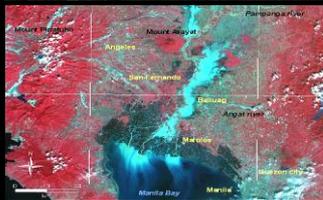


# DMCii Preliminary Experiences towards QA4EO Implementation

## WGCV 30



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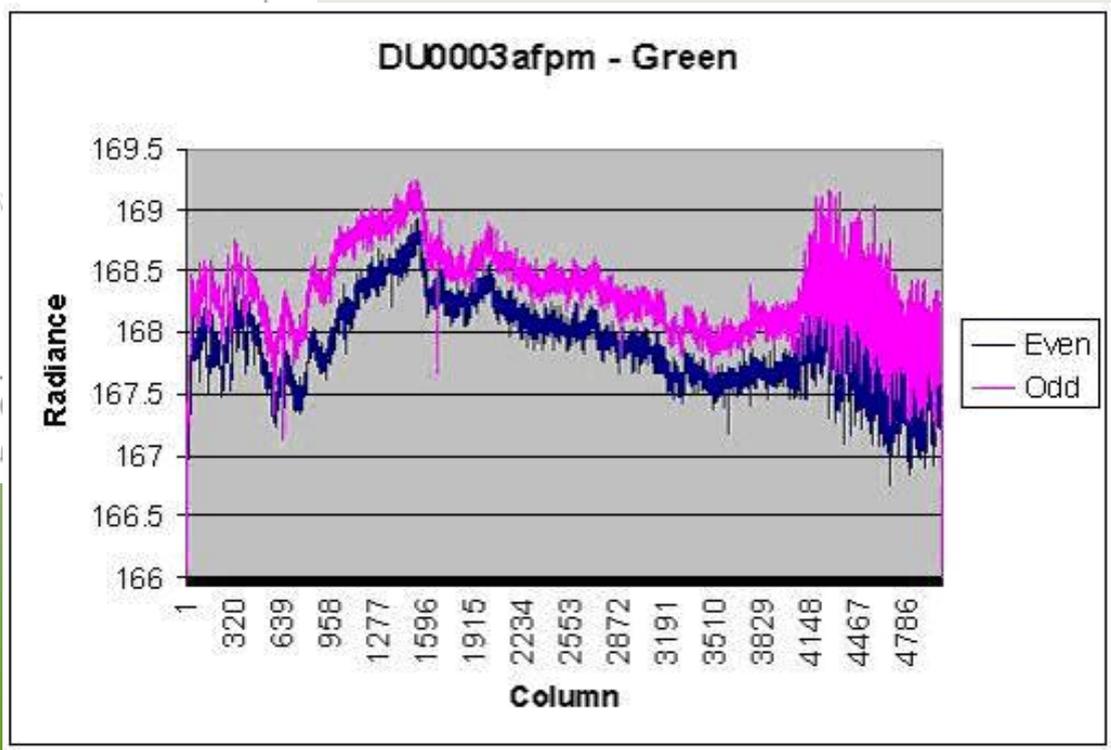
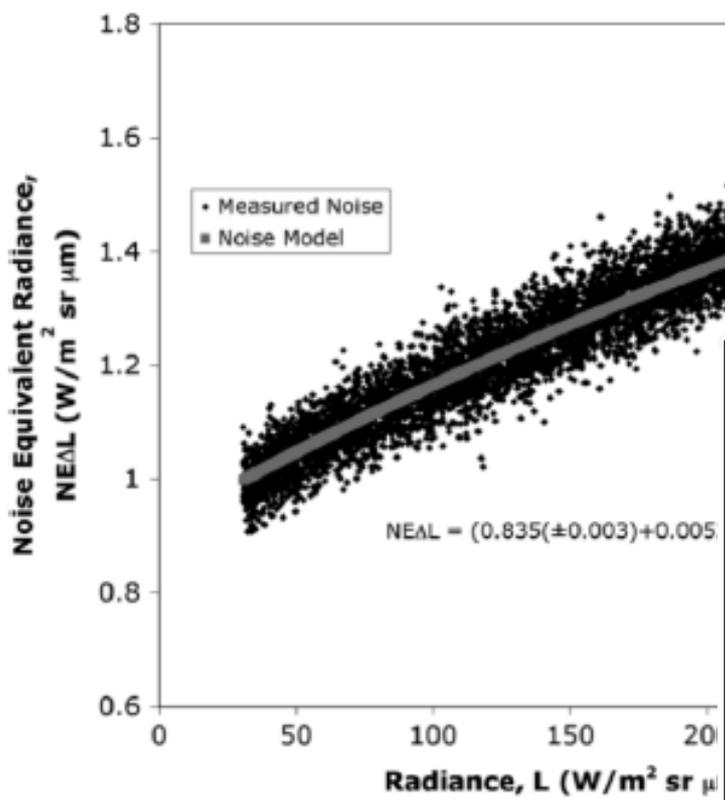
## Conclusions

- I am **not** happy with the quality indicators we currently produce for the DMC satellites.
- I believe we need to move towards a pixel based quality indicator for products
- To do this I need to understand the uncertainties of the processes I use to make the products
- To understand the uncertainty I need to document **every** process and understand how it contributes to my overall uncertainty budget
- I believe the QA4EO guidelines provide a structure that will allow me to do this

## Point 1

- I am **not** happy with the quality indicators we currently produce for the DMC Satellites.
- The calibration of the DMC satellites is as good as many other systems. However, when I produce a product I can only state
  - The overall calibration uncertainty per band (not per pixel)
  - The SNR or NE $\Delta$ L of a specific band
- This does not tell me if there is any “low-level” anomalous behaviour in the sensor
- This does not tell me the level of uncertainty over different targets in my image

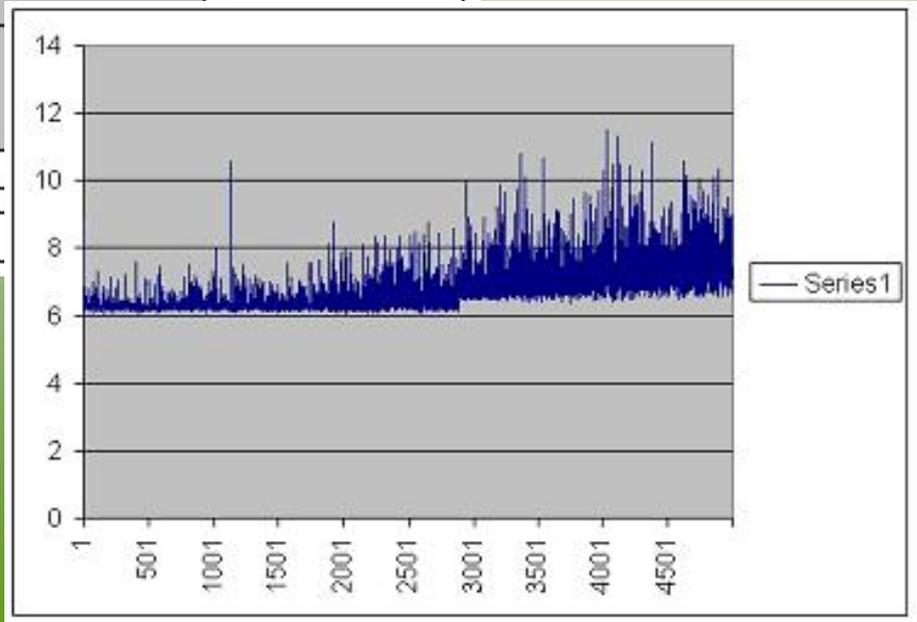
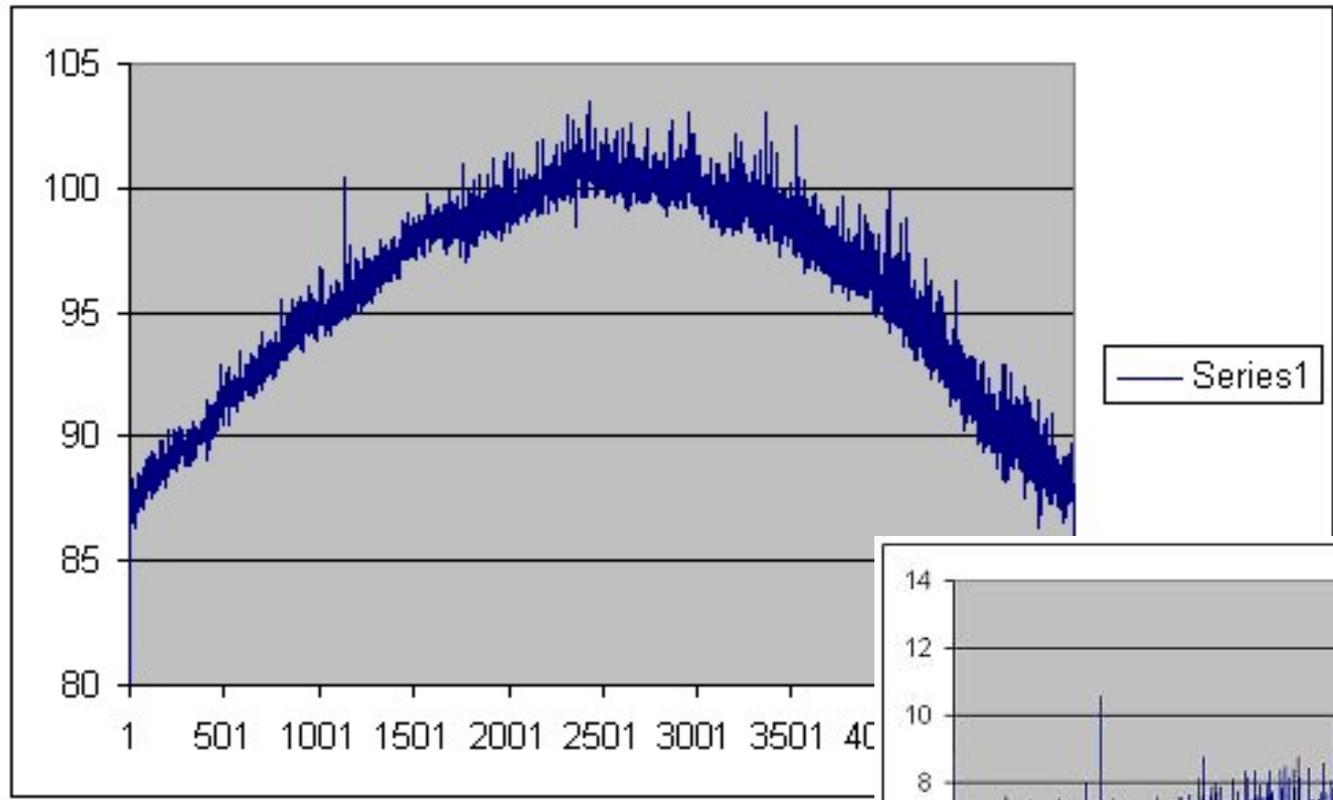
# Examples



## Point 2

- I believe we need to move towards a pixel based quality indicator for products
- In a CCD array of 20,000 detectors every one has its own noise characteristics.
- Vignetting in the optics means that the edges of the FOV the noise contribution is greater.
- The noise contribution is a function of signal level, hence the uncertainty varies with brightness of the target

# Examples



## Point 3

- To do this I need to understand the uncertainties of the processes I use to make the products
- All satellite operators have values for calibration accuracy, SNR, MTF etc. which are often stated
- Most operators have knowledge and experience of what impact these values have.
- But...can they say that a specific pixel has a specific uncertainty in its value and which processes contribute

## Point 4

- To understand the uncertainty I need to document **every** process and understand how it contributes to my overall uncertainty budget
- Unless I now explore each process and document how it operates and determine which areas contribute I can not assess where the uncertainty lies.
- Many processes are dependent on lower-level operations which also need documenting.
- Assumptions need to be explored where possible and proof given of their validity or at least an estimate of the uncertainty they induce

# TOA Radiance – Steps (in outline...!!!)

## Steps

1. TOA Radiance Product
  - a. Absolute Calibration (5 acquisitions)
    - i. Generation of TOA radiance (band integrated value)
      1. Ground data collection at RRV
        - a. Instrument and Panel Calibration
        - b. Surface Measurement
        - c. Surface Variability across site
      2. Atmospheric analysis at RRV
        - a. Instrument calibration
    - ii. DMC Data Collection at RRV
      1. Surface Variability across site
      2. System noise ( two pixel average)
      3. CCD stability – odd/even pixels
      4. CCD stability – CCD cross array variability
      5. Dark Image
    - iii. DMC Transfer to Dome-C
      1. Surface Variability across site
      2. System noise (large column average)
      3. CCD stability – odd/even pixels
      4. CCD stability – CCD cross array variability
      5. Atmospheric variability
      6. Dark Image
  - b. Cross-Calibration (19 image pairs)
    - i. DMC Collections over Dome-C
      1. Atmospheric change between overpasses
      2. Surface variability
      3. Accuracy of pointing
      4. System noise (per overlap area)
      5. CCD stability (per overlap area)
      6. Dark Image Collection
      7. Absolute Calibration accuracy (from above)
      8. Calibration drift
  - c. Calibration Drift (many images)
    - i. DMC collections over stable sites
  - d. TOA Radiance product
    - i. Variability in target brightness (hence noise)
    - ii. Absolute calibration after transfer via cross-calibration and adjustment for calibration drift.
    - iii. CCD stability

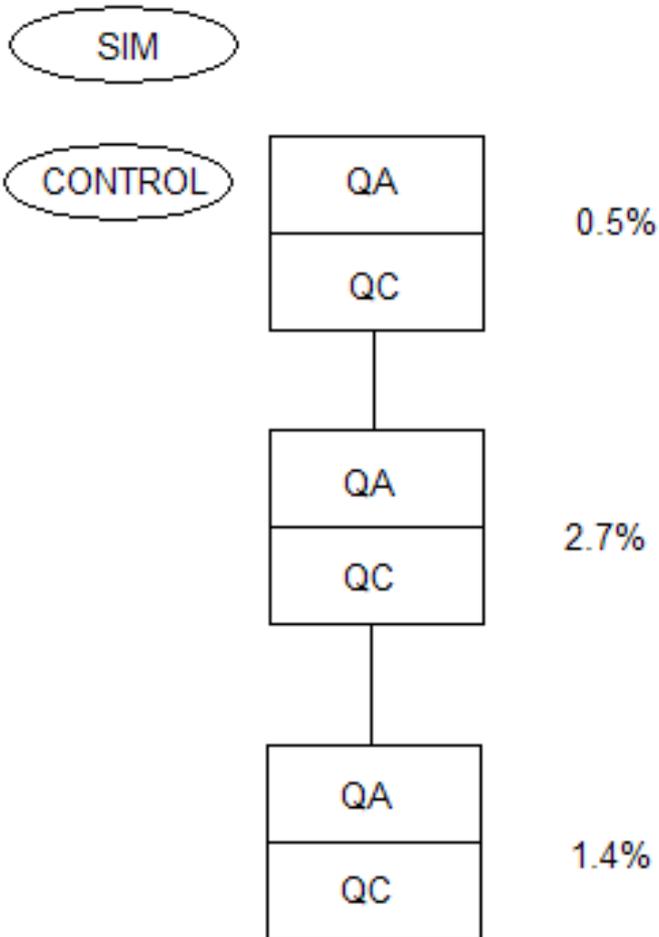
## Point 5

- I believe the QA4EO guidelines provide a structure that will allow me to do this
- The guidelines and structure provided by QA4EO is based on sound practices employed by Metrology institutes
- The structure defines, but does not dictate and provides structure on the documentary evidence and proofs.
- How you do things is up to you, as long as you can prove how you do things.

## What next

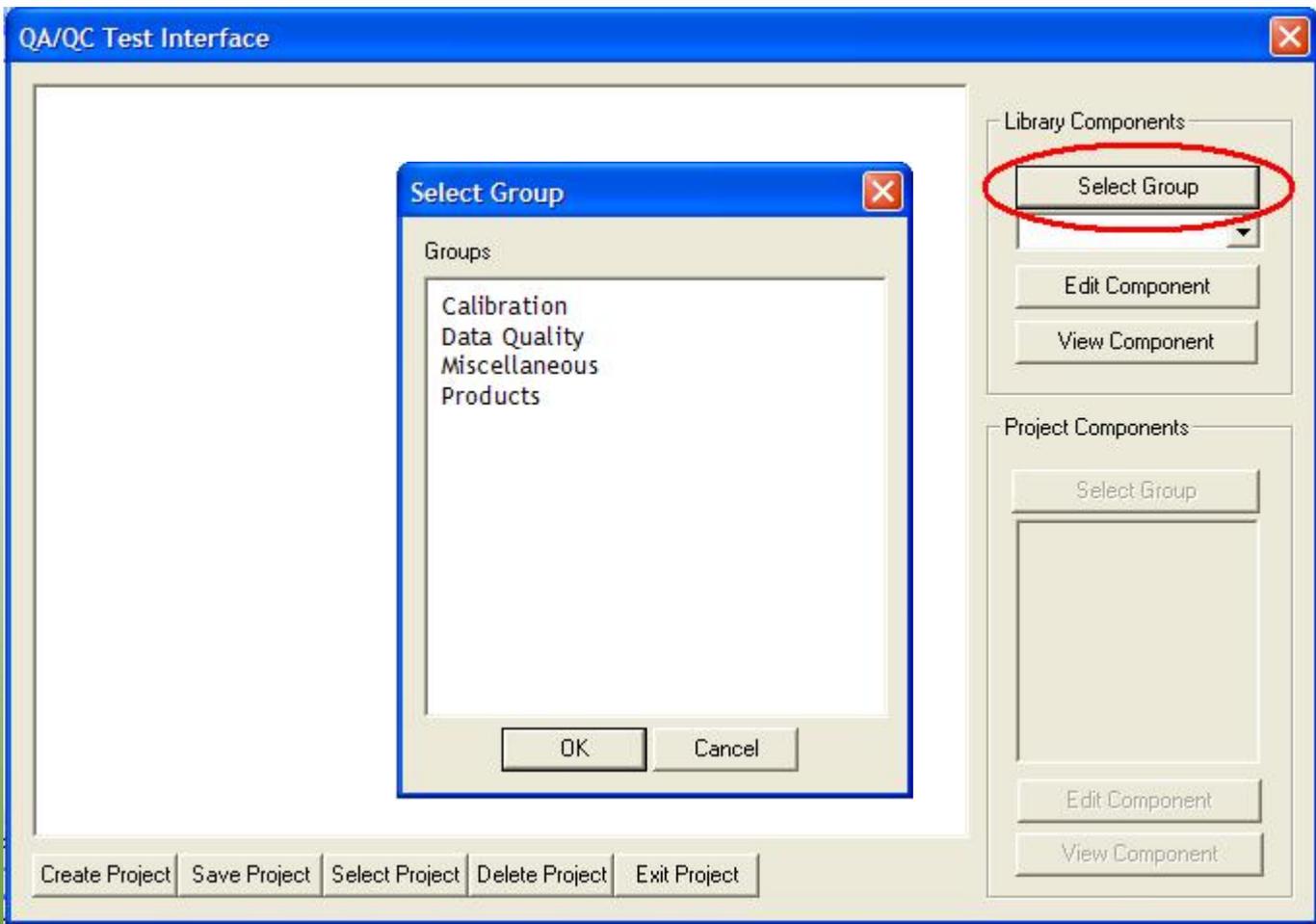
- Developing software product to
  - Manage the modules created
  - Adhere to the structure proposed within QA4EO
  - Simulate process flow in my system
  - Automatically monitor system operation (and correct..?)

# Software Structure

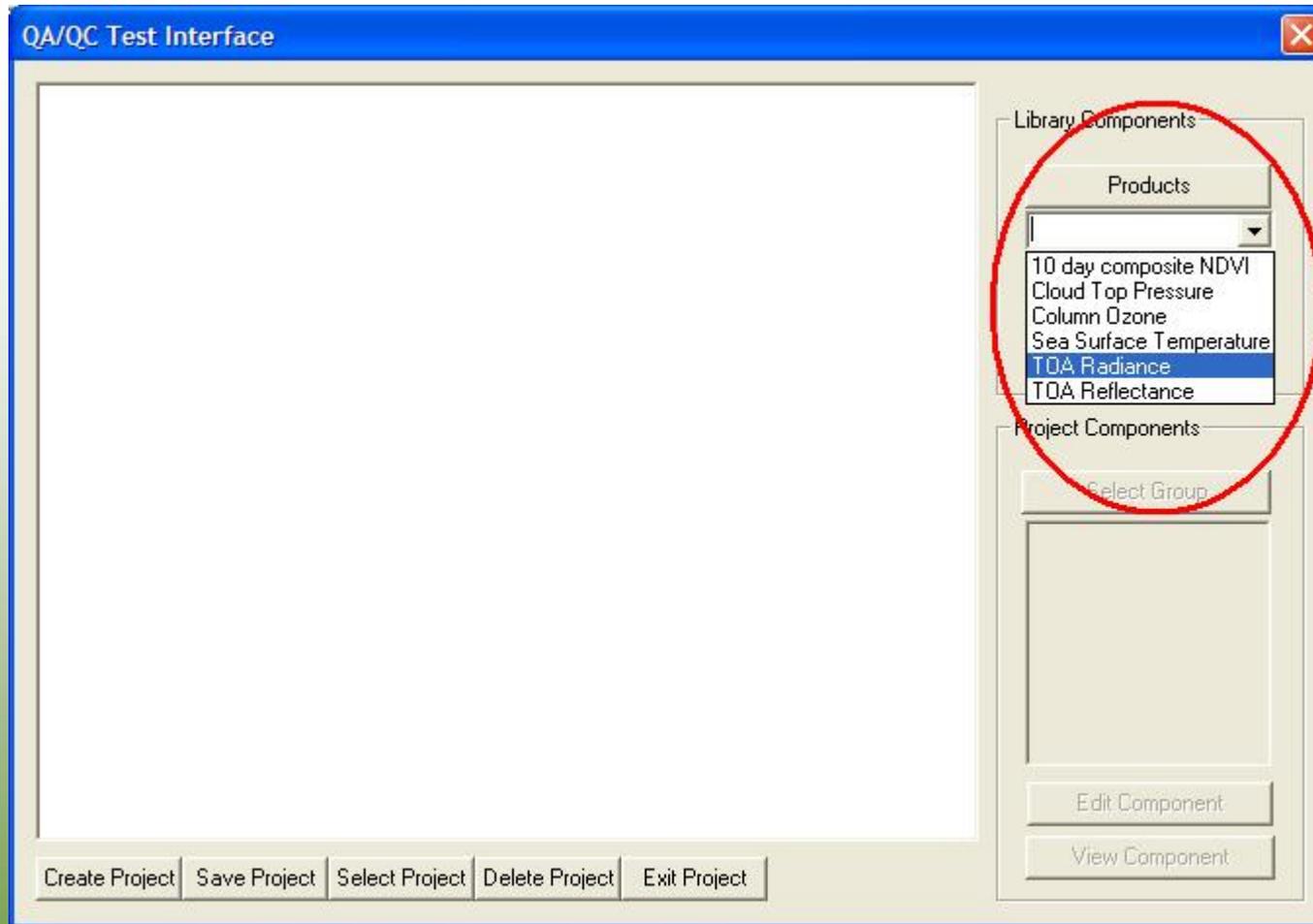


- Single or aggregated (management) modules
- Modules can be added, removed or modified
- NOT a time sequence
- QA4EO documentation supports QA and QC components
- QC can actively change operation
- Can be run as a simulator

# Some elements

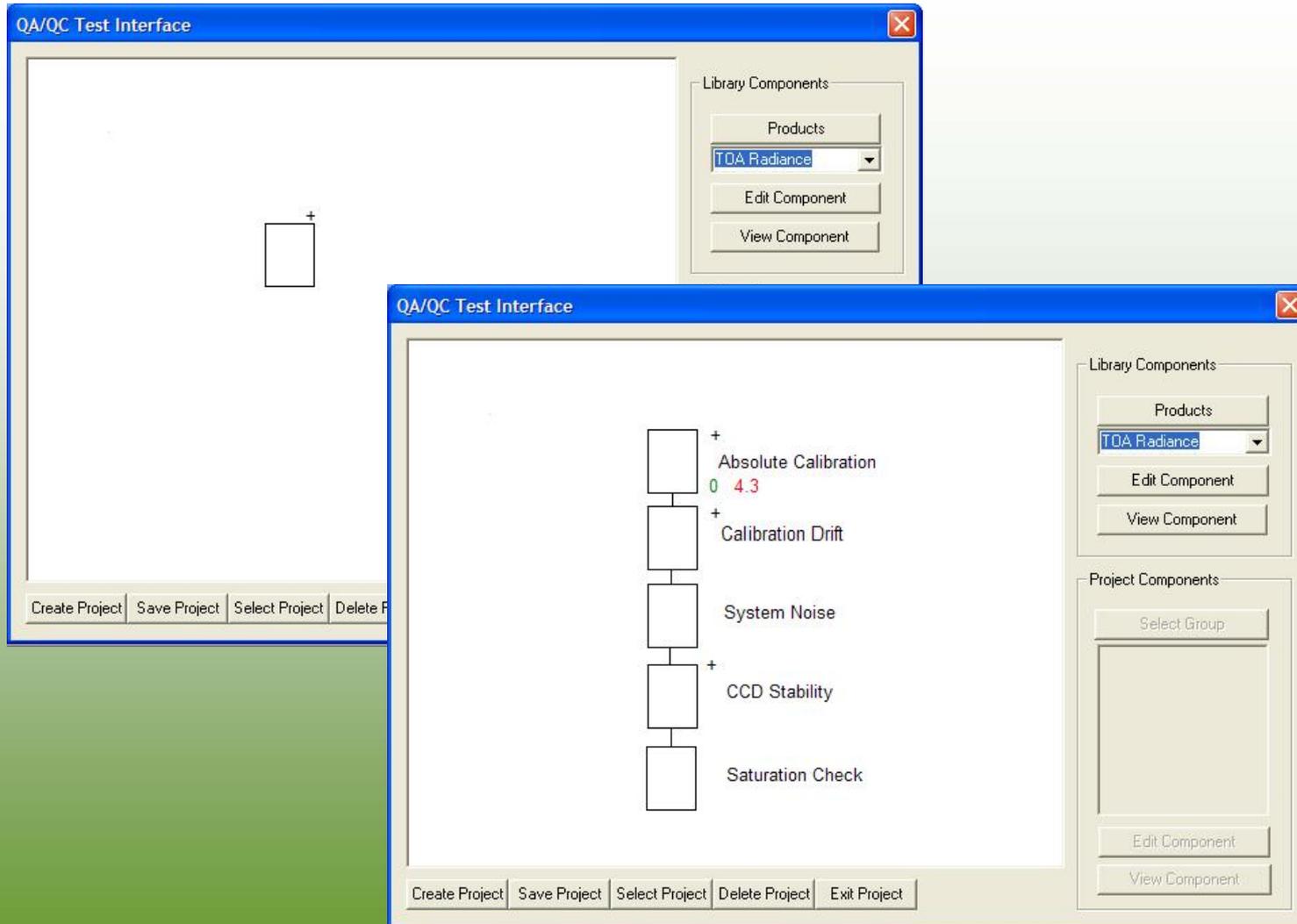


# Some elements



Product based

# Some elements



The image displays two screenshots of the QA/QC Test Interface software. The top screenshot shows a single component, 'TOA Radiance', in the 'Library Components' panel. The bottom screenshot shows a hierarchical chain of components: 'Absolute Calibration' (with a value of 4.3), 'Calibration Drift', 'System Noise', 'CCD Stability', and 'Saturation Check'. The 'Project Components' panel in the bottom screenshot is empty.

QA/QC Test Interface

Library Components

Products

TOA Radiance

Edit Component

View Component

QA/QC Test Interface

Library Components

Products

TOA Radiance

Edit Component

View Component

Project Components

Select Group

Edit Component

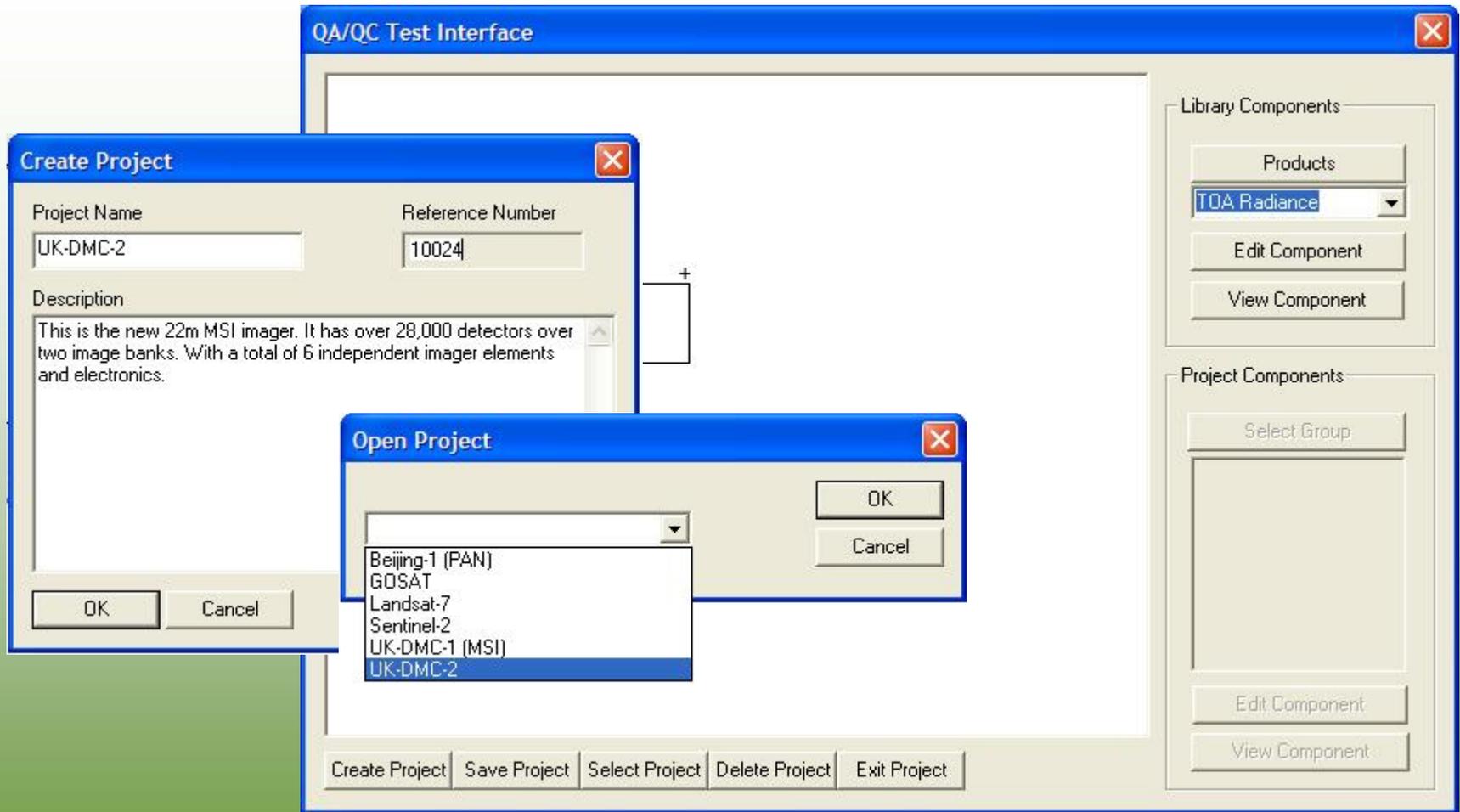
View Component

Create Project Save Project Select Project Delete P

Create Project Save Project Select Project Delete Project Exit Project

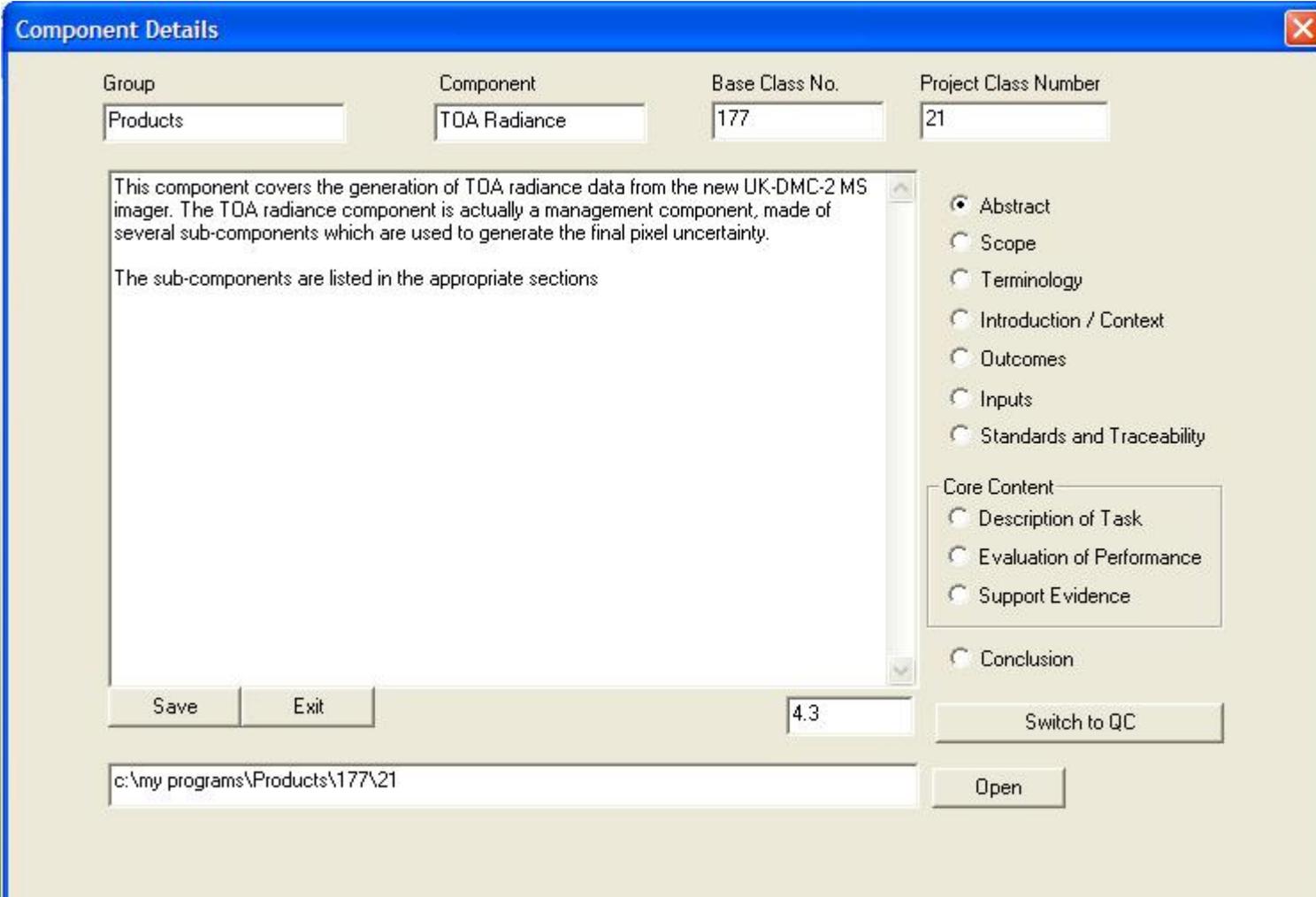
Management and aggregated chains

# Some elements



Projects and re-useable components

# Some elements



The screenshot shows a 'Component Details' dialog box with the following fields and controls:

- Group:** Products
- Component:** TOA Radiance
- Base Class No.:** 177
- Project Class Number:** 21

The main text area contains the following description:

This component covers the generation of TOA radiance data from the new UK-DMC-2 MS imager. The TOA radiance component is actually a management component, made of several sub-components which are used to generate the final pixel uncertainty.

The sub-components are listed in the appropriate sections

On the right side, there are several radio button options:

- Abstract
- Scope
- Terminology
- Introduction / Context
- Outcomes
- Inputs
- Standards and Traceability

Below these is a 'Core Content' section with a sub-section containing:

- Description of Task
- Evaluation of Performance
- Support Evidence

At the bottom, there are buttons for 'Save', 'Exit', and 'Switch to QC'. A version number '4.3' is displayed in a small box. At the very bottom, there is a file path field containing 'c:\my programs\Products\177\21' and an 'Open' button.

Manages QA4EO documentary proof

## Conclusions

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Thank You!

Sustainable Earth Observation

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