Assessing the impact of vibrations on Rubens' ceiling

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Introduction:

The paintings by Rubens are of immeasurable artistic, historical and financial value and reflect the power of Stuart dynasty in the world.[1] With a history of over 380 years the paintings at the Banqueting House in London have been removed at least five times and treated at least nine times.[3] One of the most important treatments was undertaken in 1906-08 when, due to sagging, the original canvases were removed from their frames, cleaned, repaired, marouflaged on laminated boarding and replaced on the frames.[3] The frames were in turn suspended from the roof trusses by hooks and eyes.[3] Recent condition surveys show signs of damage at the joins between the sections of the supporting plywood sheets. The project will particularly look at the role of vibrations on one painting (Wise Rule panel), as well as other damaging factors such as variations in temperature and humidity.

Banqueting House - Main hall
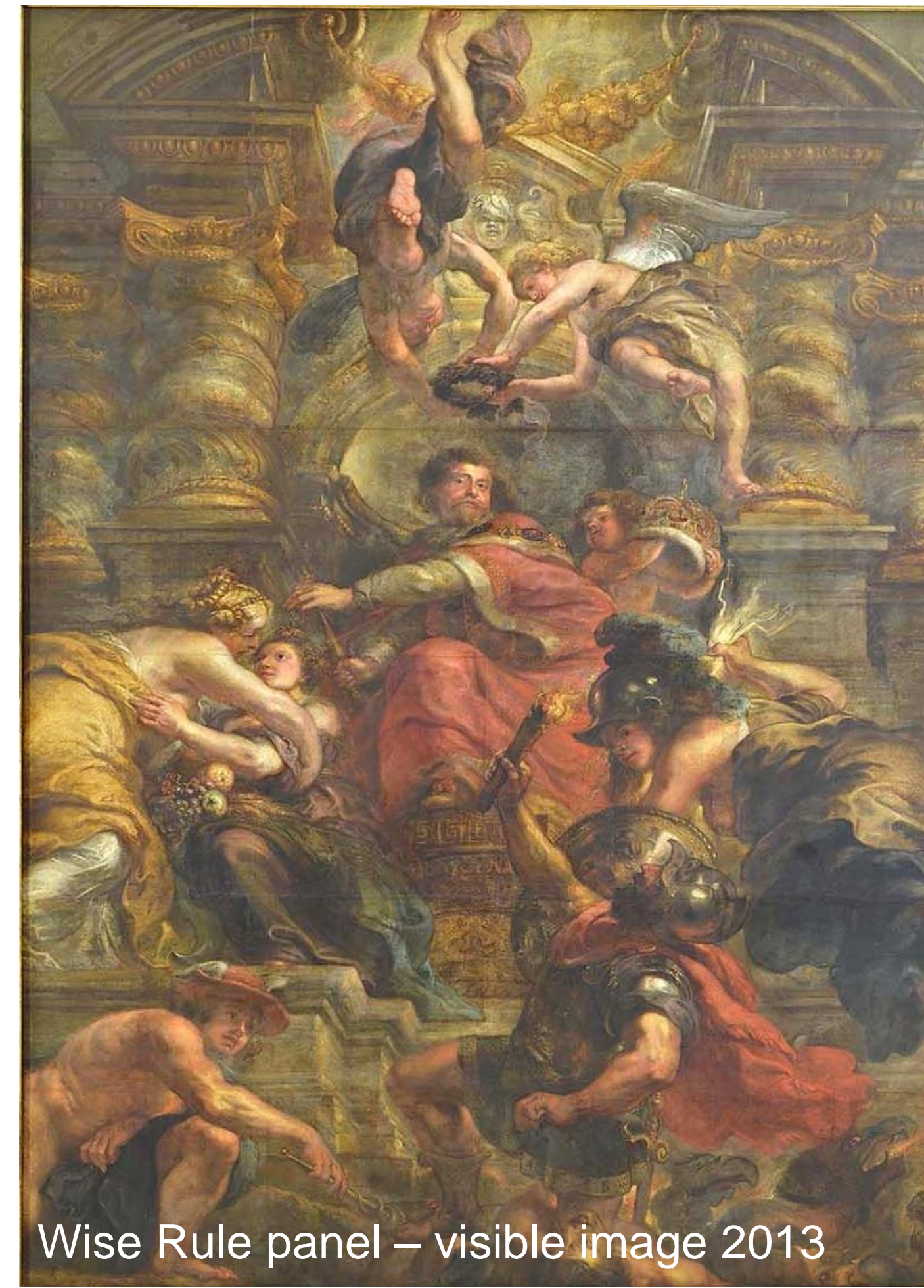
Wise Rule panel – visible image 2013

Research questions:

- Can paint damage be identified by comparing the Gigapan images (2013 & 2016) and all the other available historical images?

- What are the environmental risks to the painting and vibration conditions as measured?

- How can vibration data be best analysed and presented?

- Could such paint damage be linked to variations in the temperature or humidity in the environment or to vibrations?

- Could displacement and strain be visualised from the floor level or a scaffold using Digital Image Correlation (DIC)?
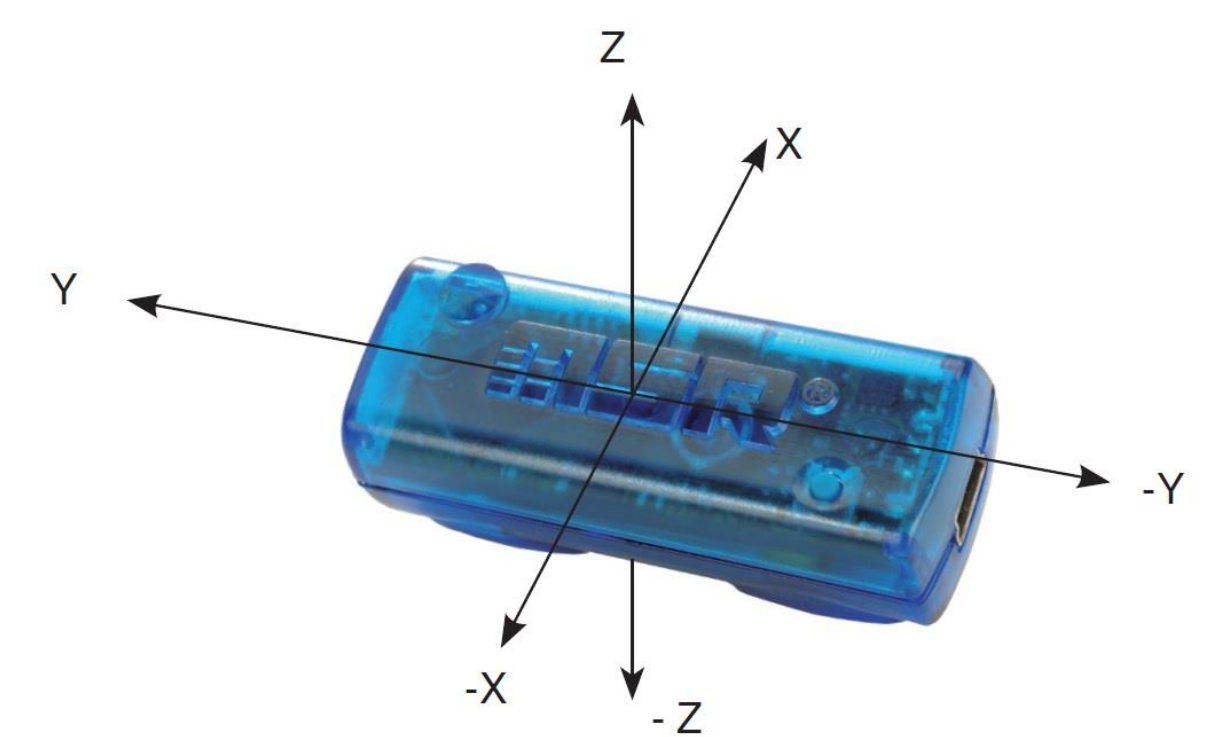
Methodology:

- Image comparison for all available images (Gigapan, multispectral and historical images) as well as image analysis (DIC) for determining a potential active damaging process

- Environmental data analysis and interpretation (vibration 2013/2016, RH & temperature 2007-17)

- DIC for testing different scenarios in order to determine potential changes on the painting

- Correlation of results (from the environmental and image analysis) for determining the causes of deterioration
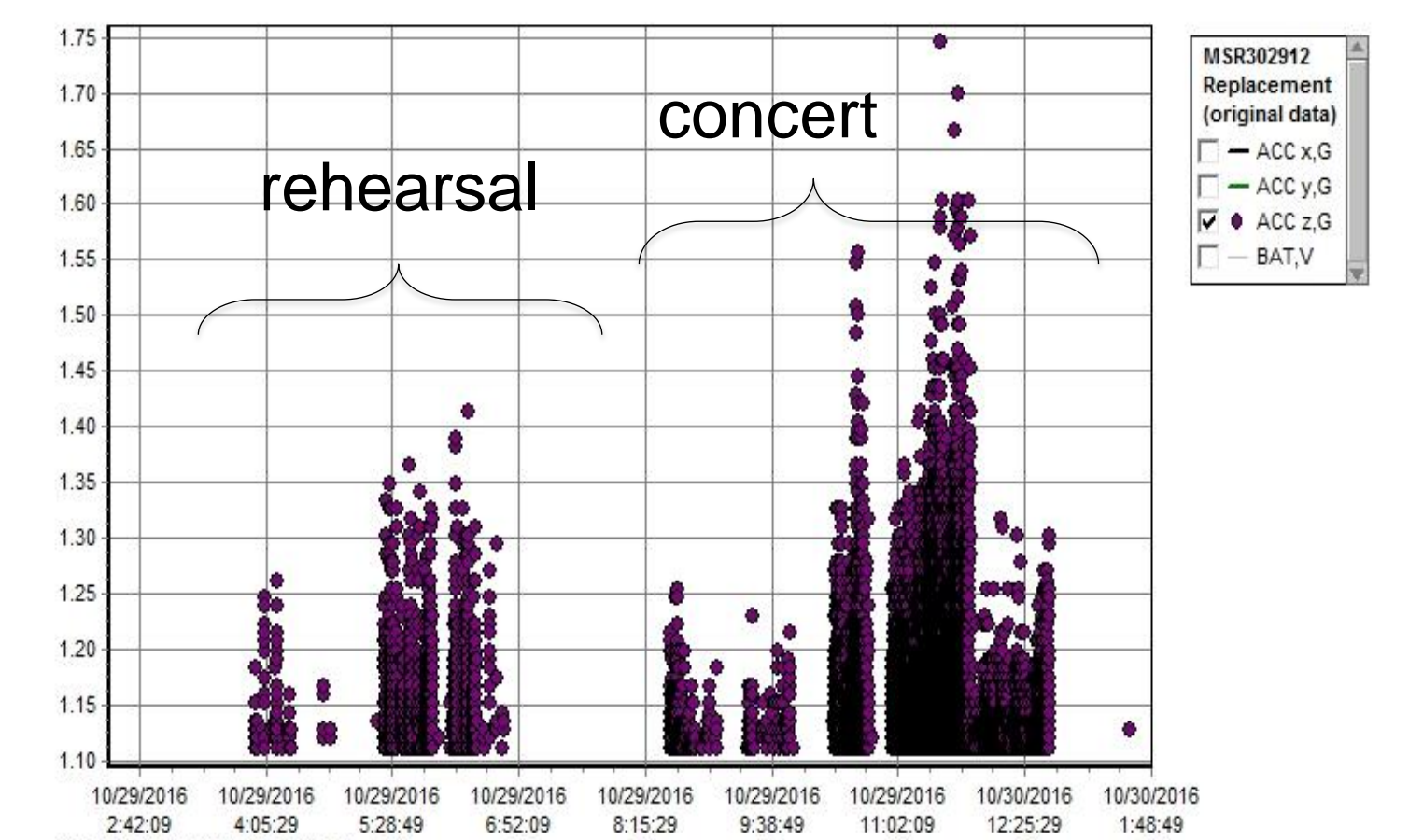

UV image - 2016
Visible image 1947
A
IR image - 2016

Vibration analysis:

- Monitoring vibration on different points on the reverse of the painting using data loggers MSR 145S ®

- Conversion of recorded data using MSR software

- Comparison of maximum values with values associated to damage (from literature)

- Correlation of recorded events to interior or exterior events for determining the sources of vibration

- Determining displacement caused by vibration

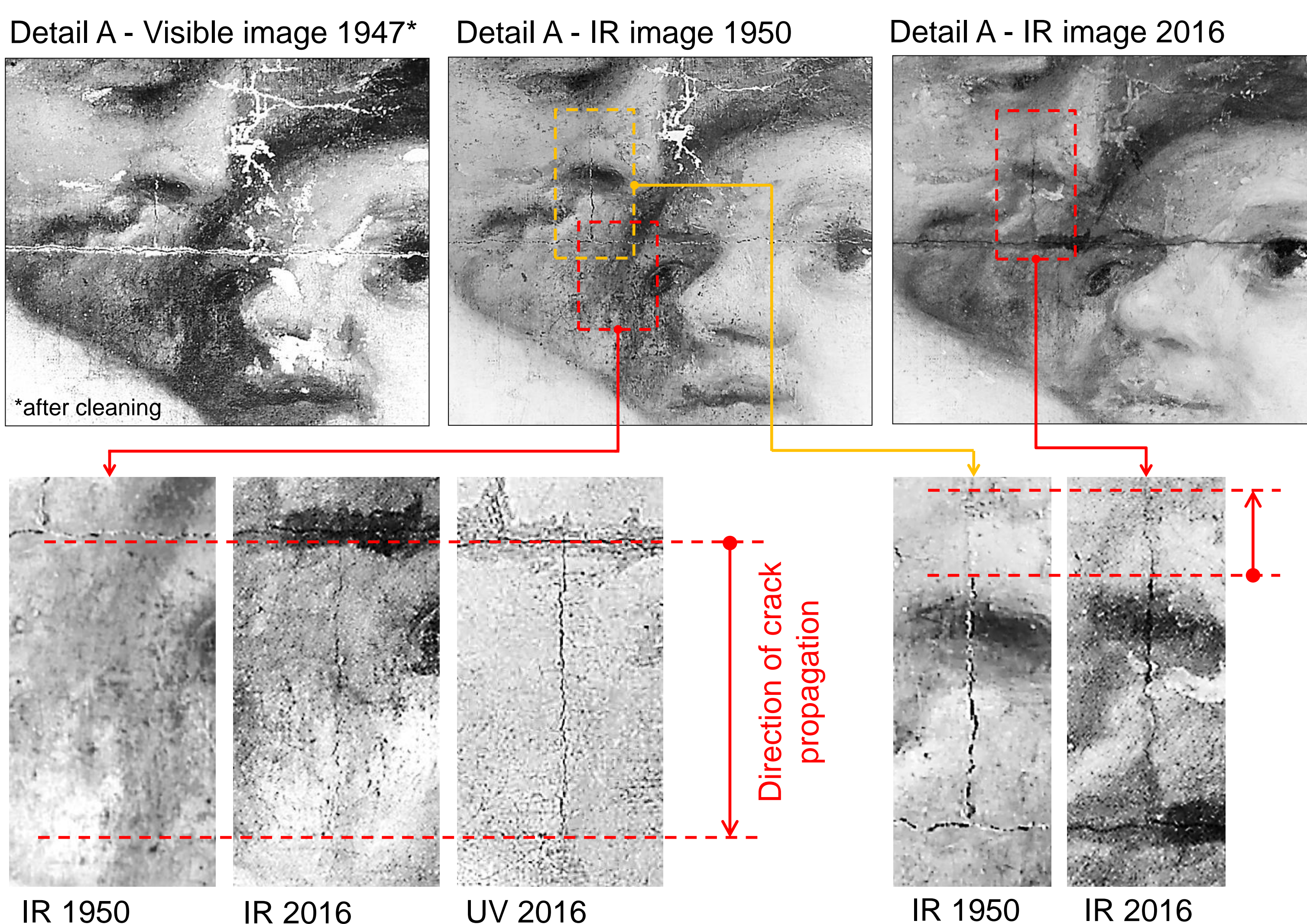- Determining potential vulnerable areas on the painting surface

Data logger MSR 145S[2]

Vibration on "z" axis – music event

rehearsal   concert

Damage at the joins between plywood sheets:

Detail A - Visible image 1947*
*after cleaning

Detail A - IR image 1950

Detail A - IR image 2016

IR 1950   IR 2016   UV 2016

Direction of crack propagation

IR 1950   IR 2016

Taking photographs for DIC using a scaffold

Expected outcomes:

- Determine the degree to which each environmental factor contributes to the damaging process in order to inform future potential risks for the paintings

- Establish if a visual analysis of the available high resolution spectral images provide enough information to determine the extent of damage or material loss over time

- Investigate potential limits to be considered for the use of the main hall and attic

- Inform decision-making towards selecting the appropriate tool for future monitoring

- Contribute to the general knowledge of vibration effects on heritage

References:
1. The Banqueting House, Whitehall - Conservation Management Plan 2015
2. MSR (Modular Signal Recorder) – User Manual MSR 145
3. Paine and Stewart (2014). The Banqueting House, Whitehall. A condition survey of the ceiling paintings by Rubens. London: Historic Royal Palaces.

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