



**Multispectral requirements for whole slide imaging  
Teleconference**

19 December 2013 • 14:00 (UK) / 9:00 (EST)

The meeting was called to order at 9:00 am (EST) by Craig Revie, acting chair, with the following attendees:

Glenn Davis	Vantana Roche
Craig Revie	FFEI
Marc Mahy	Agfa
Aldo Badano	FDA
Masahiro Yamaguchi	Tokyo Institute of Technology
Po-Chieh Hung	Konica Minolta
Bas Hulsken	Philips Healthcare Incubator
James Vogh	X-Rite
Andy Masia	X-Rite
Max Derhak	Onyx Graphics
John Dalrymple	Independent (ex Sharp)
Wei-Chung Cheng	FDA
Hong Wei	DataColor
Louise Collins	FFEI
Robert Horn	Agfa
Takashi Matsui	Eizo
David Clunie	DICOM
Tom Lianza	X-Rite
Michael Flynn	Henry Ford Health System
Masahiro Nishibori	International University of Health and Welfare
Phil Green	Gjøvik University College

Those present introduced themselves and identified their area of interest.

Mr. Revie reviewed the agenda for the meeting as follows:

1. Background and Introduction (Craig Revie)
2. Requirements from DICOM WG26 (Masahiro Yamaguchi)
3. Review of functionality in ICC Labs (Max Derhak)
4. Discussion Requirements
5. Next steps
  - a. Identification of editor for document describing use cases
6. Next meetings

One goal of the meeting was to identify someone to act as a focal point to collect uses cases for this project.

### **1. Introduction**

Mr Revie gave a brief background to the work ICC has been doing to support multispectral imaging [see attached]. He stated that the forthcoming ICC v5 would help address multispectral requirements, and that v5 was scheduled to be published by the end of 2014.

### **2. Requirements from DICOM WG26**

Yamaguchi-san presented a proposal on the multispectral presentation state for Digital Pathology [see attached]. His idea was to use ICC v4 Device Link class profiles in conjunction with a virtual input device to apply spectral unmixing. The link profile would allow conversion from raw sensor responses to the ideal virtual device and from there to visualization and output.

Mr Hulsken referred to a previously circulated proposal for a multispectral presentation state for Digital Pathology [see attached] which it was agreed appeared to be consistent with the workflow shown in Figure 1 of Yamaguchi-san's presentation. However, the latter required ICC v5 to implement the spectral unmixing, which Mr Hulsken's proposal assumed v4.

It was clarified that in Mr Hulsken's presentation the grayscale images shown could be spectral channels, colour channels or other types of image generated by an input device. They were commonly used to represent biomarkers. It was agreed that metadata was needed to distinguish which they were, and whether raw sensor data or transformed, and it was stated that there was a framework for this in DICOM. There was no spatial or frequency component in such images.

### **3. Review of IccLabs functionality**

Mr Derhak discussed how ICC v5 could support multispectral imaging. He began by showing slides from his presentation at the Vancouver meeting [see attached]. The limitation of v4 was a fixed PCS and the lack of support for spectral data and connections. The v5 specification included PCS extensions and more complex transforms through MPE, which would for example allow spectral unmixing in an ICC profile by encoding the appropriate algorithm as a Calc element. He showed an example Calc element workflow.

He then went on to present some new ideas on BioMarker Profiles [see attached]. In this he summarised the problem statements and proposed a Biomarker Connection Space (BCS) within the proposed v5 specification. Two new profile classes would be associated with this: ID class to convert from input to BCS, and Visualization class to convert from BCS to PCS or output device. The CMM is responsible for connecting channels.

He emphasized that it was the framework rather than the actual biomarker names or definitions that were being standardized in this proposal.

Mr Horn suggested there was a parallel with remote sensing where by convention a name maps to a given spectral sensitivity. Mr Hulsken stated that spectral characteristics could vary across different vendors, and so the idea would need to have extensibility and customizable visualization.

Mr Derhak agreed it would make sense to make the concept more generalized. New functionality would need to be added to the current IccLabs document, which would be useful.

Mr Revie concluded the meeting, asking Mr Derhak to modify his proposal specifically to incorporate the needs of the remote sensing / satellite imaging community, and Mr Hulsken and Yamaguchi-san to refine the use case diagram based on the input from the meeting to give a clear view of the requirements.

### **Next meetings**

Mr Revie thanked those attending and noted that the next meeting will be scheduled in the New Year. A Doodle poll will be circulated to determine the best date.

In addition the following is the schedule for subsequent meetings:

- 16 Jan: Displays (Mike Flynn)
- 20 Feb: Whole Slide Imaging / Digital Microscopy (Craig Revie)
- 20 Mar: Medical Photography (was Dental) (John Penczek)
- 17 Apr: Mobile (Andy Masia)

### **Actions:**

1. Collect information for a web page on the ICC site on spectral imaging for the medical imaging community – Mr Revie
2. Modify the biomarker profile proposal to make more general and address remote sensing requirements – Mr Derhak
3. Refine use case workflow and diagram to clarify requirements, based on input from the meeting – Mr Hulsken and Yamaguchi-san