

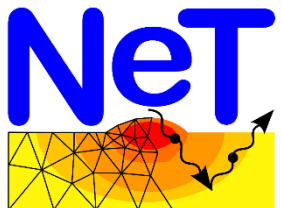
# NeT Anniversary Workshop on Assessment of Residual Stresses in Welds

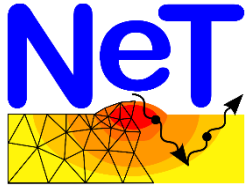
Technical University of Munich, Garching, 23 Nov 2022

## 20 years of NeT – a Summary of the Achievements

C. Ohms

Joint Research Centre-Petten





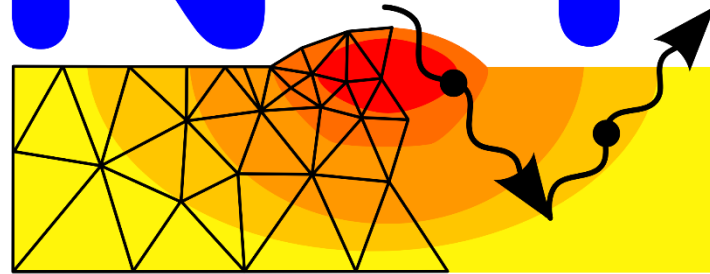
# Outline

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- Related activities
- Conclusions

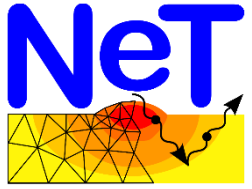
# About NeT

20.5 years

NeT



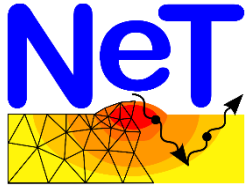
2002 - 2022



# About NeT

- A research collaboration based on a non-binding, non-written agreement between partners sharing an interest in the agreed research (Task Groups)
- Not externally funded (so far)
- Internal funding has taken place to a significant degree
- About 25 participants today, over the years about 40 different contributors
- More than 10 partners have been a member from the beginning
- Past contributions also from Australia, South-Korea, Japan, the US, and Turkey

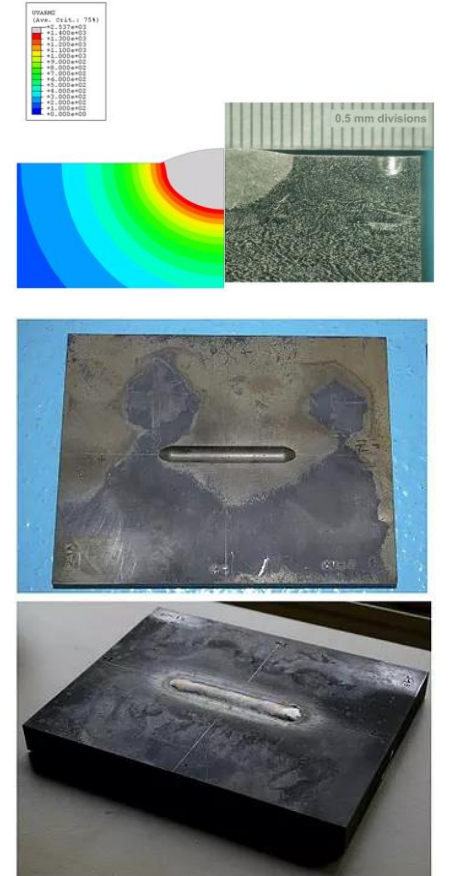
# About NeT



- NeT partners are: research centres, neutron sources, universities, industry, consulting companies
- Website: <https://www.net-network.eu/>
- 9 Task Groups so far
- Focus on residual stress measurement and simulation for model cases of welds for nuclear applications

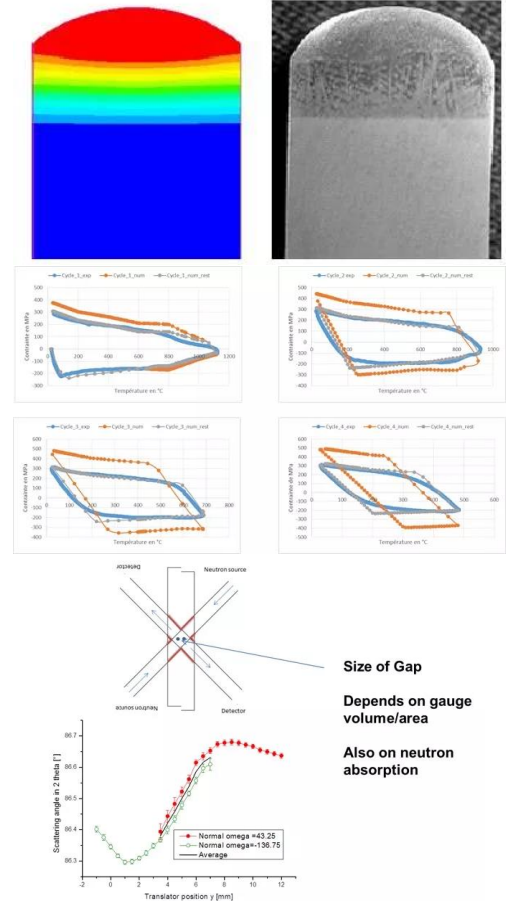
# NeT Task Groups (TGs)

- TG1: Single Bead-on-Plate Weldment (Stainless Steel)
- TG2: Letter Box Repair Weld (Ferritic Steel)
- TG2: Auxiliary Specimen (Ferritic Steel)
- TG3: Small Angle Neutron Scattering in support of NeT
- TG4: 3-Pass Slot Weld (Stainless Steel)



# NeT Task Groups (TGs)

- TG5: Edge Welded Beam (Ferritic Steel)
- TG6: 3-Pass Slot Weld (Ni alloy)
- TG7: Electron beam weld on a high strength Al alloy
- TG8: 5-Pass Slot Dissimilar Weld (Ni alloy) on Ferritic Steel
- TG9: Additive manufacturing by weld bead deposition



# Criteria for Task Groups

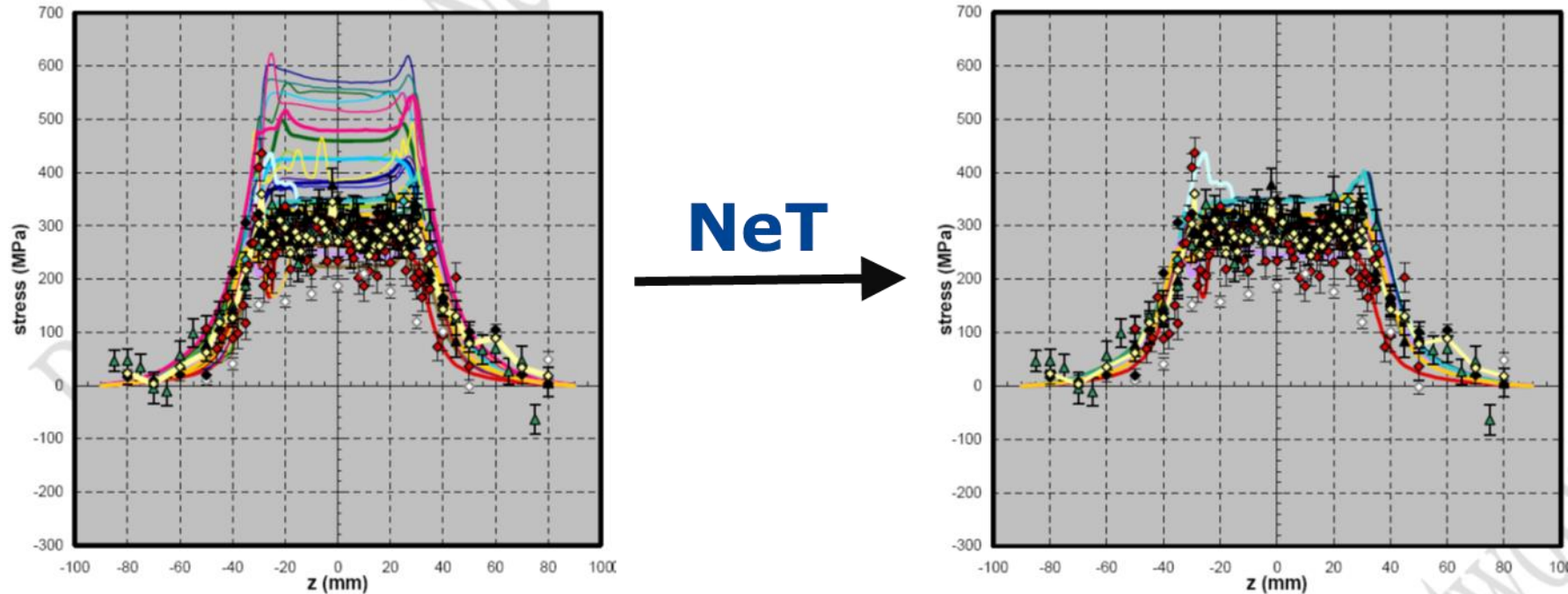
- Proposal, purpose
- Sufficient number of partners willing to contribute
- “sponsor” (in two senses of the word)
- Nuclear grade materials
- “portable” specimens
- Sponsor for the manufacturing, sufficient number of samples
- Agreement by the Steering Committee



# Net accomplishments/products

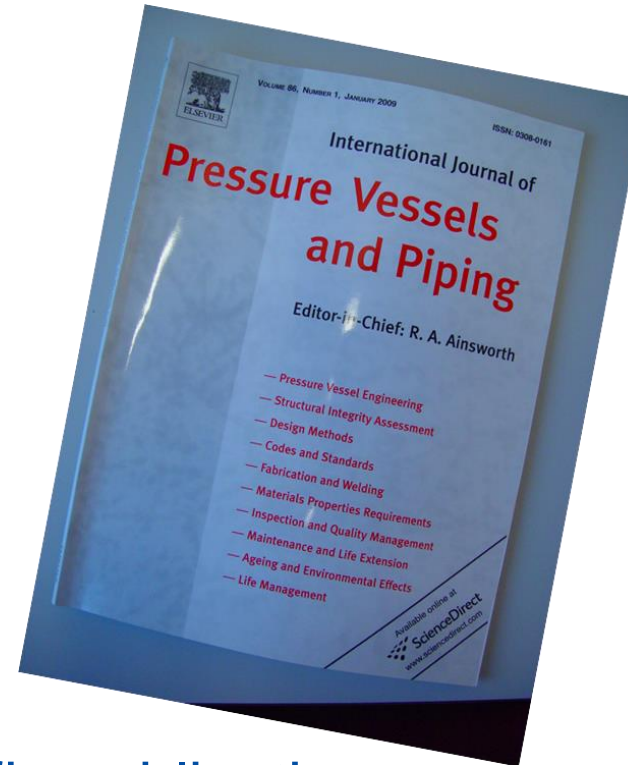
- NeT experiences have helped our industrial partners to improve their analysis techniques applied to their relevant engineering problems
- ... and to argue safety cases vis-à-vis the regulators,
- ... but also our academic partners have used lessons from NeT to reassess their methods, or in the developments of new techniques, or technique evolutions
- Lessons learned from TGs 1 and 4 included as examples in the welding simulation chapter of R6 defect assessment procedure in the UK

# NeT accomplishments/products



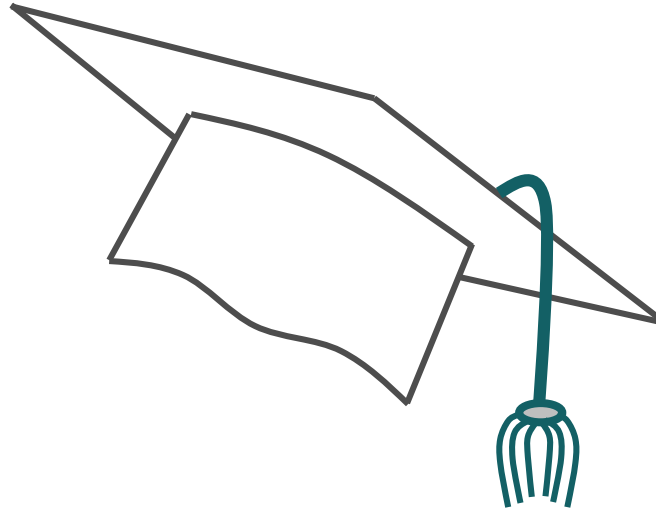
- Probably the most comprehensive welding residual stress round robins (measurement and simulation) in existence (example above from TG1)

# Net accomplishments/products



- Currently about 125 scientific publications
- 2 dedicated issues of IJPVP, on TG1 in 2009 and on TG4 in 2014

# Net accomplishments/products



- NeT has contributed to ~15 PhD theses (some of these are currently still in the making) – predominantly with British and French universities

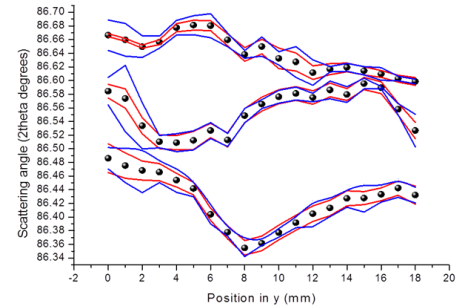
# Net accomplishments/products



- Contribution to standardization (ISO 21432 on neutron diffraction stress measurements; ISO/TS 18166 on welding simulation)

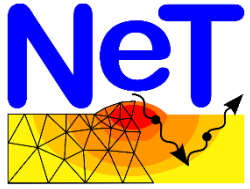
# “Secondary” outputs of NeT

- Surface machining stress evolution
- Phase transformation modelling
- Modelling of thermo-mechanical cycles
- Materials data
- Shift of gauge volume centroid in through thickness direction
- “Layzian” average
- NeT materials for benchmarking purposes – both experimental and numerical



# Related activities

that have used the model of NeT as guidance in one or the other way



- *First one should note that NeT itself had predecessor activities that played a role in its conception, for example: VAMAS TWA20 and RESTAND, ENPOWER, BIMET, ADIMEW, and others to a lesser degree*
- EU RTD Framework programme projects: STYLE, ATLAS+, GEMMA, EASI-STRESS, BrightnESS, ...
- Nationally funded activities: NNUMAN, MATTEAR (both in UK), ...
- EERA: Residual stresses in welds in P91 steel, RESTRESS, SiMeW (still under review)

# Conclusions

- NeT is a prolific research collaboration in WRS area; it has been active for 20 years
- Individual partners' interest in common research keeps it going
- Impact on residual stress aspect of integrity assessment, impact on R6 code
- Impact on standardization and harmonization
- Some scientific/engineering “side effects”
- Well defined benchmarks from several Task Groups available to external parties
- We hope to be around for several more years
- Interested parties are welcome – requirement is to contribute to agreed activities
- A model that other related projects follow



**Thank you!**