ECOMISE 30M Meeting at Hutchinson

1st Baseline Use case trial

Resin monitoring and Control

Main Contributors
Hutchinson, DLR, Synthesites

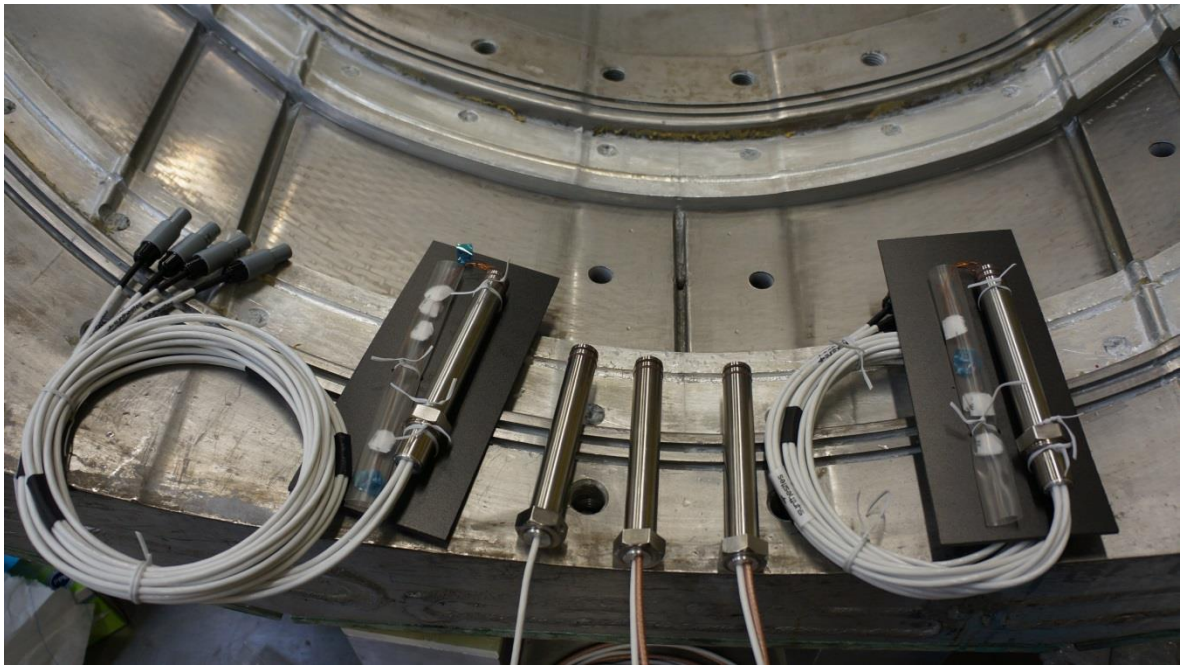
Cure, Flow and Temperature sensors
Durable and embedded sensors

Durable Sensors

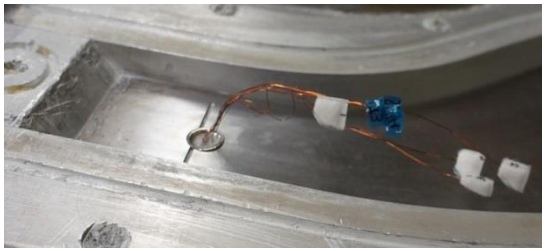
- 2 Cure
- 1 Flow+Temperature

Embedded Sensors

- 8 Flow
- 8Temperature



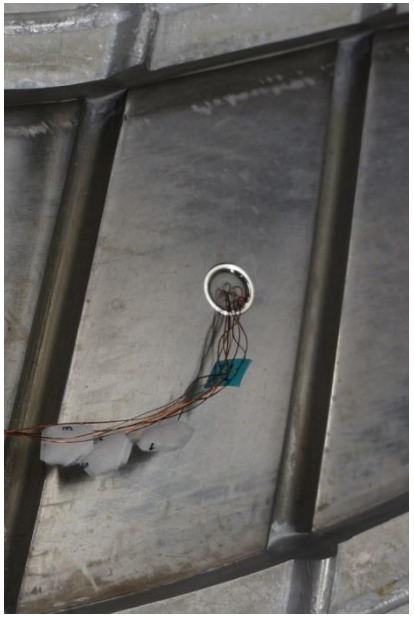
Sensors' Placement in the mould cavity



Embedded sensors (through-thickness)

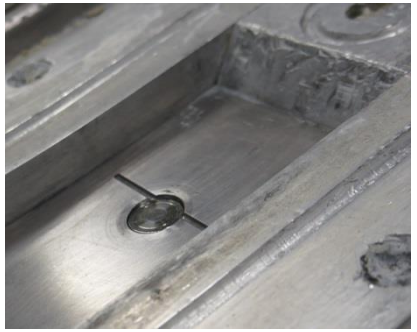
SET2

Flow and cure sensors @ inlet



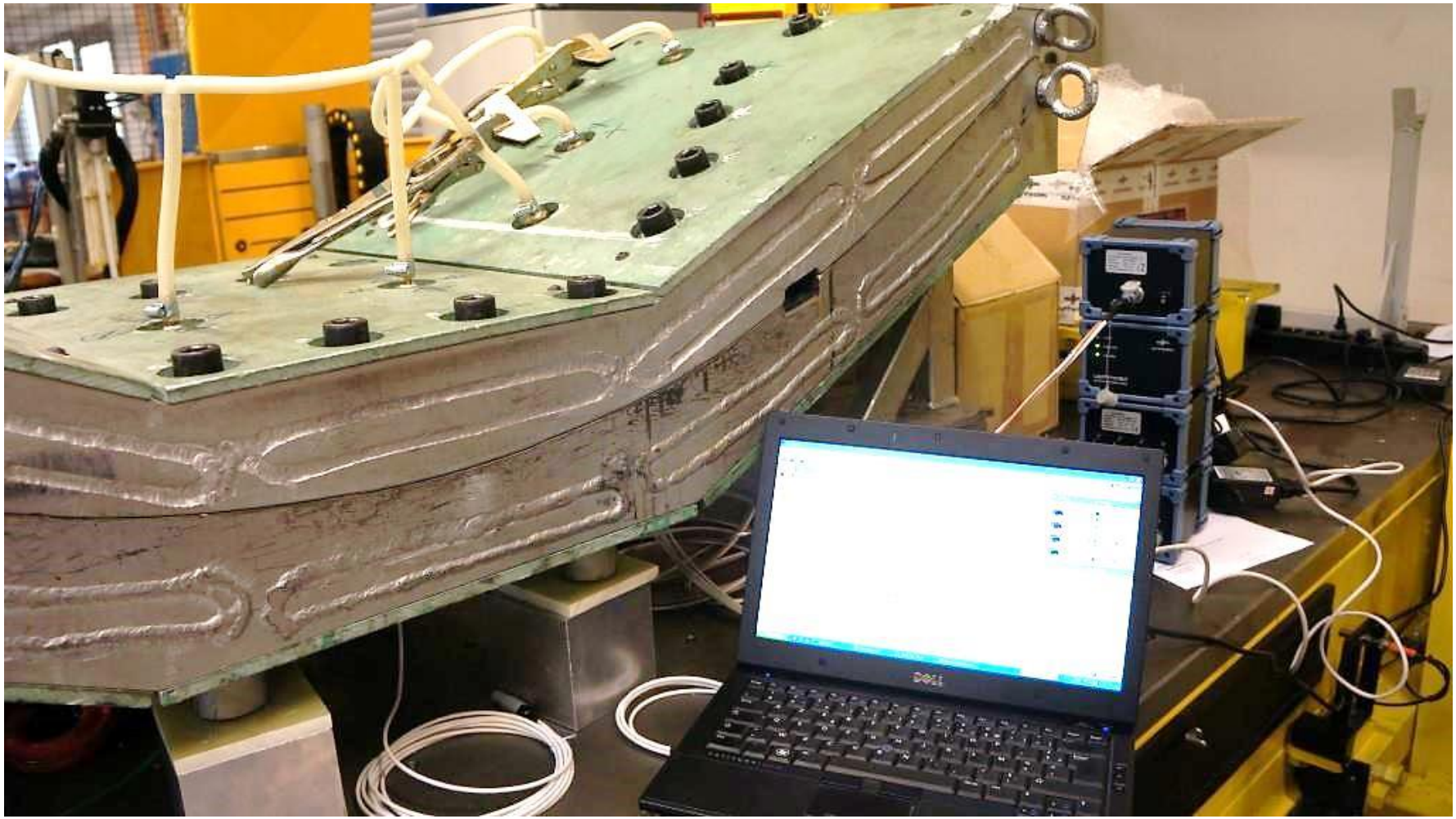
Embedded sensors (through-thickness)

SET1



Cure sensor Nr2

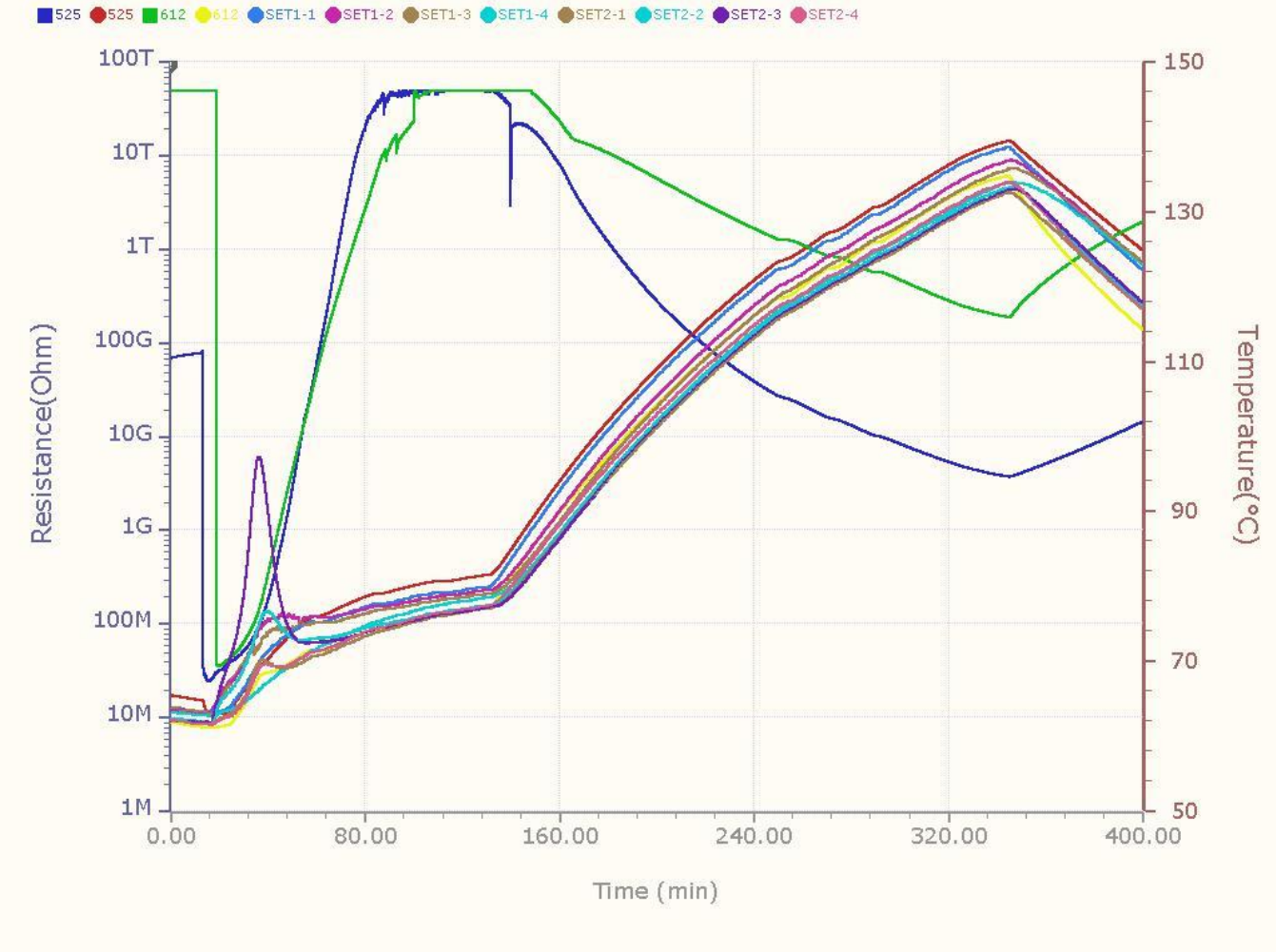
RTM mould and process monitoring systems



Sensors recordings

Notes

- Injection at 60°C and first curing at 80°C
- An optimised cycle was selected to avoid separate post-curing with continuous heating up to 140°C
- Besides the premature sharp exotherm, no significant exotherm was recorded

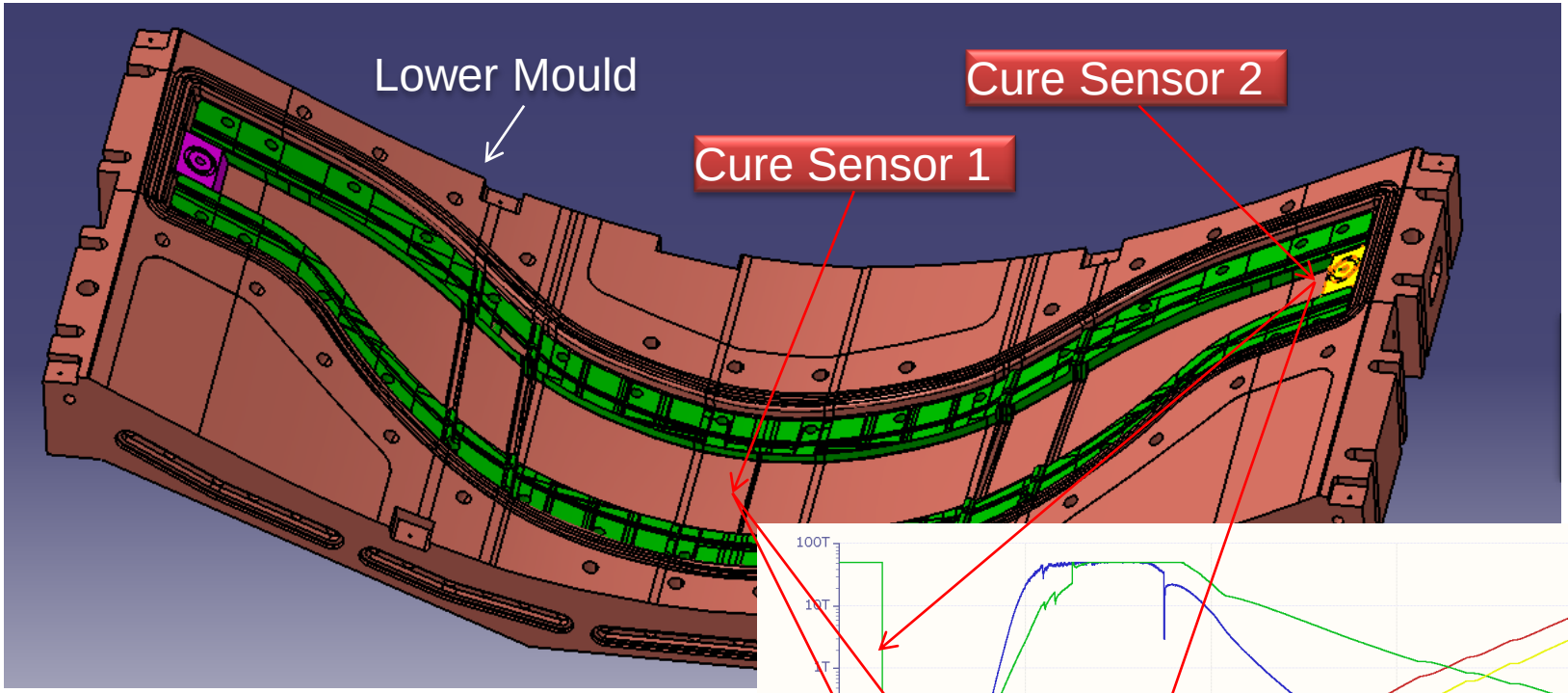


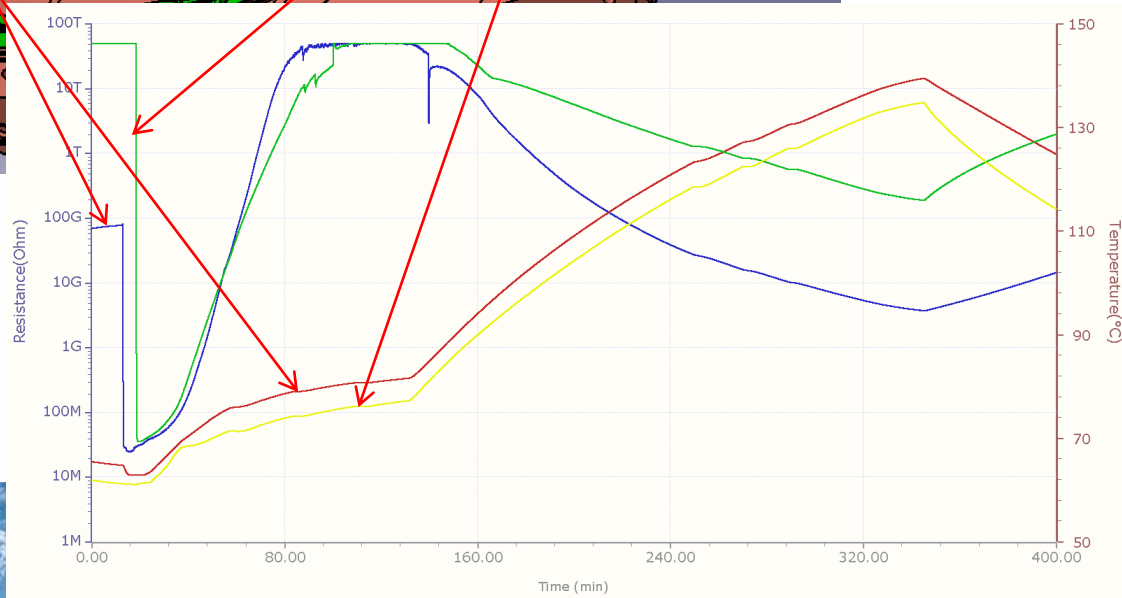
Resin arrival times

Sensor	Injection started @ 729s	Arrival time (s)
C1		54
C2		385
SET1	2	133
SET1	1	202
SET1	4	209
SET1	3	227
SET2	1	275
SET2	2	287
SET2	3	287
SET2	4	439

Cure sensors position

- 2 cure sensors (cure sensor 1 close to injection point)





Temperature sensors for validation

- 8 pt100 connected to 2 Optiflow systems

Through-thickness

B-B SET2

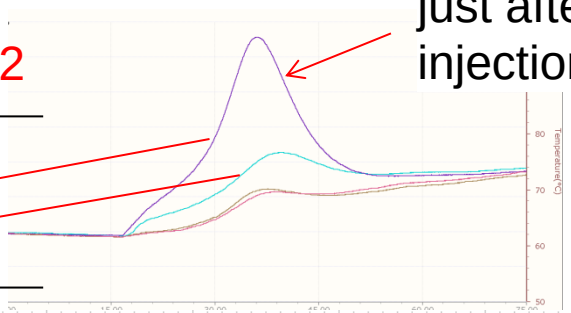
T4

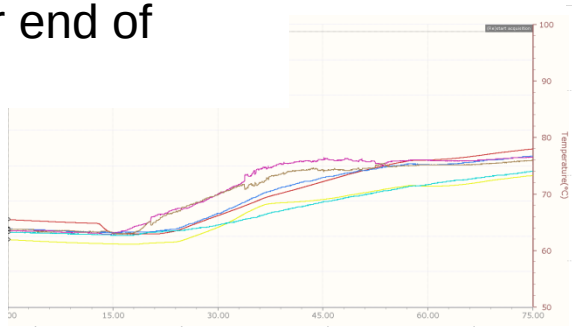
T3

T2

T1

Premature exotherm just after end of injection





Through-thickness

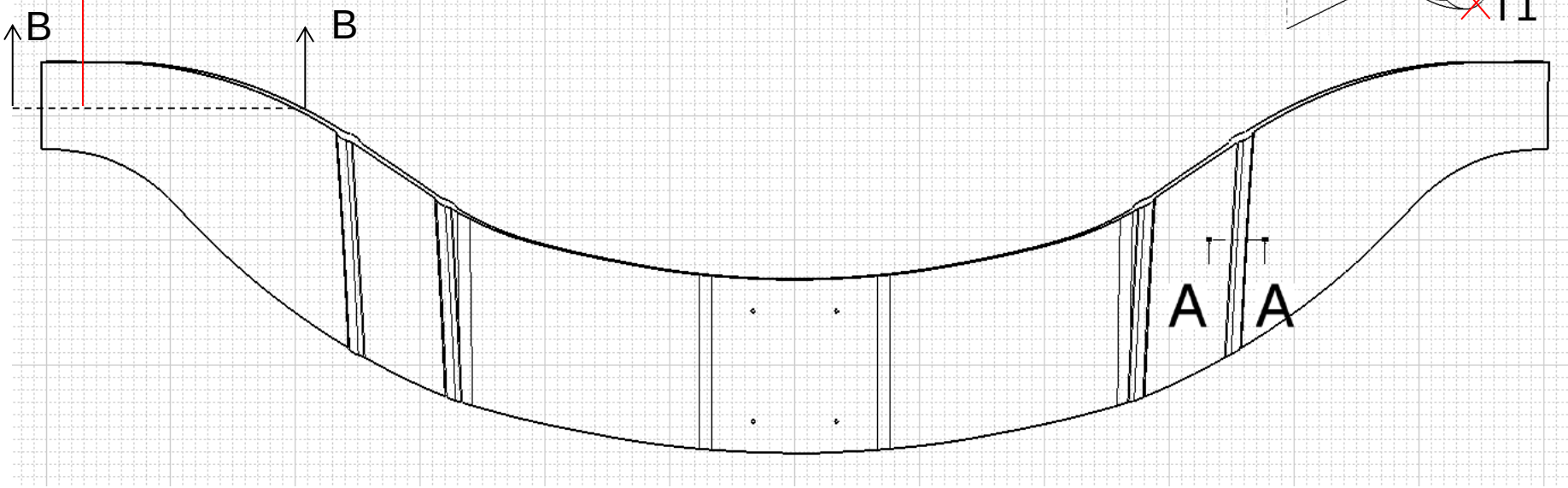
A-A SET1

T4

T3

T2

T1



Flow sensors for validation

- 8 Resin Arrival (Flowire) connected to 2 Optiflow systems

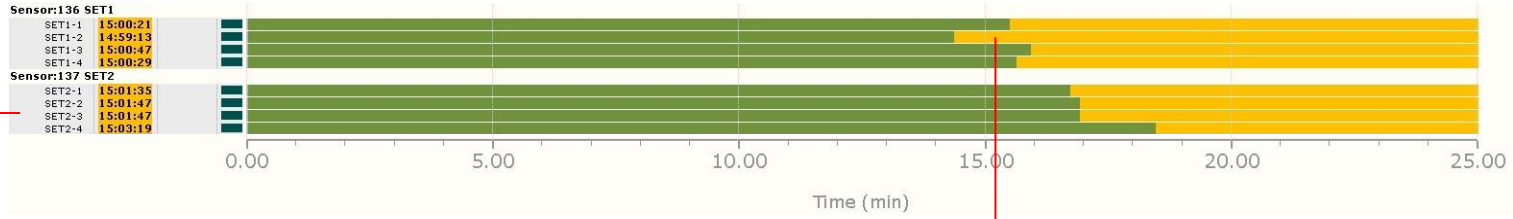
Through-thickness

B-B SET2

F4
F3
F2
F1

Flow

Resin arrival time stamps



B B

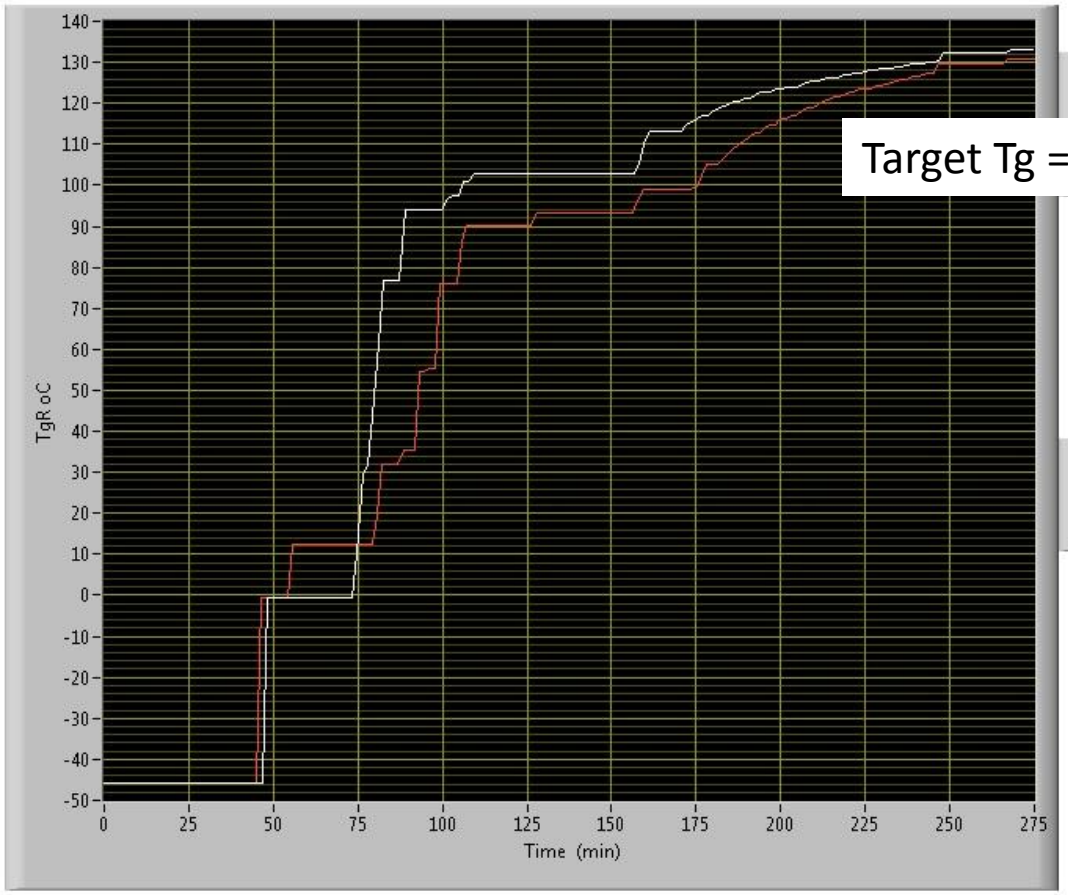
Through-thickness

SET1
On the surface tool

F4
F3
F1
F2
A A

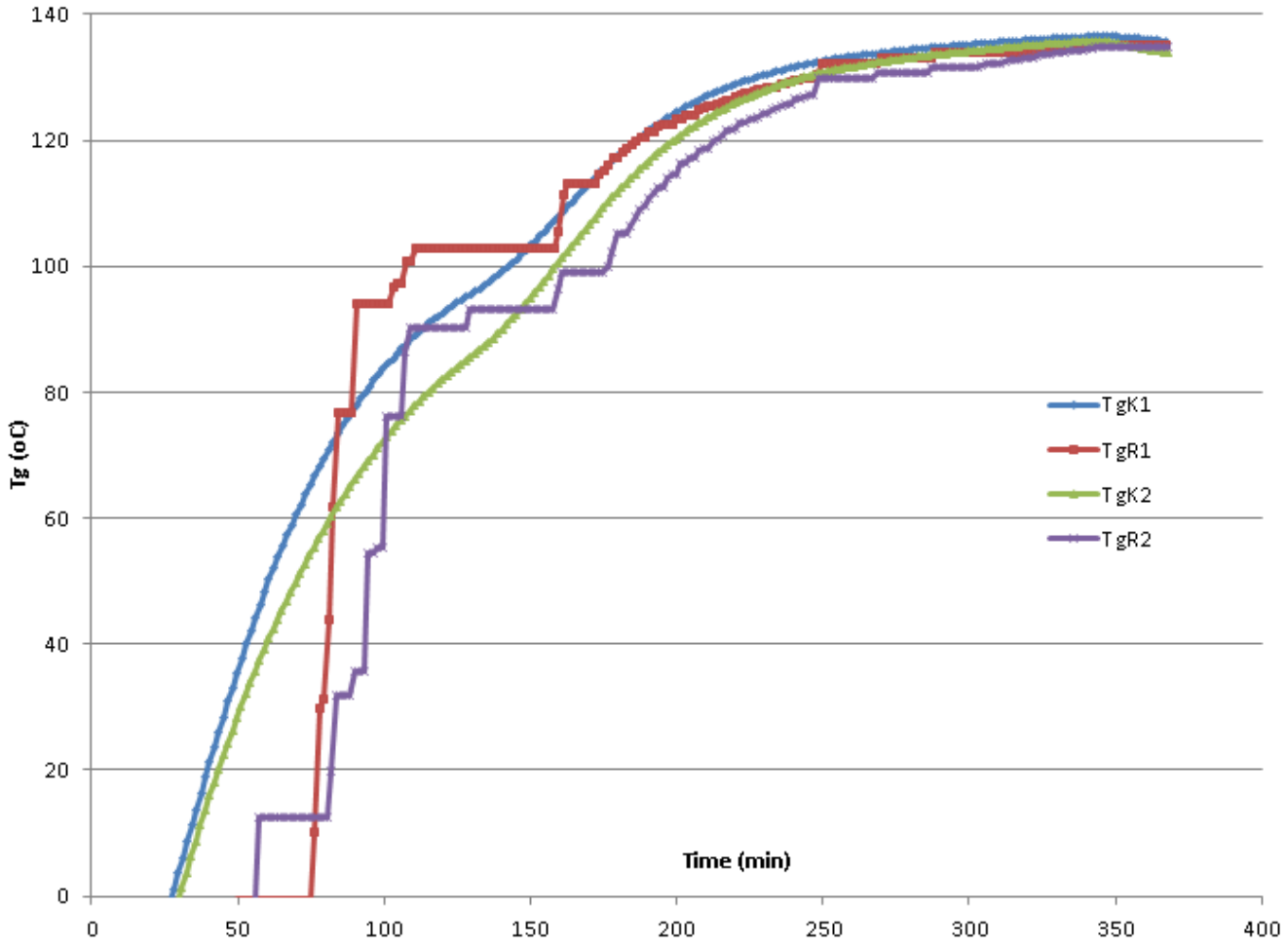
Flow

Intelligent monitoring and control



Real-time Tg calculation and demoulding decision based on targeted Tg (target Tg = 130°C)

Tg-calculation



For the 2 cure sensors

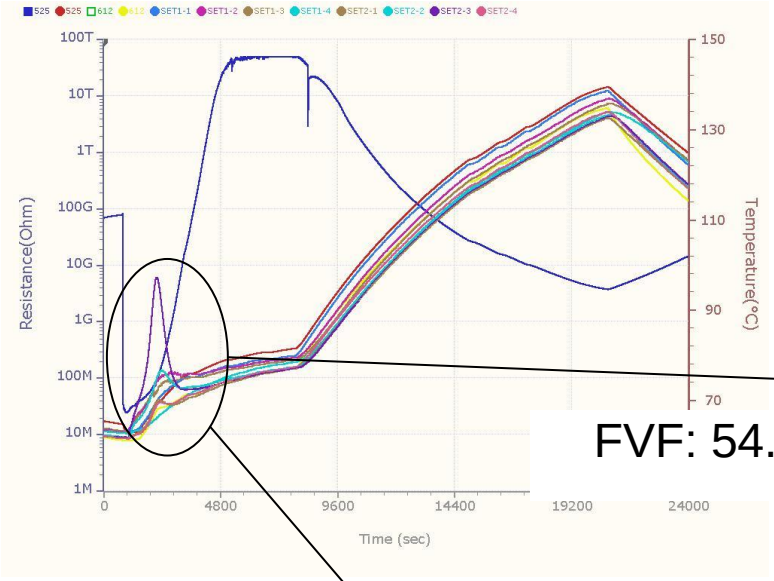
- TgK1, TgK2

Tg prediction based on kinetic model and measured temperature

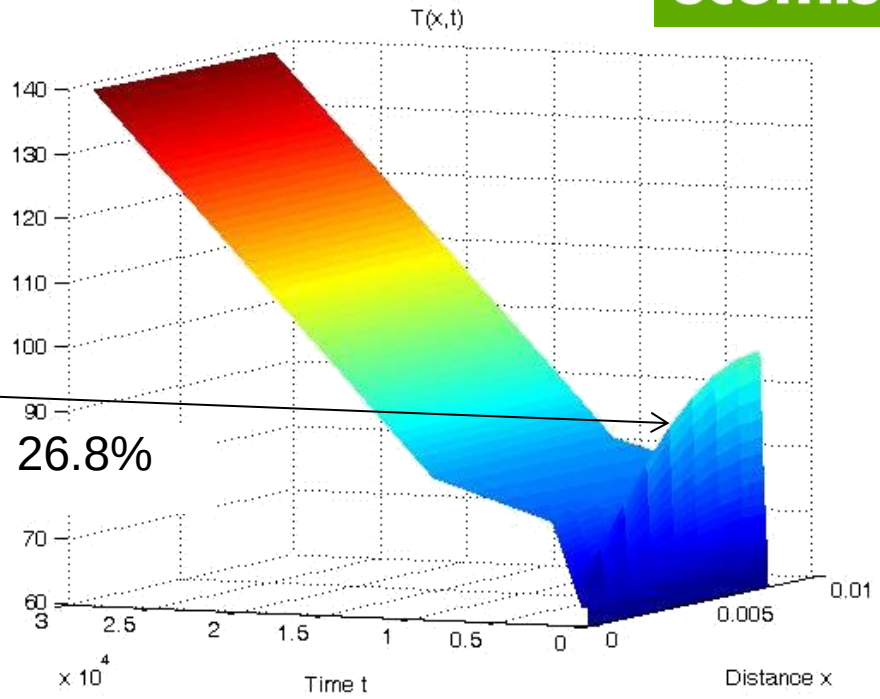
- TgR1, TgR2

Tg prediction based on measured resistance and temperature

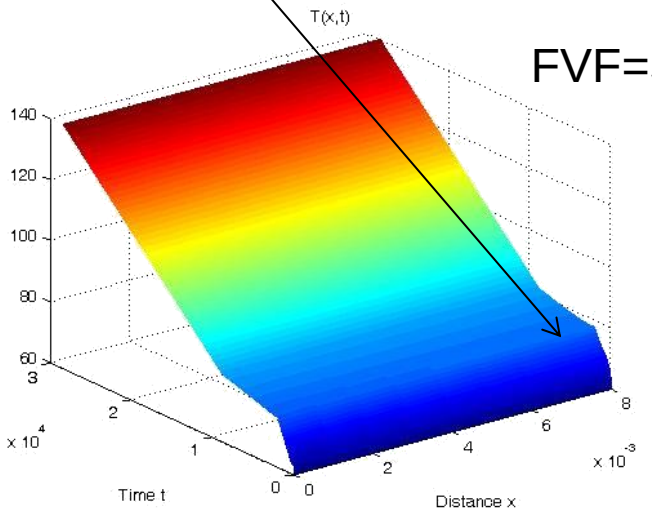
Premature exotherm investigation



FVF: 54.8% → 26.8%



FVF=54.8%



FVF=26.8%

It seems that the pre-mature exotherm was due to the high resin content locally.

The research leading to these results has received funding from European Community's FP7-2013-NMP-ICT-FoF (ECOMISE)