UVIT FM-Filter Calibrations

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Ref. Doc: UVIT-CDR-00-006: V0.1 & UVIT_Filter_Cal_Analysis: v0.5,
UVIT-PDR-009-1-V1.0 & FM_UVIT_Filter_Report_July2011

FUV – FM Filter Wheel Configuration (130 – 180nm)

Slot No.	Filter Type	Thickness (mm)	Passband (nm)
0	Block with Aluminium		
1	CaF_2 – 1	2.50	>125
2	BaF_2	2.40	>135
3	Sapphire	2.00	>142
4	Grating – 1	4.48	
5	Silica	2.70	> 159
6	Grating – 2	4.48	
7	CaF_2 – 2	2.50	>125

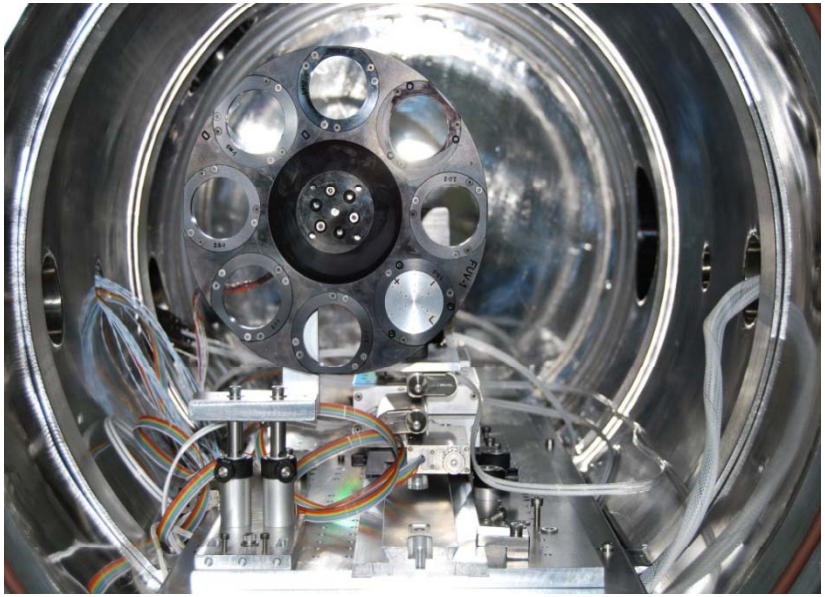
NUV – FM Filter Wheel Configuration (200 – 300nm)

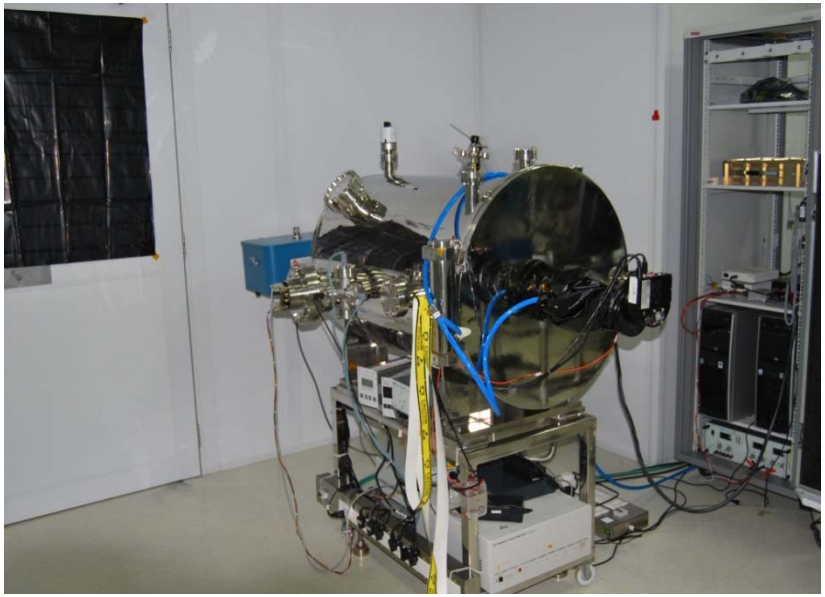
Slot No.	Filter Type	Thickness (mm)	Passband (nm)	Material
0	Block with Aluminium			
1	Fused Silica	3.00	> 159	
2	NUVB15	2.97	200 – 230	Silica (UV)
3	NUVB13	3.15	230 – 260	Silica (UV)
4	Grating	4.48		
5	NUVB4	3.33	250 – 280	Silica (UV)
6	NUVN2	3.38	275 – 285	Silica (UV)
7	Fused Silica	3.30	> 159	

VIS – FM Filter Wheel Configuration (320 – 550nm)

Slot No.	Filter Type	Filter Thickness (mm)	Passband (nm)	Material
0	Block with Aluminium			
1	VIS 3	3.00	400 – 530	UBK 7
2	VIS 2	3.00	370 – 410	UBK 7
3	VIS 1	3.00	320 – 360	UBK 7
4	Neutral Density Filter	3.00		
5	BK7 Window	3.00		

Parameters

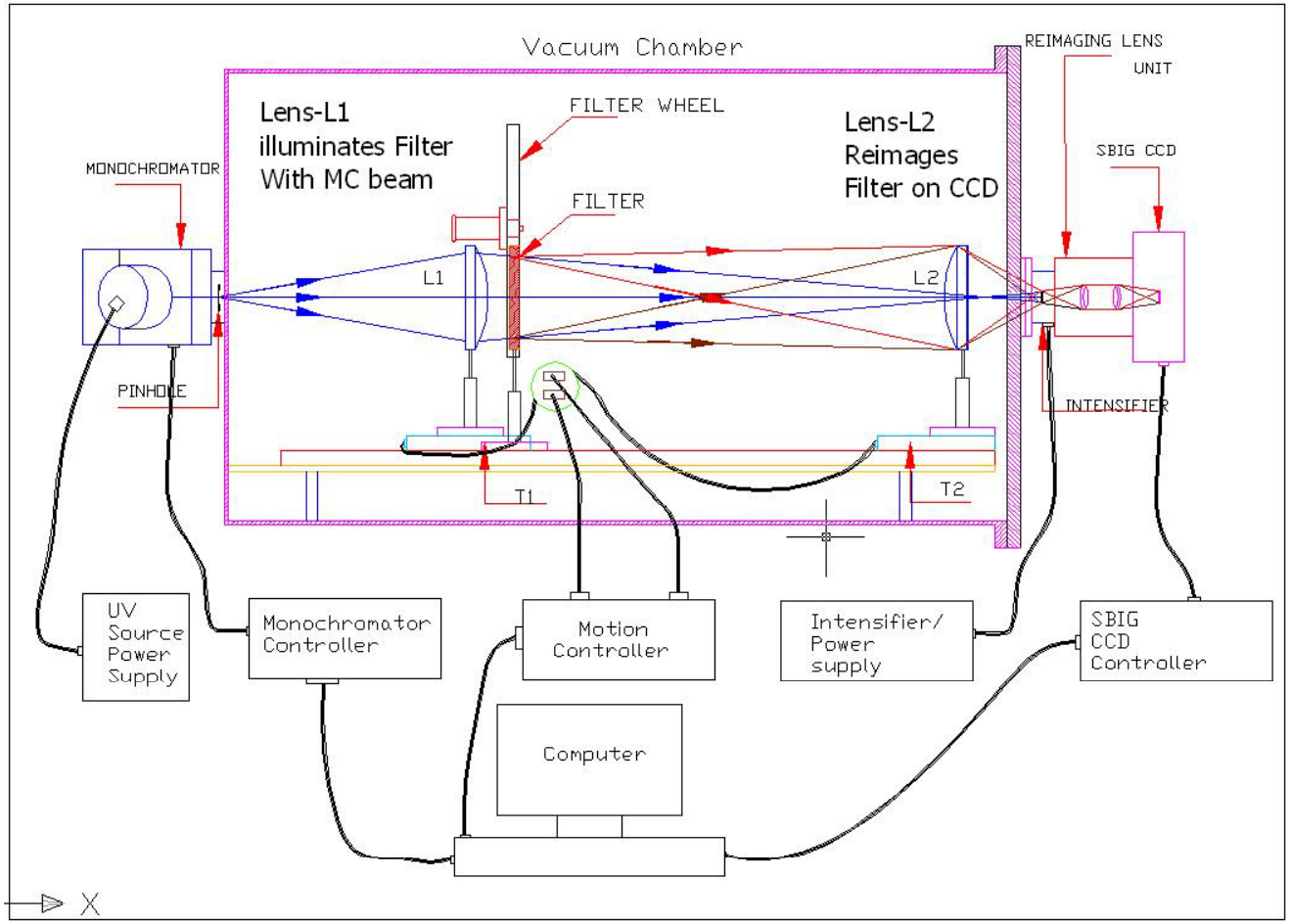




- Spatial Transmission
- Spectral Transmission
- Focus Shift
- Wedge Angle

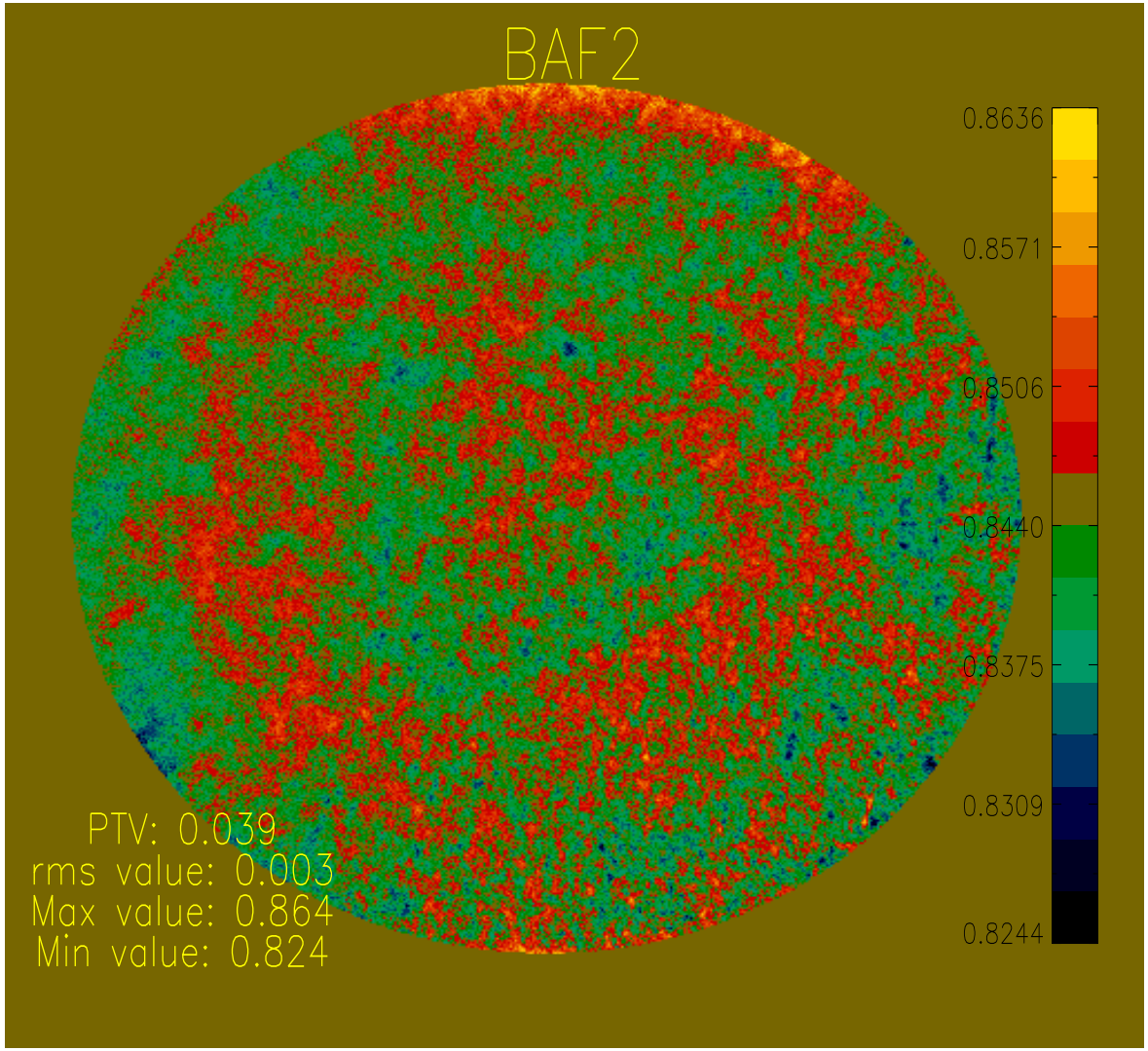
Focus Shift: Carried out with the Integrated System and hence will not be presented here.

Spatial Transmission Variation

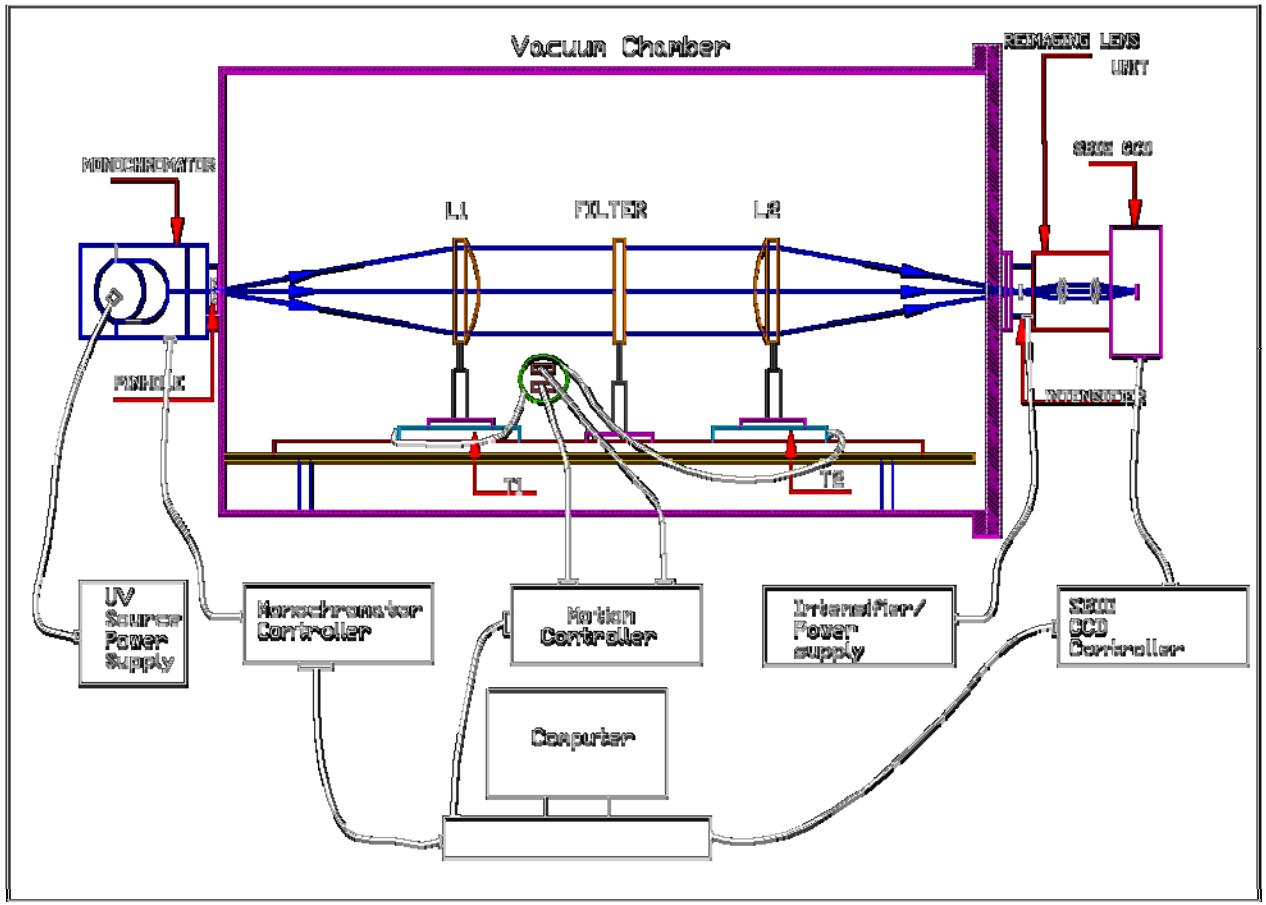


Principle:

- Image of the filter illuminated by a monochromatic source
- Ratio of the image with and without filter provides the spatial non-uniformity in the filter
- Central wavelength of the filters is used to estimate the spatial variation
- Same experiment is used to estimate the spectral transmission


BAF2
0.8636
0.8571
0.8506
0.8440
0.8375
0.8309
0.8244
PTV: 0.039
rms value: 0.003
Max value: 0.864
Min value: 0.824

Wedge Angle



Principle:

- A pinhole is imaged with and without filter.
- Filter Wheel is placed in the collimated beam
- Shift in the pinhole image position with filter compared to without filter is estimated.
- This shift divided by the focal length of L2 is the wedge angle of the filter.

Spatial Transmission Results

FUV – Results:

Slot No.	Filter Name	Wavelength (nm)	Max.	Min.	% Variation	Requirement (Uniformity)	Remarks
4	CaF2-1	154.0	0.764	0.724	± 2.7 %	< ± 10%	Complied
3	BaF2	158.0	0.768	0.709	± 4.0 %	< ± 10%	Complied
2	Sapphire	162.0	0.718	0.680	± 2.7 %	< ± 10%	Complied
6	CaF2-2	154.0	0.763	0.696	± 4.6 %	< ± 10%	Complied
0	Silica	170.0	0.697	0.665	± 2.4 %	< ± 10%	Complied

- Deviations due to small dark spots of size < 1mm reduces to < ± 3% when smoothed for beam illumination of 3mm on the filter

Spatial Transmission Results

NUV – Results:

Slot No.	Filter Name	Wavelength (nm)	Max.	Min.	% Variation	Requirement (Uniformity)	Remarks
6	Silica3.0	300.0	0.951	0.884	± 3.7 %	< ± 10%	Complied
7	NUVB15	214.0	0.190	0.016	± 84.4 %	< ± 10%	Refer. (1)
0	NUVB13	244.0	0.733	0.663	± 4.9 %	< ± 10%	Complied
2	NUVB4	264.0	0.742	0.682	± 4.2 %	< ± 10%	Complied
3	NUVN2	280.0	0.744	0.647	± 7.0 %	< ± 10%	Complied
4	Silica3.3	300.0	0.947	0.888	± 3.2 %	< ± 10%	Complied

(1) Large Deviations: New Coarse Measurements carried out at LEOS will be used

- Deviations due to small dark spots of size < 1mm reduces to < ± 3% when smoothed for beam illumination of 3mm on the filter

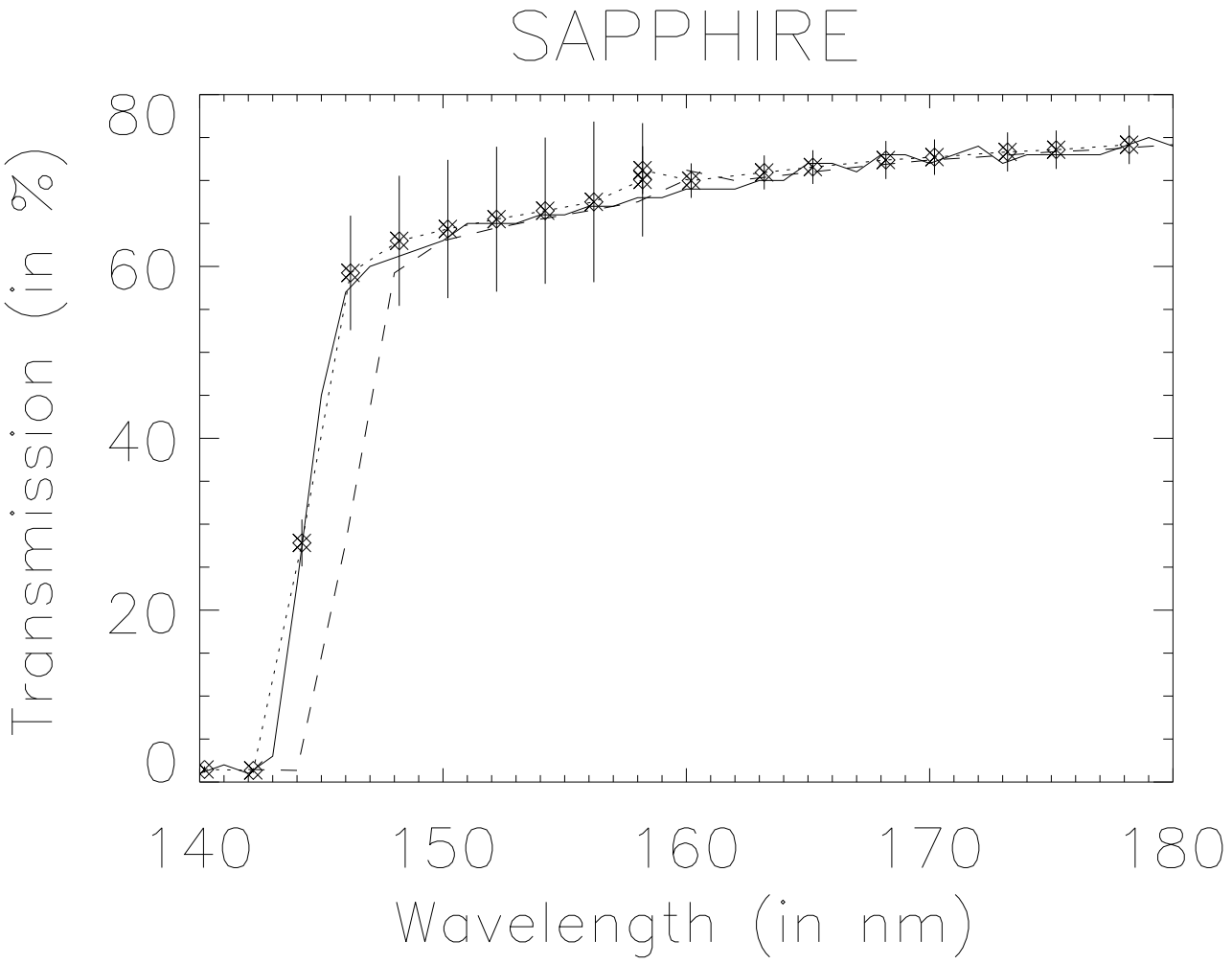
Spatial Transmission Results

Visible – Results:

Slot No.	Filter Name	Wavelength (nm)	Max.	Min.	% Variation	Requirement (Uniformity)	Remarks
3	VIS1	340.0	0.747	0.680	± 4.7%	< ± 10%	Complied
2	VIS2	390.0	0.875	0.794	± 4.9 %	< ± 10%	Complied
1	VIS3	470.0	0.994	0.894	± 5.3 %	< ± 10%	Complied
5	BK7	420.0	0.941	0.893	± 2.6 %	< ± 10%	Complied
4	NDF	Vendors data will be used					

- Deviations due to small dark spots of size < 1mm reduces to < ± 3% when smoothed for beam illumination of 3mm on the filter

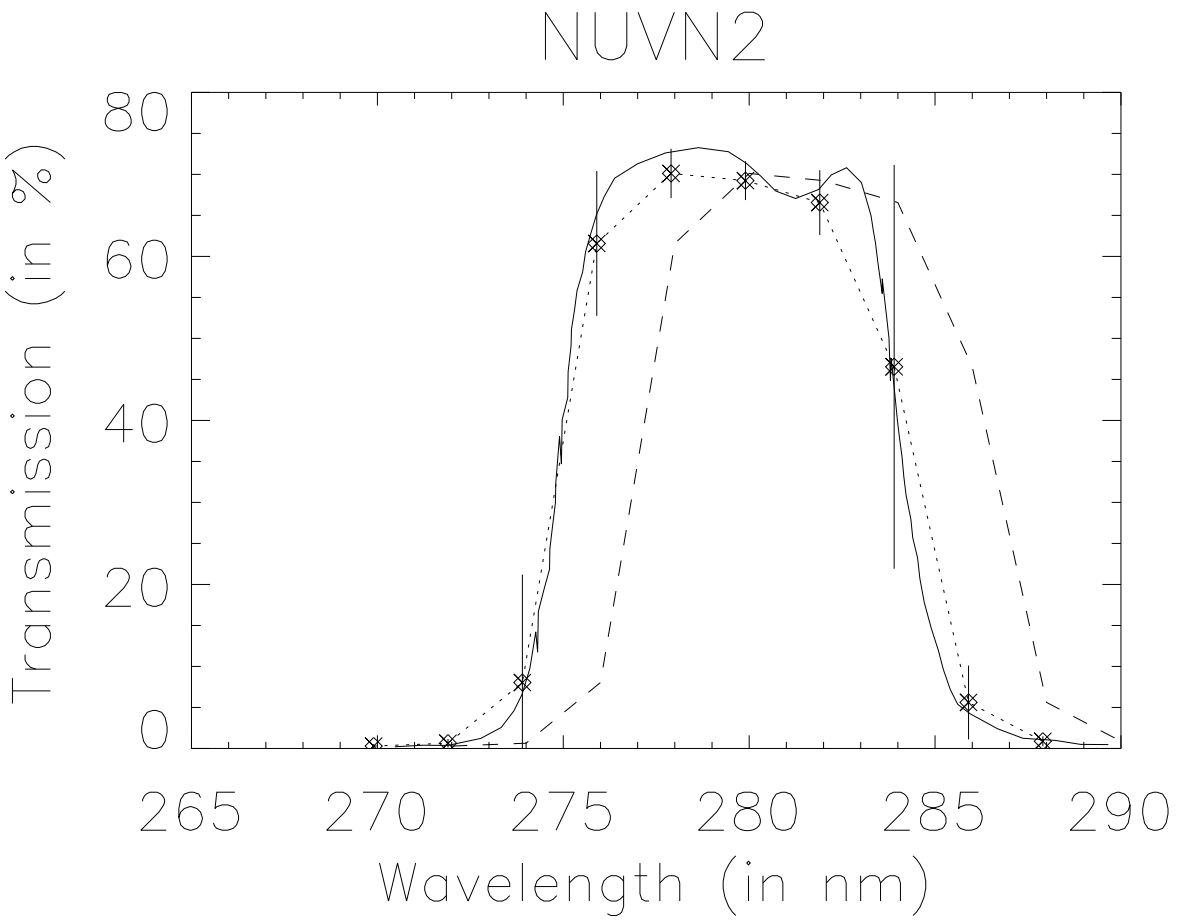
Spectral Transmission - FUV



Solid: Standard Data; Dotted: Measure at MGKM;
Data Points: Measured + Shifted (~ 2nm)

Other filters also match the standard curve

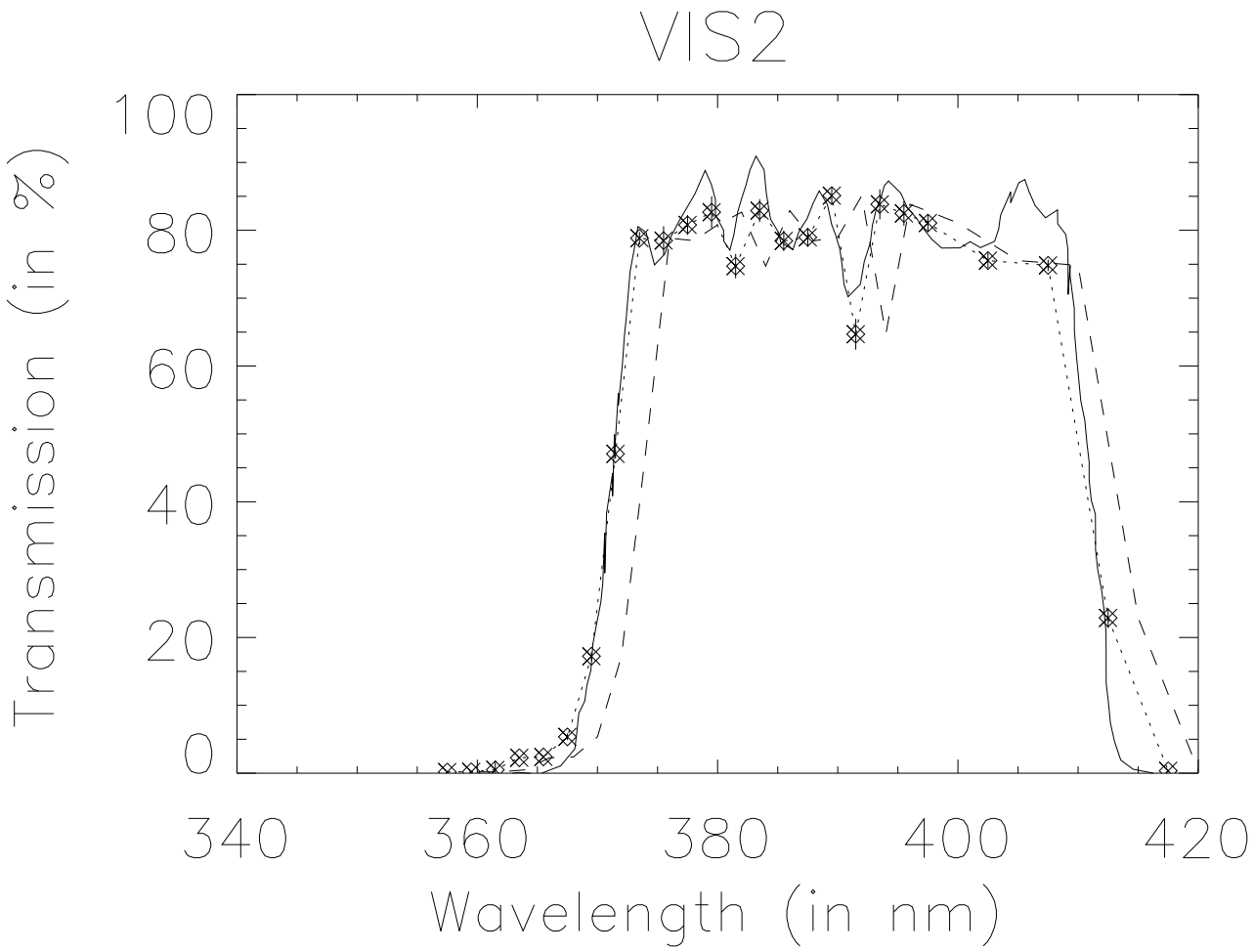
Spectral Transmission - NUV



Solid: Vendor Data; Dotted: Measure at MGKM;
Data Points: Measured + Shifted (~ 2nm)

Other filters also match the standard curve

Spectral Transmission - VIS



Solid: Vendor Data; Dotted: Measure at MGKM;
Data Points: Measured + Shifted (~ 2nm)

Other filters also match the standard curve

Wedge Angle - Results

Slot No.	Filter Name	Wavelength (nm)	Wedge Angle (arcmin)	Error (arcmin)	Requirement (arcmin)	Remarks
4	CaF2-1	180.0	0.493	0.013	3.0	Complied
3	BaF2	180.0	0.018	0.001	3.0	Complied
2	Sapphire	180.0	0.058	0.002	3.0	Complied
0	Silica	180.0	0.014	0.008	3.0	Complied
6	CaF2-2	180.0	0.857	0.016	3.0	Complied

Wedge Angle - Results

Slot No.	Filter Name	Wavelength (nm)	Wedge Angle (arcmin)	Error (arcmin)	Requirement (arcmin)	Remarks
6	Silica 3.0	293.0	0.388	0.007	3.0	Complied
7	NUVB15	210.0	6.63	0.297	3.0	Refer (1)
0	NUVB13	250.0	0.006	0.006	3.0	Complied
2	NUVB4	265.0	0.007	0.007	3.0	Complied
3	NUVN2	280.0	0.018	0.002	3.0	Complied
4	Silica 3.3	293.0	0.010	0.007	3.0	Complied

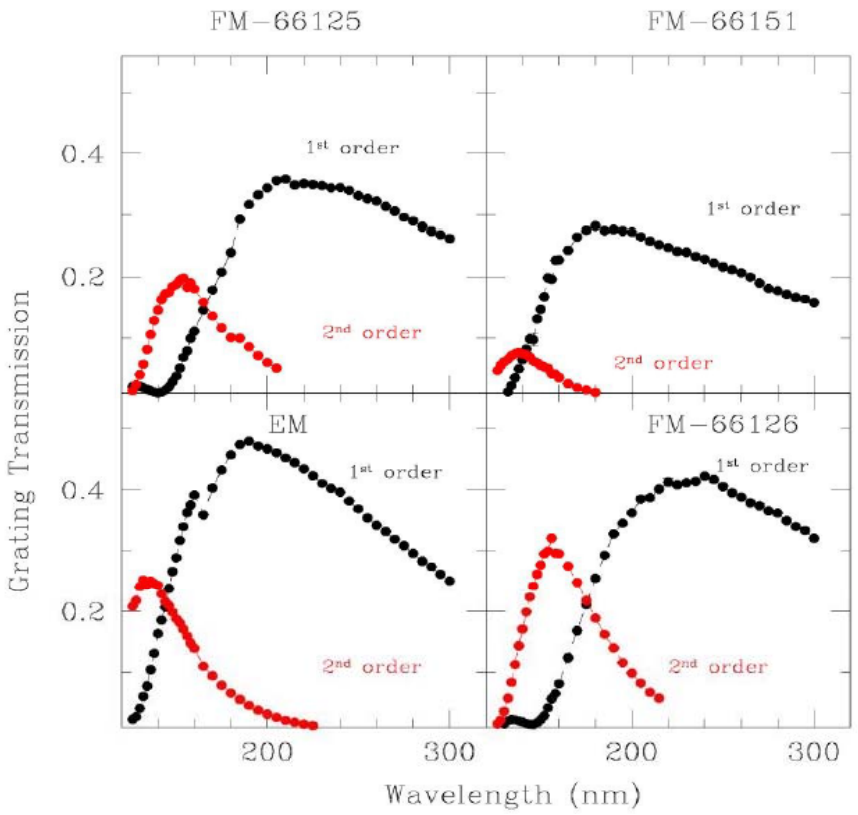
(1) Problem with this experiment. The pinhole image was not good

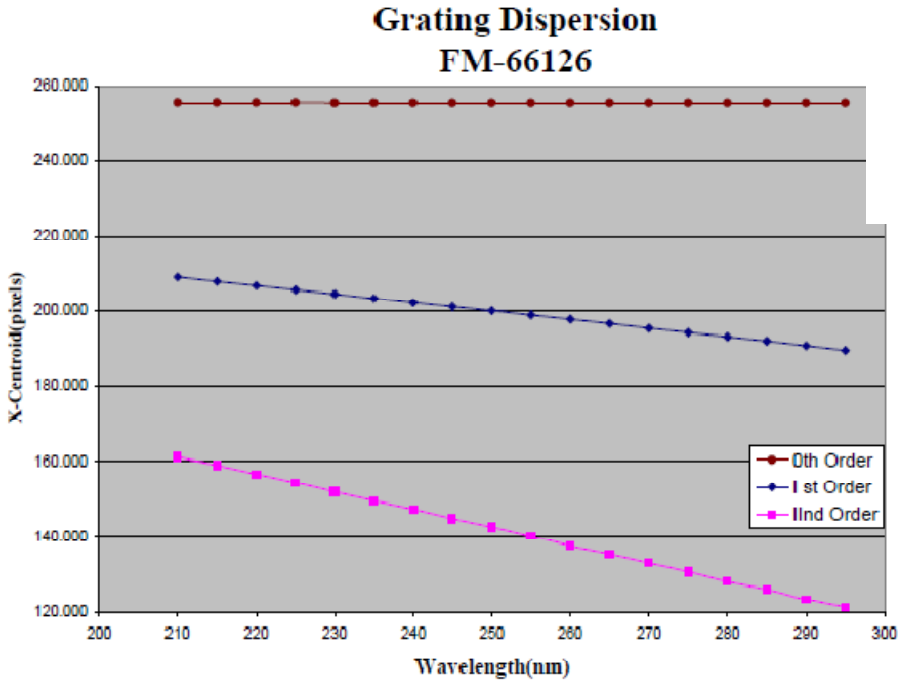
Wedge Angle - Results

Slot No.	Filter Name	Wavelength (nm)	Wedge Angle (arcmin)	Error (arcmin)	Requirement (arcmin)	Remarks
3	VIS1	330.0	0.035	0.004	3.0	Complied
2	VIS2	380.0	0.008	0.014	3.0	Complied
1	VIS3	420.0	0.082	0.034	3.0	Complied
5	BK7	500.0	0.237	0.002	3.0	Complied
4	NDF	500.0	Vendors value will be used		3.0	

Fig 3. Transmission results for the EM and FM gratings of UVIT. The names of the grating are given in each panel.

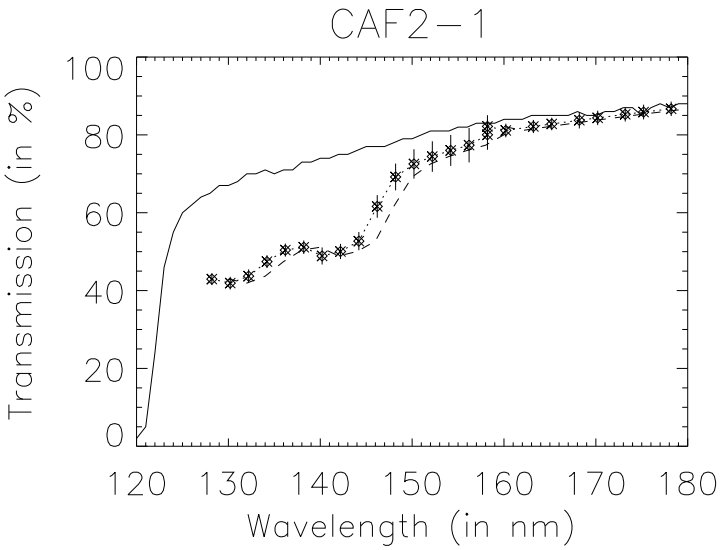
CREDIT: Stalin, Sriram et al.

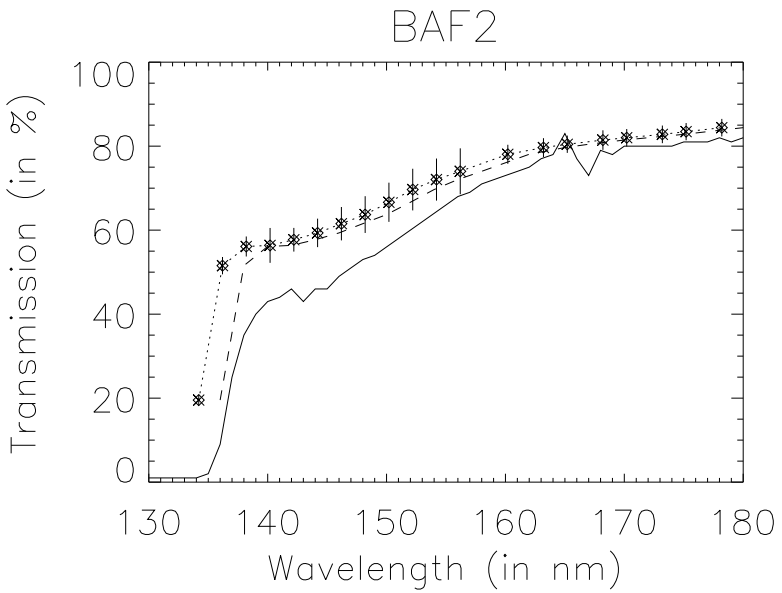


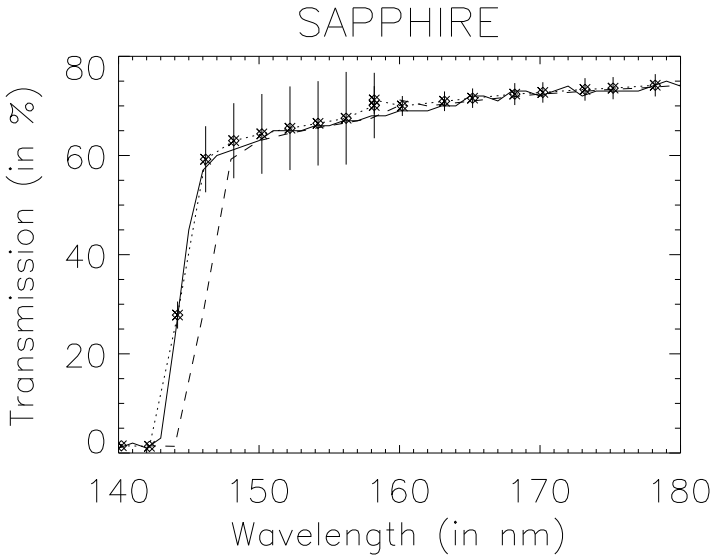


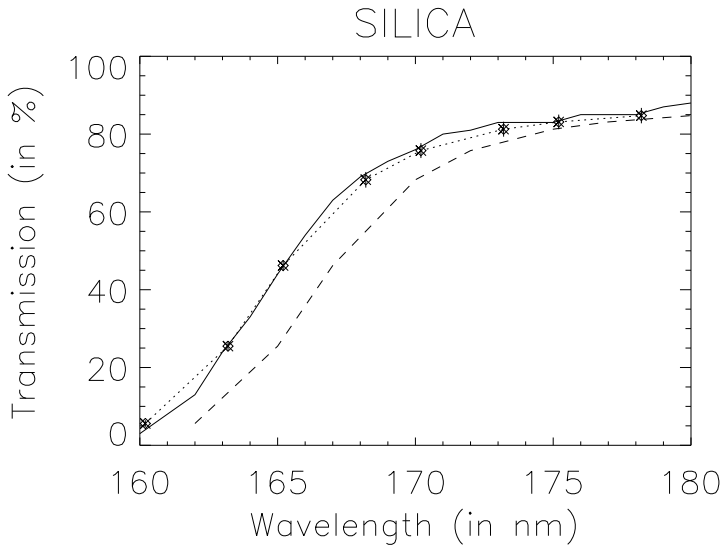
Thanks

Spectral Transmission - FUV



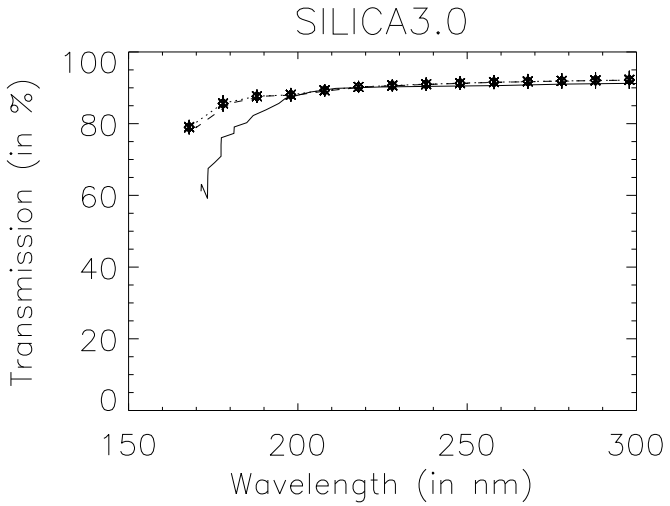


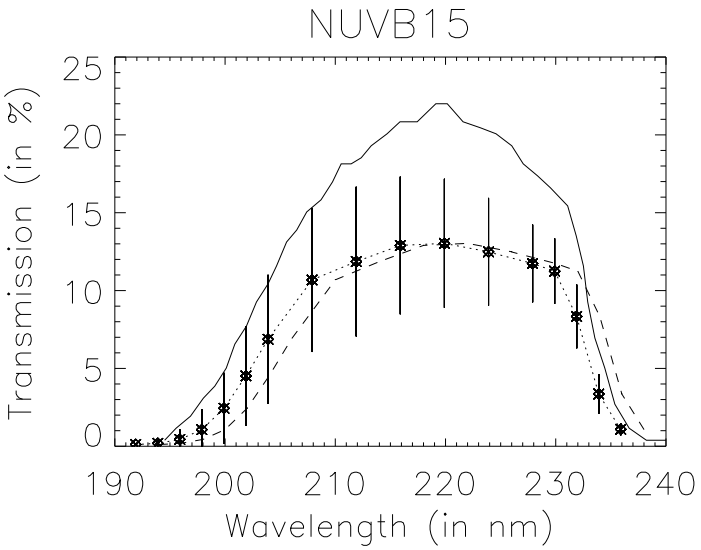


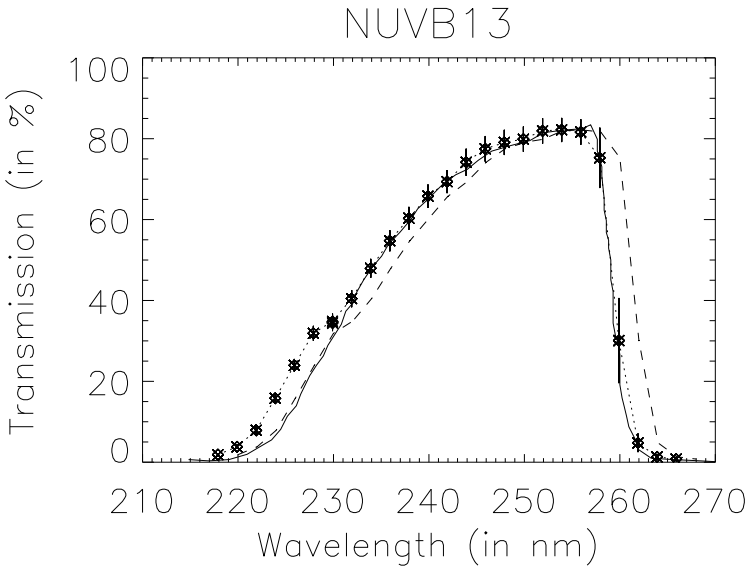


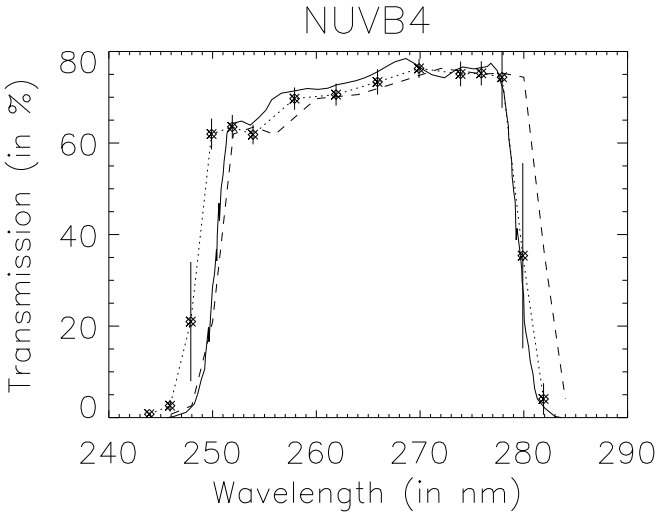
Solid: Standard Data; Dotted: Measure at MGKM; Data Points: Measured+Shifted

Spectral Transmission - NUV

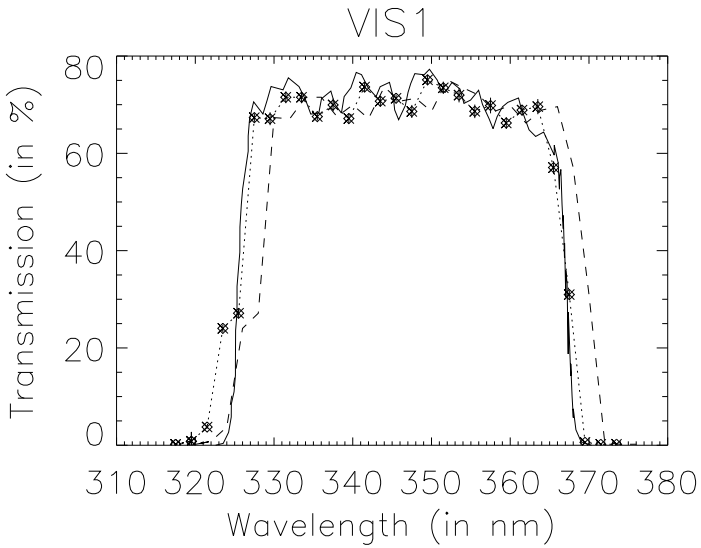


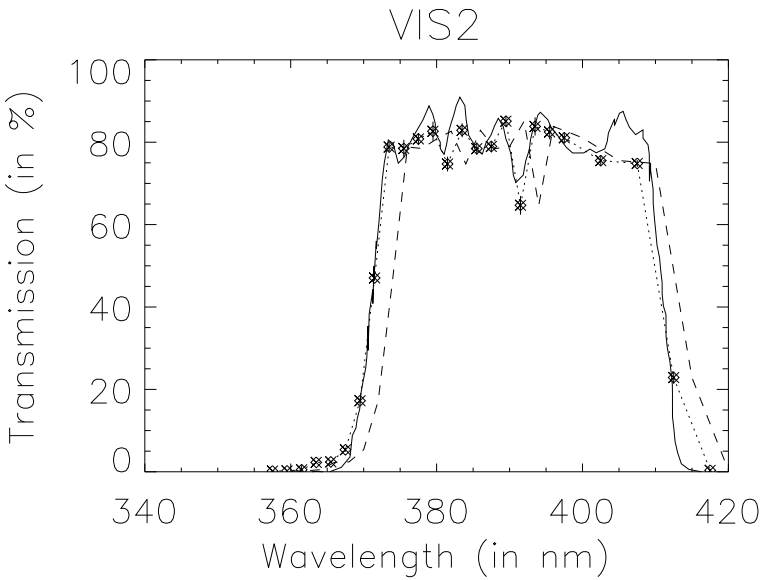


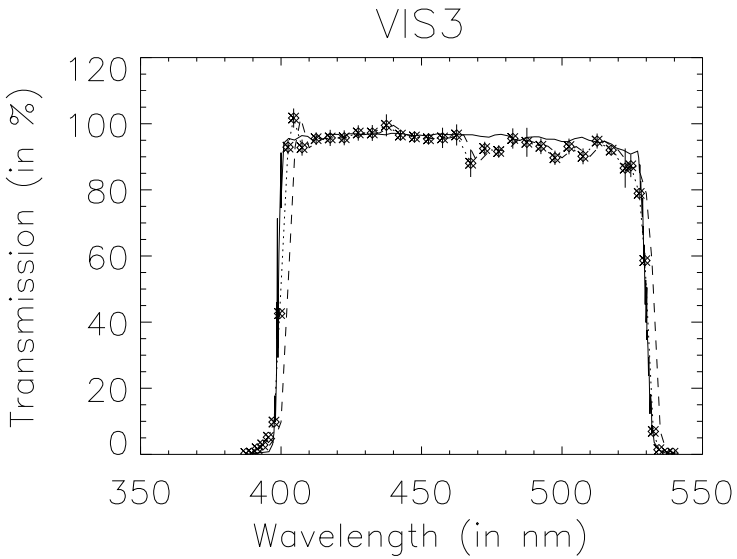


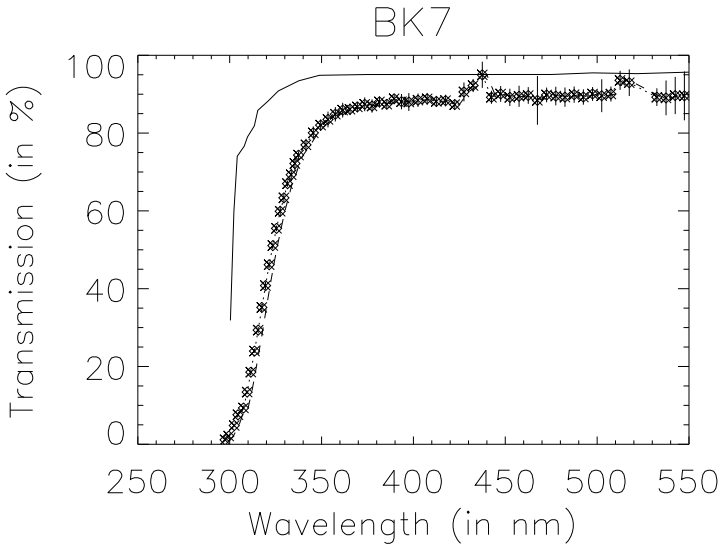


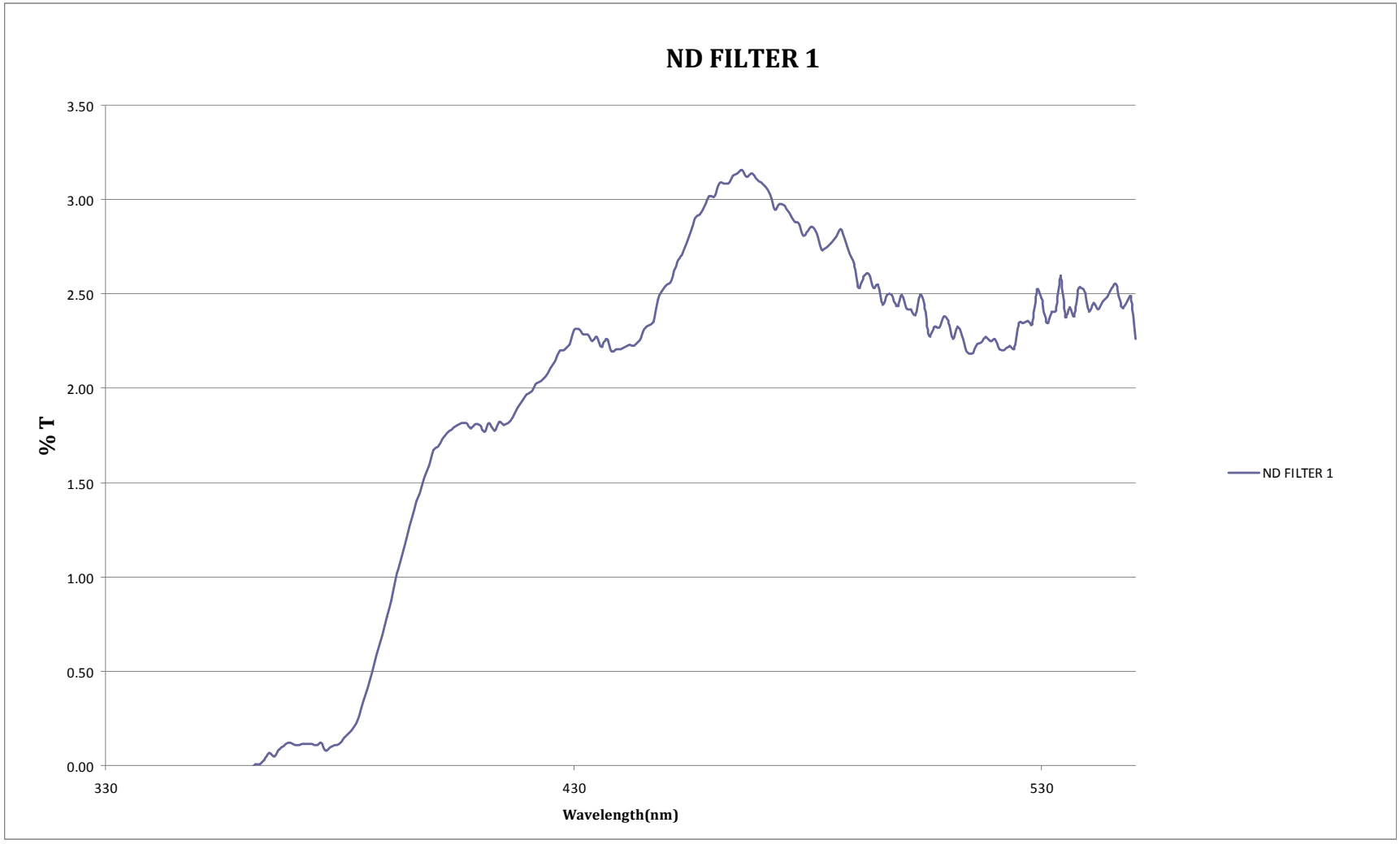
Spectral Transmission - VIS







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3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
% T
330
430
530
Wavelength(nm)
ND FILTER 1
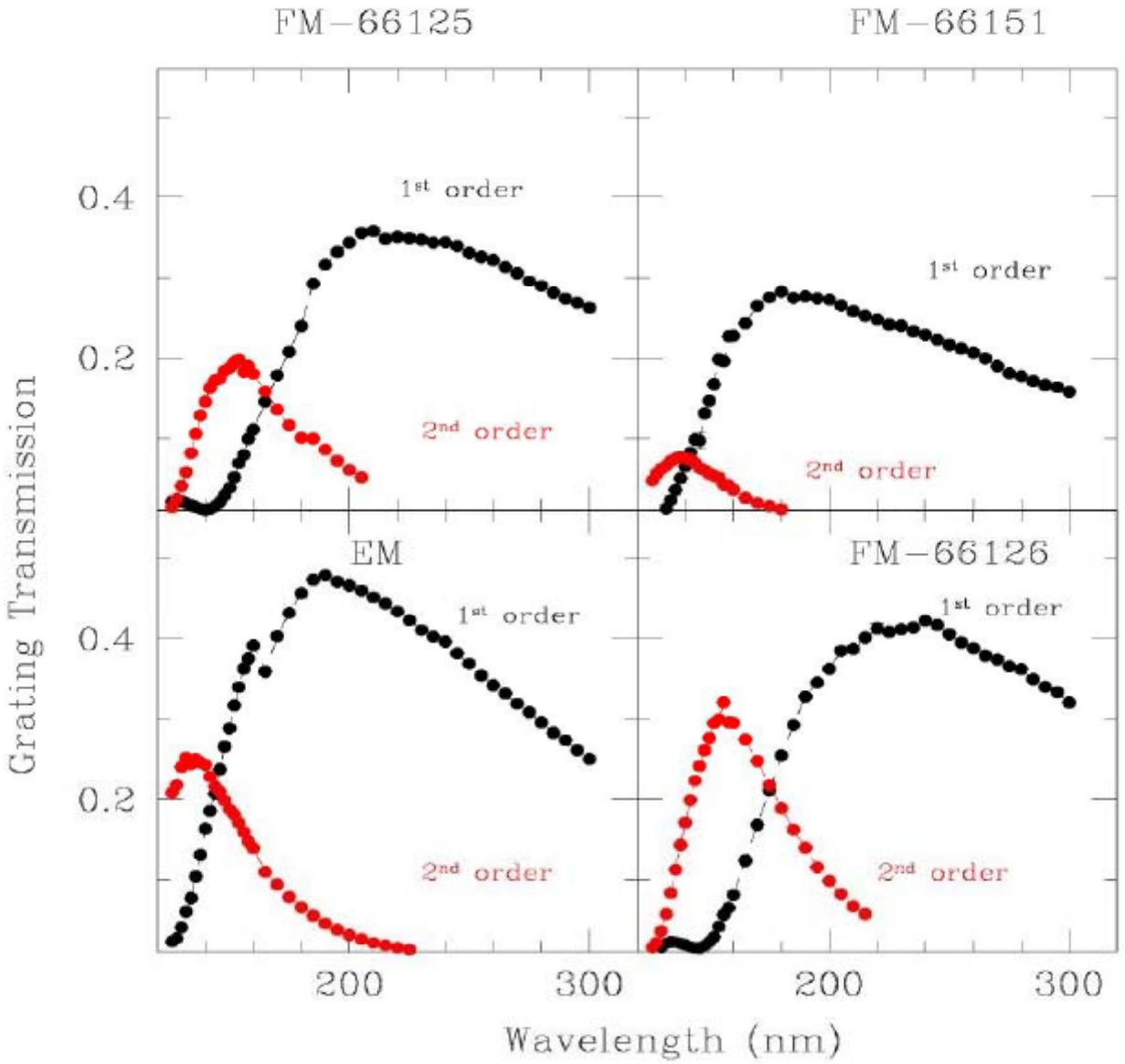
Fig 3. Transmission results for the EM and FM gratings of UVIT. The names of the grating are given in each panel. **(C.S Stalin)**