OPENCOSMO VISUALIZATION: IN-BROWSER EXPLORATION OF COSMOLOGICAL PARTICLE DATA

QUERY → VISUALIZE → EXPLORE

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OPENCOSMO VISUALIZATION APP (OVA)

BEFORE · EVERY QUERY

Query → Download → Install a viewer → Repeat

WITH OVA · SAME BROWSER TAB

Query → Open in Visualizer → Explore in 3D

No export, no installation, no preprocessing. Queried particles open straight into an interactive 3D view. [1]

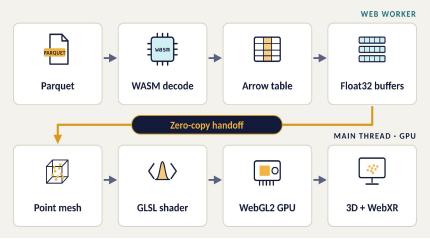


Figure 1. System Architecture.

WHAT USERS CAN DO

- Per-type controls: scalar, colormap, size, opacity
- Filter by scalar range and point cap
- 3D clipping plane for cross-sections
- Box-select for per-type statistics
- One-click WebXR with state preserved [2]

CONCLUSIONS

A simulation portal can carry its own visualization layer: queries become interactive 3D exploration in one session, on hardware users already own.

Next: WebGPU backend, level-of-detail, richer XR interaction

OVA IN ACTION

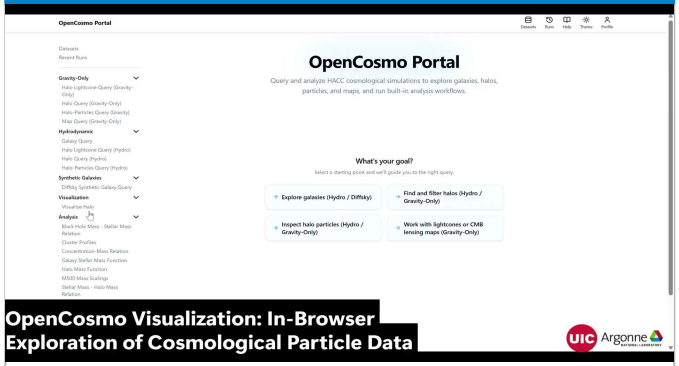


Figure 2. OVA rendering an Halo returned by an OpenCosmo portal query.

CONTRIBUTIONS

- Closes the query-to-visualization loop inside a portal
- Zero-preprocessing client-side ingestion of native Parquet
- GPU point rendering with per-type controls, filtering, clipping, selection statistics and WebXR in one interface
- Removes reliance on shared HPC resources

ACKNOWLEDGEMENTS

This research used resources of the Argonne Leadership Computing Facility, which is a U.S. Department of Energy Office of Science User Facility operated under contract DE-AC02-06CH11357.

WHERE OVA FITS

- **OVA:** reads the portal's native Parquet, fully client-side, inside the portal
- Firefly: data must first be converted to JSON or a custom binary [3]
- ParaViewWeb: needs a visualization server, reverse proxy and launcher [4]
- yt, ParaView, VisIt: the standard for deep analysis; OVA is the zero-install first look, not a replacement

PERFORMANCE & RESULTS

5M Particles

~6.7s end-to-end ingestion

114.8 FPS at full point count

0 blocking main-thread tasks

Consumer laptop, integrated AMD Radeon 780M, Chrome

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