1. Contamination of optical surfaces inside the cavity

This is the only failure mode we can definitely correct for ourselves. The most likely place for contamination to build up are the facets of the TiSapph crystal itself, although you should be able to tell if anything else is dirty by turning on the pump and seeing if there is a lot of scattered light off of any of the mirrors or other optical surfaces. Clean in a clean area without lots of dust (a laser table with HEPA filter is probably good enough. Watch to see if you observe dust in the pump beam before opening the cavity up.). Flowing in nitrogen to help with keeping the cavity clean could help, but there's some danger that you will perturb elements in the cavity so if you have a clean enough environment this probably isn't the way to go. For cleaning the surfaces, use dry, optical grade methanol that hasn't been open for a while (to ensure there isn't water mixed in with the methanol). If there is visible particulate or a lot of scattering, acetone can also be used on the Ti:sapph crystal. Don’t clean the birefringent filter and be careful with the optical diode (Faraday rotator) since it's magnetic.

2. Piezo stack sag

One mirror is attached with a ~2 cm long piezo stack. Over time, the weight of this piezo stack can cause the mirror to sag and misalign the cavity. Without opening the cavity, you can compensate for this effect by raising the input pump beam (so if you observe the spot you need to hit on the cavity keeps rising, this is likely the cause). With enough sagging, however, the cavity will eventually need to be realigned, which is something probably we couldn't do ourselves, since it requires desoldering and resoldering the cavity mirrors. If you open the cavity, you can observe the fluorescence from each direction of the crystal at the output coupling mirror. When the cavity was first aligned, these were perfectly matched. If the piezo stack has started to sag, the heights of the two will not match.

3. Etalon misaligned

There is an etalon inside the cavity that may get misaligned as well. The reflection from the etalon is used for the error signal of the etalon lock. If the etalon is misaligned, the power of this reflection increases, so the voltage for the etalon photodiode will increase. The typical factory setting has the etalon error signal voltage at ~0.5 V, but as long as the voltage is less than 1.5 V this is probably okay. This is the hardest issue to fix.

Additional Notes on 532 Pumps: 1. Sprout and Equinox beams are shaped similarly and don't require adjusting cylindrical lenses (in leg before SolsTiS) when switching between the two. If switch to Verdi, need to move cylindrical lenses further apart. 2. IPG GLR-30 (currently in use for hydrogen): If SolsTiS comes unlocked due to GLR-30 power fluctuations, increase the etalon dither drive from 15-20 (standard) to 100. This will make it harder to unlock at the expense of linewidth.