



Horizon 2020  
European Union funding  
for Research & Innovation

# Centrifugal particle receiver technology

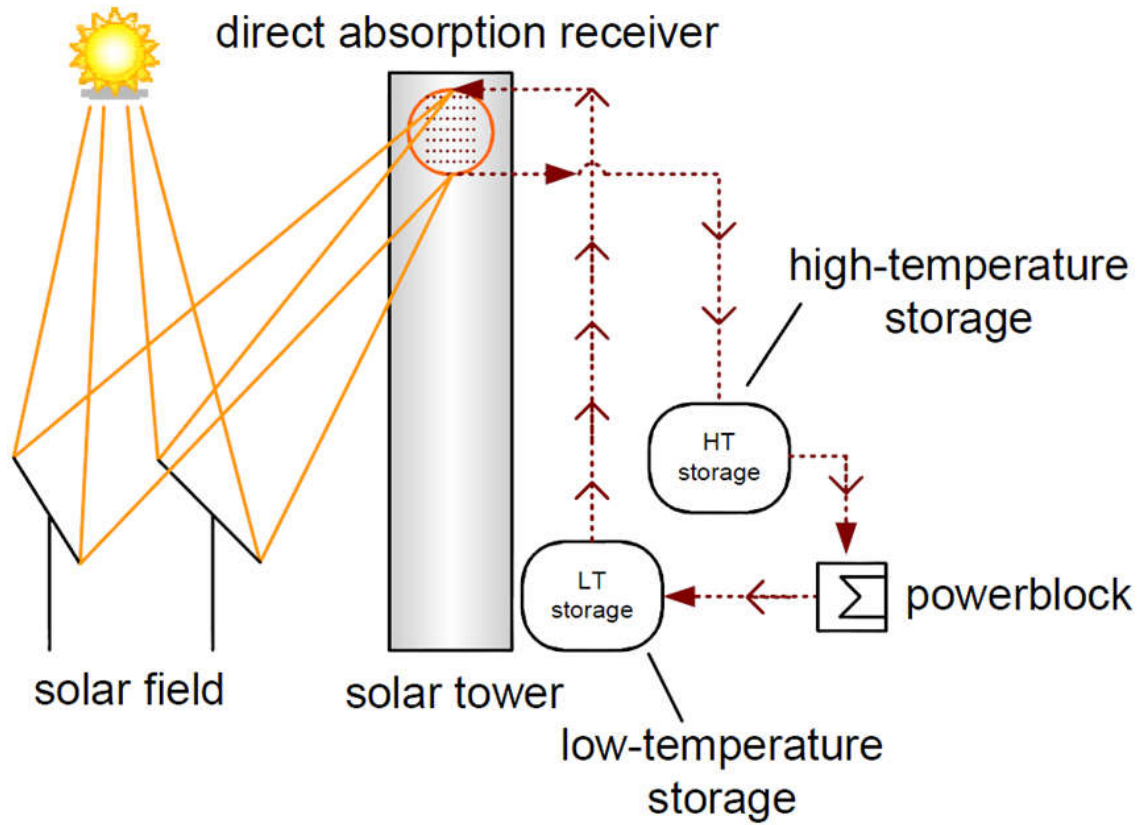
Jens Rheinländer

PEGASUS Workshop  
09.09.2021

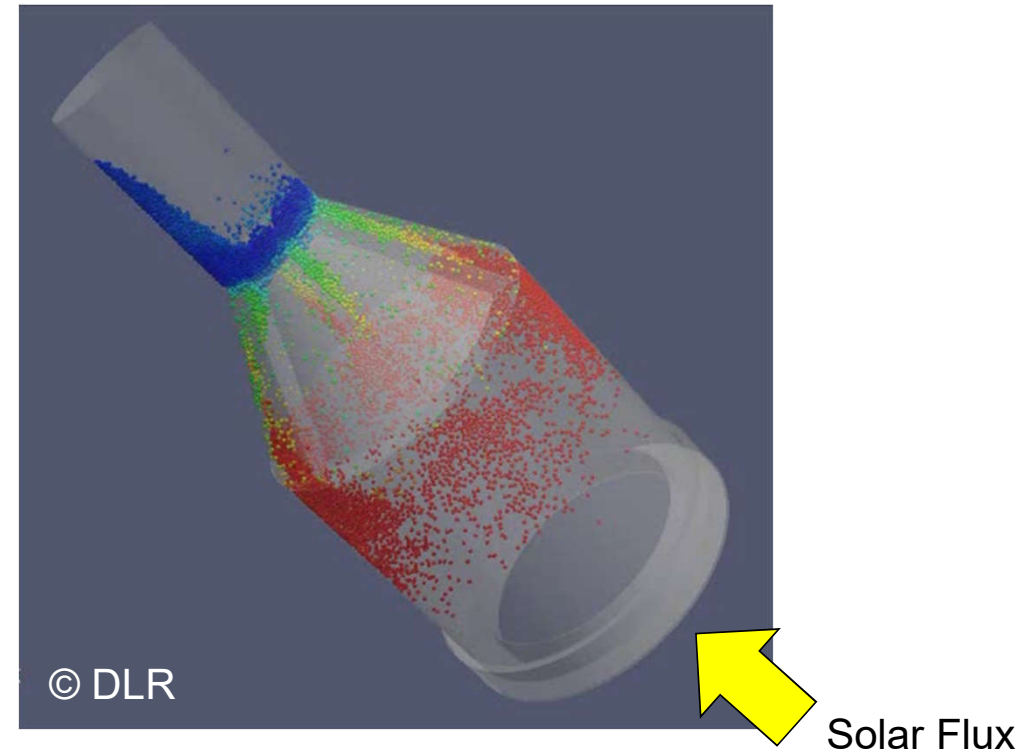
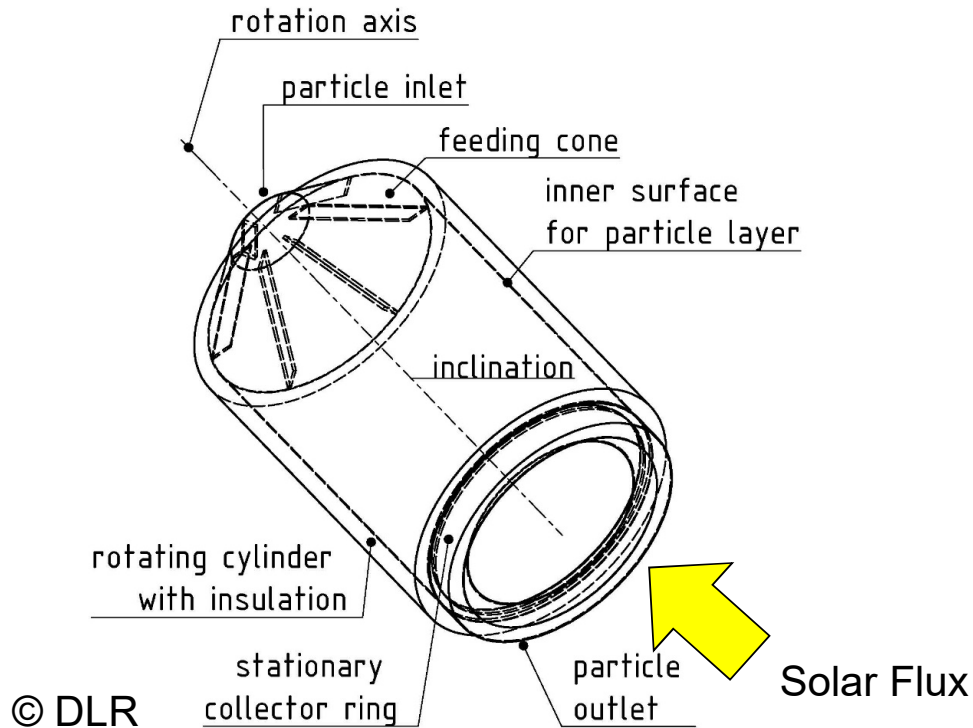


Knowledge for Tomorrow

## CentRec® particle receiver



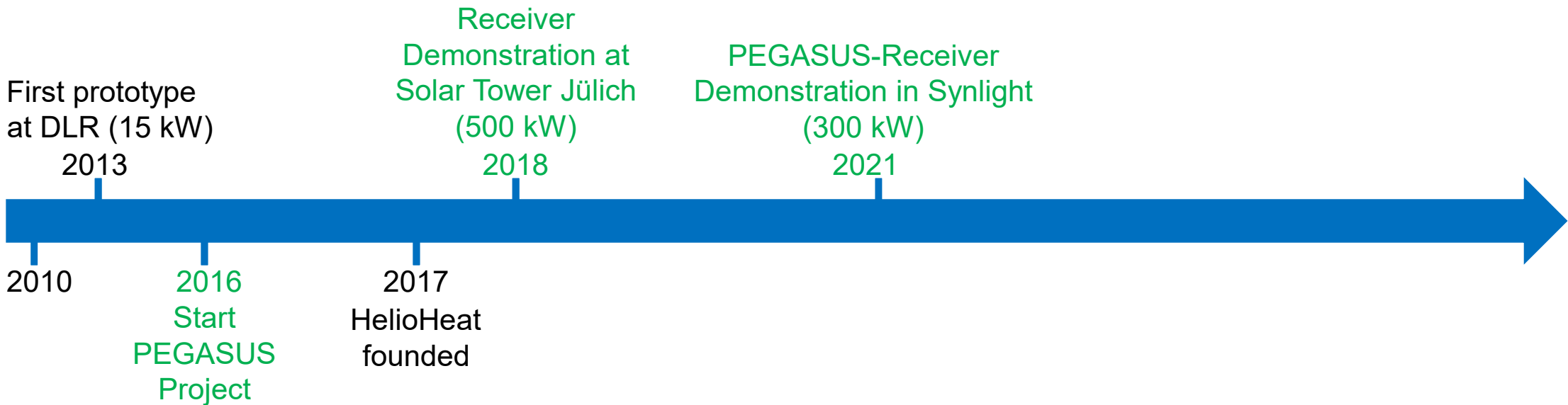
## Introduction CentRec®



- Particle residence time / receiver outlet temperature controlled by adjusting rotational speed
- Thin, optical dense layer for all load conditions



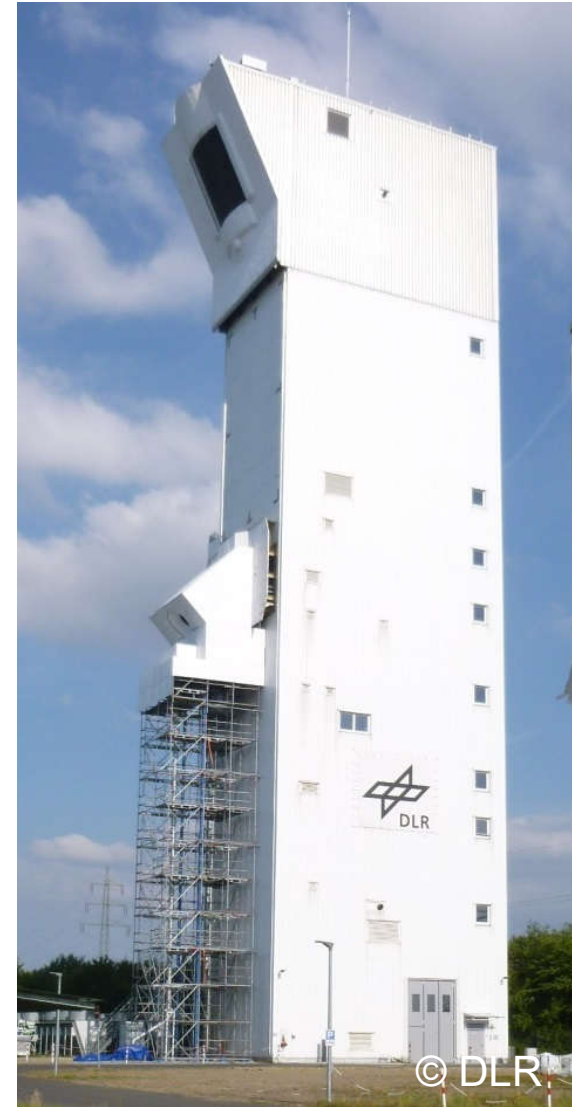
# Roadmap



Roadmap created with the kind support of HelioHeat

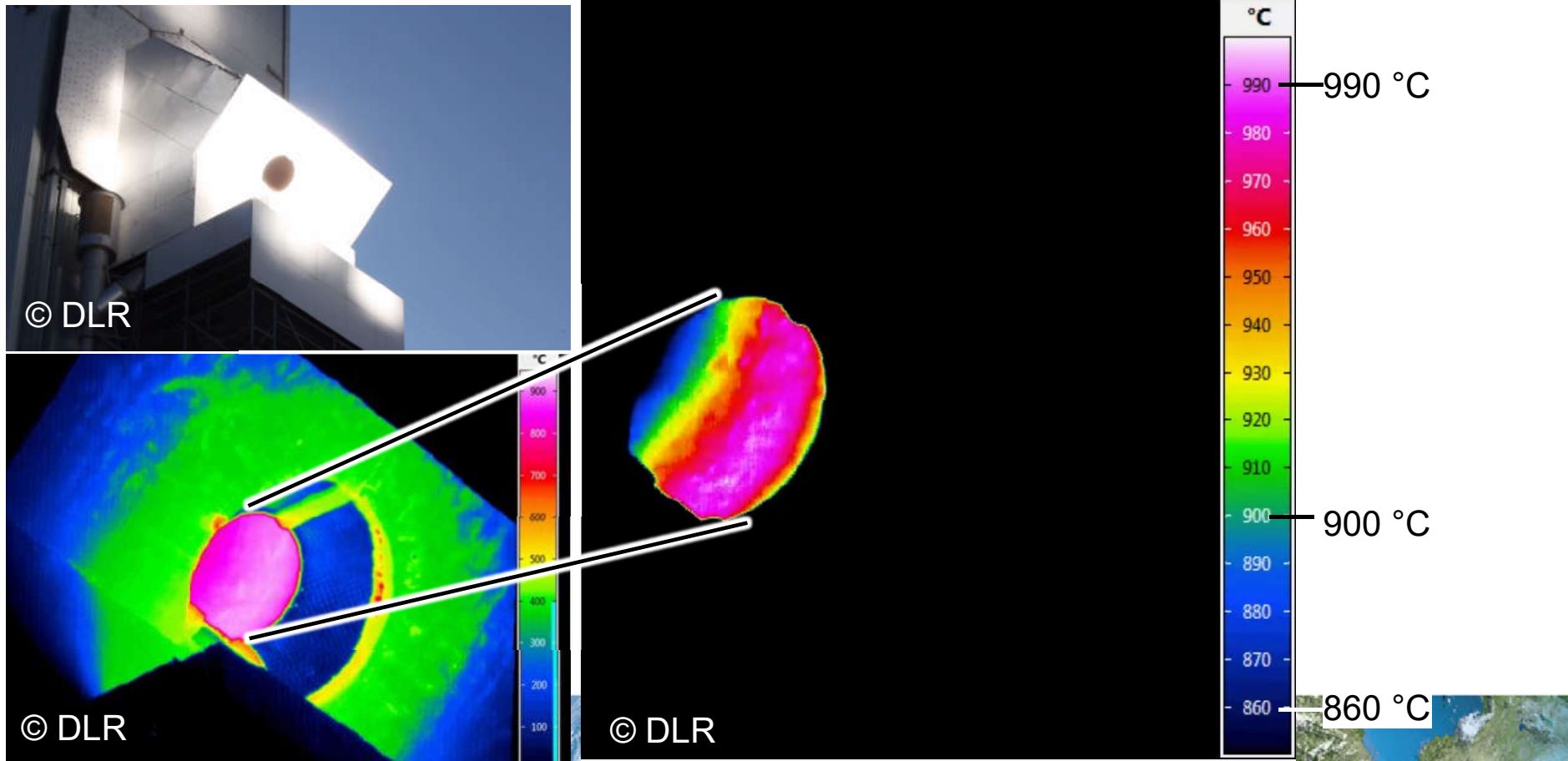
## CentRec500 installed into solar tower Jülich

- Tested in further project founded by HVF



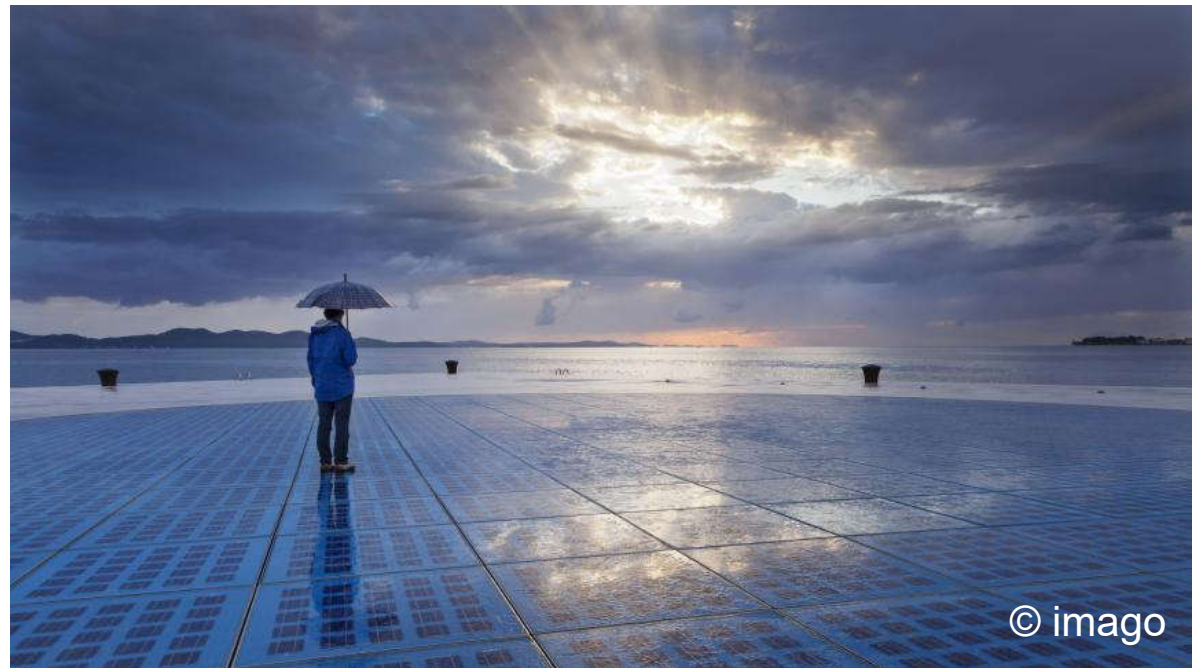
## CentRec500 installed into solar tower Jülich

- In CentRec500 particle temperatures up to 900 °C and more could be reached

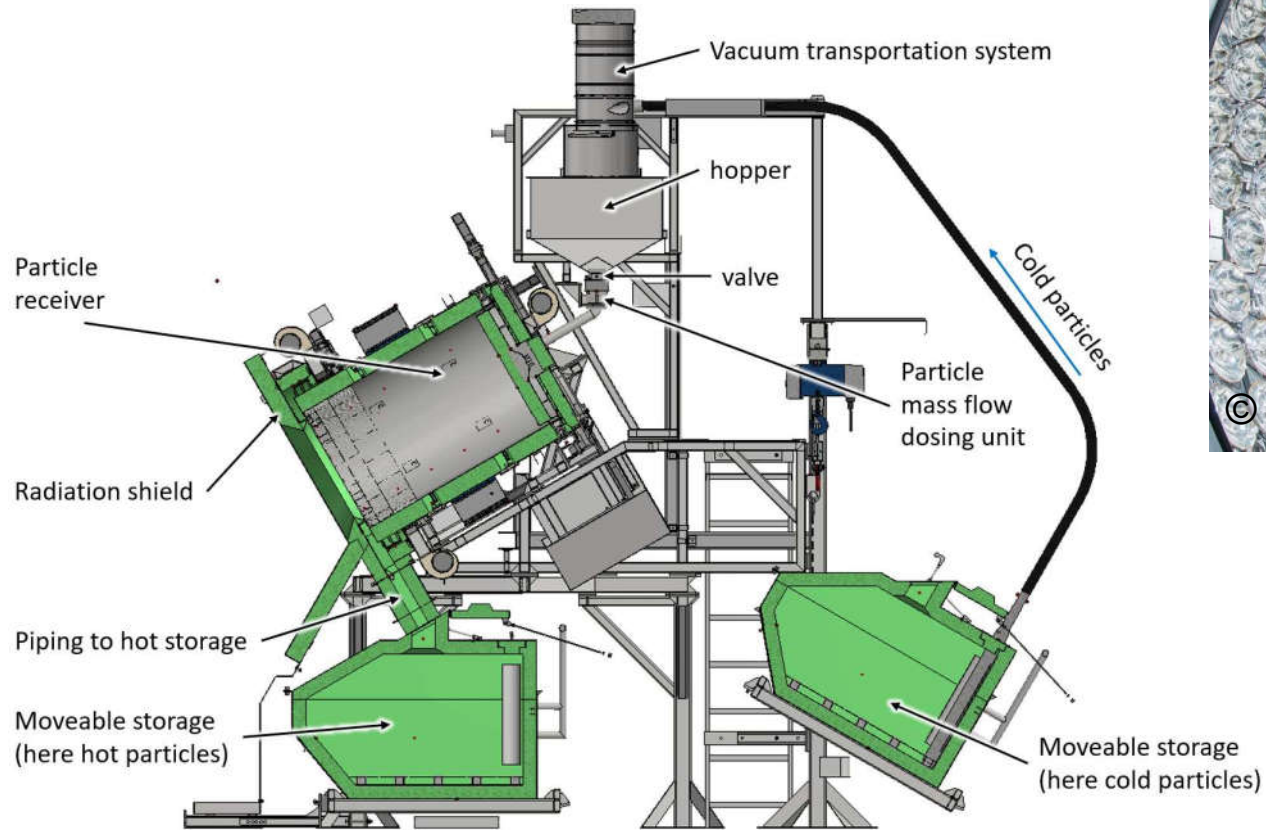


## CentRec500 installed into solar tower Jülich

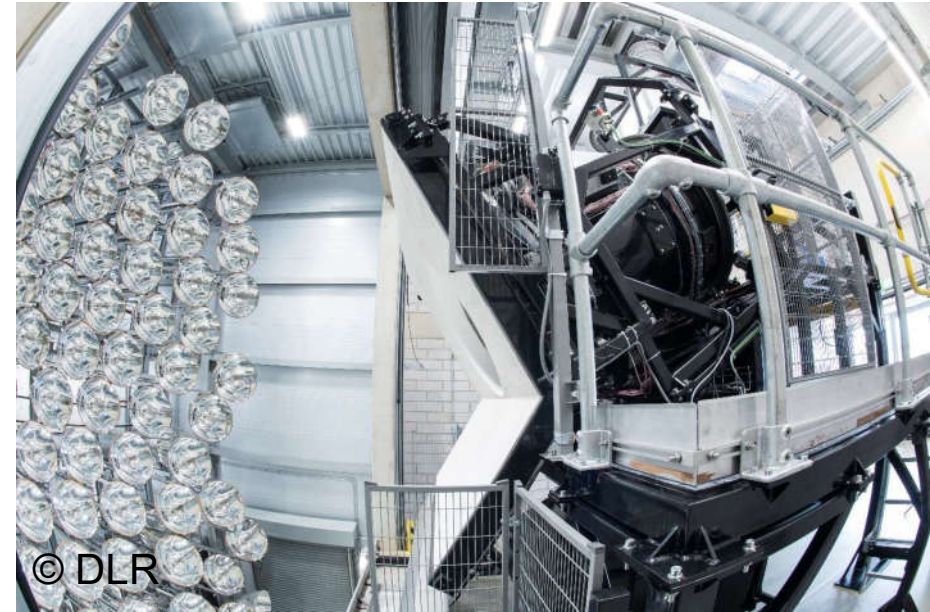
- Only very short test period available with CentRec500
- After June 2018 the CentRec500 was disassembled
- Due to a rather bad weather in June 2018 only 2 days were available
- Almost stationary conditions reached on one day
- In 2020 decision to install a smaller setup in Synlight → CentRec300S



## CentRec300S test setup in Synlight



© DLR



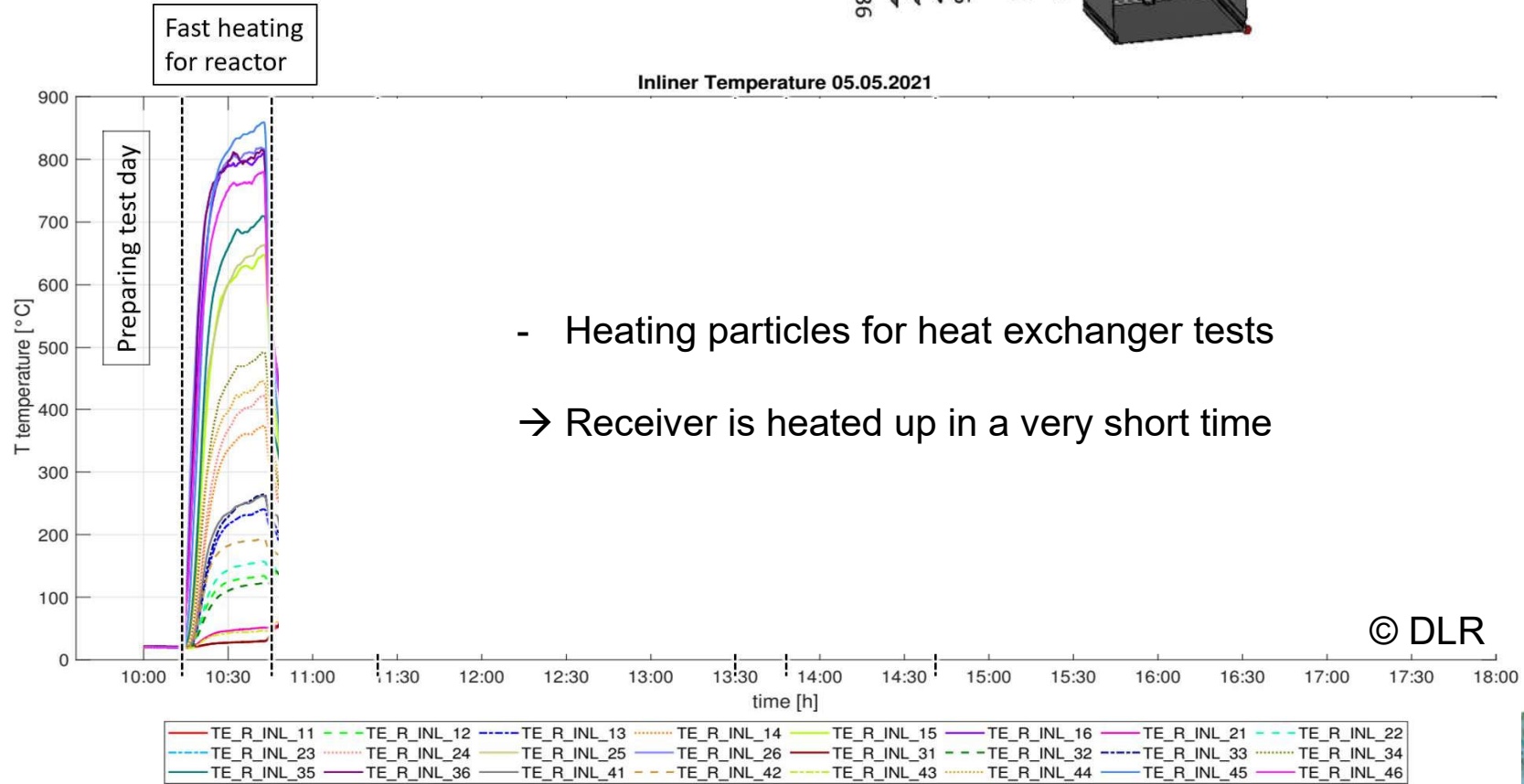
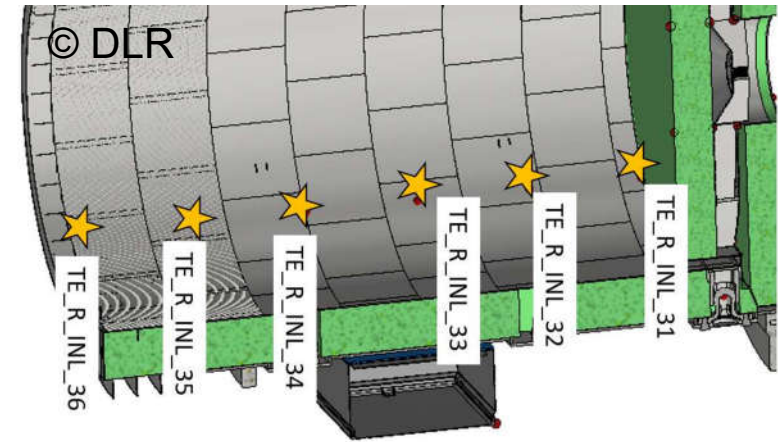
- Batch operation with 1 t of particles
- Storages also used for integrated tests in WP6





# CentRec300S - Tests

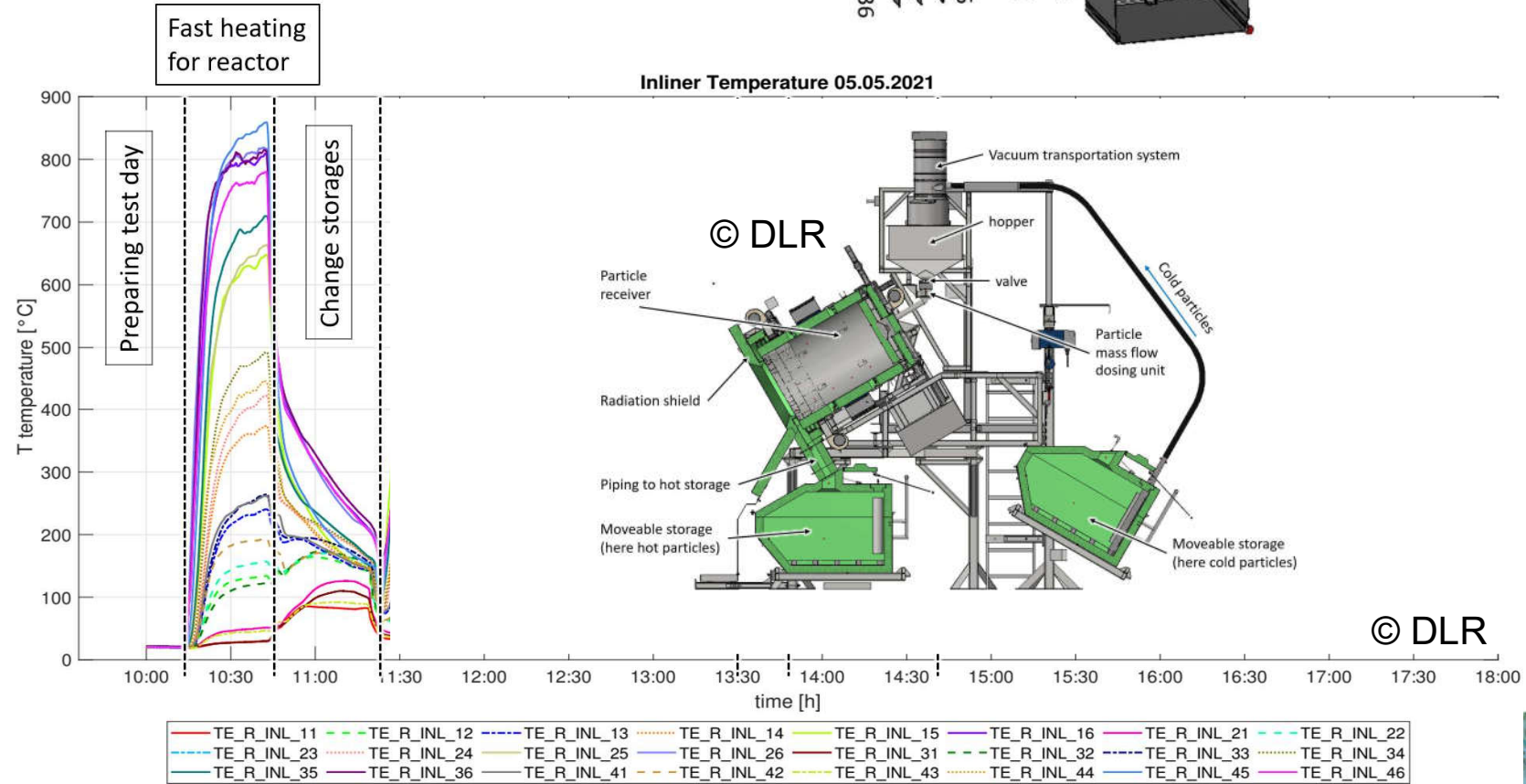
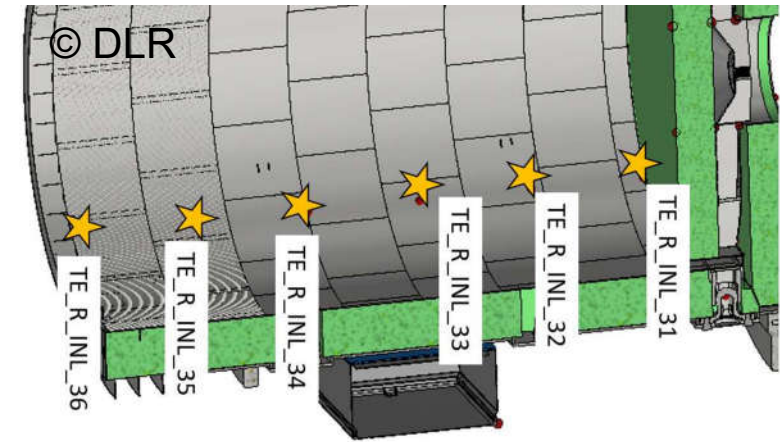
- More than 22 test days
- Approx 64 h of irradiation on receiver



- Heating particles for heat exchanger tests
- Receiver is heated up in a very short time

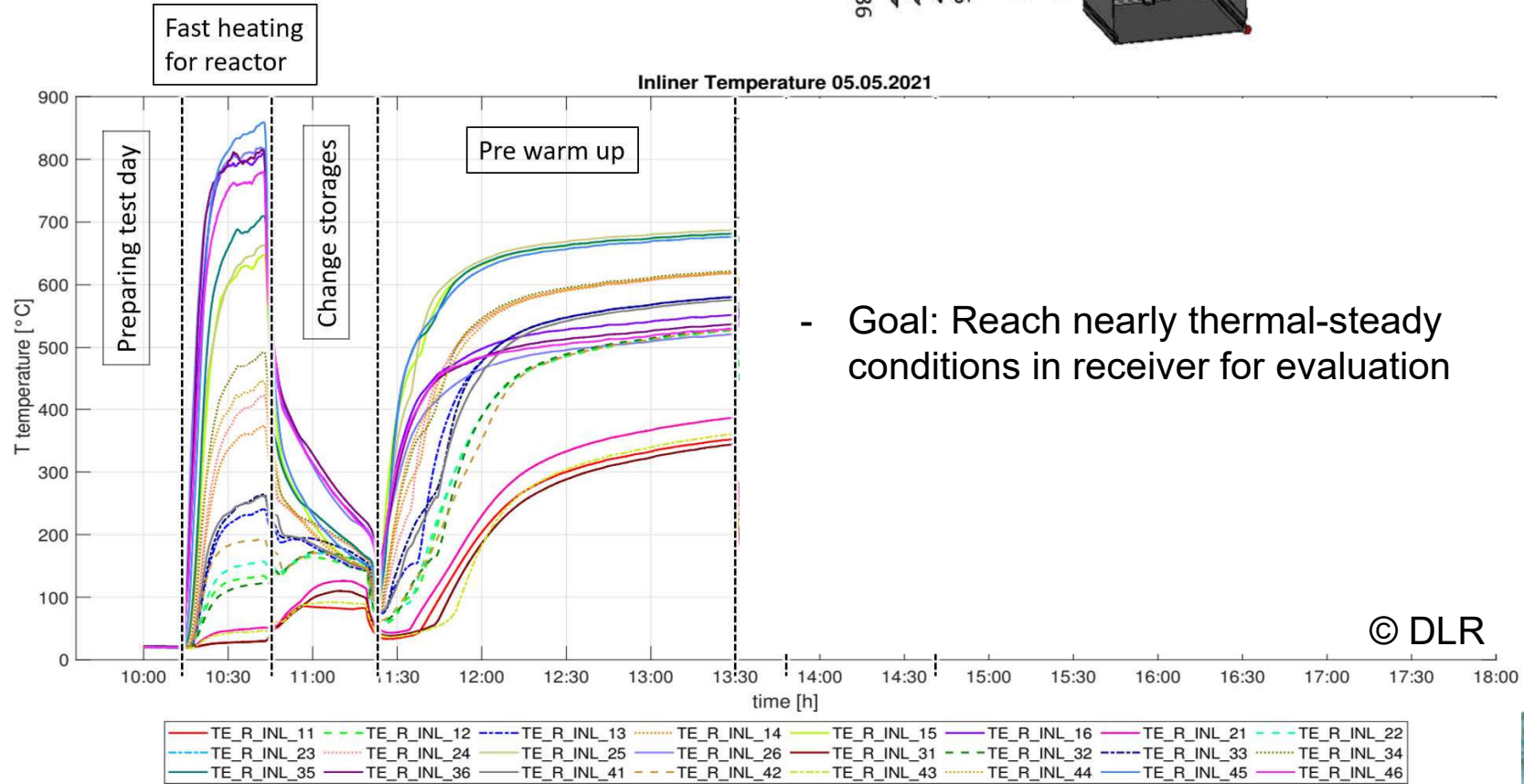
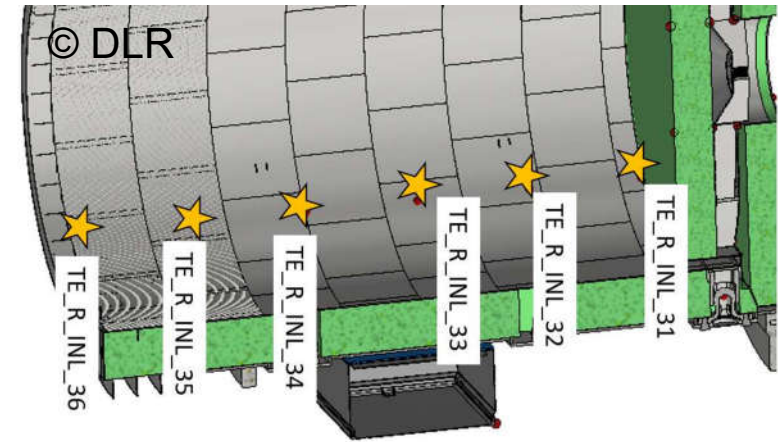
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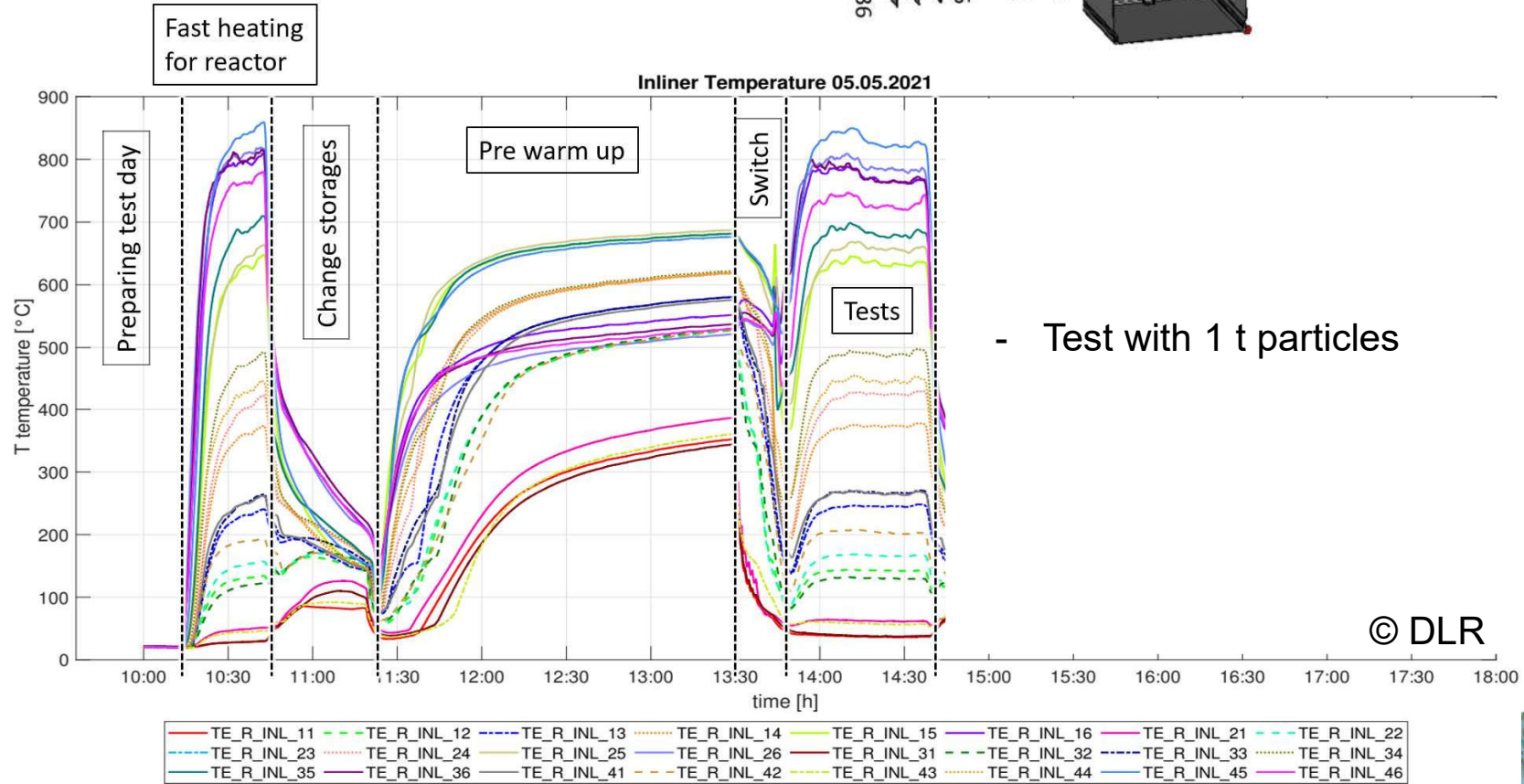
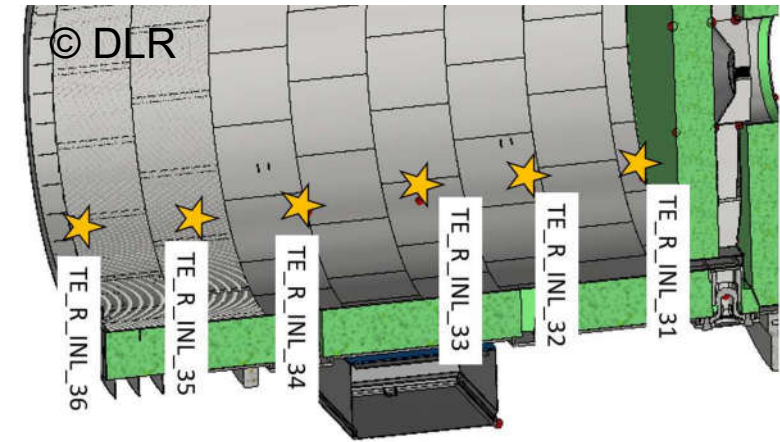
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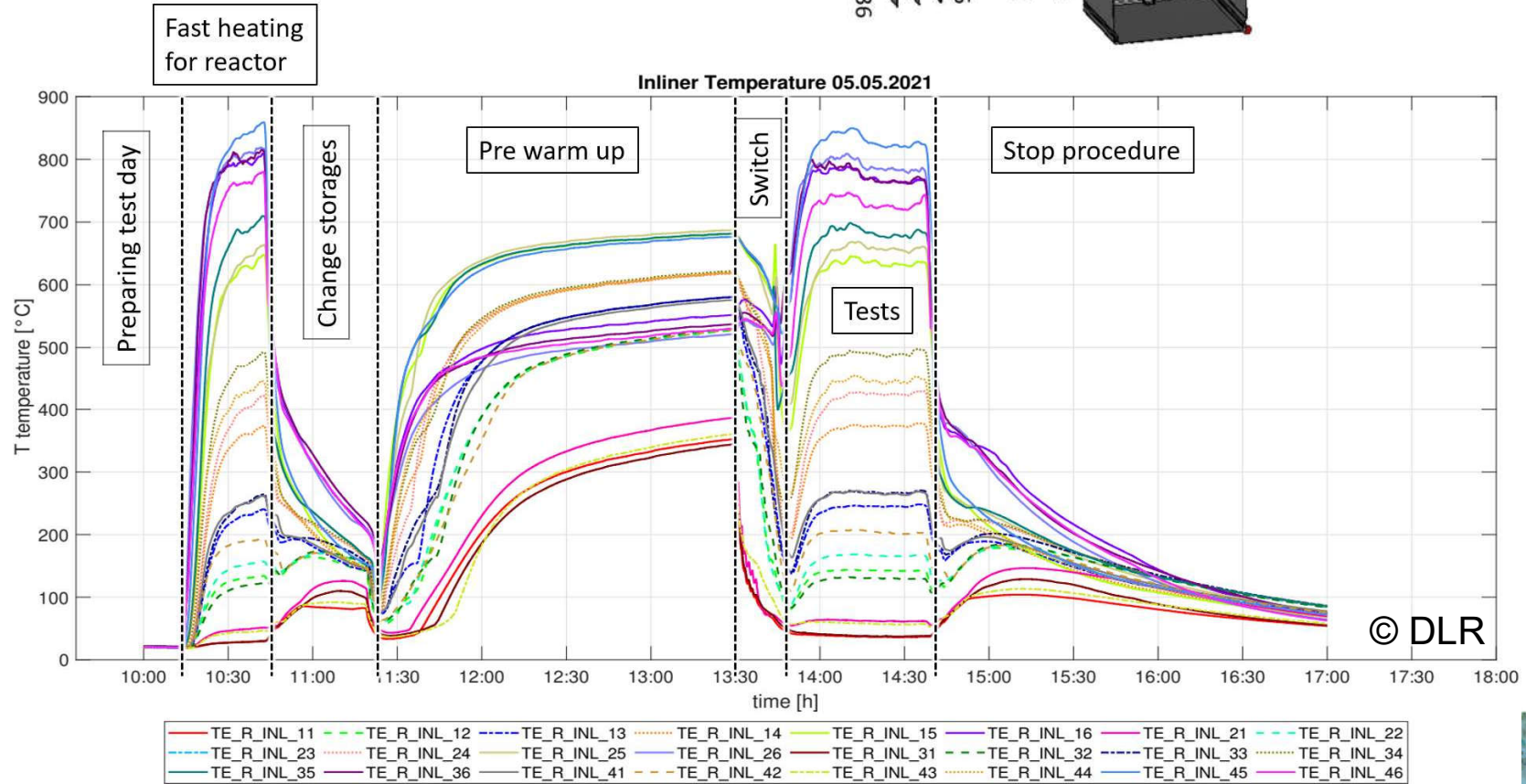
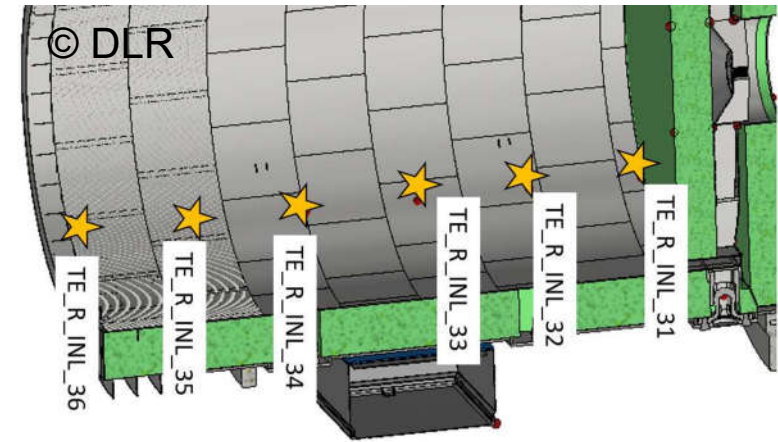
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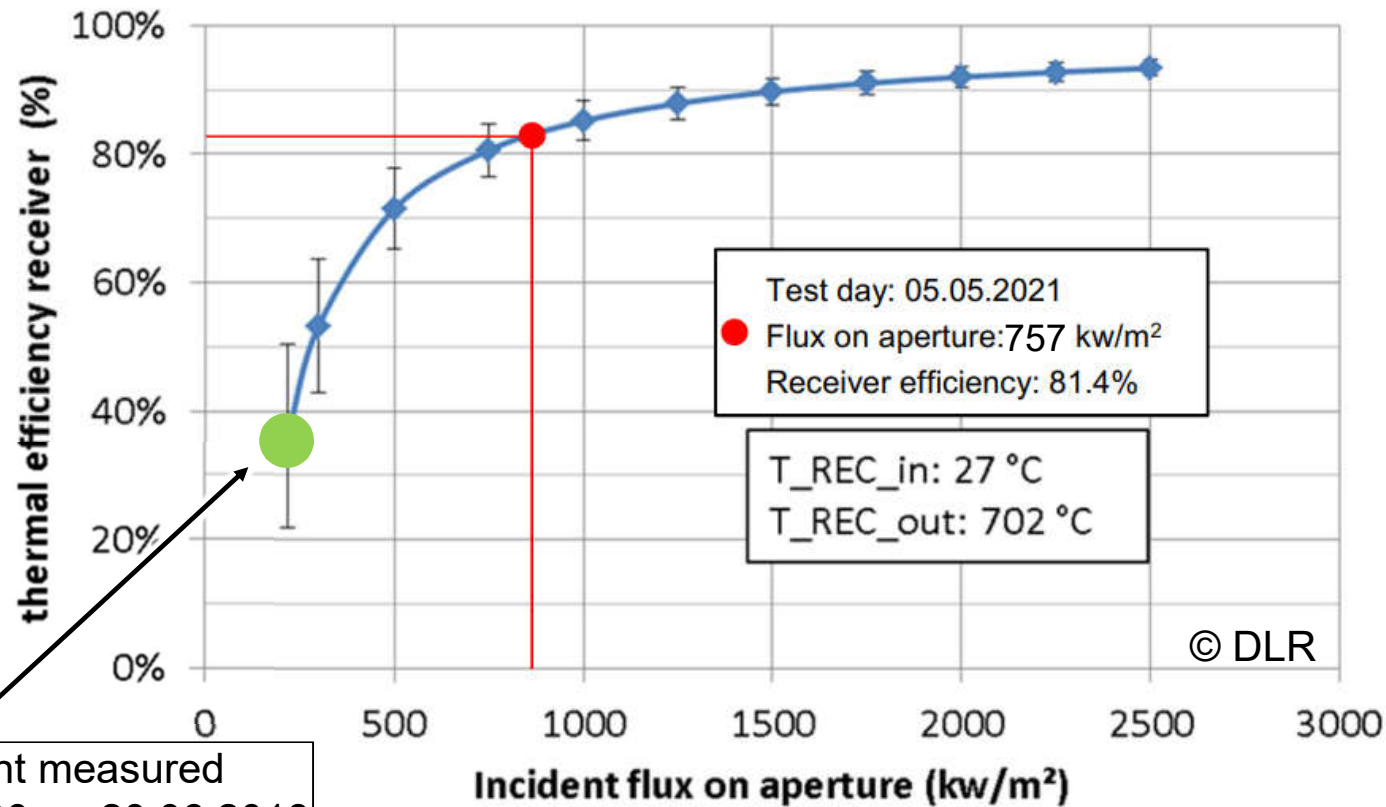
# CentRec300S - Tests

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## Validation of receiver model

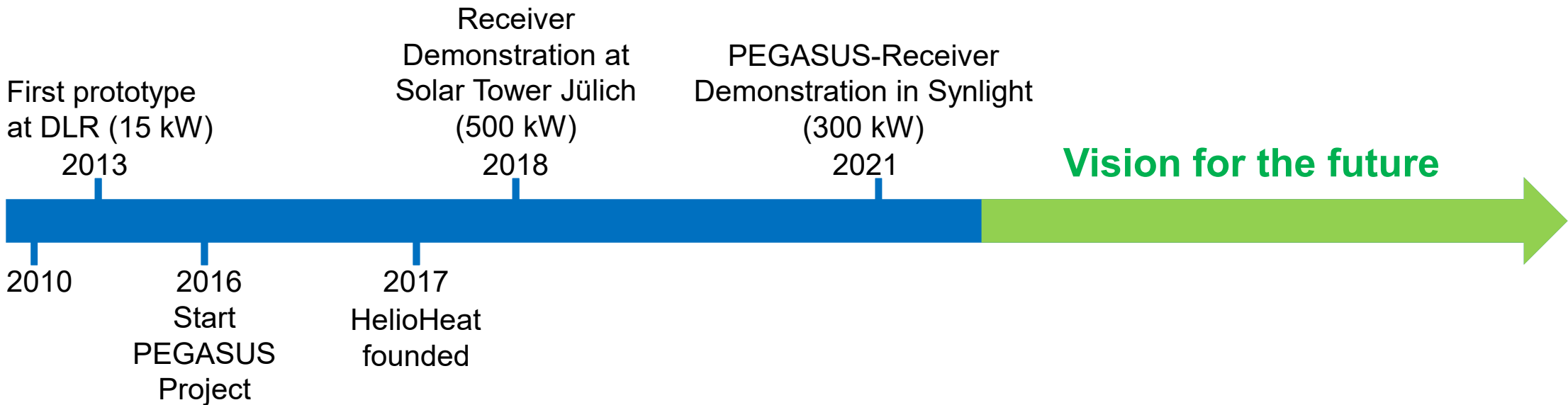
- Expected receiver efficiency by 700 °C particle output temperature for higher incident solar flux on aperture based on the measurements at 200 kW/m<sup>2</sup> on the 20.06.2018 with CentRec500. Red point corresponds to the test day on 05.05.2021 with CentRec300S.



First Point measured  
in CentRec500 on 20.06.2018

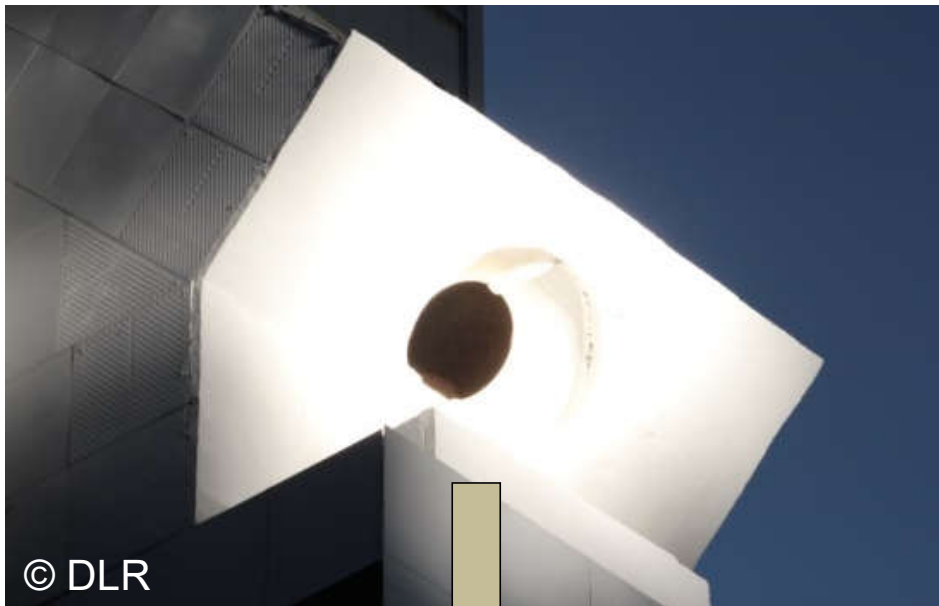


# Roadmap

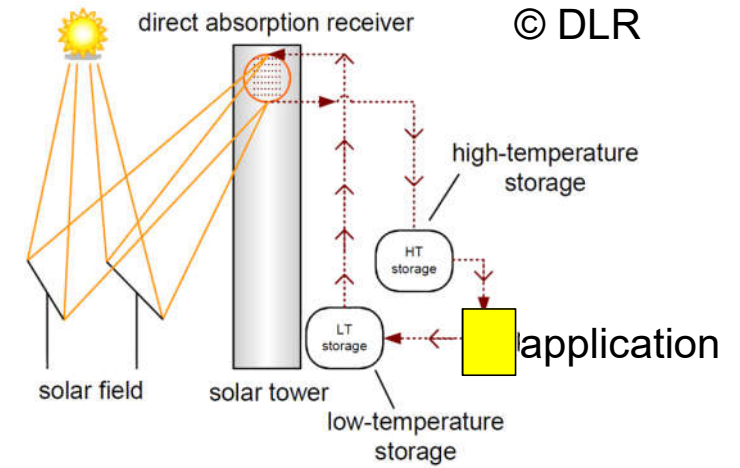


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## Applications of the CentRec® Particle Receiver



particles at 1000 °C



- **Power generation** (e.g. suited for steam turbine at 620 °C or next generation sCO<sub>2</sub> technologies at ~700 °C)
- **Process heat**, e.g. air at 800 °C
- **Solar thermal** chemical reactor / reaction (including using catalytic particles)
- Heat provision for **Solar Fuels** production





## Examples of current EU projects

### PREMA

Manganese ferroalloy production

- Providing high temperature process heat
- Production of air at ~ 800 °C



<https://www.spire2030.eu/PREMA>



### HIFLEX

Production of steam for pasta plant

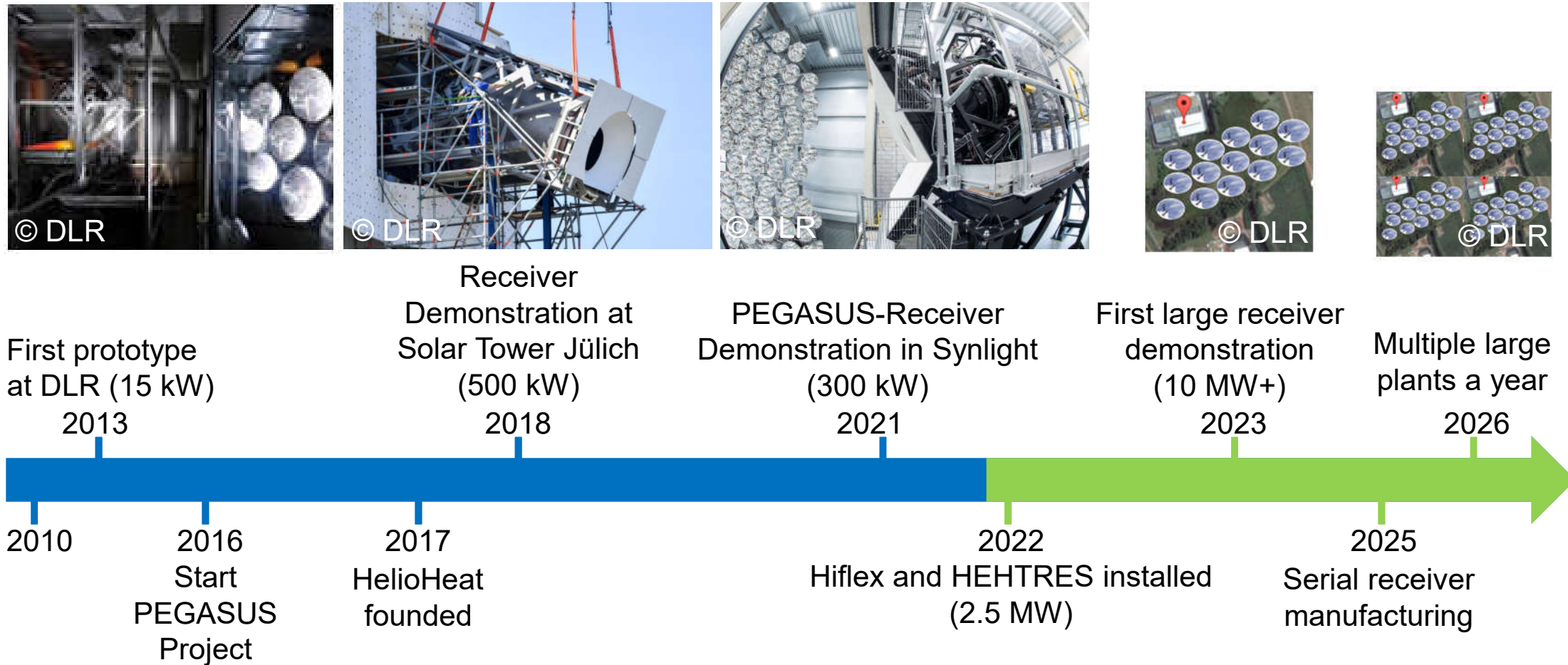
- Provision of steam for pasta drying
- Integration into an existing plant



<http://hiflex-project.eu/>



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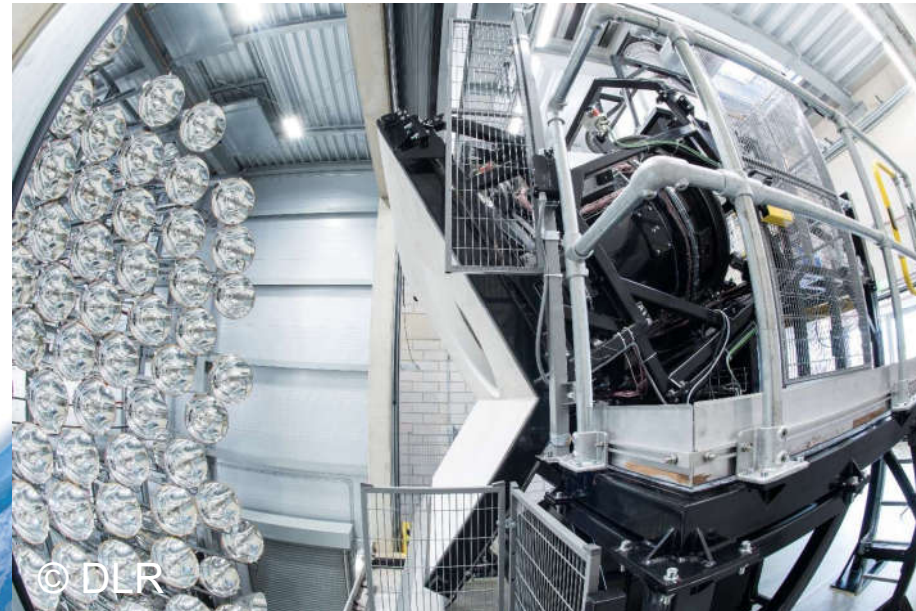


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