

QUAREP LiMi - WG10 - Image Quality – 3rd Meeting – Minutes - 2021-02-09

Participants

Ulrike Boehm (UB), Thomas Guilbert (TG), Arne Seitz, Julia Fernandez-Rodriguez, Julien Record, Steve Ogg, Peter Bajcsy, Kees van der Oord, Martin Stöckl, Gerhard Holst, Chieh-Li Chen, Alexia Ferrand, Konstantin Birngruber, Eduardo Conde-Sousa, Roland Nitschke, Ali Gheisari, Ryma Bebane, Steve Ogg, Gert-Jan

Excused: Michelle Itano,

Global Action Item

3 main IQ parameters definition

Minutes

1. Recording & Meeting 2 minutes approval (TG)
2. Welcome new participants (All)
3. Global organization, documents (TG, UB)
4. Focus on Table1 (IQ parameters) (TG)
5. Discussions : 3 Breakout rooms (UB, All)
6. Sum up of discussions (All)

Action items

1 - Recording & Meeting 2 minutes approval (TG)

- Minutes approved
- Recording approved

2 - Welcome new participants (All)

- New member: Julien Record (postdoc at Karolinska Institute)

3 - Global organization, documents (TG, UB)

- Thomas explains the structure of our WG10 folder on the server
- The global membership list can be found here:
<https://bwsyncandshare.kit.edu/apps/onlyoffice/694476721?filePath=%2FQA%20and%20Reproducibility%20for%20Instruments%20and%20Images%20in%20LiMi%2FContacts%20%2B%20People%20%2B%20Workgrouplist%2FMemberlist%20QUAREP%20LiMi.xlsx>
- A document to all tables and the Zotero page we are going to work on can be found here:
<https://bwsyncandshare.kit.edu/apps/onlyoffice/762122253?filePath=%2FQA>

[%20and%20Reproducibility%20for%20Instruments%20and%20Images%20in%20LiMi%2FWG%2010%20Image%20Quality%2FLinks%20to%20Documents.docx](#)

- Thomas explains Zotero (reference platform for our group)
- Meetings: 2nd and 4th week on Tuesday at 10 am

4 - Focus on Table1 (IQ parameters) (TG)

TG proposes to focus strictly on 3 IQ parameters applied to WF and confocal microscopy (seems reasonable) to reach the first steps of image quality evaluation. To do so, we should suspend judgment about what is good or what is bad, for which technic or whatever. Just focus on definitions.

Signal to Noise Ratio (SNR), Dynamic Range (DR), and Sampling Rate (SR) seem to be good candidates.

<https://www.iso.org/standard/77327.html>

<https://www.rms.org.uk/rms-dictionary-of-light-microscopy.html>

Before the meeting:

Sum-up of participant contributions :

- **SNR :**

[AF] The SNR measures the roughness or granularity of your image, and this is independent of the relation between signal and background.

$SNR = (\mu_s - bkg) / \sigma_s$ Also: $SNR = \text{Signal (mean)} / \text{Signal (StdDev)}$

[SP] The ratio of the signal of an object to the noise of the surrounding background, where noise is the square root of the variances of contributing noise components.

$SNR = (\text{Total signal} - \text{background signal}) / \text{standard deviation of background signal}$

- **DR :**

[SP] DR is defined as the full well capacity of a pixel (the number of photoelectrons at saturation) divided by the cameras/detectors read noise.

During the meeting:

- AS, RN and GH: finding a common definition can be very difficult for SNR

5 - Discussion in 3 Breakout rooms

Breakout room 1 (SNR):

Alexia summarizes the discussion. Signal to background noise ratio vs SNR. Metrics outside the standard SNR ratio.

Breakout room 2 (Dynamic range):

Eduardo summarizes the discussion. DR classified by the histogram and number of saturated points. Distance between min and max.

Not to be confused with sensor parameters, this IQ shall be named Image Dynamic Range (IDR).

This parameters should be consider from the image analysis point of view.

From the definitions already there in Table1, we converge to a definition which depend on histogram values.

Still, should we take in account saturated and 0 pixel values ?

Gerhard Holst: Range of the image or of the point; scope or sample

Julia: Dynamic range understanding needs to be specified before we can create a definition

→ subdefinitions are needed

Breakout room 3 (Sampling Rate):

SR should be redefined to Lateral Sampling Rate (size of the image pixel) and Axial Sampling Rate (size of the z step).

RN : it is important to notice that the pixel size optimization coming from different constructors leads to different values. They use different definitions.

JR points out a document on this topic which seems promising.

Everyone seems to agree on the SVI definition of the Nyquist Rate : <https://svi.nl/NyquistRate>