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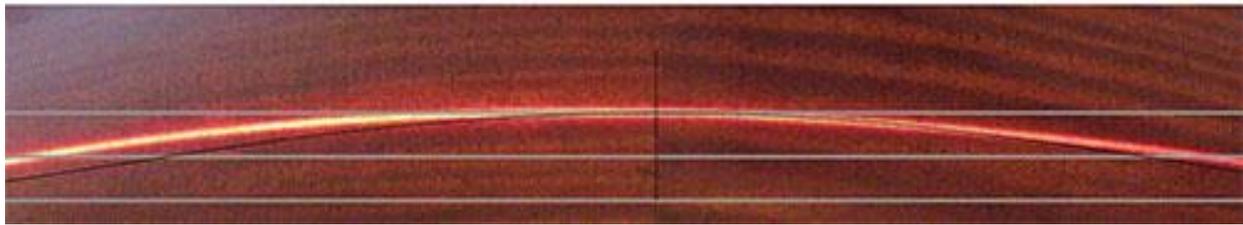
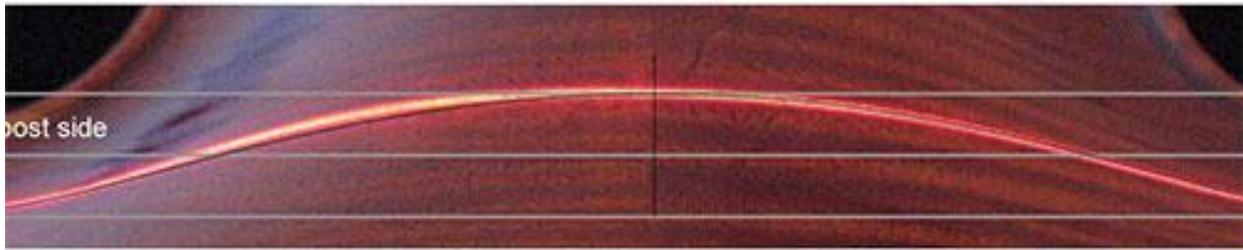
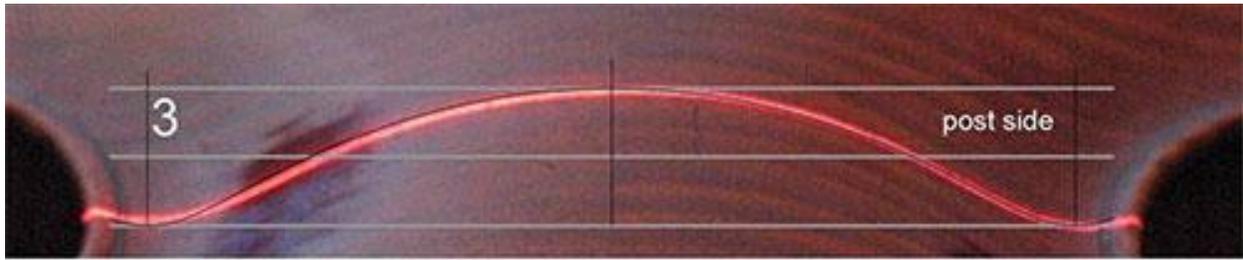
USING THE CARPENTER'S LASER LEVEL IN READING ARCHES

In 2004 one of my more creative friends, Andres Sender, suggested to me the possibility using a lecturer's laser pointer for reading violin arches. As our discussion on this progressed, we realized that cheap laser levels were available that threw a line instead of a point, for tasks like aligning picture frames in a straight line on a wall. I immediately started testing this concept, using a \$35 Sears level, handheld.

The original configuration was to set up a video camera looking at a low angle down the length of a violin top or back and filming while running the laser line across the instrument perpendicular to the center line, which gave a movie of the arching as a line moving up the length of the violin, revealing the cross arching from one end to the other. See <http://darntonviolins.com/images2/BrosAmati-arch.wmv> for an example of such a video.

By stopping the video and printing various frames I was able to build a complete set of arching templates for any violin I wished to replicate.

Here are a couple of frames from the video, and over them I have superimposed curtate cycloid arching lines, to check the violin's correspondence with the cycloid arching concept.



Because so many Cremonese instruments' arching correspond closely to curtate cycloid arching once distortions are removed and half templates are made (which permits greater freedom in precise placement of the templates) I have now moved on from doing this to using a more general method.

By the time of the Andrea Amati birthday celebration at the Shrine to Music Museum in July 2005 this concept was well enough developed that I brought a set of prints to show around to fellow makers.

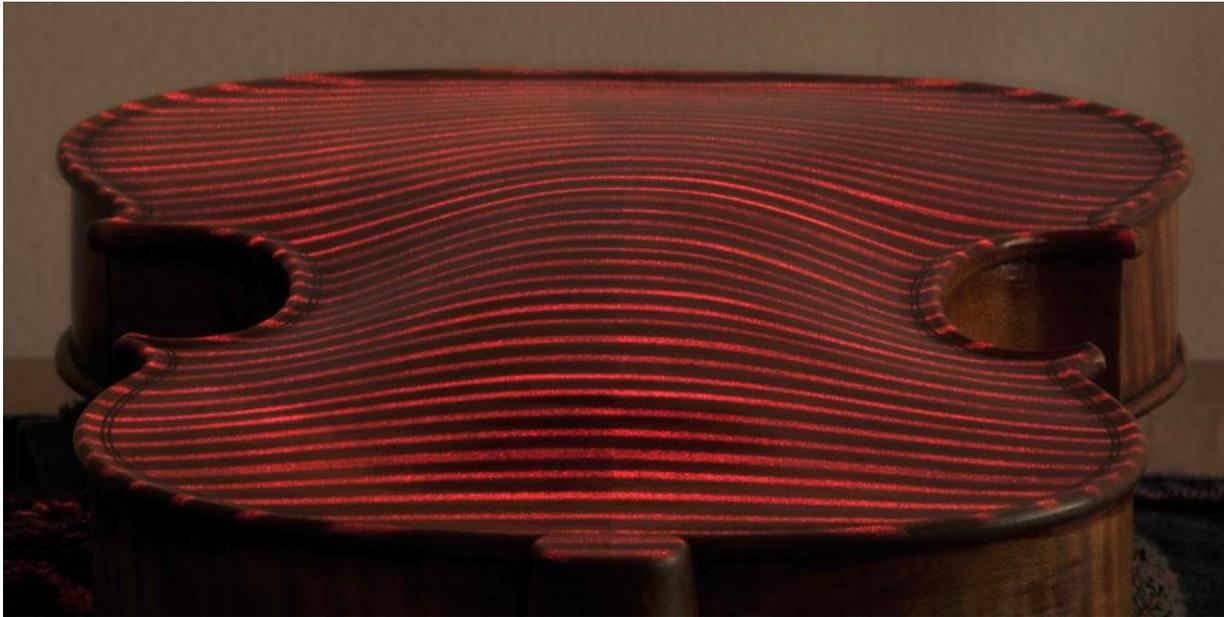
In order to make sharper templates, I also shot still frames at the critical points for the standard arching templates. Combined, these two, the stills and the video, enabled me to keep a record of some of the more interesting violins that came through the shop.

Several years later I started thinking about how to more easily capture all the information I needed to see a violin's arching in one shot of higher resolution, and developed the idea of building a jig to do this. This is the method I currently use.



The jig is a track that I suspend over the subject violin using two boom microphone stands. The track carries a sliding carriage on which the laser rides, pointing directly downward. So far this is essentially a mechanized version of what I had been doing all along by hand. The new twist was to use coffee stirring sticks as closely-spaced “ties” under this track. As the carriage is moved by hand from one end to the other, the sticks act as shutters to block or permit the light to reach the instrument below. I use a digital camera set for a time exposure, with a long lens (for perspective lessening) set to its smallest aperture (for depth of field). The ambient light in my room is dim enough to give a slightly underexposed shot of the violin, just enough to read the violin without being too bright to interfere with the laser, with a 30-second exposure. This time allows me to make several runs with the carriage back and forth down the track, which has the effect of equalizing the exposure times for each slit in the track’s bed.

In order to get good views, I shoot each violin four times: the top and the back, from each end. Using an outline taken from the violin, I am able to get the accurate width of any spot along the outline, enlarge the photo containing the laser line of that spot to the appropriate width, print that, laminate the print, and then cut out a template for that position. The vertical distortion from the slight downward view that’s necessary for seeing the instrument is negligible, on the order of a couple of tenths of a mm.



My current rig yields lines at $\frac{1}{2}$ inch intervals, but of course that could be anything and depends on the width of the coffee stirrers and the distance between them. The jig I am currently using has 2.5mm spaces ($\frac{3}{8}$ " stirrers on $\frac{1}{2}$ " centers) , which gives a wider line than necessary, but in practice I find it easy to cut templates to the forward edge of this line, and so the actual width doesn't matter. I'm contemplating what the next version of this device might be, and it will probably use a strip of black plastic with laser-cut openings.

On the following page is a shot of the current setup in action. Notice that the mic booms are on opposite sides. This assures that they can't fold up and collapse on the violin. The violin rests on strips of soft foam, which is easy to align and soft on the violin. Though the violin appears misaligned relative to the frame above it, this is because I always align the corners of the violin to the laser line. That's what's being done in the photo—the laser is moved to the nearer corners and then the violin moved so that the line falls the same on both corners.

