

Re: Projection Optics

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From: Adam Norton (*AnortonREMOVETHIS_at_ix.netcom.com*)

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Dave,

I am not nearly as pessimistic as Steve about the cost of this setup. I think you could put a telescope in front of the existing projector lens and have it work quite well. The light from the projector lens would enter the eyepiece and exit the objective end. The requirements for the telescope are:

- 1) It would have to have a decent apparent angular field to match the angular field of the projector.
- 2) It needs generous eye relief so the exit pupil of the telescope (which is now the entrance pupil) can be positioned coincident with the exit pupil of the projector.
- 3) It needs a large exit pupil (now entrance pupil) diameter to roughly match the size of the projector's exit pupil (although if it is smaller the only penalty will be lost light, and there is probably plenty of light after the image size is reduced).
- 4) The magnification needs to be roughly 30X depending on the projector lens.

I think all of the above might be met pretty closely by a good commercial rifle scope.

As for the mirror, I think just a simple piece of thin, uncoated glass would probably work since you will have plenty of light. Put a black screen behind it to avoid distraction from the transmitted image. I presume the patient would be looking up into the mirror at the transmissive screen placed a meter or so away. There will be a double image from the glass which will be less apparent as the screen is moved farther away and as the glass is made thinner. To eliminate the backside reflection you could use an AR coating on the back (you can get glass like this off the shelf) or try to find some black glass of a large enough size. Alternatively, you could have the patient look into one of those large surplus tank periscope prisms that are sold really cheap on surplus optics sites (make sure it is not silvered so it only uses total internal reflection). The prism would have to be kept fairly close to the eyes.

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Re: Projection Optics

sci.optics: Re: Projection Optics

Optical design and systems engineering for Silicon Valley and beyond.

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(Remove antispam feature before replying)

"Steve Eckhardt" <skeckhardt@mmm.com> wrote in message

news:dluned\$051\$1@tuvok3.mmm.com...

> In article <dluj0u\$1n9\$1@singer.cent.gla.ac.uk>, magnatomdb@netscape.net

> says...

>>I have an application where I want to project (probably using an LCD
>>projector) an image on a small screen (approx 10cm x 10cm) where the
>>projector is approximately 6 metres away. To complicate matters the
>>image will be projected on a screen at 90 degrees to the normal location
>>of the screen (i.e. the projection must be reflected by 90 degrees). Is
>>this possible (within a reasonable cost?) What type of lenses and
>>mirrors would I require?

>>

>>This is for stimulus presentation in an MRI scanner, so my options are a
>>little limited (i.e. no metal in the scanner room!)

>>

>>Thanks for your help

>>Dave Brennan

>

> I'm not sure what you mean by "a screen at 90 degrees". Do you mean that

> you

> want the image to be in portrait orientation (longer dimension vertical)

> rather than the usual landscape (longer dimension horizontal)? Or do you

> mean

> that the image must travel 6 metres horizontally and then bounce off a

> mirror

> onto a screen that is parallel to the floor (visible to a patient lying on

> their back and looking up)? To do this without metal, you will need a

> mirror

> with an all-dichroic coating. These are available, but plan to pay

> US\$1000

> for a piece 10 x 10 cm. A potential vendor would be Unaxis.

>

> Projecting a 10cm image at 6m is easy. The magnification is about 4X, so

> you'll need a lens 1.2m from the projector and 4.8 m from the screen. Its

> focal length should be about 1.0m. Most projectors operate at about

> F/2.8, so

> you should be able to get away with a lens (achromatic doublet) about 350

> mm

> diameter. A SWAG at the cost of a lens this large is US\$25,000, but I've

> never

> bought such a lens. (You'll also need to remove the normal projection

> lens.)

>

> The final trick is that you need to relay the pupil of the illumination

> system

> to the projection lens. If you're into delicate operations, just remove

> the

> lenses from the LCD projector that are next to the imagers. Otherwise,

> buy an

> LCOS projector. Most of the designs I've seen don't have the lenses by

> the

> imagers. Removing the projection lens will still be necessary.

>

> HTH

> --

> Best regards,

> Steve Eckhardt

> skeckhardt at mmm dot com

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