

## **EVENT: Digital Technologies for Manufacturing Innovation: Embracing Industry 4.0**

*Selected outcomes and achievements:*

### **Innovate UK Research Project**

### **“Thermally Treated Recycled Glass Abrasive Tools”**

Ref.: TSB-101275

Duration: 1<sup>st</sup> July 2013 - 30<sup>th</sup> June 2015 (extended 30<sup>th</sup> September 2015)

Prof. M Morgan



## PROJECT CONSORTIUM



VIBRAGLAZ (UK) LTD



MANUFACTURING TECHNOLOGY CENTRE



FINISHING TECHNIQUES LTD



POTTERS- BALLOTINI LTD



GLASS TECHNOLOGY SERVICES LTD



ROLLS-ROYCE



dream plan achieve

## PROJECT AIM



***“TO ESTABLISH A UK CAPABILITY FOR HIGH VOLUME PRODUCTION OF THERMALLY TREATED RECYCLED GLASS ABRASIVE MEDIA WITH DEFINED QUALITY AND INTEGRITY”***

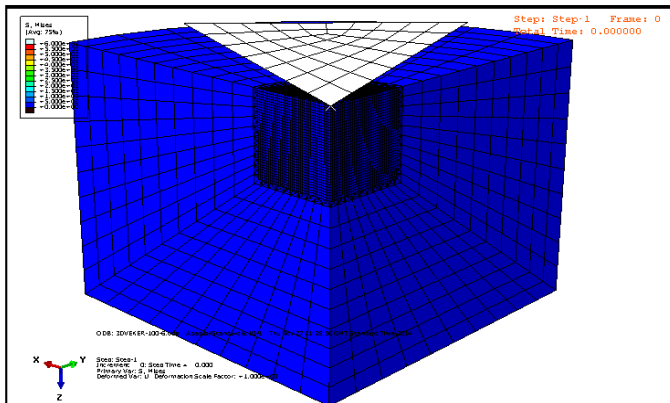
### ***Selected Objectives:***

- To characterise the recycled glass media range with respect to surface topography, mechanical properties and crystallographic structure
- To determine optimal manufacturing process parameters for delivery of media with defined capability and performance
- To establish a framework for [i] process control and [ii] flow simulation to aid evaluation of media performance in allied processes (eg. Drag finishing)

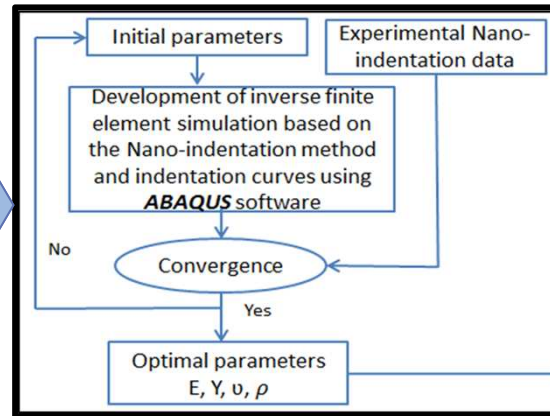
***Further.....aerospace accreditation***

**PROJECT OUTLINE**

**FEM1 – Parameter extraction**

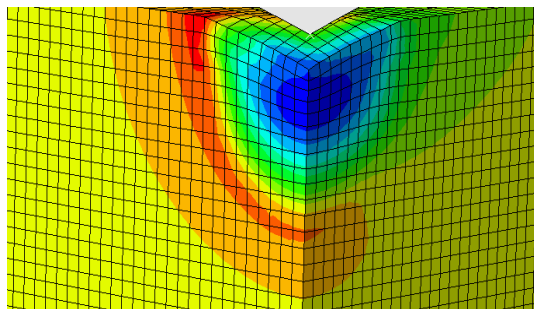


FEM Simulation –Vickers indenter contact

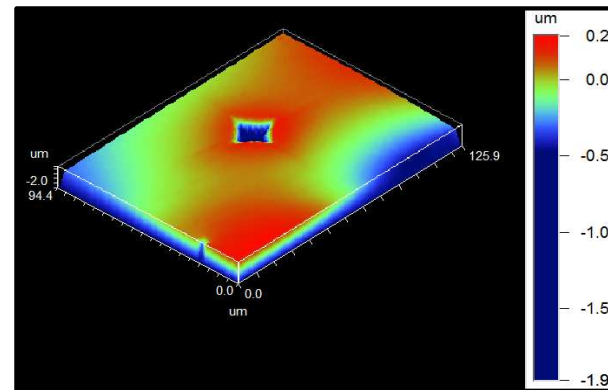


Methodology Flowchart

**FEM2 – Fracture toughness determination**



Indentation stress field (median and radial cracks)

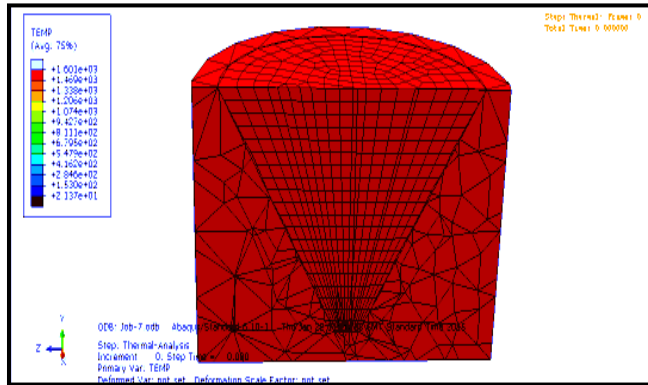


Indentation stress field (Experimental)

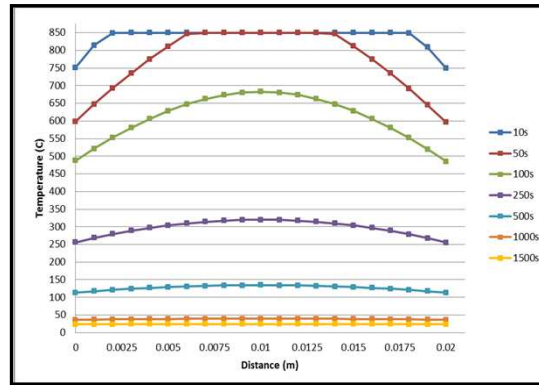
NEW MODEL

# PROJECT OUTLINE

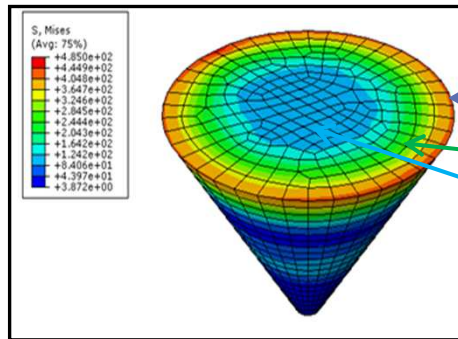
## Thermal Numerical Analyses



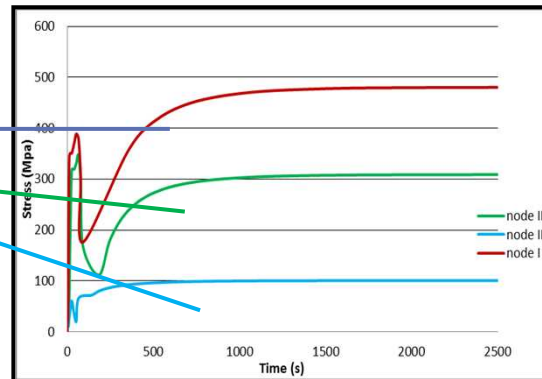
FEM simulation of heat treatment cycle



Temperature distribution with time



Residual stress results



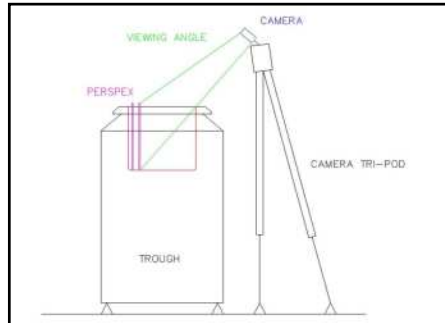
Stress change with time at different nodes

PRODUCTION  
QUALITY / CONTROL

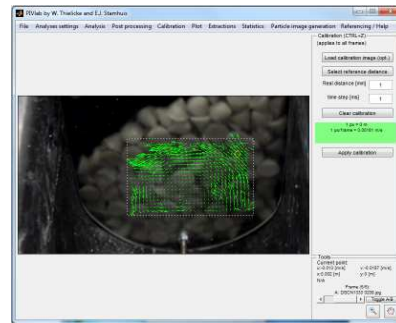
# PROJECT OUTLINE

## Flow Simulation

### PARTICLE TRACKING VELOCIMETRY

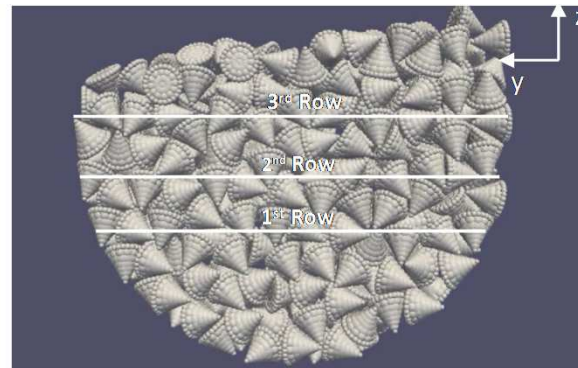
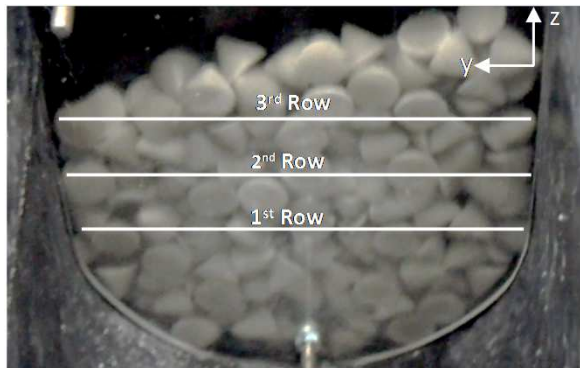


Recording Procedure



GUI PIVlab image processing

### DISCRETE ELEMENT MODELLING

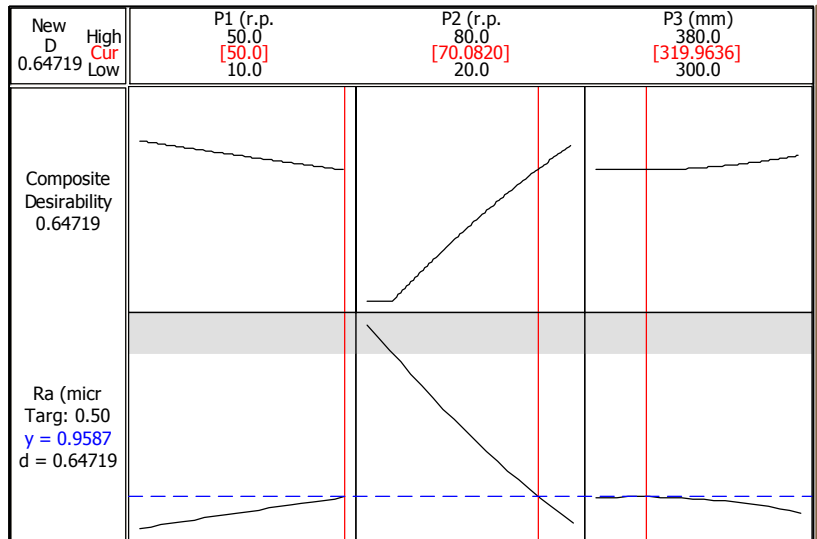
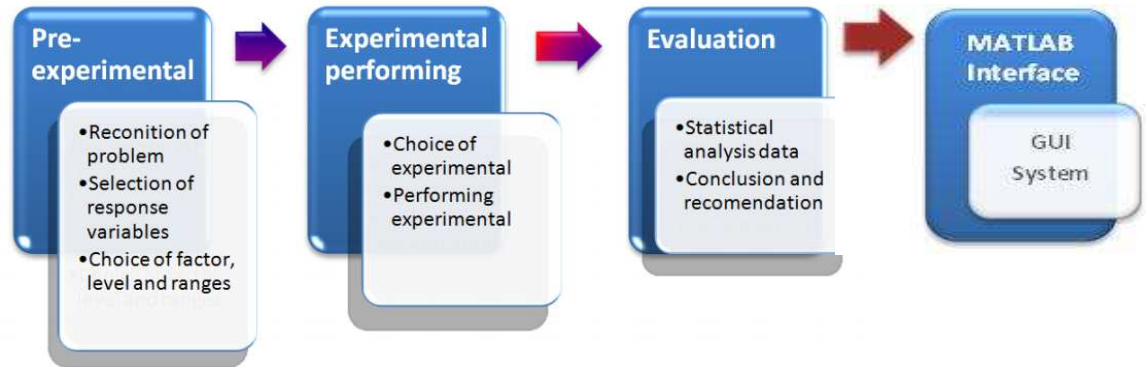


DEM images of bulk expansion and velocity distribution at different locations

WIDE GENERIC APPLICATION

# PROJECT OUTLINE

## Process Optimisation System



Optimum selection of production conditions: contributes to

- increase in productivity
- reduction of costs
- reduced output variability and closer quality conformity.

The proposed new system enables such benefits to be secured without significant development time and at a marginal cost in a robust and highly scientific manner.

Optimization System Tool



VIBRAGLAZ EQUIPPING FACILITY FOR PRODUCTION WITH JOINT VENTURE SUPPORT

- Production plant VR evaluation in-progress jointly with MTC
- Potential for automation to be evaluated (based on rheology and flowability data)



PROMOTED NEW INITIATIVE: MTC@LJMU - LAUNCHED OCTOBER 2015.  
PORTFOLIO OF MTC@LJMU PROJECTS (inc.):

- New glass abrasive tools (**MTC – CRP**)
- Process Optimisation system [**Innovate UK project**]
- Modelling & Simulation for fluidised granular flows (**Joint PhD**)
- New challenges to super-finishing (eg. AM applications)



ACADEMIC OUTPUTS

- Completions - PhD; 3.MSc; Technical pubs;
- Further PhD projects: Modelling & Simulation; Mould technologies



EPSRC PROJECT SUBMISSION: PROCESS DESIGN FOR NEXT-GENERATION MASS FINISHING TECHNOLOGIES



INNOVATE UK PROJECT (SMART): AE MONITORING



	Prof M Morgan LJMU	Mr S Vaughan Vibraglaz	Dr M Jamal MTC
E	<a href="mailto:m.n.morgan@ljmu.ac.uk">m.n.morgan@ljmu.ac.uk</a>	<a href="mailto:steve@vibraglaz.co.uk">steve@vibraglaz.co.uk</a>	<a href="mailto:mikdam.jamal@the-mtc.org">mikdam.jamal@the-mtc.org</a>
T	+44 (0) 151 231 2590	+44 (0) 153 565 2939	+44 (0) 151 231 2388
M	+447927413499	+447714019682	+447702127405

**Thank You**