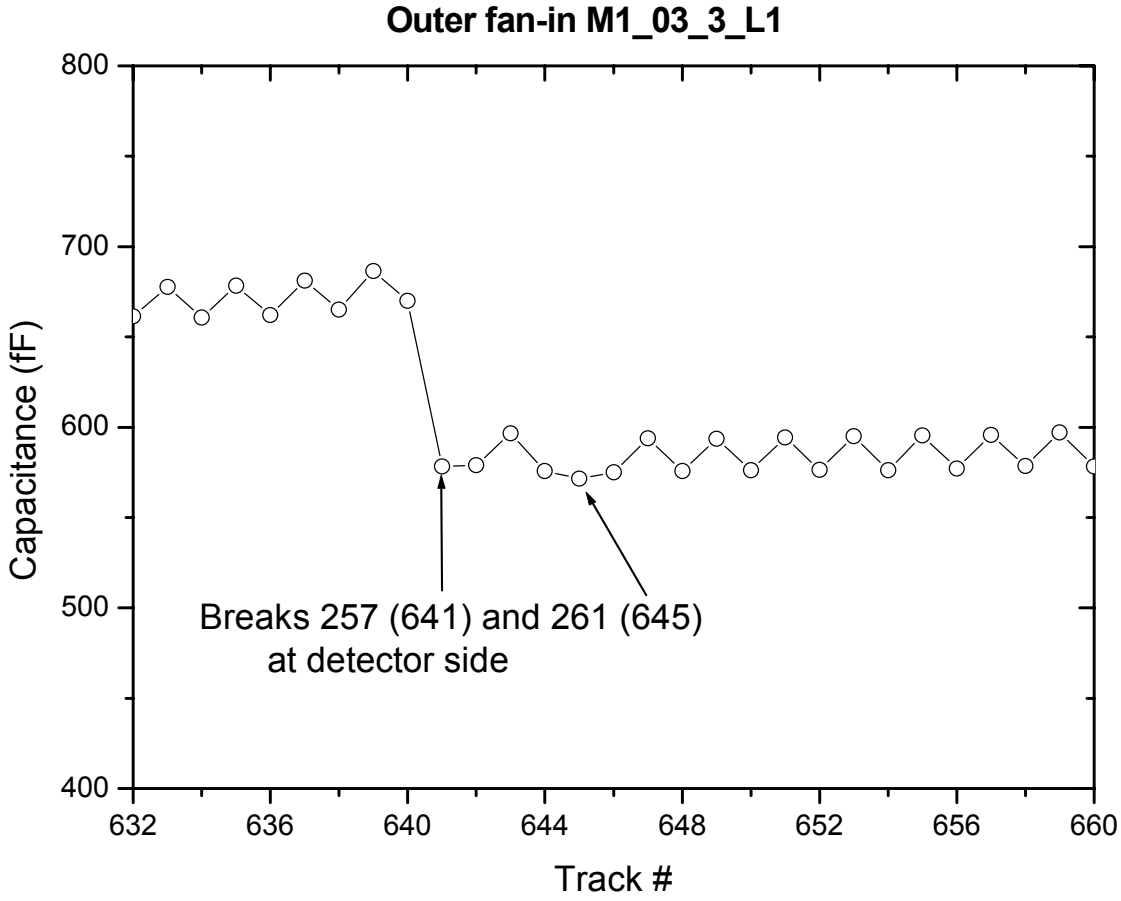


Mechanical fan-in L2: break at track 308




Outer fan-in M1_03_3_L1
Short 348-349
Breaks 257,261
at detector side
Capacitance (fF)
Track #
0
200
400
600
800
1000
0
100
200
300
400
500
600
700
800

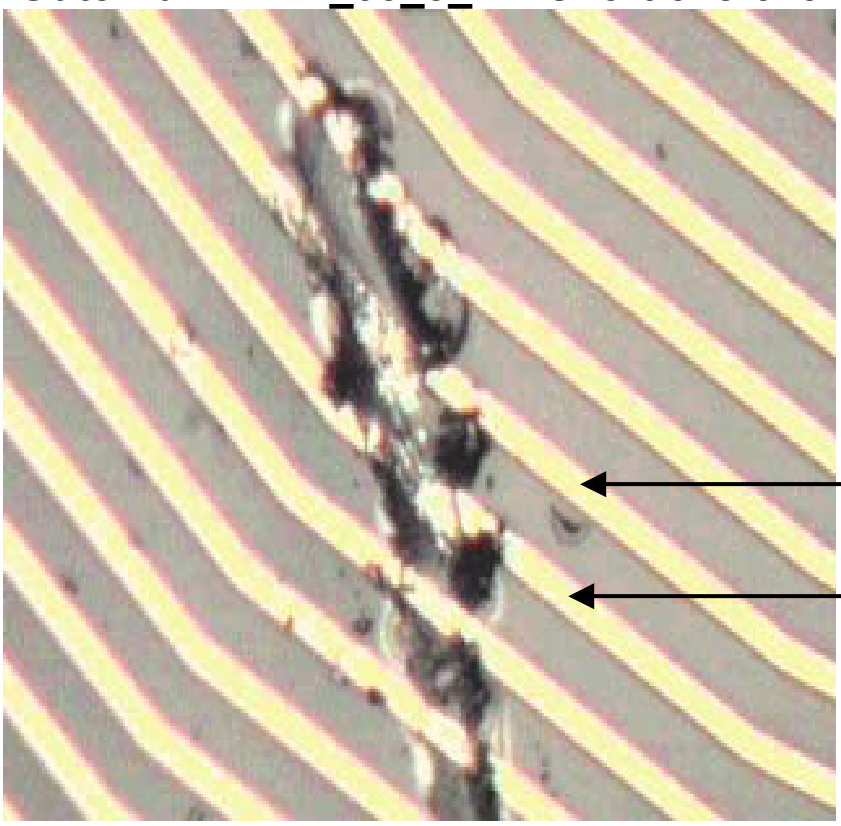

Outer fan-in M1_03_3_L1
Short 348-349
Breaks 257,261
at detector side
Capacitance (fF)
Track #
0
200
400
600
800
1000
250
260
270
280
290
300
310
320
330
340
350



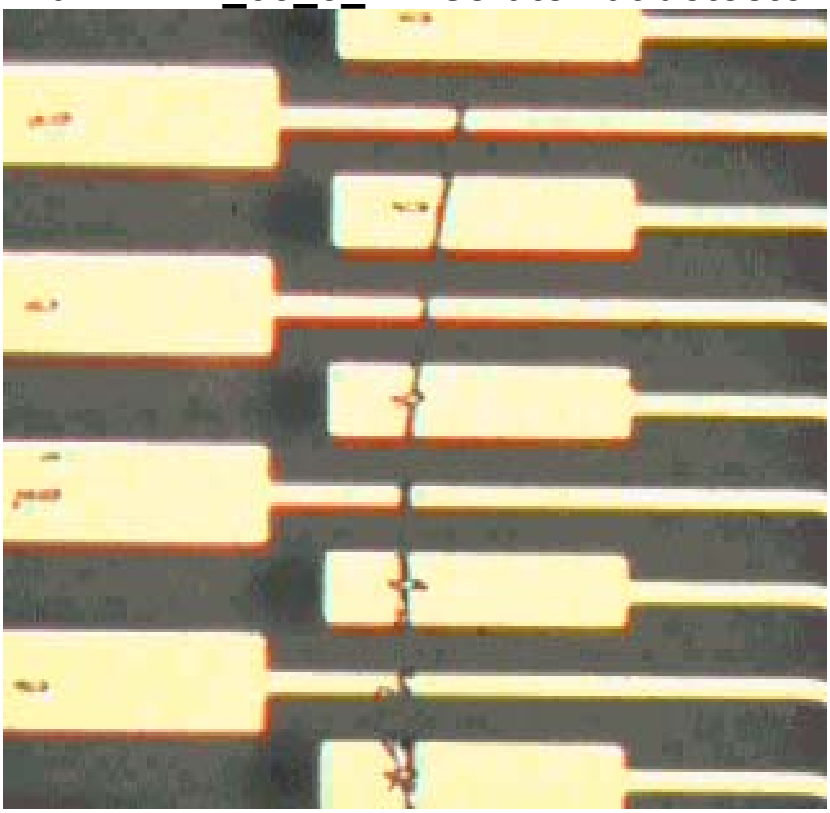
The break is so close to the detector side that the drops in C at the chip side are noticeable, but just. This explains why the measurements from both sides are necessary for reliable testing.

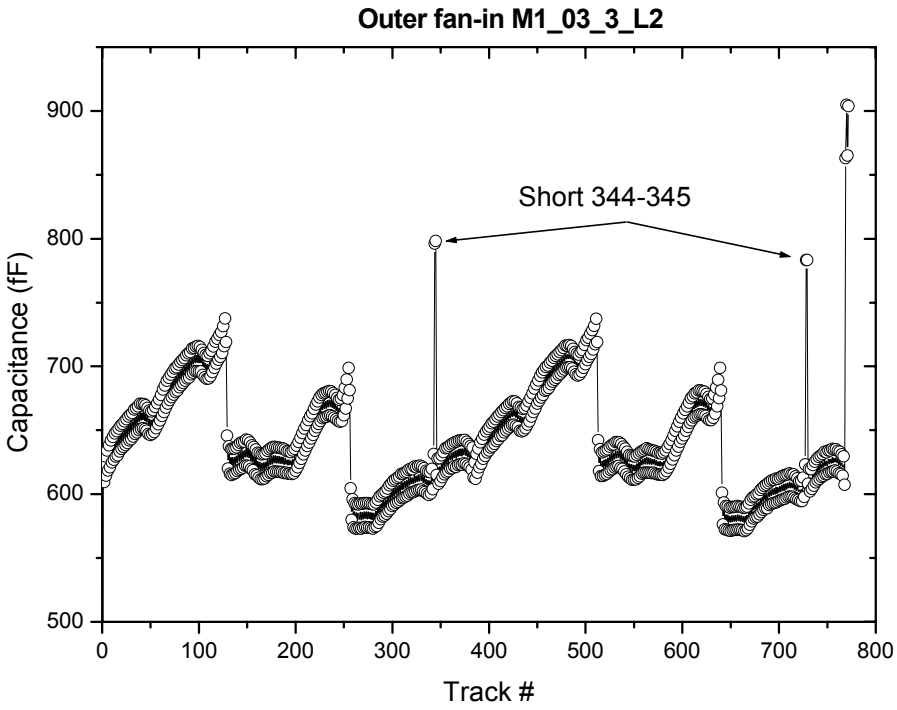
Optical inspection revealed the reasons for the short and breaks as shown below. Note that the strip 259 shows no break electrically in spite of the scratch through it looking identical to those at strips 257 and 261. A similar scratch at ~ pad 350 did not lead to any electrical defects. Hence not all suspiciously looking defects lead to the electrical defects.

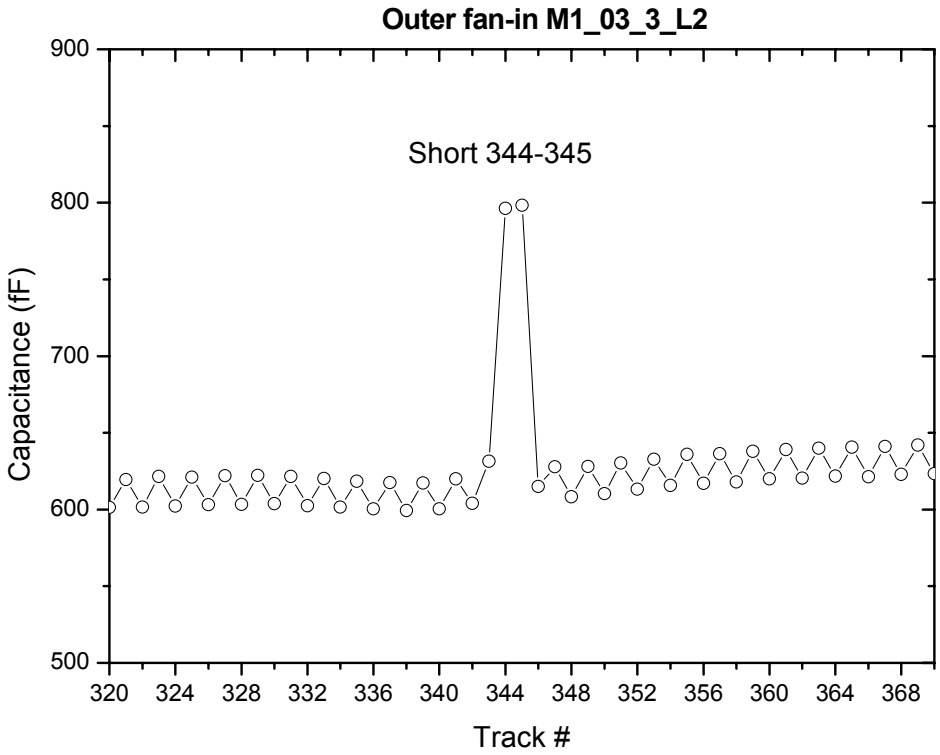
Outer fan-in M1_03_3_L1: short 348-349



Outer fan-in M1_03_3_L1: scratch at detector side







Visual inspection did not reveal any obvious reasons for the short at this fan-in. Hence not all electrical defects can be found visually.

Additional remarks

1. There is a considerable amount of dust at the fan-in surfaces. After each scan of 768 pads the tip of the probe needle invariably had one or several dust specks. Normally this does not happen after the same amount of pads probed in the detector scan. More attention is needed to the conditions in which the fan-ins are cut, packed/unpacked and stored.

2. In some cases the colour of the pads is not usual bright yellowish but a dull reddish, as if the surface is covered by a thin film. A clear example is the fan-in OF_M1_03_1_R1 (chip side pads). First group of 128 pads exhibits this phenomenon very vividly. After the scan of this fan-in I had to repeat the measurements at 19 out of these 128 pads because of a poor quality contact during the scan. In the second probing they were all OK. Usually this problem does not appear for more than a couple of pads out of 768. Hence there is clearly a problem in probing these discoloured pads. It is worth to check their bondability.

3. At the backside of the fan-ins there are burrs or "lips" along the edges left after the cuts. They may become partially loose and creep over the pads obstructing probing as happened in the scan of the fan-in OF_M1_03_8_R1. As I have learned from Steve Snow these “lips” may also lead to alignment problems. I believe the burrs have to be eliminated by a complete through cut.