

How to use FEMFAT in combination with code_aster to calculate mechanical safety factors in industrial applications

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Agenda

- Festo SE & Co. KG
- Why we calculate the mechanical safety factor of our products
- Why we automated our standard simulation for mechanical safety factor
- How we automated the process
- The initial idea
- Motivation to integrate an open-source FE solver in SAFEM
- Challenges and Solutions
- Conclusion

FESTO – innovative since 1925

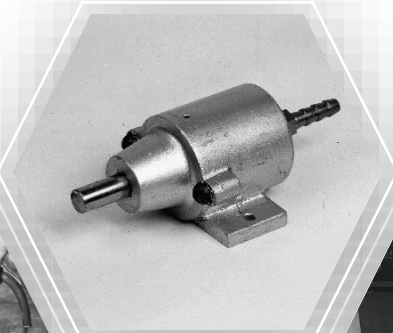
1925
Founding by
Gottlieb Stoll



1951
Orbital sander



1955
New business area
Festo Pneumatics



1965
New business area
Festo Didactic



1987
First valve terminal
worldwide



2006
Bionic Learning
Network



2017
Sales launch
Festo Motion Terminal



1927
First woodworking machine



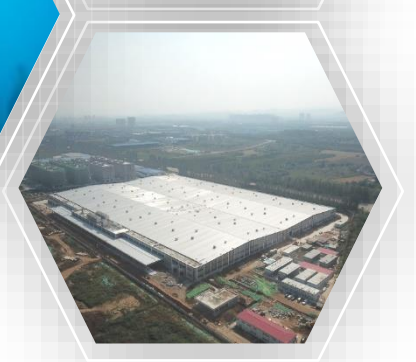
1956
First pneumatics
catalog



2000
Sales launch
Fluidic Muscle



2019
Global Production Centre
Jinan/China



Festo - Facts

Companies in
61 countries

After-sales
services in
176 countries

Over **250**
Offices

Customers
Worldwide
> 300.000

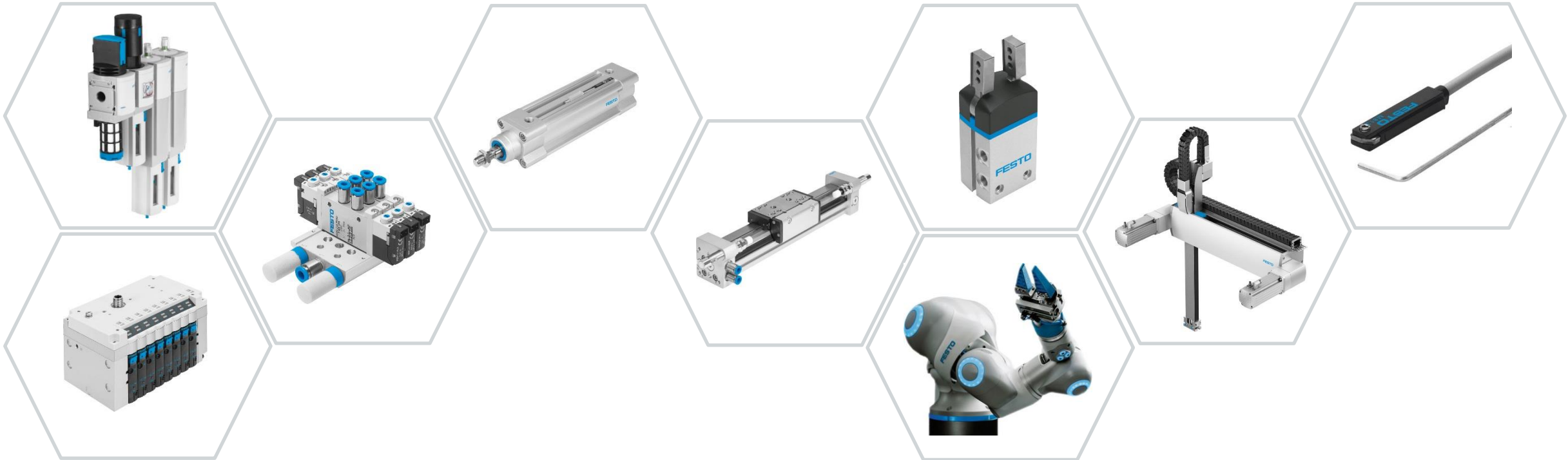
Employees
worldwide
~20.700

Customers
Didactic
> 56.000

Turnover:
3,36 billion Euro

Festo – Products for factory and process automation

Festo's product portfolio ranges from **pneumatic** and electronic products to system solutions and services for factory and process automation.



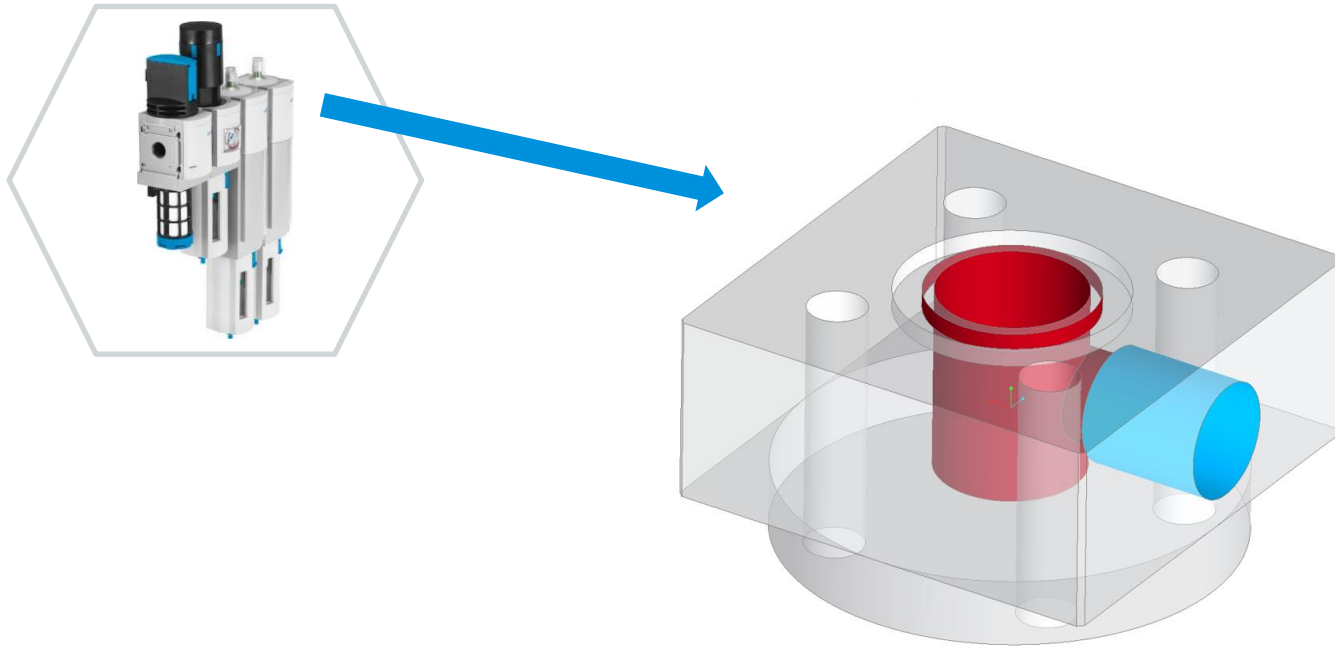
Why we calculate the mechanical safety factor of our products

Find the right balance



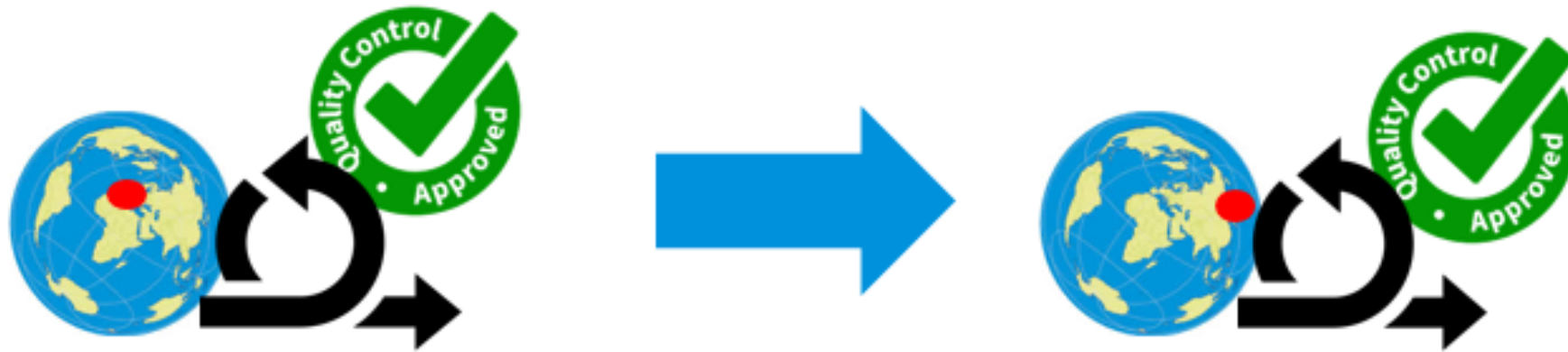
Why we calculate the mechanical safety factor of our products

Example from our daily business: Part under internal pressure with severe damage sequence in case of failure



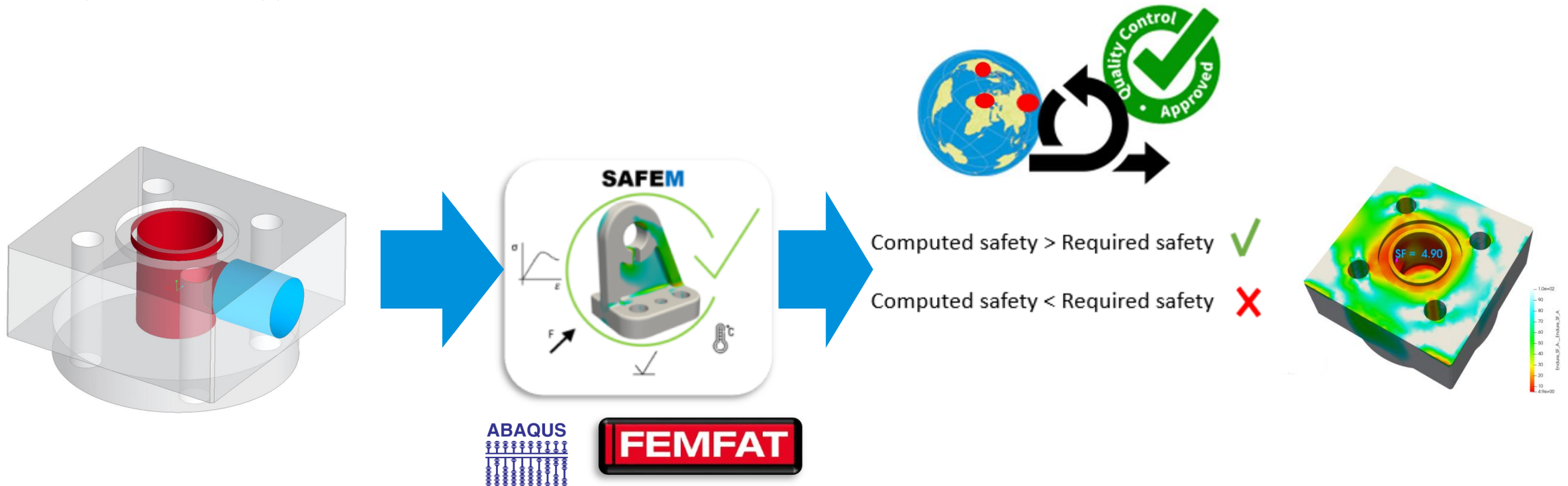
Why we automated our standard simulation for mechanical safety factor

Speed up the standardized process and ensure the same quality worldwide



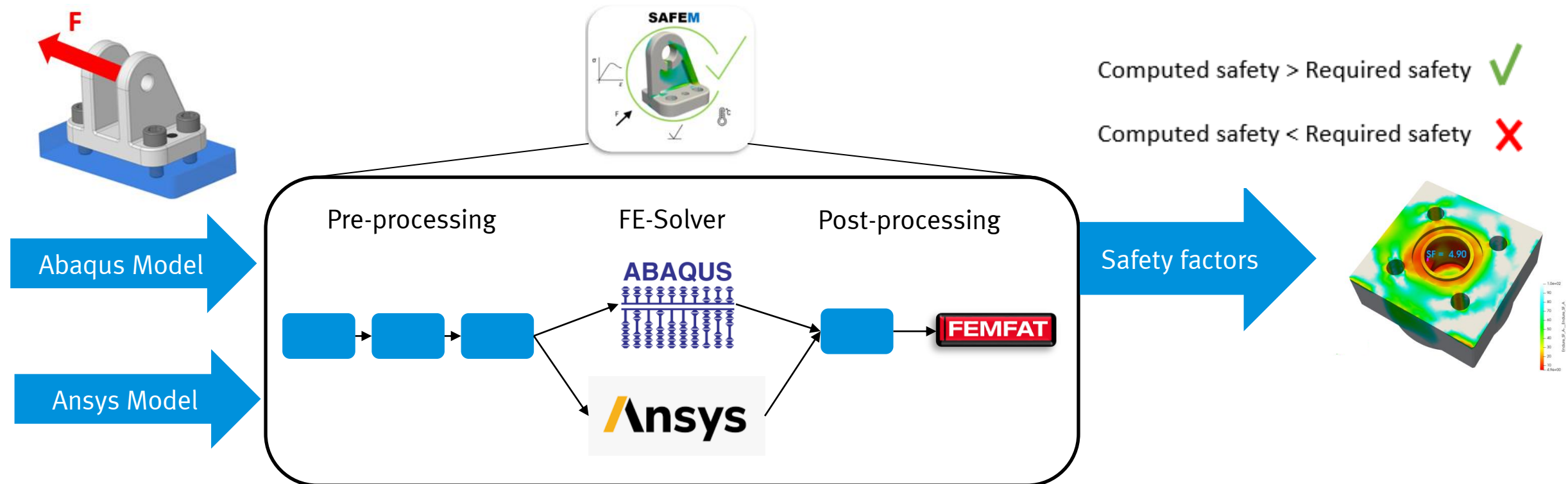
How we automated the process

We develop the SAFEM App (SAFE + FEM)



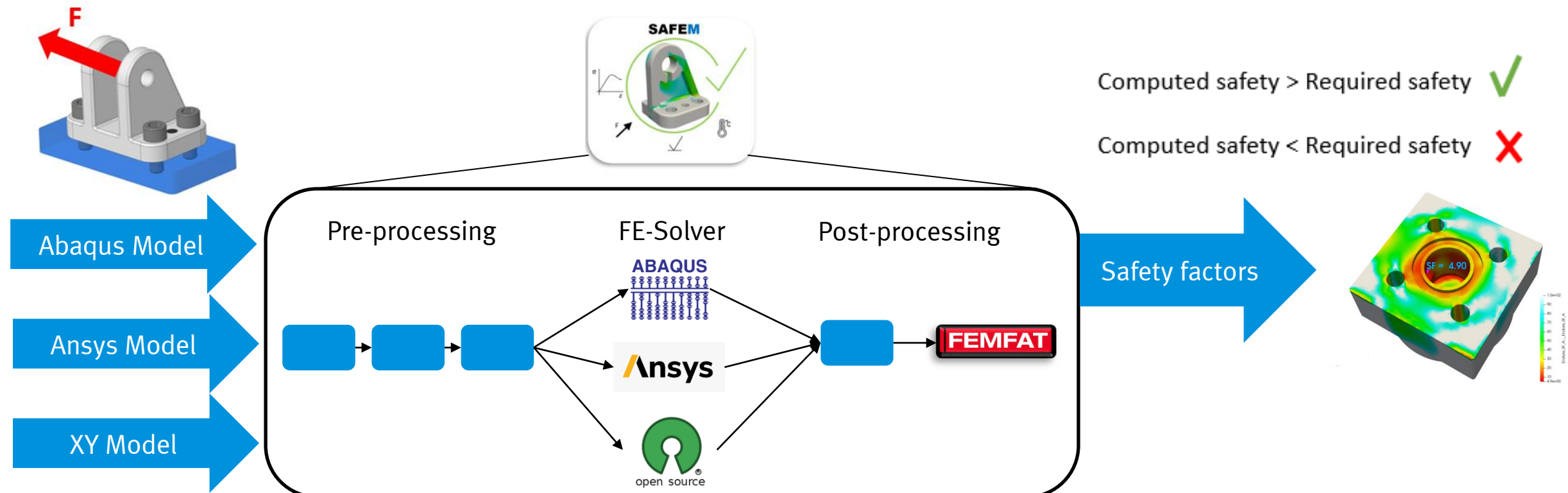
The initial idea

In 2021 Festo decided to change the FE-Solver from Abaqus to Ansys. SAFEM has been extended to work with both.



The initial idea

Due to the experience with the ANSYS conversion, the idea was born to use the new interfaces for an open-source FE solver.

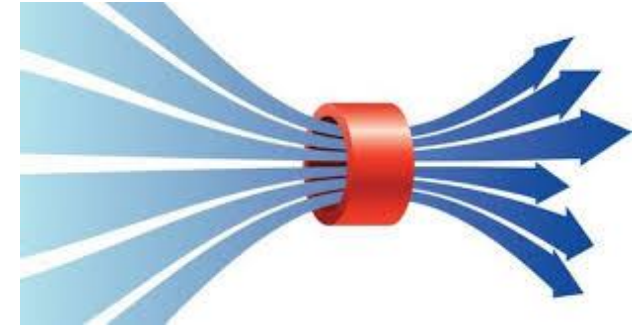


Motivation to integrate an open-source FE solver in SAFEM



Technical
Competition

Independence



Technical
Progress

Challenges and Solutions

Which open-source solver we should use



CALCULIX



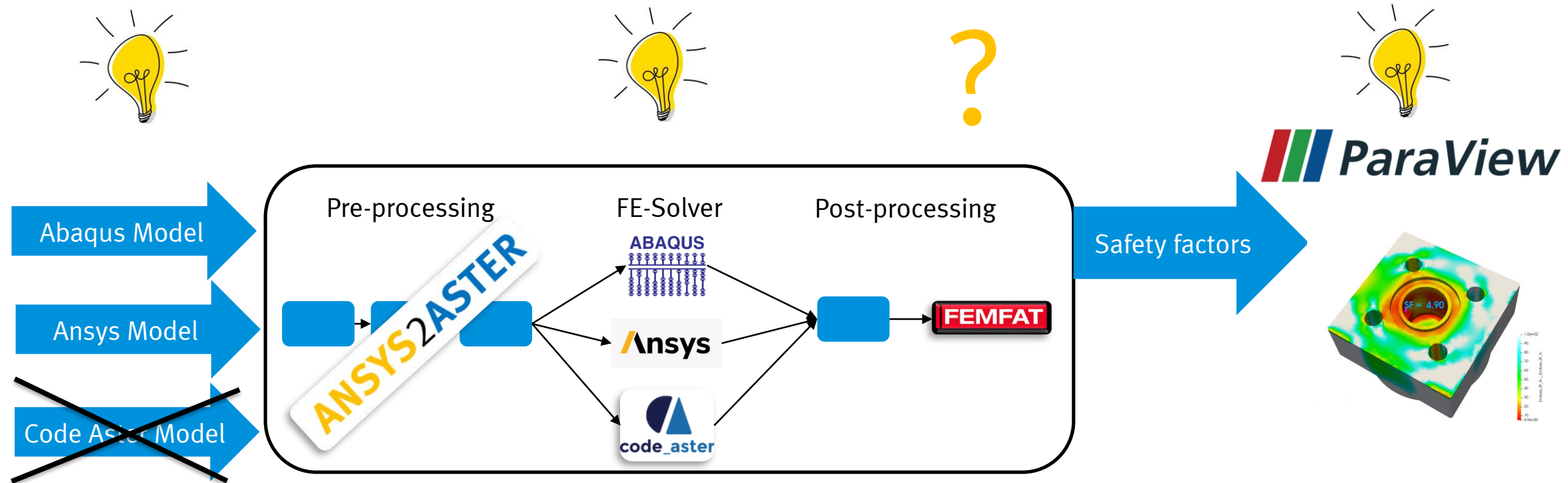
How can we avoid to learn a new Pre and Postprocessor



How can we evaluate the FE-Results with FEMFAT



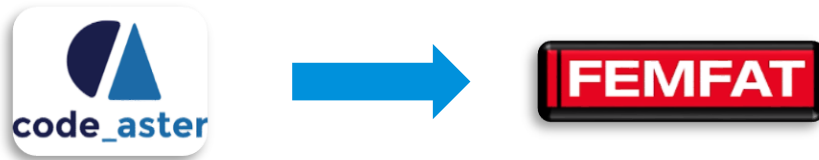
Challenges and Solutions



Challenges and Solutions

How can we evaluate the FE-Results with FEMFAT

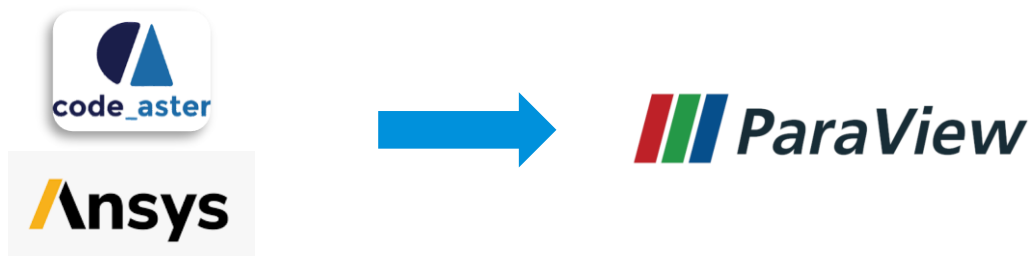
Which format can code_aster write and FEMFAT read (mesh and stress)



Which format can FEMFAT write and can be translated to vtk



How can we translate the mesh to vtk and connect the FEMFAT results



Challenges and Solutions

Format that can read code aster and write FEMFAT

With the help of the FEMFAT support we create this workflow with ideas universal file format



ideas universal file format



Axel
Werkhausen

Challenges and Solutions

Format to write FEMFAT results for vtk



```

1 $TITLE =EXPORTED BY LMS HAISTRAN DRIVER
2 $SUBTITLE=
3 $LABEL =158041X Input location
4 $ACCELERATIONS Type
5 $REAL-IMAGINARY OUTPUT
6 $SUBCASE ID = 1
7 $ENDCASE ID = 15804
8 1.000000E+00 G -2.226795E-04 2.524797E-05 4.547496E-04
9 -CONT- 0.000000E+00 0.000000E+00 0.000000E+00
10 -CONT- 0.101642E-07 -3.392872E-08 -6.323148E-07
11 -CONT- 0.000000E+00 0.000000E+00 0.000000E+00
12 0.000000E+00 G -1.931775E-04 1.411137E-05 1.611137E-03
13 -CONT- 0.000000E+00 0.000000E+00 0.000000E+00
14 -CONT- 2.449197E-04 -2.721301E-07 -5.001478E-04
15 -CONT- 0.000000E+00 0.000000E+00 0.000000E+00
16 0.000000E+00 G -2.012774E-03 2.281504E-04 4.110359E-03
17 -CONT- 0.000000E+00 0.000000E+00 0.000000E+00
18 -CONT- 8.447790E-06 -9.236039E-07 -1.722052E-05
19 -CONT- 0.000000E+00 0.000000E+00 0.000000E+00
20 0.000000E+00 G -3.591643E-03 4.070413E-04 7.334923E-03
21 -CONT- 0.000000E+00 0.000000E+00 0.000000E+00
22 -CONT- 2.017777E-05 -2.209812E-06 4.112847E-05
23 -CONT- 0.000000E+00 0.000000E+00 0.000000E+00
24 0.000000E+00 G 0.409771E-03 6.388198E-04 1.131479E-02
25 -CONT- 0.000000E+00 0.000000E+00 0.000000E+00
26 -CONT- 3.979188E-05 -4.346971E-06 8.111174E-05
27 -CONT- 0.000000E+00 0.000000E+00 0.000000E+00
28 0.000000E+00 G 0.000000E+00 0.000000E+00 0.000000E+00
29 -CONT- 0.000000E+00 0.000000E+00 0.000000E+00
30 -CONT- 0.000000E+00 0.000000E+00 0.000000E+00
31 -CONT- 0.000000E+00 0.000000E+00 0.000000E+00
32 0.000000E+00 G 0.000000E+00 0.000000E+00 0.000000E+00
33 -CONT- 0.000000E+00 0.000000E+00 0.000000E+00
    
```

NASTRAN punch



Challenges and Solutions

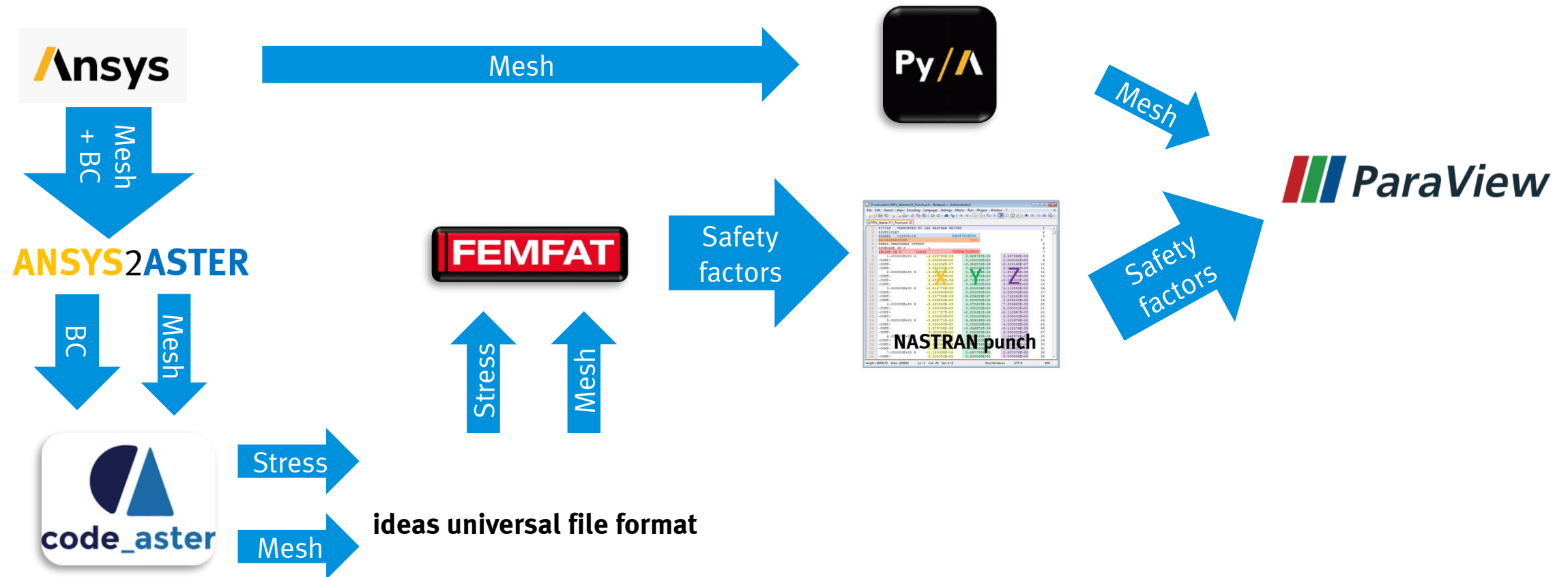
Translation of the ANSYS mesh to vtk with PyAnsys (Python + Ansys)



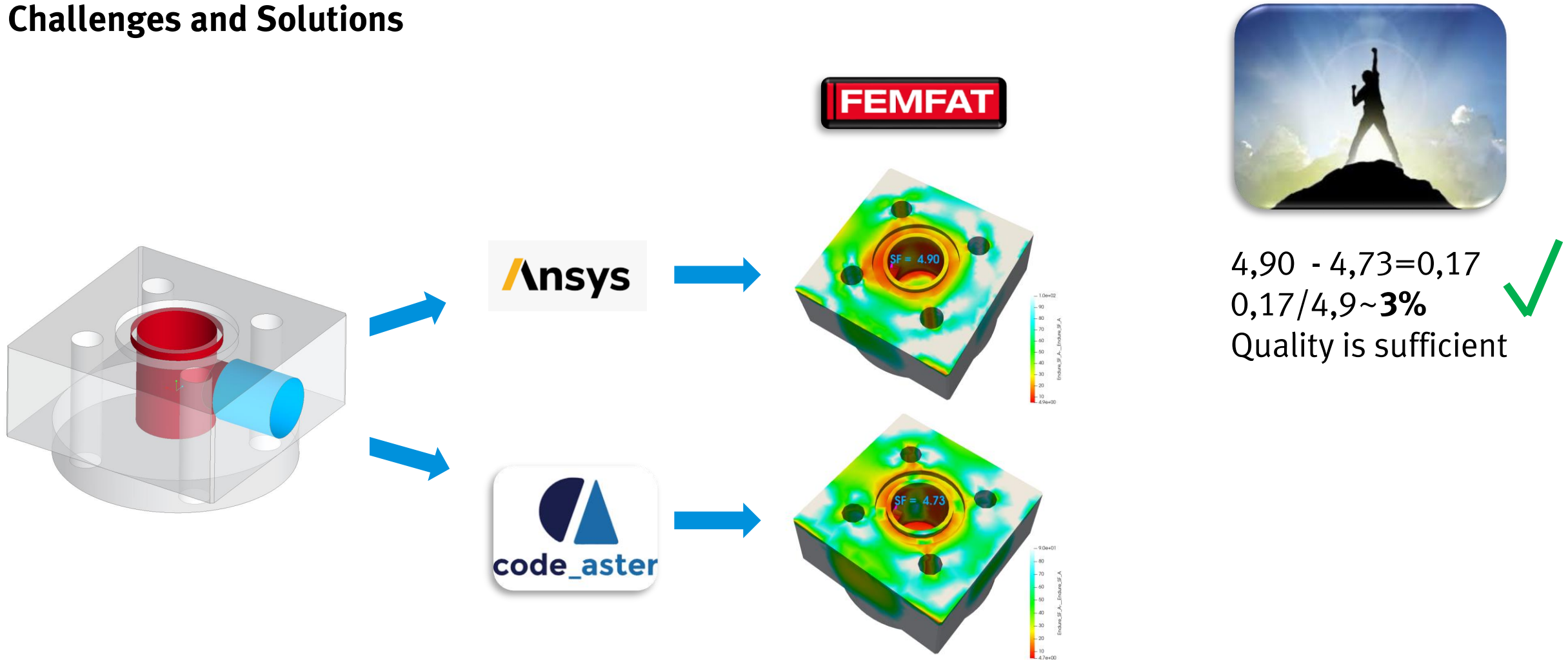
<https://github.com/pyansys>

Challenges and Solutions

Connect the FEMFAT results to the mesh for postprocessing



Challenges and Solutions



Conclusion



Are you interested to share experiences with code_aster and FEMFAT

Have you experience to run FEMFAT in a docker container

This section features a collage of icons and text. On the left, there is an icon of a blue fan with a red ring and a green checkmark. Next to it is the text 'Technical Competition' in blue, with a green checkmark above it and an 'open source' logo. To the right is an icon of a stack of money with a green checkmark. Further right is the word 'Independence' in blue, with a green checkmark above it. At the bottom right, there is a blue LinkedIn logo, a black and white portrait of a man, and the email address 'thomas.streich@festo.com'.