THOMAS CONSULTING
STRUCTURAL & CIVIL DESIGN ENGINEERS

T21023/23/001

STRUCTURAL INSPECTION

at

Whitchurch Civic Centre
High Street
Whitchurch
Shropshire
SY13 1AX

For

Shropshire Council

REPORT VERIFICATION

Site Address	Whitchurch Civic Centre, High Street, Whitchurch, Shropshire, SY13 1AX

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Originator	Hazel Durham BEng (Hons) CEng MICE
Checked	Kieron Hounslow BEng (Hons) CEng MIStructE

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Whitchurch Civic Centre, High Street, Whitchurch, Shropshire, SY13 1AX

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Whitchurch Civic Centre, High Street, Whitchurch, Shropshire, SY13 1AX

1 INTRODUCTION

Thomas Consulting has been commissioned by Shropshire Council to carry out a structural inspection to establish if Reinforced Aerated Autoclaved Concrete (RAAC) is present at Whitchurch Civic Centre, High Street, Whitchurch, Shropshire, SY13 1AX.

The inspection is limited to determining the following:

- Do the buildings contain roof structures that have been constructed using Reinforced Aerated Autoclaved Concrete (RAAC) planks?
- Where RAAC planks are identified, detail of the locations (detailed and marked on a site plan) as well as a synopsis of the current condition, and high-level proposal of how they be managed in the future.

We have confined this inspection to the identification of RAAC elements and no other elements.

Where RAAC elements are not visible from ground level, via telescopic survey ladders, through tile on grid suspended ceilings or through low level roof void inspection hatches, we have recommended an intrusive investigations which are included in this report.

2 GENERAL

The Civic Centre is situated on a hill that slopes across the front of the building, there is a slight elevation to the car park at the rear in the town centre of Whitchurch, Shropshire.

The inspection of the buildings has been undertaken on several days due to the removal of ceiling finishes for inspection.

The property is a braced steel frame with precast concrete beam and block floors to suspended floors, ground bearing slabs to the ground floor not over cellars and reinforced Autoclaved Aerated Concrete to the roof areas. The property was initially constructed during the 1950's.

3 SYNOPSIS

The report identifies that the defective material Reinforced Autoclaved Aerated Concrete (RAAC) is present in the buildings inspected. The RAAC present in some areas is classified as Red (Critical) in accordance with IStructE document 'Reinforced Autoclaved Aerated Concrete (RAAC) Investigation and Assessment – Further Guidance' April 2023.

4 OBSERVATIONS

4.1 Library

The library is situated on the ground floor to the left-hand side of the building when viewed from the High Street. The front section of the building is two storey with the suspended floor constructed of beam and block flooring. To the rear the property is single storey, the roof in this area is formed of RAAC panels supported on steel beams.

Photograph 1 RAAC panel with hole filled with wire wool and further damage and water ingress.

There are several areas of significant water ingress with efflorescence to the surface.

Photograph 2 water ingress and efflorescence.

To the rear staff room / workshop area and Registrar's Office there is significant water ingress and noticeable movement of the roof under loading. The roof around the roof lights is supported on angles off the adjacent RAAC planks. The bearings at this location is less than 75mm. There is longitudinal cracking to the planks.

At the rear wall with the garage a plank has been replaced with a cast in-situ section of concrete. There is an unsupported large opening to the rear for a soil vent pipe.

Throughout the roof area are several large penetrations for services that are unsupported and fixings for services. Several of the planks are damaged with gouges in the surface, chips at the bearings and arises and spalled/broken out sections.

4.2 First floor

The roof over the first-floor areas is RAAC panels supported on steel beams. There are areas of significant water ingress to the roof, damaged panels with missing sections of concrete so that the membrane is visible above. There are several bearings of less than 75mm as the supporting beams are 100mm wide supporting two planks.

Photograph 3 typical penetration to the slab and further damage in the panel

Within the rear rooms there are several large unsupported openings for boiler flues, gas mains and other services that are unsupported. There are several roof fans that are cut into the roof with unsupported edges. There is only one transverse reinforcement bar visible in these openings that measure approximately 450mm square. There are several areas of cracking both longitudinally and transversely to the panels.

For the flue to the boiler the reinforcement has been pulled out of the way by the contractor.

Photograph 4 typical fan installation with damaged cut ends and proprietary supports.

Photograph 5 single transverse reinforcement bar in fan opening and large void.

Photograph 6 unsupported openings filled with plywood.

Photograph 7 damaged panel adjacent to a cut opening with additional support from timber joist.

Photograph 8 holes to panels and rebar pulled out of panel for new boiler flue.

Photograph 9 watermarks to panels, note reinforcement pattern visible.

Photograph 10 cracking to RAAC panels in bar area over foyer.

4.3 External walkway

There is extensive water ingress to several areas of the walkway. The RAAC panels have been cut and do not appear to be adequately supported in many areas. There is cracking to the panels. There is visible displacement between adjacent panels. The steelwork supporting the RAAC panels is significantly corroded.

Photograph 11 typical wet panels with damages panels at corners and cracking throughout to walkway area.

Photograph 12 cut panels poorly supported and exposed reinforcement also displacement between adjacent panels.

Photograph 13 typical panel damage at edges and bearings.

4.4 Theatre and changing rooms.

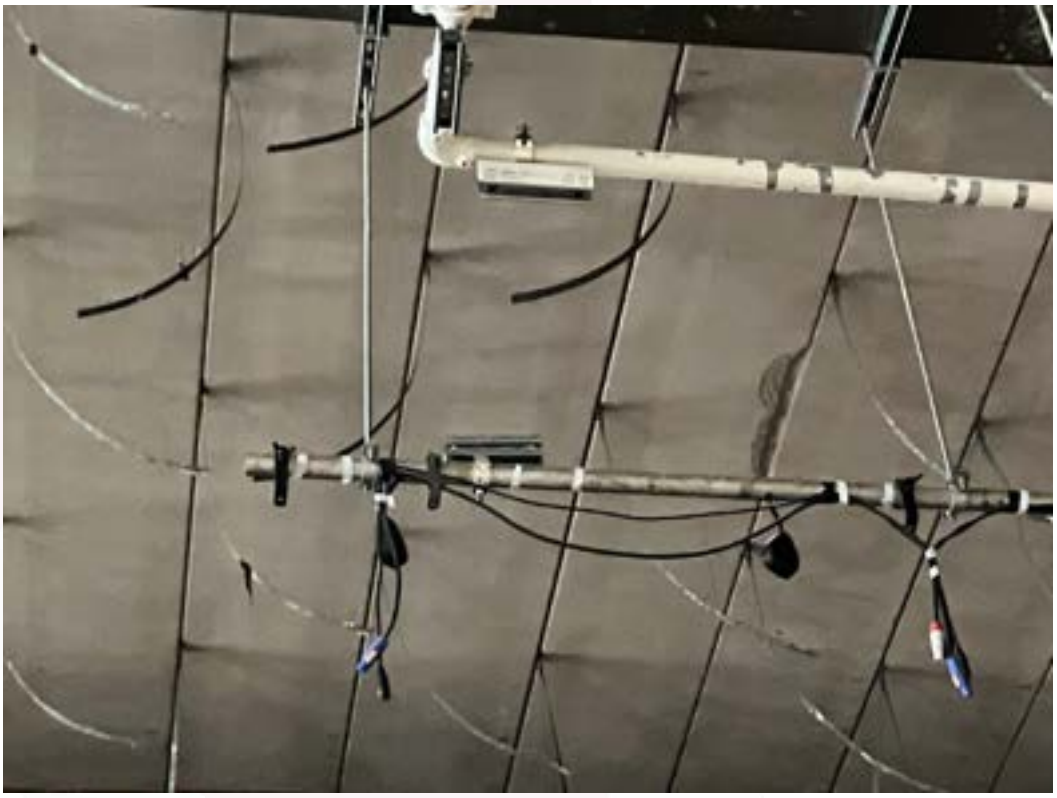
The roof over the theatre is RAAC panels supported on steel beams. There is some water ingress over the stage area unsupported openings, infilled openings with concrete and cracking to panels. An area of RAAC is supported on timber joists. The timber joists do not have noggins or strutting and are buckled / twisted.

There is some hairline cracking to panels. A full inspection of the roof has not been undertaken yet.

Photograph 14 unsupported large opening to panels ground floor rear rooms at back of stage.

Photograph 15 cracking to panel.

Photograph 16 cut panel infilled with concrete and supported on timber joists.



Photograph 17 damage to panel in main theatre area.

Photograph 18 close up of plank in theatre area with a line of honeycombing and voids. Hairline cracks also in the area but not visible in the photograph.

Photograph 19 hairline cracking to panel.

4.5 Cloud point survey

A cloud point survey has been undertaken by Severn Partnership, the full output of the areas scanned is included in Appendix A. Some of the areas are discussed below.

The scans indicate that there is a general fall on the roofs, this is in the direction of the internal gutters observed on site. They also show areas of higher in span deflection when the fall has been taken into account.

4.5.1 Library.

The library clearly shows the fall to the gutter and the lower level of the gutter along the wall of the two-storey section indicated by the blue area.

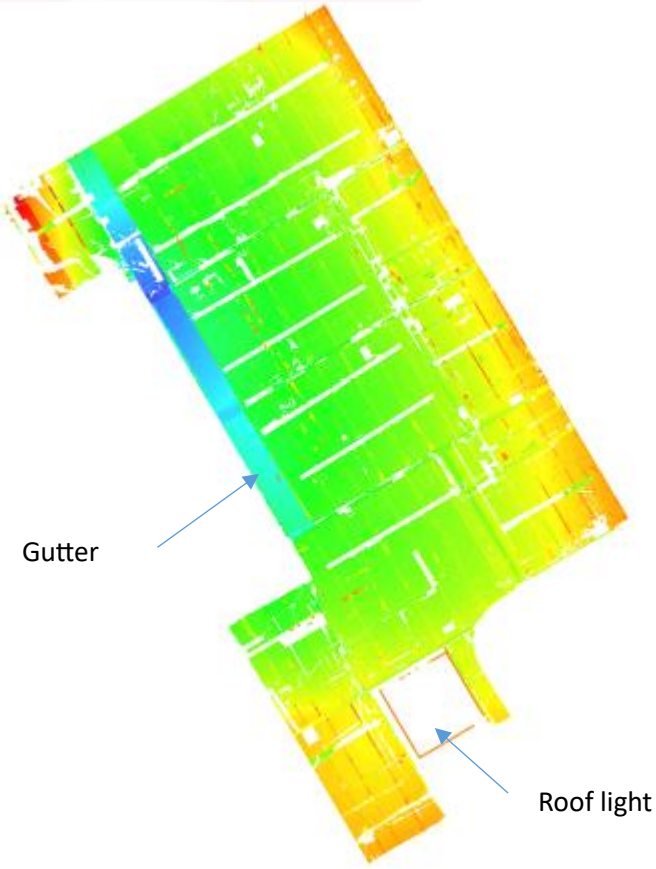


Figure 1 surface levelness Library.

The yellow and red lines that are running perpendicular to the white lines are the joints in the RAAC panels where the laser has measured within the gaps that have formed. The white lines are the beams or service positions or excluded areas such as roof lights.

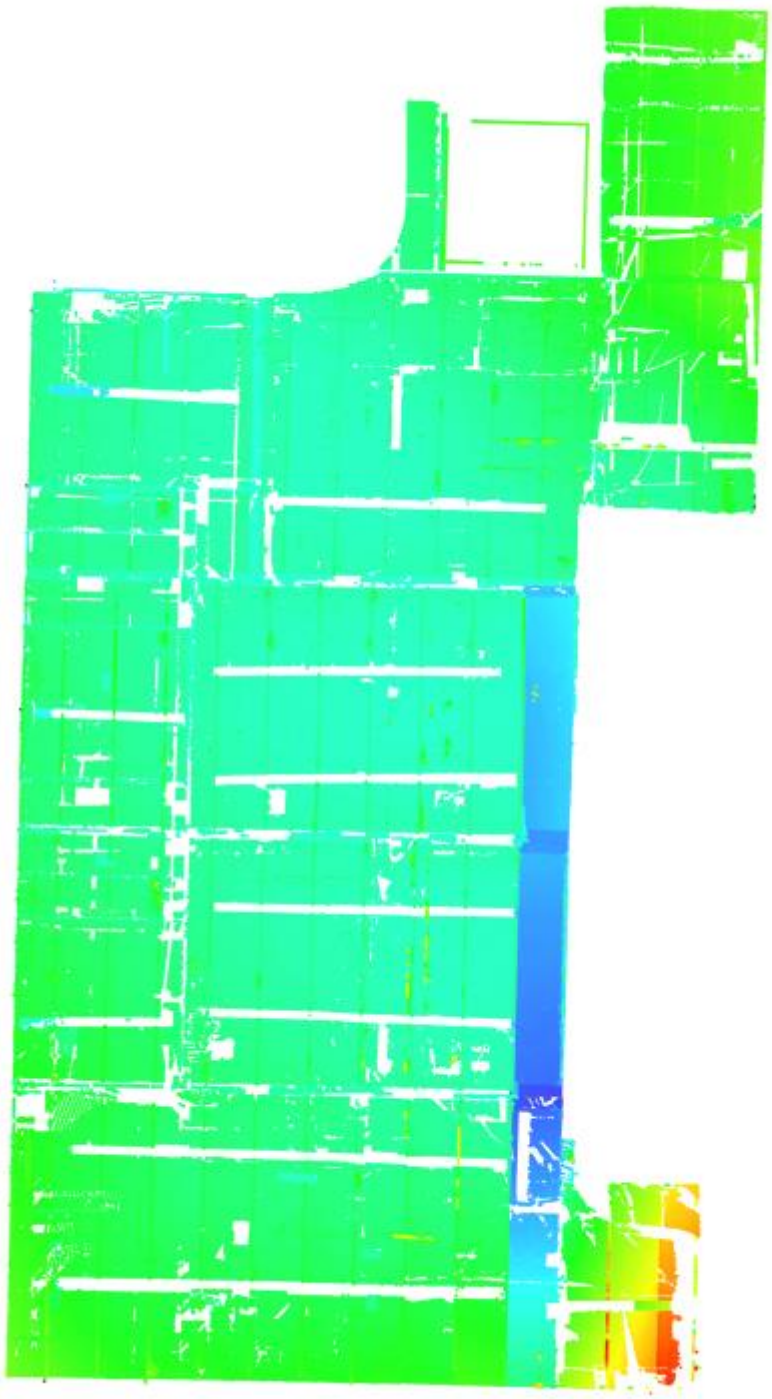


Figure 2 surface regularity from a plane

A further scan has been produced that takes a plane from the highest point and compares the position of the slab in relation to the plane.

The general in span deflections are approximately 1 in 100 to 1 in 200.

4.5.2 Library back room / workshop

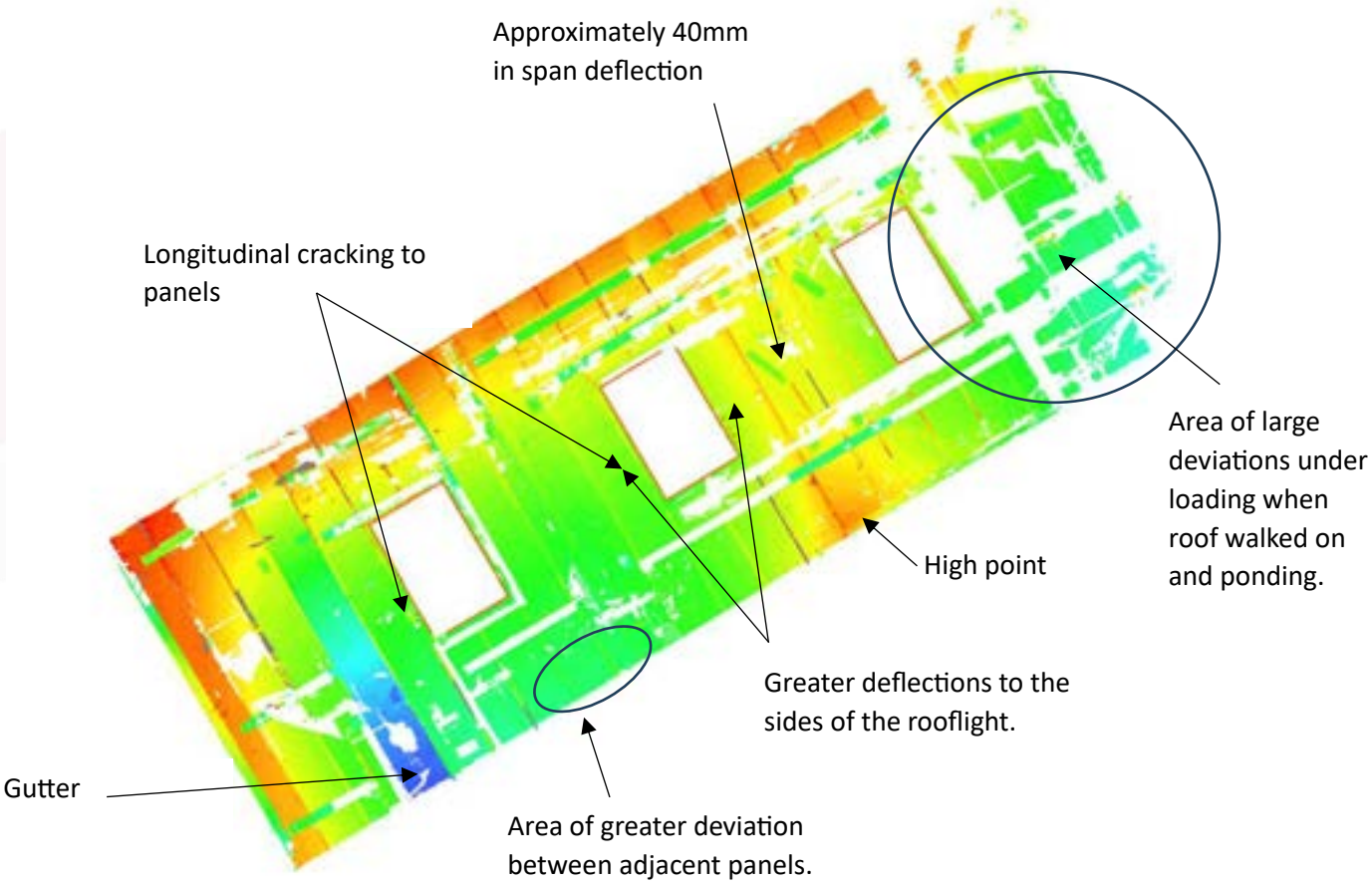


Figure 3 Library back room / workshop surface regularity

The imaging shows that there is a general fall from the external wall towards the library. This also shows that there are large deviations between panels of 20mm. There is greater deflection in the RAAC panels either side of the roof lights. The lower area is coloured green, it is in these areas that the RAAC panels have longitudinal cracking to the sides of the roof light.

There is an area that indicates 37mm in span deflection, this is taken as the difference between the red areas at the supports and the yellow area at mid-span. The green has been discounted as this is probably a prop position. This indicates in span deflections of span/100.

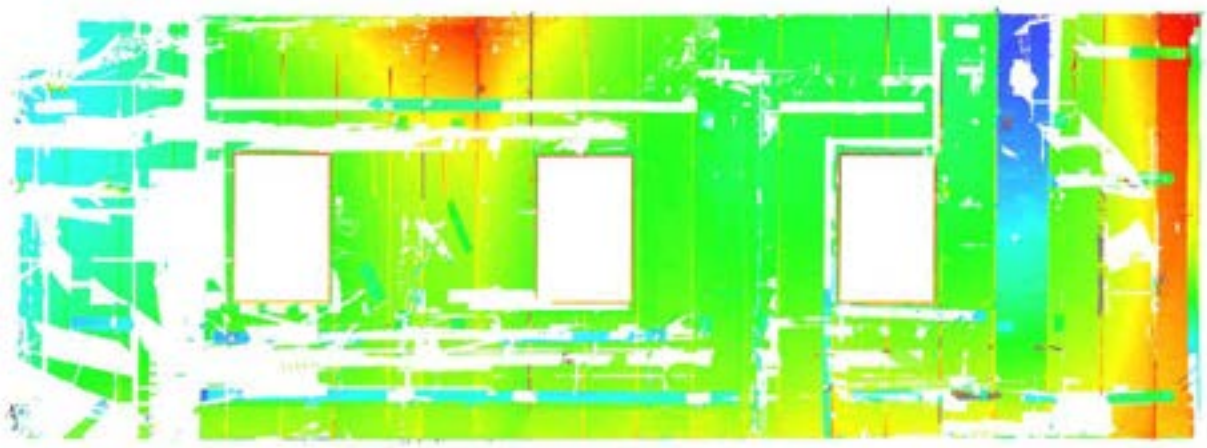


Figure 4 deviation from plane library back room / workshop

The above concurs with the findings noted above.

4.5.3 Garage

The garage roof is reasonably uniform without significant deflections.

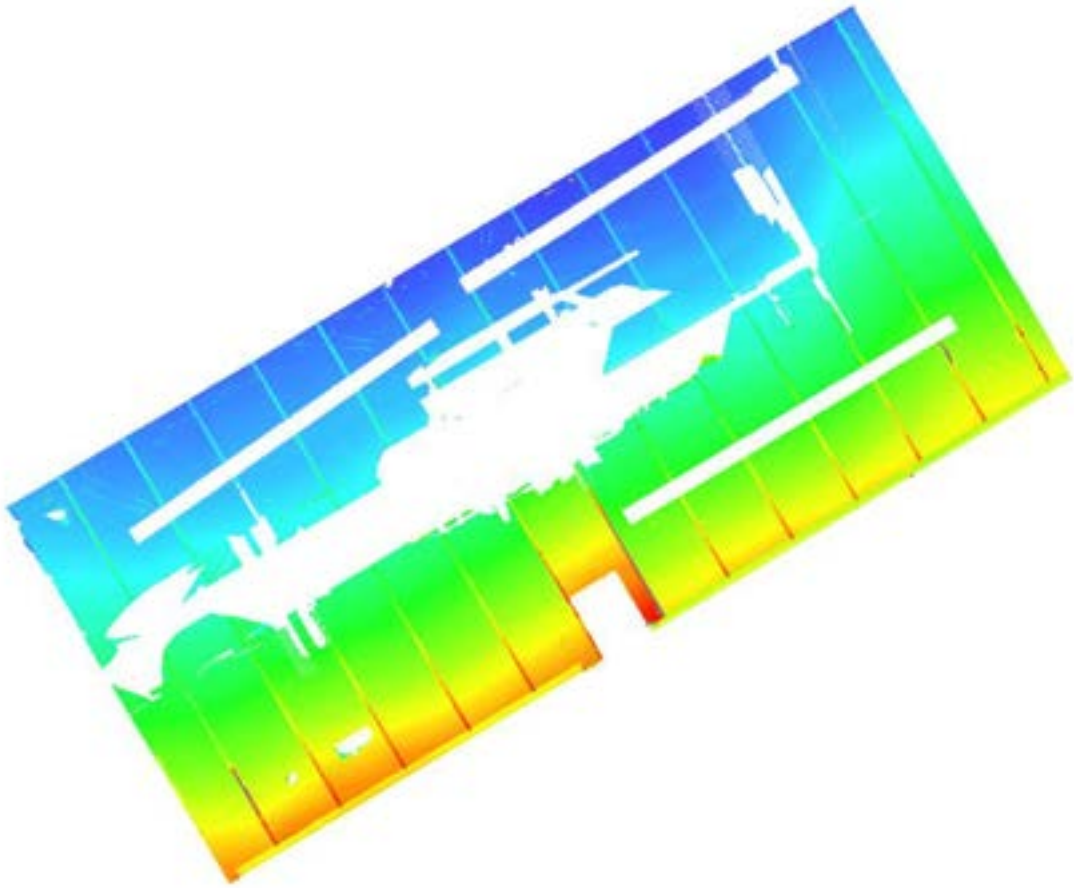


Figure 5 surface regularity garage.

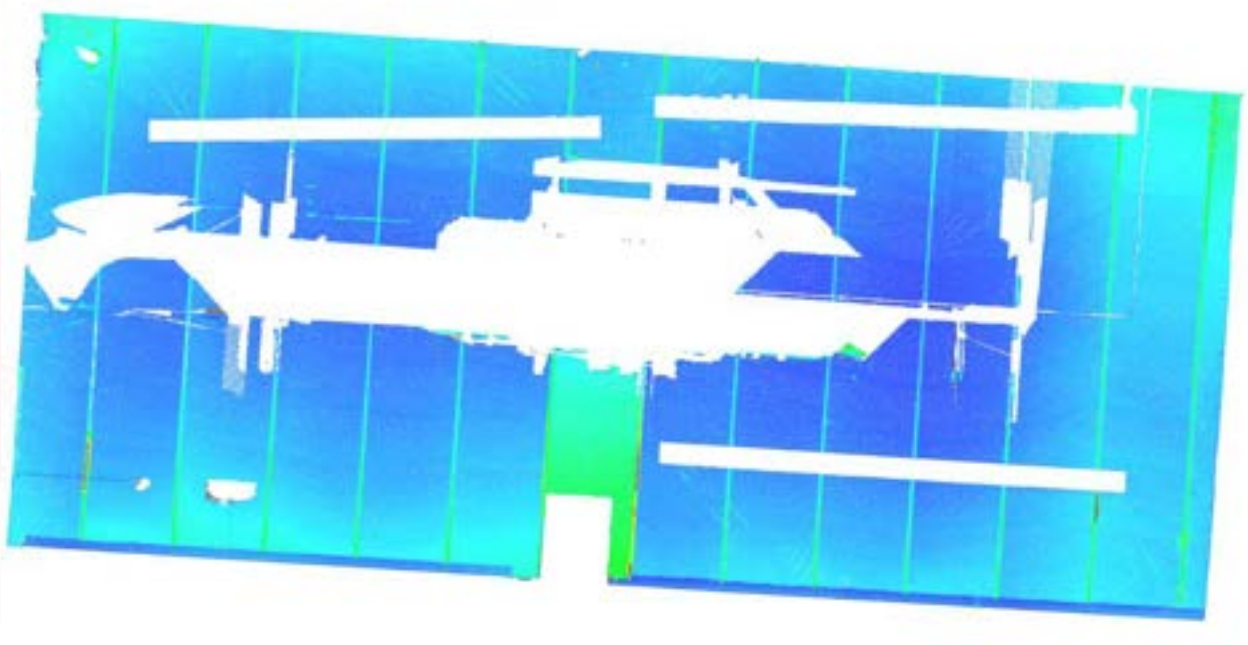
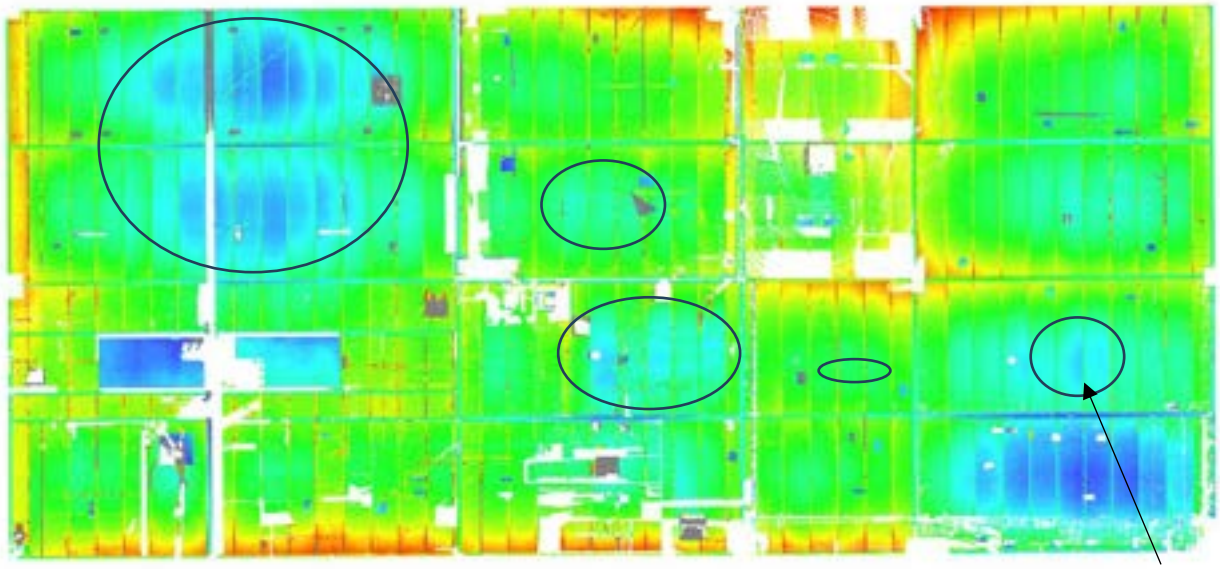


Figure 6 deviation from plane in garage.

4.5.4 Bar area



In span deflection circa 28mm

Figure 7 deviation from plane in bar area to left-hand side with some areas of large deflections shown.

The in span deflection of the roof in this area is less than span/100.

4.5.5 Theatre

The theatre shows that the roof deflections are typically span/200 to span/250.

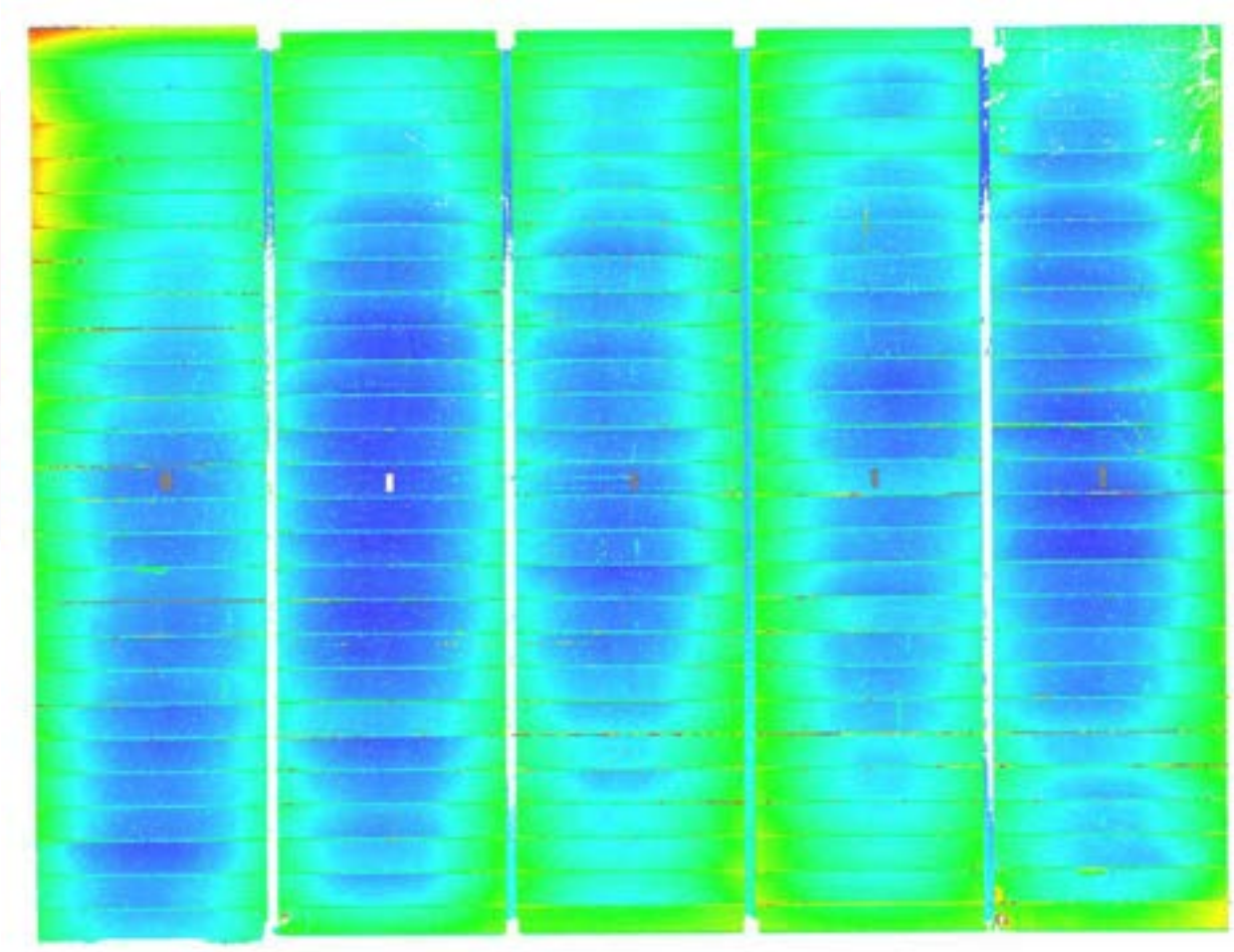


Figure 8 Theatre deviation from plane.

5 DISCUSSION

There is significant water ingress to the roof panels to the library, workshop, first floor bar areas and the walkway. There is localised water ingress to the changing rooms. This puts the roof into the Red category in the risk assessment taken from the IStructE document 'Reinforced Autoclaved Aerated Concrete (RAAC) Investigation and Assessment – Further Guidance' April 2023.

Risk assessment if water ingress is observed				
Deflection	Major cracking or spalling	Minor cracking/ or spalling within 500mm of support	Minor cracking or spalling away from the supports	No visible defect
Deflection >span/100	Red	Red	Red	Red
Span/100<deflection<span/200	Red	Red	Red	Red
Span/200<deflection<span/250	Red	Red	Amber	Amber
Deflection<span/250	Red	Red	Amber	Amber

Table 3 – Risk category with water ingress

Figure 9 extract from 'Reinforced Autoclaved Aerated Concrete (RAAC) Investigation and Assessment – Further Guidance' April 2023

Therefore, the majority of the roof is classified as Red on water ingress alone.

Where panels are supported on proprietary hangers or are cut the roof is classified as Red (Critical) as per the extract below.

4.1.1 Support condition

Support / bearing condition	Risk category
Bearing investigated and found to lack required transverse reinforcement	Red (critical)
Cut or modified panels, including where cut panels are supported on proprietary hangers	Red (critical)
Bearing <75mm with transverse anchorage reinforcement	Red
>75mm with transverse anchorage reinforcement	Green

Table 2 – Support/bearing risk category

Figure 10 extract from 'Reinforced Autoclaved Aerated Concrete (RAAC) Investigation and Assessment – Further Guidance' April 2023.

Therefore, the roofs are classified as Red (critical) with the exception of the garage, bearings need to be checked in this area but are likely to be less than 75mm as supported on block walls supporting more than one panel. Therefore, the remaining areas are classified as Red.

Intrusive investigation of the reinforcement has not been undertaken but there is an observed lack of transverse reinforcement at the fan openings. This is therefore classed as Red (Critical) throughout.

The building contains RAAC panels to the roof areas throughout. The roof is significantly damaged in several areas from chips and service penetrations.

At the time of construction, a bearing of 40mm was acceptable; however, current guidance is that the bearings should be a minimum of 75mm per panel. Therefore, any beam supporting panels needs to be at least 150mm wide. The majority of secondary beams are only 100mm wide therefore this bearing has not been achieved. Safer access for intrusive investigation will be required to determine the bearings on wider beams as they may not be to the centre of the beam.

Given the extent of the roof that is classified as Red(critical) extensive remedial works are required throughout the structure. For remedial works this will include the following:

- Temporary propping, this will include back propping the beam and block floor to take loads to a suitable load bearing strata.
- Additional steelwork at bearing positions to ensure the minimum bearing is achieved.
- Additional support is required to reduce deflections and spans of the panels.
- The roof membrane needs to be fully replaced throughout.
- Additional support at all cut panel positions.
- Additional support at damaged panel areas.
- Remedials to spalled concrete areas.

The existing steelwork will need to be assessed for the additional point loads to confirm that this is code compliant. We note that as the steelwork was designed to a code of practice in 1950 it therefore may not meet current requirements to BS EN 1993. As such, further strengthening works or additional structure may be required when detailed analysis is undertaken.

Given the extent of the works, it may be more cost effective and safer to undertake under CDM and the Building Safety Act to remove the roof and replace with a lightweight system using posi-joists or similar. This will then remove the residual risk of the damaged RAAC panels throughout.

Before detailed repair works can be detailed a full inspection of all bearings will need to be undertaken to determine the extent of additional steelwork required. This will require safe access to be within finger touching distance of the panels, intrusive works to confirm bearings at all beam and wall positions. The cost effectiveness of this needs considering with the costs of the repair vs replacement also.

We note that other areas of the building have not been inspected for the current condition. The condition and remaining life span of these areas therefore cannot be commented upon.

6 CONCLUSIONS

The roof of the Civic Centre is generally classed as Red(critical) due to the extent of damage, unsupported and cut panels, water leaks, deflections and inadequate bearings.

7 RECOMMENDATIONS

It is our recommendation that the structure remain closed due to the extent of propping required to support the damaged areas.

The whole life cost of the additional investigations and repair/remedial works need to be reviewed against the design and full roof replacement costs to establish the most cost effective and appropriate remedial works.

For the long term remedial and maintenance works we recommend that the roof be replaced.

APPENDIX A

CLOUD POINT SURVEY REPORT

23129 - Whitchurch Civic Centre RAAC Survey

Report done by Michael France

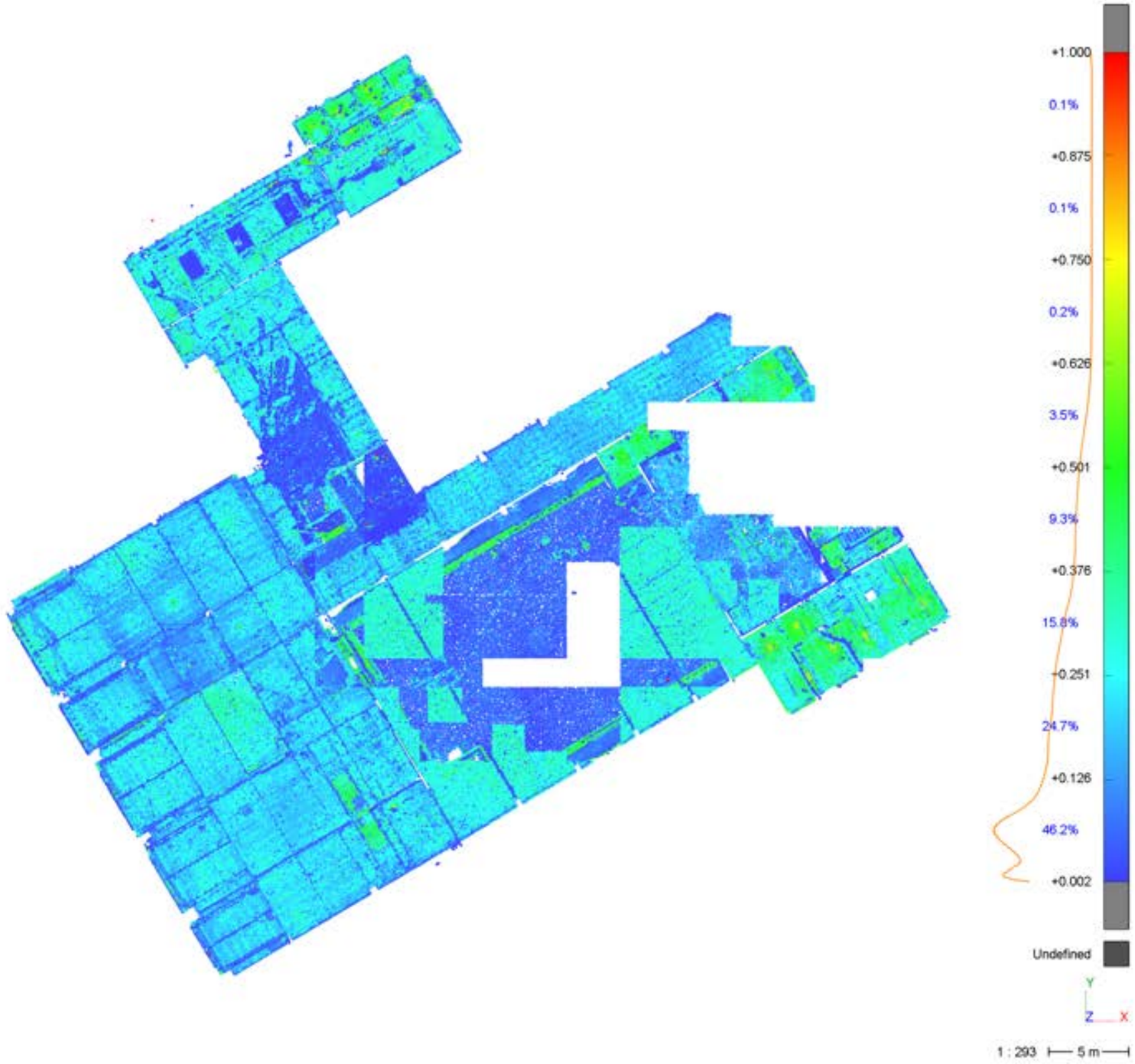
The Severn Partnership

For

Thomas Consulting

08/10/2023

Point Cloud Survey Extents



Levelness Analysis

Surface Levelness has been calculated in the vertical orientation (Z). Global elevation from Newlyn Datum is displayed in the histogram.

Deviation From Plane

A flat plane has been best fit to point cloud, averaging the flatness of the ceiling. The Plane is the offset vertically to the highest point of the point cloud and the deviation from plane analysis is run and calculates the perpendicular distance from the plane to the point cloud.

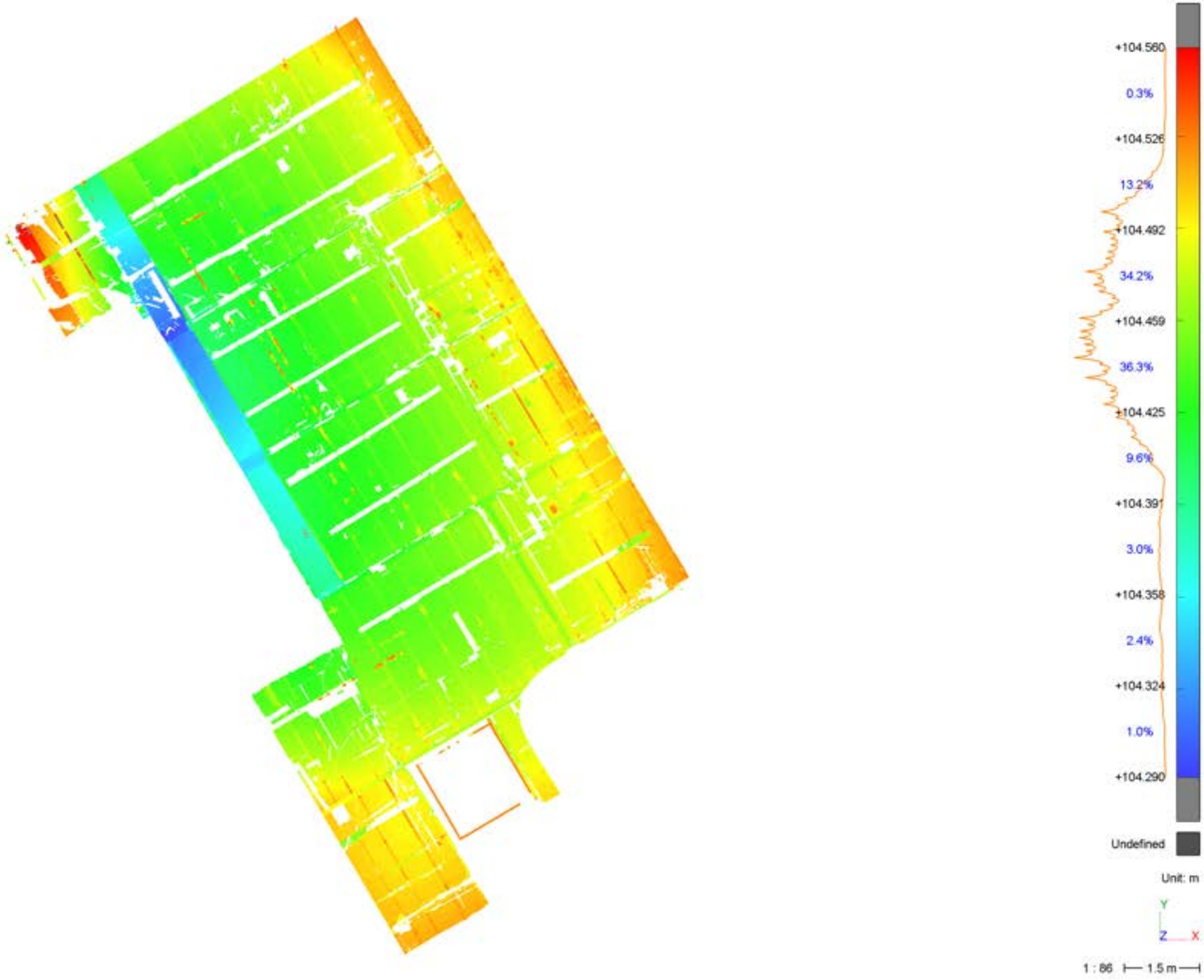
Heatmap

Highlights the value of the analysis performed. Each analysis heat map has been adjusted individually based on the values seen to best highlight areas of deviations.

Histogram

The orange line drawn to the left of the heatmap denotes the quantity of point cloud points that fall within the measured value.

Surface Levelness - Ground Floor, Library

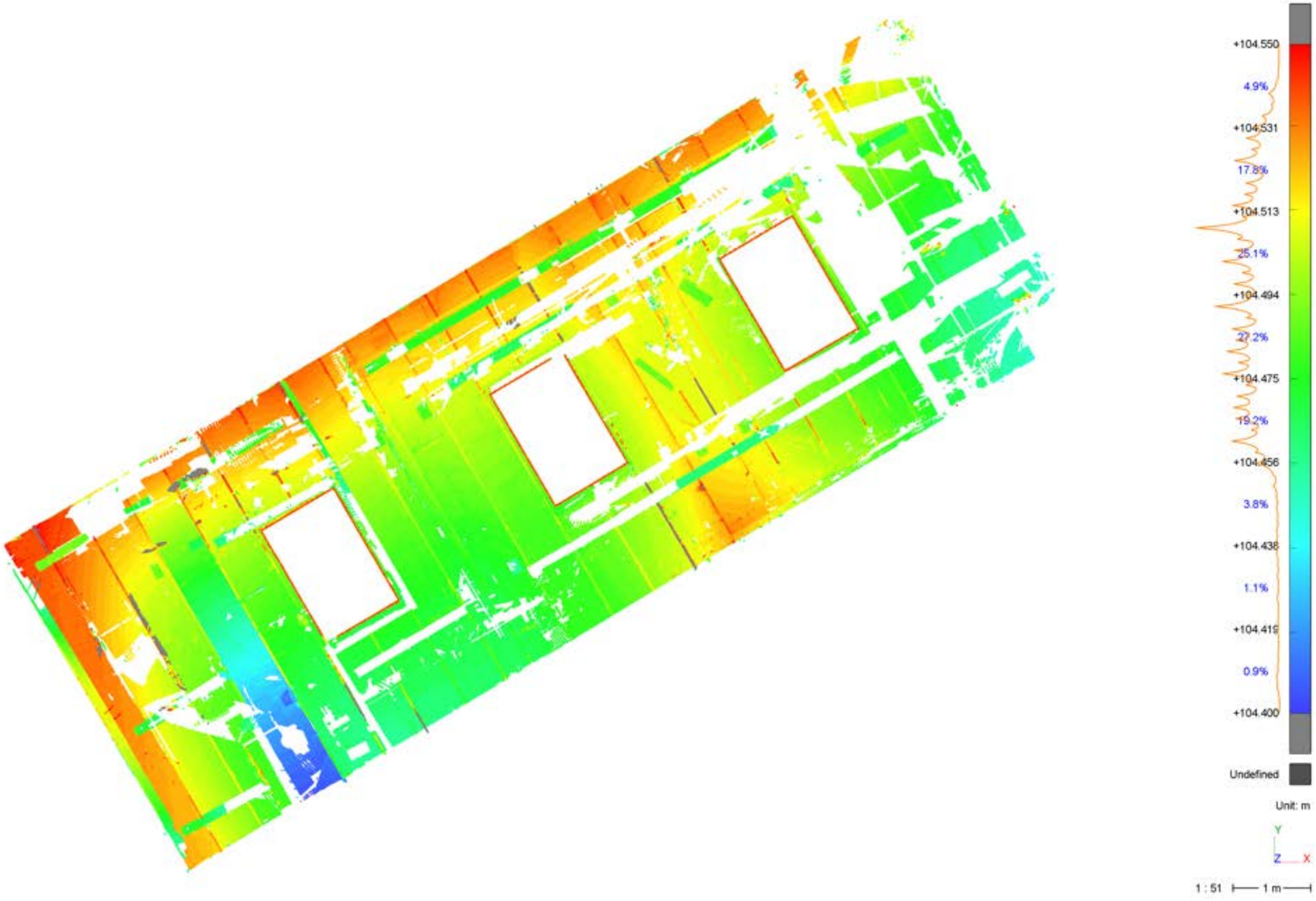


Offset: -104.276 m / **Direction:** X= 0 ; Y= 0 ; Z= 1

Deviation From Plane - Ground Floor, Library

Theoretical: Extracted Plane 23129 - Library
Measure: 23129 - Library Ceiling

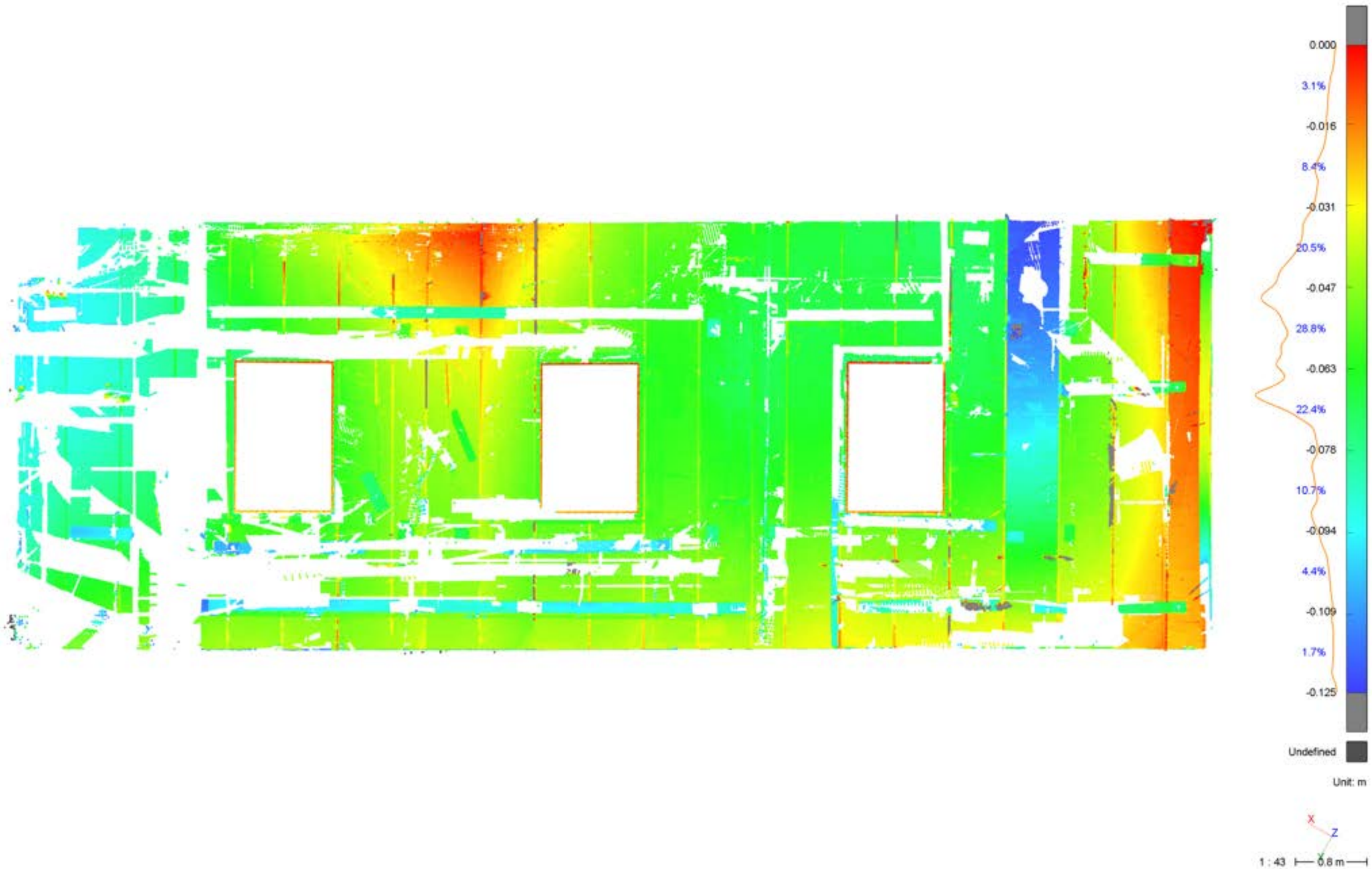
Surface Levelness - Ground Floor, Rooms Rear of Library



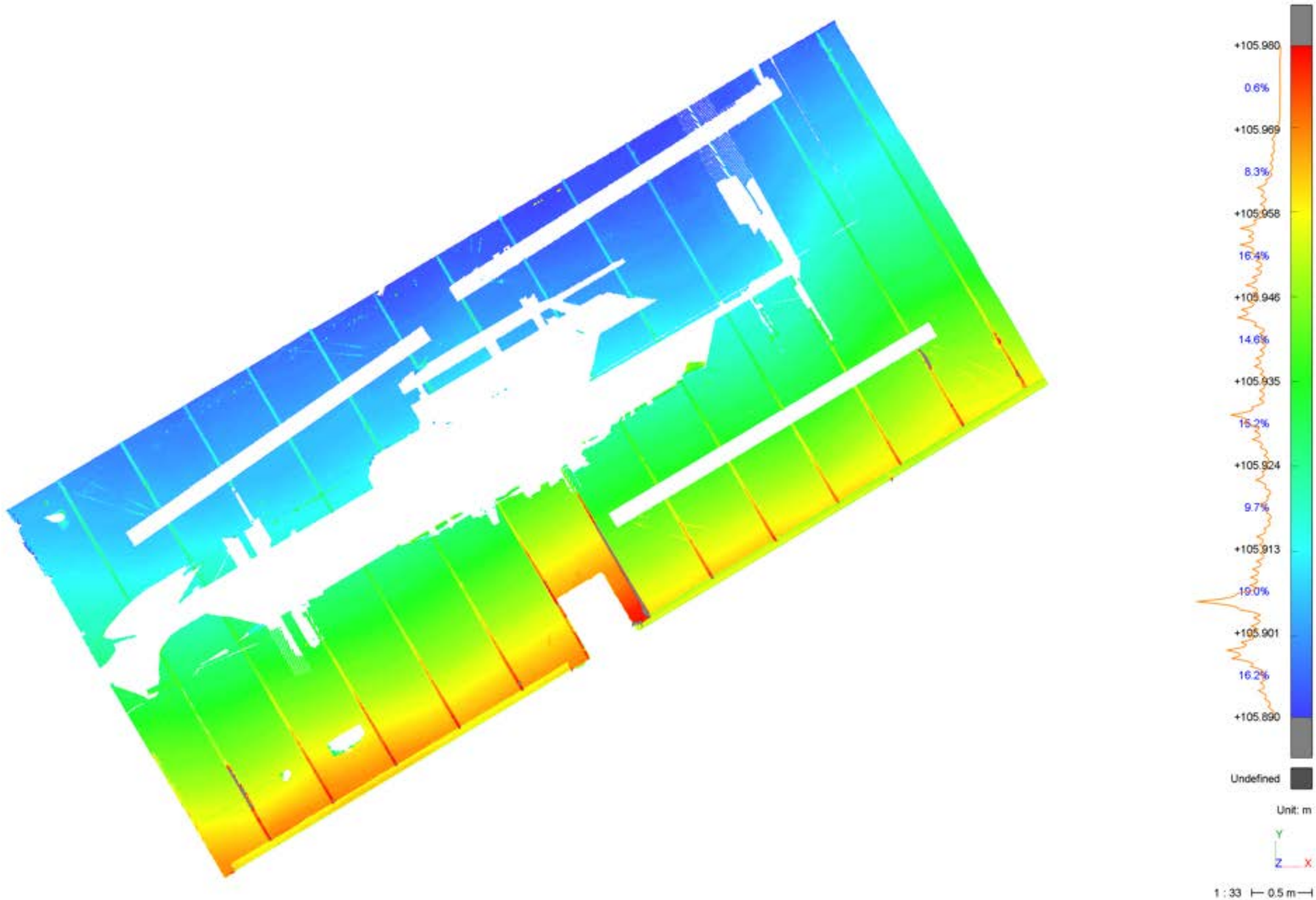
Offset: -104.383 m / **Direction:** X= 0 ; Y= 0 ; Z= 1

Deviation From Plane - Ground Floor, Rooms Rear of Library

Theoretical: Extracted Plane 23129 - Library Back Rooms
Measure: 23129 - Library Back Rooms



Surface Levelness - Ground Floor, Garage



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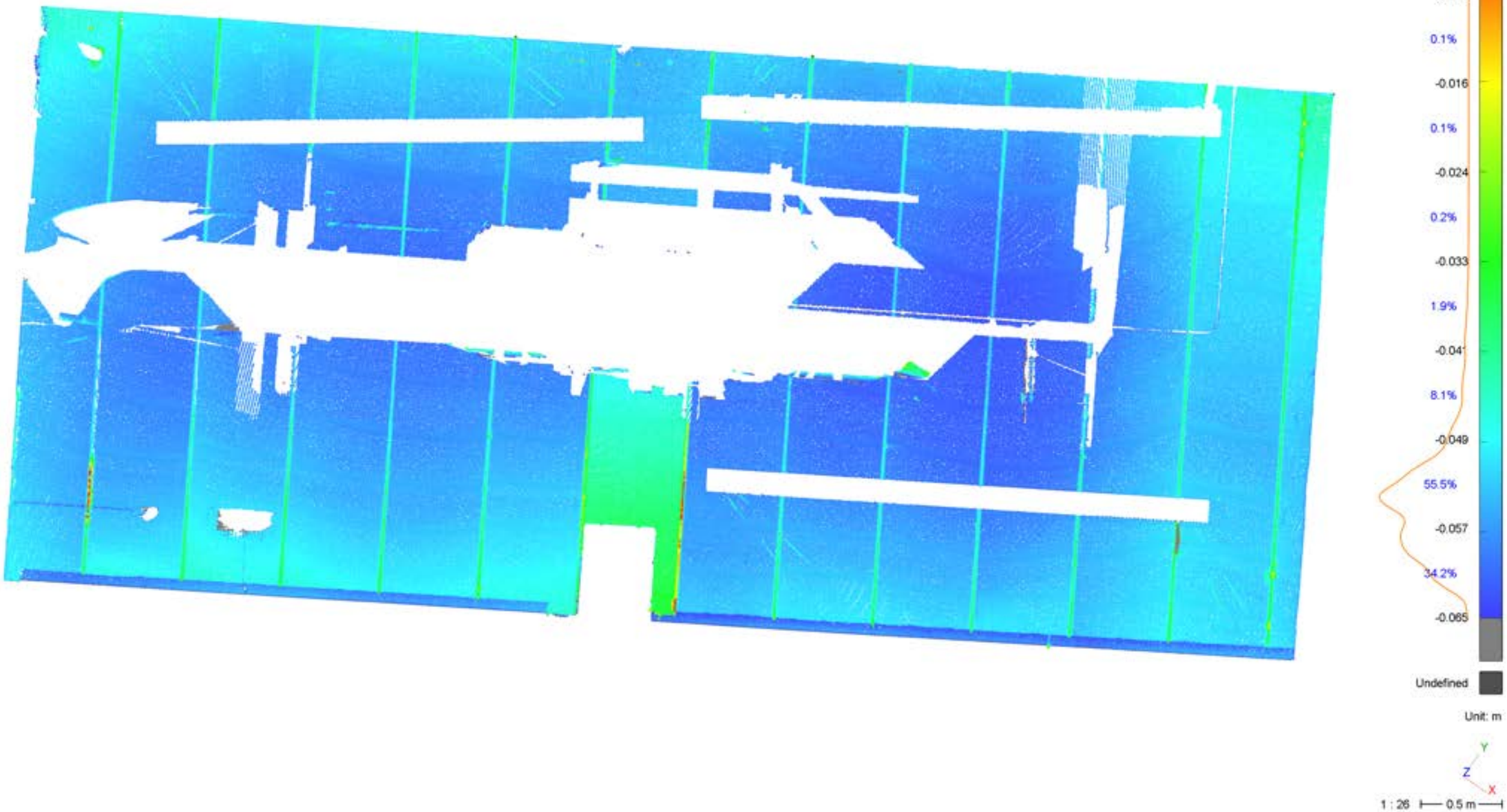
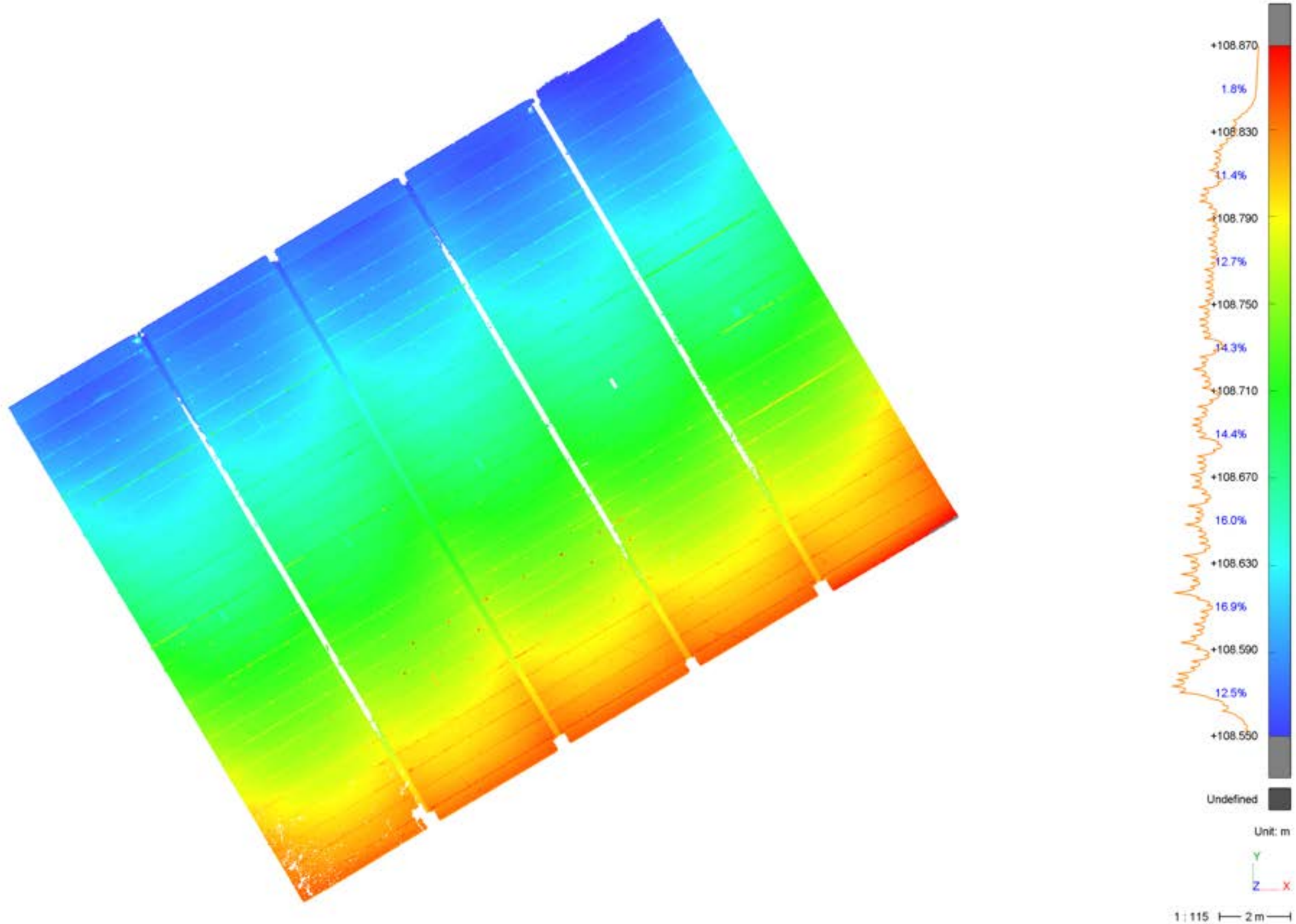
Deviation From Plane - Ground Floor, Garage

Theoretical: Extracted Plane 23129 - Garage
Measure: 23129 - Garage Ceiling



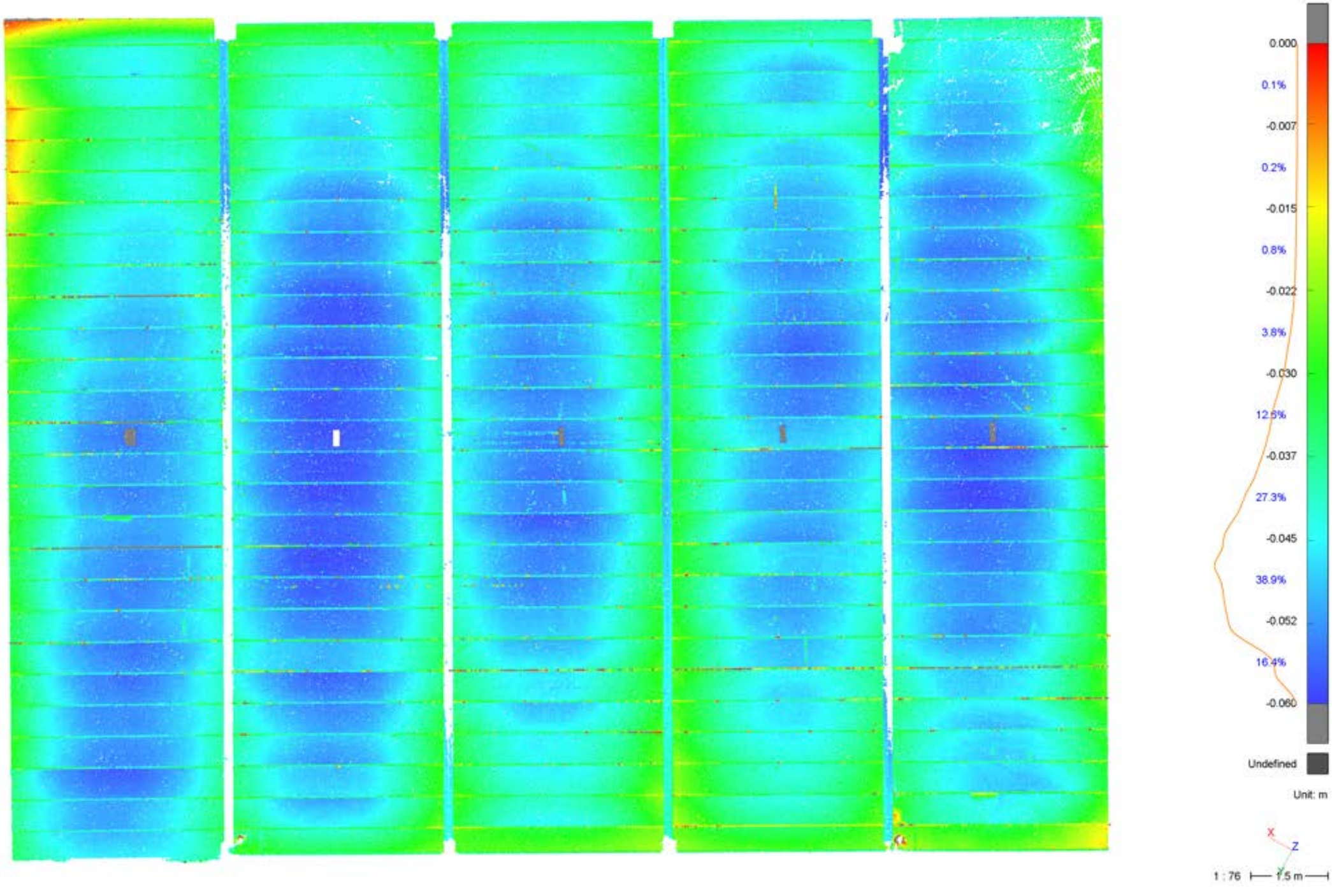
Surface Levelness - Ground Floor, Hall



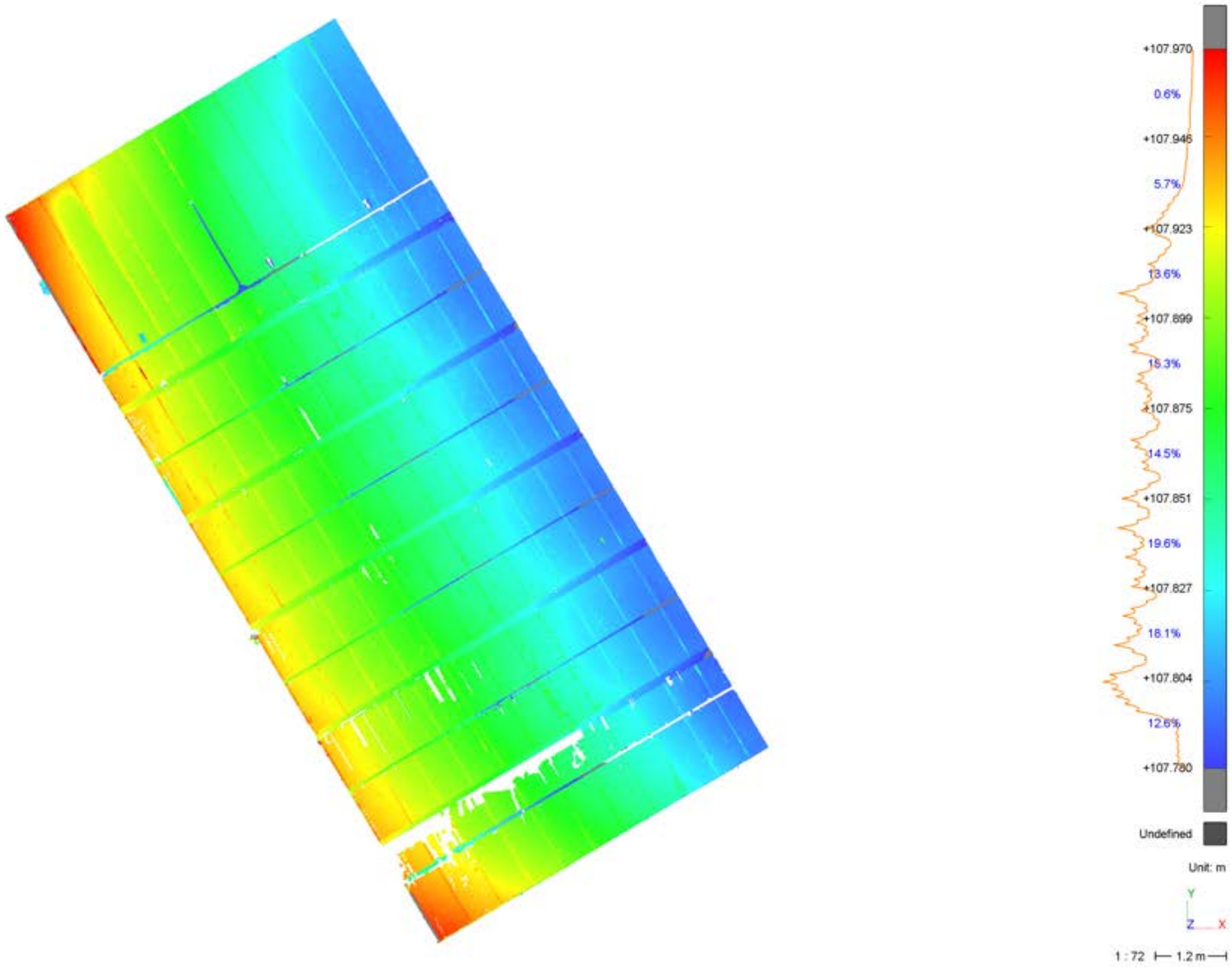
Offset: -108.527 m / **Direction:** X= 0 ; Y= 0 ; Z= 1

Deviation From Plane - Ground Floor, Hall

Theoretical: Extracted Plane 23129 - Hall
Measure: 23129 - Hall



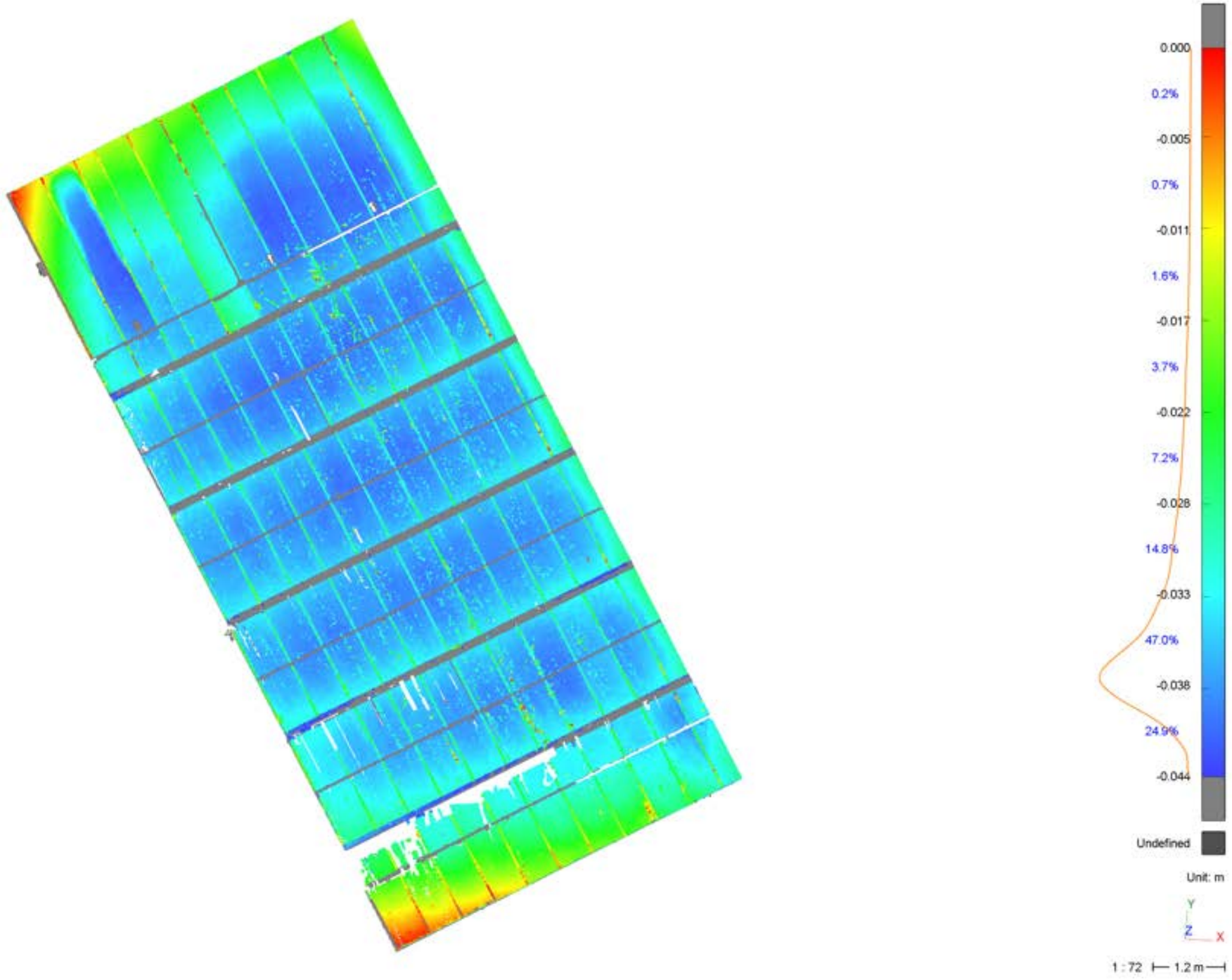
Surface Levelness - Ground Floor, Stage



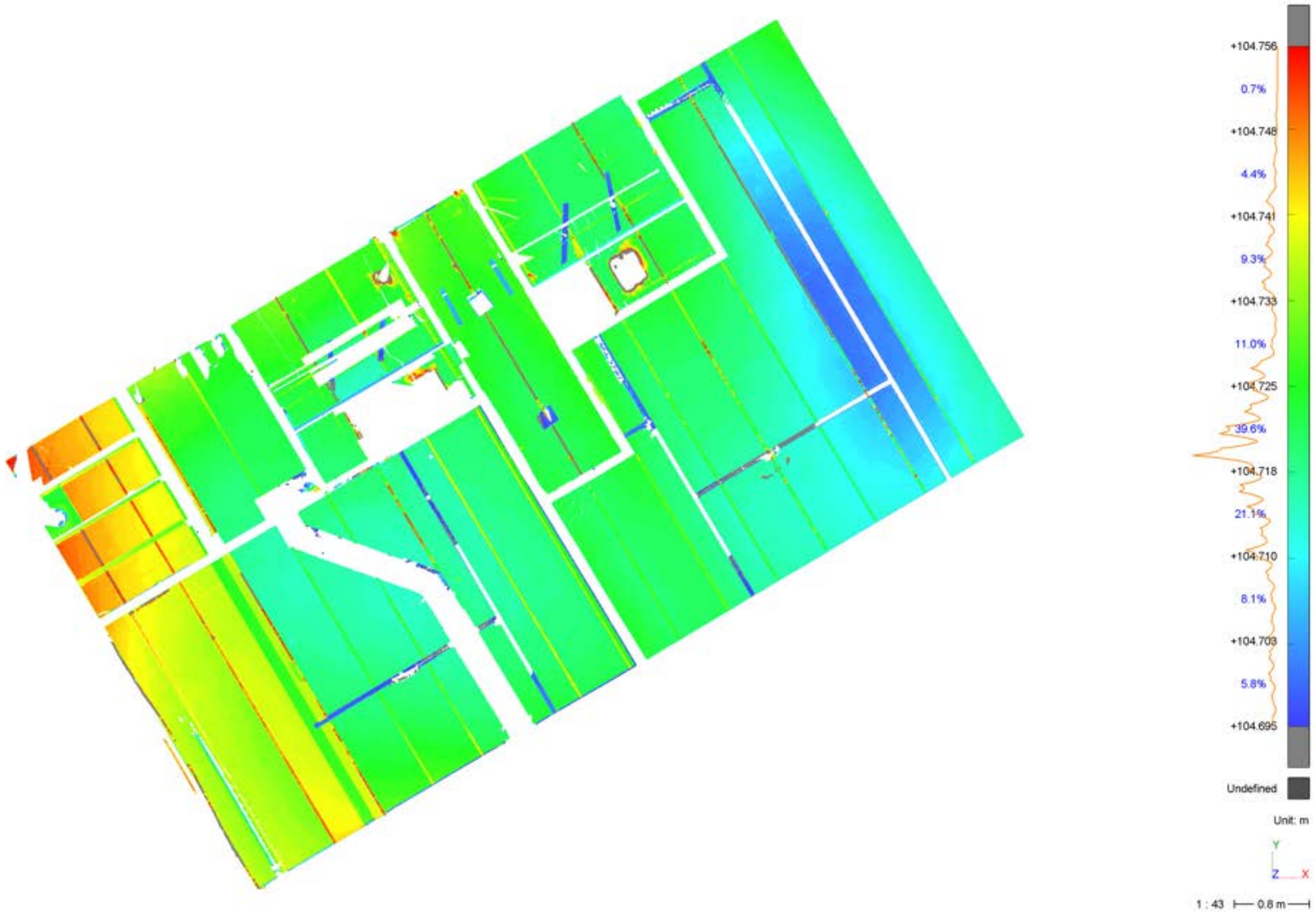
Offset: -107.766 m / **Direction:** X= 0 ; Y= 0 ; Z= 1

Deviation From Plane - Ground Floor, Stage

Theoretical: Extracted Plane 23129 - Stage Ceiling
Measure: 23129 - Stage Ceiling



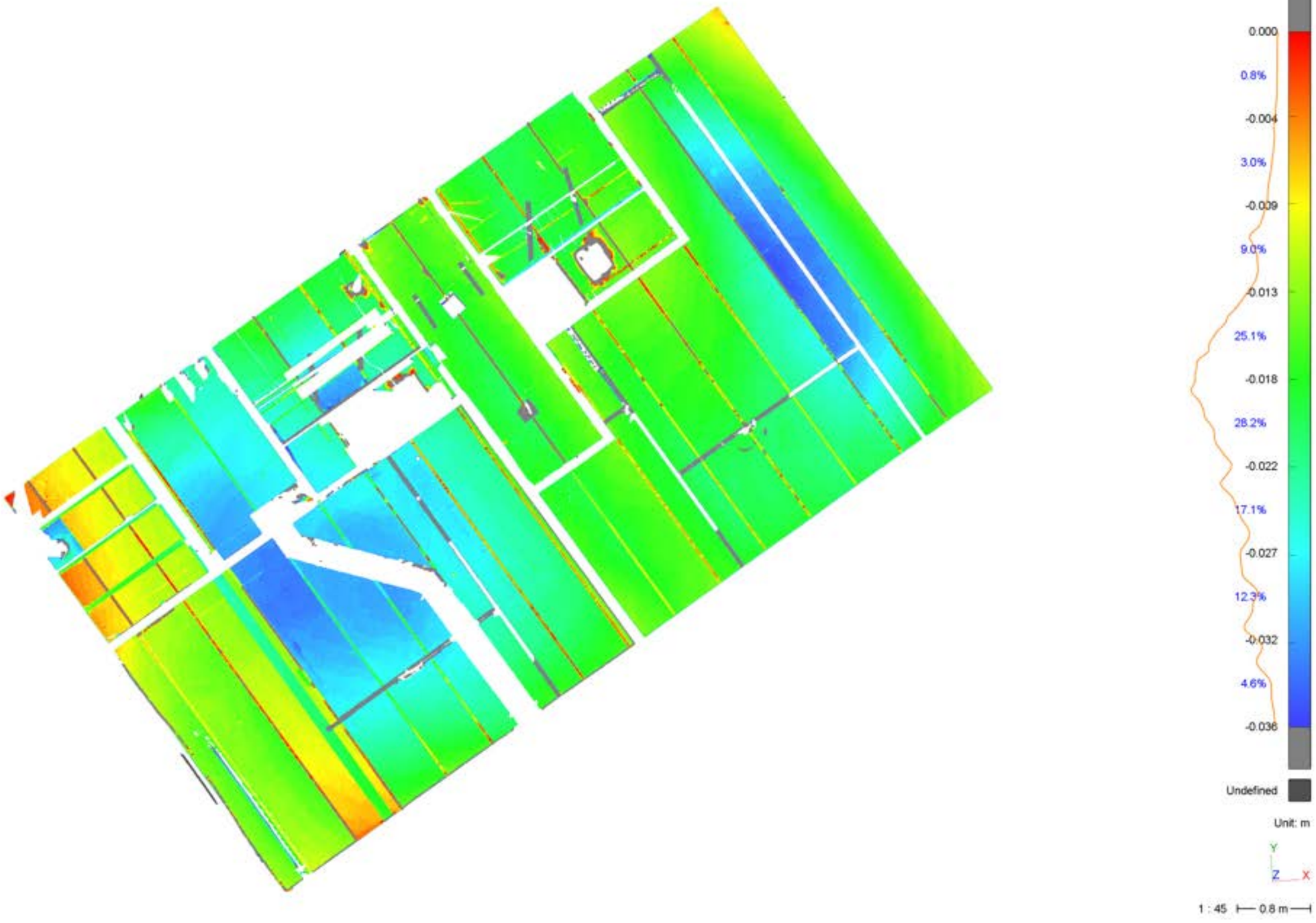
Surface Levelness - Ground Floor, Changing Rooms



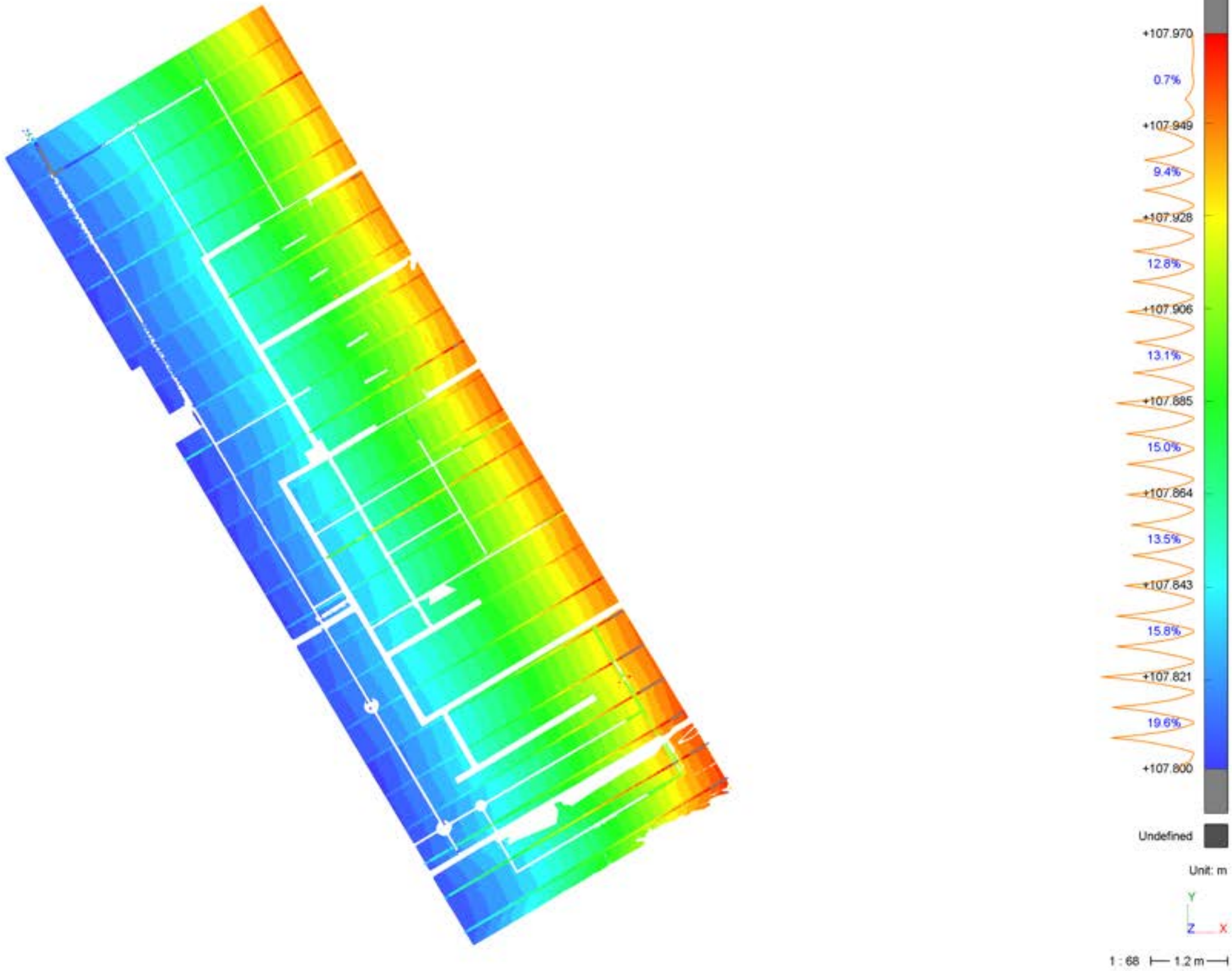
Offset: -104.690 m / **Direction:** X= 0 ; Y= 0 ; Z= 1

Deviation From Plane - Ground Floor, Changing Rooms

Theoretical: Extracted Plane 23129 - Downstairs Changing Rooms Ceiling Levelness
Measure: 23129 - Downstairs Changing Rooms Ceiling



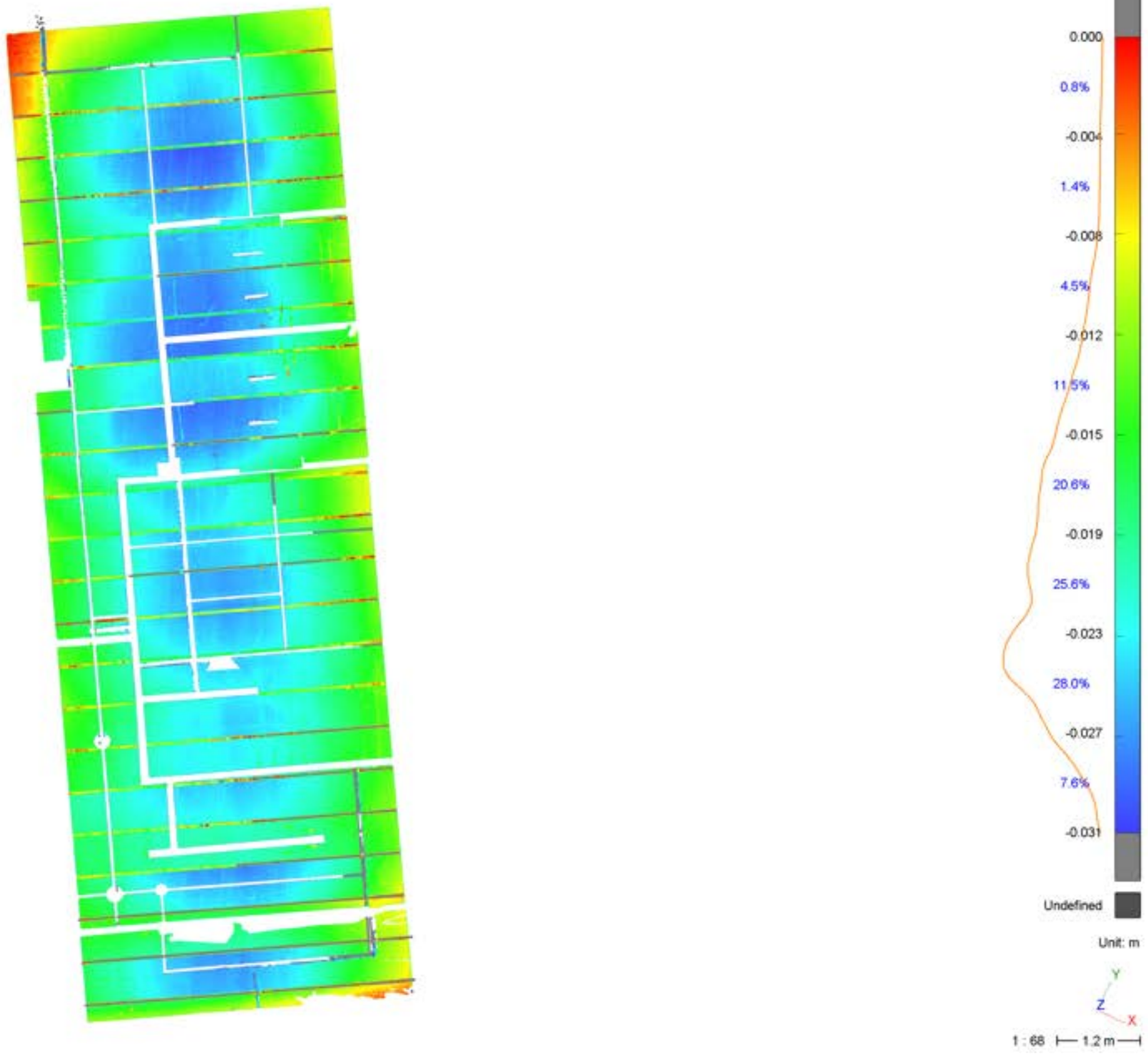
Surface Levelness - First Floor, Changing Rooms



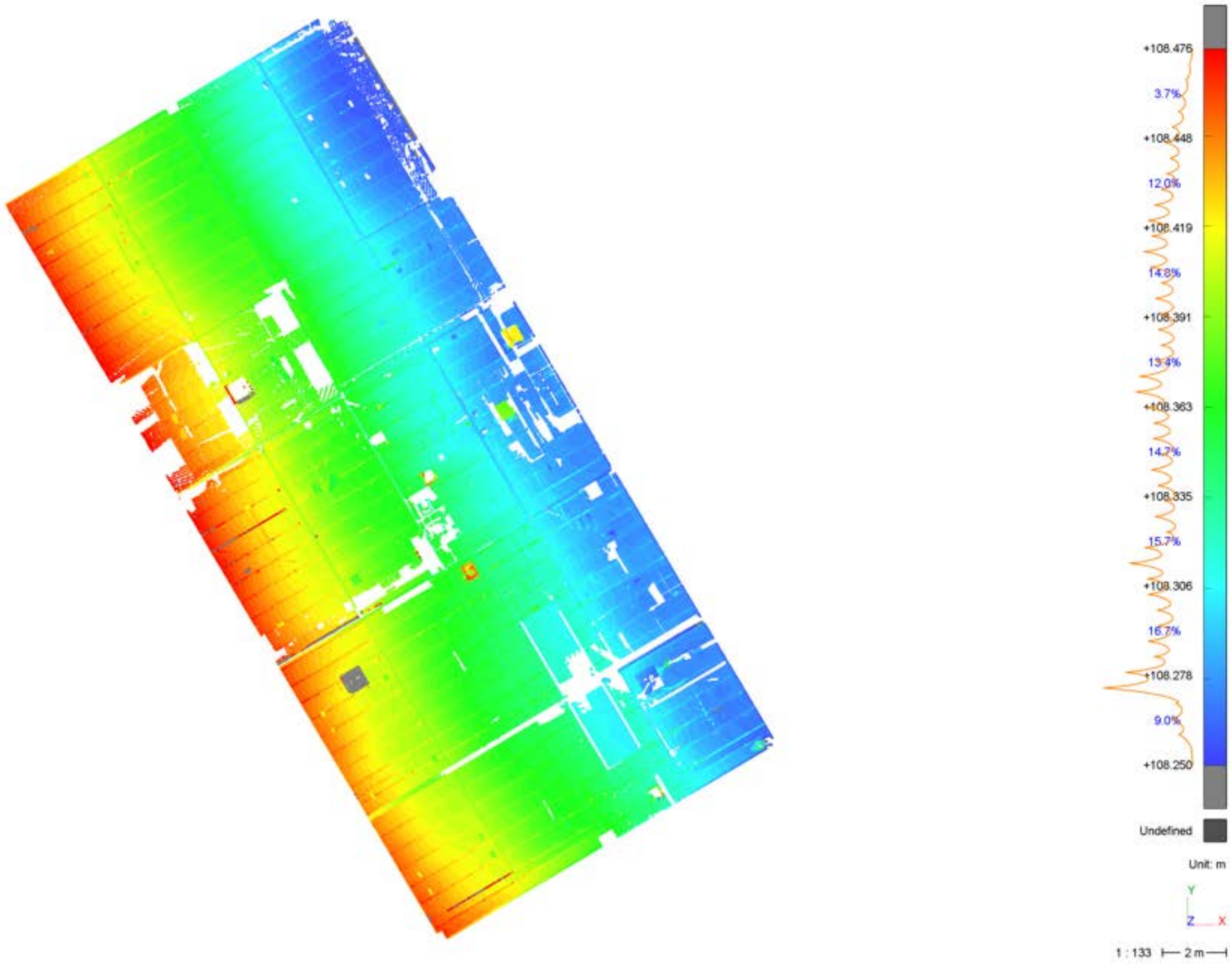
Offset: -107.772 m / **Direction:** X= 0 ; Y= 0 ; Z= 1

Deviation From Plane - First Floor, Changing Rooms

Theoretical: Extracted Plane 23129 - Upstairs Changing Rooms Ceiling
Measure: 23129 - Upstairs Changing Rooms Ceiling



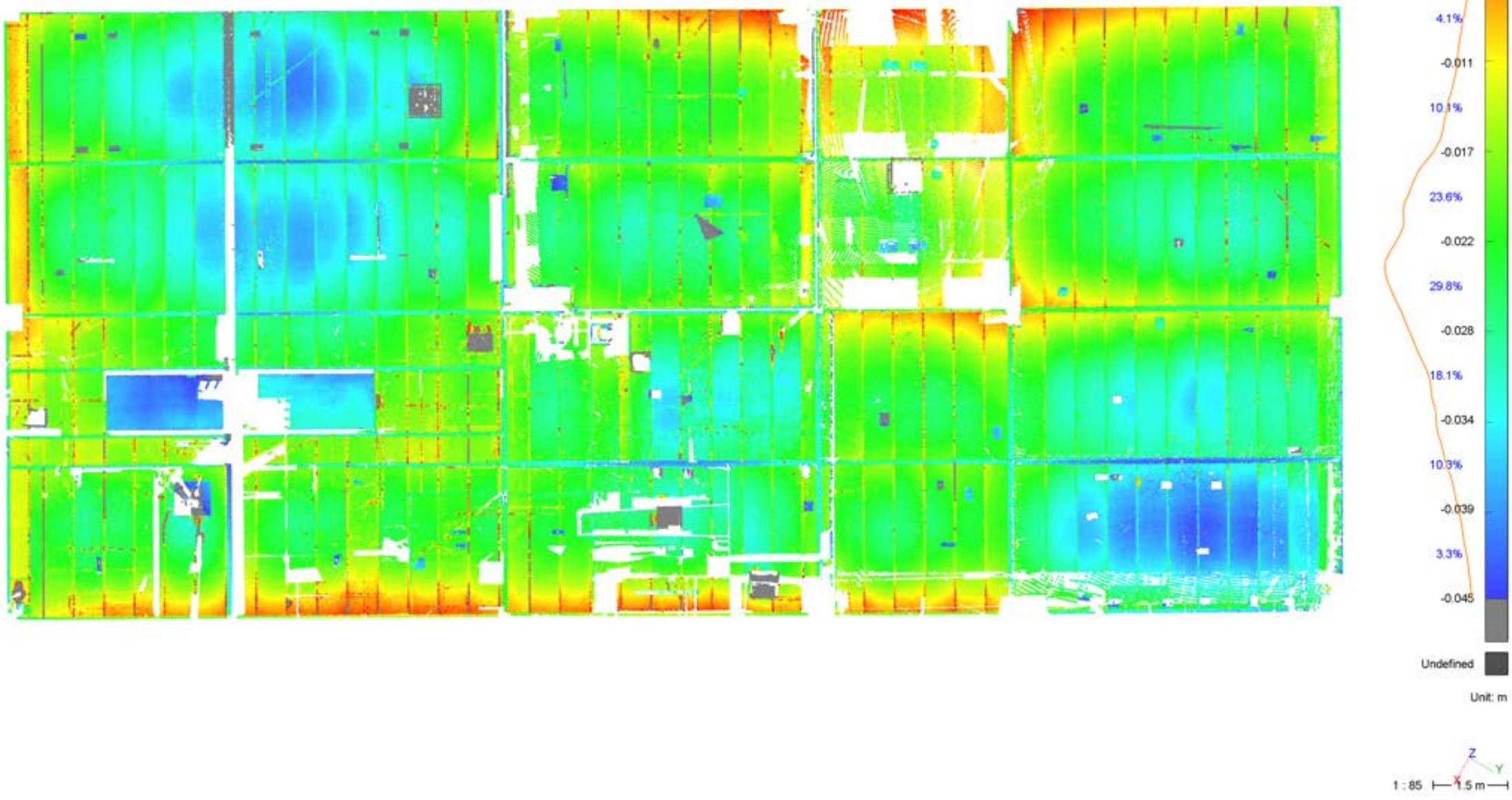
Surface Levelness - First Floor, Area 1



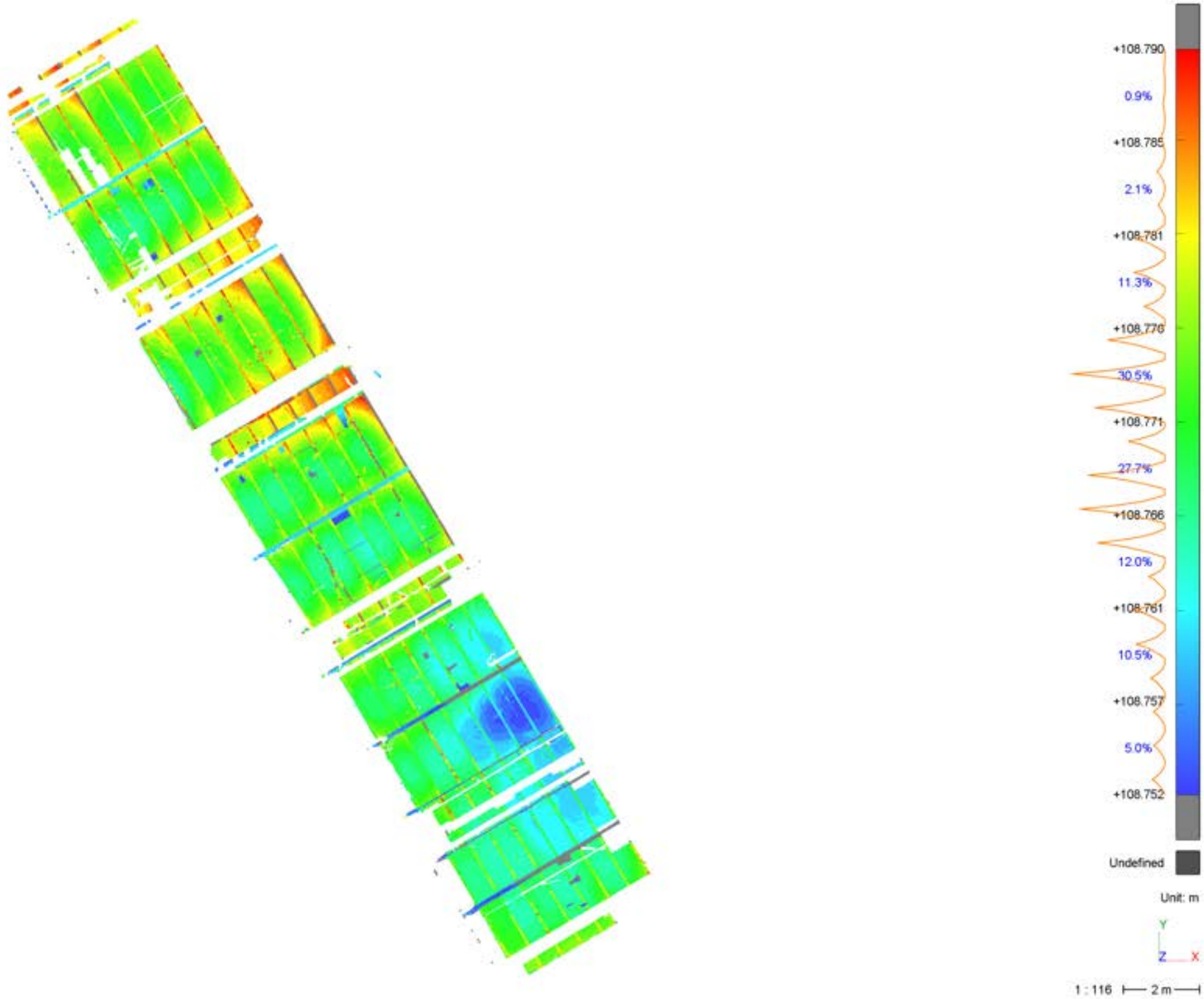
Offset: -108.240 m / **Direction:** X= 0 ; Y= 0 ; Z= 1

Deviation From Plane - First Floor, Area 1

Theoretical: Extracted Plane 23129 - Upstairs Ceiling 1
Measure: 23129 - Upstairs Ceiling 1



Surface Levelness - First Floor, Area 2



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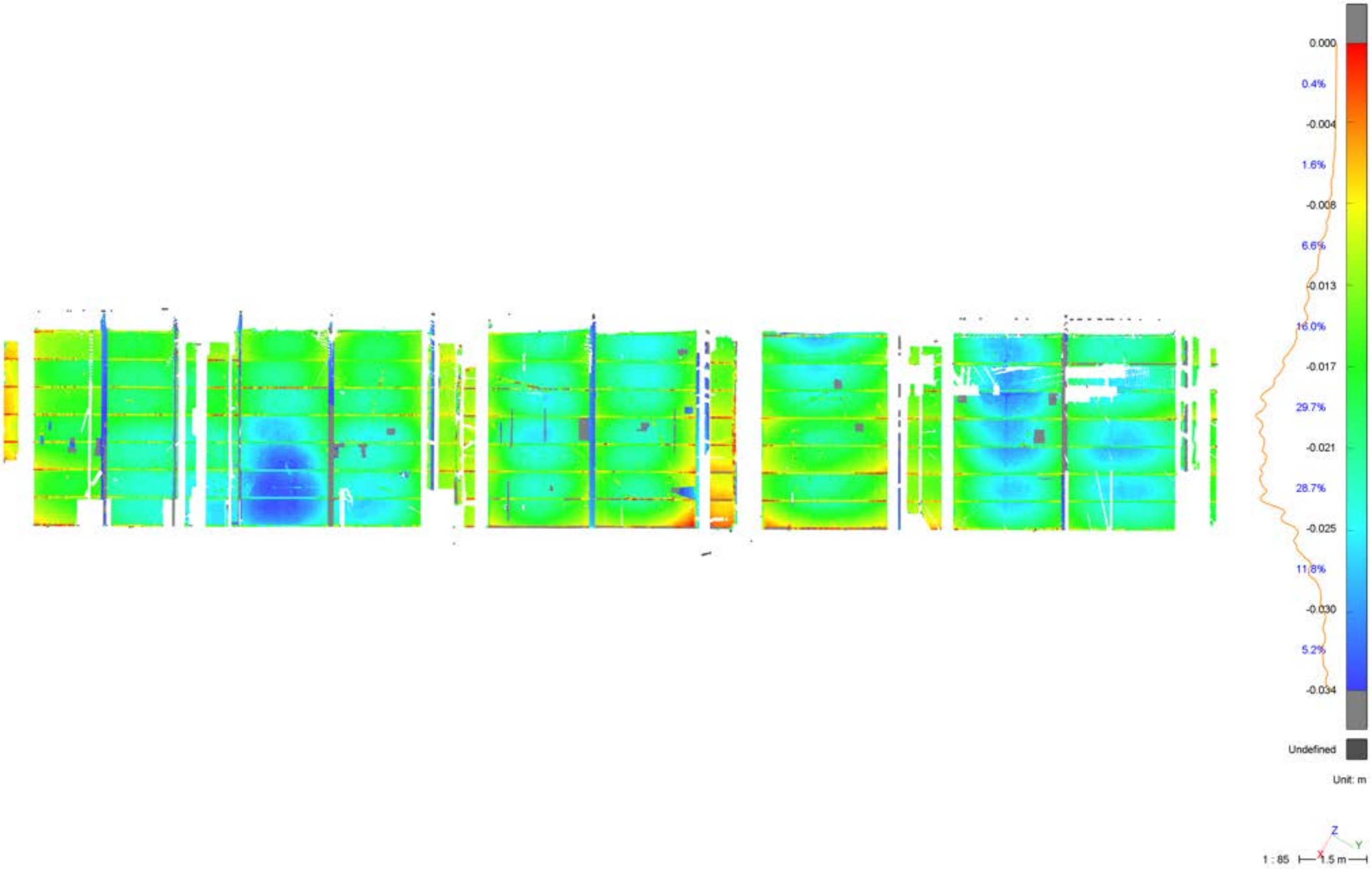
Deviation From Plane - First Floor, Area 2

Theoretical: Extracted Plane 23129 - Upstairs Ceiling 2
Measure: 23129 - Upstairs Ceiling 2



APPENDIX B

CONDITIONS OF INSPECTION

STRUCTURAL INSPECTION

CONDITIONS OF INSPECTION

Instructions are in all cases (unless any variation is agreed in writing by the Company) accepted on the basis of the following conditions which shall govern the inspection and report, and any related matters.

The object of this Report is to assess the effect of the reported defect on the structural integrity of the property. No assurances can be given or can be implied as to the effect that the reported defect may have on the market value or saleability of the property.

i) The Report is confined to an inspection of the clients specified structural elements of the property alone, i.e. foundations (if exposed), walls, floors, roof members (if accessible), and other such members providing structural support to the property, that may be deemed necessary for inspection by the Company.

The report will not cover such items as damp proofing, heating and ventilation, plumbing and electrical circuits, doors, window frames, plasterwork, fitted furniture, decoration or items of general serviceability, unless expressly agreed with the Company before the inspection is undertaken.

ii) We shall not investigate woodwork, or other parts of the structure, which are covered, unexposed or inaccessible. We are therefore unable to report that any such part is free from defects.

iii) It must be clearly understood by the client that the degree of inspection referred to in (i) above will not reveal all defects. Defects in concealed parts such as foundations, under floor areas, and areas covered by wall coverings, plaster or render, will not be revealed. It is, of course, possible to make more detailed investigations and where there is evidence to warrant this, recommendations for further investigations will of course incur further costs and may require the lifting of floor boards, breaking out brick work or digging trial holes. When such detailed investigations is required, it is the responsibility of the client to:

a) give specific written instruction to this effect to the Company and

b) obtain the necessary permission of the owner and to indemnify the Company against liability for damage caused or rectification costs.

iv) Externally the building will be inspected from ground level only, ladders will not be used to inspect roofs.

v) Internally, where appropriate, exposed surfaces of rooms will be inspected as far as reasonably possible. The engineer will not move or disturb furnishings, fittings, fitted carpets or furniture, and no responsibility will be accepted for defects which are concealed.

vi) If requested by the client or judged necessary by the Company and a trap door access exists, the roof spaces will be inspected so long as it is considered safe to do so and crawler boards, ladders etc, are available. Note that high or low confined parts of the roof space will not be inspected.

vii) Readily visible parts of the drainage installations will be inspected, if requested by the client or judged necessary by the Company.

viii) No inspection will be made of services such as gas, electricity and central heating. The client is advised to engage the services of a competent electrician and/or plumber if inspection is required.

ix) Outbuildings, including detached garages, sheds, greenhouses and similar structures will not be inspected, unless expressly requested prior to the inspection.

x) Easements, planning and other proposals by statutory authorities are outside the scope of this structural survey.

xi) Should the client require advice upon any matter other than the structural survey, e.g. proposed additions and alterations, this must be subject of a further separate instruction.

xii) The report is provided for the sole use of the named client and is confidential to the client and professional advisors. The Company accepts responsibility to the client alone and accepts no responsibility whatsoever to any person other than the client himself.

Thomas Consulting will consider re-issuing the report in its original format to a named third party within 3 months of the original report date provided:

a) We have the written permission of our original client to do so and

b) Upon payment of an administrative fee, currently set at 50% of the cost of the original report fee.

In any event the condition of the property is to be taken as that at the time of the inspection.