

um
2026

VOLTA as an enabler of Dumarey's digital transformation and AI/ML adoption

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Agenda

Objectives

Better & faster Decision-Making

IT perspective

Managing a complex environment

Template projects

Application of Volta in Dumarey's activities

AI/ML

An enabler for digital transformation

Roadmap & Conclusions

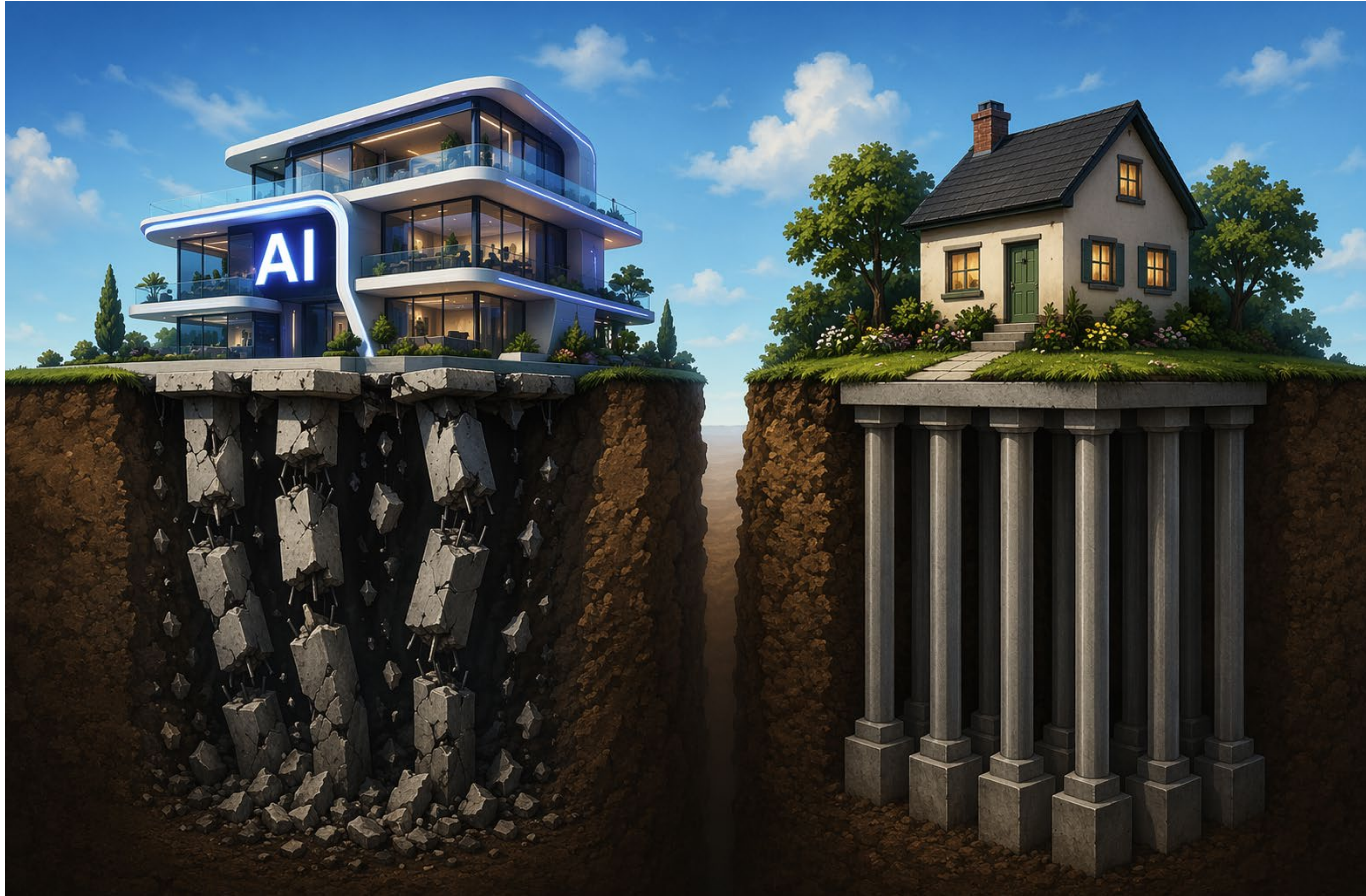
Where we are, what we want to do next



Obejctives: better & faster
Decision-Making



The Data Dilemma



The Data Dilemma

Without governed data, connected workflows and traceable engineering context, AI cannot deliver robust decisions.

It can only generate answers that *look* credible.

Data management is no longer an IT concern.

It is a **strategic** engineering capability.

It is the foundation of trustworthy AI.



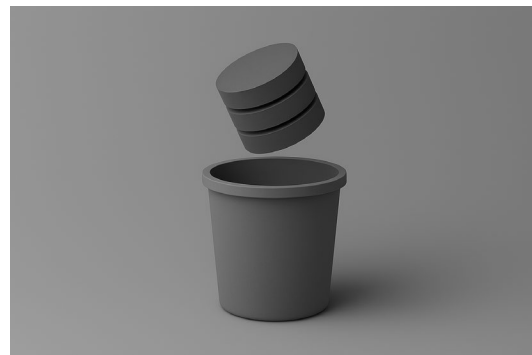
Why we are here – Data-based Engineering

Data = crude oil of 4th industrial revolution



Conventional decision-making

- ✓ Data created on the fly, only when needed, not stored
- ✓ Expert-driven iterations, causing repeated loops and delays
- ✓ Low reusability, leading to slower and more expensive decisions



Data-based Decision-Making

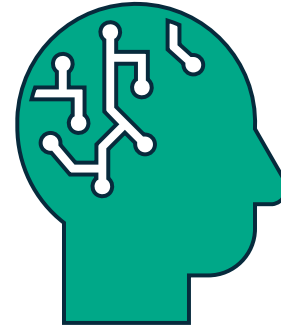
- ✓ Transforms data into reusable assets
- ✓ Faster, repeatable and scalable decision-making
- ✓ Enabling automation, analytics and AI/ML



Why we are here – The Road to Solutions



Data Management



Exploring

VOLTA

Potential

Pillars of AI/ML



Automation

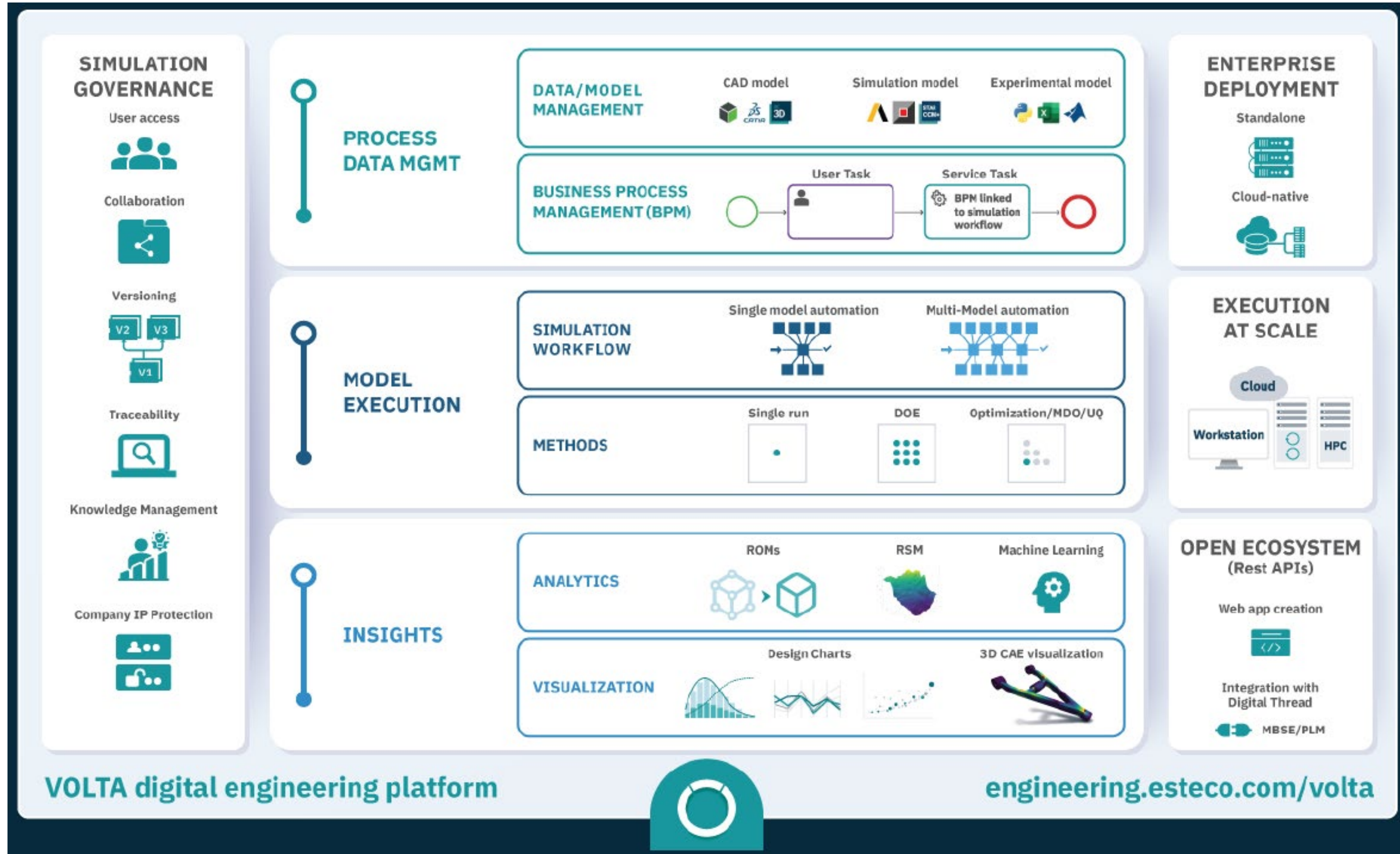


Collaborative Design



Business Process Management

What is Volta?



What is Volta?

Process Data MGMT

- Store your models and data
- Make them available for AI/ML

Model Execution

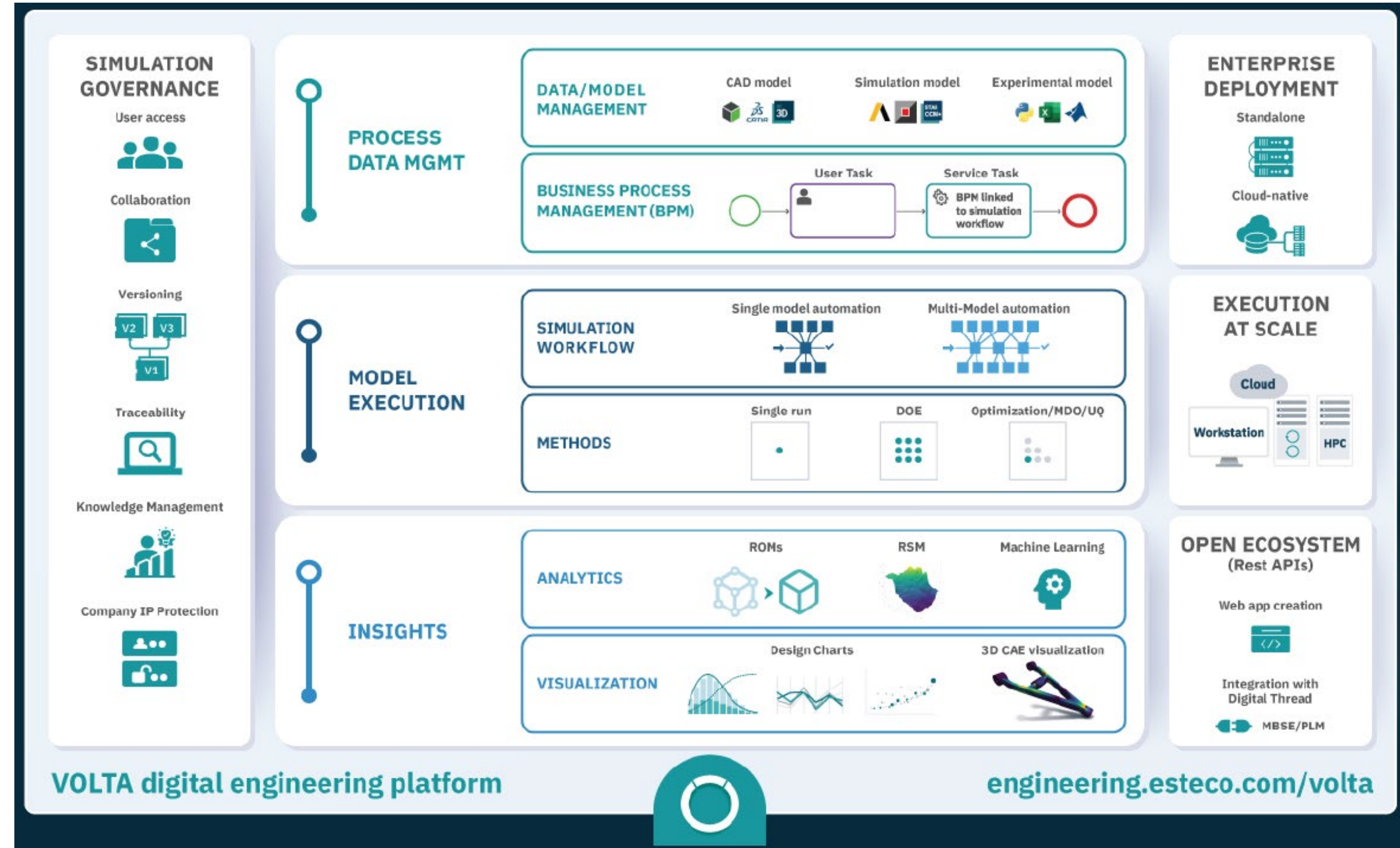
- Develop and execute your workflows to generate the data

Insights

- Extract the information from your database
- Train and deploy AI/ML models

Simulation Governance

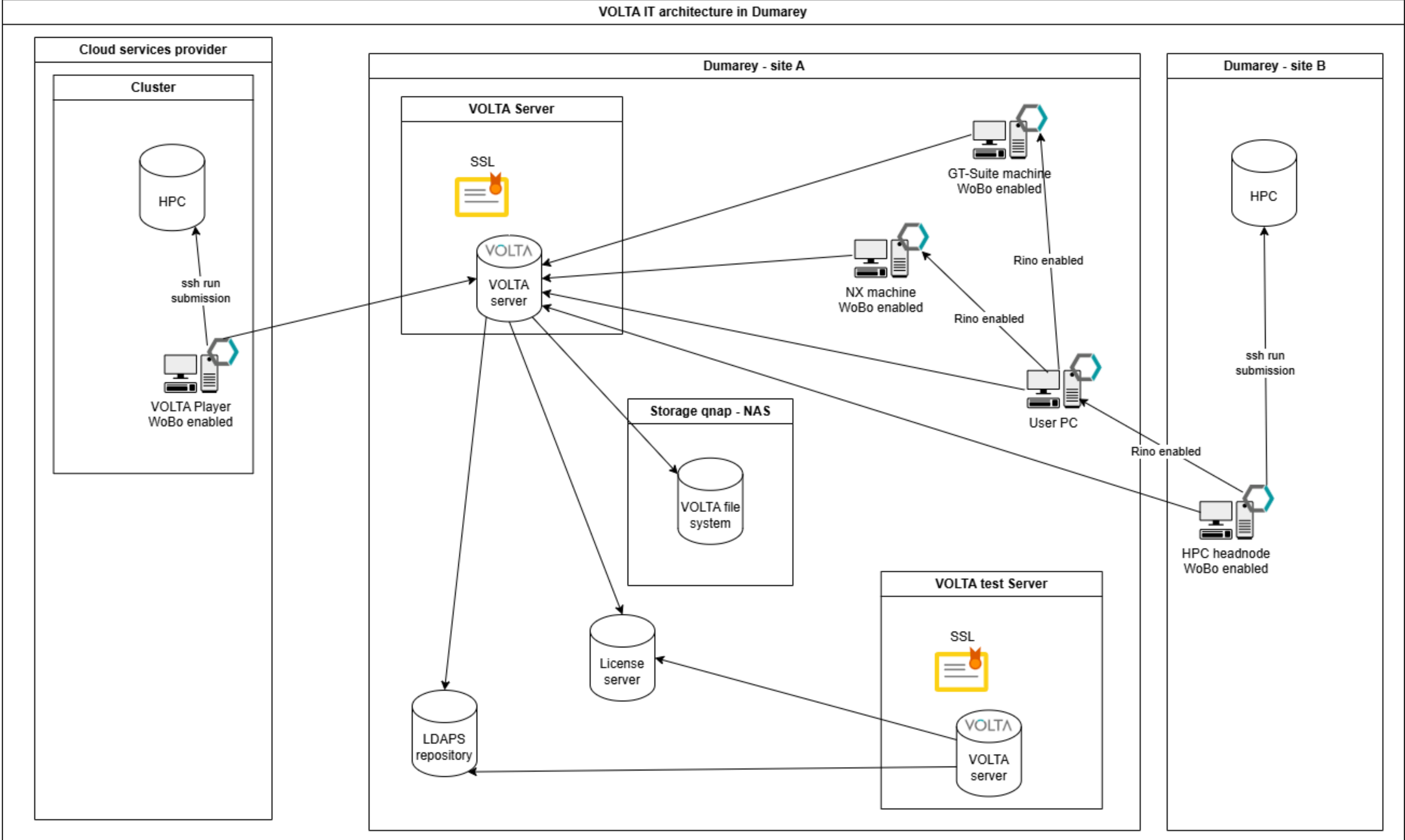
- Enable collaborative design
- Enforce traceability



IT perspectives: managing a complex environment



Dumarey's Volta IT infrastructure



Dumarey's Volta IT infrastructure

Complex IT environment

Multiple sites

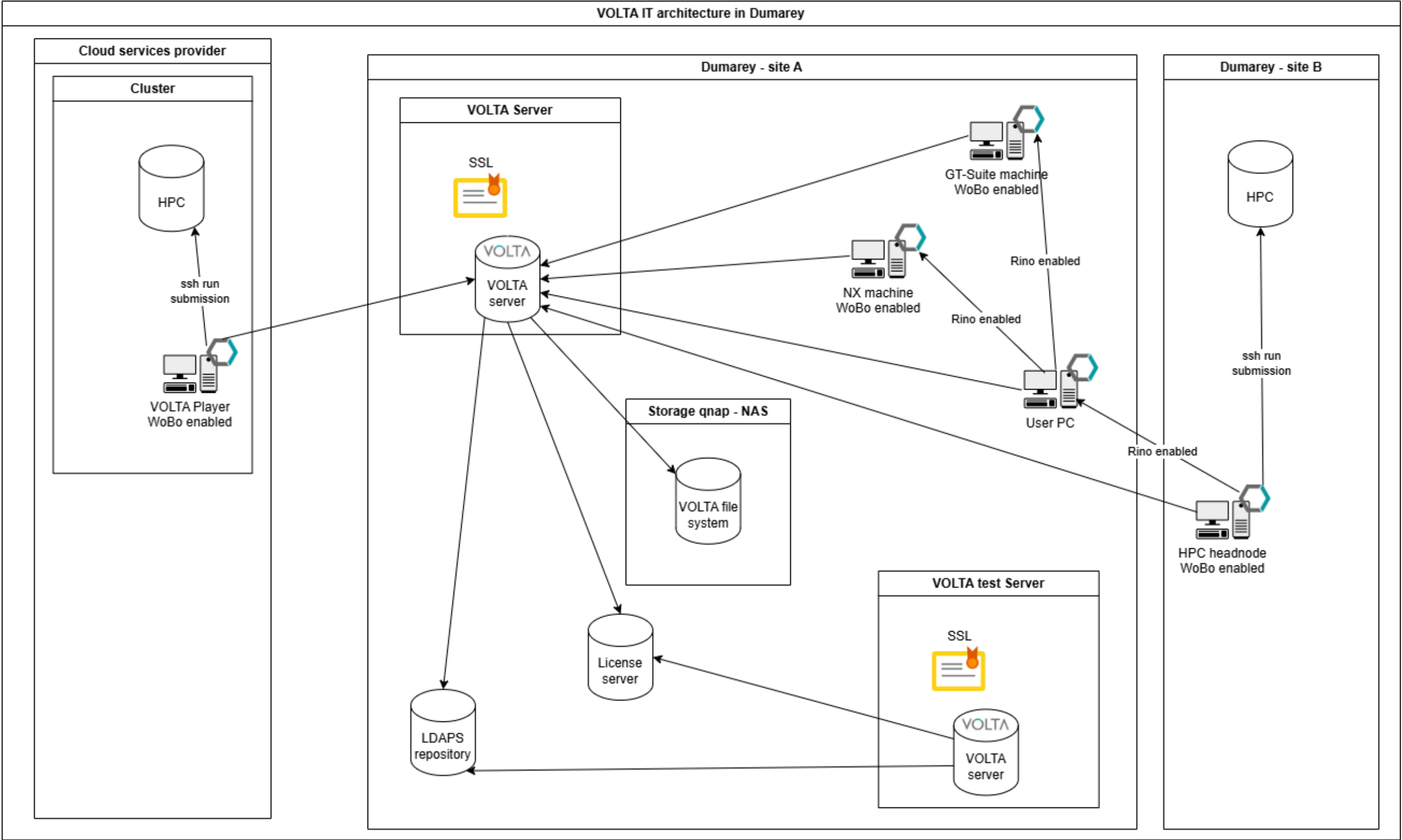
Heterogeneous computing architecture

- Users PCs
- Workstations
- On-Prem HPC
- Cloud Computing

Interoperability with Dumarey IT environment

Maintainability and Support

Cybersecurity considerations



Template Project 1: Combustion chamber design process



Project 1 – Results



Single integrated automation framework



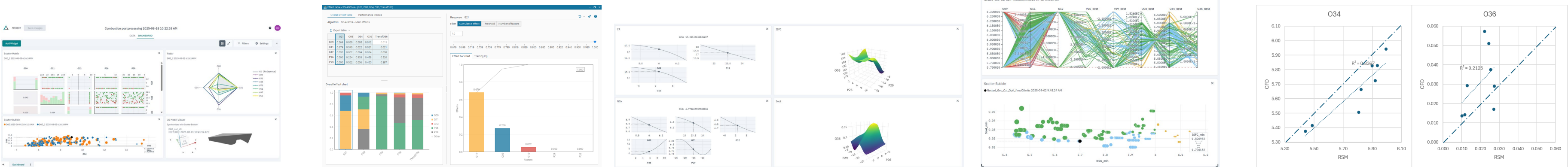
- ✓ Hundreds of jobs
- ✓ Automatic database management
- ✓ [DOE results session](#)

- ✓ Different hardcoded ML models
- ✓ GUI training interface

- ✓ Browser-based App
- ✓ Available for all Volta users
- ✓ [RSM deployment](#)

- ✓ Different hardcoded optimization algorithms
- ✓ Post-processing tools
- ✓ [RSM based optimization](#)

- ✓ Integrated workflow
- ✓ From Pareto to Validation

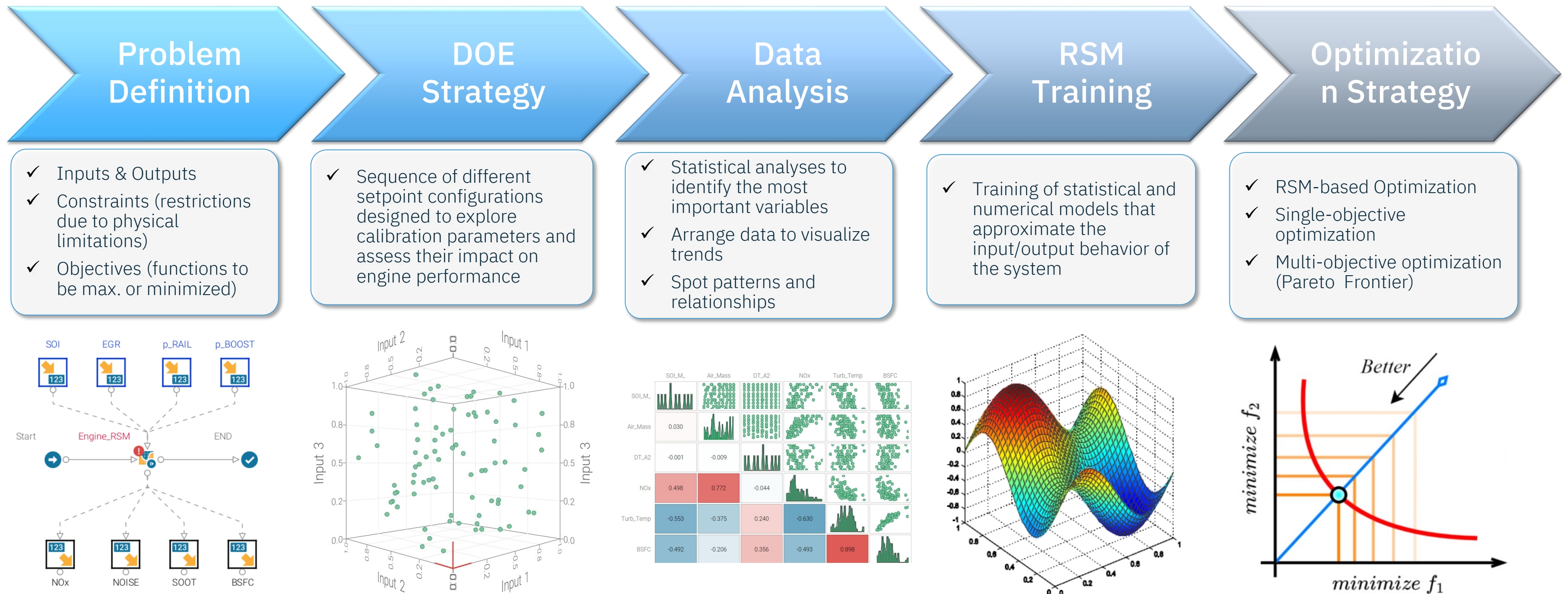


Template Project 2: Combustion calibration process



Project 2 – Calibration Optimization From Experimental Data

modeFRONTIER performs the necessary tasks for the optimization of ECU Combustion Setpoints using sophisticated algorithms, which identify a set of Pareto solutions (Multi-Objective Optimization)



Project 2 – Experimental Data Management

- ✓ Create a centralized repository to store all experimental data, ECU datasets, documents and test reports.
- ✓ Implement a standardized metadata and tagging framework to ensure consistent classification, while enabling fast and accurate data retrieval.
- ✓ Develop interactive dashboards for ‘high-level’ data analysis, allowing users to filter, compare, and visualize insights efficiently.

Search

Data

Starred

Teams

Simulation

Process Manager

Help

Teams / Project_2 / H2ICE V8 PFI - Experimental Data

New

NAME	CREATED
00 - General Info	Jul 22, 2025
01 - ECU Dataset	Jul 22, 2025
02 - Steady-state Measurements	Jun 26, 2025
03 - Transient Measurements	Jun 26, 2025
04 - In-cylinder Pressure Cycles (IFILEs)	Jun 26, 2025
05 - Reports	Jul 2, 2025
06 - RSM (DoE & Optimizations)	Jun 26, 2025
Dictionary.pdf	Jul 22, 2025
Full Load Construction.PNG	Jul 9, 2025

Metadata Categories

Project Information
 Project Name / Code
 Customer / OEM
 Development Phase (Prototype, BA, Beta, Validation)

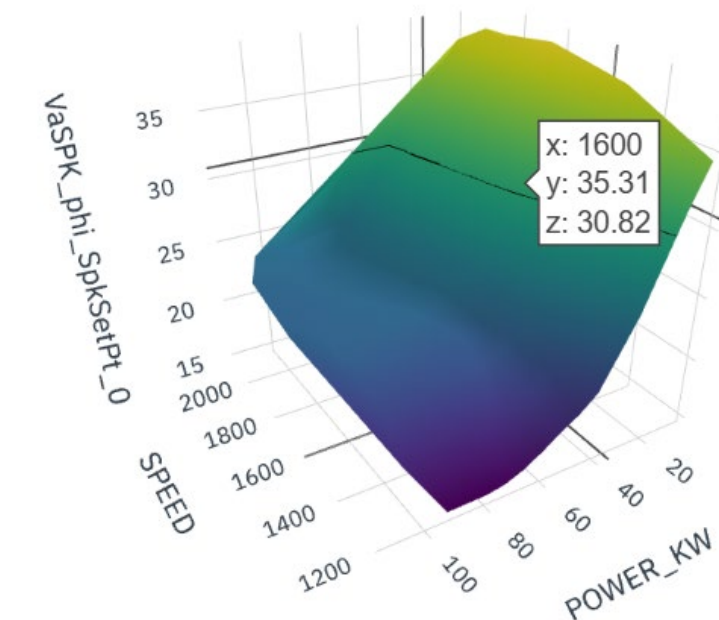
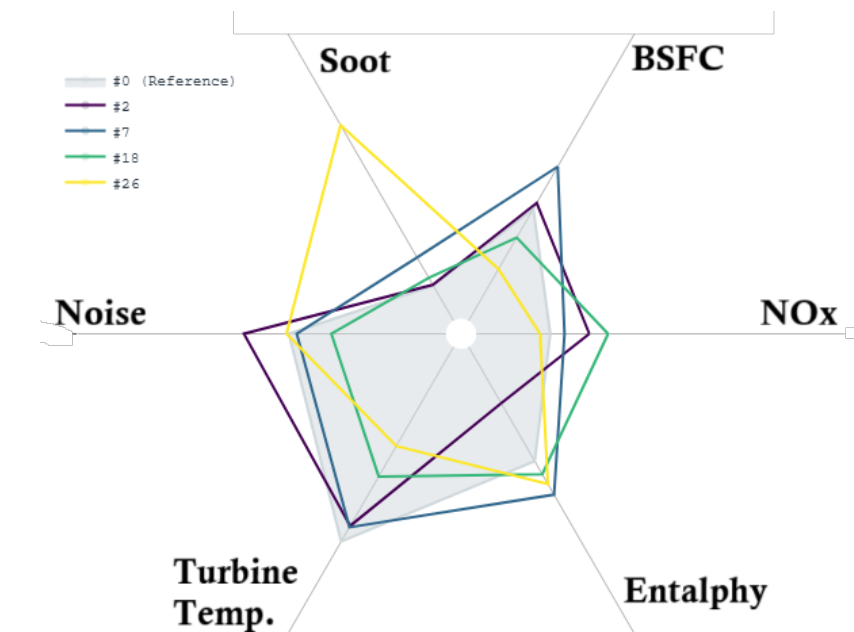
Engine Specifications
 Engine Model / Family
 Displacement (L)
 Cylinder Configuration
 Fuel Type (Diesel, H2, etc.)
 Emission Standard (Euro 6, Tier 4, etc.)

Tagging & Classification

Test Details
 Test Type (Performance, Durability, Emissions, NVH)
 Test Bench ID
 Operator / Responsible Engineer

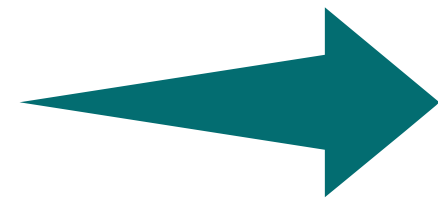
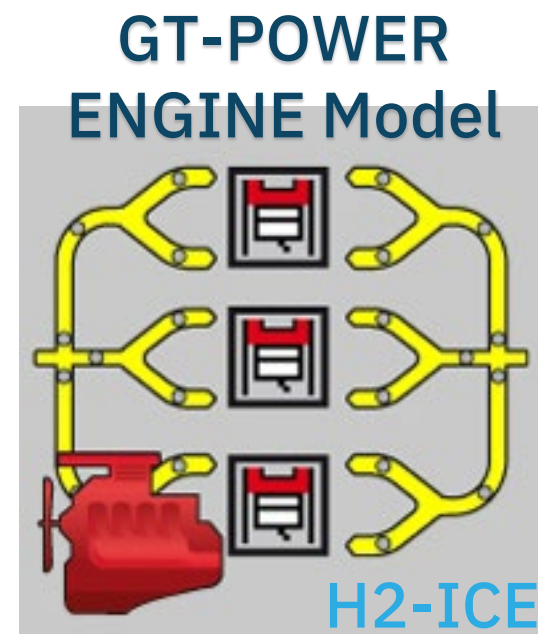
Operating Conditions
 Ambient Temperature
 Fuel Properties

Keywords (“Aftertreatment”, “Cold Start”, etc.)

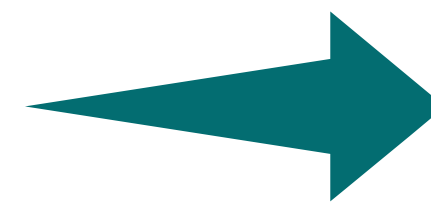
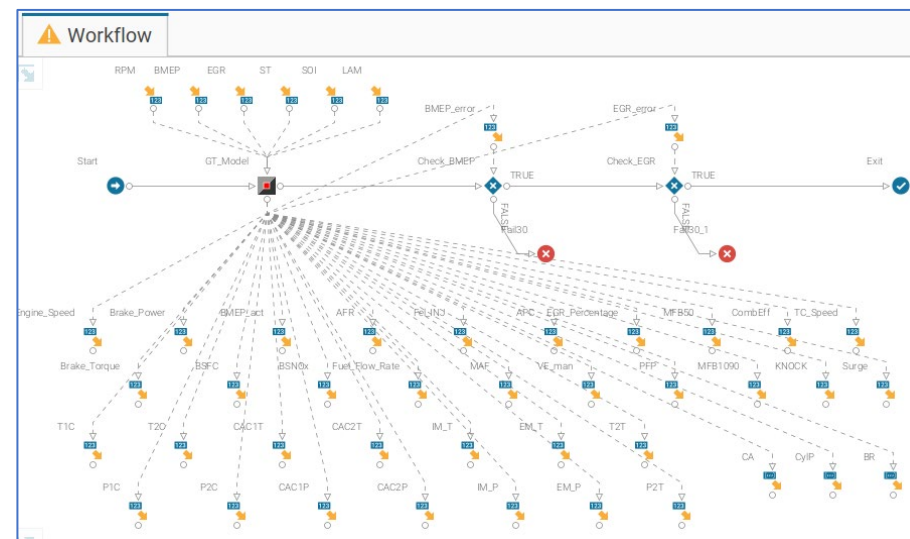


Project 2 – 1D CFD Model Management

ESTECO modeFRONTIER and VOLTA functionalities were utilized and evaluated through the introduction of a GT-Power model acting as a synthetic data generator.



modeFRONTIER

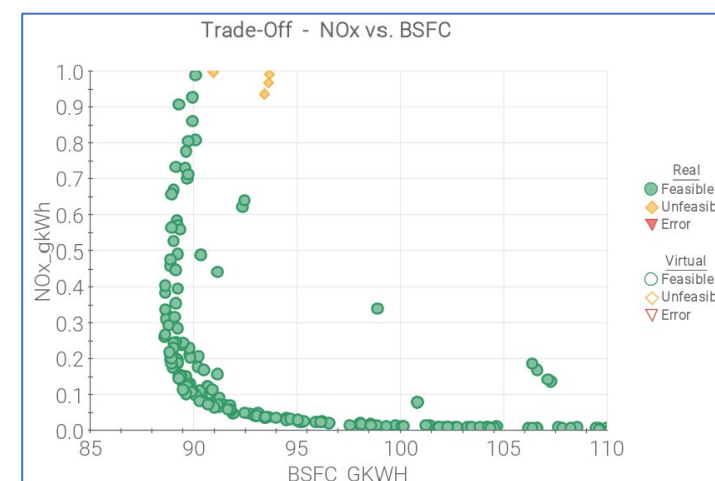


The **GT-Power model** has been set up for virtual calibration to receive:

- ✓ Calibration parameters
- ✓ Constraints and targets

The GT model was integrated into a modeFrontier workflow to generate **synthetic data for calibration**, including:

- ✓ Variation lists (sweeps, trade-offs)
- ✓ DoE
- ✓ Optimization

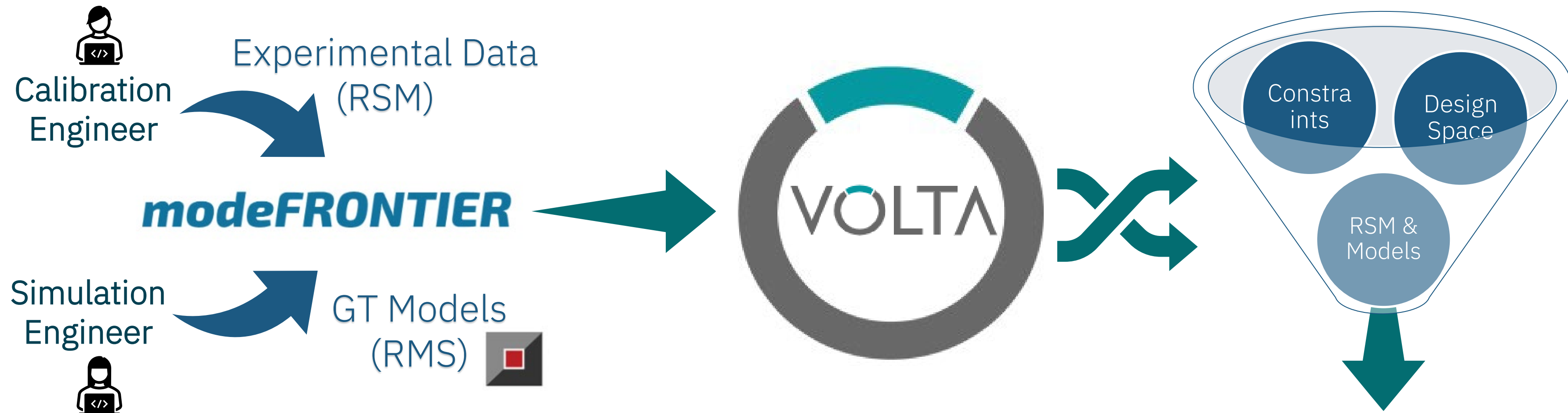


Sharing the ModeFrontier workflow on VOLTA enables to:

- ✓ Run simulations autonomously without needing GT-SUITE expertise
- ✓ Leverage synthetic data for calibration purposes or for training RMS models

Project 2 – Experimental & Virtual Synergy

- ✓ Share experimental data, models, workflows and results between departments
- ✓ Enable each team member to independently perform optimization, evaluation, and post-processing



Opportunities :

- ✓ Leverage 1D simulations to define calibration parameters ranges and assess performance when engine hardware is not available. Streamline calibration development.
- ✓ Build multi-fidelity models that blend 1D simulations data with test bench measurements.

- ✓ Explore new configurations
- ✓ Perform optimization
- ✓ Results Analysis
- ✓ Sharing of Results



Project Leader
Project Team Member



AI/ML: an enabler for digital transformation

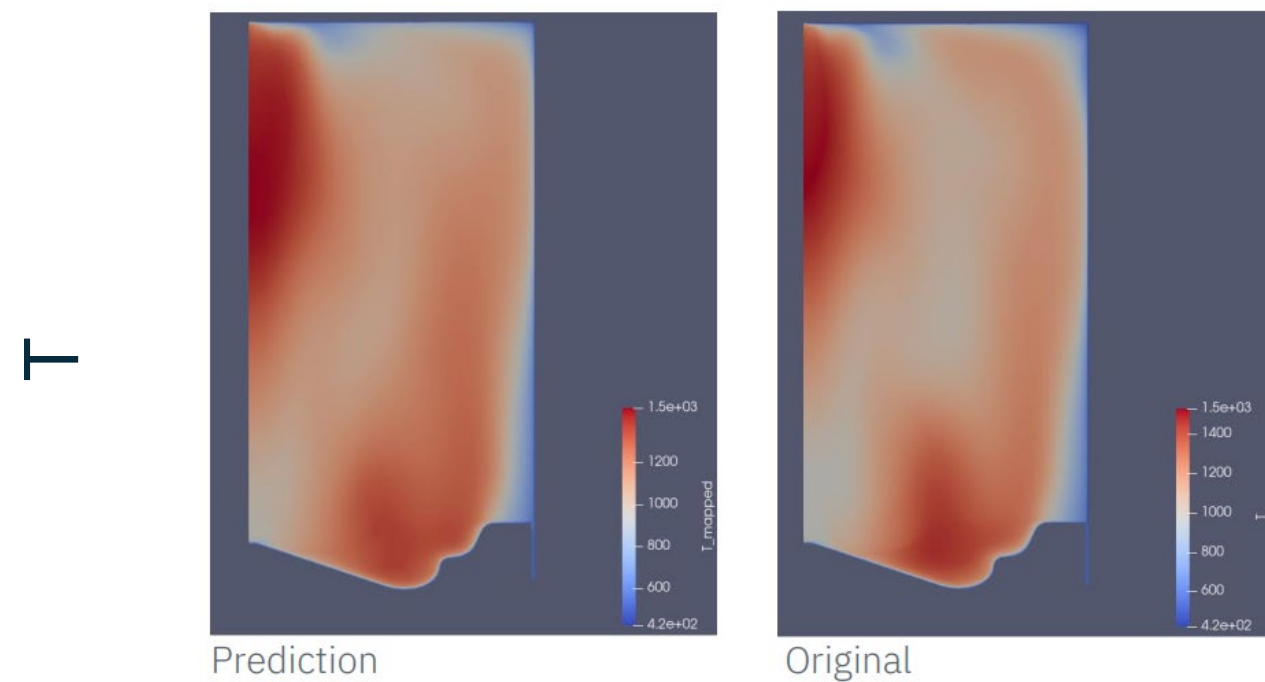


AI/ML – Reduced Order Models (ROM)

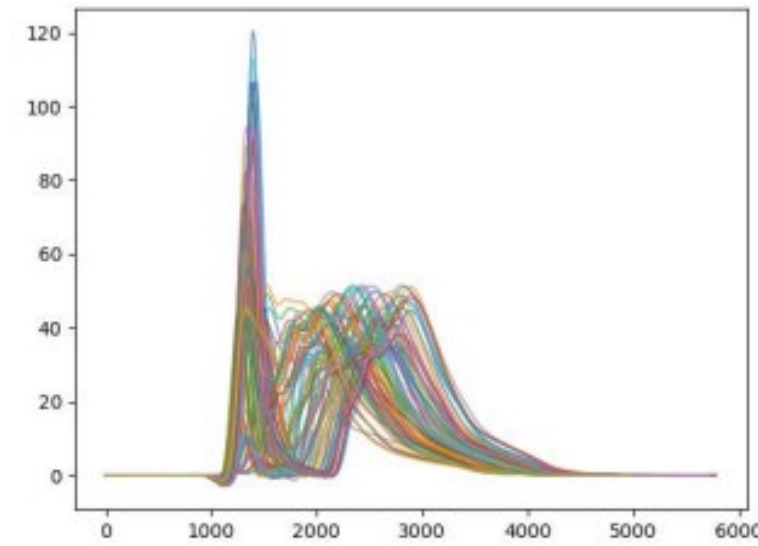
- ✓ Technology based on non-intrusive POD method
- ✓ Training based on Project 1 database
- ✓ Tests performed on:
 - Geometry auto-encoding
 - 1D ROM
 - 2D ROM

Projection error: $\bar{0.007}$
Prediction error: 0.046

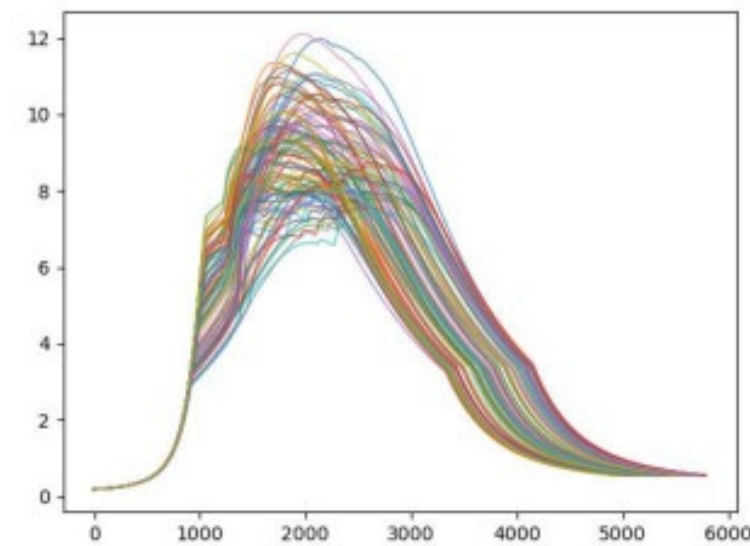
2D ROM



HRR

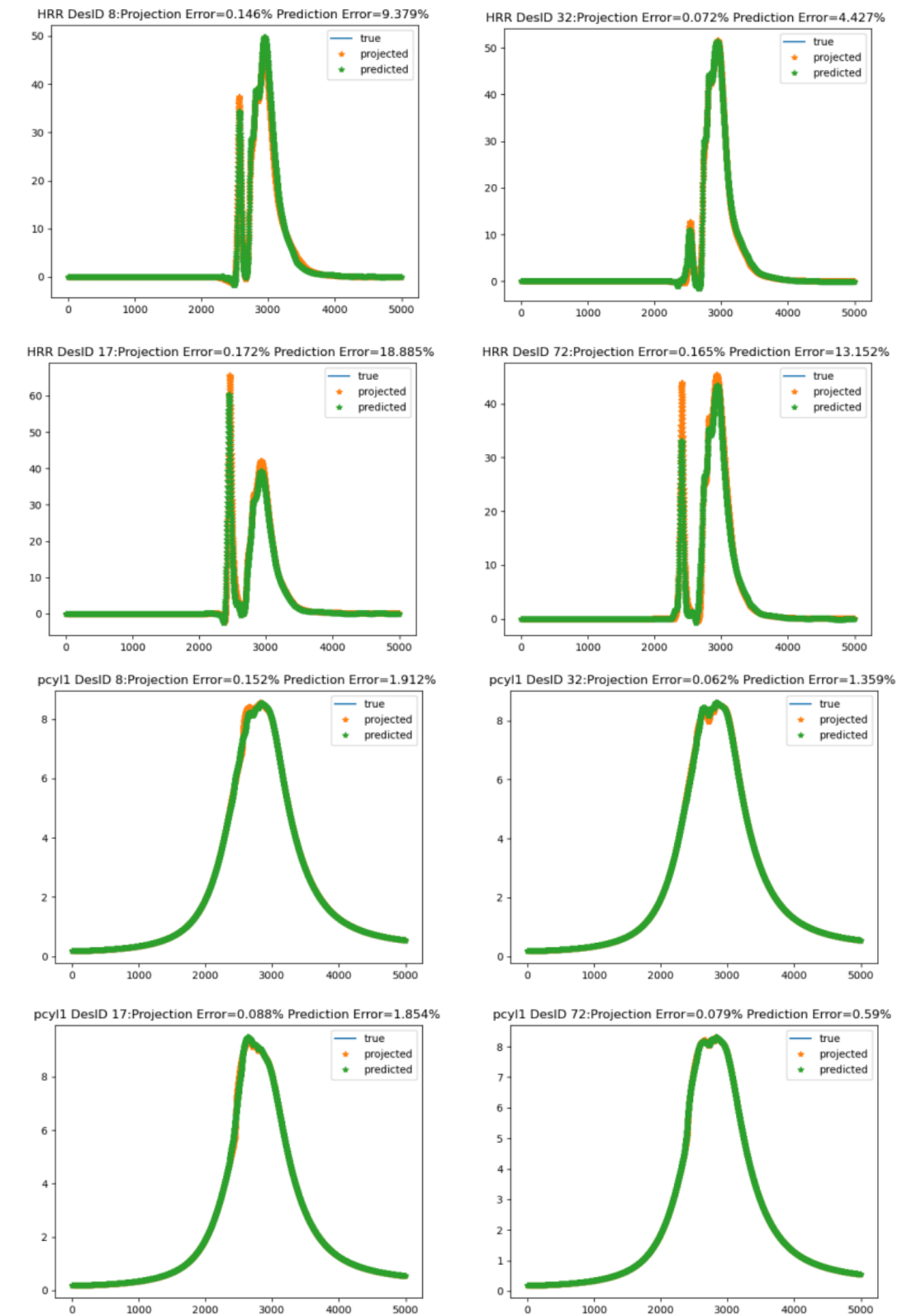


Pcyl

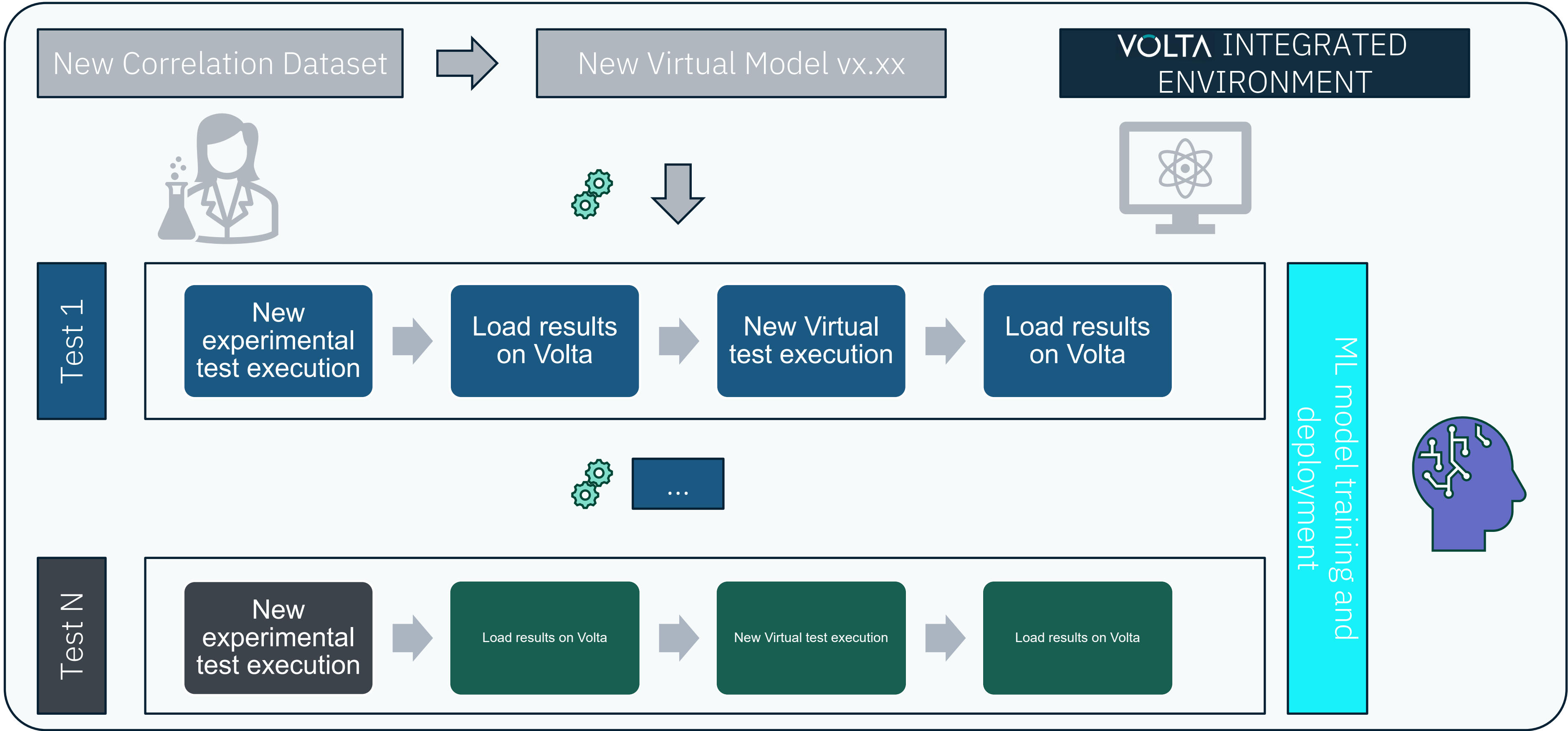


1D time-dependent
pressure and HRR
training dataset

1D ROM



Exploit Data Value



Roadmap & Conclusions: Where we are, what we want to do next

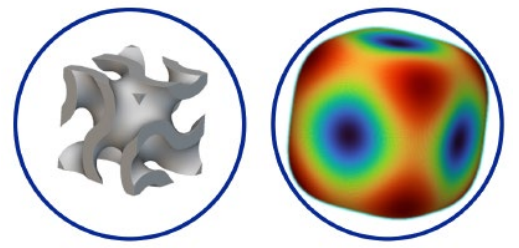


Dumarey's roadmap for 2026 and beyond

Volta penetration in Dumarey's activities

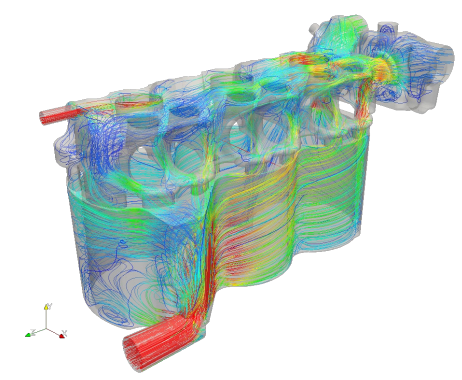
Combustion digital twin

- ✓ Upload existing combustion optimization knowledge-base
- ✓ Execution of combustion system development projects



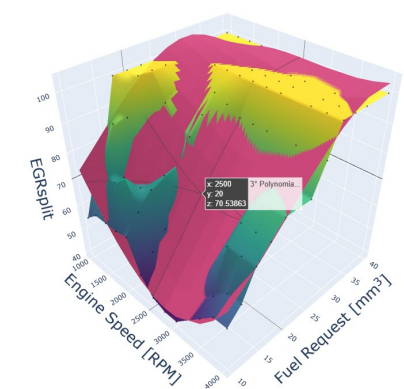
Experimental data from engines

- ✓ H2-ICE
- ✓ Gasoline



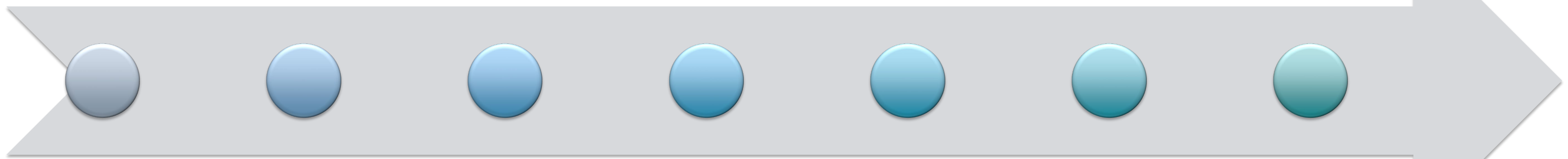
Gear digital twin

- ✓ Database of gears
- ✓ Deployment of ML models for design optimization



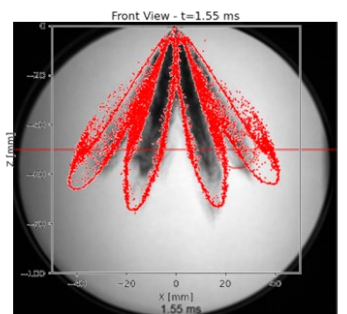
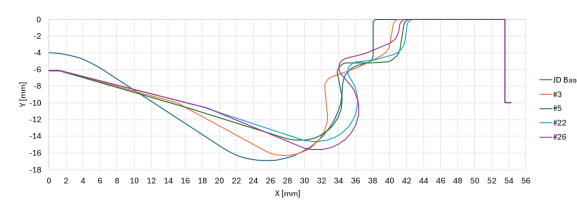
Aftertreatment digital twin

- ✓ Catalysts models' deployment
- ✓ Architectural preliminary studies



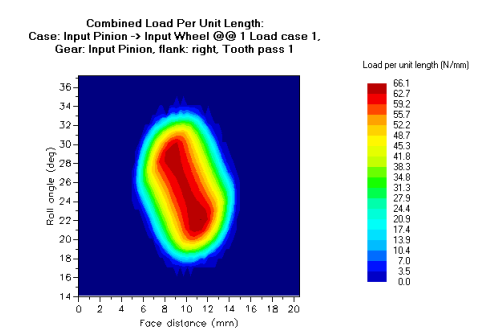
Research projects

- ✓ AMHPHEX
- ✓ AETHER
- ✓ DT-HATS



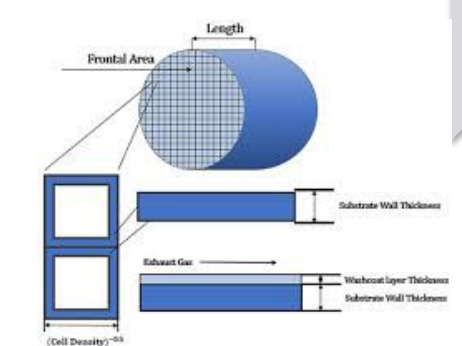
Autotools for Design

- ✓ Intake ports
- ✓ Water jacket



Automatic virtual calibration optimization process

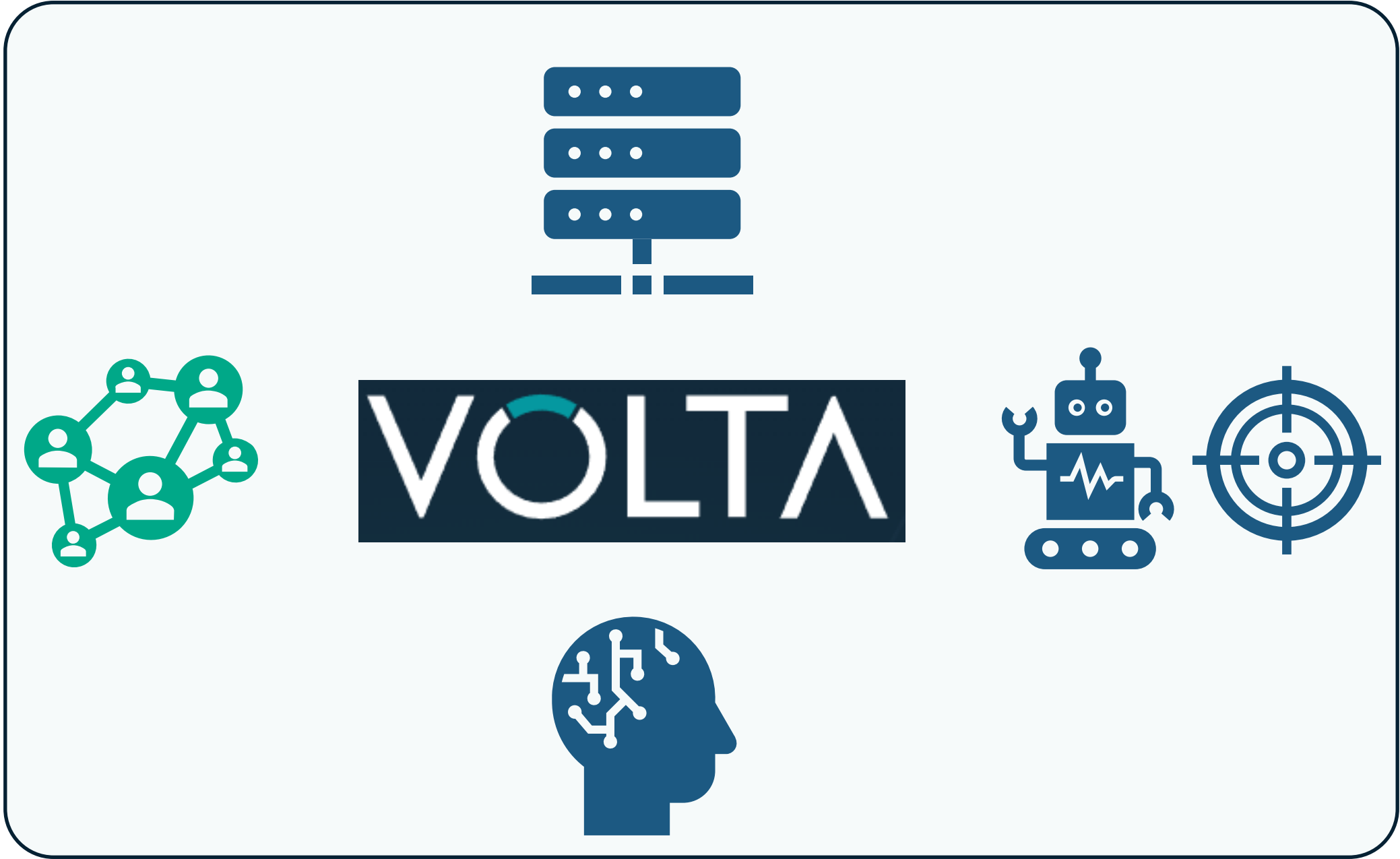
- ✓ Application to baroclimatic compensation



Conclusions

Data Management & Aggregation

Enabler for Collaborative Design faster & better Decision Making



Better Products & Projects through Optimization

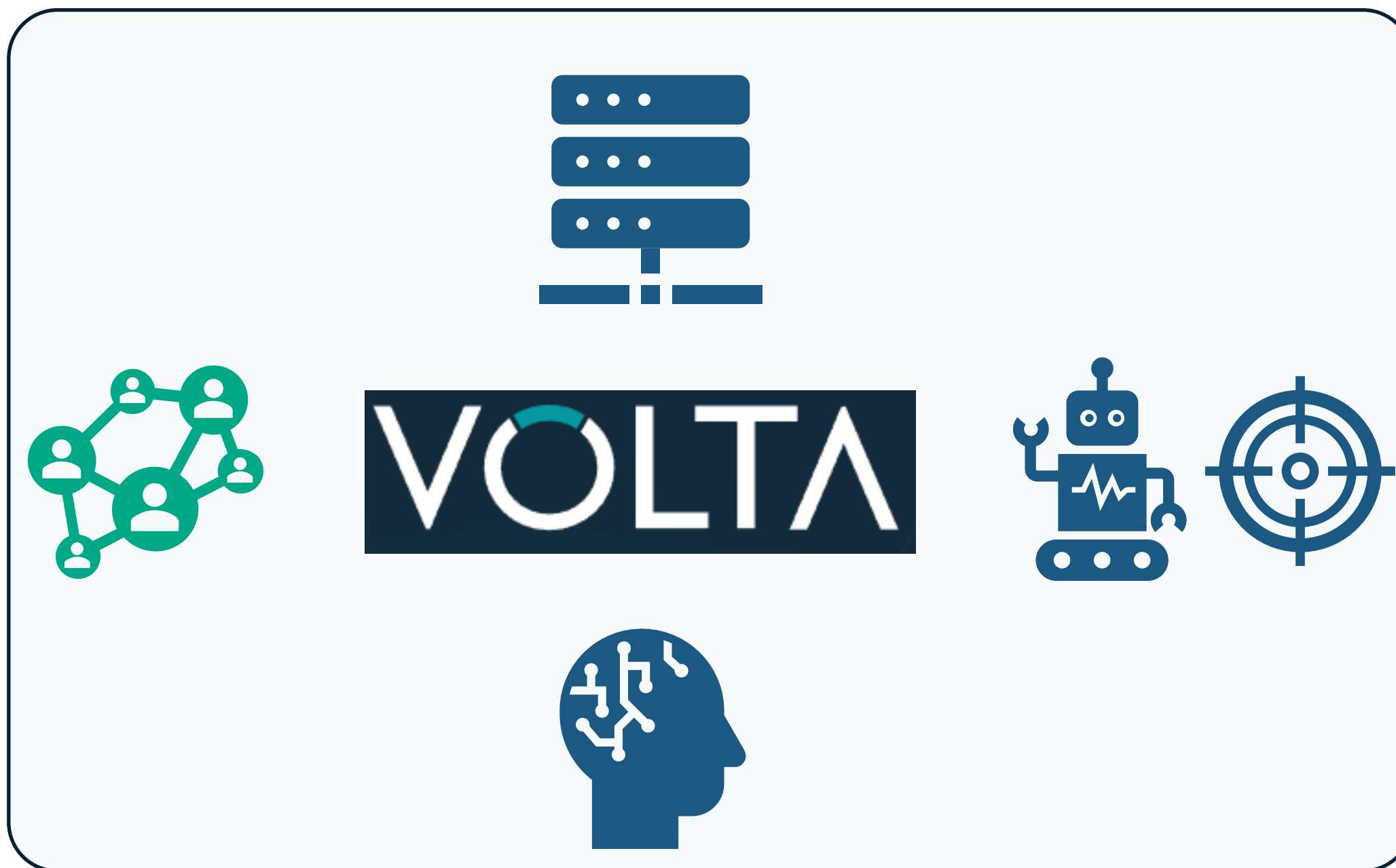
Speed-up AI/ML company-wide diffusion

The Volta Team

Dumarey Team

- Andrea Capra
- Tonio Spedicato
- Filippo Aglietti
- Matteo Luci
- Mario Saracino
- Simone Eterno
- ...and many others...

A collective effort



With a One-Team approach

Esteco Team

- Giulio Cassio
- Gabriele Degrassi
- Simone Genovese

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Thank you

[esteco.com](https://www.esteco.com)

