Programme Review Day
Brussels, 28/29 November 2012

Working towards Mass Manufactured, Low Cost and Robust SOFC stacks

MMLCR=SOFC

Contract number FCH JU 278525

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Project description

- duration 01.01.2012 – 30.06.2014
- total budget 4.494.396 €, funding 2.067.975 € (46%)
- addresses the improvement of thermo-mechanical robustness of lightweight stack designs and their automated manufacturing

The consortium consists of 8 partners:

University of Birmingham (coordinator)

Forschungszentrum Jülich

Rohwedder Micro Assembly GmbH

Turbocoating

SOFCPower

BORIT

Bekaert

CSIC

amendment for coordinator change from JUELICH to B'ham still ongoing

Problems addressed

- new architecture with reduced thermal stresses
- improvements of performance and reliability:
  robustness to cycling and transient operating conditions.
- simplification of manufacturing
- improved quality assurance by automated assembly
- cost efficient design

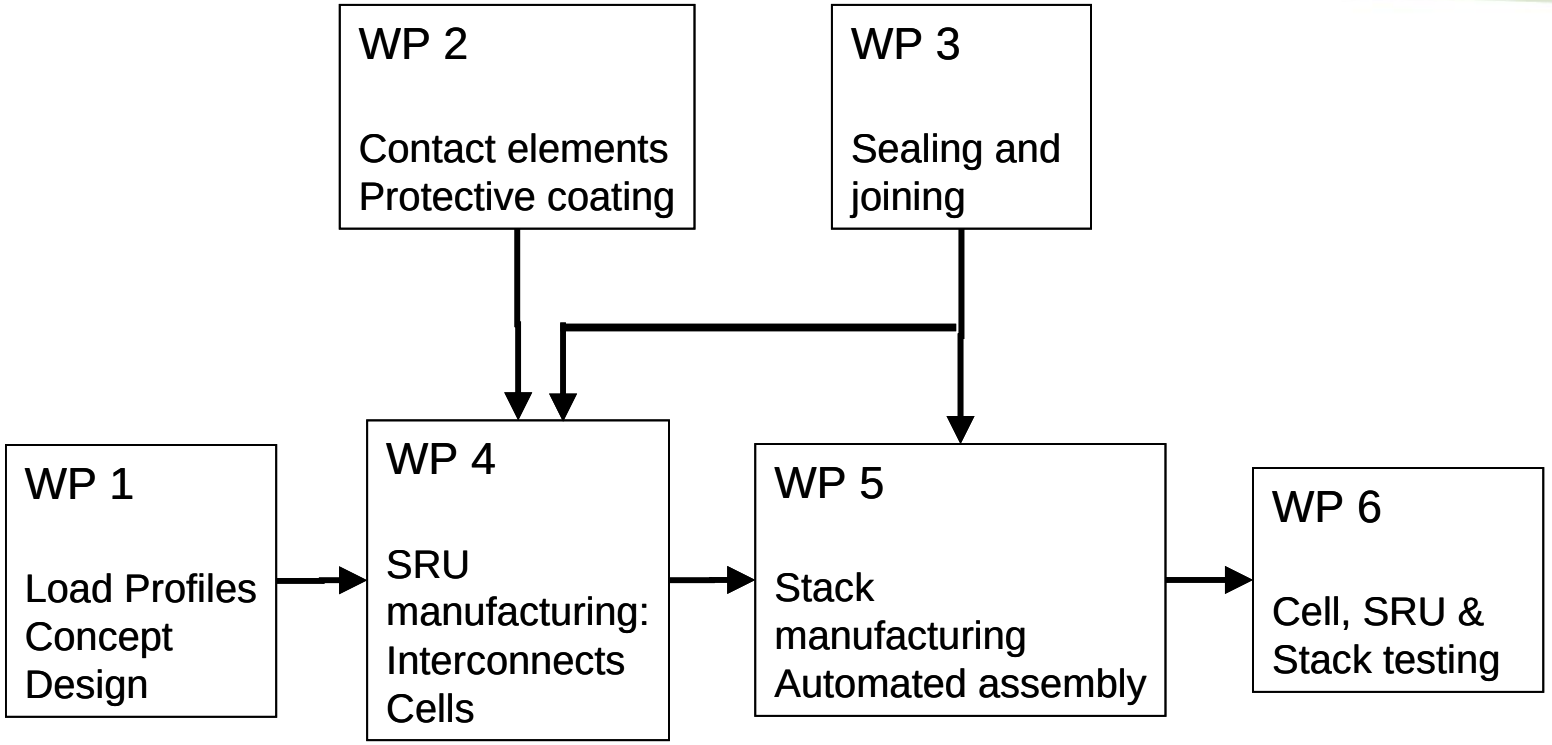
Project goals

- reduce thermal stress in modified Juelich CS IV design
- implement improved glass sealants and sealant processing
- optimise application of protective coating prior to and after forming step
- design and optimise automated manufacturing process

Outcome:

- lightweight stack for transport or stationary applications
- reduced cost, improved robustness and quality (reproducibility)
- mass-manufacturing compatible processes and assembly machines

Project Approach



Project Approach (2)

alternative routes

contacting elements

forming of cassette components

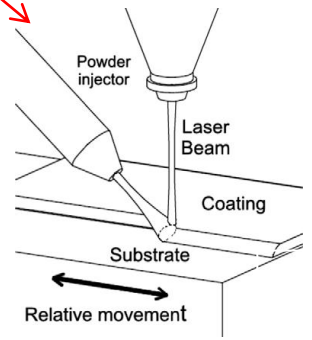
protective coatings

SOFC cells

welding of cassette (SRU)

batch process

stack assembly



continuous process

Project results: APU Benchmarking

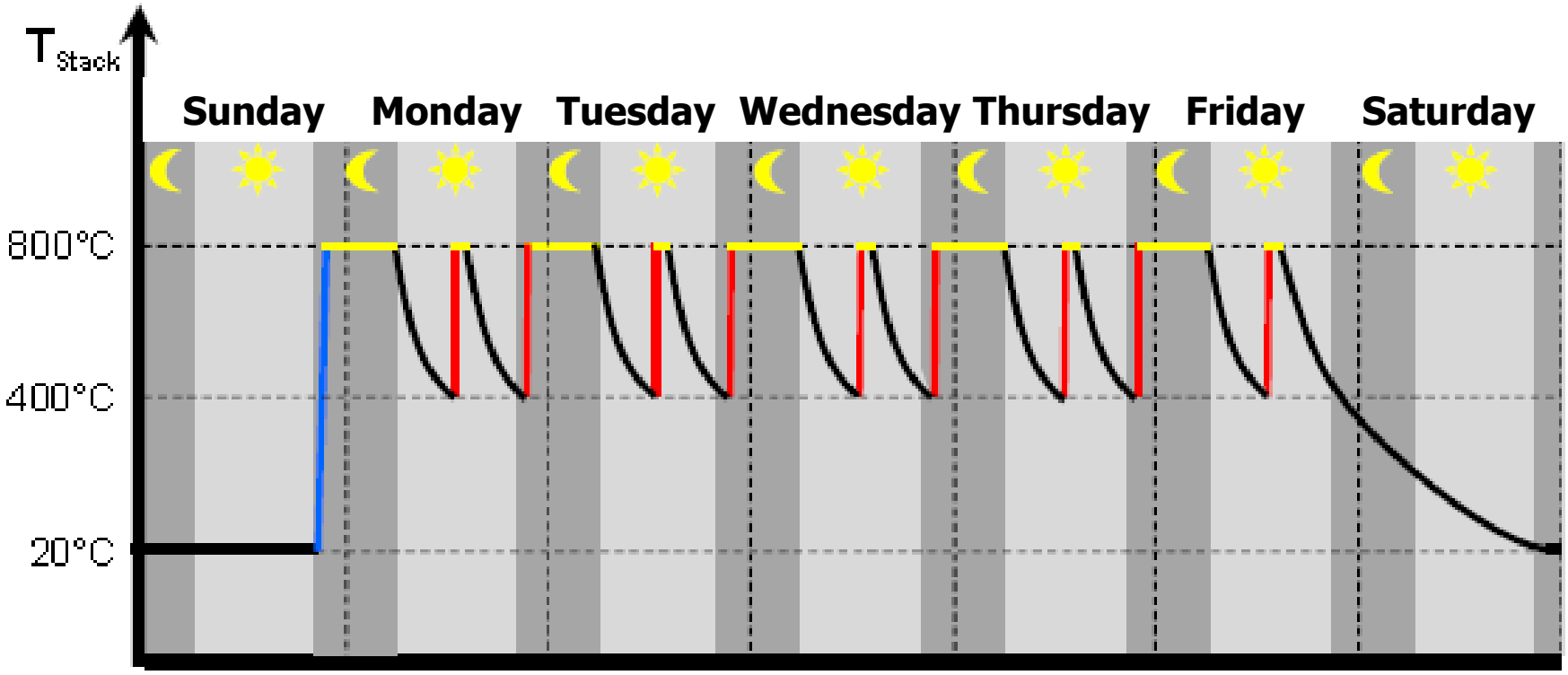
Pony Pack

	Diesel ICE APU 5 kW
Cost ($)	7000–9000
Max. efficiency (%)	30
Volume (L)	150–400
Weight (kg)	180–230
Durability (h)	>4000
Start-up time	<2 min

1400 – 1800 US$/kW

Project results: APU Benchmarking (2)

Definition of 'Cycling'



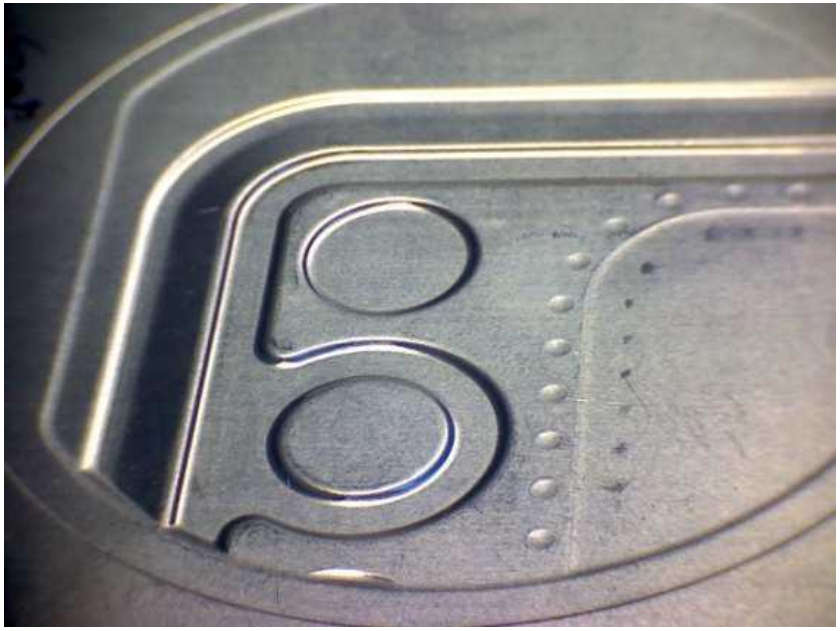
US 'Idling' case

Project results: Steel Forming

First forming tests using

- CroFer 22 APU,
- CroFer 22 H,
- Hitachi ZMG232L,
- Sandvik Sanergy HT

Geometry: CS IV (Juelich design)



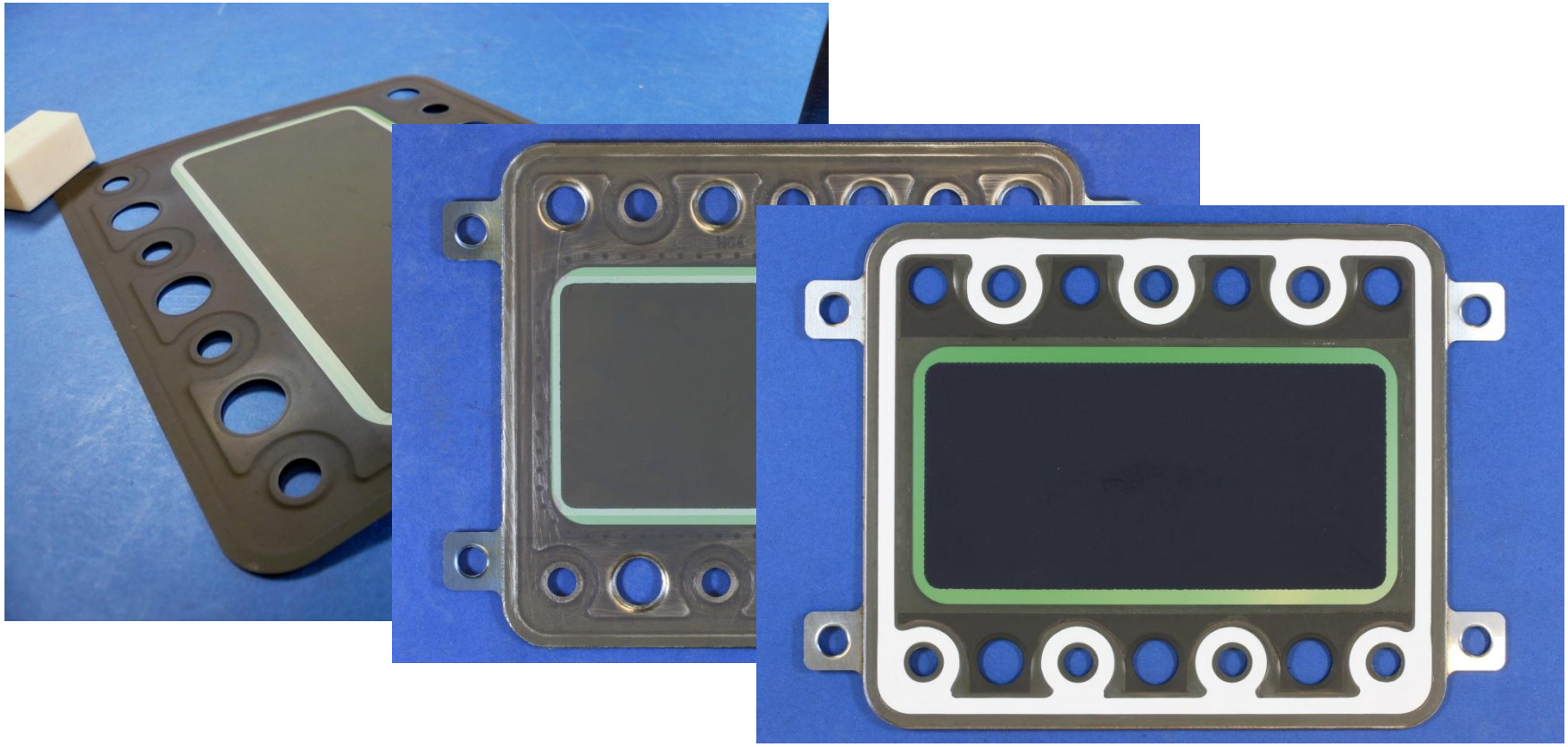
Project results: Steel Forming (2)

Design "1.0":

testing of suitability of materials & components from all partners

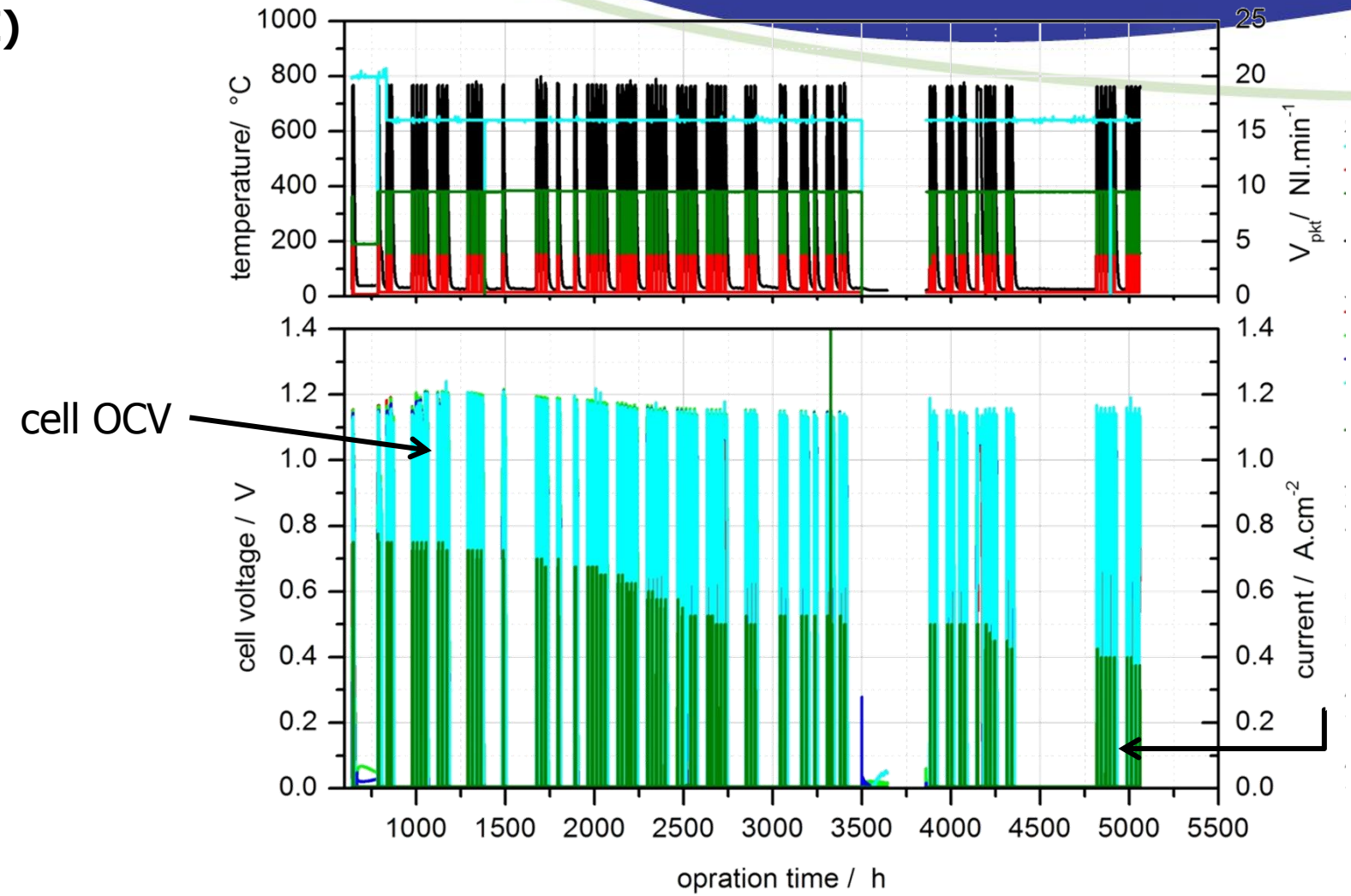
Project results: Cassette Manufacturing

Half-automated manufacturing of gas-tight cassettes, Design 1.0 (CS IV)



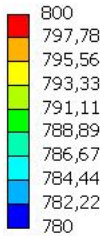
Project results:
Stack Testing (Benchmarking)

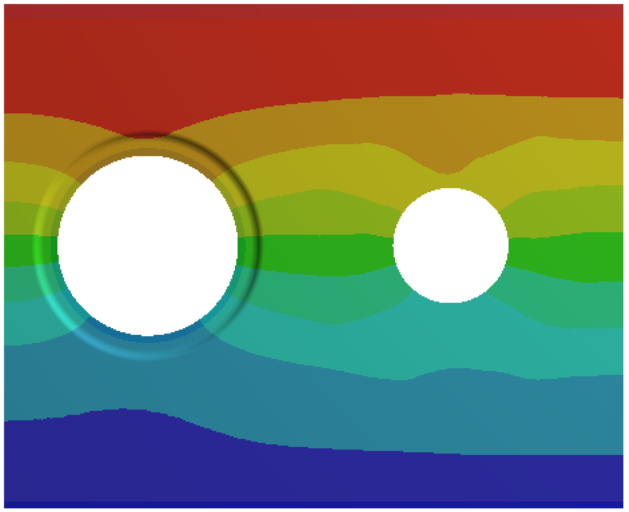
Reference stack testing (CS II)



Modelling of thermo-mechanical stress

Temperature distribution in two alternative designs

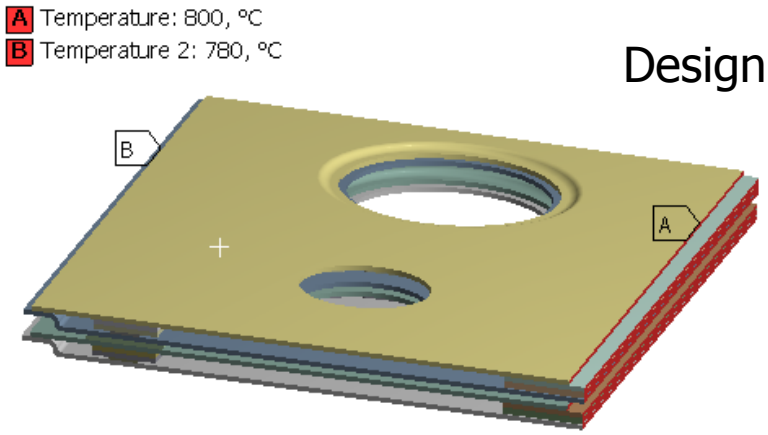




swage design CS IV (Design 1.0)

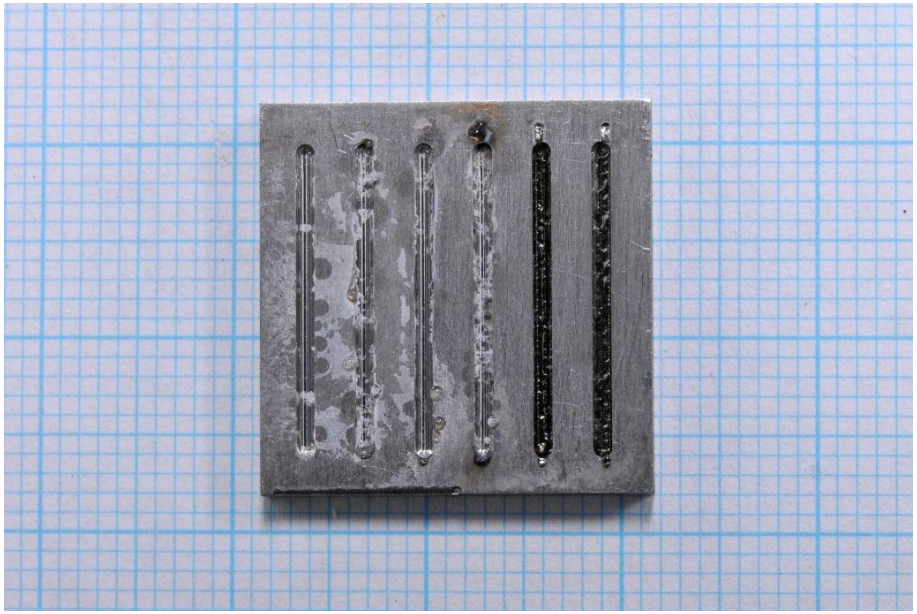
Design 1.1

Boundary Conditions →



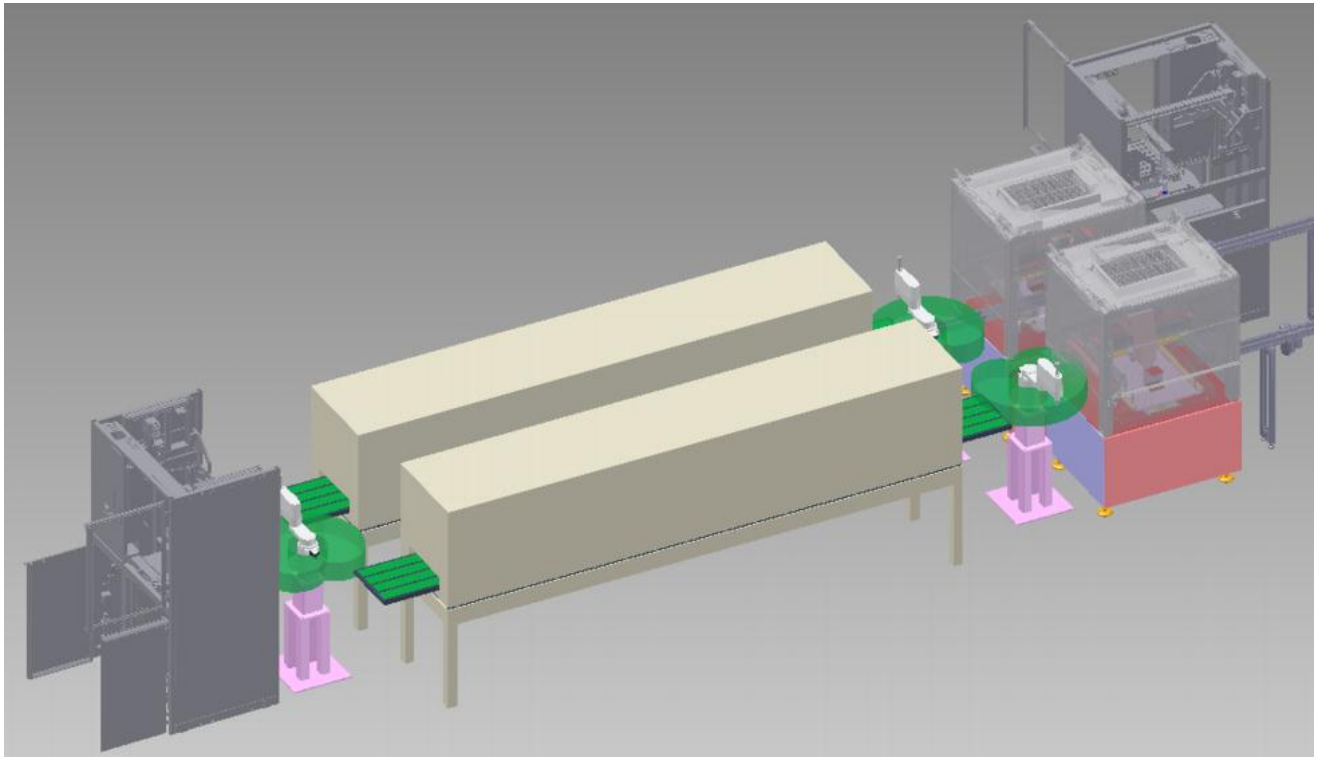
Critical Benchmarking of Glass Welding Procedures

- laser supported glass welding is extremely interesting under the aspects of automated manufacturing
- process is, though, very critical
- work has begun on evaluating potential for optimising operating parameters



Manufacturing Equipment Design

- first feasibility studies for manufacturing and assembly process



Alignment with MAIP

- “novel architectures for cell and stacks leading to step change improvements over existing technology in terms of performance, endurance, robustness, durability and cost “
- “Similarities exist between the base technology and requirements of the fuel cell technologies in this Application Area and those for on-board power generation (e.g. APU)”

- project in principle addresses stack architectures suitable both for stationary and transport applications
- besides robustness to thermal cyclin,g also addresses cost reduction and increase of quality through automated manufacturing

Future perspectives

commercialisation of

- stack technology through consortium partner SOFCpower
- coating solutions through consortium partner Turbocoating
- glass sealants via FZJ and CSIC activities
- manufacturing solutions through consortium partners BORIT and Rohwedder (both with respect to process control/machines/ process development, and component manufacturing)

possible interaction with new project (currently in negotation)
SCORED 2:0 (coating of SOFC interconnects)

Thank You for your Attention !