UM Workshop

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Support & Sales

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Top in Automatization

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7. Automatic channel/loadhistory assignment in ChannelMAX

Tcl/tk variables

Make your life easy – use variables

```
################### MANUAL INPUT ######################### START #########
# Project Directory
set ProjDir /hsgshg/shgsgjk/projectnumberXYZ/
#
# Stress Directory for Assembly and Loading
set AbaqDirAss sfasf/fasfsfd/hfsdgf/ABAQUS/
set AbaqDirStress sfasf/fasfsfd/hfsdgf/ABAQUS/yvcvvyv/
#
# Input data *.odb: Model, Assembly stresses, stresses from loading
set FeInp_ModelName MODEL.odb
set FeInp_StressAssName STRESS1.odb
set FeInp_StressLoadName STRESS2.odb
#
# analysis Group: part of the name
set SetName FEMFAT_ANA
#
# Materialfile: directory and name
set MatFileDir $ProjDir/Materials/
set MatFileName EN-GJS-620-mod.ffd
#
# Compilation of full path and names (no change necessary)
set FeInp_Model $ProjDir$AbaqDirAss$FeInp_ModelName
set FeInp_StressAss $ProjDir$AbaqDirAss$FeInp_StressAssName
set FeInp_StressLoad $ProjDir$AbaqDirStress$FeInp_StressLoadName
set MatFile $MatFileDir$MatFileName
#
#
# OUTPUT to the console for check
puts stderr "DEBUG FE-Input Model:            $FeInp_Model'
puts stderr "DEBUG FE-Input AssemblyStress:   $FeInp_StressAss"
puts stderr "DEBUG FE-Input LoadStress:       $FeInp_StressLoad"
puts stderr "DEBUG MatFile:                   $MatFile"
puts stderr "DEBUG Set Name:                  $SetName"
#
################### MANUAL INPUT ############################ END ########
```

/hsgshg/shgsgjk/projectnumberXYZ/sfasf/fasfsfd/hfsdgf/ABAQUS/MODEL.odb

Tcl/tk scripting

Use programing from tcl/tk is possible

As an example, loops can be expressed by:

```
foreach i {1 2 3 4 5} {...
for {set i 1} {$i <= 5} {incr i} {...
```

IF / ELSEIF clauses:

```
if {$MAXAnalysisMod == 0 || $MAXAnalysisMod == 1} {set ValidMAXMOD "yes"}
```

```
if {$MAXAnalysisMod == 0} {set ValidMAXMOD "yes"} elseif {$MAXAnalysisMod == 2} {set ValidMAXMOD "yes"} elseif {$MAXAnalysisMod == 3} {set ValidMAXMOD "no"}
```

System calls/ system variables:

During a FEMFAT run, some global variables are set:
e.g. the latest FEMFAT Analysis mode (MAXMODE ϵ [0-8]) is in the global variable MAXMOD_LAST_CALCRUN

Little subroutines (proc ederes)

Example taken from sensitivity template:

```
proc addStringToFilename {String NewString}
{string replace $String [string last "." $String] [string last "." $String] _$NewString.}
```

name of the procedure = addStringToFilename
First argument = String
Second argument = NewString
The function itself is in brackets: {what to do}
and uses tcl-comands like "string replace", or the search algorithm "string last" to

look for the last „.“ in „String“ and replace the „.“ by „_NewString.“

File copy and rename

To copy the old message file from *NAMEold.msg* to *NAMEnew.msg*:
(keeps the old message file also)

```
file copy NAMEold.msg NAMEnew.msg
```

To rename an old message file *NAMEold.msg* to *NAMEnew.msg*:
(replaces the old file by the new file)

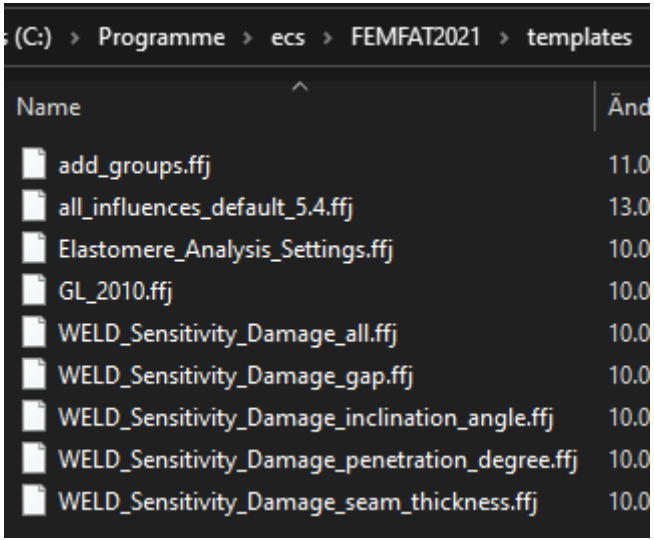
```
file rename NAMEold.msg NAMEnew.msg
```

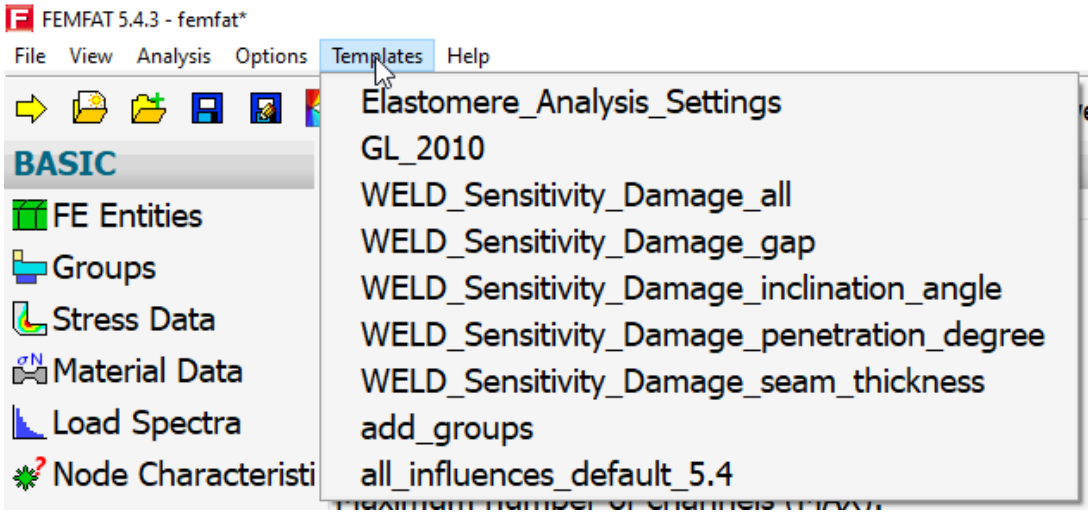
Some online documentation for tcl can be found here: https://www.tcl.tk/man/tcl8.5/tutorial/Tcl13.html

Templates in FEMFAT 2021

How to use templates

There is a predefined directory for the templates





Templates are Job-Files (.ffj) with or without the „StartAnalysisLoop“ command.
They can be called at any time from the GUI

How to save and call templates

To open the template (e.g. for Elastomere analysis parameter) in batch mode
Use the following command in the Job-file:

```
::source C:/Progr…/../..templates/Elastomere_Analysis_Settings.ffj
```

A template that has been called during the interactive FEMFAT session will be recorded without all the programming and variables!

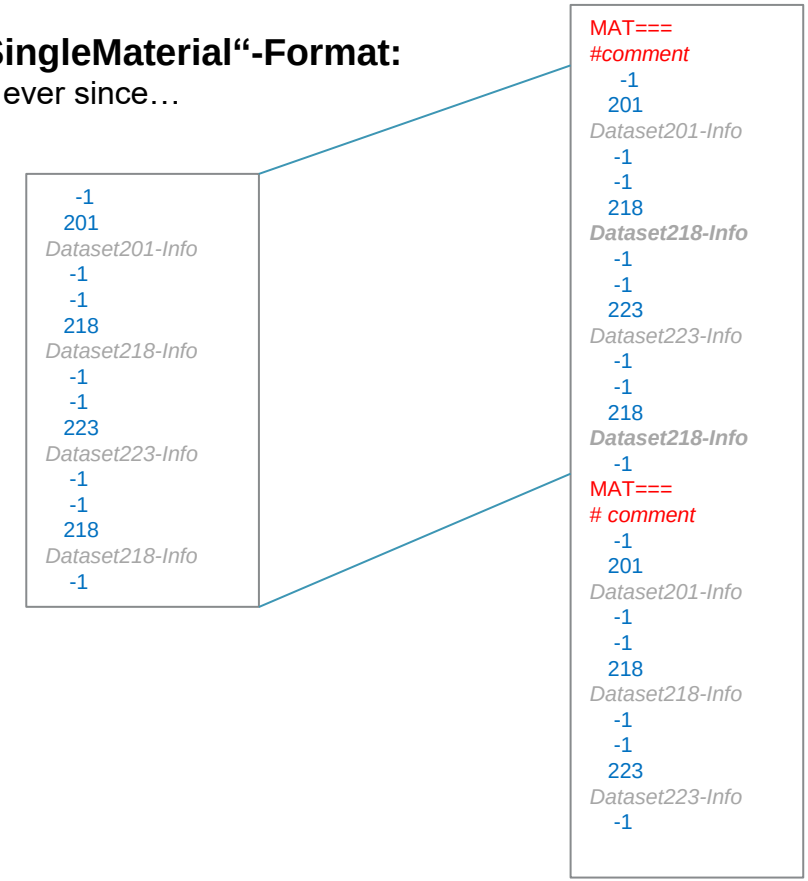
Same with the comment lines - the final Jobfile just saves the executed lines.

Save your **templates** and your **project jobfiles** in different places/file names.

Multi-Material-File

*.ffd-Fileformat for multiple MATerials in one File

„SingleMaterial“-Format:
as ever since…



„MultiMaterial“-Format:

- **MAT===** as a identifier in **position 1-6** to identify the start of a new material in the file.
  Anything in position 7+ will be ignored
- **#** in **first position** indicate the comment line.
  Not to be placed in the datasets but in between!
- **Empty lines (CR)** can be everywhere, but also not in the dataset, but in between.
- Only the first dataset of duplicates (e.g. 218 in first file) will be used. (no pop-up windows to accept the dataset)

FEMFAT Material assignment

Precondition

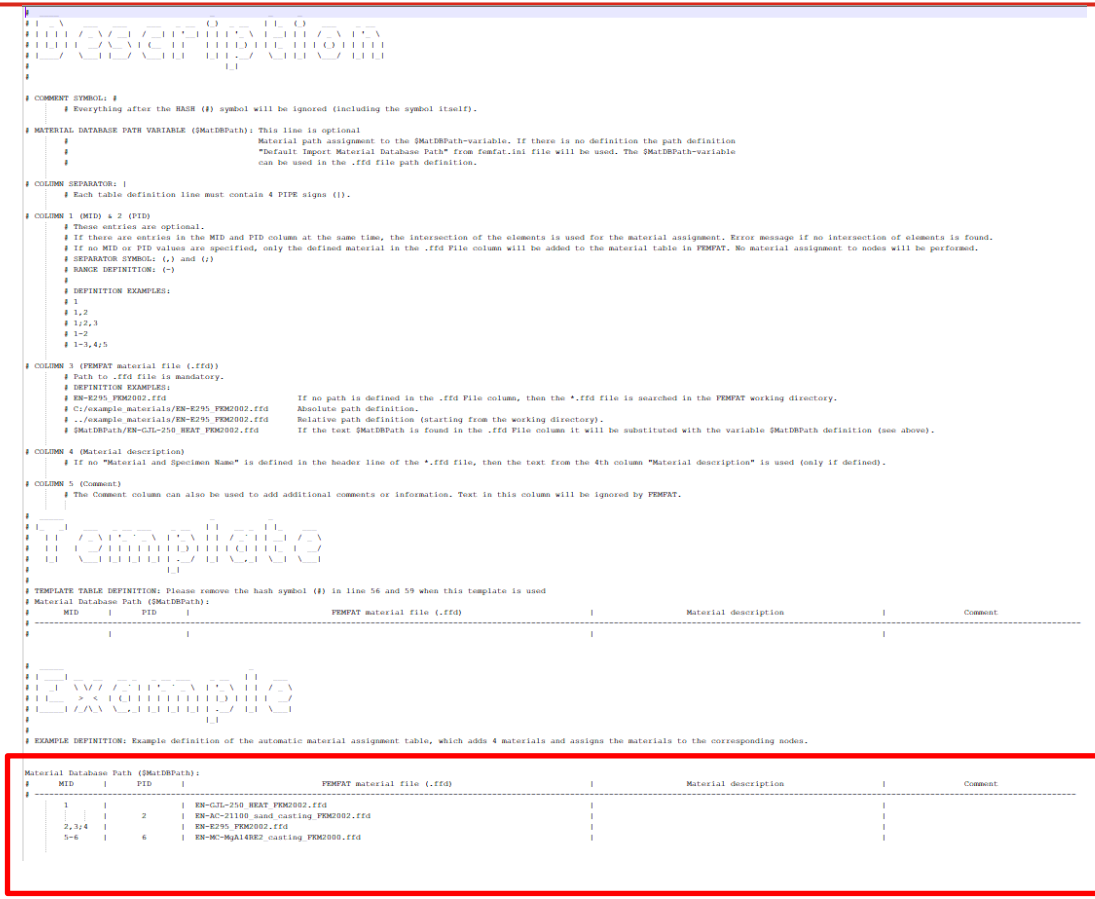
FE-structure file with PID information (Nastran.dat & op2, Medina.bif, ANSYS.cdb)

Directory with all materials for that project

FEMFAT version 5.4.3 or newer

fEMFAT **m**aterial **a**ssignment – file (suffix **fma**) in predefined format

fma-file in your example directory since 5.4.3



```
# COMMENT SYMBOL: #
    # Everything after the HASH (#) symbol will be ignored (including the symbol itself).

# MATERIAL DATABASE PATH VARIABLE ($MatDBPath): This line is optional
    #                                   Material path assignment to the $MatDBPath-variable. If there is no definition the path definition
    #                                   "Default Import Material Database Path" from femfat.ini file will be used. The $MatDBPath-variable
    #                                   can be used in the .ffd file path definition.

# COLUMN SEPARATOR: |
    # Each table definition line must contain 4 PIPE signs (|).

# COLUMN 1 (MID) & 2 (PID)
    # These entries are optional.
    # If there are entries in the MID and PID column at the same time, the intersection of the elements is used for the material assignment. Error message if no intersection of elements is found.
    # If no MID or PID values are specified, only the defined material in the .ffd File column will be added to the material table in FEMFAT. No material assignment to nodes will be performed.
    # SEPARATOR SYMBOL: (,) and (;)
    # RANGE DEFINITION: (-)
    #
    # DEFINITION EXAMPLES:
    # 1
    # 1,2
    # 1;2,3
    # 1-2
    # 1-3,4;5

# COLUMN 3 (FEMFAT material file (.ffd))
    # Path to .ffd file is mandatory.
    # DEFINITION EXAMPLES:
    # EN-E295_FKM2002.ffd                   If no path is defined in the .ffd File column, then the *.ffd file is searched in the FEMFAT working directory.
    # C:/example_materials/EN-E295_FKM2002.ffd      Absolute path definition.
    # ../example_materials/EN-E295_FKM2002.ffd      Relative path definition (starting from the working directory).
    # $MatDBPath/EN-GJL-250_HEAT_FKM2002.ffd        If the text $MatDBPath is found in the .ffd File column it will be substituted with the variable $MatDBPath definition (see above).

# COLUMN 4 (Material description)
    # If no "Material and Specimen Name" is defined in the header line of the *.ffd file, then the text from the 4th column "Material description" is used (only if defined).

# COLUMN 5 (Comment)
    # The Comment column can also be used to add additional comments or information. Text in this column will be ignored by FEMFAT.

# TEMPLATE TABLE DEFINITION: Please remove the hash symbol (#) in line 56 and 59 when this template is used
# Material Database Path ($MatDBPath):
#       MID       |       PID       |                                   FEMFAT material file (.ffd)                                   |                   Material description                    |                Comment
# ------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------
#                 |                 |                                                                                                 |                                                           |

# EXAMPLE DEFINITION: Example definition of the automatic material assignment table, which adds 4 materials and assigns the materials to the corresponding nodes.

Material Database Path ($MatDBPath):
#       MID       |       PID       |                                   FEMFAT material file (.ffd)                                   |                   Material description                    |                Comment
# ------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------
        1         |                 |  EN-GJL-250_HEAT_FKM2002.ffd                                                                    |                                                           |
                  |        2        |  EN-AC-21100_sand_casting_FKM2002.ffd                                                           |                                                           |
        2,3;4     |                 |  EN-E295_FKM2002.ffd                                                                            |                                                           |
        5-6       |        6        |  EN-MC-MgAl4RE2_casting_FKM2000.ffd                                                             |                                                           |
```

documentation

The essential part

fma-file format

That´s all you need ☺

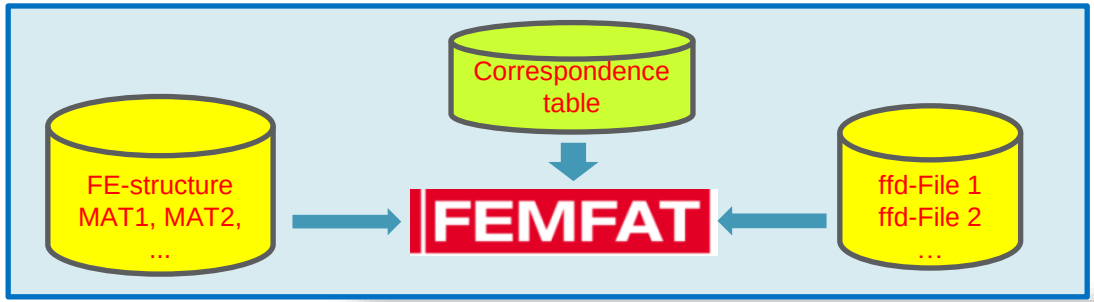
A path for quick access to your material database

```
Material Database Path ($MatDBPath): C:\SimCon_2021\materials
#       MID       |    PID   |   FEMFAT material file (.ffd)          |  Material description |  Comment
# ------------------------------------------------------------------------------------------------------
                  |     3    |   $MatDBPath\DP500_FAT_IMAB.ffd        |      mat_for PID3     |
                  |     6    |   $MatDBPath\St14_3_FAT_IMAB.ffd       |      mat_for PID6     |
                  |  7-13    |   $MatDBPath\ZStE250.ffd               |      mat_for PID7-13  |
                  |  14,21   |   $MatDBPath\zste340.ffd               |      mat_for PID14 21 |
                  |     26   |   $MatDBPath\h340LA.ffd                |      mat_for PID26    |
```

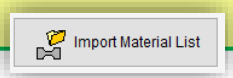
```
1     -1
2    201
3  STEYR-FILE  2.0
4  Material Properties ZSTE250
5  ZStE250
6  (ungenormtes Material)
7  Last change: Heizeneder 2006-08
8     -1
9     -1
10   218
11 ZSTE250
12 Strain data: Calculated from S-N Curve
13 Source: Material Generator MATGEN (Copy
14 0.3000E+000 0.0000E+000 0.0000E+00
```

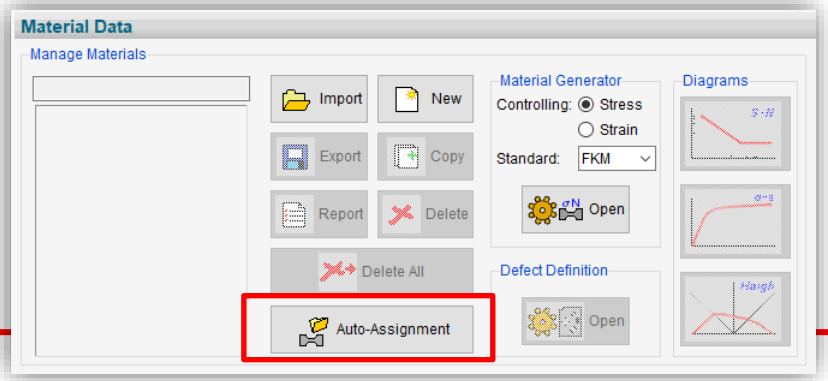
Is only used if descriptor in dataset 218 is empty

Automatic Material Assignment



- Import material correspondence table *.fma
- Loading all ffd-Files automatically
- Automatic assignment of materials to nodes at elements with MID/PID according to the correspondence table
- Supported FE-interfaces:
  NASTRAN BDF & OP2, ANSYS CDB, MEDINA BIF, I-DEAS MS UNV
- Other interfaces: material import without assignment

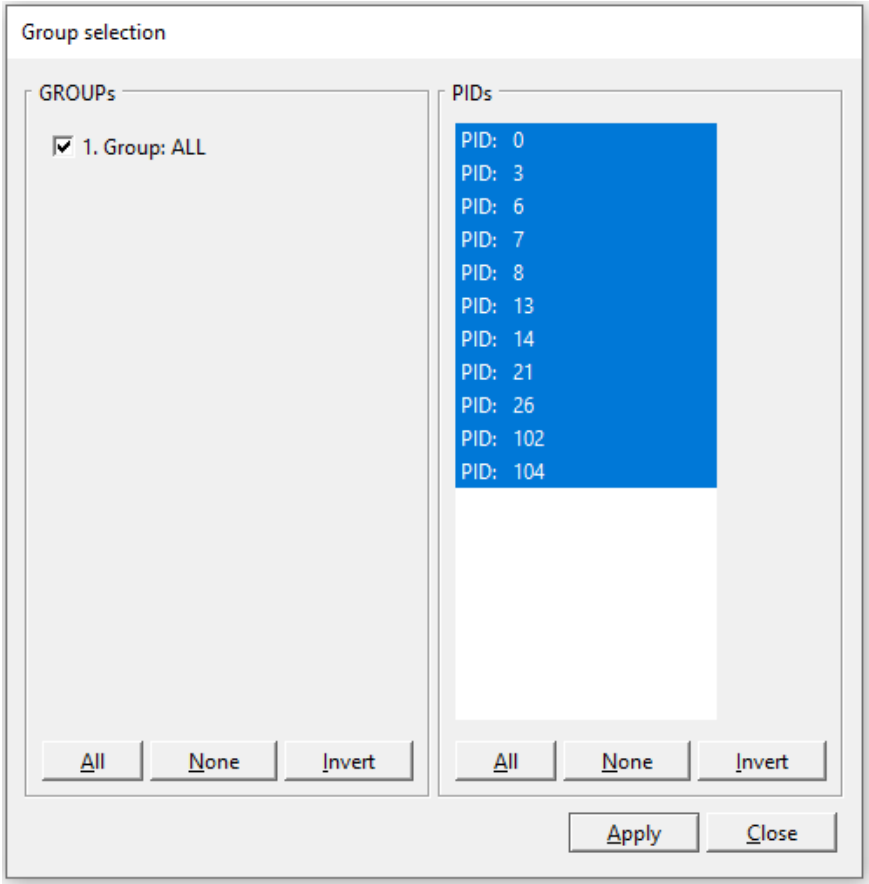


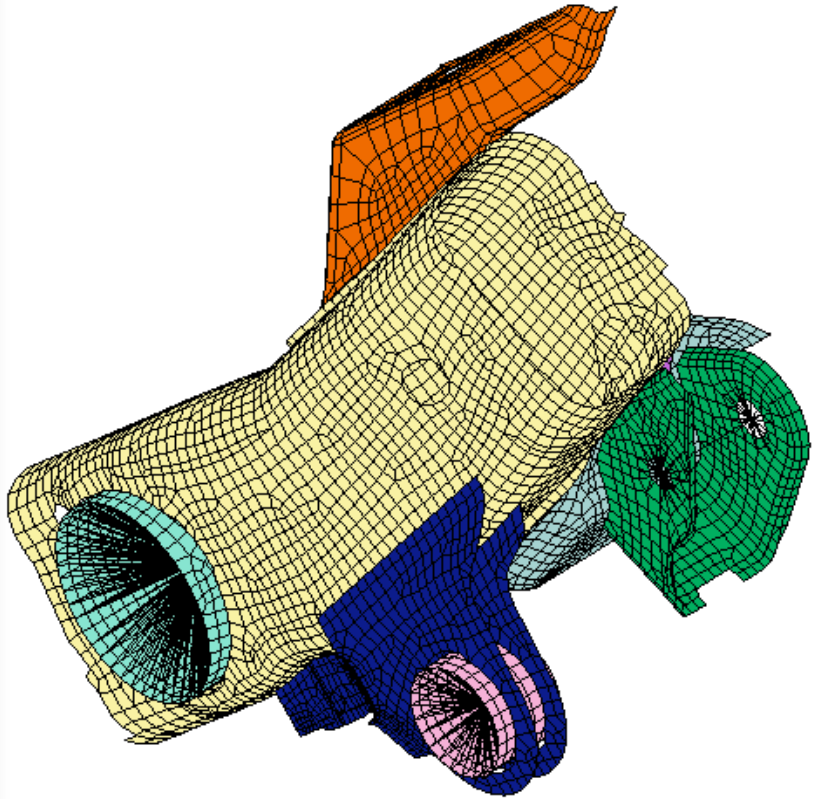


Material correspondence table *.fma-file

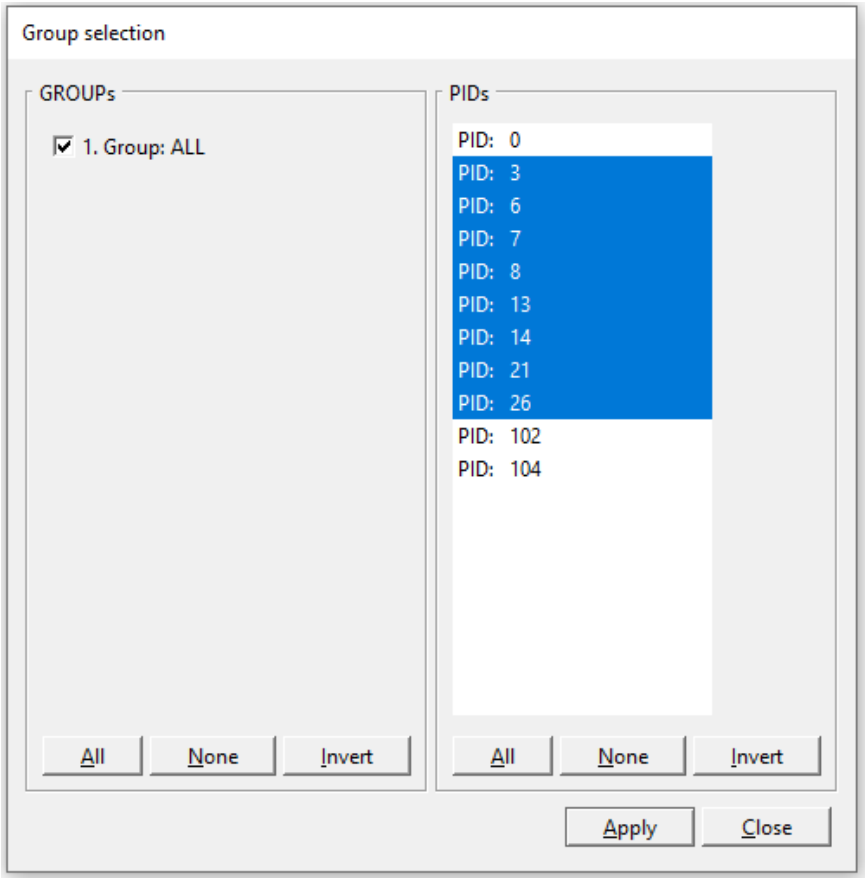
```
# Example

Material Database Path ($MatDBPath): C:\MaterialData
#       MID       |       PID       |        FEMFAT material file (.ffd)        |    Material description     | Comment
# ------------------------------------------------------------------------------------------------------------------------
        1         |                 |  EN-GJL-250_HEAT_FKM2002.ffd              | Grey Cast Iron              |
                  |        2        |  EN-AC-21100_sand_casting_FKM2002.ffd     | Aluminum                    |
        2,3;4     |                 |  EN-E295_FKM2002.ffd                      |                             |
        5-6       |        6        |  EN-MC-MgAl4RE2_casting_FKM2000.ffd       |                             |
```

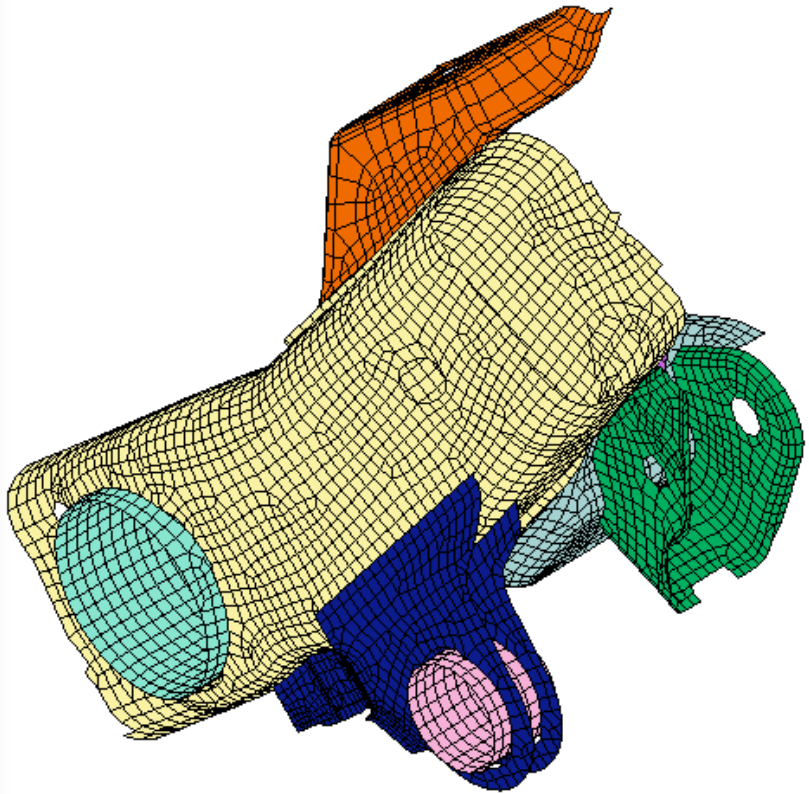
example





example





example

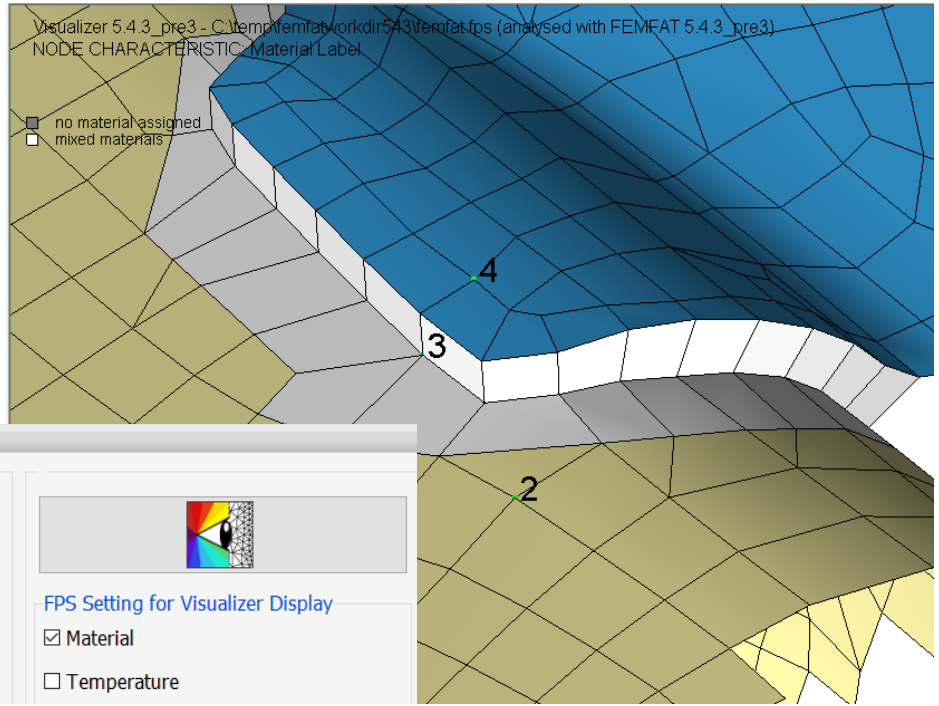
Material Data

Manage Materials

5 - H 340 LA

1 - DP500-Steel Deep-Drawing S
2 - St14-O3 Deep Draw
3 - ZSTE250
4 - ZSTE340
5 - H 340 LA

Import | New | Export | Copy | Report | Delete | Delete All | Auto-Assignment



Node Characteristics

Group Selection

2 - PID1-99(MOD.)

1 - ALL
2 - PID1-99(MOD.)
3 - Most Critical Nodes Group

Group Filter:

2 - PID1-99(MOD.)
Number of Nodes: 6297
Number of Elements: 6108

FPS Setting for Visualizer Display

☑ Material
☐ Temperature

WeldSeamScanner 1.5

Visualizer intelligence - automized

The recognition of possible weldseams in a FE-structure after import to FEMFAT (so femfat.fps file is available) is implemented into an extra TOOL:
weldseamscanner 1.5

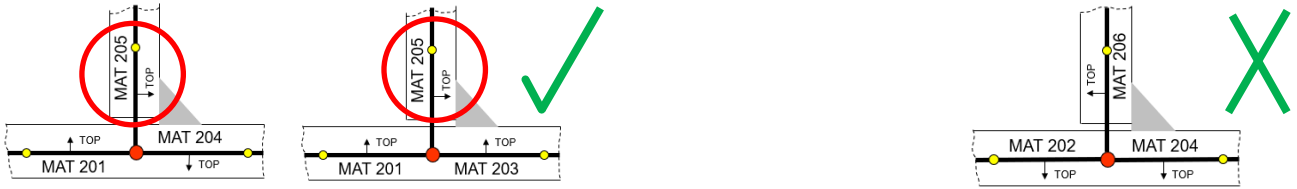
The Tool follows some simple rules;

The engineer can use some simple tricks to get the wdf-file the first time right.

The automatically created weld definition file (wdf) has to be checked actively in the **FEMFAT visualizer** before the wdf can be used in **FEMFAT**.

Automatic recognition

1) Topology: joint of 3 or more shell elements – there must be a weld seam…
2) If different PIDs are used even Butt-Welds can be identified
3) ANSYS CDB-file options to identify CM, CMBLOCK, materials, real constants as such PID for FEMFAT and FEMFAT visualizer (new in V1.3)
4) One-sided weldseams are at the TOP-side of the webplate.



5) Use the lowest SID number for the default seam type:

standard:

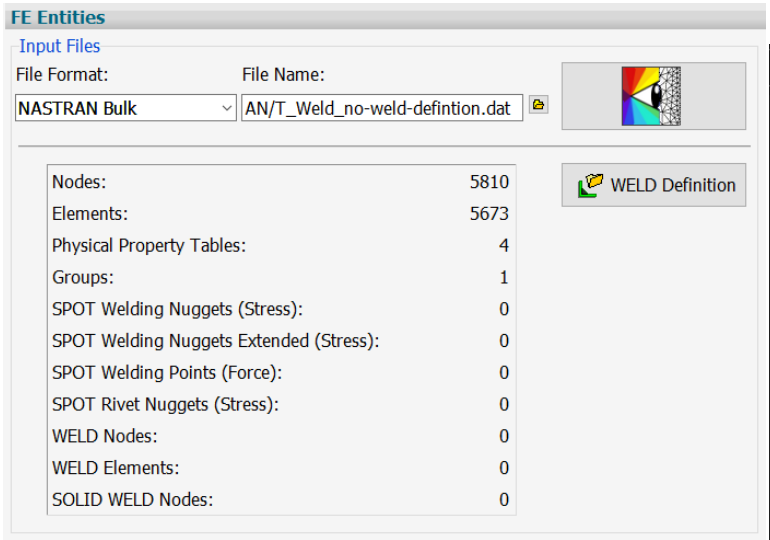
T-WELD – NAME	internal MAT lable	SID
One-Side Fillet Weld with Root Under-Cut	(MAT 201-206)	200
One-Side Fillet Weld without Root Under-Cut	(MAT 441-446)	207
Double Fillet Weld	(MAT 207-212)	201
HV-Seam	(MAT 213-218)	202
DHV-Seam	(MAT 219-224)	203
DHY-Seam	(MAT 225-230)	204

customized to have HV seams first:

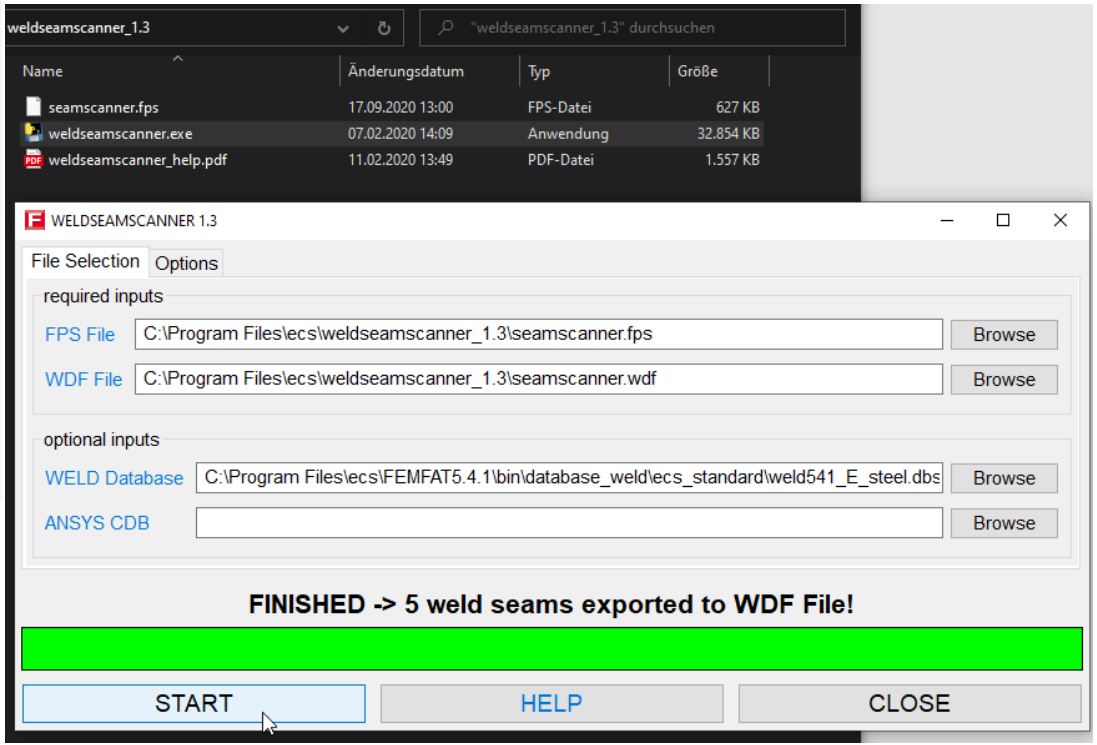
T-WELD – NAME	internal MAT lable	SID
One-Side Fillet Weld with Root Under-Cut	(MAT 201-206)	202
One-Side Fillet Weld without Root Under-Cut	(MAT 441-446)	207
Double Fillet Weld	(MAT 207-212)	201
HV-Seam	(MAT 213-218)	200
DHV-Seam	(MAT 219-224)	203
DHY-Seam	(MAT 225-230)	204

Use the weldseamscanner.exe

Create a fps-file from FE-Entities

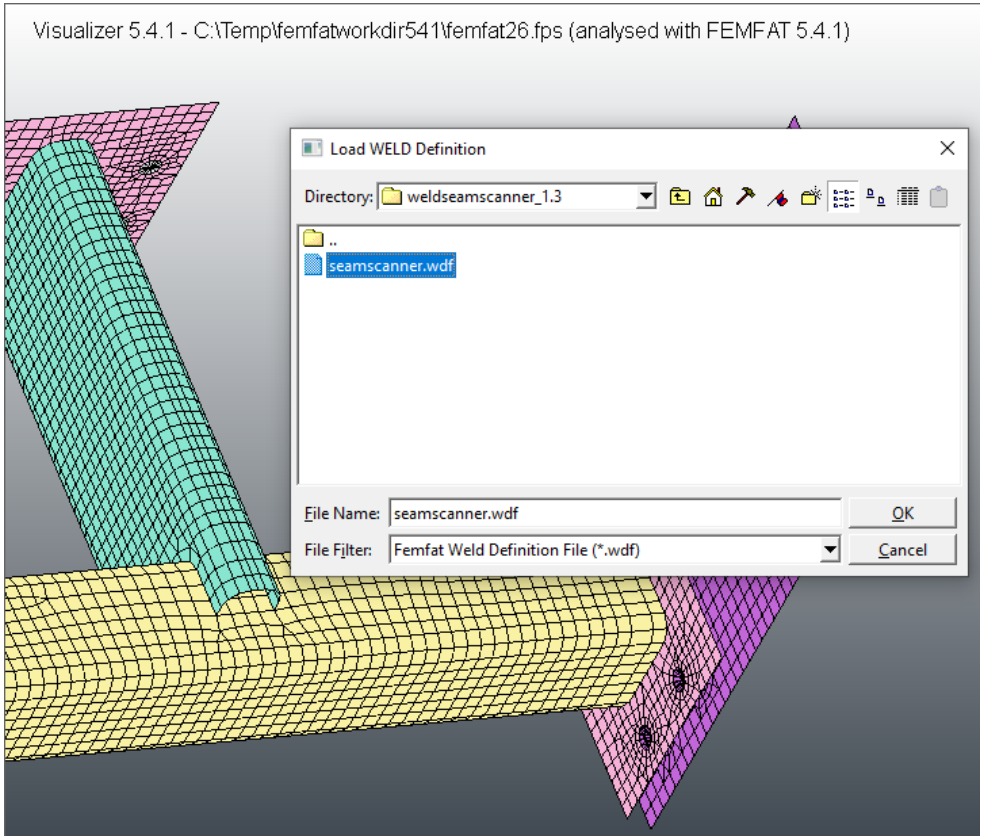


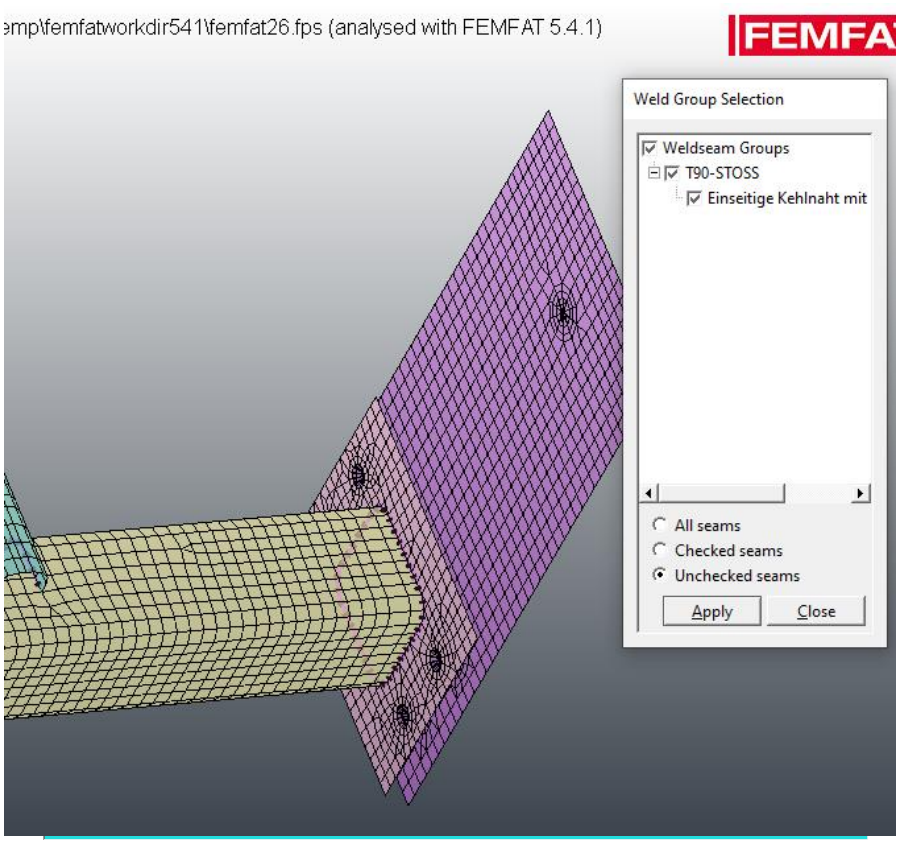
Import the fps-file and weld-database to the weldseamscanner (wdf-file name is automatic)



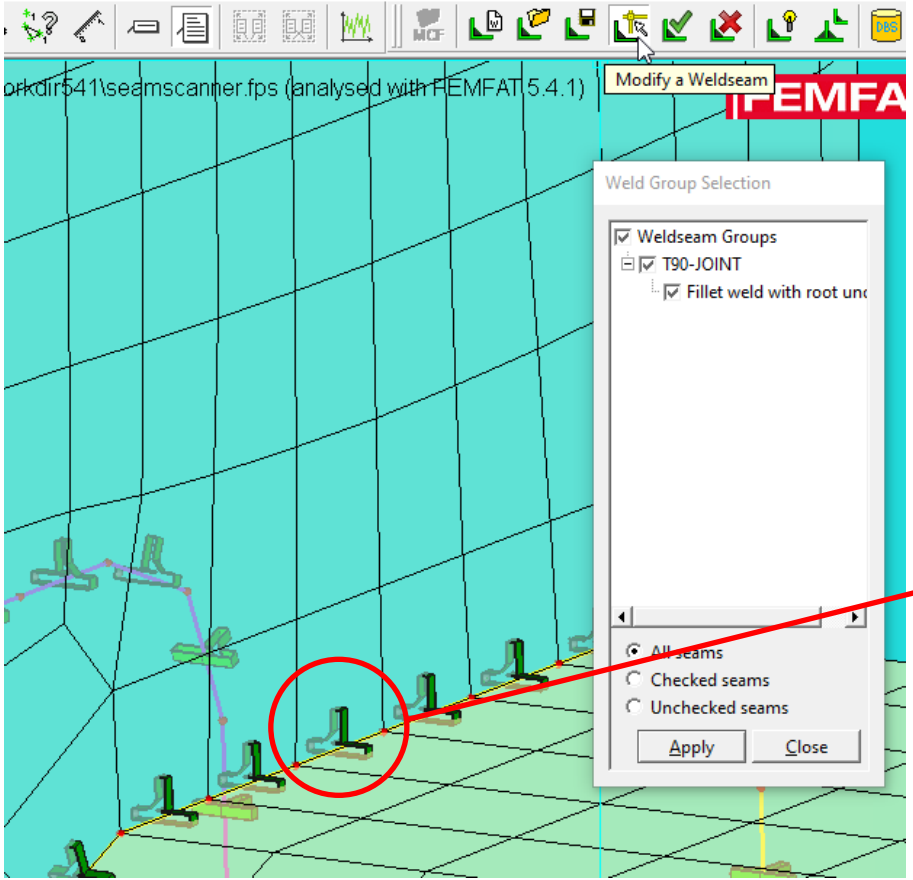
Three clicks - finished !

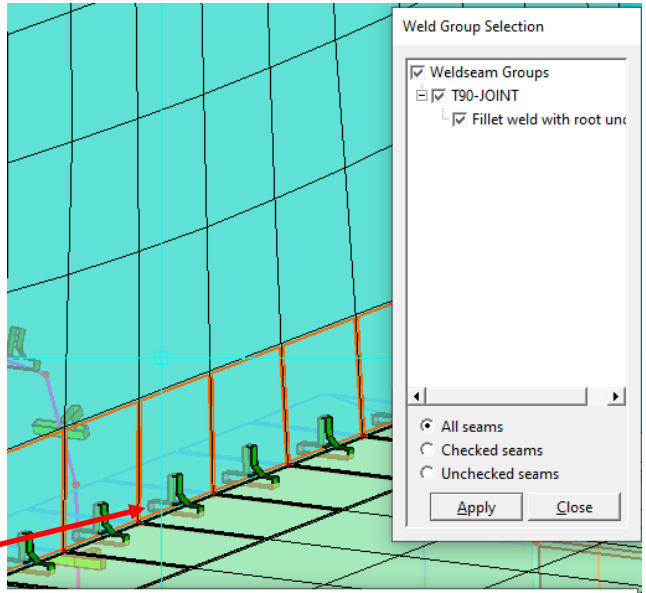
Import wdf-file: all seams are unchecked

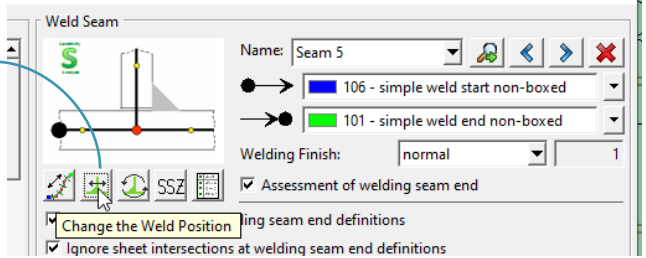




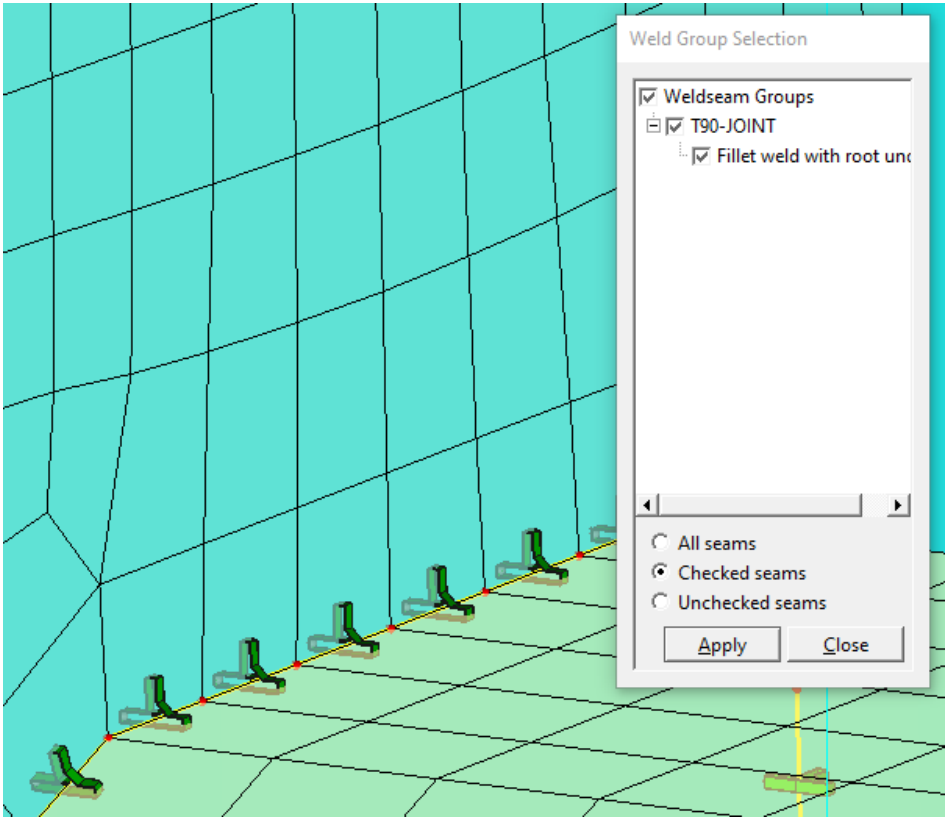
Check the seams and/or modify it







All checked seams can be imported to FEMFAT



FE Entities

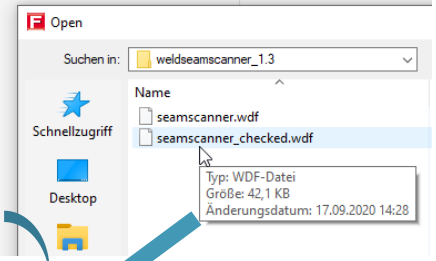
Input Files

File Format: NASTRAN Bulk

File Name: AN/T_Weld_no-weld-defintion.dat

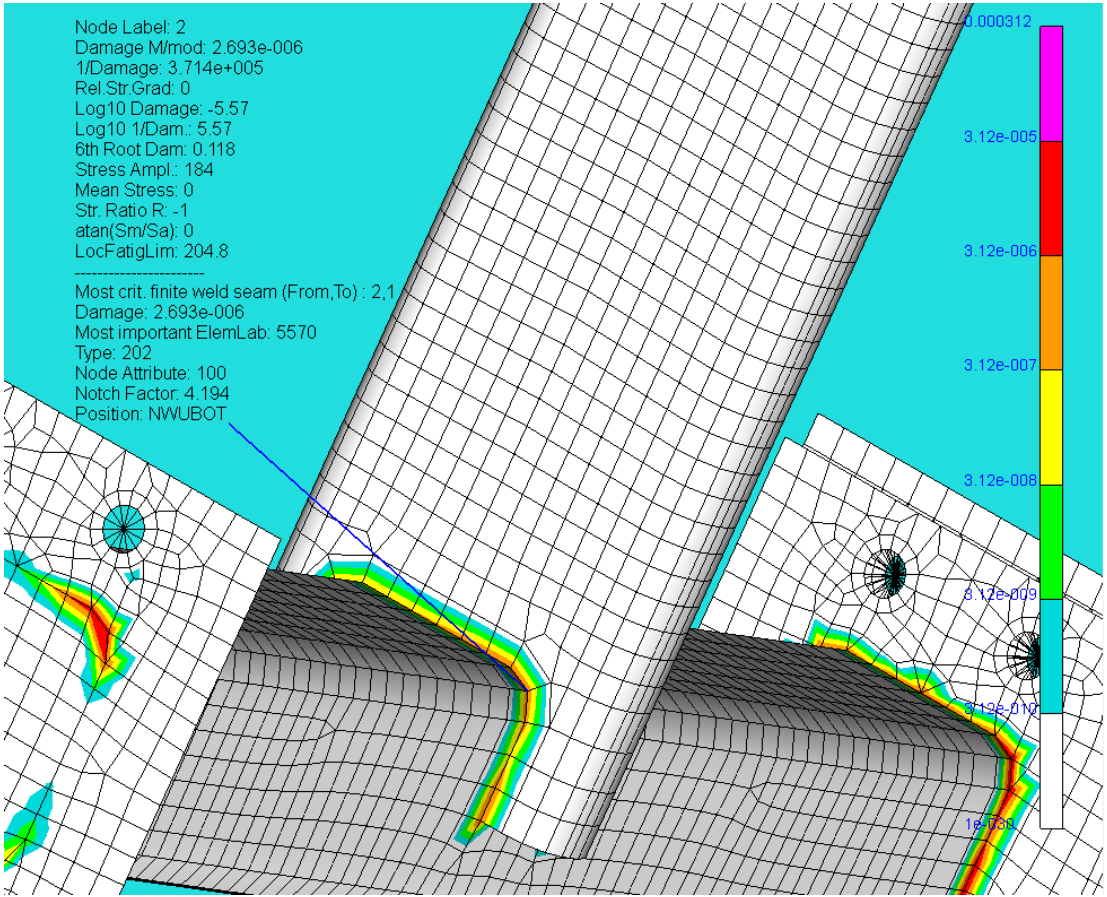
WELD Definition

Nodes:	5810
Elements:	5673
Physical Property Tables:	4
Groups:	1
SPOT Welding Nuggets (Stress):	0
SPOT Welding Nuggets Extended (Stress):	0
SPOT Welding Points (Force):	0
SPOT Rivet Nuggets (Stress):	0
WELD Nodes:	0
WELD Elements:	0
SOLID WELD Nodes:	0



SPOT Rivet Nuggets (Stress):	0
WELD Nodes:	142
WELD Elements:	452
SOLID WELD Nodes:	0

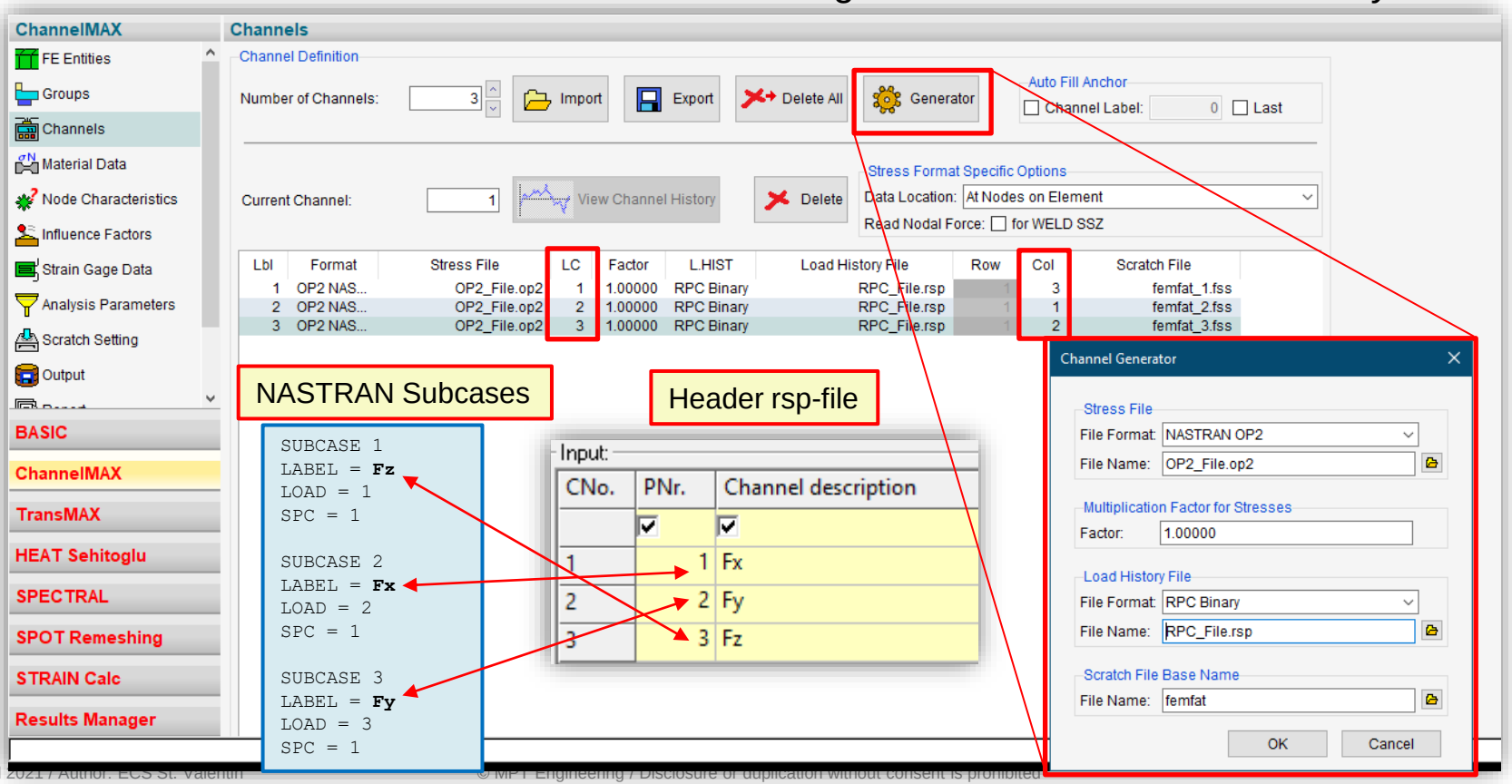
And used for analysis



Automatic channelMAX load history assignment

Automatic Channel Generation and Assignment of Load Time Data to Channels

- NASTRAN Subcase label is used for automatic assignment of RPC load time history.



example bracket_test.dat

Nastran analysis run with normal order in forces (Fx, Fy, Fz) in accordance with the binary rpc file loadhistory.rpc

```
SUBCASE      1
LABEL = Fx
SPC     =           1
LOAD    =           1
DISPLACEMENT(PLOT) = ALL
STRESS(PRINT,PLOT,CENTER) = ALL
$
SUBCASE      2
LABEL = Fy
SPC     =           1
LOAD    =           2
DISPLACEMENT(PLOT) = ALL
STRESS(PRINT,PLOT,CENTER) = ALL
$
SUBCASE      3
LABEL = Fz
SPC     =           1
LOAD    =           3
DISPLACEMENT(PLOT) = ALL
STRESS(PRINT,PLOT,CENTER) = ALL
```

Header loadhistory.rpc

Input:

CNo.	PNr.	Channel description
	☑	☑
1	1	Fx
2	2	Fy
3	3	Fz

DRIVING **EXCELLENCE.**
INSPIRING **INNOVATION.**