



TECHNICAL DOCUMENTATION RELEASE

Acatian User Manual

From governed model brief to connected engineering decision

DOCUMENT BASIS

Product workflows, visible results, review criteria, evidence boundaries and controlled handover.

TM-EN-4.2 | RELEASE 4.2

10 OCTOBER 2026



Document control

One controlled basis for public product guidance.

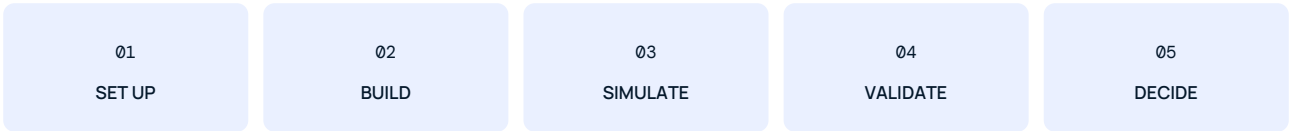
FIELD	VALUE
Document ID	TM-EN-4.2
Release	4.2
Reviewed	10 October 2026
Audience	Process development, process engineering, MSAT, modelling, facility, economics, sustainability and technical review
Purpose	Complete task guidance for building, calculating, reviewing and handing over a governed Acatian model
Owner	Acatian Product and Engineering

APPLICABILITY LIMIT

This manual explains the product workflow and the evidence needed to interpret its outputs. It does not replace qualified engineering judgement, customer quality systems, safety review, equipment-vendor data or validation for a regulated intended use.

Scope and use

Use the navigation path, input register, visible-result description, review criteria and handover record together. A screen or exported number without its model version, basis, unit, evidence status and limitations is not a controlled engineering result.



LANGUAGE

This document is written consistently in English. Product navigation names remain as displayed in the interface.

Current capability map

The map below is the documentation scope for release 4.2.

NO.	CAPABILITY	WHAT IS COVERED
01	Workspace and access	Account context, organisations, roles, project ownership, subscription entitlement and controlled sign-in.
02	Model brief and governance	Intended use, system boundary, owners, reviewers, data status, maturity and evidence gaps.
03	Flowsheet and equipment	Process hierarchy, equipment register, components, reactions, streams, ports, boundaries and equations.
04	Simulation	Steady-state balances, batch, fed-batch, perfusion and continuous dynamics, ODE/PDE states, events and solver controls.
05	Transport and scale-up	Equipment sizing, mixing, mass transfer, heat transfer and governed bioreactor CFD screening and case setup.
06	Factory operations	Batch scheduling, campaigns, finite equipment, rooms, people, utilities, cleaning, hold times and release constraints.
07	Data and integrations	Files, mappings, APIs, connectors, provenance, review, rollback and a separate customer-site OT gateway boundary.
08	Validation	Structural, numerical, physical and evidence checks, acceptance criteria, standards mapping and readiness gates.
09	Decision analysis	TEA, LCA, uncertainty, sensitivity, scenario comparison and transparent decision constraints.
10	Collaboration and outputs	Branches, versions, review, approval, restore, reports, SVG, CSV, JSON, spreadsheet and package exports.

PRODUCT BOUNDARY

Acatian connects model structure, calculation, evidence and decision outputs. It does not turn missing industrial evidence into certainty and it does not connect the public cloud service directly to PLC or safety systems.

Documentation map

Each module answers one engineering question and ends with a controlled handover. Read modules in order for a new model or open the module that matches the task in front of you.

MODULE	TASK	PATH IN ACATIAN
01	Getting started, projects and model brief	Sign in > Set up > Model brief / Projects + versions / Plant overview
02	Flowsheet, equipment, streams and equations	Build > Flowsheet studio / Diagram studio / Equipment register / Stream table / Model equations
03	Dynamic simulation, ODE/PDE and operating modes	Simulate > Dynamic simulation / Advanced modelling
04	Bioreactor CFD and transport analysis	Simulate > Bioreactor CFD
05	Scheduling, resources and factory twin	Decide > Factory twin / Scheduling
06	Data ingestion, sources and API integrations	Validate > Data & sources / API connectors
07	Physical boundaries, standards and model validation	Validate > Boundaries + AI / Standards / Readiness / Engineering review
08	TEA, LCA, uncertainty and sensitivity	Decide > Economics / LCA / Sensitivity
09	Versions, branches, collaboration and approval	Projects + versions > Branches / Versions / Collaborators / Review
10	Reports, downloads, APIs and engineering handover	Decide > Reports & downloads / API export

READING RULE

Do not read a result page in isolation. Read the input basis, model change, visible result, review criterion and applicability limit as one chain.

Process analysis and debottlenecking

Updated 10 October 2026



NAVIGATION

Simulate > Dynamic simulation > Process analysis > Debottlenecking

Start from a calculated project with reviewed equipment, connections and operation times. Declare the study basis before calculating. A source-only imported diagram does not provide a numerical simulation basis.

DECLARED BASIS	REVIEW BEFORE CALCULATION
Production and timing	Batch output, annual operating hours, plant cycle time, cycle count, fixed and proportional process time, and complete setup/process/transfer/cleanup cycles.
Physical capacity	Map procedures to physical hosts; review shared equipment, installed parallel count, size utilization, resource capacity and tank limits.
Economics	Declare the profit or cost basis, added investment, evaluation years and discount rate. Missing inputs block the affected result instead of inventing values.

Compare and inspect

Compare up to three named alternatives: batch scale, plant cycle time, cycles per batch, staggered parallel equipment, a dedicated host, preparatory duty on external equipment, or auxiliary-resource capacity. Review size, time and combined bottlenecks, conservative/realistic/theoretical throughput separately, exact operation start/finish/delay, resource demand and tank inventories.

Preserve the output

Use Process analysis > Exports for Study JSON, Study CSV and Report HTML, RTF or text. Review the engineering workbook tables when available. The full recalculated operation schedule is exported even when the visual Gantt shows only its first rows. Keep the model revision, declared assumptions, blocked results and added-investment basis with every comparison.

LIMIT

Annual throughput is a declared projection. Tank shortage blocks affected annual throughput and economics; the engine does not automatically reschedule tank draws or prove an optimal schedule. SuperPro numerical equivalence is not verified.

Bioprocess training

01
SET UP

02
BUILD

03
SIMULATE

04
VALIDATE

05
DECIDE

NAVIGATION

Simulate > More models > Bioprocess Trainer

The integrated Bioprocess Trainer provides a learning session inside the workspace. Select the process/product, review declared culture and equipment settings, run and pause the simulation, inspect variables and samples, and use the trainer’s session controls. Revisit the trainer after changing workspace views; check the restored session before continuing.

ENTRY	PURPOSE AND OUTPUT
Bioprocess Trainer	The native workspace trainer retains its own learning state. A training run does not overwrite the project’s process basis or turn training data into reviewed production evidence.
Active flowsheet training	Simulate > More models > Active flowsheet training practices the current connected flowsheet. Review imported source-diagram limitations before treating its objects as executable operations.
Separate public trainer	https://acatian.com/bioprocess-trainer opens an independent learning tool with product/reaction and hardware views, including 3D. It has a separate session; use Save & restore to download and restore that session.

Session review

CHECK	Confirm the selected product, assumptions, simulation clock and sampled variables before interpreting a result.
CHECK	Keep downloaded trainer-session files distinct from the engineering project’s Study JSON and release evidence.
CHECK	Training and 3D visualizations are learning outputs; customer calibration and engineering validation remain separate tasks.

Assistant and integrated support

NAVIGATION

Assistant > Support

Open Assistant for help in the current workspace context. Inspect proposed actions and their model basis before applying them. Close Assistant with its close control; a pending assistant response must not reopen a panel you dismissed. Reopen Assistant when you want to continue.

Create and follow a support request

Support is part of Assistant. Open its Support section, describe the issue and reproduction steps, review any supplied project context, and submit the request deliberately. Inspect your submitted request and status in the same section. A draft or assistant conversation alone is not a submitted ticket.

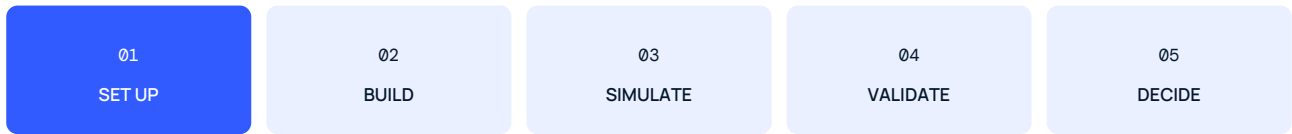
REVIEW ITEM	WHAT TO PRESERVE
Reproduction	Workspace view, relevant model/revision, expected versus observed output, and the shortest reproducible steps.
Submission	The received ticket reference and displayed status. If submission fails, review the error and retry without assuming delivery.
Sensitive context	Include only information needed for support. Do not paste passwords, tokens or unnecessary customer data into a request.

CONTACT

Product access: <https://acatian.com/login>. Email fallback: support@acatian.com.

Getting started, projects and model brief

From personal account to a clearly bounded engineering assignment



ENGINEERING DECISION	PATH IN ACATIAN
Which question should the model answer, for which project and with which evidence basis?	Sign in > Set up > Model brief / Projects + versions / Plant overview
PRIMARY USERS	PERMITTED MATURITY
Project lead, Process Development, MSAT, Reviewer, Administrator	Draft or Screening; higher only after documented calibration and review

START WITH THE DECISION

This area defines what Acatian is allowed to calculate. A precise model brief prevents technically correct calculations from answering the wrong engineering question.

Expected artifacts

ARTIFACT	RECIPIENT
Module result package	Engineering reviewer
Readiness register	Model owner
Controlled version	Project team

Prepare the model

INPUT	WHY IT MATTERS	READY WHEN
Product and process family	Defines components, unit operations and default assumptions.	Product, organism/cell line and route are unambiguous.
Intended use	Defines the decision and required accuracy.	One question states target, scale and horizon.
System boundary	Prevents double counting and hidden exclusions.	Inlets, outlets, utilities, waste and exclusions are named.
Owner and reviewer	Establishes accountability and independent review.	A person or function is assigned to each role.
Data inventory	Separates measurements, sources, assumptions and gaps.	Unit, period, provenance and confidentiality are recorded.

Preflight check

CHECK	Confirm the correct project, branch and controlled version
CHECK	Verify units, provenance and permissions
CHECK	Save a restore point before a decision-relevant change
CHECK	Keep blocking gaps visible

Workflow

01

Check account context

Open profile, organisation, role and plan state.

VISIBLE RESULT: Active user and available capabilities match the assignment.

02

Create or open project

Set project name, product, owner and confidentiality.

VISIBLE RESULT: A separate project with a stable ID is active.

03

Write the model brief

Enter product, scale, mode, decision, boundary and data state.

VISIBLE RESULT: The brief describes intended use without contradiction.

04

Classify evidence

Register available files and mark missing evidence explicitly.

VISIBLE RESULT: Every critical input is a source, assumption or open gap.

05

Protect the baseline

Save the baseline and create a branch for changes.

VISIBLE RESULT: A restorable start point with a change note exists.

Review the result

CRITERION	PASS CONDITION	IF IT FAILS
Scope and structure	The documented criterion is satisfied and supported by traceable evidence.	Correct the model or keep the output Not decision-ready.
Units and balances	The documented criterion is satisfied and supported by traceable evidence.	Correct the model or keep the output Not decision-ready.
Evidence and uncertainty	The documented criterion is satisfied and supported by traceable evidence.	Correct the model or keep the output Not decision-ready.
Reproducibility	The documented criterion is satisfied and supported by traceable evidence.	Correct the model or keep the output Not decision-ready.
Review state	The documented criterion is satisfied and supported by traceable evidence.	Correct the model or keep the output Not decision-ready.

APPLICABILITY LIMIT

A complete model brief does not prove physical correctness. It defines what later evidence must demonstrate.

Troubleshooting

OBSERVATION	LIKELY CAUSE	CORRECTION
The result looks plausible but cannot be explained	Inputs, units, model version or evidence are missing.	Open the relevant register, restore traceability and rerun.
A change affects unexpected outputs	Dependencies or imported mappings were not reviewed.	Inspect the change plan and before/after diff; undo if required.
The module appears complete but readiness is low	Required industrial evidence is still missing.	Assign the visible gaps and keep maturity at Screening or Not decision-ready.

Controlled handover

ARTIFACT	RECIPIENT	MUST CONTAIN
Module result package	Engineering reviewer	Inputs, calculations, results, units, intervals, maturity
Readiness register	Model owner	Gap, required work, owner, due date, intended use
Controlled version	Project team	Branch, version, change note, reviewer and restore point

Completion check

CHECK	The active project, branch, version and intended use are visible.
CHECK	Inputs carry units, provenance, review state and uncertainty where relevant.
CHECK	Blocking model, physical, numerical and evidence gaps are closed or assigned.
CHECK	The result maturity matches the available evidence.
CHECK	The output package opens correctly and includes its limitations.

OPEN ACATIAN

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Flowsheet, equipment, streams and equations

Build, connect and technically inspect a complete process graph

01
SET UP

02
BUILD

03
SIMULATE

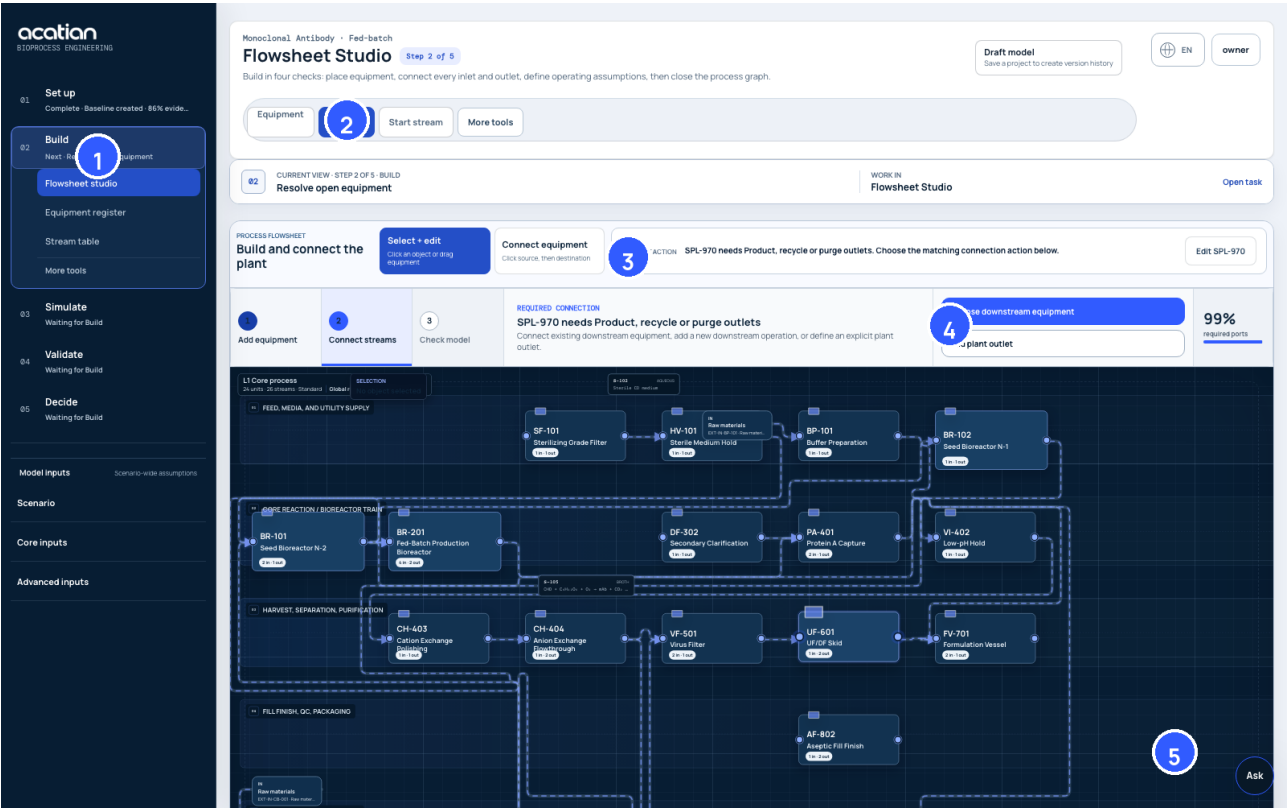
04
VALIDATE

05
DECIDE

ENGINEERING DECISION	PATH IN ACATIAN
Is the process architecture complete, directed, balance-ready and suitable for the intended study?	Build > Flowsheet studio / Diagram studio / Equipment register / Stream table / Model equations
PRIMARY USERS	PERMITTED MATURITY
Process Engineering, Process Development, MSAT, Facility Design	Draft to Screening; Calibrated only with project-specific equipment and stream data

START WITH THE DECISION

The flowsheet is the shared calculation and communication graph. Every unit needs meaningful inlets or outlets; external supply and discharge are modelled as explicit boundary streams.



Illustrative interface using a synthetic training model. Values shown are not customer data, a benchmark or a validated engineering claim.

Prepare the model

INPUT	WHY IT MATTERS	READY WHEN
Unit-operation list	Defines main, support, utility, cleaning and waste steps.	Every operation has a tag, function and stage.
Component list	Enables component balances and reactions.	Names, formulas, phase and base unit are unique.
Stream basis	Defines flow, composition, state and direction.	Source/target, units, temperature, pressure and time basis exist.
Equipment basis	Connects size, duty, material, mode and standards.	Nominal/working volume and sizing rule are documented.

Preflight check

CHECK	Confirm the correct project, branch and controlled version
CHECK	Verify units, provenance and permissions
CHECK	Save a restore point before a decision-relevant change
CHECK	Keep blocking gaps visible

Workflow

01

Read the hierarchy

Inspect L0-L6 and separate main process, support, utilities, CIP and waste.

VISIBLE RESULT: Every area has one clear technical role.

02

Place equipment

Filter the library, add a unit, tag and classify it.

VISIBLE RESULT: The unit appears on canvas and in the register.

03

Create boundary streams

Add an external inlet or outlet directly to the unit.

VISIBLE RESULT: Material can cross the model boundary.

04

Connect internal streams

Set source, target, ports, direction and stream type.

VISIBLE RESULT: Arrow direction and connection count agree.

05

Inspect equations

Open reactions, separations, accumulation, energy and economics.

VISIBLE RESULT: Every calculated quantity has equation and unit.

06

Audit the graph

Check isolated units, open ports, cycles and unexplained bypasses.

VISIBLE RESULT: No unexplained main-process island remains.

Review the result

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Scope and structure	The documented criterion is satisfied and supported by traceable evidence.	Correct the model or keep the output Not decision-ready.
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APPLICABILITY LIMIT

A connected diagram is not yet a closed model. Components, reactions, states and numerical tolerances require review.

Troubleshooting

OBSERVATION	LIKELY CAUSE	CORRECTION
The result looks plausible but cannot be explained	Inputs, units, model version or evidence are missing.	Open the relevant register, restore traceability and rerun.
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Controlled handover

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Module result package	Engineering reviewer	Inputs, calculations, results, units, intervals, maturity
Readiness register	Model owner	Gap, required work, owner, due date, intended use
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Dynamic simulation, ODE/PDE and operating modes

Calculate batch, fed-batch, perfusion and continuous processes reproducibly



ENGINEERING DECISION	PATH IN ACATIAN
How do process states evolve over time and within which operating envelope is the scenario plausible?	Simulate > Dynamic simulation / Advanced modelling
PRIMARY USERS	PERMITTED MATURITY
Process Development, Modelling, Scale-up, MSAT	Screening without calibration; Calibrated after estimation; Validated only with an independent dataset

START WITH THE DECISION

Acatian couples component balances with time-dependent states. ODEs represent ideal mixed states; PDEs represent spatial gradients as discretised fields. The operating mode and events must match real operation.

Expected artifacts

ARTIFACT	RECIPIENT
Module result package	Engineering reviewer
Readiness register	Model owner
Controlled version	Project team

Prepare the model

INPUT	WHY IT MATTERS	READY WHEN
Initial states	Start biomass, substrates, product, metabolites, volume and temperature.	Every state has value, unit and source.
Kinetics	Defines growth, uptake, formation and death.	Equation, parameter range and applicability are documented.
Operating profile	Distinguishes charge, feed, bleed, harvest and continuous flow.	Events, rates and control logic are defined.
Numerics	Controls stability, accuracy and runtime.	Solver, step size, tolerance and stop conditions are set.
Measured data	Supports calibration and independent validation.	Training and validation datasets are separated.

Preflight check

CHECK	Confirm the correct project, branch and controlled version
CHECK	Verify units, provenance and permissions
CHECK	Save a restore point before a decision-relevant change
CHECK	Keep blocking gaps visible

Workflow

01

Select operating mode

Choose batch, fed-batch, perfusion or continuous and verify working volume.

VISIBLE RESULT: Volume and transfer equations visibly change with mode.

02

Configure states and kinetics

Open ODE/PDE variables, parameters, bounds and sources.

VISIBLE RESULT: The state register is complete and dimensionally consistent.

03

Define events

Schedule feed, inoculation, harvest, bleed, samples and transfers.

VISIBLE RESULT: The event line is causal and chronological.

04

Run preflight

Check structure, units, initial values, bounds and numerics.

VISIBLE RESULT: No blocking finding remains.

05

Start simulation

Start the run and observe convergence, step size and residuals.

VISIBLE RESULT: Run ID, solver state and complete trajectory are produced.

06

Compare scenarios

Change only intended parameters and compare to branch baseline.

VISIBLE RESULT: Before/after exposes states, outputs and boundary violations.

Review the result

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Review state	The documented criterion is satisfied and supported by traceable evidence.	Correct the model or keep the output Not decision-ready.

APPLICABILITY LIMIT

A stable numerical solution is not biological validity. Project calibration and independent validation remain required.

Troubleshooting

OBSERVATION	LIKELY CAUSE	CORRECTION
The result looks plausible but cannot be explained	Inputs, units, model version or evidence are missing.	Open the relevant register, restore traceability and rerun.
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Bioreactor CFD and transport analysis

Set up geometry, boundary conditions, transport physics and validation under control



ENGINEERING DECISION	PATH IN ACATIAN
Where do mixing, oxygen, nutrient, shear or heat-transfer risks arise inside the reactor?	Simulate > Bioreactor CFD

PRIMARY USERS	PERMITTED MATURITY
Bioreactor Engineering, CFD, Scale-up, Process Development	Browser run = engineering screening; validated 3D CFD requires an external solver, mesh and validation evidence

START WITH THE DECISION

The CFD area leads from real reactor geometry and boundary conditions to a transport-physics assessment. It calculates only after an explicit start and separates screening from a qualified external 3D run.

Expected artifacts

ARTIFACT	RECIPIENT
Module result package	Engineering reviewer
Readiness register	Model owner
Controlled version	Project team

Prepare the model

INPUT	WHY IT MATTERS	READY WHEN
Geometry	Defines tank, fill height, baffles, shaft, impellers and internals.	Dimensions, coordinates and CAD/sketch source are reviewed.
Rheology and phases	Defines momentum, bubbles and species transport.	Density, viscosity, model and temperature basis exist.
gas_inlet	Defines gas holdup, plume and oxygen source at the ring sparger.	alpha.gas, U.gas, C_O2 and sparger basis are set.
feed_inlet	Defines nutrient addition and local feed-risk zones.	C_N/glucose/glutamine, rate, port and profile are set.
walls_baffles	Creates no-slip and possible near-wall dead zones.	U.liquid = noSlip and wall treatment are documented.
top_headspace	Represents pressure outlet and gas disengagement.	p_rgh/alpha.gas and foam/headspace basis are set.
impeller_zone	Defines MRF/momentum source and mixing energy.	Axis, rpm, direction, diameter and zone are reviewed.
cell_uptake	Consumes oxygen and nutrients as volumetric sinks.	S_O2/S_N, biomass field and time basis are defined.

Preflight check

CHECK	Confirm the correct project, branch and controlled version
CHECK	Verify units, provenance and permissions
CHECK	Save a restore point before a decision-relevant change
CHECK	Keep blocking gaps visible

Workflow

01

Select reactor

Open the equipment tag and reconcile nominal and working volume.

VISIBLE RESULT: The CFD case is linked to one model version.

02

Build geometry

Parameterise tank, baffles, impellers, sparger, feed and headspace.

VISIBLE RESULT: The section matches real hardware.

03

Choose physics

Select turbulence, multiphase, species, heat and reaction models.

VISIBLE RESULT: Active equations and assumptions are visible.

04

Assign boundaries

Configure gas, feed, walls, headspace, impeller and uptake zones.

VISIBLE RESULT: Every boundary has a field, unit and physical meaning.

05

Start deliberately

Confirm preflight and only then press Start.

VISIBLE RESULT: Run ID, time progress, residuals and field time appear.

06

Interpret fields

Review velocity, holdup, DO, nutrient, shear, mixing and hotspots over time.

VISIBLE RESULT: Risk zones are spatially and quantitatively documented.

07

Validate externally

Export a 3D case and compare with PIV, tracer, kLa , DO or mixing data.

VISIBLE RESULT: Solver and experimental evidence are linked to the version.

Review the result

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Review state	The documented criterion is satisfied and supported by traceable evidence.	Correct the model or keep the output Not decision-ready.

APPLICABILITY LIMIT

The browser view is a screening and setup tool. Valid 3D claims require a real solver, mesh study, verification and experimental validation.

Troubleshooting

OBSERVATION	LIKELY CAUSE	CORRECTION
The result looks plausible but cannot be explained	Inputs, units, model version or evidence are missing.	Open the relevant register, restore traceability and rerun.
A change affects unexpected outputs	Dependencies or imported mappings were not reviewed.	Inspect the change plan and before/after diff; undo if required.
The module appears complete but readiness is low	Required industrial evidence is still missing.	Assign the visible gaps and keep maturity at Screening or Not decision-ready.

Controlled handover

ARTIFACT	RECIPIENT	MUST CONTAIN
Module result package	Engineering reviewer	Inputs, calculations, results, units, intervals, maturity
Readiness register	Model owner	Gap, required work, owner, due date, intended use
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Completion check

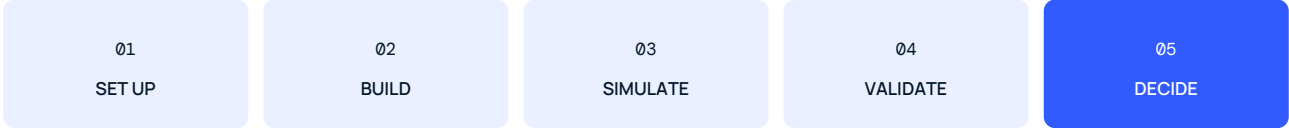
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Scheduling, resources and factory twin

Plan batches, cleaning, rooms, personnel and shared equipment at finite capacity



ENGINEERING DECISION	PATH IN ACATIAN
What production is achievable with the real resources, cleaning and release times?	Decide > Factory twin / Scheduling

PRIMARY USERS	PERMITTED MATURITY
MSAT, Manufacturing, Capacity Planning, Project Engineering	Screening with default times; Calibrated with batch/MES data; Validated with an approved operating calendar

START WITH THE DECISION

Scheduling converts the process graph into resource occupancy. Equipment can be reused only when transfer, cleaning, setup, maintenance, rooms, personnel and utilities are conflict-free.

Expected artifacts

ARTIFACT	RECIPIENT
Module result package	Engineering reviewer
Readiness register	Model owner
Controlled version	Project team

Prepare the model

INPUT	WHY IT MATTERS	READY WHEN
Operation durations	Defines occupancy and takt.	Min/typ/max or a distribution exists per operation.
Equipment pools	Defines alternatives and shared resources.	Capacity, calendar and changeover rules are set.
CIP/SIP	Prevents unrealistic immediate reuse.	Recipe, duration, dirty/clean hold and release are modelled.
Rooms and personnel	Represents non-equipment constraints.	Shift calendar, qualification and room state exist.
Utilities	Limits simultaneous steam, cooling, WFI and gas demand.	Capacity profiles and peak limits are set.
Release and holds	Links QC, release and storage to process state.	Sampling, test duration, hold limit and batch state are defined.

Preflight check

CHECK	Confirm the correct project, branch and controlled version
CHECK	Verify units, provenance and permissions
CHECK	Save a restore point before a decision-relevant change
CHECK	Keep blocking gaps visible

Workflow

01

Create operations

Translate flowsheet units into tasks with duration, precedence and batch.

VISIBLE RESULT: Each relevant unit has an executable task.

02

Assign resources

Attach equipment, room, personnel, utility and QC as finite resources.

VISIBLE RESULT: Each task shows all simultaneous requirements.

03

Model reuse and cleaning

Insert transfer, CIP/SIP, setup and release after production.

VISIBLE RESULT: The equipment state machine moves through dirty, cleaning, ready and running.

04

Plan campaigns

Schedule starts, parallel trains, product switches and maintenance.

VISIBLE RESULT: Gantt and WIP show a conflict-free sequence.

05

Optimise

Choose throughput, tardiness, WIP or cost and lock constraints.

VISIBLE RESULT: The plan improves the objective without hard violations.

06

Test robustness

Simulate duration, failure and release scenarios.

VISIBLE RESULT: Buffers, bottleneck and service level remain visible.

Review the result

CRITERION	PASS CONDITION	IF IT FAILS
Scope and structure	The documented criterion is satisfied and supported by traceable evidence.	Correct the model or keep the output Not decision-ready.
Units and balances	The documented criterion is satisfied and supported by traceable evidence.	Correct the model or keep the output Not decision-ready.
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APPLICABILITY LIMIT

A schedule is only as reliable as duration distributions, calendars, cleaning, release and failure data.

Troubleshooting

OBSERVATION	LIKELY CAUSE	CORRECTION
The result looks plausible but cannot be explained	Inputs, units, model version or evidence are missing.	Open the relevant register, restore traceability and rerun.
A change affects unexpected outputs	Dependencies or imported mappings were not reviewed.	Inspect the change plan and before/after diff; undo if required.
The module appears complete but readiness is low	Required industrial evidence is still missing.	Assign the visible gaps and keep maturity at Screening or Not decision-ready.

Controlled handover

ARTIFACT	RECIPIENT	MUST CONTAIN
Module result package	Engineering reviewer	Inputs, calculations, results, units, intervals, maturity
Readiness register	Model owner	Gap, required work, owner, due date, intended use
Controlled version	Project team	Branch, version, change note, reviewer and restore point

Completion check

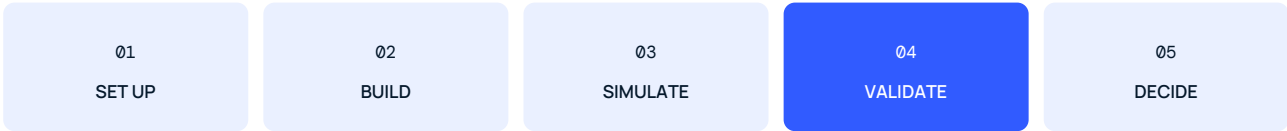
CHECK	The active project, branch, version and intended use are visible.
CHECK	Inputs carry units, provenance, review state and uncertainty where relevant.
CHECK	Blocking model, physical, numerical and evidence gaps are closed or assigned.
CHECK	The result maturity matches the available evidence.
CHECK	The output package opens correctly and includes its limitations.

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Data ingestion, sources and API integrations

Capture, map, review and apply company data under control



ENGINEERING DECISION	PATH IN ACATIAN
Which external data may replace which model assumption, and how does every change remain traceable?	Validate > Data & sources / API connectors
PRIMARY USERS	PERMITTED MATURITY
Data Engineering, Process Development, MSAT, IT/OT, Reviewer	Data ingestion alone never raises maturity; technical review and model validation remain required

START WITH THE DECISION

Acatian converts CSV, TSV, JSON and registered connectors into a governed data inventory. Accepted changes retain source, unit, timestamp, reviewer, mapping and rollback version.

Expected artifacts

ARTIFACT	RECIPIENT
Module result package	Engineering reviewer
Readiness register	Model owner
Controlled version	Project team

Prepare the model

INPUT	WHY IT MATTERS	READY WHEN
Files and endpoints	Provide historian, MES, LIMS, batch, supplier, TEA/LCA or schedule data.	Owner, period, format and usage right are confirmed.
Schema and tag map	Maps external fields to model variables.	Tag, unit, type, frequency and target are defined.
Quality rules	Detect missing data, outliers, unit and time errors.	Acceptance limits and error handling are set.
Provenance	Supports audit and reproduction.	Source, import time, hash, reviewer and transformations are stored.
Permissions	Restricts data access and writes.	Least privilege, organisation and project boundary are reviewed.

Preflight check

CHECK	Confirm the correct project, branch and controlled version
CHECK	Verify units, provenance and permissions
CHECK	Save a restore point before a decision-relevant change
CHECK	Keep blocking gaps visible

Workflow

01

Register data

Upload files in bulk or add a connector and classify the data type.

VISIBLE RESULT: Registry shows owner, type, period and state.

02

Detect schema

Detect columns, types, time axis, units and IDs.

VISIBLE RESULT: A mapping proposal is visible but not applied.

03

Inspect quality

Review completeness, plausibility, duplicates, outliers and coverage.

VISIBLE RESULT: A quality score and actionable error list are produced.

04

Map fields

Map only reviewed fields to parameters, states, streams, schedule or LCA.

VISIBLE RESULT: Every mapping shows source, transformation and target.

05

Review change plan

Read before/after, affected modules and recalculation order.

VISIBLE RESULT: No hidden or unitless change remains.

06

Apply and recalculate

Apply accepted values transactionally and refresh affected views.

VISIBLE RESULT: Version, audit entry and new results are visible.

07

Test rollback

Restore the previous version in a separate test.

VISIBLE RESULT: The original state is reproducible.

Review the result

CRITERION	PASS CONDITION	IF IT FAILS
Scope and structure	The documented criterion is satisfied and supported by traceable evidence.	Correct the model or keep the output Not decision-ready.
Units and balances	The documented criterion is satisfied and supported by traceable evidence.	Correct the model or keep the output Not decision-ready.
Evidence and uncertainty	The documented criterion is satisfied and supported by traceable evidence.	Correct the model or keep the output Not decision-ready.
Reproducibility	The documented criterion is satisfied and supported by traceable evidence.	Correct the model or keep the output Not decision-ready.
Review state	The documented criterion is satisfied and supported by traceable evidence.	Correct the model or keep the output Not decision-ready.

APPLICABILITY LIMIT

A successful connection or clean dataset does not prove model accuracy. Technical review and validation remain required.

Troubleshooting

OBSERVATION	LIKELY CAUSE	CORRECTION
The result looks plausible but cannot be explained	Inputs, units, model version or evidence are missing.	Open the relevant register, restore traceability and rerun.
A change affects unexpected outputs	Dependencies or imported mappings were not reviewed.	Inspect the change plan and before/after diff; undo if required.
The module appears complete but readiness is low	Required industrial evidence is still missing.	Assign the visible gaps and keep maturity at Screening or Not decision-ready.

Controlled handover

ARTIFACT	RECIPIENT	MUST CONTAIN
Module result package	Engineering reviewer	Inputs, calculations, results, units, intervals, maturity
Readiness register	Model owner	Gap, required work, owner, due date, intended use
Controlled version	Project team	Branch, version, change note, reviewer and restore point

Completion check

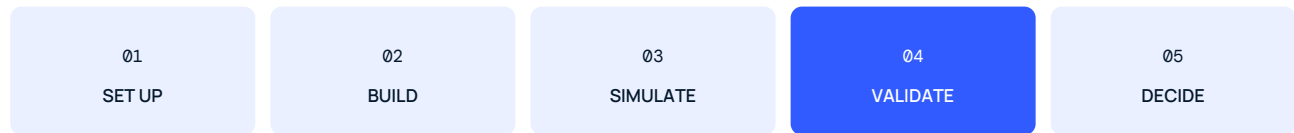
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Physical boundaries, standards and model validation

Turn a calculated result into a traceable engineering statement



ENGINEERING DECISION	PATH IN ACATIAN
Is the result sufficiently supported for its intended use, and which gaps block the decision?	Validate > Boundaries + AI / Standards / Readiness / Engineering review

PRIMARY USERS	PERMITTED MATURITY
Model Owner, Reviewer, QA, Process Safety, MSAT, Regulatory	Screening, Calibrated, Validated or Not decision-ready - always evidence based

START WITH THE DECISION

Validation connects intended use, data, equations, numerics, physical boundaries, comparison evidence and approval. Acatian exposes the state but does not replace technical or regulatory approval.

Expected artifacts

ARTIFACT	RECIPIENT
Module result package	Engineering reviewer
Readiness register	Model owner
Controlled version	Project team

Prepare the model

INPUT	WHY IT MATTERS	READY WHEN
Intended use	Defines acceptance criteria and required evidence.	Decision, population, scale and risk are explicit.
Physical boundaries	Limits working volume, oxygen, temperature, shear, ammonium and lactate.	Boundary, unit, source, action and range are documented.
Validation dataset	Tests prediction outside calibration.	An independent dataset and comparison plan exist.
Standards and requirements	Connects engineering, GMP, safety and project requirements.	Applicability, version, owner and evidence are recorded.
Approval roles	Establishes independent review and controlled approval.	Author, reviewer and approver are separated.

Preflight check

CHECK	Confirm the correct project, branch and controlled version
CHECK	Verify units, provenance and permissions
CHECK	Save a restore point before a decision-relevant change
CHECK	Keep blocking gaps visible

Workflow

01

Define validation plan

Document intended use, risk, datasets, metrics and tolerances.

VISIBLE RESULT: The plan is versioned before results are inspected.

02

Verify numerics

Assess closure, solver, convergence, discretisation and reproducibility.

VISIBLE RESULT: Numerical health has no unexplained blocker.

03

Verify physics

Evaluate process, equipment and quality bounds against trajectories.

VISIBLE RESULT: Violations include time, magnitude and action.

04

Compare data

Compare prediction and measurement with residuals, bias and intervals.

VISIBLE RESULT: Pass/fail is traceable for every criterion.

05

Map standards

Map applicable requirements to model, data, operation and documents.

VISIBLE RESULT: The matrix shows evidence or gap.

06

Set maturity

Select Screening, Calibrated, Validated or Not decision-ready by evidence gates.

VISIBLE RESULT: State, rationale, reviewer and date are stored.

07

Approve or reject

Close findings and sign a controlled version.

VISIBLE RESULT: Audit trail and residual uncertainty are complete.

Review the result

CRITERION	PASS CONDITION	IF IT FAILS
Scope and structure	The documented criterion is satisfied and supported by traceable evidence.	Correct the model or keep the output Not decision-ready.
Units and balances	The documented criterion is satisfied and supported by traceable evidence.	Correct the model or keep the output Not decision-ready.
Evidence and uncertainty	The documented criterion is satisfied and supported by traceable evidence.	Correct the model or keep the output Not decision-ready.
Reproducibility	The documented criterion is satisfied and supported by traceable evidence.	Correct the model or keep the output Not decision-ready.
Review state	The documented criterion is satisfied and supported by traceable evidence.	Correct the model or keep the output Not decision-ready.

APPLICABILITY LIMIT

Acatian organises evidence and tests; qualified people and approved company processes own regulated, safety and investment approval.

Troubleshooting

OBSERVATION	LIKELY CAUSE	CORRECTION
The result looks plausible but cannot be explained	Inputs, units, model version or evidence are missing.	Open the relevant register, restore traceability and rerun.
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Controlled handover

ARTIFACT	RECIPIENT	MUST CONTAIN
Module result package	Engineering reviewer	Inputs, calculations, results, units, intervals, maturity
Readiness register	Model owner	Gap, required work, owner, due date, intended use
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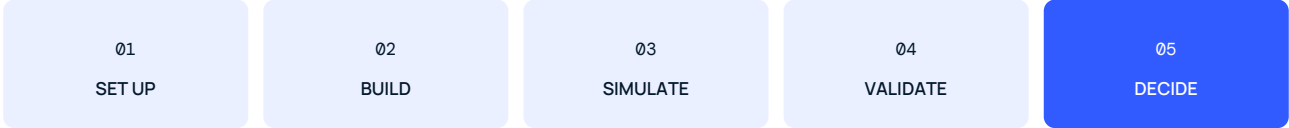
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TEA, LCA, uncertainty and sensitivity

Derive cost and environmental impact from one controlled process basis



ENGINEERING DECISION	PATH IN ACATIAN
Which process option is economically and environmentally preferable, under which assumptions and uncertainty?	Decide > Economics / LCA / Sensitivity

PRIMARY USERS	PERMITTED MATURITY
TEA, LCA, Strategy, Process Engineering, Investment Review	Screening with proxies; Calibrated with supplier/site data; Validated after methodological and technical review

START WITH THE DECISION

TEA and LCA must use the same product quantity, yield, time basis and system boundary. Acatian traces flows, costs, factors, allocation, uncertainty and sensitivity to source.

Expected artifacts

ARTIFACT	RECIPIENT
Module result package	Engineering reviewer
Readiness register	Model owner
Controlled version	Project team

Prepare the model

INPUT	WHY IT MATTERS	READY WHEN
Functional unit	Creates one denominator for all scenarios.	Product, quality, quantity, location and period are defined.
LCI and material flows	Covers media, buffer, energy, water, waste and transport.	Flow, unit, stage, geography and source exist.
Cost basis	Covers media, consumables, labour, utilities, waste, equipment and facility.	Price date, currency, region, range and source are documented.
Equipment and CAPEX	Links size, count, installation and scaling.	Quote/correlation, index, basis and life are set.
Allocation and cut-off	Controls co-products, recycle and excluded flows.	Method, rationale and sensitivity are documented.
Uncertainty	Prevents false precision.	Min/mode/max or distribution and correlations are set.

Preflight check

CHECK	Confirm the correct project, branch and controlled version
CHECK	Verify units, provenance and permissions
CHECK	Save a restore point before a decision-relevant change
CHECK	Keep blocking gaps visible

Workflow

01

Set goal and scope

Define decision, audience, boundary, FU, allocation and impact method.

VISIBLE RESULT: The study header is complete.

02

Build inventory

Classify boundary streams, utilities, cleaning, transport and waste.

VISIBLE RESULT: LCI contains external exchanges and explicit lifecycle stages.

03

Calculate cost

Calculate variable/fixed OPEX, CAPEX, working capital and output basis.

VISIBLE RESULT: Cost stack and cost/kg close to the same production amount.

04

Calculate impacts

Apply factors to quality-reviewed exchanges.

VISIBLE RESULT: LCIA shows category, unit, stage and contributor.

05

Run uncertainty

Run Monte Carlo with documented distributions and seeds.

VISIBLE RESULT: Median, P5/P95 and stability are visible.

06

Assess sensitivity

Compare key drivers and scenarios.

VISIBLE RESULT: Driver ranking explains the decision and actions.

07

Interpret and export

Document hotspots, trade-offs, limitations and gaps.

VISIBLE RESULT: The complete package is reviewable and opens correctly.

Review the result

CRITERION	PASS CONDITION	IF IT FAILS
Scope and structure	The documented criterion is satisfied and supported by traceable evidence.	Correct the model or keep the output Not decision-ready.
Units and balances	The documented criterion is satisfied and supported by traceable evidence.	Correct the model or keep the output Not decision-ready.
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Review state	The documented criterion is satisfied and supported by traceable evidence.	Correct the model or keep the output Not decision-ready.

APPLICABILITY LIMIT

Database factors and price proxies are screening data until region, technology, year and supply chain are reviewed.

Troubleshooting

OBSERVATION	LIKELY CAUSE	CORRECTION
The result looks plausible but cannot be explained	Inputs, units, model version or evidence are missing.	Open the relevant register, restore traceability and rerun.
A change affects unexpected outputs	Dependencies or imported mappings were not reviewed.	Inspect the change plan and before/after diff; undo if required.
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Controlled handover

ARTIFACT	RECIPIENT	MUST CONTAIN
Module result package	Engineering reviewer	Inputs, calculations, results, units, intervals, maturity
Readiness register	Model owner	Gap, required work, owner, due date, intended use
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Completion check

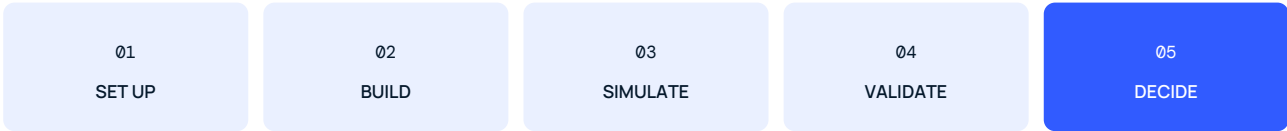
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Versions, branches, collaboration and approval

Develop, compare, review and restore alternatives traceably



ENGINEERING DECISION	PATH IN ACATIAN
Which change was approved by whom, why and with which technical impact?	Projects + versions > Branches / Versions / Collaborators / Review

PRIMARY USERS	PERMITTED MATURITY
All editors, Model Owner, Reviewer, Approver, Project Lead	Keep branch status separate from model maturity; a merge is not technical validation

START WITH THE DECISION

Acatian uses a Git-like model history. Baselines remain protected, alternatives live in branches, diffs expose structural and KPI impact, and approvals capture author, reviewer and residual uncertainty.

Expected artifacts

ARTIFACT	RECIPIENT
Module result package	Engineering reviewer
Readiness register	Model owner
Controlled version	Project team

Prepare the model

INPUT	WHY IT MATTERS	READY WHEN
Baseline	Defines the controlled starting state.	Version, scope, maturity and approval are fixed.
Change request	States objective, scope and risk.	Owner, affected modules and acceptance criteria are defined.
Branch	Isolates alternatives and parallel work.	Name, base version, owner and purpose are unique.
Review roles	Prevents self-approval for critical changes.	Author, reviewer and approver are separated.
Diff basis	Compares model structure and results, not only text.	Parameters, units, streams, equations, KPIs and evidence are included.

Preflight check

CHECK	Confirm the correct project, branch and controlled version
CHECK	Verify units, provenance and permissions
CHECK	Save a restore point before a decision-relevant change
CHECK	Keep blocking gaps visible

Workflow

01

Create branch

Create a named alternative from the approved baseline.

VISIBLE RESULT: Branch shows base commit, owner and purpose.

02

Make the change

Edit only the change scope and version intermediate work.

VISIBLE RESULT: Audit trail lists structured operations.

03

Inspect before/after

Compare flowsheet, parameters, data, equations, schedule and results.

VISIBLE RESULT: The diff explains change and impact.

04

Request review

Invite a reviewer with context, criteria and open findings.

VISIBLE RESULT: Review state and comments are linked to the model.

05

Close findings

Document correction, rationale or accepted residual risk.

VISIBLE RESULT: No blocking finding remains unanswered.

06

Merge and approve

Merge the reviewed branch and create a controlled version.

VISIBLE RESULT: Approval includes author, reviewer, date, maturity and restore point.

07

Test restore

Open the previous version in a test context.

VISIBLE RESULT: Model and artifacts are reproducible.

Review the result

CRITERION	PASS CONDITION	IF IT FAILS
Scope and structure	The documented criterion is satisfied and supported by traceable evidence.	Correct the model or keep the output Not decision-ready.
Units and balances	The documented criterion is satisfied and supported by traceable evidence.	Correct the model or keep the output Not decision-ready.
Evidence and uncertainty	The documented criterion is satisfied and supported by traceable evidence.	Correct the model or keep the output Not decision-ready.
Reproducibility	The documented criterion is satisfied and supported by traceable evidence.	Correct the model or keep the output Not decision-ready.
Review state	The documented criterion is satisfied and supported by traceable evidence.	Correct the model or keep the output Not decision-ready.

APPLICABILITY LIMIT

Versioning makes changes traceable, not automatically correct. Merge does not replace validation or QMS signatures.

Troubleshooting

OBSERVATION	LIKELY CAUSE	CORRECTION
The result looks plausible but cannot be explained	Inputs, units, model version or evidence are missing.	Open the relevant register, restore traceability and rerun.
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Controlled handover

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Module result package	Engineering reviewer	Inputs, calculations, results, units, intervals, maturity
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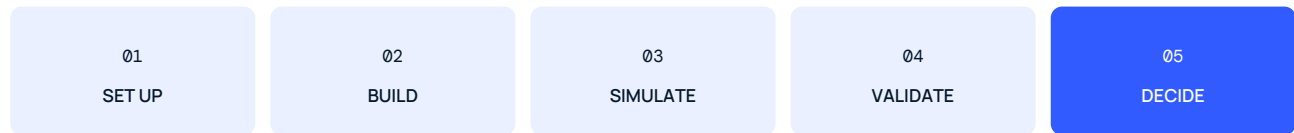
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Reports, downloads, APIs and engineering handover

Hand over complete, readable and reproducible engineering results



ENGINEERING DECISION	PATH IN ACATIAN
Can a third party understand the claim, evidence basis, model version and limitations without hidden knowledge?	Decide > Reports & downloads / API export

PRIMARY USERS	PERMITTED MATURITY
Engineering, TEA/LCA, QA, customers, suppliers, management, data teams	Every export inherits model maturity; file format never increases validity

START WITH THE DECISION

A complete handover is more than headline KPIs. Acatian exports long-form tables, visuals, process graph, inputs, equations, uncertainty, readiness, version and manifest together.

Expected artifacts

ARTIFACT	RECIPIENT
Module result package	Engineering reviewer
Readiness register	Model owner
Controlled version	Project team

Prepare the model

INPUT	WHY IT MATTERS	READY WHEN
Controlled version	Fixes the state behind each artifact.	Project, branch, version, run ID and maturity are known.
Output scope	Defines recipient and required detail.	Review question and formats are selected.
Units and metadata	Prevents unusable tables.	Unit, basis, interval, source and time context are included.
Confidentiality	Restricts confidential data sharing.	Classification, recipient and redaction are reviewed.
Integrity	Supports verification and restore.	Manifest, checksums and model snapshot exist.

Preflight check

CHECK	Confirm the correct project, branch and controlled version
CHECK	Verify units, provenance and permissions
CHECK	Save a restore point before a decision-relevant change
CHECK	Keep blocking gaps visible

Workflow

01

Define recipient

Set engineering, TEA/LCA, QA, supplier or management and their question.

VISIBLE RESULT: The output set matches the user task.

02

Choose package

Select complete package or targeted XLSX/CSV/PDF/SVG/JSON/API artifacts.

VISIBLE RESULT: The list shows content, rows/sheets and version.

03

Generate export

Create the package and write the manifest.

VISIBLE RESULT: Download completes with stable filenames.

04

Open files

Test XLSX in Excel, PDF in viewer, SVG in browser and CSV delimiter.

VISIBLE RESULT: No repair warning, clipping or encoding error.

05

Inspect content

Verify cover, dictionary, units, inputs, long-form results, gaps and version.

VISIBLE RESULT: A third party can reproduce the claim.

06

Hand over and archive

Record package, approval, recipient and retention.

VISIBLE RESULT: Handover record and restore point exist.

07

Automate API

Use JSON/REST/webhook with minimal scopes and schema version.

VISIBLE RESULT: The consumer validates schema and idempotency.

Review the result

CRITERION	PASS CONDITION	IF IT FAILS
Scope and structure	The documented criterion is satisfied and supported by traceable evidence.	Correct the model or keep the output Not decision-ready.
Units and balances	The documented criterion is satisfied and supported by traceable evidence.	Correct the model or keep the output Not decision-ready.
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APPLICABILITY LIMIT

A complete export documents model state; it does not turn a screening result into a validated result.

Troubleshooting

OBSERVATION	LIKELY CAUSE	CORRECTION
The result looks plausible but cannot be explained	Inputs, units, model version or evidence are missing.	Open the relevant register, restore traceability and rerun.
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Working glossary

TERM	MEANING
Baseline	A controlled model state used as the reference for comparison or restore.
Boundary stream	An explicit material or energy path entering or leaving the modelled system.
Evidence status	The declared state of a value: measured, sourced, assumed, calculated or still missing.
Intended use	The named engineering question, user, scale, time horizon and decision that the model supports.
Maturity	The evidence-based state of a model or result, not a score based on visual completeness.
Run ID	The stable identifier that links settings, model version, results and diagnostics for one calculation.
Screening	A directional engineering result that still requires project-specific calibration or validation.
Validation	Documented evidence that a model is suitable for its stated intended use within an approved range.

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