

Draft Minutes, Rev. 1  
 ASC OP1 ASC OP/SC 1, BSR/OEOSC-OP1.002, Optics and Electro-Optical Instruments – Optical Elements and  
 Assemblies — Wavefront Standard  
 Saturday, January 21, 2006, 1:00 p.m. — 4:00 p.m.  
 Fairmont Hotel, Cupertino Room  
 170 South Market Street, San Jose, CA 95113

**Attending**

<input checked="" type="checkbox"/>	<b>Committee Members (9)</b>	<b>Representing</b>
<input checked="" type="checkbox"/>	David Aikens	Zygo Corporation.
<input checked="" type="checkbox"/>	Gordon Boulton	JDS Uniphase Corp.
<input checked="" type="checkbox"/>	Walter Czajkowski	APOMA (Edmund Optics)
<input checked="" type="checkbox"/>	Marla Dowell	IEEE/LEOS (NIST)
<input checked="" type="checkbox"/>	Andrei Brunfeld	Xyratex
<input checked="" type="checkbox"/>	Lincoln Endelman	SPIE
<input checked="" type="checkbox"/>	John M. Hamilton	Northrop Grumman Corporation
<input checked="" type="checkbox"/>	Hal Johnson	Harold Johnson Optical Lab
<input checked="" type="checkbox"/>	Steven VanKerkhove	Corning Tropel
<b>Observers (4)</b>		
<input checked="" type="checkbox"/>	Gene Kohlenberg	OEOSC
<input checked="" type="checkbox"/>	Stephen Martinek	4D Technology Corporation
<input checked="" type="checkbox"/>	Michael Morill	Lockheed Martin Space Systems Co.
<input checked="" type="checkbox"/>	Trey Turner	Research Electro-Optics, Inc.

**Auditor's Summary of Meeting**

The committee reviewed ISO 14999-4.2, and made recommendations to correct errors. A review of ISO 14999-5 resulted in a conclusion that the document should be scrapped. The committee decided to combine ISO 1010-5, ISO 10110-14, ISO 14999-4 into one US standard.

**Welcome and Introductions**

D. Aikens opened the meeting at 1:13 p.m. with a round of introductions.

**Adoption of Agenda**

G. Boulton moved that the draft agenda be adopted. M. Dowell seconded the motion. The motion carried unanimously.

**ISO 14999-4.2 Optics and photonics – Interferometric measurement of optical elements and optical systems – Part 4: Interpretation and evaluation of tolerances specified in ISO 10110**

ISO 10100-5 was written with a metrology section in the drawing notation document. The intent was to separate the metrology information from the drawing notation document.

D. Aikens volunteered to reedit ISO 14999-4. That is what was going to be discussed today.

This committee needs to decide how to proceed.

The round robin by Birch was poorly contrived. There were no instructions concerning how the samples should be tested. The samples were scratched so that peak to valley results varied greatly. RMS measurements were deemphasized.

L. Endelman noted that in some countries a standard is a government requirement. A technical report avoids that status.

D. Aikens listed what is now left in ISO/DIS 14999-4.

S. Martinek asked who is this document directed toward? It really does not address digital interferometry. All of the visual analysis has been moved into the annex.

L. Endelman asked why we are interested in fringes. D. Aikens said that industry should be using units of nanometers.

D. Aikens said that the definition of interferometry states that the wavelength of light is the unit of measure.

There are a lot of technologies.

D. Aikens said that ISO 14999-4 will pass. And author of the corresponding ISO 10110 documents has agreed to modify them to be synchronized with ISO 14999-4.

What should this committee do? Should we strike out alone and write a new standard?

A. Brunfeld said that the definition of the fringe is not established. His problem is to know where the fringe begins and ends.

D. Aikens stated that his position is that standards should document actual practice.

D. Aikens asked what the committee wanted to do at this point.

S. VanKerkhove said that he wants to see a consistency across the industry.

D. Aikens noted that the US votes “no” it can't propose changes. So, the US has to vote for the document with comments.

D. Aikens asked, “is the US delegation's position that the industry should be using nanometers as the unit of measure?” Should we push for HeNe as the reference wavelength since most shops have tools that use HeNe laser sources rather than sodium? M. Dowell said that the reference wavelength should not be a problem; however, it should be mandatory that the drawing state what wavelength is being used. S. VanKerkhove said if the wavelength is omitted from a drawing, he always calls to confirm what wavelength was used, and he asks what the customer means when he refers to fringes. If the measurement unit is nanometers, then the wavelength does not have to be identified. At the end of this discussion the following recommendations were made:

- ISO 10110-14, clause 4.3: “To eliminate confusion, the wavelength should always be specified.”
- ISO 10110-14, clause 5.3: Remove the note “The indication;  $\lambda = E$  (last element of the three forms of indication specified above) may be omitted provided the wavelength of specification is  $\lambda = 546,07$  nm (see 5.1).”
- ISO 10110-5, clause 4.3: To eliminate confusion, the wavelength should always be specified.”
- ISO 10110-5, clause 5.3: Notation should be modified to include specification of the wavelength identical to that of ISO 10110-14, clause 5.3.
- Note 1 on page 6 of ISO14999-4.2 is not correct. Change “orthogonal” to “Zernike polynomials, as they are not orthogonal on non-circular apertures.”
- ISO 14999-4.2, clause 3.1.3 note: “The integral may be approximated by the standard deviation provided that the measurement resolution is specified and is sufficient.” In a footnote refer to Church's criteria.
- ISO 14999-4.2, clause 3.2.6: “Rotationally symmetric” should be changed to “rotationally invariant.” This appears through out the document.
- The beginning of ISO 14999-5 should be struck.
- ISO 14999-4.2, clause 3.3.4: rotationally varying wavefront error.
- ISO 14999-4.2, clause 3.3.8 : rotationally varying wavefront error.
- ISO 14999-4.2, clause 3.2.5: should be rotationally varying wavefront error.

#### **Determine the US position concerning ISO/DIS 14999-5**

D. Aikens said that the scope is redundant and broad; it does not differentiate itself from ISO 14999-1 through 4. The definitions are redundant and inconsistent with other documents. The measurement requirements and principles ignore ISO 10110-5 and the whole problem of surface measurement. It only discusses transmitted wavefront measurement. The entire section 4.2 should be deleted since it has nothing to do with the standard. Section 4.3 is biased toward one type of interferometer and is inaccurate. Section 4.3.2 has so many errors that it should be deleted. Section 4.3.3 on relative intensity is also biased toward one type of interferometer. Section 4.3.4 is unusable as written because it does not tell the user anything about what to do for thermal equilibrium. Section 4.3.5 should be deleted; however, something should be said about focus position and its influence on measurement integrity. Section 4.4.1 completely neglects instrument transfer function and spatial frequency resolution. Incorrect conclusions are drawn in section 4.4.2. He said that he stopped reviewing the document at this point with the opinion that it should be scrapped. It seems that this document is intended to be a guide to industry for making interferometric measurements. The author probably looked at parts 1-4 and concluded that there was no practical information in them for a user, and embarked upon document 5 to correct that deficiency.

The ISO committee editor said that he had removed the objectionable material from part 4, and therefore does not need the US version of the text. He suggested that the US roll its text into part 5. D. Aikens felt that the community needs a document to address calibration uncertainty and measurement set up.

S. VanKerkhove said that the US does not have a US equivalence to what ISO did in 1996.

D. Aikens asked if we should edit ISO 10110-5 and 14 and release it as a US standard? G. Boulton remarked that we were considering whether to assume responsibility for ASME Y14.18 optical drawing standard, and that there were guests at this meeting who may have the expertise to undertake that task. D. Aikens said that an alternative would be to take ISO 10110 in total and modify it to make it more acceptable to the US optical industry, then release it as an ANSI standard. M. Dowell asked if we could then propose our standard as a replacement for the current ISO document. D. Aikens said that we would be in a much stronger negotiation position if we were to adopt the ISO standard. He said that many sections of ISO 10110 would be acceptable to the US as written. It could be combined into one document. The sections that would need work are wavelength material in parts 5 and 14, the entire part 7 which is scratch and dig. He guessed that less work would be required to revise 10110 than to update Y14.18.

In order to get a US document to be used, OEOSC would have to prepare a training class to show the US industry how to use it. The lens design houses would also have to be recruited to incorporate the notation in their software.

T. Turner said that we should understand the reasons why ISO 10110 is not accepted in the US before we modify and release the US version.

S. VanKerkhove said that slope specifications have come into greater use during the past ten years, and he does not see that topic covered at all. With new deterministic processing techniques, artifacts are left on the surface that need to be addressed. Should the US write a new version of ISO 14999-5?

The committee agreed to begin a new work project to develop a standard for surface and wavefront deformation measurement and notation.

Action items:

- Task force Leader – S. VanKerkhove
- Additional participants to be invited
  - Robert Kestner, [ASNML Optics LLC](#),
  - Dan Bajuk, [ASNML Optics](#),
  - Paul Dumas, QED
  - Marla Dowell, NIST
  - Ben Catching, JDSU
  - John Kincade, [SSG-Tinsley \(ssg-eom\)Labs](#)
  - Mike McBurney, Lawrence Livermore, come and give presentation on LL slope and power spectrum specifications and software in use at LL (Ask LL to send a representative to make the presentation)
  - Kevin Thompson, ORA
  - Ken Moore, Zemax
  - [Lahassen Assoufied](#), Argon National Laboratory
  - Peter Takacs, Brookhaven National Lab
- Adoption of ISO 1010-5, ISO 10110-14, ISO 14999-4 as a US standard
  - The secretary will convert ISO 10110-14 to a Word document for S. VanKerkhove.
  - D. Aikens will send his Word version of ISO 10110-5 to S. VanKerkhove.
- D. Aikens will invite Lawrence Livermore to present at the next meeting their system for specifying slope and power spectrum..

**Next Meeting**

The committee agreed to meet in Boulder, CO on the Sunday before the international meetings.

**Adjournment**

A. Brunfeld moved that the meeting be adjourned. S. VanKerkhove seconded the motion. The meeting was adjourned at 3:58 p.m.