



And now for something completely different

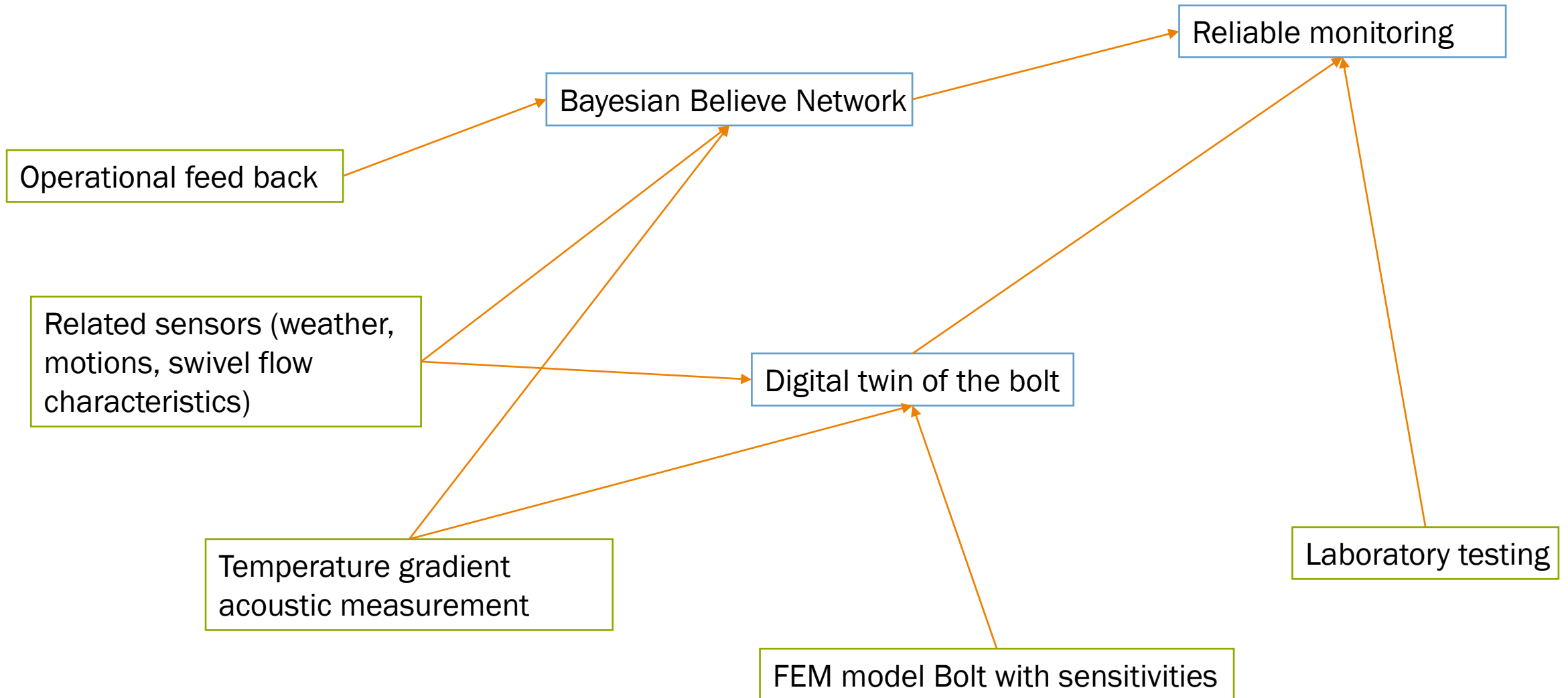
Martijn Hoogeland, Paula van Lieshout

MONITORING HIGH PERFORMANCE BOLTED CONNECTIONS

› **INSPECTION OF HIGH PERFORMANCE BOLTED CONNECTIONS IN SWIVELS, ROLLER BEARINGS AND LARGE FLANGED CONNECTIONS**

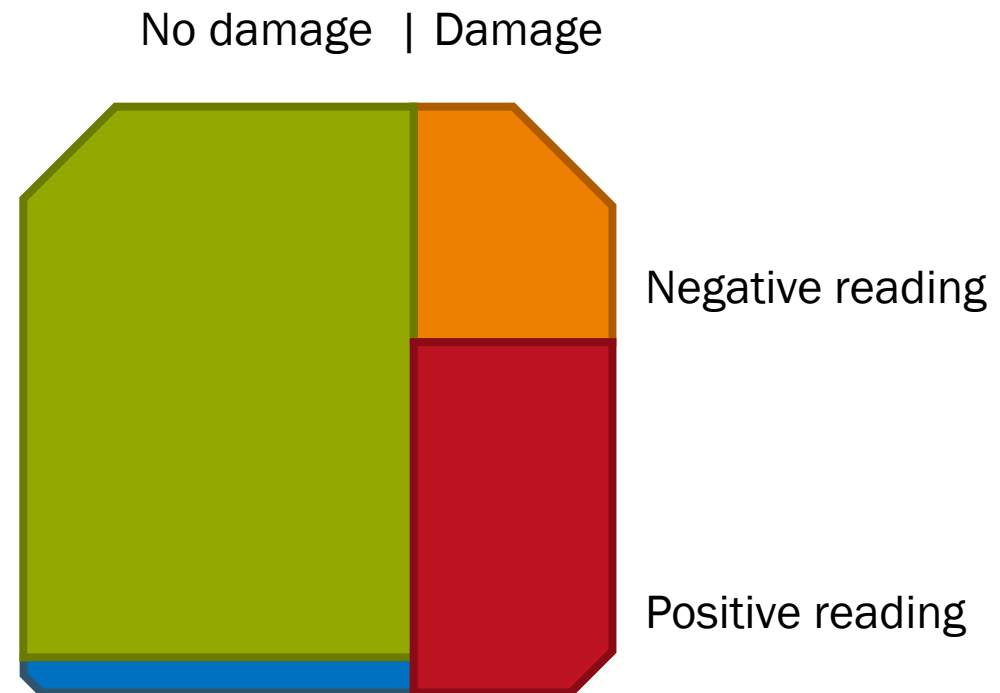
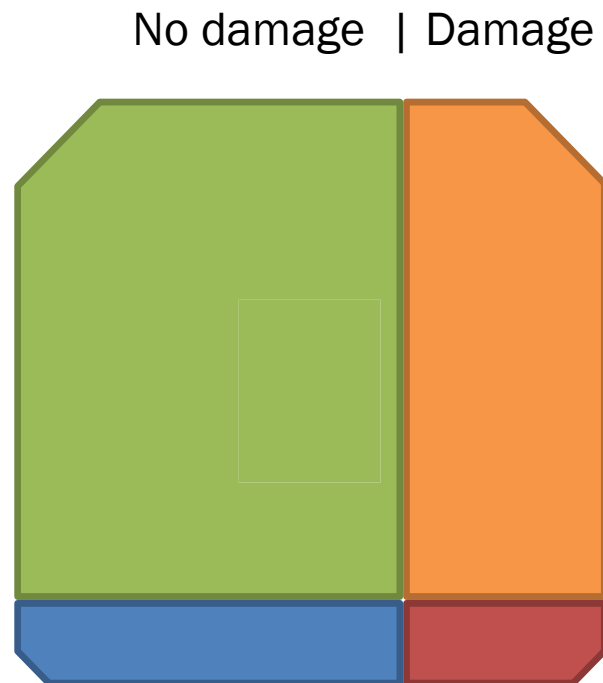
- › Size up to M100: large equipment
- › Pre-tension important design parameter
- › Bolts located in hazardous or inaccessible areas
- › Yearly inspection by two people
- › Inspection results normally positive (only for the records)
- › Inspection may damage existing corrosion protection

› NO PEOPLE REQUIRED FOR BOLT INSPECTION



› BAYESIAN BELIEVE NETWORK

- › Add operational feedback
- › Add more sensor data
- › Train the system in laboratory

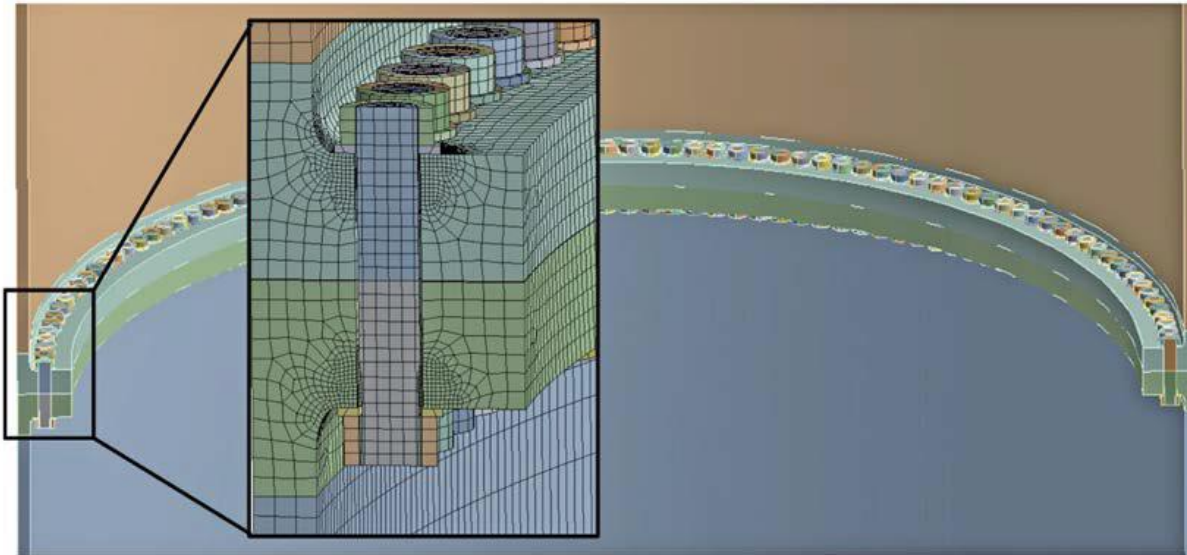


› DELIVERABLES

- › Guideline remote bolt pre-tension monitoring
- › Temperature gradient compensated acoustic sensor
- › Validated bolt model
 - › Numerical model
 - › Probabilistic model (BBN)
 - › Laboratory tests
 - › Optional: Field tests

› WHY TNO

- › Independent, impartial
- › Numerical and experimental knowledge
 - › Acoustic measurements
 - › Influence geometry on pre-tension & fatigue
- › Applied Bayesian Believe Network in infrastructural projects



› COST AND PLANNING

- › Duration: 3 years
- › Total cost: €600,000
 - › Oil Majors and large contractors: €30,000/yr
 - › Research institutes, class societies and small contractors: €10,000/yr
- › Coming half year detail work plan & consortium
- › Kick-off Next FSPO week
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