Potree-Next and Instant Point Cloud Visualization

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Instant Point Cloud Visualization

- Real-Time Rendering requires Level-of-Detail structures (LODs)
- Creating LODs takes hours to days
- Our goal: Instant visualization without preprocessing

LidarScout

- Drag & Drop a large data set
- See results right away
- No LODs!
- Original LAZ tiles
- https://github.com/cg-tuwien/lidarscout

High-Performance Graphics (2025)
A. Knoll and C. Peters (Editors)

LidarScout: Direct Out-of-Core Rendering of Massive Point Clouds

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[1]TU Wien, Austria

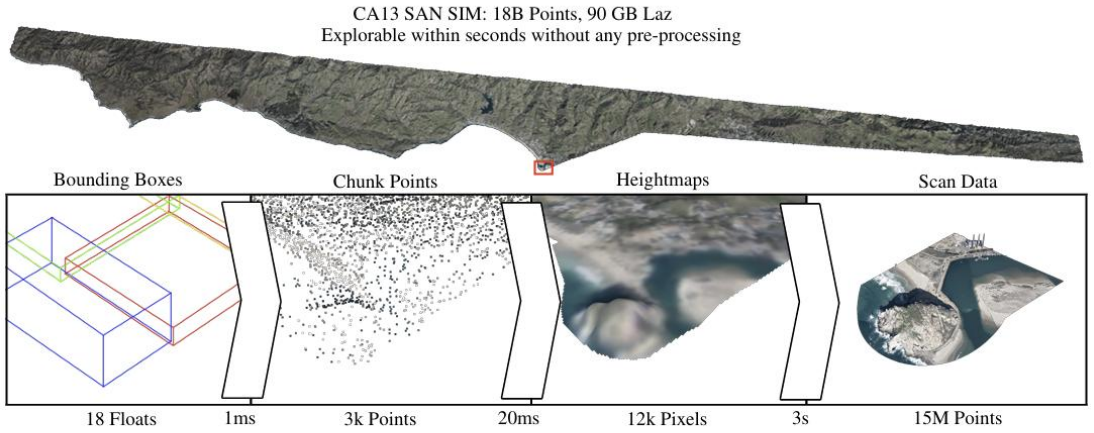


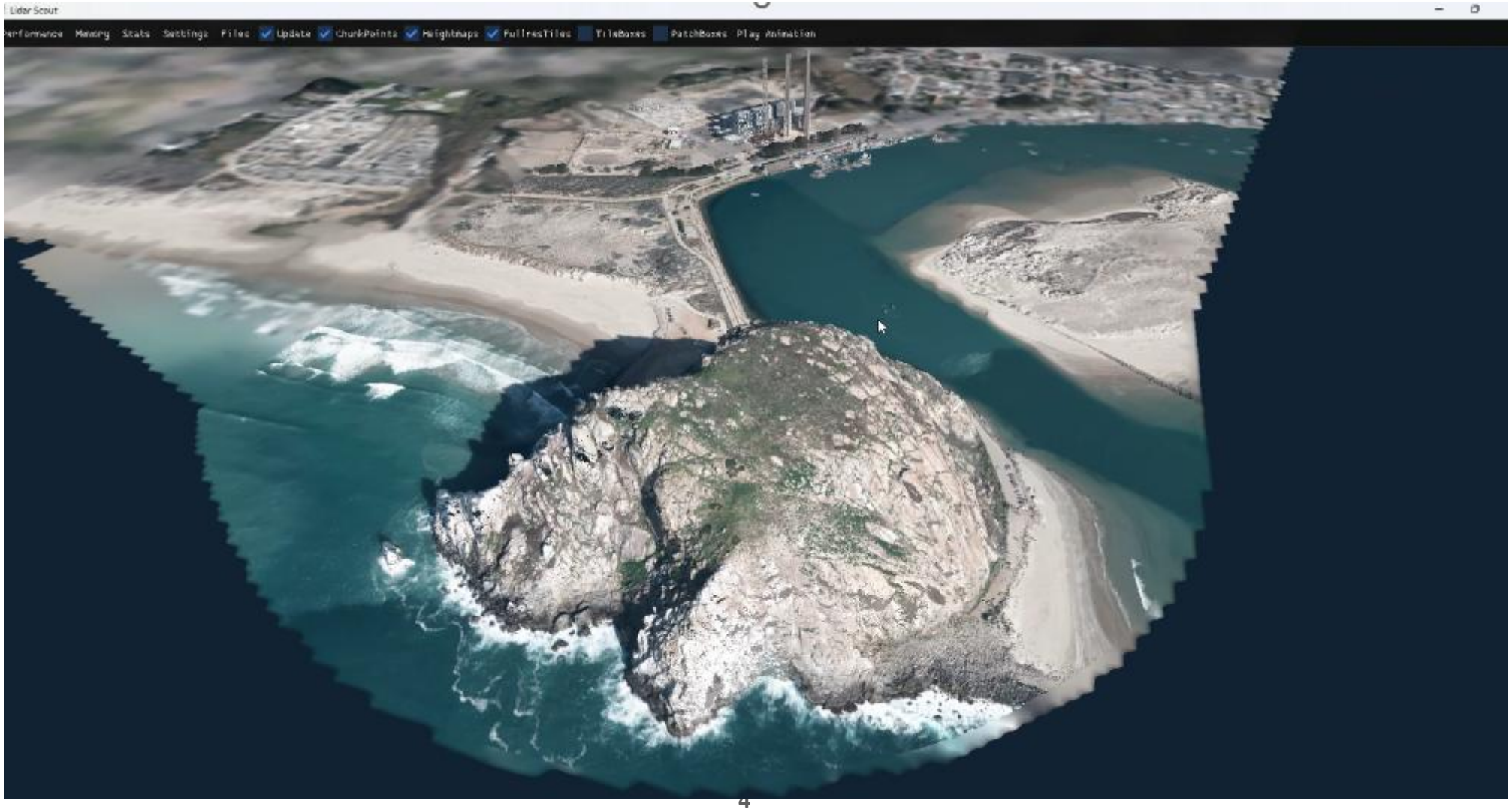
Figure 1: *We present* LIDARSCOUT, *a method to explore huge, compressed point clouds within seconds. The example shown here contains the Morro Bay area focusing on Morro Rock, rendered with three heightmaps of 640m x 640m.*

Abstract

Large-scale terrain scans are the basis for many important tasks, such as topographic mapping, forestry, agriculture, and infrastructure planning. The resulting point cloud data sets are so massive in size that even basic tasks like viewing take hours to days of pre-processing in order to create level-of-detail structures that allow inspecting the data set in their entirety in real time. In this paper, we propose a method that is capable of instantly visualizing massive country-sized scans with hundreds of billions of points. Upon opening the data set, we first load a sparse subsample of points and initialize an overview of the entire point cloud, immediately followed by a surface reconstruction process to generate higher-quality, hole-free heightmaps. As users start navigating towards a region of interest, we continue to prioritize the heightmap construction process to the

LidarScout

- CA13: 18 billion points (90GB)



LidarScout

- Gisborne+Addendum: 262 billion points
- 25’190 tiles, 2.4TB





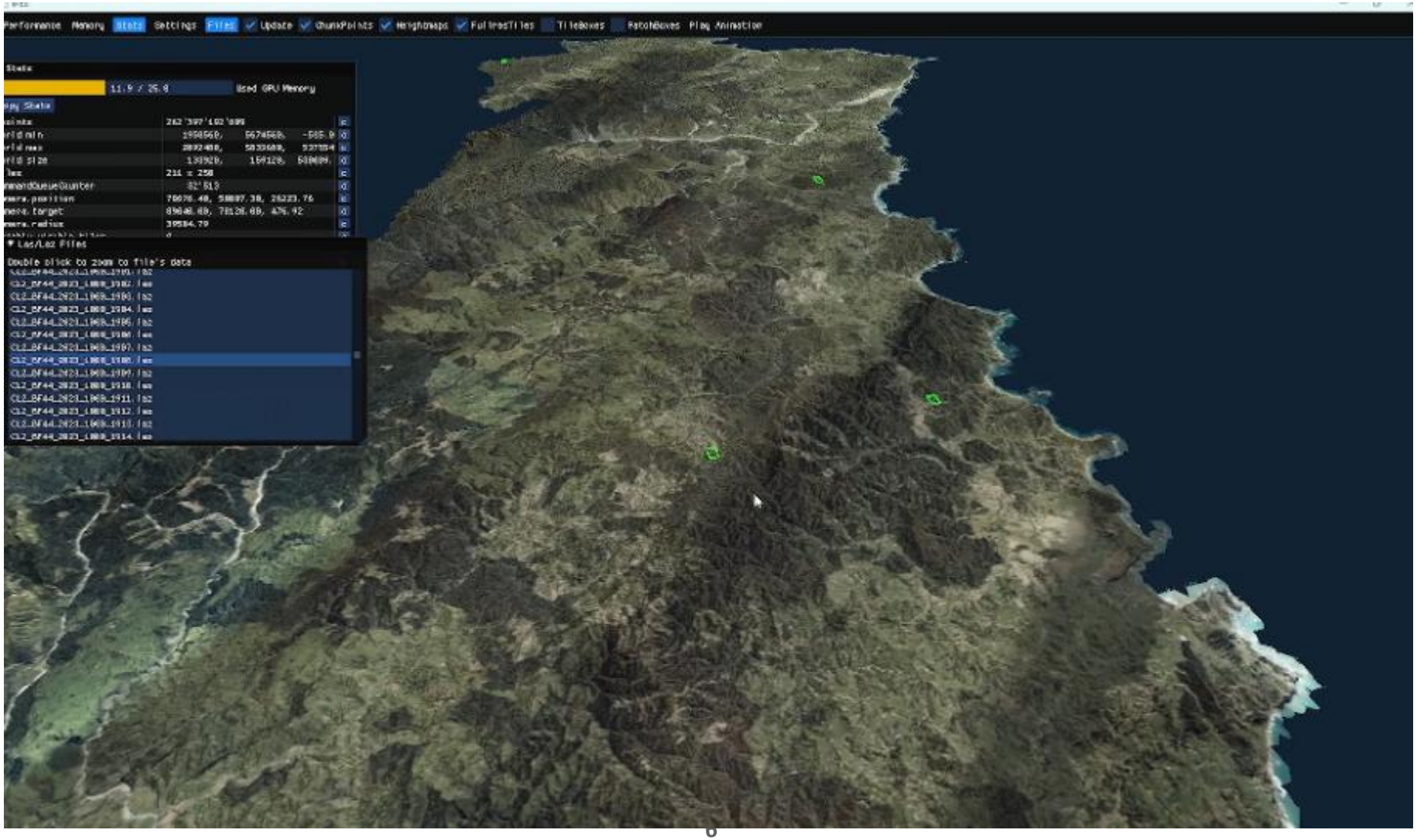






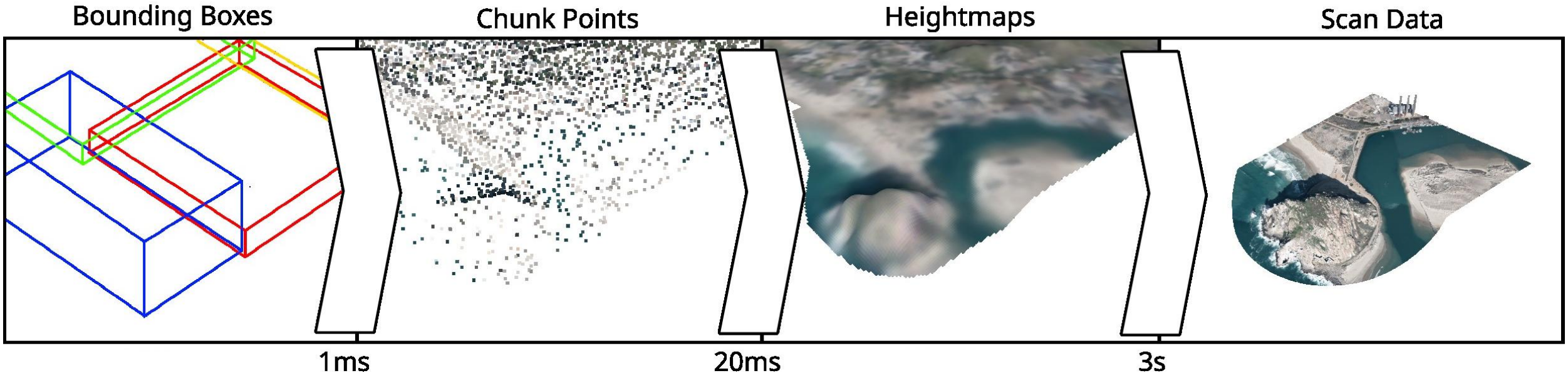
LidarScout

- Gisborne (+Addendum): 262 billion points (2.4TB)



LidarScout

- Instant Preview without LODs
- Multiple stages:
  - Stage 1: Coarse Overview
  - Stage 2: Heightmap Generation
  - Stage 3: Full-Res on close-up



LidarScout

- Github: https://github.com/cg-tuwien/lidarscout
- Note: Academic Prototype (…for now!)

Simultaneous LOD Generation and Rendering

- Incremental construction
  - Insert some points to octree
  - Render results
  - Add more points in next frame



0.9sec, 20M



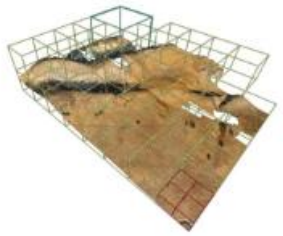
1.8sec, 40M



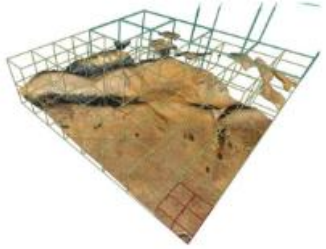
2.6sec, 60M



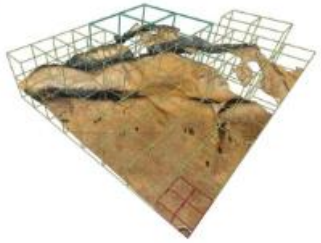
3.5sec, 80M



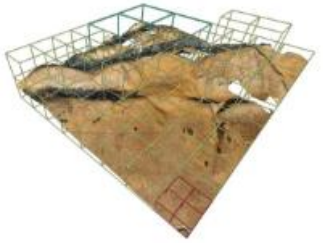
4.4sec, 100M



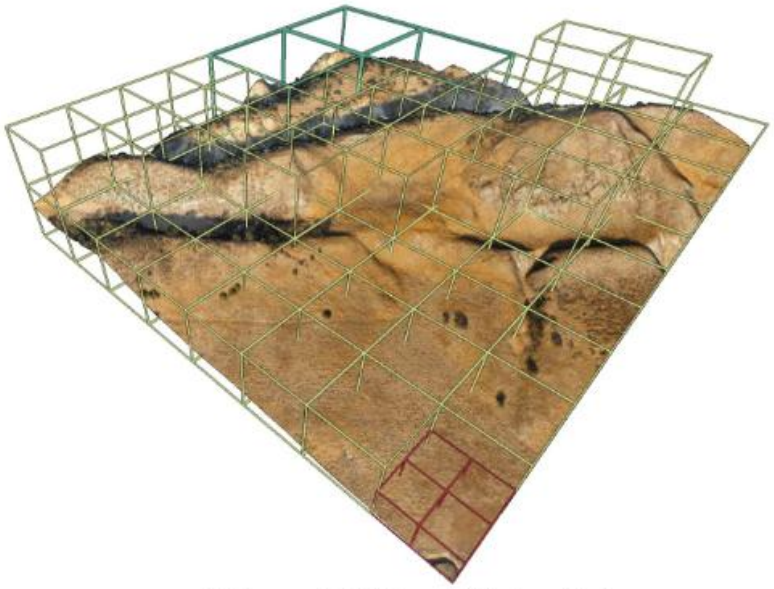
5.3sec, 120M



6.1sec, 140M

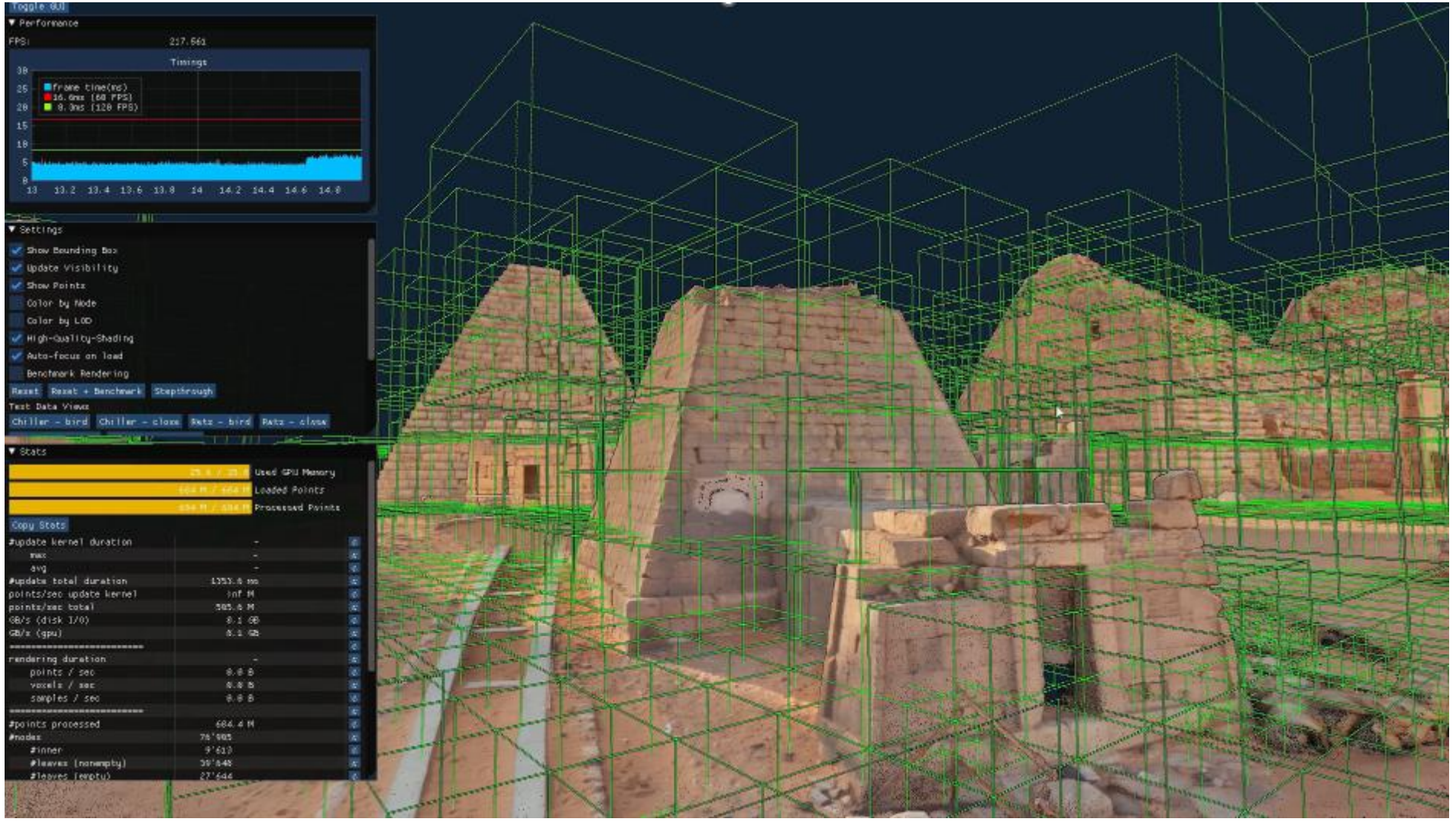


7.0sec, 160M



7.9sec, 175 M points loaded,
2.2 M voxels&points rendered

Simultaneous LOD Generation and Rendering



Simultaneous LOD Generation and Rendering

- https://github.com/m-schuetz/SimLOD
- Only in-core for now. Out of core work in progress.

Instant Point Cloud Visualization

- We‘ve got further research in the pipeline:
  - WWTF Project:
    “Instant Visualization and Editing of Arbitrarily Large 3D Data Sets”
- Creating LOD structures on-the-fly instead of as a preprocess
- Apply to other data sets such as meshes, splats, …

Potree-Next

Potree-Next

- Potree 1.8 a bit dated
  - Old three.js version
  - WebGL
- Potree-Next
  - Rewrite based on WebGPU and latest three.js
- Most old functionality
- Some new
  - 3D Tiles (via NASA-AMMOS's three.js renderer)
  - Gaussian Splats



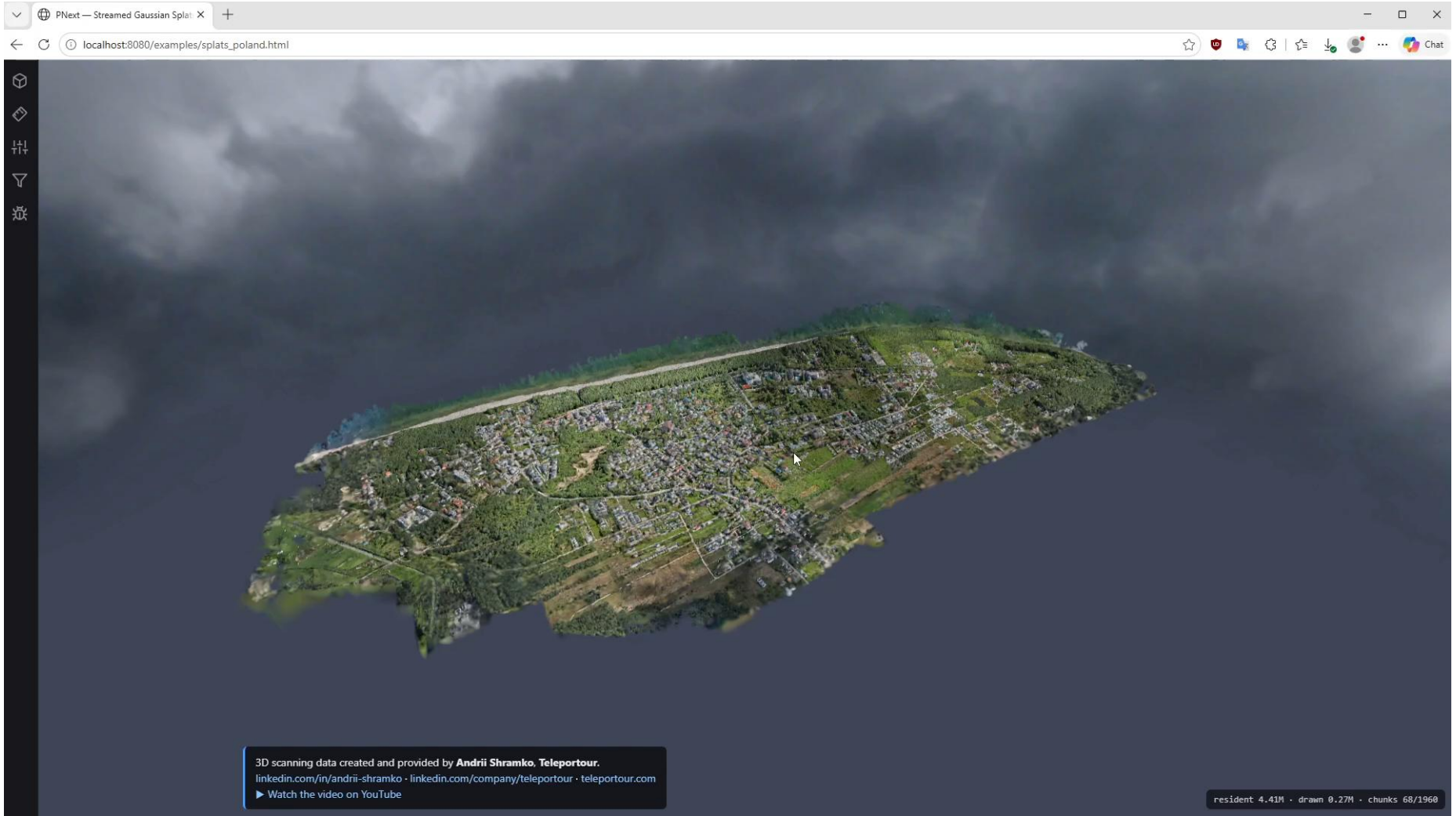
Potree-Next

- 3D Tiles via NASA AMMOS
- https://github.com/NASA-AMMOS/3DTilesRendererJS

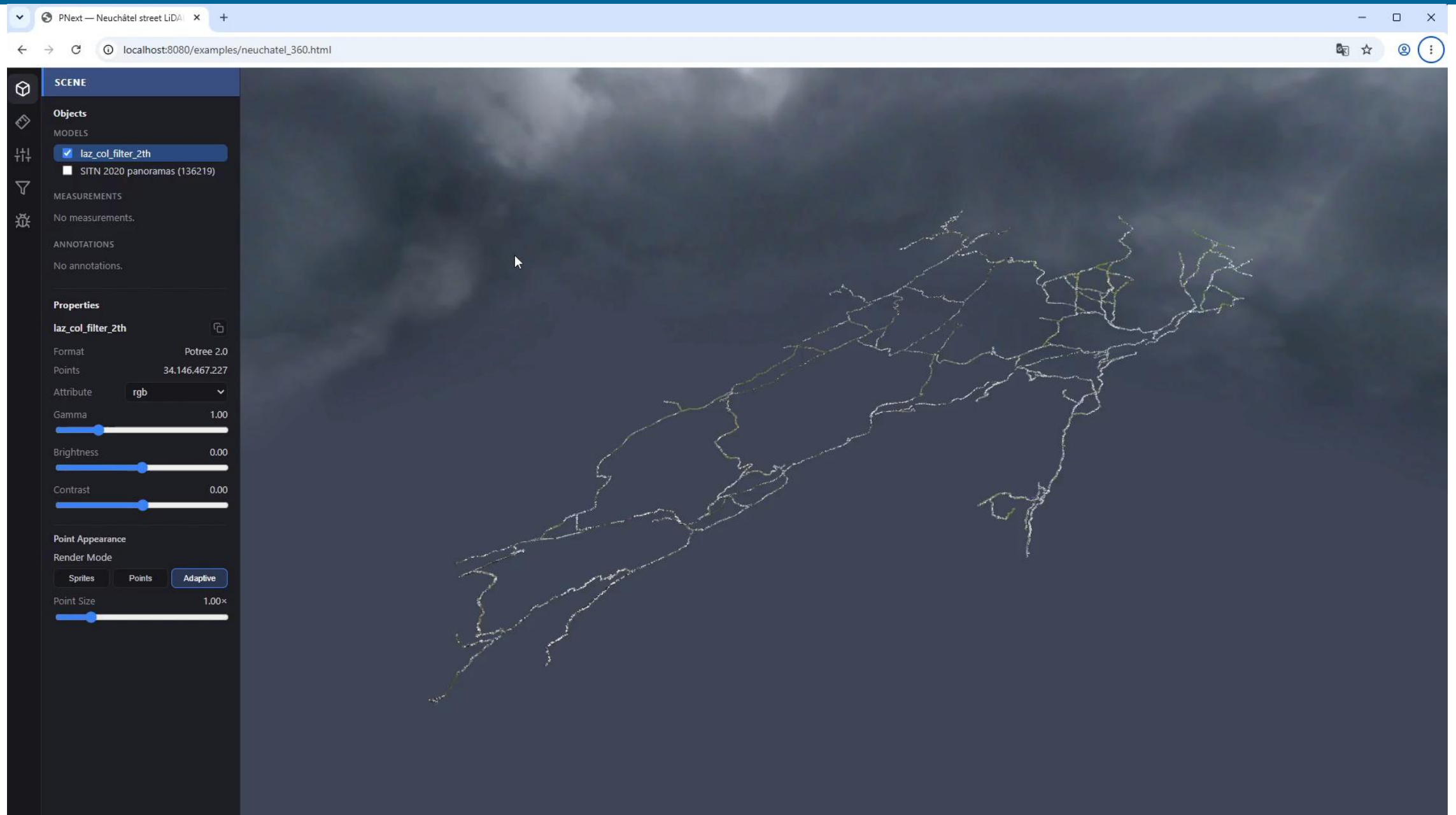


Potree-Next

- Gaussian Splatting via PlayCanvas‘ Streamed SOG Format
- https://developer.playcanvas.com/user-manual/gaussian-splatting/formats/streamed-sog/

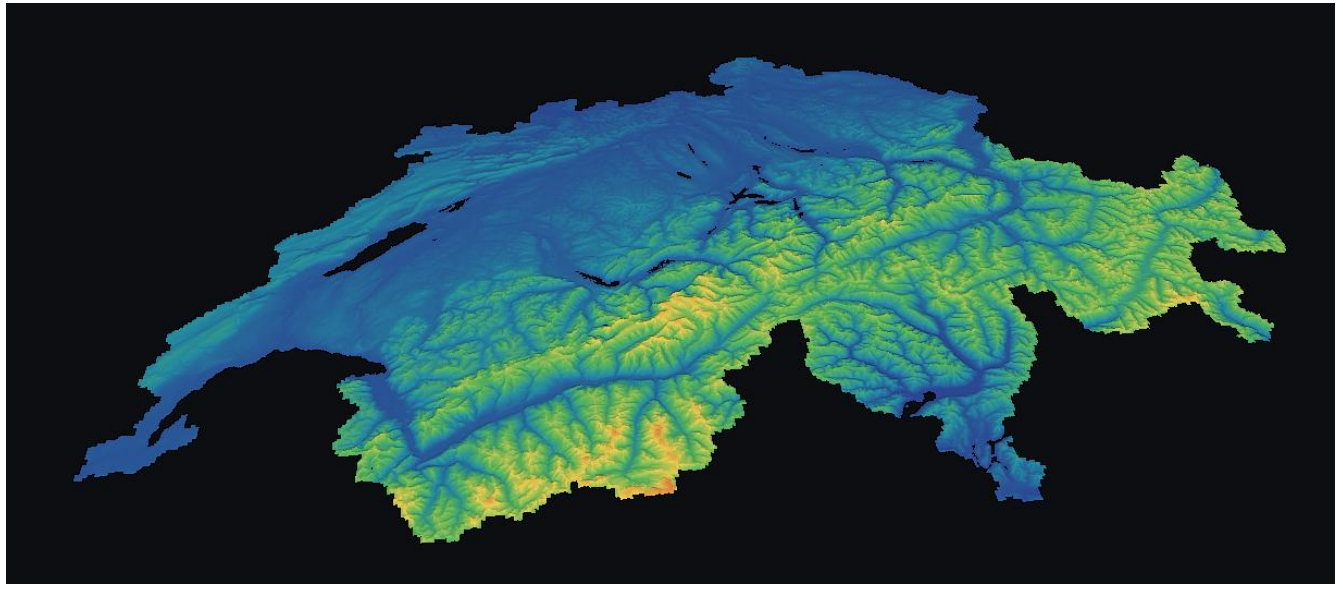


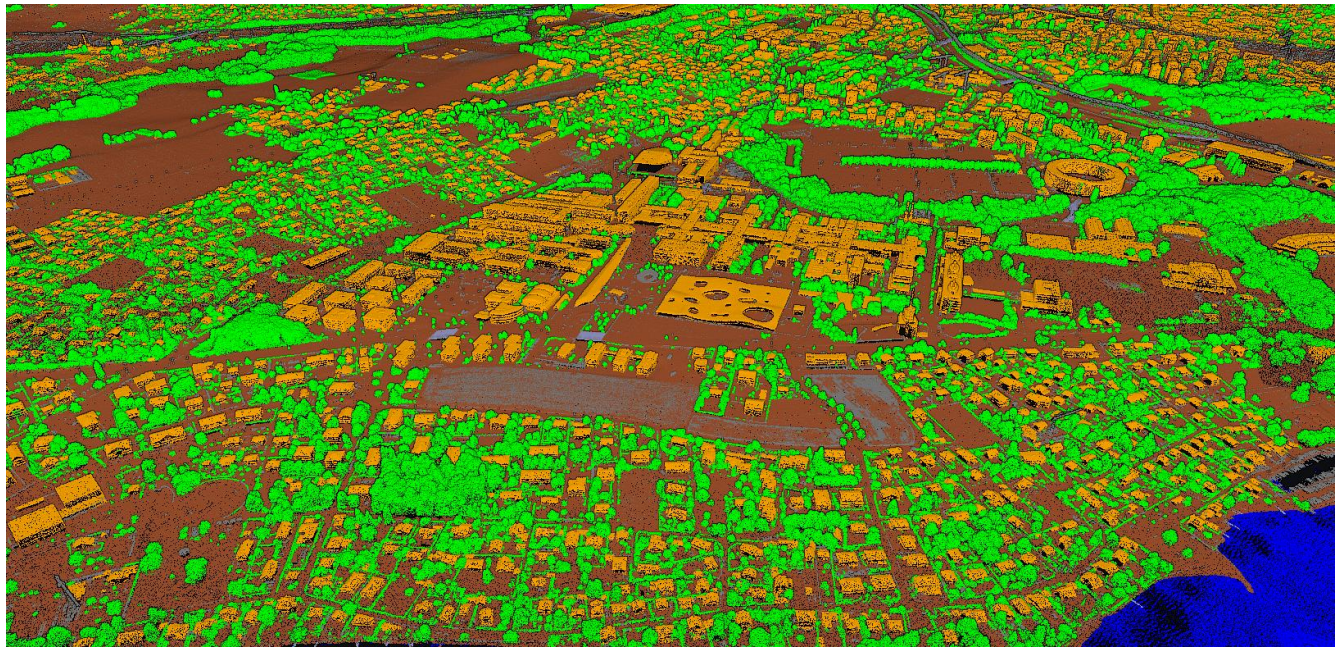
Potree-Next: Faster Panoramas (136k Images)

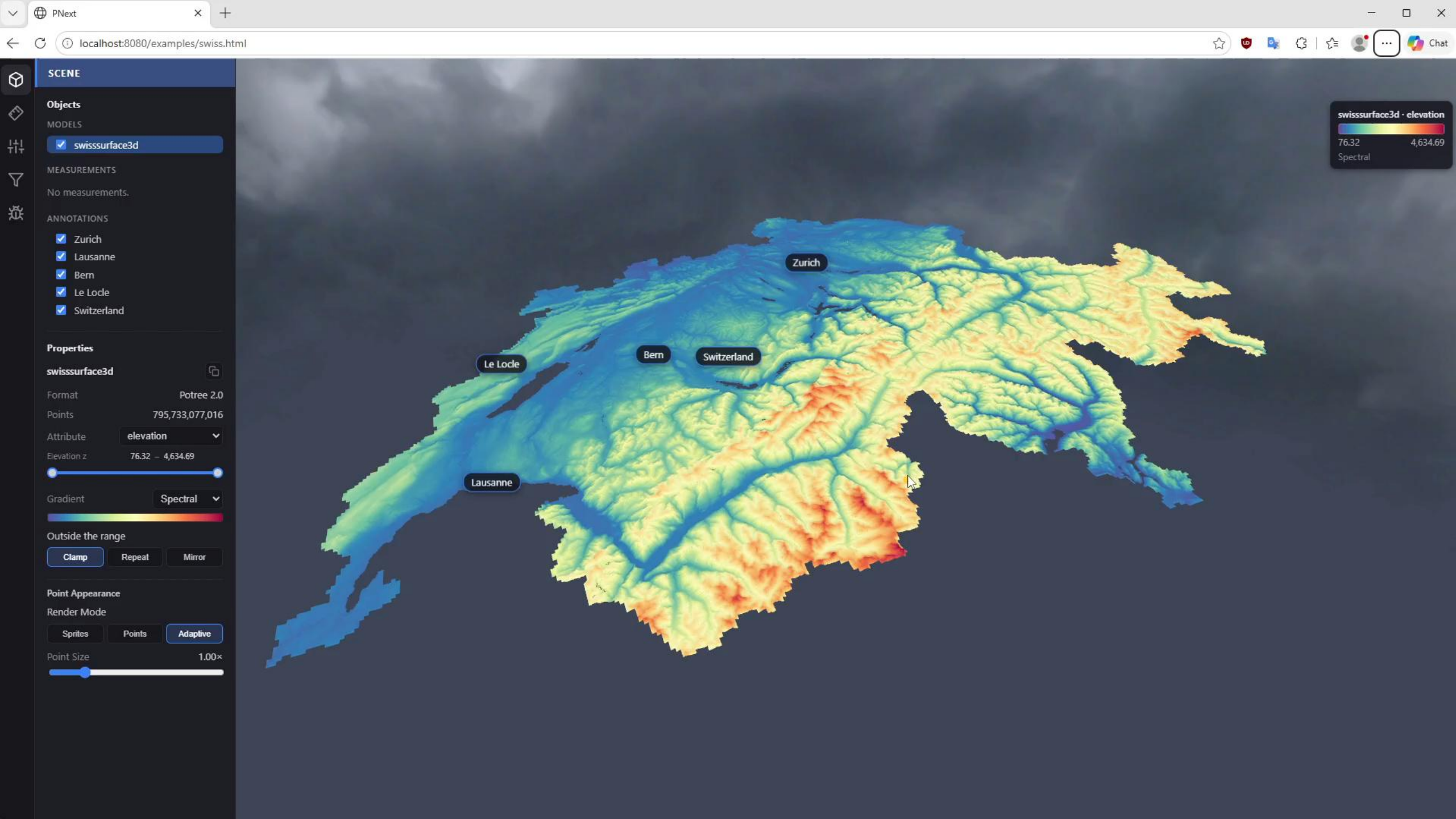


Potree-Next / Potree Converter

- Swisstopo
- In:
  - 795 billion points, 4.1TB
- Out:
  - 7.1TB Octree
  - Brotli-Compressed
- 2 days, 16 hours
  - Chunking: 36.8 hours
  - Indexing: 26.5 hours
  - Merging: 1.3 hours






PNext
localhost:8080/examples/swiss.html
Chat
SCENE
Objects
MODELS
swisssurface3d
MEASUREMENTS
No measurements.
ANNOTATIONS
Zurich
Lausanne
Bern
Le Locle
Switzerland
Properties
swisssurface3d
Format
Potree 2.0
Points
795,733,077,016
Attribute
elevation
Elevation z
76.32 – 4,634.69
Gradient
Spectral
Outside the range
Clamp
Repeat
Mirror
Point Appearance
Render Mode
Sprites
Points
Adaptive
Point Size
1.00×
swisssurface3d · elevation
76.32
4,634.69
Spectral
Zurich
Le Locle
Bern
Switzerland
Lausanne

Potree-Next

- Release Date: 31.12.2026
- Complete rewrite so expect missing features or breaking changes
- Still fine to stick with Potree 1.8 until rewrite fully mature

Thank you for your attention

