

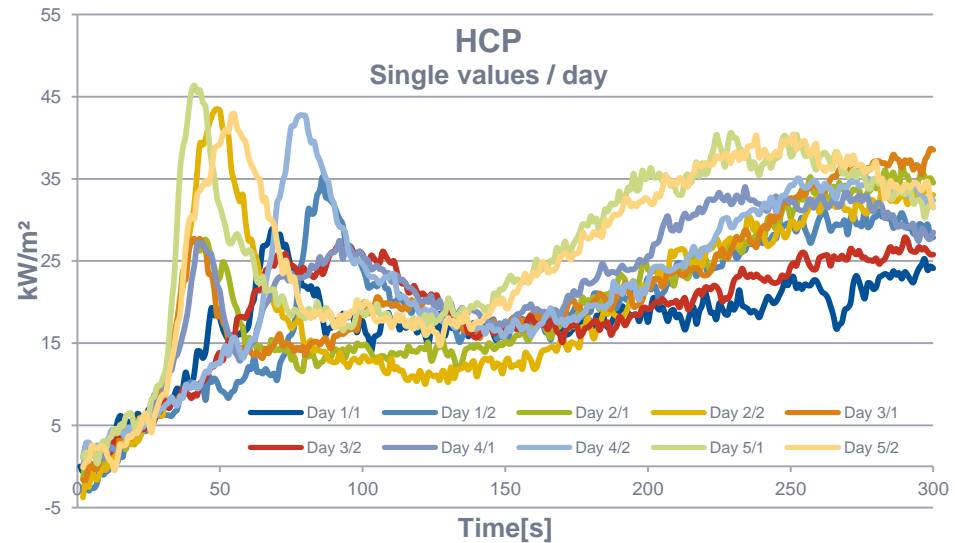
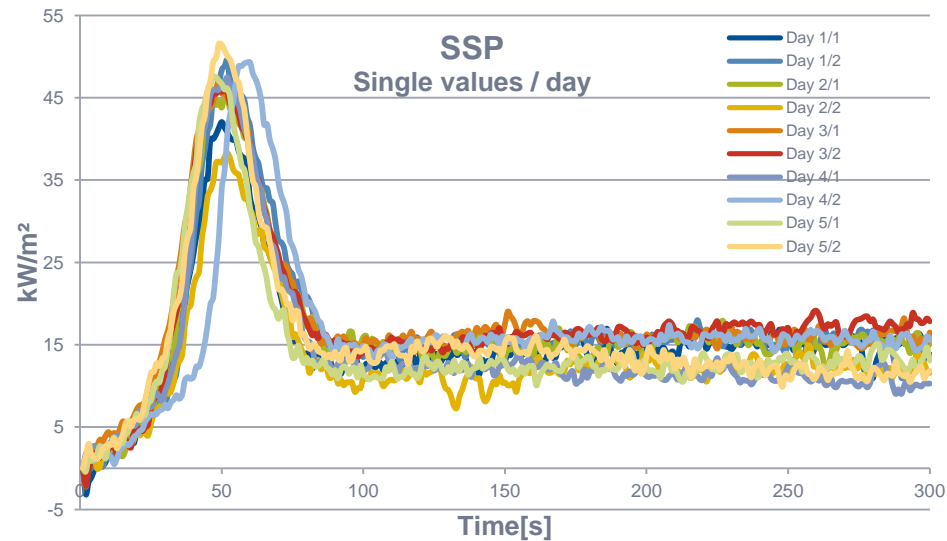
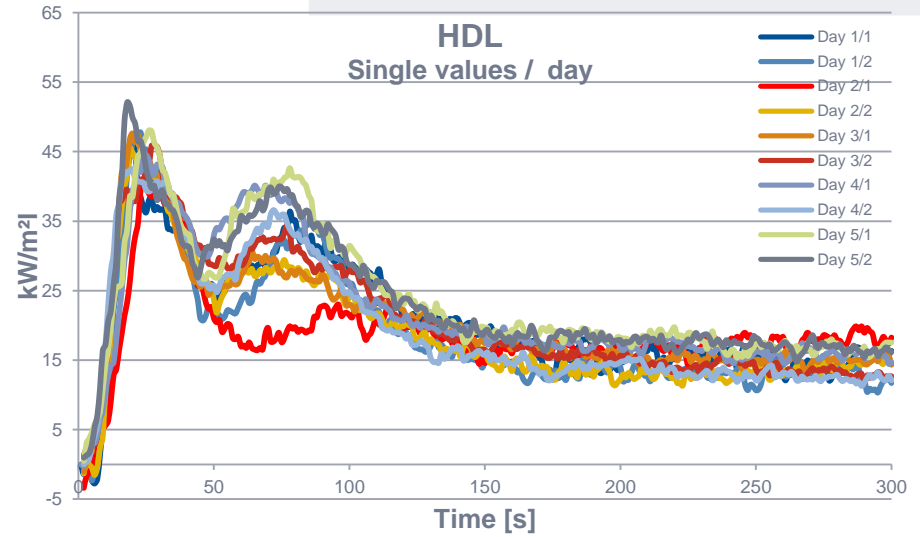
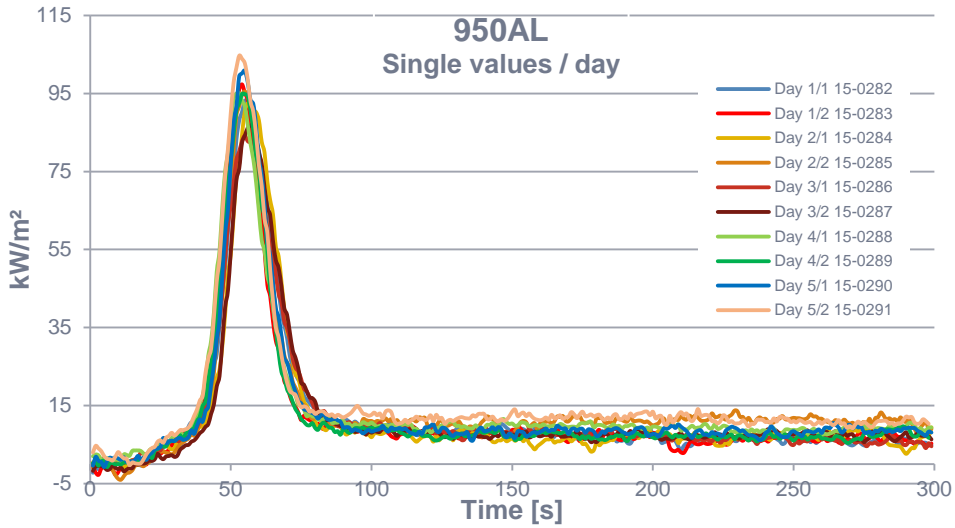
MPaT

Heinz-Peter Busch
Fire Safety Expert

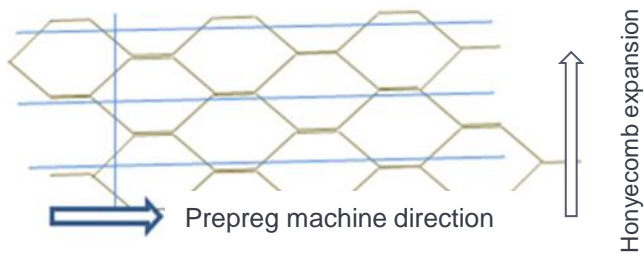
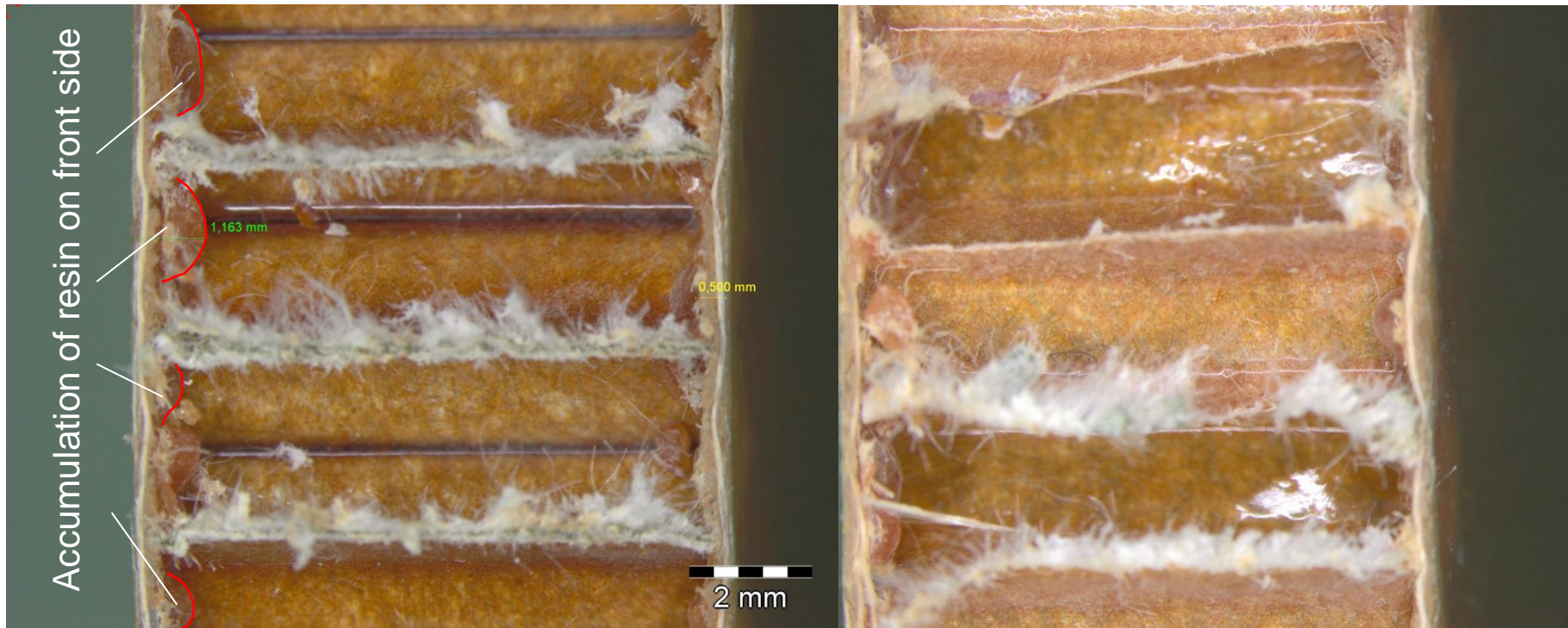
OSU Round Robin 2015

Airbus data analysis linked to the
HR2 project

OSU RR2015 Airbus Result Overview



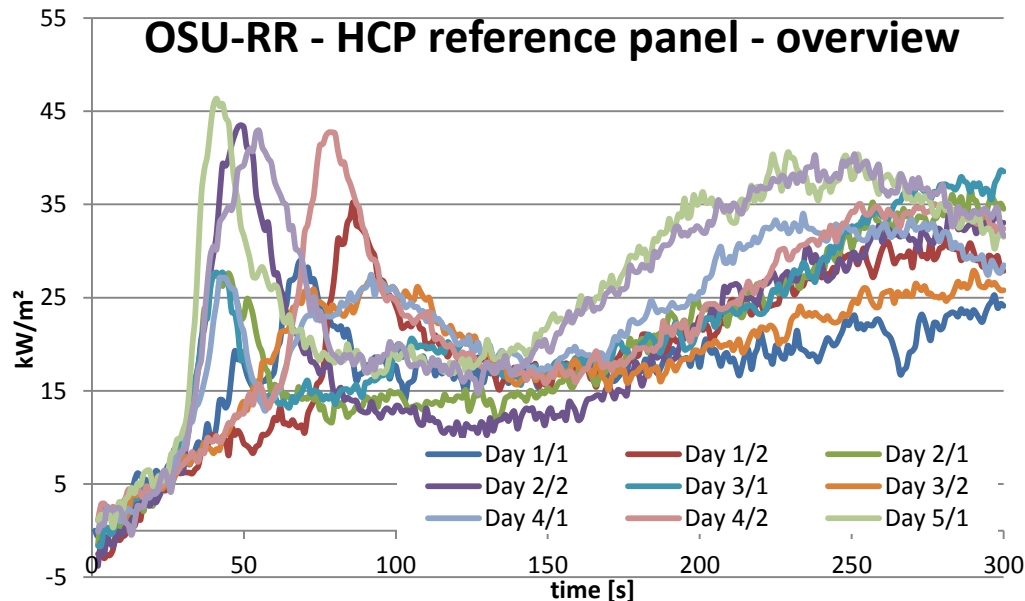
Test sample orientation details



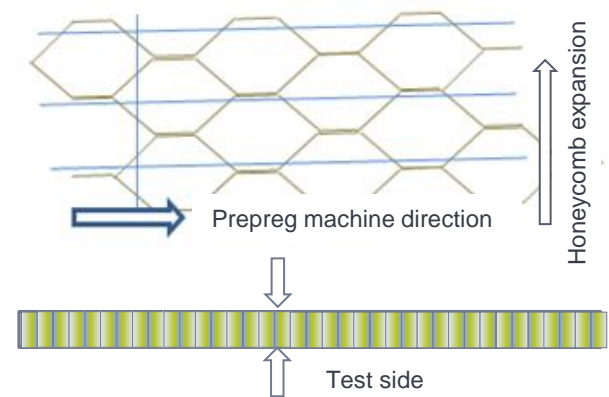
Resin content different in top-layer and honeycomb orientation influencing Heat Release and Heat Release Rate

HCP Test result overview

No.	Weight [g]	[kW/m ²]	Peak Time [s]	[kW*min/m ²]	Thickness [mm]
Day 1/1 - 1	55,2	28,95	69,47	29,68	9,9
Day 1/2 - 1	54,6	35,24	86,98	28,30	10
Day 2/1 - 1	55,5	36,6	289,71	26,71	10
Day 2/2 - 1	55,2	43,51	49,5	32,47	10
Day 3/1 - 1	58,3	38,65	299,58	28,83	9,9
Day 3/2 - 1	55,5	27,87	290,57	32,70	9,96
Day 4/1 - 1	55,2	34,02	234,23	34,82	9,94
Day 4/2 - 1	56,5	42,74	78,64	36,35	9,98
Day 5/1 - 1	54,2	46,37	41,05	38,31	9,95
Day 5/2 - 1	55,2	42,93	55,58	39,30	9,95
Mean	55,13	37,69	149,53	32,75	9,96
STAD [%]	0,59	15,84	72,36	12,67	0,38

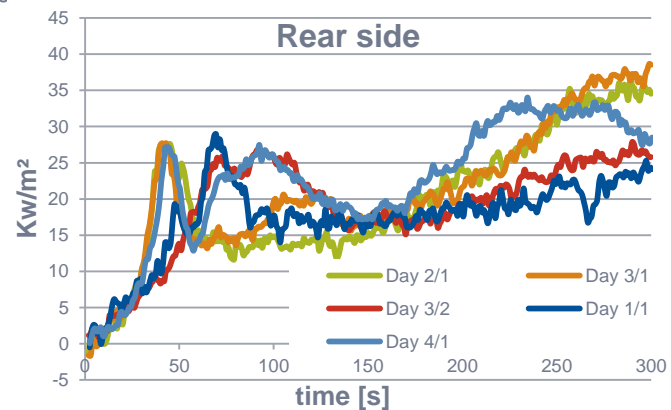
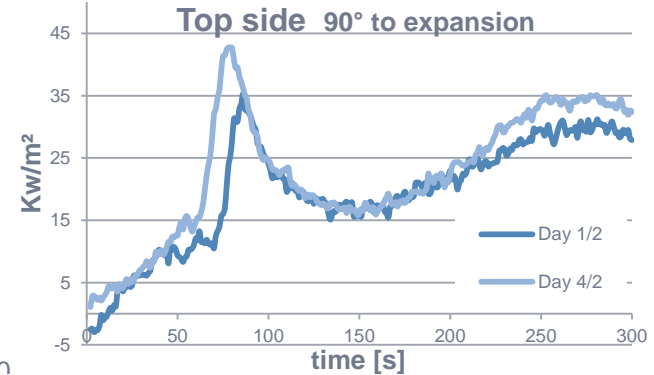
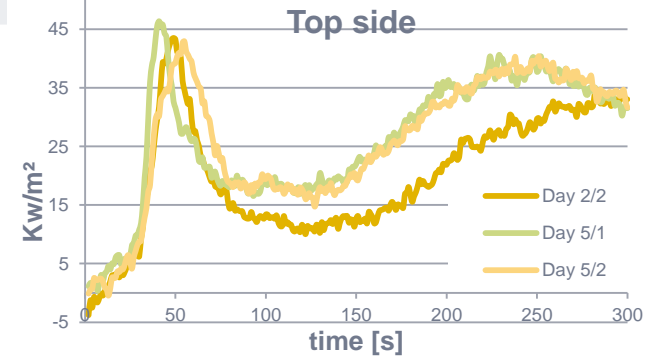
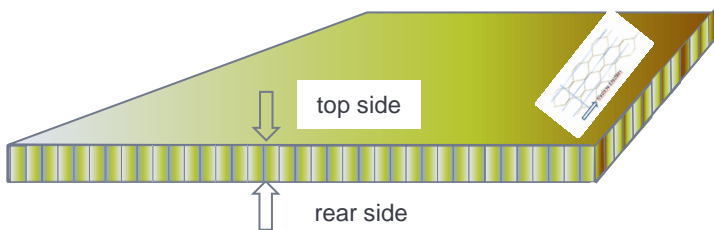
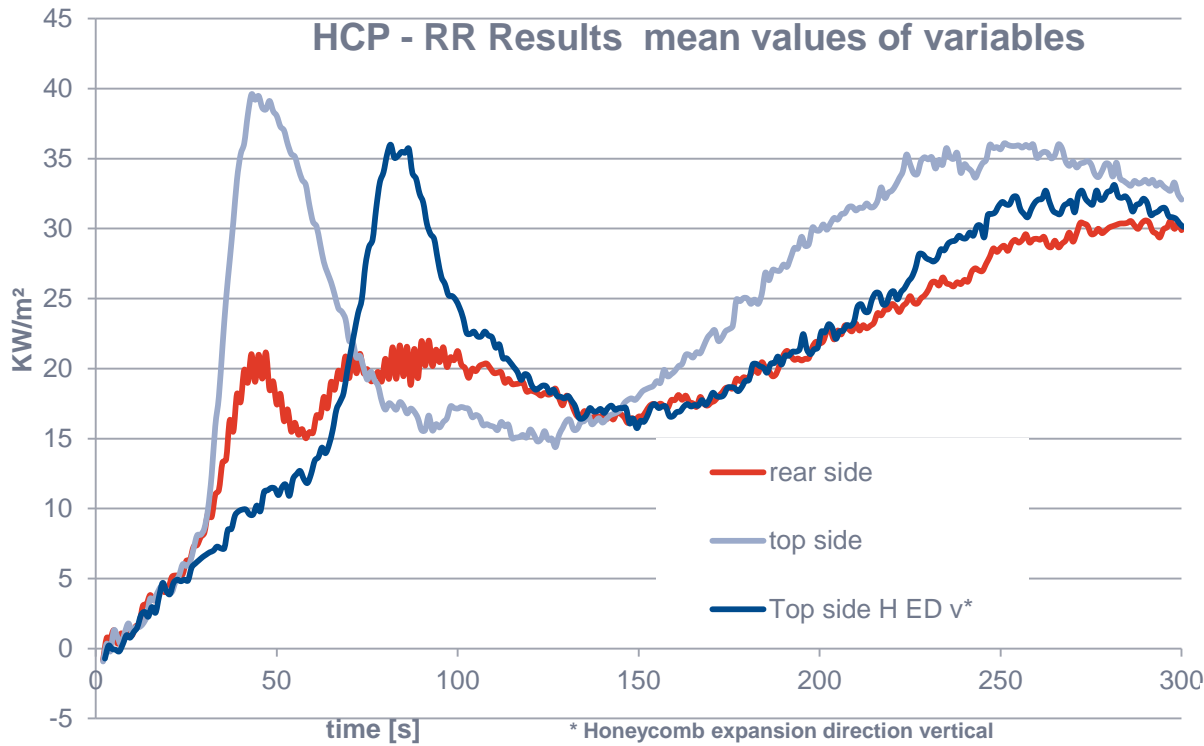


Sample orientation not specified

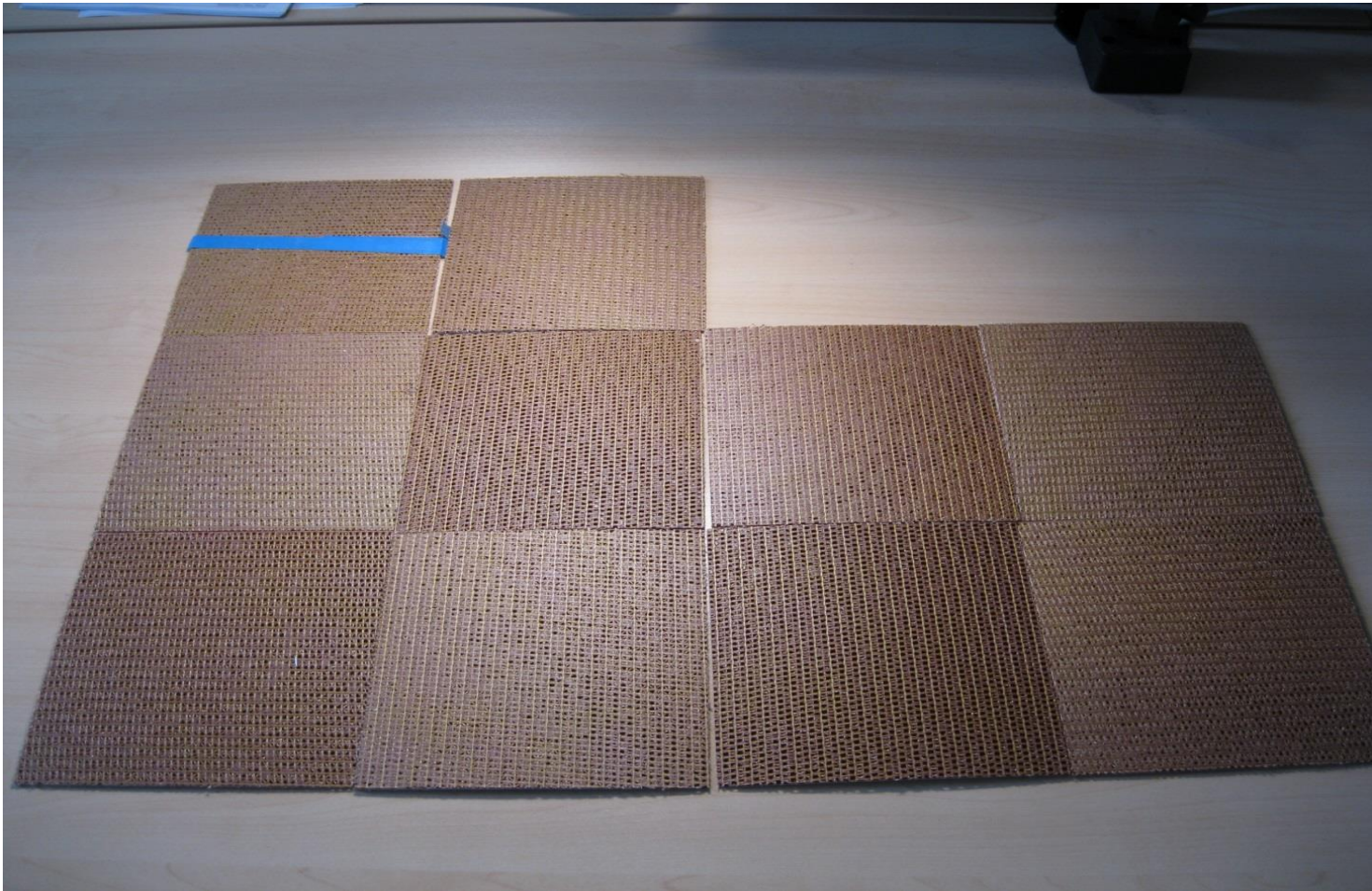


therefore a high standard deviation

Heat Release dependance of Sandwich Orientation

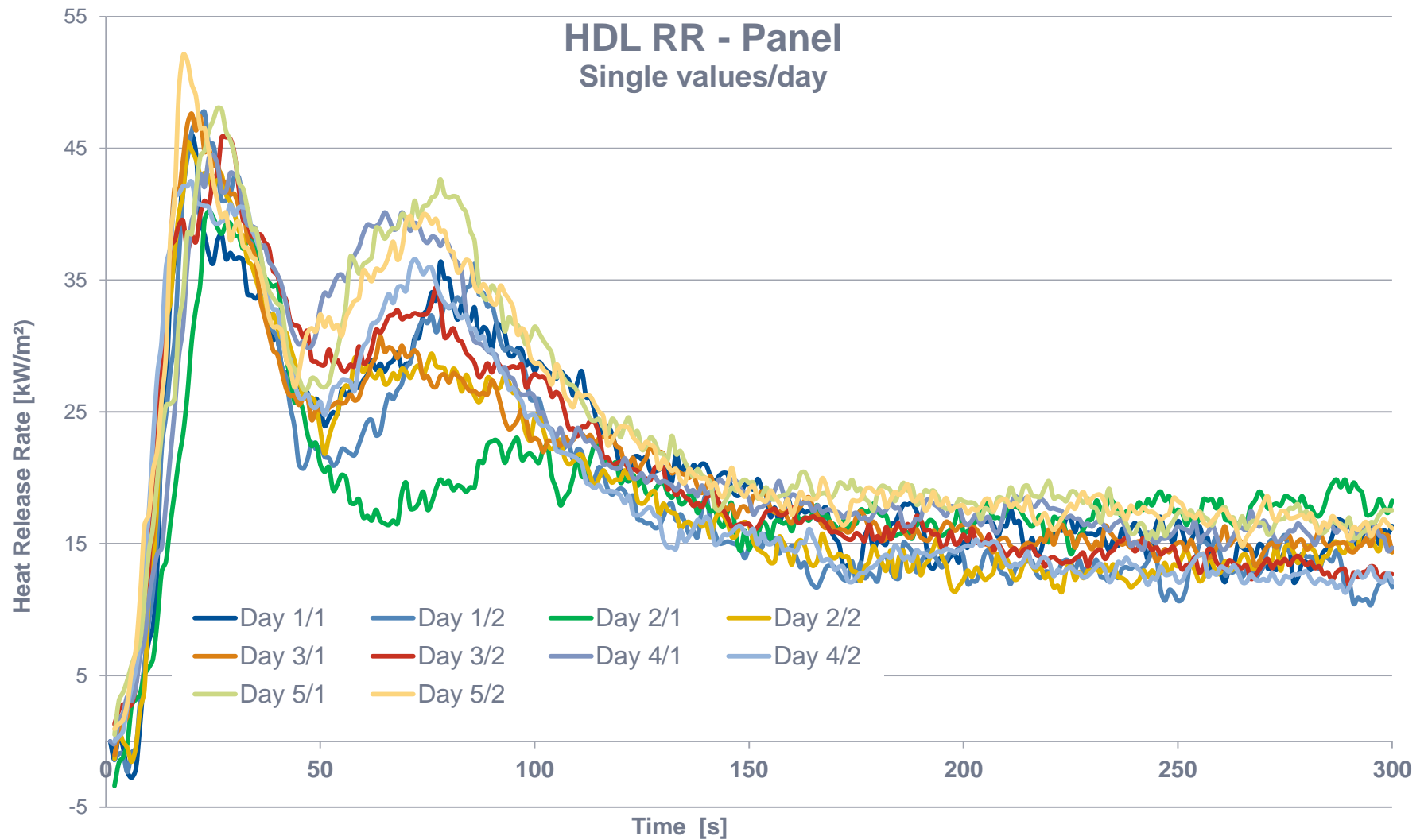


HDL - RR Panel

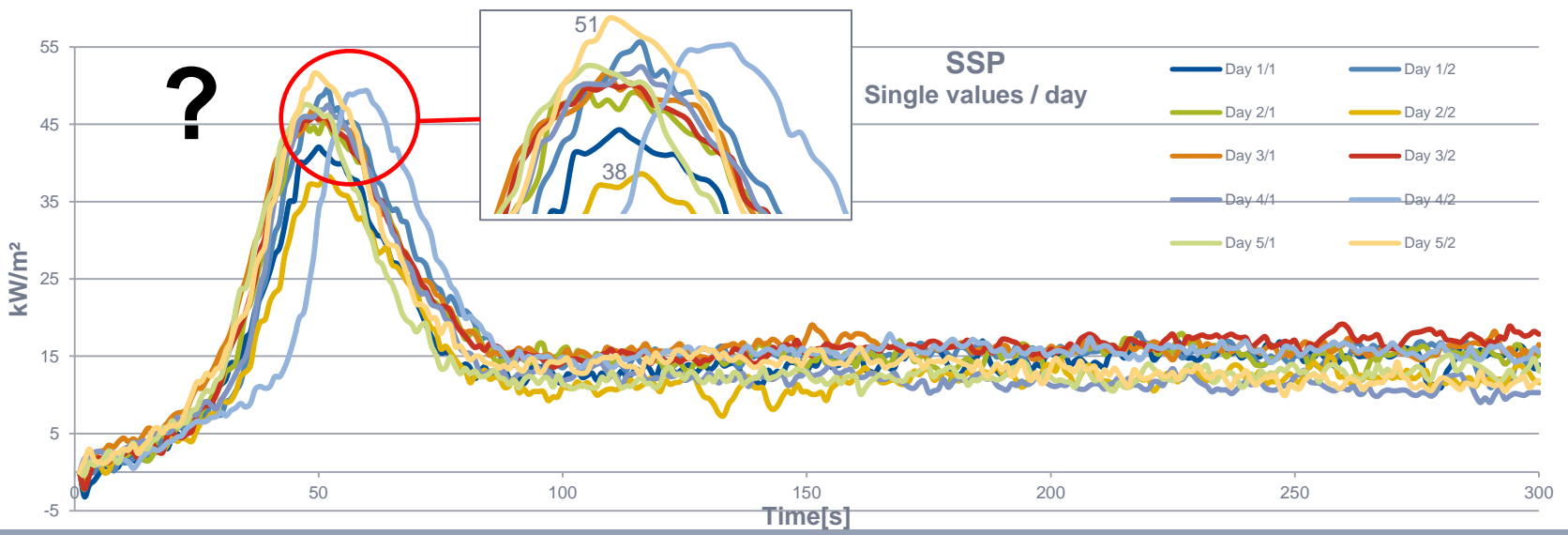
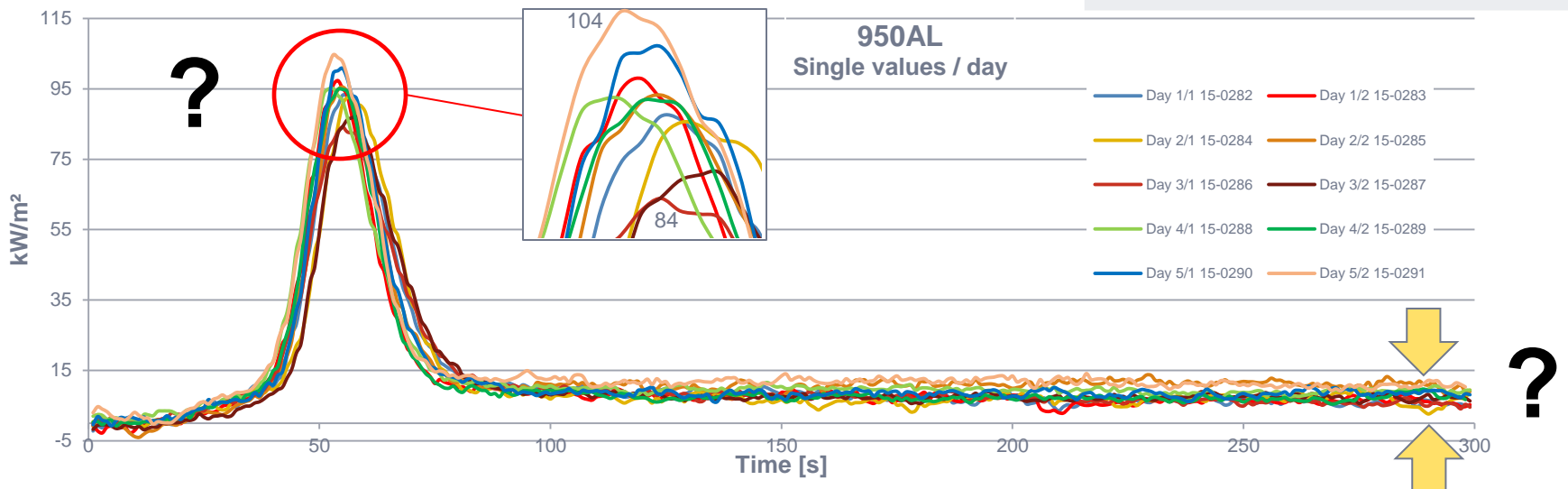


Picture shows rear side of HDL - RR panel with inhomogeneity of resin allocation

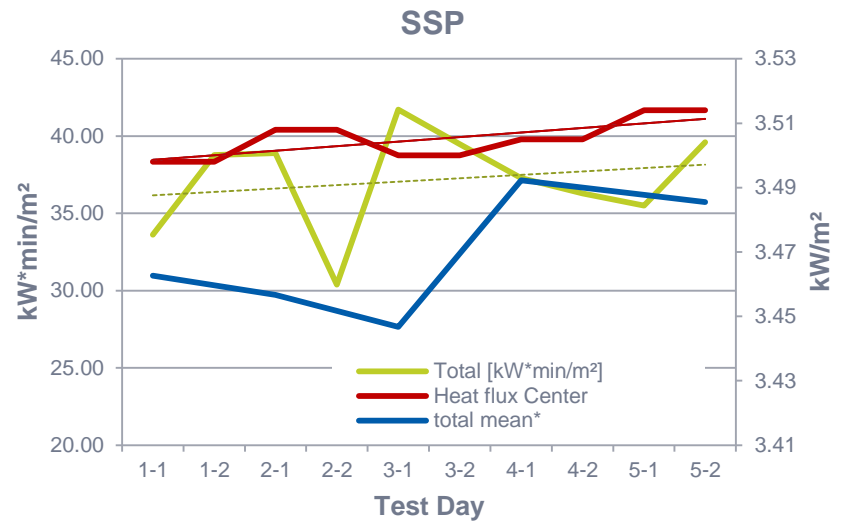
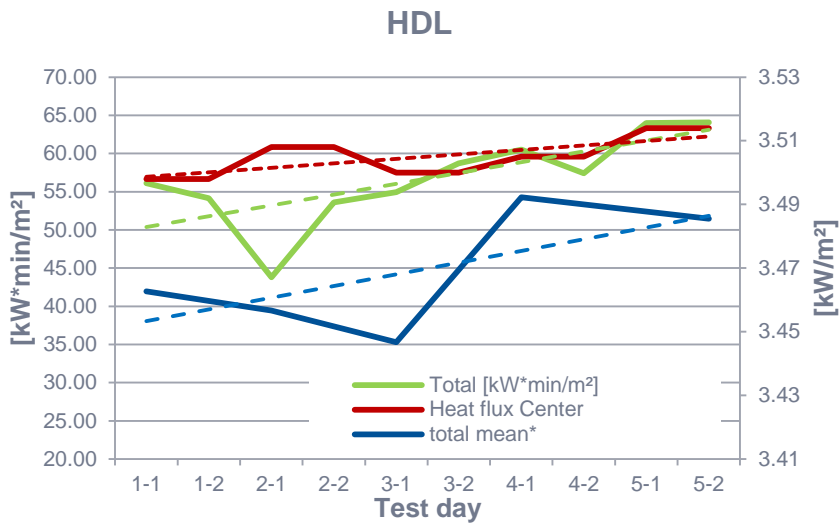
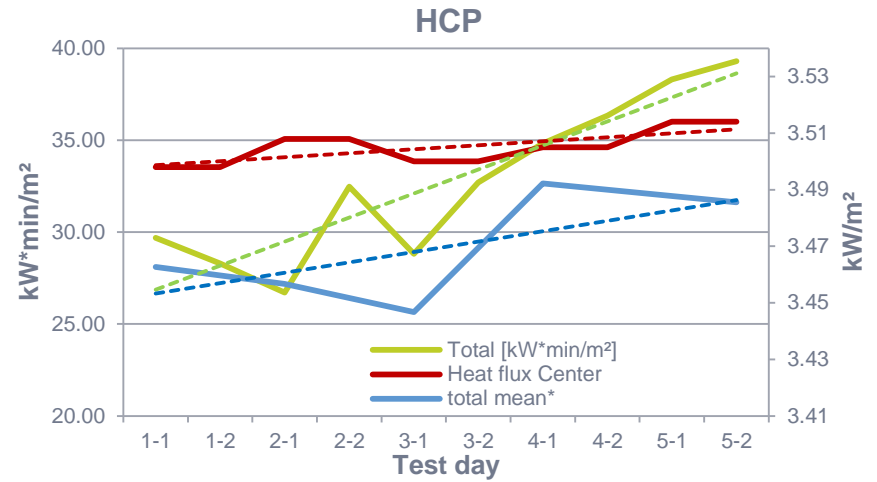
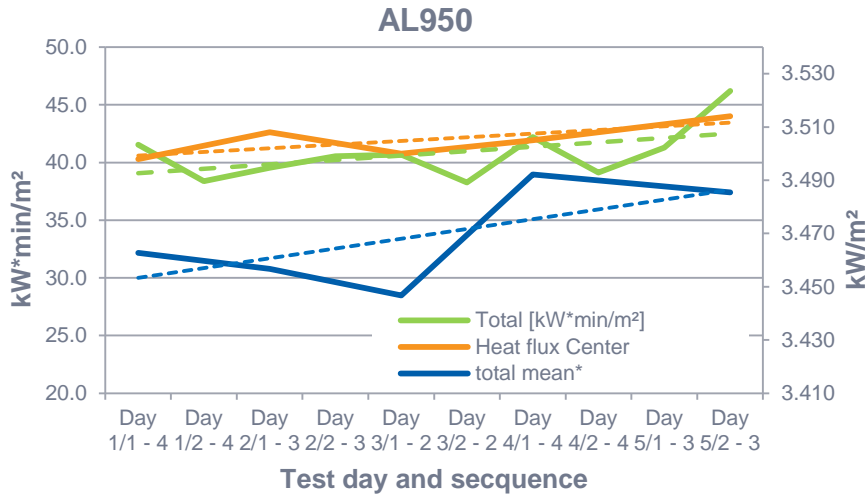
HDL RR-Panel Results



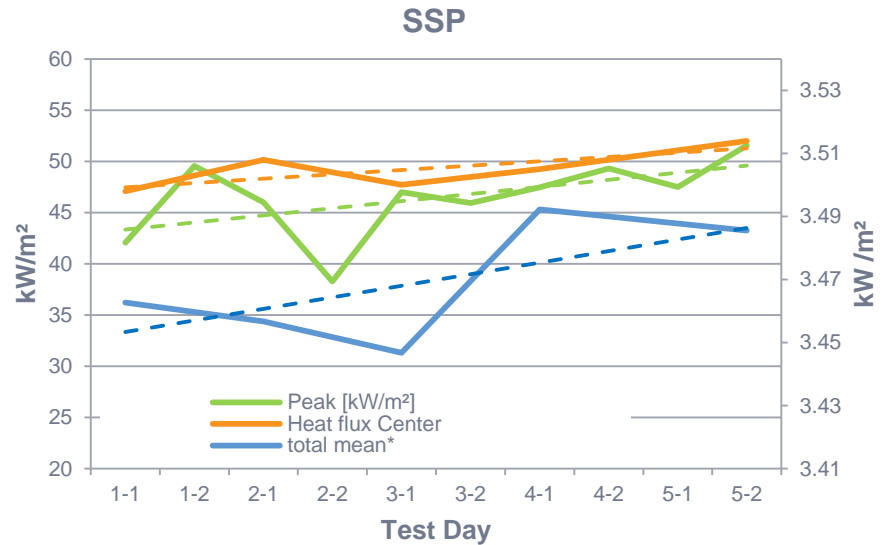
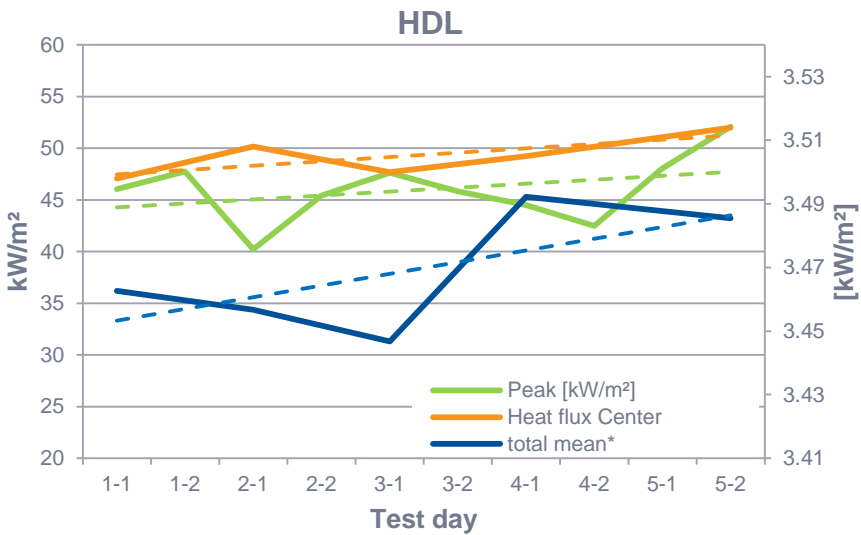
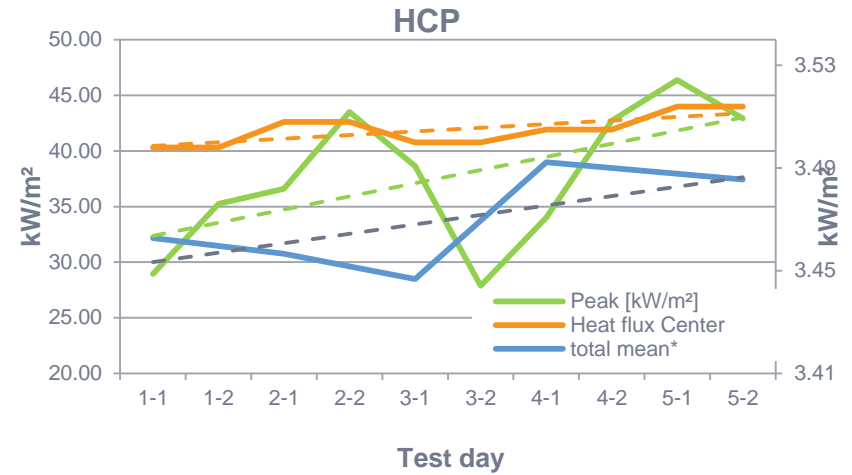
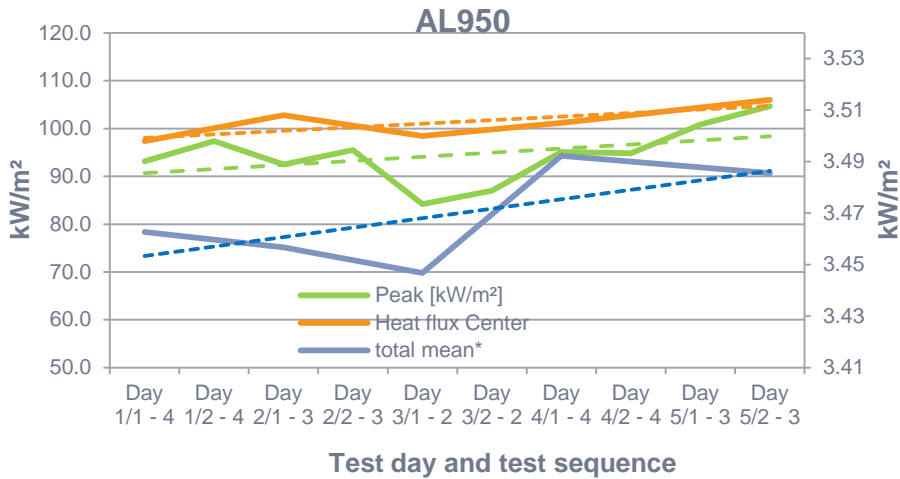
Data analysis



Heat flux versus HR Total



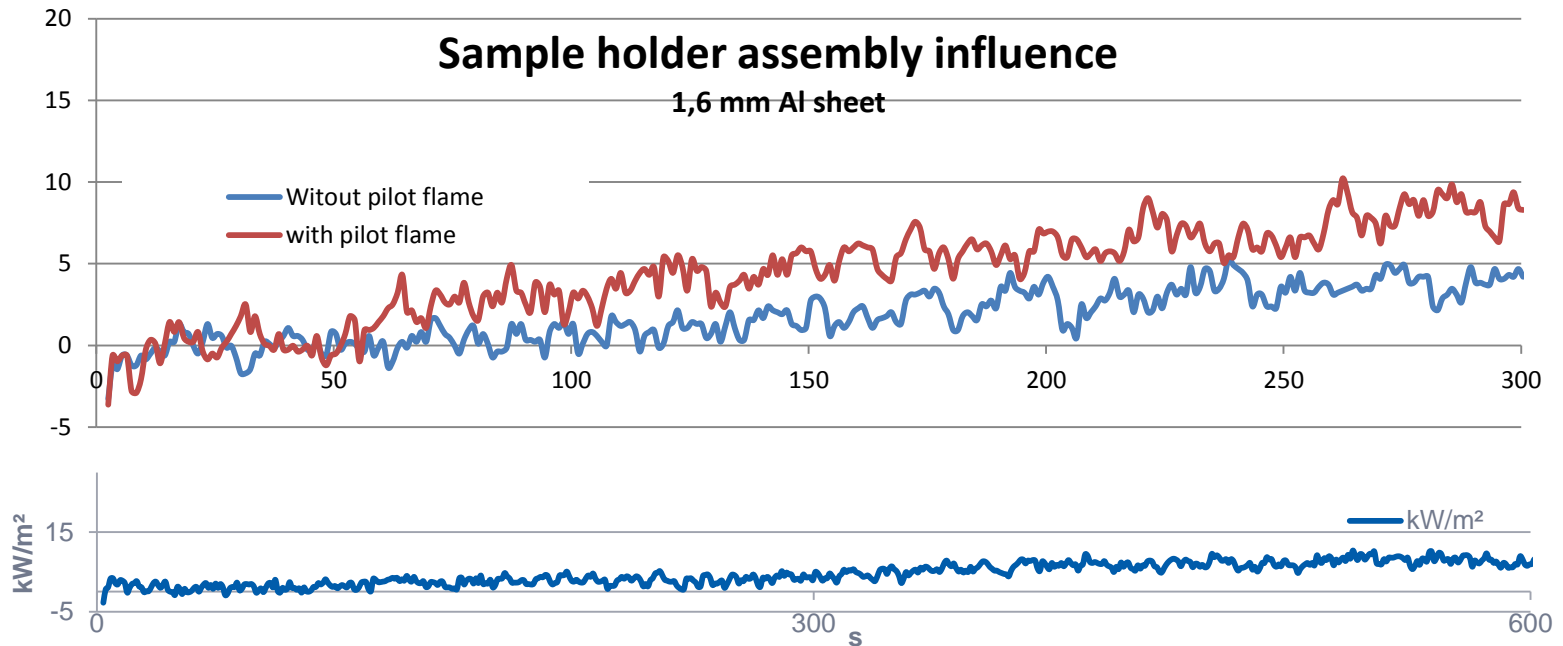
Heat flux versus HRR max - Peak



Old Lady



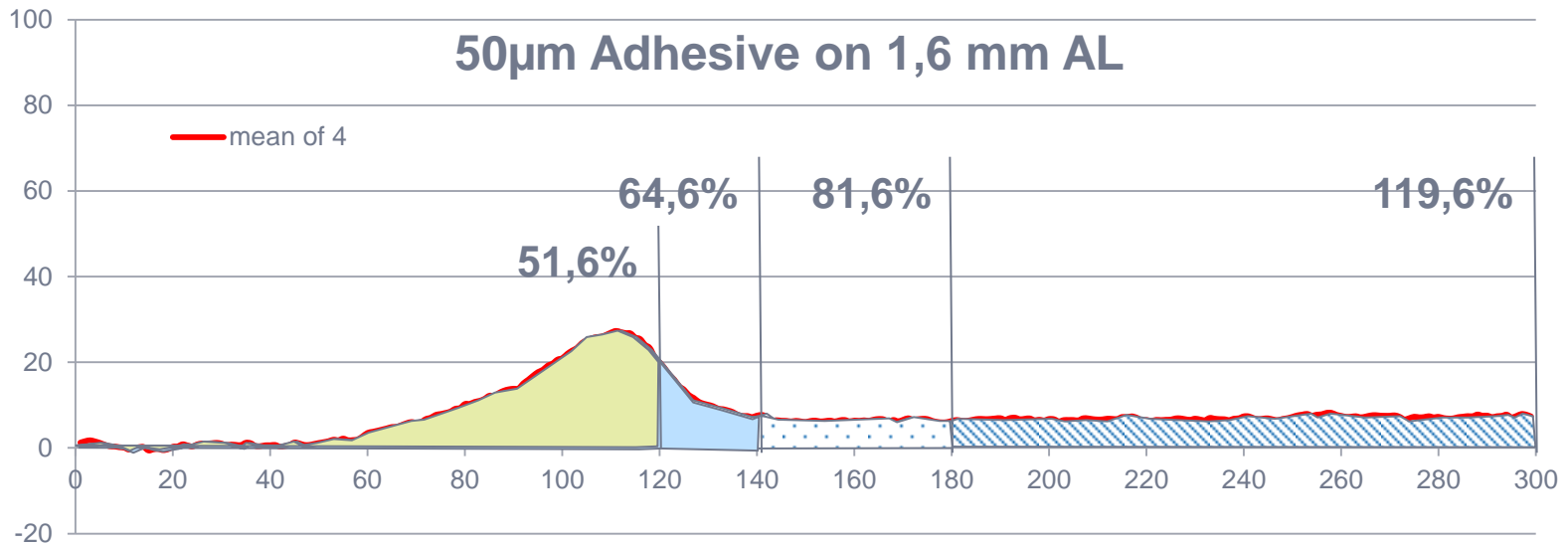
Factors influencing results: Sample holder assembly



The sample holder assembly with an 1,6 mm AL sheet without any organic material, lead to a total heat release rate after

	without pilot flame	with pilot flame
<input type="checkbox"/> 120 s of	2,6 kW*min/m ²	2,4 kW*min/m ²
<input type="checkbox"/> 140 s of	3,5 kW*min/m ²	3,6 kW*min/m ²
<input type="checkbox"/> 180 s of	5 kW*min/m ²	6,7 kW*min/m ²
<input type="checkbox"/> 300 s of	11 kW*min/m ²	22,4 kW*min/m ²

Factors influencing results: Efficiency



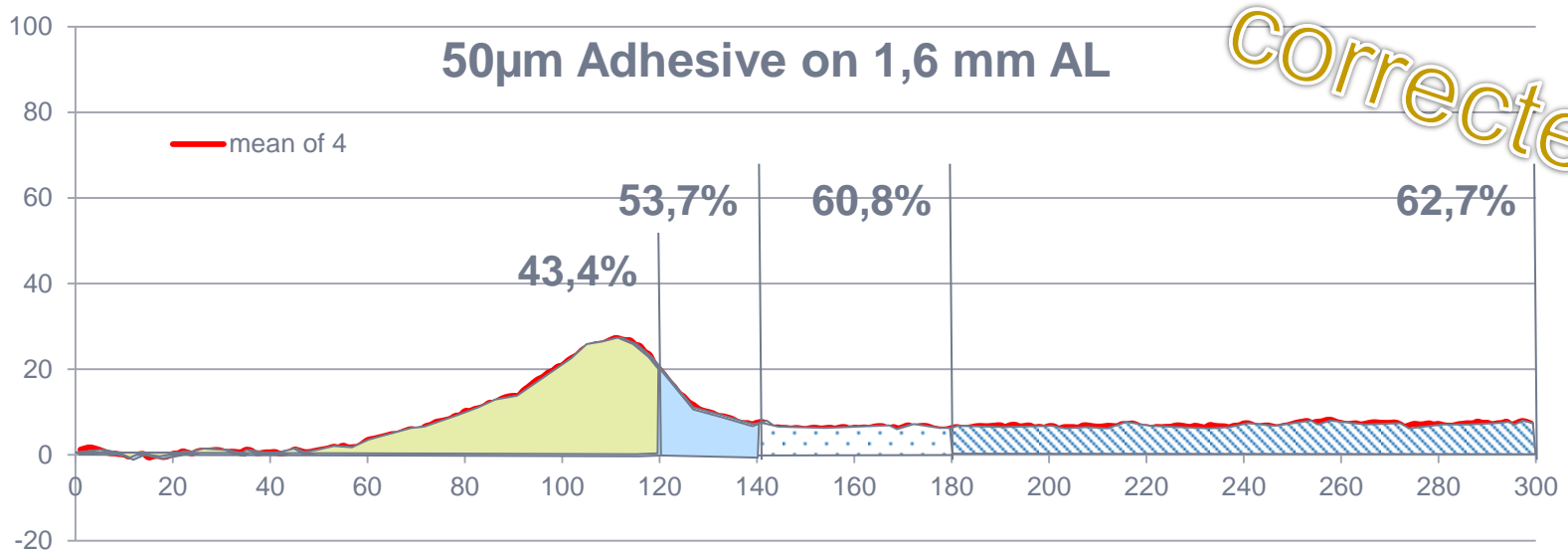
	120 s	140 s	180 min	300 min
	15	20,38	25,42	36,57
	16	19,59	24,06	33,19
	19	23,75	31,47	49,56
	16	18,98	23,46	33,86
Mean	16,50	20,67	26,10	38,29
STADV %	9,09	8,93	12,18	17,31
	51,60%	64,60%	81,60%	119,60%

The adhesive has a combustion heat energy of 33,88MJ/Kg measured in a bomb calorimeter

$$33,88\text{MJ/kg} \Rightarrow 32 \text{ kW} \cdot \text{min/m}^2$$

max possible heat release in OSU

Factors influencing results: Efficiency

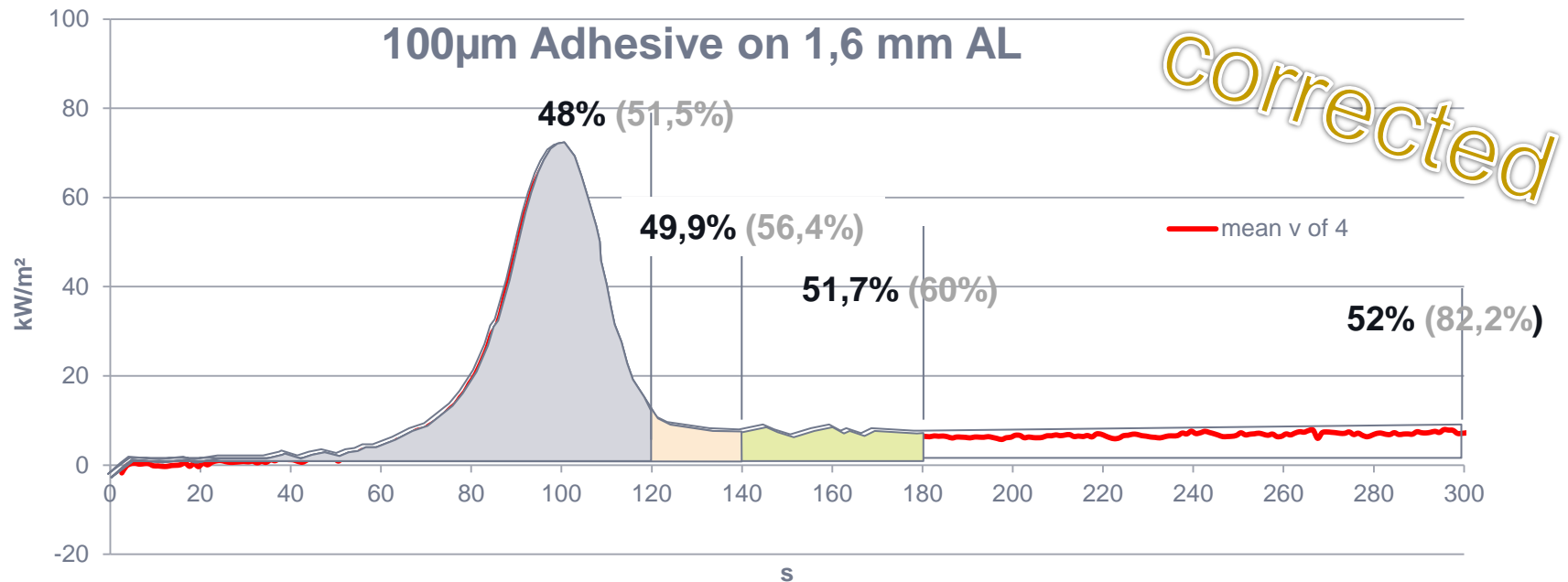


	120 s	140 s	180 min	300 min
	12,40	16,88	18,82	19,00
	13,40	16,09	17,46	18,52
	16,40	20,25	24,77	25,62
	13,40	15,48	16,76	17,06
Mean	13,90	17,18	19,45	20,05
STADV %	10,79	10,73	16,23	16,44
	43,43%	53,68%	60,8%	62,7%

Adhesive => 33,88MJ/kg =>

32 kW*min/m² max heat release in OSU

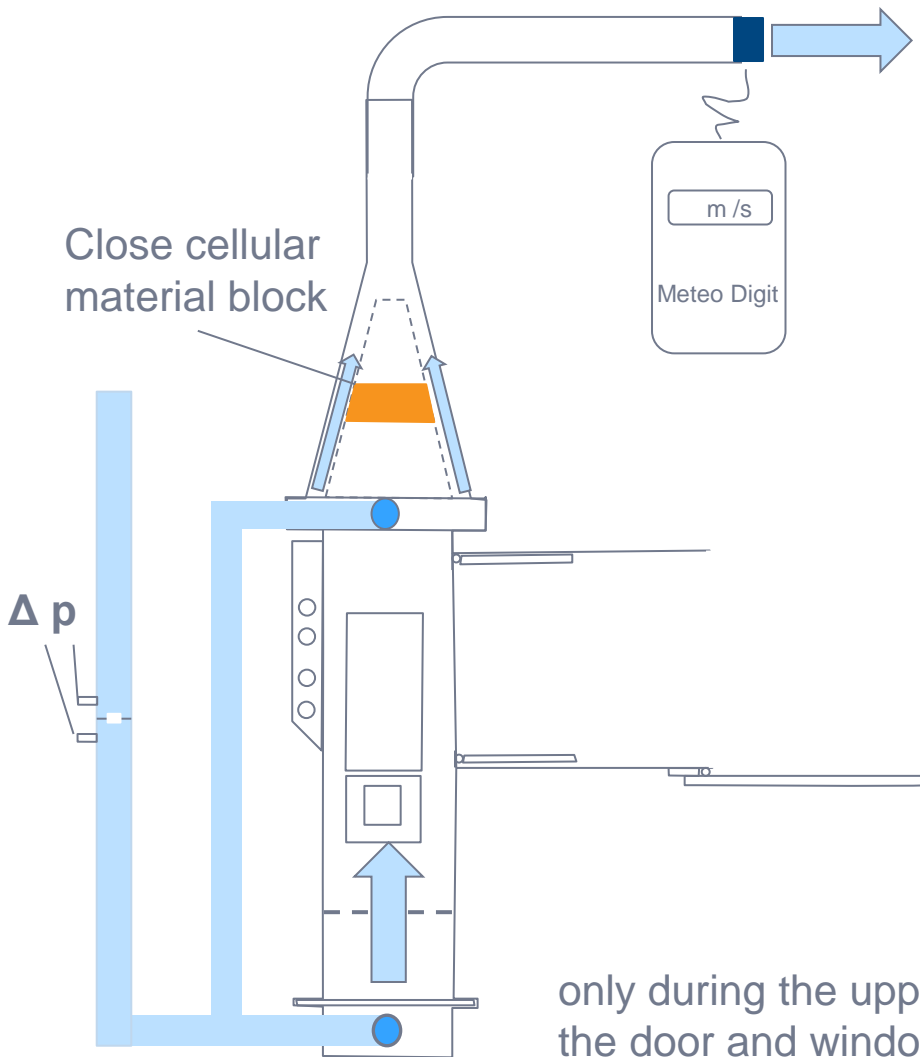
Factors influencing results: Efficiency



Adhesive has a combustion heat energy of 33,88kJ/g

This combustion energy of one layer lead to a theoretical HR within 5 min of
32 kW*min/m²

Factors influencing results: Air-split



Air-split measurement

	Run 1	Run 2	Run 3
	m / s		
total air	6,65	6,25	6,5
upper air	5,2	4,8	5,1
Δp^*	205	191	196

* chamber temp 20°C

Air-split calculation

	Run 1	Run 2	Run 3
	l/s		
total air	43,46	40,52	42,48
upper air	34	31,37	33,33
lower air [l/s]	9,46	9,15	9,14

only during the upper air stream measurement
the door and window shall be open

Factors influencing results: Air-split

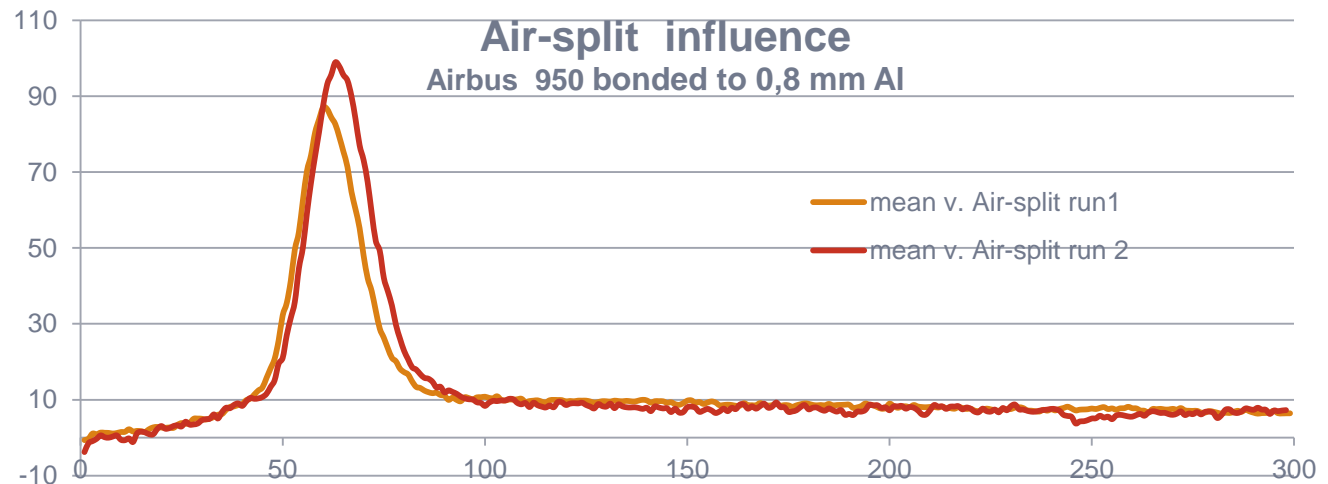
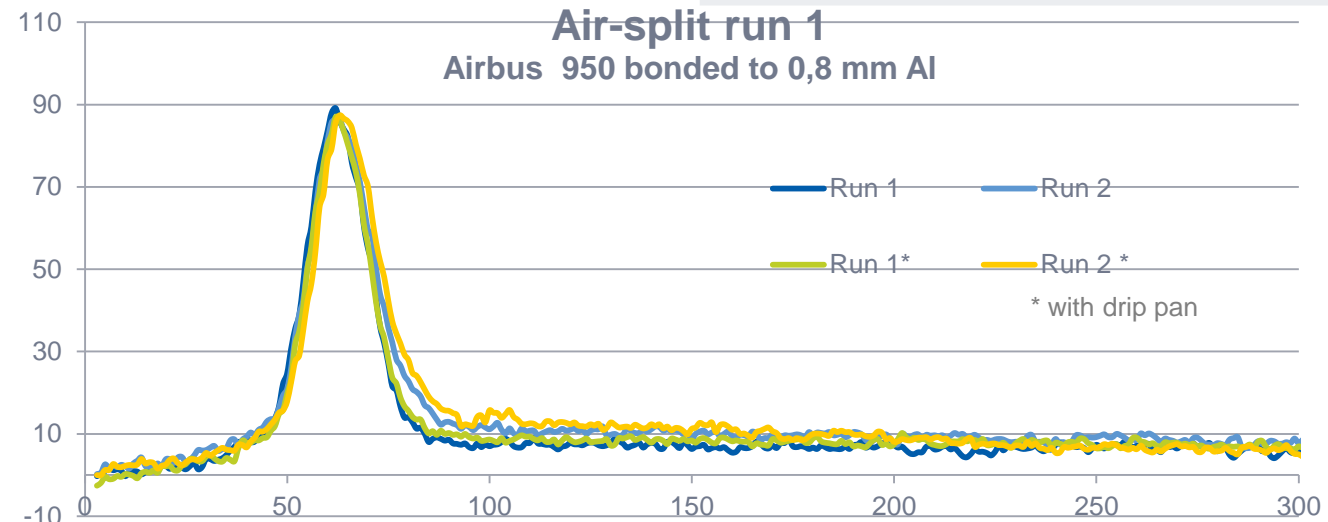
Run 1

total air	43,46
upper air	34
lower air [l/s]	9,46

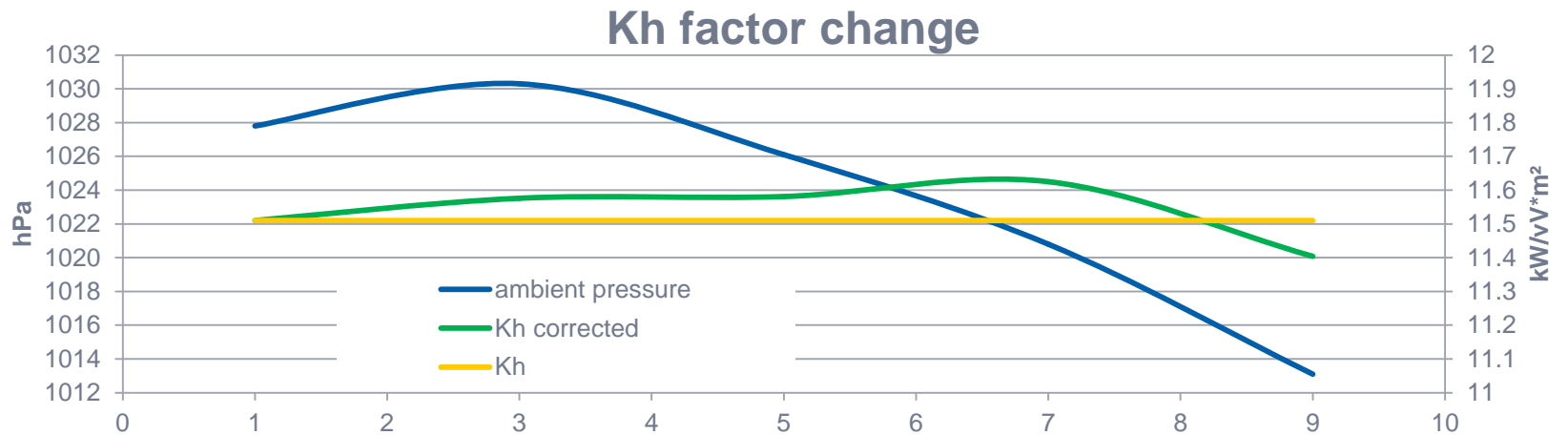
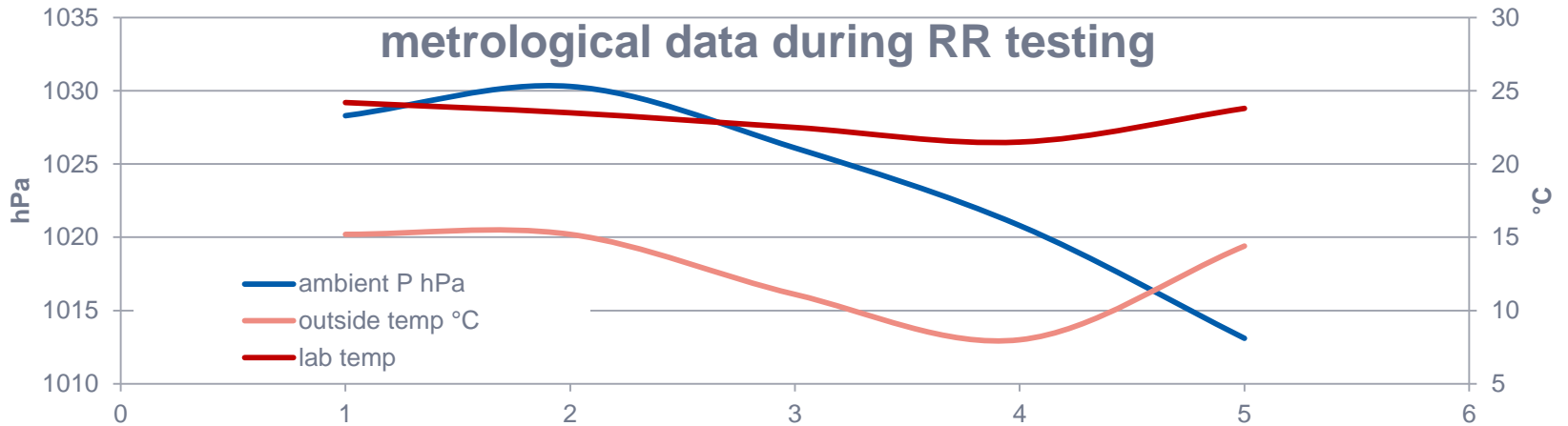
Run 2

total air	40,52 => - 7,2%
upper air	31,37 => - 8,4%
lower air [l/s]	9,15 => - 3,4%

HRRmax => - 14%

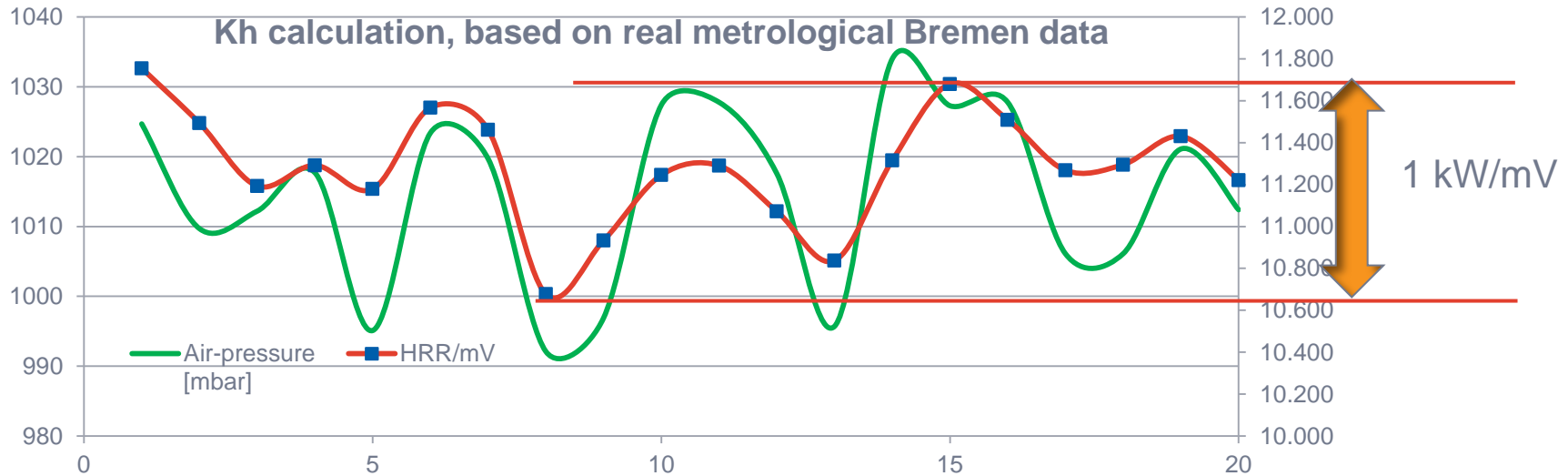


Kh factor: influence of ambient pressure and temperature



Correction of Kh factor lead to only ca. +1kW/ m² for 950AL sample

Kh factor: influence of ambient pressure and temperature



The OSU calibration factor K_h can differ ca. $\pm 2\%$ at $(23 \pm 2) ^\circ\text{C}$ and $(1013,25 \pm 10) \text{ hPa}$

Example:

- $25 ^\circ\text{C}$ and $1003,25 \text{ hPa}$ $\Rightarrow 11,63 \text{ kW/mV}$
- $21 ^\circ\text{C}$ and $1023,25 \text{ hPa}$ $\Rightarrow 11,18 \text{ kW/mV}$

if the worst comes to the worst the HRR_{max} differs up to $\pm 9,4 \%$ *

*Calculation base: $K_h 11,17\text{kW/mV} \pm 0,5\text{kW/mV}$

Proposal

- Only robust, repeatable materials shall be used for RR
- The influence of the air-split should be measured and investigated
- The efficiency factor of each OSU chamber should be established
- Correction factor for kH value based on metrological data should be considered

Conclusion

- As long as the logic of our „Old Ladies“ is not completely known, we should not believe in values generated in a new OSU generation

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