

Streamlining End-to-End Safety Analysis Workflows:

Integration of SNAP[®] and OGMA

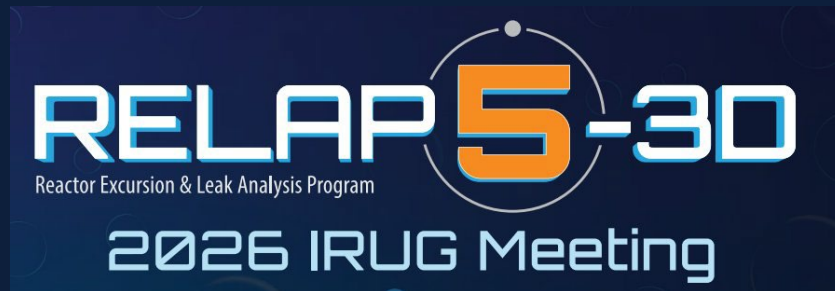
Connecting Certified Test Data to RELAP5-3D Model Development
and Automated Calculation Documentation

SNAP

OGMA

QuARTIC

Digitally Implementing RG 1.203 EMDAP



2026 IRUG Meeting

ISL · FPoliSolutions



Why This Matters

Nuclear safety analysis faces systemic workflow inefficiencies that compromise quality and delay licensing.

1 Safety Analysis Workflows Are Disconnected

Test data, model inputs, simulation results, and documentation live in separate silos. The gap between certified measurements and RELAP5-3D input decks is where traceability breaks down — every handoff is manual, introducing transcription errors across the workflow.

2 Weeks of Engineering Time Lost Per Project

Analysts spend more time finding, reformatting, and re-qualifying data than performing actual analysis. The same experimental datasets are independently re-processed by every organization, every project — duplicating effort industry-wide with no shared benefit.

3 Traceability Gaps Create Licensing Risk

Without a machine-readable link from certified measurements to RELAP5-3D model inputs and calculation notebooks, auditors cannot independently verify data provenance. This gap slows NRC reviews and increases the burden on applicants to demonstrate compliance.

OGMA + SNAP provide the infrastructure to automate these workflows — starting with a full EMDAP implementation.

The Problem These Tools Solve

Five challenges facing every institution doing EMDAP-based analysis — and the one gap that SNAP + OGMA + QuARTIC closes.

1

Disparate legacy data

Experimental data arrives in dozens of formats — paper records, HDF5, CSV, proprietary binaries — across decades of test programs.

2

Repeated qualification work

Each organization independently re-qualifies the same test datasets. UPTF Test 6 geometry has been re-processed by dozens of teams.

3

Per-project re-organization

Gathering, qualifying, and organizing data for each analysis consumes weeks of engineering time on every single project.

4

Not searchable or scrutable

Finding what data exists for a given facility, FOM, or program requires contacting colleagues rather than querying a system.

5

No direct link from data to model

EMDAP is fundamentally about traceability — yet the path from a certified measurement to a RELAP5 input card is entirely manual today.

OGMA addresses 1–4. The SNAP + QuARTIC integration solves 5 — closing the last mile between certified data and model development.

Three Tools. One Data Source. Full EMDAP Coverage.

OGMA-Tests becomes the single certified reference for model building, input generation, and calculation documentation.



SNAP[®]

ISL

RELAP5-3D Model Builder

Element 3

GUI-based model editor with a plug-in architecture supporting RELAP5-3D, TRACE, RADTRAD and more. The industry standard for building and managing nuclear T-H input models.

Upcoming Integration

Upcoming: Data Store integration pulls geometry parameters and boundary conditions from OGMA-Tests directly into input parameters — no manual entry.



OGMA

FPoliSolutions

EMDAP Digital Platform

Elements 1, 2, 4

Collaborative platform linking test data (OGMA-Tests), simulations (OGMA-Sim), calculation notebooks (OGMA-Calcs), and documents (OGMA-Docs) in a single database.

Upcoming Integration

Serves as the authoritative data source for both SNAP and QuARTIC — geometry modules, test constants, HDF5 time-series, all qualified and version-controlled.



QuARTIC[®]

ISL

Auto-Documentation Engine

Element 3

Qualified Automated Reporting Tool for Inputs and Calculation Notebooks. Used to perform and document model parameter calculations RELAP5 input models from an excel dataset.

Upcoming Integration

Upcoming: Uses OGMA-Tests as its reference data source instead of Excel — enabling certified, traceable auto-documentation directly from the qualified test database.

Both SNAP and QUARTIC pull from the same OGMA-Tests source — ensuring every model parameter and every documentation value traces to the same certified record.

OGMA: A Connected EMDAP Platform

Four integrated modules — qualified data, simulation execution, calculation notebooks, and documentation — sharing one database.



OGMA-Docs

Reports & Provenance

- ✓ Reference Data Source (RDS) reports
- ✓ Document management with structured metadata
- ✓ Machine-readable audit trail across the platform
- ✓ Cross-references every value to its source record



OGMA-Tests

Certified Test Data

- ✓ Geometry modules and test constants per facility
- ✓ HDF5 transient time-series, md5-verified
- ✓ Version-controlled with full provenance
- ✓ Single source feeding SNAP and QuARTIC



OGMA-Sim

Simulation Execution

- ✓ Runs RELAP5-3D and other codes
- ✓ Uncertainty quantification via RAVEN
- ✓ Parameterized inputs with card-level substitution
- ✓ Simulation dashboard tracks every run



OGMA-Calcs

Validation Notebooks

- ✓ Post-processing on archived simulation results
- ✓ Figure-of-merit extraction and residual analysis
- ✓ Validation plots against experimental data
- ✓ Closes the EMDAP assessment loop

OGMA-Tests: The Certified Data Source

Structured, qualified, and version-controlled test data — ready for SNAP and QUARTIC to consume.



Geometry Modules

- ✓ Named plant components: General Reactor Vessel, Cold Leg Horizontal Pipe, Reactor Coolant Pump, Lower Downcomer, and more
- ✓ Engineering parameters per module with quantity types (Di, L3, Rbend, flow area...)
- ✓ 3D rendering and engineering drawing linked to each module
- ✓ Directly maps to RELAP5-3D pipe, junction, and vessel geometry input cards

UPTF-001: Cold Leg Horizontal Pipe
Di = 0.750 m | L3 = 1.78 m | Rbend = 0.125 m



Test Case Constants

- ✓ Scalar values per test run with full metadata: quantity type, units, measurement classification
- ✓ Values linked to test program and facility for complete data provenance
- ✓ Direct, Derived, and Calculated measurement types supported
- ✓ Maps to RELAP5-3D boundary condition and initial condition input cards

UPTF Test 6 / Run 131
ECC Rate: 1451 kg/s | Subcooling: 59 K |
Start: 12 s



HDF5 Time-Series Data

- ✓ Full transient measurement files per test run, md5-verified for integrity
- ✓ Browseable in-browser via built-in HDF5 Viewer with channel-level navigation
- ✓ Organized by measurement type: wall/fluid temperature, differential pressure, water level
- ✓ Source for boundary condition tables and experimental comparison in OGMA-Calcs

Run 131: Test06-Run131.bin
md5: *****

SNAP[®] + QuARTIC[®]: What Each Tool Brings

Two complementary tools for RELAP analysts — both gaining the ability to draw directly from OGMA-Tests.



SNAP[®] — Model Building



Model Editor

GUI for building RELAP5-3D, TRACE, and RADTRAD models; plug-in architecture supports all major T-H codes.



User-Defined Numerics (UDN)

Variable system drives component property values — change a variable, every component using it updates. Supports Python, MATLAB, and Mathcad scripting.



Upcoming: OGMA Data Store

OGMA-Tests geometry modules and test constants populate SNAP variables directly. The model knows its data source.



Upcoming: Parameter Binding

SNAP variables reference live OGMA values with auto unit conversion and full cross-reference in the model notebook.

Output: A RELAP5-3D model whose every parameter traces to OGMA-Tests



QuARTIC[®] — Auto-Documentation



Simplified Calculation and Documentation Model Params

Calculates RELAP5 input decks from a single reference dataset — today from Excel, soon from OGMA-Tests.



Calculation Notebook in PDF

Produces a complete calculation notebook with LaTeX-quality formatting, symbolic equations, and structured documentation sections.



Upcoming: OGMA-Tests as Source

Replaces Excel reference data with certified OGMA-Tests values — same certified source driving both SNAP models and QUARTIC docs.



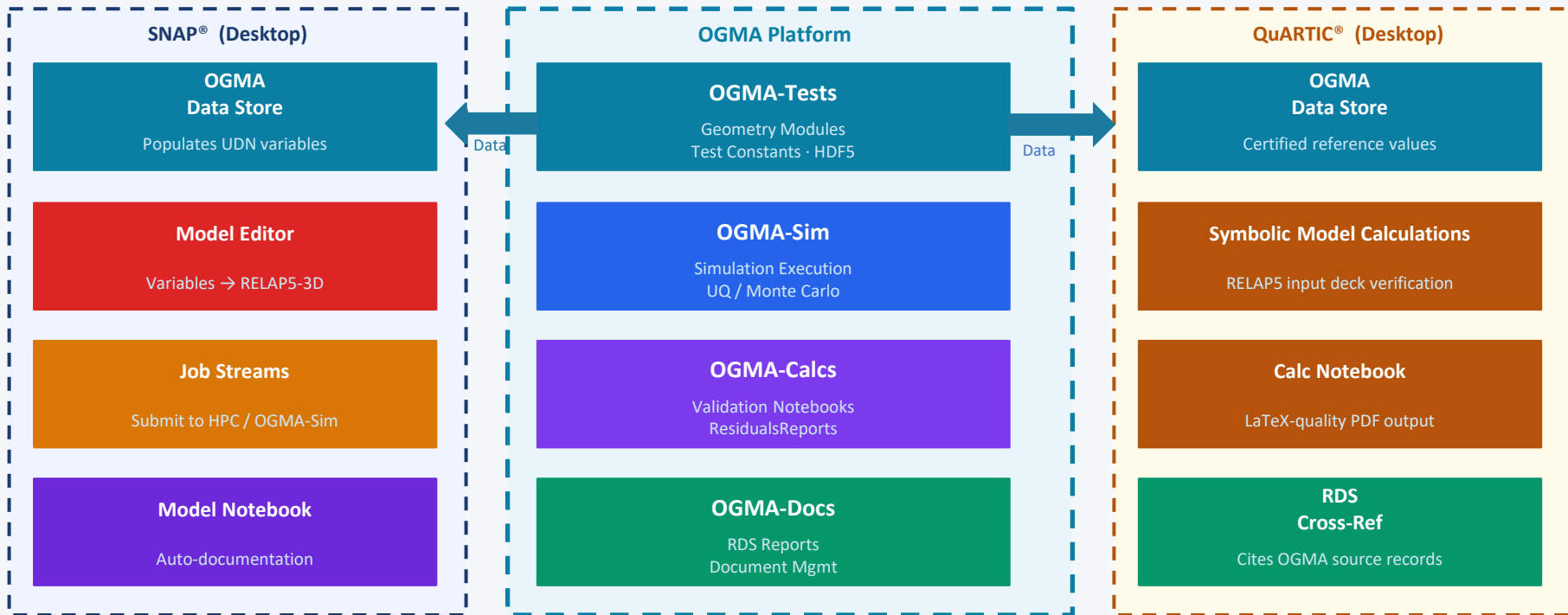
Upcoming: RDS Cross-Reference

Generated notebooks cite OGMA RDS reports and test case IDs for every parameter value — machine-generated audit trail.

Output: A complete calculation notebook tracing every value to OGMA-Tests

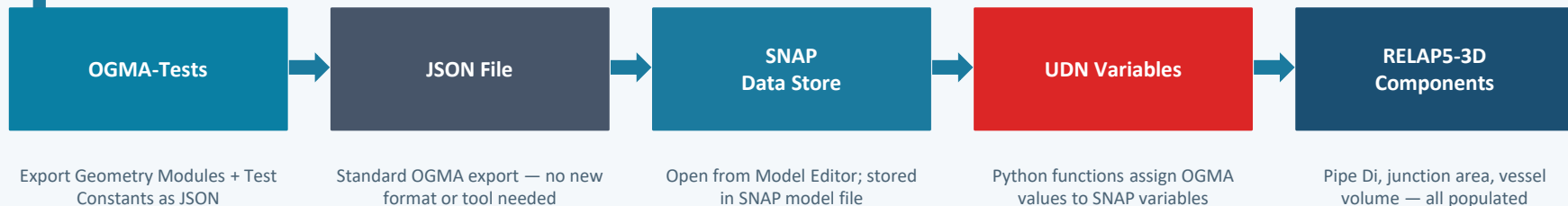
Integration Architecture

OGMA-Tests serves as a live, certified data source for both the model and its documentation.



SNAP® Data Store for OGMA-Tests

The first SNAP release supporting OGMA-Tests data — available to SNAP users as a new Model Editor Data Store Library.



What Users Get



No new OGMA infrastructure

Works with the existing JSON export in OGMA-Tests today. No API changes or server-side work required.



Python variable assignment

Full Python scripting available to assign OGMA values, perform unit conversions, and compute derived quantities.



Foundation for Phase 2 & 3

Model files built with Feature 1 are forward-compatible — data bindings upgrade seamlessly in later releases.



Self-contained model files

JSON contents stored inside the SNAP model — portable across teams, fully version-controlled.



Plug-in agnostic

Data Store supports RELAP5-3D today and is extensible to TRACE, RADTRAD, and any other SNAP plug-in.



Client-demonstrable now

First tangible deliverable showing UPTF geometry driving RELAP5-3D component values from certified OGMA data.

Direct API Connection to OGMA-Tests

SNAP connects to OGMA-Tests directly from the model editor — browse facilities, select parameters, populate the Data Store without leaving SNAP.

Feature 1 Workflow

1. Open OGMA-Tests in browser

2. Navigate to test program

3. Export JSON to disk ✗

4. Open file dialog in SNAP ✗

5. Load JSON into Data Store

Manual file management is a friction point clients will not accept.

Feature 2 Workflow

1. Click 'Connect to OGMA' in SNAP

2. Log in — session only, no stored credentials

3. Browse facility → program → module tree

4. Select parameters → Data Store populates

5. Model is ready — no file management

One tool, one workflow, zero file management.

Key Capabilities



Embedded OGMA Web UI

Pass-through OGMA-Tests browser interface within SNAP — familiar to existing OGMA users.



Session-based credentials

Login per-session — credentials never stored persistently. Satisfies site security policies.



API-based remote pull

Programmatic data access enables seamless workflows and supports demo environments.

Live Parameter Binding + Auto-Documentation

SNAP model parameters reference OGMA-Tests values directly. Unit conversion is automatic. The model notebook documents itself.



Graphical Parameter Tree

Browse OGMA-Tests facilities, programs, and geometry modules in SNAP's navigator. Click a parameter to bind it — no copy-paste, no typing.



Auto Unit Conversion

Assign quantity types to OGMA values (length, area, temperature...). SNAP converts automatically to RELAP5-3D input units at model-build time.



Live Update on Data Revision

When a test constant is revised in OGMA-Tests, bound SNAP models are notified. Analysts update parameters in one place — the model reflects it everywhere.



Auto-Generated Notebooks

Every OGMA-bound parameter auto-populates a model notebook entry: data table, source test case, engineering drawing image, and RDS cross-reference.



RDS Lineage on Every Value

Each model parameter carries a machine-readable citation to its OGMA source record. No manual audit trail maintenance — it's generated at binding time.

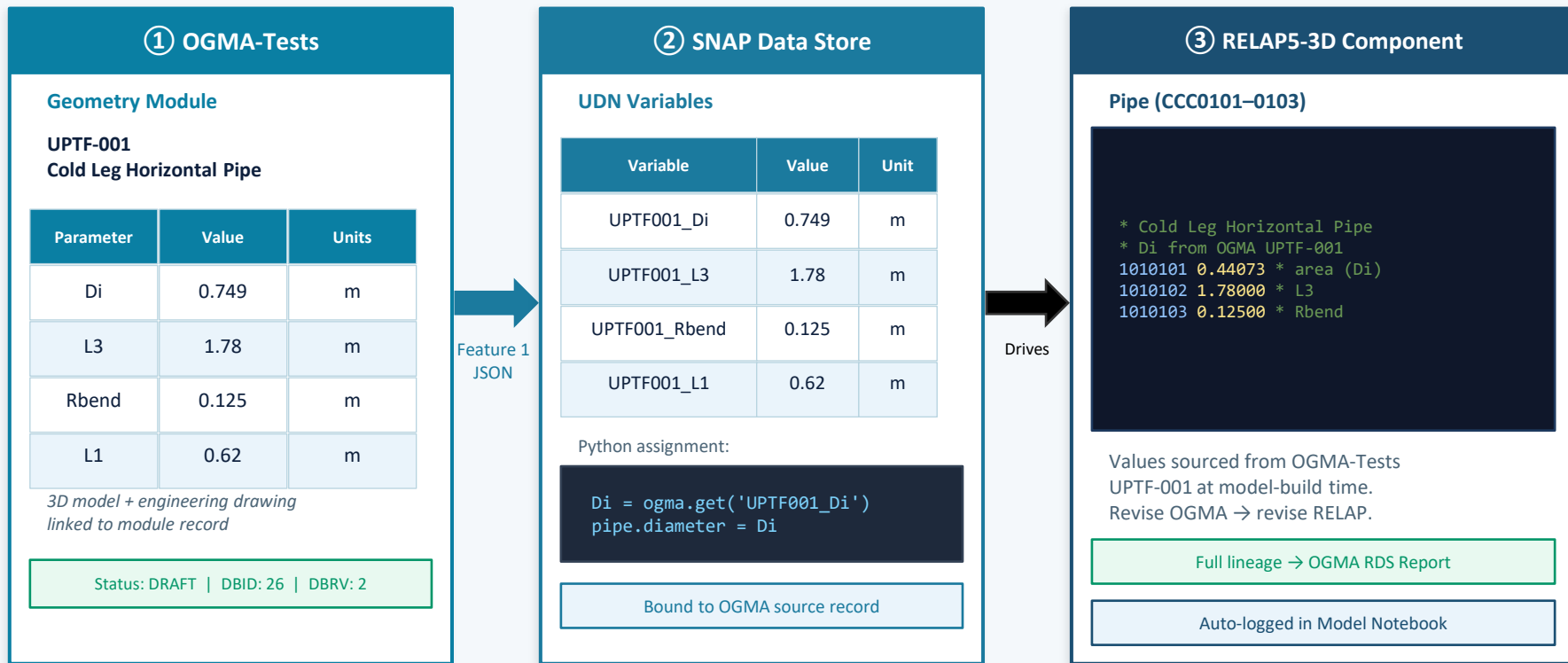


Multi-Code Support

The same binding architecture works for any SNAP plug-in. RELAP5-3D today — TRACE and RADTRAD with the same OGMA geometry in future releases.

Feature 1 in Action: UPTF Cold Leg Pipe → RELAP5-3D

OGMA-Tests geometry module UPTF-001 driving a RELAP5-3D pipe component — zero manual data entry.



QuARTIC® + OGMA-Tests: Traceable Auto-Documentation

QuARTIC today uses Excel as its reference data source. With OGMA-Tests, every generated document traces directly to certified test records.

QuARTIC® Today

Excel reference data

Analyst manually maintains spreadsheet of geometry and reference data



QuARTIC processes

Reads Excel; evaluates symbolic calculations to generate RELAP5/TRACE model inputs



PDF Calc Notebook

LaTeX-quality output with symbolic calculations and documentation

QUARTIC® + OGMA-Tests

OGMA-Tests as reference

Certified geometry modules and test constants — qualified, version-controlled, md5-verified



QuARTIC processes

Reads OGMA values; perform Model parameter calculations and generate documentation with full OGMA data provenance



Traceable PDF Notebook

Every value cites OGMA RDS report + test case ID. Machine-readable audit trail throughout

SNAP + QUARTIC + OGMA-Tests = Model + Documentation from a single certified source

SNAP builds the RELAP5-3D model from OGMA data. QUARTIC documents it from the same OGMA data. Both outputs are traceable to identical certified values.

HPC Workflow: SNAP® Job Streams + OGMA-Sims

Submit from SNAP or OGMA — results archive automatically in OGMA for post-processing, validation, and documentation.



Submit via SNAP Job Streams

Build the model in SNAP, configure a job stream, and submit to any HPC platform — AWS Batch, Torque/Maui, or Slurm. SNAP's File API stages results into OGMA for archival and post-processing.

- ✓ SNAP submits RELAP5-3D, TRACE, or multi-code coupled workflows to HPC clusters
- ✓ Output files (plot files, restart files) staged into OGMA database via File API
- ✓ Scalar result extraction: PyPost, AptPlot and GRAVE Plot can extract scalar values: peak cladding temperature, peak dome pressure, FOM values → OGMA fields
- ✓ OGMA-Calcs post-processing notebooks run on stored results



Submit via OGMA Simulation Manager

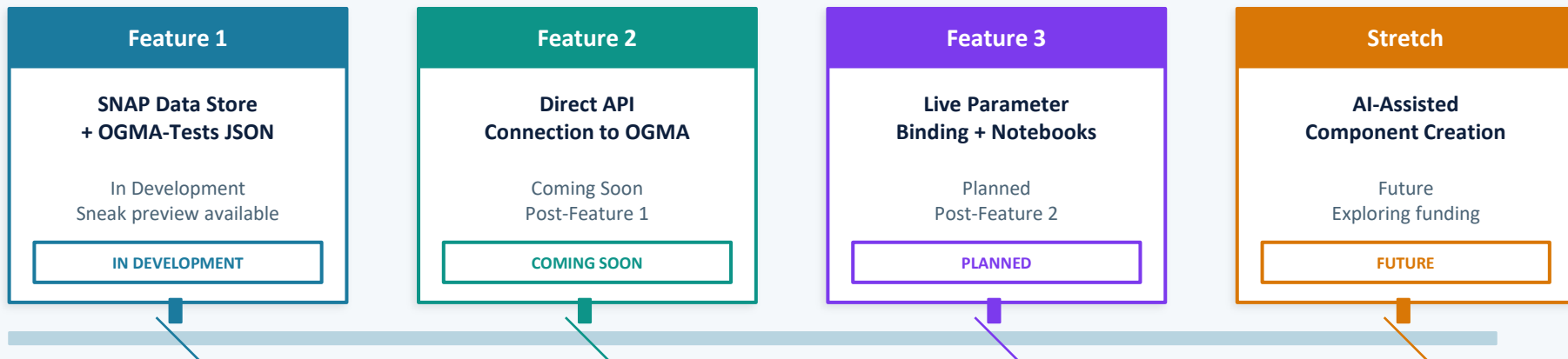
Use OGMA-Sims to define and launch simulation cases directly — with full UQ, Monte Carlo sampling, and chained multi-code workflows. Results populate the OGMA database automatically.

- ✓ OGMA-Sims supports RAVEN-based uncertainty quantification with Monte Carlo sampling
- ✓ Parameterized RELAP5-3D inputs support direct card substitution (e.g., cold leg temp → cards 20543000:3...)
- ✓ Custom expressions compute derived RELAP inputs: ``%card%*0+rcsmflo*4``
- ✓ Simulation Dashboard monitors running cases;

Both paths deliver results into OGMA-Calcs for FOM assessment, validation plots, and residual analysis — feeding the full EMDAP assessment loop.

Feature Roadmap

From first release to full EMDAP-integrated model development — available incrementally.



QUARTIC Integration Track

- ✓ **OGMA-Tests as Reference Source**
Replaces Excel with certified OGMA data for QUARTIC reference values — same release window as Feature 1
- ✓ **RDS Auto-Citation**
Generated notebooks cite OGMA report + test case ID — Feature 2 timeframe
- ✓ **Combined SNAP + QUARTIC Output**
Model (SNAP) + documentation (QUARTIC) from same OGMA source — Feature 3 timeframe

Why Incremental Delivery

- ✓ Working capability available early — Feature 1 in weeks, not months
- ✓ Each feature adds immediate value; later features build on earlier foundations
- ✓ Forward-compatible model files — Feature 1 work upgrades seamlessly

Thank You

Questions & Discussion

- ✓ Feature 1: SNAP Data Store for OGMA-Tests — in development
- ✓ QUARTIC + OGMA-Tests integration — coming in parallel
- ✓ Feature 2 & 3: Direct API, live binding — on the roadmap

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