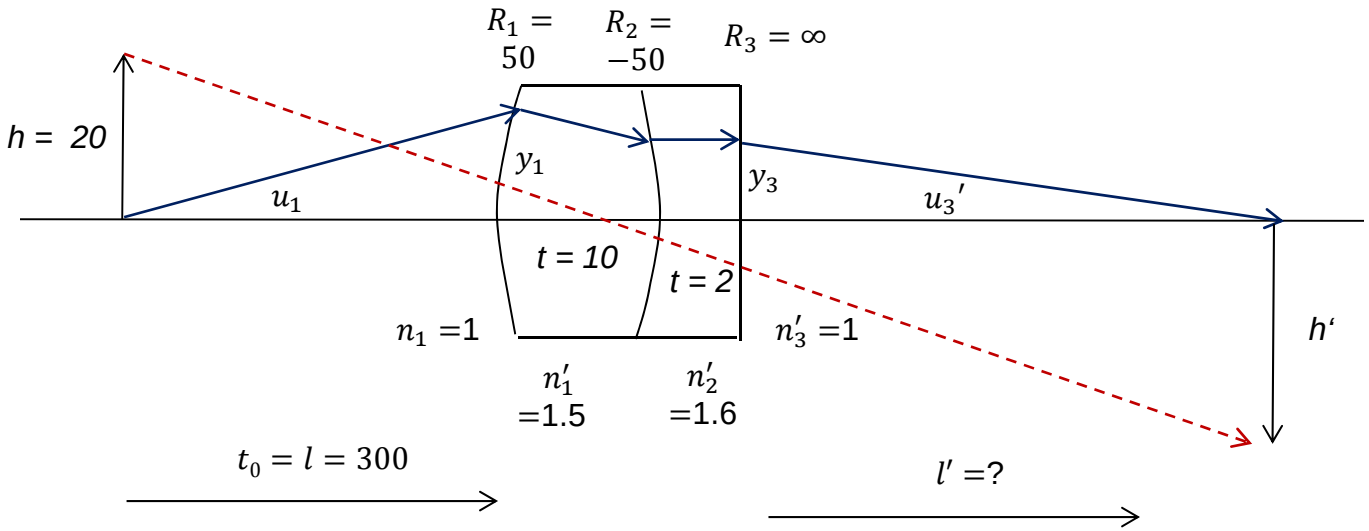
The y-nu ray trace method

The y-nu method uses paraxial ray-trace equations to estimate ray heights and slopes at each surface in an optical system. These calculations can be used to find focal lengths, image location & size, pupil locations & sizes, principal-plane locations, etc.

YNU Ray Trace Sheet

	Surf #1	Surf #2	Surf #3	Surf #4	Surf #5
c					
t					
n					
$-\phi$					
t/n					
Ray #1					
y					
nu					
u					
Ray #2					
y					
nu					
u					
Ray #3					
y					
nu					
u					

Doublet y-nu ray trace example



Curvatures:

$$c_1 = \frac{1}{R_1} = 0.02$$

$$c_2 = \frac{1}{R_2} = -0.02$$

$$c_3 = \frac{1}{R_3} = 0$$

Powers:

$$\varphi_1 = (n_1' - n_1)c_1 = 0.01$$

$$\varphi_2 = (n_2' - n_2)c_2 = -0.002$$

$$\varphi_3 = (n_3' - n_3)c_3 = 0$$

Reduced thicknesses:

$$\tau_1 = \frac{t_1}{n_1'} = 6.6666$$

$$\tau_2 = \frac{t_2}{n_2'} = 1.25$$

$$\tau_3 = \frac{t_3}{n_3'} = l'$$

Start by entering "optical prescription"

	Surf #1	Surf #2	Surf #3	~~Surf #4~~	~~Surf #5~~
c	0.02	- 0.02	0		
t	300	10	2	l'	
n	1	1.5	1.6	1	

~~-~~ϕ	-0.01	0.002	0		
t/n	300	6.666	1.25	l'	

Ray #1

y						
nu						
u						

Ray #2

y						
nu						
u						

Ray #3

y						
nu						
u						

Enter "guess" values to start ray #1

	Surf #1	Surf #2	Surf #3	~~Surf #4~~	Surf #5
c	0.02	- 0.02	0		
t	300	10	2	l'	
n	1	1.5	1.6	1	

$-\phi$	-0.01	0.002	0		
t/n	300	6.666	1.25	l'	

$0 = 9.49611 + (-0.047555)l'$ … $l' = 199.69$

Ray #1 … from object axial point

y	"0"	"10"	9.5556	9.49611	"0"	
nu	0.03333	-0.0666	-0.04755	-0.047555		
u	0.03333	-0.0444	-0.02972	-0.047555		

Ray #2

y						
nu						
u						

Ray #3

y						
nu						
u						

Enter "guess" values to start ray #2

	Surf #1	Surf #2	Surf #3	~~Surf #4~~	Surf #5
c	0.02	- 0.02	0		
t	300	10	2	l'	
n	1	1.5	1.6	1	
$-\phi$	-0.01	0.002	0		
t/n	300	6.666	1.25	199.69	

Ray #1 … from object axial point

y	"0"	"10"	9.5556	9.49611	"0"	
nu	0.03333	-0.0666	-0.04755	-0.047555		
u	0.03333	-0.0444	-0.02972	-0.047555		

Ray #2 … from top of object

y	20	"0"	-0.4444	-0.52554	*h*'=14.015	
nu	-0.0666	-0.0666	-0.06755	-0.06755		
u						

Ray #3

y						
nu						
u						