

Enabling a credible simulation process

SSP Traceability



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presented by

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Peter Lobner



Pierre R. Mai



Status in the usage of simulation

- We do a lot of simulation,
- We have great tools,
- We have great modeling languages
- We have a lot of experience

→ **We trust our simulations**



But...

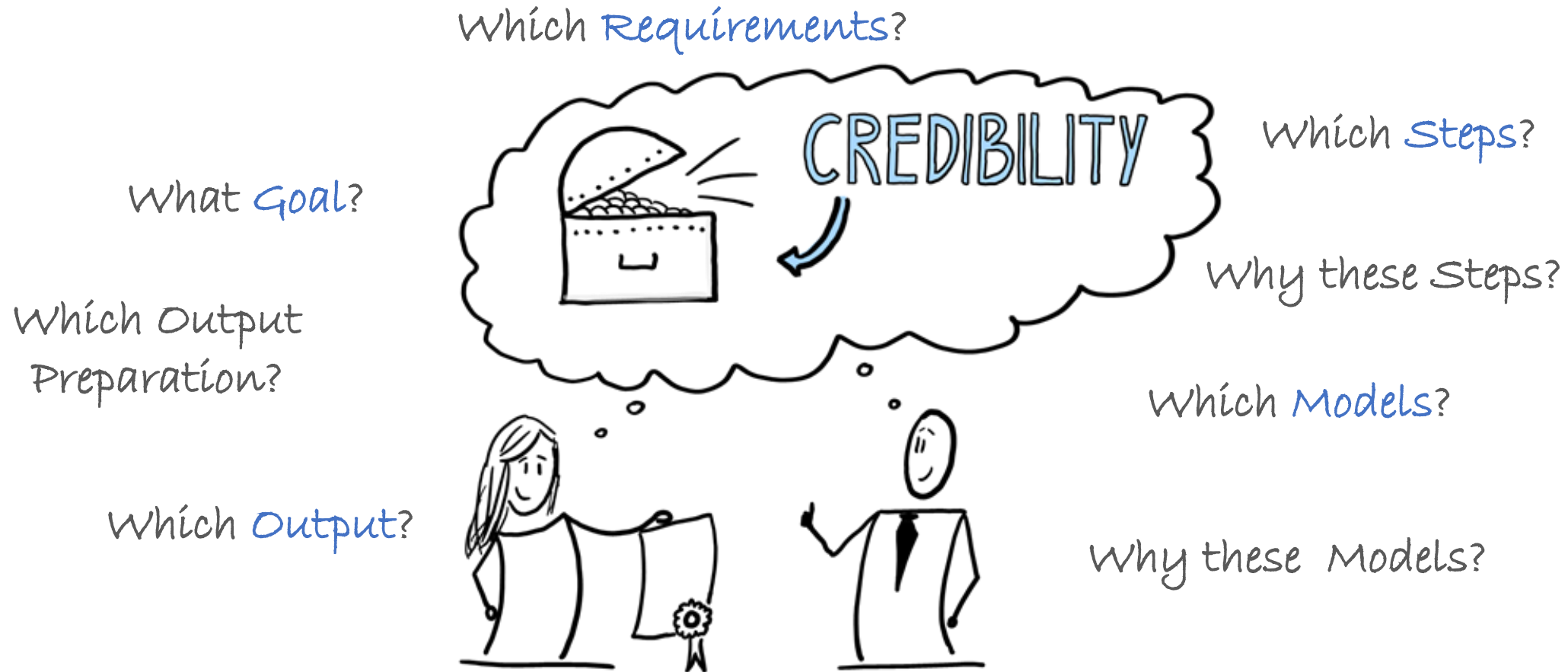
..do others trust our simulations?

- Decisions are increasingly based on the results of simulations
- Decisions have far-reaching consequences



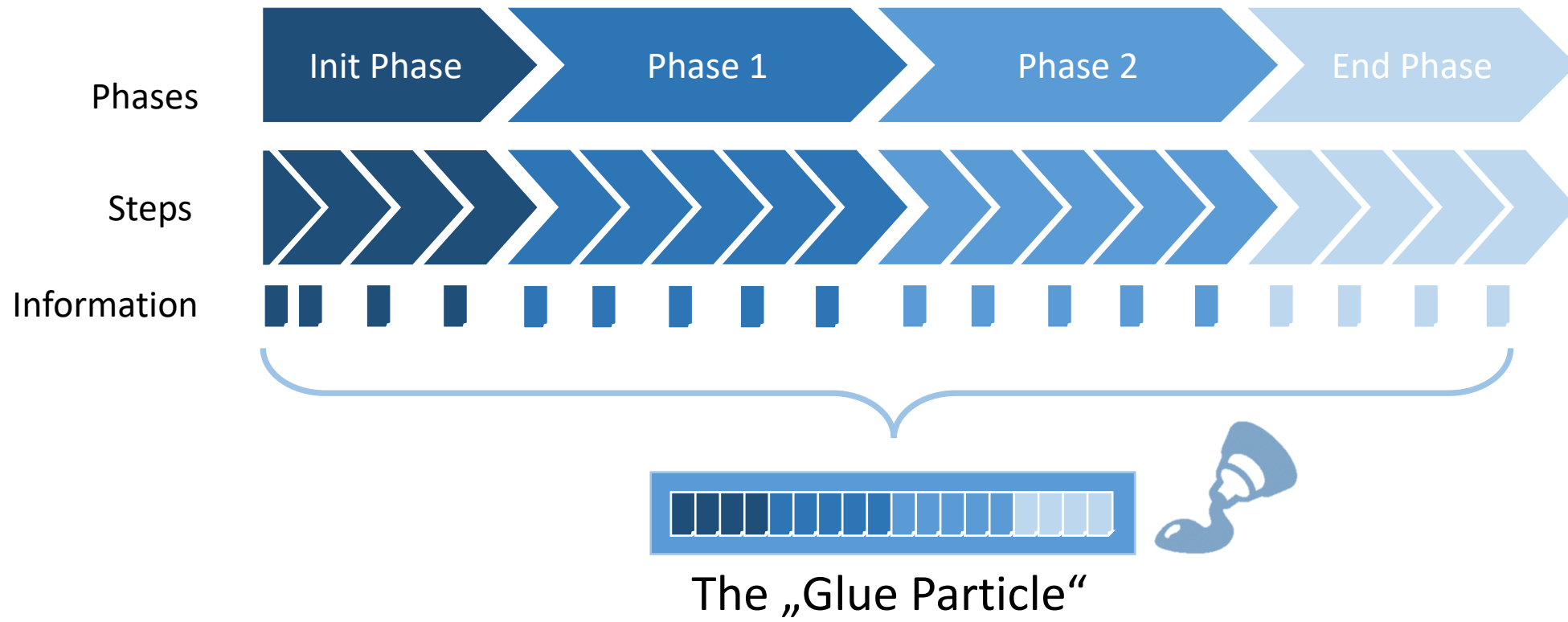
→ How do we make it possible for someone to make a decision with clear conscience based on simulation results?

By presenting simulation results in a credible way.

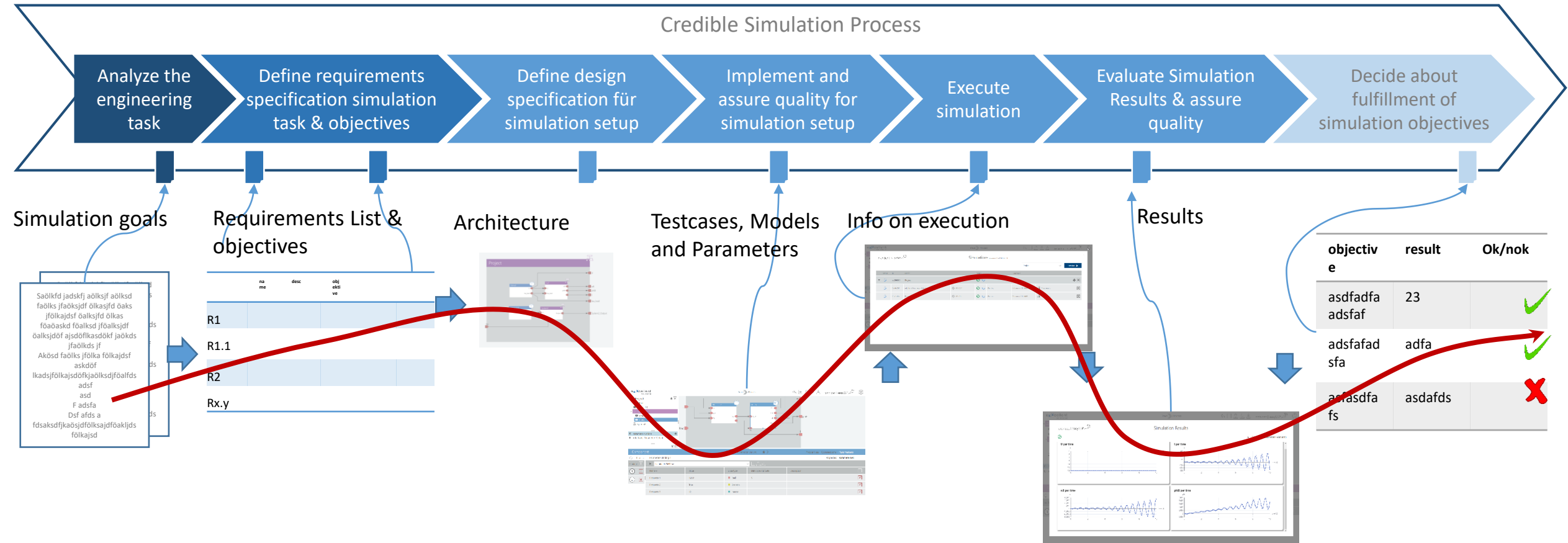


What is necessary to easily and reliably answer these questions?

2nd: Traceability as basis for Credible because of information in a uniform structure on each step, glued together to a gapless information chain



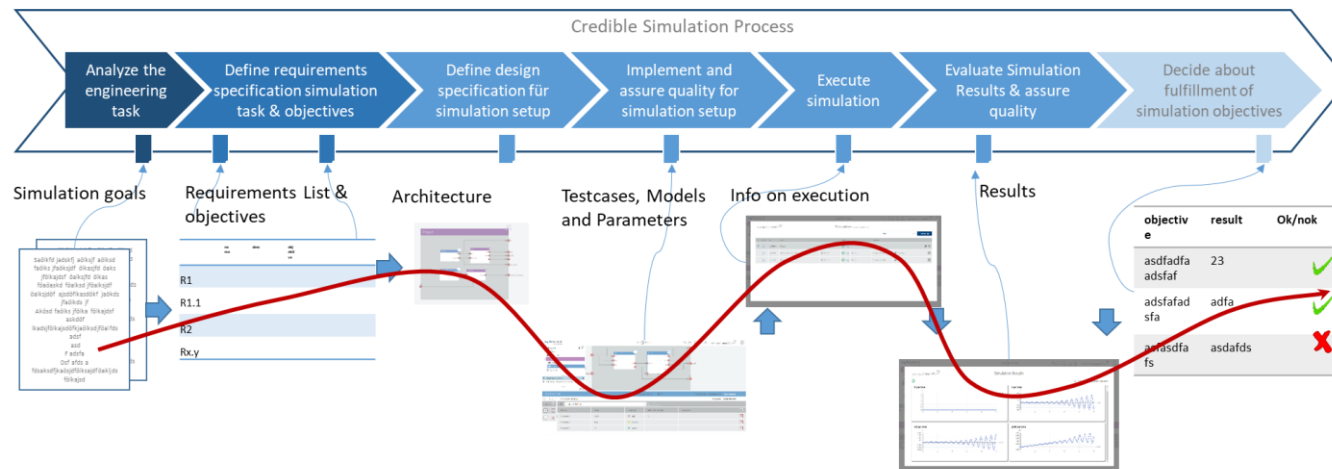
Along the process, we collect all necessary information in glue particles for credibility



SSP Traceability Specification

- Based on SSP Formats and Principles

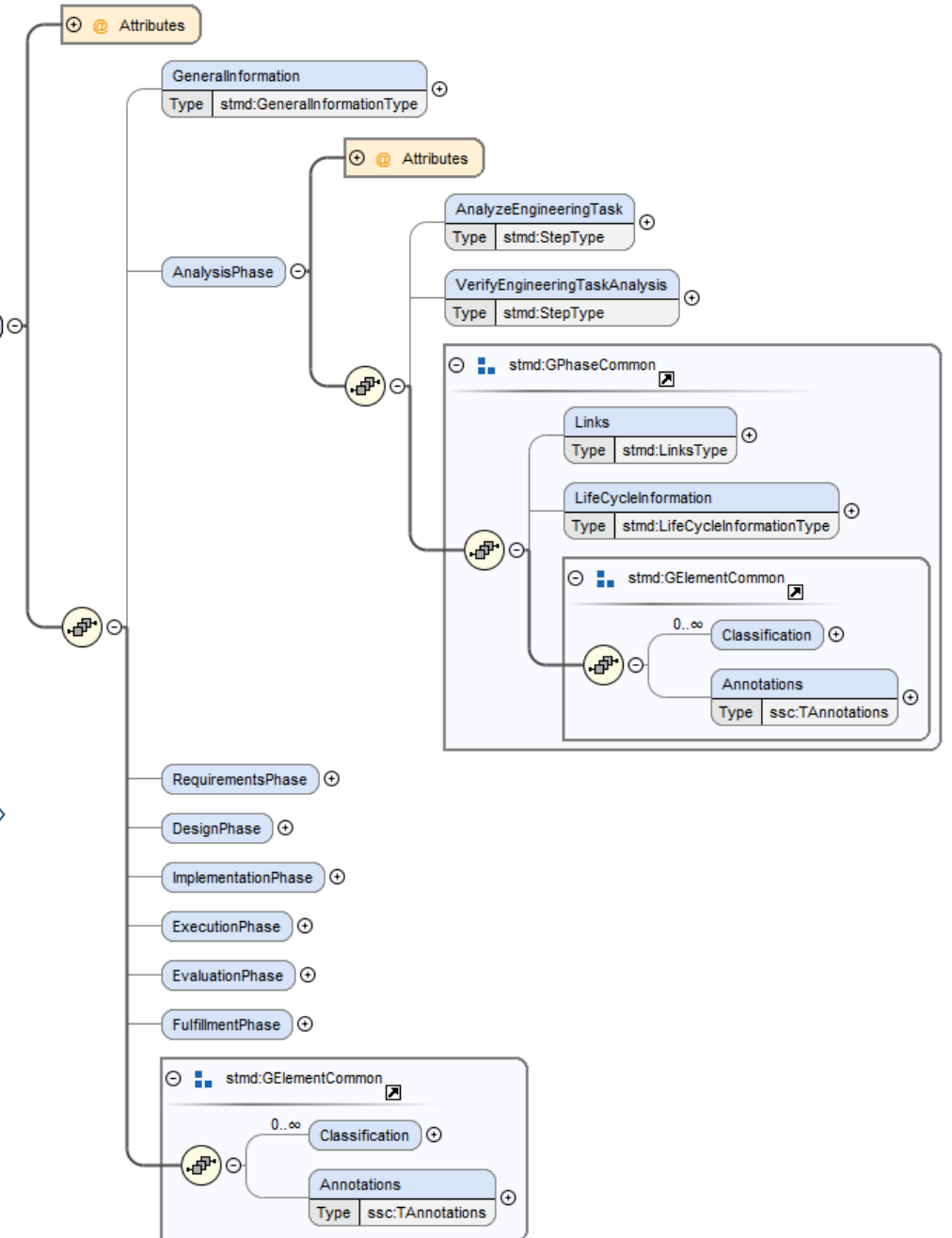
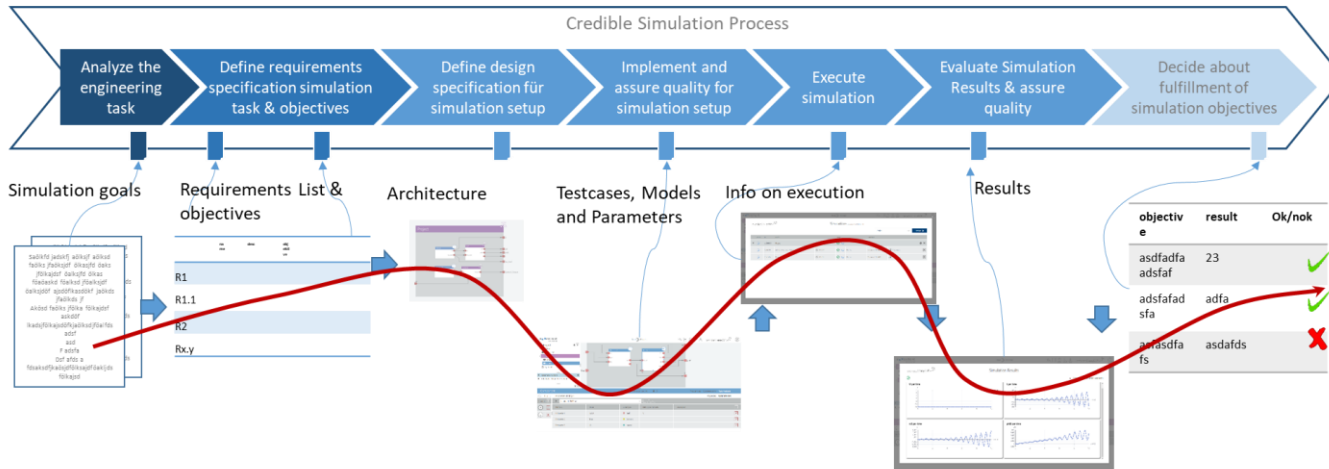
- SSP ZIP Packaging
- (Relative) URI References to Resources
- Multi-Format Support for Resources
- Common XML Schema Components
- Extensibility via Annotations
- Can devolve into pure SSP for tools without support of SSP Traceability



SSP Traceability Specification

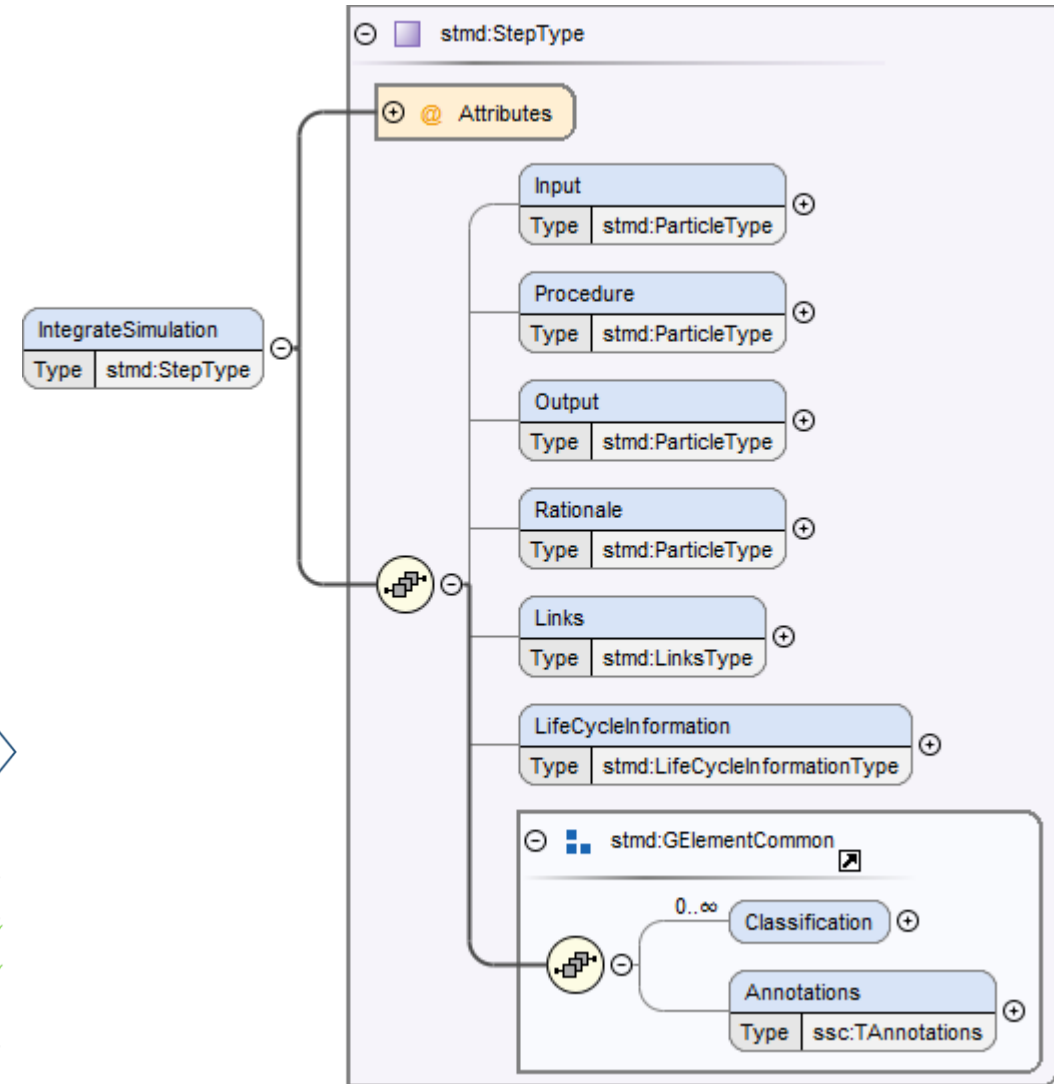
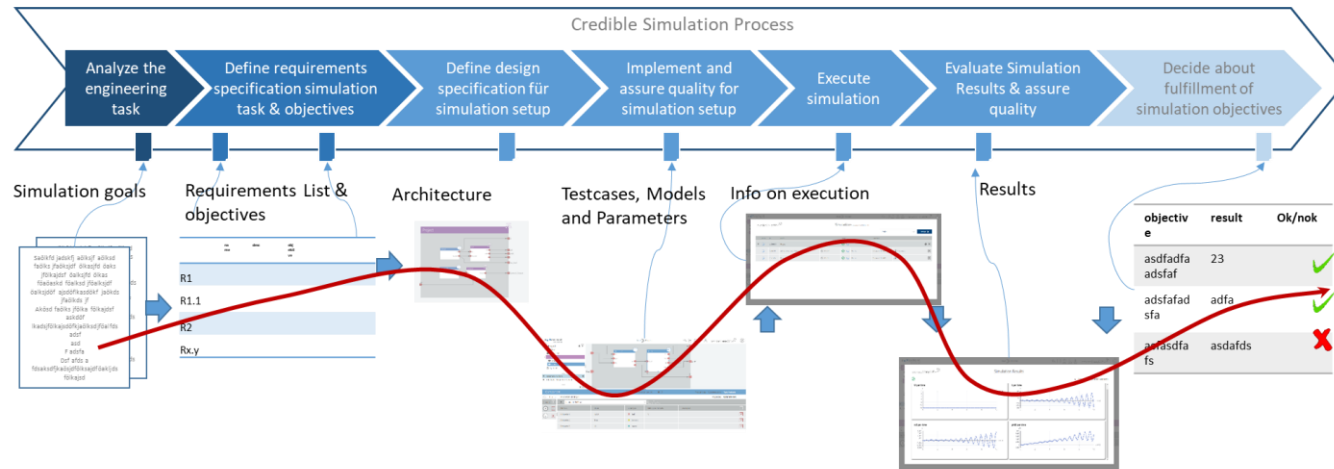
- Based on SSP Formats and Principles
- Generic Approach of Phases and Steps
- Instantiated for CSP as STMD Format

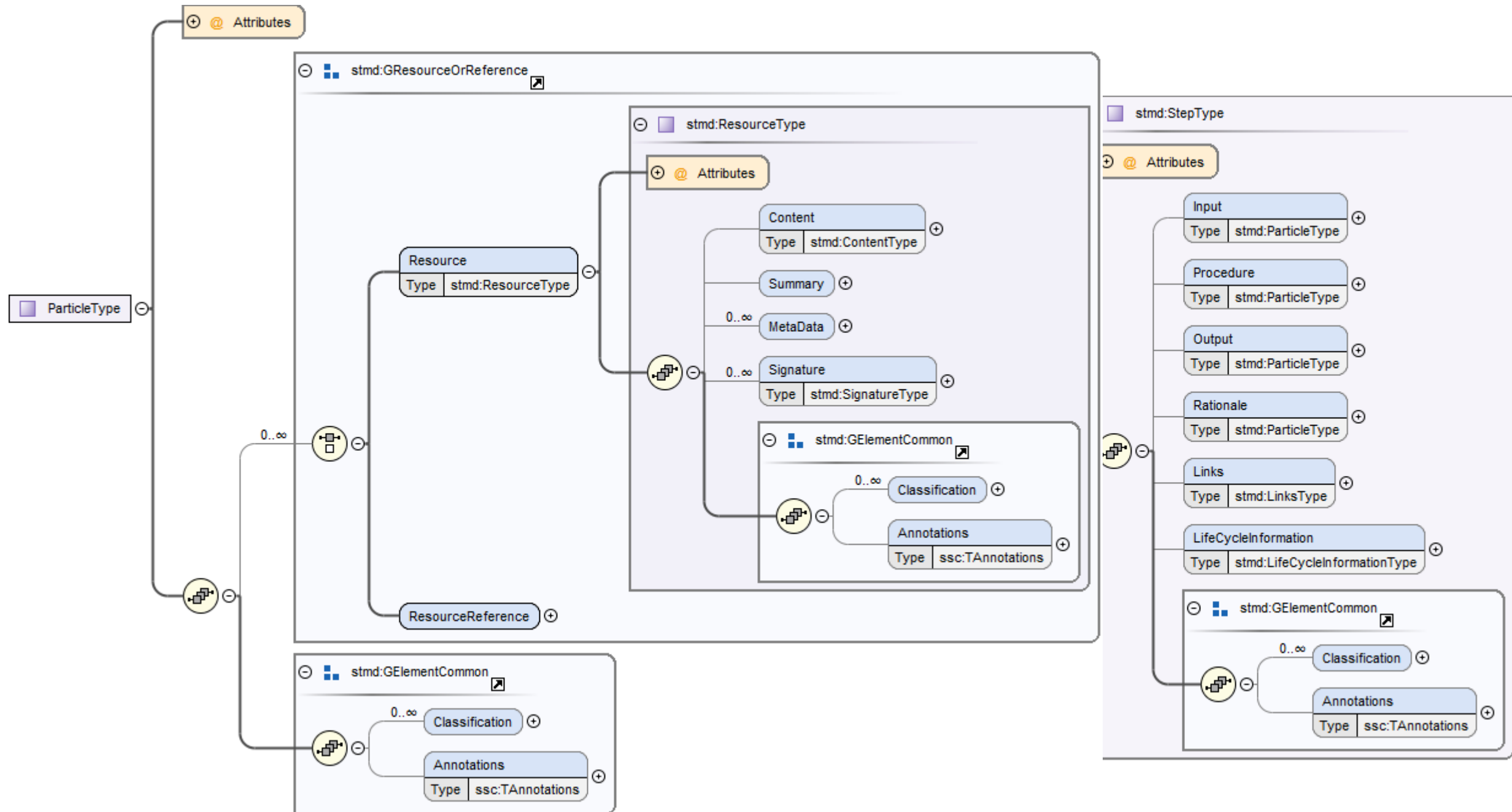
SimulationTaskMetaData



SSP Traceability Specification

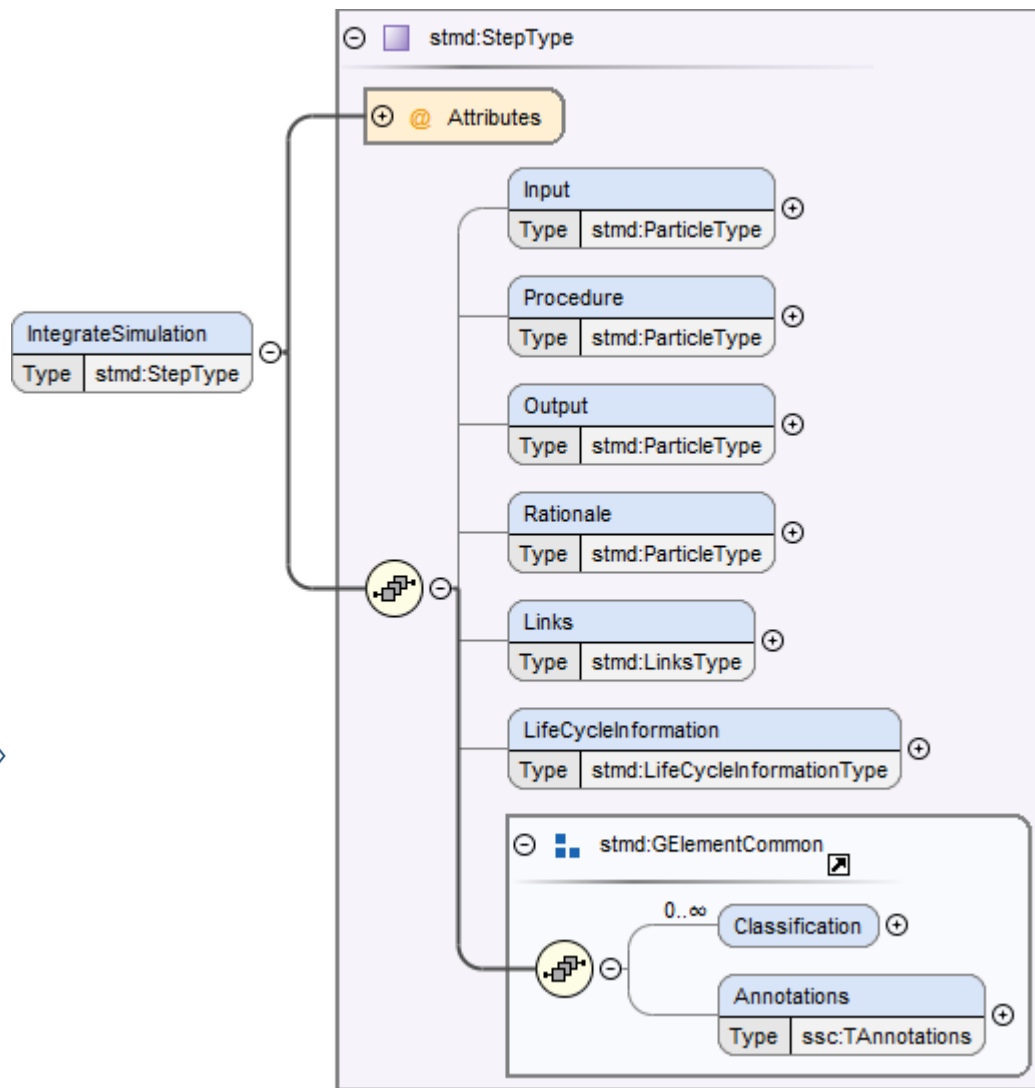
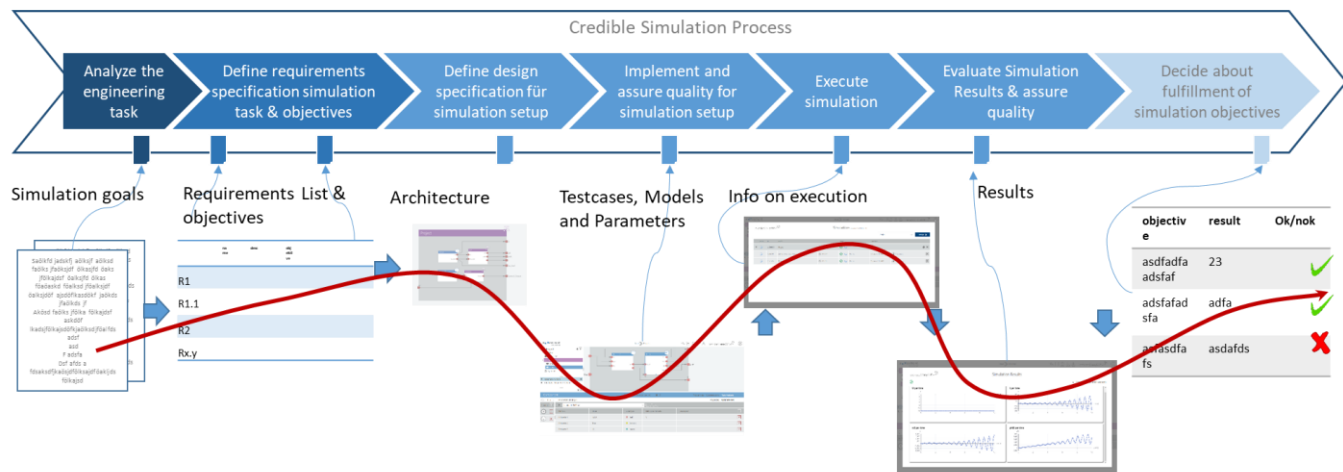
- Based on SSP Formats and Principles
- Generic Approach of Phases and Steps
- Instantiated for CSP as STMD Format
- Each Step contains Input, Procedure, Output, Rationale information, referencing Resources



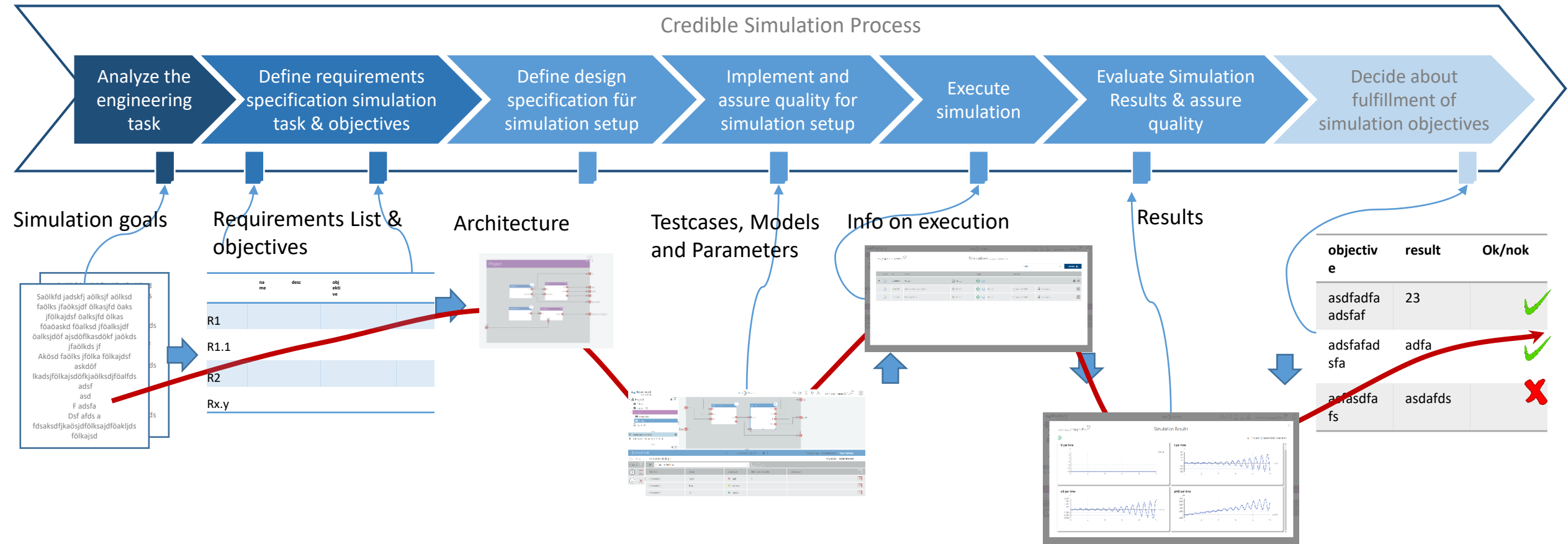


SSP Traceability Specification

- Based on SSP Formats and Principles
- Generic Approach of Phases and Steps
- Instantiated for CSP as STMD Format
- Each Step contains Input, Procedure, Output, Rationale information, referencing Resources
- Additional Linking, Life Cycle & Classification



Prototypical application of SSP Traceability across a sample process based on CSP/SSP



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SSP-Editor

orchideo | easySSP

Trace DC Motor Example

for Project

Analyze Requirements Design Implementation Execution Evaluation **Fulfillment**

Model Parameter Environment Integration Test Cases Quality Assurance **Verify**

Input Procedure Rationale Output

Available Resources

- net.pmsf.ssp.stmd/CSP-6-2-Eval-DCsource.md
- net.pmsf.ssp.stmd/CSP-6-3-Eval-DCsource.md
- net.pmsf.ssp.stmd/CSP-6-3-Eval-DCsource.md
- net.pmsf.ssp.stmd/CSP-7-Fullfill-DCsource.md
- net.pmsf.ssp.stmd/DataSheet-XY12346-MildHyb-V01.xlsx
- net.pmsf.ssp.stmd/DataSheet-XY12346-MildHyb-V01.xlsx
- net.pmsf.ssp.stmd/GP-DC-Motor-MildHybrid-2020-01.pptx
- net.pmsf.ssp.stmd/GP-DC-Motor-MildHybrid-2020-01.pptx
- net.pmsf.ssp.stmd/InOutParam-DC-MotModell.xlsx
- net.pmsf.ssp.stmd/SimulationExecutionResult-Dummy.xlsx
- Project

Input Resources

- net.pmsf.ssp.stmd/CSP-1-1-SimTask-DCsource.md
- net.pmsf.ssp.stmd/DataSheet-XY12346-MildHyb-V01.xlsx

Resource

Source: net.pmsf.ssp.stmd/DataSheet-XY12346-MildHyb-V01.xlsx

Kind: Document

Type: application/vnd.openxmlformats-officedocument.spreadsheetml.sheet

Master:

Description: Data sheet DC-Motor

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Feasibility CSP/SSP



Simulation goals

Saölkfd jadskf aölkjsf aölkisd
 faölkfs jfaölkjsfd ölkasjfd öaks
 jfölkajdsf öalksjfd ölkas
 föaöaskd föalksd jföalksjfd
 öalksjdof ajsdöfkasdoöf jaökds
 jfaölkds jf
 Akösd faölkfs jfölkfa fölkajdsf
 askdöf
 lkadsjfölkajdsdöfjaölkjsdföalfds
 adsf
 asd
 F adsf
 Dsf adfs a
 fdsaksdofjkaösjdfölkasjdföalkjsd
 fölkajds

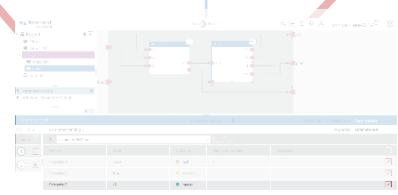
Requirements List & objectives

| no | desc | obj | edu | ve |
|------|------|-----|-----|----|
| R1 | | | | |
| R1.1 | | | | |
| R2 | | | | |
| Rx.y | | | | |

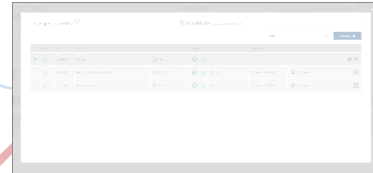
Architecture



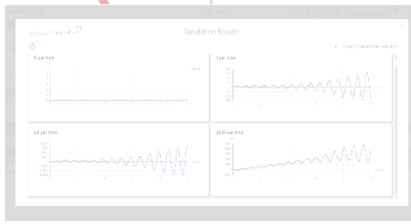
Testcases, Models and Parameters



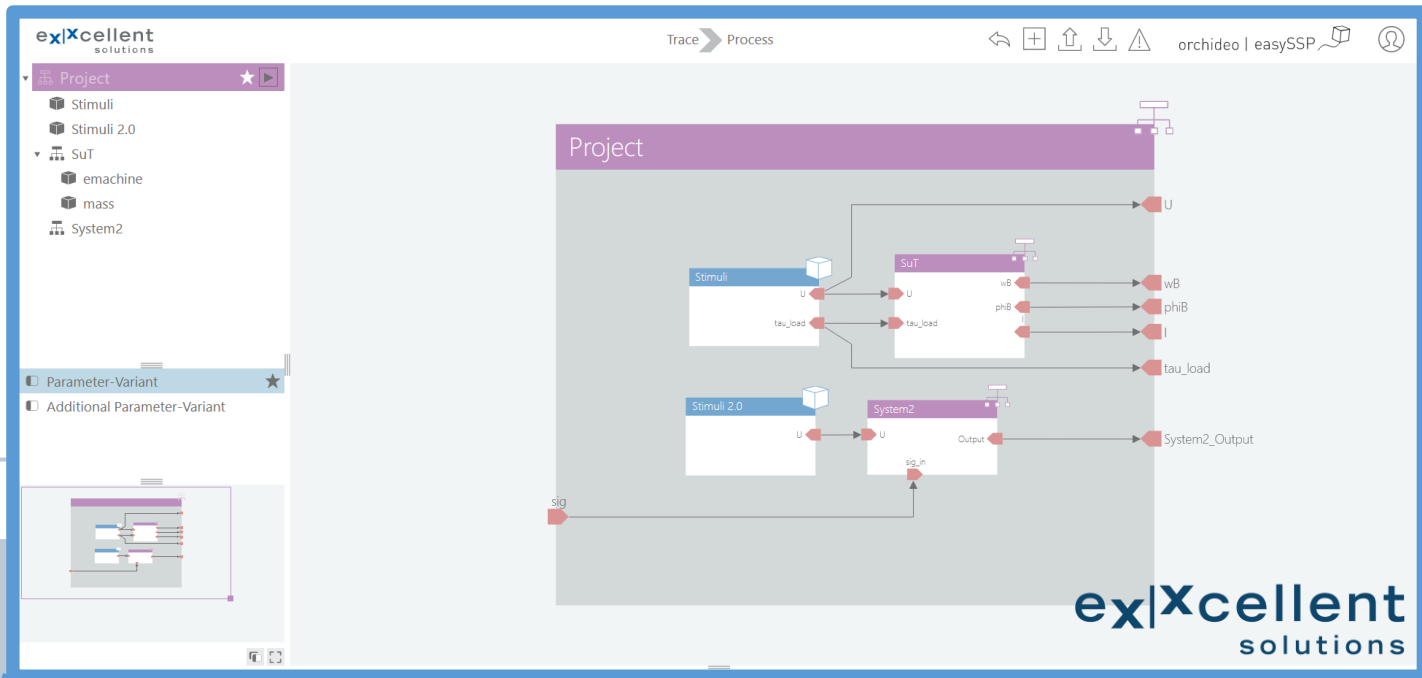
Info on execution



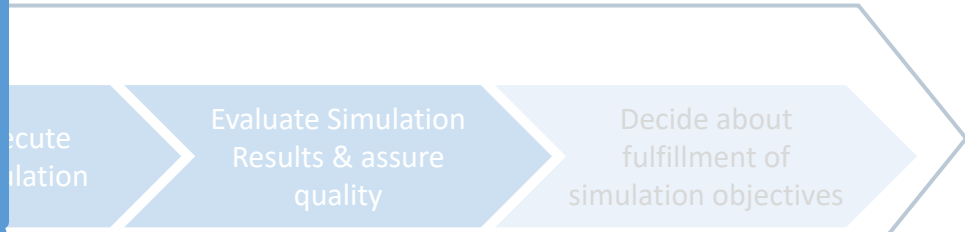
Results



| objective | result | Ok/nok |
|--------------------|---------|--------|
| asdfadfa adsfaf | 23 | ✓ |
| adsfafad sfa | adfa | ✓ |
| asasdf fs | asdafds | ✗ |



Feasibility SSP/SSP



Simulation goals

Requirements List & objectives

Architecture

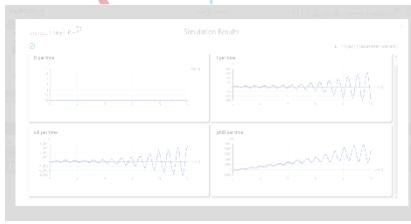
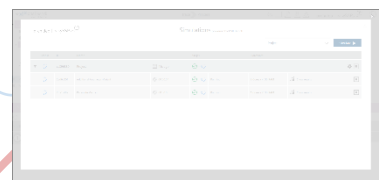
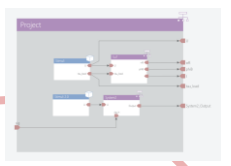
Testcases, Models and Parameters

Info on execution

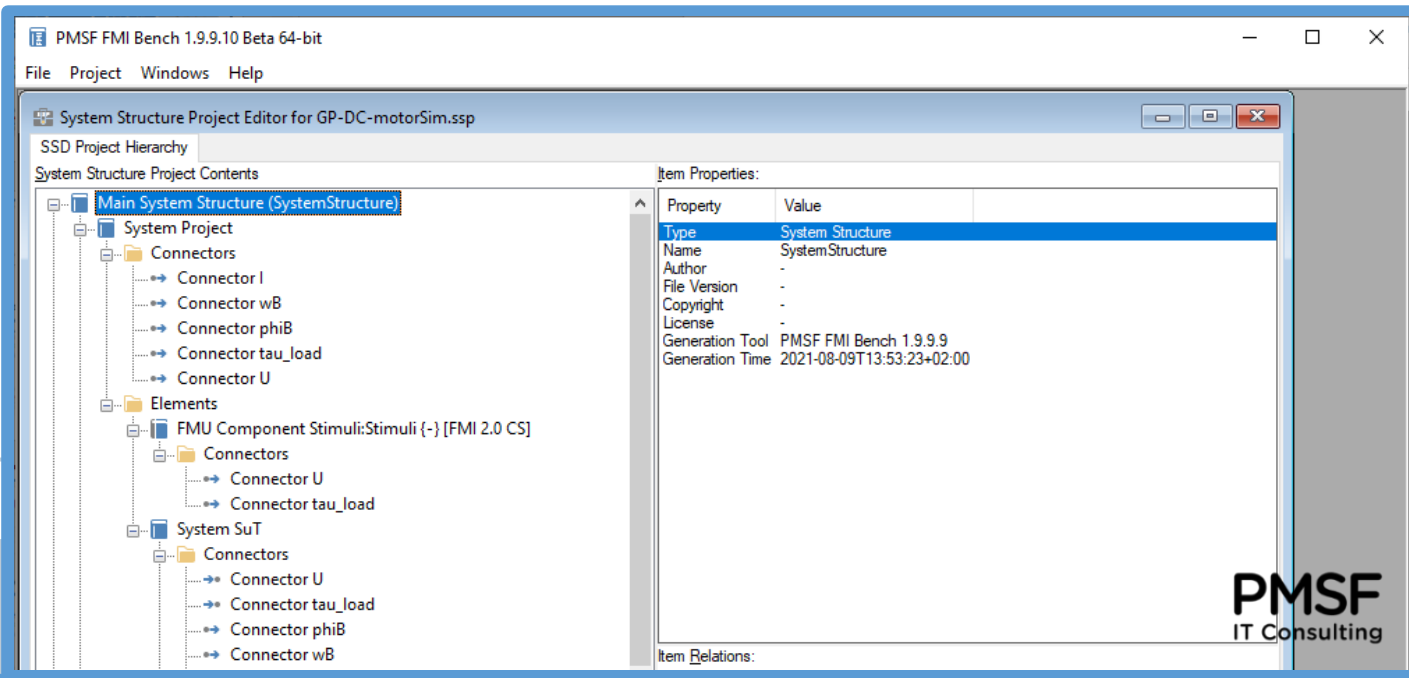
Results

Saölkfd jadsfj aölkcsjf aölkcsd
faölkcs jfaölkcsjfd ölkcsjfd öaks
jfölkajdsf öalkcsjfd ölkcs
föaöaskd föalksd jföalkcsjfd
öalkcsjfd ajsdöfkcsdökf jaökds
jfaölkcs jf
Akösd faölkcs jfölkcs jfölkcsjfd
askdöf
lkadsjfölkcsjfdöfkcsjfdöfkcsjfd
asfd
asf
F adfsa
Dsf adfs a
fdsaksd jföalkcsjfdöfkcsjfdöfkcsjfd
fölkcsjfd

| na | me | dec | obj | obj | obj |
|------|----|-----|-----|-----|-----|
| R1 | | | | | |
| R1.1 | | | | | |
| R2 | | | | | |
| Rx.y | | | | | |



| objectiv e | result | Ok/nok |
|--------------------|---------|--------|
| asdfadfa adsfaf | 23 | ✓ |
| adsfafad sfa | adfa | ✓ |
| asasdf fs | asdafds | ✗ |



Availability
SP/SSP



PMSF
IT Consulting

Simulation goals

Requirements List & objectives

Architecture

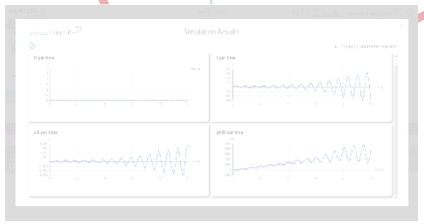
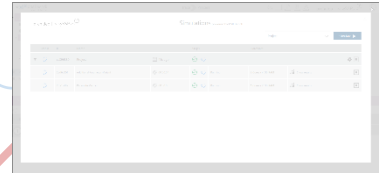
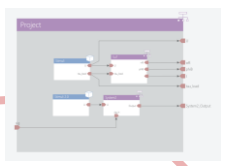
Testcases, Models and Parameters

Info on execution

Results

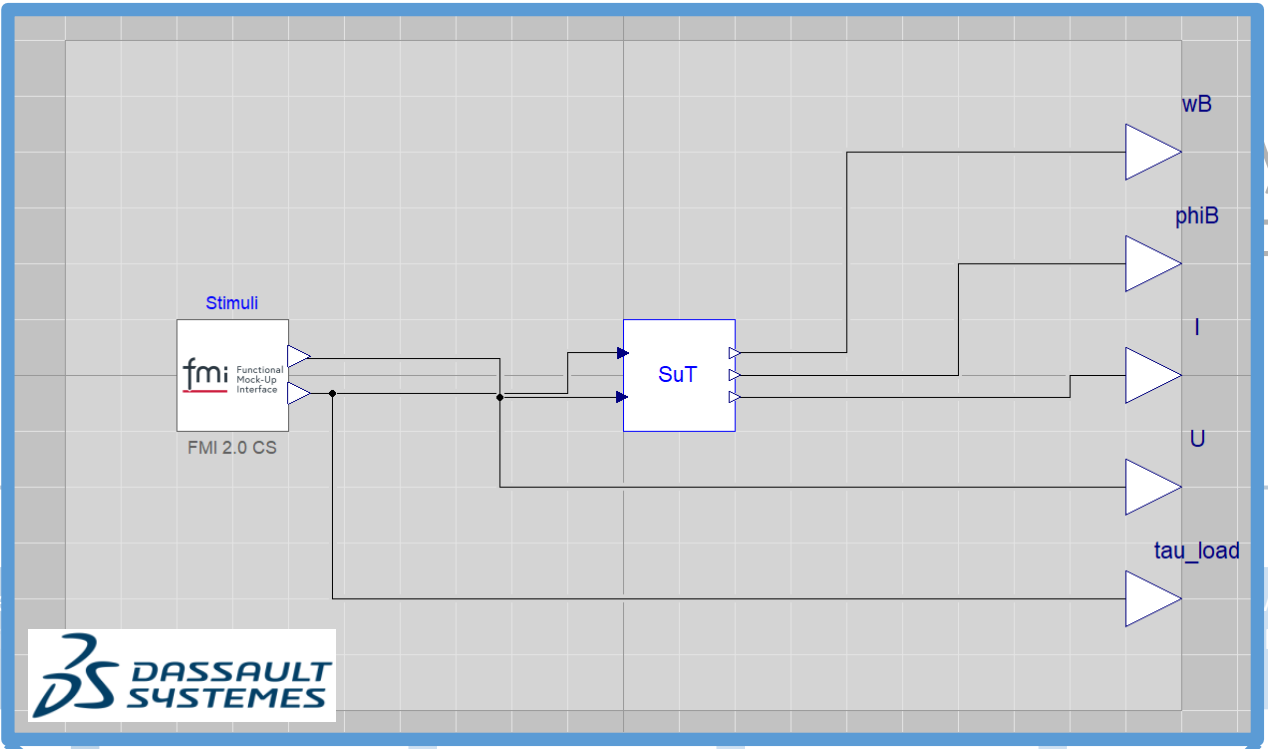
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faölkcs jfaölkcsjdf ölkcsjfd öaks
jfolkajdsf öalkcsjfd ölkcs
föaöaskd föalksd jföalkcsjfd
öalkcsjdf ajsdöfkcsdöfk jaölkcs
jfaölkcs jf
Akösd faölkcs jfölkcs jfölkcsjfd
askdöf
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Dsf adfs a
fdsaksd jfaöksjdfölkcsjdföalks
jfdölkcsj

| na | me | dec | obj | obj | obj |
|------|----|-----|-----|-----|-----|
| R1 | | | | | |
| R1.1 | | | | | |
| R2 | | | | | |
| Rx.y | | | | | |



| objective | result | Ok/nok |
|--------------------|---------|--------|
| asdfadfa adsfaf | 23 | ✓ |
| adsfafad sfa | adfa | ✓ |
| asdfadfa fs | asdafds | ✗ |

Prototyp across a



Simulation goals

Requirements List & objectives

Architecture

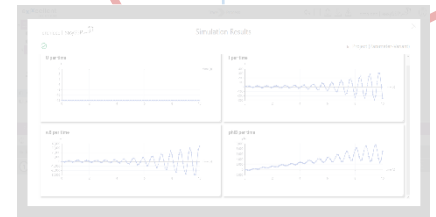
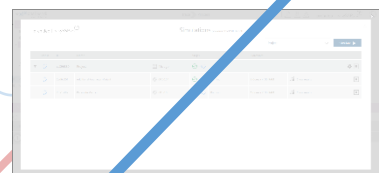
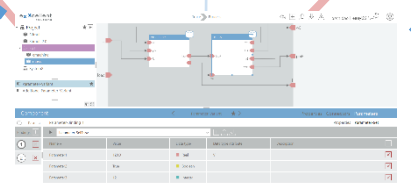
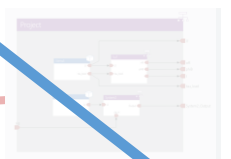
Testcases, Models and Parameters

Info on execution

Results

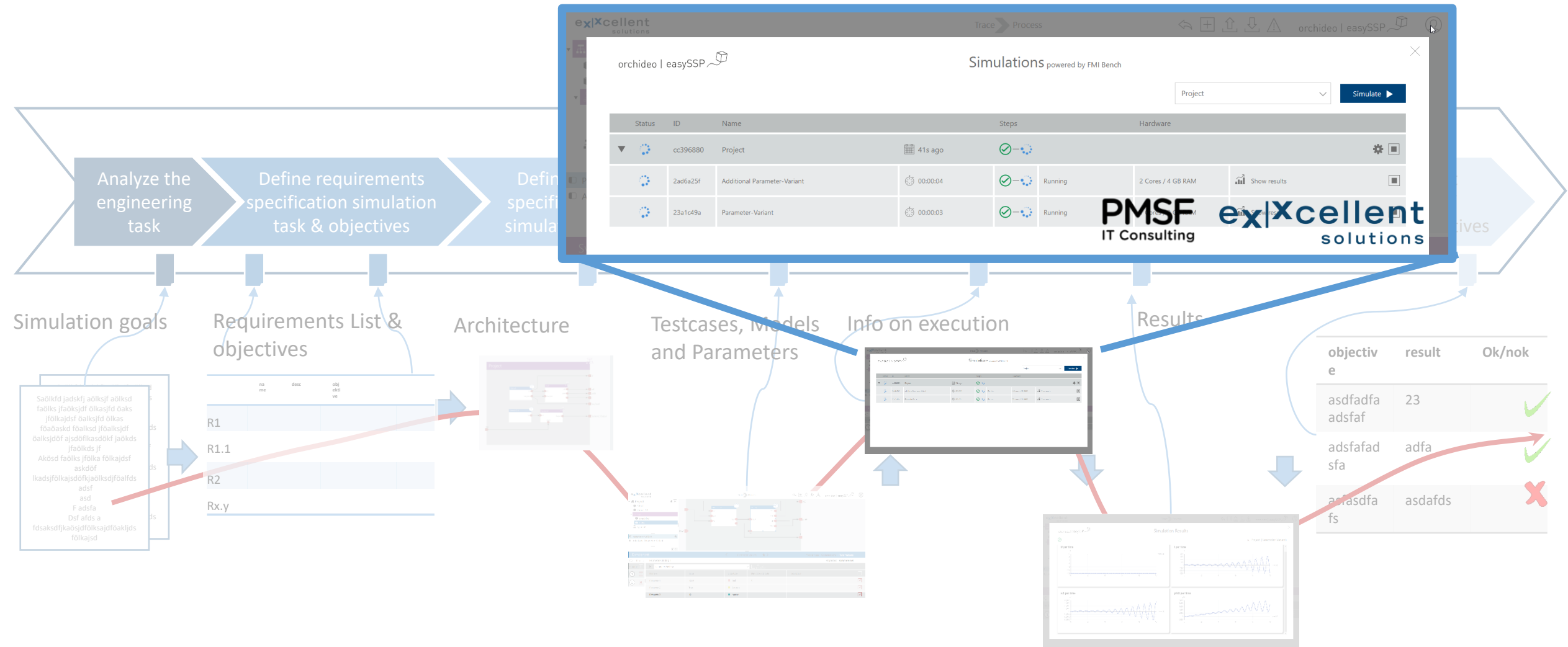
Saölkfd jadsfj aölkcsjf aölkcsd
faölkcs jfaölkcsjdf ölkcsjfd öaks
jfolkajdsf öalkcsjfd ölkcs
foaöaskd foalksd jfoalkcsjfd
öalkcsjdf ajsdölkcsdökf jaökds
jfaölkcs jf
Akösd faölkcs jfölkcs jfölkcsjfd
askdöf
lkadsjfolkajdsdöfjkaölkcsjfoalfds
asdf
asd
F adfsa
Dsf adfs a
fdsaksdofjkaöbsjdfölkcsajdföalkjds
fölkajds

| na | me | dec | obj | obj | obj |
|------|----|-----|-----|-----|-----|
| R1 | | | | | |
| R1.1 | | | | | |
| R2 | | | | | |
| Rx.y | | | | | |

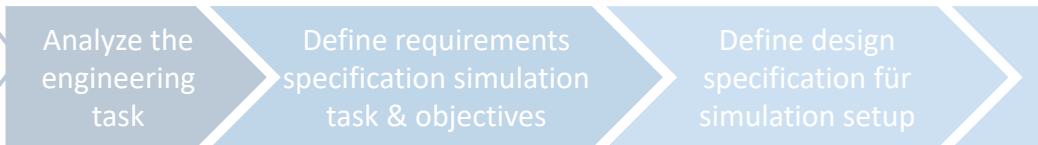
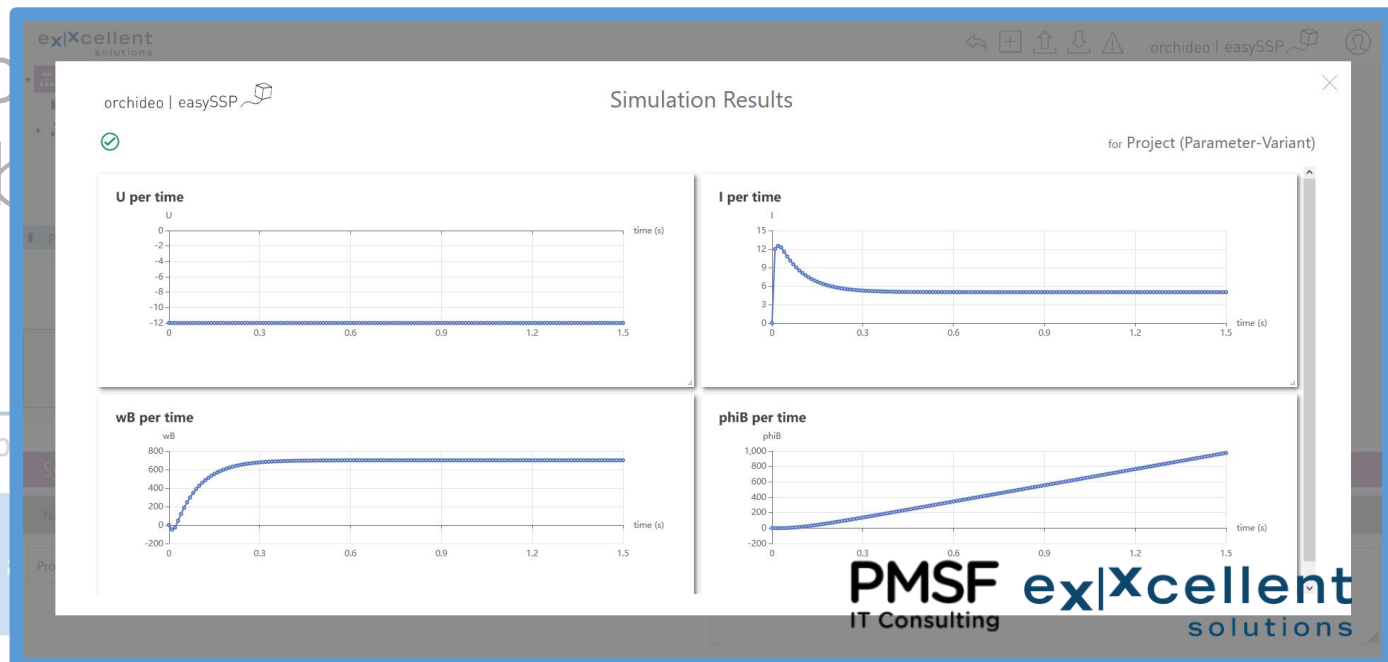


| objectiv e | result | Ok/nok |
|---------------------|----------|--------|
| asdfsadfa adsfaf | 23 | ✓ |
| adsfafad sfa | adfa | ✓ |
| asdfsadfa fs | asdfsads | ✗ |

Prototypical application of SSP Traceability across a sample process based on CSP/SSP



Prototypical application of simulation across a sample process



Simulation goals

Saölkfd jadskf aölkjsf aölkds
faölkjs jfaölkjsdf ölkasjfd öaks
jfolkajdsf öalksdfd ölkas
foaöaskd foalksd jfoalksdfd
öalksjsdf ajsdöfkasdoöf jaökds
jfaölkds jf
Akösd faölkjs jfölkja fölkajdsf
askdöf
lkadsjfölkajdsdöfjaölkjsdföalfds
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F adfsa
Dsf adfs a
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fölkajds

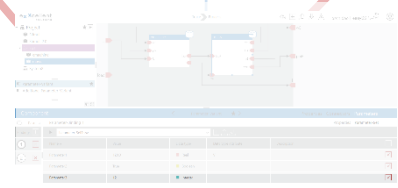
Requirements List & objectives

| na | dec | obj | etu | ve |
|------|-----|-----|-----|----|
| R1 | | | | |
| R1.1 | | | | |
| R2 | | | | |
| Rx.y | | | | |

Architecture



Testcases, Models and Parameters



Info on execution

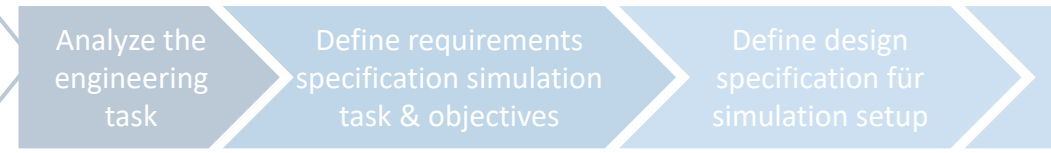
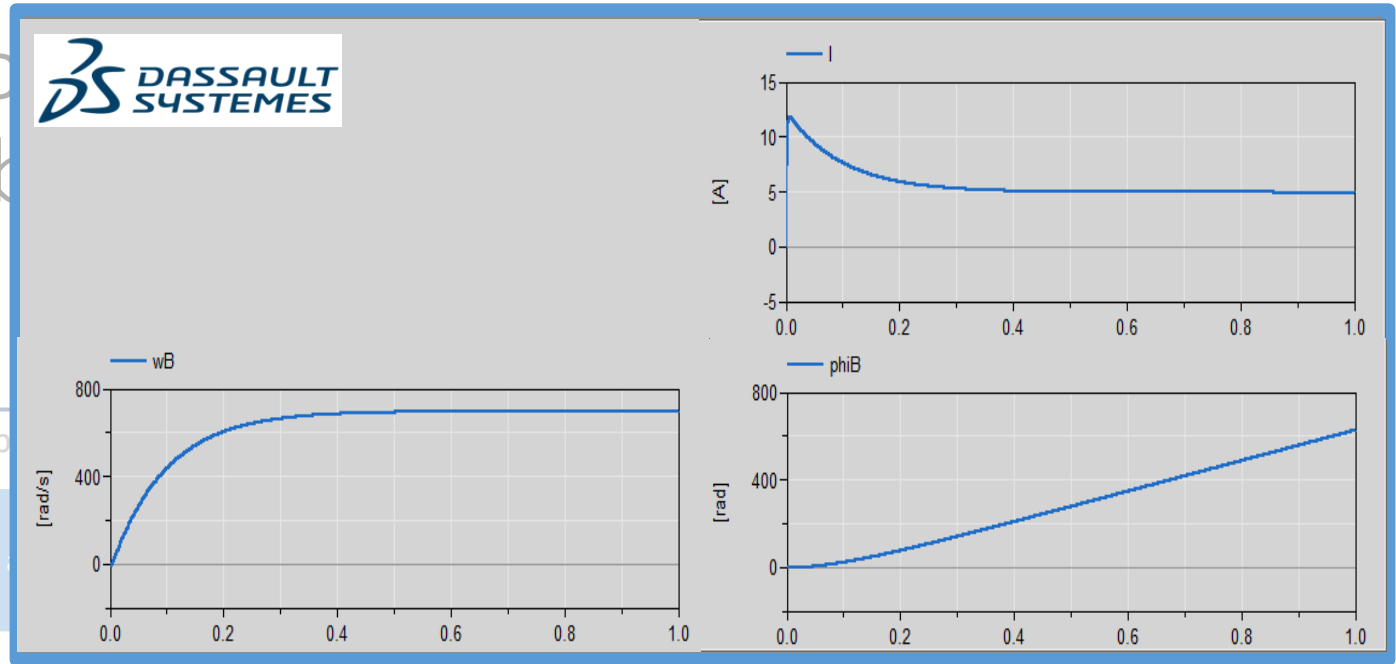
| Task | Status | Start | End | Duration |
|--------|--------|-------|-------|----------|
| Task 1 | OK | 10:00 | 10:05 | 5 min |
| Task 2 | OK | 10:05 | 10:10 | 5 min |
| Task 3 | OK | 10:10 | 10:15 | 5 min |

Results

| objective | result | ok/nok |
|---------------------|----------|--------|
| asdfsadfa adsfaf | 23 | ✓ |
| adsfafad sfa | adfa | ✓ |
| asdfsadfa fs | asdfsdfs | ✗ |

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Prototypical application of simulation across a sample process



Credibility

Simulation goals

Saölkfd jadsfj aölkfsj aölkfd
faölkfs jfaölkfsjd ölkasjfd öaks
jfolkajdsf öalksafd ölkas
foaöaskd foalksd jfoalksjfd
öalksjdof ajsdöfkasdoöf jaökds
jfaölkds jf
Akösd faölkfs jfolka fölkajdsf
askdöf
lkadsjfölkajdsdöfjaölkfsjfoafds
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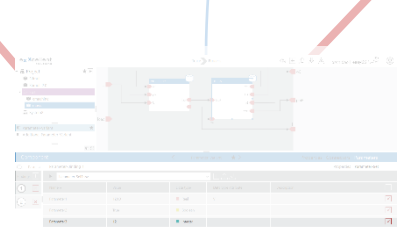
Requirements List & objectives

| na | dec | obj | edu | ve |
|------|-----|-----|-----|----|
| R1 | | | | |
| R1.1 | | | | |
| R2 | | | | |
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Architecture



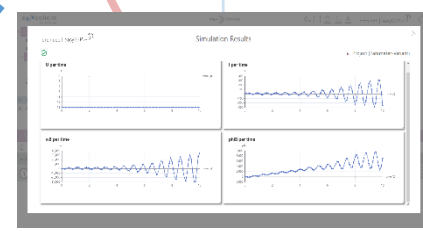
Testcases, Models and Parameters



Info on execution

| Simulation ID | Status | Start Time | End Time | Duration |
|---------------|---------|------------|----------|----------|
| 1 | Success | 10:00:00 | 10:00:05 | 5s |
| 2 | Failure | 10:00:05 | 10:00:10 | 5s |
| 3 | Success | 10:00:10 | 10:00:15 | 5s |

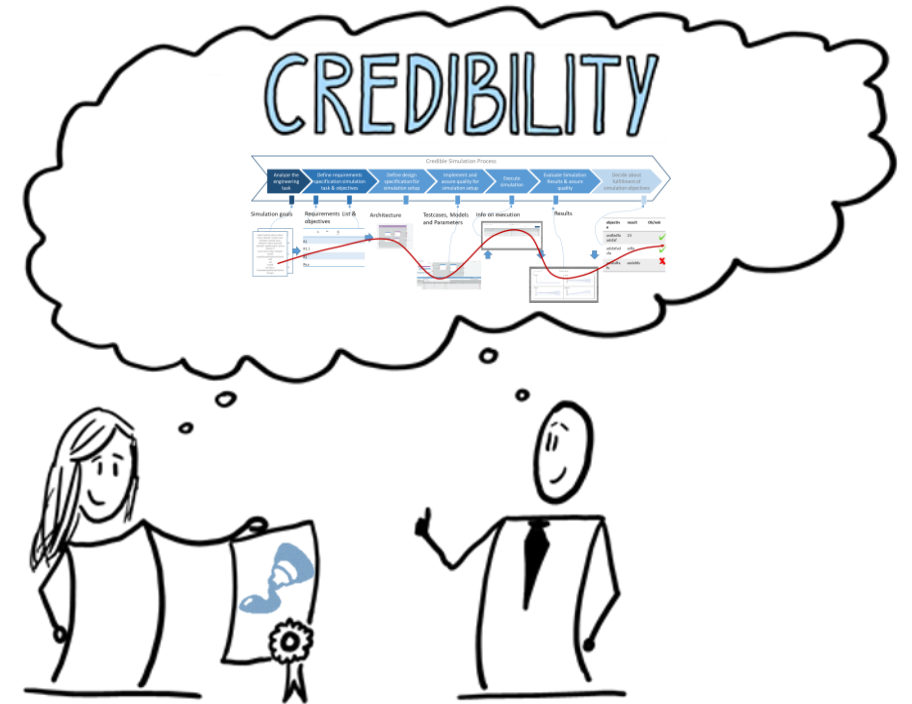
Results



| objective | result | ok/nok |
|--------------------|---------|--------|
| asdfadfa adsfaf | 23 | ✓ |
| adsfafad sfa | adfa | ✓ |
| asfasdfa fs | asdafds | ✗ |

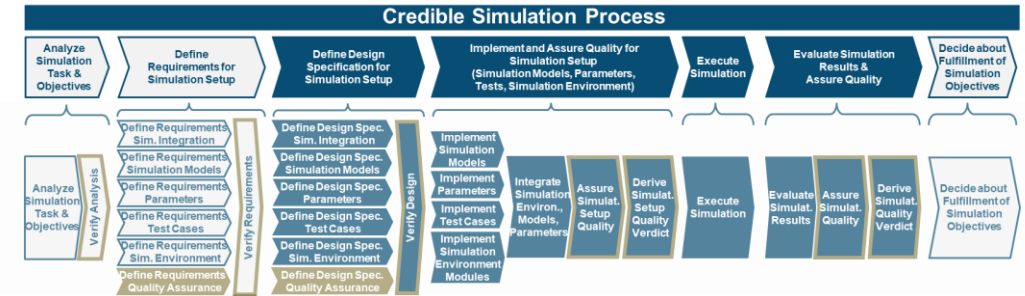
Summary & Benefits

- Credibility is key to acceptance of simulation for high-stakes decision making
- Credibility requires common understanding of simulation process → CSP
- Common understanding allows traceability of results to all inputs
- Glue particle approach allows traceability across parties and toolchains



Status and Outlook

- SmartSE project defined initial CSP
- SETLevel research project validated CSP
2021-07-02: Release of refined CSP
<https://setlevel.de/neuigkeiten/credible-simulation-process>
- Draft Version of SSP Traceability Specification
<https://github.com/PMSFIT/SSPTraceability>
- Prototype Implementations from eXXcellent solutions, PROSTEP, PMSF, 3ds, Bosch
- Interested in CSP/SSP Traceability/SmartSE?
 - November Presentation Day at SmartSE Project: Demonstrators, more detailed overview of SSP Traceability, CSP
 - Phase V of SmartSE Project starts in 2022, open to new members!



SET Level