



# EASI-STRESS - EUROPEAN ACTIVITY FOR STANDARDISATION OF INDUSTRIAL RESIDUAL STRESS CHARACTERISATION

Mar 16, 2021 – OntoTrans

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This project has received funding from  
the European Union's Horizon 2020 research  
and innovation programme under grant  
agreement No 953219.





Residual stresses influence many properties of a component, such as e.g.

- strength,
- fatigue behaviour,
- corrosion resistance.



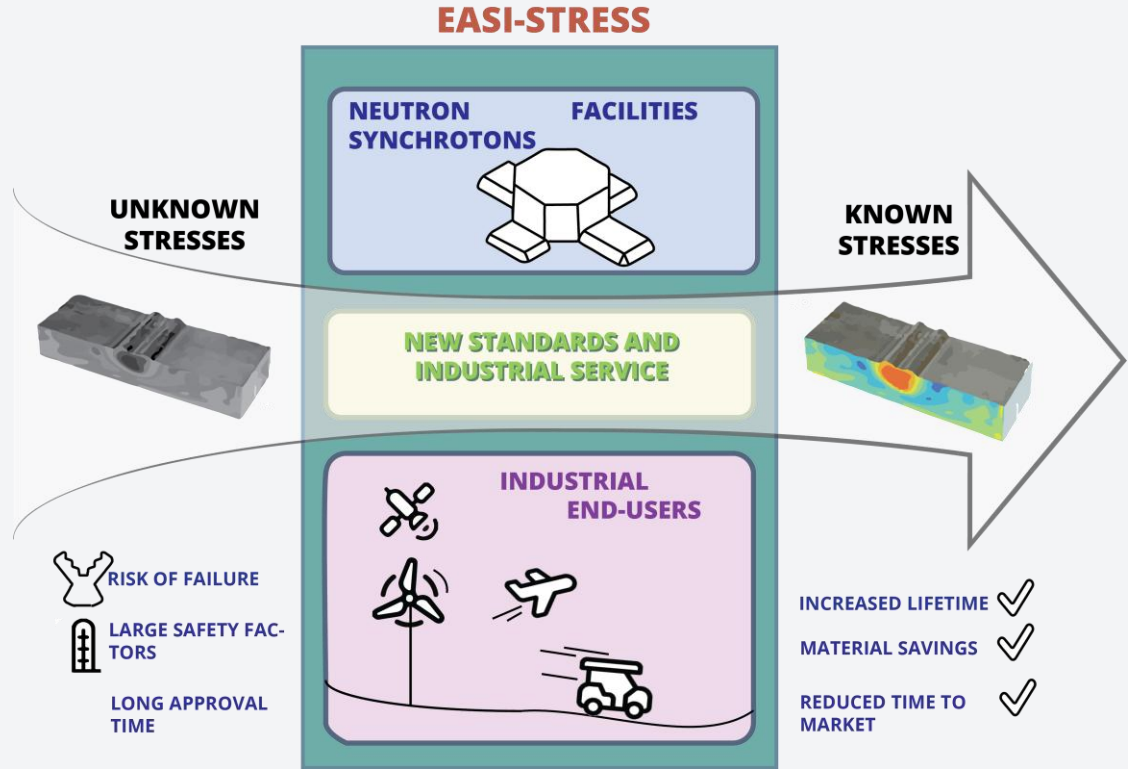
gifak-net



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# EASI-STRESS: PROJECT GOALS

- Start date: Jan 1st, 2021
- Duration: 36 months
- Budget: EUR 4.5 million



# EASI-STRESS: CONSORTIUM

RTOs and  
Universities



**DANISH  
TECHNOLOGICAL  
INSTITUTE**  
(Coordinator)



Advanced Research Facilities



Centre for  
Energy Research

Standardisation  
Body



Industry



Rolls Royce PLC





# EASI-STRESS: CONSORTIUM

RTOs and  
Universities

**MANCHESTER**  
1824

The University of Manchester

Standardisation  
Body



DANSK STANDARD



Research Facilities



Centre for  
Energy Research



**SIEMENS Gamesa**  
RENEWABLE ENERGY

# MEASURING RESIDUAL STRESSES IN METALS

## Choosing the right method

### Destructive or non-destructive?

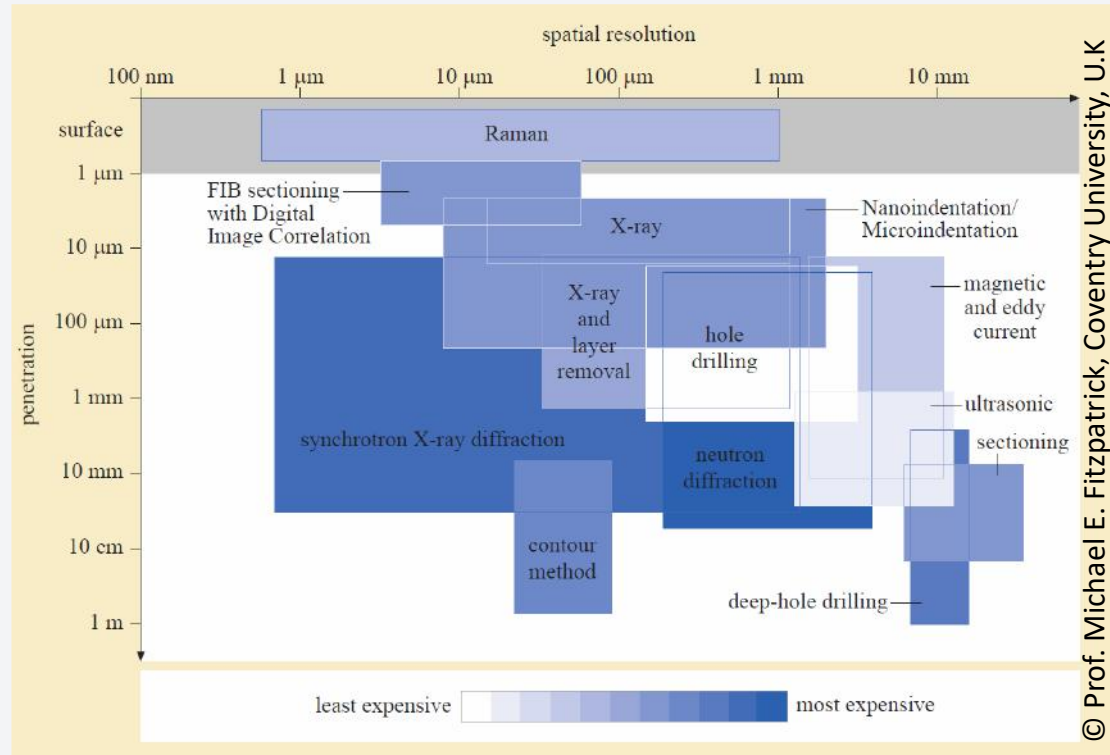
- Diffraction
- Mechanical

### Relevant geometry?

- Resolution
- Gauge depth
- Number of stress orientations

### Delivery?

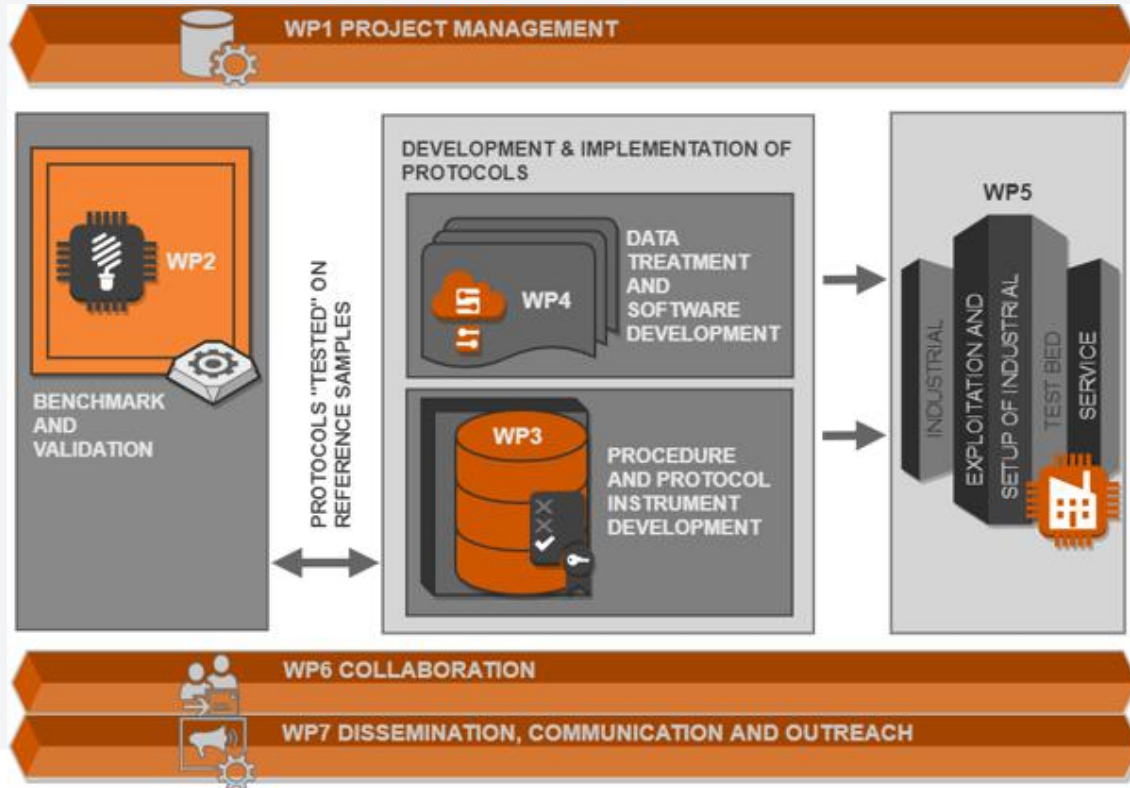
- Measurement time
- Cost
- Expertise/consultancy
- Material handling



© Prof. Michael E. Fitzpatrick, Coventry University, U.K



# EASI-STRESS: PROJECT STRUCTURE



Industry specifies output (WP5)

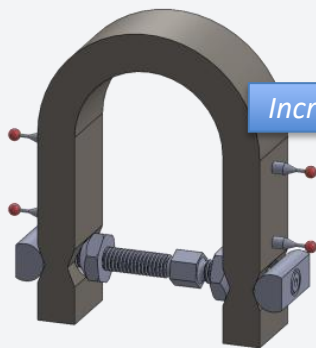
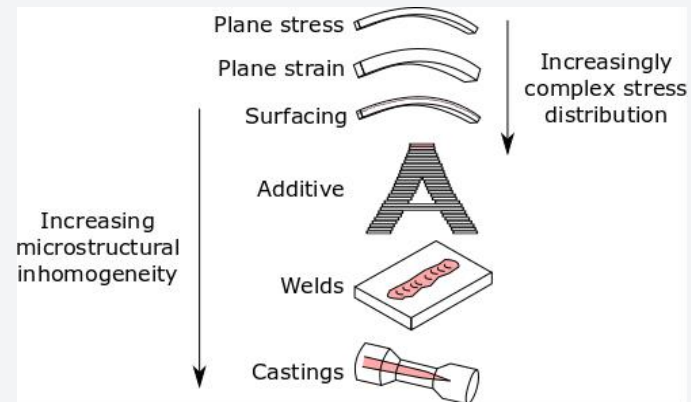
Language barriers and ontologies

Facilities develop methods (WP3-4)

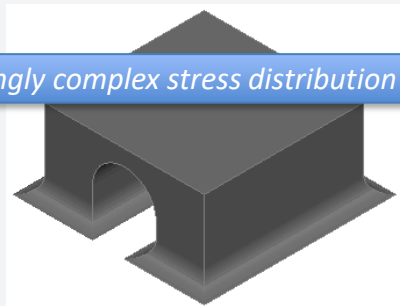
# BENCHMARK SAMPLES

Reference samples defined:

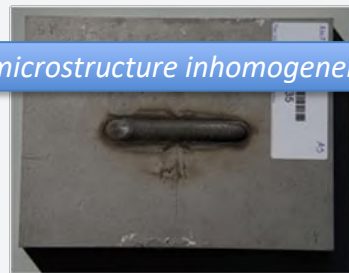
- Benchmark different techniques (round robin samples)
- Illuminate range of challenges
- Validate applicability for standards



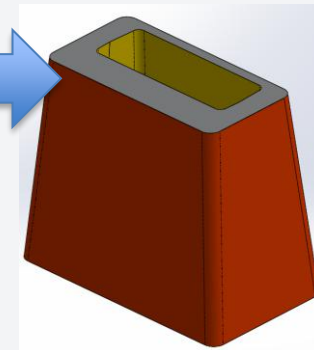
U-flexures/ U-bends  
(S355 stainless steel)



Additively manufactured  
arches (316 steel)



Inconel GTAW welded  
plates (*NeT* project)



Cast wedge (AlSiMg)

*Increasingly complex stress distribution and microstructure inhomogeneity*

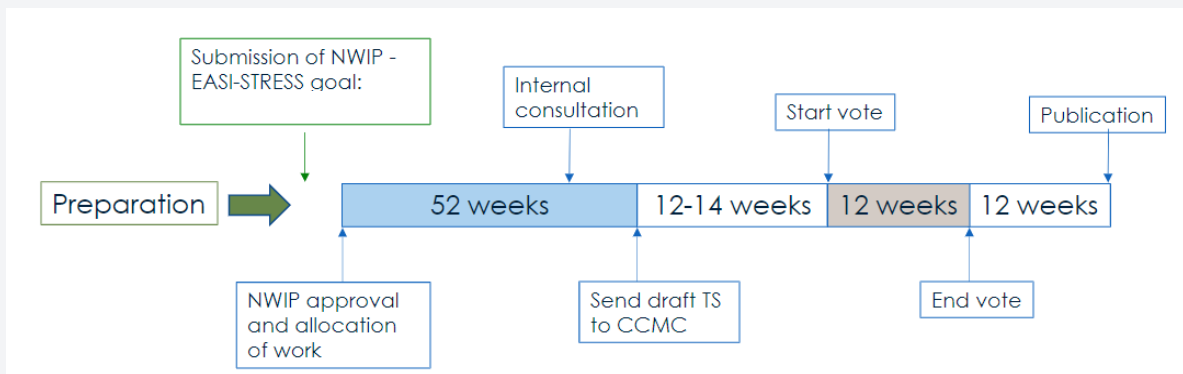


# EASI-STRESS: STANDARDISATION EFFORT

EASI-STRESS will develop and implement protocols/good practice guides for neutron and synchrotron x-ray stress measurement, e.g.:

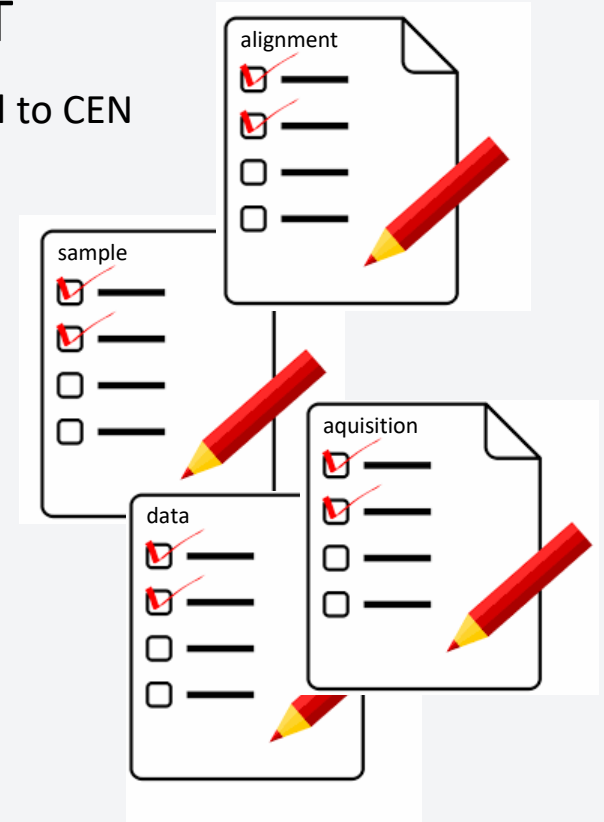
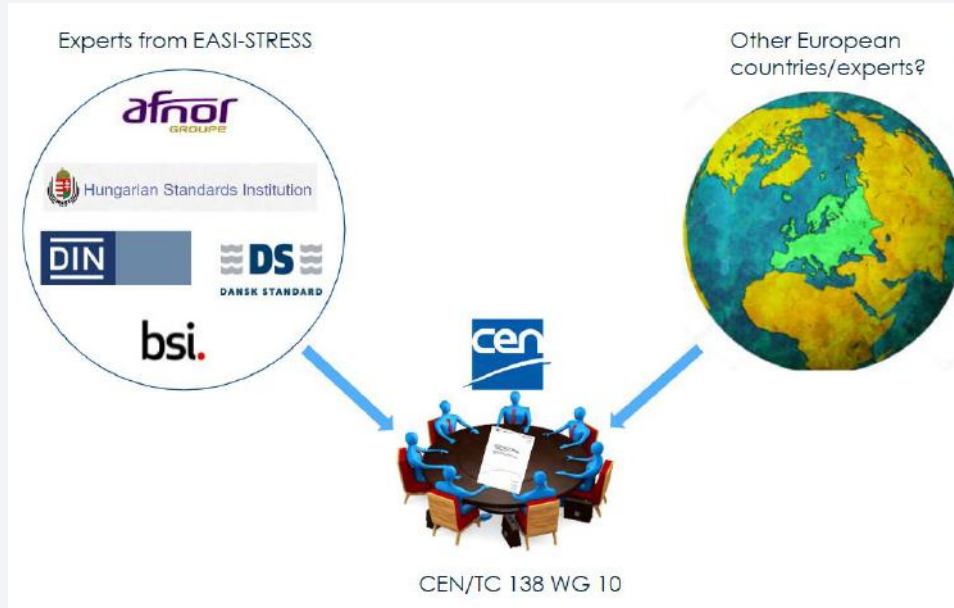
- Calibration procedure and reference samples
- Definition of sample preparation
- Homogenise data acquisition
- Guidelines for data reduction and analysis

Standards are  
the language  
of industry



# EASI-STRESS: STANDARDISATION EFFORT

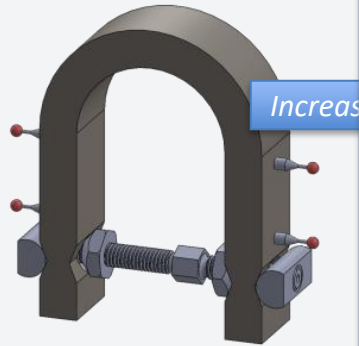
May 2022: EASI-STRESS will submit New Work Item Proposal to CEN WG10 on diffraction in TC 138 (Non-Destructive Testing)



# BENCHMARK SAMPLES

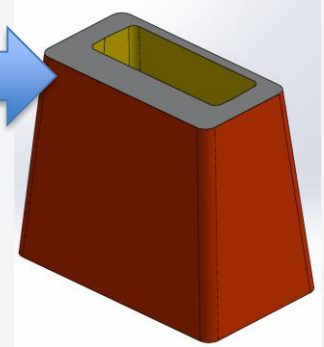
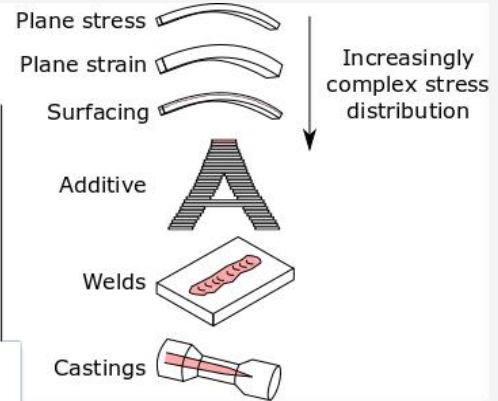
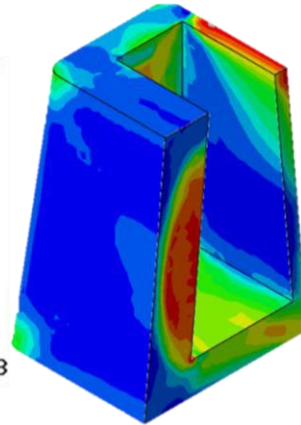
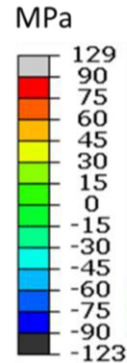
Reference samples defined:

- Compare results from different techniques (round robin samples)
- Illuminate range of challenges
- Validate appli



U-flexures/ U-bends (S355 stainless steel)

...and compared with FEM modelling data



Cast wedge (AlSiMg)

# ENGAGING INDUSTRIAL STAKEHOLDERS

Ensure broad industrial adaptation of the new techniques AND recruit support for standardisation effort.

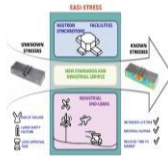


## EASI-STRESS

### European Activity for Standardisation of Industrial Residual STRESS characterisation

The EASI-STRESS project has the overall aim to strengthen industrial access and uptake of non-destructive synchrotron x-ray and neutron diffraction-based residual stress characterization tools by validation against accepted destructive techniques and development of protocols, in close collaboration with industry.

This will enable a better understanding of the formation and progression of residual stresses by direct comparison with and incorporation of the measured data into modelling tools. Incorporating this knowledge into the design process and lifetime assessment of metallic components will give more reliable products with increased lifetime and reduced material usage. Currently, conservative worst-case scenario safety factors, e.g. as defined by EUROCODE, are used when designing metallic components exposed to cyclic loads. In knowing the actual internal stress levels, the safety factors can be relaxed, resulting in an estimated expense cost saving of around 15%.



Homepage: [www.easi-stress.eu](http://www.easi-stress.eu)  
Form for registration of interest



## EASI-STRESS

European Activity for Standardisation of Industrial Residual Stress Characterisation

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### About

The EASI-STRESS project has the overall aim to strengthen industrial access and uptake of non-destructive synchrotron x-ray and neutron diffraction-based residual stress characterization tools by validation against accepted destructive techniques and development of protocols, in close collaboration with industry. This will enable a better understanding... see more



LinkedIn Showcase



Public webinars to share technical insights

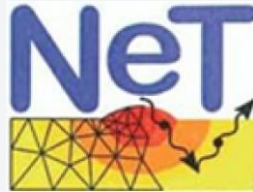
# EASI-STRESS PUBLIC WEBINAR SERIES 2022

March 25, 2022:

**How reliable are residual stress measurements and modelling?  
- The work of the NeT network**

**Mike Smith**

Professor of Welding Technology  
EPSRC Manufacturing Fellow  
Dalton Nuclear Institute  
The University of Manchester



April 25, 2022:

**In-situ diffraction experiments at the  
Hereon beamlines at PETRA III**

**Peter Staron**

Head of department  
X-ray Diffraction with Synchrotron Radiation  
Institute of Materials Physics  
GEMS Helmholtz-Zentrum Hereon





# THANK YOU!

Please contact us, if you would like to stay informed about the project activities and events.

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