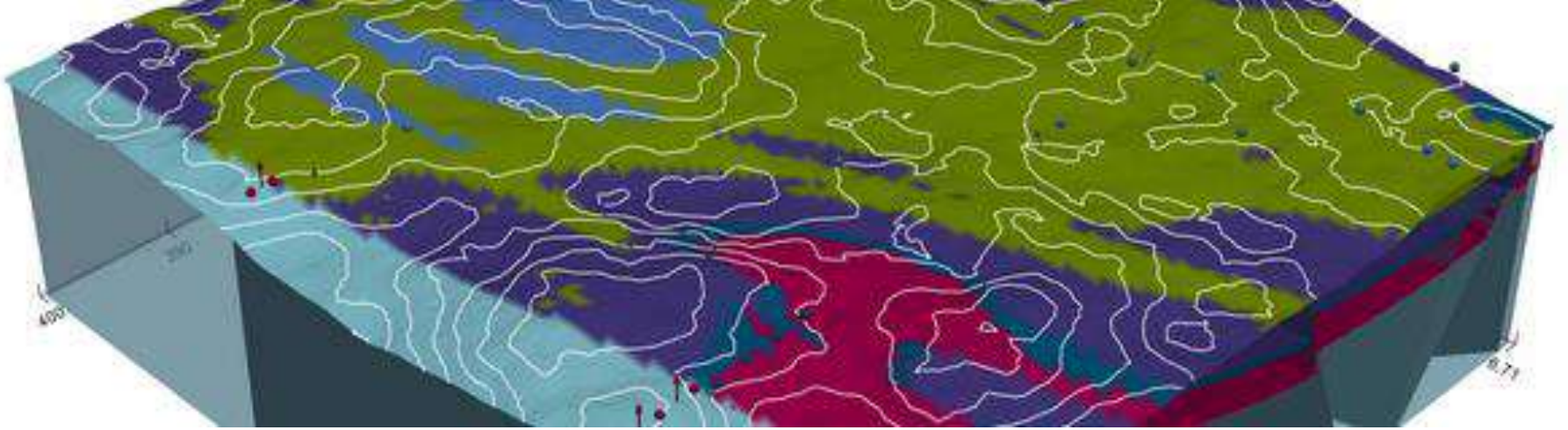


GemPy: Open-source Software for Implicit 3D Structural Geological Modelling in Python

Open-source geomodeling library for complex 3D geological models

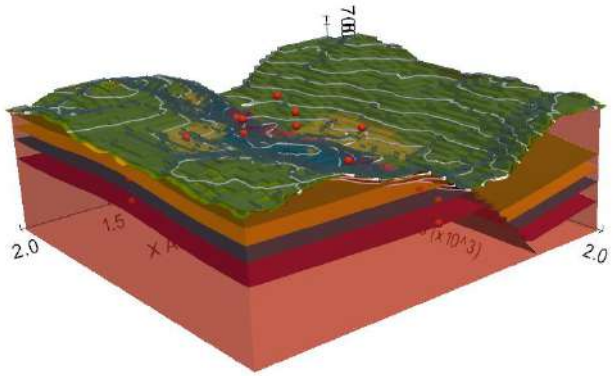
https://docs.gempy.org

Computational Geoscience, Geothermics
and Reservoir Geophysics

E.ON Energy Research Center | RWTH AACHEN UNIVERSITY

About GemPy

- Open-source Geomodeling Library
- Constructs 3D geological models
  - Fold structures
  - Fault networks
  - Unconformities
- Implicit approach
- Embeds probabilistic frameworks for uncertainty analysis



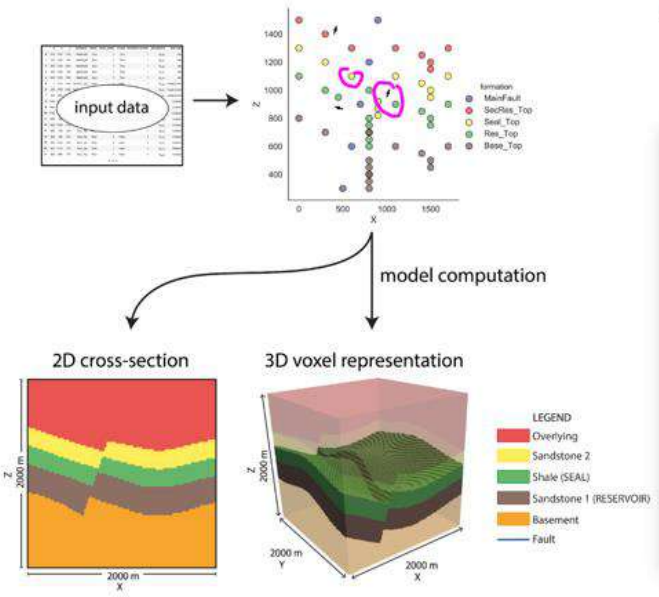
Source: https://docs.gempy.org

About GemPy

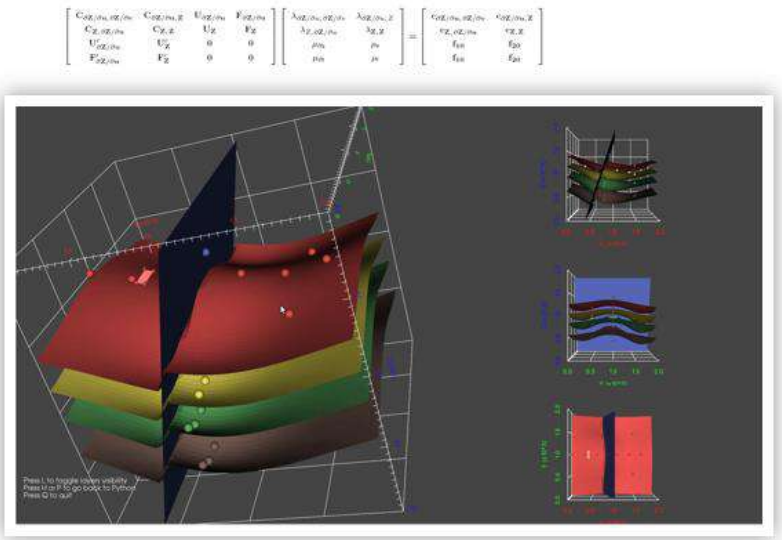
Gempy – A special implicit surface representation method

Potential-field interpolation algorithm based on universal cokriging (Chiles and Delfiner, 2009)

- Raw data, mostly in CSV files, that are stored in Python objects.
  - Surface contact points (x, y, z) assigned a lithological unit or fault (topological relationships)
  - Orientations (x, y, z, poles, azimuth and polarity)
- Grid (extent and resolution)



Universal cokriging:



Sources:

- *https://docs.gempy.org*
- *Miguel de la Varga, Alexander Schaaf, and Florian Wellmann. GemPy 1.0: open-source stochastic geological modeling and inversion. Geoscientific Model Development, 12, 1–32, 2019. https://doi.org/10.5194/gmd-12-1-2019*
- *Presentation by Florian Wellmann, Modeling geological interfaces using implicit surface representations with gempy. Why, when and how? Computational Geoscience and Reservoir Engineering, RWTH Aachen University, Germany*

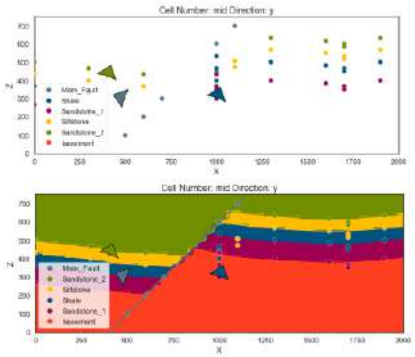
Basic Model Workflow in GemPy

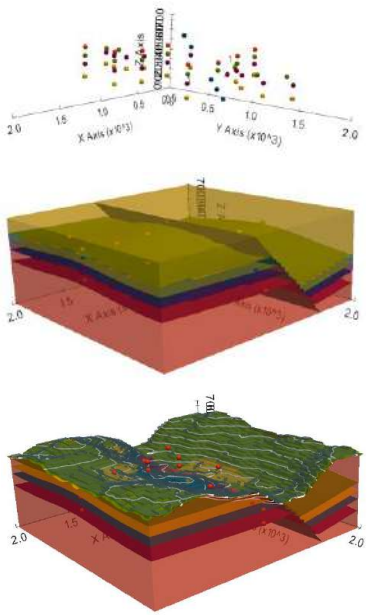
- Create the model create_model()
- Load input data get_data()
- Create surfaces If using Python 3.6 or newer, key order gives formation order
- Define sequential order of geological formations If using Python 3.5 or older, with set_series() and order_series()

Source: https://docs.gempy.org

	surface	series	order_surfaces	color	id
4	Main_Fault	Fault_Series	1	#443988	1
0	Shale	Strat_Series	1	#015482	2
1	Sandstone_1	Strat_Series	2	#9f0052	3
2	Siltstone	Strat_Series	3	#ffbe00	4
3	Sandstone_2	Strat_Series	4	#728f02	5
5	basement	Strat_Series	5	#ff3f20	6

- Read and/or visualiza data (2D or 3D) in needed, or for QA/QC
  plot_2d() or plot_3D()
- Interpolate data set_interpolator()
- Compute model compute_model()
- Visualize plot_2d() or plot_3D()
- Add topography plot_2d() or plot_3D()

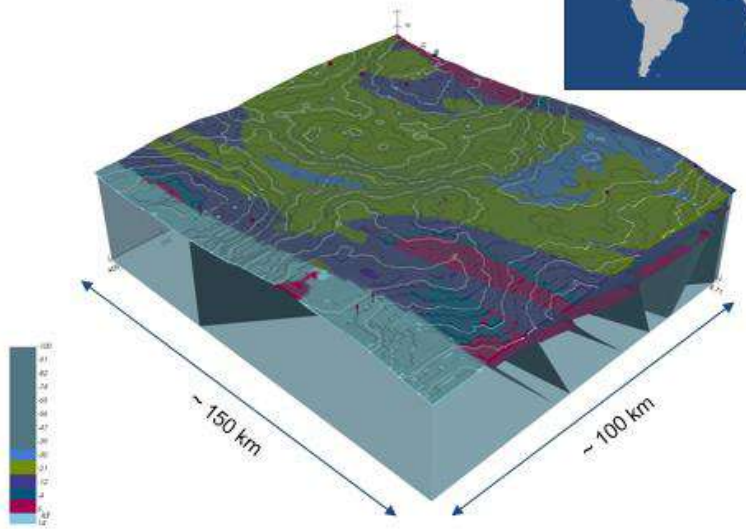




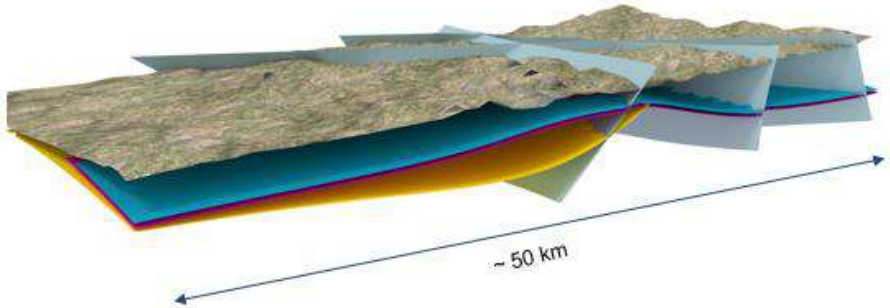
Example Models with GemPy

Check Notebooks by Miguel de la Varga at https://docs.gempy.org/examples/index.html

- Perth Basin, Australia



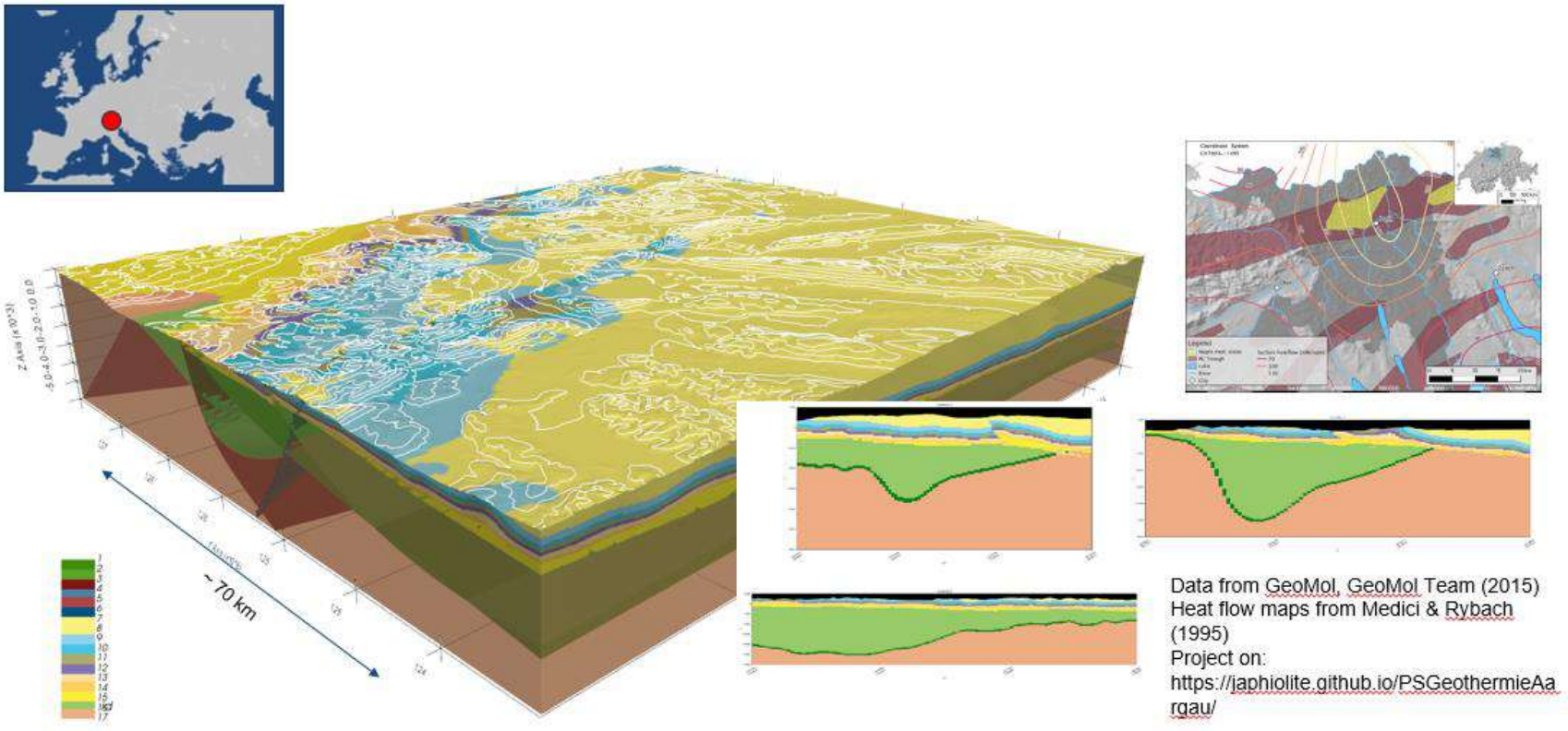
- Alès, France



Source: Presentation by Florian Wellmann, Modeling geological interfaces using implicit surface representations with gempy. Why, when and how? Computational Geoscience and Reservoir Engineering, RWTH Aachen University, Germany

Example Models with GemPy

- Permo-Carboniferous Trough, regional geothermal potential evaluation



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Example Models with GemPy

- Comprehensive survey of geological conditions at potential ET location

Potential ET configurations

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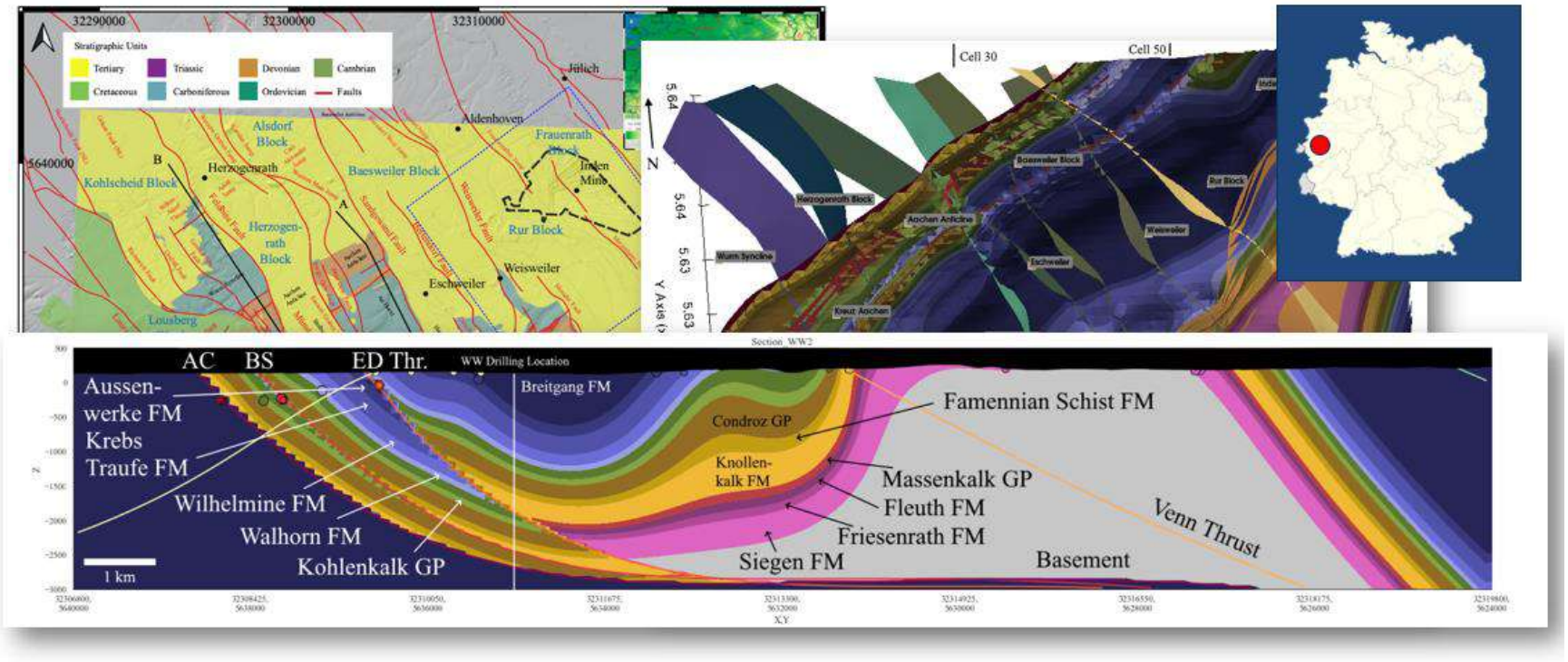
Example Models with GemPy

- Aachen – Weisweiler



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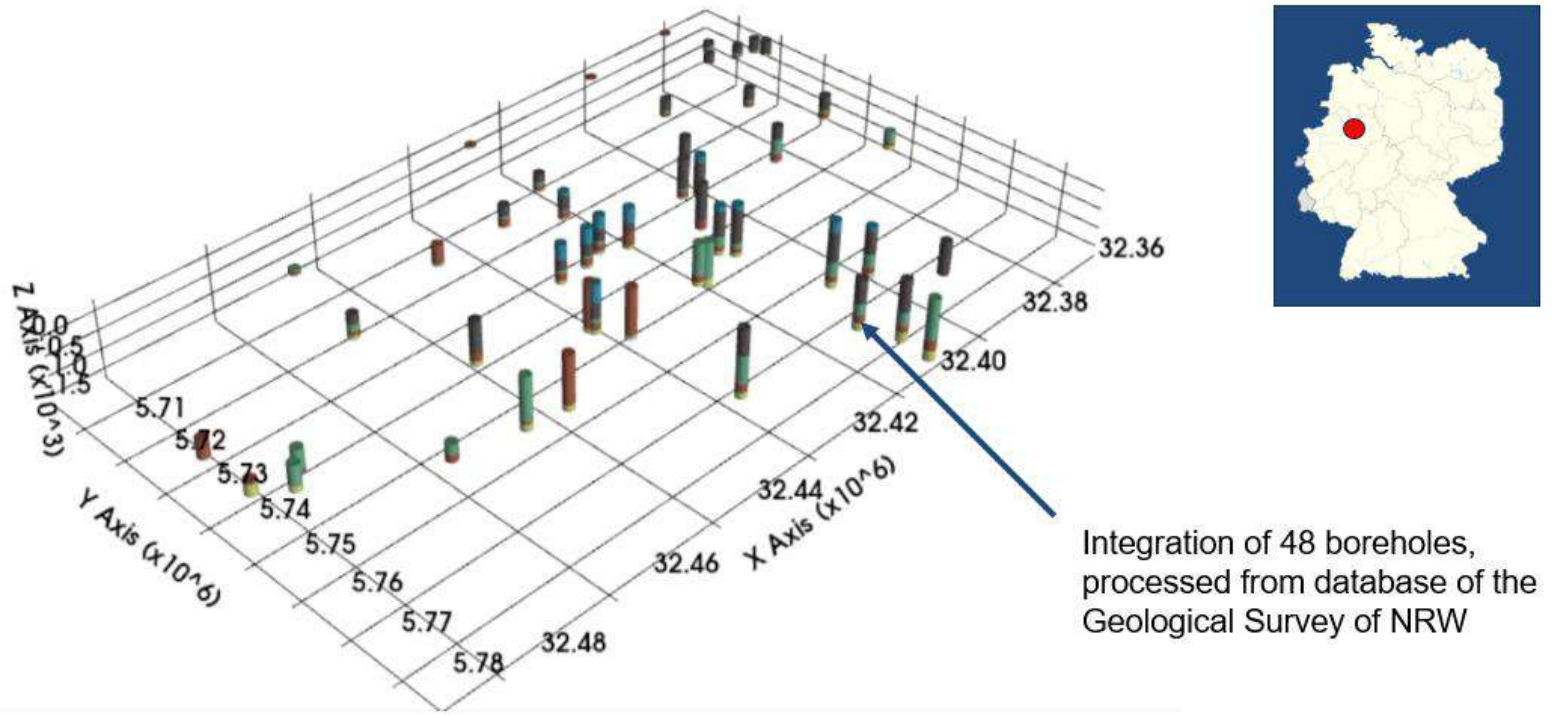
Example Models with GemPy

- Münster – Regional Geothermal Study



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Contact

E.ON Energy Research Center
Mathieustraße 10
52074 Aachen
Germany

FIRST NAME SURNAME
T +49 241 80 49xxx
F +49 241 80 49xxx
xxx@eonerc.rwth-aachen.de
http://www.eonerc.rwth-aachen.de

E.ON Energy Research Center | RWTH AACHEN UNIVERSITY