The Hardware vs. Software on new Equipment "Design to Cost" Struggle

2nd ESA - CNES SPACE COST ENGINEERING CONFERENCE

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KOSTENKLARHEIT SCHAFFT GEWINN
COST CLARITY CREATES PROFIT

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Introduction

Challenge → **Target**

Evaluate cost effects of design changes in a space industry project.

Valid and transparent cost estimation considering all relevant cost effects including hardware and software cost.

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Introduction

Challenge → **Design to Cost Struggle** → **Target**

Evaluate cost effects of design changes in a space industry project.

Usable data?
Reasonable detail level?
Affected cost elements?
Suitable methods & tools?

Valid and transparent cost estimation considering all relevant cost effects including hardware and software cost.

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Initial Situation – Fictional Example on Base of a historical Project

Redesign

Modification of an antenna system of a TV satellite payload module.

- new / redesigned hardware components
- different software protocols
- integration into the payload module

Design to cost approach

Adjusting an existing parametric model of the TV satellite payload module.

- restructuring of WBS
- addressing differences to old design
- supporting parametric model with other estimation methods

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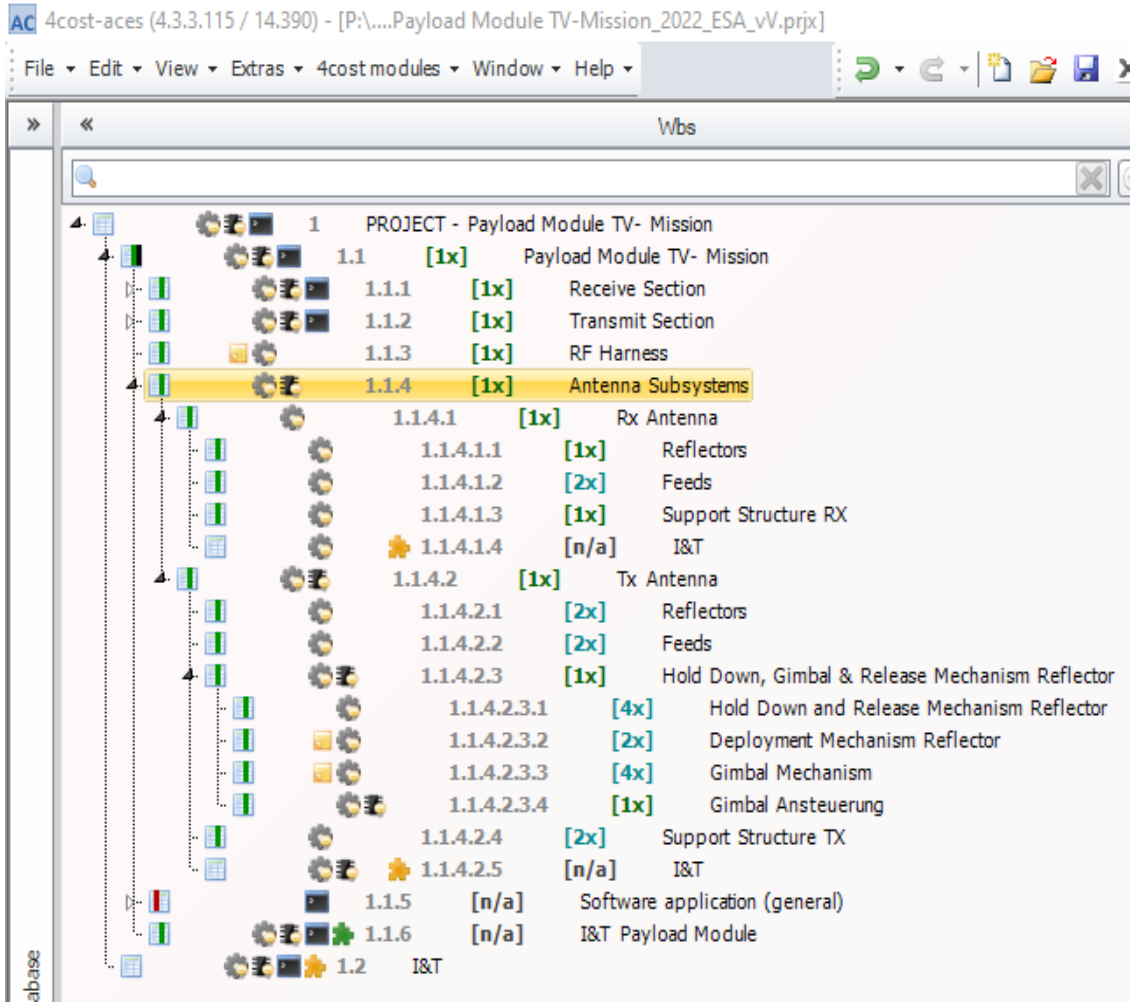
Hardware Cost Estimation – 4cost-aces

- 4cost-aces as leading tool
- WBS – freely adaptable changes
- first step – hardware adjustments (parametric)



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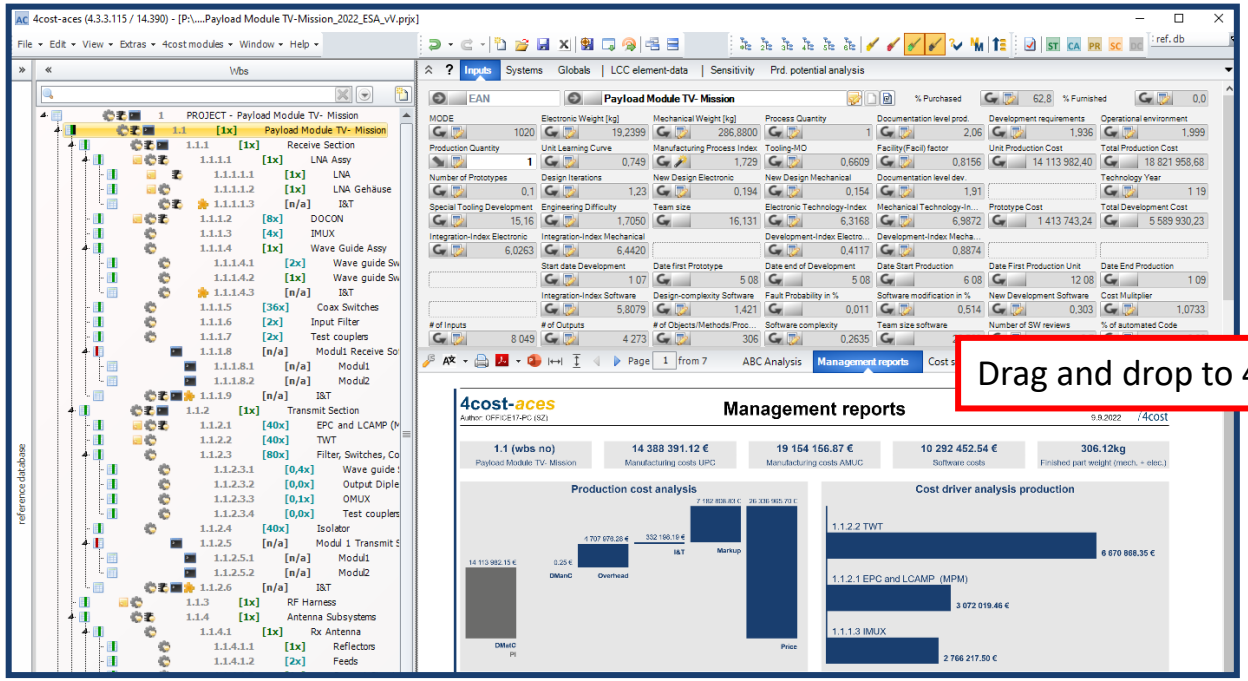
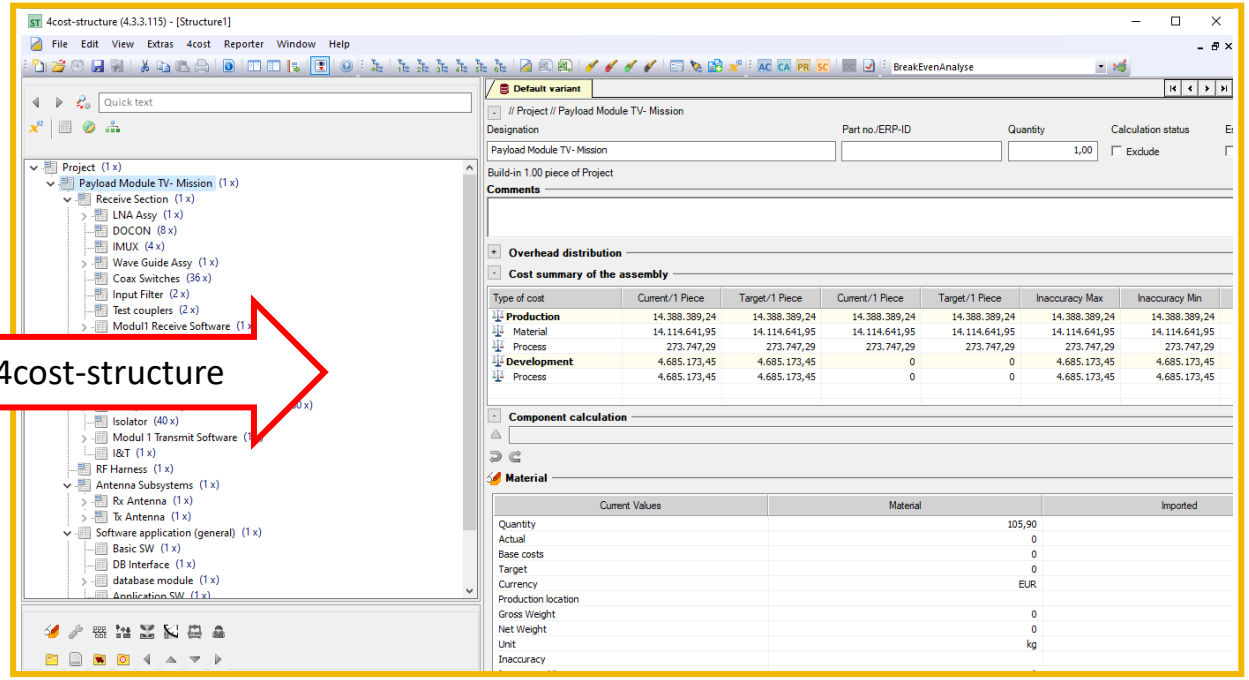
Alternative Hardware Cost Estimation – 4cost-stucture



Drag and drop to 4cost-structure



4cost-aces
(top-down)

4cost-structure
(bottom-up)

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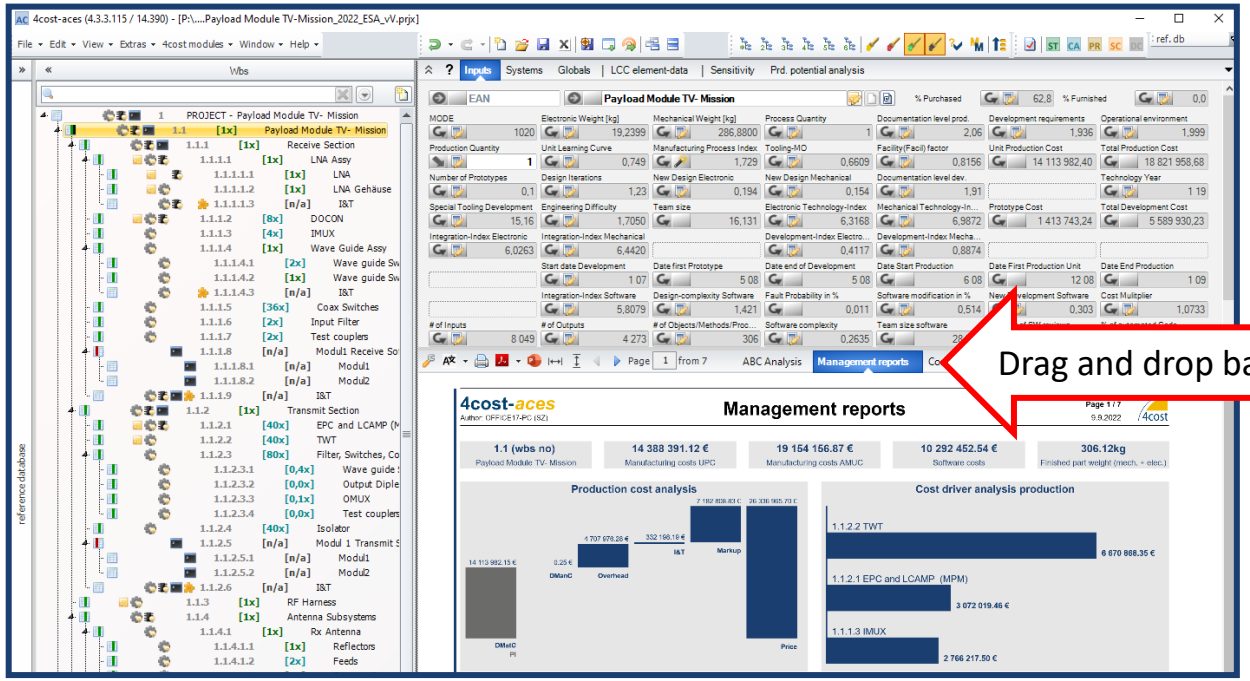
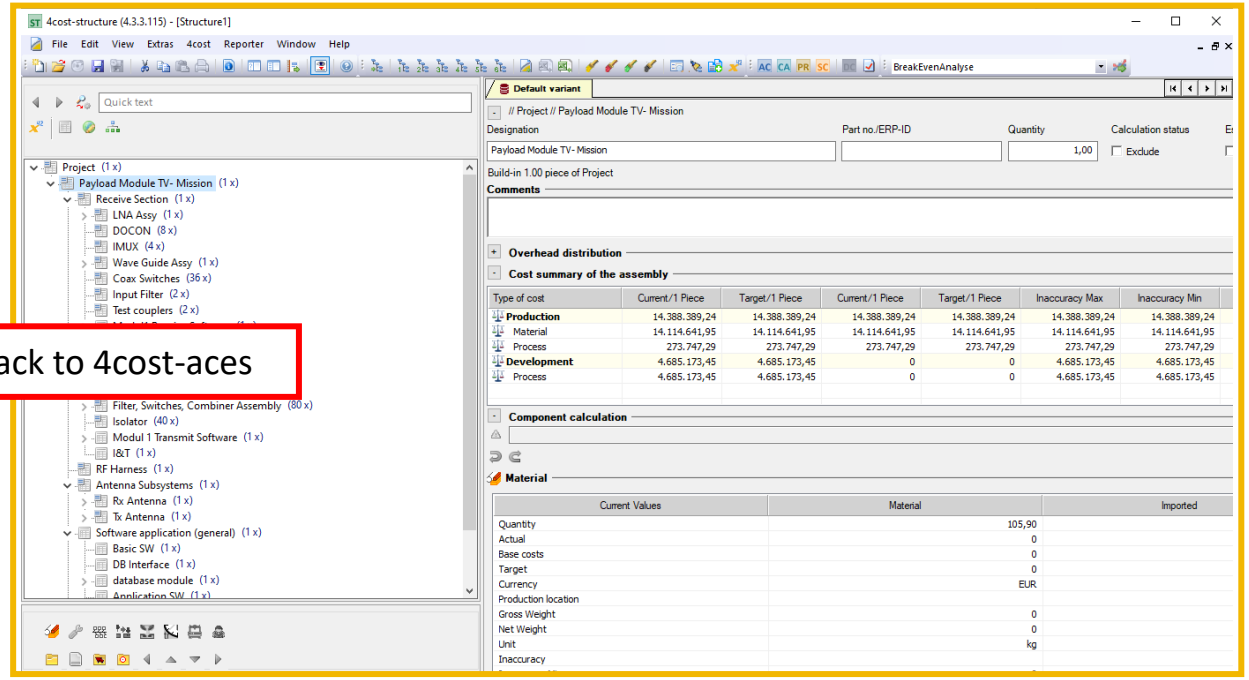
Alternative Hardware Cost Estimation – 4cost-stucture





4cost-aces
(top-down)

4cost-structure
(bottom-up)

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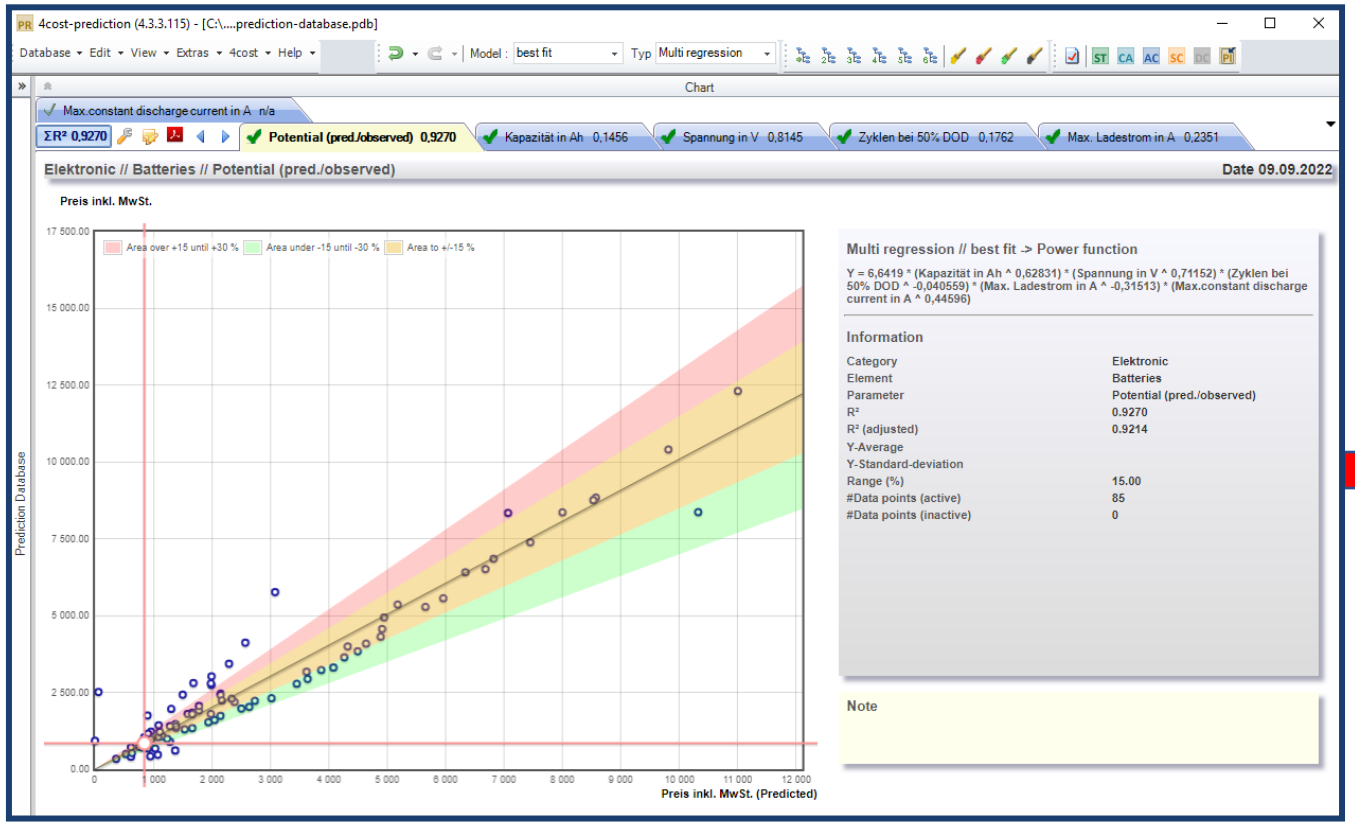
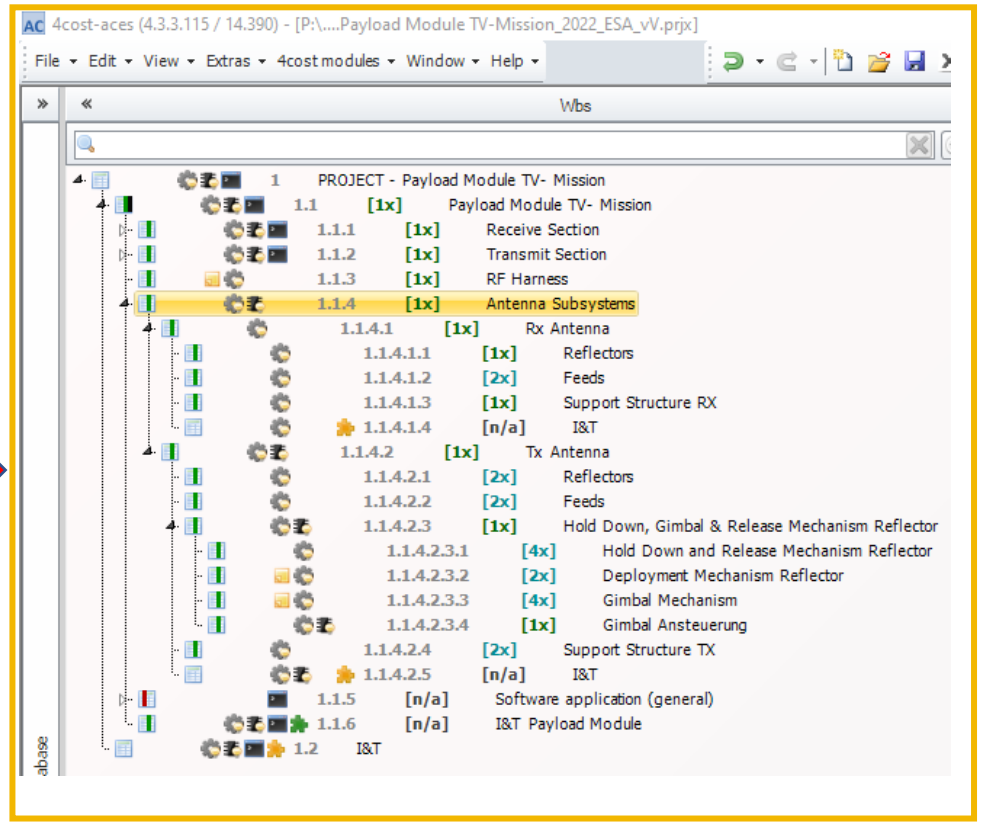
Alternative Hardware Cost Estimation – 4cost-prediction





4cost-prediction
(regression analysis)

4cost-aces
(top-down)

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The Hardware vs. Software on new Equipment “Design to Cost” Struggle

Project Status

- hardware configuration ✓

What else?

software modification

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Software Cost Estimation – 4cost-aces

4cost-aces uses the HIPO (**H**ierarchy **I**nput **P**rocessing **O**utput)
method to structure software cost like hardware.

Advantages of HIPO

- software language and methods independent
- usability at every design step (rough, very early phase, using the software-assistant (SW Expert))
- one box of a software-structure (WBS) may represent a function, an object or summation of objects within a software-program

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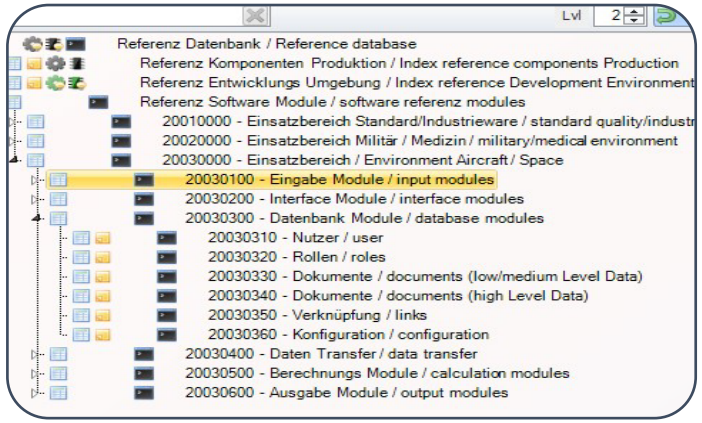
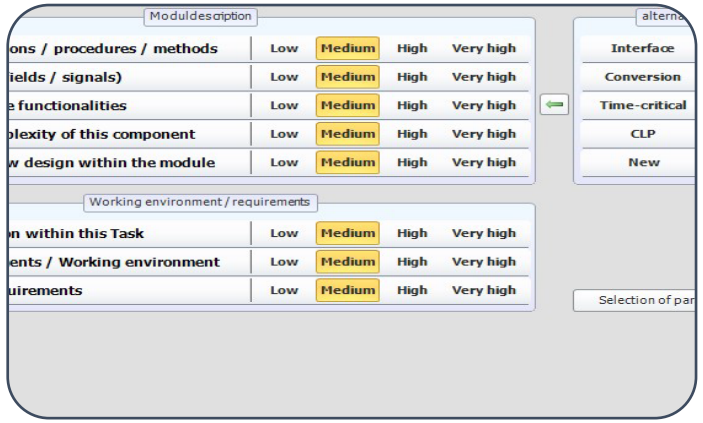
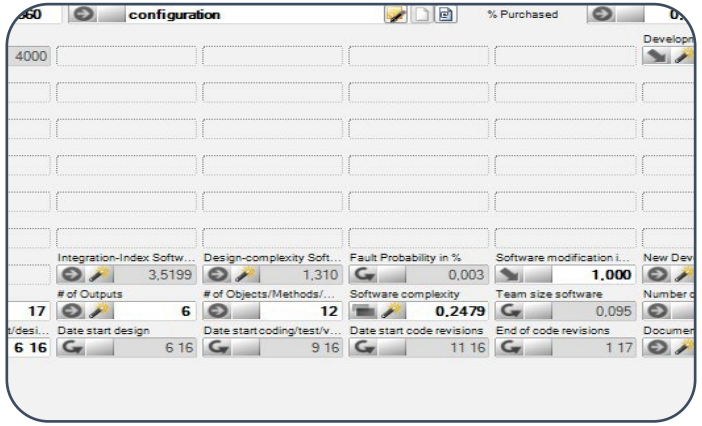
Software Cost Estimation – 4cost aces

Consider Software Modifications (adjust or add)







Reference Database

- large selection of modules already available

Software Expert

- alternative descriptions
- automatic translation
- transformation into parameters

Parameter Setting

- no. of inputs/outputs
- software modification %
- new development %
- ….

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The Hardware vs Software on new Equipment “design to cost” struggle

Project Status

- hardware configuration ✓
- software configuration ✓

What else?

integration and test

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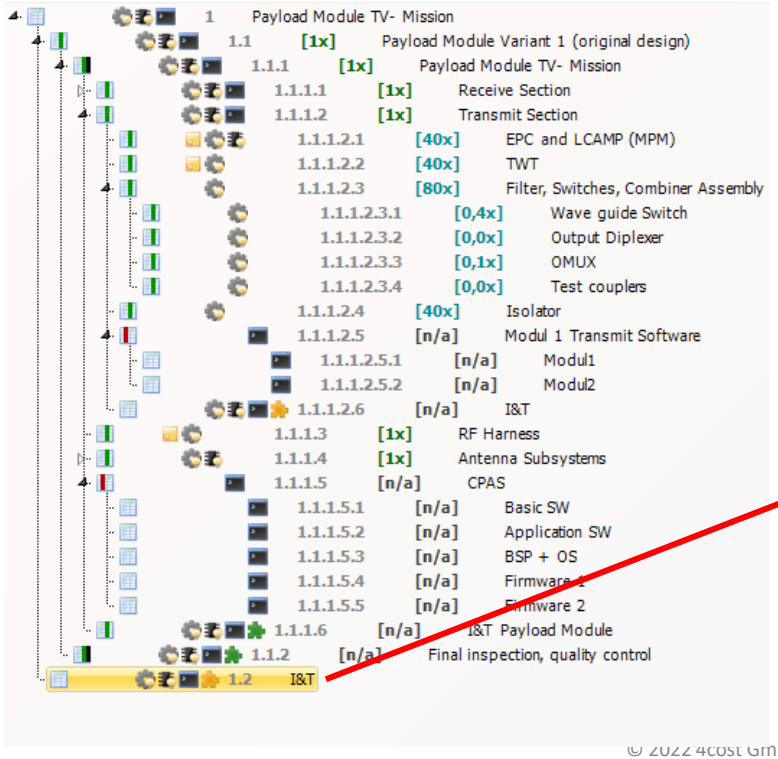
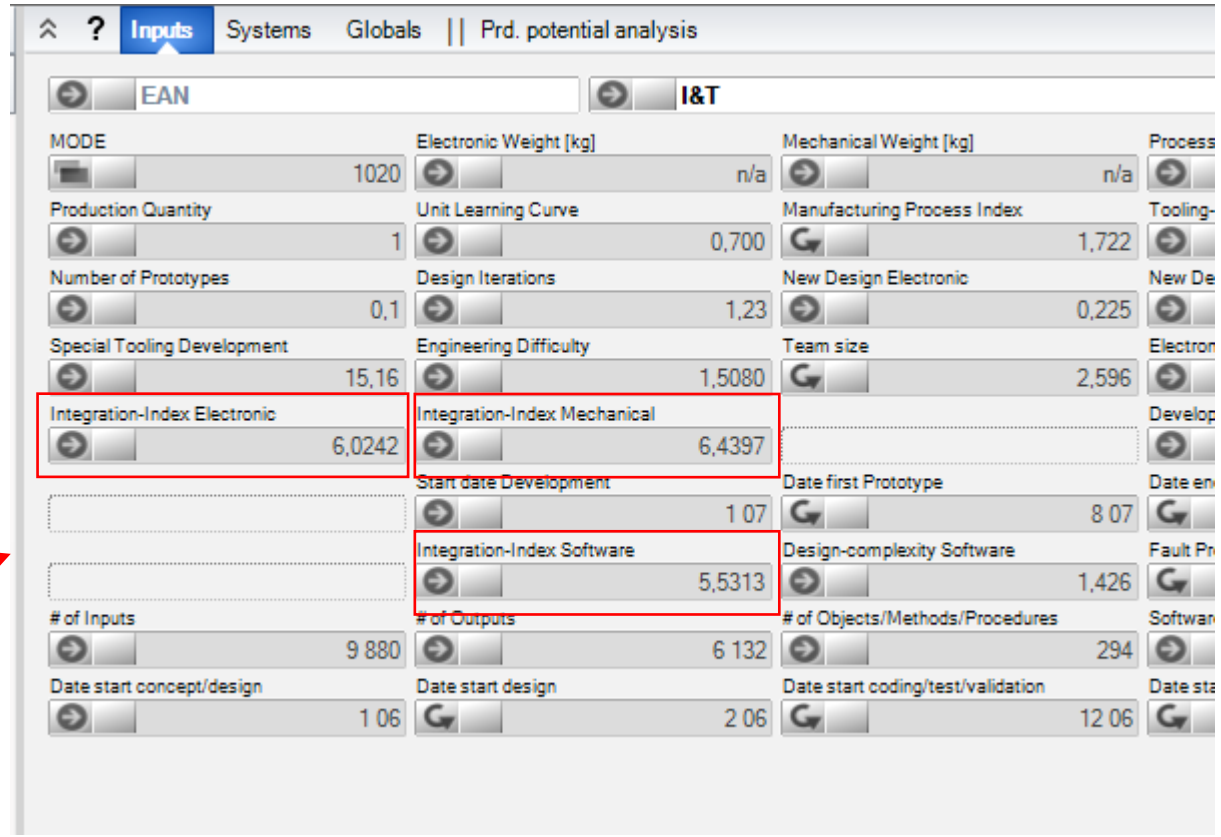
Integration & Test of Hardware and Software – 4cost-aces

- hardware to hardware
- software to software
- software to hardware





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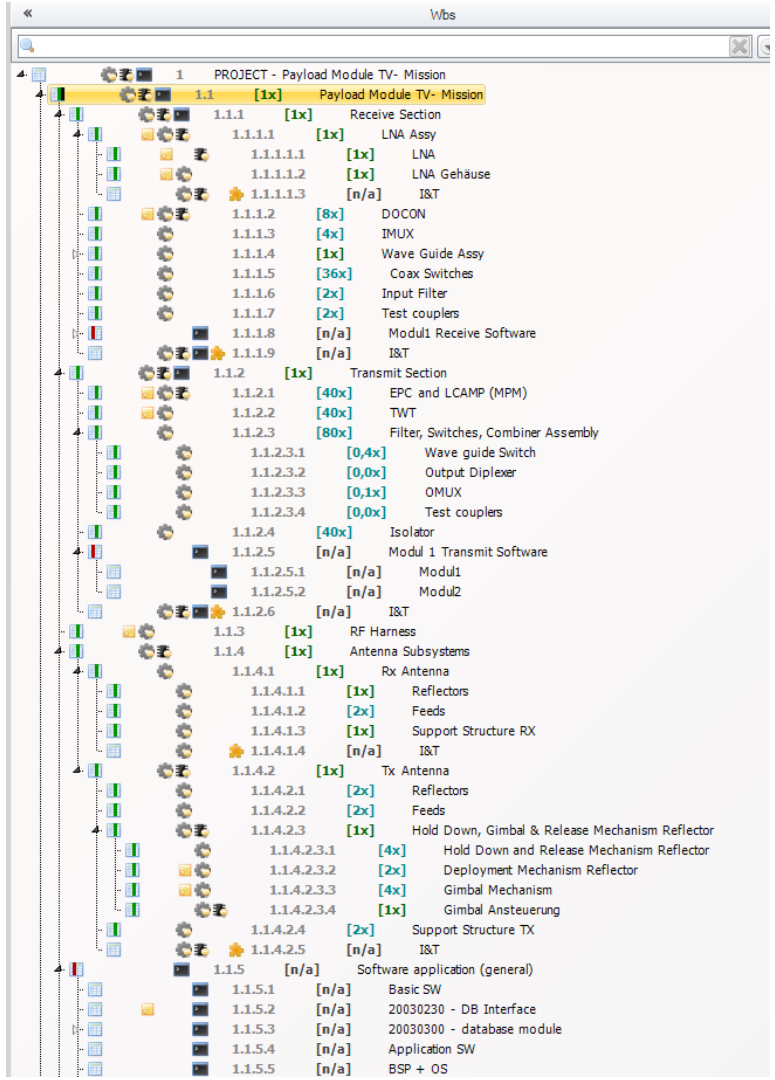
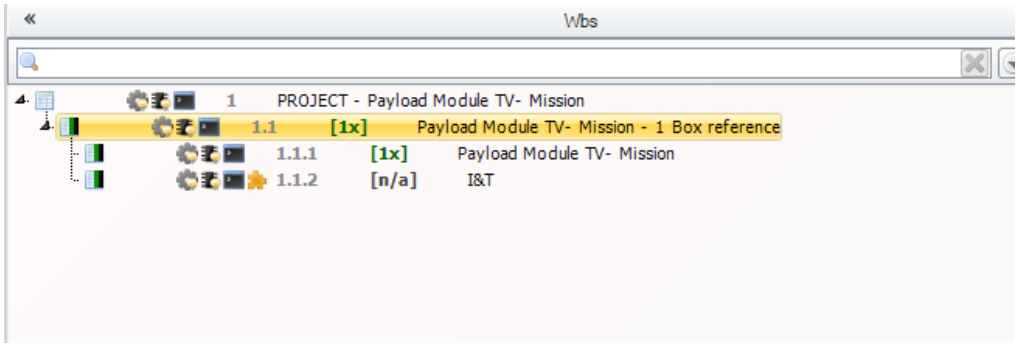
Merge and Calibration into one Box – 4cost-aces





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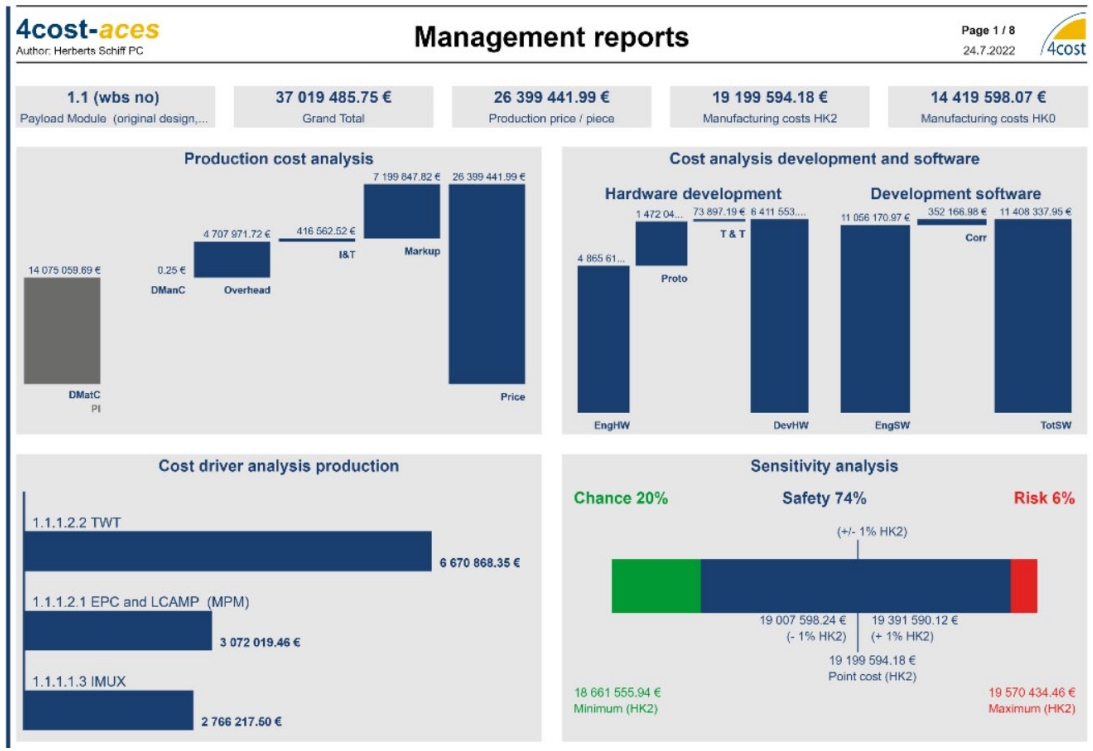
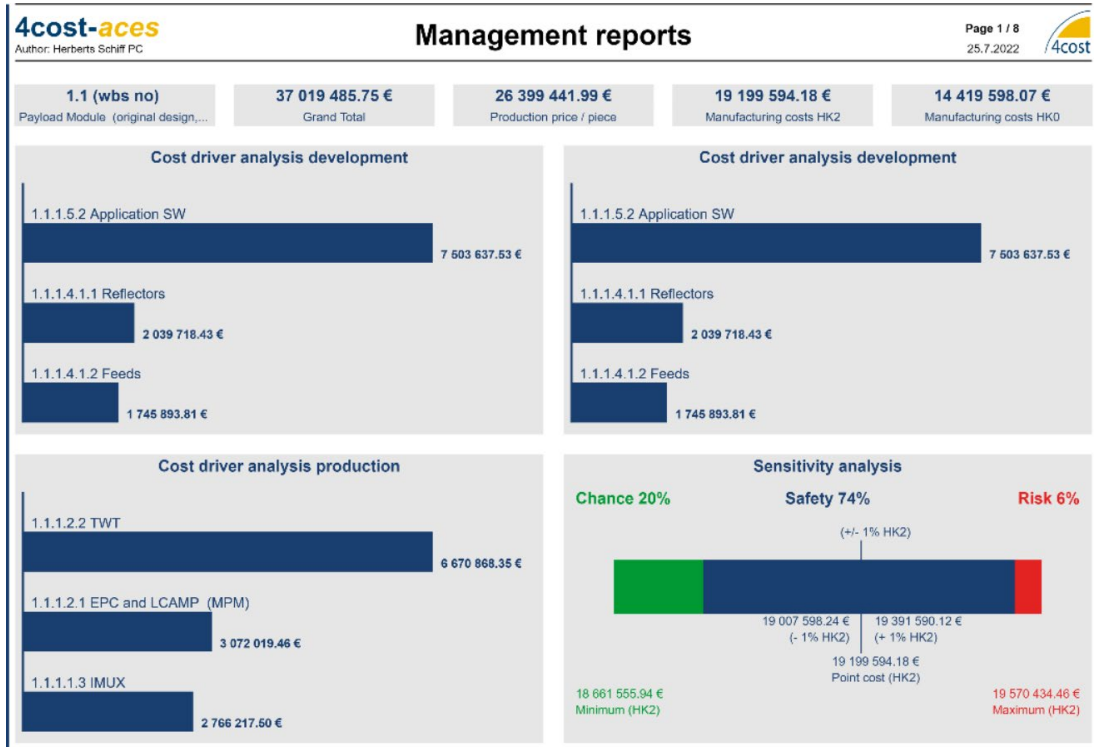
Meaningful Reports immediately available – 4cost-aces





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Bottom Line

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Bottom Line

Challenge → **Design to Cost Struggle** → **Target**

Evaluate cost effects of design changes in a space industry project.

Modify a parametric cost model to consider all redesigns regarding hardware, software and integration.

Support by bottom-up calculation or regression analysis, depending on available data.

Merge and calibrate whole structure to one-box model.

Valid and transparent cost estimation considering all relevant cost effects including hardware and software cost.

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Thank you – please raise your questions!

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