

10-15-2014

Potential evidence of spectral hole burning:

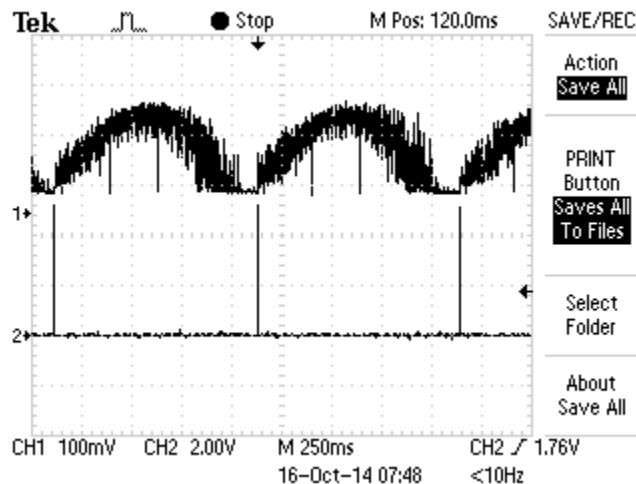
We have set up the green laser through a double-passed 85MHz AOM. The AOM is parked at 85MHz for some seconds and then scanned from 80 to 90MHz. We park the laser on resonance, which is apparent as there is ample fluorescence.

Learned (or re-learned) an important lesson re: 2x passed AOMs, you only get the benefit of not steering the beam, if you place the AOM at the focal length of a lens. It doesn't work without the lens. I saw this referred to as a cat's eye reflector in a paper by E.A. Donley: Double-pass acousto-optic modulator system in Rev. Sci. Instruments.

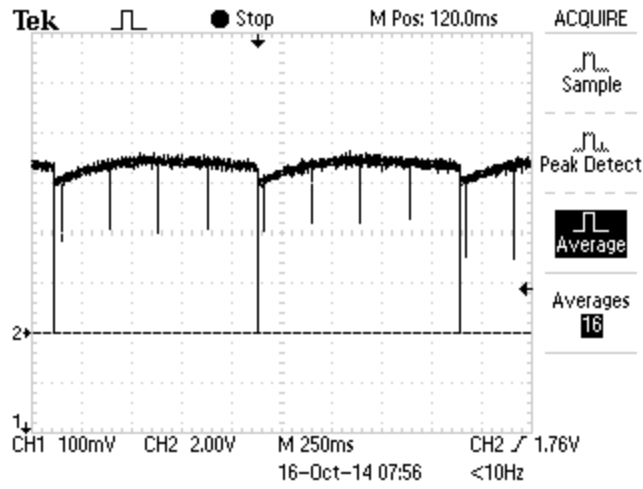
If we look at a photodiode after the crystal, I think we are starting to see a feature as we scan the AOM. If we average the feature seems to wash out or is unpredictable, I think this is because the laser is drifting after we've burned our hole and so the hole moves relative to the current laser frequency. ~10MHz width, and moving more at longer time scales seems very reasonable for our problematic seed laser.

Combined with this evidence is the observation of geometrical structure to the fluorescence. When burning, much of the crystal glows. When scanning, the front of the crystal glows, then the fluorescence seems to come from deeper in the crystal as the scan ramps. This makes sense to me if the front of the crystal has a spectral hole burned in its Eu population, as you reach that frequency, the laser can penetrate further before eliciting fluorescence.

Also, changing laser performance could make the hole confusing or more difficult to discern- conclusion: we need to narrow the laser. 1) better laser, 2) lock to ref cavity, 3) better electronics



Hint of spectral hole burning? 20MHz frequency ramp after the crystal, feature seems to be ~10MHz, comparable in size to our AOM bandwidth, but more pronounced, narrower.



20MHz freq ramp before the crystal, we see a slight hump, indicating the bandwidth of the AOM set-up, but it is not as sharp as the feature above, supporting the above feature being a spectral hole.

Next Priority: 1) better laser, 2) lock to ref cavity, 3) better electronics?