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“Details about Oe, Ow Tcal and CDMS Power Supply Failures”

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Details about Oe, Ow Tcal and CDMS Power Supply Failures

Eskil Varenius, 2021/12/21

In late November 2021, Ow Tcal power suddenly dropped by 70% despite no obvious changes to hardware or software. We also saw gain compression being reported in the FS ONOFF VAL output. There were changes to hardware and software during this time, but these should not be related to the Tcal signal. “Should” is a dangerous word, so I spent many days trying to prove that the work done was indeed not related. After a few days of pulling my hairs, the Oe antenna Tcal power dropped in a similar fashion. This was a real mystery.

While trying to establish if the two telescopes suffered the same behavior, the Ow power disappeared completely. Also, the CDMS USRP unit failed to respond via Ethernet. This was good, because it meant a clear failure and something clear to look for. Quickly it was discovered that the reason was that the CDMS ground unit had no power. CDMS is not obviously related to Tcal, but in the Oe/Ow setup, the 80 Hz TTL signal generated by the DBBC3 is converted from RF to fiber in the CDMS ground unit box, and then sent up to the telescope, where it is converted back to RF again before injection into the signal chain. After looking further into the problem, it was discovered that the reason for the CDMS ground unit failure was that both (!) power supplies inside had died. The PSU units (coming with the unit when delivered from MIT Haystack) were models:

- CUI Inc, VDRS-100, 24 VDC @ 4 A, 88-264 VAC in, DIN rail;
- DeltaPSU MDS-065APS18B, 18 VDC, 3.61 A, 90-264 VAC in, open-frame, mounting holes spaced 95.3 mm and 44.5 mm distance, 3.2 mm diameter.

While investigating the Ow unit, we also checked the Oe unit. Although still alive, the Peltier temperature control circuit had a very strange on/off behavior, consistent with lack of power. This pointed towards a similar problem in the Oe box. Therefore, we bought two sets of replacement PSU units. The original ones were not available from our standard reseller at quick delivery, so instead we used these two replacement models:

- TDK-Lambda DRB Switch Mode DIN Rail Power Supply 85 → 264V ac Input, 24V dc Output, 4.2A 100W;
- Mascot Embedded Switch Mode Power Supply SMPS, 18V dc, 3.6A, 65W Open Frame.

We then replaced the PSU units in both the OE and OW CDMS ground units, and since then the Tcal power levels (and USRP behavior) has been back to normal.

That four power supplies fail within practically the same week is surprising. This could be a “components-of-similar-age” problem; but I would still expect some common external trigger like an AC power spike. However, nothing else in this rack (fed by the same power circuit) suffered any known damage.