ZTF Grounding or Yes, there are two paths you can go by Stephen Kaye

ZTF Instrument - Topology





ZTF Instrument - Preamplifier



Noise Problem for ZTF

- Ideally, single sided mode should have an rms noise which is V2 lower than differential mode
- Single sided configuration reveals rms noise much higher than differential mode
- There must be noise pickup on the video signal
- Differential mode takes care of the noise, so the pickup is common mode



Zoomed in noise images





Single Sided

Differential

Nature of Single Sided Noise

- Using FFTs of the raw data to see dominant frequencies
- Can we understand what is causing the noise by dominant frequency
- Dominant frequency is 53.88 kHz. Maybe a switching supply?
- FFTs were interesting, but minimally useful to solve the noise problem



Build Up of Dewar

- After returning from Palomar, the build up of the dewar proceeded slowly to discover where the noise was coming from.
- Typical noise was seen when the video cable shield came into contact with the dewar without any cables connected on the dewar side
- Grounding and shielding were suspected in the noise pick up

Eliminating the Noise

- It was found that the single sided noise was greatly reduced when the compressor lines were detached from the dewar (orange plot)
- Also, the backplate temperature cable was disconnected



Grounding

- We completed, by ohmic measurement, the grounding diagram for the instrument
- Due to multiple controllers and multiple paths back to earth ground, the entire dewar needed to be disconnected to understand the grounding.



Original Video Cable Grounding Diagram



Original Clock and Bias Cable Grounding Diagram

New Grounding Configuration

- The video shields should be connected to the chassis ground on the controller side of the cable
- A temporary grounding with alligator leads we implemented to complete the shield grounding
- No effect was seen with the clock and bias cables, so these were left as is for the first test



New Video Cable Grounding Diagram

Detail of grounds for one controller



Video Shield to Controller Chassis

- Video shield connected to controller chassis
- This completes the chassis shield from controller through shield to dewar
- Rms noise for single sided case is reduced nearly to differential levels.
- Interference is still degrading noise in single sided transmission but...
- Common mode rejection provides ample noise margin in differential mode.



Conclusions and Take-Aways

- Compressor lines add an extra ground path for the dewar
- Cable tray also add an extra unanticipated ground path
- Grounding of the instrument should be completed so that unanticipated paths don't affect the instrument
- Double check grounding on each component with an ohm meter as the instrument is going together
- Measure and complete a grounding diagram as the instrument is going together
- All this is especially important with a multiple controller configuration, where grounding everything is necessary yet loops are inevitable. The goal then is to shunt the resulting currents around the signal wiring.