TRIDIAGONAL GROUP

HAH Software
Authentic Results

How can you improve up- and down-scaling processes in pharma and chemical manufacturing?

The challenge

In pharma and chemicals, processes that succeed at 2 L often fail at 20,000 L. While the science is unchanged, the process environment shifts dramatically — and that uncertainty returns whenever teams re-validate, change batch sizes, transfer sites, or adjust operating conditions across a product's commercial life.

- **Chemical mixing complexity:** Powders, granules, suspensions, emulsions, and gas–liquid systems show scale-dependent behaviour that is difficult to predict across vessels.
- **Biological variability:** Living cells respond differently to shear forces and gradients as scale and operating conditions change.
- **Equipment heterogeneity:** Vessel geometry and impeller differences alter fluid dynamics during scale-up, scale-down, and site changes.
- **Limited observability:** Sensors cannot capture critical internal states such as local turbulence or mass transfer.
- **Small data constraints:** High costs limit the experimentation needed to validate behaviour across scales.
- **Tech-transfer failures:** The result is inconsistent CQAs and costly batch variability throughout manufacturing.

Together, this drives long timelines, repeated trial-and-error, and processes that fail to behave consistently across scale, site, and lifecycle.

The answer

Hybrid modelling translates process behaviour into scale-independent metrics — descriptors of the internal mixing environment such as shear stress and mixing time — that remain valid across vessel sizes, batch volumes, and operating conditions. This gives teams physics-based confidence not only for scale-up, but for scale-down, tech transfer, and lifecycle re-validation. This is where Tridiagonal's MixIT and SimSight platforms come in — solutions that are trusted by global top-10 pharma and biotech companies.

TRIDIAGONAL GROUP

HAH Software
Authentic Results

The solution

MixIT

A CFD-enabled mixing intelligence tool that shows how reactors truly behave — revealing flow patterns, shear zones, mixing times, gas distribution, and impeller performance. It turns mixing from guesswork into engineering — enabling reliable decisions across scale-up, scale-down, and long-term manufacturing changes.

- Reveals real hydrodynamics using Computational Fluid Dynamics insights.
- Optimises reactor design and operation by guiding impeller choice, configuration, and operating conditions.
- Predicts key mixing KPIs (Key Performance Indicators) — mixing time, power number, droplet size — with far greater accuracy than empirical rules.
- Troubleshoots scale-up issues by identifying hydrodynamic bottlenecks that cause variability or long blend times.

SimSight

A hybrid-modelling decision-support platform that operationalises scale-up. It uses physics-driven digital twins and process-metric equivalence to deliver predictable, repeatable performance from lab to plant.

- Translates lab conditions into plant-ready operating ranges.
- Predicts process behaviour across vessels, geometries, and manufacturing sites.
- Reduces experimentation by 30%+ through virtual testing and reusable asset knowledge.
- Supports robust tech transfer by aligning internal environments, not just equipment settings.

Together, MixIT and SimSight give process teams a unified, physics-aware, data-augmented view of their process — from bench to production. Teams can confidently predict how a process will behave when batch sizes, vessels, or operating strategies change over time.

What it delivers	MixIT	SimSight
User audience	Mixing specialists, process engineers	Bioprocess engineers, scale-up teams
Understand internal environment	CFD-based flow, shear, mixing insights	Physics-driven digital twins + process metrics
Improve equipment performance	Optimises impellers, configurations, operating conditions	Predicts behaviour across vessels, geometries, sites
Predict key outcomes	Accurate mixing KPIs (mixing time, power, droplet size)	Plant-ready, scale-up performance
Reduce development risk	Identifies hydrodynamic bottlenecks	Cuts experimentation 30%+ and strengthens tech transfer

TRIDIAGONAL GROUP

HAH Software
Authentic Results

Engineering-grade insight for every mixing challenge

Tridiagonal MixIT

Our mission

Democratise complex mixing analysis by replacing the “black box” of stirred-tank design with a collaborative platform that blends empirical correlations and automated 3D CFD (Computational Fluid Dynamics).

By bridging the gap between theoretical fluid dynamics and real-world plant data, we empower you to reduce batch variability and accelerate development cycles.

This helps to ensure every design choice — from impeller selection to feed pipe location — is backed by rigorous, repeatable, and digital physics.

MixIT is a platform for optimising reactor configurations. Its advanced impeller library and automated CFD modules cut simulation time from weeks to hours, giving teams fast, high-fidelity hydrodynamic insights.

Users can predict mixing time, power numbers, and droplet size while visualising flow fields to identify dead zones and shear hotspots. A centralised database makes it easy to share geometries and experimental results globally.

Troubleshoot complex mixing challenges and scale bioreactors, with clarity for consistent, reliable product quality at any scale.

Build processes you can trust — not just at first scale-up, but throughout the entire product lifecycle. Book your free demo!

www.hahsoftware.com | info@hahsoftware.com

TRIDIAGONAL GROUP

HAH Software
Authentic Results

Predictive scale-up intelligence for every vessel and site

Tridiagonal SimSight

Our mission

Overcome the “small data” challenge by using hybrid, or *grey box*, models — frameworks that combine scientific principles with machine-learning insights to fill in the gaps where real-world data is limited or cannot be measured.

We help you to focus on scale-independent indicators, such as how efficiently oxygen moves through a system or the level of mechanical stress inside the equipment that can damage cells or reduce product quality.

This gives process development and scale-up teams a shared language to enable predictable, low-risk technology transfer across equipment, scales, and sites.

SimSight is a scale-up and asset-characterisation platform built around a library of asset digital twins. These models let engineers run virtual test runs to explore operating conditions and define safe design spaces.

By combining lab-scale data with equipment metadata, SimSight predicts outcomes such as viable cell density and titer across different bioreactor types and scales.

Its intuitive tools provide fast calculators for blend time and scale alignment, helping teams harmonise conditions across sites and reduce costly physical trials.

Boost yields, cut waste and get it right the first time with HAH Software, the UK and Ireland partner of Tridiagonal. Book your free demo!

www.hahsoftware.com | info@hahsoftware.com