LoT-NET

Advisory Board Meeting 5th October 2021
WP 3.5, 3.6 and 3.7

Low Temperature Heat Recovery and Distribution Network Technologies

Work Package 3.5 – Sorption chillers for cooling from network (commercial use)

A few systems available commercially and characteristics known – no research needed prior to application.

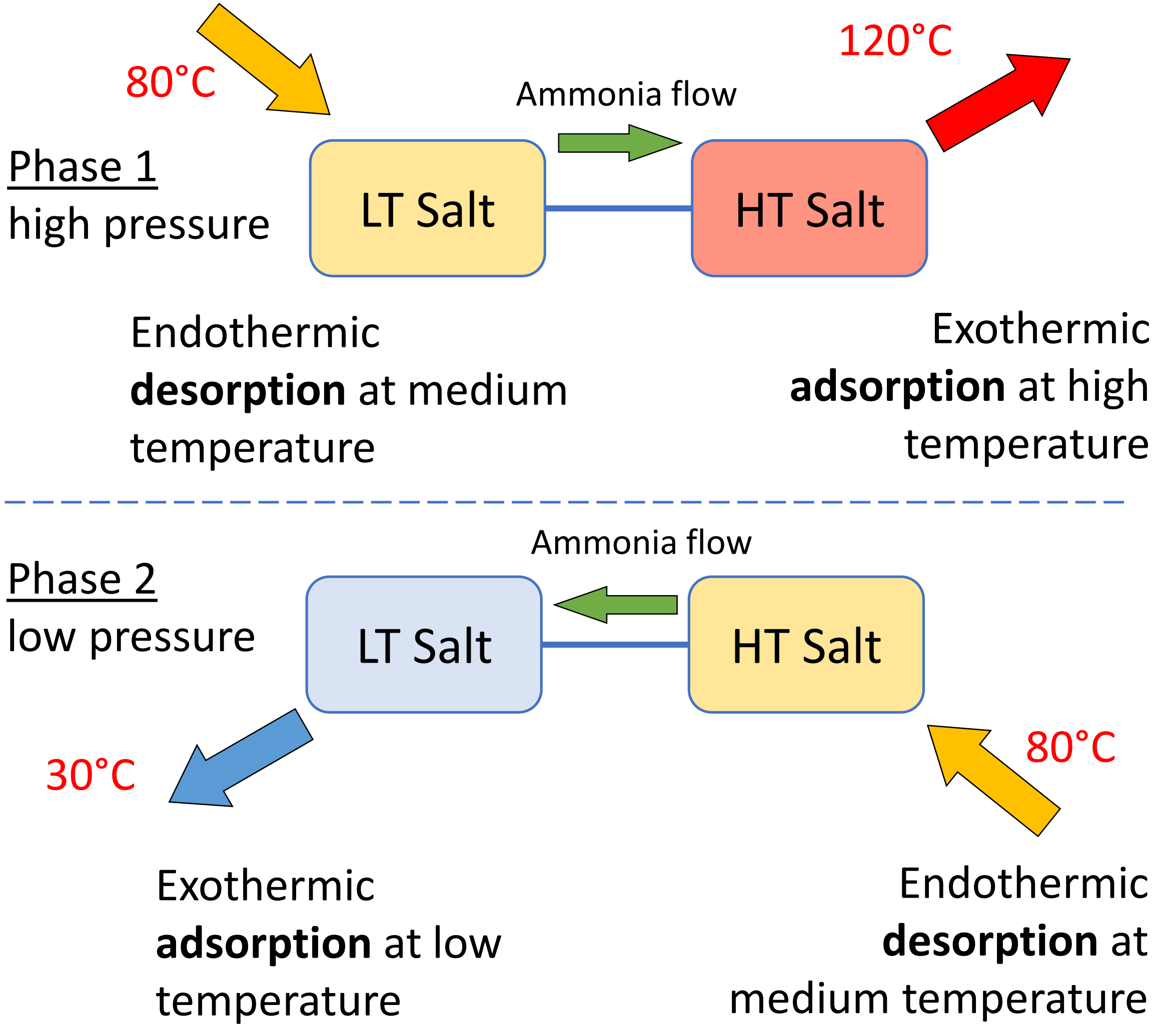
Work Package 3.6 –Sorption heat pump from HT waste to network

Similar technology to domestic gas heat pump research already underway at Warwick (BEIS and MI) and can receive results from those projects.

Work Package 3.7 – Heat transformer from waste to process heat and output to network

1. How it works
2. LTJ tests and modelling
3. Peak power per composite volume vs COP
4. Preliminary design for resorption machine

Work Package 3.7 – Heat transformer from waste to process heat and output to network



How it works:

- A 2-stage process adsorbing/desorbing ammonia into salts impregnated into ENG
- Typically $MnCl_2$ and $CaCl_2$
- Potentially very simple construction

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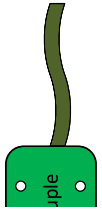
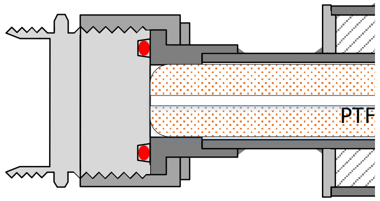


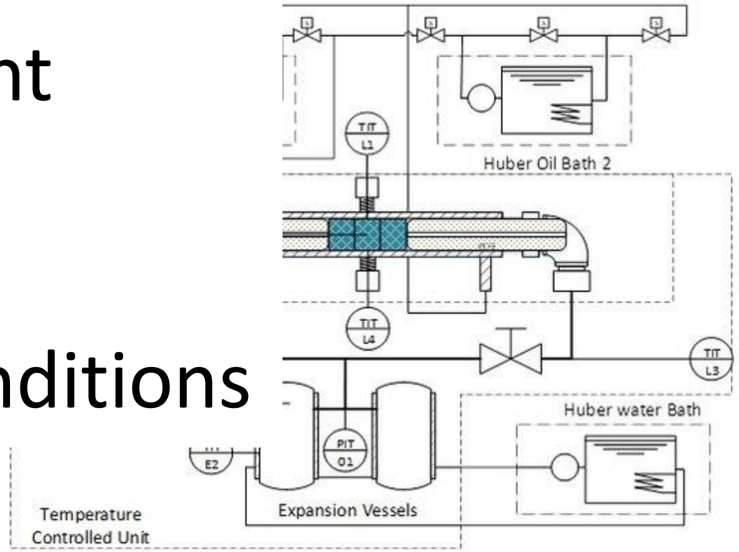
LTJ Reactor



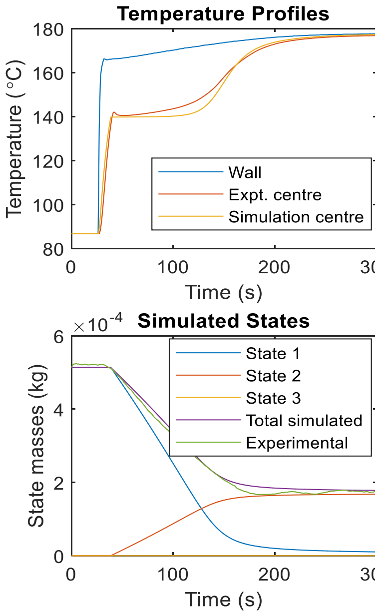
LTJ test in English:

1. Heat or cool a sample quickly
2. Measure the centre temperature and pressure rise/fall
3. Match simulation with experiment

Successful/useful if the parameters identified apply to a big range of conditions



Simulating Results from LTJ

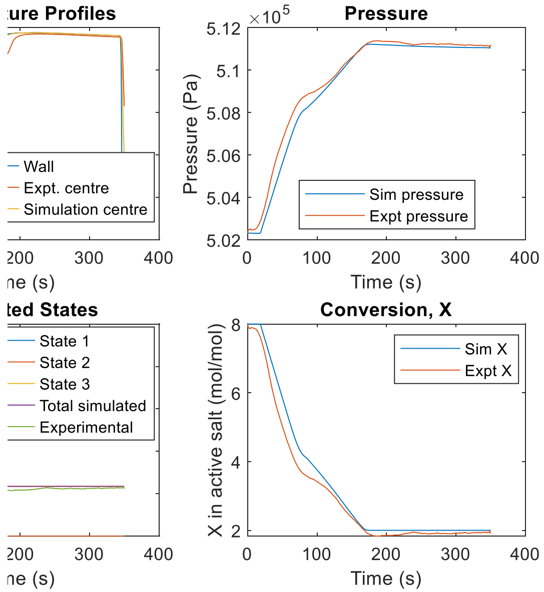


Manganese Ch

Successful/useful if the parameters identified apply to a big range of conditions

They do!!!

We have a better model than any previous ones.

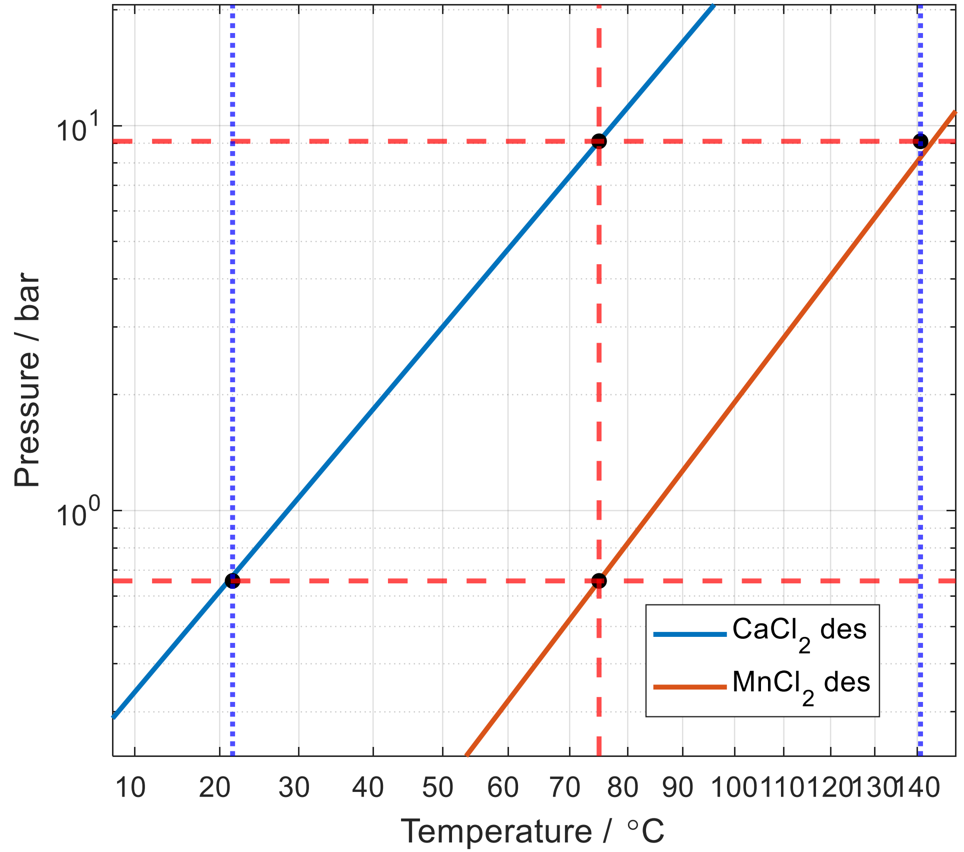


Chloride Desorption 2

Manganese Chloride Adsorption

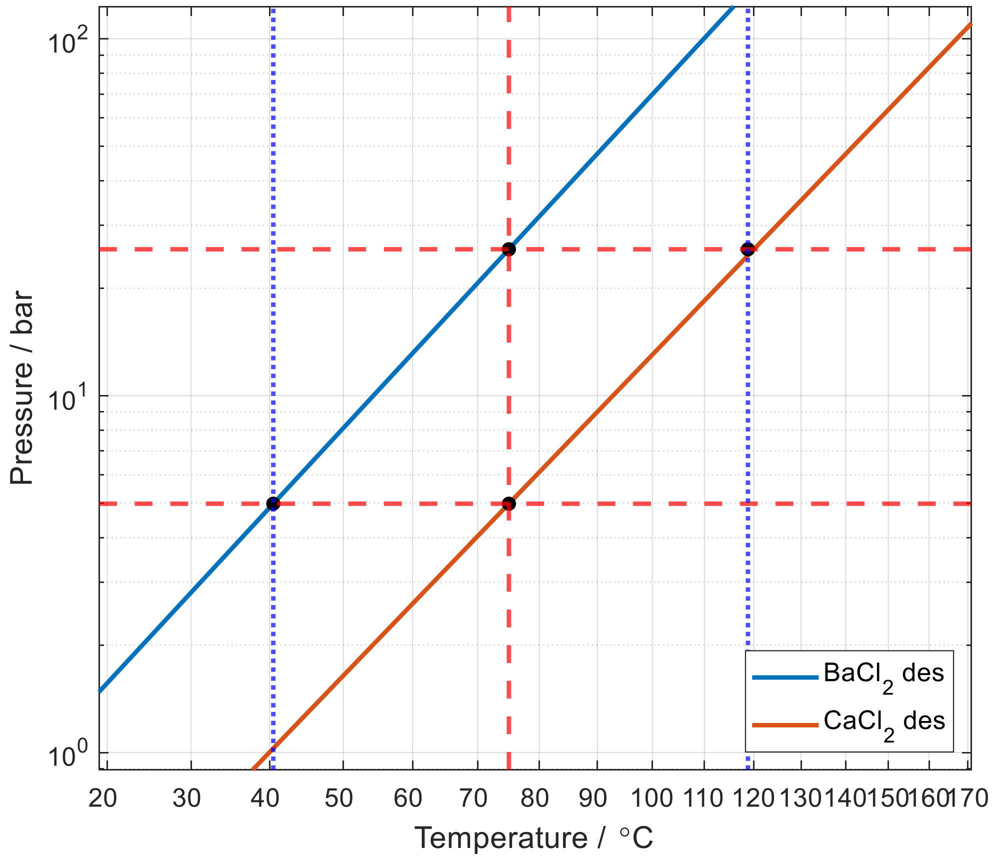
Salt Pairs

Working condition flexibility, temperatures can be adjusted but dictated by the **mid**-Temperature



$CaCl_2$ (8-4) - $MnCl_2$ (6-2)

22 - 75 - 140



$BaCl_2$ (8-0) - $CaCl_2$ (4-2)

42 - 75 - 120

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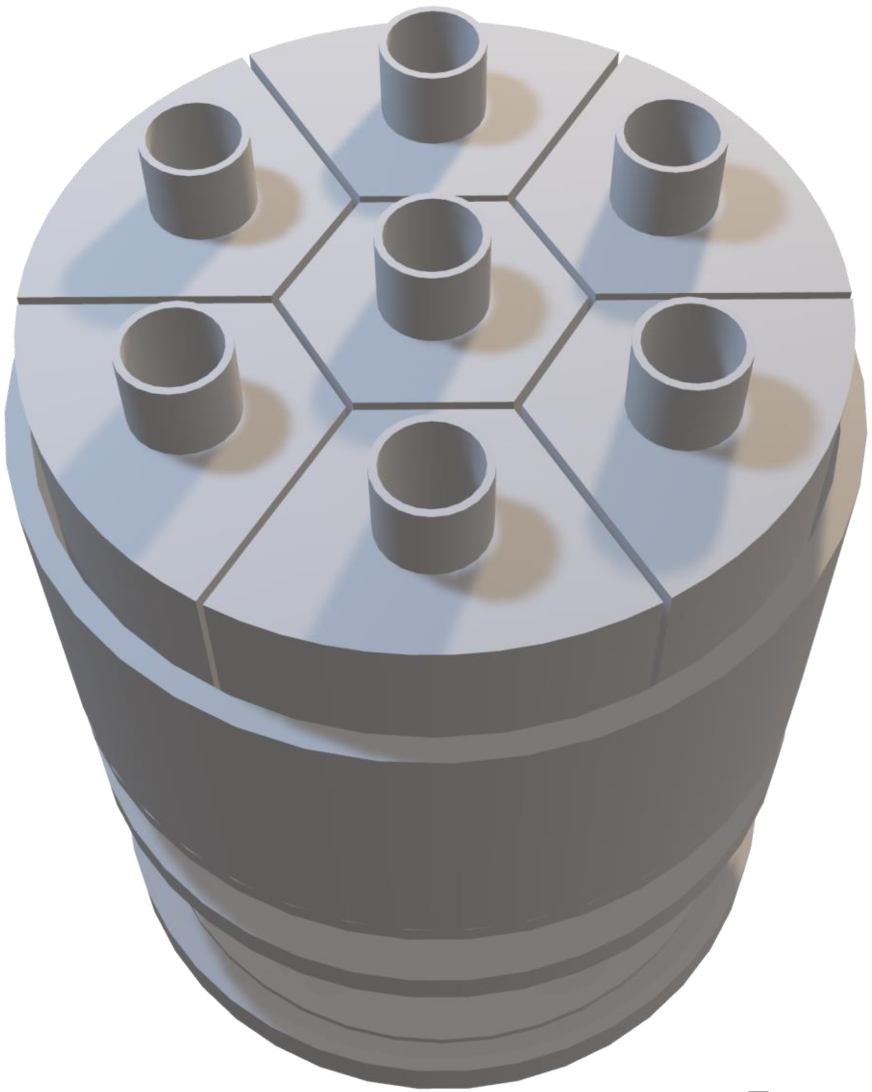
Initial Design

- Fill void volume with material
- Concerns over gas velocity at low pressures
- Gas gap to reduce heating/heat loss to shell
- Difficult to evidence wedge shape's performance



Equalised flow distribution through manifold and orifice

Working Design

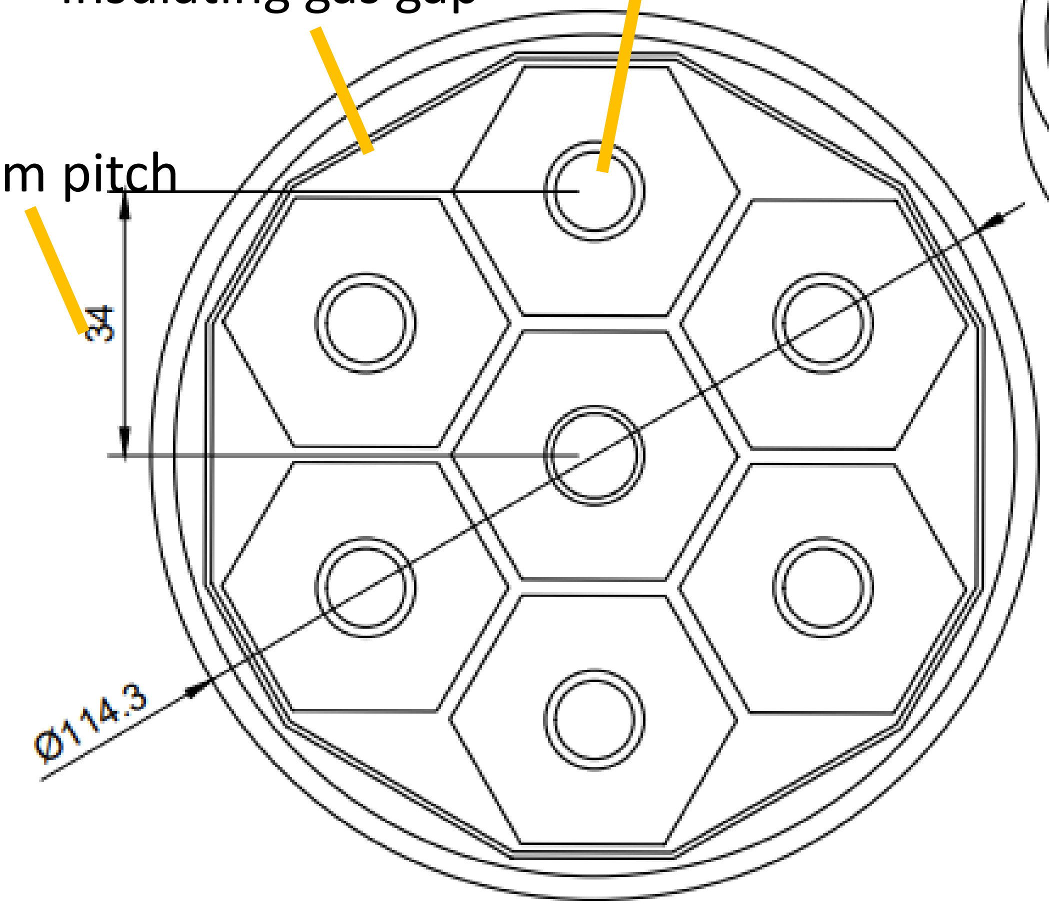
4.5” OD shell

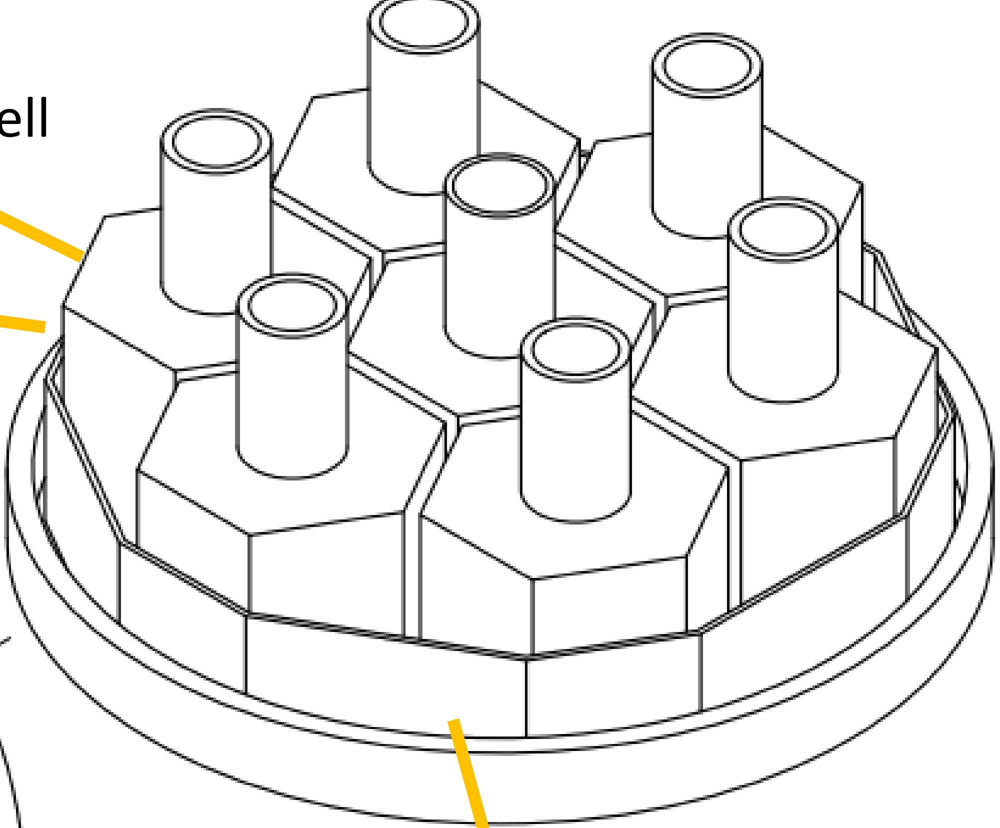
Hexagonal samples

Insulating gas gap

½” tubes

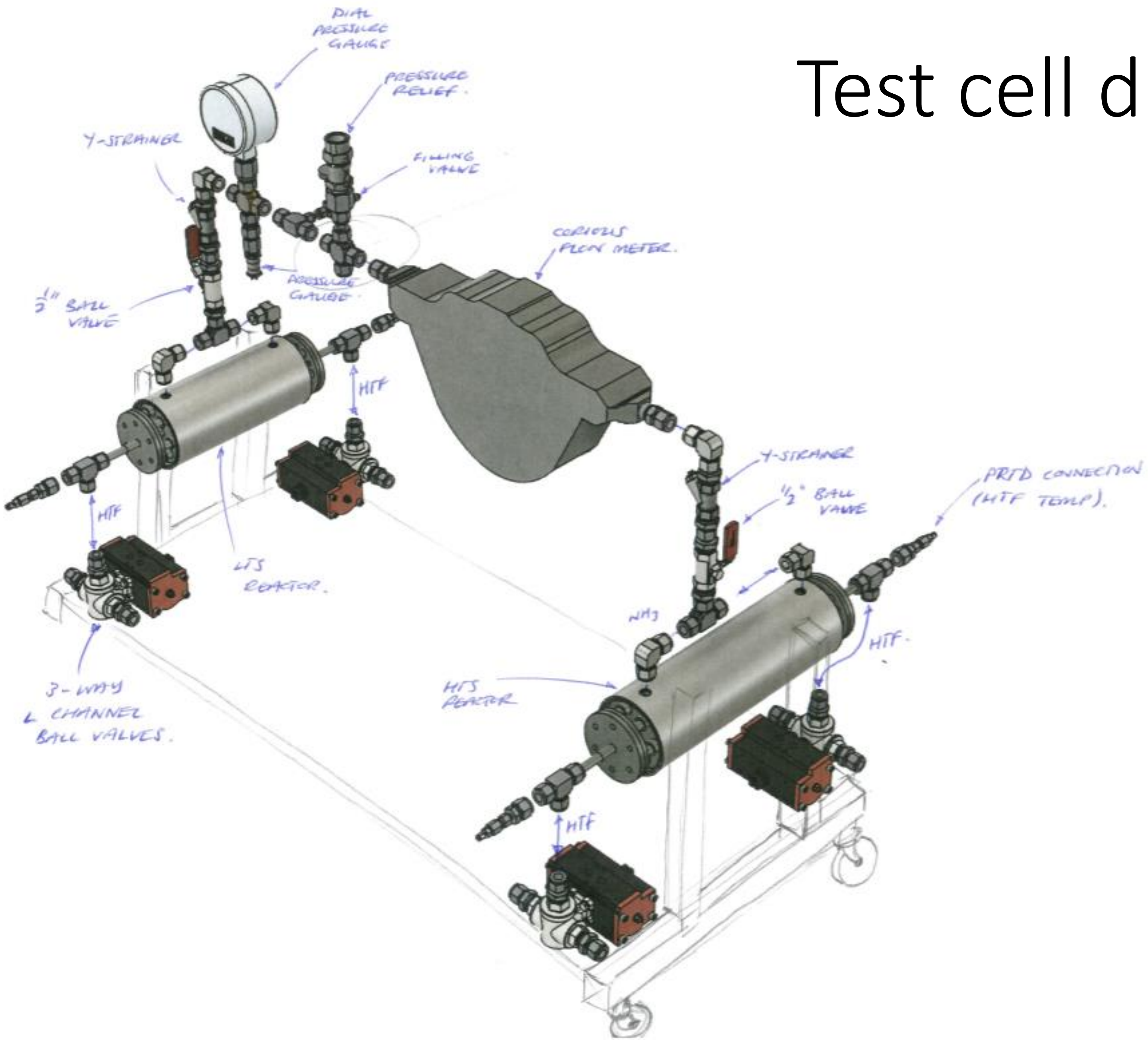
34mm pitch





Gas flow channels created by folded aluminium sheet

Optimised size with FAST LTJ cycles of 5-10 minutes

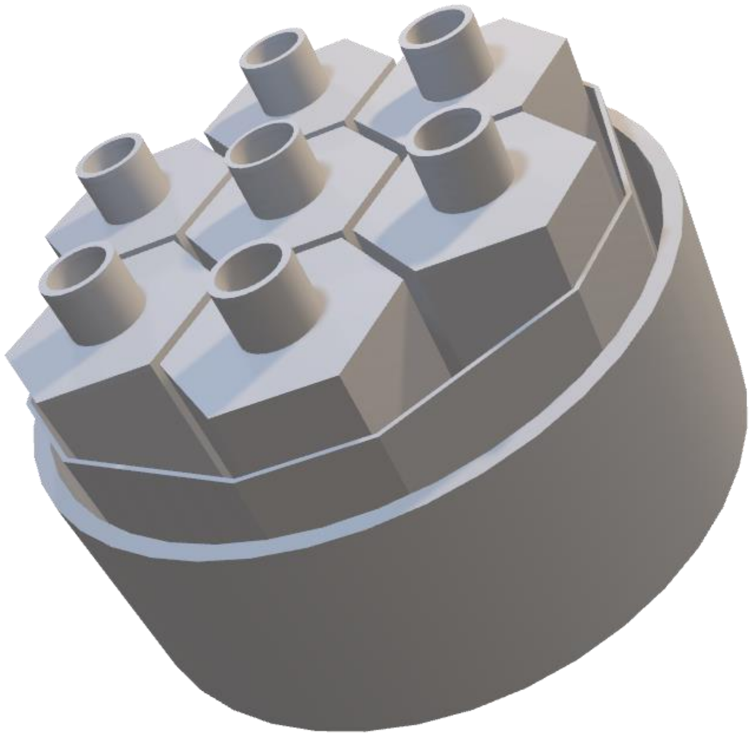


Test cell drawing

- High pressure water from Huber baths
- Plug in plug out design
- Flow meter (in both directions)
- Pressure relief valve rated to 31 bar

Conclusions and OnwardPlan

- Working on a test analysis paper to be published in IJR
- Energies paper with Generator design in the works
- Currently fabricating the resorption transformer at 1kW scale
- Results early 2022 – aiming for a COP of 0.3 which with heat recovery (2 pairs of reactors) would be around 0.4 with some calculations to evidence



Questions?

Progress and Plans for Future Work

- Review of technical progress and plans for improvement / implementation
- Progress on 3 Case Studies for technologies and modelling
- Dissemination and Impact

Getting the balance of effort right for the remainder of the project