

Monocromator Setup & Measurements - 1

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6/10/2021

McPherson Monocromator & accessories and
Tungsten lamp
are to be delivered on October 29th

McPherson will provide us with the technical drawings of the
whole system as soon as possible

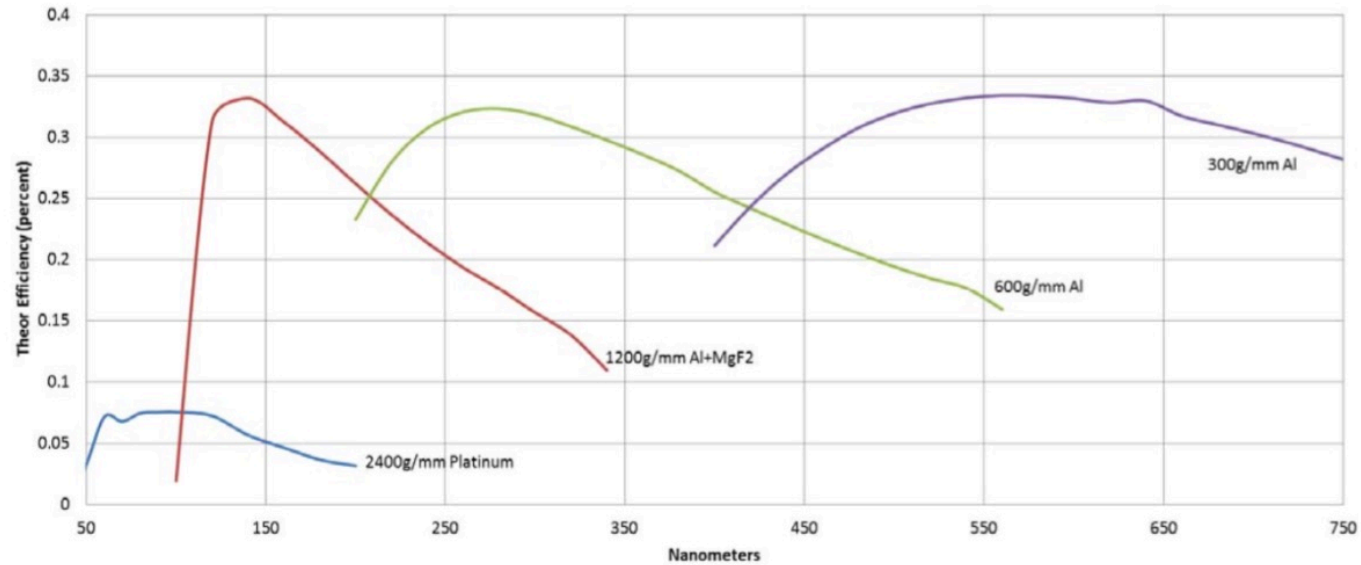
McPherson 234/302 Vacuum MC

Optical Design	Aberration Corrected Seya-Namioka
Angle of Incidence	32 degrees
Focal Length	200 mm
f/no.	4.5
Wavelength Range	refer to grating of interest for range
Wavelength Accuracy	+/- 0.10 nm (with 1200 g/mm grating)
Wavelength Reproducibility	+/- 0.05 nm (with 1200 g/mm grating)
Grating Size	40 x 45 mm (single kinematic grating holder, turret optional)
Slits	Continuously variable micrometer actuated width 0.01 to 3 mm. Settable height.
Vacuum	High vacuum 10E-6 torr standard, UHV optional
Focal Plane	25 mm microchannel plate or direct detection CCD



SIMILAR CHARACTERISTICS as HORIBA
DELIVERY : October 29, 2021

Grating selection

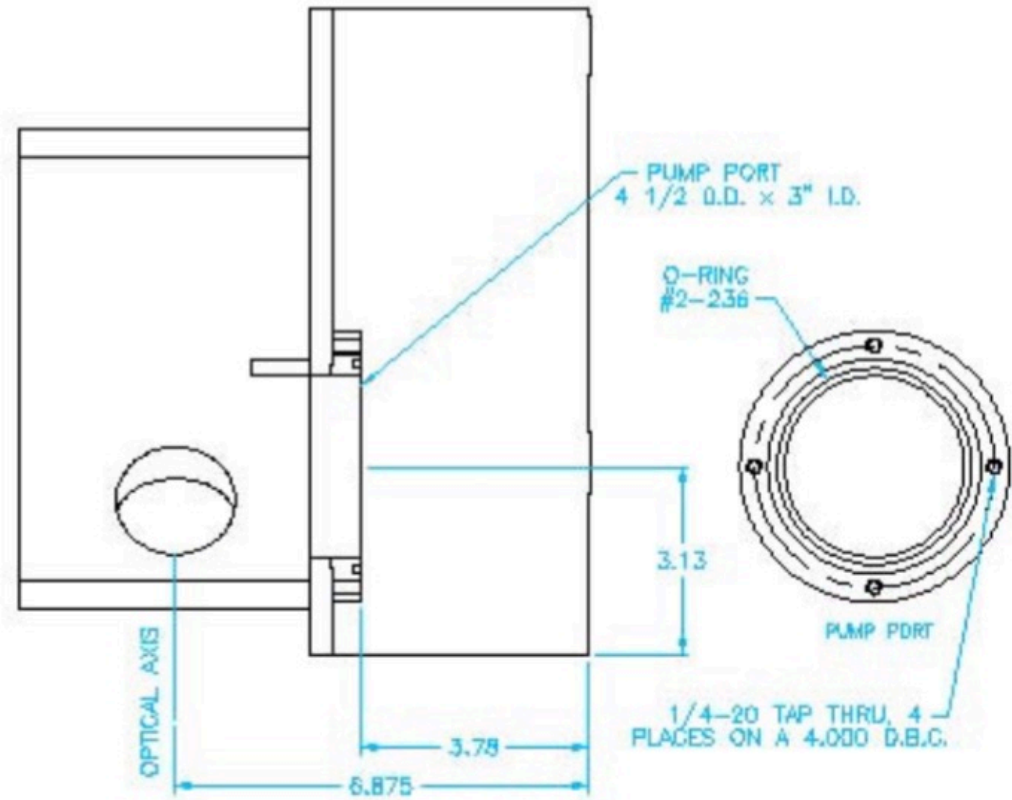
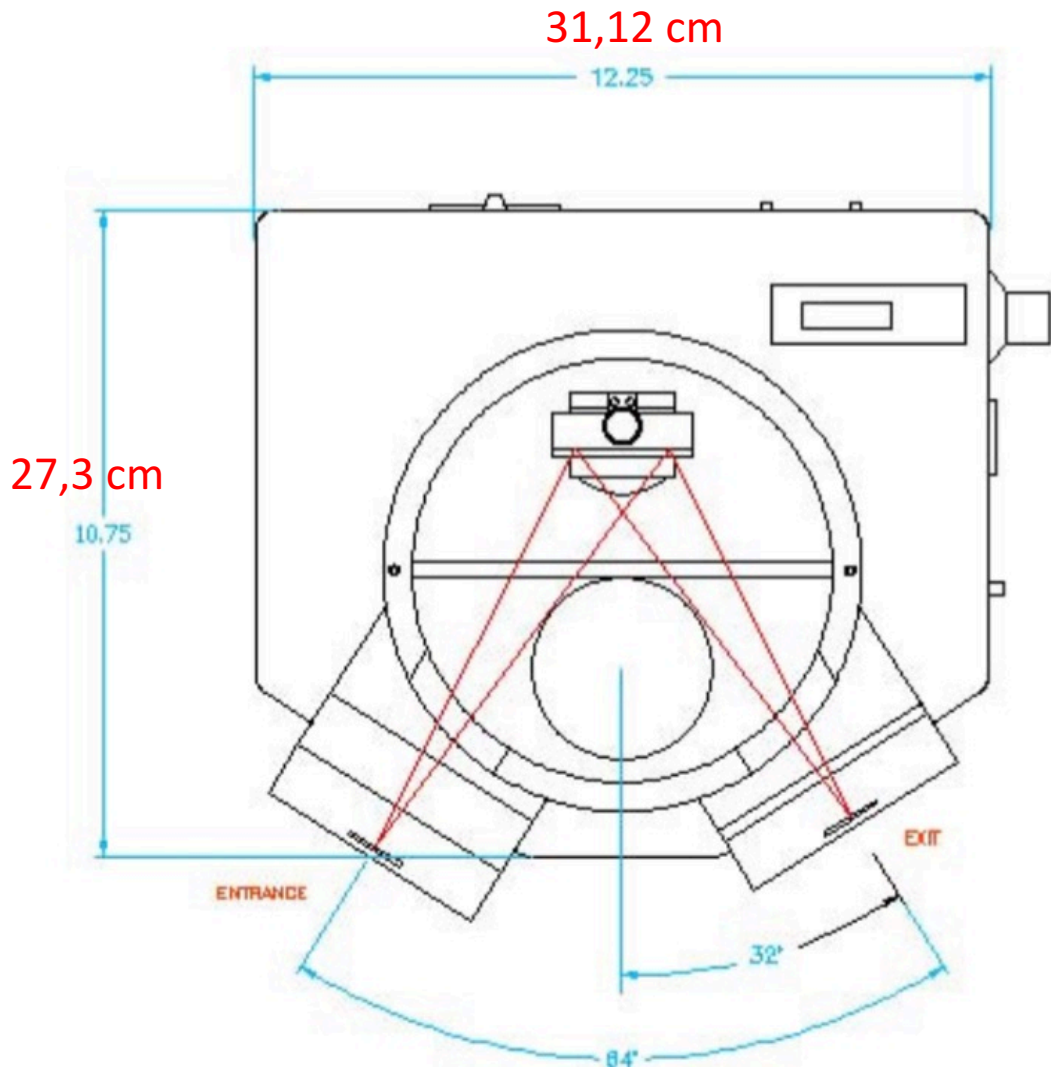


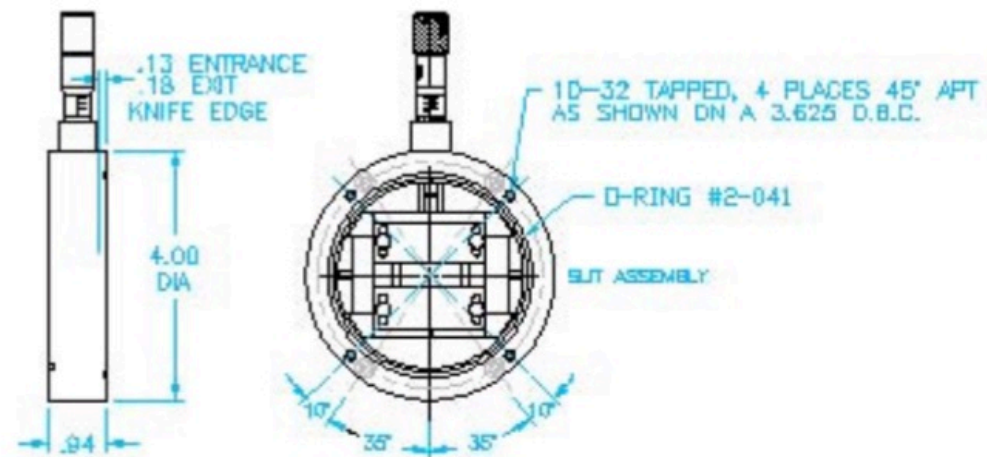
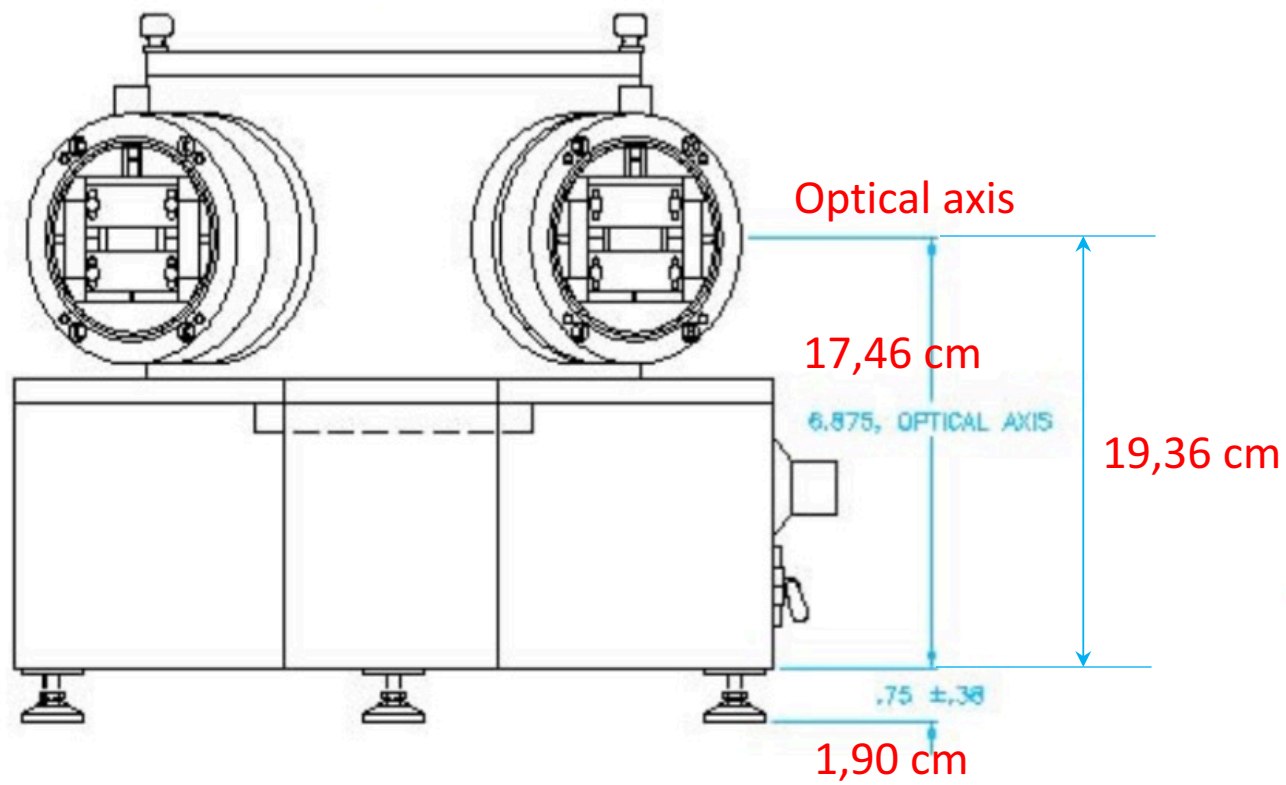
OUR SYSTEM: ONE GRATING ONLY

Performance with different gratings

Grating Groove Density (g/mm)	2400	1200	600	300
Spectral Resolution (nm, FWHM) ¹	0.05	0.1	0.2	0.4
Dispersion (nm/mm)	2	4	8	16
Wavelength Range up to (nm)	225	550	1100	2200
Holographic Optimization: (nm) ²	80	140	140	140
	140		300	

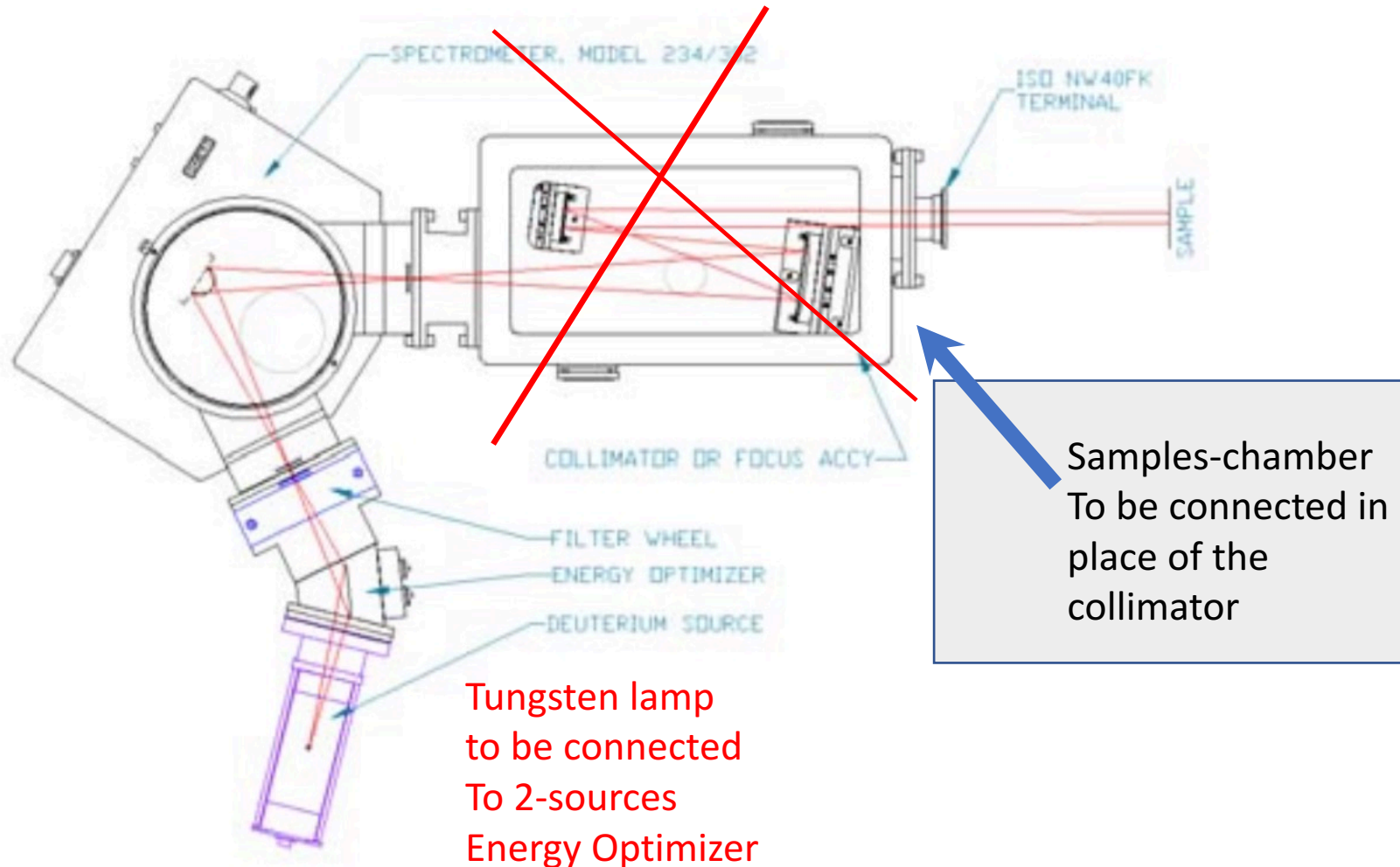
234/302 Dimensions





System Example 2 – Deep & VUV

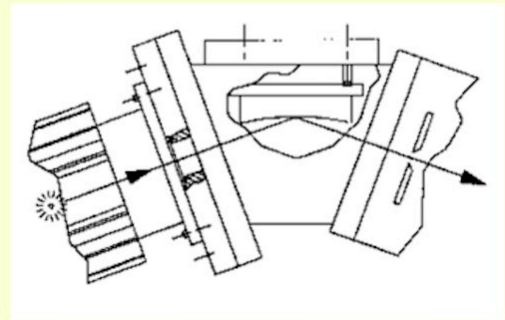
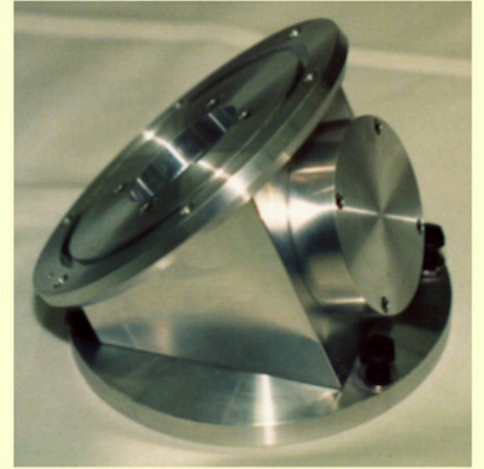
Tunable Light Source 120 to 220 nm



Energy Optimizer

Model 615B vacuum UV energy optimizer with two source branches. Uses reflective condenser mirror to collect light from sources and focus at monochromator entrance slit. Mirror can be rotated 180deg to choose from between two sources in vacuum. Manually operated
8102-0113-0

Model 615 - Energy Optimizer

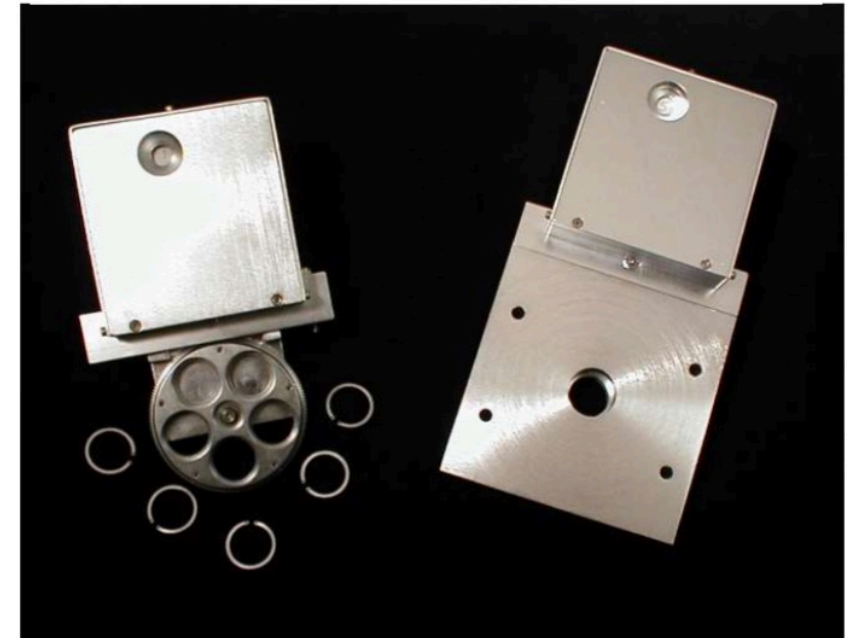
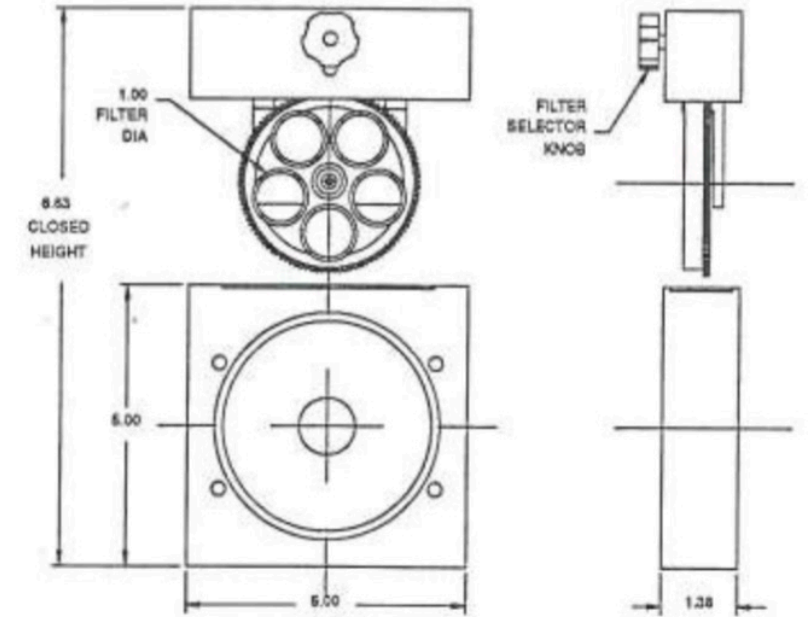
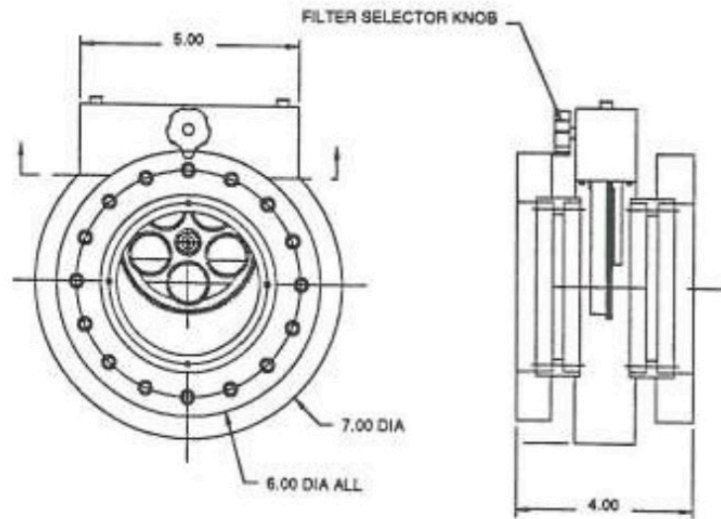
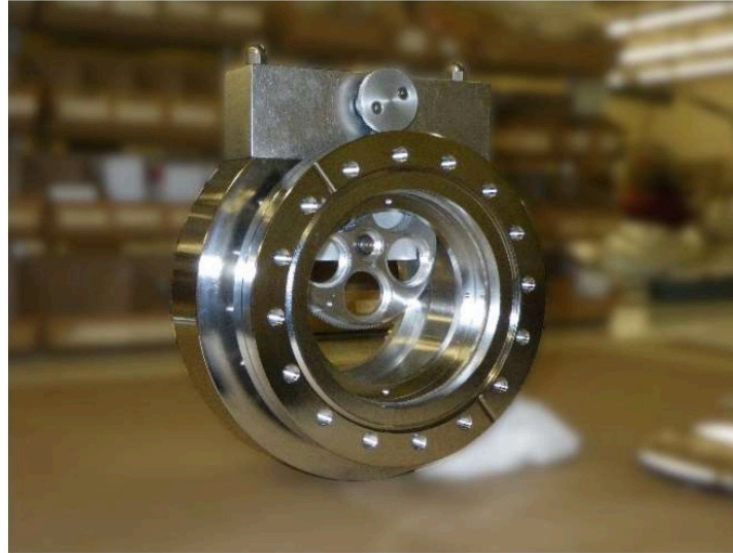


Filter wheel

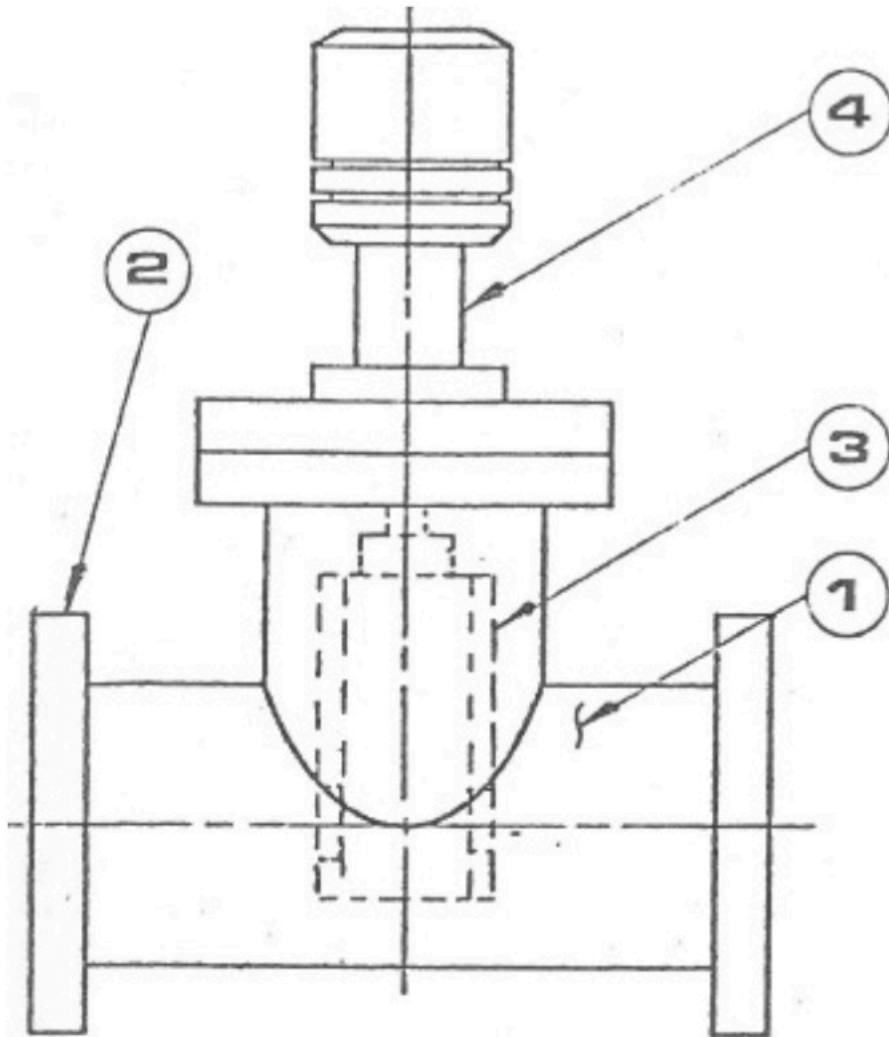
Vacuum manual filter wheel, 5X
25mm DIA. Easy to change
filters via slide
out selector wheel. Fits
McPherson slit housings

225 nm long pass filter, 90%T
+
400 nm long pass filter

If system requirements call for automation, the
model 648-1 should be specified. The 648-1
(pictured) features motorized filter changes and
RS232 operation.



Filter wheel assembly

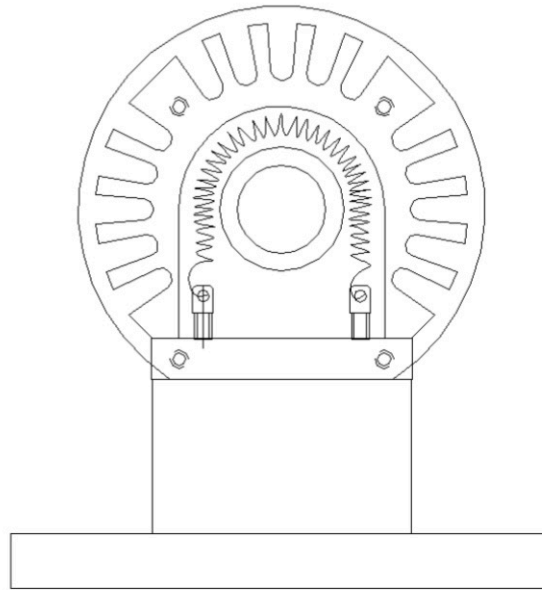
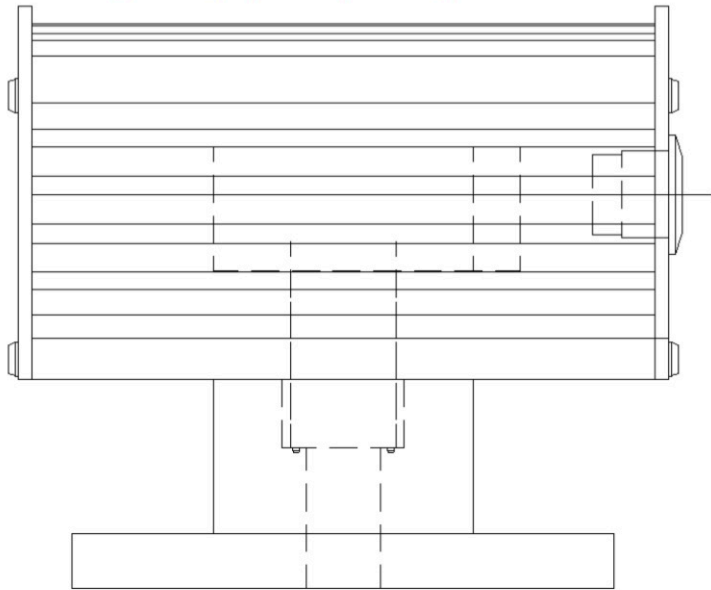


D2 Lamp

30 W lamp | f/6 beam | Magnesium Fluoride window | No flowing gas, coolant or pumps

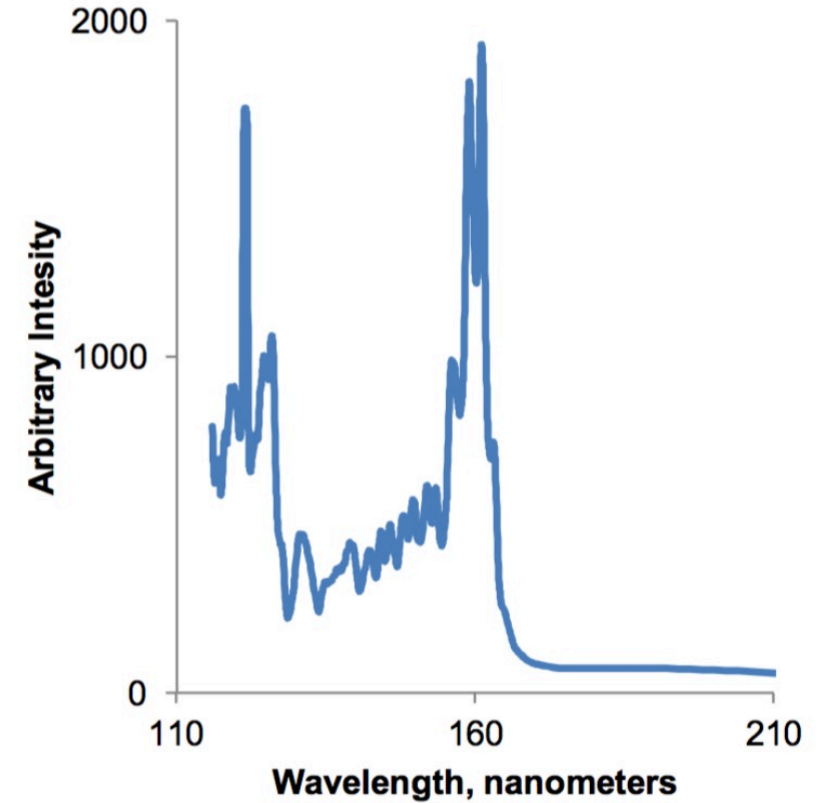
Optional, calibration & vacuum UV reflective condenser

This lamp has a 5" outer-diameter mounting flange. It is suitable for use on the slit assemblies found on most McPherson spectrometers. This light source system is convenient to use, demonstrates excellent stability, and has found widespread popularity through the vacuum and deep UV.



Power supply: Easy to use, line operated, universal input

- Width: 8.38 In (21.3 cm)
- Height: 5.22 In (13.3 cm)
- Depth: 14.38 In (36.5 cm)



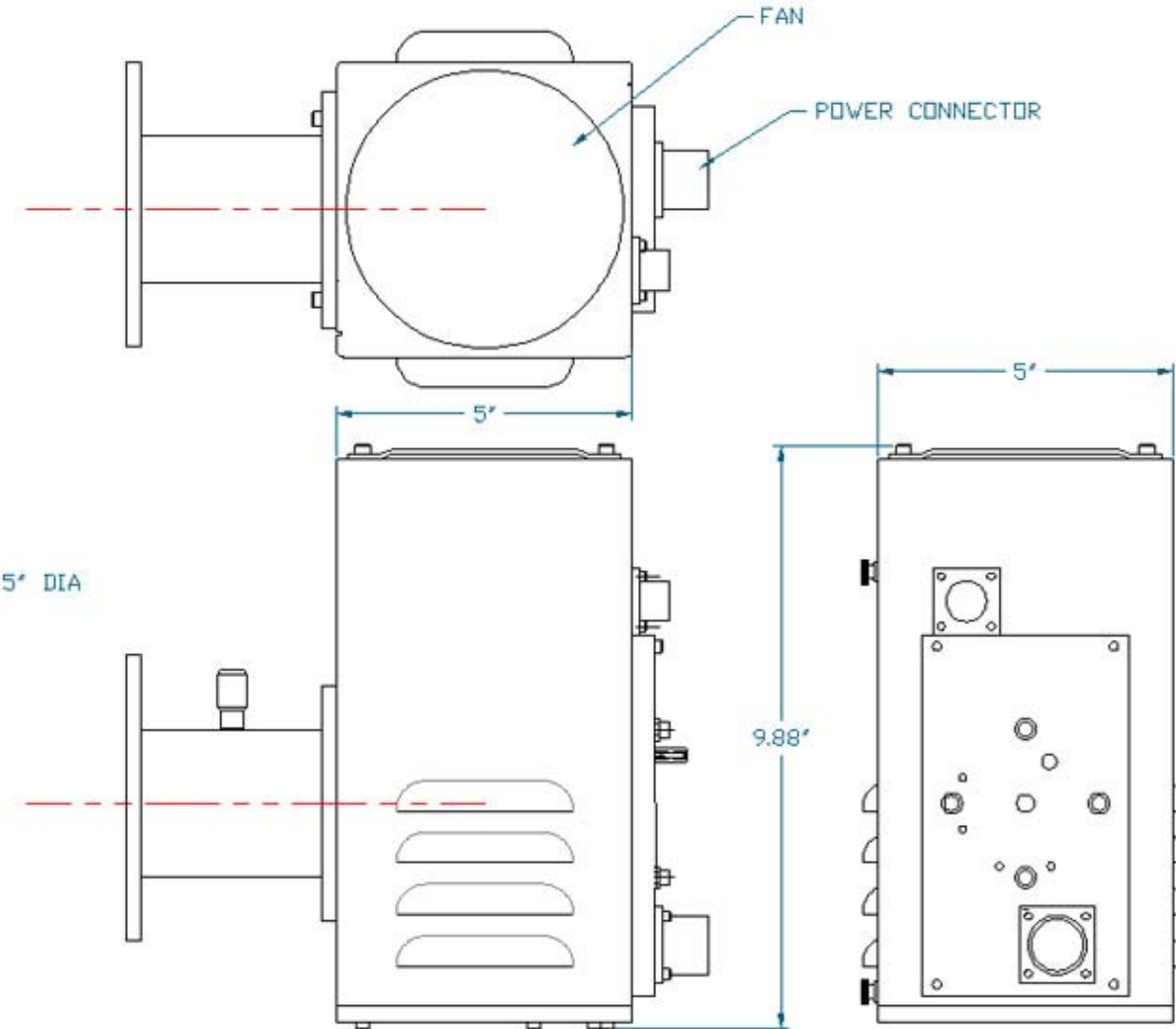
Model 634 Source system
Part No. 105-103053-0

Tungsten lamp

MODEL 621 UNIVERSAL SOURCE HOUSING
TUNGSTEN / XENON / IR EMITTER
PART 105-101717

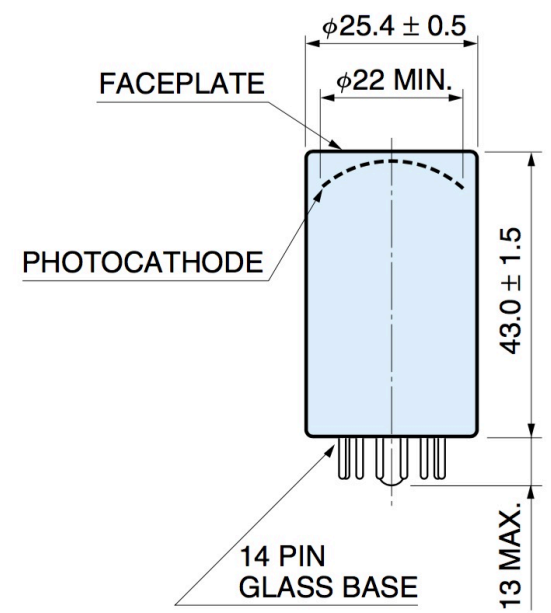
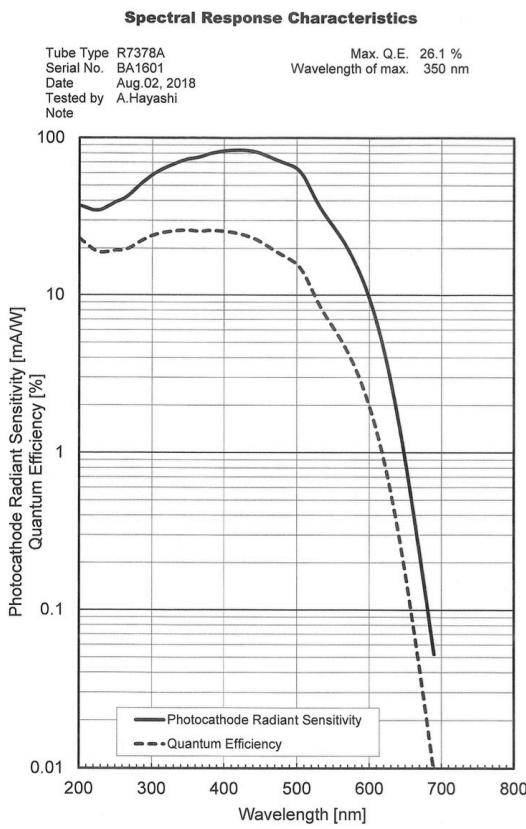
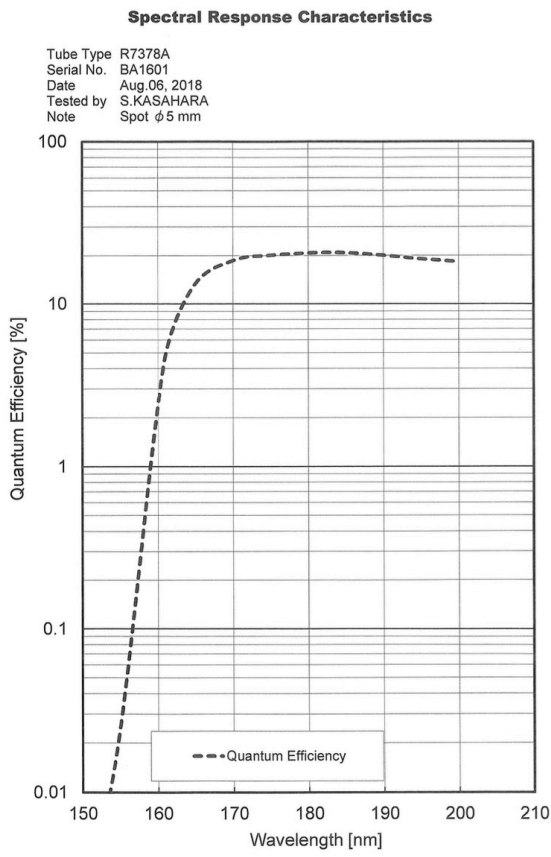
0.28" DIA THRU FOR 1/4-20 THD
5 PLACES, ON 4.5" BOLT CIRCLE.
FITS MCPHERSON 5" DIA SLITS

LIGHT OUTPUT
1.37" DIA



Connection to the
Energy optimizer
through a quartz
window.
Operation in air

Calibrated Photosensors PMT-1



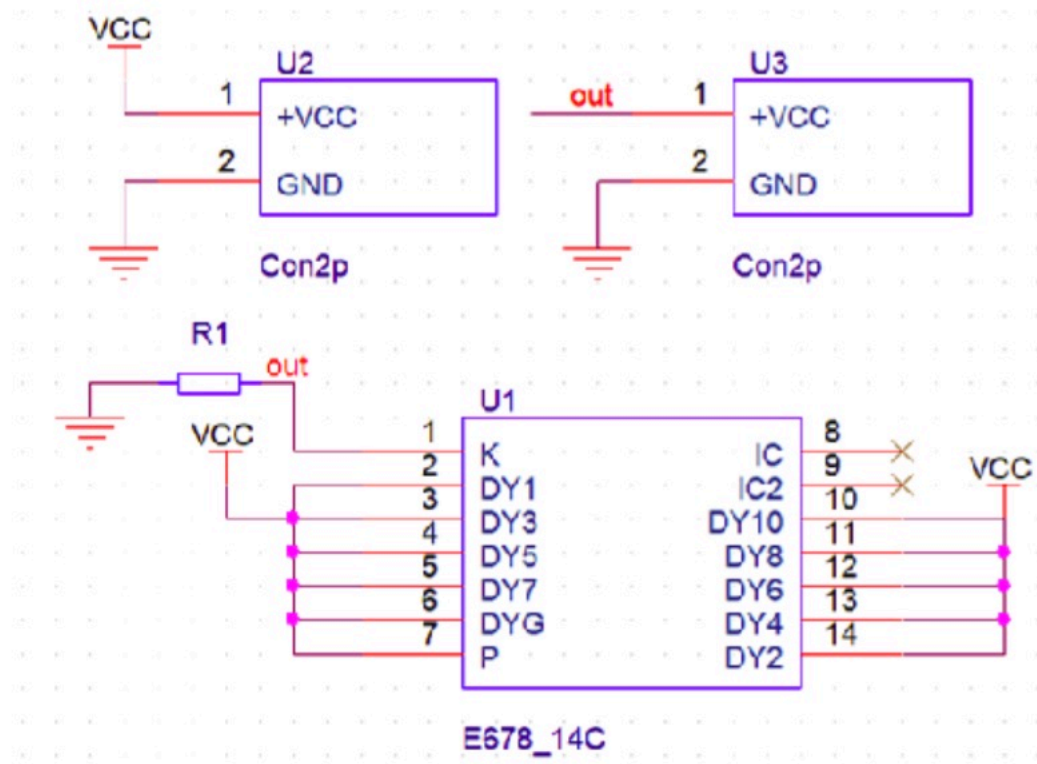
Quantum Efficiency [%] VUV

Wavelength [nm]	154.5	160.8	164.8	170	175	182.3	187.9	193.7	200
Quantum Efficiency [%]	0.02	4.25	13.06	18.68	20.12	20.91	20.46	19.31	18.38

Quantum Efficiency [%] VISIBLE

Wavelength [nm]	0	10	20	30	40	50	60	70	80	90
200	23.26	21.34	19.67	18.95	19.11	19.49	19.56	20.22	21.62	22.89
300	24.12	24.88	25.40	25.75	26.00	26.09	25.78	25.73	25.98	25.85
400	25.66	25.29	24.75	24.07	23.21	22.05	20.67	19.32	18.15	17.08
500	15.87	13.77	10.99	8.81	7.34	6.22	5.24	4.34	3.48	2.69
600	1.98	1.38	0.90	0.56	0.32	0.17	0.09	0.04	0.02	0.01

PMT base: for extraction of photocurrent from Cathode or first dynode current



Current is taken at Cathode (K)
Dynodes are shortcut

Manufactured at IFIC, but not functional: either the PCB is defective or not properly polarized. **To be re-examined and tested again.**

Calibrated Photosensors PMT - 2

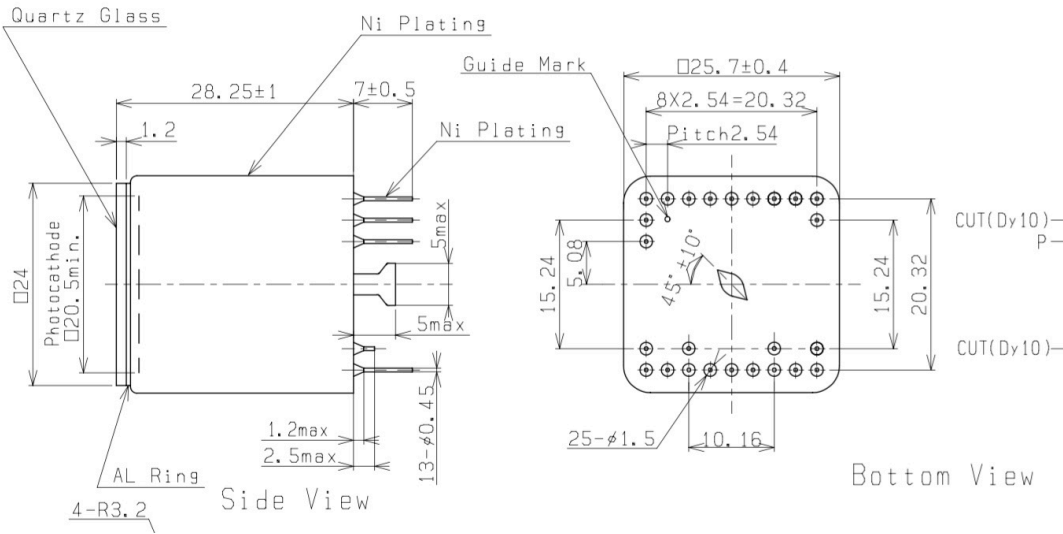
Spectral Response Characteristics

Tube Type R8520-06SEL
Serial No. ZB2771

WL (nm)	QE (%)	WL (nm)	QE (%)	WL (nm)	QE (%)
160.8	15.21	200	28.83	500	20.69
164.8	23.41	210	28.88	510	19.55
170.0	31.08	220	28.88	520	17.63
175.0	33.21	230	28.68	530	14.71
182.3	31.92	240	29.79	540	12.11
187.9	31.03	250	30.17	550	10.28
193.7	29.93	260	30.55	560	8.84
		270	30.86	570	7.59
		280	31.47	580	6.53
		290	32.52	590	5.54
		300	33.55	600	4.62
		310	33.88	610	3.80
		320	34.29	620	3.09
		330	34.21	630	2.31
		340	33.82	640	1.78
		350	33.73	650	1.33
		360	33.38	660	0.95
		370	33.24	670	0.67
		380	33.30	680	0.44
		390	32.79	690	0.28
		400	32.31	700	0.18
		410	31.60	710	0.11
		420	30.81	720	0.07
		430	29.76	730	0.04
		440	29.12	740	0.02
		450	28.04	750	0.01
		460	26.63	760	0.01
		470	25.15	770	0.01
		480	23.44	780	0.00
		490	21.89	790	0.00
				800	0.00

VISIBLE

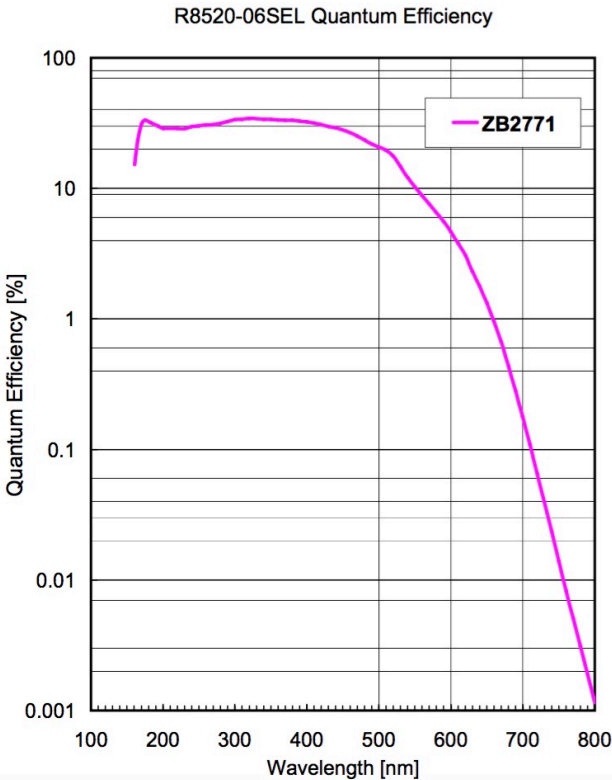
R8520-06SEL Dimensional Outline [Unit : mm]



Spectral Response Characteristics

Tube Type R8520-06SEL
Serial No. ZB2771

MaxQE 34.3 %
wl of max 200 nm



Calibrated Photosensors **PMT - 2**

PMT base: photocurrent extracted from first dynode

Manufactured at IFIC several years ago. **Functional.**

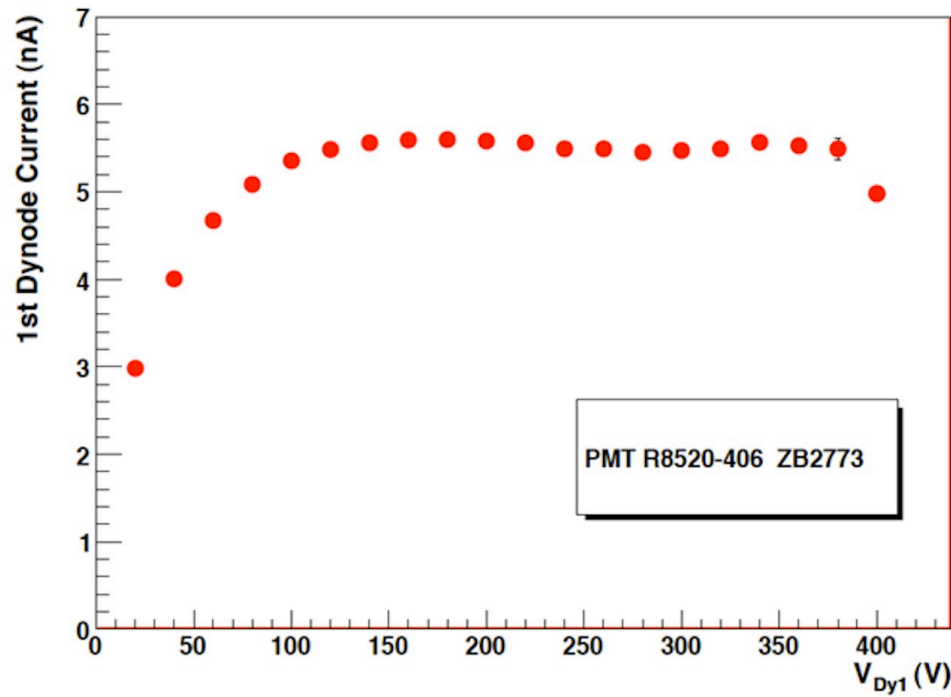


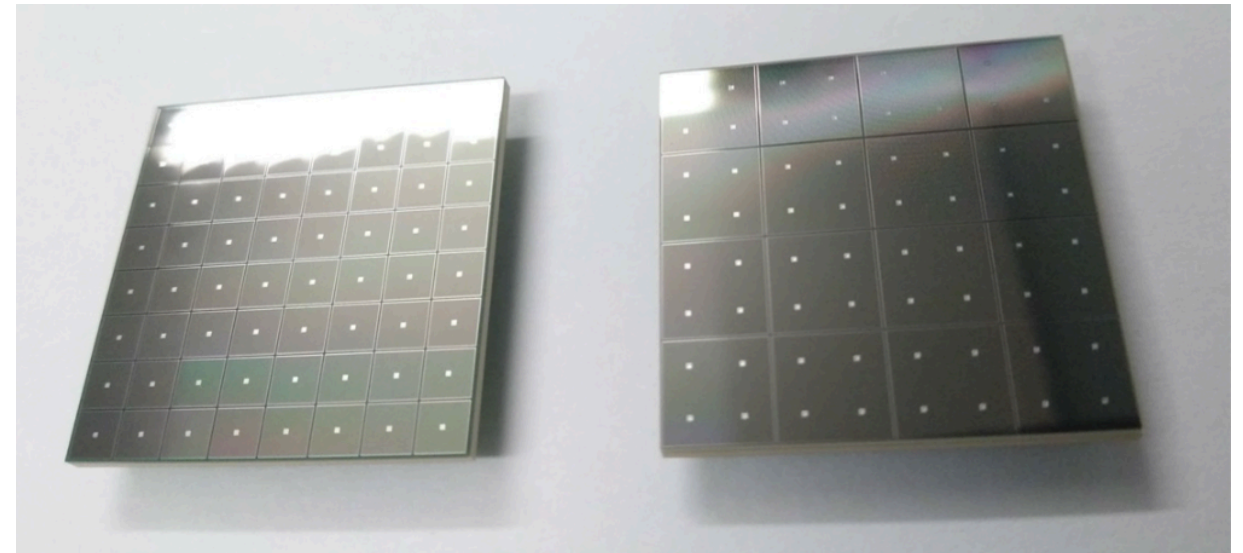
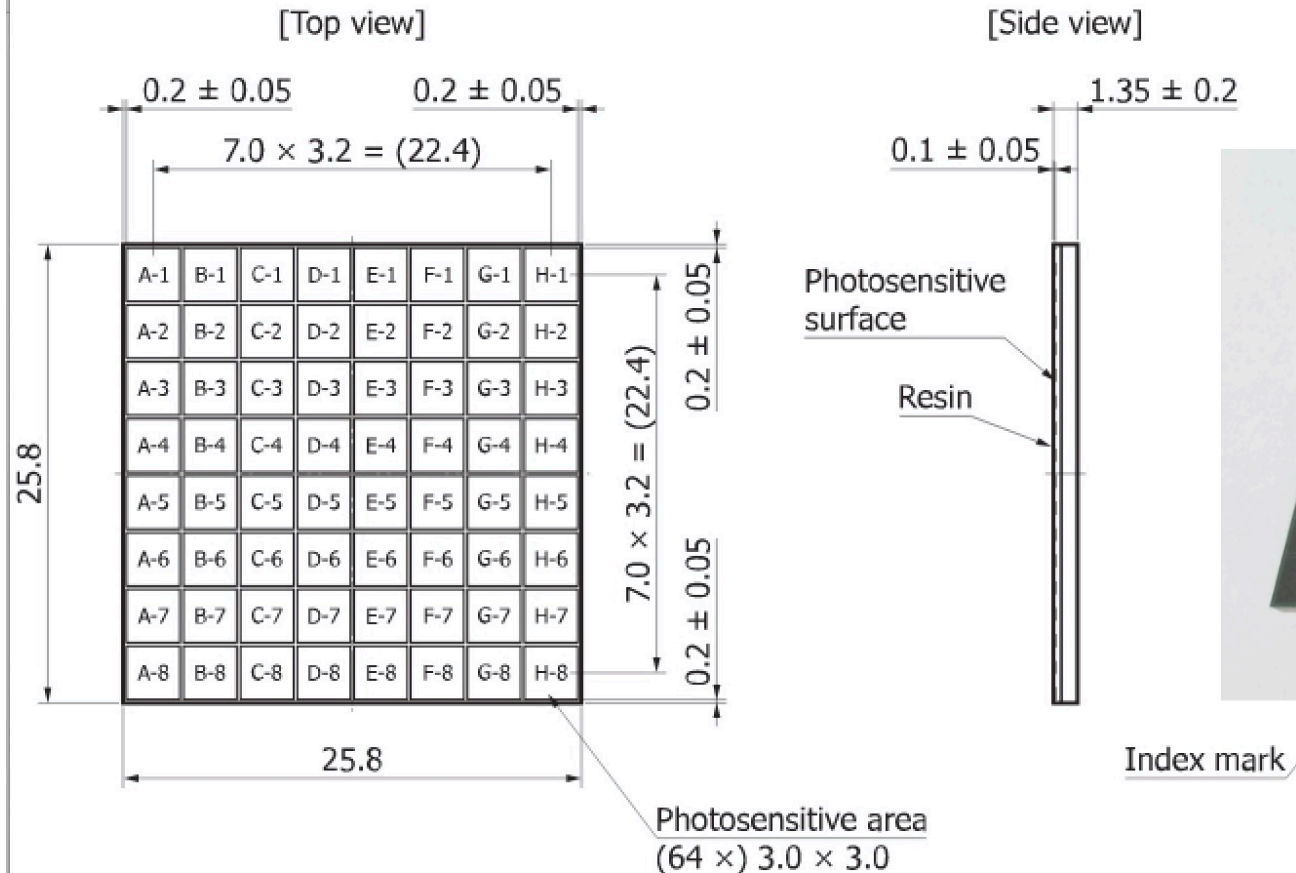
Figure 10. PMT photocurrent as a function of the bias voltage of the first dynode

At First dynode voltage > 100 V
collection efficiency is 100%

Usual voltage used : at mid-plateau

MPPC arrays – (Blue sensitive)

VERY GOOD OPTION TO CHARACTERIZE THE
LIGHT OUTPUT PROFILE OF THE
MONOCHROMATOR



MPPCs: S13361-3075AE-08
and S13361- 6075AE-04

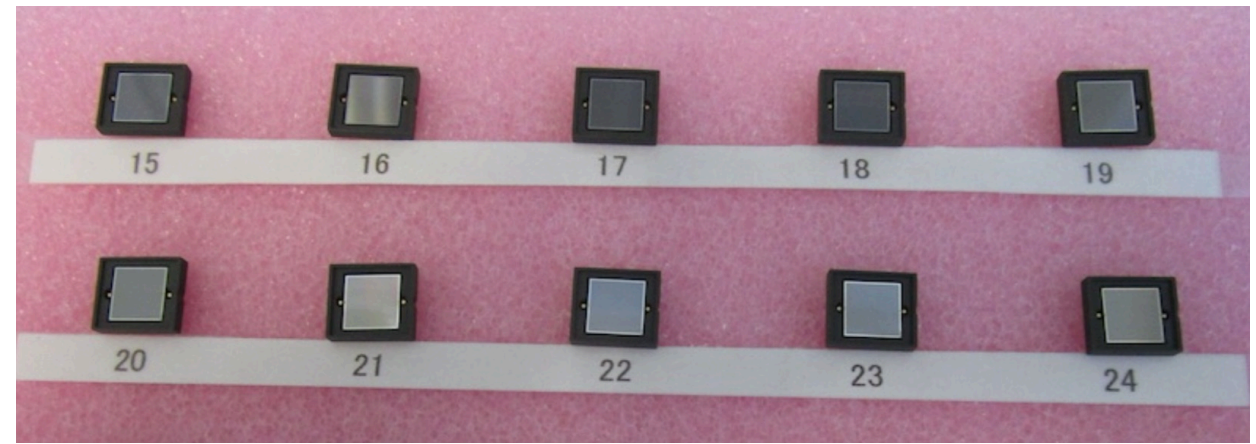
TO-DO: PCB card for polarization and extraction of the current

Alternative: read out with PETsys (available)

VUV - SiPMs

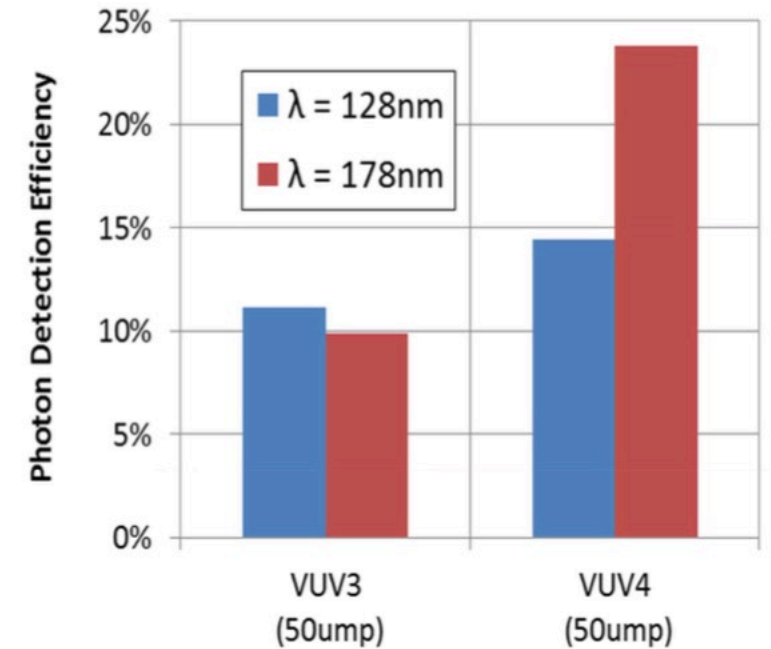
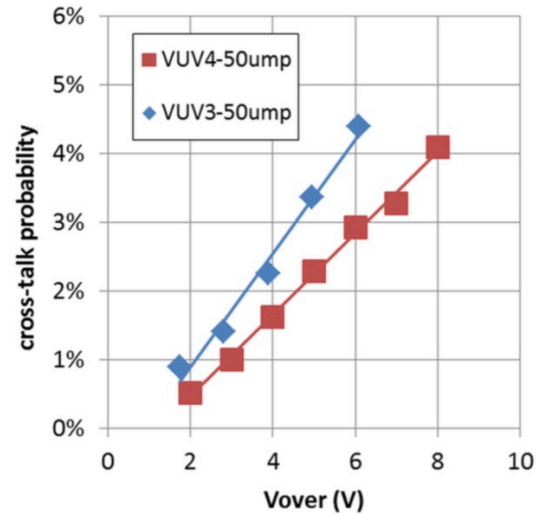
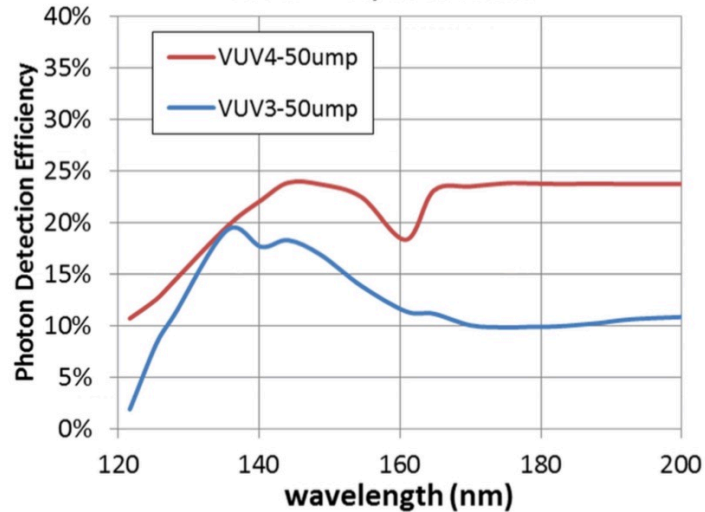
■ VUV-Sensitivity improvement

- ✓ VUV-MPPC has VUV-sensitivity down to 120 nm.
- ✓ The new 4th generation VUV-MPPC (VUV4) has improved photon detection efficiency, which becomes much higher than that of the 3rd generation VUV-MPPC (VUV3).
- ✓ Since optical crosstalk is suppressed by the inter-pixel trench structure, VUV4-MPPC has also improved signal-to-noise ratio



VUV-4 generation

PDE measurement data
Vover = 4V, in vacuum



TO-DO: PCB card for polarization and extraction of the current

To Do

- Get **precise drawings of the whole system** assembly from McPherson(MC, Filter wheel, Energy optimizer, ..) of all the components. **Already requested.**
- **Prepare Table support:** The whole system should be mounted in a table, large enough, with adjustable height and wheel to be moved (see examples in NEXT Lab). **To be manufactured at IFIC with mountable bars or use the Integration sphere table setup**
- Test **the vacuum pumps & sample chambers:** especially the **vacuum pump** (Justo's one) **sharing** between large and small vacuum chamber.
- **Reference photosensors (SiPM):** prepare and test polarization PCB for VUV SiPMs
- Test a **MPPC array (8x8)** for illumination profile of a LED.
- **reference photosensors(PMT):** repair bases for photocurrent extraction **(already manufactured but defective)** and test them with calibrated PMTs (150nm – 600 nm)

To Do

- Install PETsys software and Monochromator Software in a **dedicated Lab PC** to be used exclusively for monitoring the V-MC, PETsys and any remote control of samples positioning.
- Investigate **sample-holders** to be remotely controlled (for sample substitution) as to keep stable measurement conditions.
- Work on **measurement setups (reflectivity and PDE measurements)** to be implemented (more details next week)
- Get in touch with researchers from ICMUV (material sciences) and Optics department for experience sharing (visit their labs and setups). **Already requested.**