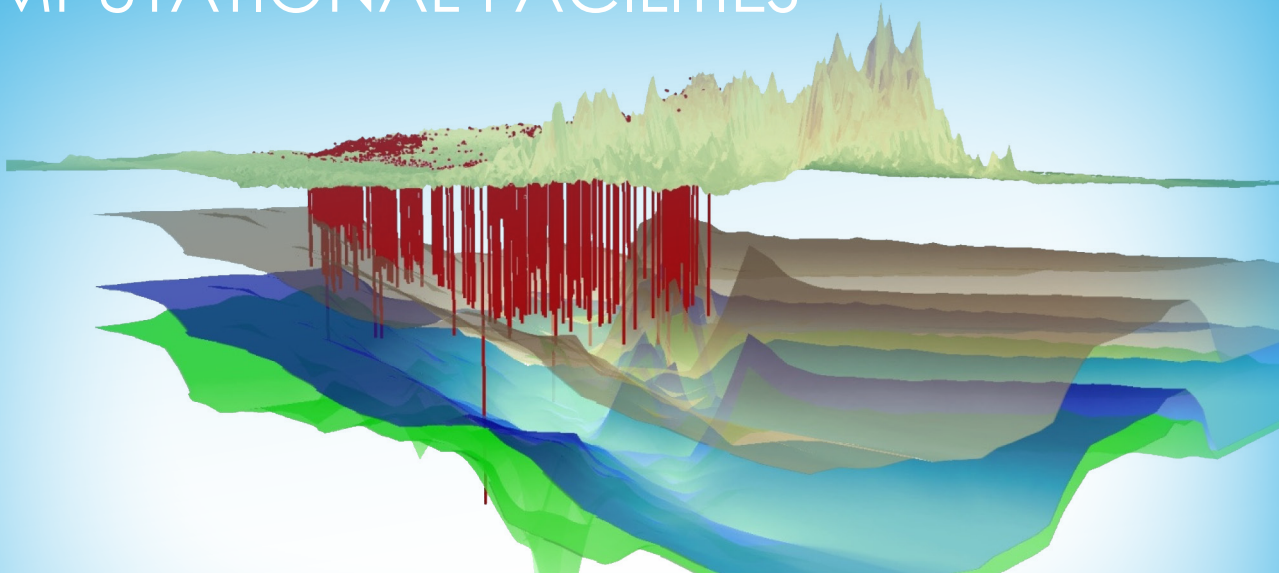


# GEOSCIENCE ANALYSIS, INTERPRETATION, AND ASSESSMENTS COMPUTATIONAL FACILITIES



3D visualizations of topography and subsurface layers/intervals in the Appalachian Basin can be created using the GAIA facility. These interpretations support geospatial and geo-statistical evaluations associated with carbon storage assessments, as well as subsurface risk and impact studies associated with hydrocarbon systems and underground injection and storage.

# NETL

NATIONAL ENERGY TECHNOLOGY LABORATORY

## DESCRIPTION

Researchers use the U.S. DOE NETL Geoscience Analysis, Interpretation, and Assessments (GAIA) Computational Facilities to perform a range of computational research across the Albany, Morgantown, and Pittsburgh, sites. The GAIA facilities provide access to terabytes of geologic and environmental datasets on high-end computational workstations loaded with advanced tools, models, and software. In addition, the desktop and video sharing capabilities within the GAIA facilities support real-time research collaboration and analysis across all NETL sites and with outside collaborators.

# GEOSCIENCE ANALYSIS, INTERPRETATION, AND ASSESSMENTS COMPUTATIONAL FACILITIES

## CAPABILITIES

The GAIA facilities permit researchers to access, interpret, analyze, visualize, and model data on high-end computational workstations with pre-loaded software, such as ArcGIS, Petra, EarthVision, GoldSim, MATLAB, and other advanced analytical, statistical, modeling, and bioinformatic packages. These computers are equipped with high performance Intel processors, graphics cards, and large amounts of RAM. Real-time collaboration among researchers is facilitated using webcams and video/desktop sharing applications, such as Skype, Join.me, and WebEx.

In the GAIA facilities, researchers can evaluate and utilize their data, whether generated in the field or from laboratory experiments, such as the geomaterial, geoinaging, and geomicrobiology facilities. Additionally, the GAIA facilities connect scientists to external data, models, and tools, including those available through the Energy Data eXchange (EDX) to process, analyze, and visualize their research to satisfy their project's needs. GAIA workstations also support high-performance and big data computing, allowing researchers to access both NETL's supercomputer, Joule, as well as NETL's big data cluster. The hardware and software accessible at the GAIA facilities support the development of novel approaches, models, and tools that integrate functionality from multiple fields, including advanced 3D and 4D visualization, geostatistics, augmented and virtual reality, data science, data analytics, machine learning, artificial intelligence, and programming.

Ongoing research conducted in the GAIA facilities encompasses a wide range of activities. NETL researchers and collaborators study engineered-natural systems related to several research topics, including assessing resource potential, identifying knowledge and technology gaps, analyzing various material's performance, modeling multiphase fluid flow, evaluating infrastructure integrity, analyzing metagenomic and genomic data from various microbial communities, conducting site and study feasibility analyses, and characterizing spatial and temporal patterns to support various research, management, and policy decision needs.

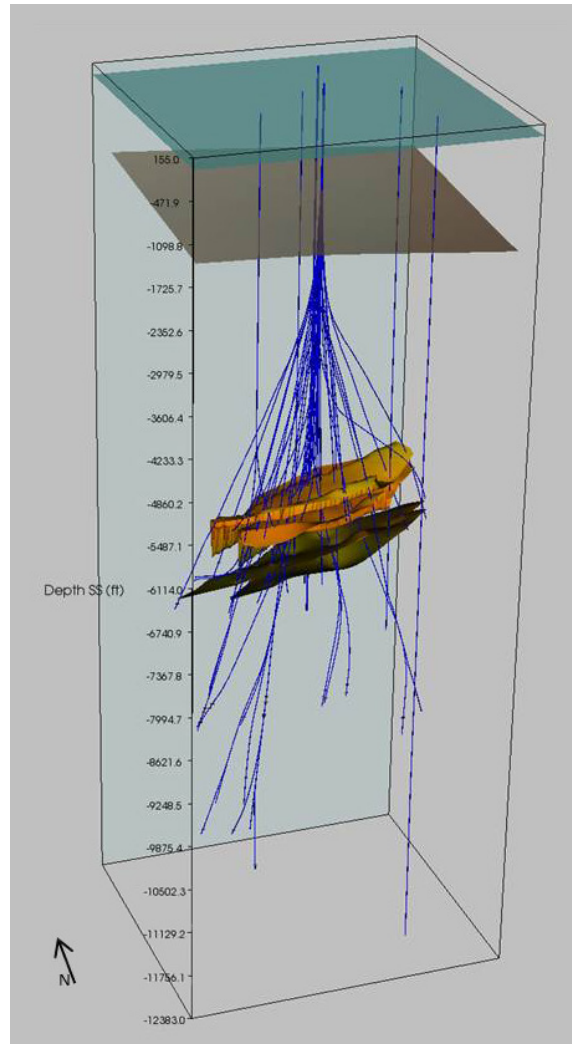


Figure 1. NETL interpretation generated using GAIA facility resources and 3D visualization of directionally drilled boreholes in the Gulf of Mexico showing two reservoir sand intervals.

# GEOSCIENCE ANALYSIS, INTERPRETATION, AND ASSESSMENTS COMPUTATIONAL FACILITIES

## BENEFITS

The GAIA facilities provide consistent access to research-caliber work stations at all NETL sites to meet geologic and environmental science research and development needs for a range of projects and users. GAIA facilities also provide a place for visiting scientists and researchers with NETL information technology credentials to efficiently work at any NETL site.

The science-based analyses conducted using GAIA facilities improves our understanding of geologic and environmental systems, exposes knowledge and technology gaps, and drives further research. The integrated and collaborative setting of GAIA facilities enables knowledge-sharing across projects and disciplines, thus improving NETL's efforts in solving energy issues related to these systems.

Research carried out through the GAIA facilities helps ensure enduring access to domestic energy resources. This research influences the safe and reliable use of our natural resources, development of new energy resources, and protection of the environment.

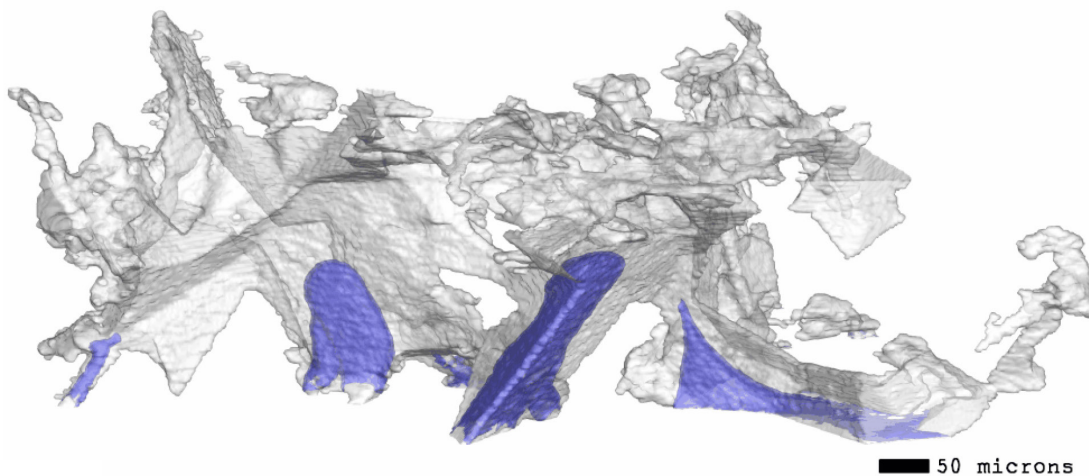


Figure 2. The GAIA facility allows researchers to study multiphase computational fluid dynamics such as this example from a micron computed tomography derived image that shows CO<sub>2</sub> flow in pore space in a Mt. Simon sandstone core.

## GAIA Locations

**Albany, Oregon**  
Building 1, Room 315  
541.918.4561  
Building 28, Room 115  
541.967.5964

**Morgantown, West Virginia**  
Building 17, Room 101  
304.285.0516

**Pittsburgh, Pennsylvania**  
Building 84, Room 327  
412.386.6622

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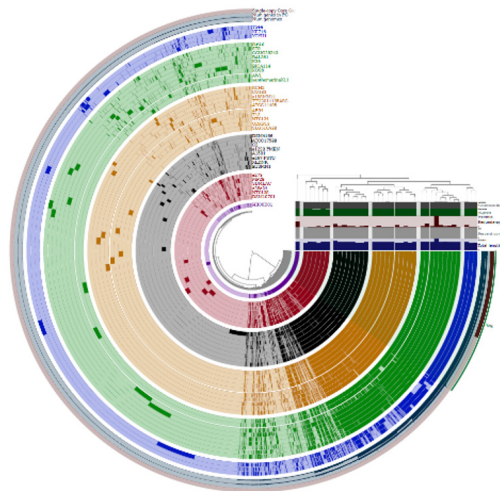


Figure 3. Pan-genomic analysis of *Pseudomonas* isolated from various hydrocarbon environments allow a comprehensive evaluation of core genomes and accessory genomes.

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