Lafayette Avenue Presbyterian Church
Fort Greene, Brooklyn, New York
REPORT OF INVESTIGATION: CEILING
22 February 2024

EXECUTIVE SUMMARY

During the overnight of August 10-11, 2023, a significant section of the plaster ceiling – approximately 50 feet above the floor – gave way and fell to the balcony and floor below. While this event is, on its face, is a frightening prospect, there are some associated silver linings:

- No one was in the Sanctuary; no one was hurt;
- The loss occurred at the extreme southwestern edge of the ceiling, avoiding damage to the organ, pulpit, balcony and other church furnishings; and
- We are now alerted to the urgency and extent of this imminent threat, allowing us to address and defuse it in a safe, deliberate, efficient and durable fashion.

Our initial report to the Church is included in Appendix A. As a direct result of the Church leadership's responsiveness and deliberation, a full and timely investigation has been both funded and completed.

INVESTIGATION METHODOLOGY

The Church's enormous suspended plaster ceiling is an artisanal masterpiece in its own right, allowing for the fulfillment of Theodore Cuyler's dream of an open auditorium setting for the new Church. This style of ecclesiastical architecture was, in fact, more than a decade ahead of its time: reducing columns and aisles meant every congregant gathered in the Sanctuary had a superb view. In many ways, this original plaster ceiling is still functioning well after more than 160 years of service.

To grasp the pathology of deterioration leading to the collapse in August 2023, deformation across every inch of ceiling would be required, correlating findings to observed cause-and-effect. That is, in a word, how the investigations proceeded:

- An initial visual examination to swiftly determine severity, safety hazards and recommended immediate action and stabilization required, followed by…
- LiDAR (Light Detection and Ranging) scanning of the entire ceiling and cove from multiple station points within the Sanctuary, basically creating a laser topographic map of the ceiling, followed by…
- A hands-on survey of both the plaster ceiling surfaces and attic (where the critical plaster keying into wood lath is revealed). LiDAR scanning provided clues to the specific locations requiring close, hands-on investigation.

With this full complement of coordinated data gathering, we are now in position to surgically tailor repair and restoration strategies to the specific pathologies of deterioration, addressing the *causes* underlying the symptoms (e.g., the plaster that fell is a *symptom* of a larger issue; it is not the cause).

The Appendices following this report include written, graphic, and photographic information correlating to both methodology and findings, which will be the basis of documents and approvals required for the desired restoration. Identifiable patterns reflecting cause-and-effect clearly exist, the understanding of which is a significant contribution to an efficient, targeted response… and to its long-term performance.

FINDINGS

1. The ceiling was likely last tended to (painted with localized repairs) in the 1970s, although there's a possibility it was as early as the 1950s. The nature of interventions at that time indicated that some deformation was already underway (over 100+ years), mostly associated with the central air vents.
2. Deterioration around the air vents is directly attributable to the designed ventilation system of the Church; that is, large volumes of air – hot and cold, wet and dry, depending on the season and external atmospheric effects – are in constant contact with the open edges of plaster around the perimeters of the decorative vent registers, or screens. Mostly, these surfaces would have been adequately protected when painted; over time, though, the paint erodes and plaster is exposed. Clearly, as a casualty of its height and scale, the ceiling has not been painted often.
3. Compounding the issue above are the belt-driven motors and fans designed to move air, which are determined as non-original because they are electric, and the Church's construction pre-dated the arrival of electricity in New York by more than two decades. The action of the motors presents a significant source of high-frequency vibration, which would negatively affect plaster keying.
4. Exterior roofing & flashing leaks contributed to cracked and dislodged (though not fallen) molded elements comprising the perimeter cove; recent work on the roof drainage system has corrected the primary source of affected locations in proximity to the steeple and Pastor's Study towers in the northwest and northeast corners, respectively.
5. Molded cove elements are cracked and dislodged at the proscenium arch defining the northern balcony choir loft, as well as to either side of the organ. These, too, are associated with roofing and flashing issues (that haven't yet been addressed) relating to transverse masonry walls providing both fire separation and structural support in those locations.
6. The interposition of relatively modern downlights ("high hats") consistently is the cause of much localized cracking, presumably resulting from the vibration of equipment used to cut holes for the lights and the presence of people applying unintended loads to the plaster and lath around each installation. *It's notable that the fallen plaster was in direct proximity to just such a light fixture.*
7. The vast majority of the field (flat) plaster is stable and remains in plane… although we caution that our attic survey did indicate that much of the plaster keying is missing, joist bays are filled with dust and debris, and areas of the attic have been used for storage in past years. All of these are distinct contributors to ongoing degradation and potential failure. For now, as it concerns the flat plaster, it appears that we have arrived just in time to make the necessary corrective repairs without removal of original historic material.
8. Timber trusses supporting struts that in turn support joists to which the plaster and lath are affixed remain in superlative condition. These elements comprise the principal roof framing and structural support of the Sanctuary ceiling. It's worth noting that this particular form of construction is among the best we have ever investigated.
9. Attic catwalks remain in useful locations, though they have the effect of limiting the ability to assess the condition of the plaster keying and lath beneath them; this also is true where mechanical has been mounted.
10. Given the amount of dust and limited access, it is a concern that the attic has no fire suppression system of any kind. Notre Dame's devastating fire in 2019 began in its attic.

RECOMMENDATIONS

1. This is a defined holistic project; that is, it will not be made whole until all of the contributing factors have been remedied.
2. There are known hazards associated with this work: lead and molds, both of which will be airborne as work progresses. Defined safety protocols will need to be in place for the duration of the work.
3. Because of its holistic nature – and with economy in mind – it's anticipated that universal access for work crews will be provided via a rolling bridge scaffold system, which can limit the distribution of loads to controllable areas while obviating the need to remove pews and other furnishings. Note that because of the nature of deterioration identified above the organ, partial disassembly of organ piping – or specialized protection – will be required to work safely within the south alcove space.
4. Paint analysis is recommended for all surfaces above the *Mighty Cloud of Witnesses*, to inform decisions regarding appropriate paint/finishes upon completion of specified restoration.
5. A refined lighting plan should precede this work, allowing for selection of appropriate new fixtures, armatures, and controls. All non-original light fixtures mounted within the plaster surfaces should be removed.
6. Mechanical interventions should include remote fans for attic ventilation (i.e., not directly mounted to the perimeter framing of original air vents) and fire suppression, as well as more uniform ambient lighting to facilitate safer and more periodic inspections.
7. All uniform flat plaster – whether or not its keys remain intact – will require reattachment to its lath and substrate uniformly, so that gravity-induced loads are distributed evenly across the entirety of the ceiling. Upon completion of this step, extraneous skim coats and peeling paint are removed.
8. As an interim measure, upon completion of flat plaster stabilization, with the scaffold remaining in place, it may be advisable to secure all surrounding endangered plaster elements with netting or other effective means to minimize additional failures until each location can be addressed.
9. Cracked and dislodged running molding (e.g., that which comprises the upper cove and the band course above the mural and leaded glass windows) may be removed and re-attached, once the underlying cause of their disturbance has been corrected and the substrate is stable.
10. Molded rosettes and decorative grilles defining the three central vents will be protected, encased and removed in their entirety, allowing restorative processes to take place in a shop (or within the Church, if a pop-up field shop is a possibility). Restored rosettes may be safely and permanently re-adhered once restored. Grilles will require more deliberation, once fully removed, to determine the optimal course of action (i.e., restoration or re-fabrication in an alternate material).
11. Missing plaster sections will be rebuilt utilizing the same lime plaster as the original, thus ensuring a lasting marriage of the new and heritage materials. Note that the horsehair used in the original for micro-reinforcing may still be emulated today with cashmere (goat hair), which is readily available.
12. Residual hairline cracks will be evaluated and categorized as either beneficial (allowing for natural thermal expansion) or detrimental (causing a structural deficiency in the material or location). The latter will be injected with a lime plaster compatible grout.
13. Finally, all surfaces will be painted; preferably, in the historic paint color palette.

BUDGETS & FUNDING

We will continue to work with the Church to develop appropriate budget and funding scenarios, based largely on the direction of Church leadership. Without question, the comprehensive nature of the work outlined above may appear daunting, but it remains a welcome scope of work compared to what might have been had we not been able to effectively intervene at this point in the Church's history. Also, with the exception of the flat plaster remediation, much of the remaining work is iterative. We also have the benefit of soliciting bids from a variety of artisans within the NYC metropolitan area. Finally, it is useful to keep in mind that perhaps 80-85% of the Church's plaster ceiling remains in remarkable condition.

That is a testament to the magnificent skill and vision embedded forever in its design and construction, something to celebrate.

APPENDIX A

WSA Initial Response Memo to LAPC dated 08.15.2023

LAPC Sanctuary Plaster Ceiling Event

Walter Sedovic

Tue 8/15/2023 5:13 PM

To:Deborah Howard <debghoward@outlook.com>;

Cc:Morgan Valencia King <mvk@lapcbrooklyn.org>; J. David Williams <jdavidw@gmail.com>; Janis Russell <janisrweatherly@gmail.com>; Isaiah Pinckney <isaiahpinckney@hotmail.com>; sl2004@hotmail.com <sl2004@hotmail.com>; Andrew Wright <awright@starboardarch.com>; Phillip Kellogg <phillipkellogg@me.com>; ebanksjoann33@gmail.com <ebanksjoann33@gmail.com>; hbodner@lapcbrooklyn.org <hbodner@lapcbrooklyn.org>; Jill H Gotthelf <jhgotthelf@modernruins.com>;

13 attachments (8 MB)

LAPC.00 Ref. Plaster Clg Keys.jpg; LAPC.01 i0000 Ameen.jpg; LAPC.02 i3817.jpg; LAPC.03 i3819.jpg; LAPC.04 i3820.jpg; LAPC.05 i3818.jpg; LAPC.06 i3821.jpg; LAPC.07 i3824.jpg; LAPC.08 i3825.jpg; LAPC.09 i3822.jpg; LAPC.10 i3823.jpg; LAPC.11 i3826.jpg; LAPC.12 i3828.jpg;

Dear Deb & Friends,

Responding to an event – partial collapse of the Sanctuary's plaster ceiling – occurring during the overnight between Aug 10-11, I inspected on-site conditions yesterday, Monday, August 14. During the interim, over the weekend, the Sanctuary remained closed to parishioners and the public, and attic access was secured (locked) at both points of entry. In discussions with Deb & Ameen on Friday, I asked if we could sweep and save the fallen plaster debris for evaluation, which was nicely done and placed in two containers.

Here's a summary of our findings, to date:

CAUSE

It is natural, when an event like this occurs, to first seek a cause. Though causes have been conjectured, there's no evidence to support them. Let's rule out a few:

- ConEd (or its assigned agent) dropping a steel road plate. NEGATIVE. First, the timing overnight. Second, even if it did occur, steel plates dropped on a perimeter bituminous bed 100+ feet away would have no measurable effect on the Church; besides, it isn't susceptible to this type of high frequency vibration.

- Something was dropped in the attic. UNLIKELY. There simply isn't anything to support such a claim: No remnants, no footprints, nothing dislodged, no broken lath, etc.

- Roof leaks. NEGATIVE. There is zero evidence of leaks or any other damage on the attic side; in fact, the fasteners attaching the lath are still in pristine condition.

FINDINGS

Approximately 8 sq ft of flat plaster ceiling, at the margin of the Sanctuary, de-keyed* and de-laminated**, falling roughly 24 ft to the floor below. No one was present in the Sanctuary at the time of the event, and the entire space has been cordoned off, by Ameen, to prevent access by others.

** De-keying is the term for when a lateral break occurs through the neck of the plaster, between the lath; generally, the plaster below falls, while the remaining key above stays.*
***De-laminating is particular to this event, where an apparent adhesive "flow coat" may have been injected into the plaster ceiling from above, in an attempt to stabilize it.*

The site of the damage is to the left of the chancel/pulpit/organ (as you face it), as indicated in the attached images.

From above, this location is open to the Church's roof framing above, while the areas around it are either partially covered by adjacent roof framing, or fully covered by original catwalks and decks floating above the ceiling (providing access to equipment, structural ties, and air vents). This is important, because the building construction & design in this location allows for greater volumes of air to pass through (vs areas that are covered). Dry air can have the effect of increasing the brittleness of plaster over time, making it more susceptible to applied stresses that normally occur in traditional buildings (moving, changing with the seasons, et al....).

In fact, the condition of the plaster remaining above the immediate area of the collapse is very brittle; it has no cohesion, and therefore little resistance to stress. By contrast, the intact plaster keys surrounding the collapsed area are in markedly better condition, and fully formed. Investigation of the collected plaster debris supported this: the plaster that fell is very dry and brittle.

This location, as noted from below, holds other secrets. It is proximate to 3 relatively modern light and sensor fixtures penetrating the plaster ceiling immediately above the organ. Around the large, original convection vent in the ceiling at this same position, it is apparent that a very large section of plaster is also dislodged, perhaps in peril of falling itself. Even more compelling is the supposed remnant "flow coat" remaining within the lathed area of the collapsed plaster (also identifiable in attached images). This suggests that – perhaps at the same time as the installation of the newer light fixtures – an injected adhesive technology was applied to stabilize what had already been identified as compromised.

The more you look, the more you see undulations in this vast plaster ceiling.

Another contributing factor that supports the idea that the plaster has been slowly disintegrating is this: Inspection of the fallen debris also revealed broken keys with decades of dust covering the breaks. That is, these are not fresh (which would be clean).

The plaster itself, including its thickness, consistency, method of application, etc. seems sound. But there are locations that appear to harbor increased vulnerability to dislodging. This statement is consistent with the overall level of quality exhibited throughout the Church in its design and construction technology; that is to say, this event does not signal a systemic failure, but it is crucial to know the pattern and extent of serious degradation.

Until then, WSA strongly advises the Sanctuary remain closed to congregational or casual use.

REMEDIATION

Generally, there are several effective remedial repair techniques – well understood and evolved within the industry – that may come into play. First, though, it is crucial to identify any patterns to inherent failing so that a more surgical, studied approach to the stabilization and restoration of this original plaster ceiling may be effected.

We can discuss both the methods of understanding extent of concern, as well as potential sources of funding for a holistic investigative analysis. That analysis would likely involve one form of digital mapping (e.g., LIDAR) which would reveal inconsistencies in the ceiling plane, or levelness.

Following that analysis, which would be conducted largely from the floor of the Sanctuary, a more specific, hands-on, sampling of, say, 12-24 location would be conducted. From there, additional analysis may be warranted, or remediation may begin in earnest. Conservation techniques to re-secure plaster ceilings are effectively completed both from above and below the ceiling, or both. Generally these involve physical ties or screws back to the lath and framing timber, as well as fluid methods that have the ability to reconstitute friable plaster materials. Ultimately, the selection and implementation of one or more of these methods would be consensus-driven, based on a number of critical factors, many of which will become better known as the analysis progresses.

EPILOGUE

I did mention at the beginning that we were looking for causes. Certainly, if someone dropped a bowling ball

through the ceiling the issue would be easy to understand and, ultimately, to resolve. This is a complex issue, and the path to an economic and lasting solution is to gather information. Meanwhile, I am sorry to have to advise closure of the Sanctuary until conditions are more fully understood, **but everyone's safety is paramount. And this still remains a dangerous, active condition.**

Sincerely,
Walter&Co.
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Walter Sedovic FAIA FAPT LEED
Founding Principal & CEO

"Be more like a dog: Never pass up the opportunity to go for a joyride…!"

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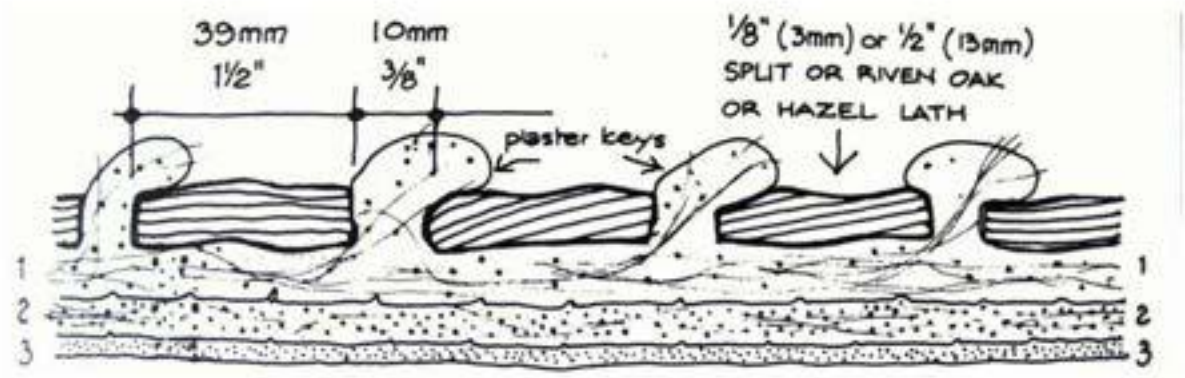
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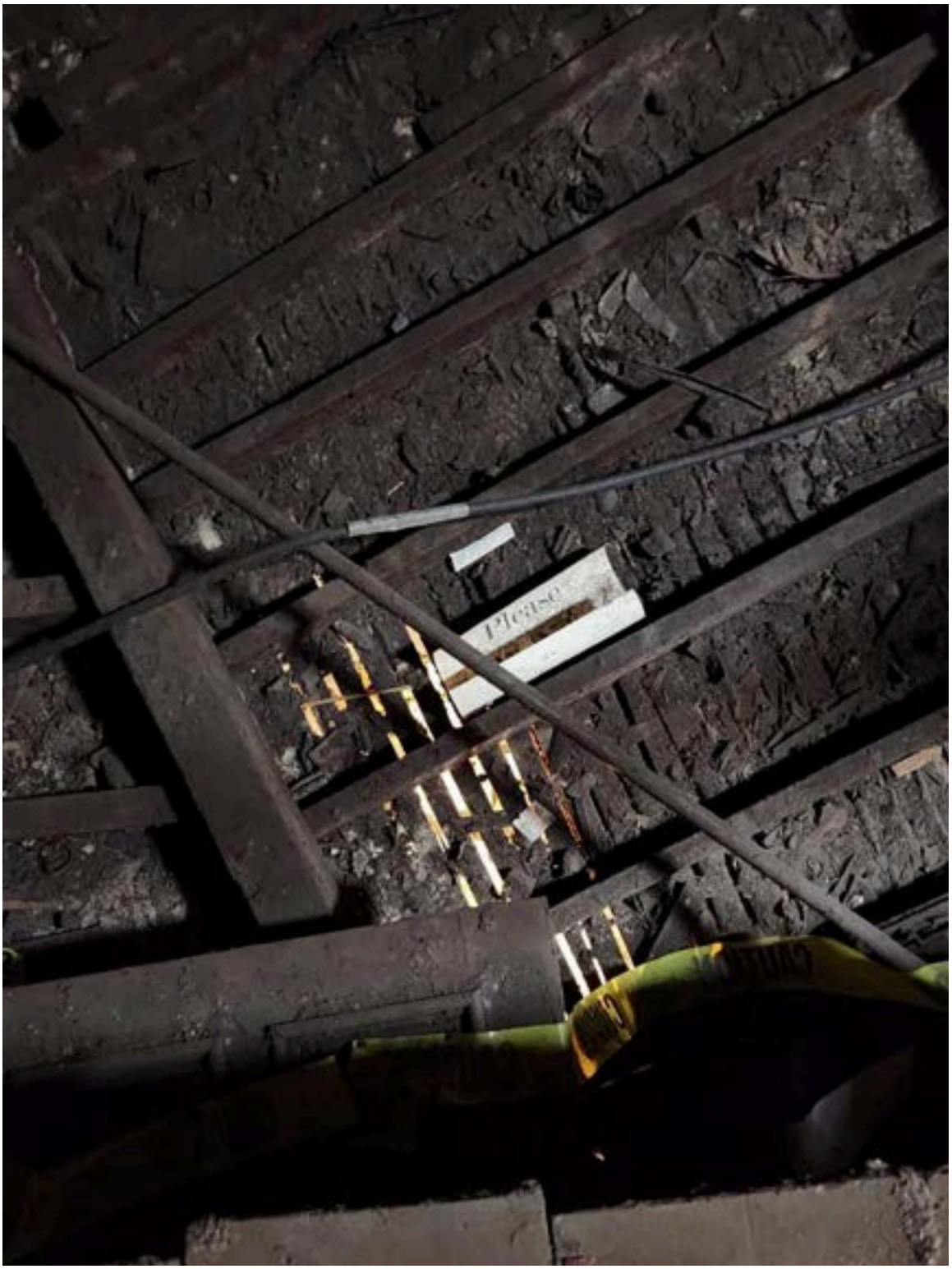

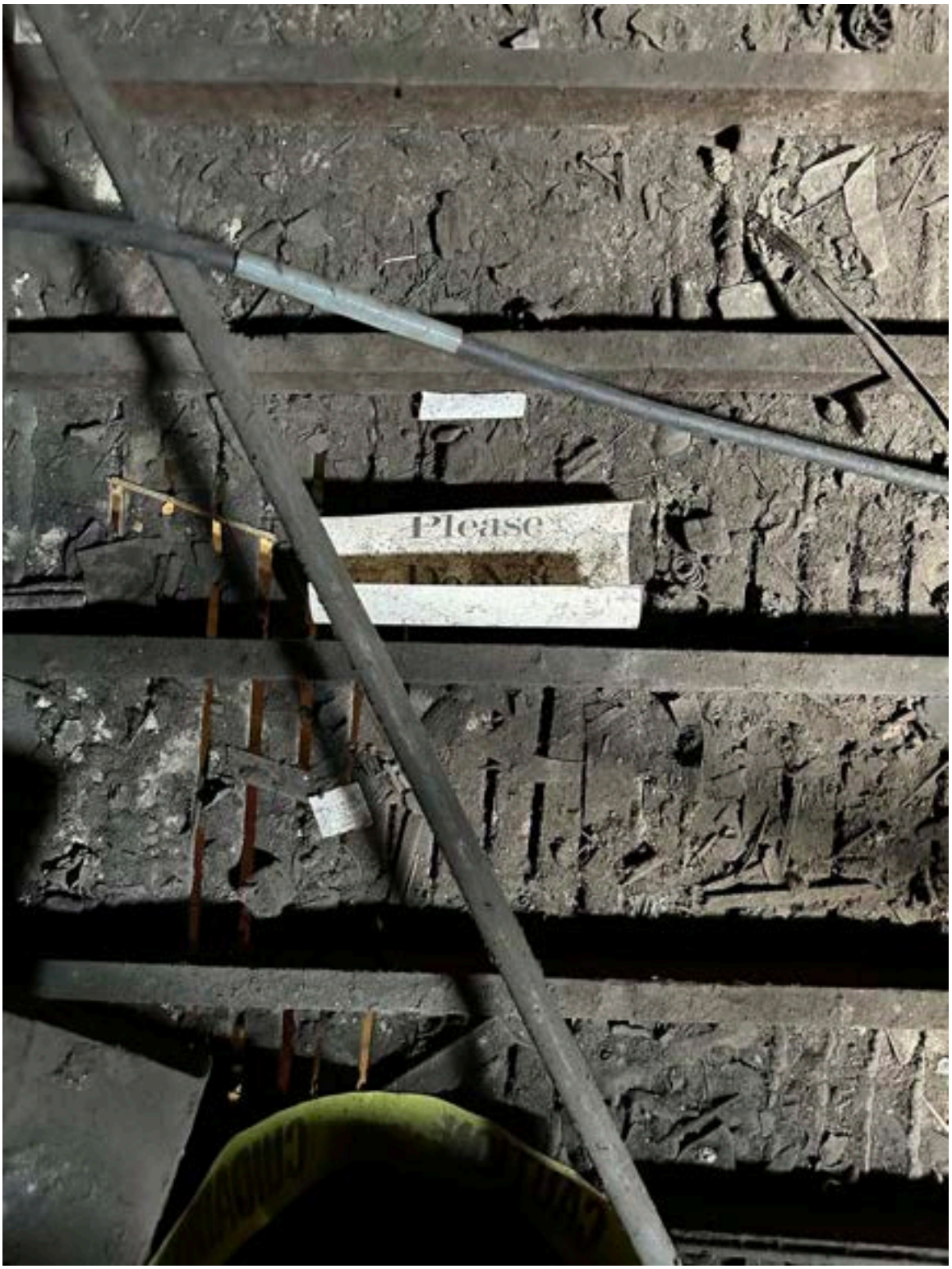
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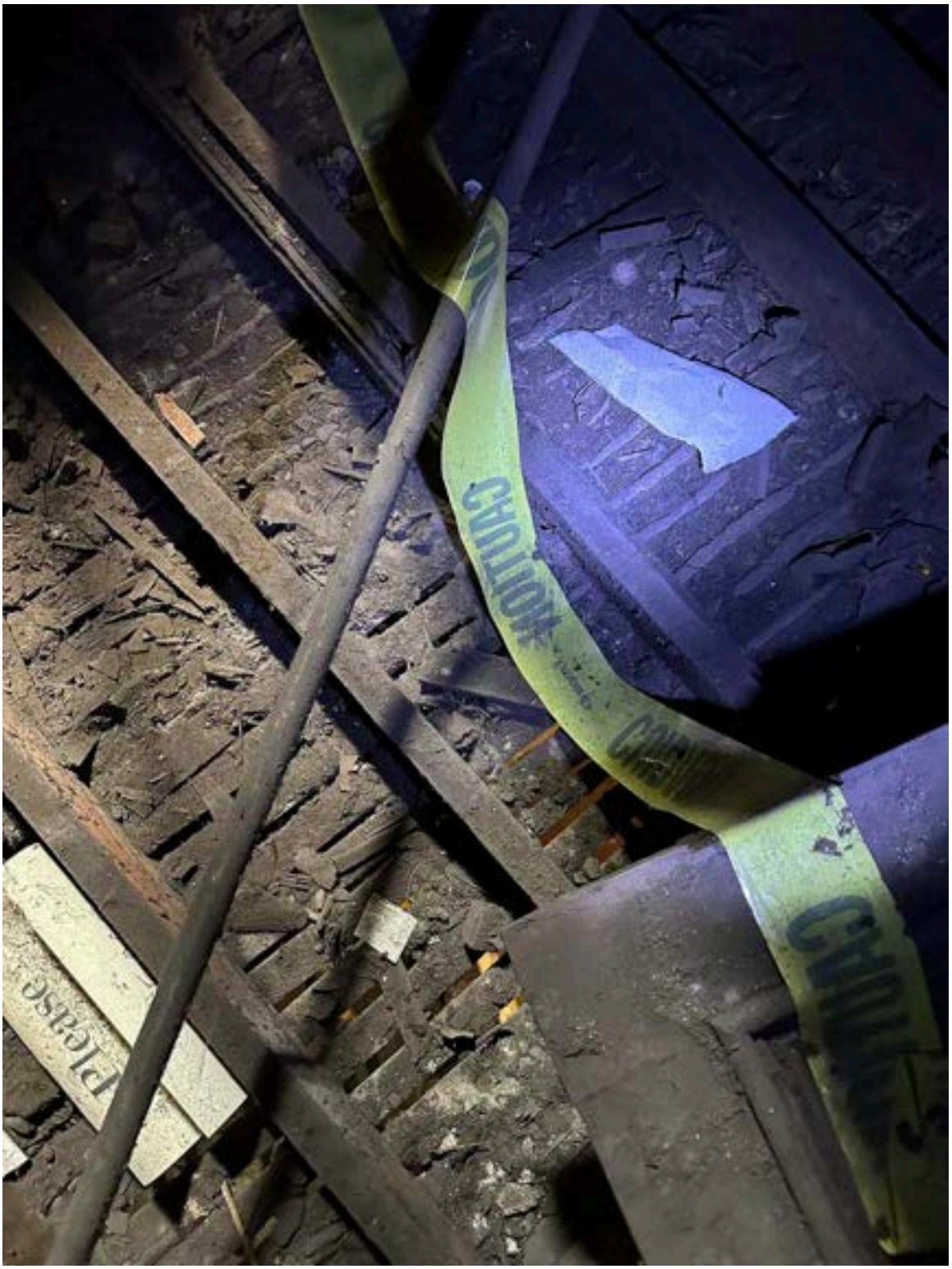
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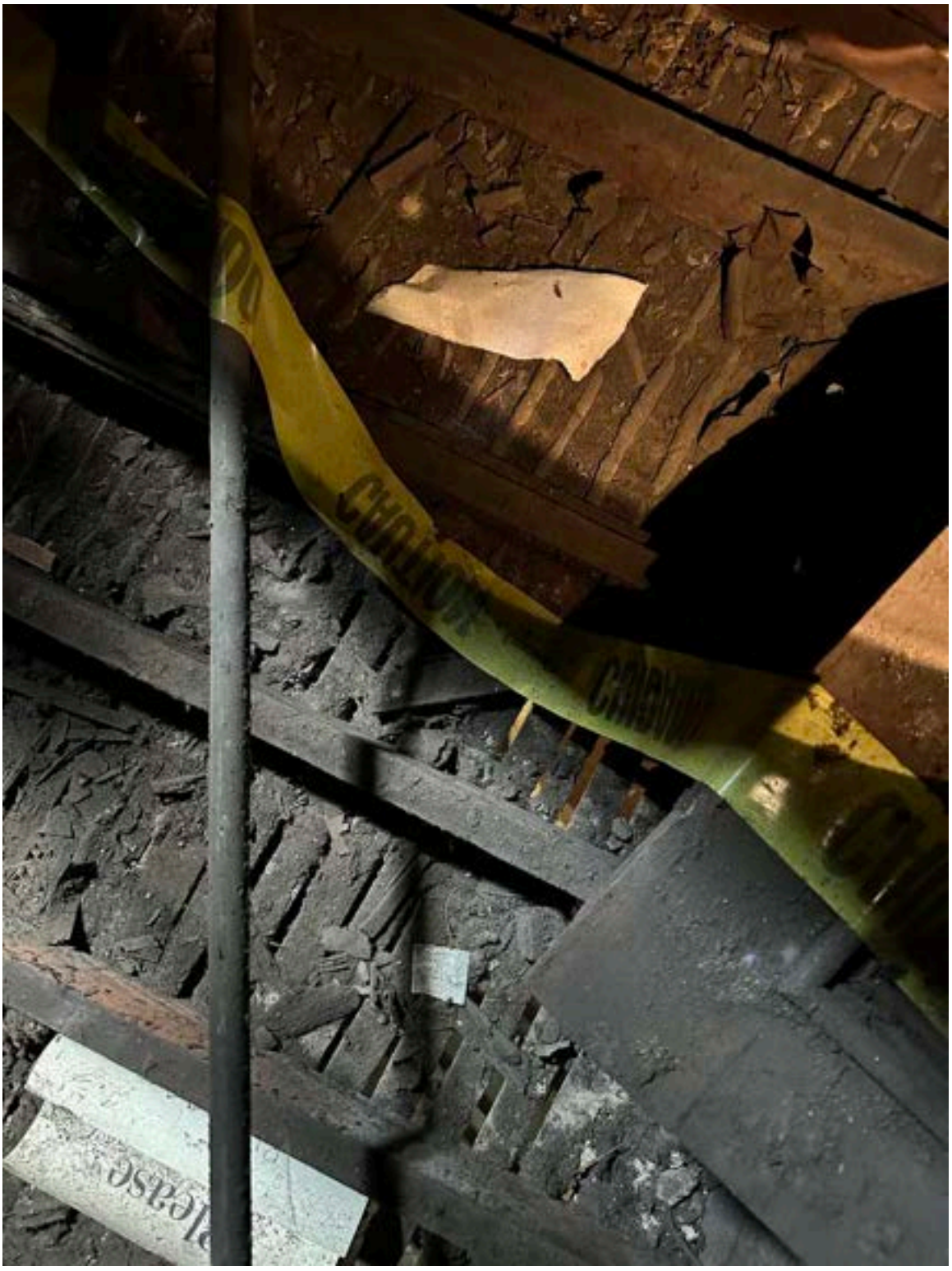
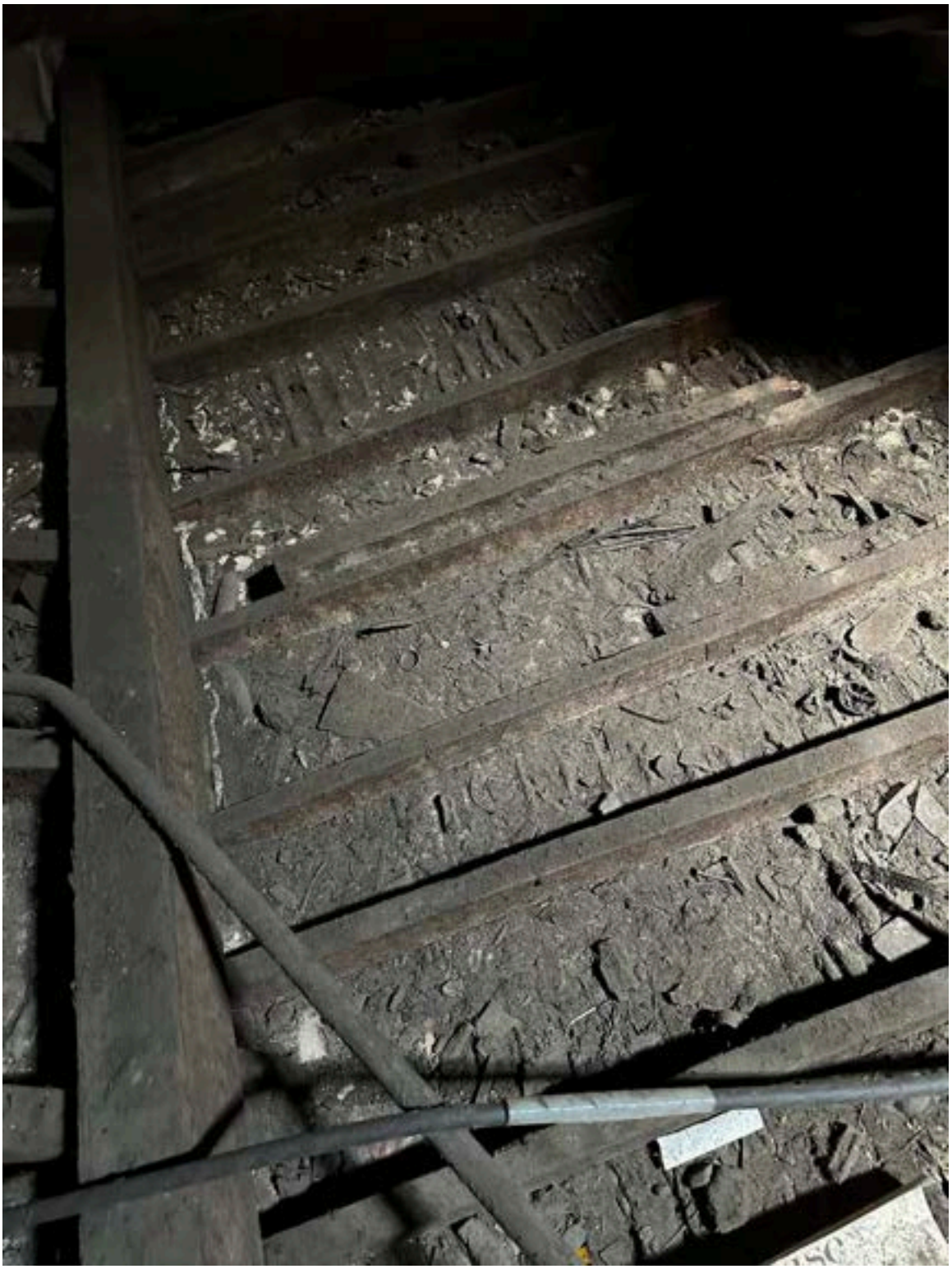
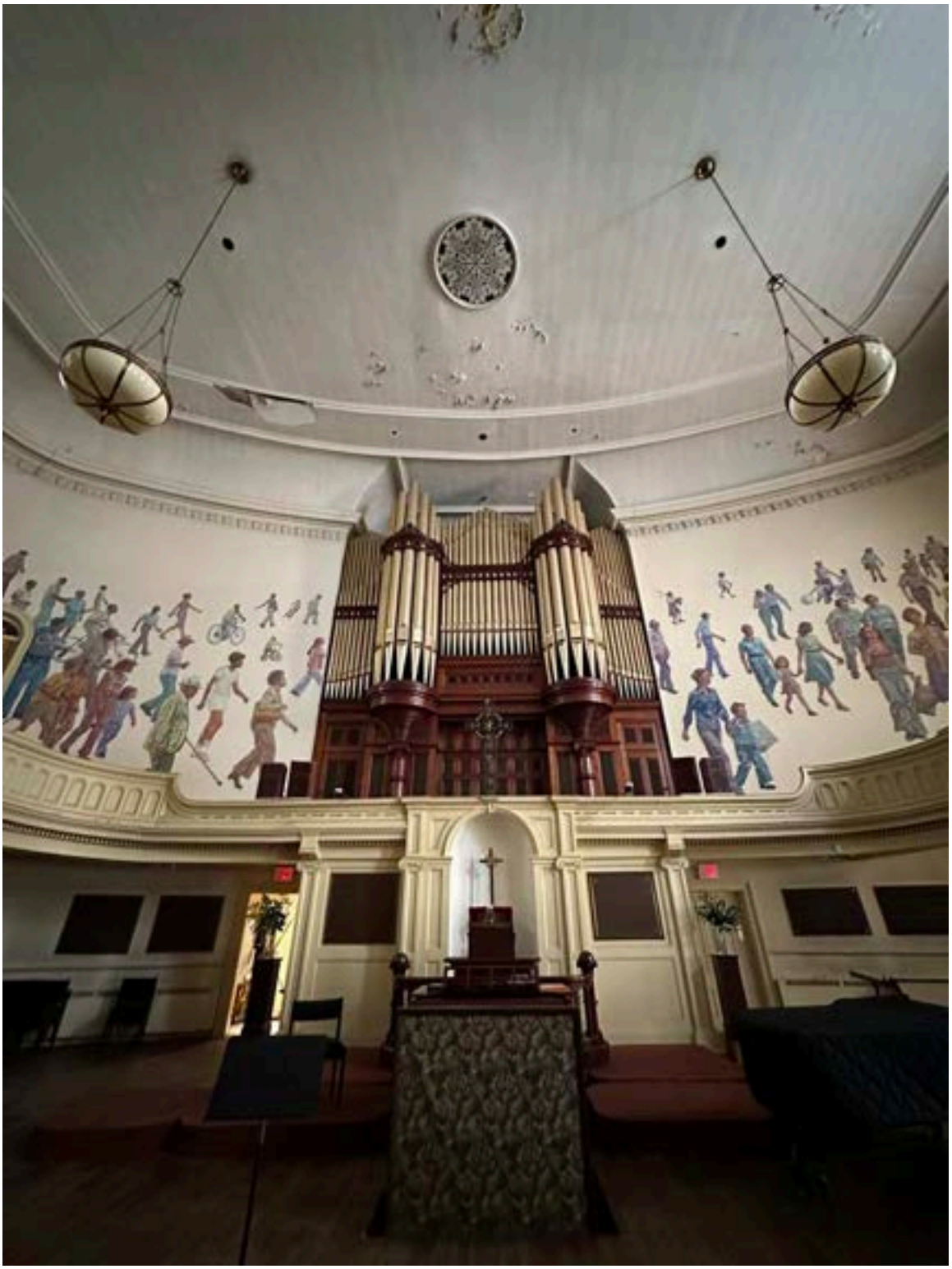
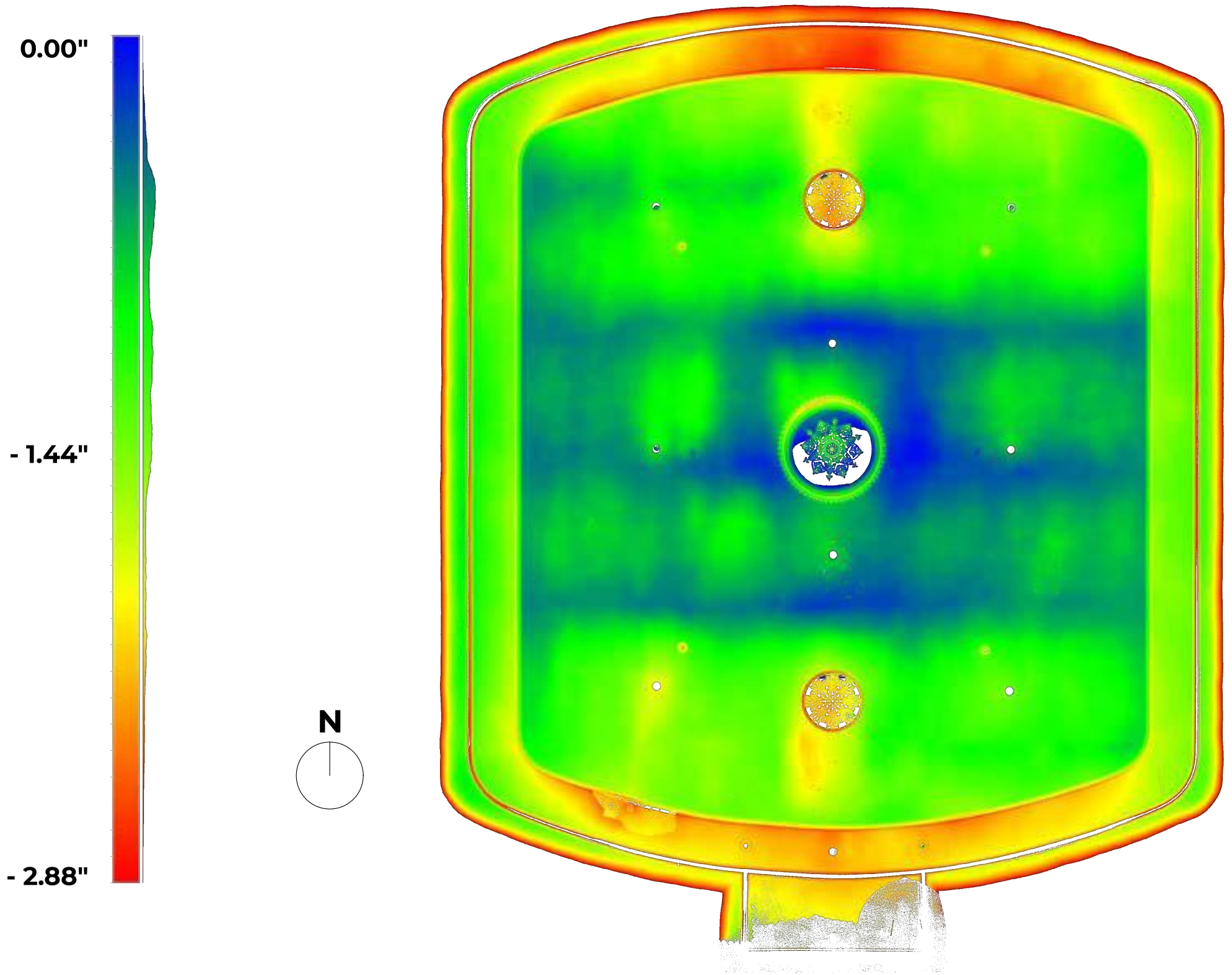






APPENDIX B

LiDAR Scan



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Lafayette Presbyterian Church - Ceiling Analysis
Scale: 3/32" = 1'-0"
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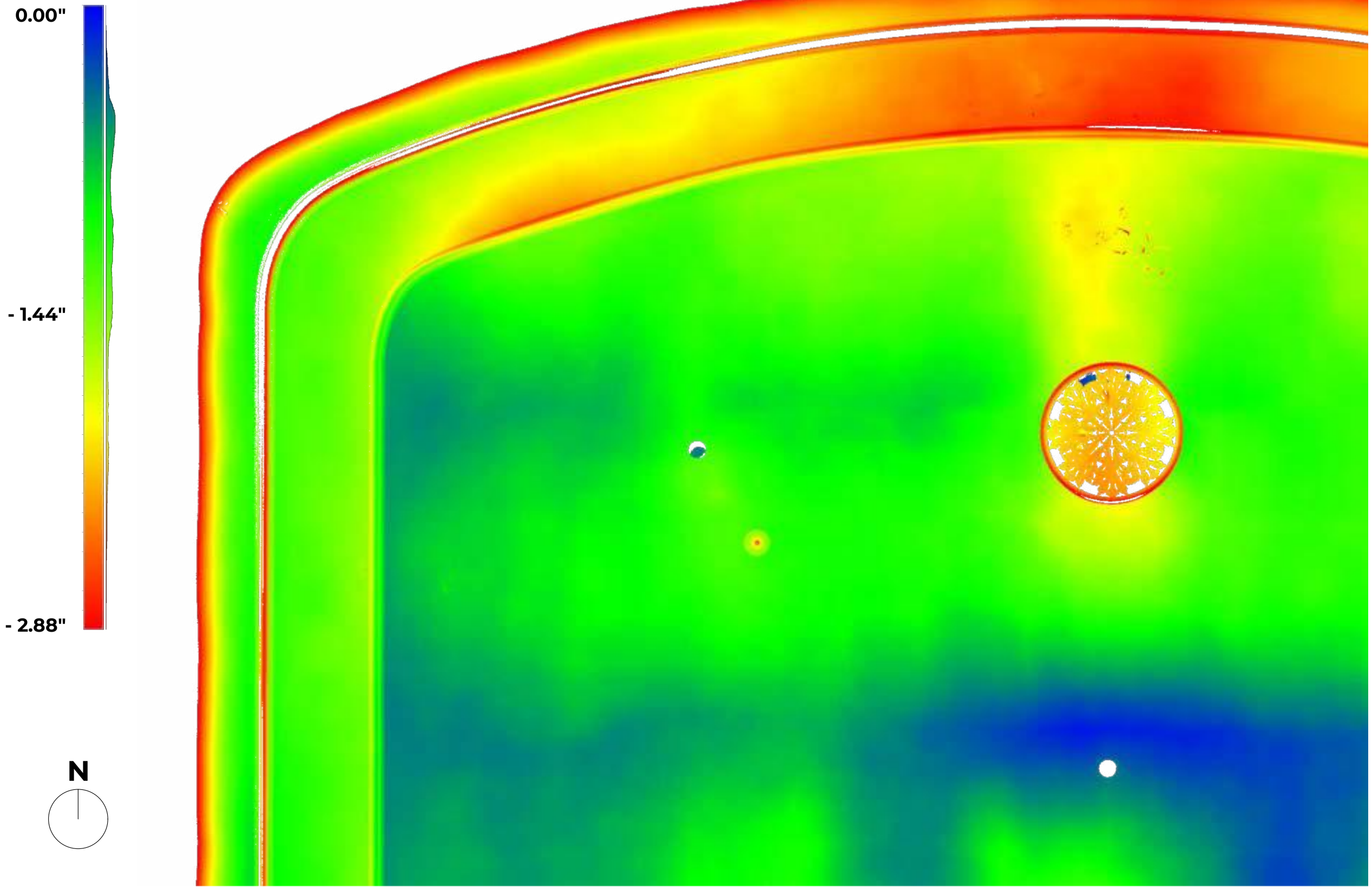
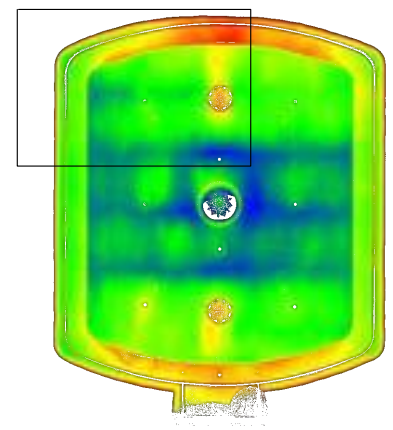
Date: 12/07/2023

EX-100

Main Space - Full Ceiling
Inverse RGB Gradient





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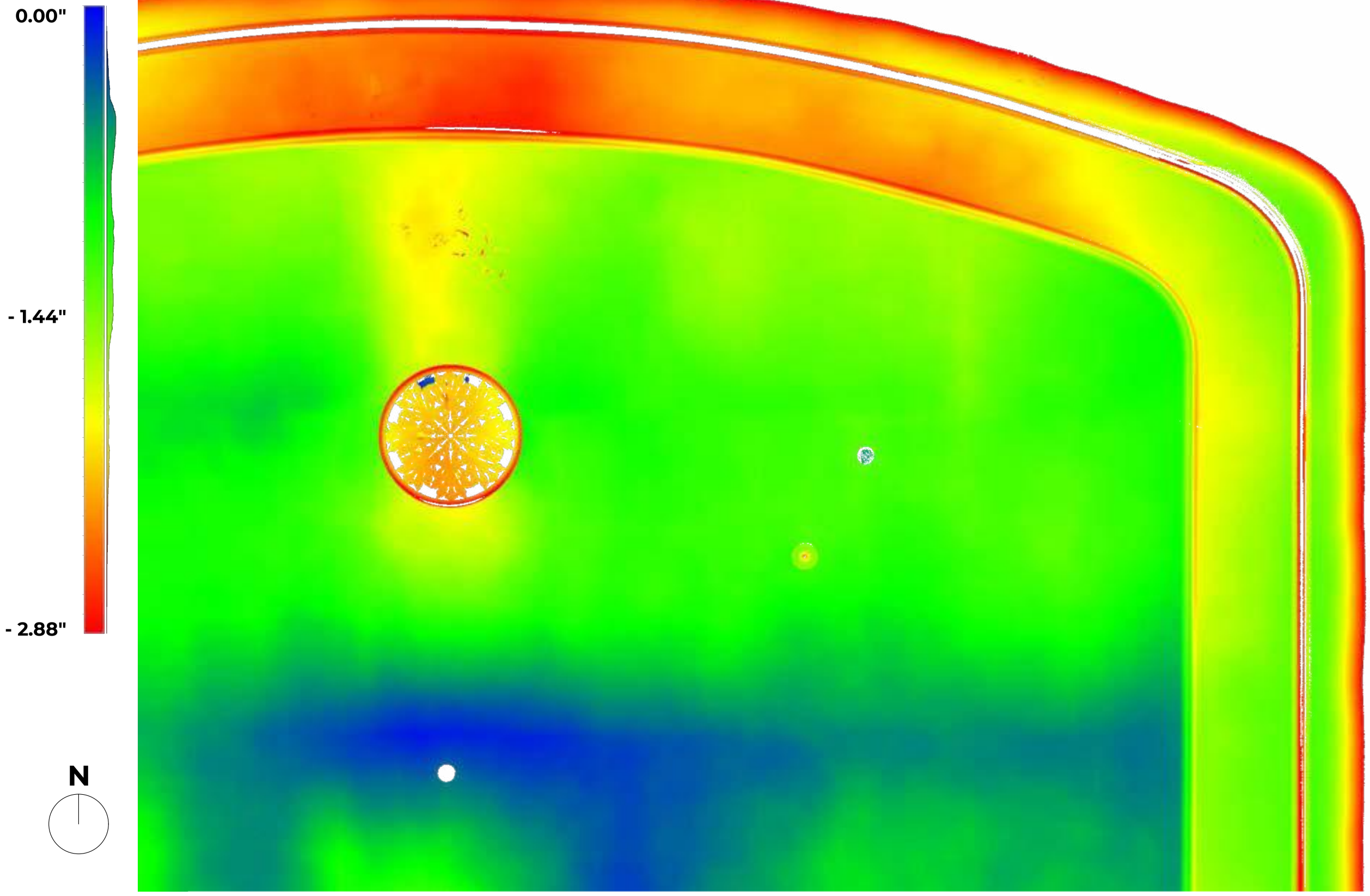
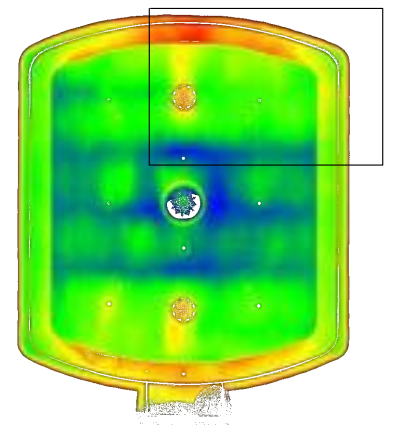
EX-101
Main Space - Detail
Inverse RGB Gradient





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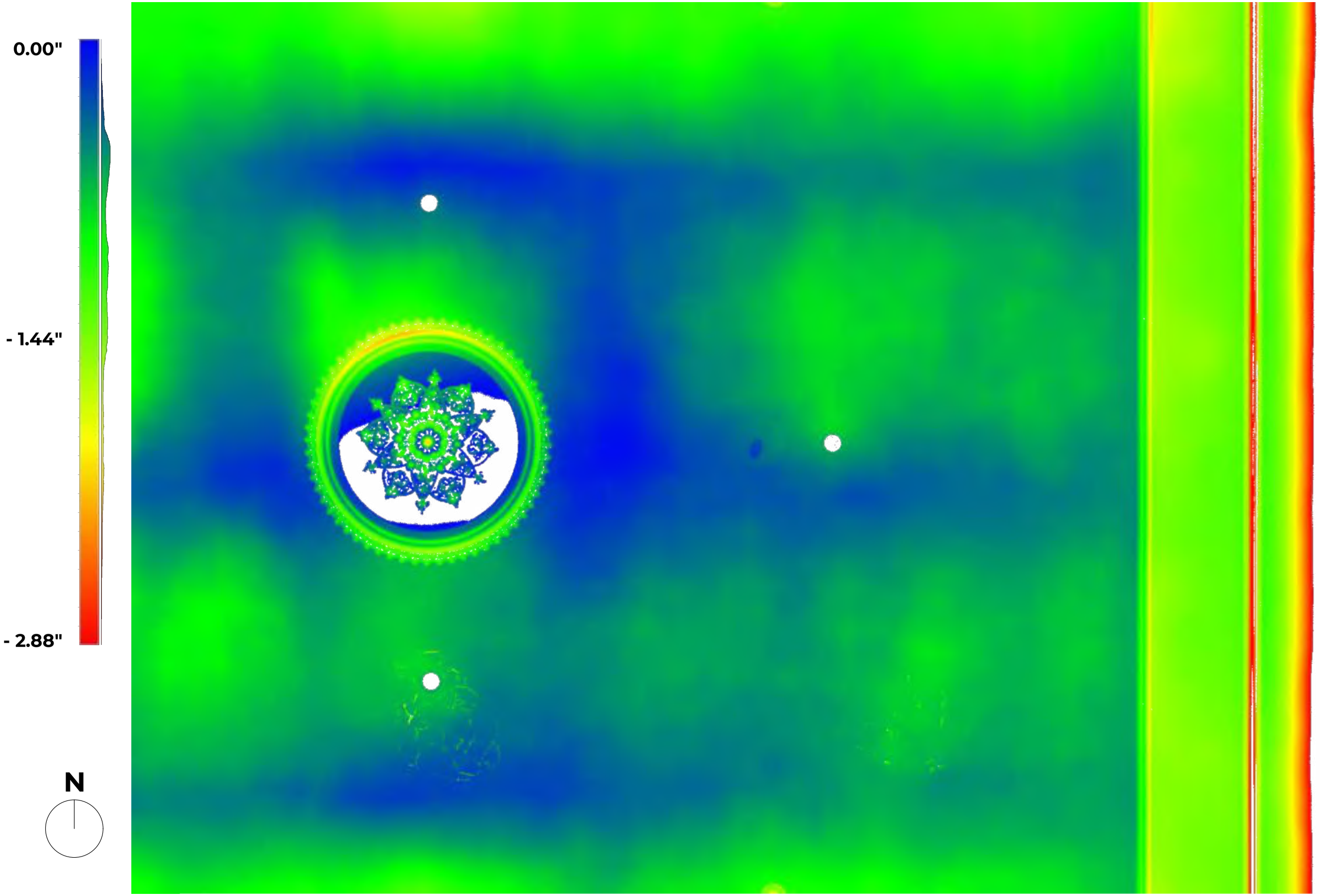
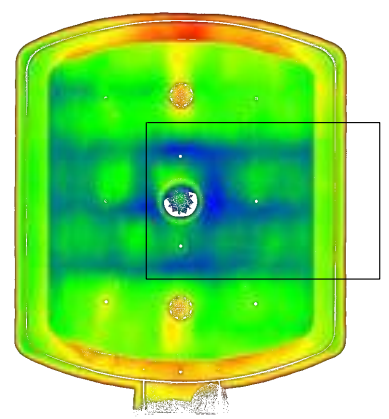
EX-102
Main Space - Detail
Inverse RGB Gradient





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EX-103
Main Space - Detail
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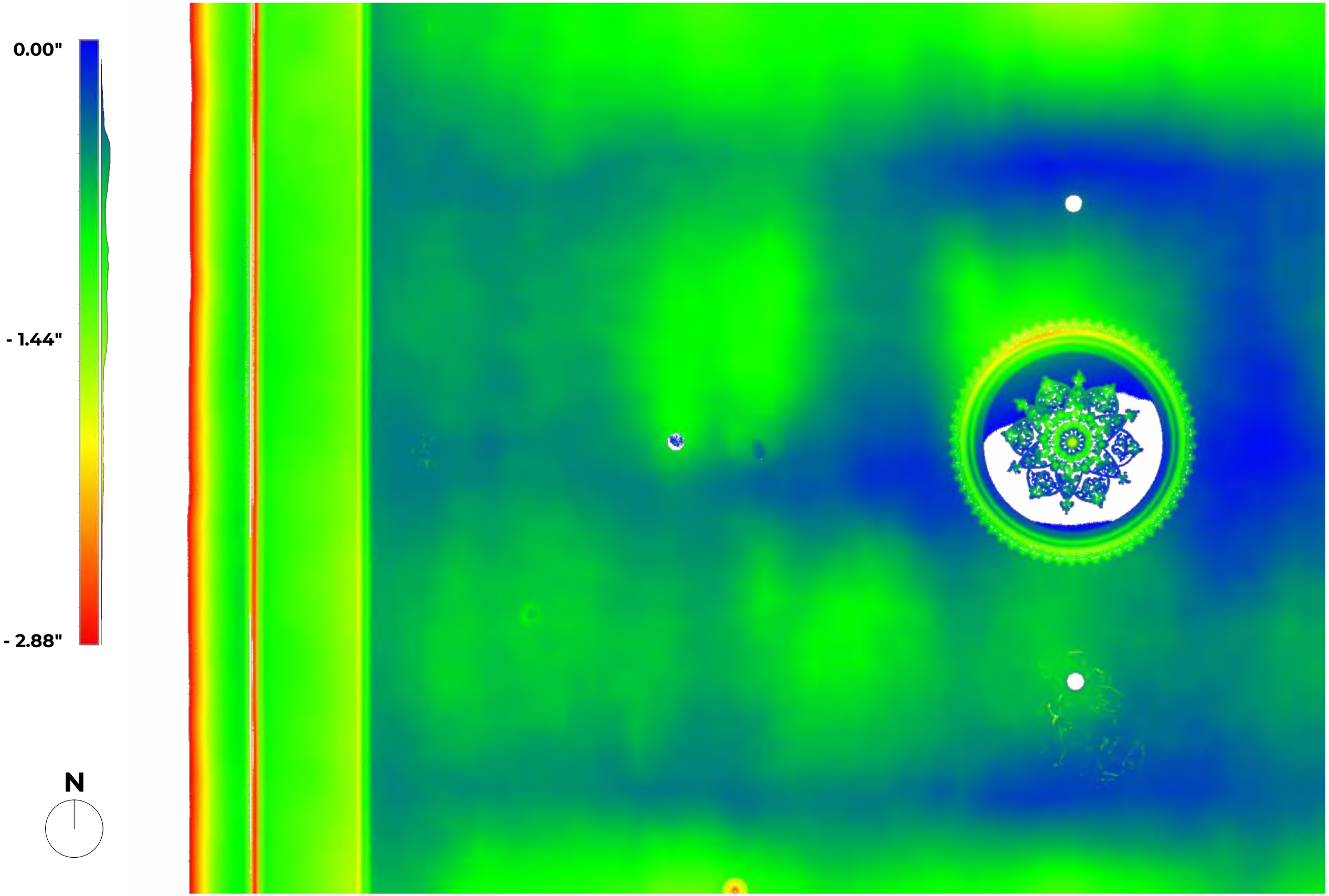

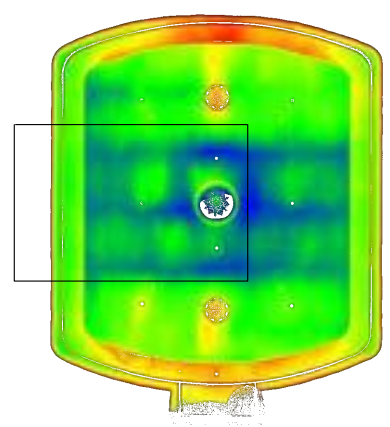

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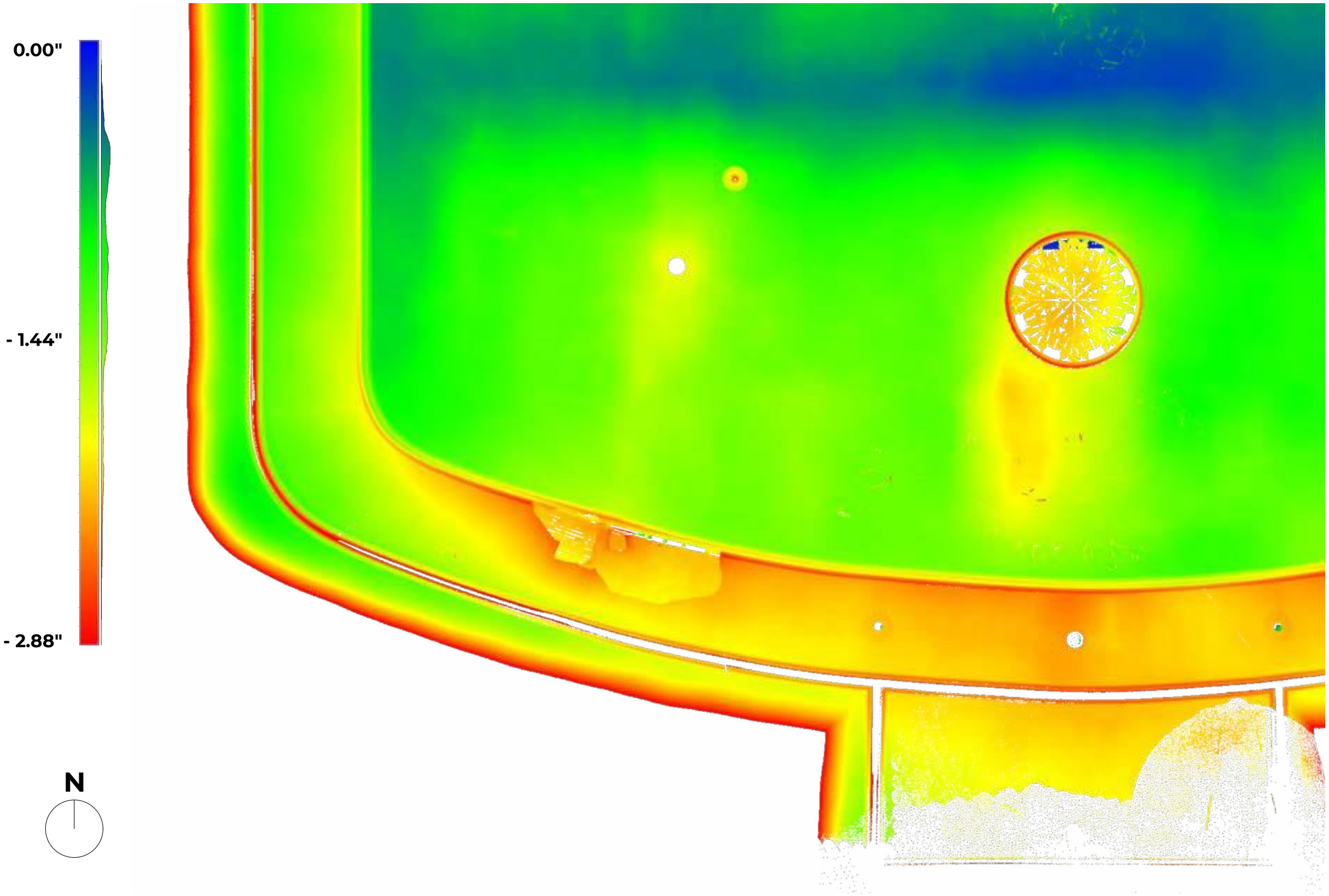
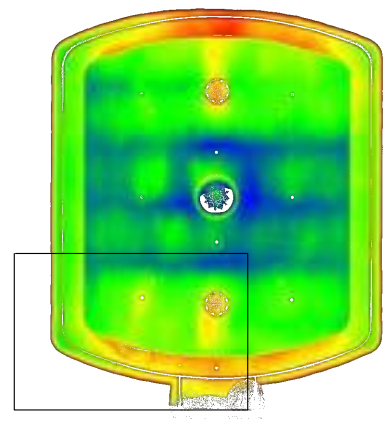
EX-104
Main Space - Detail
Inverse RGB Gradient





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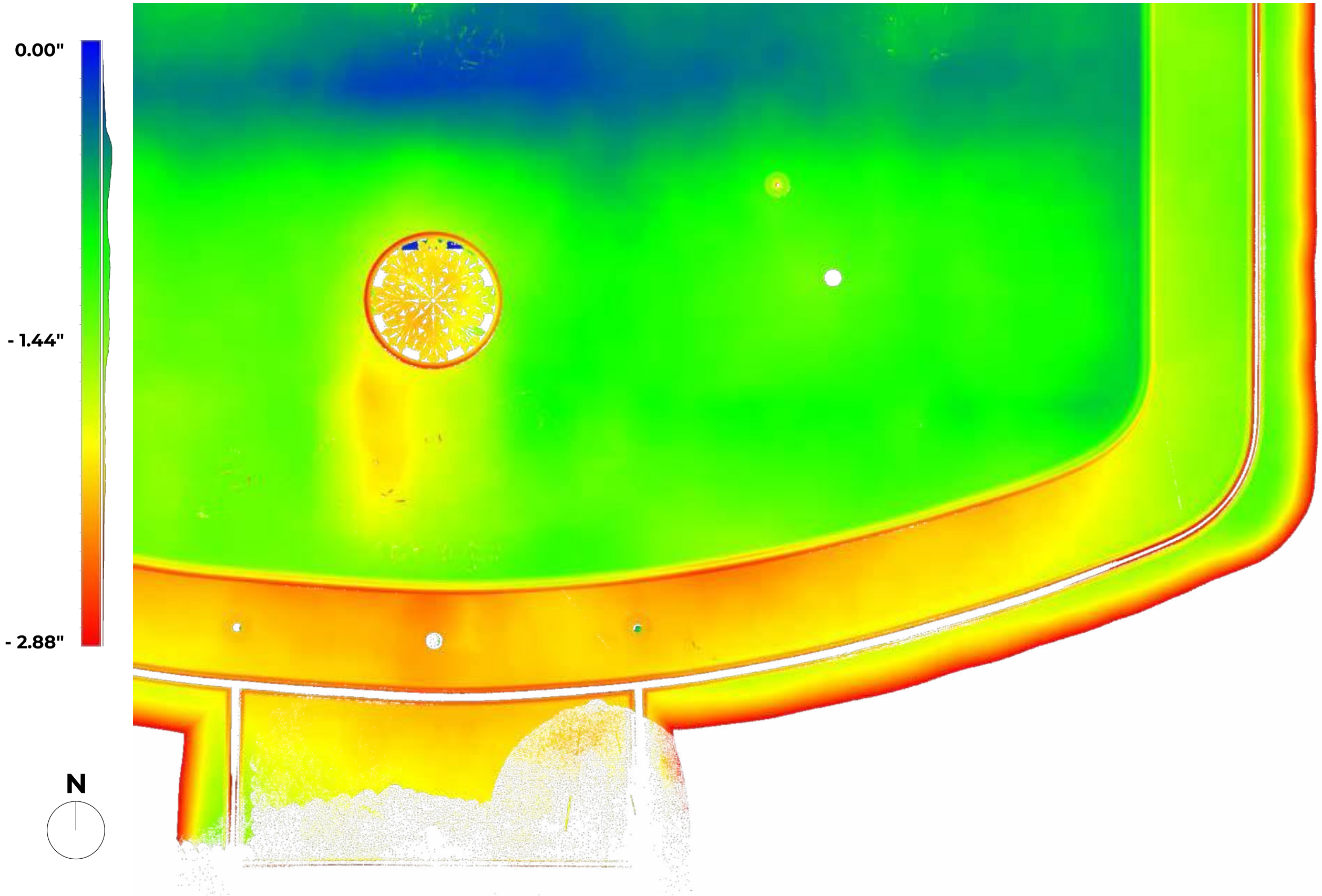
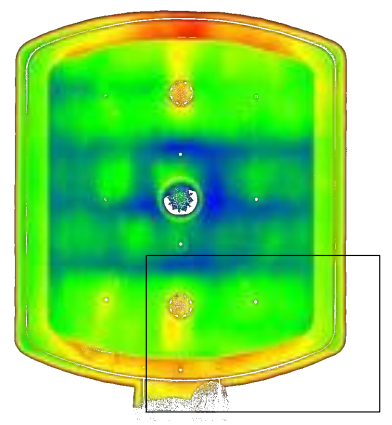
EX-105

Main Space - Detail
Inverse RGB Gradient





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EX-106

Main Space - Detail
Inverse RGB Gradient

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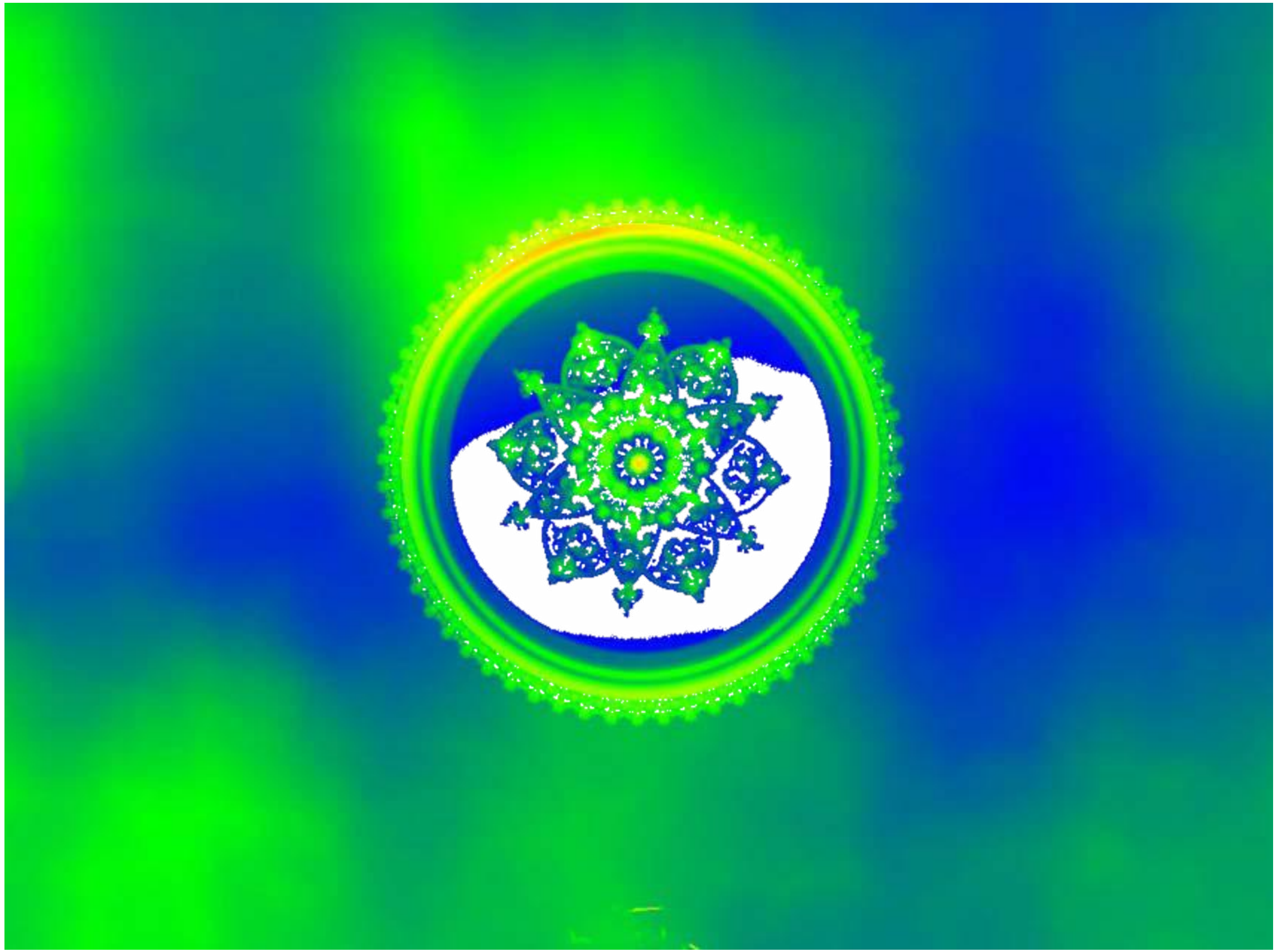

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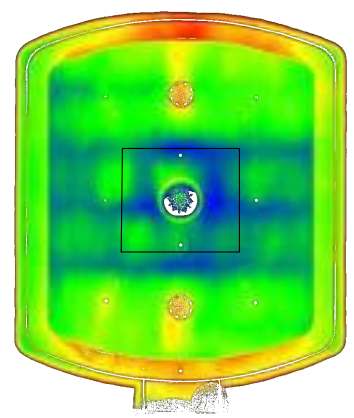

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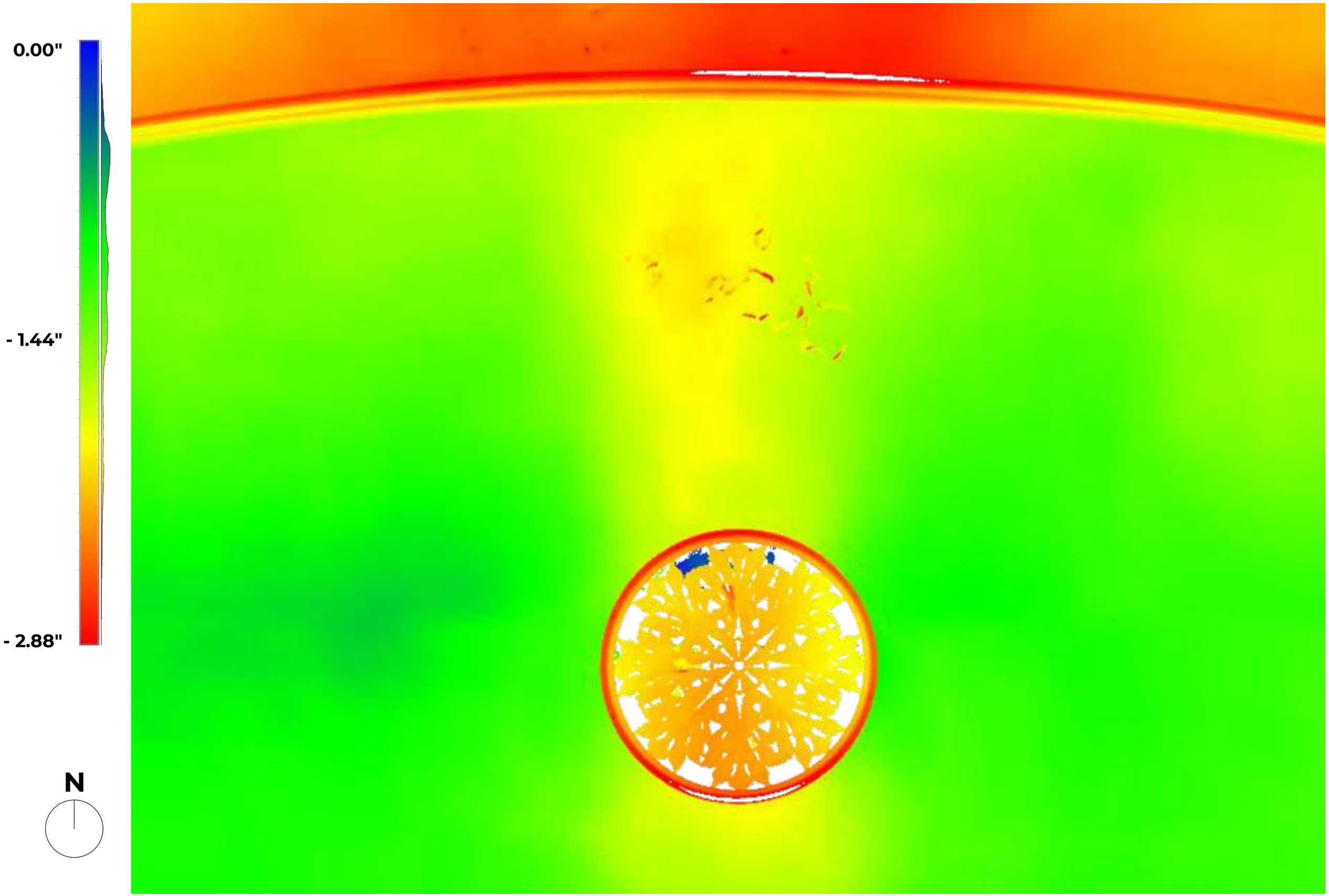
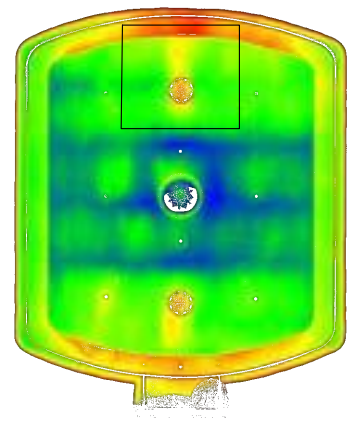
EX-107
Main Space - Detail
Inverse RGB Gradient





MYND Scan to BIM
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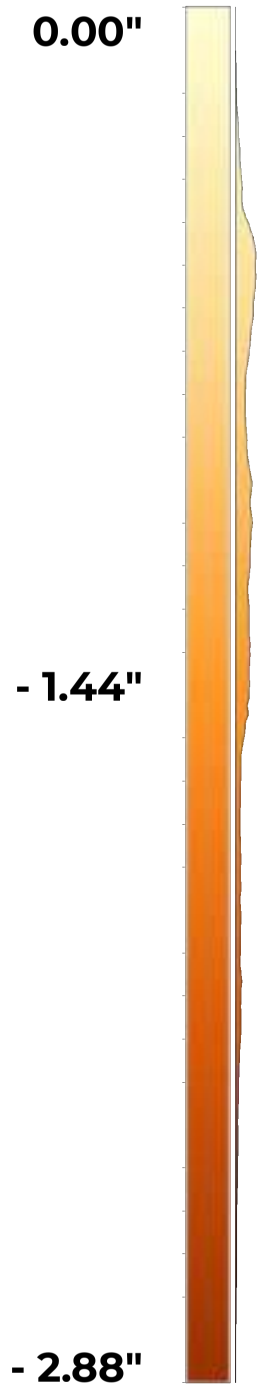
Lafayette Presbyterian Church - Ceiling Analysis
Scale: 1/2" = 1'-0"
Drawn by: MR, MYND Workshop
Date: 12/07/2023

EX-108
Main Space - Detail
Inverse RGB Gradient



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Lafayette Presbyterian Church - Ceiling Analysis
Scale: 3/32" = 1'-0"
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Date: 12/07/2023

EX-200

Main Space - Full Ceiling
Brown to Yellow Gradient

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Lafayette Presbyterian Church - Ceiling Analysis
Scale: 1/4" = 1'-0"
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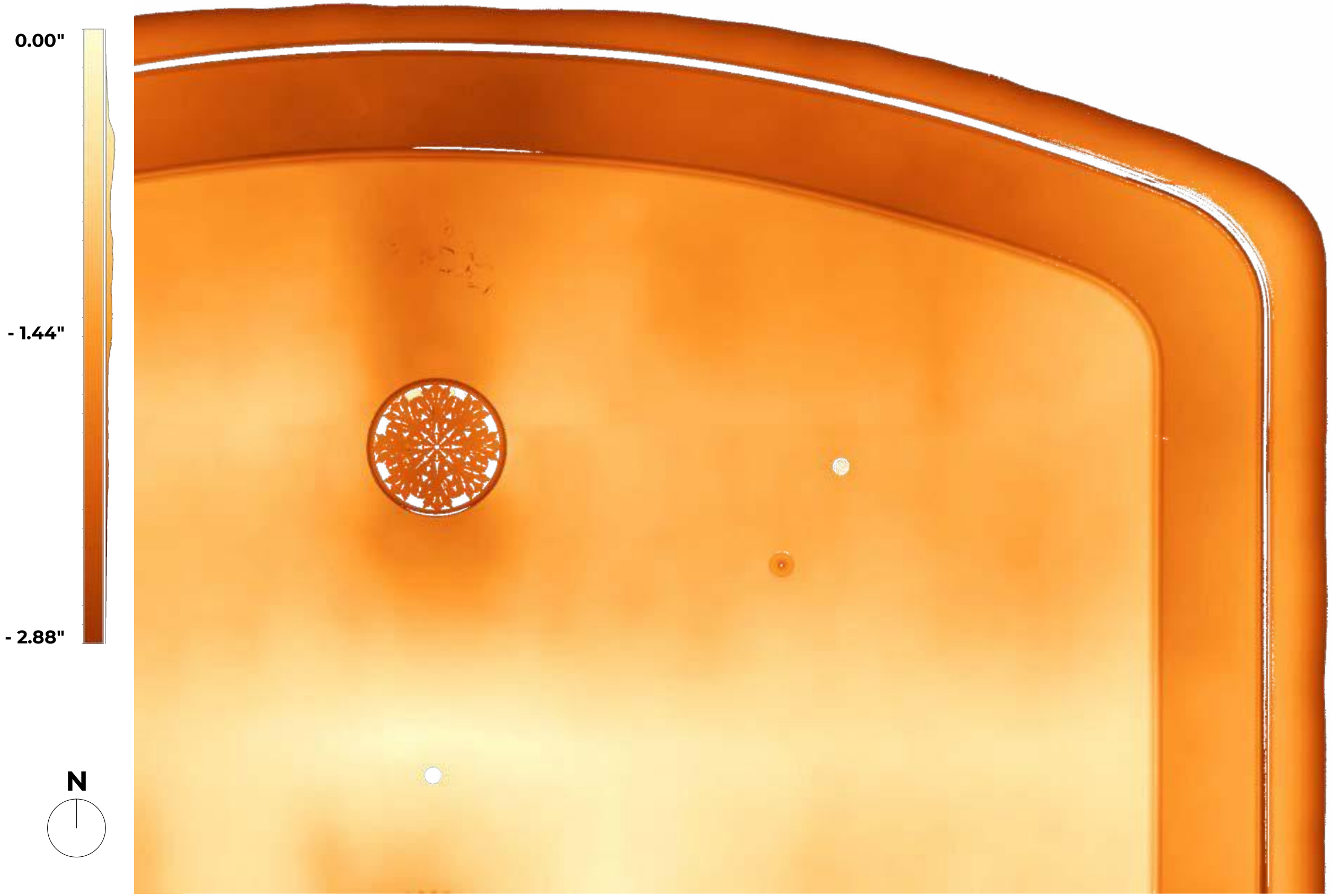
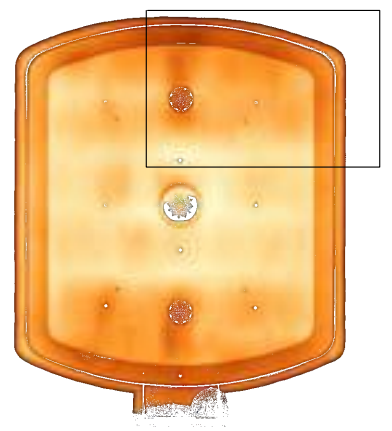
Date: 12/07/2023

EX-201
Main Space - Detail
Brown to Yellow Gradient





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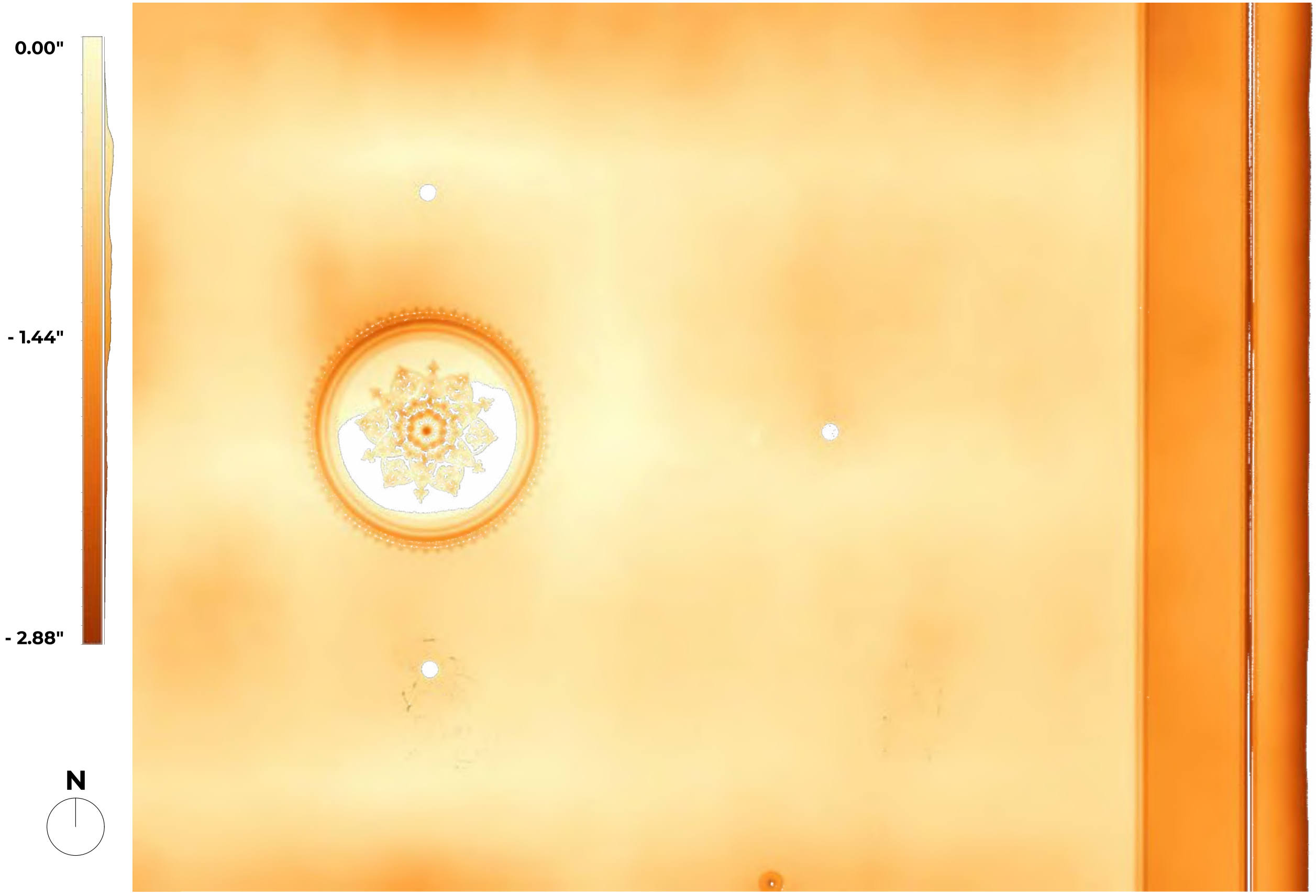
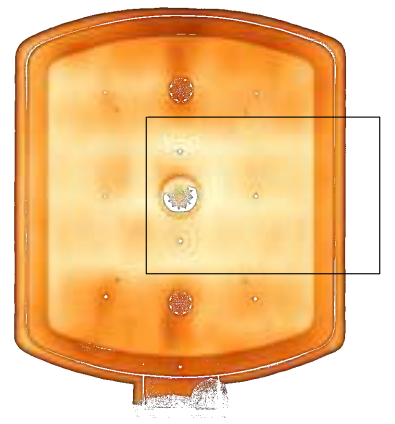
Lafayette Presbyterian Church - Ceiling Analysis
Scale: 1/4" = 1'-0"
Drawn by: MR, MYND Workshop
Date: 12/07/2023

EX-202

Main Space - Detail
Brown to Yellow Gradient





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Lafayette Presbyterian Church - Ceiling Analysis
Scale: 1/4" = 1'-0"
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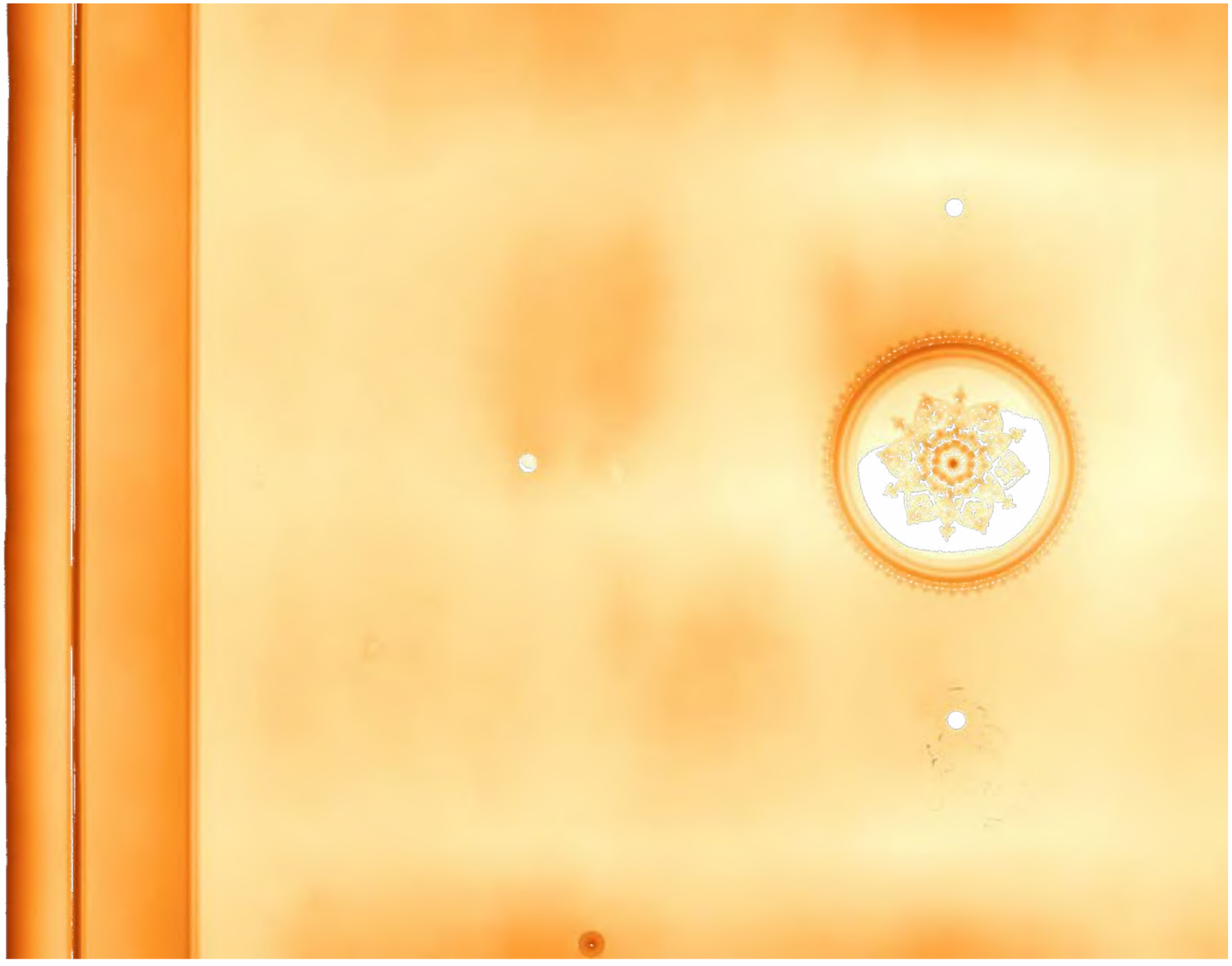
Date: 12/07/2023

EX-203
Main Space - Detail
Brown to Yellow Gradient

0.00"

- 1.44"

- 2.88"



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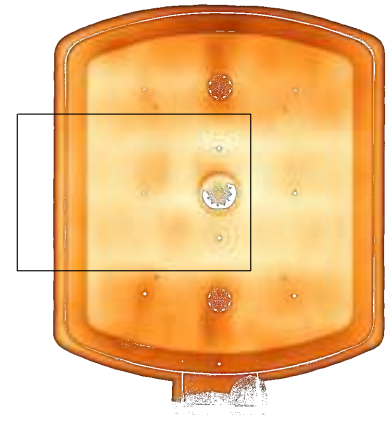

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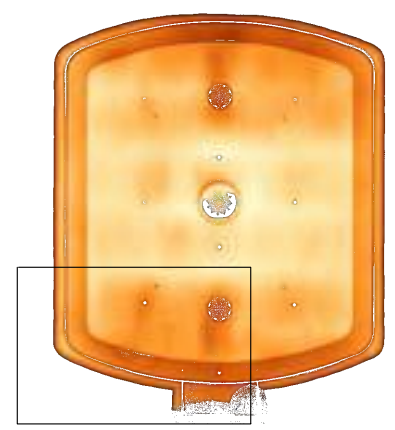
Lafayette Presbyterian Church - Ceiling Analysis
Scale: 1/4" = 1'-0"
Drawn by: MR, MYND Workshop
Date: 12/07/2023

EX-204
Main Space - Detail
Brown to Yellow Gradient



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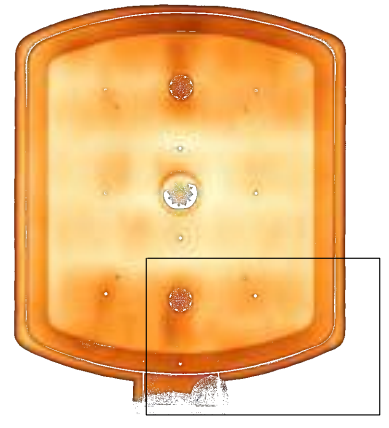
Lafayette Presbyterian Church - Ceiling Analysis
Scale: 1/4" = 1'-0"
Drawn by: MR, MYND Workshop
Date: 12/07/2023

EX-205
Main Space - Detail
Brown to Yellow Gradient



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Laser Scanning for Historic Preservation
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Lafayette Presbyterian Church - Ceiling Analysis
Scale: 1/4" = 1'-0"
Drawn by: MR, MYND Workshop
Date: 12/07/2023

EX-206

Main Space - Detail
Brown to Yellow Gradient

N

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Lafayette Presbyterian Church - Ceiling Analysis
Scale: 1/2" = 1'-0"
Drawn by: MR, MYND Workshop
Date: 12/07/2023

EX-207
Main Space - Detail
Brown to Yellow Gradient

N

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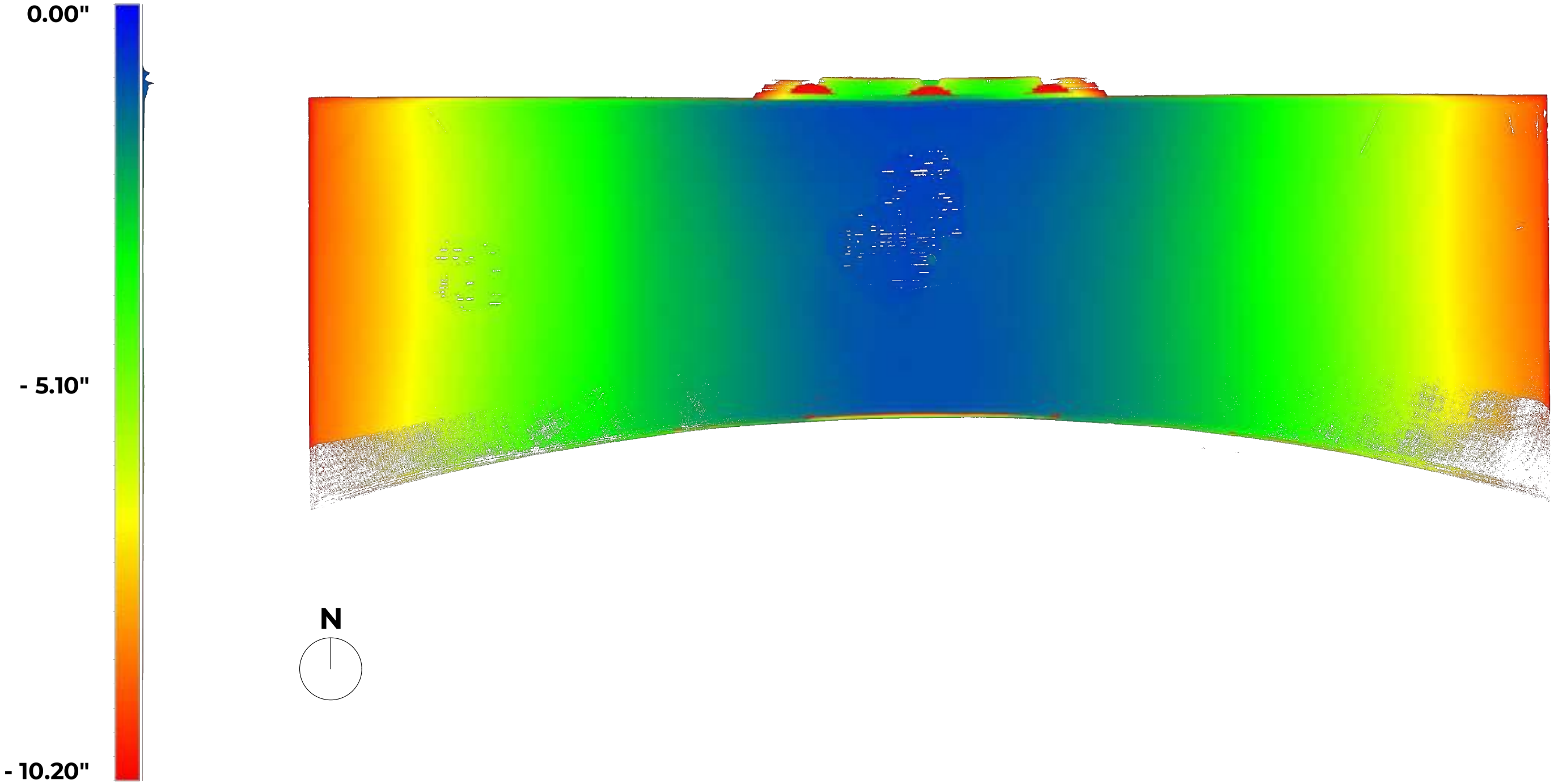
Lafayette Presbyterian Church - Ceiling Analysis
Scale: 1/2" = 1'-0"
Drawn by: MR, MYND Workshop
Date: 12/07/2023

EX-208
Main Space - Detail
Brown to Yellow Gradient



MYND Scan to BIM
Laser Scanning for Historic Preservation
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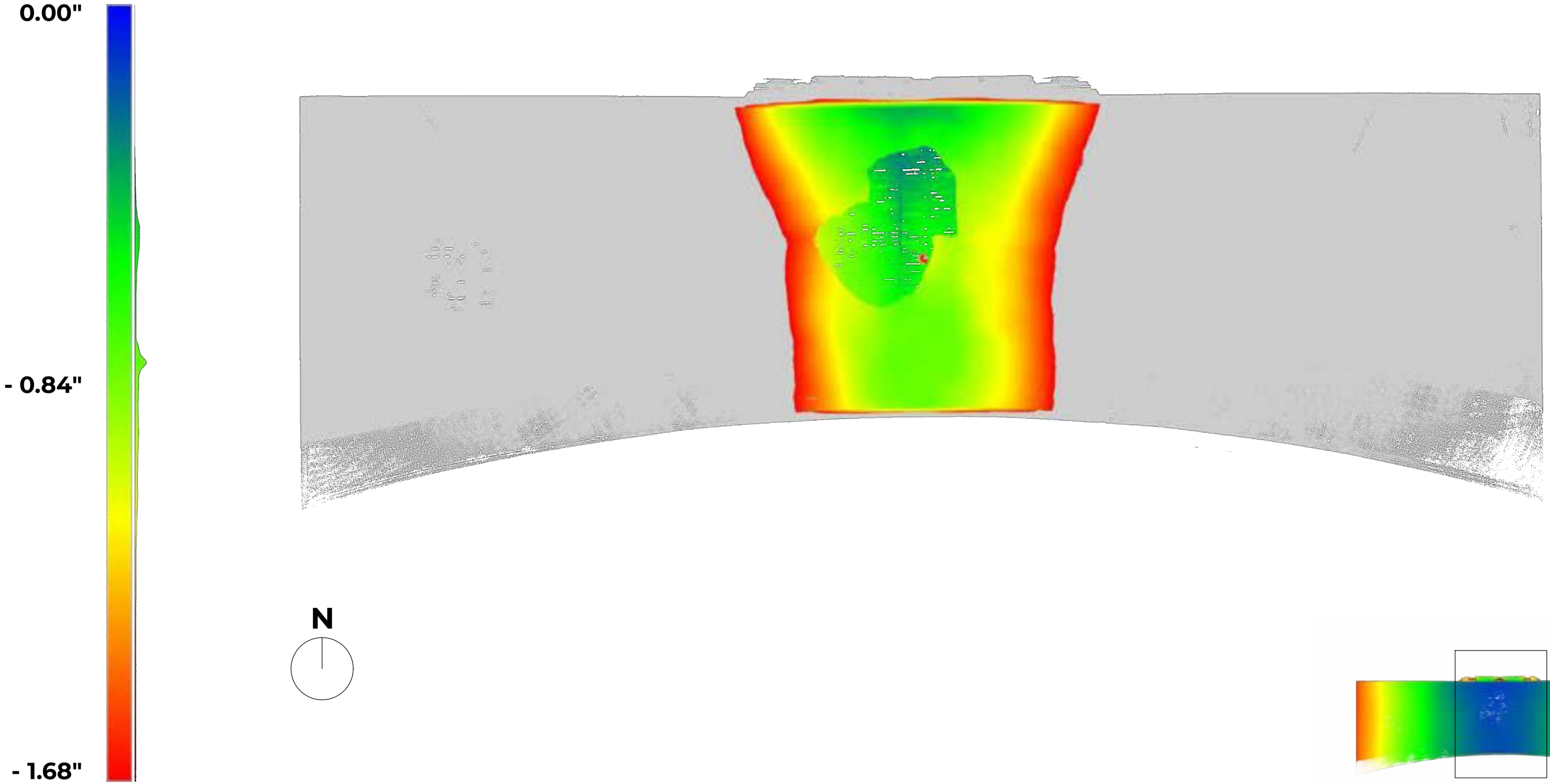
Lafayette Presbyterian Church - Ceiling Analysis
Scale: 1/4" = 1'-0"
Drawn by: MR, MYND Workshop
Date: 12/07/2023

EX-300

Main Space - North - Full
Inverse RGB Gradient



MYND Scan to BIM
Laser Scanning for Historic Preservation
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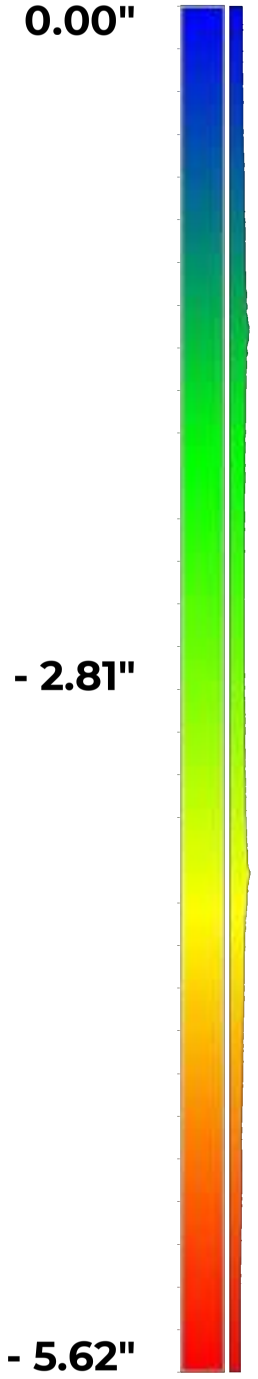
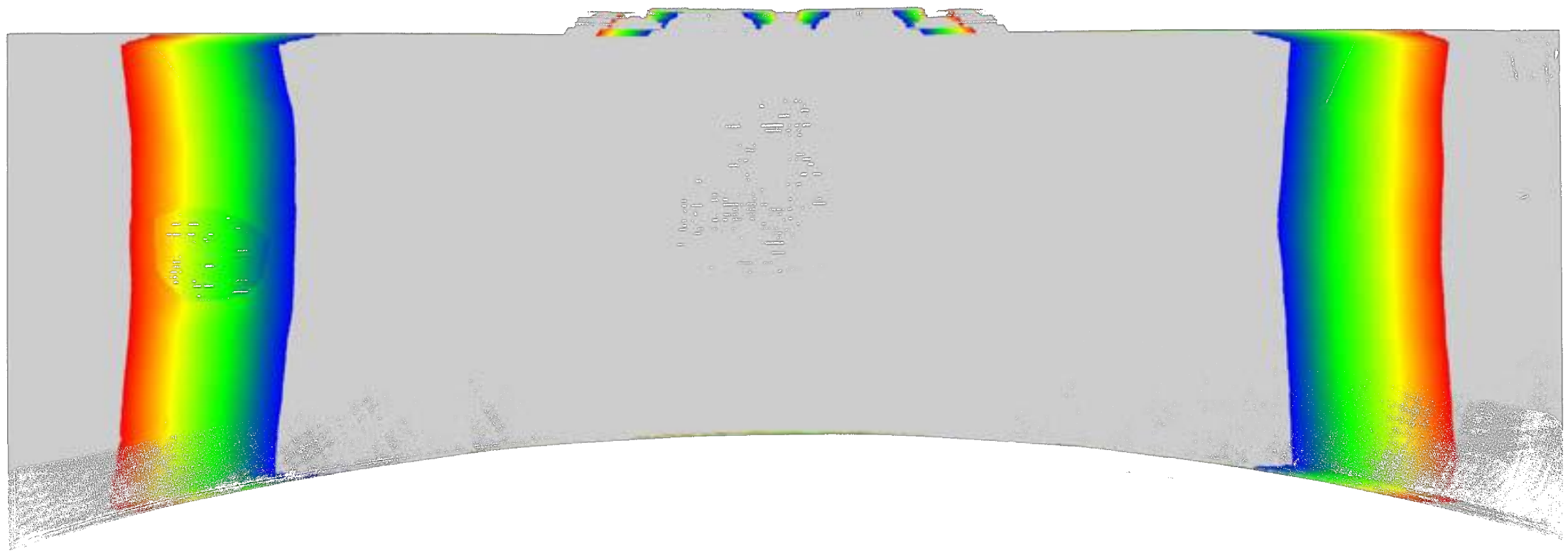
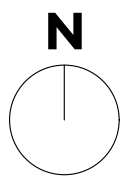
Lafayette Presbyterian Church - Ceiling Analysis
Scale: 1/4" = 1'-0"
Drawn by: MR, MYND Workshop
Date: 12/07/2023

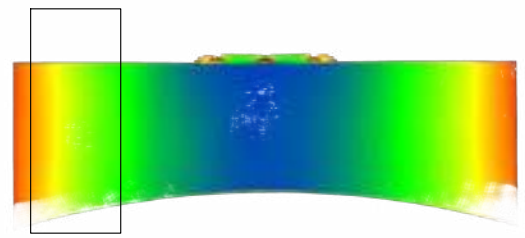
EX-301

Main Space - North - Mid Crop
Inverse RGB Gradient









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Lafayette Presbyterian Church - Ceiling Analysis
Scale: 1/4" = 1'-0"
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Date: 12/07/2023

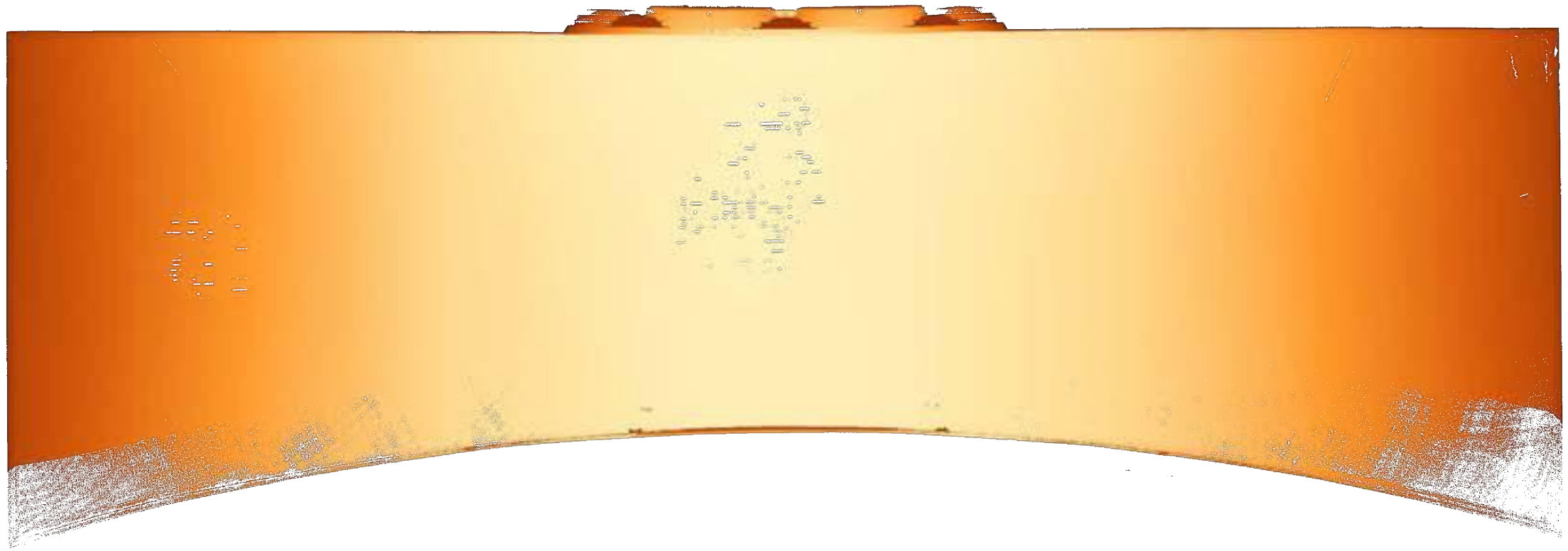
EX-302

Main Space - North - Sides Crop
Inverse RGB Gradient

0.00"

- 5.10"

- 10.20"



N

MYND Scan to BIM
Laser Scanning for Historic Preservation
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Lafayette Presbyterian Church - Ceiling Analysis
Scale: 1/4" = 1'-0"
Drawn by: MR, MYND Workshop
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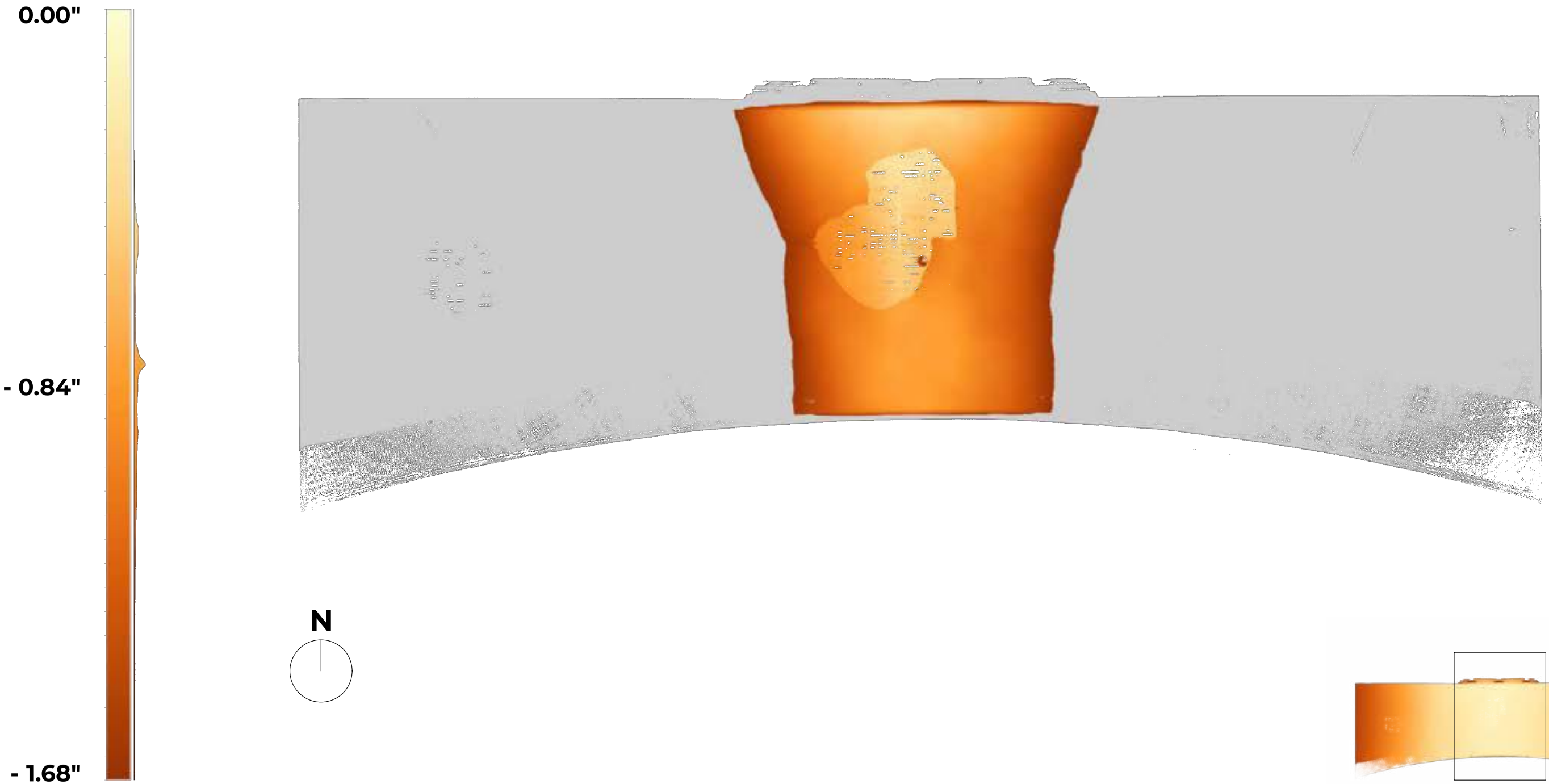
EX-400

Main Space - North - Full
Brown to Yellow Gradient



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Lafayette Presbyterian Church - Ceiling Analysis
Scale: 1/4" = 1'-0"
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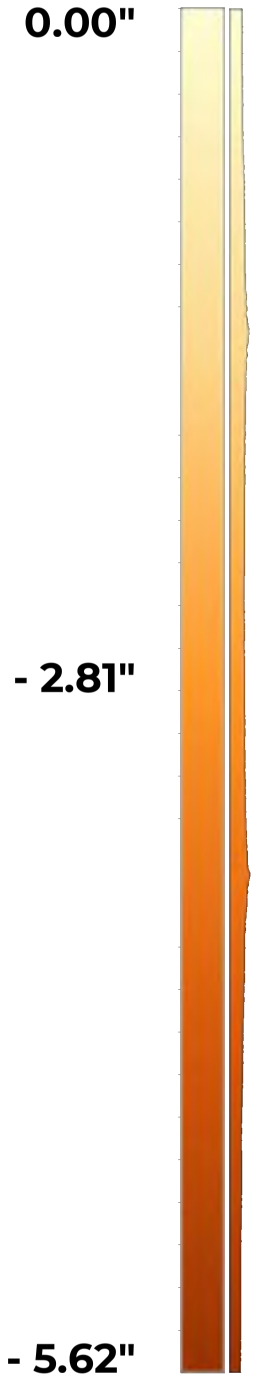
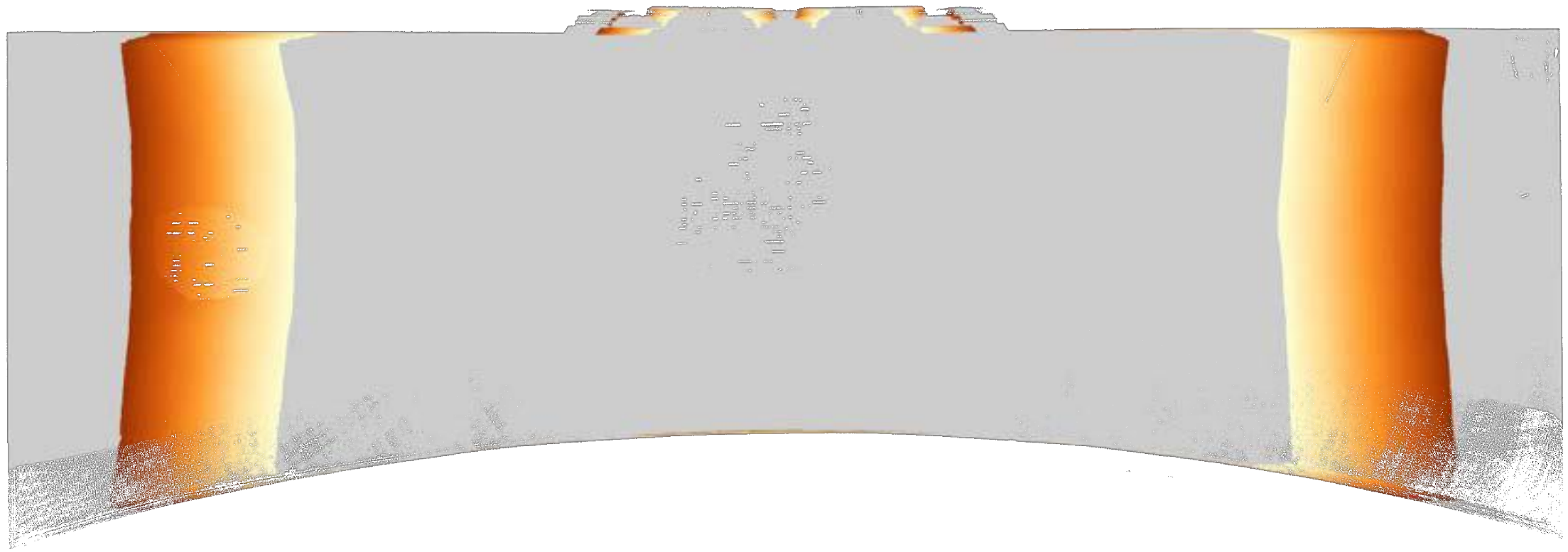
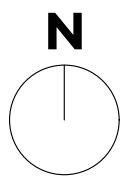
Date: 12/07/2023

EX-401

Main Space - North - Mid Crop
Brown to Yellow Gradient







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Lafayette Presbyterian Church - Ceiling Analysis
Scale: 1/4" = 1'-0"
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Date: 12/07/2023

EX-402

Main Space - North - Sides Crop
Brown to Yellow Gradient

APPENDIX C

WSA Survey Photos

Photo 01. Overview of ceiling and survey methodology, looking south from choir loft.

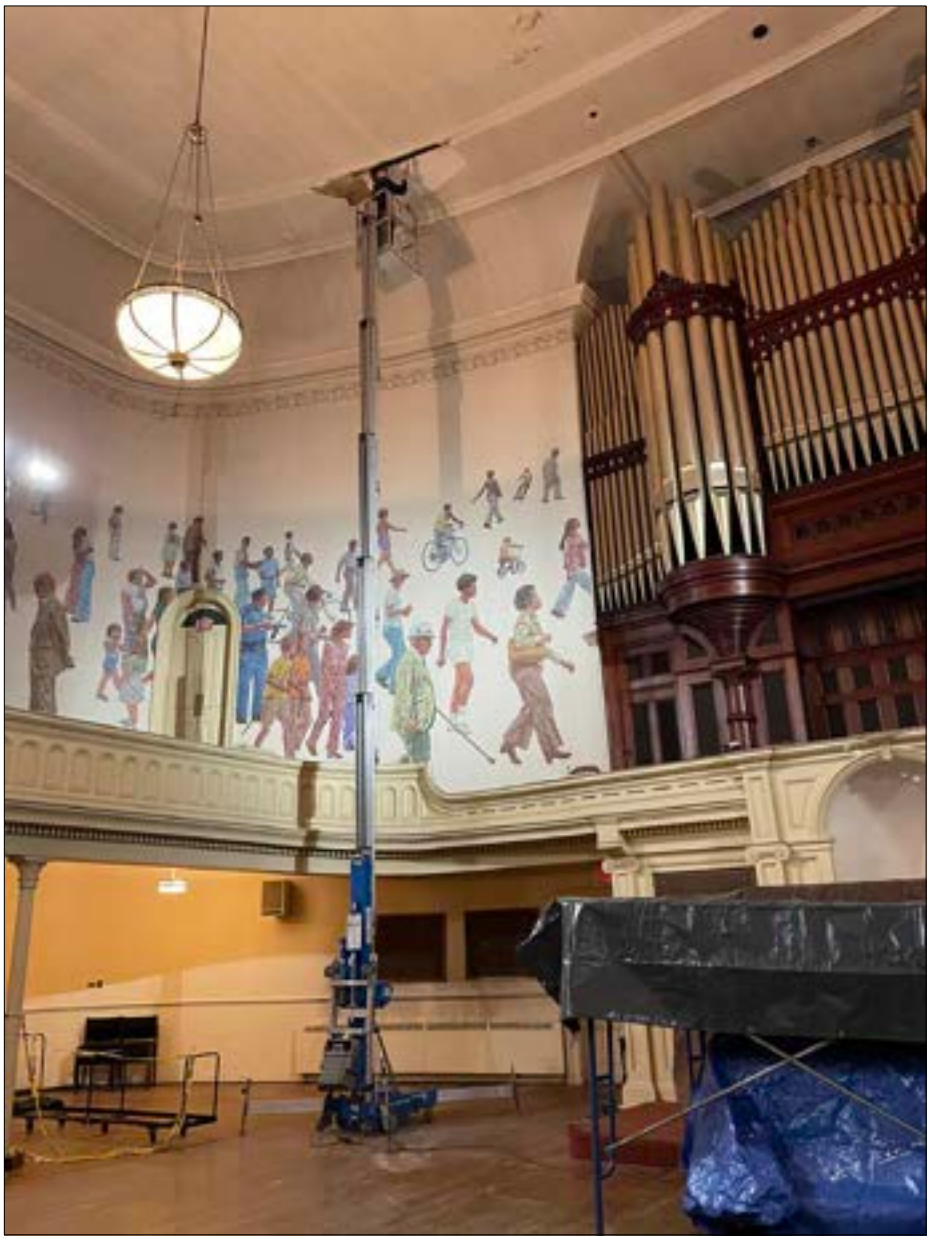

Photo 02. Detail of personnel lift allowing direct access for hands-on inspection.

Photo 03. Remnant plaster shards remain scattered in upper reaches of balcony.

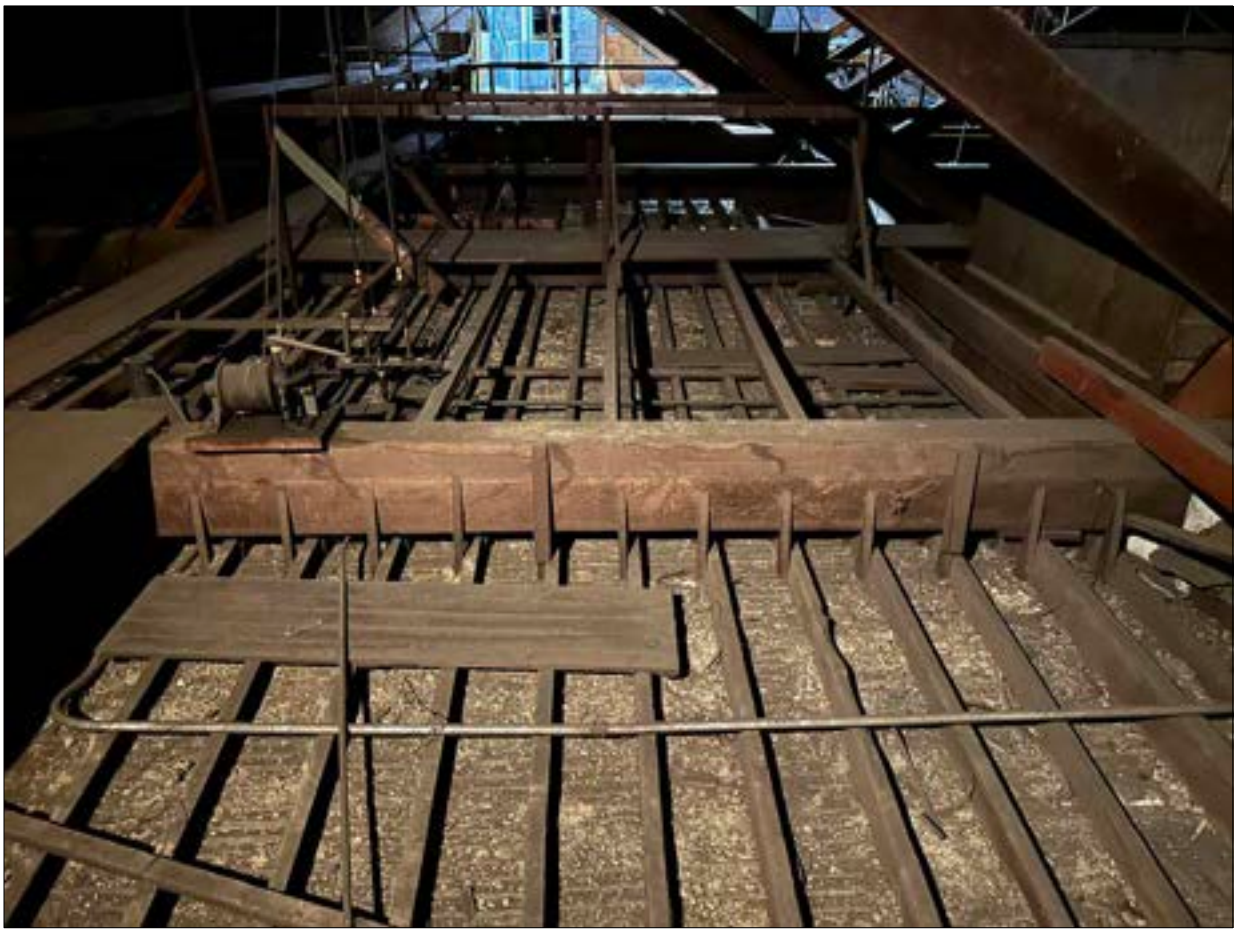

Photo 04. Exceptionally crafted in 1860, the timber & wood framing structural system supporting the ceiling remains in excellent condition; plaster keying through lath, on the other hand, is corrupted in many locations.

Photo 05. Catwalk over the proscenium arch, where an additional plaster collapse occurred. Concentrated foot traffic in this location renders it more prone to applied forces and, corrsepondingly, to damage.

Photo 06. The quality of keying within the coved cornice is clear; its geometry helps to sustain its formidable condition.

Photo 07. Site of flat plaster failure of August 10-11, 2023, located in the southeast quadrant of the ceiling, above the cove and just east (left) of the organworks.

Photo 08. Detail of failure looking west toward organ. The white plane of material represents a flow coat of adhesive applied when the high-hat light fixtures were installed, likely because cracking was evident in the area of the intervention.

Photo 09. Dislodged molding at belt course above mural and leaded glass. The source of this damage is water penetration at the tower of the Pastor's Study, which has been restored as a result of the "Opening Doors" campaign. This – and other – large plaster sections are completely disengaged from the wall system.

Photo 10. Damage is clearly apparent in the vicinity of all high-hat light fixtures. Reasons include unintended air passage, extreme drying-out because of their heat, and physical damage resulting from their installation.

Photo 11. Installation of a high-hat light fixture from above, viewed from within the attic.

Photo 12. Installation of mechanical equipment introduces a significant level of vibration never intended for this structural system. Aside from drawing large volumes of concentrated air (vs the ambient, more gentle, convective heating/cooling of the 1860s design) inflexible ducted systems present myriad negative issues.

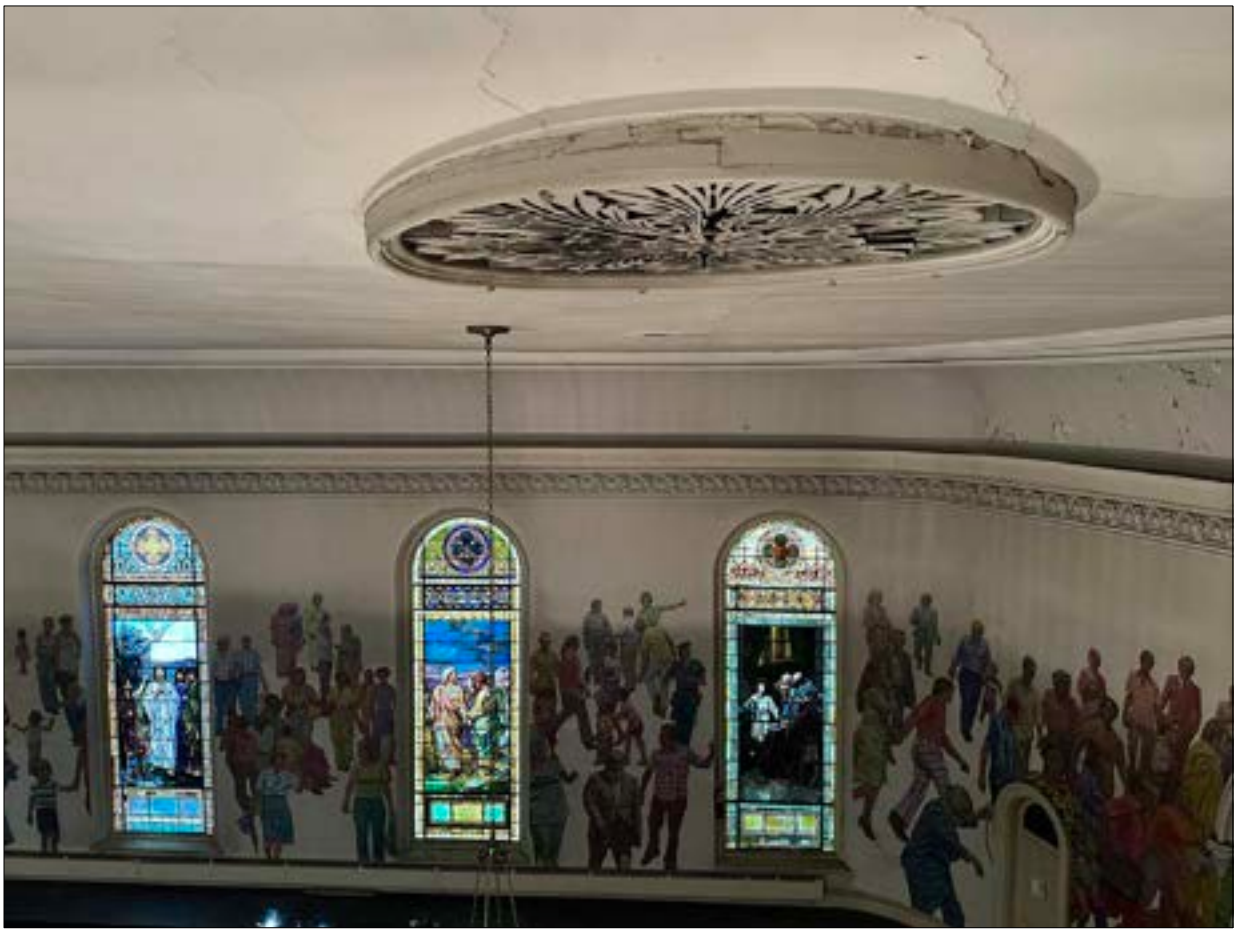

Photo 13. One of three targeted terminals of the ducted system above, deformation and other damage was clearly evident during the last painting campaign, 50-70 years ago. It's gotten worse.

Photo 14. Detail of the molded medallion and vent grille in Photo 13. Note the buildup of infill material applied during the last painting project; this feature was already in a failure mode then.

Photos 15. Studies of deterioration pathologies highlight worst conditions by definition. It's also important to recognize that the vast majority of the ceiling remains in very good condition.

Photo 16. A view across the ceilingscape supports the notion that this ceiling remains a remarkable remnant of an exemplary period of building and construction technology, notwithstanding current maladies that are now far better and more precisely understood, categorized and restorable.

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