NVIDIA.

STONE RIDGE TECHNOLOGY REDUCES COMPOSITIONAL MODEL RUNTIMES
with NVIDIA GPU-Powered Reservoir Simulation Software

> *"The speed and flexibility of ECHELON will be the key elements of the subsurface modelling in the energy transition pathway."*
>
> — **Alessandro Caschili,** Head of Reservoir Innovative Technologies, Eni

Complex Reservoir Models Outpace Legacy Simulator Capabilities

Multi-core CPU simulators struggle to retain the reservoir detail and complexity needed for the accurate risk analysis of increasingly large geological models. Reservoir engineers spend days or weeks on large clusters simulating upscaled reservoir models.

World's Fastest Reservoir Simulation Software for Complex, Large-Scale Models

To address these issues, Stone Ridge Technology (SRT) and Eni developed ECHELON, the world's fastest reservoir simulation software, to run multi-million cell models using the massive parallelism of NVIDIA GPUs. ECHELON gives reservoir engineers the opportunity to simulate fields using the scale of the geological grid, with the possibility to capture and better estimate uncertainty by running an ensemble of reservoir models.

ECHELON 2.0 is the most significant release of SRT's reservoir simulation software since its introduction to the market in 2016. One of the key features is compositional formulation, which was planned, designed, implemented, and rigorously tested by SRT and Eni. ECHELON 2.0 was created to make full use of GPU capabilities and resources, optimizing for memory bandwidth, storage, and floating point operations per second (FLOPS). This release is the industry's first compositional simulator exclusively formulated from inception to run on NVIDIA GPUs.

STONE RIDGE
T E C H N O L O G Y

Stone Ridge Technology and Eni released ECHELON 2.0, the first commercial reservoir simulation software designed from inception to run on NVIDIA GPUs with compositional simulation capabilities.

INDUSTRY

> Energy

CHALLENGE

> Legacy reservoir simulators are unable to run large compositional models with high accuracy in a time frame compatible with reservoir engineering workflows.

PRODUCTS USED

> NVIDIA A100 40GB Tensor Core GPUs
> NVIDIA V100 Tensor Core GPUs on Eni's HPC5 cluster

RESULTS

> Launched first commercial compositional simulation software to run exclusively on NVIDIA GPUs
> Ran an 11.2-million-cell model with nine components and forecast out 20 years in 30 minutes
> Accelerated deep-water reservoir, offshore oil field, and deep-water gas field simulations with ECHELON 2.0 running on Eni's HPC5 cluster

20-Year Simulation in 30 Minutes

To test ECHELON, Stone Ridge Technology made a goal to define 100 new well locations in a high-resolution geologic model using a fully implicit (FIM) simulation. ECHELON 2.0's compositional formulation ran the 11.2-million-cell model with nine components for 20 years of forecast. The entire simulation took 30 minutes with eight NVIDIA A100 40GB Tensor Core GPUs and 45 minutes with four NVIDIA A100 40GB Tensor Core GPUs. ECHELON's FIM compositional formulation scales both runtime and memory requirements linearly with respect to the number of components, a unique feature in the energy industry.

Simulator Runtime
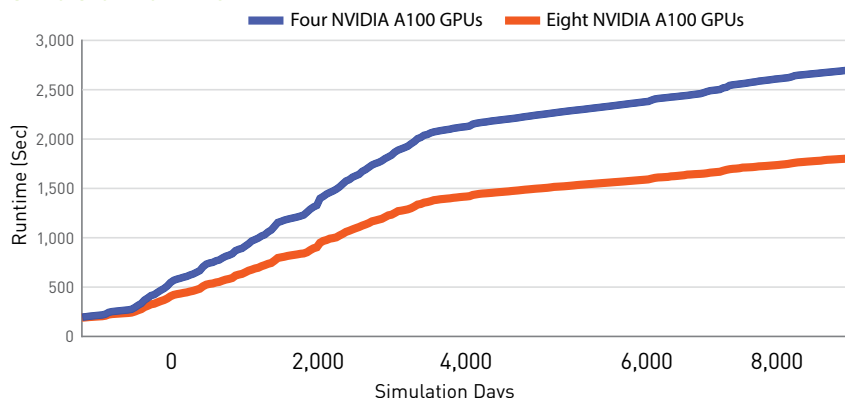
Simulator runtime of an 11.2-million-cell test model run on NVIDIA A100 eight-GPU and four-GPU configurations

Eni Accelerates Simulation Use Cases

Since 2018, SRT and Eni have partnered from the initial deployment of ECHELON through ECHELON 2.0 to enhance software capabilities and deploy in industrial environments. Eni accelerated its digital transformation efforts with the HPC5 supercomputer consisting of 1,820 Dell EMC servers, each with four NVIDIA V100 Tensor Core GPUs. In total, the system comprises 7,280 NVIDIA V100 GPUs.

In a webinar presented by SRT and Eni, Eni presented results from three different types of use cases for ECHELON 2.0. The first was a deep-water reservoir using compositional formulation on four V100 GPUs for 150 runs on Eni's HPC5 cluster. In this trial, most realizations ran in less than four hours. The second was an offshore oil field that took 10 hours to run five reservoirs, each ranging from 300,000 to 2,100,000 grid blocks with multi-reservoir coupling. The third was a deep-water gas field with three reservoirs, each approximately 1,000,000 grid blocks, with reservoir coupling. In this third use case, SRT's proprietary integrated-facility-network solver was linked to ECHELON and coupled at each time step. The full field development ran in 15 minutes.

Setting a New Performance Bar for Reservoir Simulation Software

ECHELON's compositional formulation sets a new bar for industry performance. Powered by NVIDIA GPUs, ECHELON opens up the possibility of simulating large systems with significantly more detailed fluid models. To accelerate future workloads, SRT is launching an ECHELON and NVIDIA DGX™ bundle, with ECHELON coming preinstalled in DGX for immediate deployment. Users can reduce their hardware footprint for large-scale simulations by replacing thousands of processors in a data center that covers half a football field with a compact bundle that fits in the space of half a table tennis table.

About Eni www.eni.com

Eni is an energy company that operates in oil and gas exploration, development and production, refining and marketing, trading and shipping, chemical, renewable energies, and innovative solutions. Inspired by the UN 2030 Agenda, Eni's values are based on long-term carbon neutrality, operational excellence, and the creation of alliances for local development. Eni is focused on efficiency, integration, and the deployment of new technologies.

About NVIDIA www.nvidia.com

NVIDIA's invention of the GPU in 1999 sparked the growth of the PC gaming market, redefined modern computer graphics, and revolutionized parallel computing. More recently, GPU deep learning ignited modern AI—the next era of computing—with the GPU acting as the brain of computers, robots, and self-driving cars that can perceive and understand the world.

About Stone Ridge Technology www.stoneridgetechnology.com

Stone Ridge Technology, founded in 2005, develops and markets ECHELON, the fastest reservoir simulation software in the world, designed from inception to run on massively parallel NVIDIA GPUs.

Learn more

Find out more about NVIDIA's energy solutions at **www.nvidia.com/energy** or email Nefeli Moridis (**nmoridis@nvidia.com**)