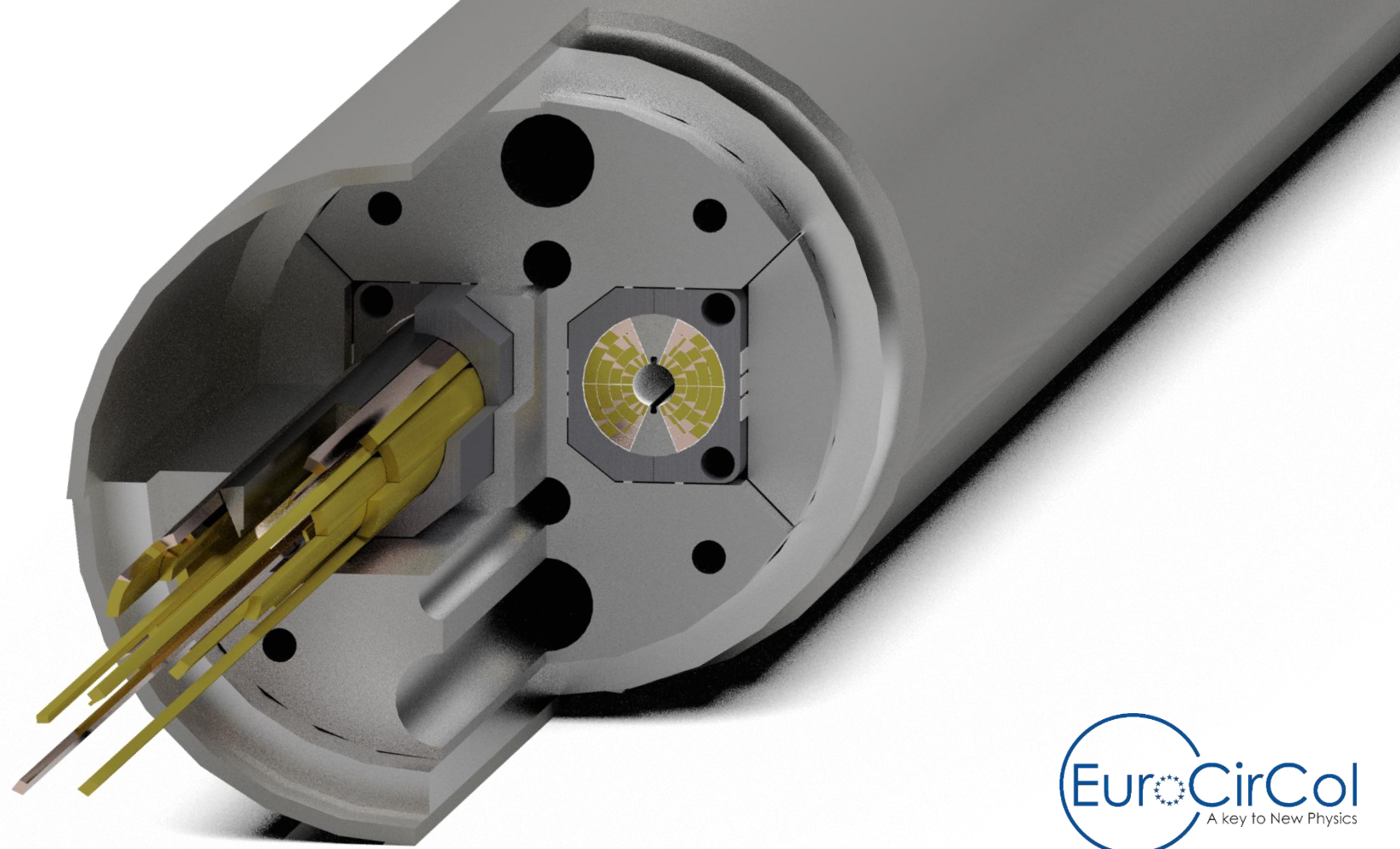


# EuroCirCol

## Cos $\theta$ 16 T dipole

Haris Kokkinos on behalf of the UPATRAS team



UNIVERSITY OF  
**PATRAS**  
ΠΑΝΕΠΙΣΤΗΜΙΟ ΠΑΤΡΩΝ





# Who we are - UPAT

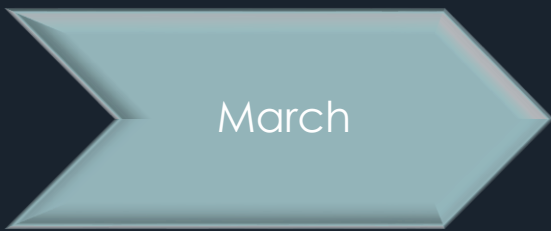
- UPAT: University of Patras, Greece
- Department of Mechanical & Aeronautical Engineering
- Most probably the newest member in the EuroCirCol and a newcomer in the magnet community

- Team:
  - Small (6 Engineers)
  - Flexible,
  - Specialized (Engineering & Simulation)
  - Excited
  - & Ambitious

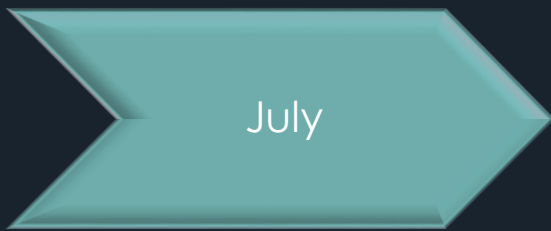
- Tools used:
  - SIEMENS PLM portfolio**
  - ANSYS portfolio (only for cross-checking)
  - PITHIA



2018



March



July



September -  
October



November -  
December

Addendum

**The agreement Cern-Patras University**

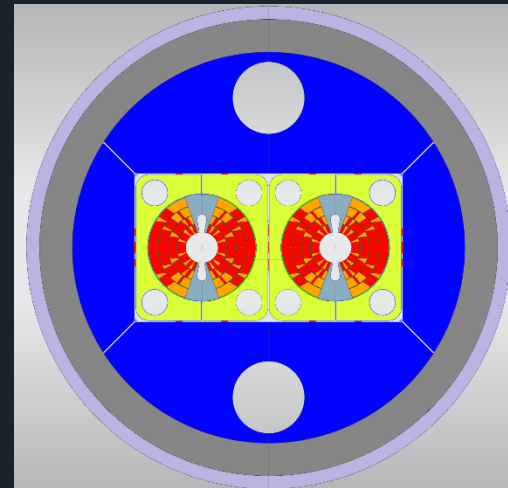
<b>OBJECTIVE</b>	The Agreement (Agreement for the Research "FCF" in the framework of the European Union) is a key to New Physics, a key to the development of the Future Circular Collider (FCC) in the framework of the European Union.
<b>SCOPE</b>	The Agreement covers the collaboration between the University of Patras and the European Commission for the development of the FCC in the framework of the European Union.
<b>UNIVERSITY OF PATRAS</b>	University of Patras, 26504 Patras, Greece. Email: info@upatras.gr
<b>EUROPEAN COMMISSION</b>	European Commission, Directorate-General for Research and Innovation, 10499 Brussels, Belgium. Email: fcc@ec.europa.eu
<b>CONTACTS</b>	For more information, please contact the following contacts: Dr. Davide Tommasini (UP) or Dr. Giancarlo Ferrarini (EC). Email: davide.tommasini@upatras.gr, giancarlo.ferrarini@ec.europa.eu
<b>DATE</b>	July 10th, 2018

@Davide Tommasini

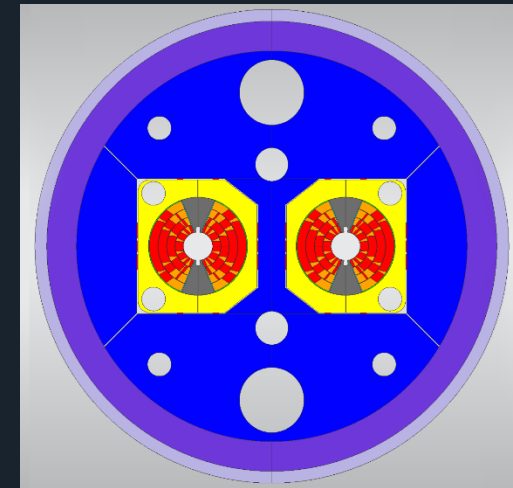
Kick-Off Meeting @ CERN



Initial Design Results Comparison



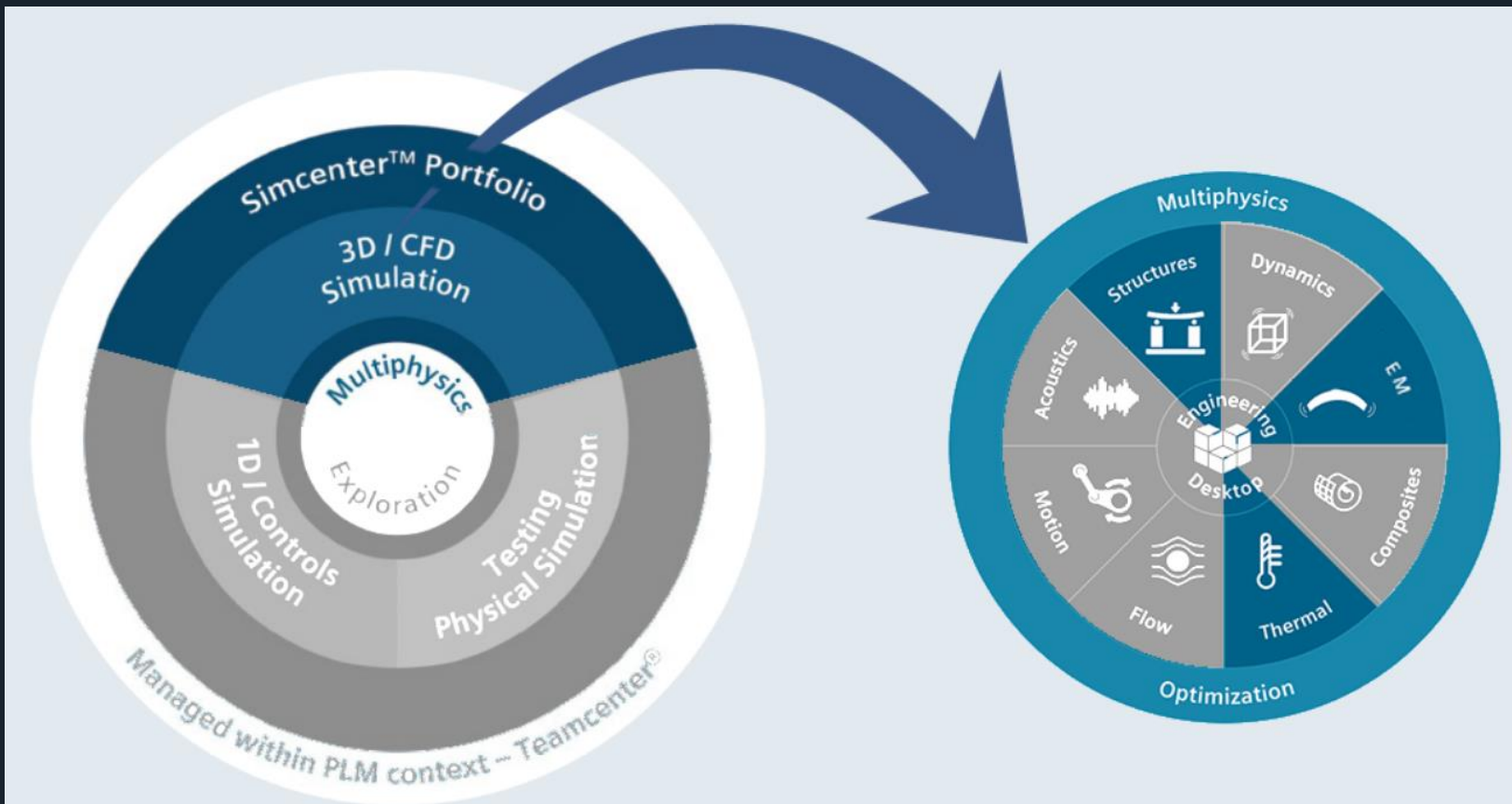
CDR Design Results Comparison



# SIEMENS PLM Portfolio

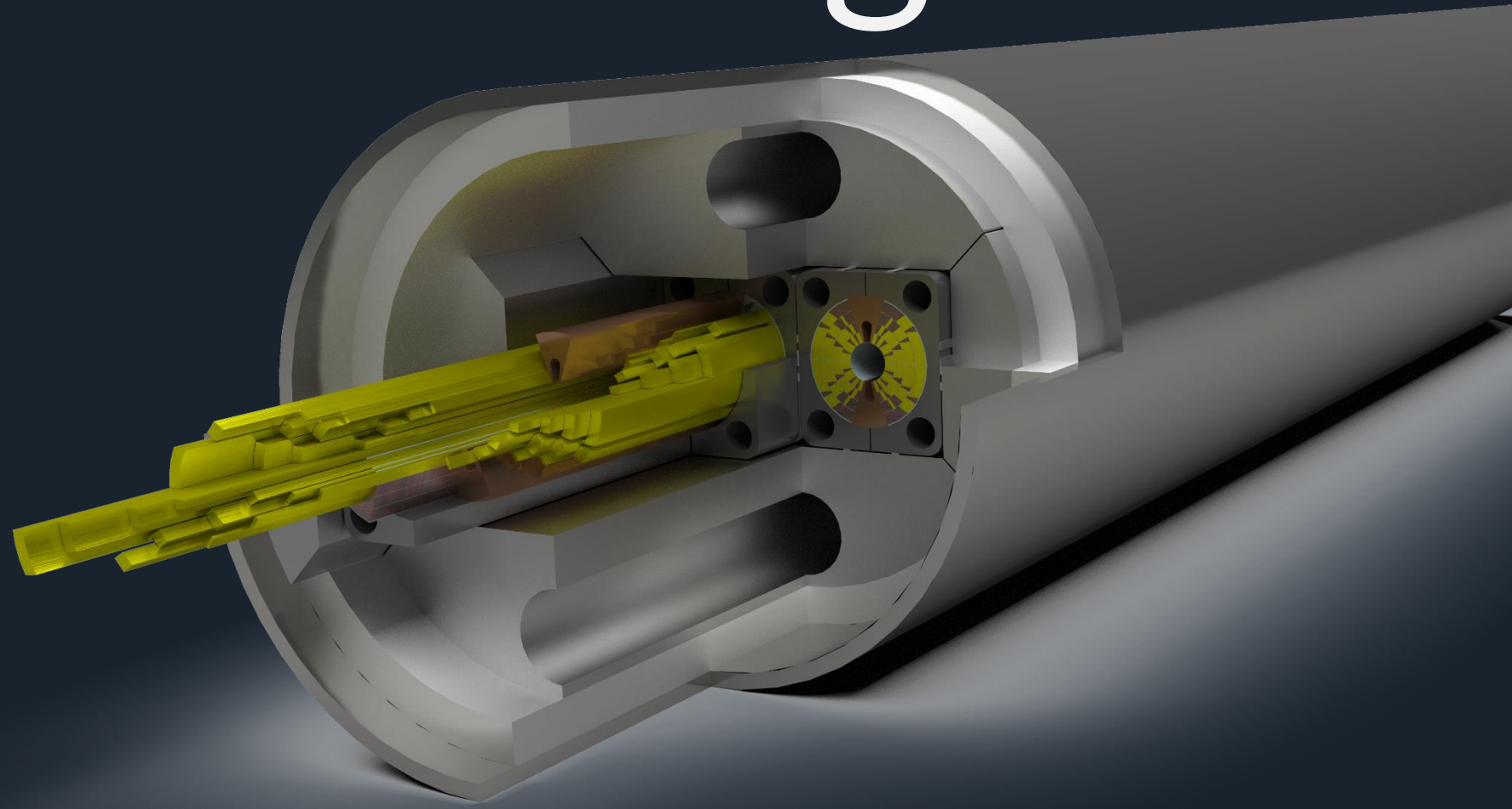
We use the SIEMENS PLM portfolio, so as to introduce to the magnet community a portfolio that is not being used in these fields up to now and to compare results between completely different solvers.

CAD: NX CAD  
 Magnetic Analysis: Star-CCM+  
 Structural/Thermal Analysis: Simcenter / NASTRAN  
 Optimization: HEEDS

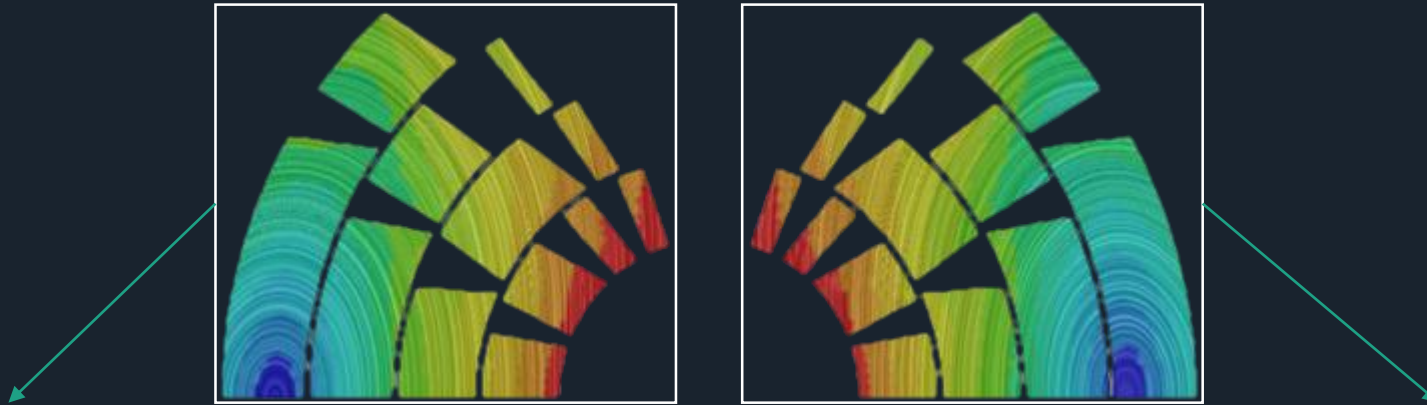




# Initial Design



# Lorentz Forces



UPATRAS				INFN					
B (T)	I (kA)	Calculated Forces		Calculated Forces		B (T)	I (kA)		
16.40	11.39	Fx Sum (MN)	Fy Sum (MN)	Fx Sum (MN)	Fy Sum (MN)	16.44	11.39		
		Layer 1 (LH)	-2.1	-0.2	-2.1			-0.2	Layer 1 (LH)
		Layer 2 (LH)	-2.4	-0.6	-2.4			-0.6	Layer 2 (LH)
		Layer 3 (LH)	-2.2	-1.2	-2.2			-1.2	Layer 3 (LH)
		Layer 4 (LH)	-0.6	-2.3	-0.7			-2.3	Layer 4 (LH)
SUM		-7.3	-4.2	-7.4	-4.2	SUM			

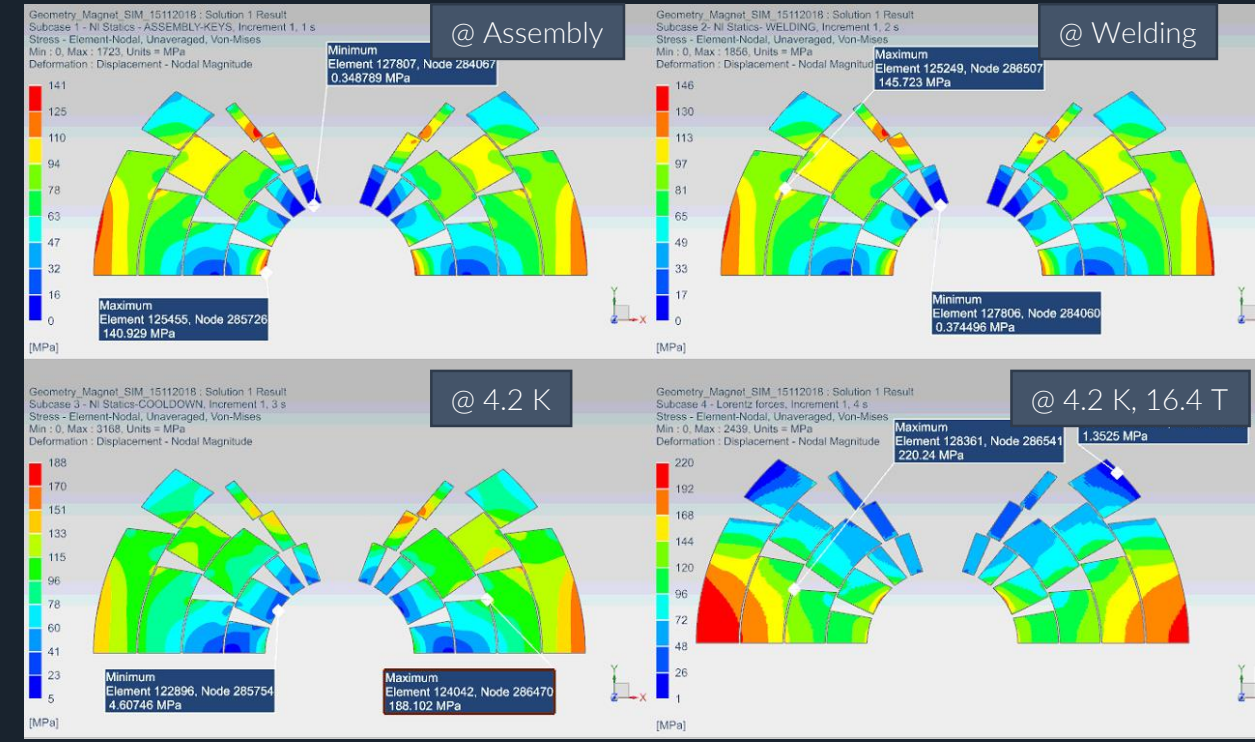
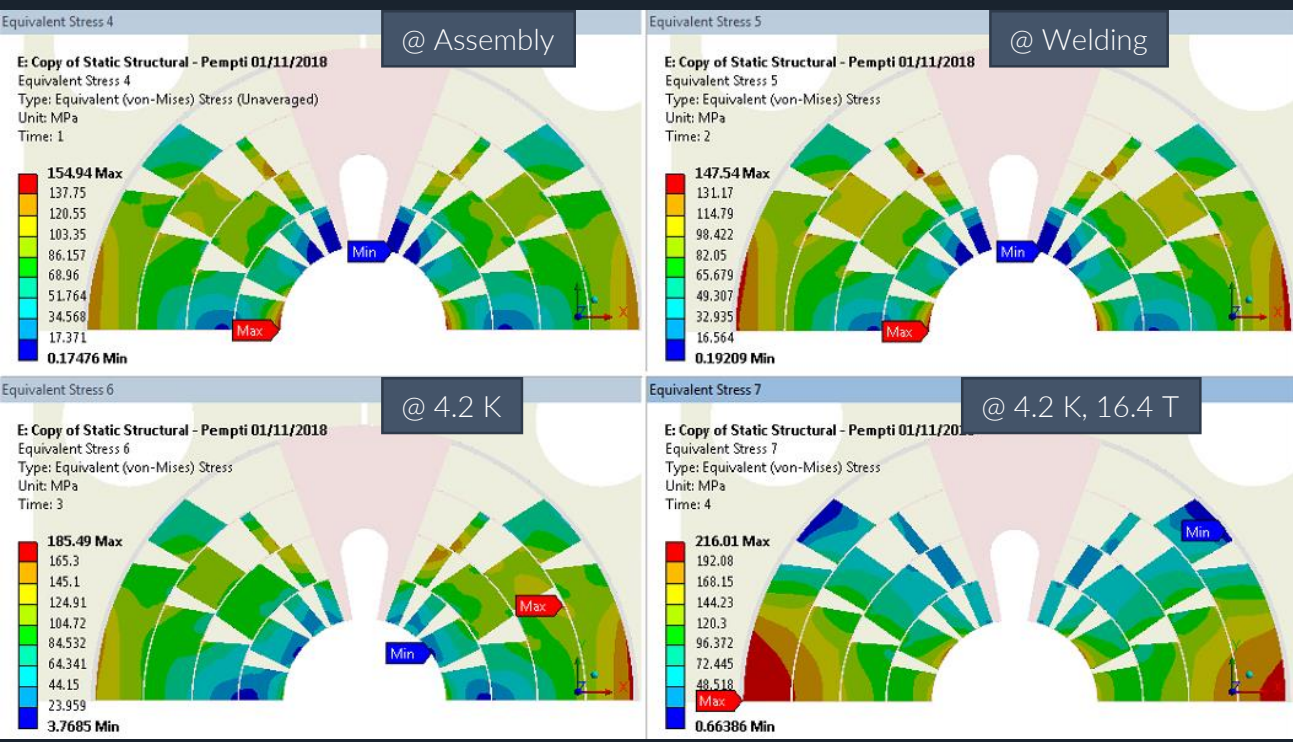
UPATRAS				INFN					
B (T)	I (kA)	Calculated Forces		Calculated Forces		B (T)	I (kA)		
16.40	11.39	Fx Sum (MN)	Fy Sum (MN)	Fx Sum (MN)	Fy Sum (MN)	16.44	11.39		
		Layer 1 (RH)	2.1	-0.1	2.1			-0.1	Layer 1 (RH)
		Layer 2 (RH)	2.4	-0.5	2.3			-0.5	Layer 2 (RH)
		Layer 3 (RH)	2.0	-1.1	2.0			-1.1	Layer 3 (RH)
		Layer 4 (RH)	0.3	-2.0	0.3			-2.0	Layer 4 (RH)
SUM		6.9	-3.7	6.8	-3.7	SUM			

# Coil – VonMises Stress

Component: Coil  
 Component: St. Shell  
 Component: Alu. Shell  
 Component: Yoke  
 Component: Pads  
 Component: Pole

## ANSYS Workbench

## SIEMENS Simcenter 3D

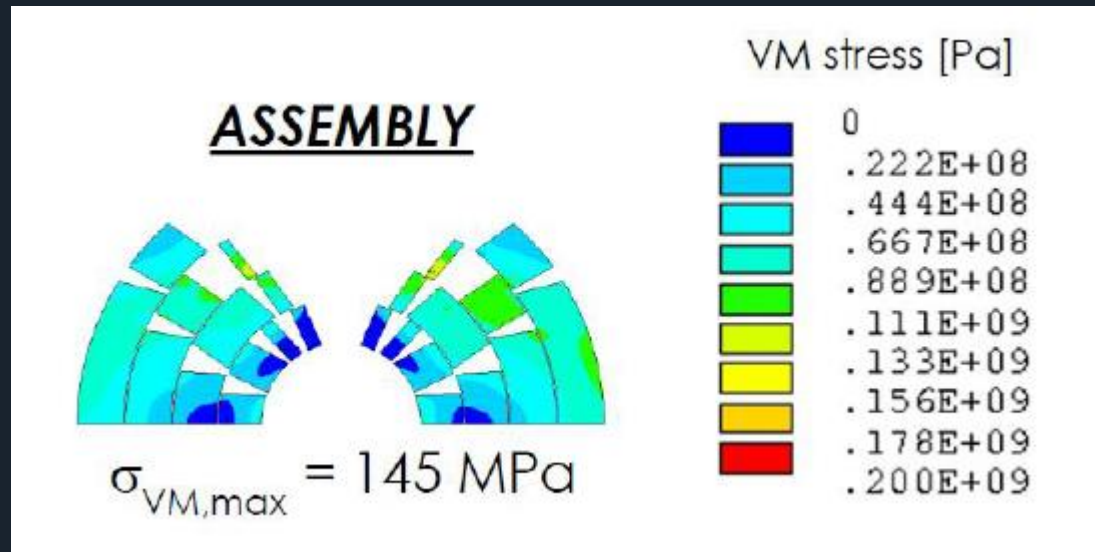




# Comparison INFN vs. UPATRAS

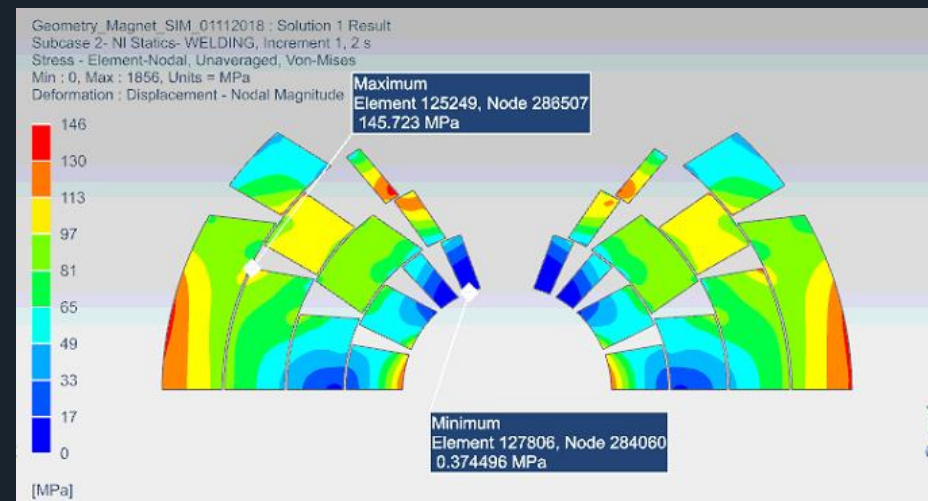
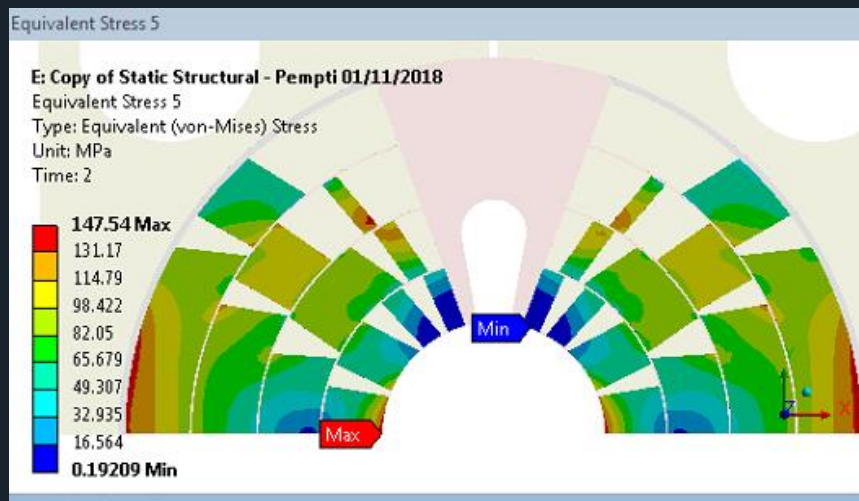
## Overview – VonMises Stress

INFN



UPAT

Loadstep1: Assembly @ RT  
Loadstep2: Welding @ RT  
Loadstep3: Cooldown @ 4.2K  
Loadstep4: Powering @ 16.4T





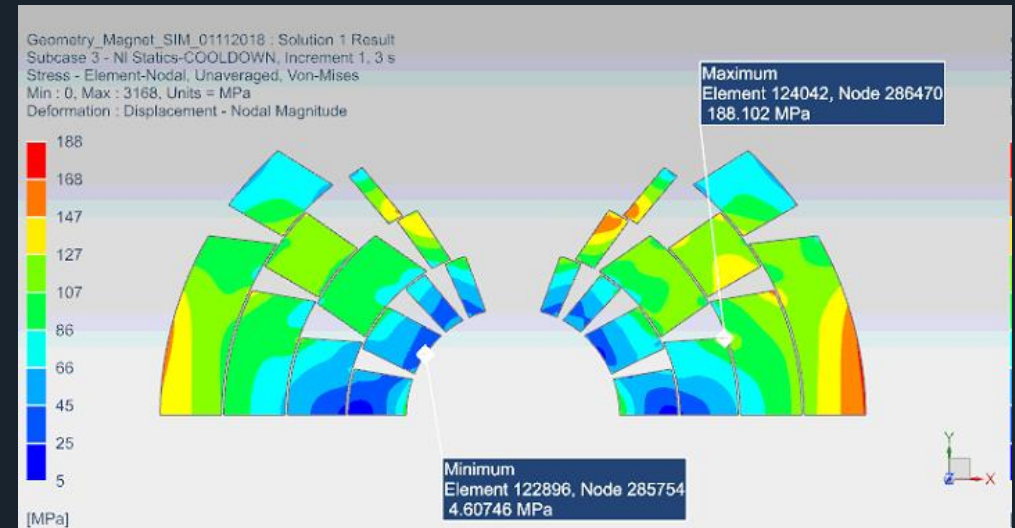
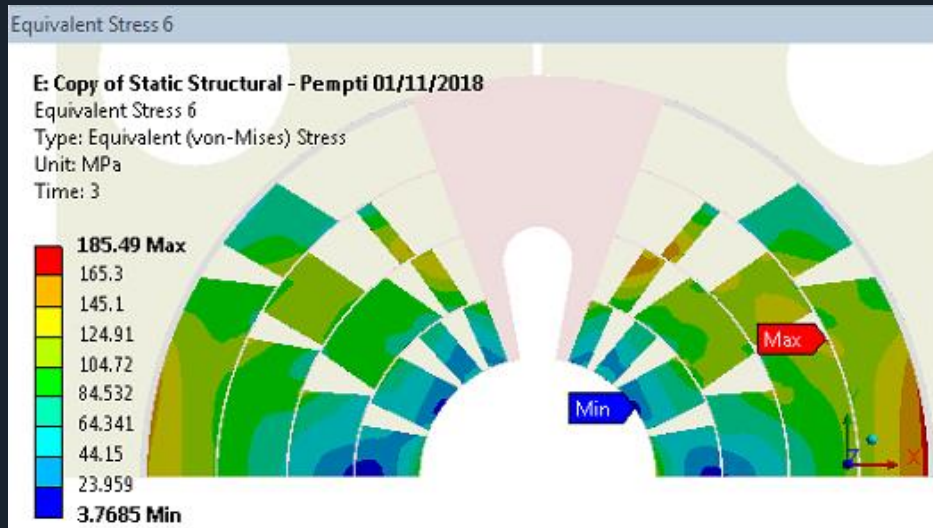
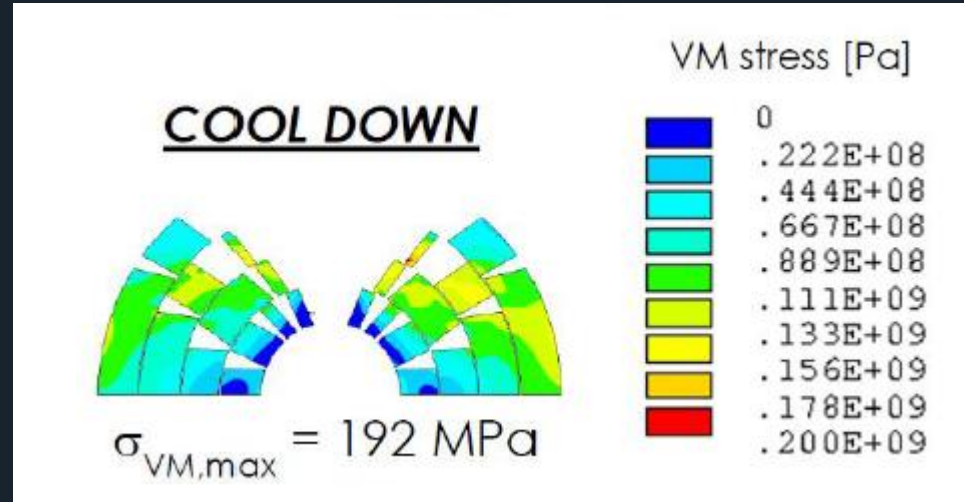
# Comparison INFN vs. UPATRAS

## Overview – VonMises Stress

INFN

UPAT

Loadstep1: Assembly @ RT  
Loadstep2: Welding @ RT  
Loadstep3: Cooldown @ 4.2K  
Loadstep4: Powering @ 16.4T



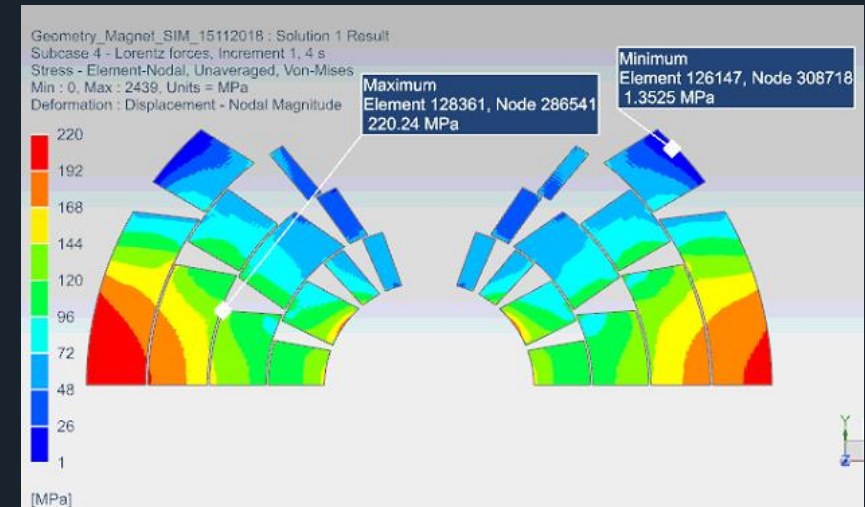
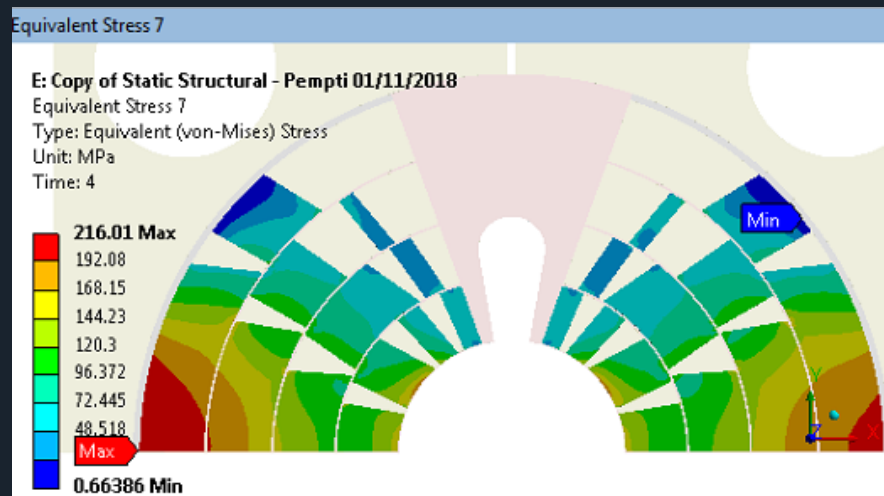
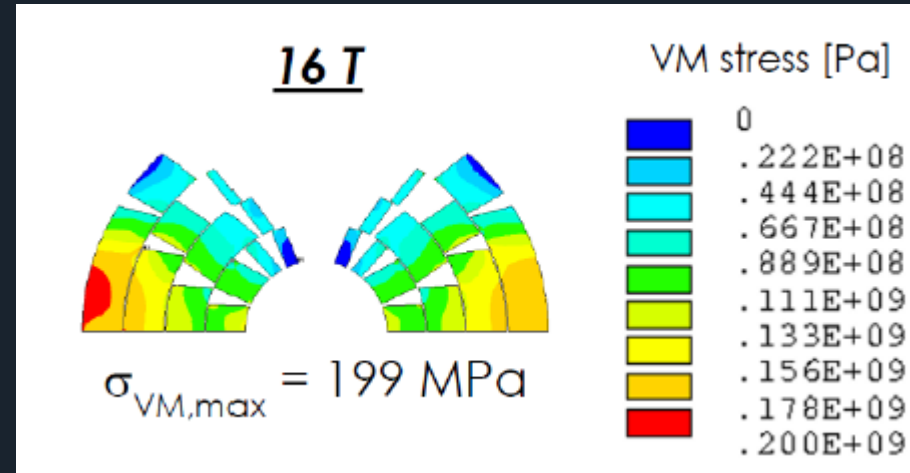
# Comparison INFN vs. UPATRAS

## Overview – VonMises Stress

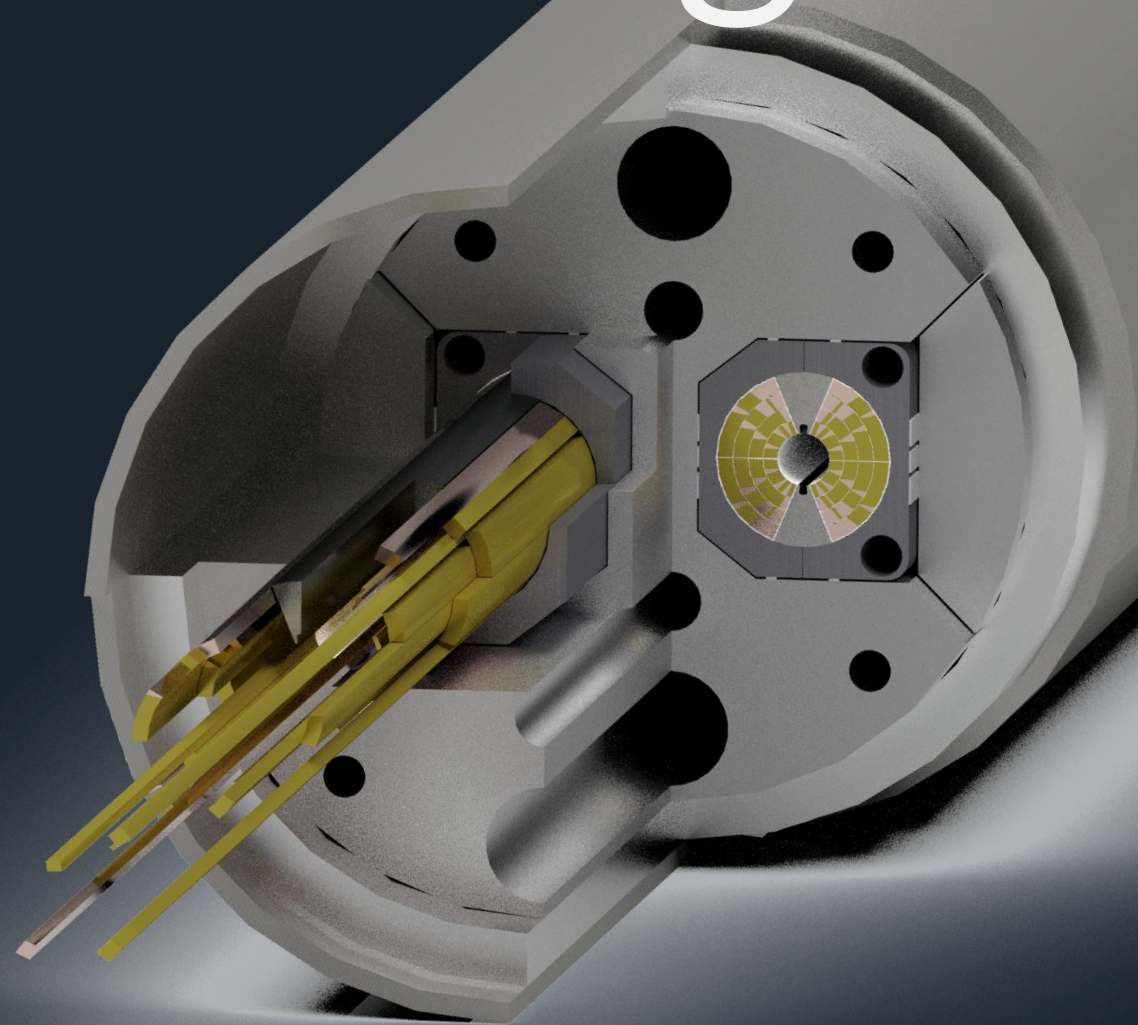
INFN

UPAT

Loadstep1: Assembly @ RT  
Loadstep2: Welding @ RT  
Loadstep3: Cooldown @ 4.2K  
Loadstep4: Powering @ 16.4T

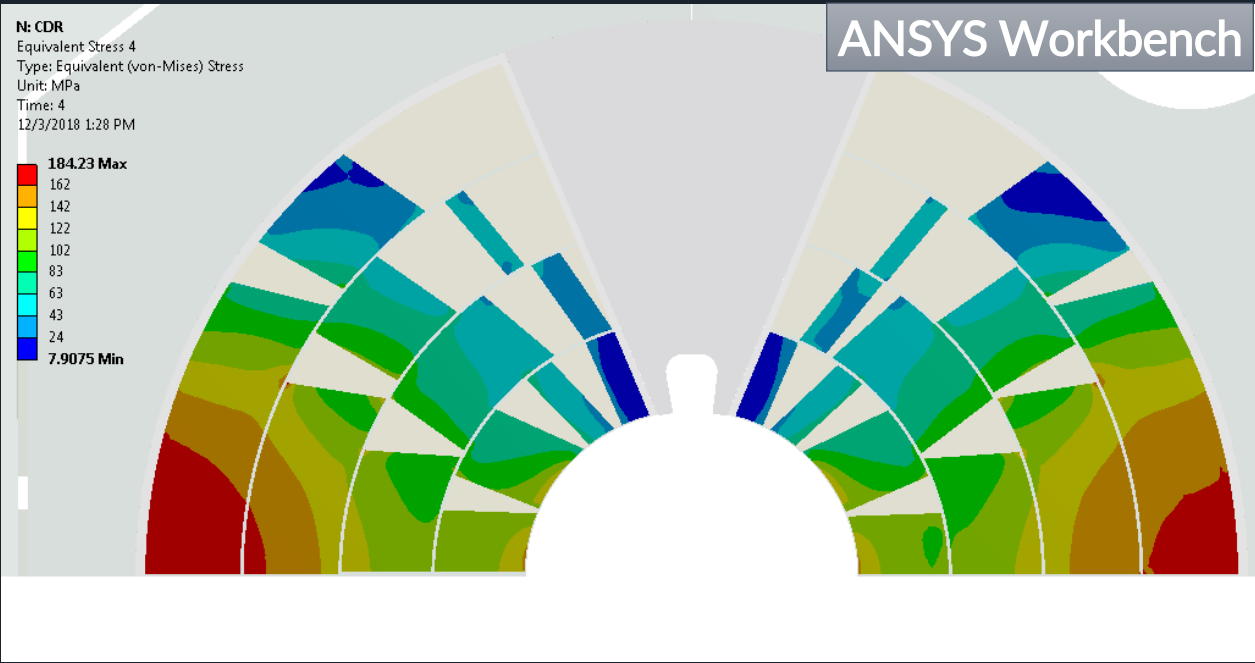
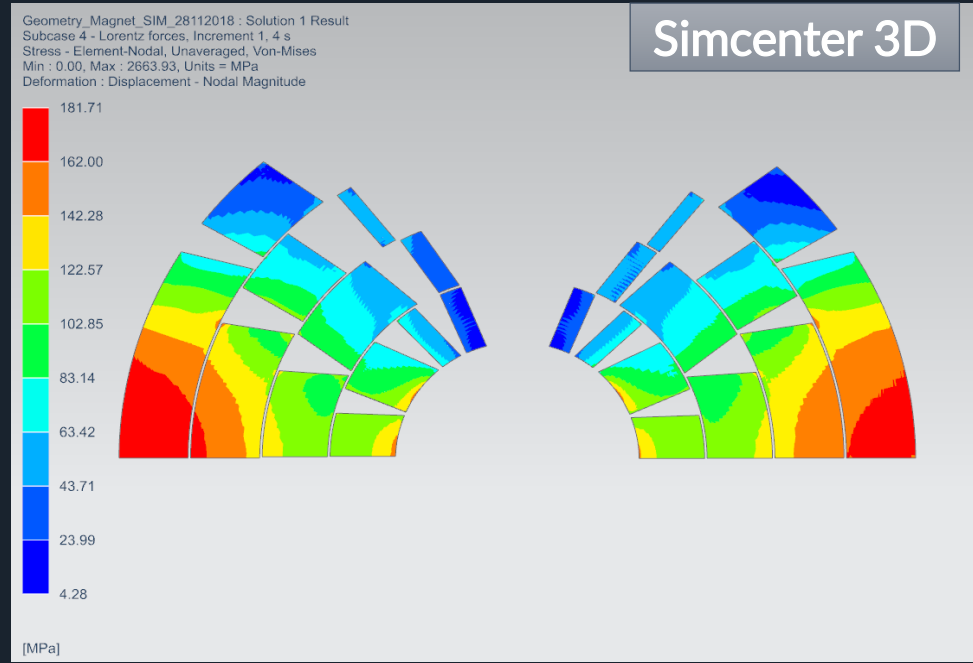
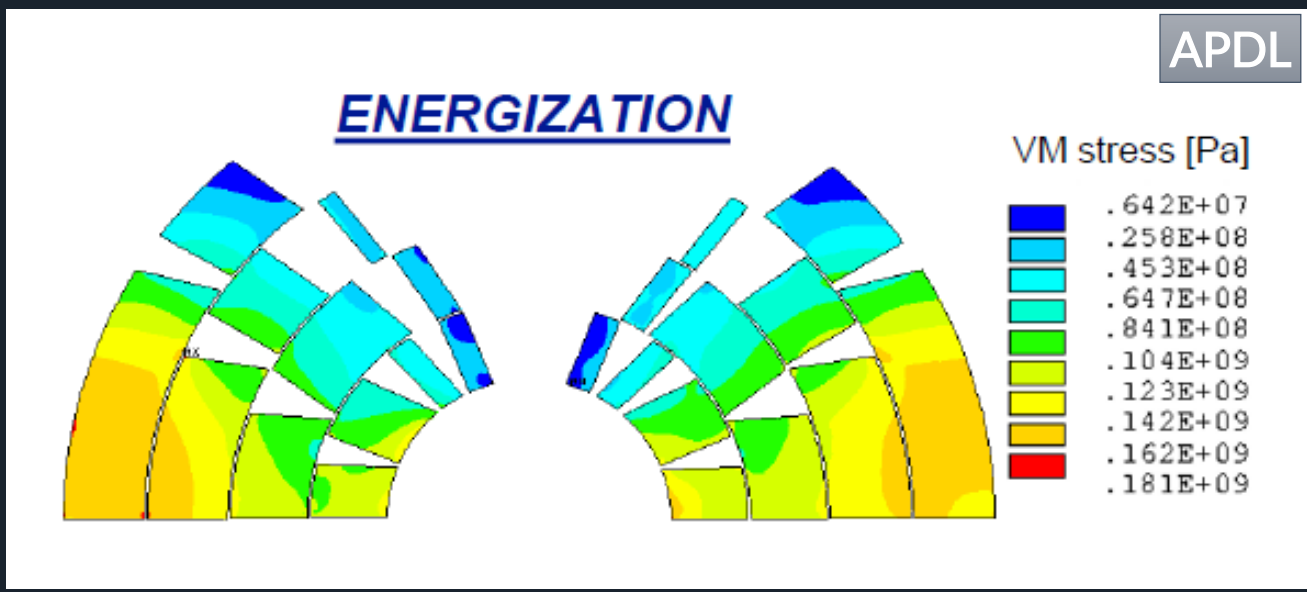


# CDR Design





# Coil Stress @ 16T



INFN

UPAT

- The results computed at UPAT with Simcenter & Workbench are comparable and almost identical, which is a good sign as the solvers are completely different.
- Though, there are some differences between the results of UPAT & INFN.
- Since the SIEMENS & ANSYS solvers provide the same results by using the same modeling approach, it seems that there might be some differences between the UPAT & INFN models which need to be discussed and addressed.
- **NEXT STEPS:**
  1. To complete the comparison of the results regarding the CDR model, so as to be fully aligned with the current developments at INFN.
  2. To find the source that creates the differences between the UPAT & INFN results.



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