

Re: true magnification of Televue 3x?

Source: <http://sci.tech--archive.net/Archive/sci.astro.amateur/2005-12/msg02358.html>

- *From:* "Roger Hamlett" <rogerspamignored@xxxxxxxxxxxxxxxxxxxxxx>
 - *Date:* Tue, 27 Dec 2005 16:40:49 GMT
-

"Jason Watters" <jw@xxxxxxxxxxxxxx> wrote in message
[news:vgdsf.10069\\$3Z.4198@xx](mailto:news:vgdsf.10069$3Z.4198@xx)

> Hi again Roger,

>

> First off, thanks again for trying to help me out. Allow me to first
> explain what I used to have, and now what I am trying to achieve once
> again:

>

> My setup used to be as follows in the optical train:

> C9.25 > JMI zero shift focuser > Televue 3x barlow > Toucam Pro webcam

>

> With this setup, I never had vignetting problems and since the Toucam
> was

> color, no filter wheel to add to the length of the optical train. Enter

> a

> Lumenera LU 075. This camera's CCD is the ICX424 which covers a larger

> area

> than the Toucam's CCD. I've attempted to try to achieve the same focal

> length as with the former Toucam, but that's where I've had vignetting

> problems. Here's the optical train:

>

> C9.25> JMI focuser > *modified* Televue 3x > "Astro Engineering" manual

> filter wheel> Lumenera camera

>

> I say modified for the Televue, because I shortened the tube so that

> when

> the filter wheel and Lum camera were added, the total length came to the

> same as when I used the webcam without filter wheel.

>

> This worked ok, except I later discovered that I wasn't getting the same

> focal length due to the larger size of this CCD, so that's when I tried

> to

> increase the length between the camera and Televue 3x. I already had

> vignetting beforehand and this only made things worse. When I added

> roughly

> 50mm greater distance between the camera and modified barlow, I was

> achieving roughly the same focal length as with the Toucam. So my

> problem

Re: true magnification of Televue 3x?

> has been simply to try and eliminate this vignetting I now seem to have.
> Whoa.

The size of the CCD, _has no effect whatever_ on the 'focal length'....
You are getting your thinking very confused. I suspect what you are saying, is that you found the image scale was smaller, because of the larger pixels.

> I think I mentioned that I previously tried a 2" Powermate 4x which
> worked
> great, but then I wasn't achieving the same focal length as with the
> Televue. According to Televue's chart, it takes a lot of added distance
> with the 4x Powermate to achieve greater focal length. If the 5x
> Powermate
> could be shortened before I added the filter wheel/ camera, it might
> work
> but then again I may have problems since it's only 1.25" size.
>
> I am currently experimenting with some eyepiece projection software.
> Maybe
> I can couple the camera to a premium eyepiece and get the same focal
> length
> as with the former system.
>
> To be honest, I don't know the exact focal length I had but the image
> scale
> was sufficient with the C9.25, Televue 3x, and webcam system. It's been
> a
> royal pita trying to achieve the same thing with this camera!
You had exactly the same focal length, as with your first setup, with the shortened Barlow.

What you have found is very simple. The new CCD, has larger pixels, and these cover more of the sky. The object of having larger CCD's, is to give greater coverage, and because the pixels are bigger, collect more light, and have larger 'well depth'. These are all features, that are 'desirable' for deep sky imaging, but basically don't matter for webcam planetary imaging, which is what I suspect you are trying to do.

> I'd like to get my same focal length back at minimal added cost if
> possible.
> If all else fails, I had considered the Baader FFC, but its price range
> is
> beyond what I want to pay, especially if eyepiece projection might be a
> viable alternative.
>
> Jason

If you are trying to work at the sort of focal lengths you are producing, for anything other than planetary imaging, then 'think again', and instead work to reduce the image scale. You will gather more light per pixel, see deeper, and the resolution will be limited by the atmosphere, not your optics.

Even for planetary imaging, a quick estimate, suggests you won't actually

Re: true magnification of Televue 3x?

have been gaining much from your larger scale. The 'limit' of resolution, is the point at which the CCD, can resolve the highest frequency sinusoidal component in the waveform across the Airy disk. For an 8" scope, this corresponds to sampling at about 0.2 arc seconds/pixel. A little beyond this, may be worthwhile (perhaps 0.15 arc seconds/pixel), but going much further, is really just a waste of time. Now with the ICX424, the pixel size is 7.4um across, so a focal length, of about:

$$(7.4*206)/0.2 = 7622\text{mm}$$

is about the maximum it is worth trying for (you might 'push' to perhaps 10m, especially a colour camera, which has lower 'spatial' resolution, to be really safe).

Now this range is about *4 to *5 on your scope. Given that I suspect your spacing with the existing Barlow, is already giving this sort of figure, then what you should be asking, is not 'how do I get the old image scale', but 'do the new images actually show as much as the old ones'?

Now I suspect your 'vignetting', is actually being caused by pushing the optical angles on your existing Barlow too far. If you have access to another Barlow (*2), try putting the spacing back to how it was on the older CCD, and adding the second Barlow in front of the existing unit. Ongoing, I realise the focal length I gave, was for the *2 Barlow. The *3, has a focal length of -2.06". If you measure the length to where your old CCD sat, you can then calculate pretty closely, the magnification you had, and with the pixel size, work out the image scale. The Toucam has 5.6*5.6um pixels.

You could then wait till after the holidays, and ring Televue, and ask for their advice on image magnifiers to use. Make sure you know the size of your CCD, the image scale you want, and how far the CCD is spaced from where the camera would fit in the eyepiece tube. I suspect they will say the 5*, will not vignette on a 1/3" CCD.

Best Wishes

> Roger Hamlett" <rogerspamignored@xxxxxxxxxxxxxxxxxxxx> wrote in message
> [news:LWbsf.26335\\$zt1.23100@xxxxxxxxxxxxxxxxxxxxxxxx](mailto:news:LWbsf.26335$zt1.23100@xxxxxxxxxxxxxxxxxxxxxxxx)

>>

>>

>> "Jason Watters" <jw@xxxxxxxxxxxx> wrote in message

>> [news:Jqbsf.10653\\$nm.8986@xx](mailto:news:Jqbsf.10653$nm.8986@xx)

>>> Hi Roger,

>>>

>>> Thanks for the very useful info. The only thing I want to correct is

>>> that I

>>> do have the JMI installed between the scope and the Televue, and have

>>> been

>>> wondering how much this distance also adds to the magnification with

>>> the

>>> Televue 3x.

>> It doesn't directly (this helps a _lot_ in the figures... :-)

>> However it _does_ increase the focal length of the scope itself. The

>> secondary on the SCT, is also acting as an image multiplier. Increasing

>> the spacing from this to the image plane, makes it's factor increase,

Re: true magnification of Televue 3x?

Re: true magnification of Televue 3x?

>> and
>> makes the SCT, act as a longer focal length scope.
>>
>> > I've had these vignetting problems for some time, especially since
>> > switching
>> > from a webcam sized CCD to a 1/3" format. I did at one point borrow
>> > a
>> > friend's 4x Powermate in the 2" size and no longer had vignetting,
>> > but
>> > the
>> > image scale was smaller than with the 3x barlow. I'd be tempted to
>> > try
>> > the
>> > 5x Powermate, but it is only available in 1.25" size so I may still
>> > have
>> > vignetting problems plus the distance above the top of the barlow
>> > would
>> > be
>> > increased by the filter wheel/ camera. If there was a way to shorten
>> > the
>> > Powermate 5x (and thereby get less overall magnification once the
>> > filter
>> > wheel and camera are added), and not have vignetting problems due to
>> > the
>> > 1.25" size, it might be ideal.
>> >
>> > Jason
>> What focal length do you actually 'want'. What is the pixel size of
>> your
>> CCD?. Whose CCD is it?. What is the filter wheel?.
>>
>> Best Wishes
>>
>> > "Roger Hamlett" <rogerspamignored@xxxxxxxxxxxxxxxxxxxx> wrote in
>> > message
>> > [news:vC9sf.15657\\$f7.6495@xxxxxxxxxxxxxxxxxxxxxxxxxxxx](mailto:news:vC9sf.15657$f7.6495@xxxxxxxxxxxxxxxxxxxxxxxxxxxx)
>> >>
>> >> "Jason Watters" <jw@xxxxxxxxxxxx> wrote in message
>> >> [news:05Arf.10191\\$nm.14@xx](mailto:news:05Arf.10191$nm.14@xx)
>> >> > I have been trying to figure out the true magnification of my
>> >> > Televue
>> >> > 3x.
>> >> > I
>> >> > use it with my C 9.25 SCT and it is inserted into a JMI
>> >> > motofocuser
>> >> > which
>> >> > adds some length between the barlow and visual back, plus I have
>> >> > some
>> >> > length
>> >> > between the barlow and CCD camera due to a filter wheel in the
>> >> > path.

Re: true magnification of Televue 3x?

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>>>> I
>>>> realize that the magnification is way beyond 3x– is there any way
>>>> to
>>>> figure
>>>> out the true magnification?
>>>>
>>>> Thanks,
>>>> Jason
>>>> The Barlow lens, is simple to calculate the 'magnification' factor
>>>> produced. It is:
>>>> $Mf = (f-s)/f$
>>>>
>>>> Where 'Mf' is the effective factor applied to the scopes focal
>>>> length,
>>>> 'f'
>>>> is the focal length of the Barlow assembly, and 's' is the
>>>> separation
>>>> between the optical centre of the assembly, and the focal point.
>>>>
>>>> Now, if you have a filter wheel, adding perhaps 1.2" to the length,
>>>> together with a CCD, perhaps 1" inside it's own camera body. The
>>>> JMI,
>>>> will
>>>> add perhaps another 2", making 's', perhaps 7.2". It is designed to
>>>> be
>>>> about 3.2", and the focal length if I remember correctly, is
>>>> about -1.65".
>>>> With your spacing, this will give:
>>>> $(-1.65-7.2)/-1.65 = 5.3*!...$
>>>>
>>>> You are also talking about vignetting. This will be being made worse
>>>> by
>>>> the long distance between the lens assembly, and the CCD (you don't
>>>> say
>>>> how large the CCD is, which is critical data).
>>>>
>>>> For Powermates, these are effectively complete 'scope' assemblies
>>>> used
>>>> to
>>>> alter the light paths in a much more complex way.
>>>> If you look at:
>>>> <http://www.televue.com/engine/page.asp?ID=42>
>>>> This gives graphs for the magnification of the various PowerMates,
>>>> with
>>>> different spacings.
>>>>
>>>> First general comment, put the JMI, in front of the lens assembly.
>>>> You
>>>> do
>>>> not want variable lengths in the light path after the Barlow. Now
>>>> try

Re: true magnification of Televue 3x?

>> >> to
>> >> shorten the light path as much as possible. You may even be able to
>> >> get
>> >> a
>> >> threaded adapter to replace the top tube of the Barlow, and screw
>> >> directly
>> >> into the filter wheel. Provided your CCD is not too large, this
>> >> should
>> >> solve the magnification/vignetting problems. However if the CCD is
>> >> big
>> >> (a
>> >> unit like the ST2000 or larger), then you should be looking at using
>> >> 2"
>> >> accessories, rather than 1.5", to keep the light path as large as
>> >> possible. You may well also find that results would be better
>> >> without
>> >> the
>> >> JMI, but using a RoboFocus on the main scope focuser instead (this
>> >> keeps
>> >> the length/weight at the back of the scope down, brings the optics
>> >> closer
>> >> to the focal point they are designed for, and reduces potential
>> >> flexure
>> >> points behind the scope).
>> >>
>> >> Best Wishes
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• **References:**

- ◆ ***true magnification of Televue 3x?***
 ◇ From: Jason Watters
- ◆ ***Re: true magnification of Televue 3x?***
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◇ *From:* Jason Watters

- Prev by Date: ***Re: Uncollimated binoculars repairable?***
- Next by Date: ***Re: Uncollimated binoculars repairable?***
- Previous by thread: ***Re: true magnification of Televue 3x?***
- Next by thread: ***Re: Time Lapse animation of the asteroid Vesta***
- Index(es):
 - ◆ ***Date***
 - ◆ ***Thread***