1) DICOM GSDF calibration accuracy in ICC context

Question to be answered:

How accurate can a display system be calibrated to DICOM GSDF in function of different image pipeline characteristics. This is a very relevant question since medical applications may in the future use the ICC framework to render (a mix of) greyscale and color images for which the greyscale images should be rendered as closely as possible to DICOM GSDF.

Methods:

For a number of display systems (the displays that the group has available and for which characterization data is available) with their specific image pipeline, determine how accurately the display system can be calibrated to DICOM GSDF (metrics: deviation from target curve, dL/L, JND/step) by making use of the ICC profile framework. This can be done by means of actual bench testing or simulation.

Specifically it is very interesting to understand the influence of:

- the type of ICC profile (and rendering intent) that is being used
- the underlying native behavior of the display system (gamma, sRGB, …)
- whether or not there is already a LUT available in the display that can be used for calibration (and the characteristics of this LUT such as dimensionality [1D LUT; 3D LUT; combination of several LUTs], number of entries, input and output bit depth)
- changing ambient light conditions
- changes in display behavior over time (eg. aging effects)

2) Absolute color calibration accuracy in ICC context

Question to be answered:

How accurate can one reproduce absolute colors on a display system in function of different image pipeline characteristics. Very relevant question for medical specialties such as dermatology, fundus imaging, …

Methods:

For a number of display systems (the displays that the group has available and for which characterization data is available) with their specific image pipeline, determine how accurately the display system can reproduce absolute colors. The metrics that could be used are:

- min, max, average deviation in deltaE2000 between target color and actually rendered color
- % of colors which is in gamut
- (maybe smoothness in some way?)

Specifically it is very interesting to understand the influence of:

- the type of ICC profile (and rendering intent) that is being used
- the underlying native behavior of the display system (gamma, sRGB, …)
- whether or not there is already a LUT available in the display that can be used for calibration (and the characteristics of this LUT such as dimensionality [1D LUT; 3D LUT; combination of several LUTs], number of entries, input and output bit depth)
- changing ambient light conditions
- changes in display behavior over time (eg. aging effects)

3) Perceptually linear color calibration accuracy in ICC context

Question to be answered:

How accurate can one calibrate a display system to be perceptually linear in function of different image pipeline characteristics?

Methods: ***(we need to discuss about this for sure)***

For a number of display systems (the displays that the group has available and for which characterization data is available) with their specific image pipeline, determine how accurately the display system can be calibrated to show a perceptually linear color behavior. The metrics that could be used are ***(we need to discuss about this for sure)***:

- metric that defines perceptual linearity
- luminance, contrast, color gamut size of the display
- smoothness of the display behavior
- …

Specifically it is very interesting to understand the influence of:

- the type of ICC profile (and rendering intent) that is being used
- the underlying native behavior of the display system (gamma, sRGB, …)
- whether or not there is already a LUT available in the display that can be used for calibration (and the characteristics of this LUT such as dimensionality [1D LUT; 3D LUT; combination of several LUTs], number of entries, input and output bit depth)
- changing ambient light conditions
- changes in display behavior over time (eg. aging effects)

4) Tests on medical images

Once we have at least basic answers on the questions above, and we better understand what imaging pipelines are suitable for which applications, then we can start with experimenting on medical images. Eg. we could then study the impact of the choices made on specific clinically relevant features in medical images. .