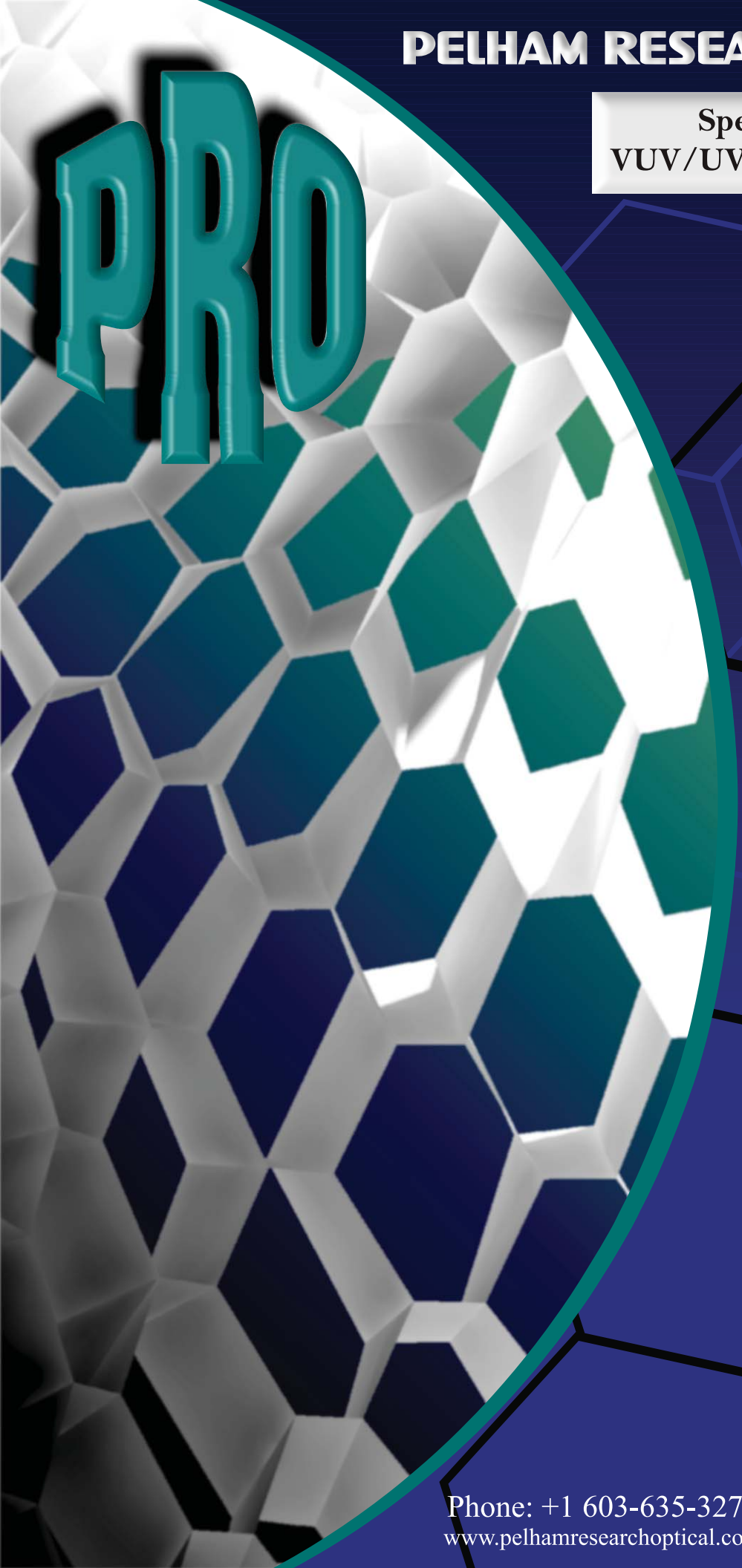
# PELHAM RESEARCH OPTICAL L.L.C.




**Specializing in Precision**
**VUV/UV Optical Coating and Service**

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email:sales@pelhamresearchoptical.com

# PELHAM RESEARCH OPTICAL L.L.C.

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Thank you for your interest in Pelham Research Optical (PRO), we are proud to offer our complete catalog of standard filters and broadband VUV broadband metallic mirrors. In the following pages you will find our standard narrowband filters, broadband filters as well as UV beamsplitters, neutral density filters and broadband reflective coatings. Custom coatings and mounts can be designed specifically to your application, please contact our sales staff with you requirements. All coatings can be provided on Pelham Research Optical's standard substrates as well as custom sizes and customer supplied material.

For over 30 years we have been involved in designing and coating VUV/UV optical components for analytical, astronomy and semi-conductor metrology markets. Our team has had the pleasure of working on aerospace projects which include TRACE Program, UVCS-SOHO Mission and WFPC II - Wide Field Planetary Camera on the Hubble Space Telescope and the AFM- Actuated Fold Mirror for the 1993 Hubble Servicing Mission. Pelham Research Optical state-of-the-art coating chambers have designed specifically for the difficult requirements of VUV/UV optical coating applications.

Pelham Research Optical's in-house metrology capabilities include UV-VIS-NIR spectrometers and vacuum (VUV) monochromators for reflectance and transmission measurements. To ensure consistent quality and coating performance, filters are measured for transmission (0 degree Angle of Incidence) and all broadband reflection coatings are measured in reflectance at normal incidence (12 degrees Angle of Incidence). A detail spectral curve is provided with all shipments. All optics and coatings are visually inspected to MIL-SPEC specification prior to shipment.

We look forward to working with you on your VUV/UV coating requirements

Thank you
Michael J. Laforge
President

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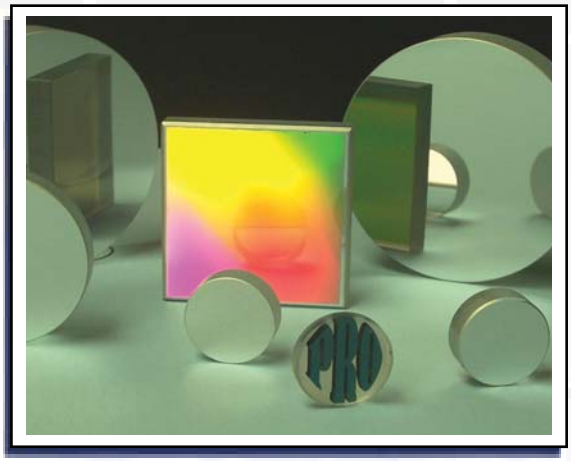

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# PELHAM RESEARCH OPTICAL L.L.C.

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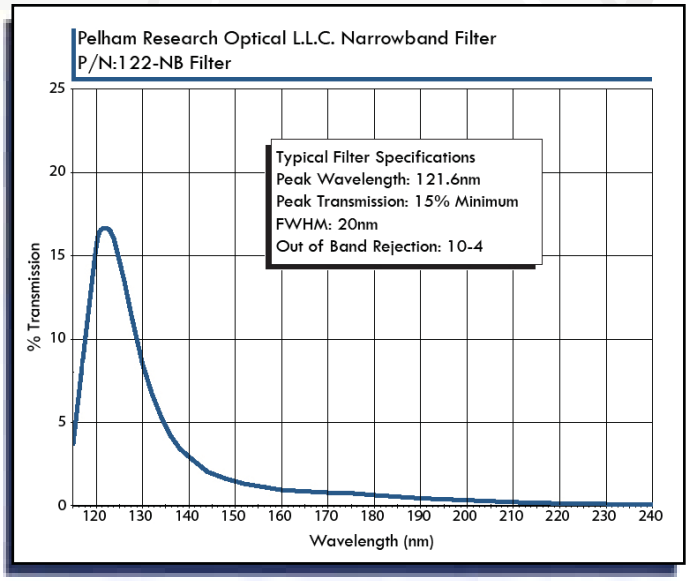
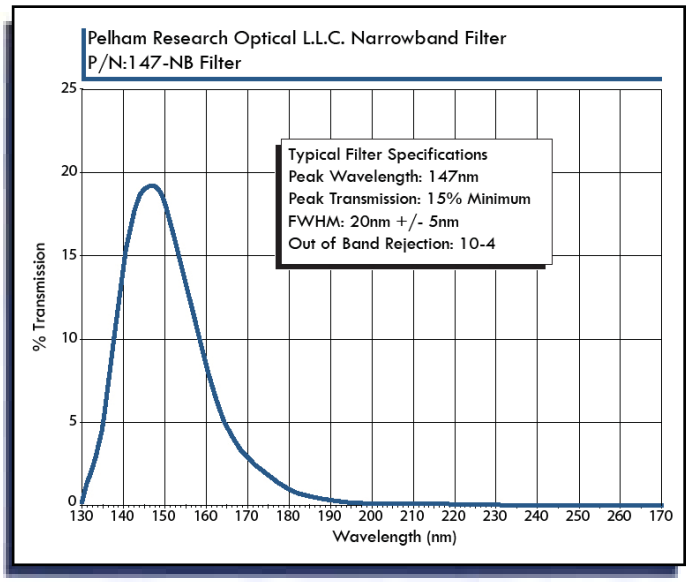
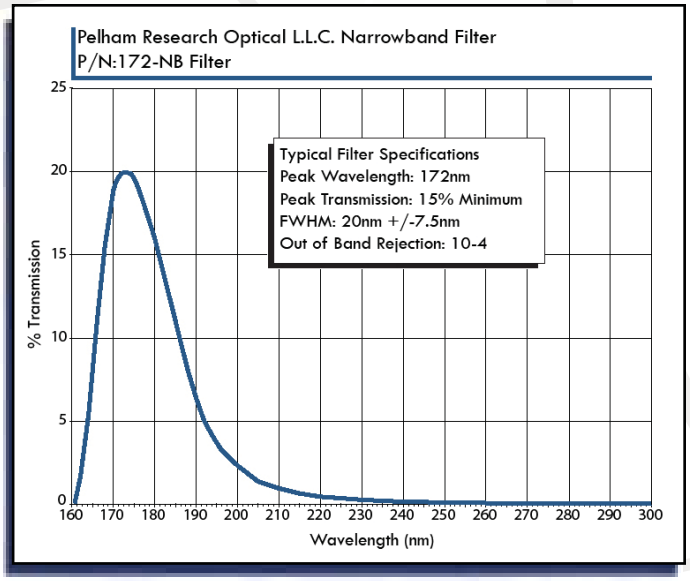
## Narrowband Filters

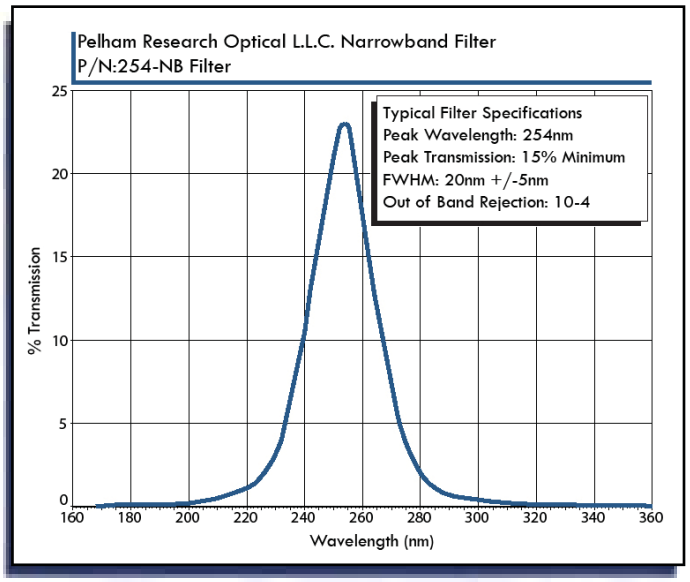
All of Pelham Research Optical (PRO) filters supplied with individual VUV-UV % transmission calibration curve detailing their VUV-UV spectral performance. VUV-UV narrowband (NB) optical filters are used in applications requiring a narrow spectral bandwidth (FWHM) and a high signal-to-noise ratio. Filters from 130nm to 170 nm are manufactured on high purity VUV grade MgF2, CaF2, and cultured quartz substrates. Filters from 180nm to 320nm are manufactured on UV grade fused silica substrate and can be covered and edge sealed for added protection. Please see page 10 for covered and sealed information and filter substrate specifications. Image quality filters available by request. OEM and Research Applications: analytical and biotechnology instrumentation, environmental monitoring, spectroscopy, element analysis, and space exploration.




Typical Transmission Curves for Narrowband Filters

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## Narrowband Filter Part Numbers

Pelham Research Optical (PRO) manufactures a standard product line of VUV-UV NARROWBAND (NB) optical filters. Narrowband (NB) filter designs have a bandwidth of ~20nm FWHM with a minimum transmission of 15%. Visible rejection for PRO filter is typically 10-4. Standard VUV-UV Narrowband (NB) filters are available on ½" (12.7mm), 1" (25.4mm), and 2" (50.8mm) diameter substrates, please see page 10 for filter substrate specifications. PRO filter coatings can be applied to custom sized substrates as well as customer supplied material.

Filters available for all wavelengths in the range of 120-320nm, filter specifications fall within the ranges specified below. Please contact our sales staff for your custom filter requirements

| Peak Wavelength (nm) | FWHM (nm) | Minimum Peak %T | 0.5" Dia. Part Number | 1.0" Dia. Part Number | 2.0" Dia. Part Number |
|---|---|---|---|---|---|
| 122 +/- 2.5 Lyman Alpha | ~10 | 5 | 122-NBX-.5D | 122-NBX-1D | 122-NBX-2D |
| 122 +/- 2.5 Lyman Alpha | ~15 | 15 | 122-NBV-.5D | 122-NBV-1D | 122-NBV-2D |
| 122 +/- 2.5 Lyman Alpha | ~20 | 15 | 122-NB-.5D | 122-NB-1D | 122-NB-2D |
| 125 +/- 2.5 | 20 +/- 5 | 15 | 125-NB-.5D | 125-NB-1D | 125-NB-2D |
| 130 +/- 2.5 | 20 +/- 5 | 15 | 130-NB-.5D | 130-NB-1D | 130-NB-2D |
| 135 +/- 2.5 | 20 +/- 7.5 | 15 | 135-NB-.5D | 135-NB-1D | 135-NB-2D |
| 147 +/- 2.5 | 20 +/- 5 | 15 | 147-NB-.5D | 147-NB-1D | 147-NB-2D |
| 150 +/- 2.5 | 20 +/- 5 | 15 | 150-NB-.5D | 150-NB-1D | 150-NB-2D |
| 155 +/- 2.5 C IV | 20 +/- 5 | 12 | 155-NB-.5D | 155-NB-1D | 155-NB-2D |
| 158 +/- 2.5 F Laser | 20 +/- 5 | 12 | 158-NB-.5D | 158-NB-1D | 158-NB-2D |
| 160 +/- 2.5 | 20 +/- 5 | 12 | 160-NB-.5D | 160-NB-1D | 160-NB-2D |
| 172 +/- 2.5 Xe Laser | 20 +/- 7.5 | 15 | 172-NB-.5D | 172-NB-1D | 172-NB-2D |
| 180 +/- 2.5 | 20 +/- 7.5 | 15 | 180-NB-.5D | 180-NB-1D | 180-NB-2D |
| 184.9 +/- 2.5 Hg | 20 +/- 7.5 | 15 | 185-NB-.5D | 185-NB-1D | 185-NB-2D |
| 190 +/- 2.5 | 20 +/- 5 | 15 | 190-NB-.5D | 190-NB-1D | 190-NB-2D |
| 193 +/- 2.5 ArF Laser | 20 +/- 5 | 15 | 193-NB-.5D | 193-NB-1D | 193-NB-2D |
| 200 +/- 2.5 | 20 +/- 5 | 15 | 200-NB-.5D | 200-NB-1D | 200-NB-2D |
| 210 +/- 2.5 | 20 +/- 5 | 15 | 210-NB-.5D | 210-NB-1D | 210-NB-2D |
| 214 +/- 2.5 Zn | 20 +/- 5 | 15 | 214-NB-.5D | 214-NB-1D | 214-NB-2D |
| 220 +/- 2.5 | 20 +/- 5 | 15 | 220-NB-.5D | 220-NB-1D | 220-NB-2D |
| 222 +/- 2.5 KrCl Laser | 20 +/- 5 | 15 | 222-NB-.5D | 222-NB-1D | 222-NB-2D |
| 230 +/- 2.5 | 20 +/- 5 | 15 | 230-NB-.5D | 230-NB-1D | 230-NB-2D |
| 240 +/- 2.5 | 20 +/- 5 | 15 | 240-NB-.5D | 240-NB-1D | 240-NB-2D |
| 248 +/- 2.5 KrF Laser | 20 +/- 5 | 15 | 248-NB-.5D | 248-NB-1D | 248-NB-2D |
| 253.7 +/- 2.5 Hg | 20 +/- 5 | 15 | 253.7-NB-.5D | 253.7-NB-1D | 253.7-NB-2D |
| 260 +/- 2.5 | 20 +/- 5 | 15 | 260-NB-.5D | 260-NB-1D | 260-NB-2D |
| 266 +/- 2.5 | 20 +/- 5 | 15 | 266-NB-.5D | 266-NB-1D | 266-NB-2D |
| 280 +/- 2.5 | 20 +/- 5 | 15 | 280-NB-.5D | 280-NB-1D | 280-NB-2D |
| 282 +/- 2.5 XeBr Laser | 20 +/- 5 | 15 | 282-NB-.5D | 282-NB-1D | 282-NB-2D |
| 290 +/- 2.5 | 20 +/- 5 | 15 | 290-NB-.5D | 290-NB-1D | 290-NB-2D |
| 296.7 +/- 2.5 Hg | 20 +/- 5 | 15 | 296.7-NB-.5D | 296.7-NB-1D | 296.7-NB-2D |
| 300 +/- 2.5 | 20 +/- 7.5 | 15 | 300-NB-.5D | 300-NB-1D | 300-NB-2D |
| 308 +/- 2.5 XeCl Laser | 20 +/- 7.5 | 15 | 308-NB-.5D | 308-NB-1D | 308-NB-2D |
| 320 +/- 2.5 | 20 +/- 7.5 | 15 | 320-NB-.5D | 320-NB-1D | 320-NB-2D |

Note*

Filter part numbers are shown as open faced, to specify a part number as covered and sealed add -C&S to the part number

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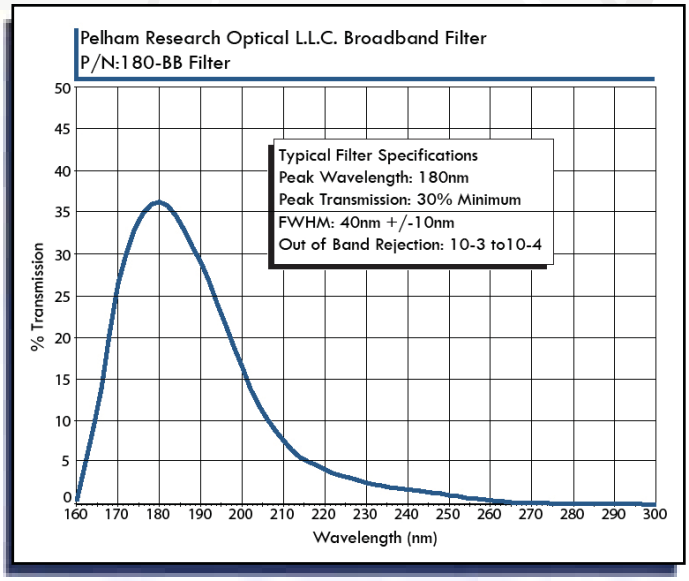
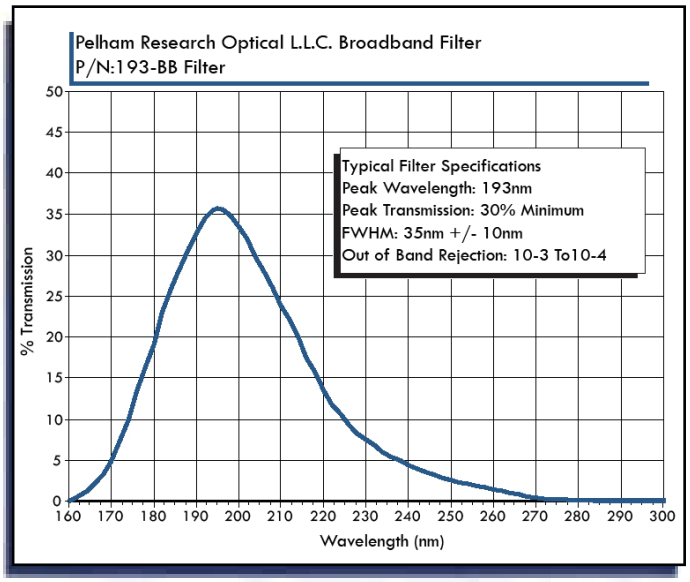
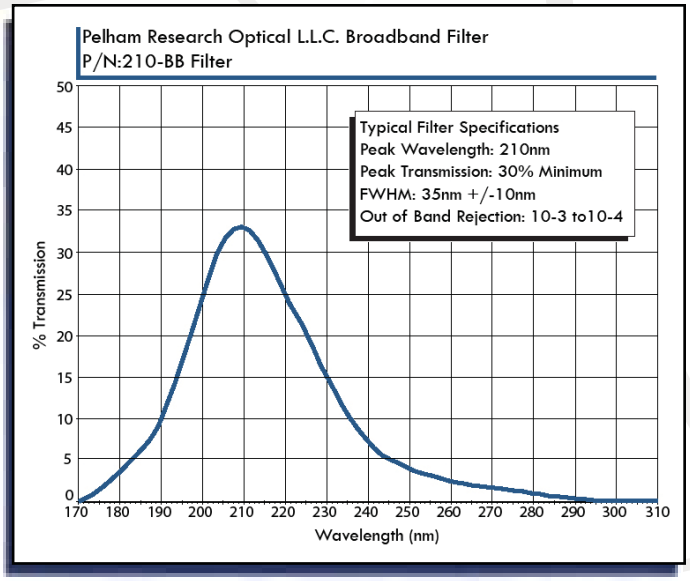
## Broadband Filters

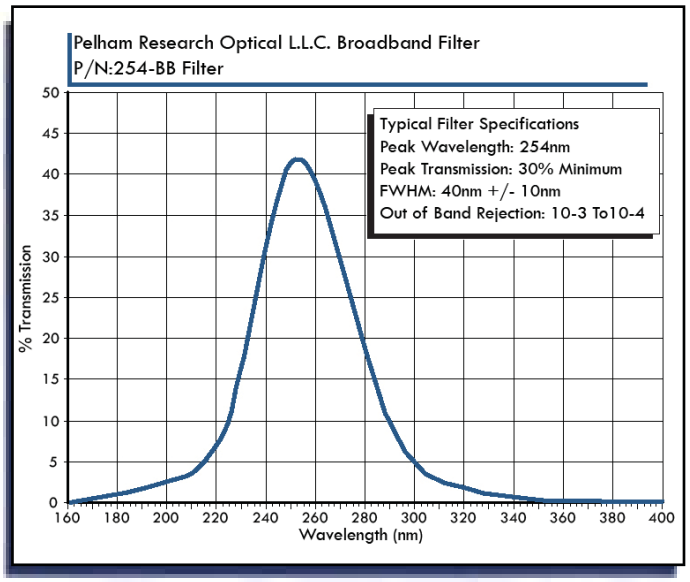
All of Pelham Research Optical (PRO) filters supplied with individual VUV-UV % transmission calibration curve detailing their VUV-UV spectral performance. VUV-UV broadband (BB) optical filters are used in applications requiring a broader spectral bandwidth (FWHM) and a high signal-to-noise ratio. Filters from 130nm to 170 nm are manufactured on high purity VUV grade MgF2, CaF2, and cultured quartz substrates. Filters from 180nm to 320nm are manufactured on UV grade fused silica substrate and can be covered and edge sealed for added protection. Please see page 10 for covered and sealed informartion and filter substrate specifications. Image quality filters available by request. OEM and Research Applications: analytical and biotechnology instrumentation, environmental monitoring, spectroscopy, element analysis, and space exploration.




Typical Transmission Curves for Broadband Filters

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## Broadband Filter Part Numbers

Pelham Research Optical (PRO) manufactures a standard product line of VUV-UV BROADBAND (BB) optical filters. Broadband (BB) filter designs have a bandwidth of ~ 35nm to 50 nm (FWHM) depending on wavelength and with a minimum transmission of 30%. Visible rejection for PRO filter is typically 10-3 to 10-4. Broadband (BB) filters are available on ½" (12.7mm), 1" (25.4mm), and 2" (50.8mm) diameter substrates, pplease see page 10 for filter substrate specifications. PRO filter coatings can be applied to custom sized substrates as well as customer supplied material.

Filters available for all wavelengths in the range of 120-320nm, filter specifications fall within the ranges specified below. Please contact our sales staff for your custom filter requirements

| Peak Wavelength (nm) | FWHM (nm) | Minimum Peak %T | 0.5" Dia. Part Number | 1.0" Dia. Part Number | 2.0" Dia. Part Number |
|---|---|---|---|---|---|
| 130 +/- 5 | 40 +/- 10 | 30 | 130-BB-.5D | 130-BB-1D | 130-BB-2D |
| 140 +/- 5 | 60 +/- 10 | 30 | 140-BB-.5D | 140-BB-1D | 140-BB-2D |
| 150 +/- 5 | 60 +/- 10 | 30 | 150-BB-.5D | 150-BB-1D | 150-BB-2D |
| 160 +/- 5 | 45 +/- 10 | 30 | 160-BB-.5D | 160-BB-1D | 160-BB-2D |
| 170 +/- 5 | 45 +/- 10 | 30 | 170-BB-.5D | 170-BB-1D | 170-BB-2D |
| 180 +/- 5 S. Ph | 40 +/- 10 | 30 | 180-BB-.5D | 180-BB-1D | 180-BB-2D |
| 190 +/- 5 As | 35 +/- 10 | 30 | 190-BB-.5D | 190-BB-1D | 190-BB-2D |
| 193 +/- 5 ArF Laser | 35 +/- 10 | 30 | 193-BB-.5D | 193-BB-1D | 193-BB-2D |
| 200 +/- 5 Se | 35 +/- 10 | 30 | 200-BB-.5D | 200-BB-1D | 200-BB-2D |
| 210 +/- 5 | 35 +/- 10 | 30 | 210-BB-.5D | 210-BB-1D | 210-BB-2D |
| 214 +/- 5 Zn | 35 +/- 10 | 30 | 214-BB-.5D | 214-BB-1D | 214-BB-2D |
| 220 +/- 5 Pb | 35 +/- 10 | 30 | 220-BB-.5D | 220-BB-1D | 220-BB-2D |
| 230 +/- 5 Cd. Ni | 35 +/- 10 | 30 | 230-NB-.5D | 230-BB-1D | 230-BB-2D |
| 240 +/- 5 Co. Tin | 35 +/- 10 | 30 | 240-BB-.5D | 240-BB-1D | 240-BB-2D |
| 248 +/- 5 KrF Laser | 35 +/- 10 | 30 | 248-BB-.5D | 248-BB-1D | 248-BB-2D |
| 250 +/- 5 | 40 +/- 10 | 30 | 250-BB-.5D | 250-BB-1D | 250-BB-2D |
| 253.7 +/- 5 Hg | 40 +/- 10 | 30 | 253.7-BB-.5D | 253.7-BB-1D | 253.7-BB-2D |
| 260 +/- 5 Fe | 40 +/- 10 | 30 | 260-BB-.5D | 260-BB-1D | 260-BB-2D |
| 266 +/- 5 | 40 +/- 10 | 30 | 266-BB-.5D | 266-BB-1D | 266-BB-2D |
| 270 +/- 5 Cr | 45 +/- 10 | 30 | 270-BB-.5D | 270-BB-1D | 270-BB-2D |
| 280 +/- 5 | 45 +/- 10 | 30 | 280-BB-.5D | 280-BB-1D | 280-BB-2D |
| 290 +/- 5 | 50 +/- 10 | 30 | 290-NB-.5D | 290-BB-1D | 290-BB-2D |
| 300 +/- 5 | 50 +/- 10 | 30 | 300-BB-.5D | 300-BB-1D | 300-BB-2D |
| 310 +/- 5 | 50 +/- 10 | 30 | 310-BB-.5D | 310-BB-1D | 310-BB-2D |
| 320 +/- 5 | 50 +/- 10 | 30 | 320-BB-.5D | 320-BB-1D | 320-BB-2D |

Note*
Filter part numbers are shown as open faced, to specify a part number as covered and sealed add -C&S to the part number

Note**
Operating tempurature range of -20 - +100 Degrees C, Peak wavelength shift of approx. 0.1 Å/1 Degree C

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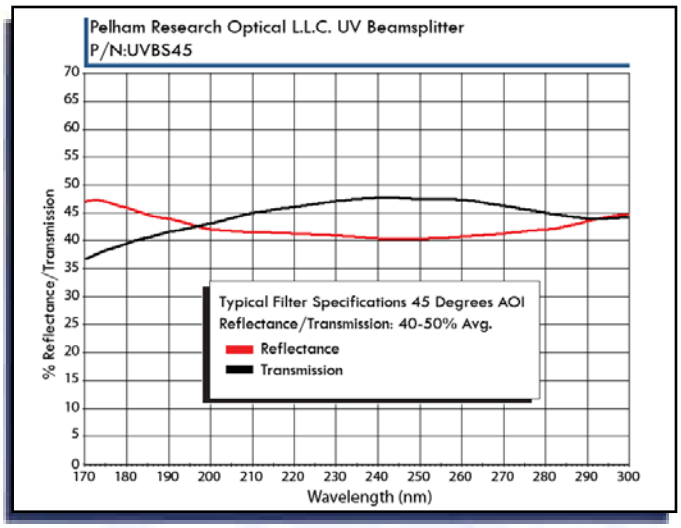
## UV Beamsplitters

Pelham Research Optical (PRO) manufactures a Broadband UV Metallic Beamsplitter (UVBS) from 170nm to 300nm @ 45 degrees AOI with 40% to 50% average reflectance and transmission. These UVBS filters cannot be covered and edge sealed and are supplied as open-faced filters only. PRO UVBS coatings can be applied to different sized substrates to meet your instrument requirements, please see page 10 for filter substrate specifications, image quality filters available by request. The light beam must enter the coated surface (reflective side) first. Metallic beamsplitters are very broad so they can cover a larger wavelength than dielectric beamsplitters. Due to their metallic coating UVBS are designed for low power applications.

| %R and %T Average | 1.0" Dia. Part Number | 2.0" Dia. Part Number |
|---|---|---|
| 40-50% | UVBS45-1D | UVBS45-2D |




Typical Transmission Curve

## UV Neutral Density Filters

Metallic neutral density (ND) filters work on the principle of the combination of reflectance, transmission and absorption to achieve the desired optical density. Neutral density (ND) filters are used in a variety of applications where the intensity of light needs to be evenly reduced. These filters are used in applications such as microscopy and optical calibration. PRO manufactures a standard line of UV metallic neutral density (UVND) optical filters ranging from 0.3 to 4.0 optical densities. PRO UV neutral density (UVND) filters uniformly attenuates the intensity of transmitted light from 200m to 320nm. Please see page 10 for filter substrate specifications, image quality filters available by request. All of PRO neutral densities are covered and edge sealed.

| Optical Density (O.D.) | Nominal Transmittance | Transmission Tolerance ±%T | 0.5" Dia. Part Number | 1.0" Dia. Part Number | 2.0" Dia. Part Number |
|---|---|---|---|---|---|
| 0.3 | 50% | ± 8% T | 0.3UVND-.5D | 0.3UVND-1D | 0.3UVND-2D |
| 0.5 | 30% | ± 5% T | 0.5UVND-.5D | 0.5UVND-1D | 0.5UVND-2D |
| 1 | 10% | ± 2.5% T | 1UVND-.5D | 1UVND-1D | 1UVND-2D |
| 1.5 | 3% | ± 0.7% T | 1.5UVND-.5D | 1.5UVND-1D | 1.5UVND-2D |
| 2 | 1% | ± 0.4% T | 2UVND-.5D | 2UVND-1D | 2UVND-2D |
| 3 | 0.10% | ± 0.06% T | 3UVND-.5D | 3UVND-1D | 3UVND-2D |
| 4 | 0.01% | ± 0.008% T | 4UVND-.5D | 4UVND-1D | 4UVND-2D |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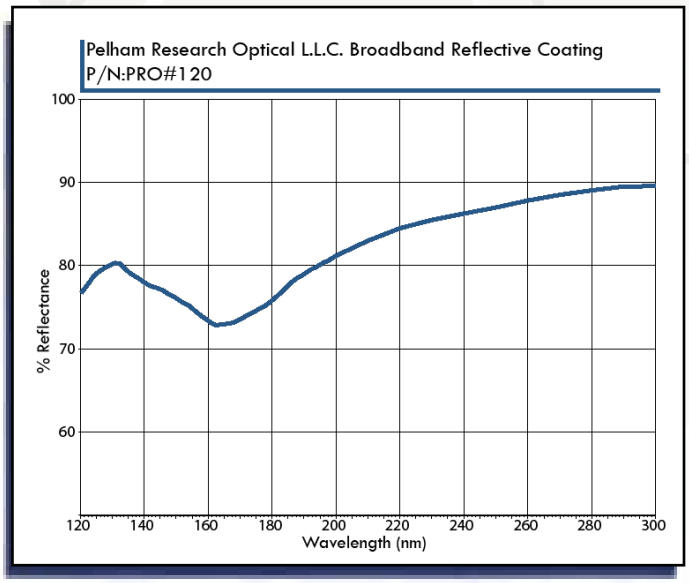
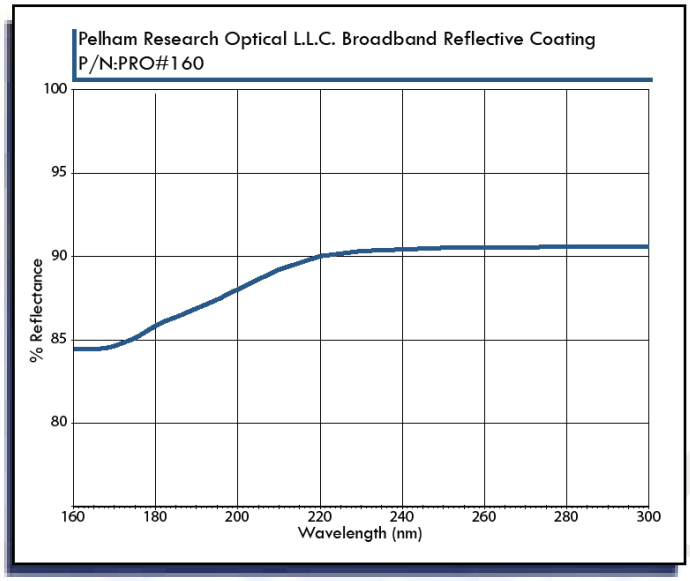
## VUV/UV Broadband Mirror Coatings

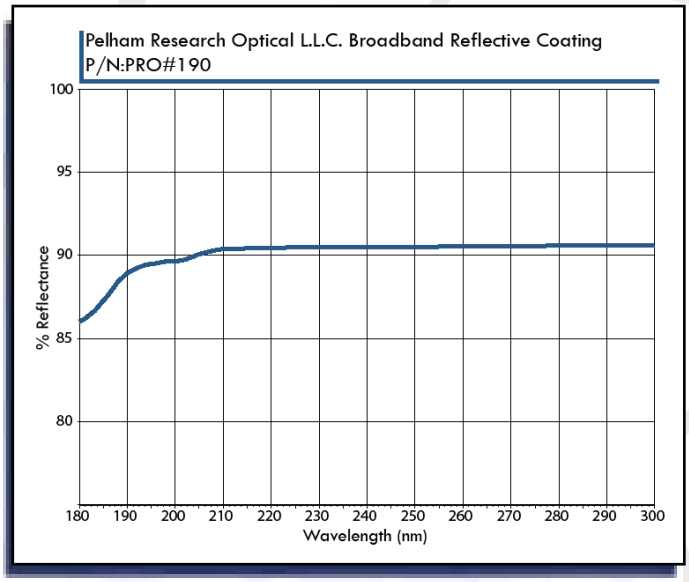
Pelham Research Optical VUV/UV broadband mirror coatings are designed to provide superior reflectance at critical vacuum wavelengths. This provides increased throughput for low light applications in the VUV wavelength range. To ensure consistent quality every coating batch is measured for reflectance and a coating curve is supplied with each shipment. These coatings are especially suitable for OEM and Research applications, including DUV Spectrometers, ICP Spectroscopy, Semi-conductor Metrology and Astronomy applications. Our VUV/UV broadband mirror coatings can be applied to all of our standard optical components, including CSM (Customer Supplied Material) or supplied complete from your supplied substrate drawing. Please see page 10 for a list of standard optical components.

| Peak Wavelength | Reflectance @ 12 Degrees | Part Number |
|---|---|---|
| 120nm | >/=78% | PRO#120 |
| 160nm | >/=84% | PRO#160 |
| 190nm | >/=88% | PRO#190 |




Typical Reflectance Curves for VUV/UV Broadband Reflectors

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## Standard Optical Components

Pelham Research optical (PRO) offers a large line of Analytical Grade (AG) and Laser Grade (LG) flat circular optical windows. These flat circular windows are available in UV grade Fused Silica (UVFS), BK7 glass. VUV grade CaF2 and VUV grade MgF2. Analytical Grade Windows (AG) are commonly used for instrumentation windows, filters, beamsplitters, vacuum view port windows, and slight glasses. Laser Grade Windows (available on request) are commonly used for applications requiring tighter surface specifications for improved performance. Pelham Research Optical (PRO) stocks large lines of flat optical windows from ½" (12.7mm) to 4" (101.6mm) diameter substrates. These substrates have a thickness range from 0.040" (1.0mm) to ½" (12.7mm) thick. We can also supply custom optics made to your detailed specifications, please contact our sales department with your request.

### Analytical Grade (Standard Filter Substrate)

Diameter (Ø) Tolerance: +0.00/-0.005"
Thickness: ±0.25mm
Surface Figure: <1-2 waves @ 632.8nm Nominal
Surface Finish: 20-10 both surfaces
Clear Aperture: Central 85%
Parallelism: < 3 arc minutes
Chamfer: 0.3 to 0.5mm @45 deg.
Clear Aperture: Central 85%

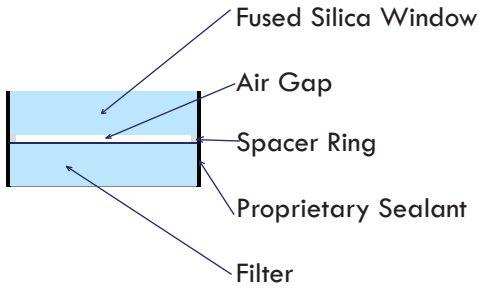
### Laser Grade

Diameter (Ø) Tolerance: +0.00/-0.005"
Thickness: ±0.25mm
Surface Figure: 1/10 waves @ 632.8nm Nominal
Surface Finish: 20-10 both surfaces
Clear Aperture: Central 85%
Parallelism: < 3 arc minutes
Chamfer: 0.3 to 0.5mm @45 deg.
Clear Aperture: Central 85%

| Stocked Filter Substrate Size: | UV Grade Fused Silica | VUV Grade CaF2 | VUV Grade MgF2 |
|---|---|---|---|
| 0.5" (12.7mm) Ø x 2mm Thick | ● | ● | ● |
| 1.0"(25.4mm) Ø x 2.5mm Thick | ● | ● | ● |
| 2.0" (50.8mm) Ø x 4mm Thick | ● | ● | ● |
| | | | |

## Covered and Edge Sealed Filter Information

UV filters above 190nm can be covered and edge sealed for added protection against physical damage. A fused silica window is used to cover the filter and is sealed with a proprietary sealant and a spacer ring leaving a small air gap between the two optics. By adding the fused silica window the peak transmission of the filter is typically reduced by 2-3%.




Note*
Edge sealing adds approximately 0.012" to the outside diameter of the substrate.

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## Ordering and Warranty Information

### Placing Orders & Payment:

All orders are Pre-Paid with Visa or MasterCard unless you have an established open line of credit.

### Purchase Orders:

Pelham Research Optical accepts written purchase orders with an established open line of credit. New customers must supply credit and trade references to be approved for NET 30 payment terms.

### Payment Terms:

Net 30 days from the date of invoice for customers with established lines of credit. Credit and Trand references will be required to validate account.

### Method of Shipment:

Pelham Research Optical normally ships to most USA & Canadian customers via UPS Ground service. Federal Express can also be specified and if you have a preference, please select when ordering. We will also be happy to ship overnight or 2nd day delivery via UPS or FEDEX at an increased charge if requested. Special handling, freight, taxes and insurance charges may also be added if appropriate. International Customers must supply a freight forwarding account number for shipment. It is the Buyers responsibility to report any shipping errors or any damage during shipping within 7 days after delivery (must have the original packing material).

### Returns:

Pelham Research Optical wants all customers to be satisfied that our products are of the highest quality. If you wish to return any of our products within 30 days of ordering, you must first obtain a RETURN MATERIAL AUTHORIZATION NUMBER (RMA #) before shipping the product back to us. Please contact us via e-mail at sales@pelhamresearchoptical.com to obtain an RMA #. All returns must be carefully packaged to prevent damage in transit and must be labeled on the outside of the package with the RMA # issued by Pelham Research Optical. The customer is responsible for all returned freight charges. Pelham Research Optical reserves the right to hold back a 35% restocking fee on all returned products. Custom designed products or products damaged by the customer may not be returned.

### Limited Warranty:

There is no warranty except where specifically provided herein: any other warranty, express or implied, including any warranty of merchantability or fitness for any particular purpose, is hereby excluded. Subject to the limitations, exemptions and conditions set forth as follows: Pelham Research Optical LLC optical components are guaranteed to perform within specifications. Purchaser agrees to notify Pelham Research Optical of any non-conformity in an optical component within 30 days after ordering. Warranty is limited to repair or replacement of any part sold by Pelham Research Optical that is defective in material or workmanship. Pelham Research Optical shall be released from any liability under this warranty for any optical component which in the sole discretion of Pelham Research Optical was modified, misused, abused, or not maintained in a proper manner. If any product sold shall prove defective, then the liability of Pelham Research Optical shall be limited to the price paid by the Purchaser for such product Pelham Research Optical shall in no event be liable for any loss of profit; nor shall it be liable for special or consequential damage arising from any sale of non-conforming products. Certain products may be subject to export controls and/or resale restrictions or regulations. Customer acknowledges that it is familiar with, and will comply with such export control and/or resale restrictions or regulations.



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# PELHAM RESEARCH OPTICAL L.L.C.

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*VUV/UV Optical Coating and Service*

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