



KONGSBERG

CAESES USERS MEETING 2019

Advanced Feature Modeling

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Presentation Structure

- Understanding *FFeatureDefinitions*
- Motivation
- Starting point
- Examples
 - Shipflow
 - NAPA arrangement generation
- Challenges
- Conclusions

Understanding *FFeatureDefinitions*

What are they for?

“Encapsulation of recurrent tasks”

-  Curve Engines ->  Meta Surfaces

-  File I/O - reading and writing

- Conditional statements

```
1 if(condition)
2   echo("hello")
3 elseif(condition)
4   echo("world")
5 else
6   echo("!!!")
7 endif
```

```
1 switch(myIntegerValue)
2 case 1
3   echo("value is one")
4 case 2
5   echo("value is two")
6 default
7   echo("value is neither one nor two")
8 endswitch
```

- Run external processes

- Loops

```
1 while(condition)
2   echo("do something")
3 endwhile
```

```
1 loop(count)
2   echo("iteration count: " + $$i)
3 endloop
```

```
1 foreach(F3DPoint p in myObjectList)
2   // set the x-coordinate for all points in the objectlist to 4.
3   // Objects that are not points are skipped.
4   p.setX(4)
5 endfor
```

- Containers



FEntityGroup



FObjectList

- Functions

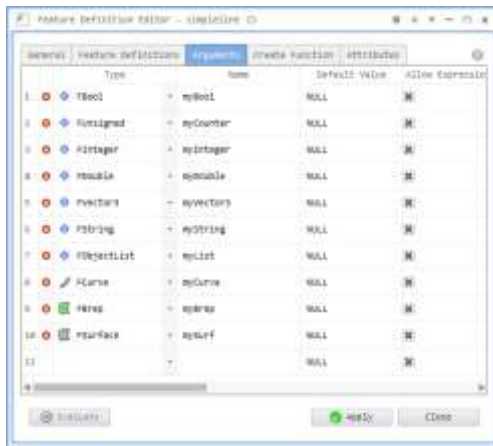
```
1 function myLineCreator(F3DPoint p1, F3DPoint p2) : FLine
2   line l(p1, p2)
3   return(l)
4 endfunction
```

- Nesting

Understanding *FFeatureDefinitions* F

How do I use them?

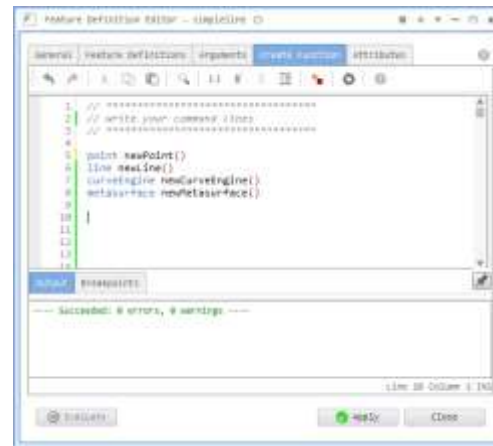
1. Input arguments



understand entities



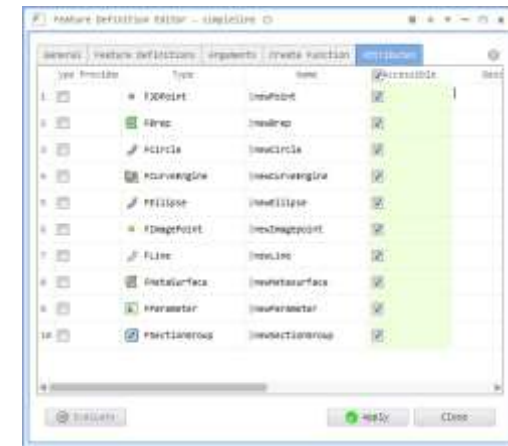
2. Command sequence



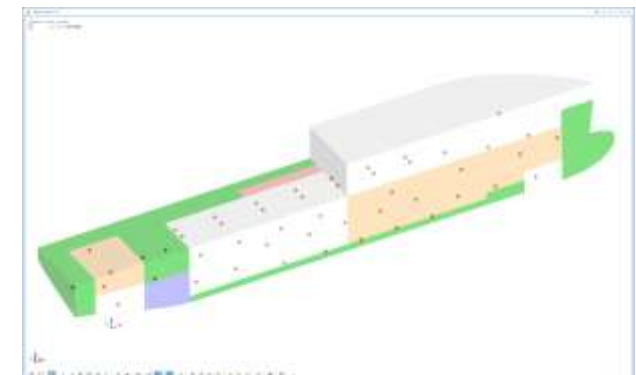
program desired actions

```
1 // set up string for current design directory adding the name of the feature
2 string workingDir(getDesignDir() + "/" + this.getName() + "/")
3 // create a new path
4 mkpath(workingDir)
5
6 // open a file for writing
7 FFile out(workingDir + "value.dat")
8 out.openWrite()
9 // write out the parameter value of myParam
10 out.writeln("value="+myParam.toString())
11 out.close()
12
```

3. Output attributes



return/display results



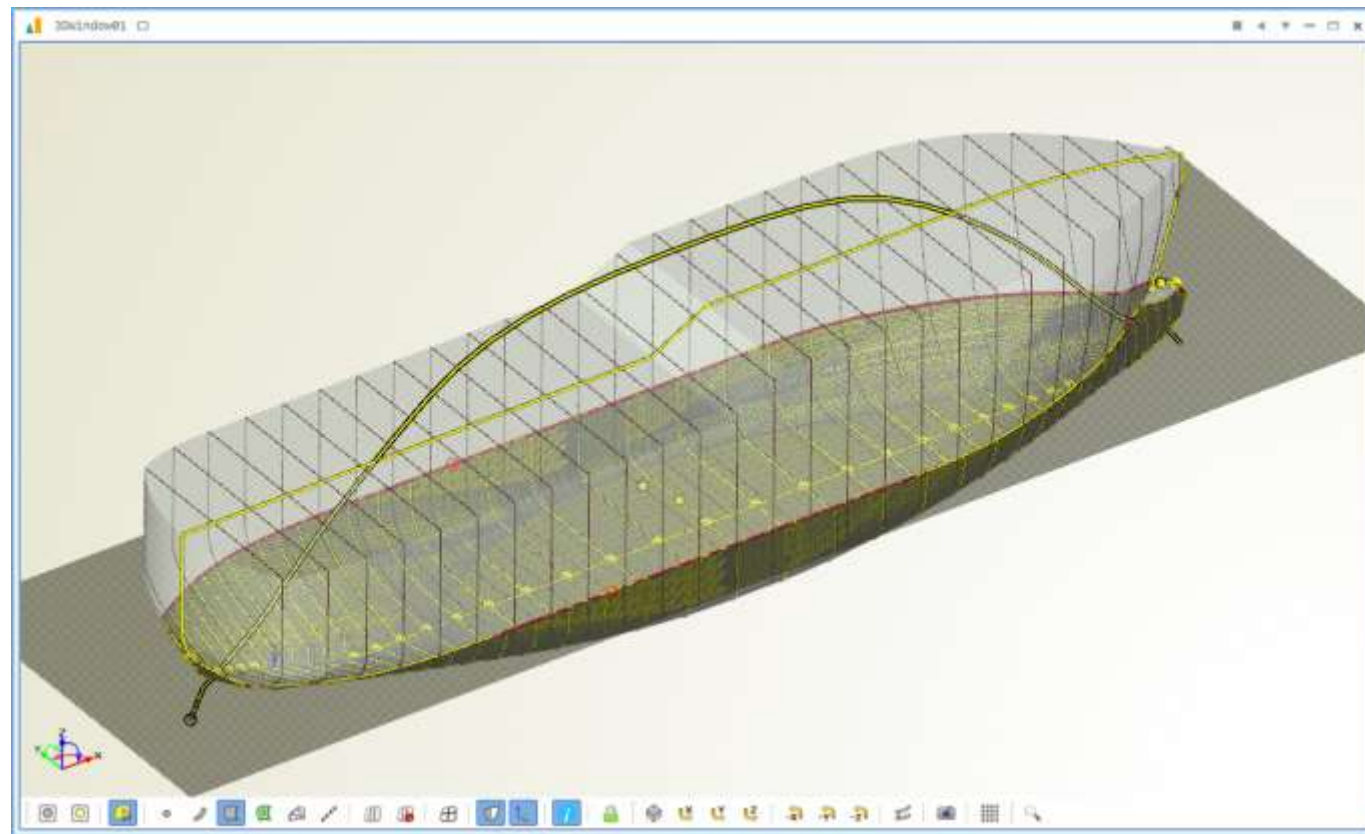


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Motivation

Ship Design at Kongsberg Maritime

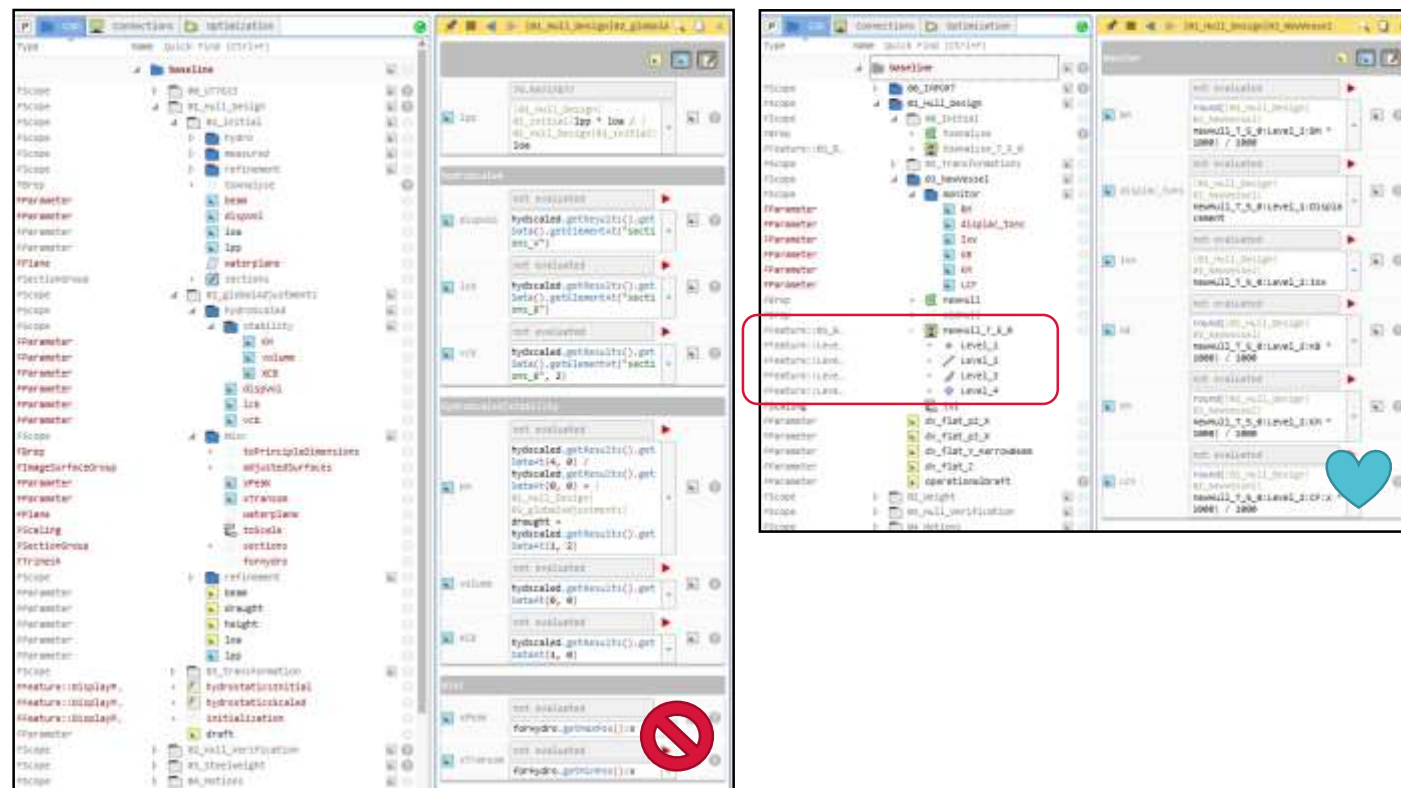
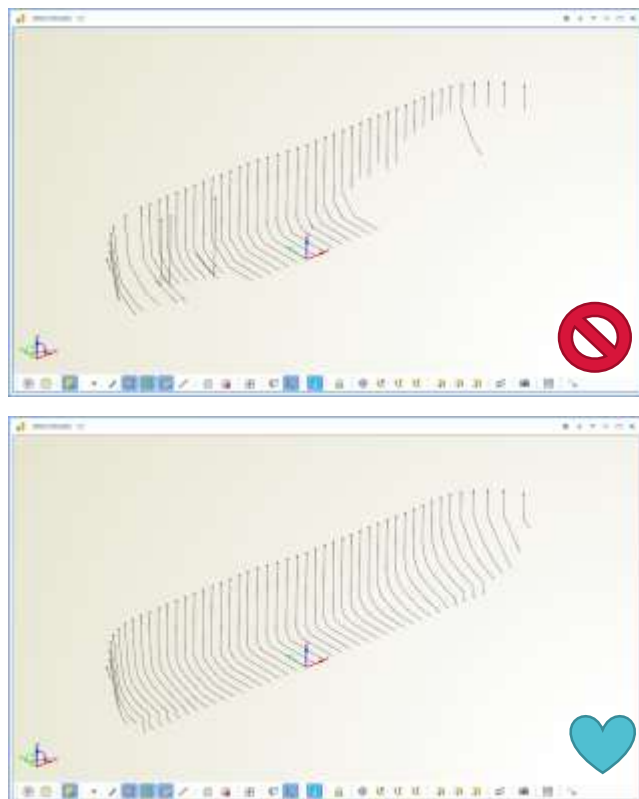
- Increase **efficiency** in early design phase
 - Hydrostatics extraction
 - Intact stability, IMO criteria
 - Crane positioning/capacity
 - Resistance estimations / initial optimization
 - Seakeeping evaluations
 - Station-keeping – future
 - Maneuvering – future
 - Simplified damage stability – future



Motivation

Ship Design at Kongsberg Maritime

- Robust results
- Organization and user-friendliness




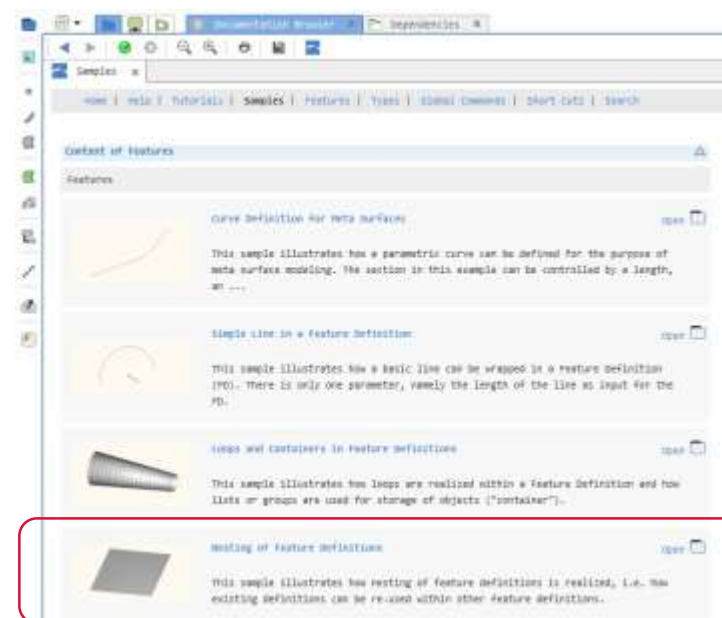
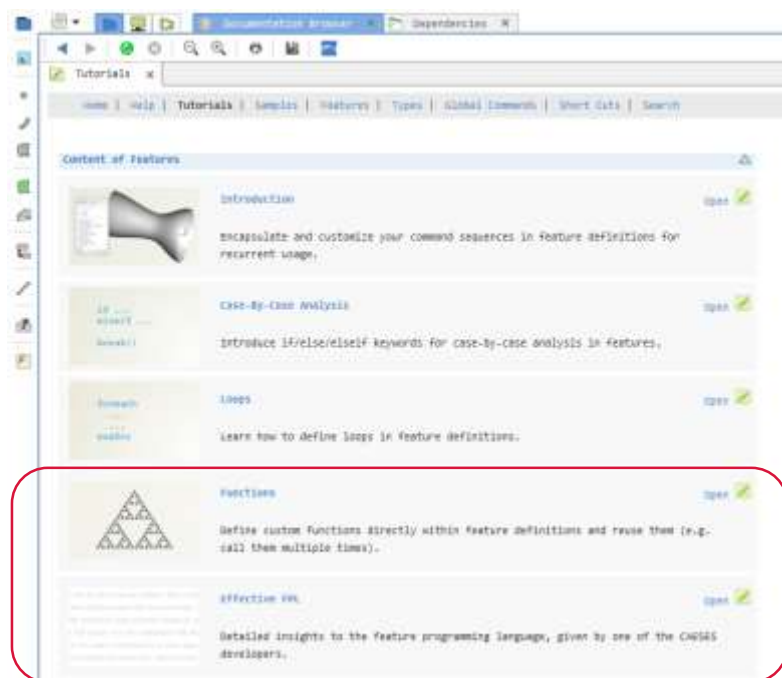


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Starting Point

Tutorials & Samples

- Learn  Types and its available commands (“. + ctrl + space”)
- Documentation on functions and features



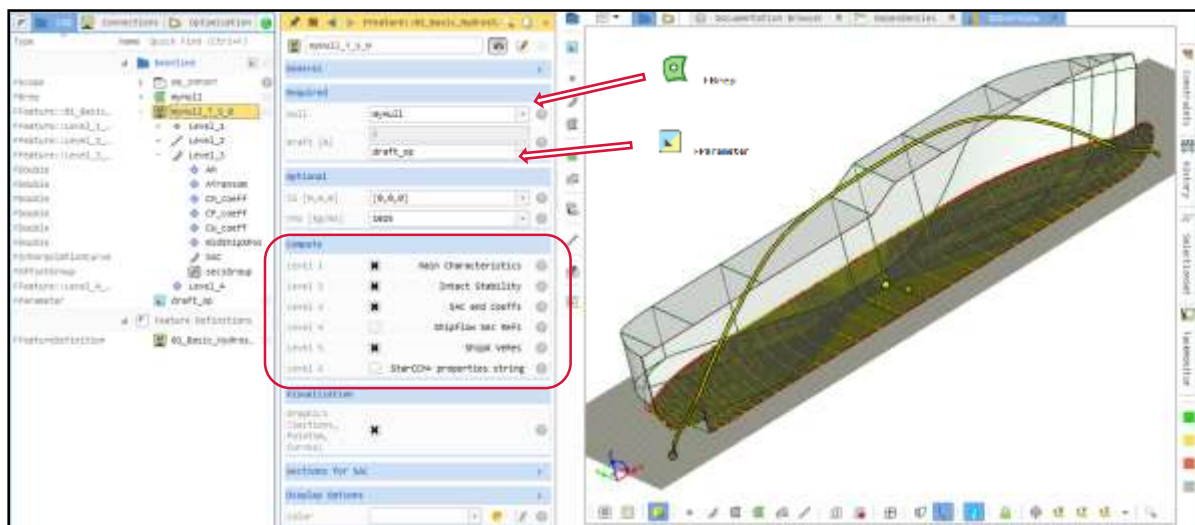


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Starting Point

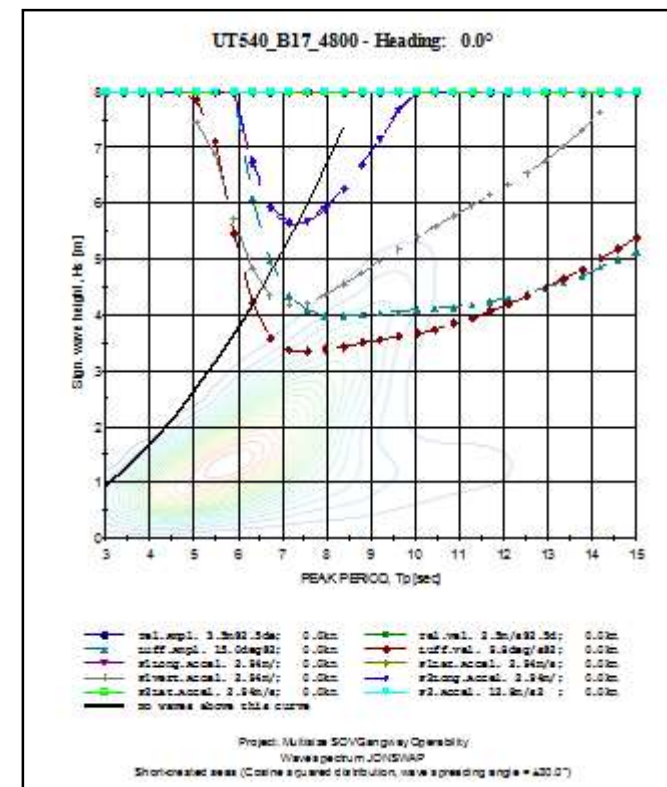
First usages

- “Basic Hydrostatics” FFeature::

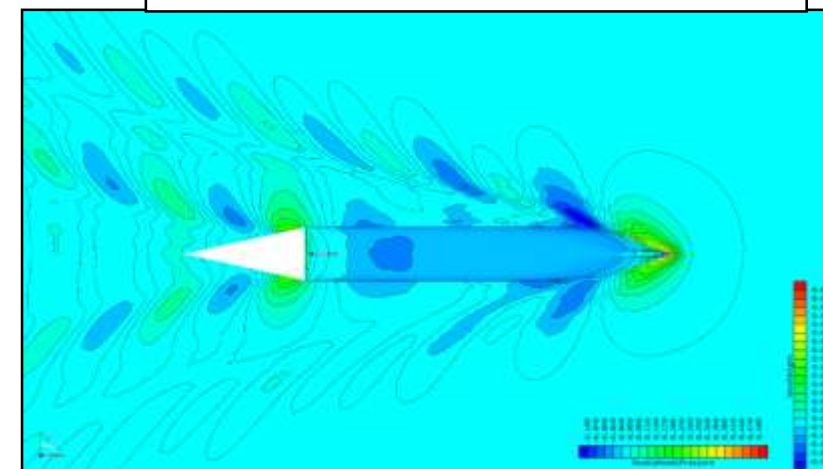


- Main characteristics
- Geometry conversions (including ASCII)
- *String* scripting

ShipX VeRes



Shipflow



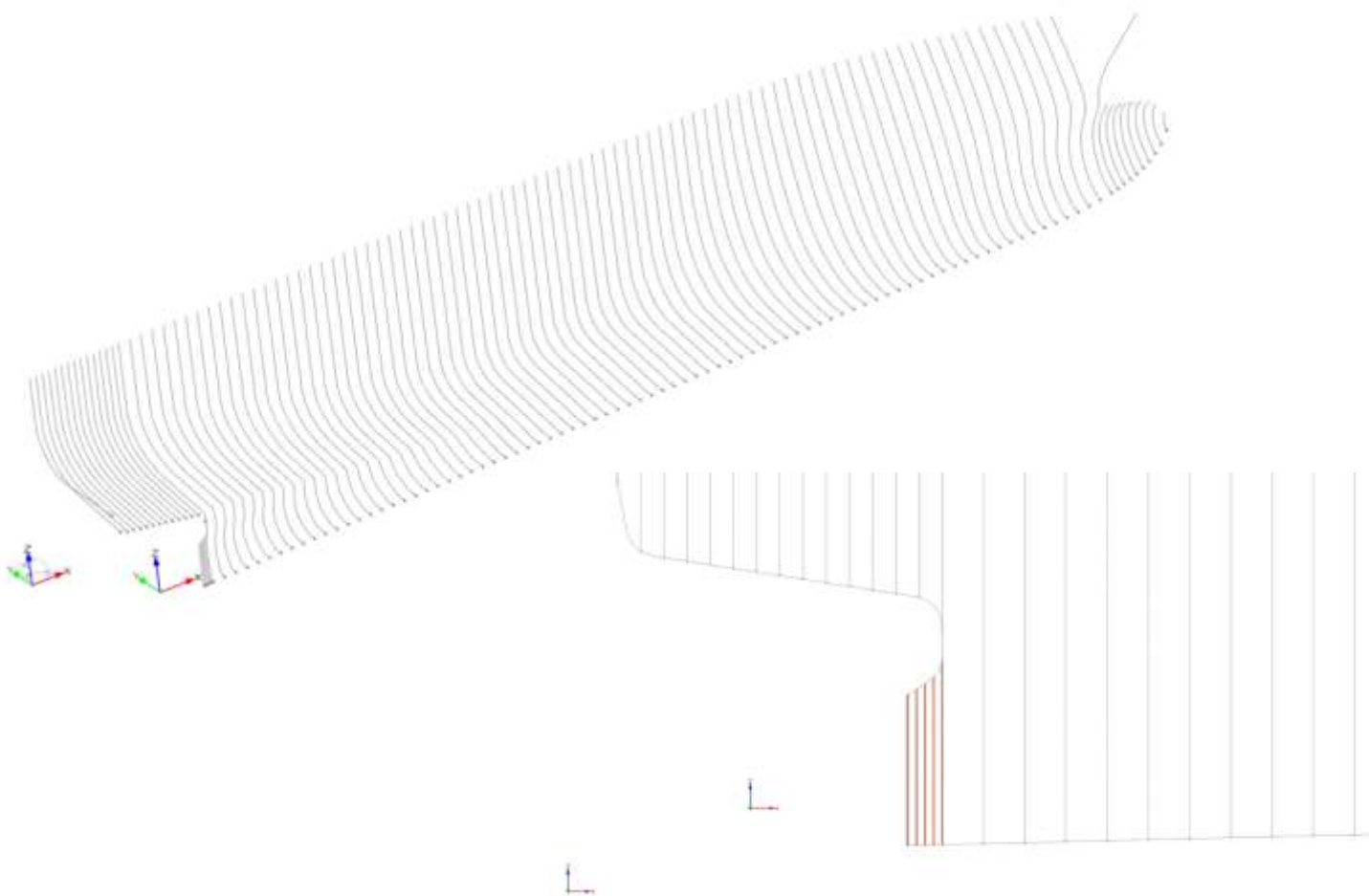
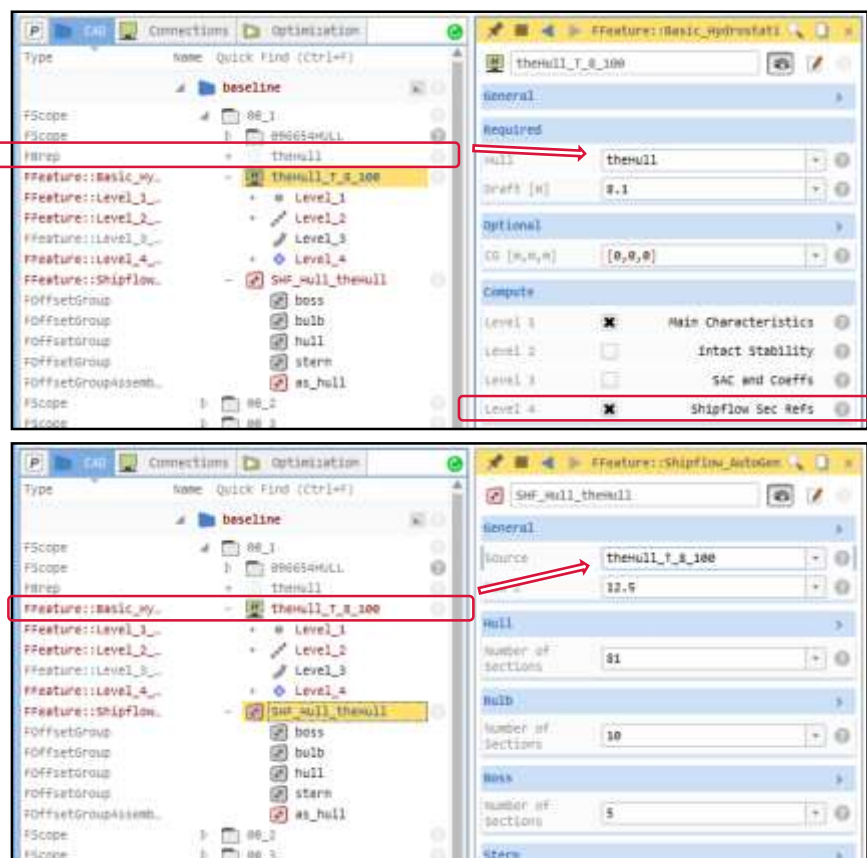


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Examples

Shipflow

- Robust sections generation

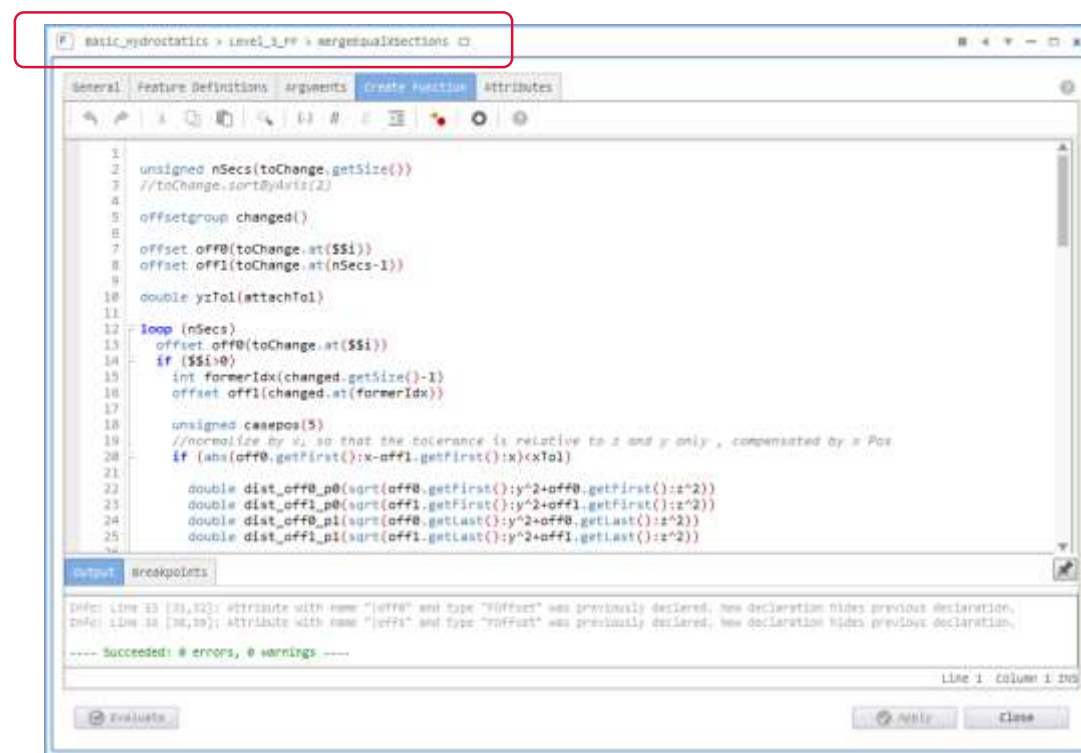
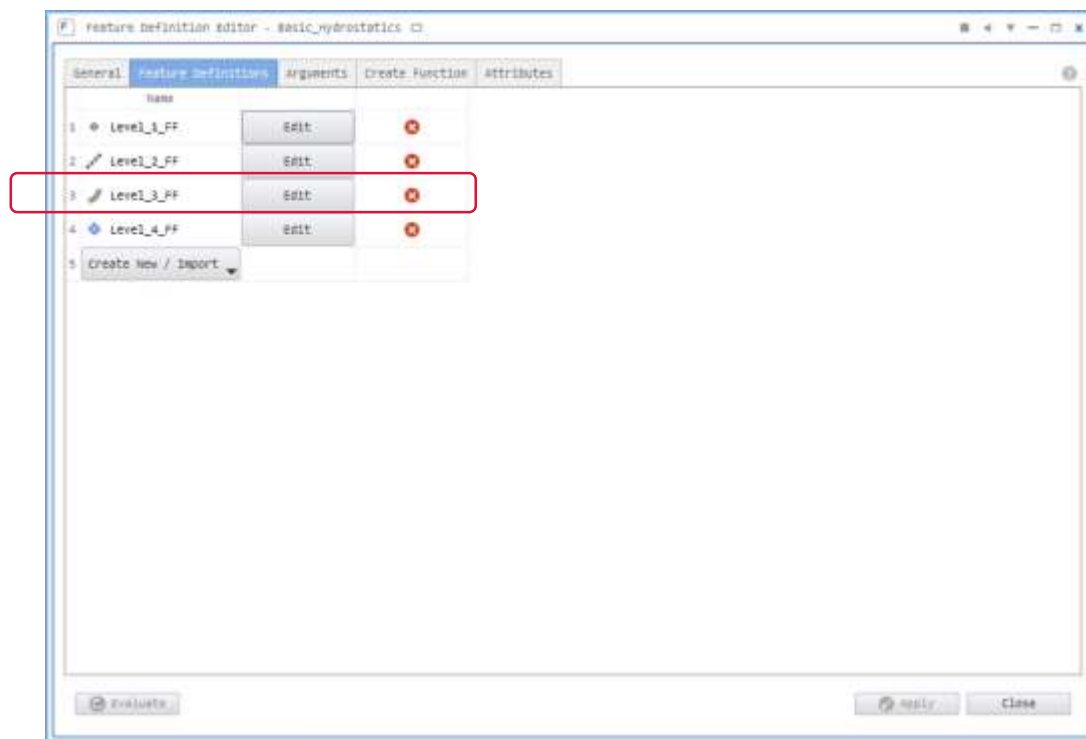




Examples

Shipflow – Coding

- Nesting features





Examples

Shipflow – Coding

- Calling nested features

- “fp_FFeature_name”
- FFeature::name
- (arguments) - “ctrl+space” for hints

```
39: fp_mergeEqualSections changed(sectionsForSAC.getSections().cutMinMax(-999,9999,0,999,-100,draft),0.5,min(startDis,endDis)/2)
40: changed.run()
41: offsetGroup secsGroup(changed.getChanged())
42:
```

- Run (if update only on user request)
- Transfer results

```

1 //=====
2 //CAUSES FEATURE - KONGSBERG MARITIME
3 //=====
4 //fp_level_1: # 05* 00000
5 //fp_level_1: # 05* 00000
6 //fp_level_1: # 05* 00000
7 //fp_level_1: # 05* 00000
8 //fp_level_1: # 05* 00000
9 //fp_level_1: # 05* 00000
10 //fp_level_1: # 05* 00000
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13 //fp_level_1: # 05* 00000
14 //fp_level_1: # 05* 00000
15 //fp_level_1: # 05* 00000
16 //fp_level_1: # 05* 00000
17 //fp_level_1: # 05* 00000
18 //fp_level_1: # 05* 00000
19 //fp_level_1: # 05* 00000
20 //=====
21
22
23 fp_level_1_FF level_1(hull,this.getDraft(),rho,true,true)
24 level_1.setVisible(view_feats)
25 level_1.run()
26
27 IF (lv12)
28 fp_level_2_FF level_2(hull,this.getDraft(),level_1.getMirrorFlag(),level_1.getCD(),level_1.getVolume(),this.getCD(),level_1.getBeamL())
29 level_2.setVisible(view_feats)
30 level_2.run()
31 endif
32
33 IF (lv13)
34 fp_level_3_FF
35 level_3(hull,level_1.getMirrorFlag(),disAft,disMax,disFore,manDistPos,level_1.getInLine(),level_2.getLvl(),this.getDraft(),level_1.getBeamL(),level_2.getAft(),
36 level_3.getHind_underDut(),level_1.getMaxUnderDut())
37 level_3.setVisible(view_feats)
38 level_3.run()
39 endif
40
41 IF (lv14)
42 fp_level_4_FF level_4(hull,this.getDraft())
43 level_4.setVisible(view_feats)
44 level_4.run()
45 endif
46
47 this.setName(hull.getName()+"_T_"+floor(draft).toString()+"_"+round((draft-floor(draft))*1000).toString())
48

```

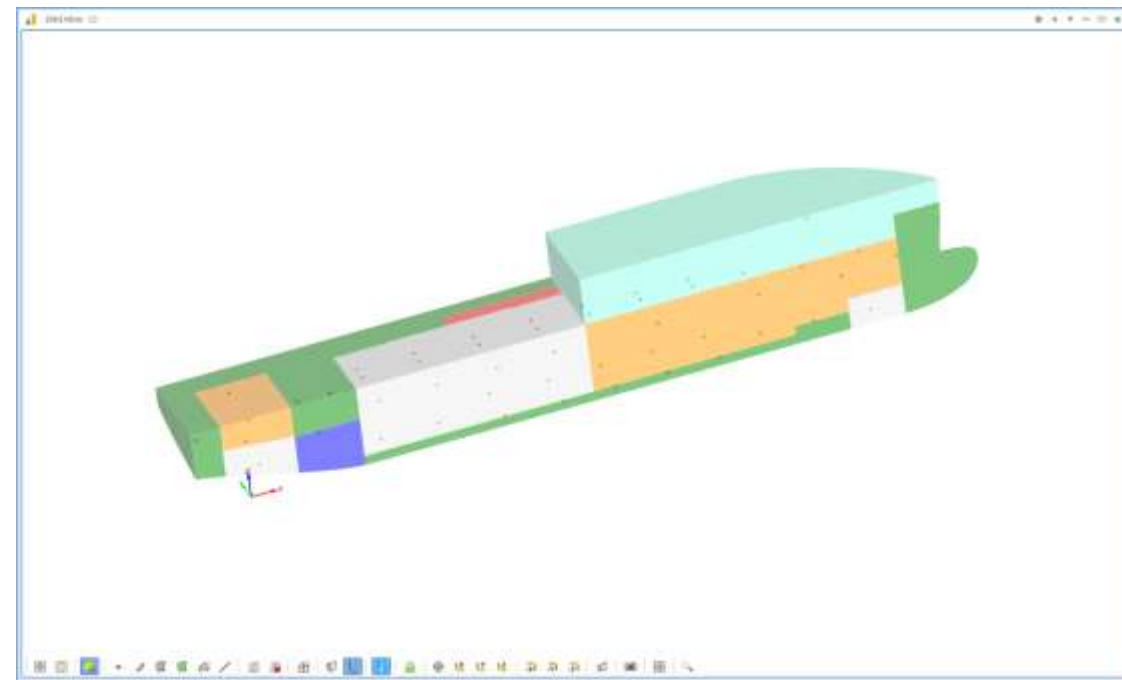
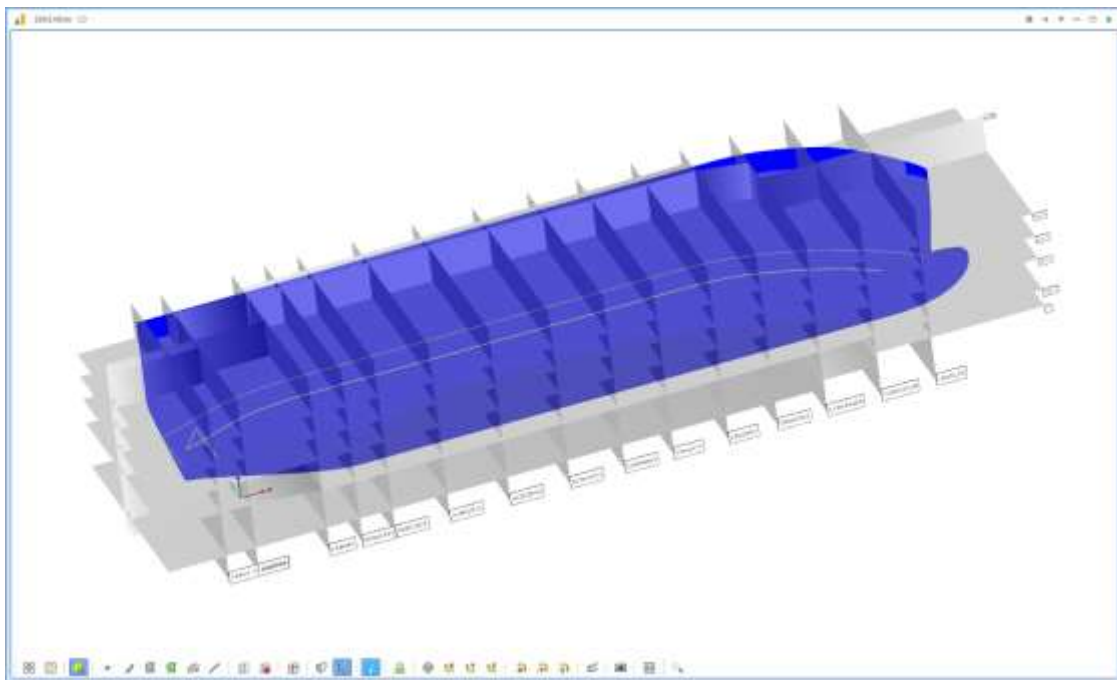


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Examples

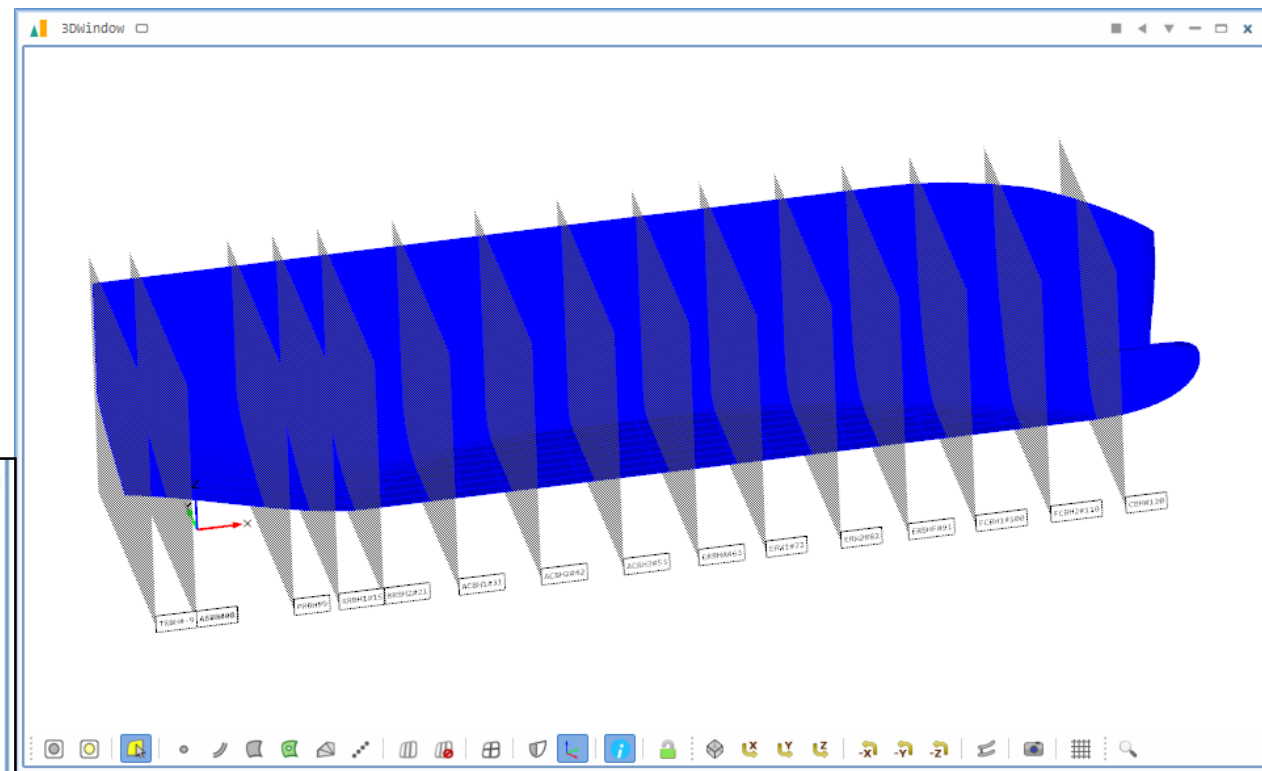
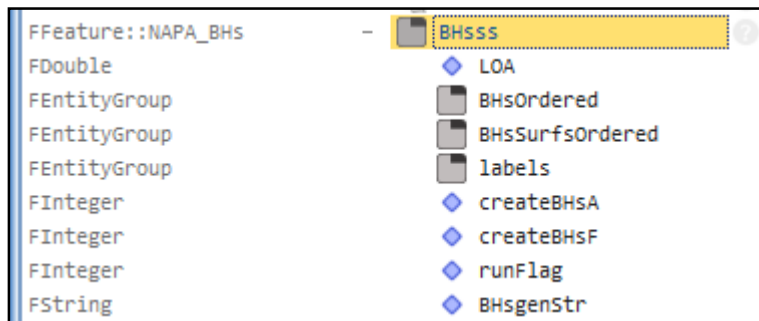
NAPA Damage Stability

- Flexible arrangement creation
- NAPA equivalent (user friendliness)



NAPA Damage Stability

- Flexible arrangement creation
- NAPA equivalent (user friendliness)
- Transversal bulkheads
 - *FFeature:NAPA_BHs*

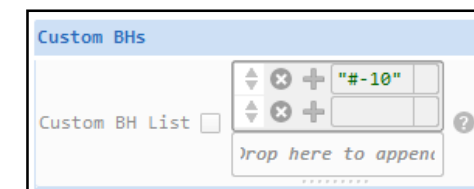
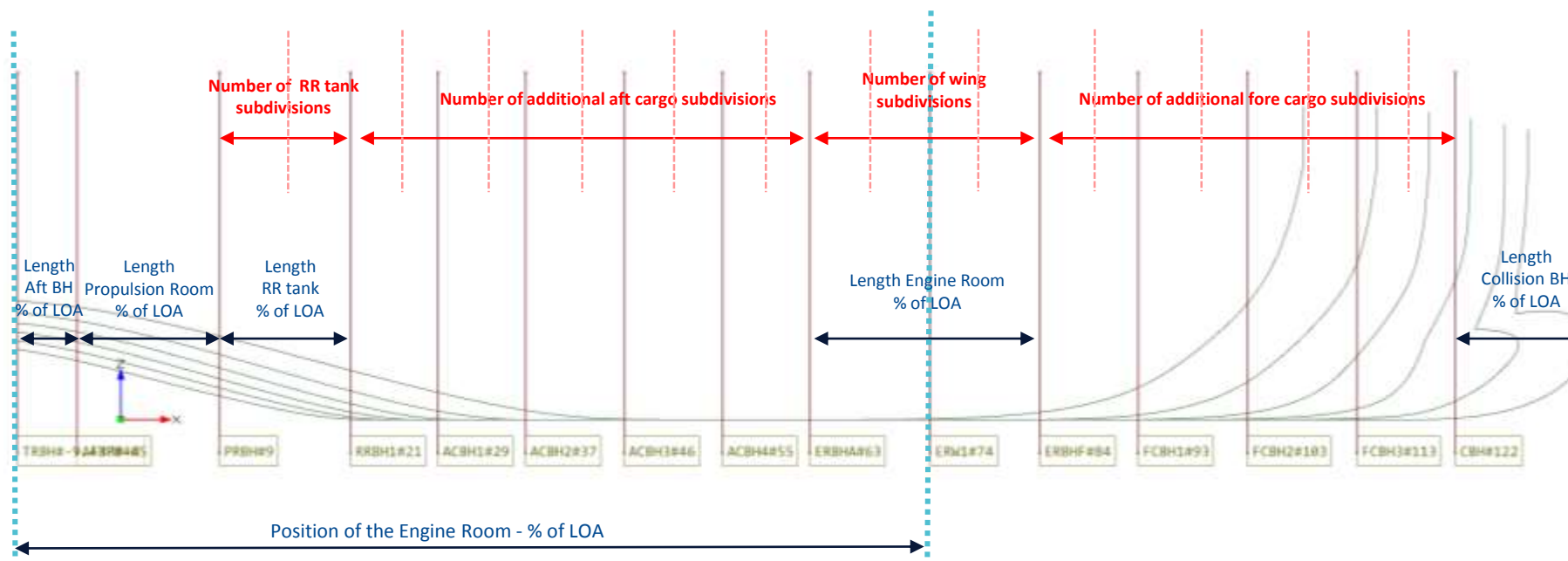




Examples

NAPA Damage Stability

- Transversal bulkheads
 - *FFeature:NAPA_BHs*
- Auto ordering, naming and numbering
- #Frames positioning system
- Custom manual BHs
- Auto restriction of BH length and/or quantity



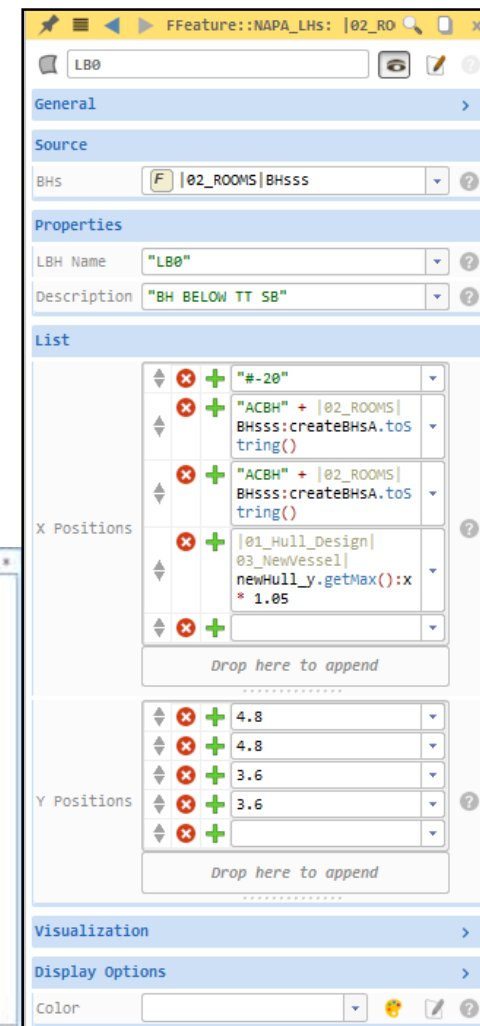
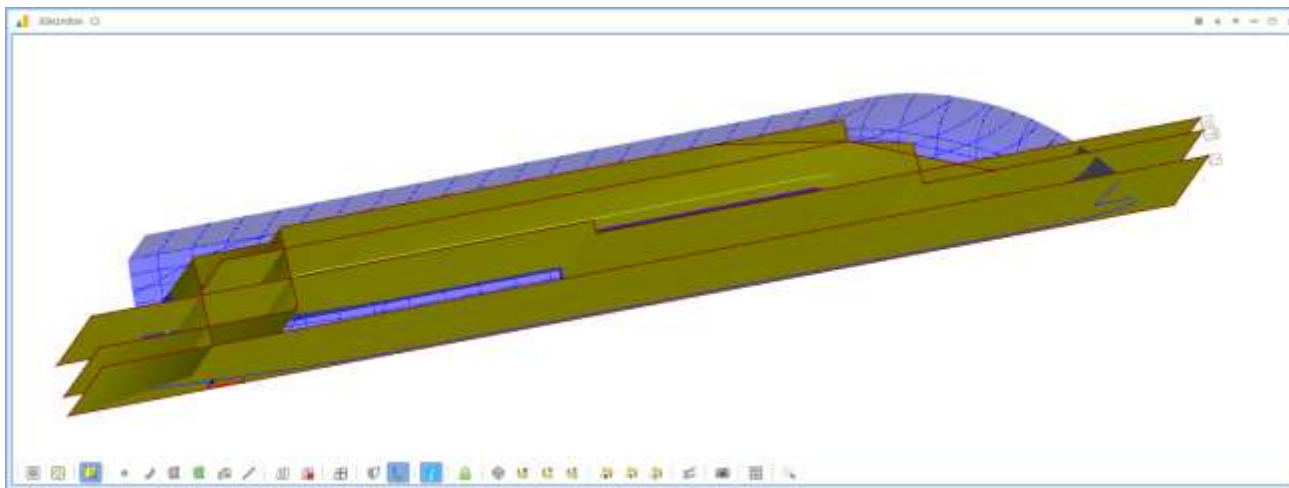


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Examples

NAPA Damage Stability

- Flexible arrangement creation
- NAPA equivalent (user friendliness)
- Longitudinal bulkheads
 - *FFeature:NAPA_LHs*



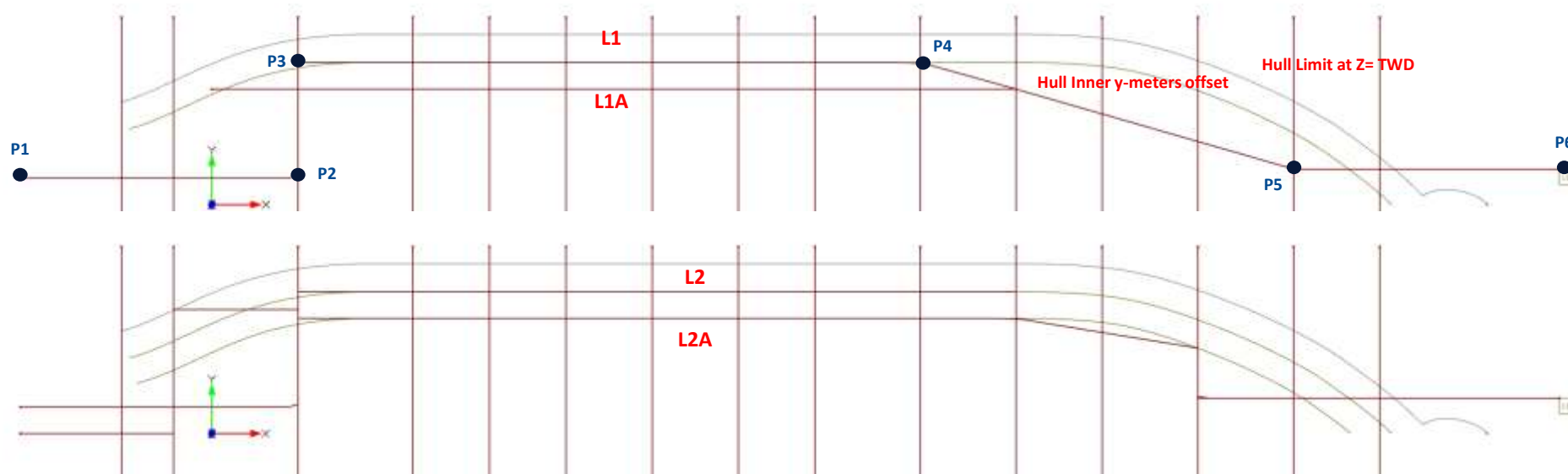


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Examples

NAPA Damage Stability

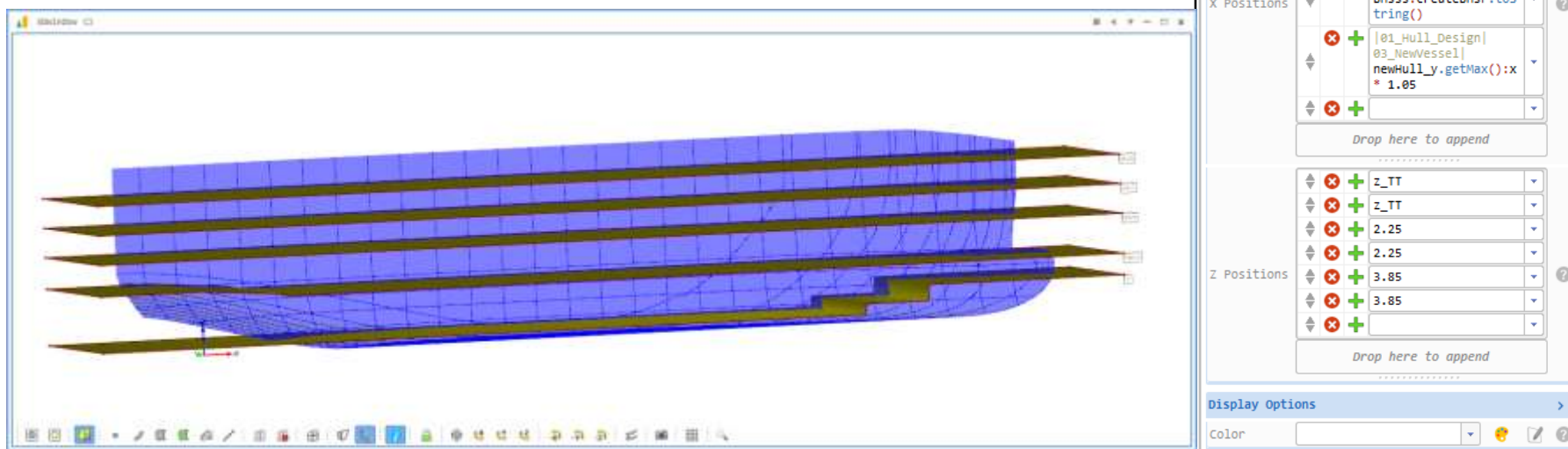
- Longitudinal bulkheads
 - *FFeature:NAPA_LHs*
 - Point based
 - As many as you need
 - BHs snapping
 - Hull clearance/offset snapping



Examples

NAPA Damage Stability

- Flexible arrangement creation
- NAPA equivalent (user friendliness)
- Deck level bulkheads
 - *FFeature:NAPA_THs*



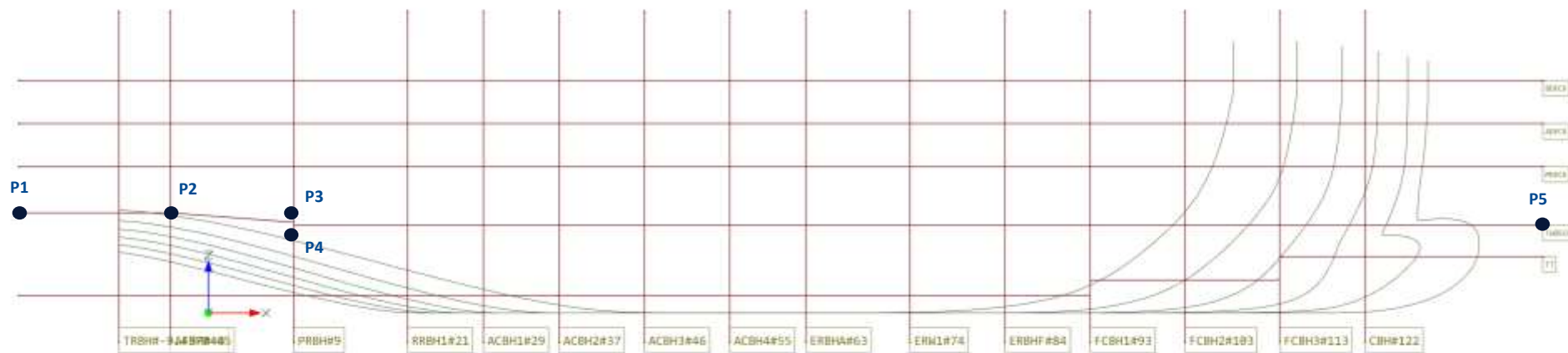


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Examples

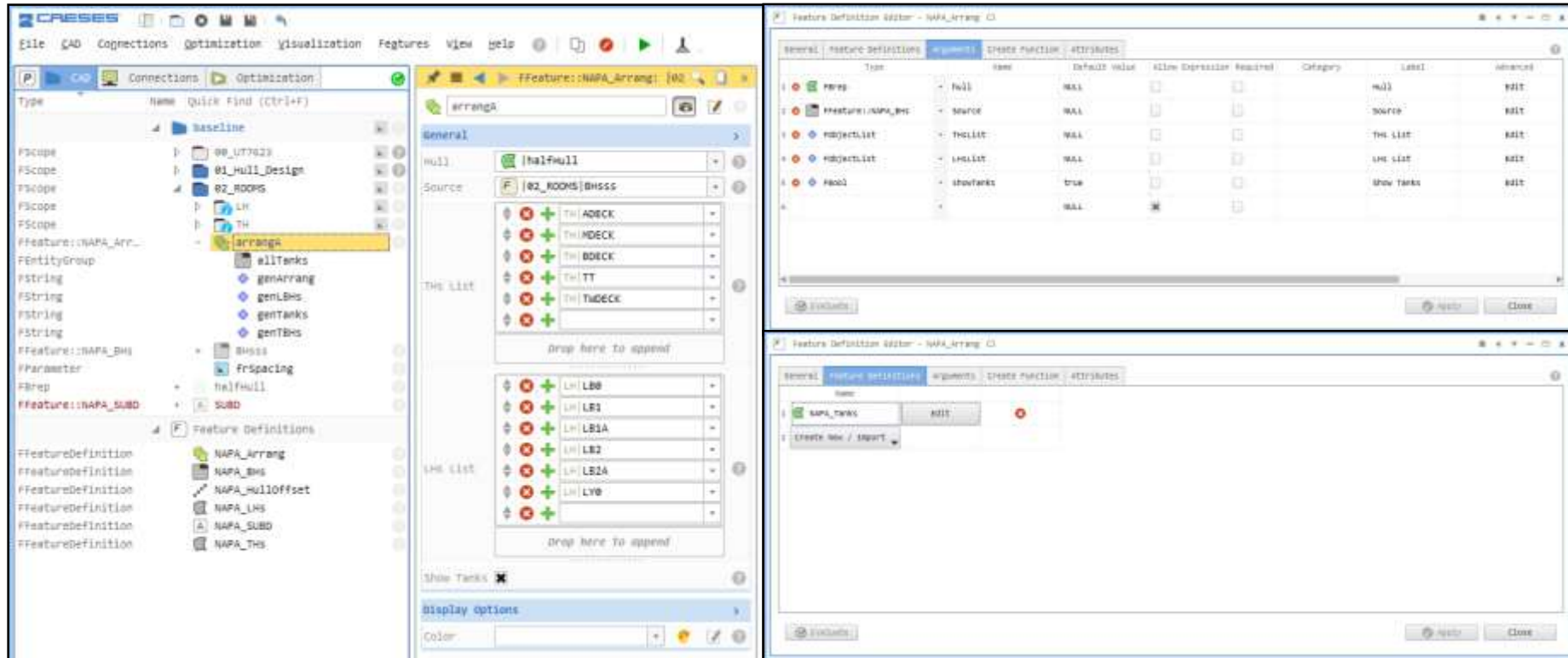
NAPA Damage Stability

- Deck level bulkheads
 - *FFeature:NAPA_THs*
- Point based
- As many as you need
- BHs snapping



NAPA Damage Stability

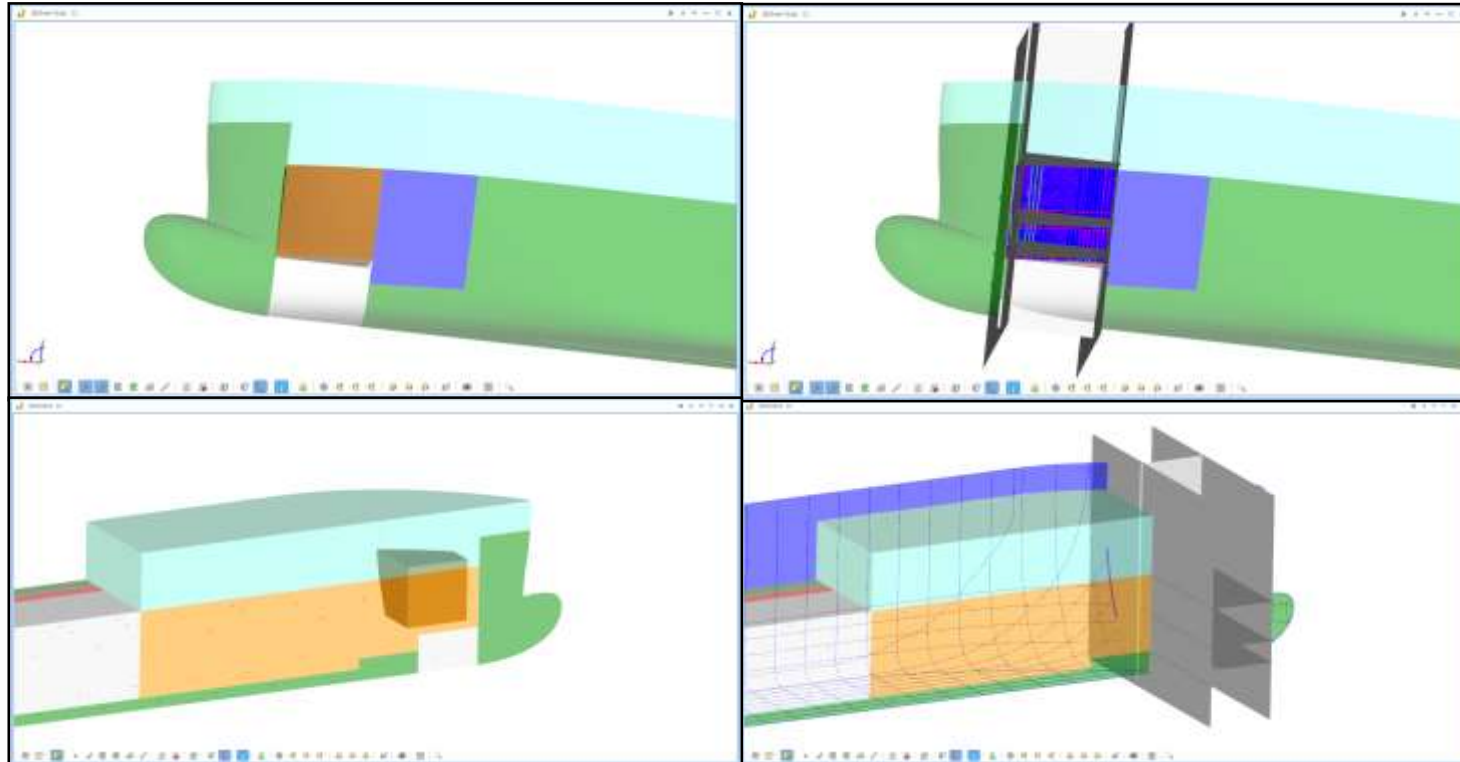
- The arrangement
 - *FFeature::NAPA_Arrang*



Examples

NAPA Damage Stability

- The arrangement
 - *FFeature::NAPA_Arrang*
 - Tank intersections
 - Tank merging





Examples

NAPA Damage Stability

- Similar to NAPA (list of limits)

```
fp_NAPA_Tanks T1_ForePeak(showTanks,hull,AllBHs,["CBH","-","LY0","HULL","-","ADECK"],1,2,idxs.at(1),true,false)
```

- Combination of tanks

```
fp_NAPA_Tanks R1_AuxMachAUX(showTanks,hull,AllBHs,["ERBHF",Source.at(findBHsID("CBH")-
IF(size>2,2,size)).getname(),"LY0","LB1","TT","TWDECK","Y<HULL"],5,6,91,true,true).setVisible(false)
fp_NAPA_Tanks R1_AuxMach(showTanks,hull,AllBHs,["ERBHF",Source.at(findBHsID("CBH")-
IF(size>2,2,size)).getname(),"LY0","LB2","TWDECK","MDECK","Y<HULL"],5,6,idxs.at(5),true,false,true,[R1_AuxMachAUX])
```

- Loop generation between n-BHs for tank generation

```
// ANTI ROLLING TANKS
size = Source.getN_RR()
loop (size)
```

- Purpose definition

```
//purps.add([PURP,PDES,RHO,PERM,COLOUR R,COLOUR G,COLOUR B])
purps.add(["VOI","VOID SPACE","T8",1,0.95,211,211,211]) //lightsilver 1
purps.add(["WB","WATER BALLAST","T1",1,0.25,0.95,0,128,0]) //green 2
purps.add(["FW","FRESH WATER","T2",1,0.95,0,0,255]) //blue 3
purps.add(["FO","FUEL OIL","T3",0.9,0.95,255,0,0]) //red 4
purps.add(["MIS","MISCELLANIES","R2",1,0.95,127,255,212]) //aqua marine 5
purps.add(["ENG","MACHINERY SPACE","R1",1,0.85,255,250,250]) //snow white 6
purps.add(["CHA","CHAIN LOCKER","T6",1,0.85,255,0,255]) //fuchsia 7
```

```
89 integer size(Source.getCreateBHsF())
90 loop (size)
91 fp_NAPA_Tanks T2_WBbottomTT_Aut(showTanks,hull,AllBHs,
[Source.at(findBHsID("CBH")-2-$i).getname(),Source.at(findBHsID("CBH")-$i-1).getname(),"LY0","HULL","-","TT"],3,2,idxs.at(1),true,false)
92 genTanks.append(T2_WBbottomTT_Aut.getTankDef())
93 idxs.replace(idxs.at(1)+1,1)
94 tanklist.at(1).castto(fstring).append(findTNum(T2_WBbottomTT_Aut.getTankDef()))
95 T2_WBbottomTT_Aut.setName(T2_WBbottomTT_Aut.getTankname())
96 allTanks.add(T2_WBbottomTT_Aut)
97
98 integer myID(if($i==0,3,2))
99
100 fp_NAPA_Tanks T_Fore_wing_Aut_Aux(showTanks,hull,AllBHs,
[Source.at(findBHsID("CBH")-2-$i).getname(),Source.at(findBHsID("CBH")-1-$i).getname(),"LB1","HULL","TT","TWDECK"],2,myID,idxs.at(myID-1),true,false)
101 fp_NAPA_Tanks T_Fore_wing_Aut(showTanks,hull,AllBHs,
[Source.at(findBHsID("CBH")-2-$i).getname(),Source.at(findBHsID("CBH")-1-$i).getname(),"LB2","HULL","TWDECK","MDECK"],2,myID,idxs.at(myID-1),false)
102 e,[T_Fore_wing_Aut_Aux],[T_Fore_wing_Aut_Aut.getTankDef()],T_Fore_wing_Aut_Aut.getTankCG())
103 genTanks.append(T_Fore_wing_Aut.getTankDef())
104 tanklist.at(myID-1).castto(fstring).append(findTNum(T_Fore_wing_Aut.getTankDef()))
105 idxs.replace(idxs.at(myID-1)+2,myID-1)
106 T_Fore_wing_Aut.setName(T_Fore_wing_Aut.getTankname())
107 allTanks.add(T_Fore_wing_Aut)
108 endloop
109
```



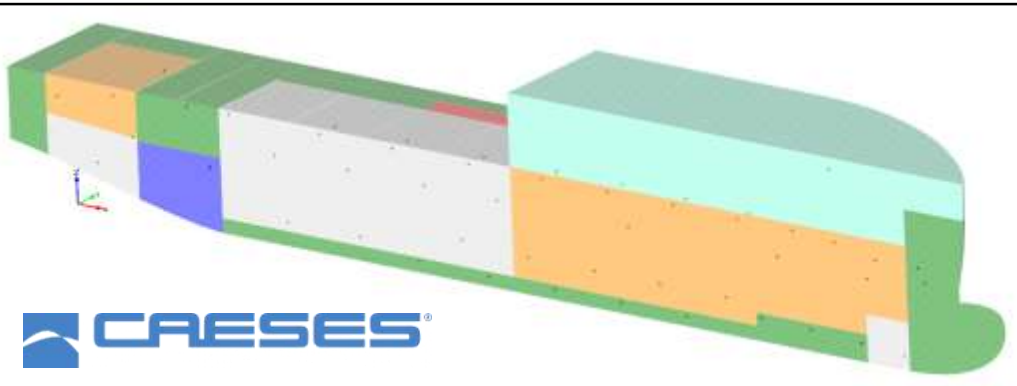
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Examples

NAPA Damage Stability

- Resulting geometry: CAESES -> NAPA (via Software connection)

```
1 ## Note 1: 3-4 non-essential or blank lines in beginning - required for napa
2 ## Note 2: double# is interpreted as a comment line in napa
3 ## Note 3: commands in this script are restricted to "command window" in napa
4
5 #projname='KONGSBERG_CAESSES_DMG' <entry> projname</entry>
6 #descr='CAESES DMG STABILITY DEMO FOR HOLIGHTIP'
7 ## array maindim containing reference dimensions (Lpp,B,T,frdnet)
8 @maindim=arr(2)
9 @maindim(1)=<entry>length</entry>
10 @maindim(2)=<entry>beam</entry>
11 @maindim(3)=<entry>draught</entry>
12 @maindim(4)=0.65
13 #run.deleteproject(projname)
14 #run.newproject(projname,descr,'','','',maindim)
15
16
17 ref
18 cooord RIGHTHANDED
19 end
20
21 def
22 from iges <entry>Exports(hull.iges</entry> HULL out-y !
23 ok
24 ROOM DAMHULL
25 LIM - = 0 hull - MDECK
26 ADD EBBHA - 0 hull MDECK BDECK
27 SYM
28
29
30 <entry>genHsPlanes</entry>
31 <entry>genTHs</entry>
32 <entry>genLHs</entry>
33 ok
34 <entry>SICH_T</entry>
35 ok
36 end
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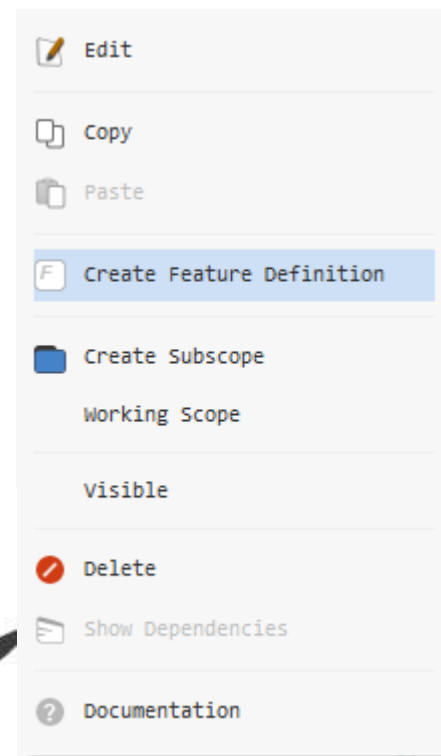
Challenges

- Improve scripting
 - Computational efficiency
 - User-friendliness
- Reach robustness
 - Geometry quality
 - Sewing tolerances
- Increase CAESES usage within Ship Design
 - Steep learning curve
 - Resources availability



Conclusions

- *FFeatureDefinitions* is the way forward with CAESES
 - Learn object types and its commands/possibilities
 - Tutorials, community forum and helpdesk
 - Create Features from CAD objects
- Your imagination is the limit





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