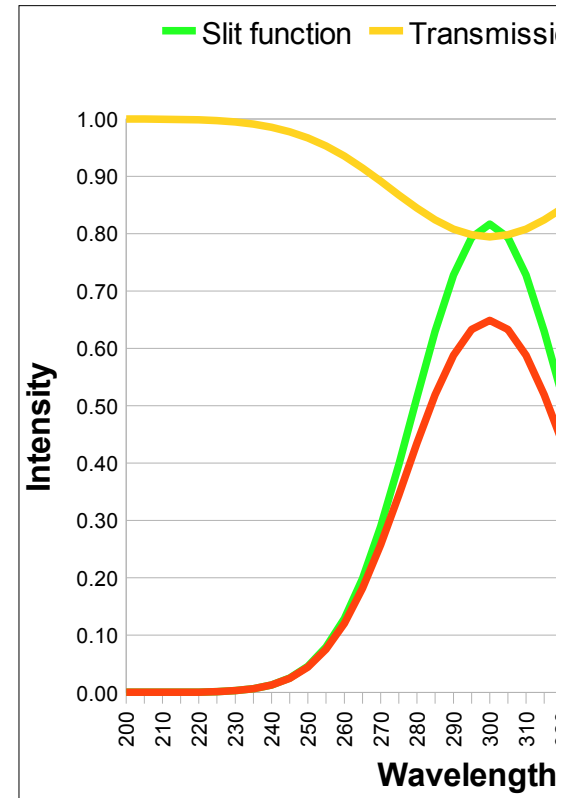


Effect of Slit Width on Signal-to-Noise Ratio in Absorption Spectroscopy

Absorber wavelength, nm	300	◀	▶
Slit width, mm	=D4/10	◀	▶
Dispersion, nm/mm	=D6/10	◀	▶
Absorber width, nm	60	◀	▶
Concentration	=10 ^{^(I42/50)/100}	◀	▶
Path length, cm	1	◀	▶
Unabsorbed stray light	=I41/10000	◀	▶



Measured absorbance	Measured incident intensity (I _{zero})	Measured transmitted intensity (I)	Signal-to-photon noise ratio	Signal-to- detector noise ratio
###	=I _{zero}	=I	###	###
Spectral bandpass, nm		=RLD*sw		
Measured transmittance		=I/I _{zero}		
Spectral bandpass/peak width		=SB/aw		
Noise table	noise factor*	incident	transmitted	total
Photon Noise	400000	=SQRT(I _{zero})/\$B\$22	=SQRT(I)/\$B\$22	
Relative photon noise		=C22/B17	=D22/C17	=SQRT(C23^2+D23^2)
Detector noise		1.00E-05	1.00E-05	
Relative detector noise		=C24/B17	=D24/C17	=SQRT(C25^2+D25^2)

* From cell F38 of [AbsorptionSNR.ods](#)

Named variables

W	Wavelength, nm
sw	Slit Width of monochromator, mm
aw	Absorber peak width (half-width of the absorption band), nm
RLD	Reciprocal linear dispersion of monochromator, nm/mm
c	Concentration of the absorber

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b	Absorption path length, cm	
sl	Stray light (fraction of incident light)	
I	Transmitted intensity (arbitrary units)	61
Izero	Incident intensity (arbitrary units)	37
Ameas	Measured absorbance	
SB	Spectral bandpass of monochromator, nm	
		0
		50

y

Version 2



Wavelength	Slit function	Slit function + Stray light	Sample Absorptivity	Transmission
200	=EXP(-1*((A3-300)/(0.6006*SB))^2)	=sw*C3+\$C\$45*sl/41	=EXP(-1*((A3-W)/(0.6006*aw))^2)	=10^(-\$E3*b*c)
=A3+5	=EXP(-1*((A4-300)/(0.6006*SB))^2)	=sw*C4+\$C\$45*sl/41	=EXP(-1*((A4-W)/(0.6006*aw))^2)	=10^(-\$E4*b*c)
=A4+5	=EXP(-1*((A5-300)/(0.6006*SB))^2)	=sw*C5+\$C\$45*sl/41	=EXP(-1*((A5-W)/(0.6006*aw))^2)	=10^(-\$E5*b*c)
=A5+5	=EXP(-1*((A6-300)/(0.6006*SB))^2)	=sw*C6+\$C\$45*sl/41	=EXP(-1*((A6-W)/(0.6006*aw))^2)	=10^(-\$E6*b*c)
=A6+5	=EXP(-1*((A7-300)/(0.6006*SB))^2)	=sw*C7+\$C\$45*sl/41	=EXP(-1*((A7-W)/(0.6006*aw))^2)	=10^(-\$E7*b*c)
=A7+5	=EXP(-1*((A8-300)/(0.6006*SB))^2)	=sw*C8+\$C\$45*sl/41	=EXP(-1*((A8-W)/(0.6006*aw))^2)	=10^(-\$E8*b*c)
=A8+5	=EXP(-1*((A9-300)/(0.6006*SB))^2)	=sw*C9+\$C\$45*sl/41	=EXP(-1*((A9-W)/(0.6006*aw))^2)	=10^(-\$E9*b*c)
=A9+5	=EXP(-1*((A10-300)/(0.6006*SB))^2)	=sw*C10+\$C\$45*sl/41	=EXP(-1*((A10-W)/(0.6006*aw))^2)	=10^(-\$E10*b*c)
=A10+5	=EXP(-1*((A11-300)/(0.6006*SB))^2)	=sw*C11+\$C\$45*sl/41	=EXP(-1*((A11-W)/(0.6006*aw))^2)	=10^(-\$E11*b*c)
=A11+5	=EXP(-1*((A12-300)/(0.6006*SB))^2)	=sw*C12+\$C\$45*sl/41	=EXP(-1*((A12-W)/(0.6006*aw))^2)	=10^(-\$E12*b*c)
=A12+5	=EXP(-1*((A13-300)/(0.6006*SB))^2)	=sw*C13+\$C\$45*sl/41	=EXP(-1*((A13-W)/(0.6006*aw))^2)	=10^(-\$E13*b*c)
=A13+5	=EXP(-1*((A14-300)/(0.6006*SB))^2)	=sw*C14+\$C\$45*sl/41	=EXP(-1*((A14-W)/(0.6006*aw))^2)	=10^(-\$E14*b*c)
=A14+5	=EXP(-1*((A15-300)/(0.6006*SB))^2)	=sw*C15+\$C\$45*sl/41	=EXP(-1*((A15-W)/(0.6006*aw))^2)	=10^(-\$E15*b*c)
=A15+5	=EXP(-1*((A16-300)/(0.6006*SB))^2)	=sw*C16+\$C\$45*sl/41	=EXP(-1*((A16-W)/(0.6006*aw))^2)	=10^(-\$E16*b*c)
=A16+5	=EXP(-1*((A17-300)/(0.6006*SB))^2)	=sw*C17+\$C\$45*sl/41	=EXP(-1*((A17-W)/(0.6006*aw))^2)	=10^(-\$E17*b*c)
=A17+5	=EXP(-1*((A18-300)/(0.6006*SB))^2)	=sw*C18+\$C\$45*sl/41	=EXP(-1*((A18-W)/(0.6006*aw))^2)	=10^(-\$E18*b*c)
=A18+5	=EXP(-1*((A19-300)/(0.6006*SB))^2)	=sw*C19+\$C\$45*sl/41	=EXP(-1*((A19-W)/(0.6006*aw))^2)	=10^(-\$E19*b*c)
=A19+5	=EXP(-1*((A20-300)/(0.6006*SB))^2)	=sw*C20+\$C\$45*sl/41	=EXP(-1*((A20-W)/(0.6006*aw))^2)	=10^(-\$E20*b*c)
=A20+5	=EXP(-1*((A21-300)/(0.6006*SB))^2)	=sw*C21+\$C\$45*sl/41	=EXP(-1*((A21-W)/(0.6006*aw))^2)	=10^(-\$E21*b*c)
=A21+5	=EXP(-1*((A22-300)/(0.6006*SB))^2)	=sw*C22+\$C\$45*sl/41	=EXP(-1*((A22-W)/(0.6006*aw))^2)	=10^(-\$E22*b*c)
=A22+5	=EXP(-1*((A23-300)/(0.6006*SB))^2)	=sw*C23+\$C\$45*sl/41	=EXP(-1*((A23-W)/(0.6006*aw))^2)	=10^(-\$E23*b*c)
=A23+5	=EXP(-1*((A24-300)/(0.6006*SB))^2)	=sw*C24+\$C\$45*sl/41	=EXP(-1*((A24-W)/(0.6006*aw))^2)	=10^(-\$E24*b*c)
=A24+5	=EXP(-1*((A25-300)/(0.6006*SB))^2)	=sw*C25+\$C\$45*sl/41	=EXP(-1*((A25-W)/(0.6006*aw))^2)	=10^(-\$E25*b*c)
=A25+5	=EXP(-1*((A26-300)/(0.6006*SB))^2)	=sw*C26+\$C\$45*sl/41	=EXP(-1*((A26-W)/(0.6006*aw))^2)	=10^(-\$E26*b*c)
=A26+5	=EXP(-1*((A27-300)/(0.6006*SB))^2)	=sw*C27+\$C\$45*sl/41	=EXP(-1*((A27-W)/(0.6006*aw))^2)	=10^(-\$E27*b*c)
=A27+5	=EXP(-1*((A28-300)/(0.6006*SB))^2)	=sw*C28+\$C\$45*sl/41	=EXP(-1*((A28-W)/(0.6006*aw))^2)	=10^(-\$E28*b*c)
=A28+5	=EXP(-1*((A29-300)/(0.6006*SB))^2)	=sw*C29+\$C\$45*sl/41	=EXP(-1*((A29-W)/(0.6006*aw))^2)	=10^(-\$E29*b*c)
=A29+5	=EXP(-1*((A30-300)/(0.6006*SB))^2)	=sw*C30+\$C\$45*sl/41	=EXP(-1*((A30-W)/(0.6006*aw))^2)	=10^(-\$E30*b*c)
=A30+5	=EXP(-1*((A31-300)/(0.6006*SB))^2)	=sw*C31+\$C\$45*sl/41	=EXP(-1*((A31-W)/(0.6006*aw))^2)	=10^(-\$E31*b*c)
=A31+5	=EXP(-1*((A32-300)/(0.6006*SB))^2)	=sw*C32+\$C\$45*sl/41	=EXP(-1*((A32-W)/(0.6006*aw))^2)	=10^(-\$E32*b*c)
=A32+5	=EXP(-1*((A33-300)/(0.6006*SB))^2)	=sw*C33+\$C\$45*sl/41	=EXP(-1*((A33-W)/(0.6006*aw))^2)	=10^(-\$E33*b*c)
=A33+5	=EXP(-1*((A34-300)/(0.6006*SB))^2)	=sw*C34+\$C\$45*sl/41	=EXP(-1*((A34-W)/(0.6006*aw))^2)	=10^(-\$E34*b*c)

=A34+5	=EXP(-1*((A35-300)/(0.6006*SB))^2)	=sw*C35+\$C\$45*sl/41	=EXP(-1*((A35-W)/(0.6006*aw))^2)	=10^(-\$E35*b*c)
=A35+5	=EXP(-1*((A36-300)/(0.6006*SB))^2)	=sw*C36+\$C\$45*sl/41	=EXP(-1*((A36-W)/(0.6006*aw))^2)	=10^(-\$E36*b*c)
=A36+5	=EXP(-1*((A37-300)/(0.6006*SB))^2)	=sw*C37+\$C\$45*sl/41	=EXP(-1*((A37-W)/(0.6006*aw))^2)	=10^(-\$E37*b*c)
=A37+5	=EXP(-1*((A38-300)/(0.6006*SB))^2)	=sw*C38+\$C\$45*sl/41	=EXP(-1*((A38-W)/(0.6006*aw))^2)	=10^(-\$E38*b*c)
=A38+5	=EXP(-1*((A39-300)/(0.6006*SB))^2)	=sw*C39+\$C\$45*sl/41	=EXP(-1*((A39-W)/(0.6006*aw))^2)	=10^(-\$E39*b*c)
=A39+5	=EXP(-1*((A40-300)/(0.6006*SB))^2)	=sw*C40+\$C\$45*sl/41	=EXP(-1*((A40-W)/(0.6006*aw))^2)	=10^(-\$E40*b*c)
=A40+5	=EXP(-1*((A41-300)/(0.6006*SB))^2)	=sw*C41+\$C\$45*sl/41	=EXP(-1*((A41-W)/(0.6006*aw))^2)	=10^(-\$E41*b*c)
=A41+5	=EXP(-1*((A42-300)/(0.6006*SB))^2)	=sw*C42+\$C\$45*sl/41	=EXP(-1*((A42-W)/(0.6006*aw))^2)	=10^(-\$E42*b*c)
=A42+5	=EXP(-1*((A43-300)/(0.6006*SB))^2)	=sw*C43+\$C\$45*sl/41	=EXP(-1*((A43-W)/(0.6006*aw))^2)	=10^(-\$E43*b*c)

Total intensity =sw*SUM(C3:C43)
Measured absorbance
Theoretical absorbance

1711.95

Izero
=SUM(D3:D43)

Observed intensity

- =sw*F3*C3+\$C\$45*sl/41
- =sw*F4*C4+\$C\$45*sl/41
- =sw*F5*C5+\$C\$45*sl/41
- =sw*F6*C6+\$C\$45*sl/41
- =sw*F7*C7+\$C\$45*sl/41
- =sw*F8*C8+\$C\$45*sl/41
- =sw*F9*C9+\$C\$45*sl/41
- =sw*F10*C10+\$C\$45*sl/41
- =sw*F11*C11+\$C\$45*sl/41
- =sw*F12*C12+\$C\$45*sl/41
- =sw*F13*C13+\$C\$45*sl/41
- =sw*F14*C14+\$C\$45*sl/41
- =sw*F15*C15+\$C\$45*sl/41
- =sw*F16*C16+\$C\$45*sl/41
- =sw*F17*C17+\$C\$45*sl/41
- =sw*F18*C18+\$C\$45*sl/41
- =sw*F19*C19+\$C\$45*sl/41
- =sw*F20*C20+\$C\$45*sl/41
- =sw*F21*C21+\$C\$45*sl/41
- =sw*F22*C22+\$C\$45*sl/41
- =sw*F23*C23+\$C\$45*sl/41
- =sw*F24*C24+\$C\$45*sl/41
- =sw*F25*C25+\$C\$45*sl/41
- =sw*F26*C26+\$C\$45*sl/41
- =sw*F27*C27+\$C\$45*sl/41
- =sw*F28*C28+\$C\$45*sl/41
- =sw*F29*C29+\$C\$45*sl/41
- =sw*F30*C30+\$C\$45*sl/41
- =sw*F31*C31+\$C\$45*sl/41
- =sw*F32*C32+\$C\$45*sl/41
- =sw*F33*C33+\$C\$45*sl/41
- =sw*F34*C34+\$C\$45*sl/41

=sw*F35*C35+\$C\$45*sI/41
=sw*F36*C36+\$C\$45*sI/41
=sw*F37*C37+\$C\$45*sI/41
=sw*F38*C38+\$C\$45*sI/41
=sw*F39*C39+\$C\$45*sI/41
=sw*F40*C40+\$C\$45*sI/41
=sw*F41*C41+\$C\$45*sI/41
=sw*F42*C42+\$C\$45*sI/41
=sw*F43*C43+\$C\$45*sI/41

|

=SUM(G3:G43)
=LOG(Izero/I;10)
=c*b*\$E\$23

