



Honeycomb Panels



CMS BARREL MUON DT CHAMBERS

Check of Honeycomb Panels from new batch

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Measurement



Panels:

- MB1 size panels
- 2 from old batch
- 6 from batch 020322; are 3 pairs produced under different conditions, to optimize production parameters - mainly flatness.

Aim:

Check improvements of new batch, concerning cleanliness, diagonals and flatness. Give rapid feedback to producer.

Inspected and Measured:

- No rests of glue left (especially in grooves). **Still to be improved.**
- No dust left. **Still to be improved.**
- No damage of precision holes and small threaded holes for alignment forks. **Protection during aggressive cleaning not yet done.**
- Thickness along border (every 300 mm). **Is o.k.**
- Width, length, diagonal. **Dimensions o.k.; difference of diagonals still too large in 2 (out of 6) cases.**
- Distance between the edges of the skins and corresponding edges of the profiles; should be < 1 mm. **Is zero along the length (2458 mm) and 2 to 7 mm along the width (2033 mm for MB1). Is o.k.?**
- Height over flat table (100 mm x 100 mm grid, 550 points), for each face, measured with coordinatograph. **See data.**



Arrival, Inspection, ...



6 Honeycomb panels MB1, received 020322

HR 0203

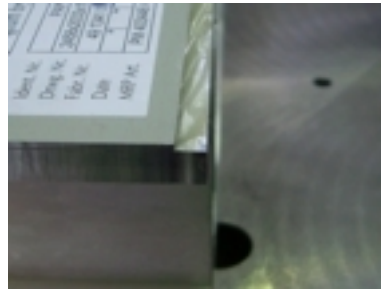


HR 0203

Glue rests in groove are visible; also dirt in profiles (mainly glue rests, from grinding).



HR 0203

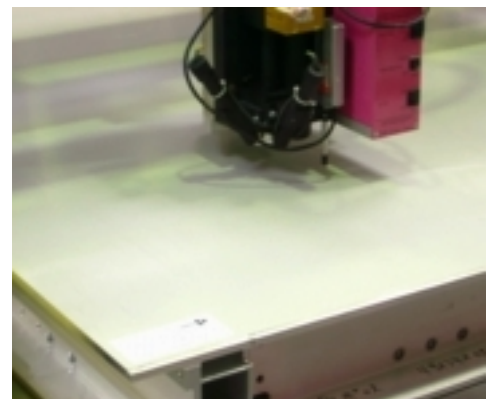


HR 0203

Skin matches exactly the border of the 2.5 m long c-profiles and is retracted by 2 to 7 mm along the other two borders (both ends of same border shown here).



Placing a panel on the flat table for measurement.



HR 0203

Measuring height over flat table (100 mm x 100 mm grid, 572 points on each face)

Measurements on honeycomb panels, batch ser. 06 to 11, March 2002.

Panel serial no. Ac Hexcel	face	min. height [mm]	max. height [mm]	diff. height [mm]	min. thickness [mm]	max. thickness [mm]	diff. thickness [mm]	first diagonal [mm]	second diagonal [mm]	diff. diagonal [mm]	width MB1 [mm]	width MB1 [mm]	length [mm]	length [mm]
01 01A	top	128.4	129.5	1.1	=	=	=	-	-	-	-	-	-	-
01 01A	bottom	128.7	129.6	0.9	128.19	128.88	0.69	3188	3190	2	2033.5	2032.0	2458	2458
02 02A	top	128.2	131.2	3.0	=	=	=	-	-	-	-	-	-	-
02 02A	bottom	128.4	129.0	0.6	128.20	128.63	0.43	3191	3188	3	2032.0	2033.0	2458	2458
03 03A	top	-	-	-	128.20	128.83	0.63	3187	3188	1	2031.5	2033.0	2458	2457.5
03 03A	bottom	-	-	-	=	=	=	-	-	-	-	-	-	-
06 01	top	128.4	129.1	0.7	=	=	=	-	-	-	-	-	-	-
06 01	bottom	128.5	129.5	1.0	128.28	128.85	0.57	3189	3188	1	2032.0	2031.5	2458	2458
07 02	top	128.5	129.8	1.3	=	=	=	-	-	-	-	-	-	-
07 02	bottom	*	*	2.0	128.05	128.92	0.87	3186	3188	2	2032.0	2031.5	2458	2458
08 03	top	128.4	129.2	0.8	=	=	=	-	-	-	-	-	-	-
08 03	bottom	128.4	129.0	0.6	128.40	128.65	0.25	3186	3191	5	2032.0	2032.0	2457	2457
09 04	top	128.4	129.3	0.9	=	=	=	-	-	-	-	-	-	-
09 04	bottom	128.6	129.3	0.7	128.38	128.95	0.57	3188	3190	2	2031.5	2032.0	2458	2458
10 05	top	128.3	129.5	1.2	=	=	=	-	-	-	-	-	-	-
10 05	bottom	128.2	129.5	1.3	128.15	128.95	0.80	3186	3191	5	2031.0	2032.0	2457	2457.5
11 06	top	128.6	130.1	1.5	=	=	=	-	-	-	-	-	-	-
11 06	bottom	128.3	129.7	1.4	128.25	128.92	0.67	3186	3190	4	2032.0	2032.0	2458	2458
Required [1]:														HR 020390
>127.5 <131.0 <3.0 >127.50 <128.50 <1.00														<3 2031 to 2034 2456 to 2460

Remarks:

- Height is height above a flat table; "diff. height" limit is sum of thickness and nonplanarity tolerances.
- Serial numbers: Aachen is numbering through; first batch was 5, recent batch 6, total 11 panels.
- Top face is face where the Hexcel label was placed (new batch).
- Panels 01 and 02 (old batch): (re)-measured now.
- Panel 03: outer dimensions shown are from old measurement.
- Panel 07, bottom face, all points measured, although the common reference height is unknown.

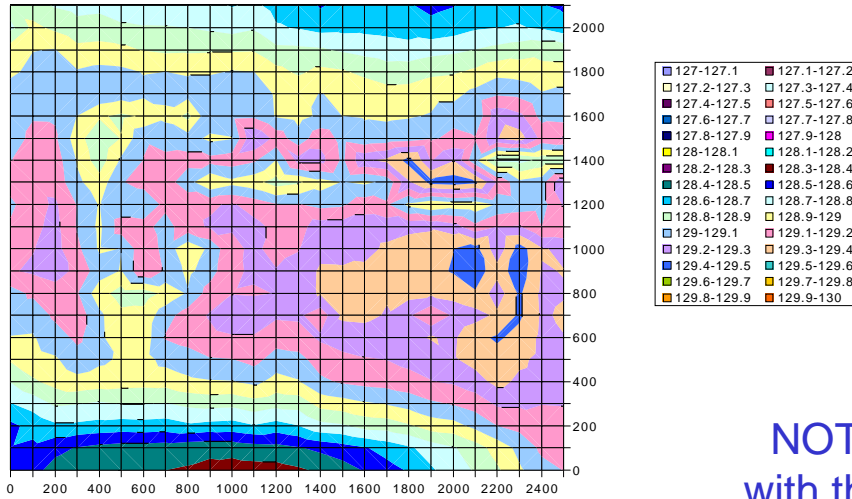
[1] Report hexcel_001003 / M. Benettoni, 14 panels
Tender IT-2728/EP/CMS
Statement Hexcel: nonplanarity < 2 mm

Required:
Thickness = 128 +0.5 -0.5 mm
Width = w +1 -2 mm; w(MB1) = 2033 mm
Length = 2458 + 2 -2 mm
Thus diagonal(MB1) = 3187.0 to 3192.0 mm
Diff. between diagonals <3 mm



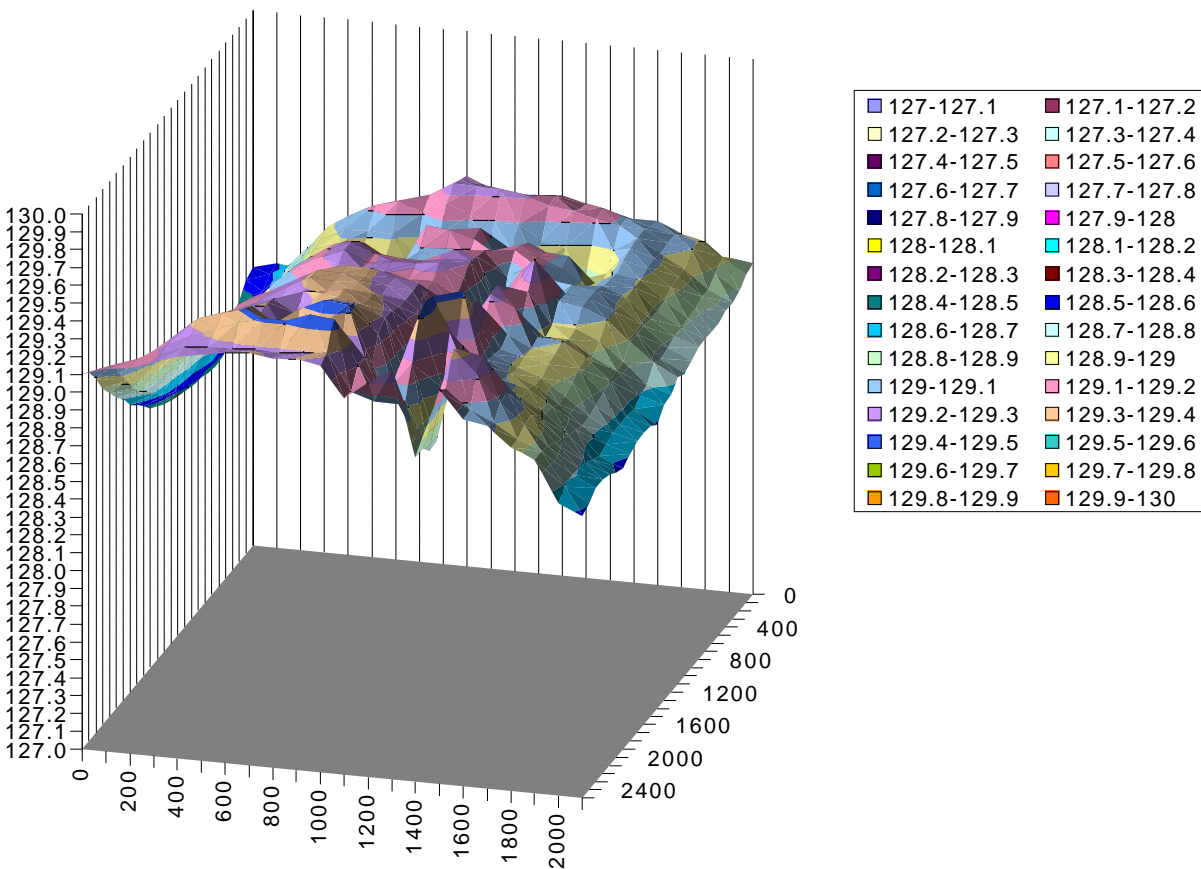
Panel 01 Top Face

Height col



NOTE that to compare with the image below one has to turn by 90 deg

Height 3D col

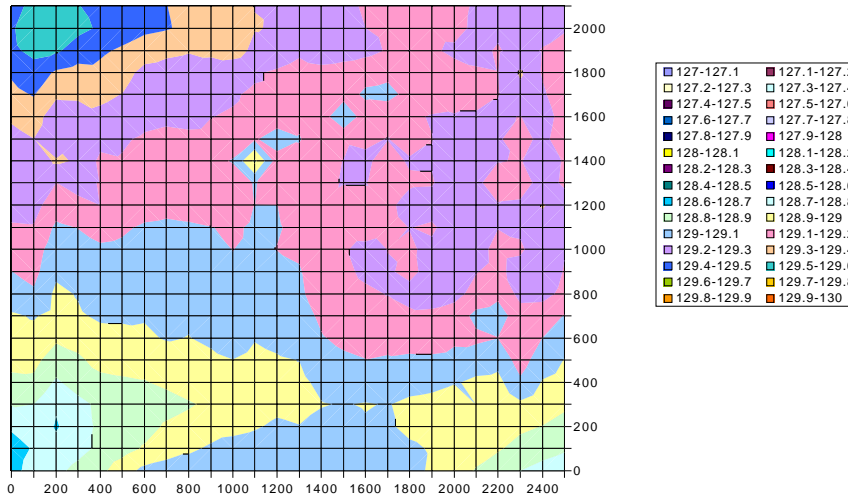




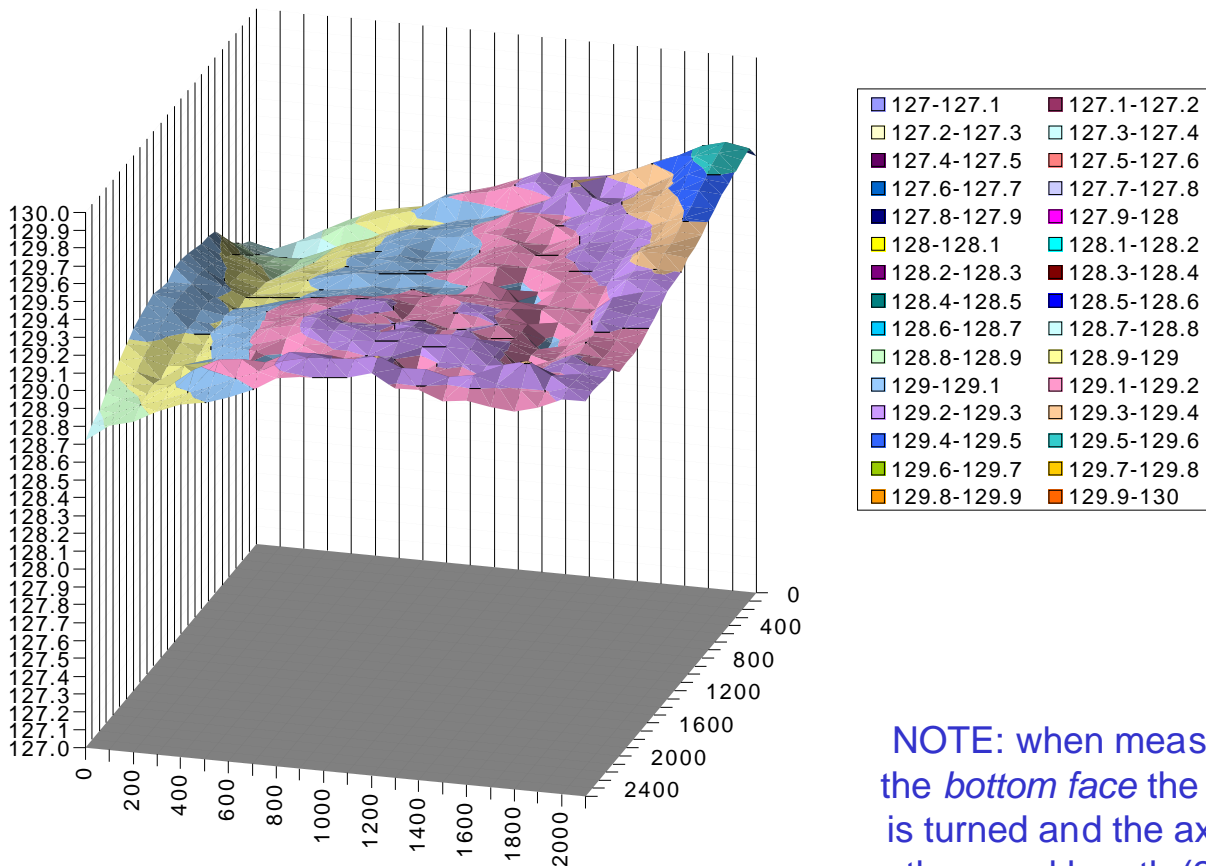
Panel 01 Bottom Face



Height col



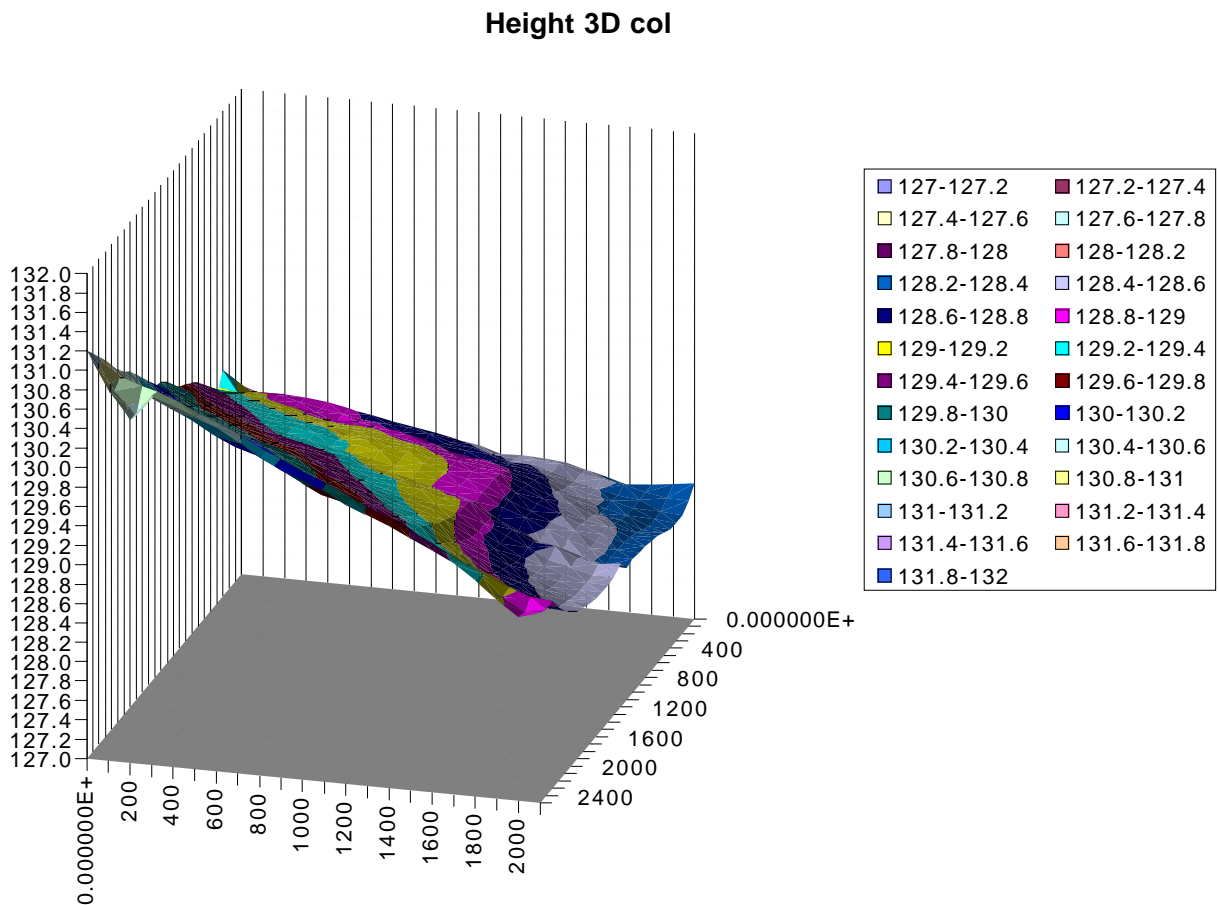
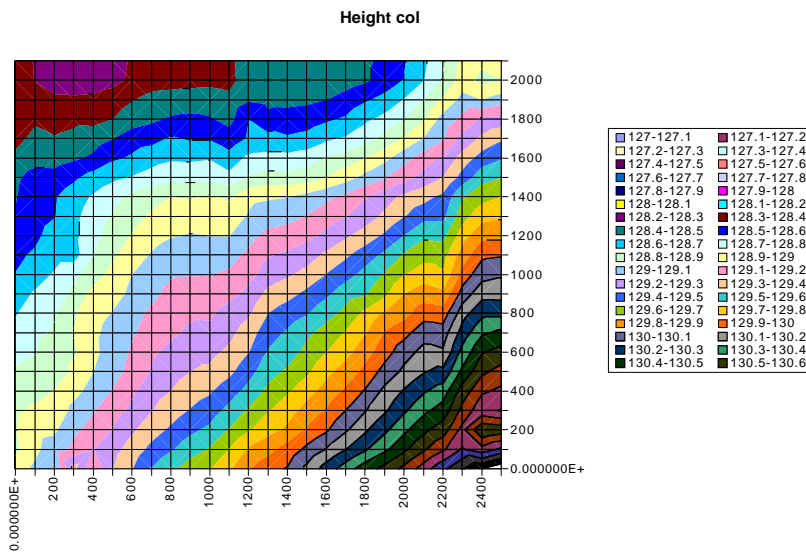
Height 3D col



NOTE: when measuring the *bottom face* the panel is turned and the axis for the panel length (2458 mm) appears reversed.



Panel 02 Top Face

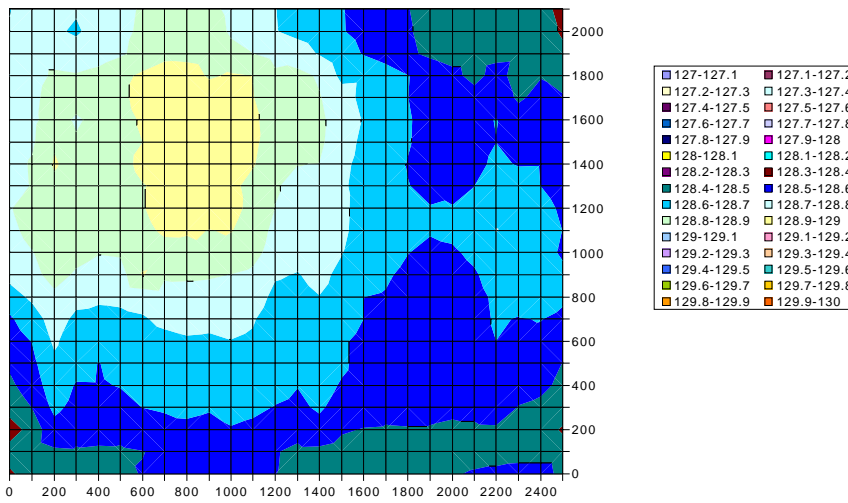




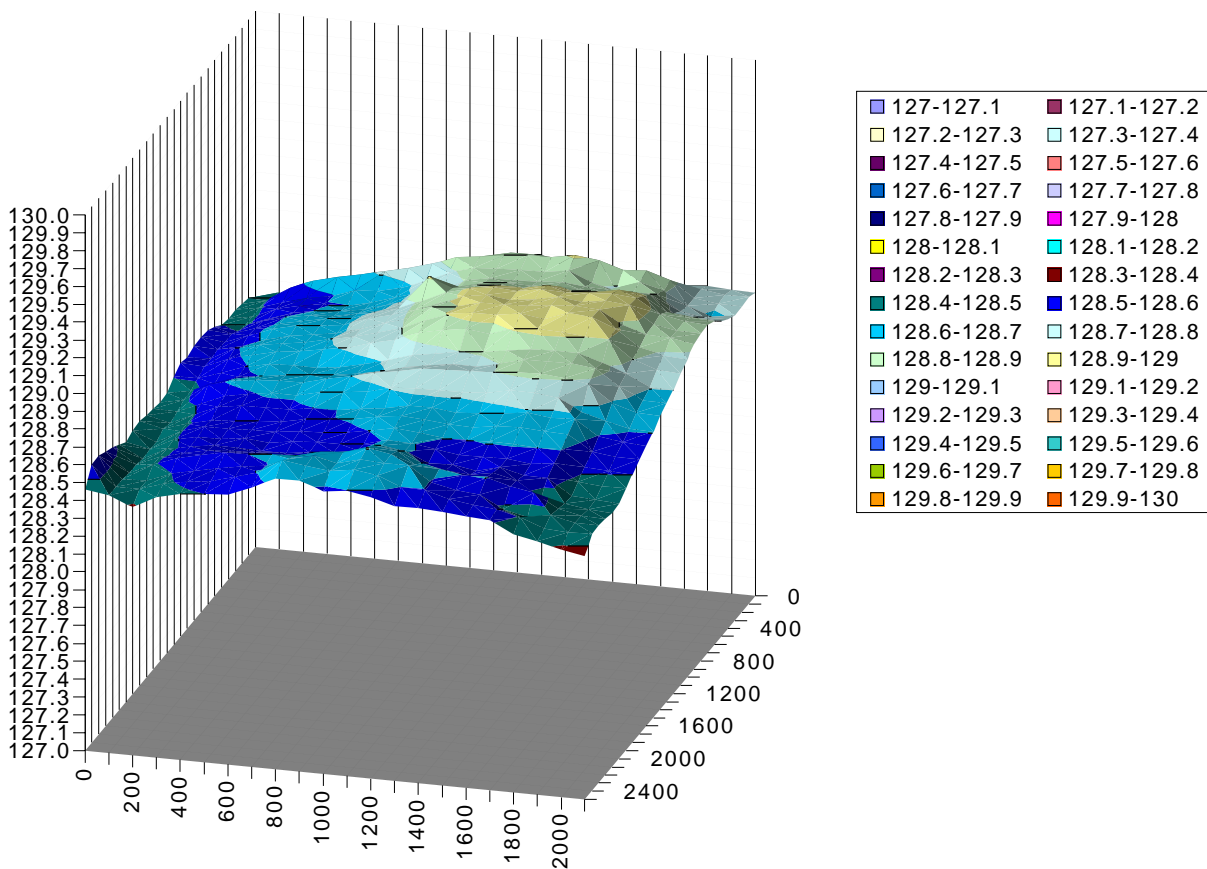
Panel 02 Bottom Face



Height col



Height 3D col

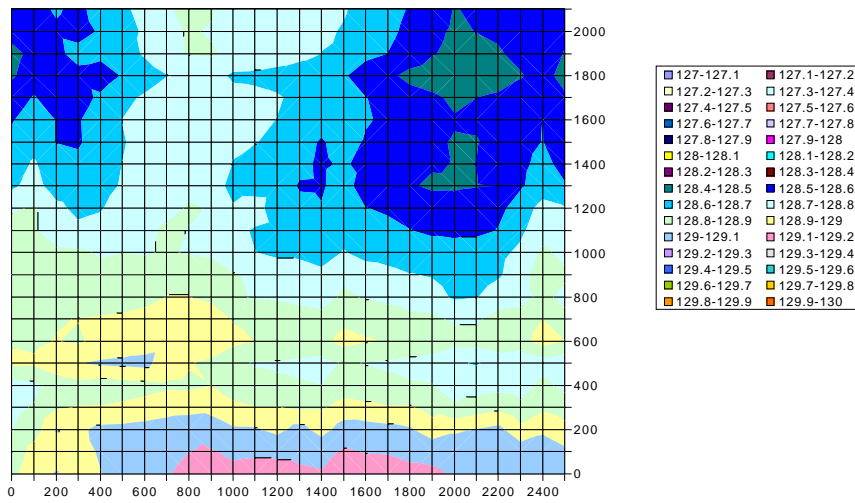




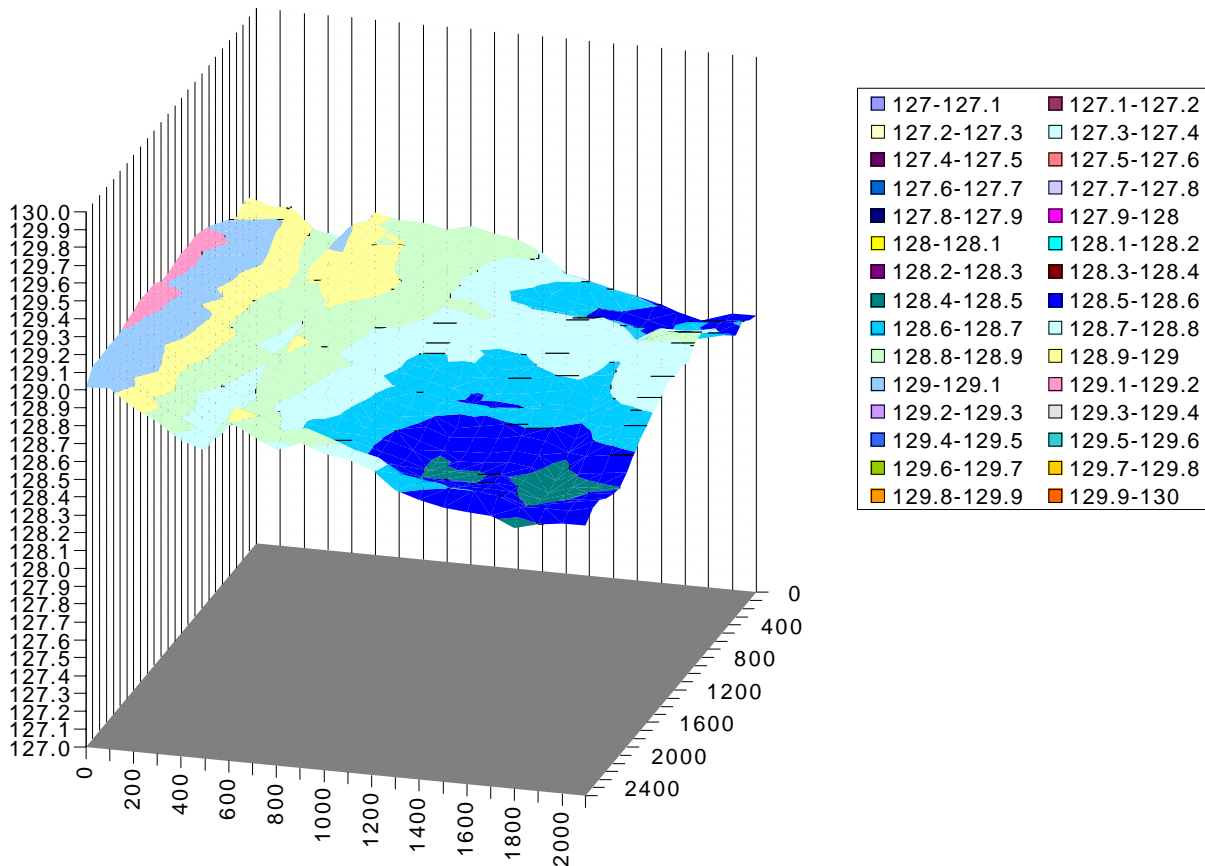
Panel 06 Top Face



Height col



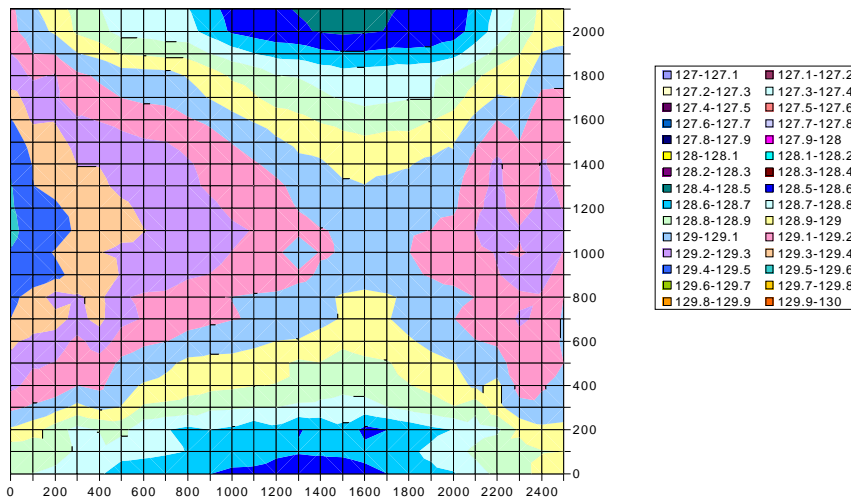
Height 3D col



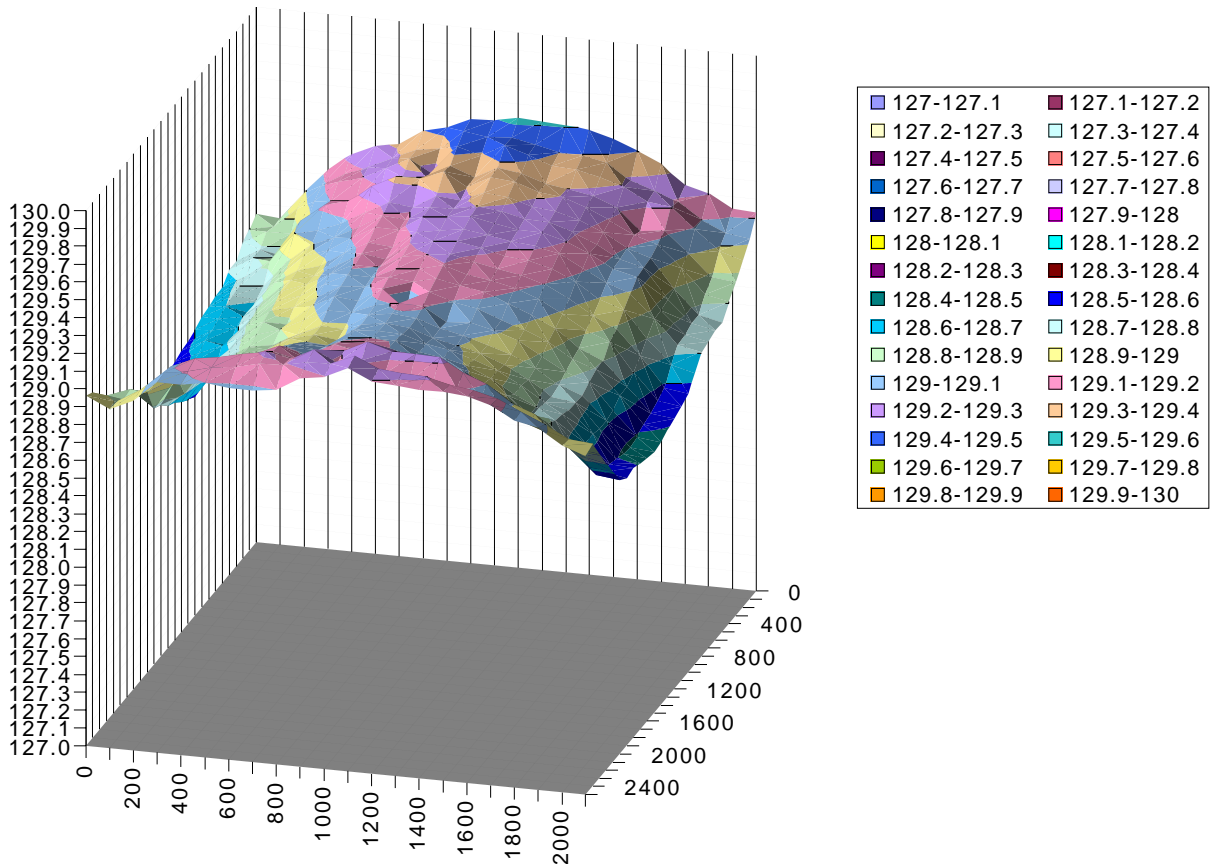


Panel 06 Bottom Face

Height col



Height 3D col

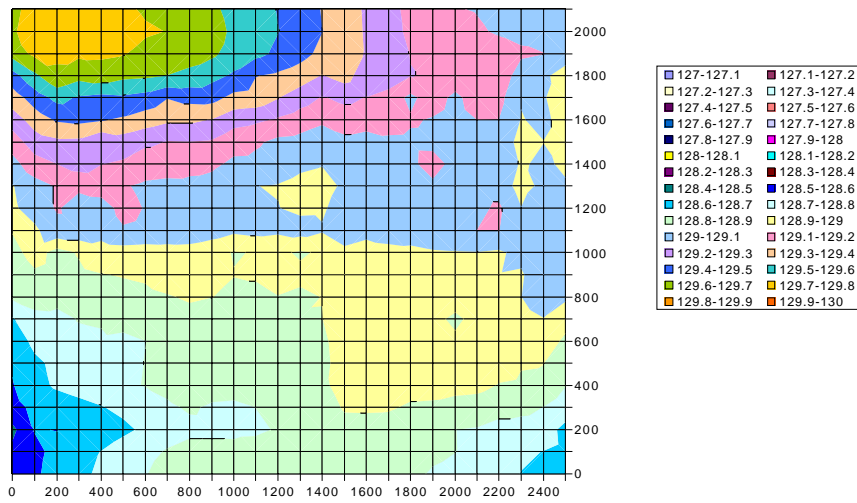




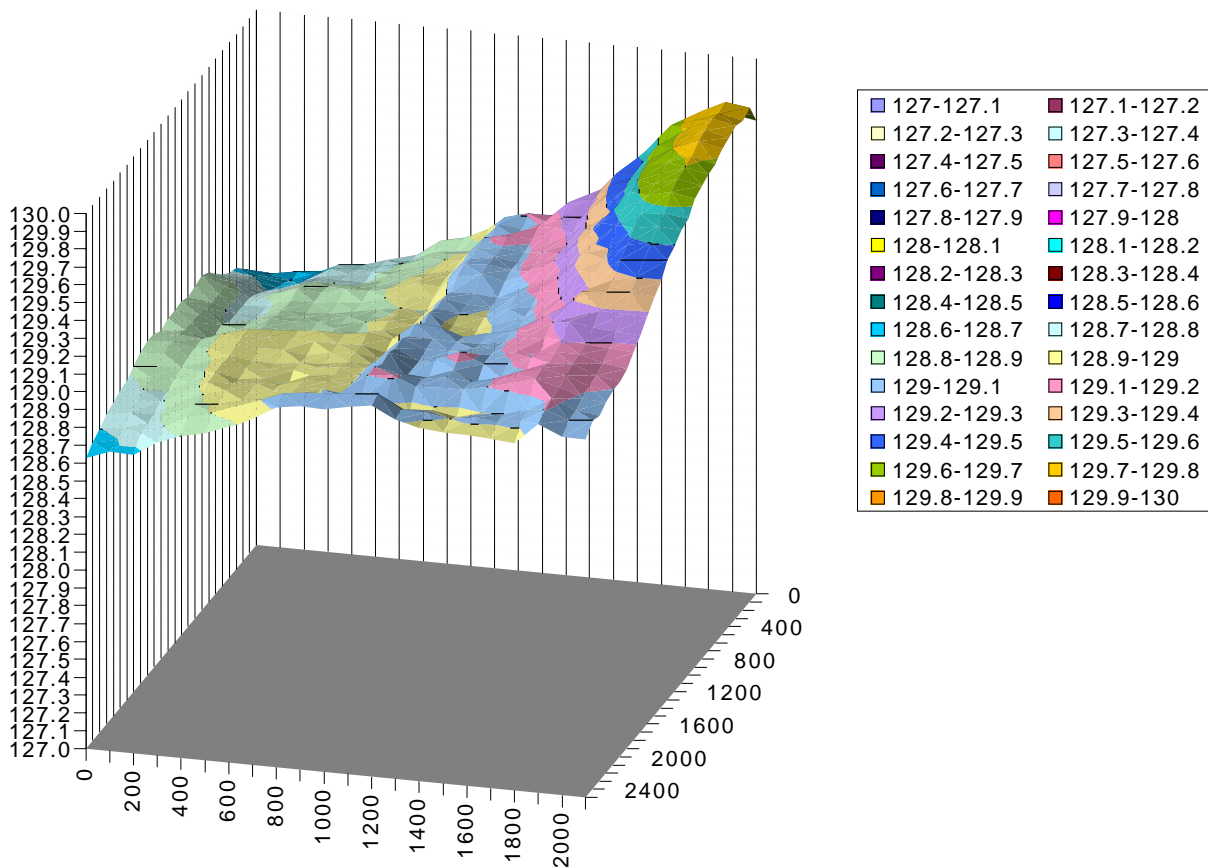
Panel 07 Top Face



Height col



Height 3D col

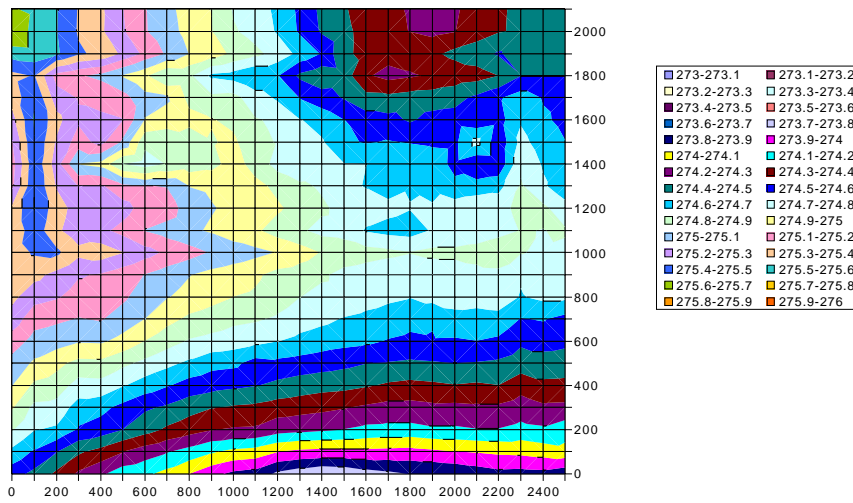




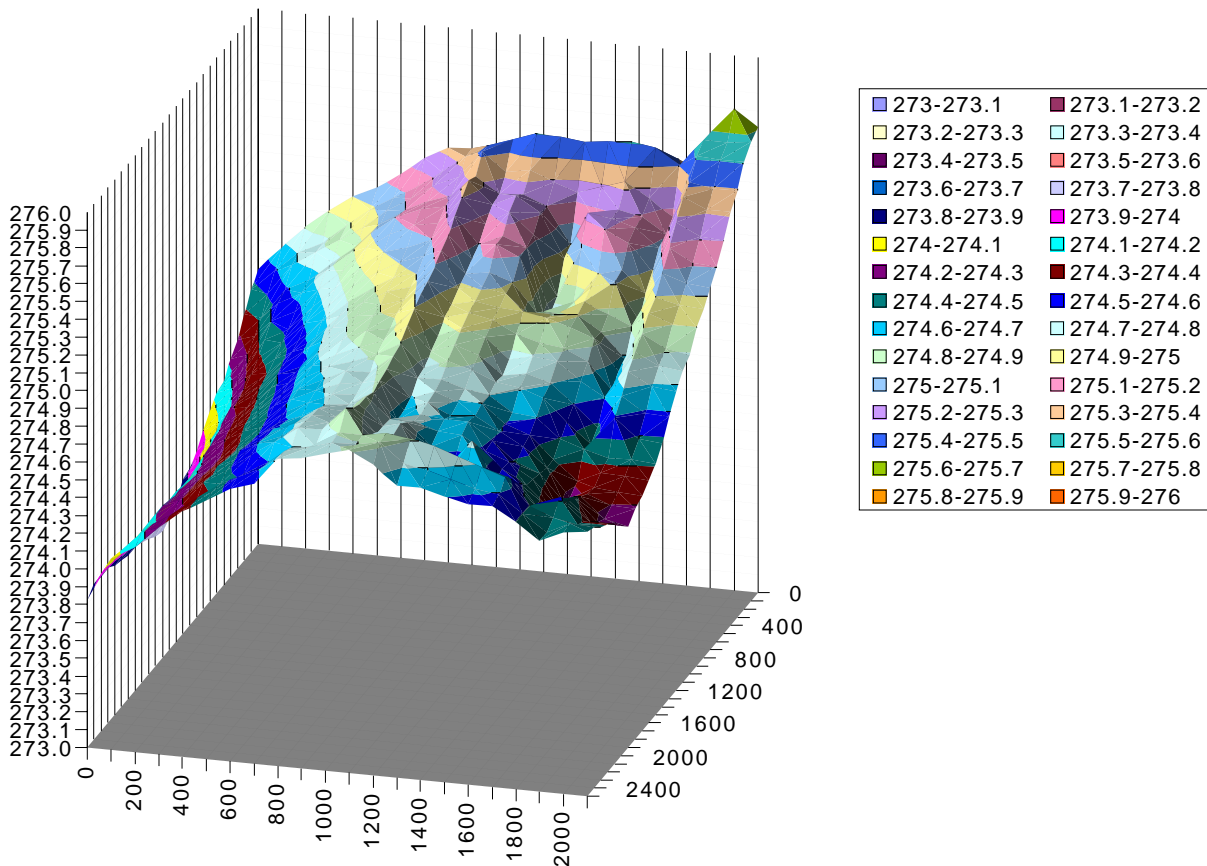
Panel 07 Bottom Face



Height col



Height 3D col

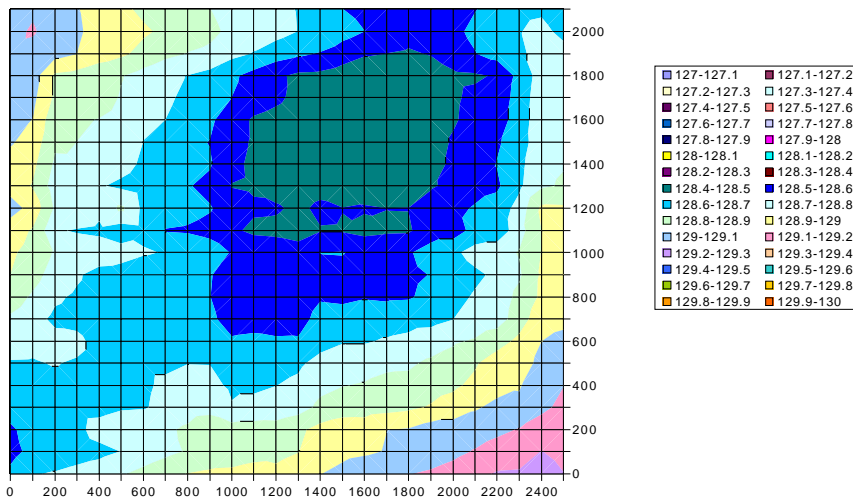




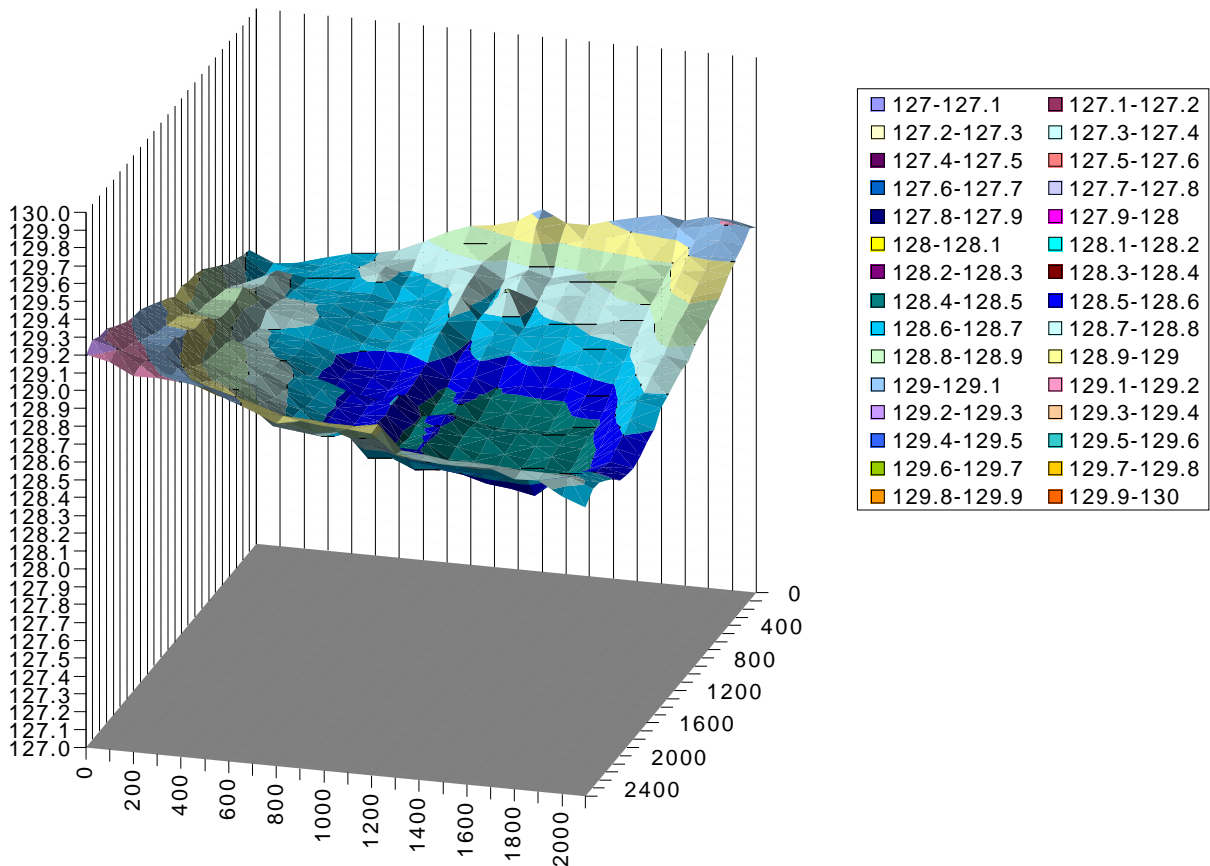
Panel 08 Top Face



Height col



Height 3D col

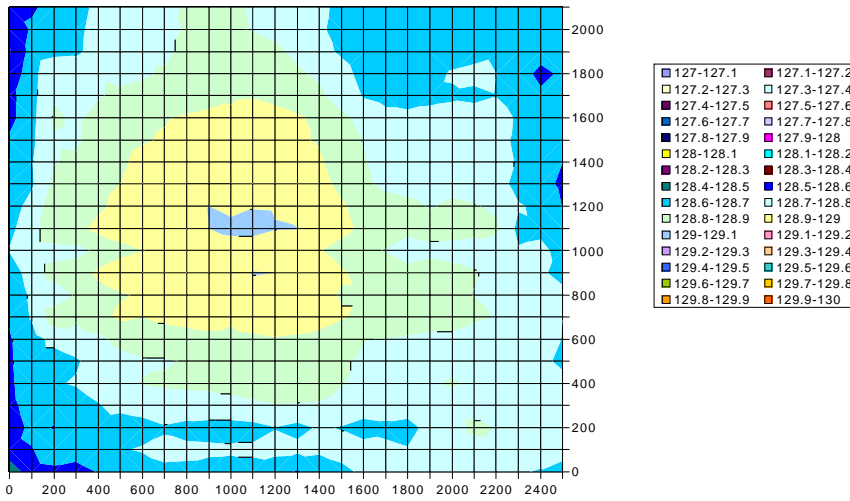




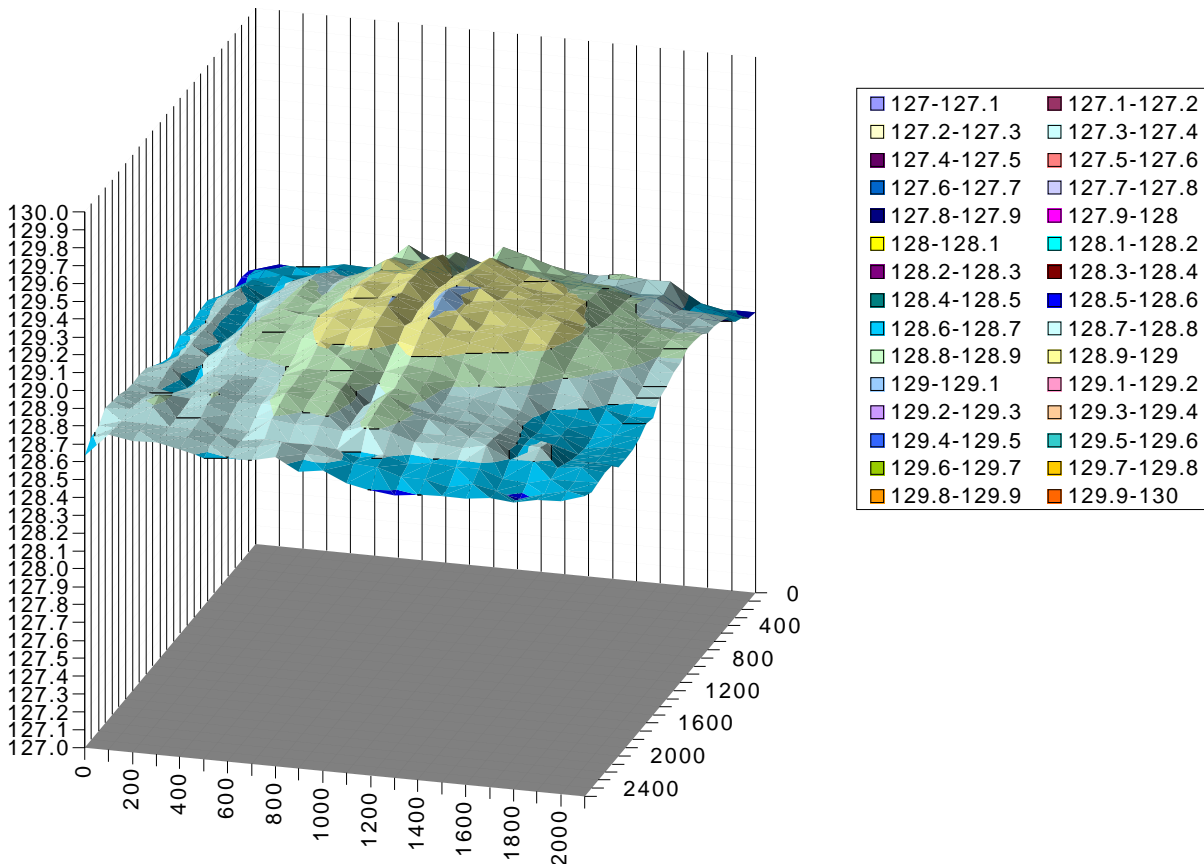
Panel 08 Bottom Face



Height col



Height 3D col

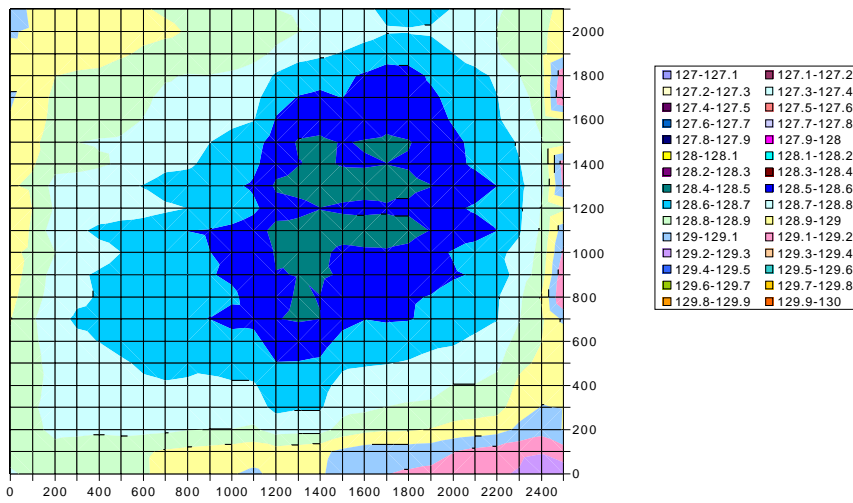




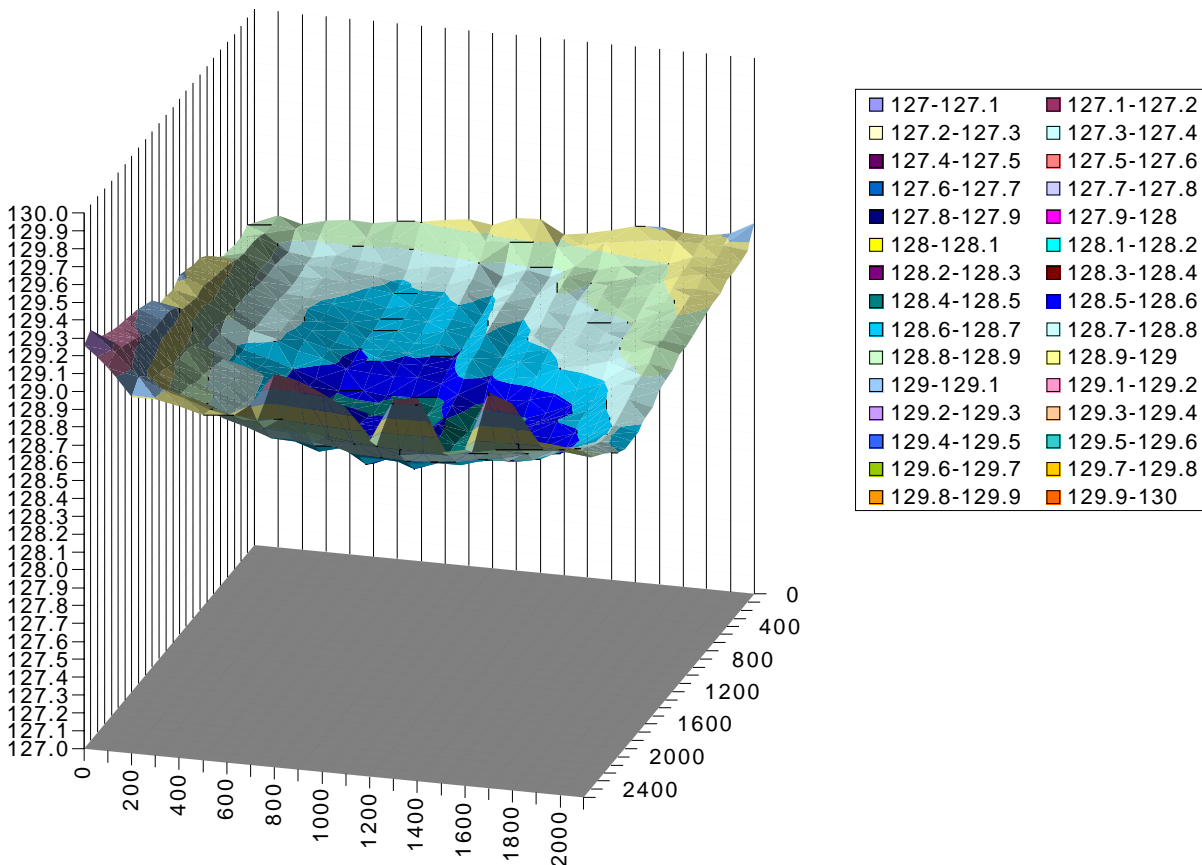
Panel 09 Top Face



Height col



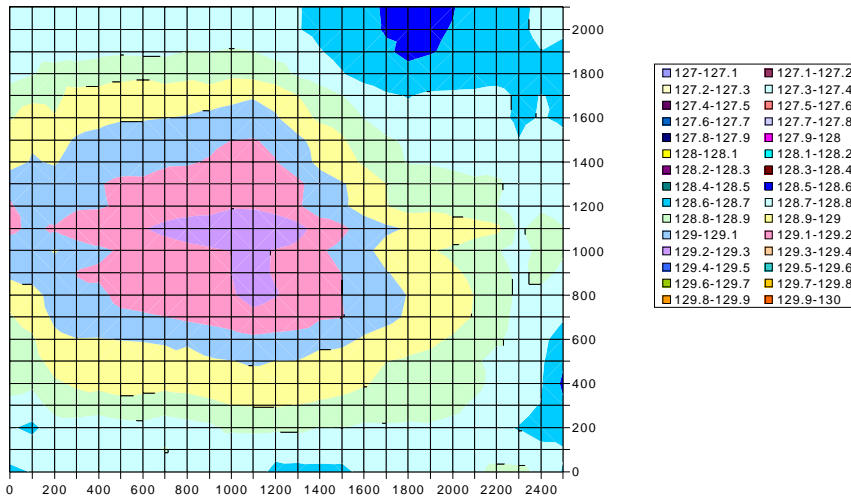
Height 3D col



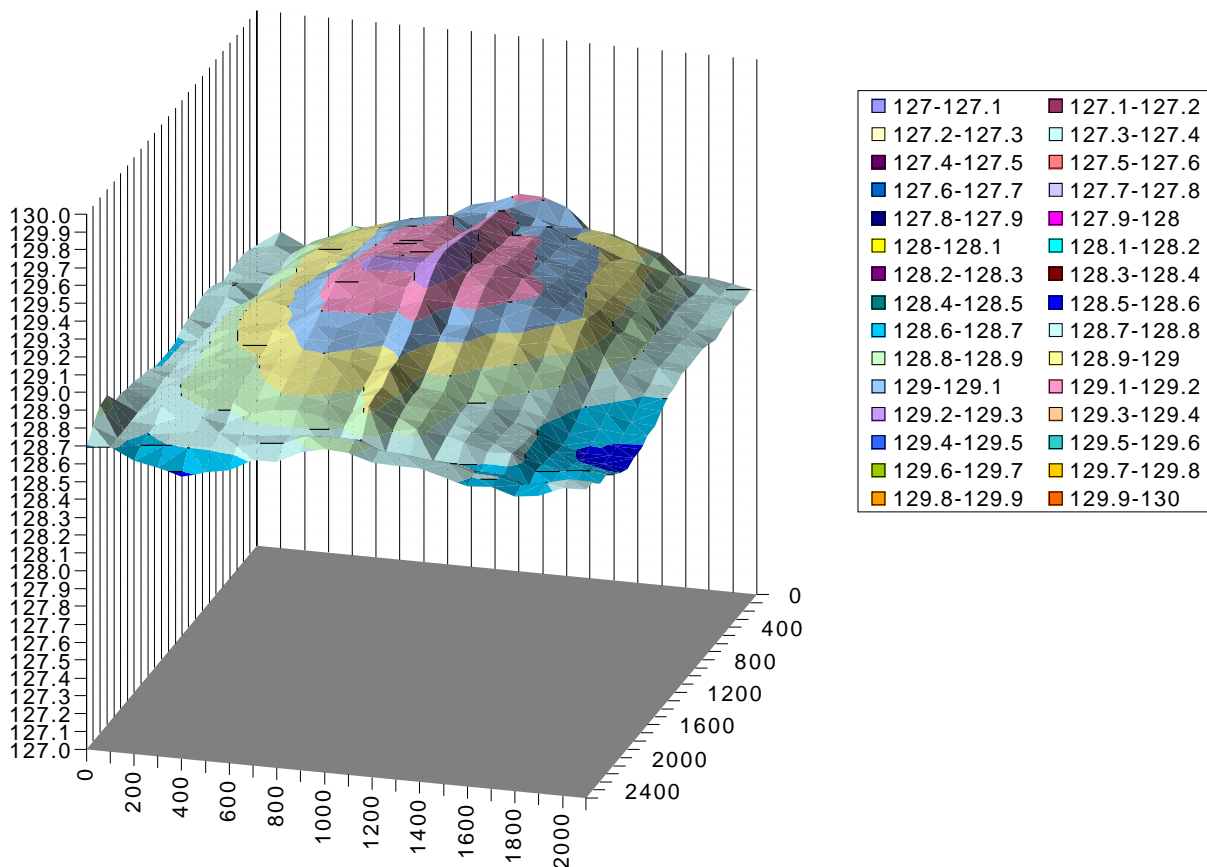


Panel 09 Bottom Face

Height col



Height 3D col

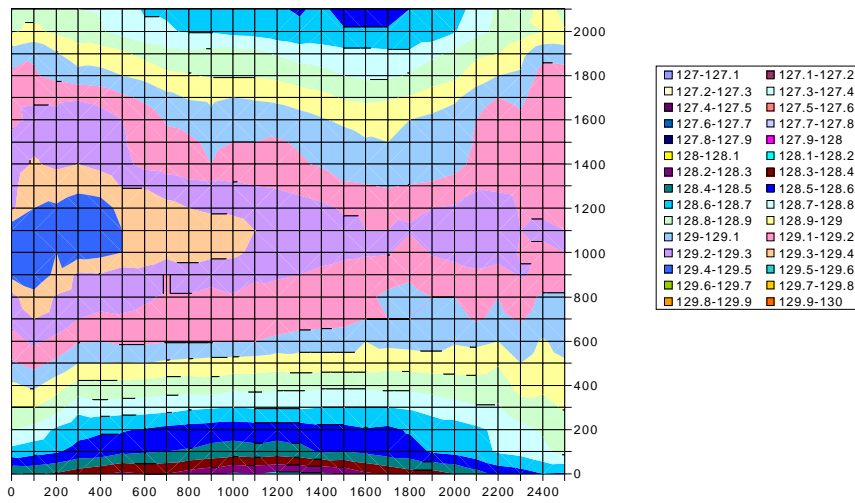




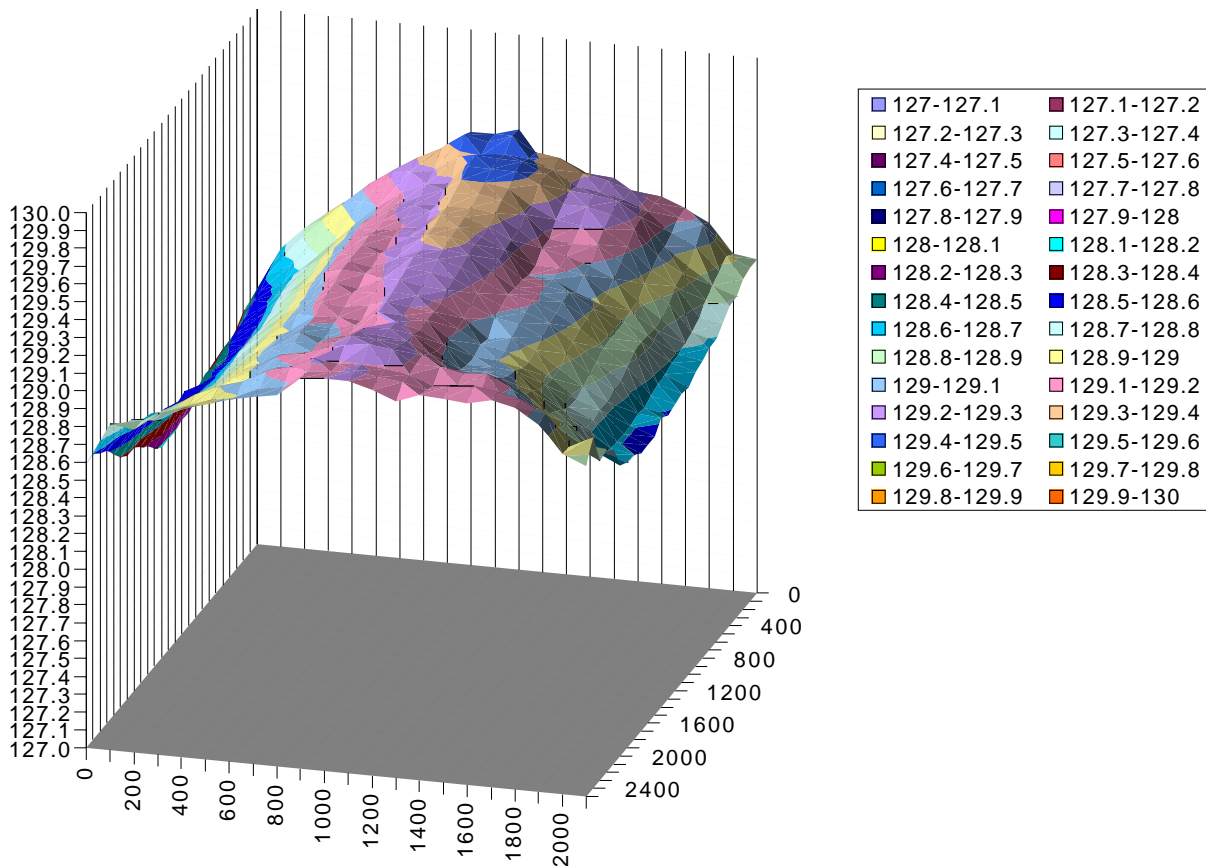
Panel 10 Bottom Face



Height col



Height 3D col

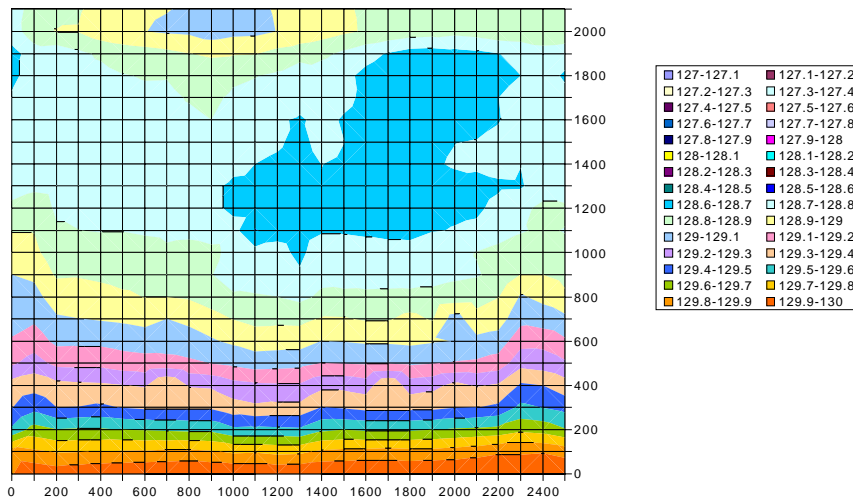




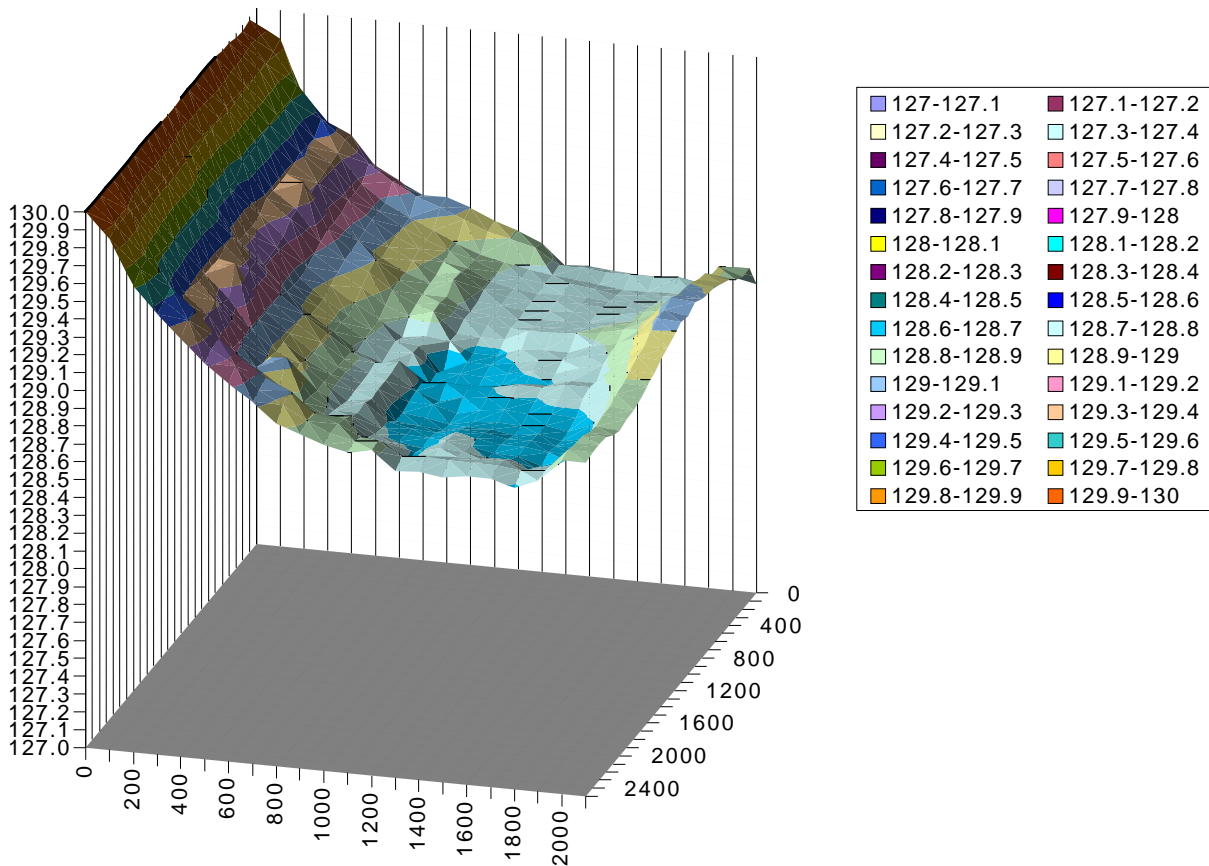
Panel 11 Top Face



Height col



Height 3D col

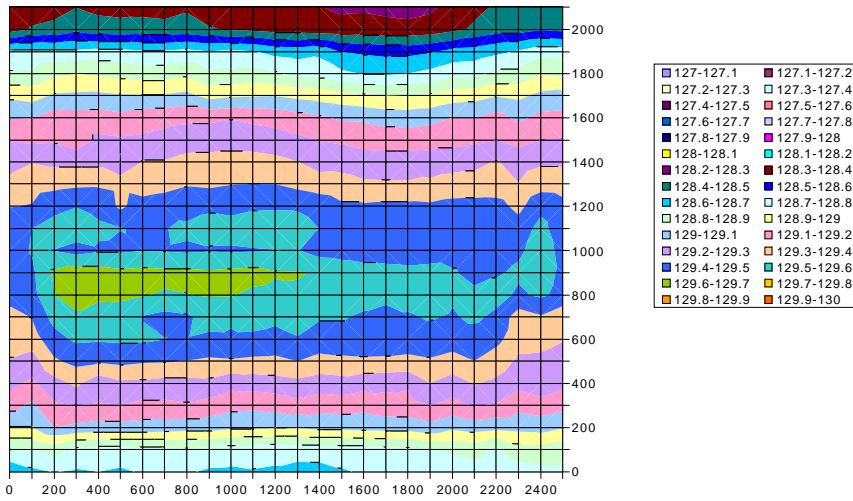




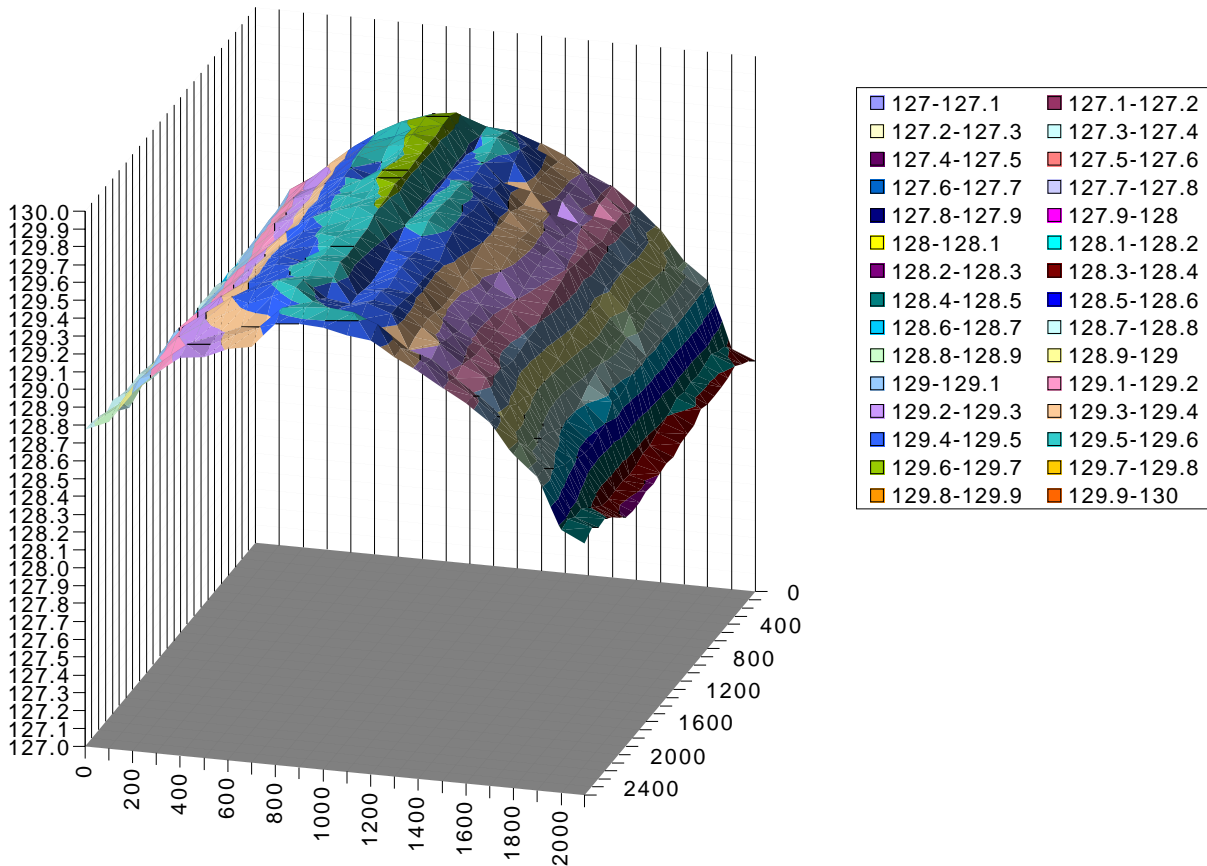
Panel 11 Bottom Face



Height col



Height 3D col





Conclusion



Summary:

- 6 honeycomb panels MB1 received Friday 020322 (serial no 06 to 11)
- Inspected and measured them, as well as two from old batch (ser. 01, 02)
- Glue rests: some left, on last ~3 cm of groove for minicrate
- Dirt: small particles and dust left. Seem to be mainly glue and Al, probably from grinding at finish phase.
- Protection of precision holes and small threaded holes, during chemical cleaning of the c-profiles: *not attempted so far*.
- Note that the flat surfaces remain flat and in the same orientation, and thus do not require a protection during cleaning.
- Width and length dimensions: o.k.
- Diagonals: difference in 3 out of the 6 panels too large.
- Panel thickness (meas. at borders): max. values always above tolerance, but thickness variations are well within tolerance. ~o.k.
- Planarity: three of the six new panels feature *height variations over a flat table* of up to 1 mm, the others are above 1 mm.

Conclude:

- Quality comparable in old and present batches
- Glue rests, dirt and diagonal difference can surely be improved
- Protection of precision holes „to be done“
- Thickness, width, length o.k.
- Planarity - the difficult part - 50% are surely under 1 mm nonplanarity. *Is this related to some production parameter, which can be maintained or even further improved?*



Further Panels



The honeycomb panels MB1 ser. 006 to 011 were done as three pairs of panels, each pair under slightly different conditions, to optimize the quality of the production, especially the planarity.

A. Wiertz / Hexcel commented on these panels (020403):

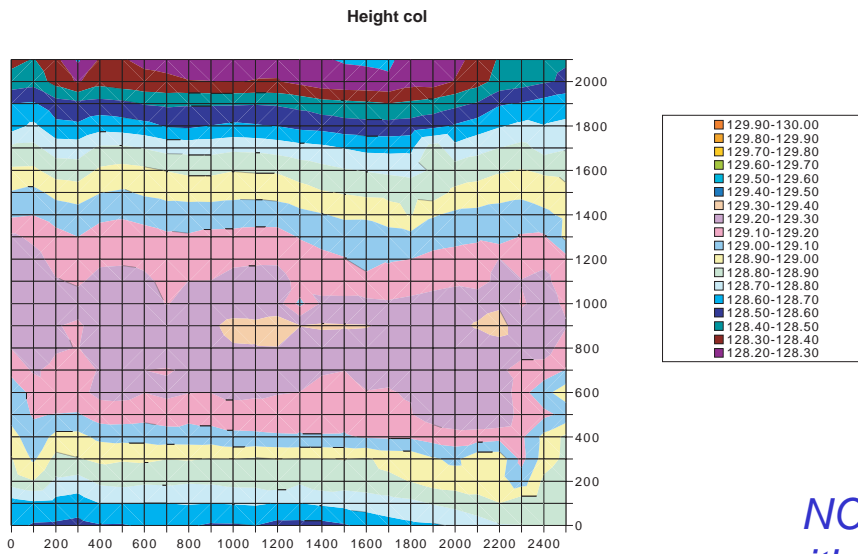
- Same measurement results at Aachen and Hexcel; those from Aachen are more precise and detailed
- Improvement on difference of diagonals expected for next ones
- Protection of precision holes under test; looks promising
- Panels 009, 010 were the last pair produced; the next four MB1 panels will be produced and sent to Aachen this week
- Can produce 10 panels per week.

The following pages show the result of the measurement of these last four panels.

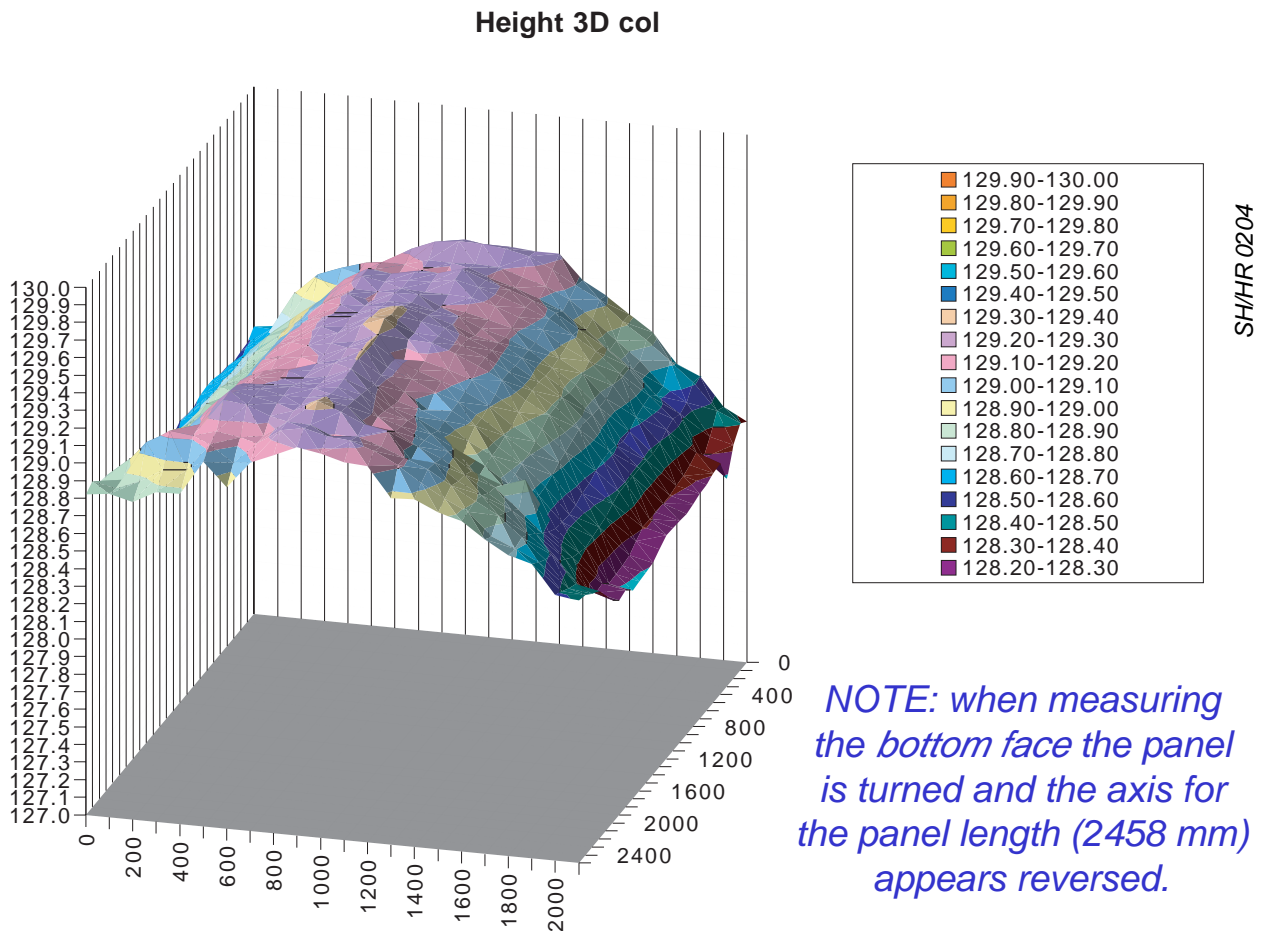


Panel 12 Top Face

Shown: height
over a plane, in
mm, of MB1 size
honeycomb
panel.



NOTE that to compare
with the image below one
has to turn by 90 deg



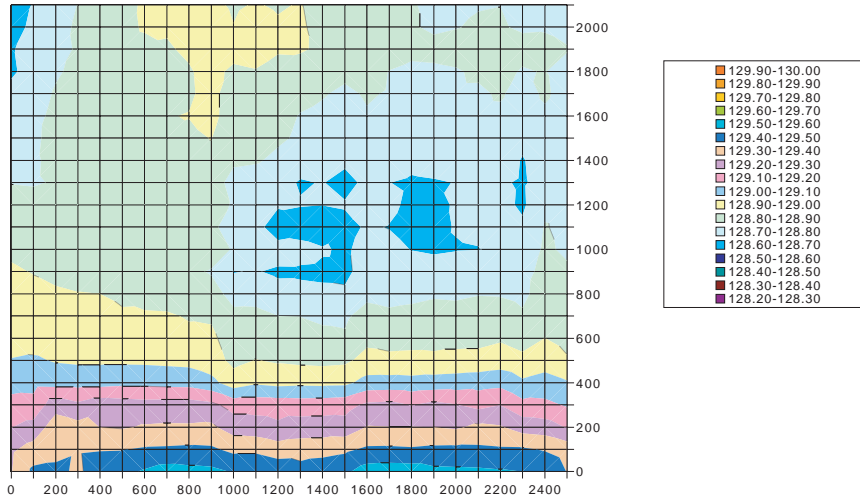
NOTE: when measuring
the bottom face the panel
is turned and the axis for
the panel length (2458 mm)
appears reversed.

Difference in height: 1.16 mm

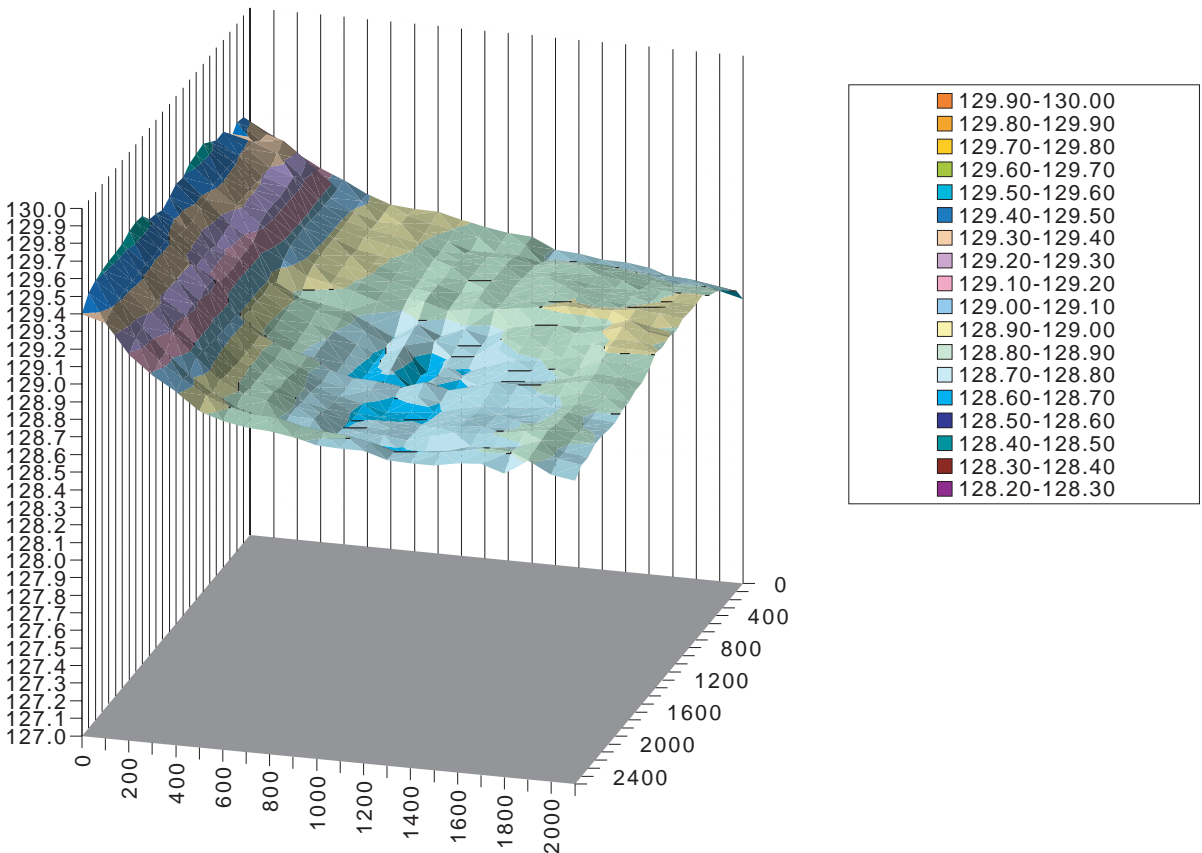


Panel 12 Bottom Face

Height col



Height 3D col



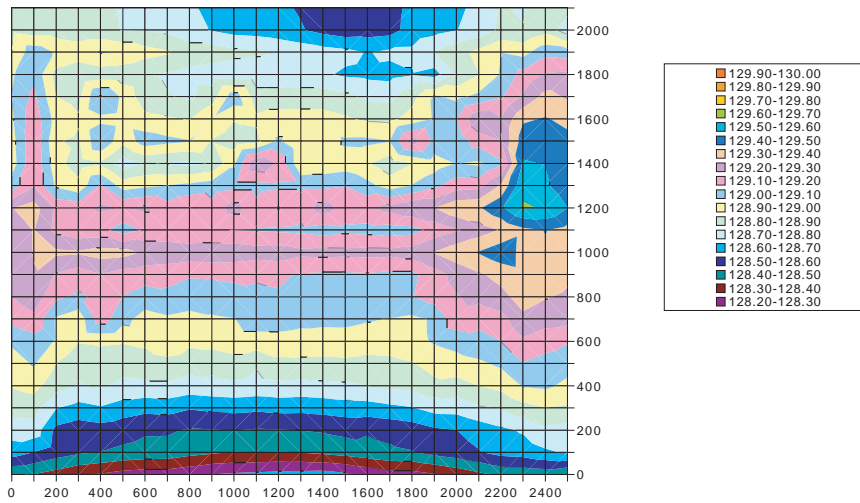
Difference in height: 0.94 mm



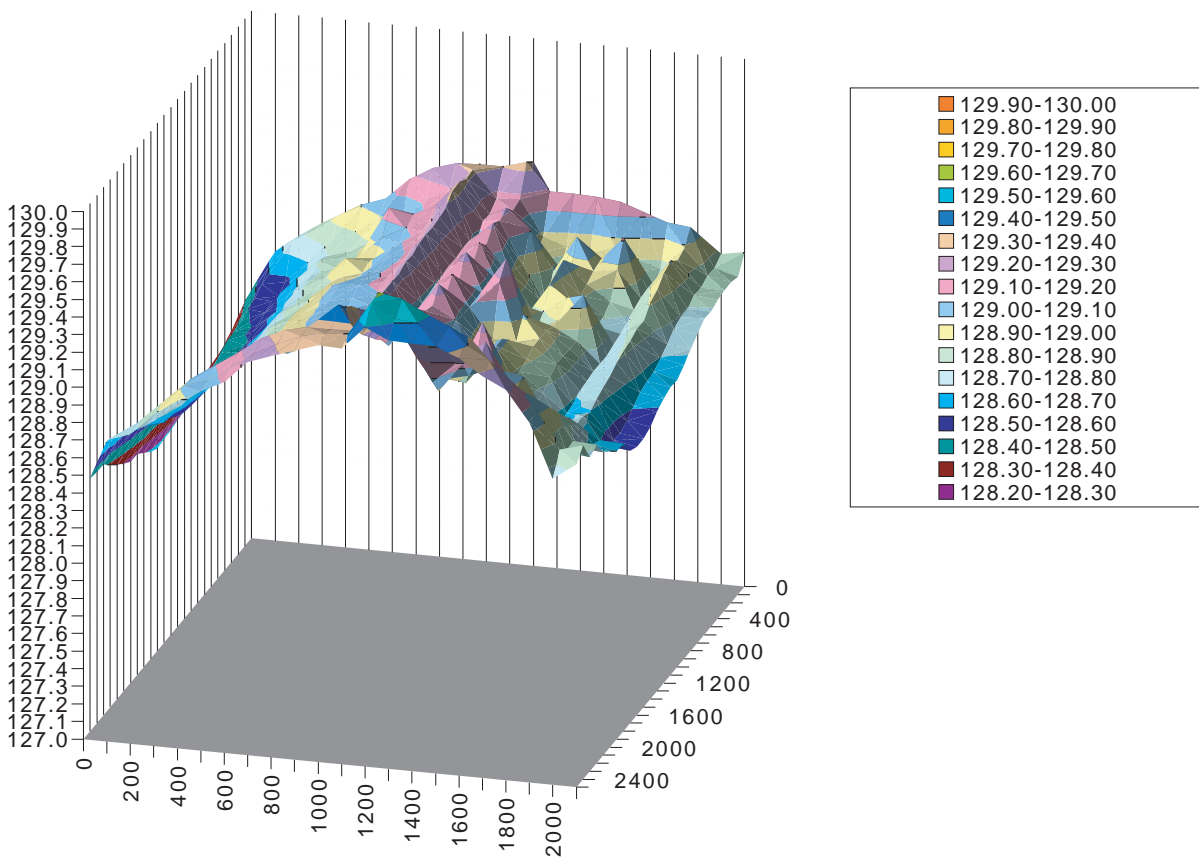
Panel 13 Top Face



Height col



Height 3D col



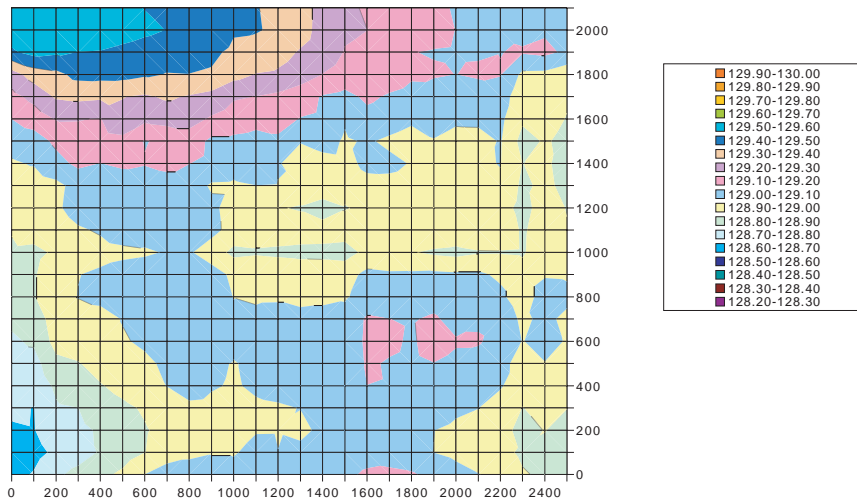
SH/HR 0204

Difference in height: 1.46 mm

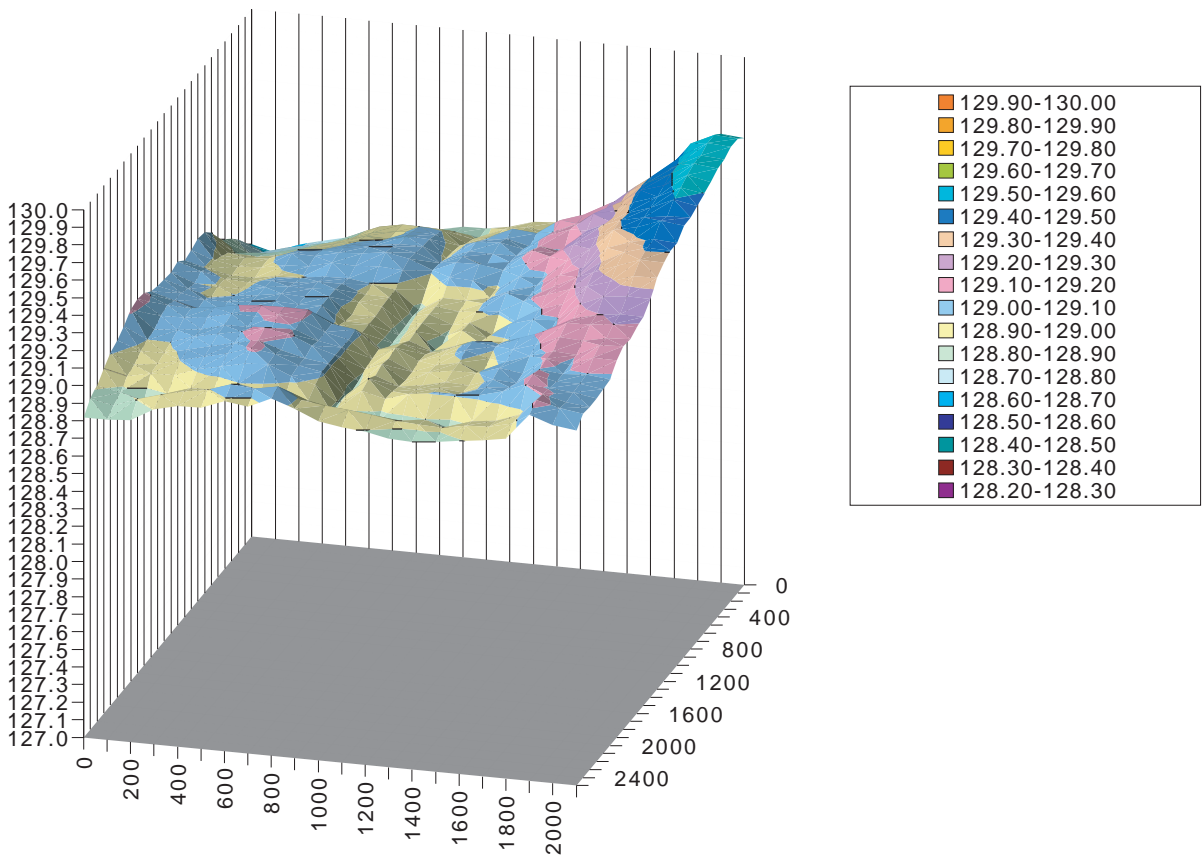


Panel 13 Bottom Face

Height col



Height 3D col



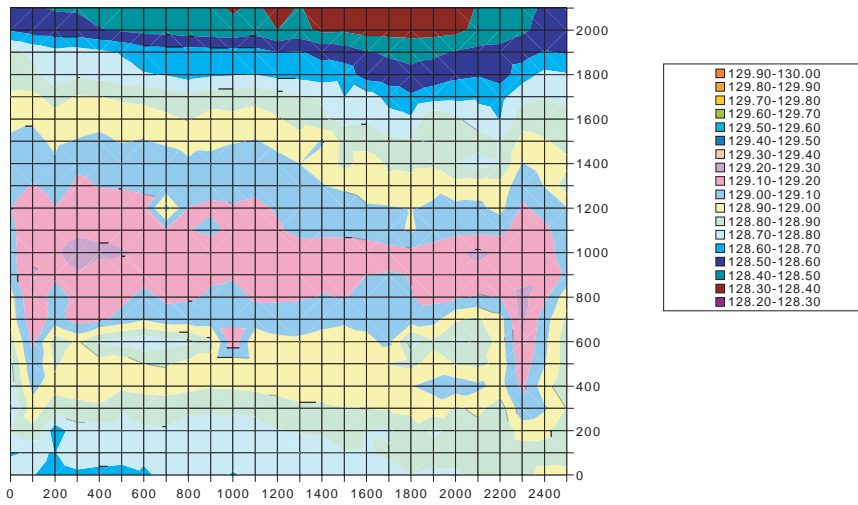
SH/HR 0204

Difference in height: 0.97 mm

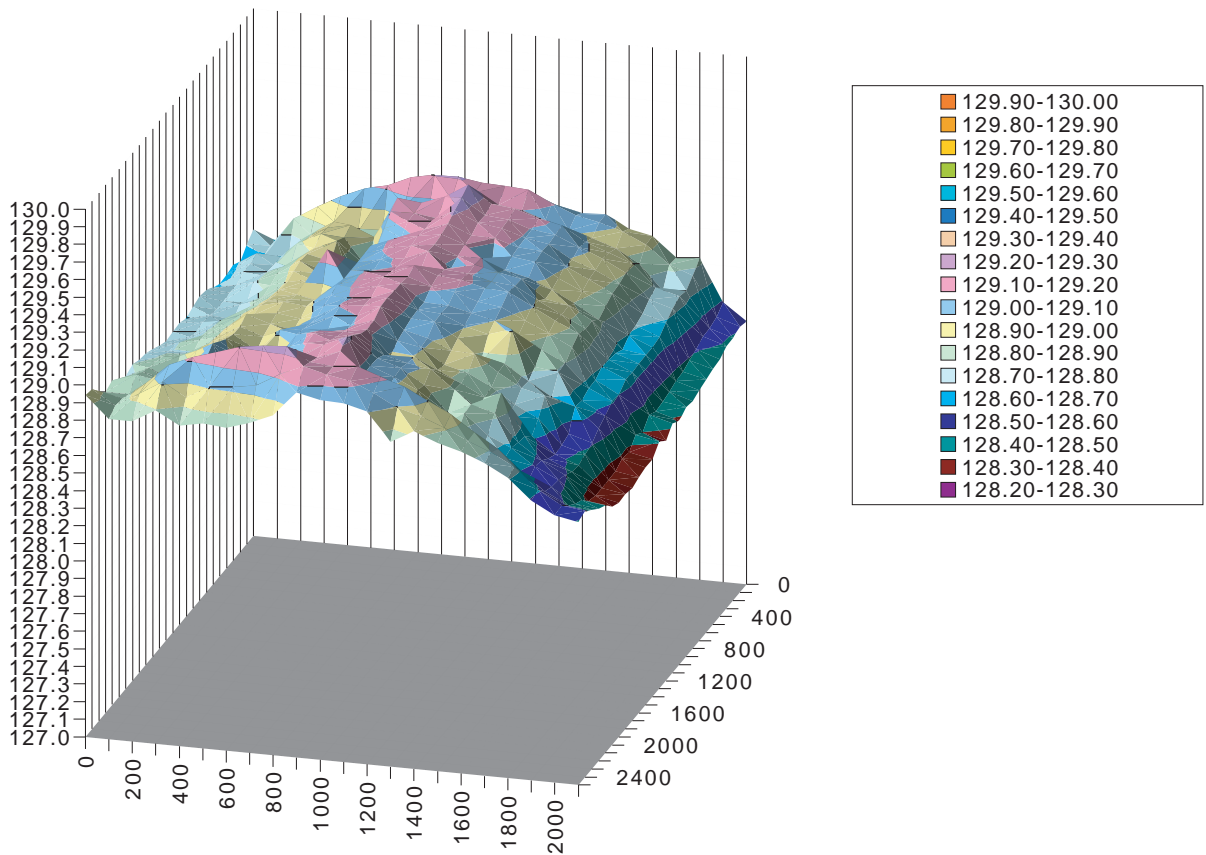


Panel 14 Top Face

Height col



Height 3D col



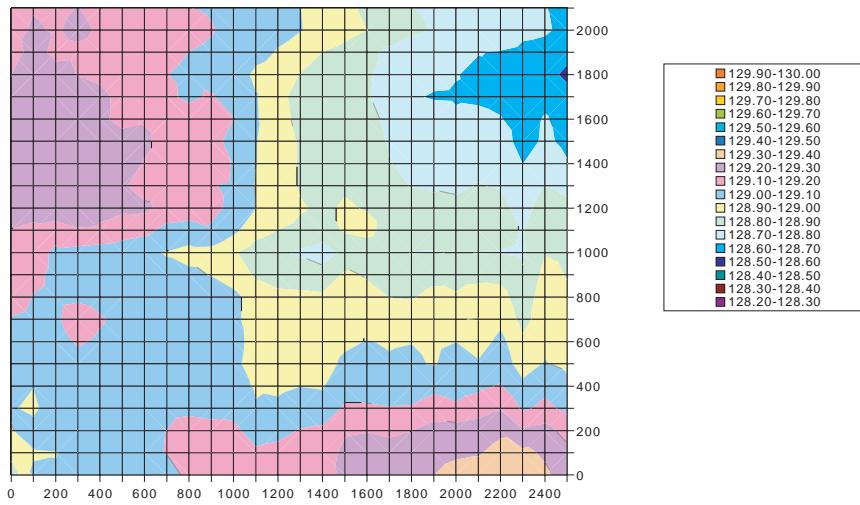
SH/HR 0204

Difference in height: 0.94 mm

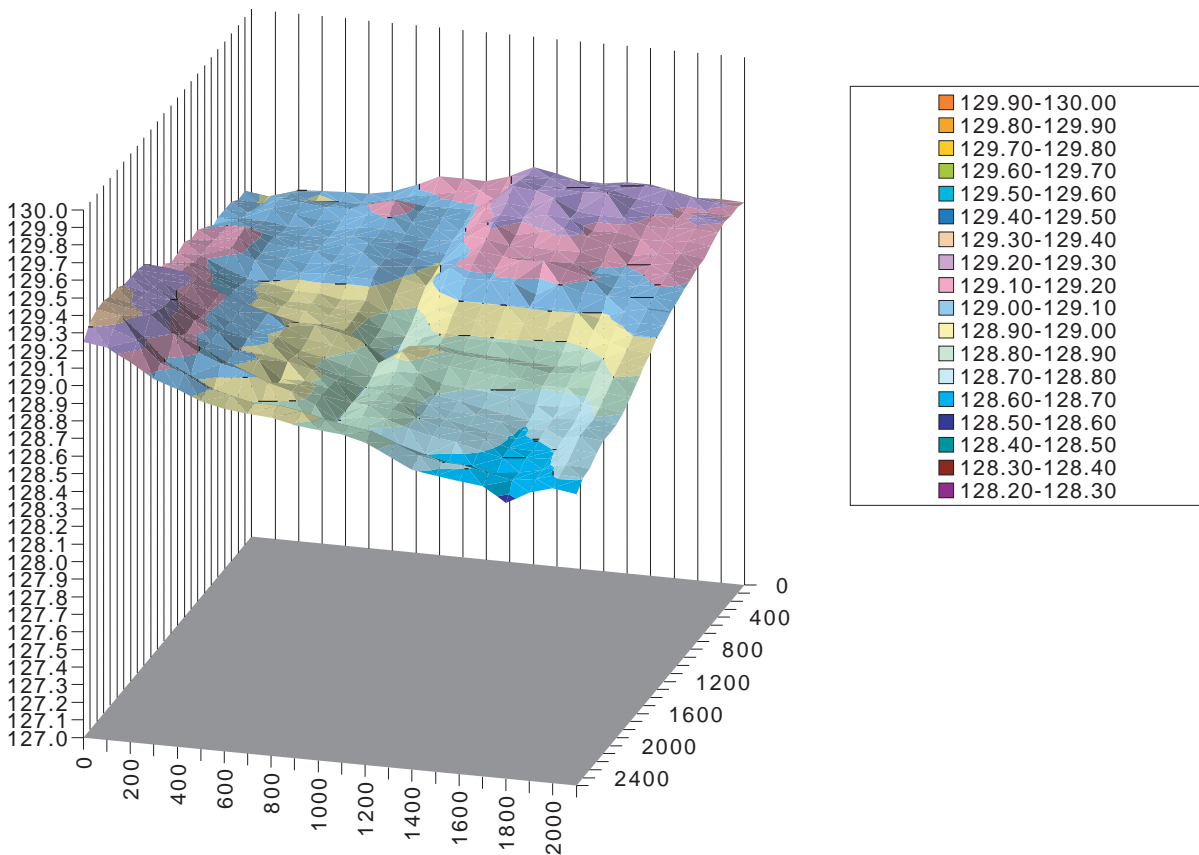


Panel 14 Bottom Face

Height col



Height 3D col



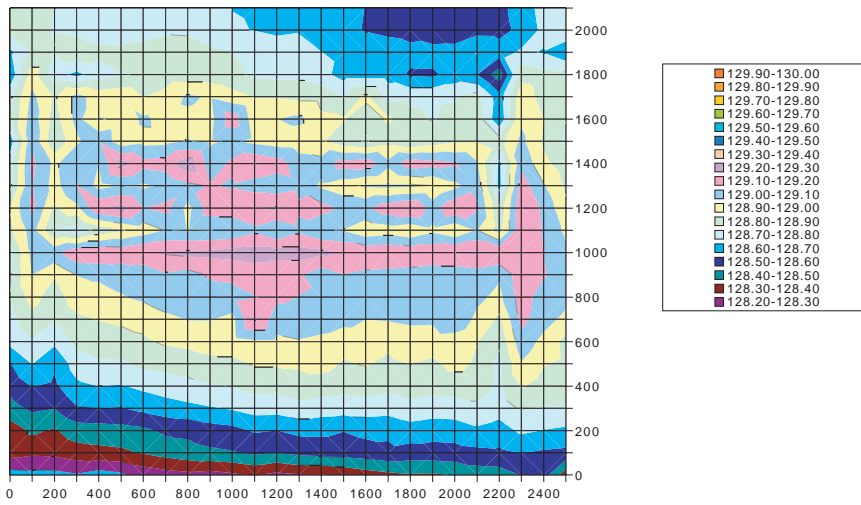
Difference in height: 0.78 mm



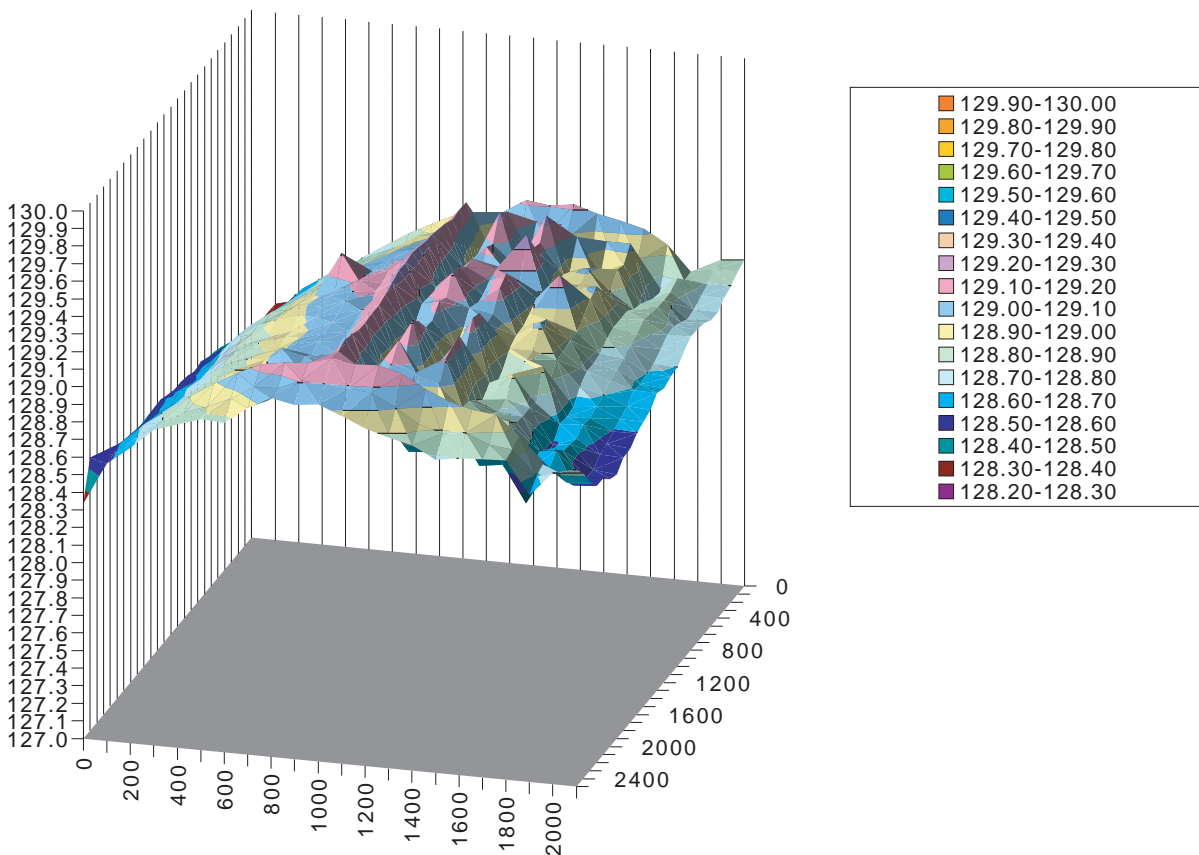
Panel 15 Top Face



Height col



Height 3D col



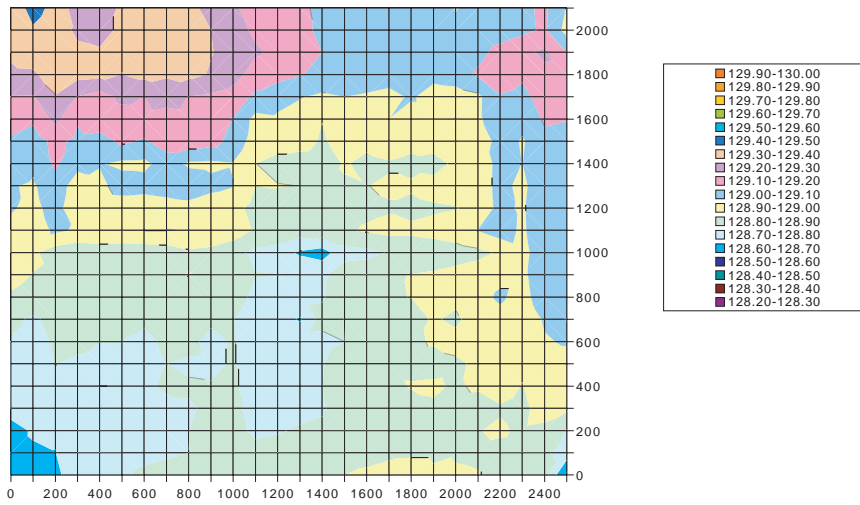
SH/HR 0204

Difference in height: 1.12 mm

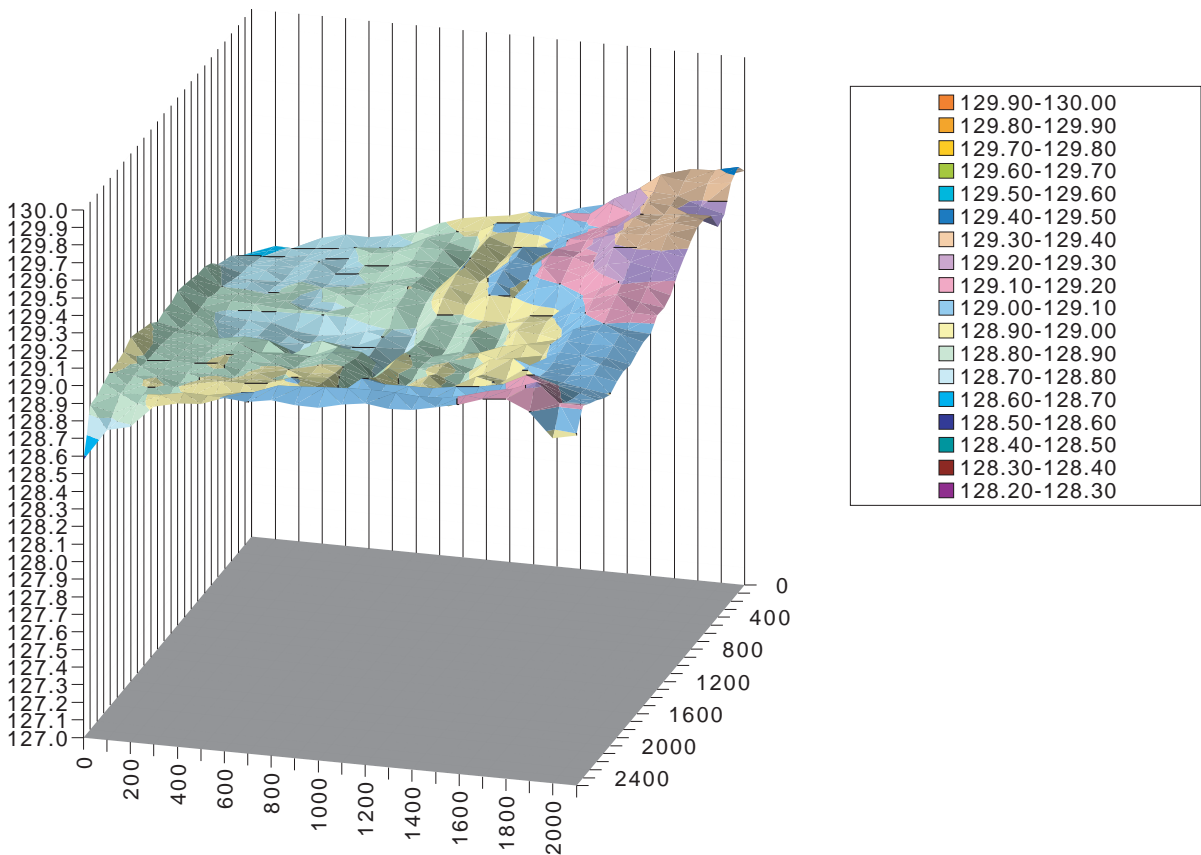


Panel 15 Bottom Face

Height col



Height 3D col



SH/HR 0204

Difference in height: 0.85 mm