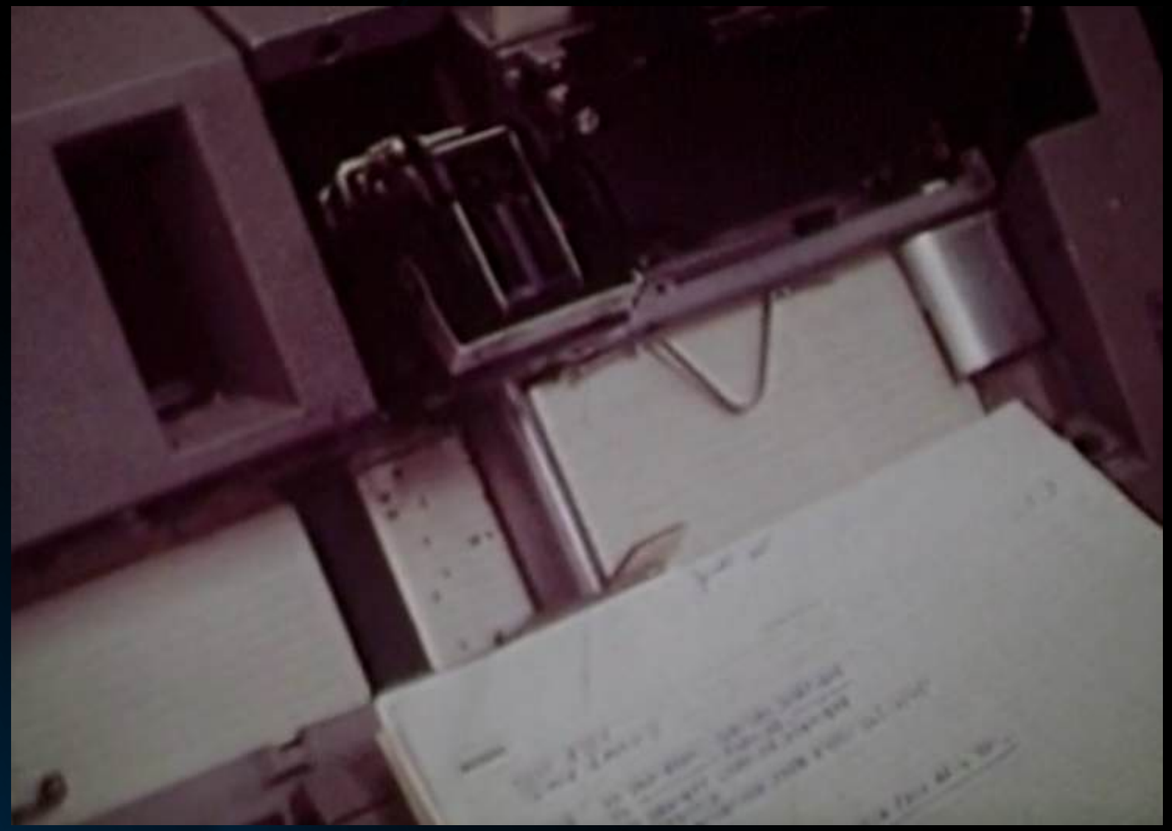
eRoots Analytics

GridCal - Open-source for Modern Power Systems

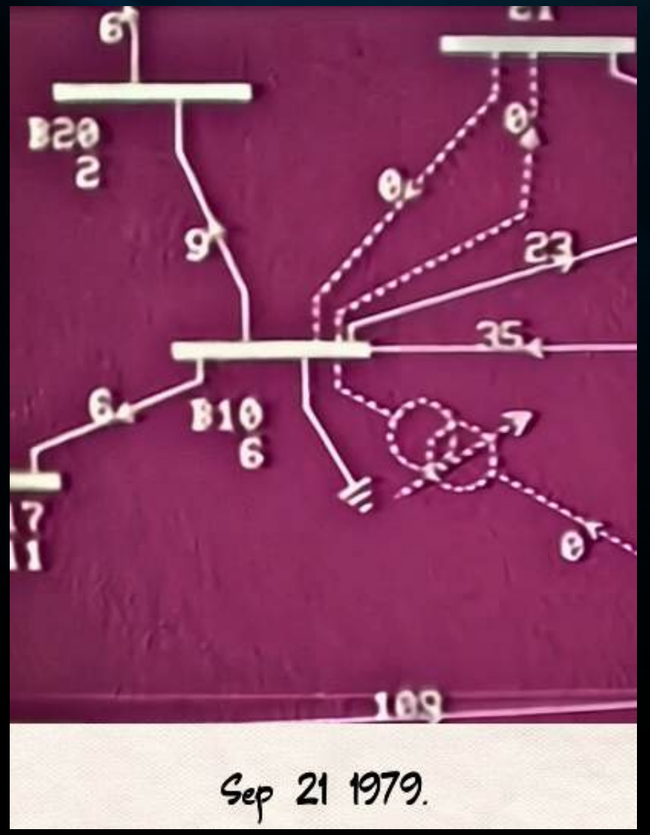
FERC, July 2025

eRoots

Why simulate?



Source: IPSA, by TNEI. https://www.ipsa-power.com/a-blueprint-for-power/



Context

Legacy

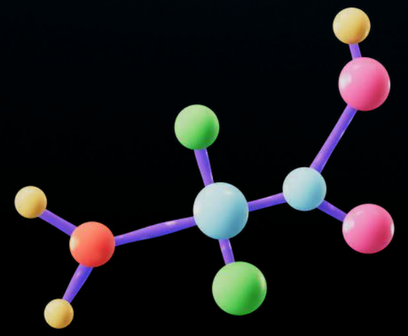
Companies rely on software built 30+ years ago, with lacking functionalities, integration difficulties, and limited capabilities to tackle modern grids

Blindness

Enterprises connect assets to grids they know very little off. Actionable insights for both planning and operation stages are non-existent

Grid complexity

Renewables, storage, data centers, HVDC systems, among others, create a rapidly changing landscape with greater uncertainty levels



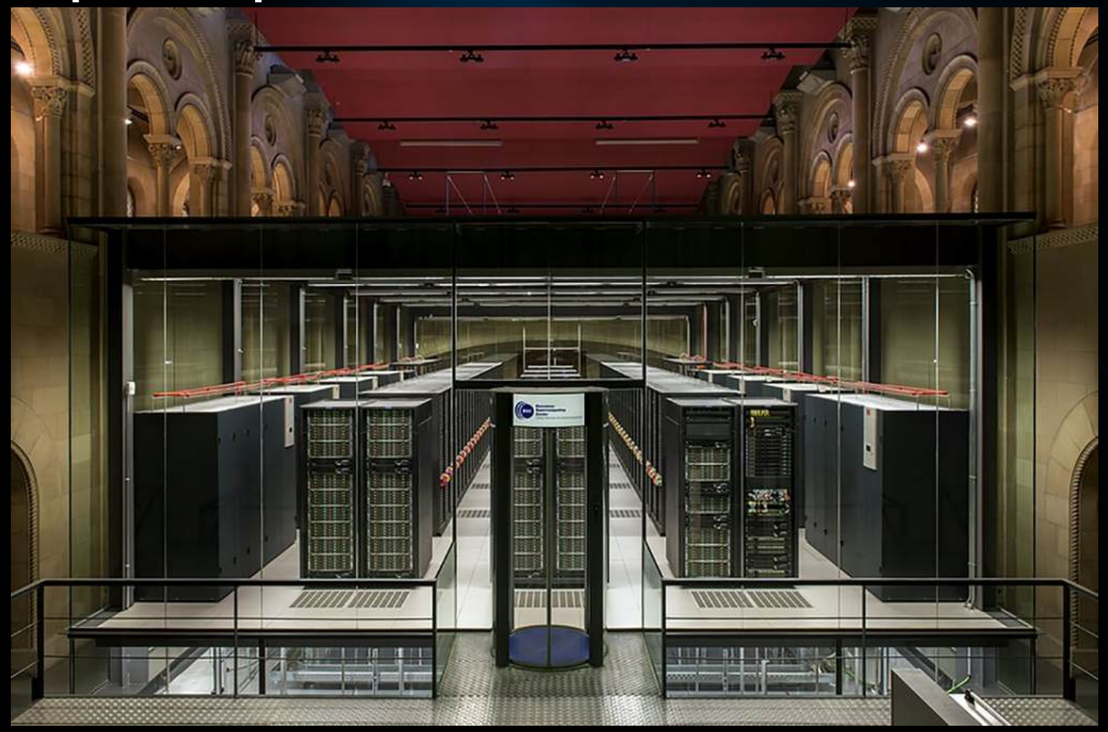
From the micro computer to the super computer

Real time micro PC

GridCal's engine has been used for real time control systems R&D as a lightweight simulation engine.

Scaling as the complexity requires

Supercomputer



GridCal has been used for large scale simulations at the Barcelona Supercomputing Center

One database, many simulations

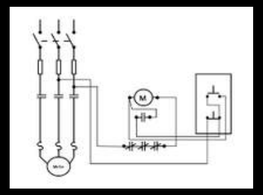
3D Data model

- Power flow
- Stochastic power flow
- Optimal power flow
- Voltage collapse
- Short circuit
- Investments analysis
- RMS dynamic simulation

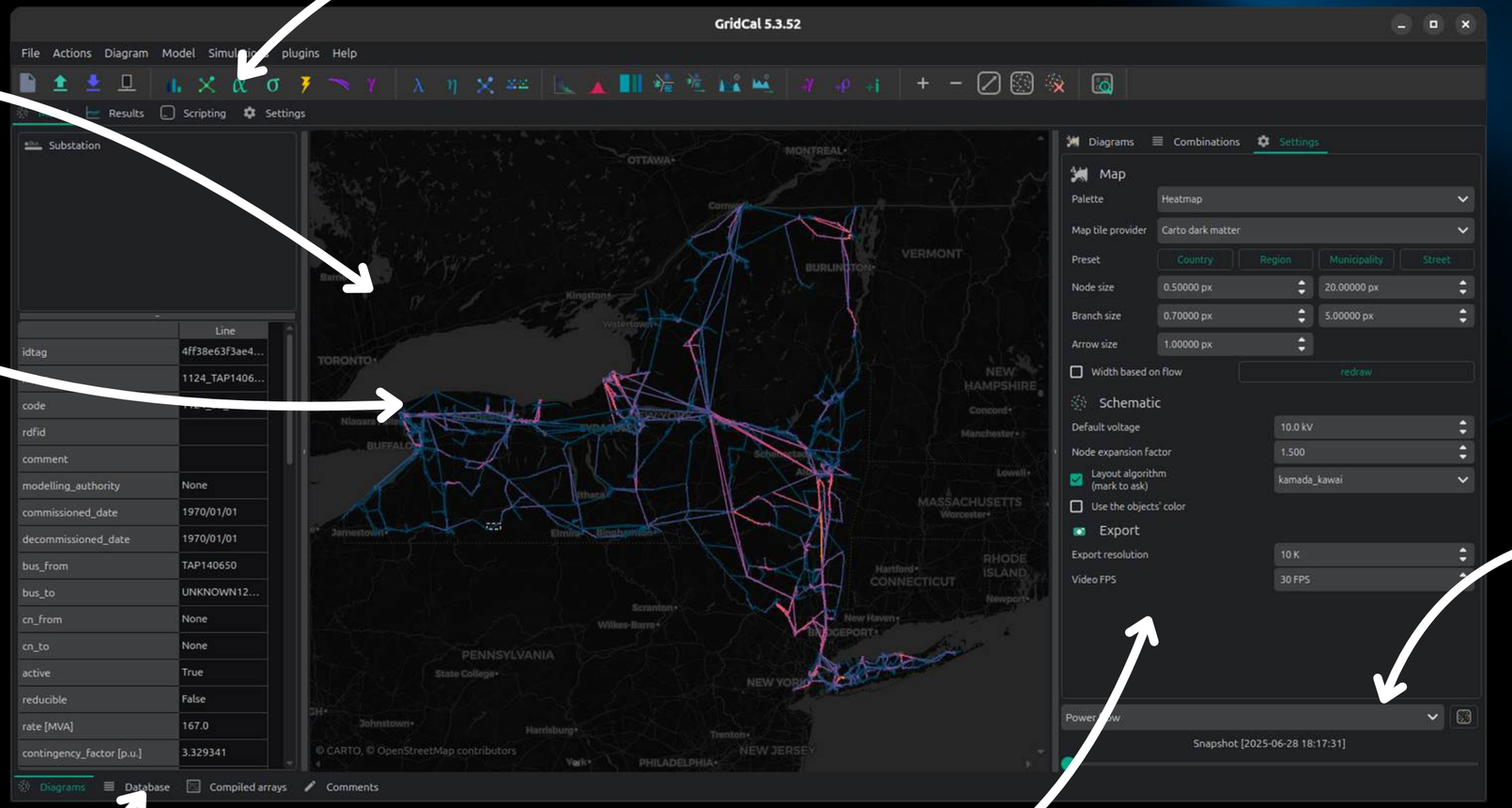
User Interface

Scripting

Unlimited Maps



Unlimited Schematics

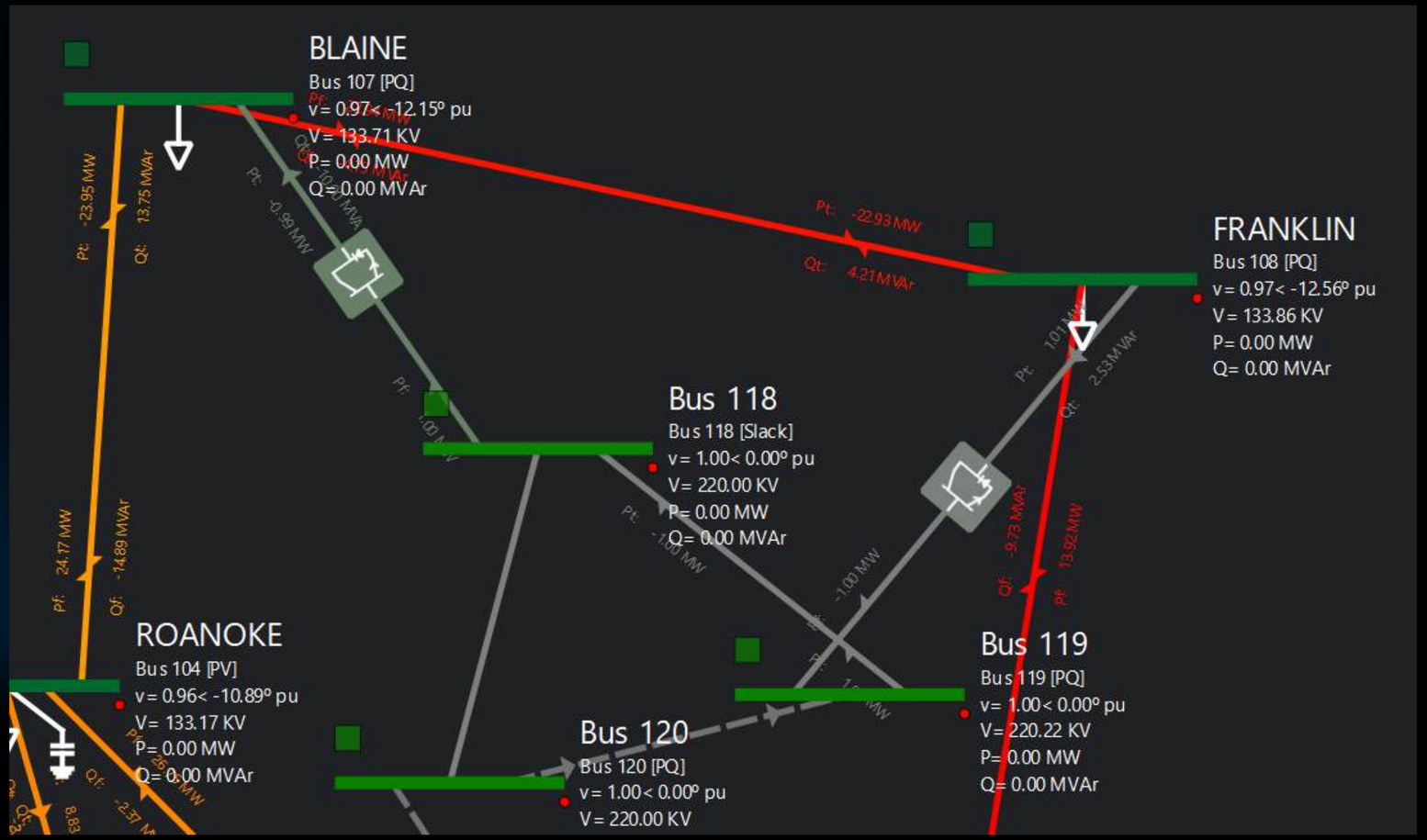


3D Data model

Picture & video recording

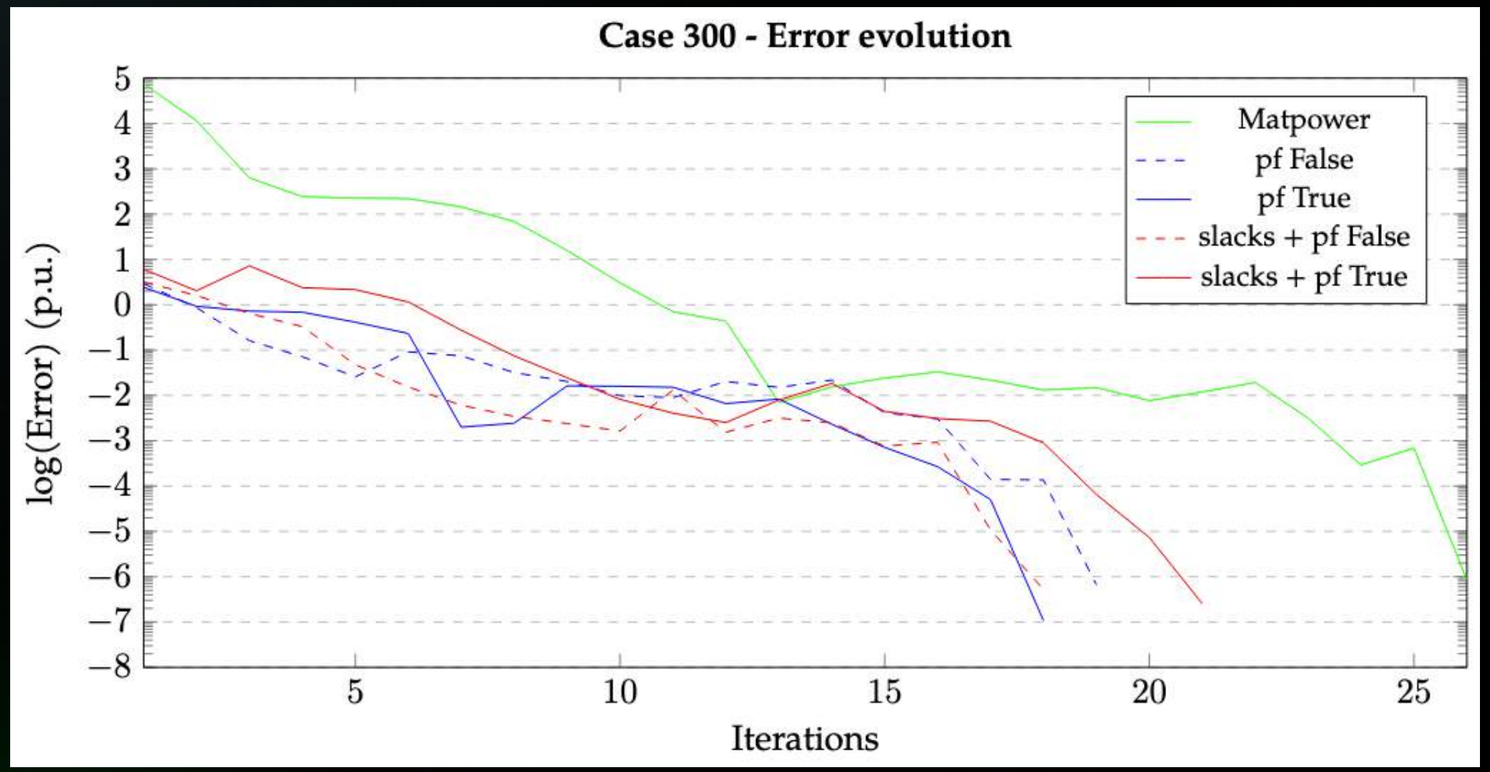
Interactive results visualization

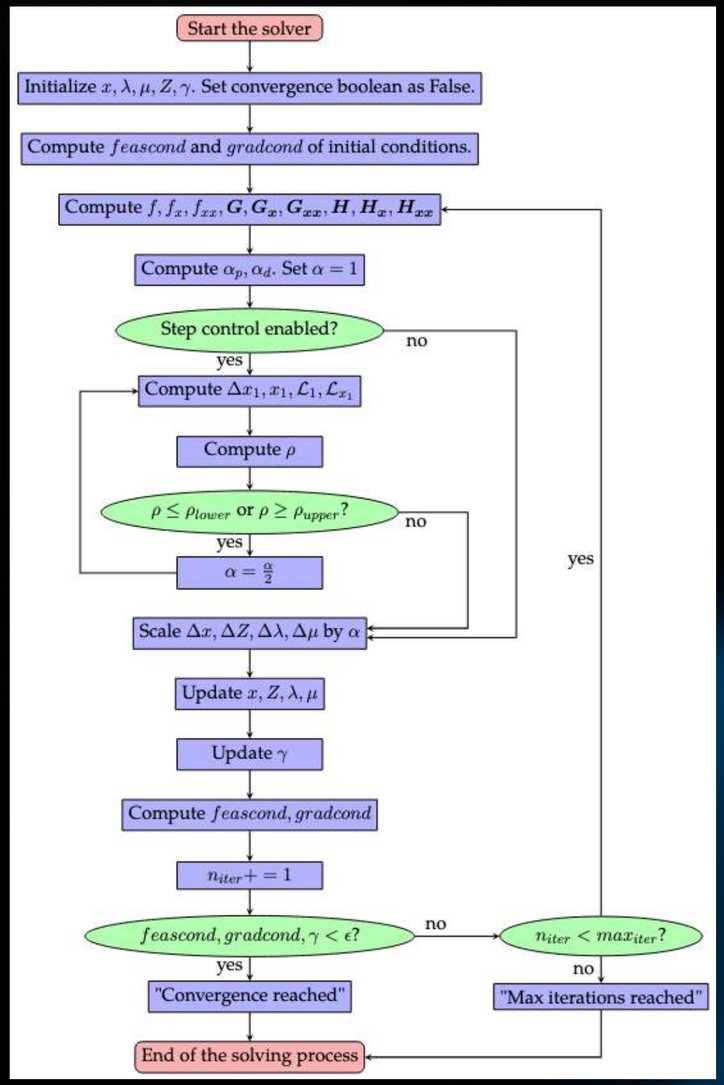
AC/DC Grid Planning



- AC/DC converter integration
- Current limit enforcement
- Controllable tap changers
- HVDC point-to-point connection
- Remote controls
- PQV buses
- 3000 buses solved in 40 ms
- Quadratic convergence

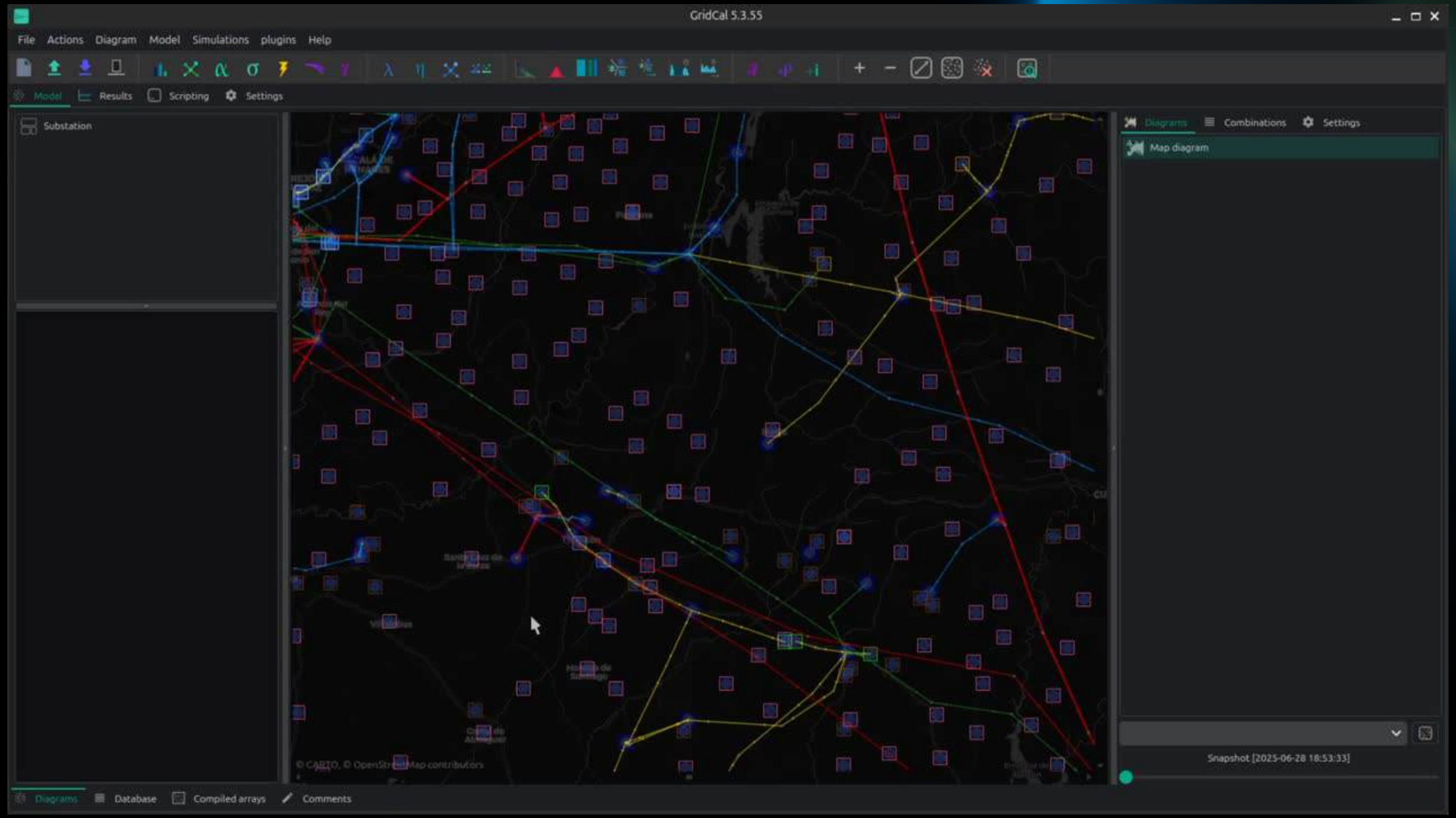
Optimal Power Flow



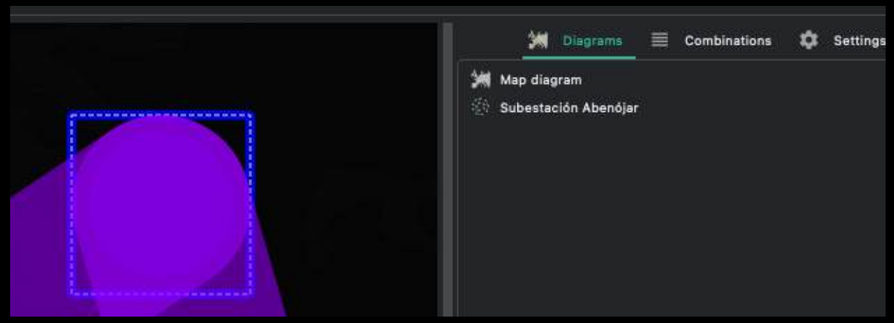


- Interior Point Solver for maximum performance
- No external dependencies

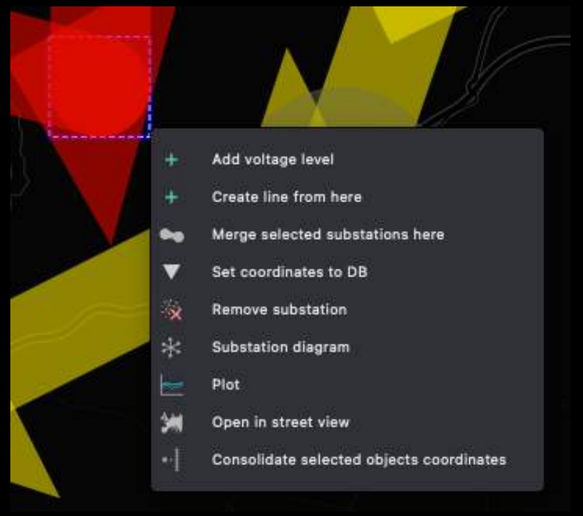
Maps


GridCal 5.3.55
File
Actions
Diagram
Model
Simulations
plugins
Help
Model
Results
Scripting
Settings
Substation
Diagrams
Combinations
Settings
Map diagram
Snapshot [2023-06-28 18:53:33]
Diagrams
Database
Compiled arrays
Comments

Topology Editing



Map and bus-branch diagrams



Substation edits

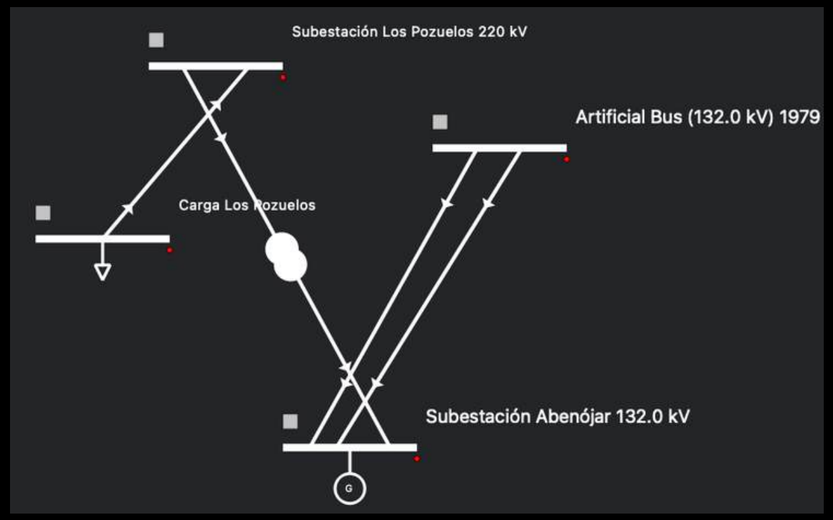
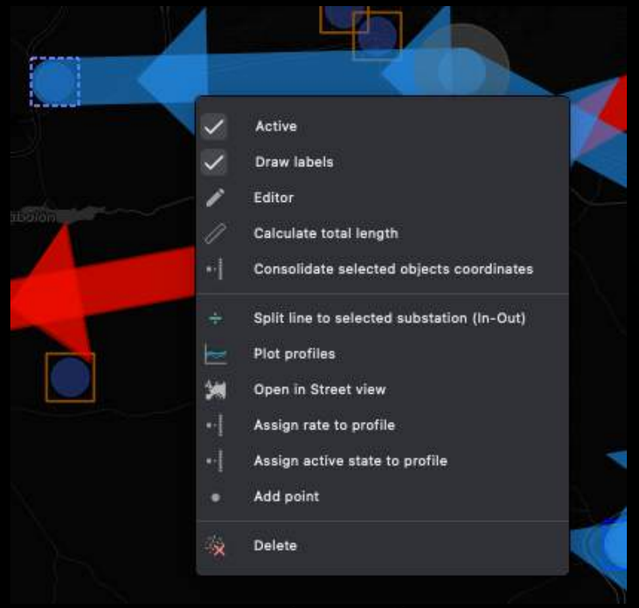


Diagram expansion



Line edits

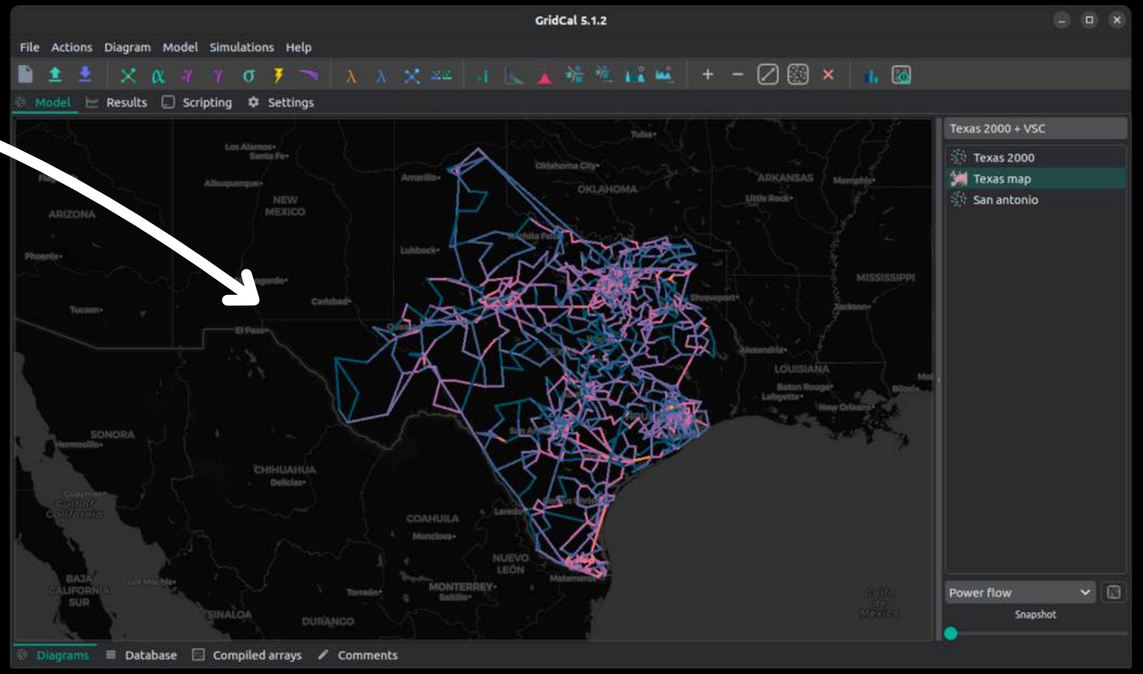
Database Merge

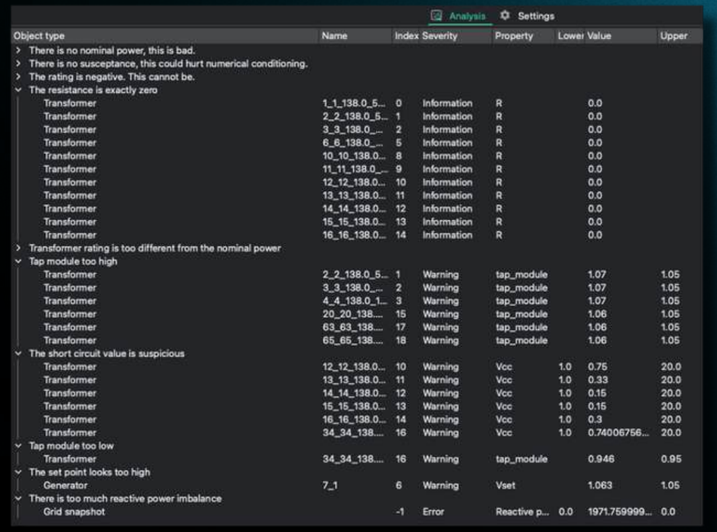
- Differentiable grid model
- Allows seamless version control
- Easy collaboration between teams (like Git)
- Exchange of differential files

Interoperability

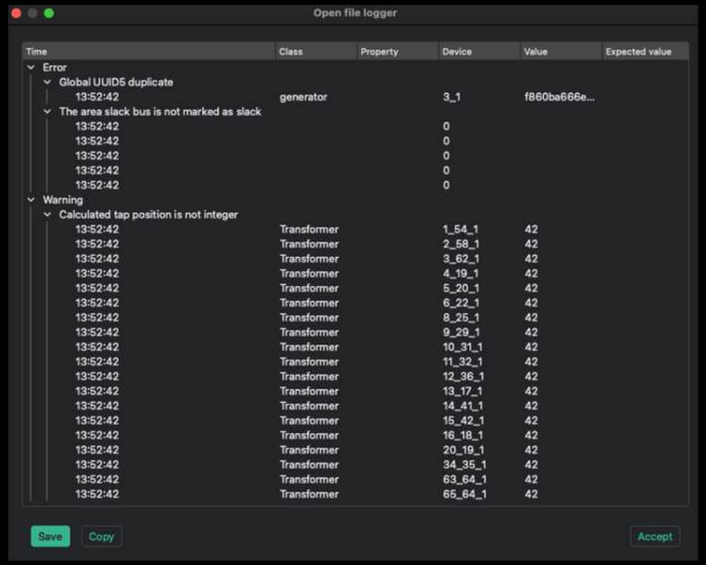
Drag & Drop files:

- raw & rawx (PSSe)
- EPC (Power World)
- Matpower
- CIM / CGMES
- Power Factory (dgs)
- Most open source
- Json
- Excel





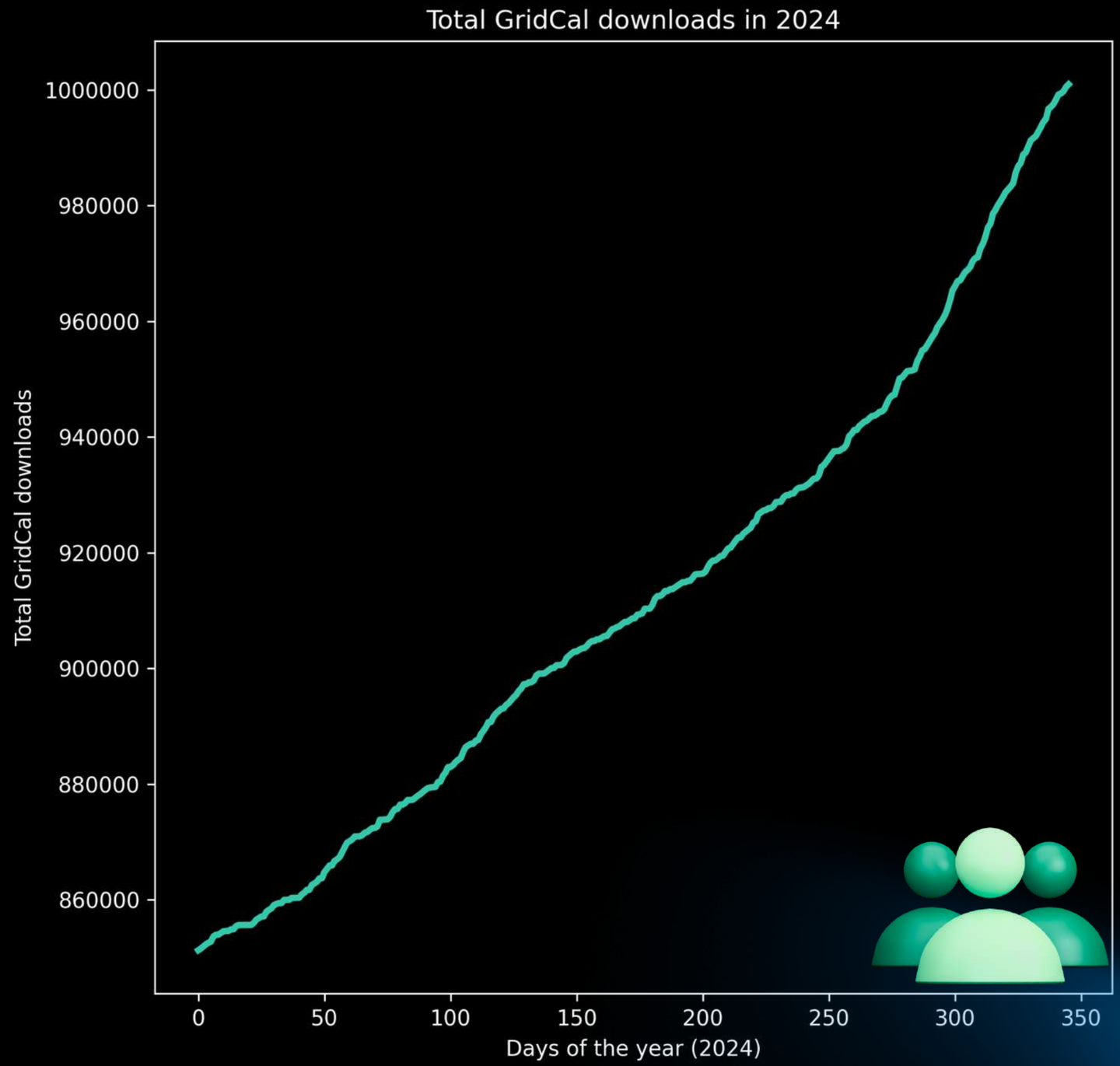
Model logger



Model debug & fix

Adoption

- Used at electrical companies & consultancy
- 100+ GitHub forks
- 450+ GitHub stars
- Industrial projects in 4 continents
- 5+ European R+D projects



Roadmap

Dec. 2025
AC/DC OPF

May 2026
Autonomous
operation AI agent

Nov. 2025
Benchmarked RMS
simulations

Feb. 2026
Small-signal stability

July 2026
EMT simulations

Conclusions

- Simulations are central to power systems planning and operation
- GridCal offers best-in-class algorithms: power flow, OPF, short-circuits, contingencies, dynamics, etc.
- Distinctive to other tools, GridCal comes with a feature-rich user interface
- Performance and user-friendliness, for both academia and industry, are at the core of GridCal
- Innovation and business models around GridCal are possible

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FERC, July 2025

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