Reactor design

combined salt separation and HTL

BL2F Mid Term Workshop, Tero Joronen, Tampere University

BL2F

Transforming Black Liquor to Biofuel

This project has received funding from the European Union Grant Number 884111

EHTA

Equipment for HyrdoThermal Applications

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EHTA process currently

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Office and process containers at test field

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Reaction design first steps and one conclusion

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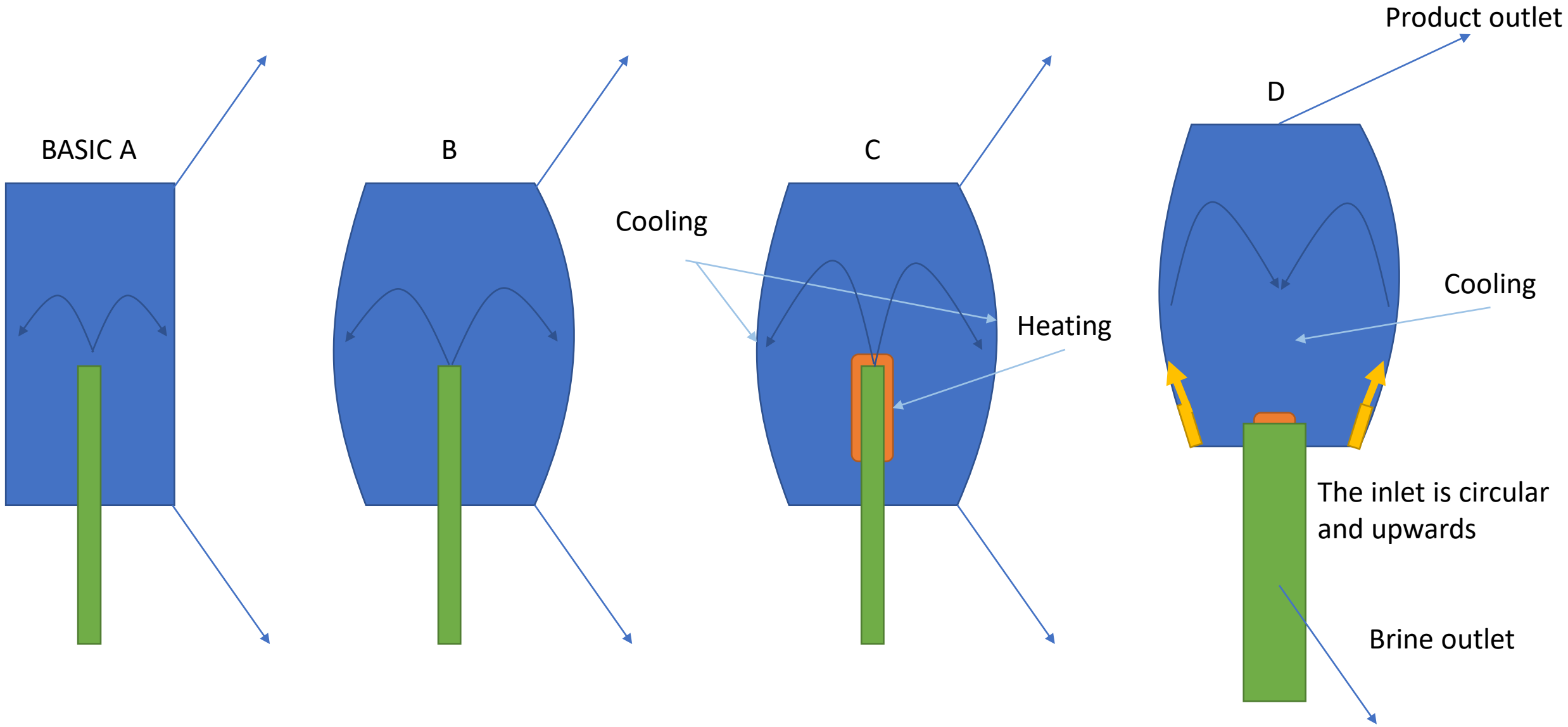
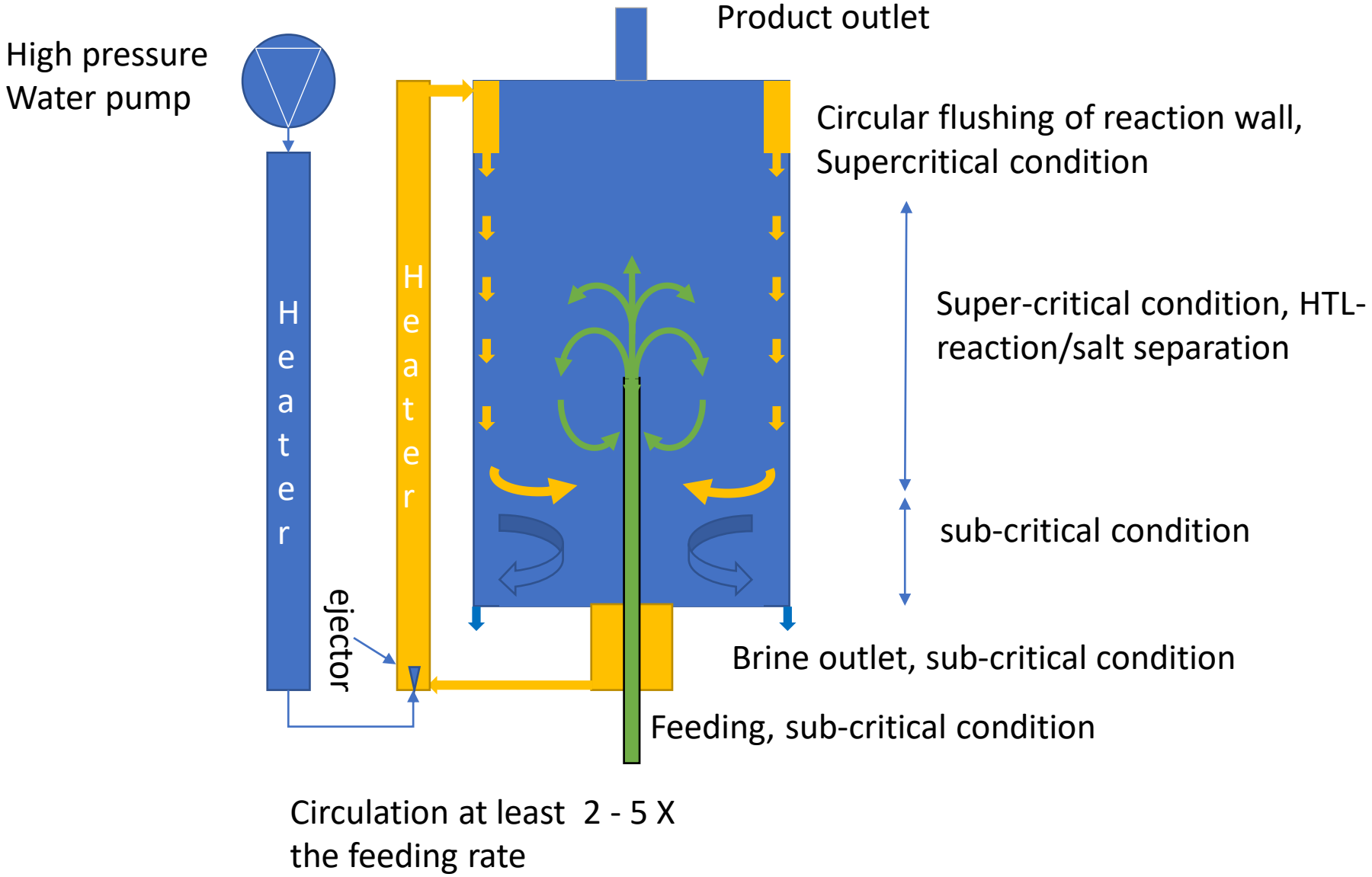

BASIC A
B
C
Cooling
Heating
D
Product outlet
Cooling
The inlet is circular and upwards
Brine outlet

One conclusion – circulation for heating – fouling risk high



Circulation at least 2 - 5 X
the feeding rate

Basics revisited

- Simplification of the design after a rather complex solution

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Requirements

HTL reaction (SC)

Salt separation from product (SC conditions)

- Separation (< 90 %)
- Enough residence time
- Extraction

Heating

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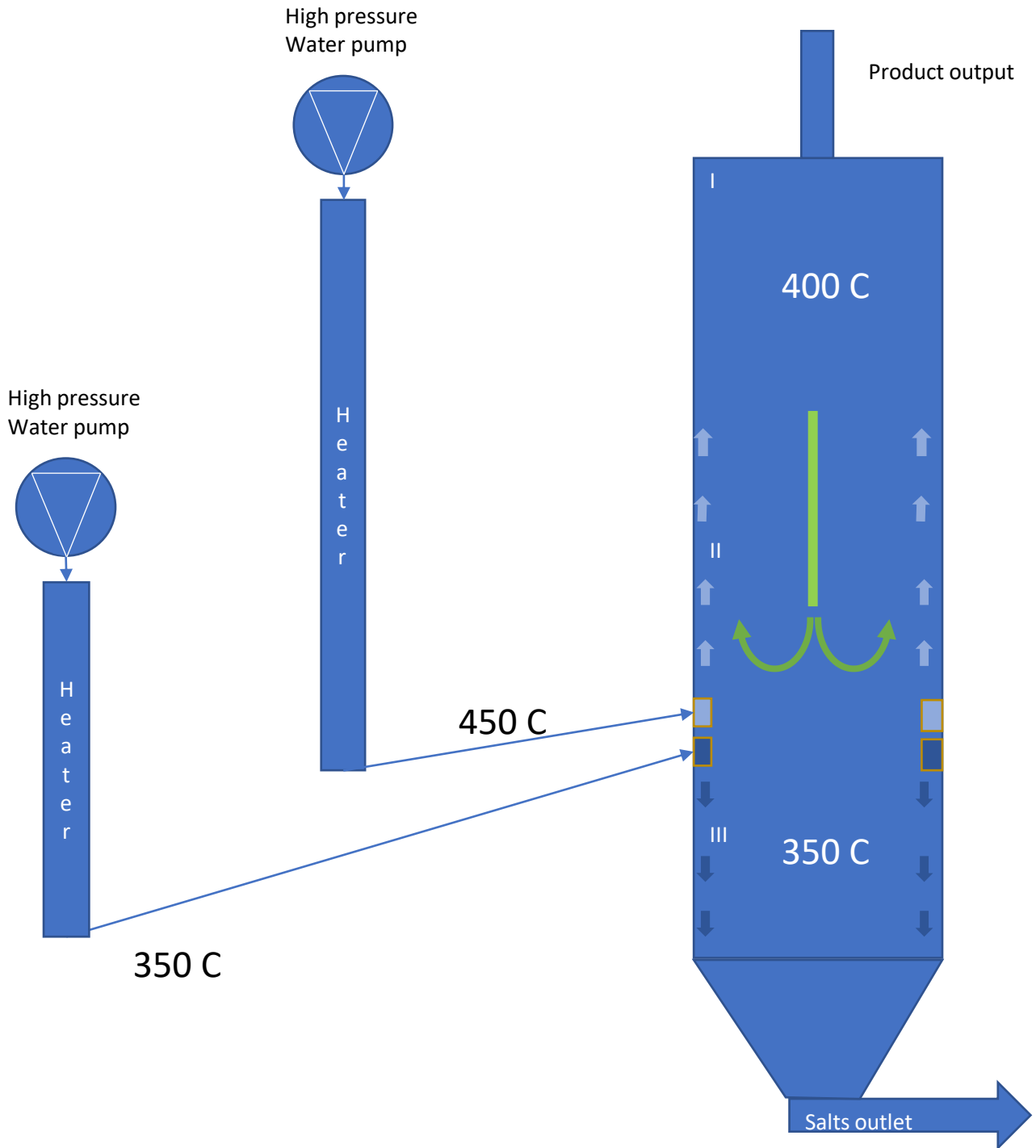

Super-critical conditions
- effective HTL

Sub-critical conditions
- salts recovery
- heavies and solids reactions

Actual design

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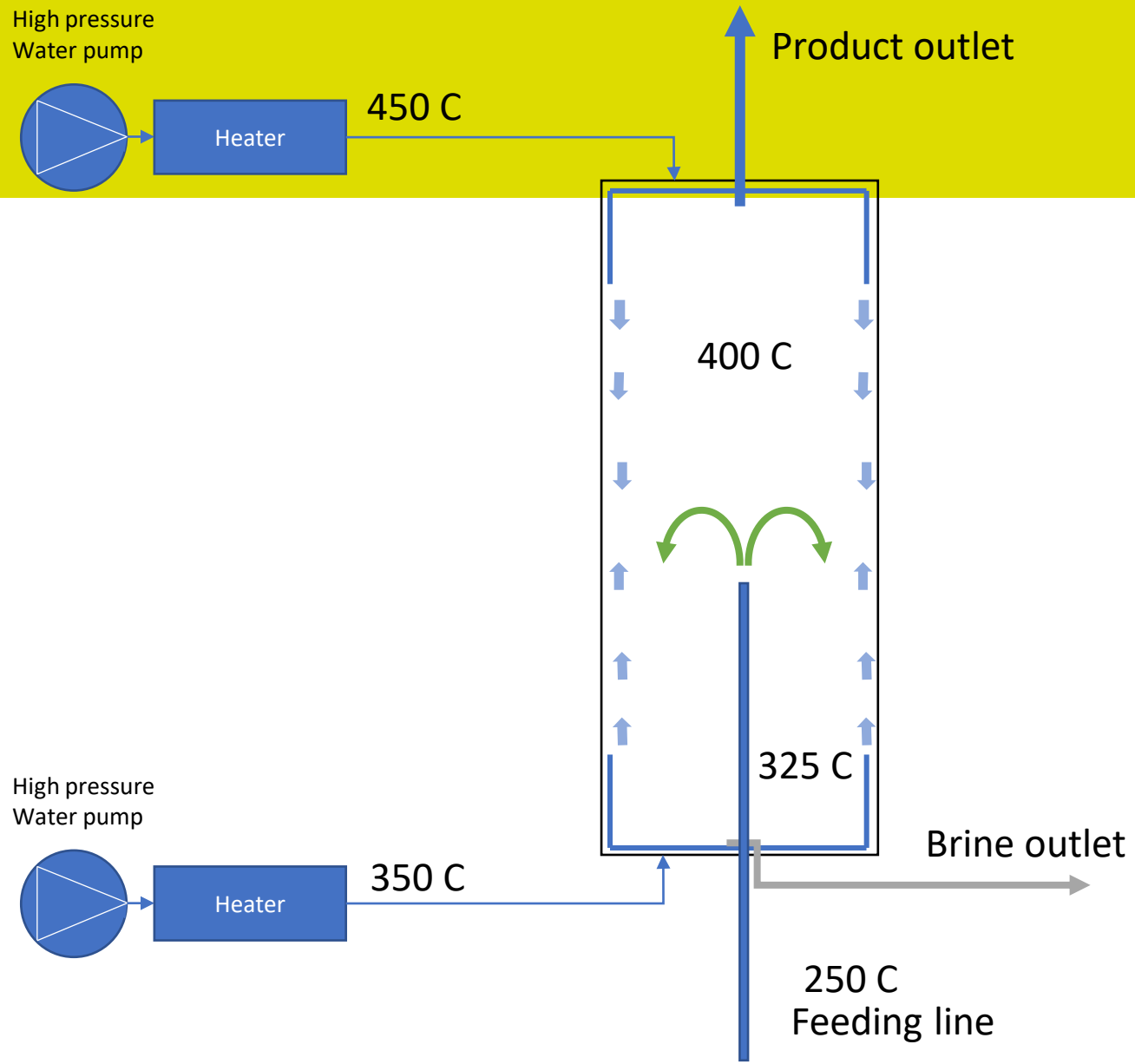
Reactor

- Two flushing inlets
- Two reaction zones; sub- and super-critical
- Heating/control trough the flushing inlets
- Different flushing caps



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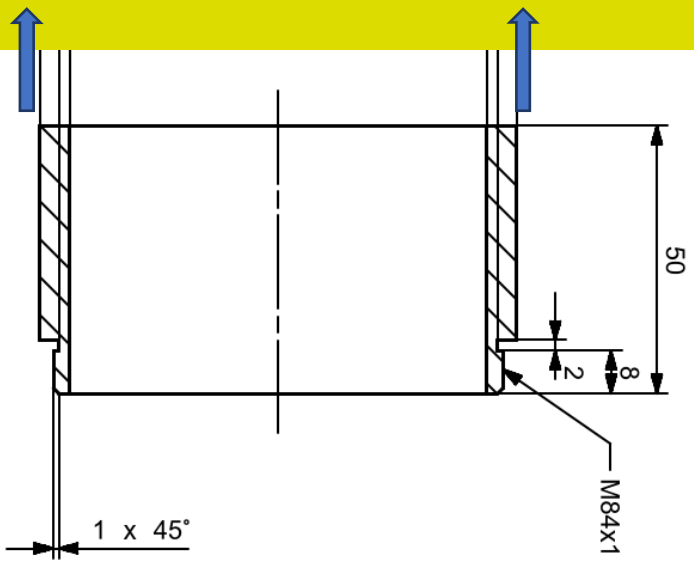
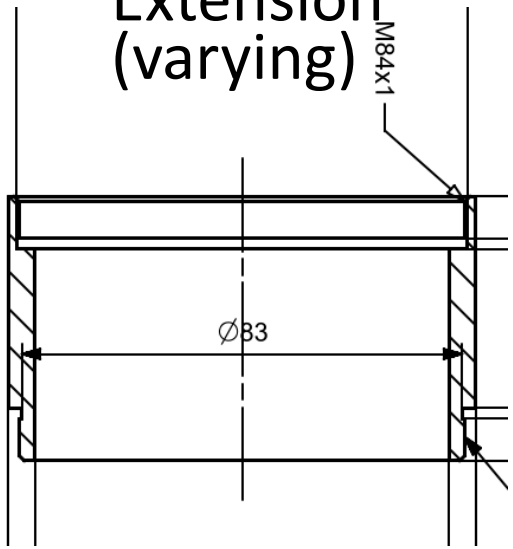
Different alternatives

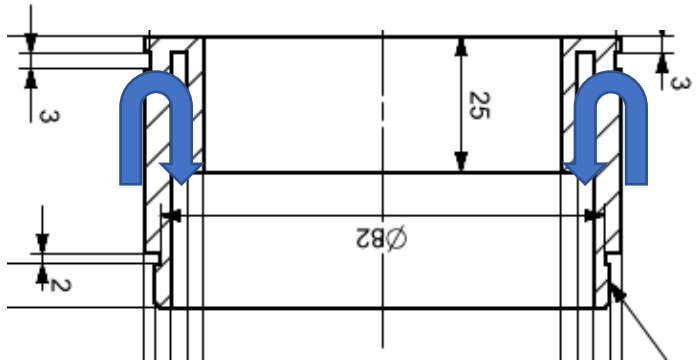
Straight



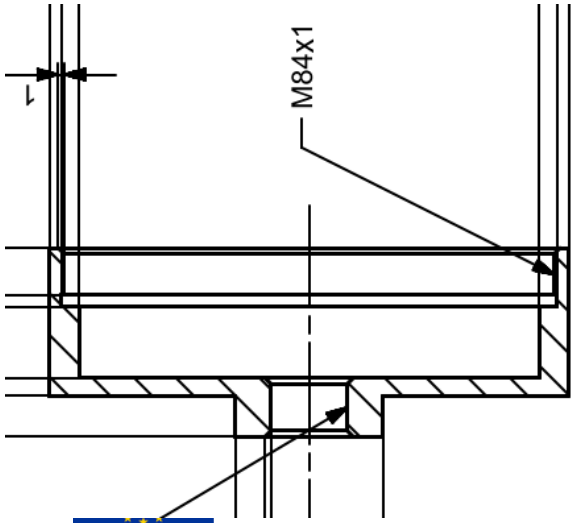
Extension
(varying)



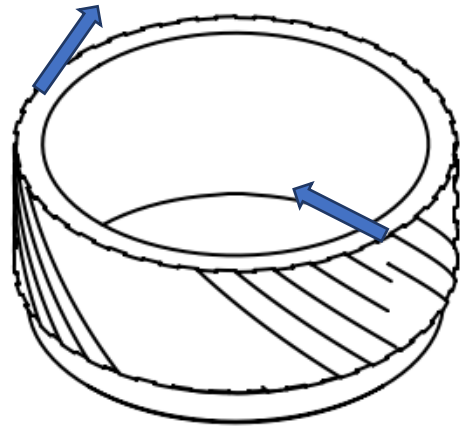
Inverse



Cap
(both ends)



Swirl



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Conclusion

Reactor design was challenging due to several features

Required several iterations

Currently manufacturing under finalization

In future, CFD and Aspen models for scale-up

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Thank you!

Get in touch with the project:

- Coordinator: Prof. Dr. Tero Joronen, Tampere University
- Website: www.bl2f.eu

 hello@bl2f.eu  @BL2F_EU  BL2F_EU

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