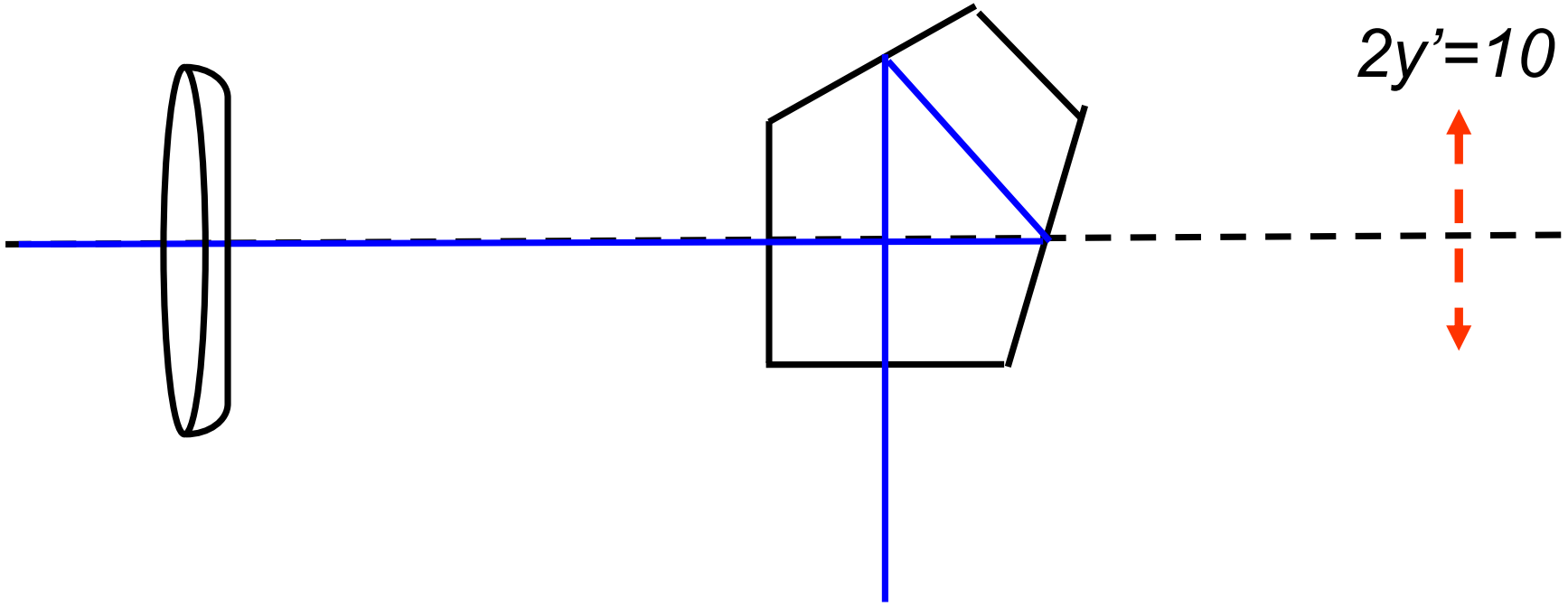
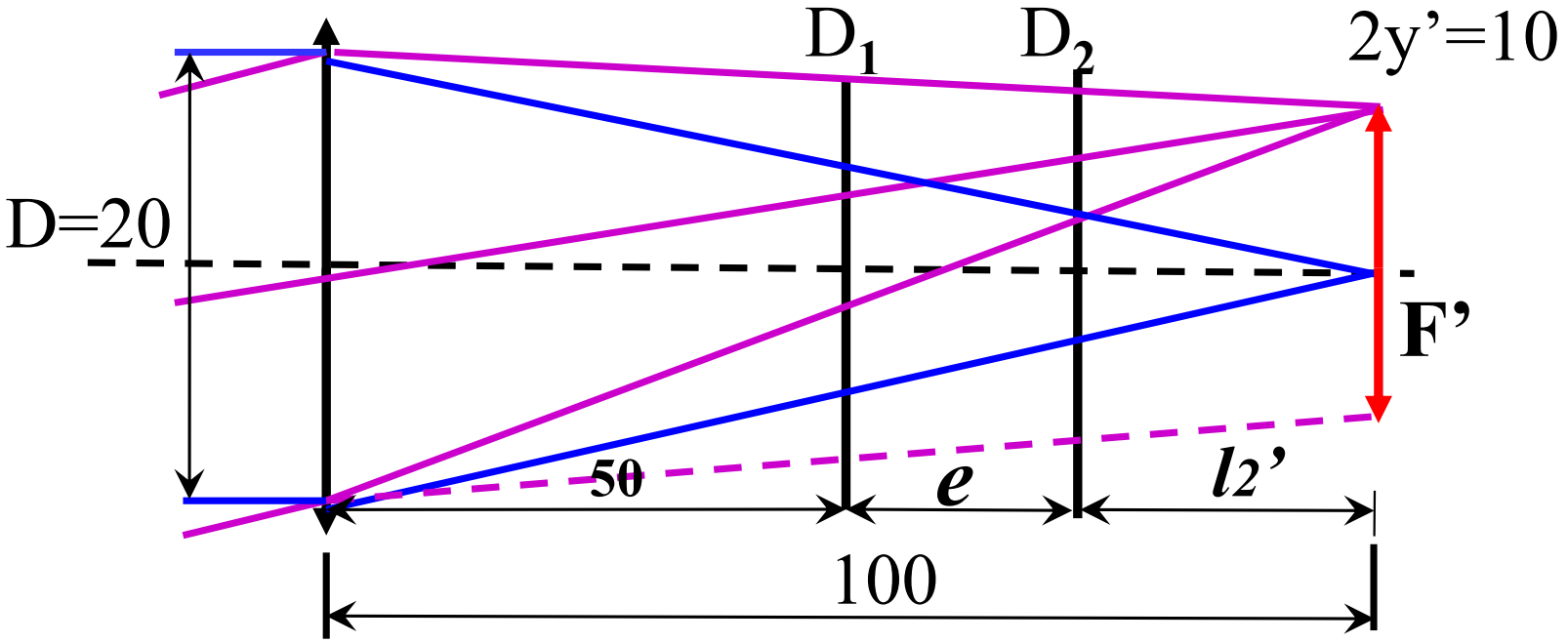
第8讲　棱镜外形尺寸计算

◆ 一个薄透镜组f’=100，口径D=20，对无限远目标成像，像高2y’=10，在距透镜组50处加入一个五角棱镜，使光轴偏转90度，求棱镜尺寸和像面位置。（n=1.5163）



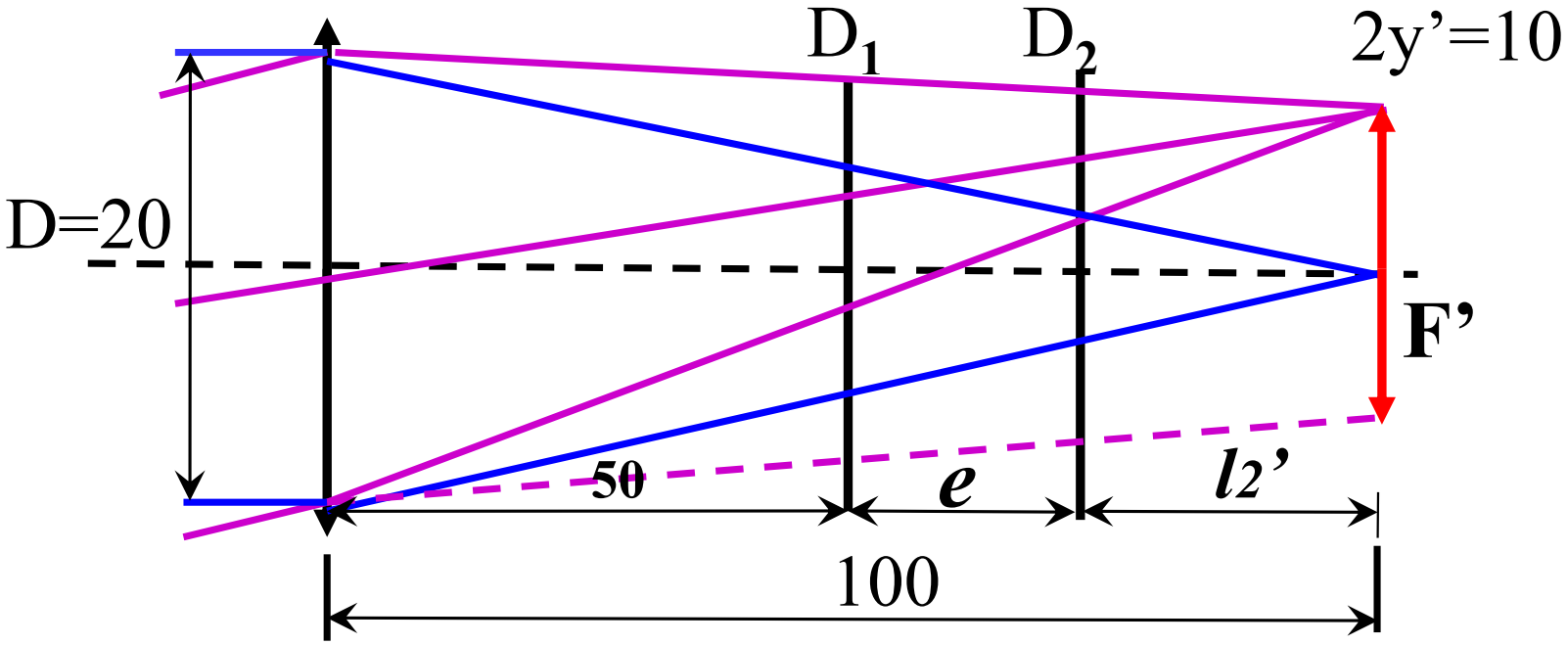
第一步：作出对应的等效光路图

棱镜——平行平板——相当空气层



第二步：求棱镜第一面通光口径D1

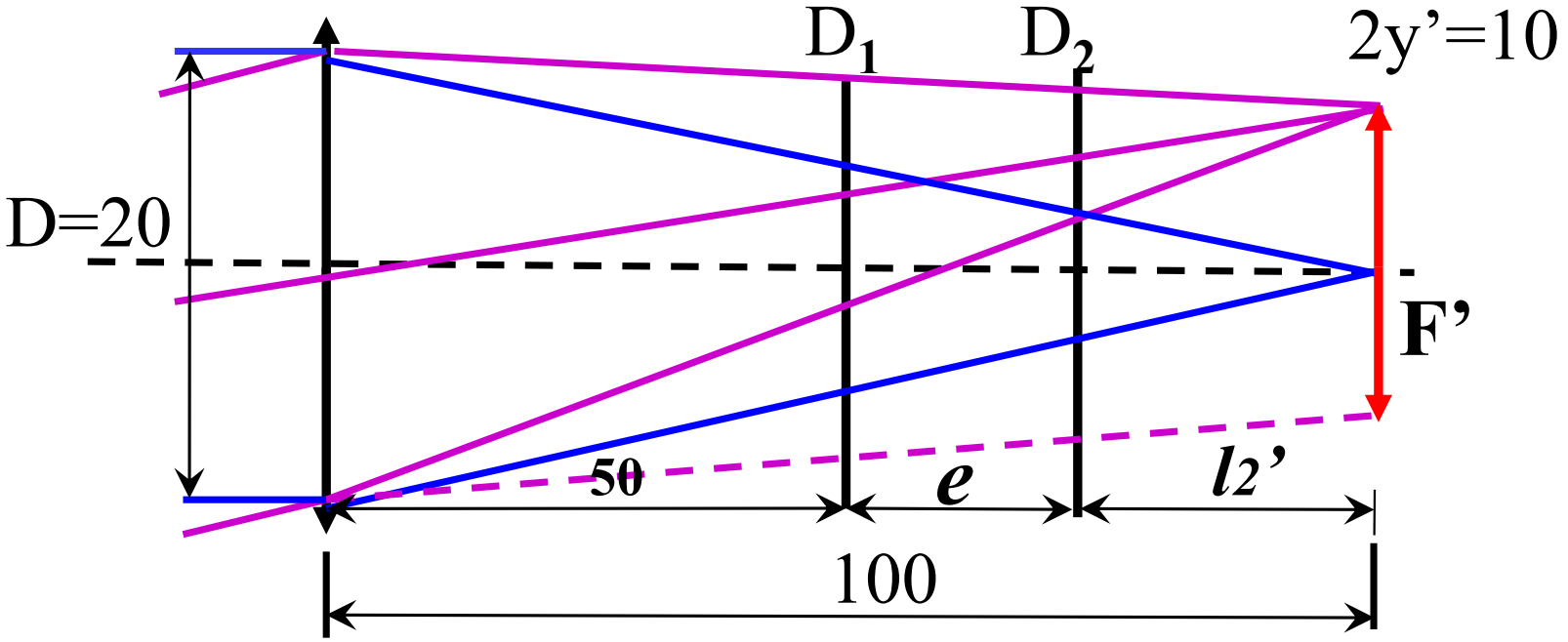
D_1=（20+10）/2=15



第三步：求玻璃板厚度和等效空气层厚度

$$L = (2+\sqrt{2})D_1 = 3.414D_1 = 51.21$$

$$e = L/n = 33.8$$

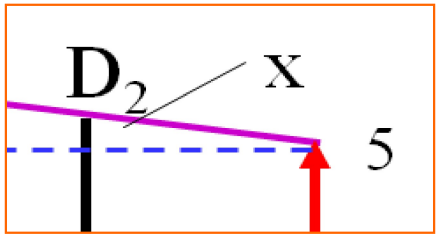


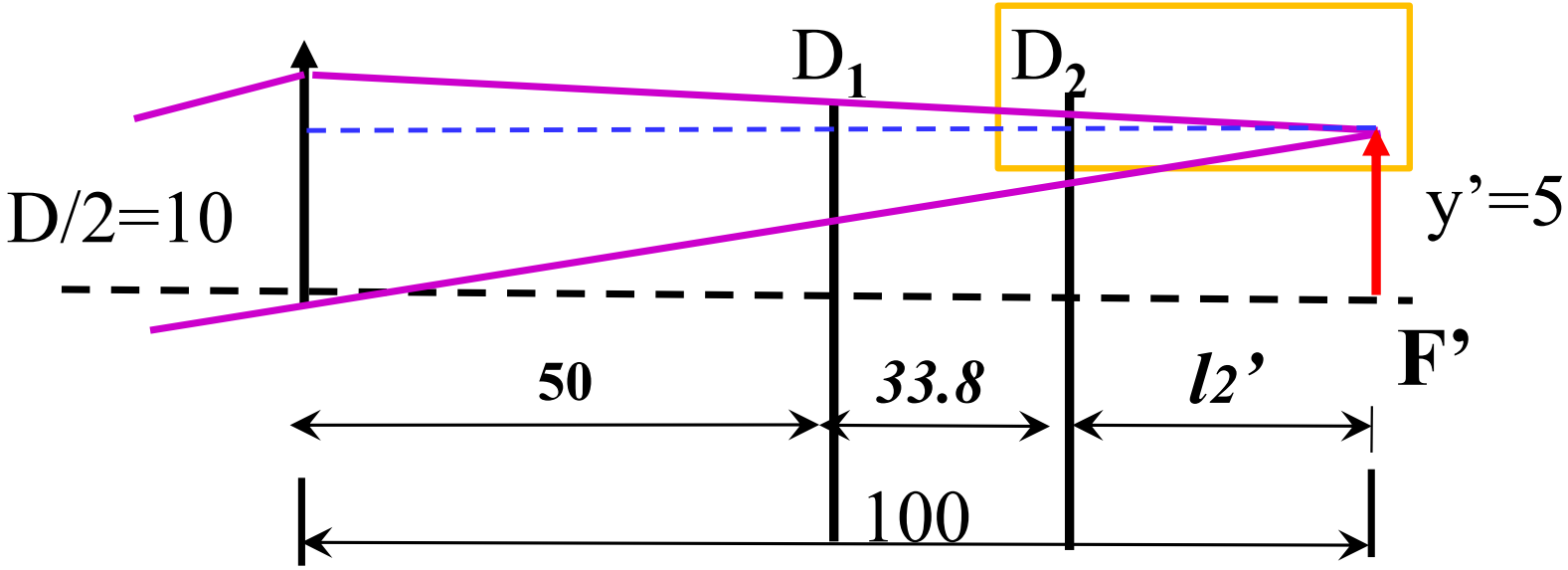
第四步：求棱镜第二面通光口径D2

$$\frac{10-5}{x}=\frac{100}{50-33.8}=\frac{100}{16.2}$$

$$x=0.81$$

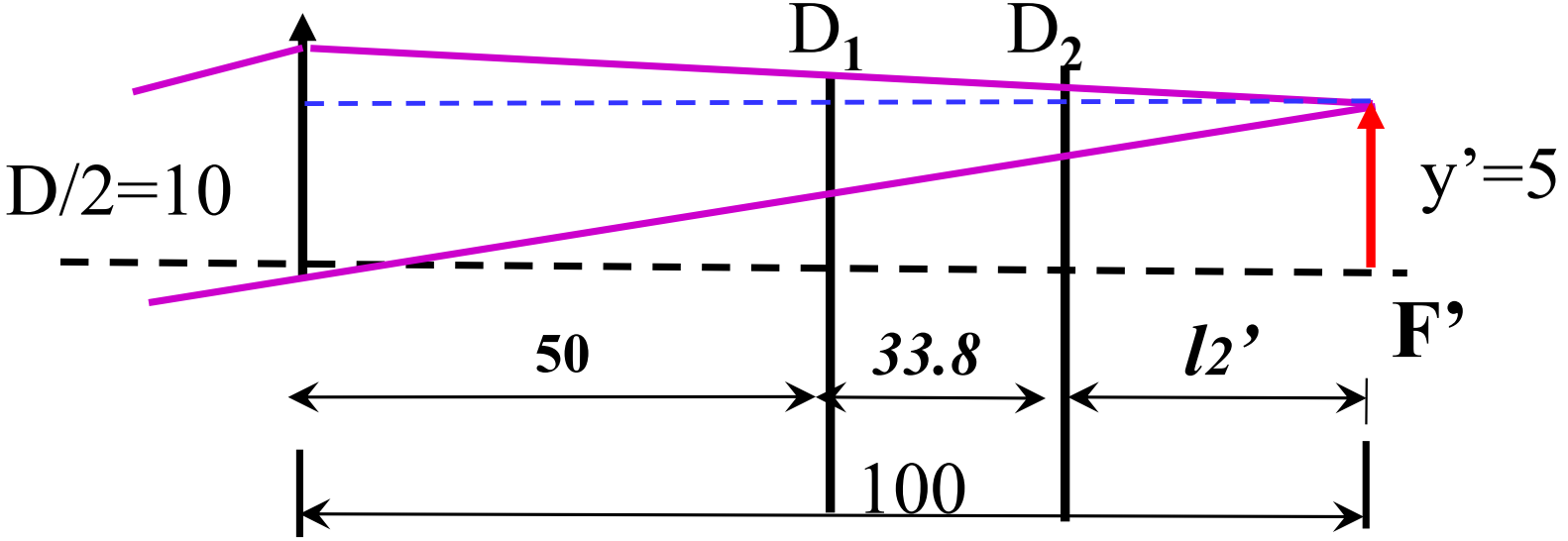
$$\therefore D_2=10+2x=11.62$$



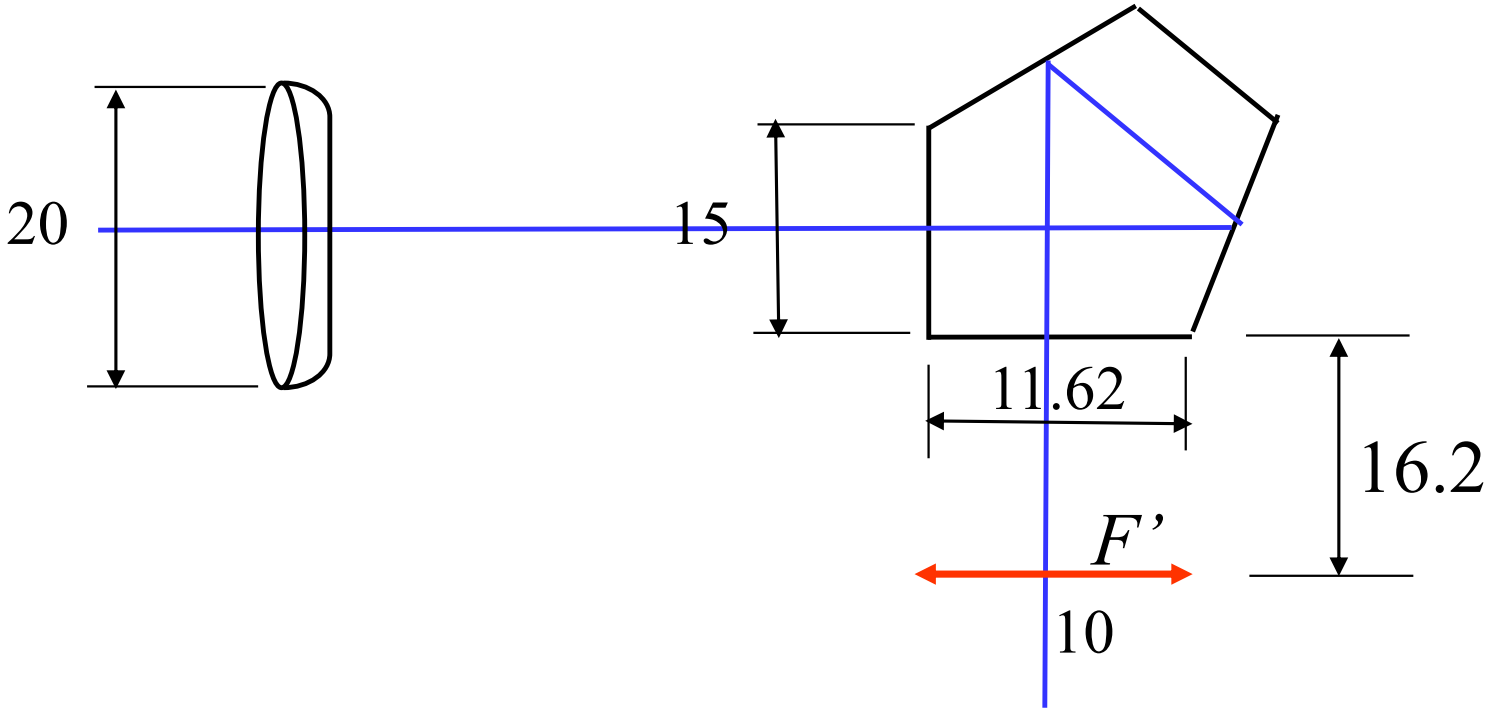


第五步：求像面位置

$$l_2' = 50 - 33.8 = 16.2$$



实际成像情况

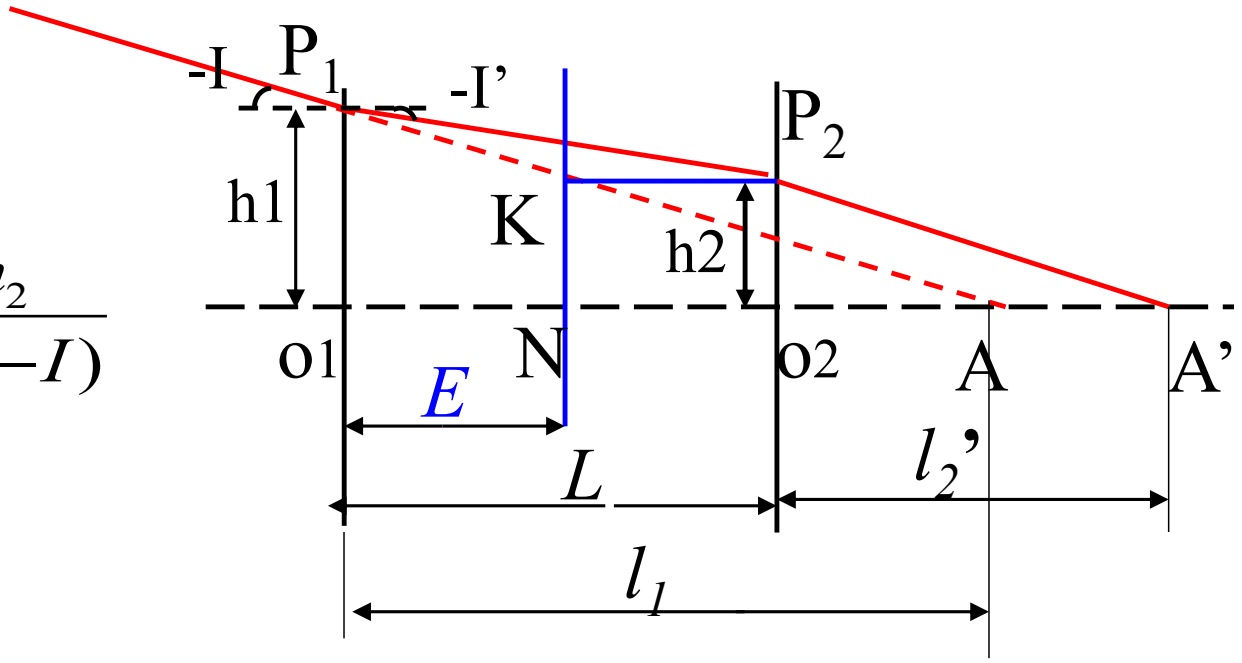


◆ 大入射角度时的相当空气层厚度E

$$E = O_1A - NA$$

$$O_1A = \frac{h_1}{tg(-I)} \qquad NA = \frac{h_2}{tg(-I)}$$

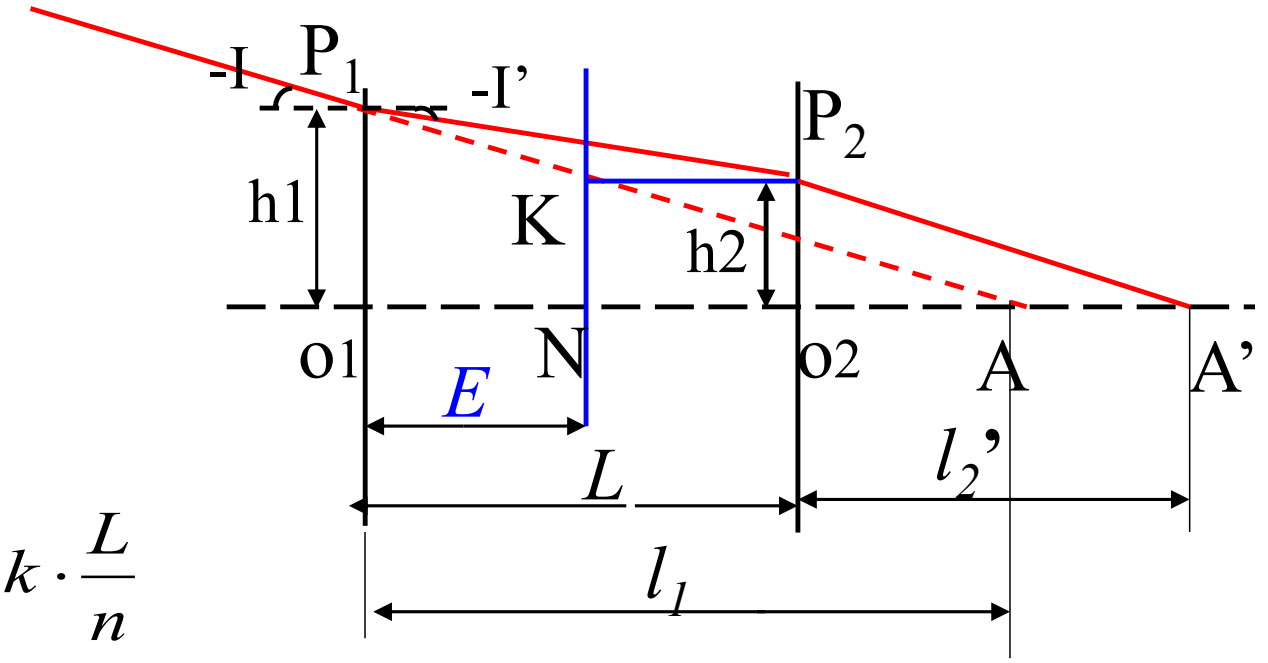
$$E = \frac{(h_1 - h_2)}{tg(-I)} = \frac{Ltg(-I')}{tg(-I)}$$



$$E = \frac{(h_1 - h_2)}{tg(-I)} = \frac{Ltg(-I')}{tg(-I)}$$

$$= L\frac{tgI'}{tgI} = L\frac{\dfrac{\sin I'}{\cos I'}}{\dfrac{\sin I}{\cos I}}$$

$$= L\frac{\sin I'}{\sin I}\cdot\frac{\cos I}{\cos I'} = \frac{L}{n}\cdot\frac{\cos I}{\cos I'} = k\cdot\frac{L}{n}$$



大入射角度时的相当空气层厚度E

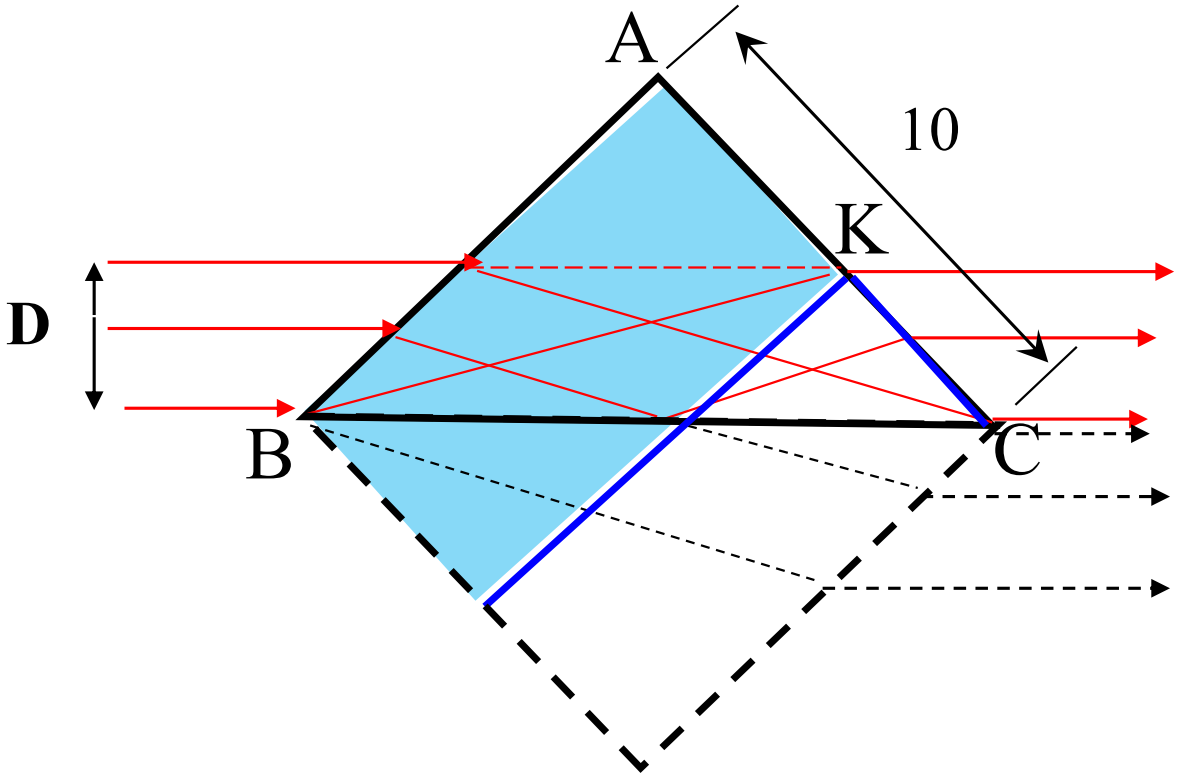
$$E = k \cdot \frac{L}{n}$$

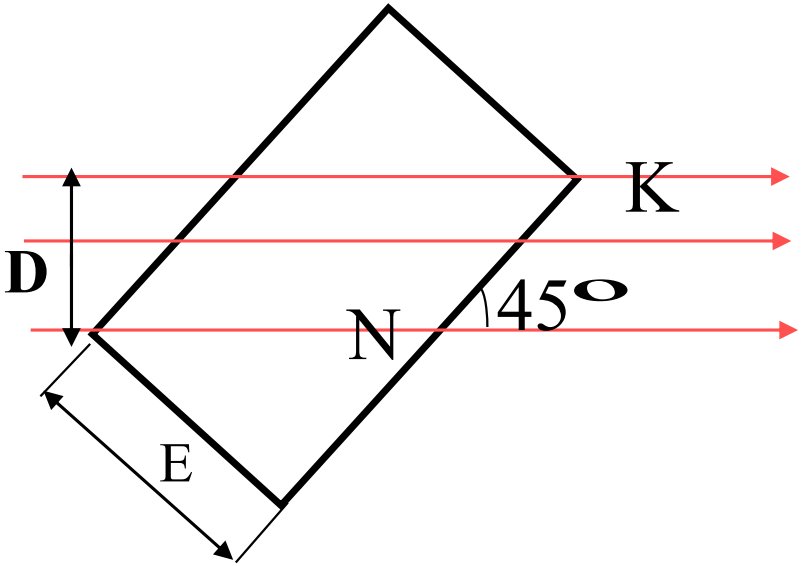
$$k = \frac{\cos I}{\cos I'}$$

I vs k(n=1.5163)

I	10°	20°	30°	40°	50°	60°
k	0.99	0.97	0.92	0.85	0.75	0.61

例：直角棱镜口径为10，在入射和出射光轴平行的情况下，求光束通光口径。





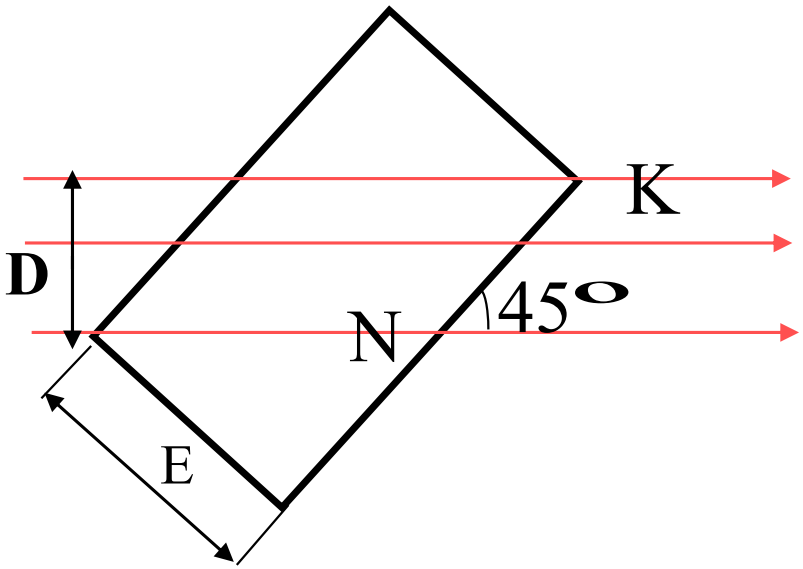
棱镜展开后平行玻璃板厚度：

$$L = 10$$

相当空气层厚度：

$$\mathrm{E} = k\frac{L}{n}, \because k = 0.8, n = 1.5163$$

$$E = 5.28$$



由图示关系，

$$D = KN \cdot \sin 45^\circ$$

$$= (10 - 5.28) \cdot \sin 45^\circ = 3.34$$