TECHNISCHE UNIVERSITÄT DRESDEN

innovatION
Selektive Entfernung monovalenter Ionen aus salzhaltigen Wässern

GEFÖRDERT VOM
Bundesministerium für Bildung und Forschung

Institute of Urban and Industrial Water Management
Chair of Process Engineering in Hydro Systems

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SELECTIVE DESALINATION OF MONOVALENT IONS BY APPLICATION OF NANOFILTRATION MEMBRANES IN CAPACITIVE DEIONISATION

David Schödel, Hanna Rosentreter, André Lerch

MELPRO 2022, Praque, 20.09.2022

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Selektive Entfernung monovalenter Ionen aus salzhaltigen Wässern

... consists of 11 partners from science and industry:

TECHNISCHE UNIVERSITÄT DRESDEN

Carl von Ossietzky Universität Oldenburg

ipf Leibniz-Institut für Polymerforschung Dresden

fumatech Funktionelle Membranen und Anlagentechnologie BWT GROUP

elkoplan staiger GmbH Automation

DEUKUM

Kreisverband für Wasserwirtschaft WASSER

OOWV

KWR

UNITED NATIONS UNIVERSITY UNU-FLORES

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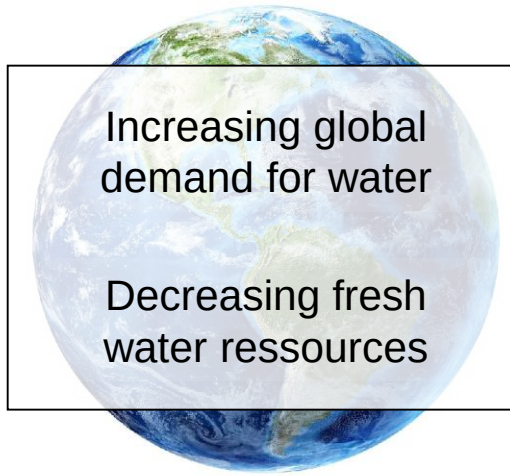
Objective of innovatION



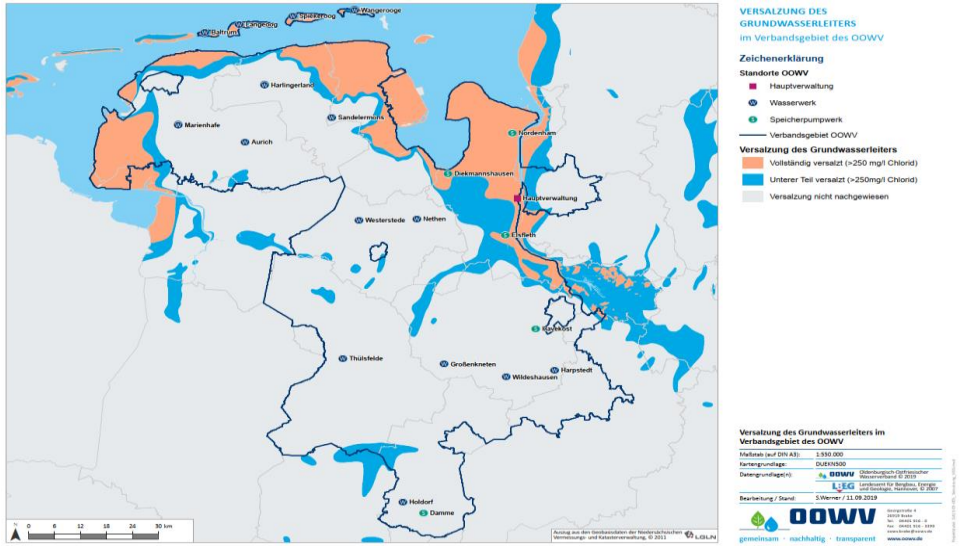
Increasing global demand for water

Decreasing fresh water ressources

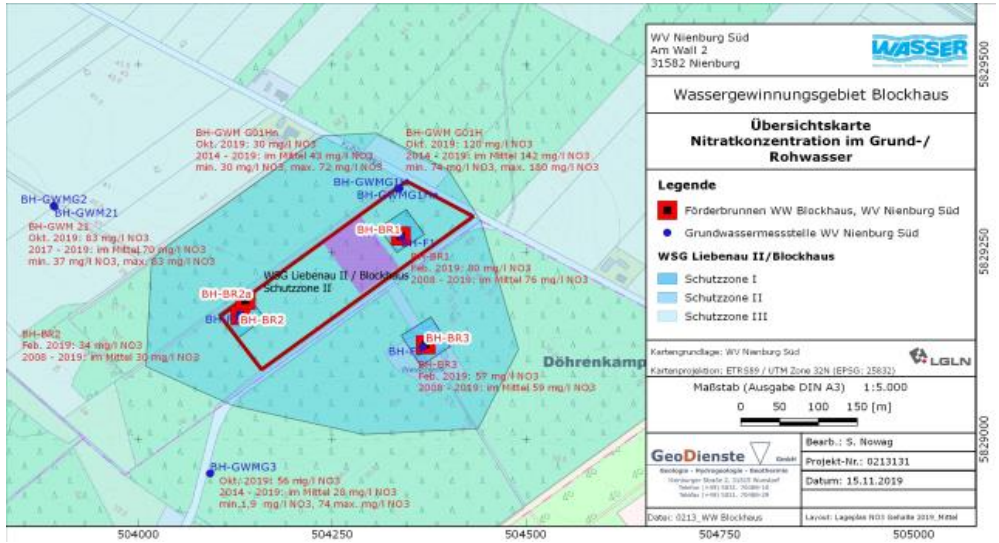
→ Worldwide demand for energy efficient desalination technologies

1. Development of an **energy efficient desalination process** for **selective removal** of **monovalent ions** from saline ground and surface waters

2. Examination of **potential applications and field of application** with focus on water chemistry, ecological and economical aspects



Groundwater salination in the working area of OOWV *[NIBIS® Kartenserver 2021 LBEG, Hannover]*



Concentrations of nitrate in the catchment area for ground and raw water at “Blockhaus” treatment plant of KWN *[KWN]*

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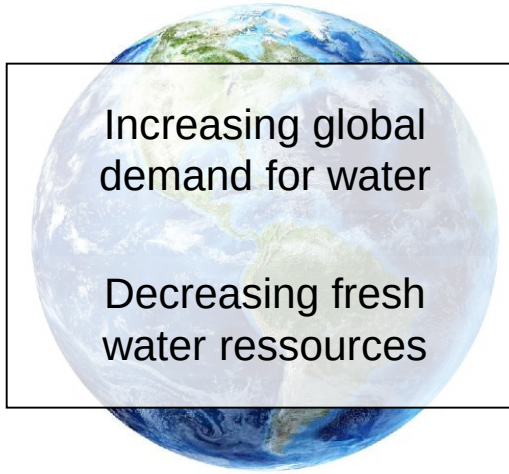

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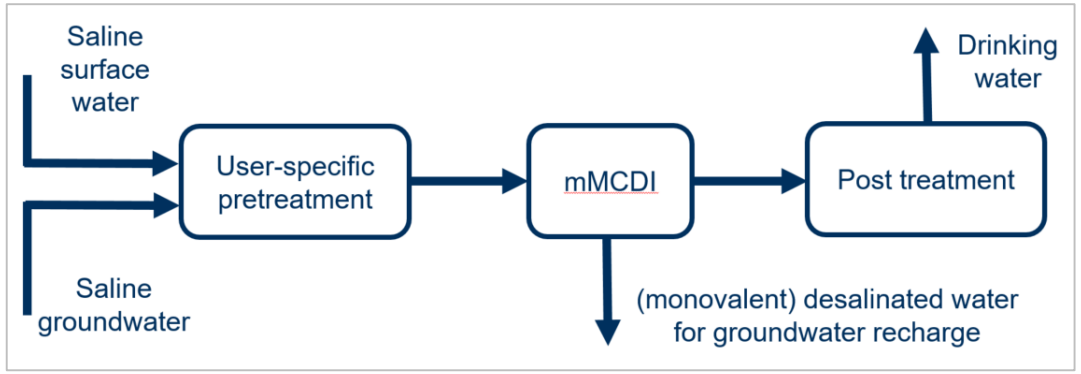
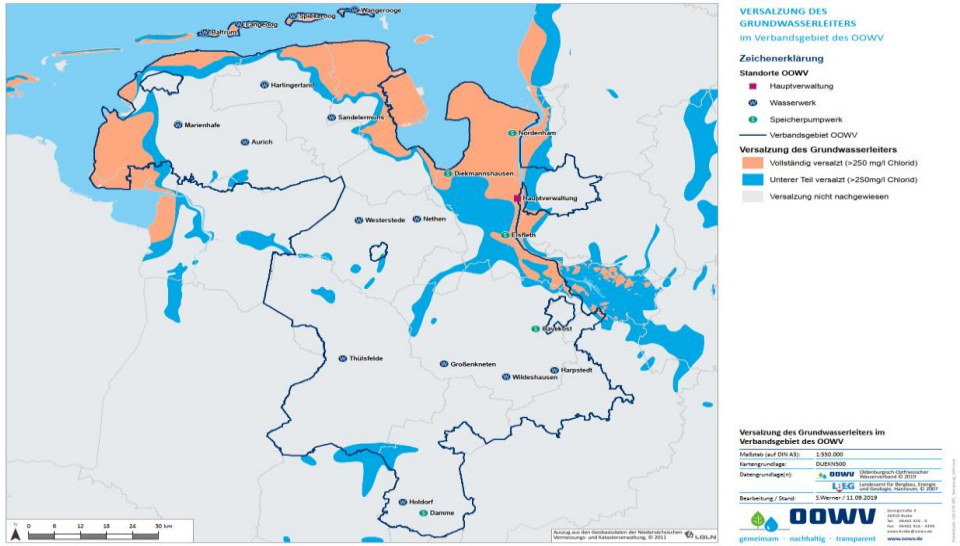


Process principle for implementation of mMCDI (monoselective membrane capacitive deionization) in desalination of saline waters



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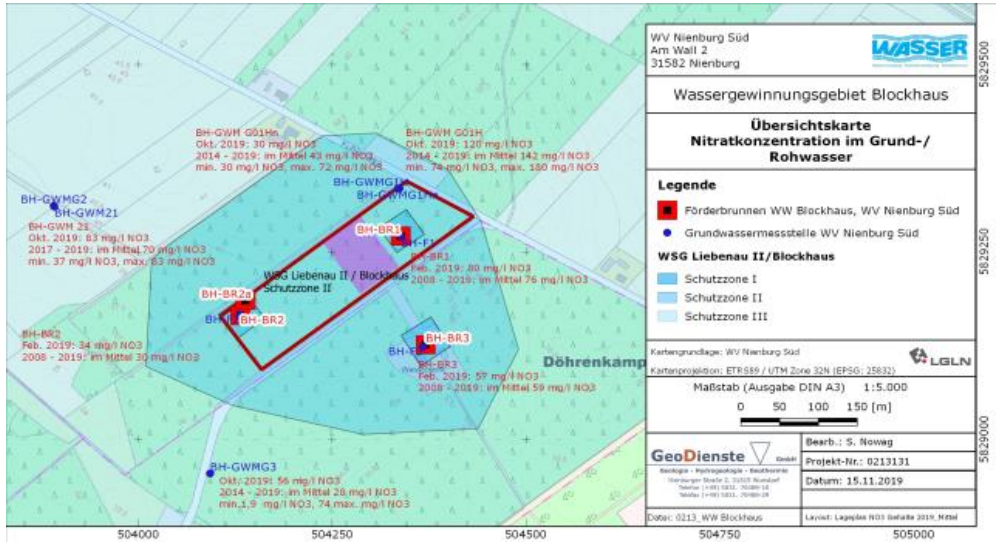

Concentrations of nitrate in the catchment area for ground and raw water at “Blockhaus” treatment plant of KWN *[KWN]*

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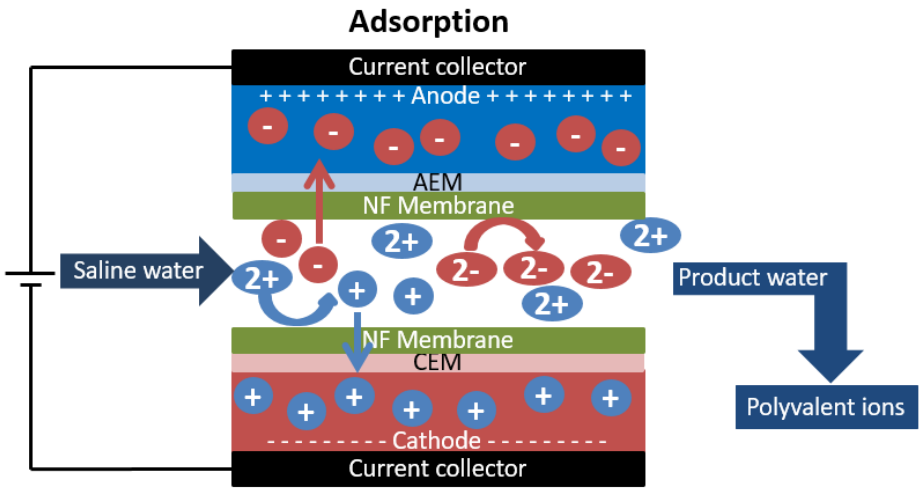
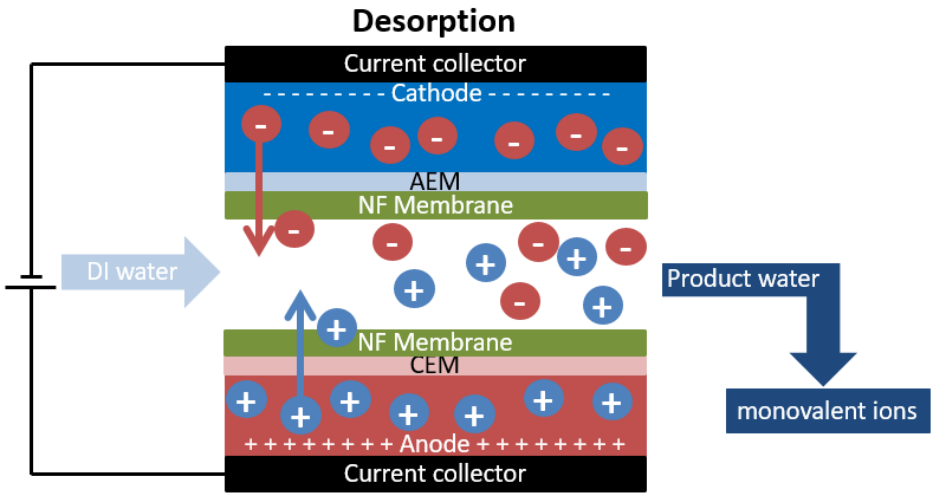
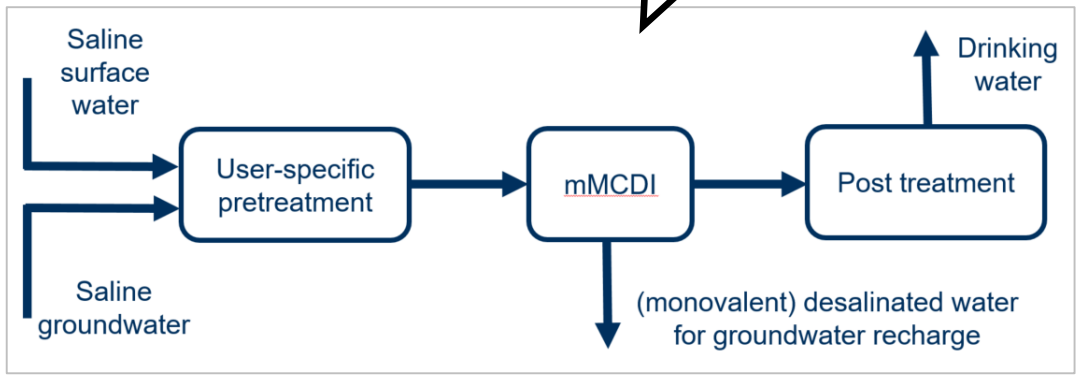
Objective of innovatION







Process principle for implementation of mMCDI (monoselective membrane capacitive deionization) in desalination of saline waters

3. Elicit the **resulting effects** and challenges of potential **applications**,

4. Development of a holistic **economic-ecological sustainability assessment** to manage operational **resource efficiency**.

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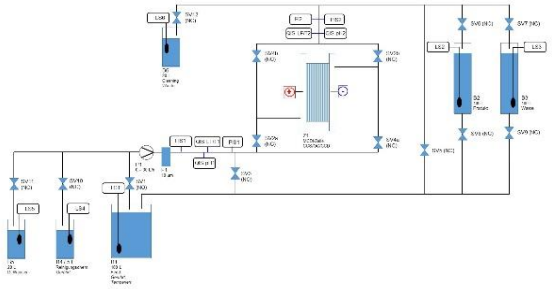
Work packages and project scope
Technology development

Sustainability assessment

Ion exchange membranes and composites

Automation and digital transformation



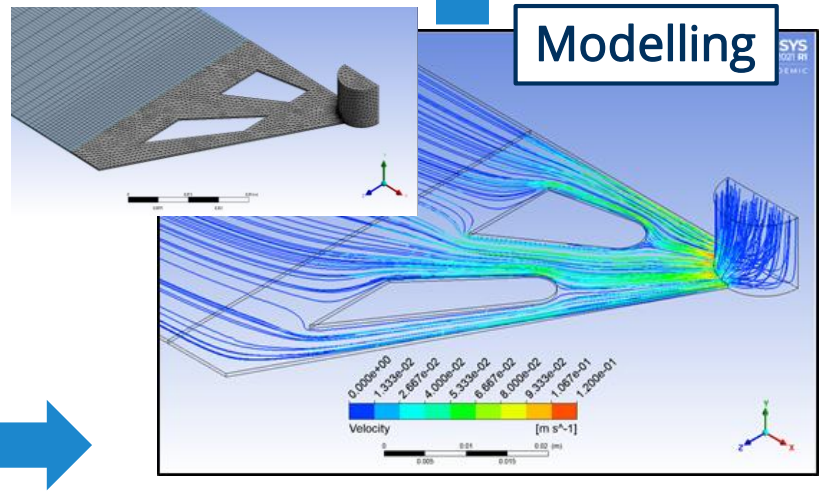
PI scheme

Plant construction of laboratory and pilot plant

Lab/Experimental

Module development

Modelling



Hybrid meshing to reduce computational effort

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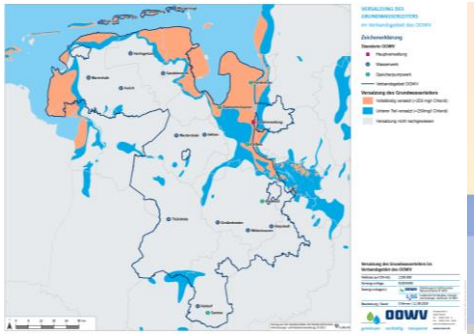
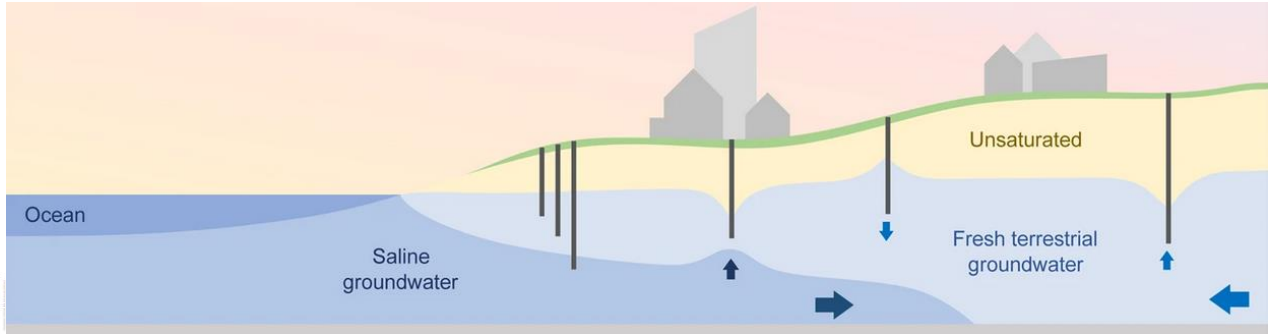
Work packages and project scope
Technology application

Practical desalination and infiltration studies



Saline waters in OOWV area
[NIBIS® Kartenserver 2021 LBEG]

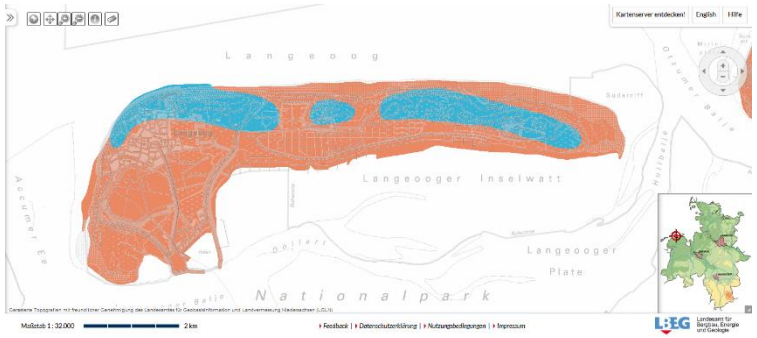


Scheme of a shallow, urbanized coastal region
[Costall, A.R., Harris, B.D., Teo, B. et al. Sci Rep 10, 9866 (2020)]

Soil columns [UOL]

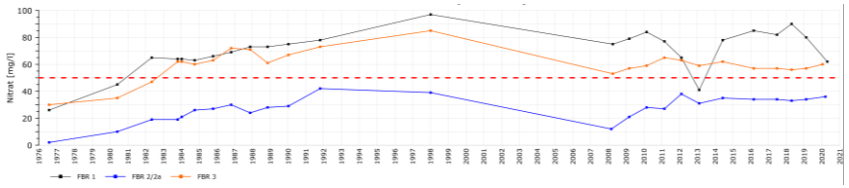
Lab plant [TUD]

Practical examples Langeoog and Nienburg



Groundwater salinization on Langeoog island
[NIBIS® Kartenserver 2021 LBEG]

Wells on Langeoog[OOWV]



Nitrate concentration of wells for Blockhaus treatment plant [KWN]

Blockhaus treatment plant [KWN]

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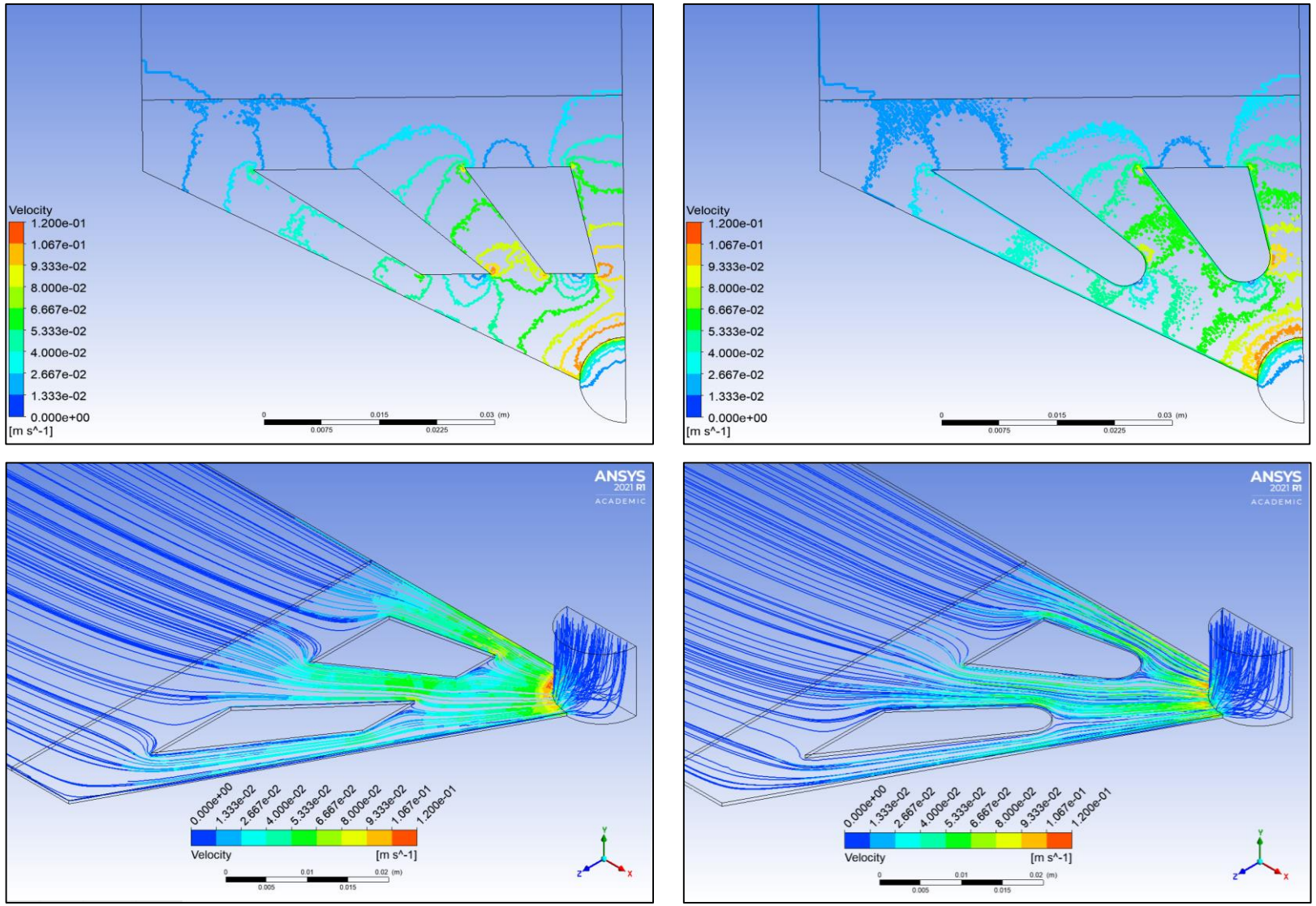
Preliminary Results
Modelling

Isotaches (top) and velocity track (bottom)

for standard diffusor shape (left) and optimized geometry (right) (Franz, 2021)



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Preliminary Results
Lab plant

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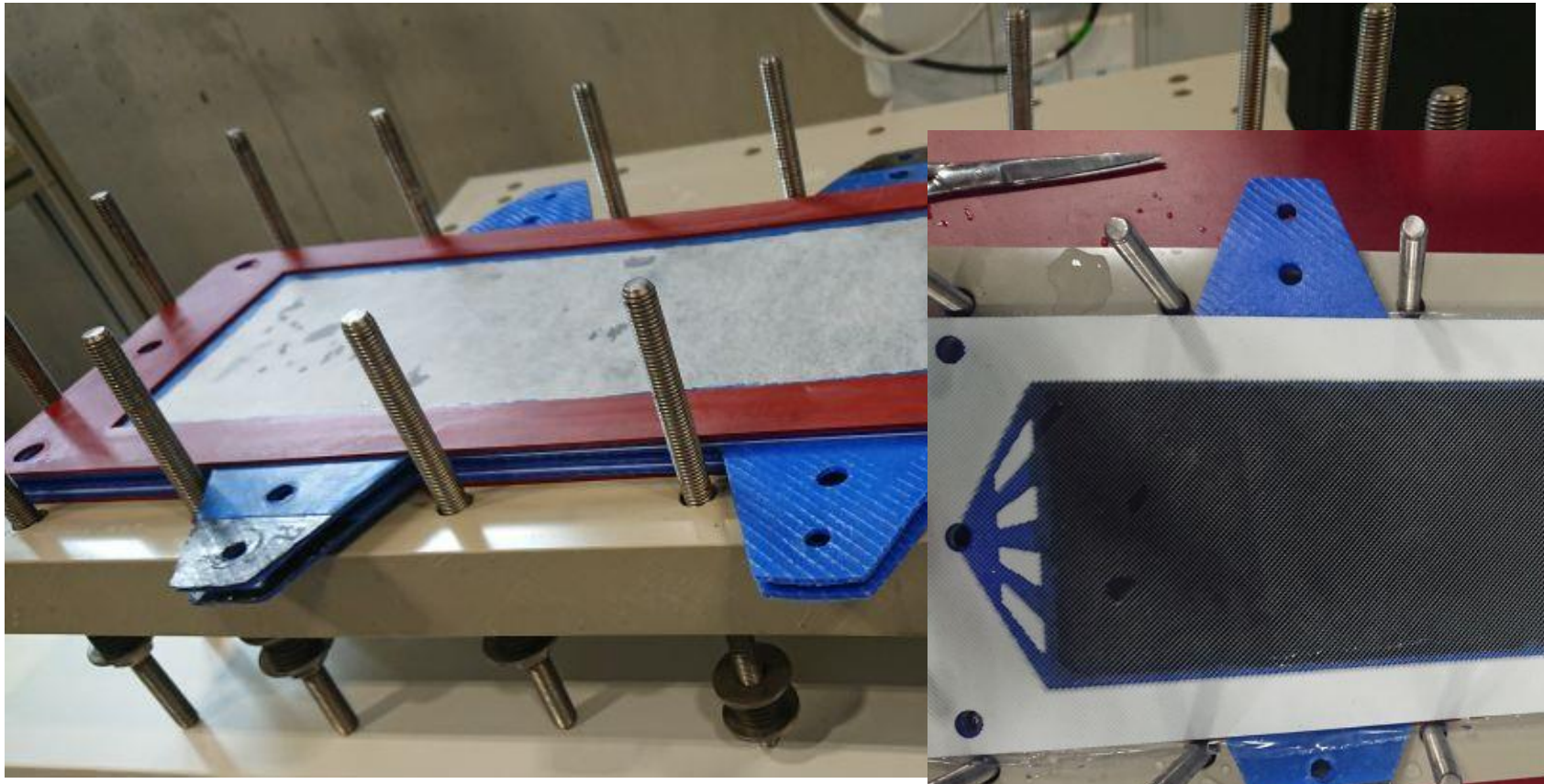
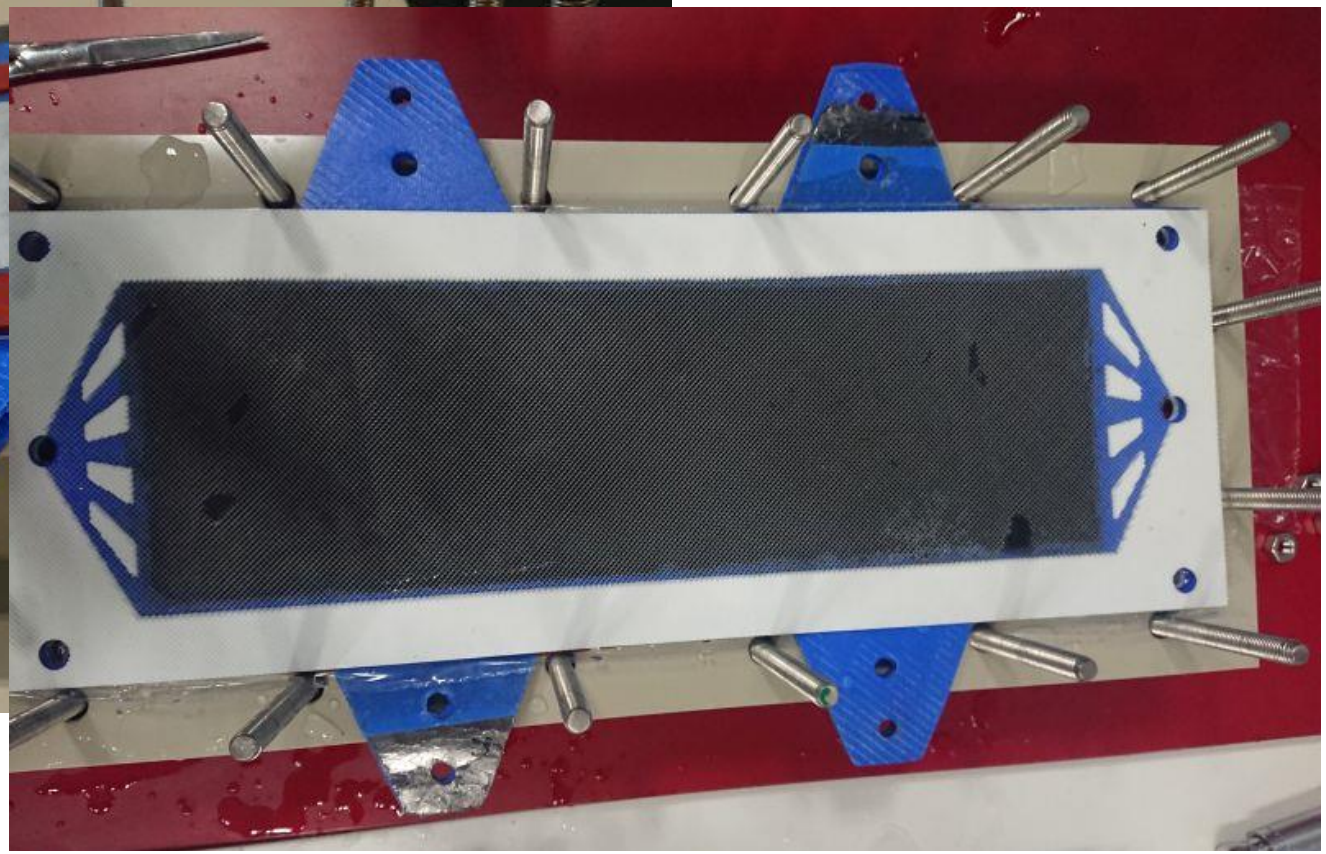
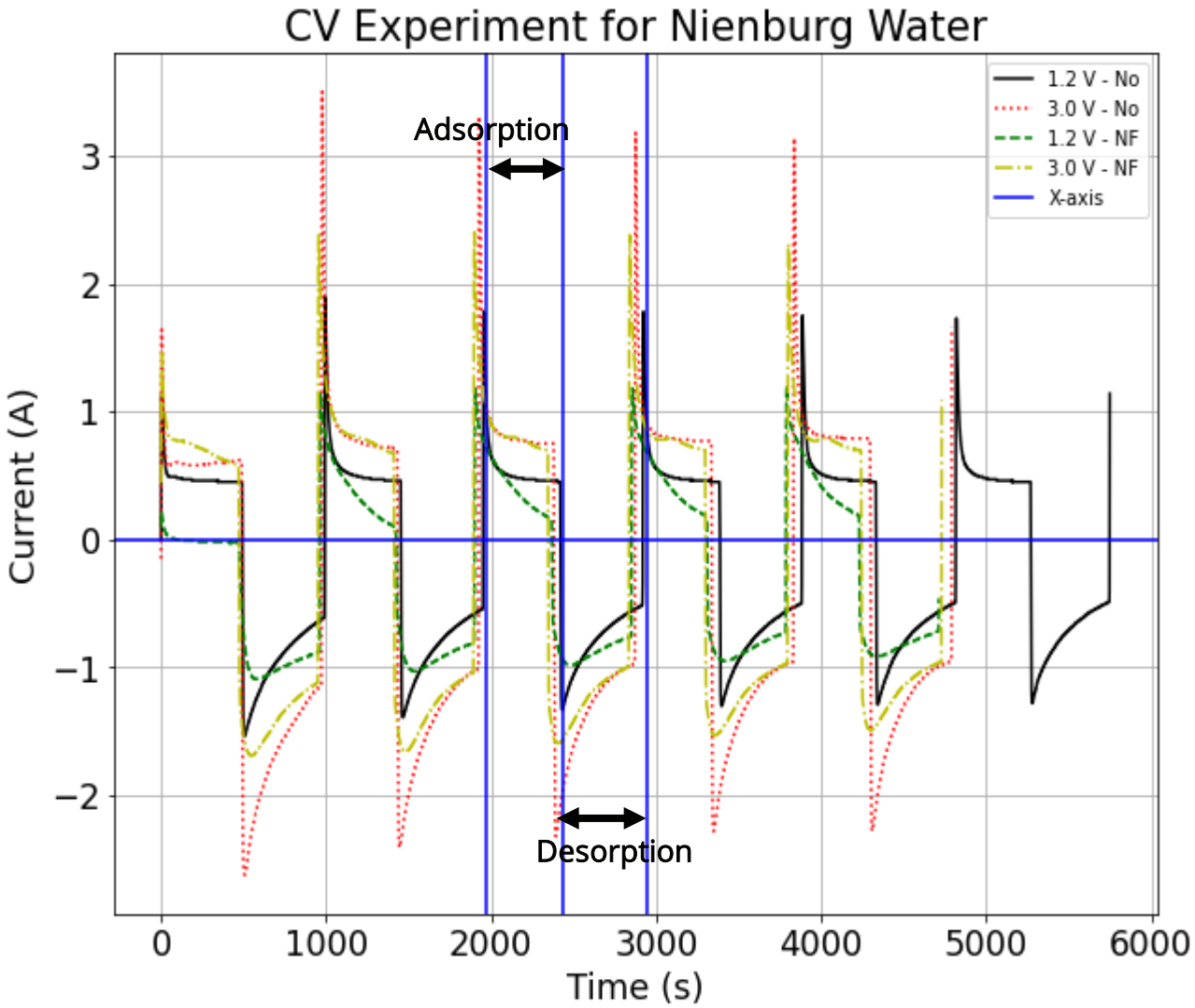
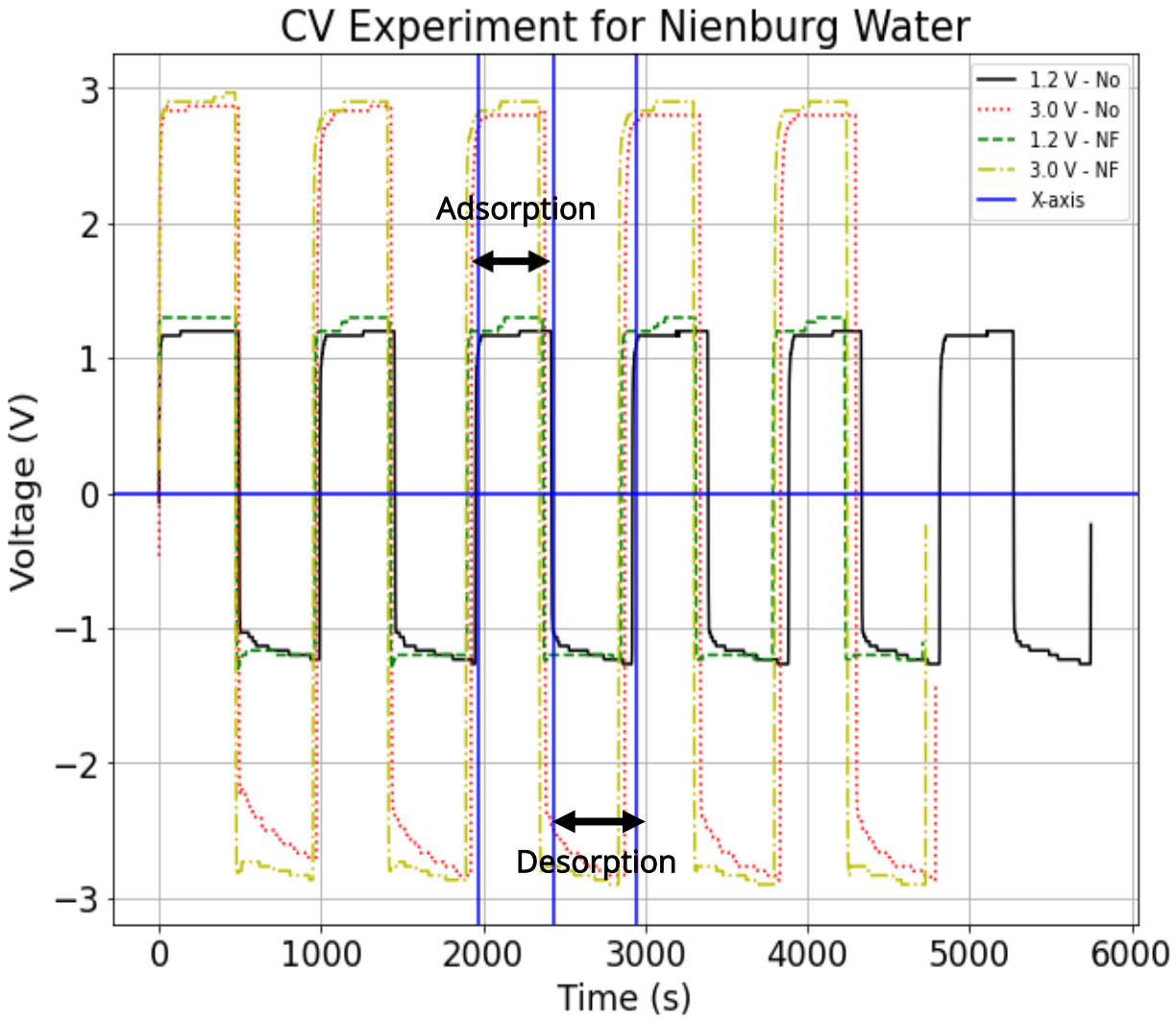
Preliminary Results
Lab plant – Module setup





Results with old setup - Nienburg





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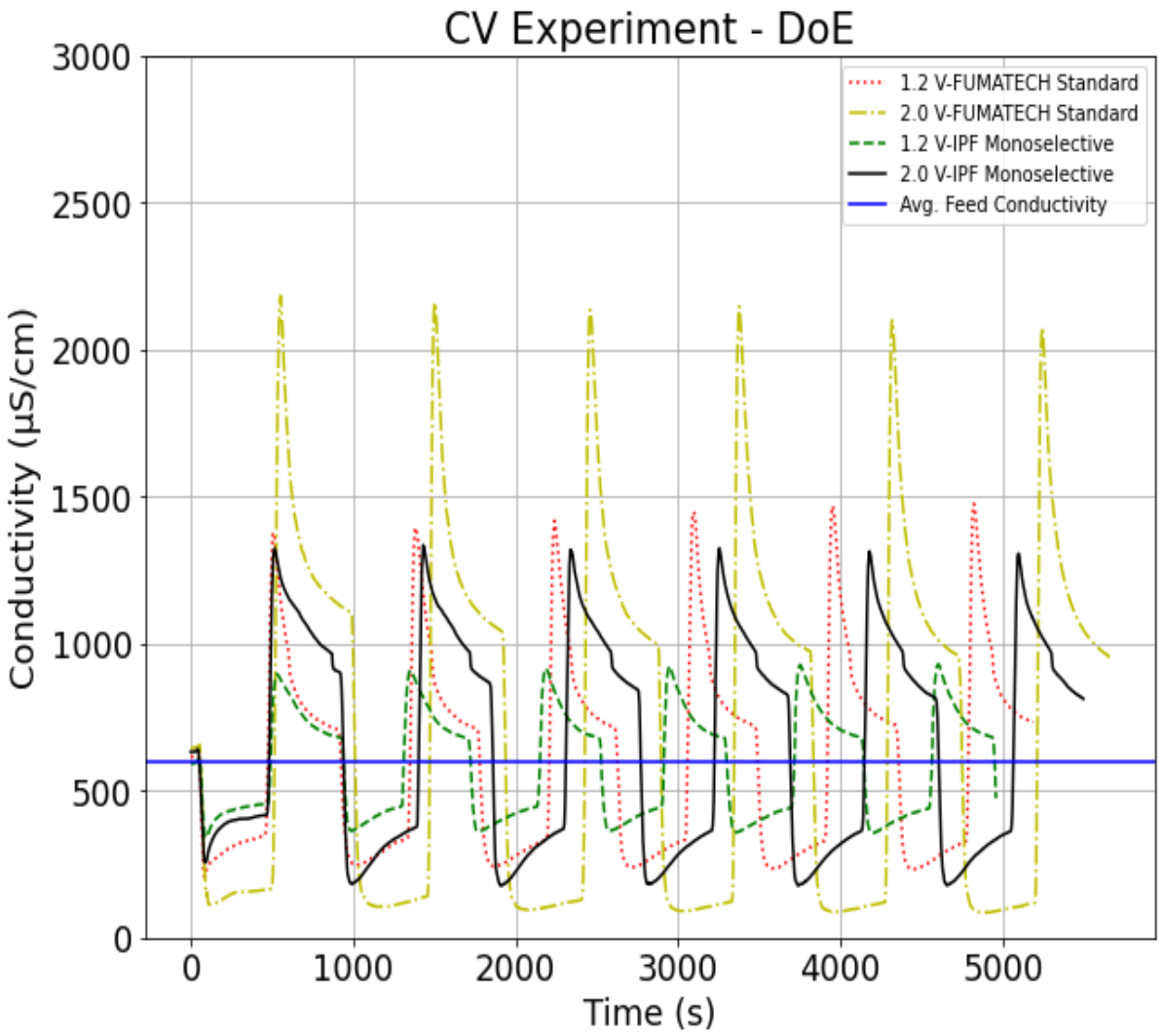
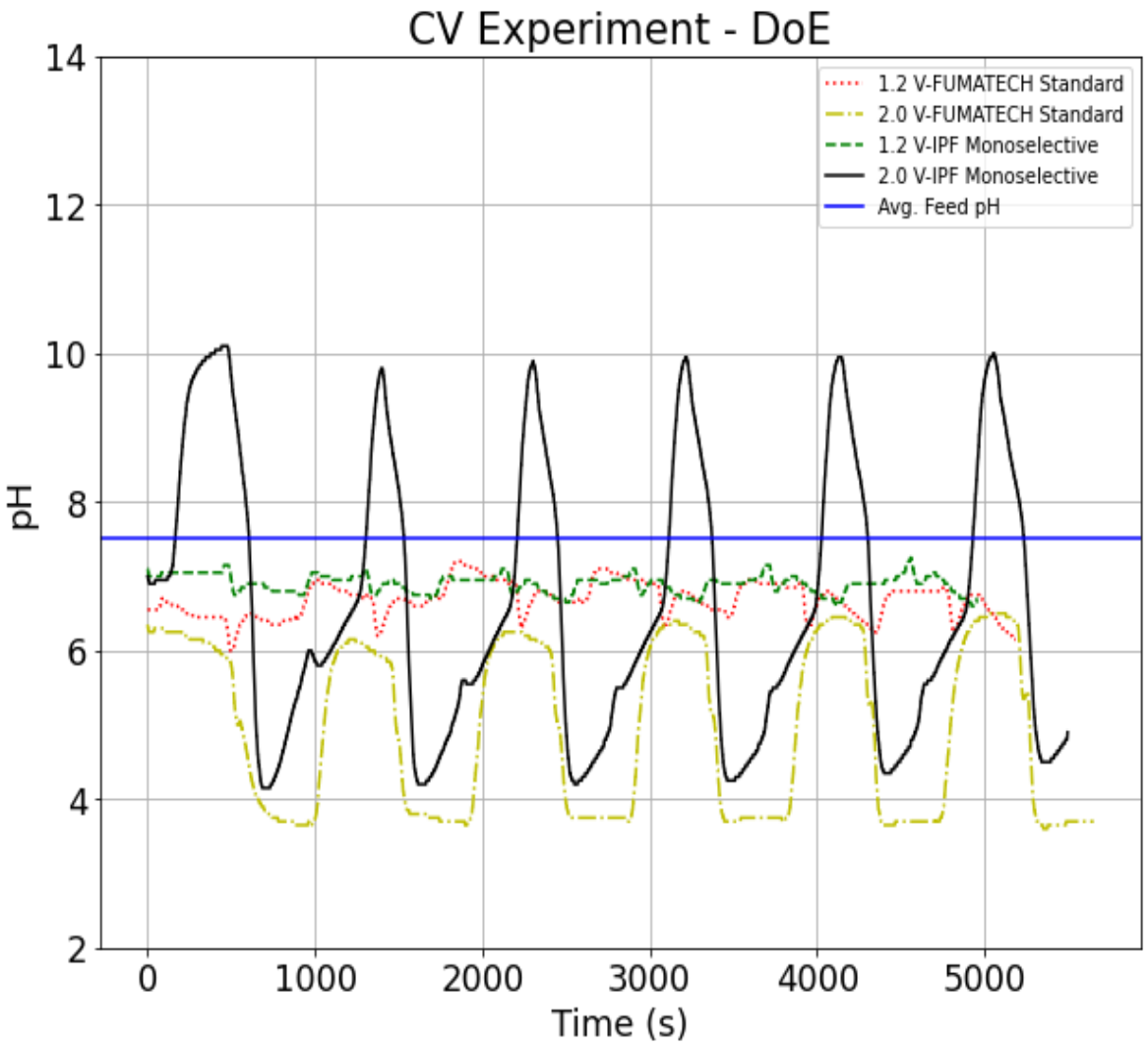
Results with new setup – DoE





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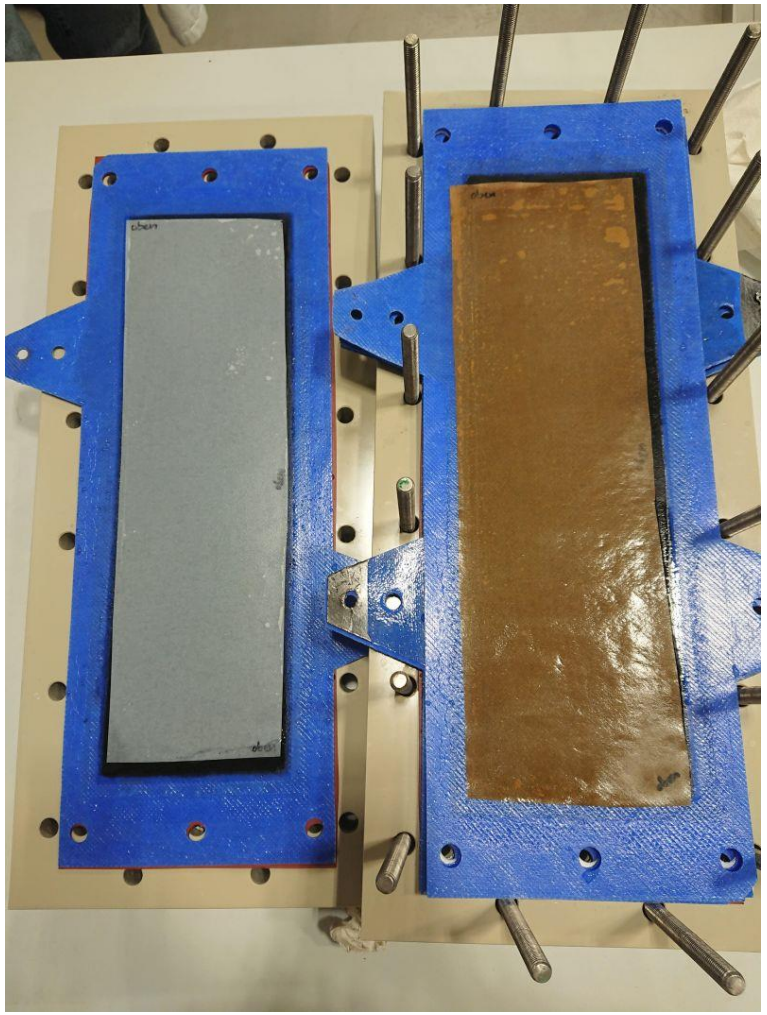
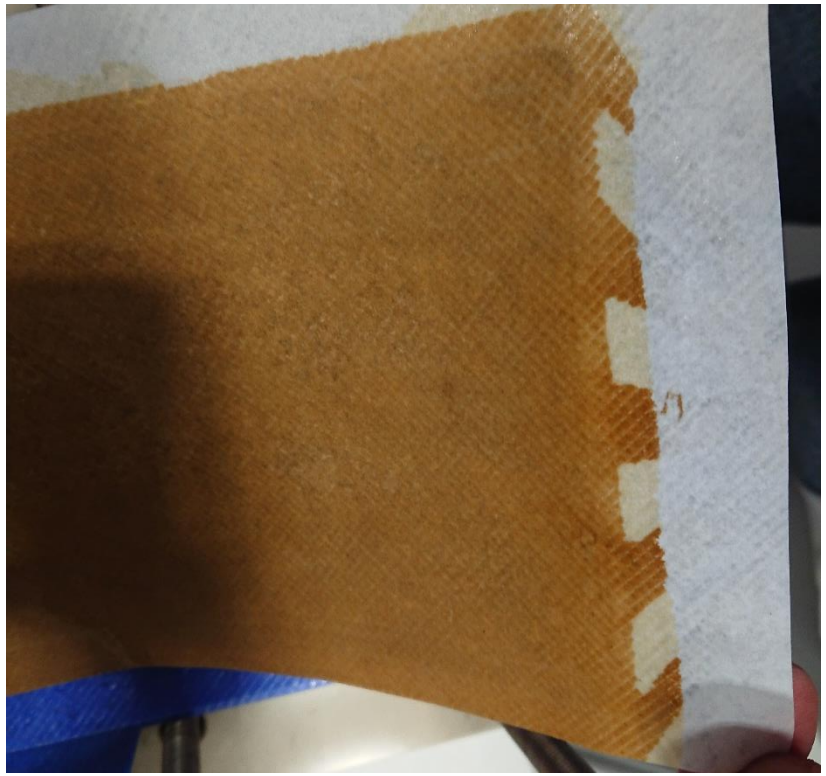
Preliminary Results
Lab plant Long term experiments with Langeoog Groundwater





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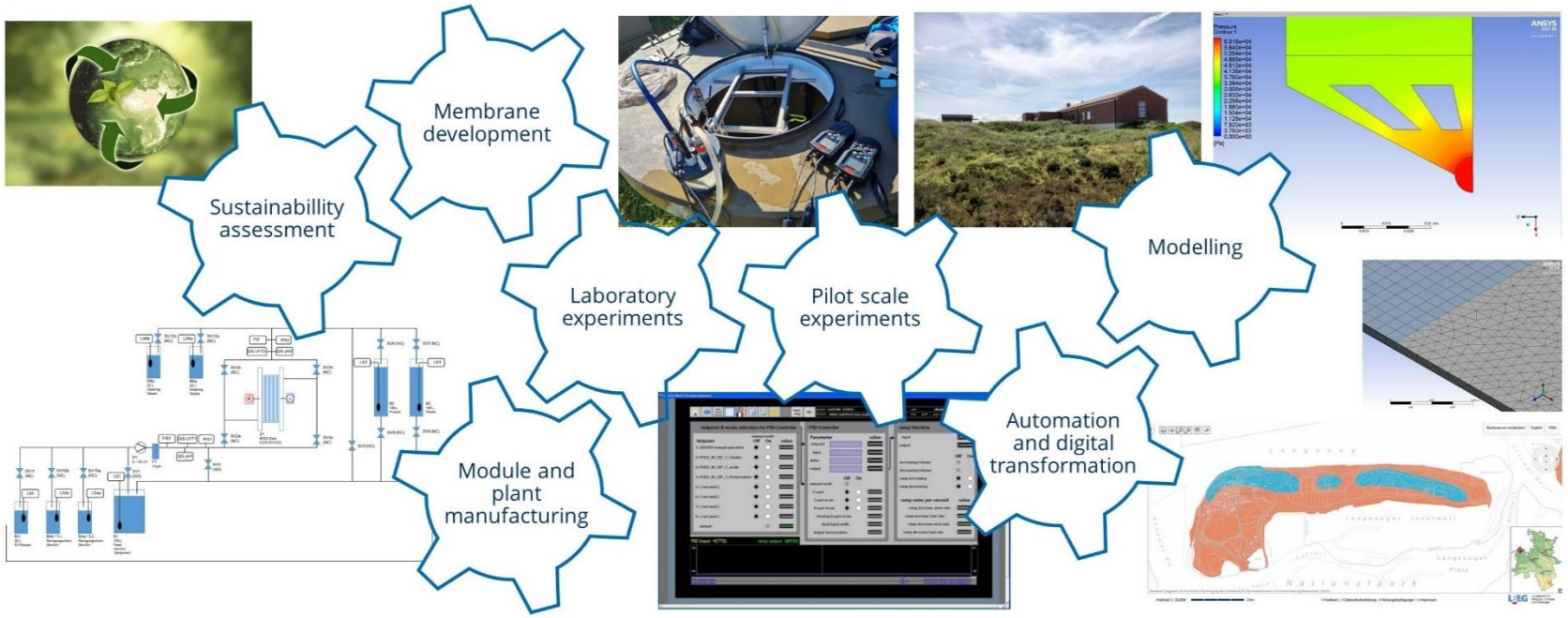
Summary



1. Efficient desalination process for selective removal monovalent ions
2. Identifying potential application and operation ranges
3. Determining the effects and challenges of potential applications
4. Development of a holistic economic-ecological sustainability assessment

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Thank you for your attention!

www.innovat-ion.de

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