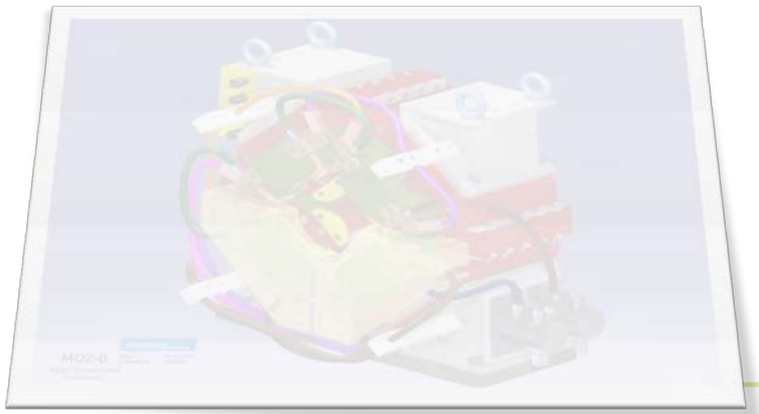
Parametric design of a Magnet with Catia

Christopher Siedler



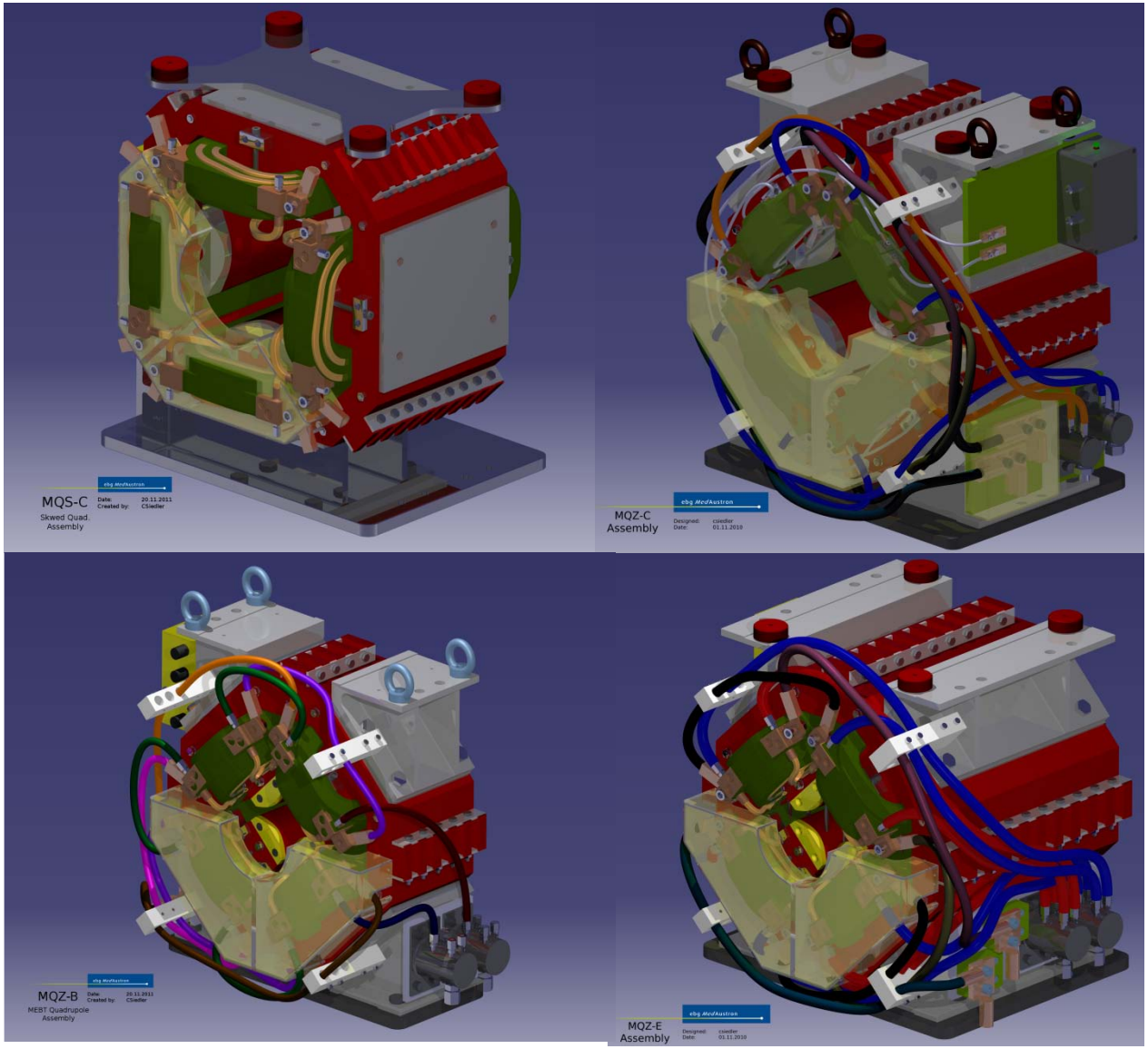
Content:

- Example
- Reasons to use parameterized models
- The parameterized Quadrupole magnet:
  - Lamella and excel sheet
  - Yoke, Coil
  - Assembly, Drawings
- Useful scripts
  - More complex coil
  - Export to Opera

Videos:

- Yoke & Coil adapt to new parameters
- A script based Coil
- Export to Opera

Example as introduction :



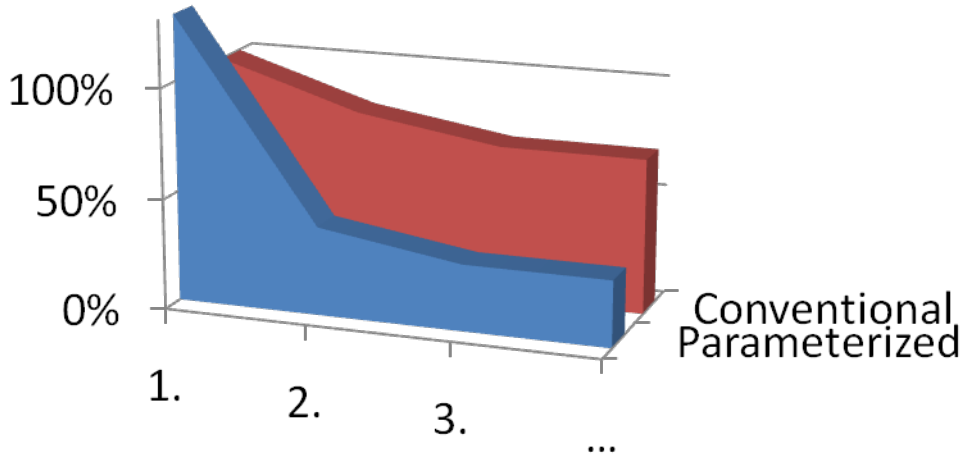
This 4 magnets where created with the same parameterized model.

The yoke and the coil adapted 100% automatically.

Only “fancy stuff” like the cabling and the connection box was added afterwards.

Reasons to use parameterized models:

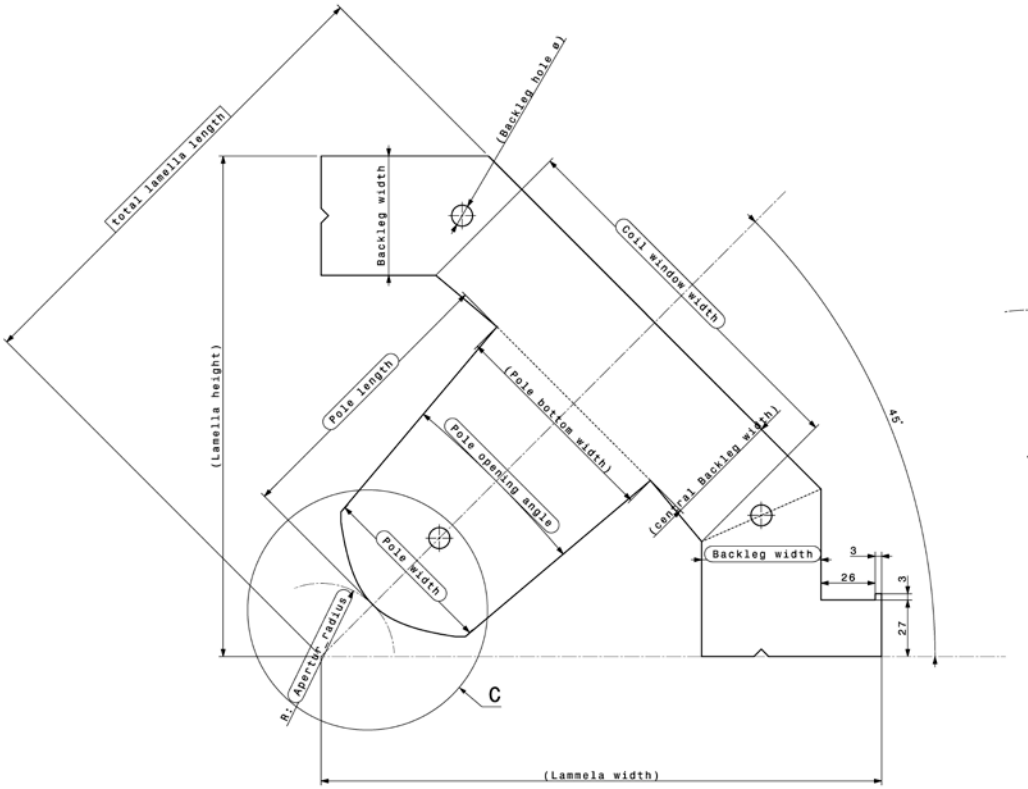
- Time:
  You need more time for the first model.
  But afterward the timesaving is enormous

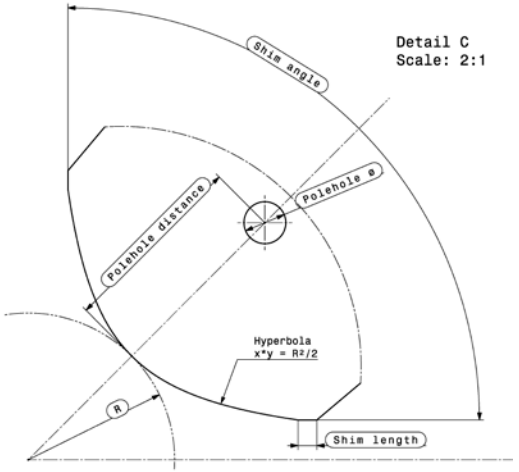


- Flexibility:
  Something changes always during designing
- Networking:
  use the same model for CAD and FE with a script to export it.

The parameterized Quadrupole magnet:

- When the lamella is defined by the magnet designers, this could be the input information:





Required paramters:
- Aperture radius
- Pole width
- Pole length
- Pole window width
- Backleg width
- Polehole ø
- Polehole distance
- Shim length
- Shim angle

Optional paramters:
- central backleg width
- Backleghole ø

Control paramters:
- Pole bottom width
- total lammela length
- lamella width

The parameterized Quadrupole magnet:

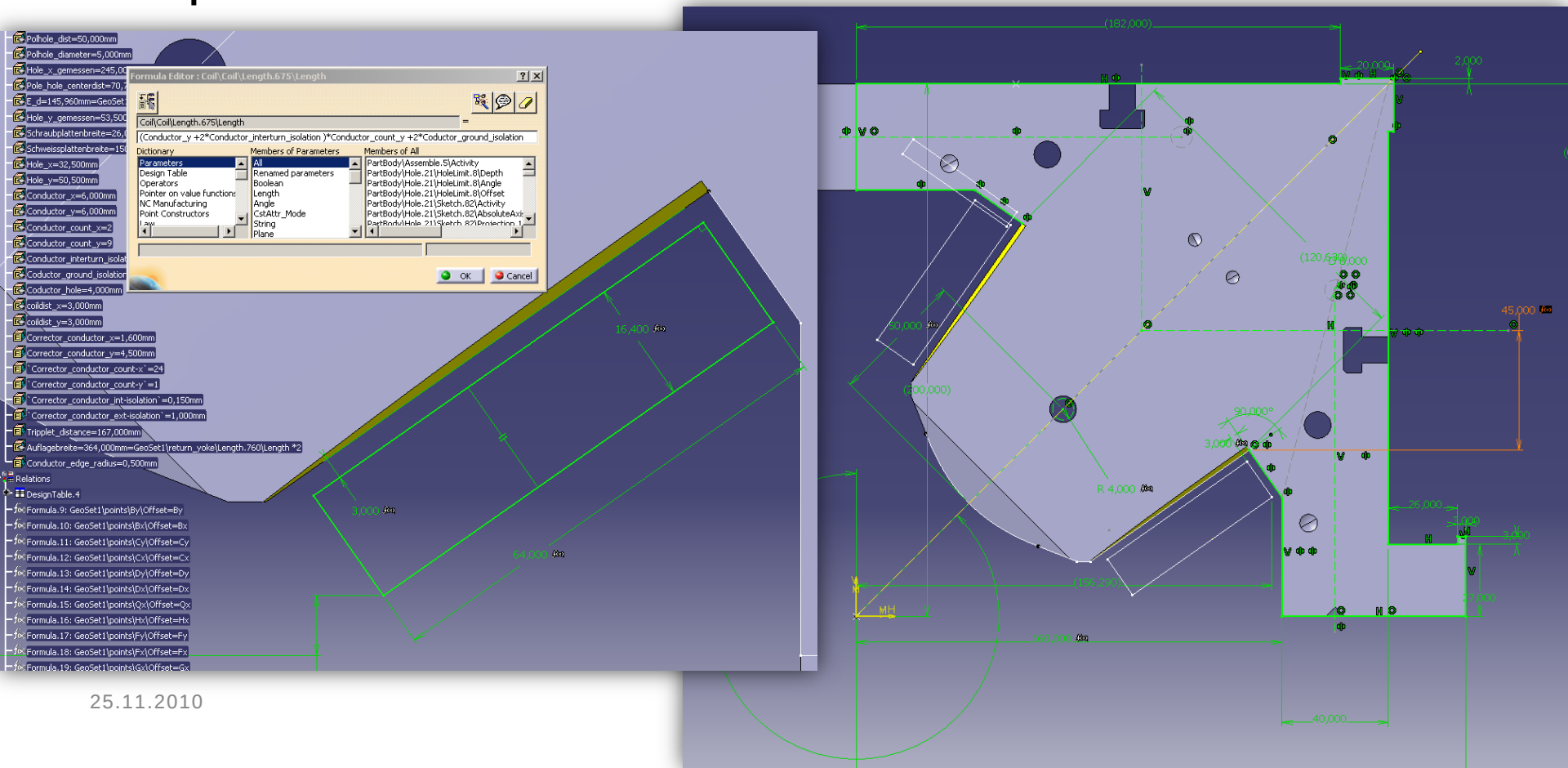
- The Values need to be stored in one Excel sheet: One line equals one magnet configuration.

ALL values are stored in this sheet.
No info will be entered in Catia!

	A	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK
1	type	Ny (mm)	Ox (mm)	Oy (mm)	Px (mm)	Py (mm)	Qx (mm)	thick (mm)	space (mm)	length (mm)	Hole_x (mm)	Hole_y (mm)	Conductor_x (mm)	Conductor_y (mm)	Conductor_count_x	Conductor_count_y	Conductor_interturn_isolation (mm)
2	Syncrotron	27,000	272,530	72,040	177,290	167,280	167,280	1,500	0,600	278,000	27,500	47,000	11,000	10,000	4	5	0,500
3	MEBT	27,000	279,260	91,740	190,500	180,500	180,500	1,500	0,000	185,000	32,500	50,500	10,000	10,000	4	10	0,250
4	HEBT	27,000	279,260	91,740	190,500	180,500	180,500	1,500	0,000	420,000	32,500	50,500	10,000	10,000	4	10	0,250
5	LEBT	20,000	210,000	52,987	131,500	131,500	130,000	1,500	0,000	124,000	32,500	50,500	6,000	6,000	2	9	0,400
6	HEBT_MA	27,000	234,000	80,000	20,000	20,000	157,000	1,000	0,000	420,000	32,500	50,500	8,000	8,000	4	9	0,250
7	HEBT_MA3	27,000	239,000	80,000	20,000	20,000	159,500	1,000	0,000	420,000	32,500	50,500	8,000	8,000	4	9	0,250
8	MEBT_MA1	27,000	239,000	80,000	20,000	20,000	159,500	1,000	0,000	200,000	32,500	50,500	8,000	8,000	4	9	0,250
9	Syn_MA0	27,000	270,000	64,000	167,000	167,000	167,000	1,000	0,600	283,000	27,500	47,000	11,000	11,000	4	5	0,500
10	LEBT_MA0	20,000	210,000	52,987	131,500	131,500	130,000	1,000	0,000	95,000	32,500	50,500	6,000	6,000	2	9	0,400
11																	
12																	

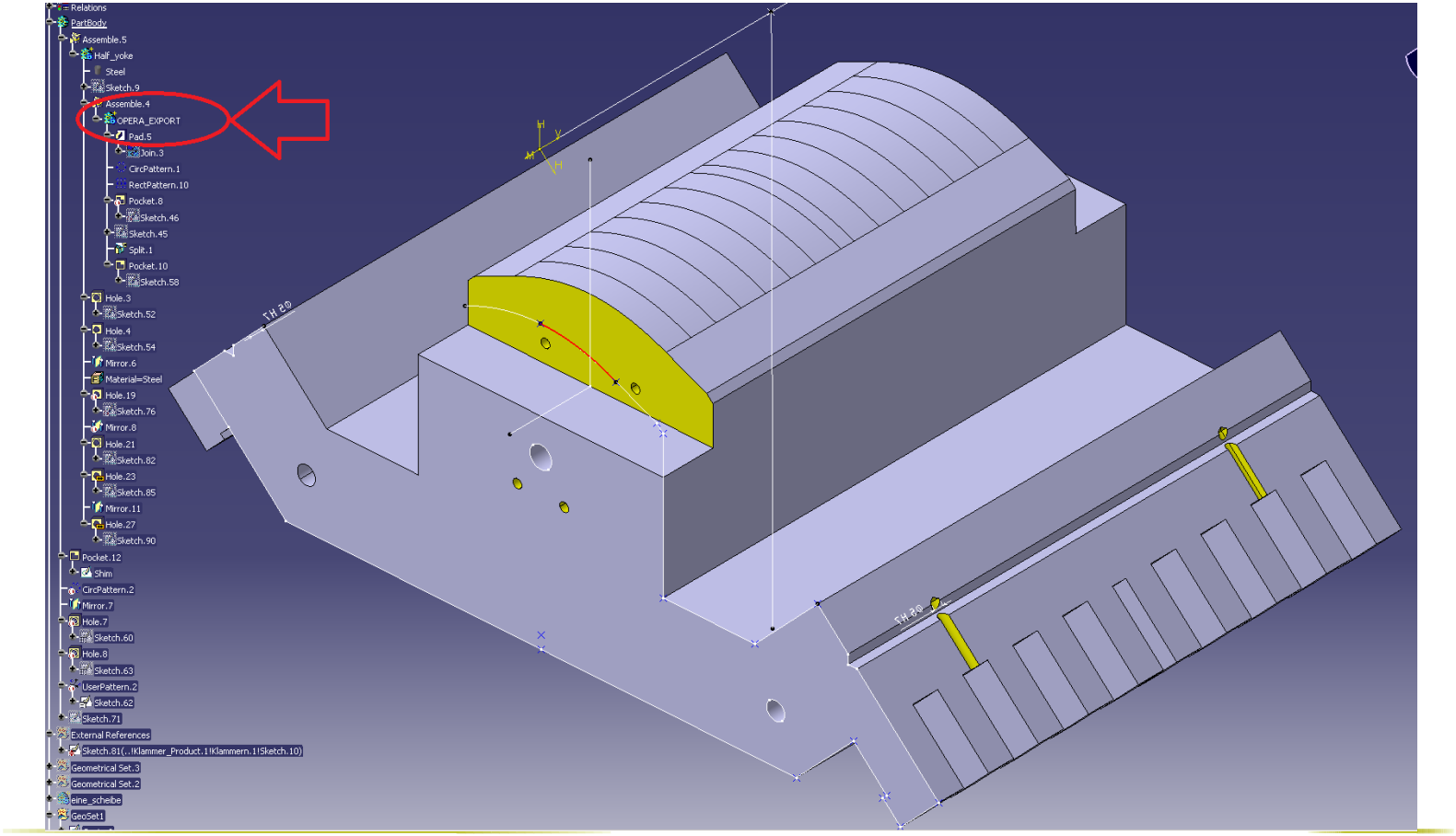
The parameterized Quadrupole magnet:

- OR:
  Define (parts of the) yoke by the required aperture and coil:



The parameterized Quadrupole magnet:

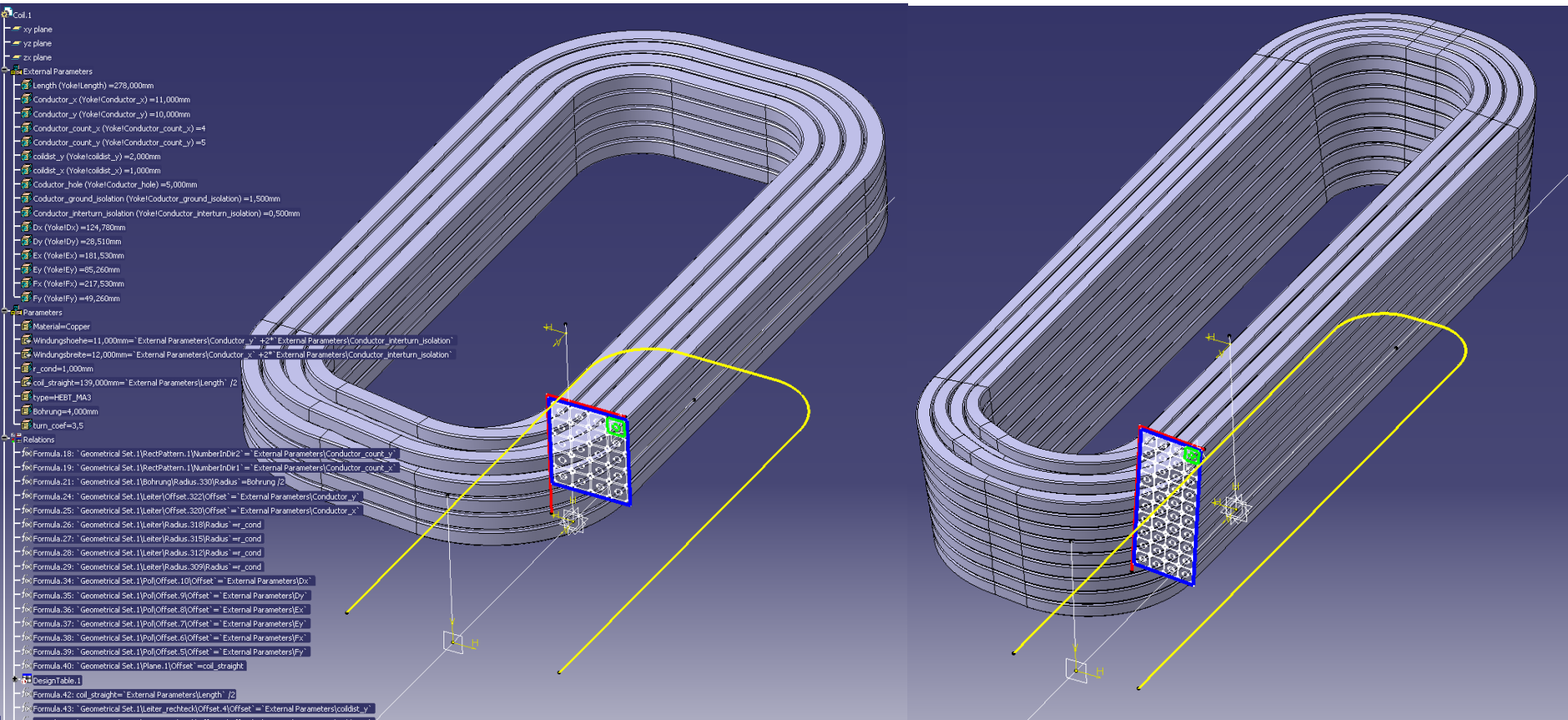
- The finished Yoke:



The parameterized Quadrupole magnet:

- The Coil:

  It’s not necessary to define it’s size or shape.
  It adapts automatically to the Yoke. Only the wire size, cooling hole and the number of turns is needed.



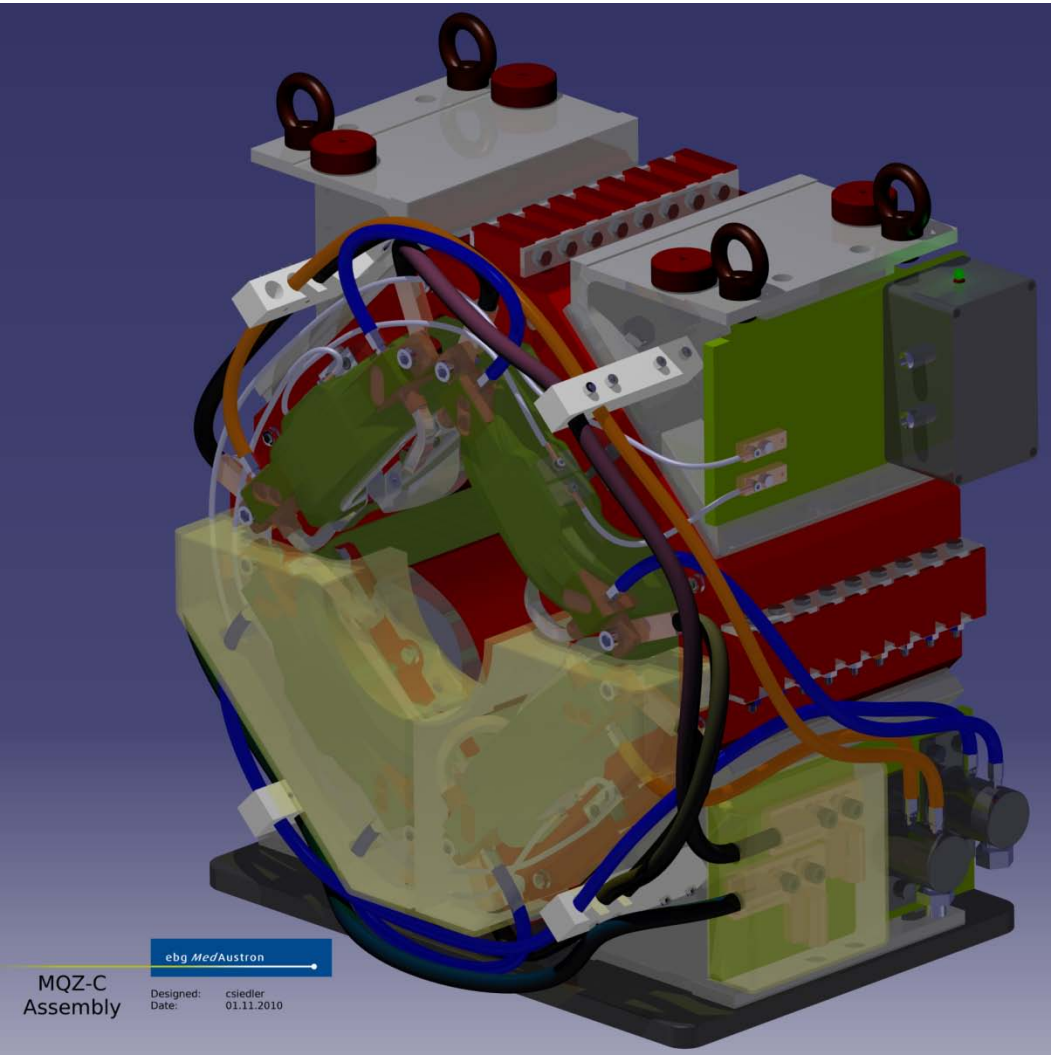
The parameterized Quadrupole magnet:

- Coil and Yoke adapt to changes:

  (see Movie 1)

The parameterized Quadrupole magnet:

- Assembly:



Also adapting:

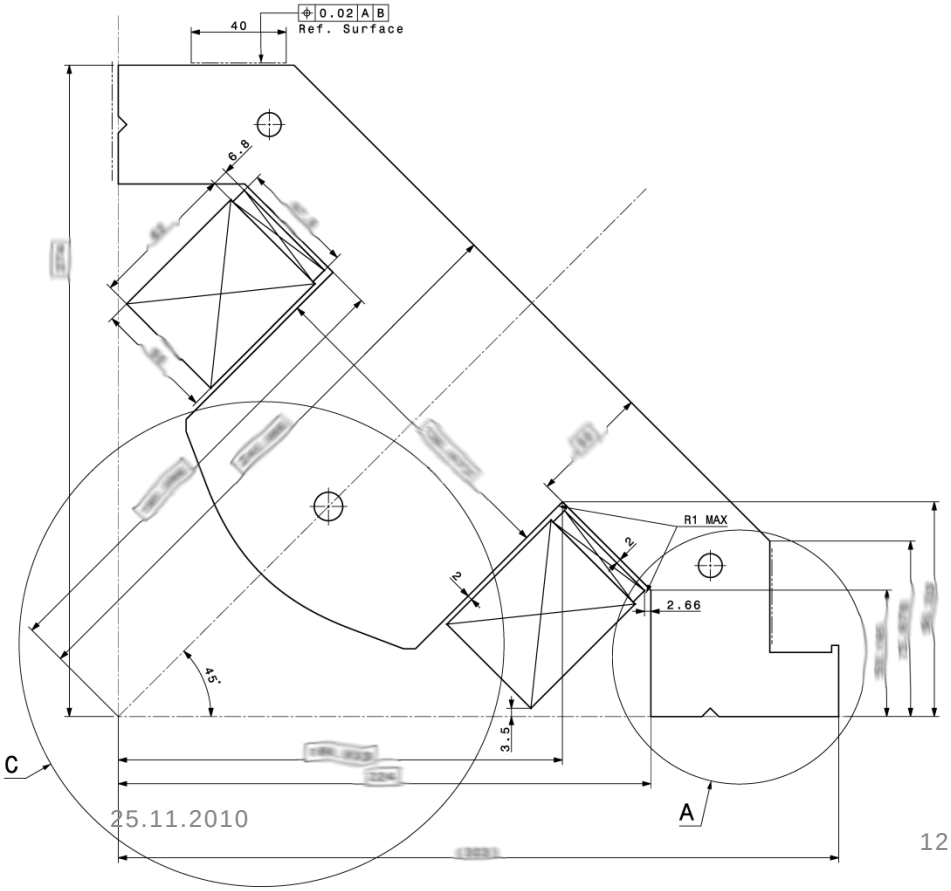
- Support, Crane hooks
- Shim
- Protection Cover
- (Coil Connectors)

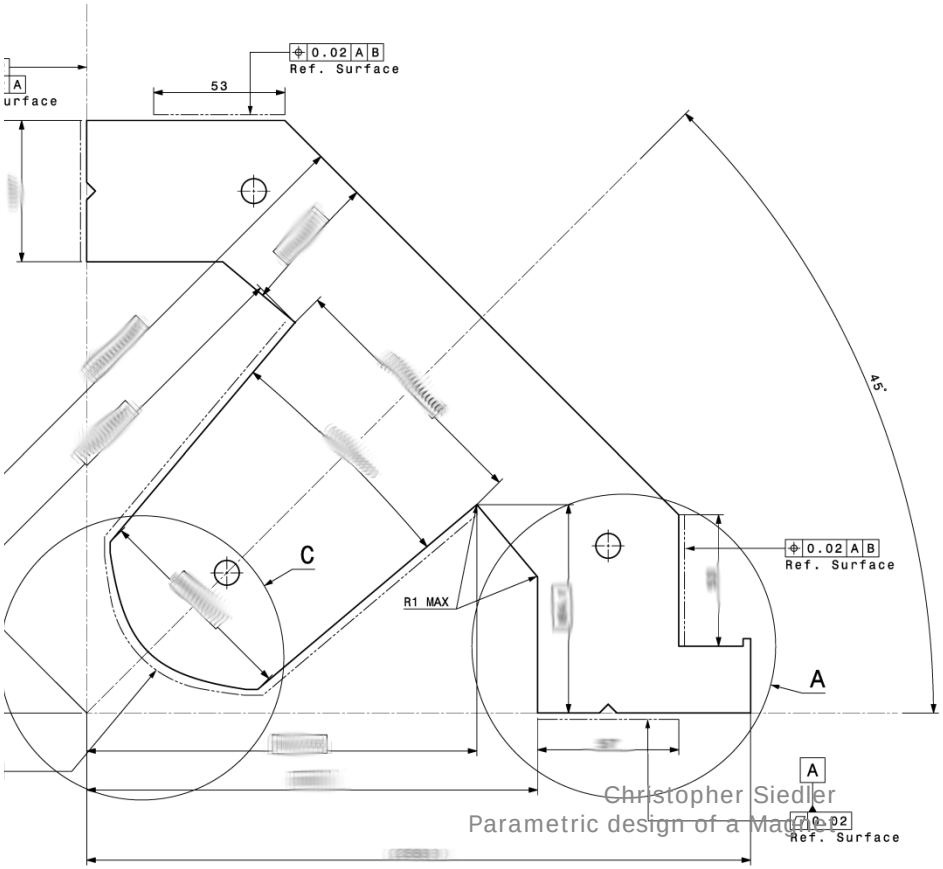
Limits of the model:

- Cabling and cooling circuits.
- Alignment System
- Special stuff (like K-Mod Coil)

The parameterized Quadrupole magnet:

- Drawings:
  adapt also automatically (with limits)
  early drawings make error checks, colaboration and controlling easier.

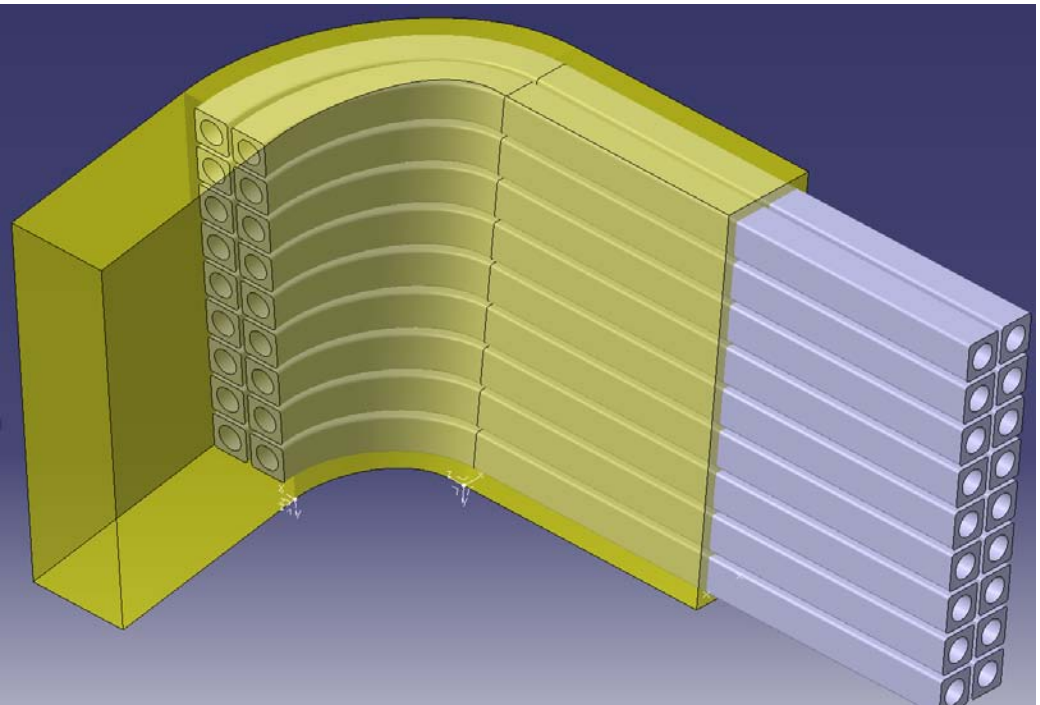




Useful scripts:

- Coil wires generated by a Script:
  The parameterized model is limited in complexity.
  It is possible to generate more advanced coils with a script.

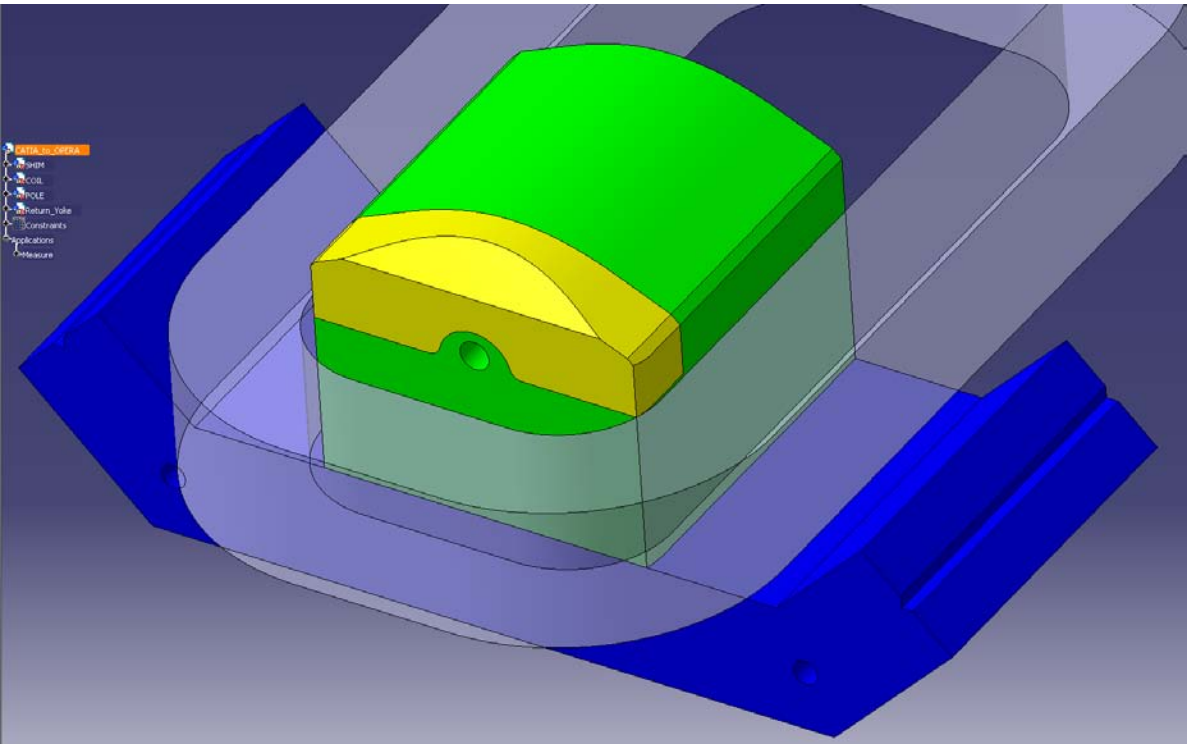
  In this case the script takes automatically the parameters of the part as input. After a change of the geometry it's only necessary to start the script again.



Movie 2

Useful scripts:

- Export a simplified Version to OPERA:
  - It's possible to export automatically only the for FE required parts into iges files.

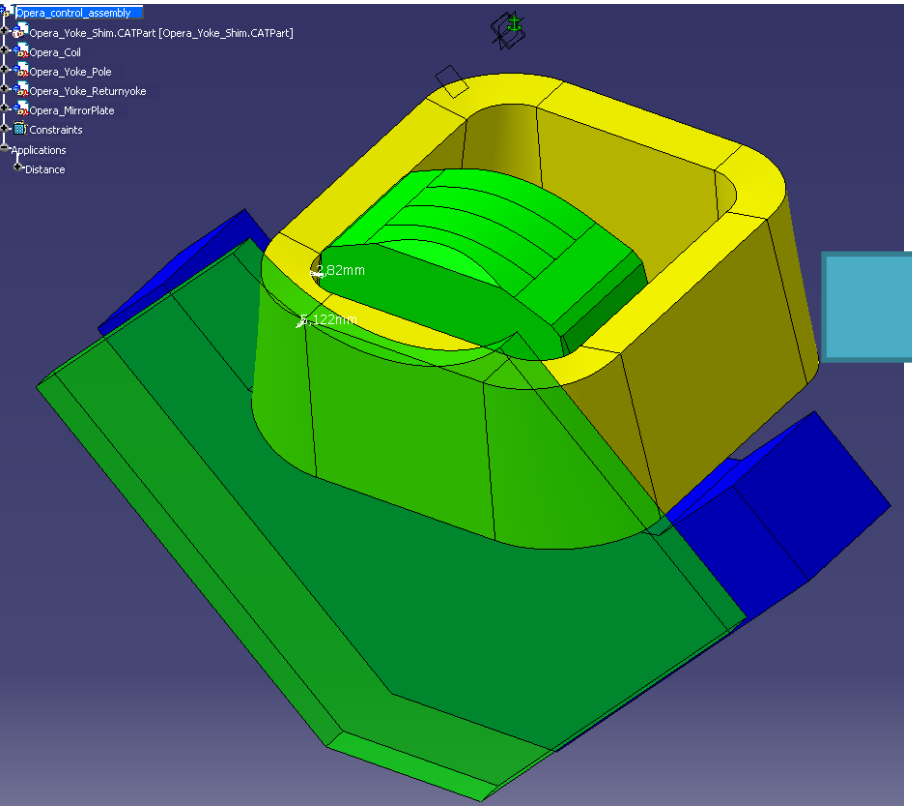


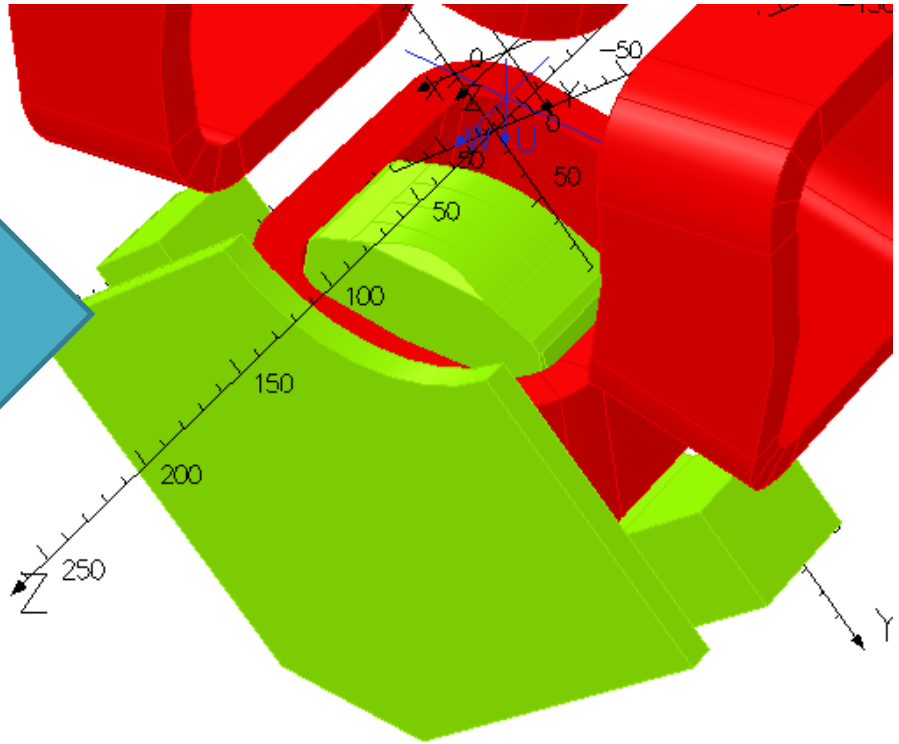
- Only the required details (Sub body copied as result with link)
- Spitted in parts as needed for FE (Shim / Pole / Return Yoke)
- Automatically saved as iges

Movie 3

Useful scripts:

- Export a simplified Version to OPERA:





Thanks:

Questions?

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