**IEEE P4001 Working Group**

Meeting #34 Meeting Minute [7 & 8 April 2022] – [See Time Below] - V00

2-Day In-Person Workshop @ SPIE DCS) & Virtual Zoom Meeting

1. Call to Order – John Gilchrist (JG)
   1. Introduction and Affiliation Declarations
      1. Roll call of Individuals online and in person
   2. Establishment of Quorum – Report on Membership
      1. Quorum achieved
      2. Attendance: attendees captured by Chris Durell (CD)
2. Approval of Agenda - JG
   1. Agenda Review for Meeting #34 – (JG)
      1. Overview of the topics for the meeting as below which are residual items that have not yet been settled for the standard. Objective of the meeting was to move these items as close to finished as possible.
         1. What do YOU want to achieve form this workshop !
            1. What are your questions and comments about the draft documents?
         2. Straylight update (update by CD)
         3. Optical characteristics: with and without fore-optics
         4. Effective pixel count versus Average Energy / pixel – Deferred?
         5. Nominal along-track IFOV – Still needs discussion (notes)
         6. Nominal scan – Definition (same as above)
         7. Peak Centre and Width – how to deal with camel shaped peaks, etc.
         8. Reference Illuminants: 2,855.5K and 6,500K
         9. Temporal co-registration / Motion threshold – Standard OK, but need assumptions
         10. How to define “Typical” and “Threshold” Values
         11. Spatial fill factor effect - 4.8.4. needs updating – TS/AF
         12. Resampling
         13. Stability / repeatability / uncertainty / orientation
   2. Meeting agenda approval was motioned by Bob Arlen and seconded by Torbjorn Skauli.
   3. Explanation of the workshop: The two meetings together on April 7-8 count for one attendance towards membership. This was done because of the afternoon and morning time zone on the different days to get different time zones and because a two meeting credit would give new attendees automatic membership at this late stage and was considered unfair to long term participants.
      1. Reminder that membership is obtained through attendance of two successive meetings. Members are allowed to skip one meeting but will lose membership status and voting priveldges if two meetings are missed in a row.
      2. Up until the tracking of membership status has been consistent but not emphasized to encourage as large a participation group as possible.
      3. **Emphasis on voting privileges**. From this meeting forward, as we are moving towards finalization, there will a few more meetings. Attendance and membership will become crucial towards final voting on the standard. Each member is encouraged to know their status and attend as many meetings as possible to retain that status.
      4. CD has the action to police the membership aggressively and will be alerting people to their status in the coming weeks. If there are any questions, please contact Chris.
   4. Approval of Meeting Minutes from meeting #33
      1. No prior minutes reviewed – will conduct at the next meeting.
3. As a special note, selected members wrote (5) papers and gave (5) presentation on Tuesday April 5 from 0830-1030 EDT. The speakers supported the following topics under development in the P4001:
   1. Paper Number: 12094-1  - John Gilchrist

The P4001 standard for hyperspectral imaging: overview and status update for draft standard

* 1. Paper Number: 12094-2 – Torbjorn Skauli  
     Camera performance characteristics in the IEEE P4001 standard for hyperspectral imaging: a status update
  2. Paper Number: 12094-3 – David Conran  
     Development of test methods for hyperspectral cameras characterization in the P4001 standards development
  3. Paper Number: 12094-4 – Chris Durell for Jan Makowski & Barbara Eckstein (unable to attend)  
     Metadata definitions for a set of notional use cases in the P4001 standard for hyperspectral imaging
  4. Paper Number: 12094-5 – Bob Arlen  
     Choice of terminology in the P4001 standard for hyperspectral imaging
  5. The session was very well attended with >40 people in the room for each talk.
  6. The leadership of the P4001 would like to extended its thanks to the members that gave the extra effort for this special session.
  7. Those papers are still being processed by SPIE and a link will be provided by John as soon as the material is available for review.

1. Overview of IEEE Patent & Copyright Policies - JG
   1. Call for Patents - JG
   2. Copyright Policy - JG

**NOTE from Secretary** – The following minutes are an almagamation of two days of workshop discussion and activity. The topics were not covered sequentially over the two days. The minutes record only the salient points for discussion and actions.

1. Standards Document review – Lead by TS and JG
   1. [*https://docs.google.com/document/d/1S8ktuPBAJBhW5\_uAJ0MyMInFyzIR3j2USIqPWWwp\_60/edit#heading=h.4cvxnwnxc70x*](https://docs.google.com/document/d/1S8ktuPBAJBhW5_uAJ0MyMInFyzIR3j2USIqPWWwp_60/edit#heading=h.4cvxnwnxc70x)
2. Topics of Group Discussion (not in order of discussion)
   1. Presentation for the draft of the straylight testing document by CD
      1. Notes and changes were actively noted in the standard document by CD. The document is available here (still very much a draft):
         1. <https://docs.google.com/document/d/14maBwSN5bV6i1TujL0AuddxQLQWT-0L5uf-UCAaRVfY/edit?usp=sharing>
   2. Optical characteristics: with and without fore-optics
      1. Blackbox needs to include foreoptics – any change of foreoptics constitutes a new characterization effort.
      2. It was recommended that users of the P4001 create a data sheet for each confuguration of camera and optics.
   3. Effective pixel count versus Average Energy / pixel
      1. It was discussed how the effective pixel count of a hyperspectral camera may be defined. Andrei briefly re-iterated the concept of the effective pixel count and how it is calculated from the two different criteria for image sharpness: the first criterion as suggested by Gudrun Høye, Trond Løke, Andrei Fridman (and as described in C1 Spatial-Spectral document) and the second criterion as suggested by Torbjørn Skauli. Andrei and Hannu(?) expressed the preference for the first criterion. John commented that there seems to be a quite distinct split between manufacturers preferring the first criterion and users, preferring the second criterion. John concluded that this discussion should be continued.
   4. Nominal along-track IFOV
      1. Recommended that iFOV should be along track but other iFOV can be reported as needed by the P4001 user.
   5. Nominal scan
      1. Things got a bit complicated here and there was quite a debate about the following concepts:
         1. Speed of motion \* frame rate = equivalent along track scan rate.
         2. Cross-track pixel GSD plus iFOV, frame rate, and Motion = Ground sampling distance.
         3. During the discussion on the "nominal scan length" Hannu recommended to specify pushbroom cameras in static mode (i.e. without the scanning motion).
      2. Recommended to add definitions of GSD and GRD to the standard – Bob Arlen took that action.
         1. David Conran volunteered a reference document for this.
         2. There was a suggestion of creation of a table of value for nominal scanning modalities. Still under debate.
      3. At this time there is no consensus on how to specify the effects of scan motion, since these effects are highly dependent on operating parameters. This issue will have to be further developed in working groups, aiming to arrive at well-informed alternatives that can be voted over if necessary.
   6. Peak Centre and Width – how to deal with camel shaped peaks, etc.
      1. No conclusion was reached on characteristics for peak center and width. David Perry has started on a review which is not yet finished. This issue will need to be further developed in working groups.
   7. Reference Illuminants: 2,855.5K and 6,500K
      1. Recommended that these two spectrums should be defined by P4001 consistently in all referenced tests.
   8. Temporal co-registration / Motion threshold
      1. Recommended that users should indicate some motion thresholds that are acceptable to normal use.
      2. John & Torbjorn need help here!
         1. The draft contains a tentative definition for a measure of the amount of movement during recording which would introduce an amount of coregistration error equivalent to the static coregistration error. This needs further review, and testing in practice.
   9. How to define “Typical” and “Threshold” Values
      1. Recommended that this also has impact to topics listed below in (6.l) in terms of repeatability.
         1. Recommended that threshold should be the values that are reported
         2. Recommended that Typical values are left to the manufacturer or tester to conduct an appropriate level of testing to provide the users confidence in the camera spects.
   10. Spatial fill factor effect - 4.8.4. needs updating – TS/AF
       1. Andrei and Torbjorn will do this offline and bring it back.
   11. Resampling
       1. Recommended that resampling be an option in reporting.
          1. There was unresolved concern that users need to be aware that resampling is happening and this was balanced against IP concern from manufacturers and the perception that resampling is perceived as “bad”.
          2. Torbjorn will propose a way to characterize the effect of resampling as a form of coregistration nonuniformity which may resolve this issue, but this is currently an immature idea.
   12. Stability / repeatability / uncertainty / orientation
       1. Recommended that users attempt several mount/dismounts to the test jig to determine repeatability – frequency and number TBD by the standard user, but should be noted.
       2. Recommended that this is the first step to understand aspect of Type A and B uncertainties. Further comment or effort should be remanded to the review NIST General Uncertainty Method:
          1. <https://www.nist.gov/itl/sed/topic-areas/measurement-uncertainty>
       3. Recommended that the user should note the orientation of the camera in the what the test was performed.
3. Next Meeting(s)
   1. Meeting #35 – Proposed for the week of May 30 (Virtual)
   2. Meeting #36 timing is TBD.
4. Outreach
   1. Trond Loke has submitted submitted a P4001 Overview for EARSeL Workshop in Pottsdam on June 22-24
      1. <https://is.earsel.org/workshop/12-IS-Potsdam2022/>
   2. John and Chris have submitted a P4001 Overview paper for SPIE Optics & Photonics in San Diego for August 21-25
      1. <https://spie.org/conferences-and-exhibitions/optics-and-photonics>
   3. Trond Loke has submitted submitted a P4001 Overview paper for Whispers in Rome on Sept 13-15.
      1. <https://www.ieee-whispers.com/>
5. AOB
6. Adjourn General Meeting
   1. Bob Arlen (BA) moved / Alex Fong (AF) seconded.
7. Meeting closed.