EyeRIS PDR Notes
April 18, 2019

Notes from the preliminary design review for EyeRIS

Attendees:

AS : Alana Sherman
BE : Ben Erwin
BT : Bryan Touryan-Schaefer
DG : Dale Graves
DK : Denis Klimov
FC : Francois Cazenave
JD : Joost Daniels
JE : Jon Erickson
KB : Knute Brekke
KK : Kakani Katija
MC : Mark Chaffey
PM : Paul McGill
PR : Paul Roberts
RH : Rich Henthorn

Optical design

- MC [slide 7]: Is CoaXPress an industrial standard? There may be other standards for high bitrate streams.
    - PR: 300 m coax cables possible with CoaXPress.
- [slide 9] Perspective reconstruction / mesh creation
    - JD: Can you reduce occlusion by focusing closer? PR: Yes.
    - BE: Goal is more macro scale imaging? PR: Yes.
- [slide 11] particle concentration tests
    - DK: Not bad for a particle counting method.
    - KB: Single light source? PR: Yes.
- [slide 12] Lens selection
    - FC: OTher lenses with smooth adjustment of aperture
    - DK: You might be able to modify into smooth adjustment. PR: This seems close.
    - JD: You might consider using lens extender, aperture shape important? PR: Aperture of selected objective appears close to round at f/2.8.
    - DK: Use slower lens for 2.8 instead of 1.4, potential benefits?
- [slide 13] Port selection

    - PM: Use r^2 correction to correct images in microarray prior to processing
    - DK: Correction with microlenses not straightforward
    - DK: Where does the processing from microlens array happen? PR: In software (black box).
- [slide 14-17] Illumination
    - DK: How does calibration change at depth within image? PR: Will study. Calibration procedure can be done with grid target at any location, does not have to be fully known.
    - PM: What particle densities are you expecting?
    - PM: Imaging and light spread is more forgiving at low particle densities.
    - JD: Shaping of light; avoid illumination of water body in front of volume of interest.
- [slide 20] Optical power
    - DK: Using light absorption of particles?
    - JD: Is blur actually a problem? Could use blurred particles/streaks to address occlusion problem. PR: Can investigate in the laboratory.
    - DK: Would it be easier to work in ambient light? PR: Dependent on exposure settings, need artificial light
    - PM: What SNR do you need for effective PIV? PR: 10 dB is general , KK: will investigate, PR: more light will be helpful, but better scatterers could be injected, KK: which is something we want to avoid
    - BE: What working volume are you working with? PR: 20 cm x 20 cm x 10 cm
    - DK: 12 db of SNR, is that for plenoptic or conventional imaging? PR: conventional, Raytrix does not specify

Electrical design

- [slide 22]
    - BE: 5 wavelengths? TX only, or bi-directional? Have 3 wavelengths available (1350, 1370, 1470, 1490, 1510, 1530 nm)
    - DG: anything 1340 and above we can have
    - KB: What about Ventana? Avoid deviating between systems.
    - BE: If system has its own CDWM, could reserve a wavelength for science system.
- [slide 23] High level block diagram
    - DK: Can you run with fewer optical channels?
    - MC: Why do you need so many channels?
- [slide 24] CoaXPress to fiber
    - MC: USe of a lot of fiber, but promising approach to make it work. We need a dark fiber.
    - DK: Can software reduce ROI? PR: You can reduce datarate in some cases, but of course to be avoided.
- [Slide 25] Power conversion

    - DK: Is there a penalty in efficiency of DC vs AC? PR: 90% efficiency at higher voltage.
    - AS: Advantage to this method is easy switching between miniROV and other vehicles.
    - DK: Standard describing leakage current not clear. Could this become a problem? PR: Manufacturers states their board is compliant with specification, so likely less that 100/300 uA.
    - PM: They state as 'typical' 300 uA. BE: Expect ground fault issues?
    - BE: The pin-outs are the same between DR and V
- [Slide 26] System diagram
    - On DR, science can, split port into individual lancers, 5 wavelengths with 5 lancers; gigE is on 1310 and 1350
    - BTS: remove science can and give us direct fiber; BE: this precludes use of science serial ports. Alternatively, use your own dedicated science can. Can give us FS1; DG: can't provide dark fiber on MiniROV
    - MC: Could use a cable instead of junction box for lights.
    - DK: fusing between lights in the junction box. AS: Yes, not shown
- [slide 27] Stock Arduino control board
    - MC: Does board have overcurrent protection? PR: Not sure. MC: Did make a similar design for i2MAP with similar function, worth looking into.
- [slide 28]: Power budget
    - DG: Is 64W full power per light? PR: 100 W max power for each light but converter will limit power

Mechanical design

- [slide 30] external assembly
    - DG: What is the miniROV version of this design? PR: Similar, it will be fairly heavy. Aluminum arms.
    - BE: Where do comp for j-box and lights go. PR & AS: Perhaps on back? PR: Below the camera housing between two mounts.
    - BE: Where is light j-box? BE: Where are cables? PR: follow along from lights along aluminum arms of light array
    - DK: Could you implement either light direction control (4-bar linkage) or set it up so the lights always point in the right direction regardless of degree of extension.
    - FC: Note bars in folded position are near parallel. This significantly increases required force to open.
    - BE: Light connectors should maybe be upgraded. One in drawing is something pilots have problems with occasionally.
    - PM: Singificant pinch hazard around moving objects. Something to be mindful of procedurally. BTS: Hydraulic noise is warning.
    - PM: Think of significant grounding risks. Could/should run a deliberate ground from outside case. Could ground inside MinK from shell to braid.

    - DG: Would likely have to change sleds between collections and EyeRIS.
- [Slide 33] Thermal distribution
    - DK: Could use sliding bar for camera adjustments. JE: This increases thermal resistance.
    - JE: Cannot run lights on deck, PR: Camera will be 10 deg warmer on deck.
    - FC: Do you need titanium ends? Could just make lens port titanium? JE: Housing diameter is a concern as well.
    - DG: Move light power board to the light j-box to reduce heat load in the camera housing. Just use pressure-tolerant electronics. Similar to what is being done on MiniROV.

Risks

- [slide 34] Risks and mitigation
    - MC: Look into dispersion of fiber over length, could test with spare umbilical.
    - MC: Would be interesting to compare other 12G standards (Black Magic) to CoaXPress.
- BE: How to deploy both DeepPIV and EyeRIS? Put on tray and swap? DeepPIV on ram? AS: Talk to KK.

Safety

- See slide 33 for mechanical safety considerations.