

From: [Poenar Daniel Puiu \(Assoc Prof\)](#)
To: [Sansan Low](#)
Subject: RE: Inquiry about possible product
Date: Monday, 14 June 2021 12:35:00 PM
Importance: High

Dear Sansan Low,

Let me quickly address your queries, with my answers in [blue](#):

- What is the application the products are used for?
[All the items I asked \(or am asking, see below\) you to include in the quotation are for a project proposal regarding monitoring potable water contaminants using fluorescence](#)
- Are you the end user of the product?
[It depends what you define as “product” and “end user”, and for what time frame. If you consider only the project itself at whose proposal I am now working, of course I am the only end user. But on the long run of course we want to have successful prototype\(s\) which if possible to later become products useful for PUB, but what would happen at that stage I can’t even imagine, for the moment my main worry is much closer to reality, namely to put up a project proposal, and hopefully have it approved.](#)
- Is the product used for testing and/or prototype?
[Well, you can say is for both: we will test 1 or 2 ideas with a few prototypes of devices to see how/which is working best](#)
- What is the future expectation in volume and timing for this product?
[The volume will not be very large, I think maybe 10 pieces will already be a number more than sufficient for us! The timing is totally unknown, I don’t know when & if the proposal will be approved!](#)
- What is the expected price for this product?
[I don’t have expectations, I need to build the proposal’s budget based on practical cost consideration, hence the request for quotation. Of course, the lower the better, if you can kindly provide academic discount it would be greatly appreciated!](#)

Finally, a few more remarks:

To make things simpler for everybody, for the start you can consider just your standard product PAUV-SQM-1025-C as the main element to be added in the quotation. Once it is clear that that is available, then you can move on to the other subsequent questions that I asked in my previous message, namely:

- a. Can it be made on fused silica substrate instead of BK7? This is important because -although it may seem irrelevant for a mirror- actually for our application is important because the light will be launched into the system from BEHIND (like in a Fabry-Perot), and another version actually may use a nested double set of mirrors (i.e. the light sources and a set of mirrors inside another set of mirrors), so any absorption of the UV in the substrate is unwanted. Such an absorption will degrade the substrate since the UV will gradually break down its chemical composition and therefore even its refractive index won’t be the same hence even the reflective properties will change.

- b. Can it be made as a convex mirror, not spherical, but cylindrical? In this case the height would be probably around 3...5 mm and the length (along the axis of the cylinder, in the direction normal onto page) 60...70 mm or something like that – can use what dimensions you have as your fabrication standard or convenient for you.
- c. More important than the previous point is the extension of the reflection spectrum to shorter wavelengths, so as to have $R > 90\%$ (which actually is not that demanding, many high-end applications demand $R > 99.9\%$!) starting from 230 nm, because one of our light sources could be a 235 nm LED. As I mentioned, this extension of the high reflectivity range to shorter wavelengths can be done at the expense of the broadband reflectivity which may need to extend only up to ~600 nm or even 500 nm if necessary. And this extension is easily done as the manufacturers certainly must have a professional software like TFCalc or another equivalent one, in which they need just to tweak the numbers -most probably decrease the QWOT of their layers correspondingly i.e. with abt 8% (maybe except for those layers that do the matching with the substrate), MAYBE just add a few more to maintain the overall behaviour, i.e. the long wavelength boundary of the hi R range- and then re-do a few more optimizations. IF it helps, can also consider/design the coating to get its highest performance at an AOI of 45° instead of 0° . All in all, I think in 2-3 days (at the very most!) the whole re-design should easily be finished. Actually, I am sure the manufacturer knows that the most critical part is not this one, is the fact that having now thinner layers will increase their sensitivity/tolerance to inherent thickness variations in the deposition process, which means that the yield (i.e. the nr. of) of correct (within the specs) filters will be less since the spread (the number of those above or below) will be larger than usual.

In any case, please do also put the normal standard product PAUV-SQM-1025-C in the quotation together with the modified one(s) (mentioned above) as well.

Regarding the fibers and other optical elements, you stated that “the request is ambiguous”, but actually is not. If for the mirror the initial specs was for the wavelength interval of 230 nm ... 600 nm, obviously the UV part of it (230 nm till 380 or 400 nm) will be for the UV fibers & optics, and the rest (from 380 or 400 nm till 600 nm) will be for the visible range. Of course, it may very well be that you may have a material that could be usable for both, e.g. fused silica could in principle be used equally well for both if you do have such fiber bundles. The lenses may refer to, say, only 2 convex lenses (or one planoconvex and one convex) to enable the focusing light from the mirrors output into the fibers (at one end of the system), as well as from the light source into the mirrors (at the other end). It does not need to be accurate because of course at this moment we don't know the exact specifics like focal length, but from your experience you would know which are usually the most often used ones (or which we could use) for the desired purposes, and which can be quoted for us to have a good idea of the necessary cost involved.

I hope this provide the necessary extra info.

Thank you very much for your kind effort and help!
With best wishes,
Daniel

From: Sansan Low <sansan.low@laser-21.com>

Sent: Monday, 14 June 2021 10:49 AM

To: Poenar Daniel Puiu (Assoc Prof) <EPDPuiu@ntu.edu.sg>

Cc: 'Dennis Wee' <dennis.wee@laser-21.com>

Subject: RE: Inquiry about possible product

Dear Dr Poenar,

Good day.

We receive updates from CVI optics.

CVI will need MOQ order for custom size substrate of PAUV mirror.

Also, factory will need the following info :

What is the application the products are used for?

Are you the end user of the product?

Is the product used for testing and/or prototype?

What is the future expectation in volume and timing for this product?

What is the expected price for this product?

Thanks

**** Lead times for out-of-stock items may be longer than usual due to supply chain disruptions resulting from COVID-19.**

Best regards,

San San

Sales Engineer

From: Sansan Low [<mailto:sansan.low@laser-21.com>]

Sent: Friday, June 11, 2021 5:15 PM

To: 'EPDPui@ntu.edu.sg' <EPDPui@ntu.edu.sg>

Cc: 'Dennis Wee' <dennis.wee@laser-21.com>

Subject: RE: Inquiry about possible product

Dear Dr Poenar,

Good day.

Unfortunately, we don't have a mirror around 230nm.

If the start of wavelength would be 250nm, I could recommend you F01(UV-Enhanced Aluminum) coating.

https://www.thorlabs.co.jp/newgrouppage9.cfm?objectgroup_id=5840

Also, we do not have broadband dielectric mirror for UV-range.

As for the other items, please refer to the below answer.

1) Bundle of multimode fibers:

We cannot offer complex custom bundles, but we can offer simple change customs, for example simple fiber change that has same fiber size and length as a standard one.

a. The fiber is Solarization-Resistant Step Index MM.

[0.22 NA Solarization-Resistant Step Index Multimode Optical Fibers \(thorlabs.co.jp\)](https://www.thorlabs.co.jp)

b. The above fiber is good, but for 750-800nm, Glass Clad Multimode Optical Low-OH on the below web page

might be better. (Please note that there are Low-OH and High-OH on the web page.)
[0.22 NA Silica Core, Glass Clad Multimode Optical Fiber, Step Index \(thorlabs.co.jp\)](https://www.thorlabs.co.jp)

2) Some focusing lenses, again for the same two ranges listed above (UV + vis)
Since the request is ambiguous, we can't advise the exact product.

Can you please which of the following is acceptable for your application?

[Objective Lenses, Scan Lenses, and Tube Lenses - Thorlabs](#)

[Spherical Singlet Lenses - Thorlabs](#)

[Collimation / Coupling - Thorlabs](#)

3) We don't have a line array of APDs. Info such as power and bandwidth are necessary for selection.

https://www.thorlabs.co.jp/navigation.cfm?guide_id=36

Hope to hear from you soon.

Thanks

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Best regards,
San San
Sales Engineer

From: Sansan Low [<mailto:sansan.low@laser-21.com>]

Sent: Friday, June 11, 2021 10:51 AM

To: 'EPDPuiu@ntu.edu.sg' <EPDPuiu@ntu.edu.sg>

Cc: 'Dennis Wee' <dennis.wee@laser-21.com>

Subject: RE: Inquiry about possible product

Dear Dr Poenar,

Good day and thank you for your kind patience.
I am still discussing with factory on your enquiry.
I will get back to you once we have conclusion.
Thank you

**** Lead times for out-of-stock items may be longer than usual due to supply chain disruptions resulting from COVID-19.**

Best regards,
San San
Sales Engineer

From: Poenar Daniel Puiu (Assoc Prof) [<mailto:EPDPuiu@ntu.edu.sg>]

Sent: Tuesday, June 8, 2021 4:40 PM

To: Sansan Low <sansan.low@laser-21.com>

Cc: 'Dennis Wee' <dennis.wee@laser-21.com>

Subject: RE: Inquiry about possible product

Importance: High

Dear Mr. Sansan Low,

Thank you for your reply! For the moment I am building the budget for a project proposal, but for the start you can consider the minimal nr. of pieces required by you for the quotation. If 1 piece is enough, very good. If you need 10 pcs. as min. amount then consider that instead (but, of course, please also indicate in the quotation that the prices you quoted is for 10 pcs.)

The dimension of the filter is still not very clear for our design but let's consider a large one, e.g. 25.1 x 25.1 mm or whatever you have that is the closest.

For the project I would also be interested in a few other things, if you have available:

1. Also, I am interested in a good mirror with very high R (>90%, if possible even >95% though this may not be feasible practically?) in the UV, in the same range between 230 nm and 380 or 400 nm, while at the same time having reasonable reflectivity in the visible.

Although the reflectivity of a dielectric mirror can be excellent and probably close to 99%, but I don't think a dielectric mirror can cover such a broad range (but maybe you double check your product range and tell me if I am wrong).

I think an enhanced Al mirror is the most feasible practical solution, like the "PAUV" mirror produced by CVI-LaserOptics. So if indeed there is no dielectric mirror that can cover the desired broad range, please include this mirror (PAUV-SQM-1025-C) in the quotation as well.

Actually, regarding this last one (PAUV-SQM-1025-C) I have 2 more Qs:

- a. Can it be made on fused silica substrate instead of BK7?
- b. Can it be made as a convex mirror, not spherical, but cylindrical? In this case the height would be probably around 3...5 mm and the length (along the axis of the cylinder, in the direction normal onto page) 60...70 mm or something like that.

If the answers to both the Qs above is "Yes", then please also include the last one in the quotation (together with the simple PAUV flat one, just for comparison).

2. Bundle of multimode fibers:
 - a. one with very good transmission in UV (again, in the same range between 230 nm and 380 or 400 nm)
 - b. one with very good transmission in the visible range (between approx. 380 or 400 nm and 750...780 nm)
3. Some focusing lenses, again for the same two ranges listed above (UV + vis)
4. Detectors for the two indicated ranges. For vis probably can use a line array of APDs, but for UV it is much more problematic. Ideally, it would be excellent if I could find a line array of APDs operating at such short wavelengths (or at least with their peak response at ~400 nm or 450 nm), but as far as I know they usually peak their responsivity at ~800 nm, which is way too far away for me. Of course, a separate discrete/stand-alone detector optimized for each range can be considered, including PMTs, although those are bulky and very expensive.

Thank you very much!

With best wishes,
Daniel

From: Sansan Low <sansan.low@laser-21.com>
Sent: Tuesday, 8 June 2021 3:55 PM
To: Poenar Daniel Puiu (Assoc Prof) <EPDPuiu@ntu.edu.sg>
Cc: 'Dennis Wee' <dennis.wee@laser-21.com>
Subject: FW: Inquiry about possible product

Dear Dr Poenar,

Good day.
I am San San from Laser 21.
I will check with factory if customisation is possible,
May we know how many pcs needed?
Thanks

**** Lead times for out-of-stock items may be longer than usual due to supply chain disruptions resulting from COVID-19.**

Best regards,
San San
Sales Engineer

From: Poenar Daniel Puiu (Assoc Prof) [<mailto:EPDPuiu@ntu.edu.sg>]
Sent: Tuesday, 8 June 2021 1:56 PM
To: sales@laser-21.com
Subject: Inquiry about possible product

Dear Lady/Sir,

I am an Assoc.Prof. in the EEE School of NTU of Singapore. I would like to know if you have available or if it is possible for you to fabricate a UV-vis long-pass dichroic mirror, although maybe a more appropriate name would be edge filter because the ideal desired operation should be for an AOI of 0°, NOT 45° as is typical with normal applications for dichroic mirrors (e.g. in a filter cube).

The specs for this filter are: high reflectivity (R>90%) in the UV (between 230 nm and 380 or 400 nm) and high transmissivity (T>90%) in the visible range (between approx. 380 or 400 nm and 750...780 nm). If the latter too tough, the vis range transmission window's long wavelength limit can be reduced down to 600 nm or even 550 nm if really necessary.

If you have it/can do it, then please kindly send me quotation for it, including the cost of packaging & shipping.

Thank you for your help and am looking forward for your quick feedback !

With best wishes,
Poenar Daniel
