# Modifications of the Type 17 Iris Record

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# Technical Issues Addressed :: Ins and Outs

## In

- Rectilinear compact formats (ISF)
- Compression algorithms (CGA)
  - PNG (lossless)
  - JPEG2000 (lossless + lossy)
- Scan (IST)
  - Progressive
  - Undefined
- Illumination (EAS)
  - NIR [700,900]
  - Defined spectrum [a,b]
  - Visible + Red [Caveated]
- Markup (xEB, OCC)
  - Iris-sclera, Pupil-sclera, Eyelids
  - Occlusions

## Out

- Polar formats
- Compression algorithms
  - JPEG

- Scan
  - Interlaced frame
  - Interlaced field

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# Technical Issues Addressed :: Ins and Outs

## In

- Frontal gaze (GAZ)
  - Angle between optical axis of eye and line connecting optical centers of eye and camera
- Boundaries as N  points (x,y)
- Eye color (ECL)
  - Estimating eye color … subjective, … very limited reliability despite its intuitive use in a policing context. It is determined by … melanin pigmentation, and spectrum of the incident light.  Historically unavailable to recognition algorithms, and not currently used.
- Vocabulary issue (ELR)
  - Eye label L/R/U vs. Feature Identifier

## Out

- Full pose description
  - Head pose (RPY) AND
  - Eye pose (RPY)
- Boundaries as Fourier Descriptors
- Transformation flags
  - Dropped
- Interlace options
  - Interlaced imagery is prohibited

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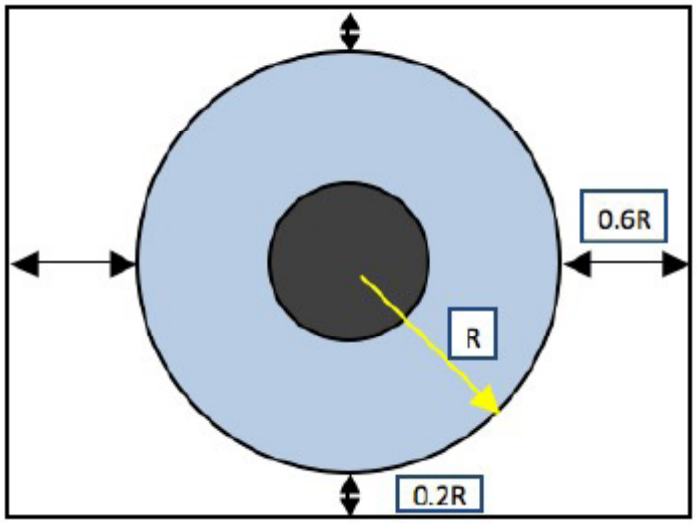
# Iris Geometries :: Compact vs. Not

**Table 75 Iris storage formats**

| ISF code | Description | Iris Centering | Iris margin requirement | |
|---|---|---|---|---|
| | | | Horizontal | Vertical |
| 1 | Unconstrained | Recommended | ≥ 0.6R | ≥ 0.2R |
| 2 | Raw: 640x480 | Recommended | ≥ 0.6R | ≥ 0.2R |
| 3 | Cropped | Required | = 0.6R | = 0.2R |
| 7 | Cropped and Masked | Required | = 0.6R | = 0.2R |




No provision for storing irises that are too close to the boundary.

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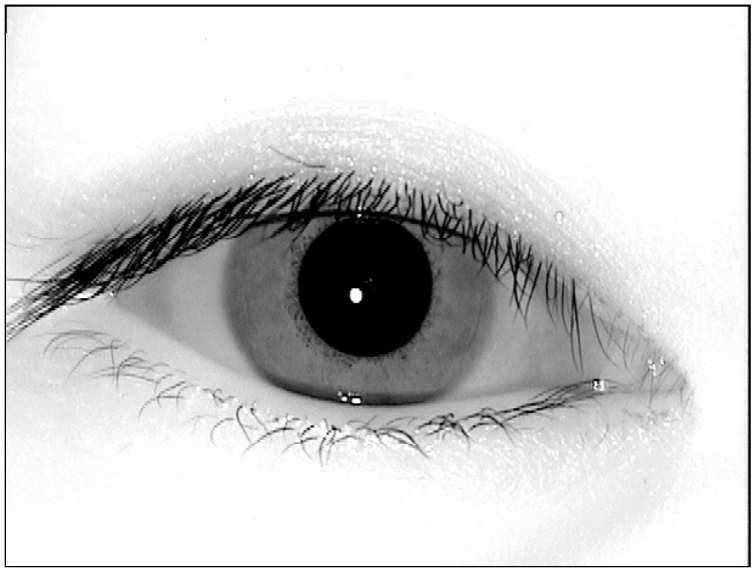
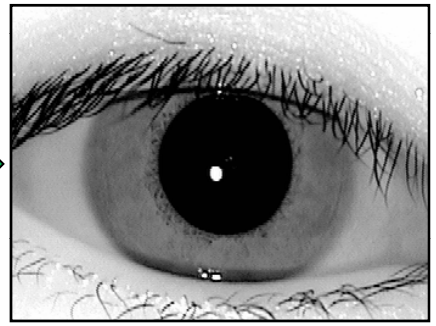
# Type 17 :: New sets of fields 5 of 7 :: Compact

| | | | | | | |
|---|---|---|---|---|---|---|
| ISF | O | 17.032 | N | COMPACT STORAGE FORMAT | 1 | 1 |



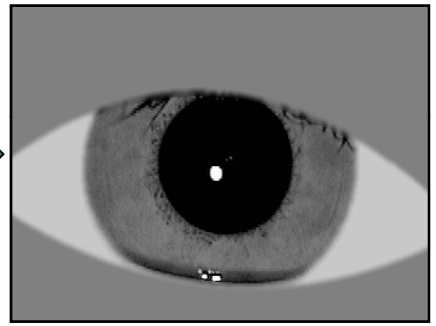
Parent image from camera

ISF 1



Cropped image

ISF 3



Cropped and masked image

ISF 7

Specialized image formats are standardized in

**ANSI/NIST Type 17**

**ISO/IEC 19794-6:2011 Iris Image Format**

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# Type 17 has new optional SAP field

- 7.13.3 Subject acquisition profile for iris
  - The SAP levels for iris acquisition are optional and are based upon those listed in the Mobile ID Best Practice Recommendation. They are entered in Field 17.031: Subject acquisition profile / SAP. Table 9 lists the differences between the SAP levels.

**Table 9 Subject acquisition profiles for iris**

| CAPTURE | SAP 20 | SAP 30 | SAP 40 |
|---|---|---|---|
| Iris diameter in true, non up-sampled pixels | ≥ 140 pixels | ≥ 170 pixels | ≥ 210 pixels |
| Number of (quasi-) simultaneously captured eyes | ≥ 1 | ≥1 | 2 |
| Exposure time | ≤ 33 ms | ≤ 15 ms | ≤ 10 ms |
| Viewfinder & image quality feedback | External or internal | Internal, optical or electronic | Internal, at least electronic |

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# Two standards :: Two communities :: One Origin

## A/N Type 17

- Law enforcement, gov. apps
- XML + Traditional Encoding
- Vendor defined fields
- SAPs
- Publication
  - TBD this week…

## ISO/IEC 19794-6

- Generic, civil applications
- Fixed length binary
- No vendor defined data
- Image capture best practice annex
- Publication
  - Final text circ 2/18/2011
  - Imminent

- Syntactically far apart (but so what)
- Semantically “close”
  - ISO does not support boundary nor occlusion opacity/type markup
  - ISO does not allow non-IR images.
  - ISO does not allow color images, nor eye-color labels

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# New standard :: ISO/IEC 29794-6

Iris image quality standard establishing normative requirements on iris images and thereby requirements on cameras. Expected completion: Late 2012.

- 6.2 IRIS IMAGE QUALITY METRICS COMPUTED FROM A SINGLE IMAGE
  - 6.2.1-3 Frontal gaze – azimuth, polar, roll
  - 6.2.4 Gray scale utilization
  - 6.2.5 Iris image authenticity
  - 6.2.6 Iris boundary shape
  - 6.2.7 Iris-pupil boundary contrast
  - 6.2.8 Iris pupil concentricity
  - 6.2.9 Iris-sclera boundary contrast
  - 6.2.10 Iris size
  - 6.2.11 Margin
  - 6.2.12 Motion blur
  - 6.2.13 Pupil boundary shape
  - 6.2.14 Pupil to iris ratio
  - 6.2.15 Sharpness
  - 6.2.16 Signal-to-Noise Ratio
  - 6.2.17 Usable iris area
- 6.3 IRIS IMAGE QUALITY METRICS COMPUTED FROM TWO IMAGES
  - 6.3.1 Common usable iris area
  - 6.3.2 Dilation constancy
  - 6.3.3 Illumination similarity

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# Three IREX Activities

**IREX I**

- Formats, cropping, masking
- Compression limits
- Geometry, Margins, Radius
- Dilation, concentricity
- Concluded mid 2009
- Supported ISO/IEC 19794-6

**IREX III**

- 1:N with N in the millions
- One and two eyes
- Cross camera interop.
- Timeline
  - Started February 2011
  - Initial Report July 2011

Open call for images


**IREX II / IQCE**

- Iris Image Quality
  - Definition
  - Evaluation
  - Calibration
- Supporting ISO/IEC 29794-6
- Report Spring 2011

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# Thank You

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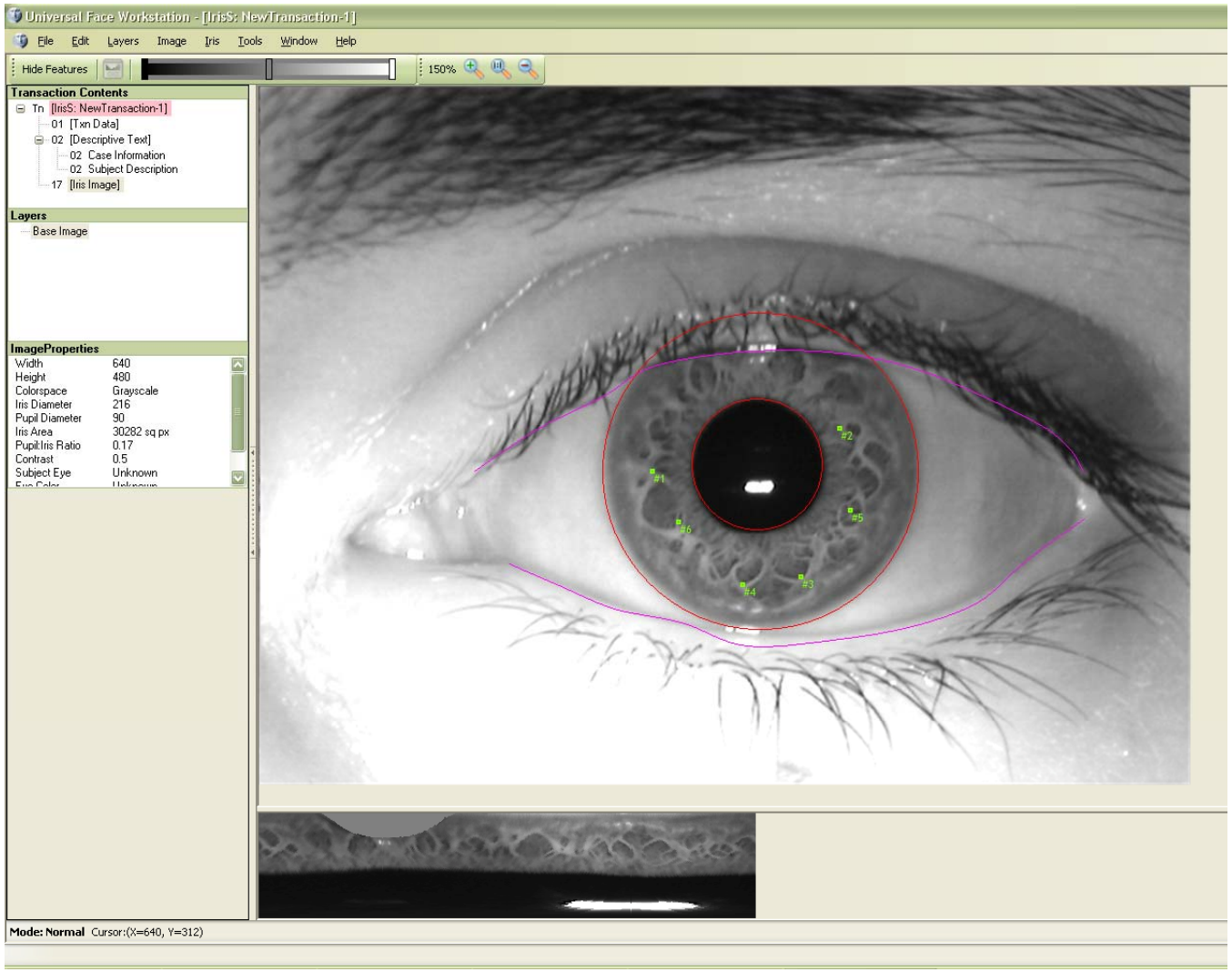
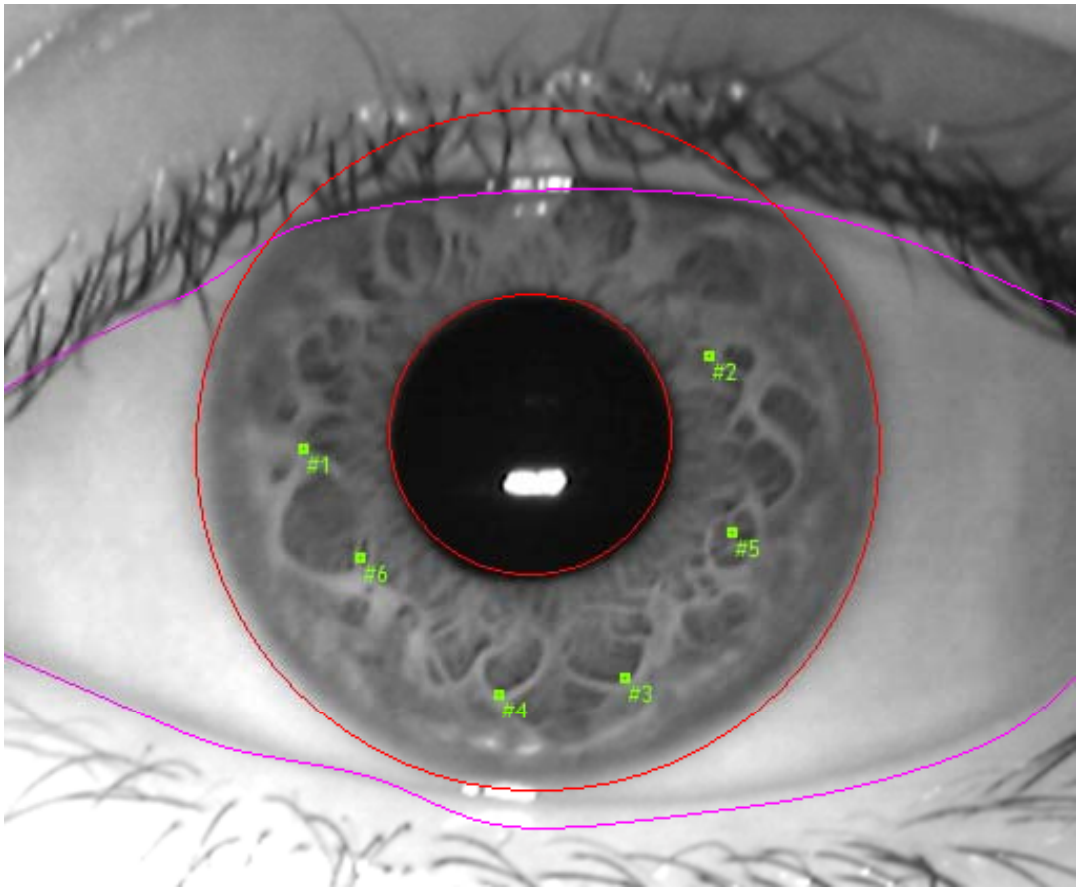
# Iris Markup :: UFW Example 1 of 2



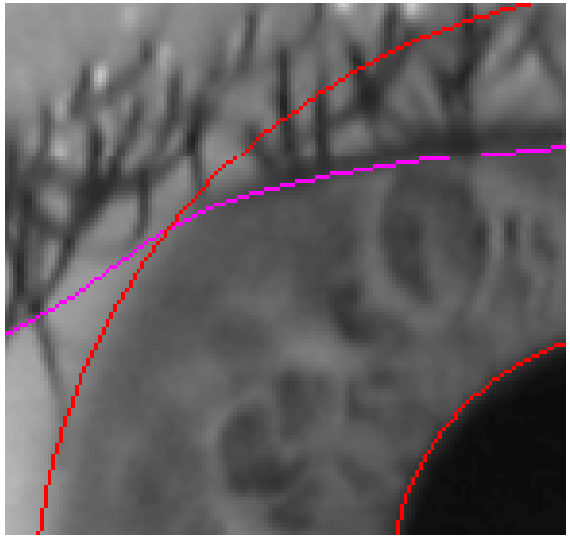

Screenshot from the Universal Face Workstation

Thanks to Noblis for this image

# Iris Markup :: UFW Example 2 of 2




Zoomed part of screenshot from the Universal Face Workstation



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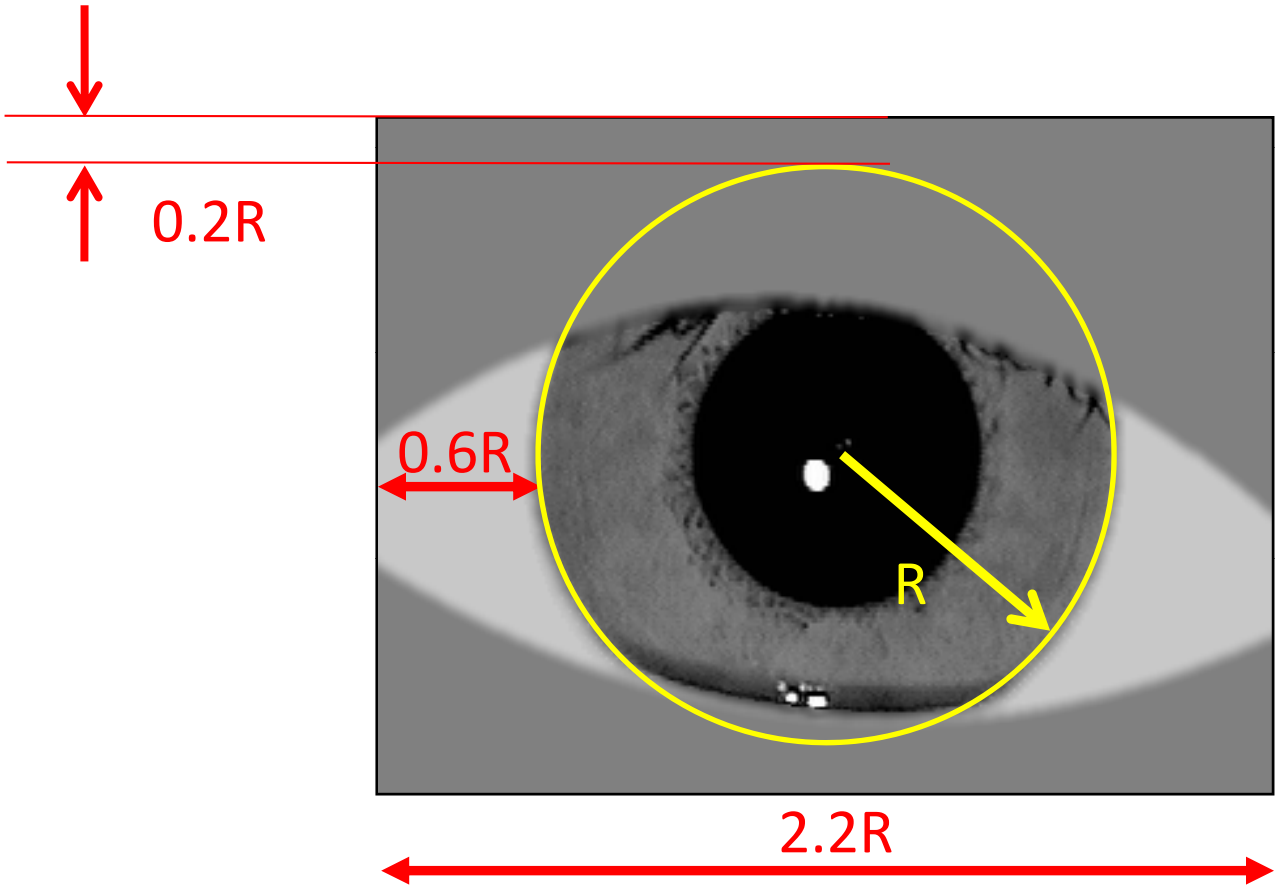
Thanks to Noblis for this image

# Compact Forms :: Geometric Requirements




This set of specifications is not in the current A/N draft - It needs to be.

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# Compression Requirements

- PNG is allowed
  - Recommended for 1:N
  - Lossless (preserves iris texture)
  - Standardized ISO/IEC 15948, free
  - You get what you get, around 2:1
- JPEG 2000 for higher compression
  - Can be lossless (setting bit rate to 8)
  - Can be lossy
    - Can precisely target bit rate, or file size.
    - Lossy compression ultimately damages iris texture
  - Standardized as ISO/IEC 15444
  - No formal profile for iris (or face)
- JPEG is out. It's not a good idea
  - Don't do it!

This set of specifications is not in the current A/N draft - It needs to be.

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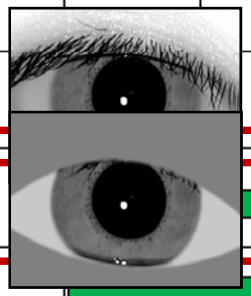
# Compression + Format Recommendations

- Compression – Avoid it when you can!
  - Lossy compression does incremental damage to images.
  - Either no compression, or lossless may be sufficient.

| | Recommended | | Target Record Size | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Role | Format | Compressor | 2KB | 4KB | 8KB | 16KB | 32KB | 64KB | 128KB | 256KB | 307KB |
| All | KIND 1 | Uncompressed | | | | | | | | | |
| All | KIND 3 | Uncompressed | | | | | | | | | |
| All | KIND 7 | Uncompressed | | | | | | | | | |
| All | KIND 3 | PNG Lossless | | | | | | | | | |
| All | KIND 7 | PNG Lossless | | | | | | | | | |
| 1:N | KIND 3 | JPEG 2000 Lossy | | | | | | | | | |
| 1:N | KIND 7 | JPEG 2000 Lossy | | | | | | | | | |
| 1:1 | KIND 3 | JPEG 2000 Lossy | | | | | | | | | |
| 1:1 | KIND 7 | JPEG 2000 Lossy | | | | | | | | | |



45KB

18KB

# Type 17 :: Revise field 14 :: Rotation ??

- Regarding 17.014: Rotation Angle of Eye (RAE)
  - Currently encodes in-plane rotation *"This optional field shall indicate the rotation angle of the eye".*
- But could be extended
  - Restate using Tait-Bryan (Y, P, R)
  - Reword as "This optional field gives an estimate of the angle between the optical axis of the eye and the optical axis of the camera, measured in degrees."

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# New topics 3 of 3, since July 27, yesterday

- Proposal to remove ability to store color images in Type 17
  - i.e. retain only grey-scale images
  - Why? Because mainstream cameras all produce single luminance channel (from NIR illumination)
  - Why not? The possibility to compare NIR enrollments with color search images, for example. The color image would be acquired in the visible.
  - But interoperability concern would be that you could slip hyper-spectral images into three RGB channels, without knowing what they mean.
  - So keep color: But add text: “If the image is encoded as a color image, the illuminant shall be VIS”.

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