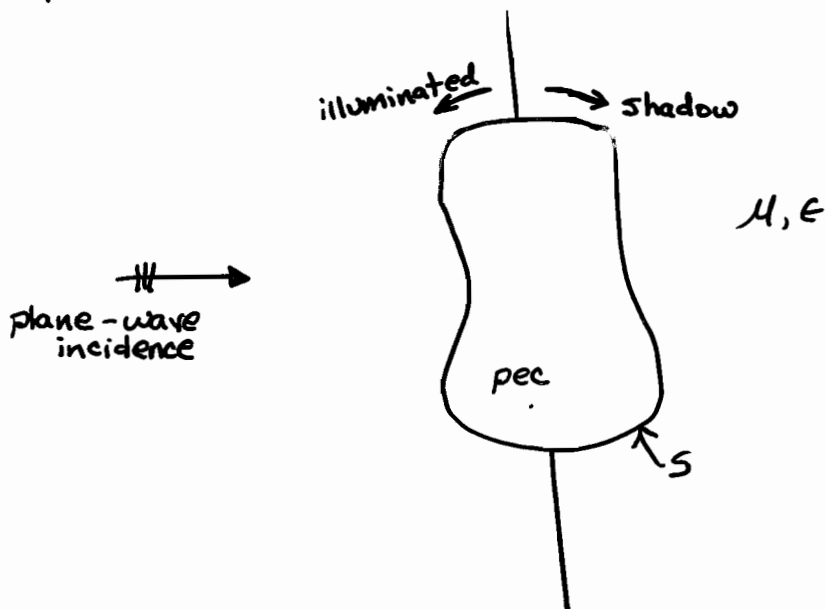
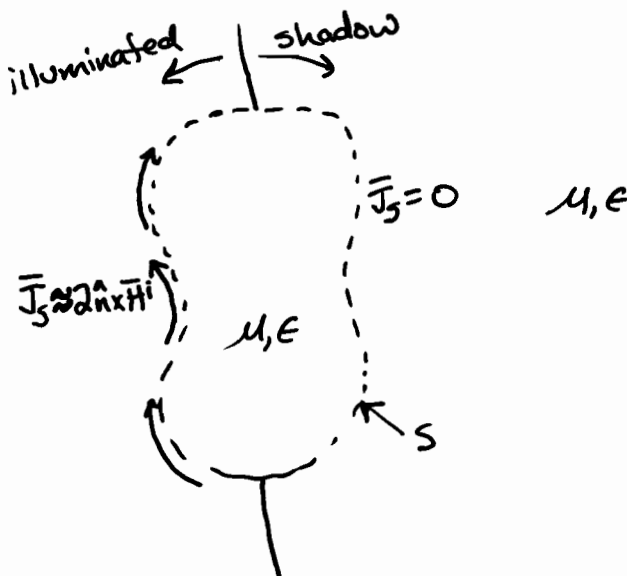


For large, smooth pec scatterers it is possible to obtain a rough measure of the scattering with surprisingly little computational effort. This technique is referred to as the Physical Optics (PO) approximation.

Consider a pec scatterer illuminated as shown  $\rightarrow$



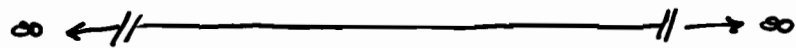
The PO approximation assumes that a known surface current density resides on the equivalent surface as shown, while  $\vec{J}_s = 0$  on the shadow side.



It is important to notice that  $\bar{J}_s = 2 \hat{n} \times \bar{H}^i$  which is known. Therefore, the scattered fields can be found from a source/field relationship.

This approximation can be partially justified by considering each elemental segment of the pcc scatterer as an infinite pcc plane!

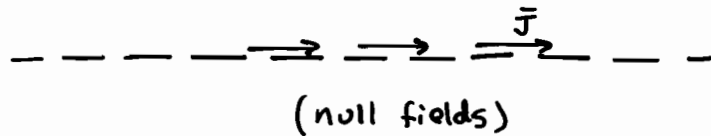
In that case -



can be replaced with the equivalent problem -



equivalent fields



where  $\bar{J} = 2 \hat{n} \times \bar{H}^i$  (from image theory)

Representative monostatic RCS curves are shown in the following 2 slides. Notice that the monostatic pattern is polarization independent!

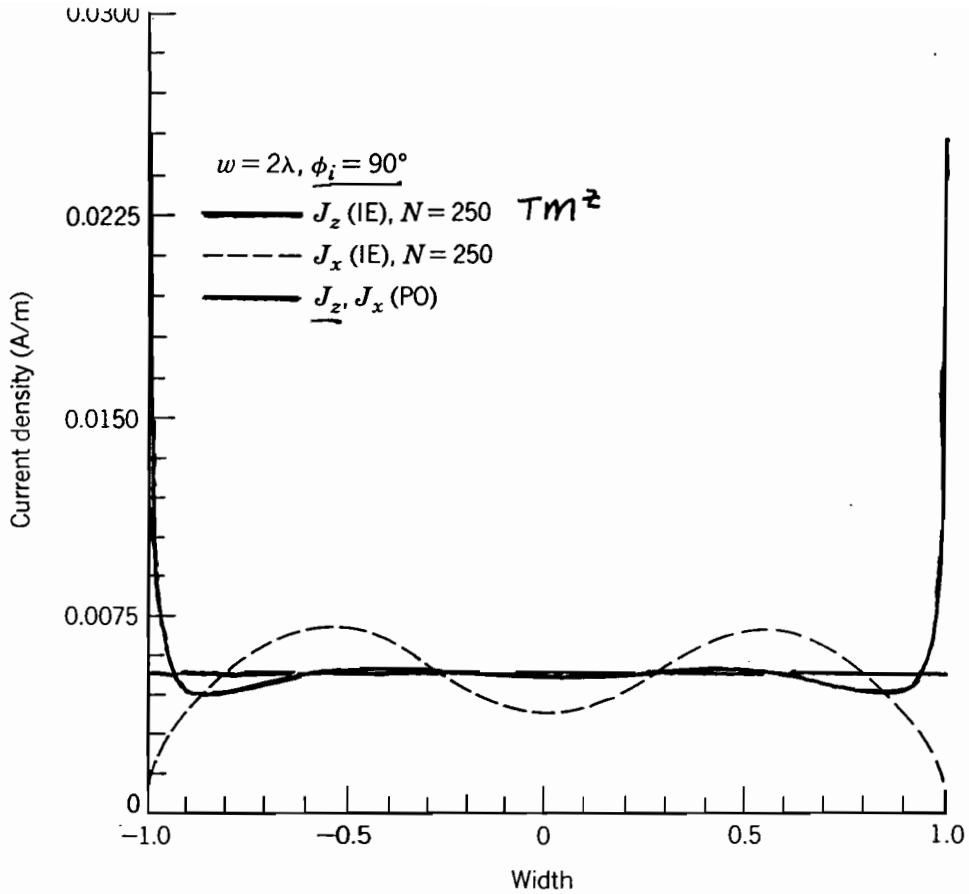


FIGURE 12-15 Current density induced on a finite width strip by a plane wave at normal incidence.

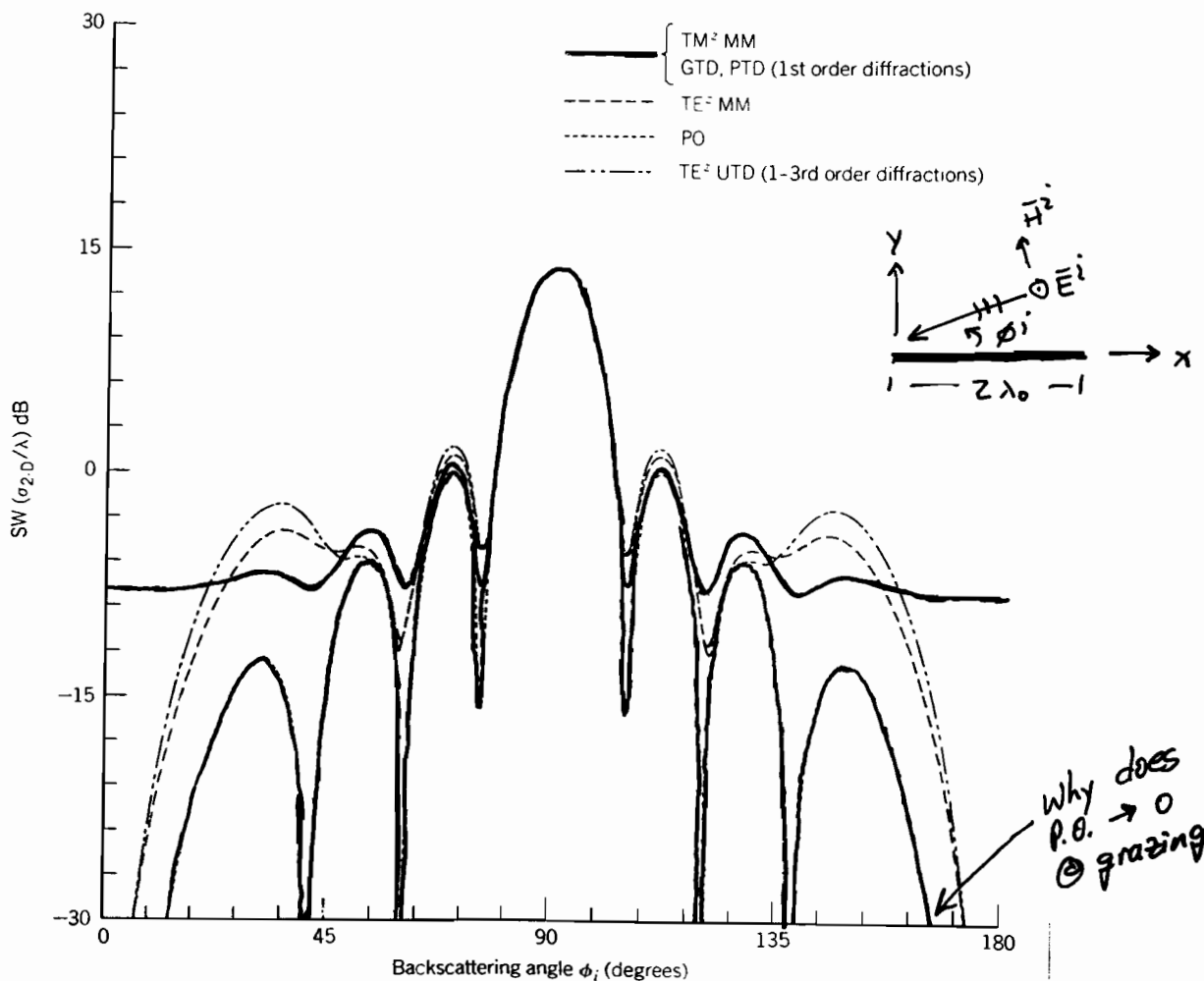


FIGURE 12-16 Monostatic scattering width of a finite width strip ( $w = 2\lambda$ ).

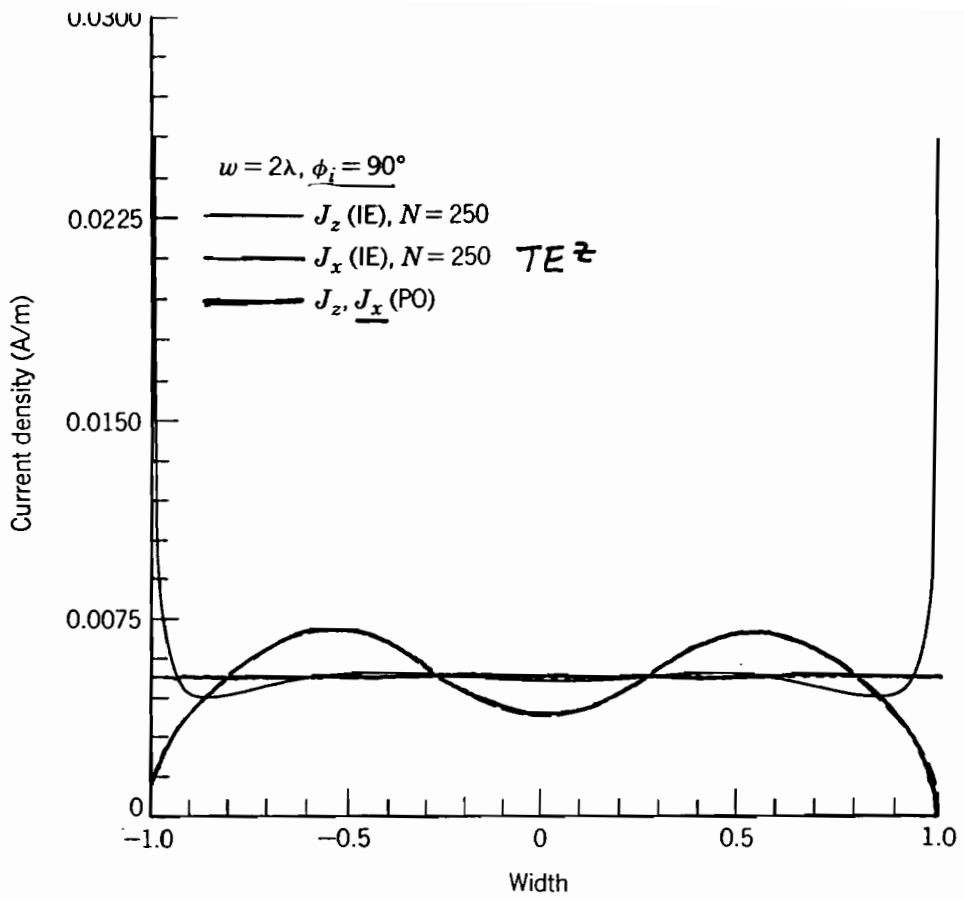


FIGURE 12-15 Current density induced on a finite width strip by a plane wave at normal incidence.

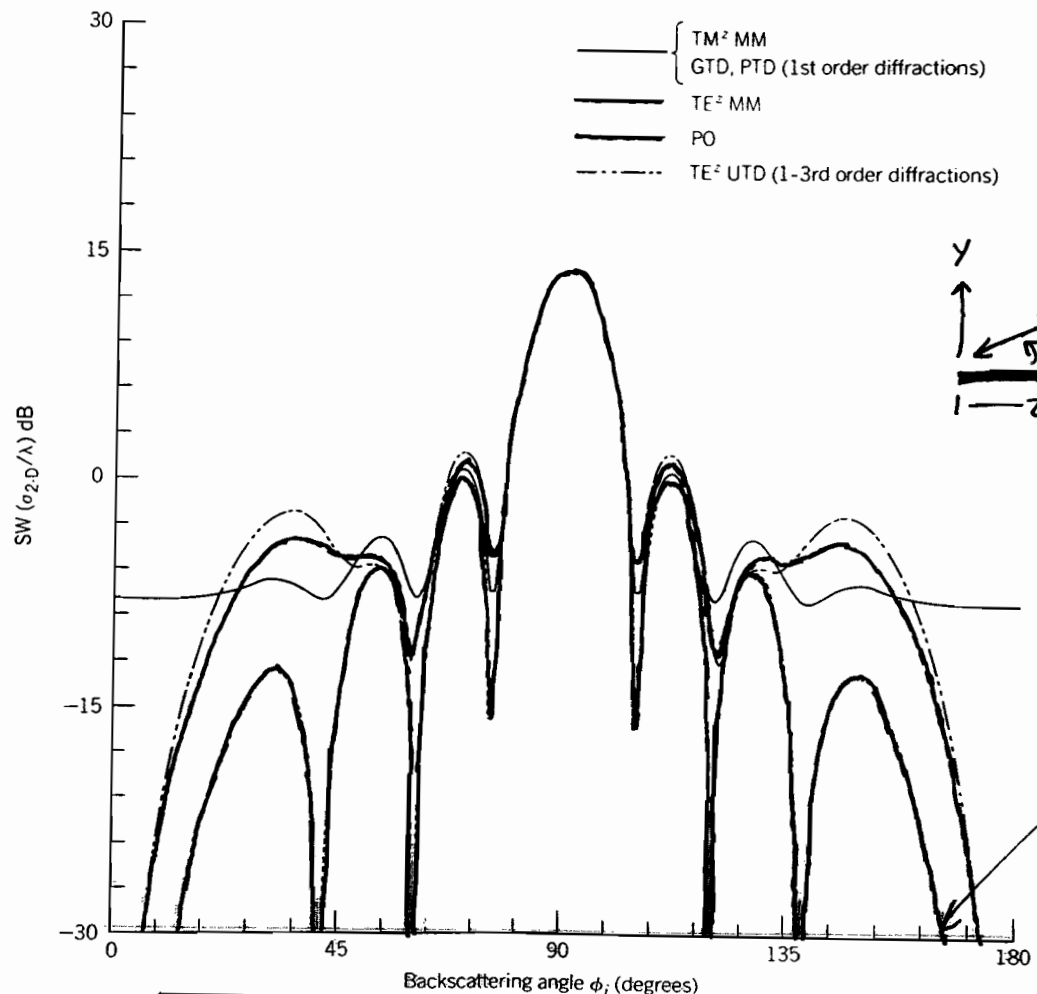
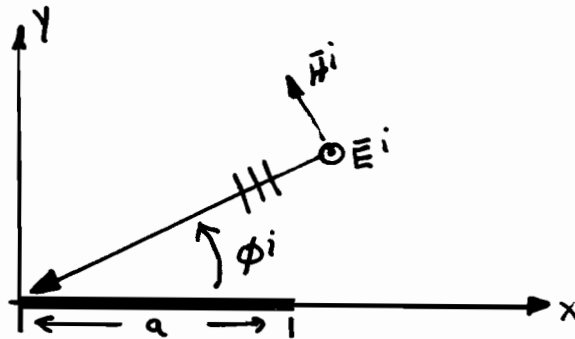


FIGURE 12-16 Monostatic scattering width of a finite width strip ( $w = 2\lambda$ ).

Additional current and bistatic RCS curves are shown on the following slides for TM<sup>z</sup> incidence on a PEC strip as -



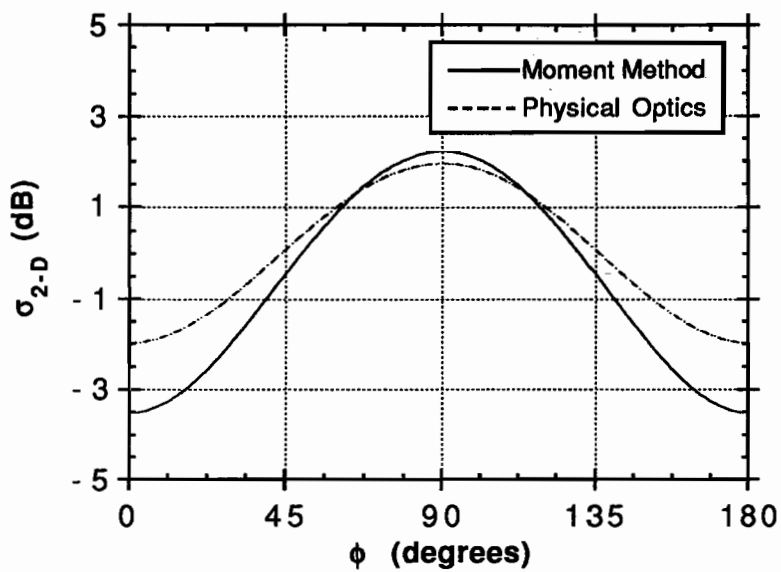
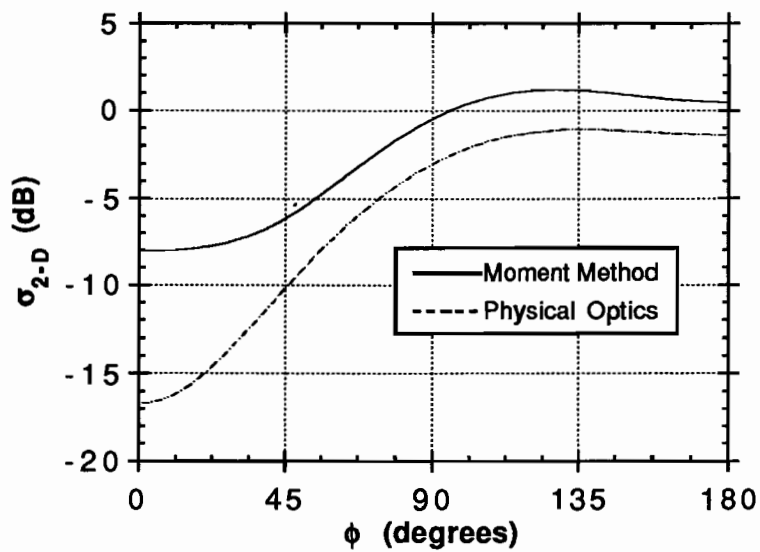
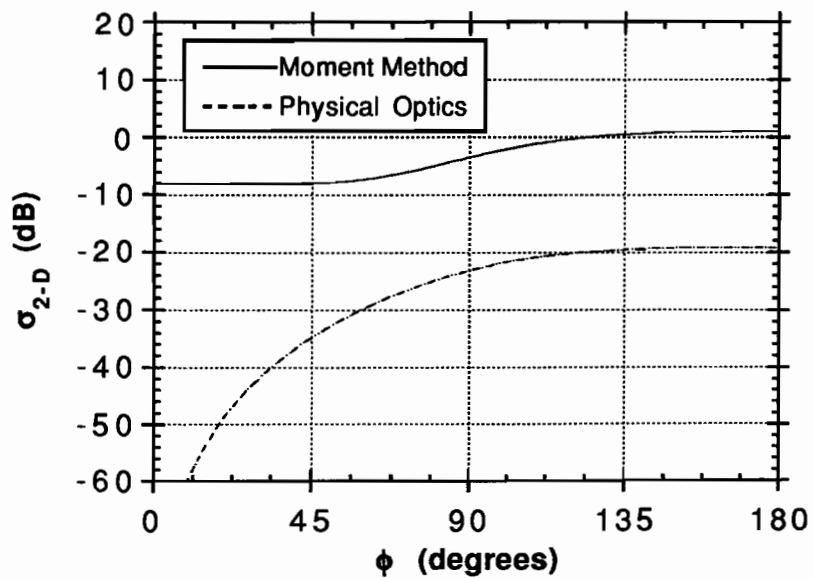
The PO current is thus  $\bar{J}^{PO} = \hat{z} \frac{2 \sin \phi^i}{\eta} e^{jk_x^i x}$

The far scattered fields produced by this current supported only on the strip (remember PO neglects edge effects) is the Fourier transform given as

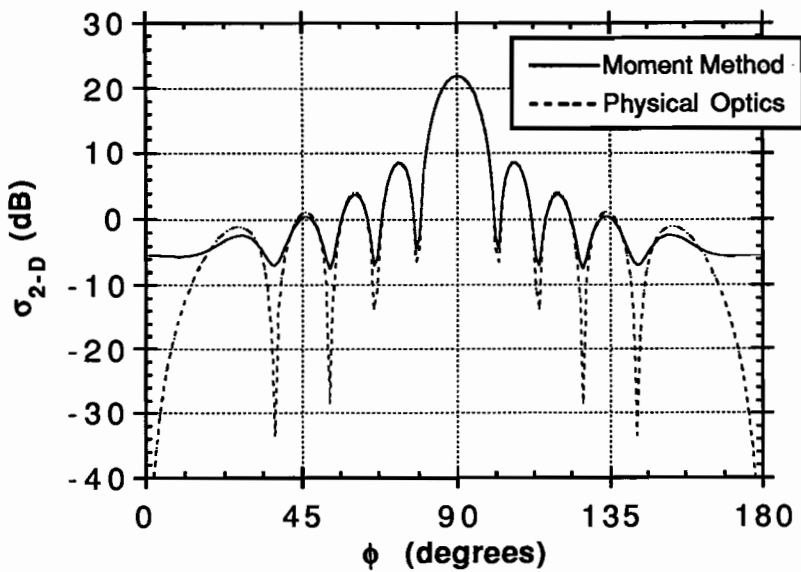
$$E_{\phi}^{PO} = -jk\eta \hat{\phi} \cdot \bar{A} \sim -\frac{k \sin \phi^i}{2} \sqrt{\frac{jz}{\pi k \rho}} e^{-jk\rho} \int_0^a e^{j(k_x^i + k_x)x} dx$$

The echo width therefore is

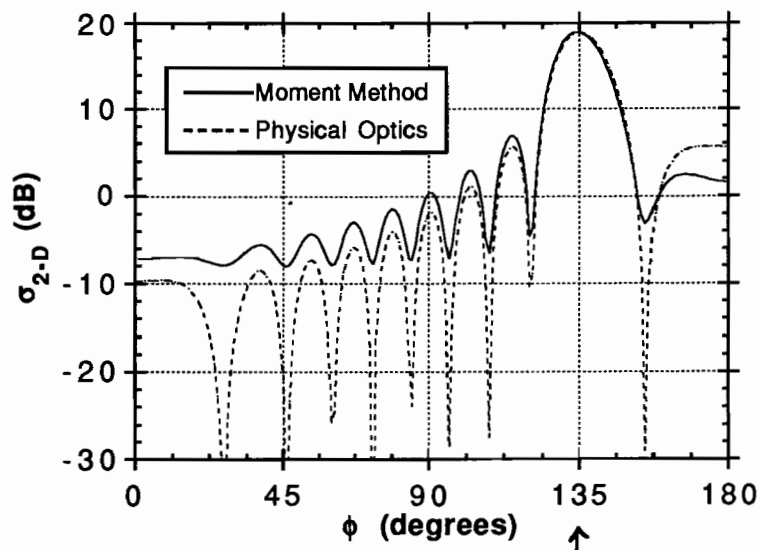
$$\sigma_{2-D}^{PO} = \lim_{\rho \rightarrow \infty} \left\{ \frac{2\pi\rho |\bar{E}^s|^2}{|\bar{E}^i|^2} \right\} = ka^2 \sin^2 \phi^i \operatorname{sinc}^2 \left( \frac{k_x^i + k_x}{2} a \right)$$

pec strip,  $\phi^i = 90^\circ$ , width =  $0.5 \lambda$ pec strip,  $\phi^i = 45^\circ$ , width =  $0.5 \lambda$ pec strip,  $\phi^i = 5^\circ$ , width =  $0.5 \lambda$ 

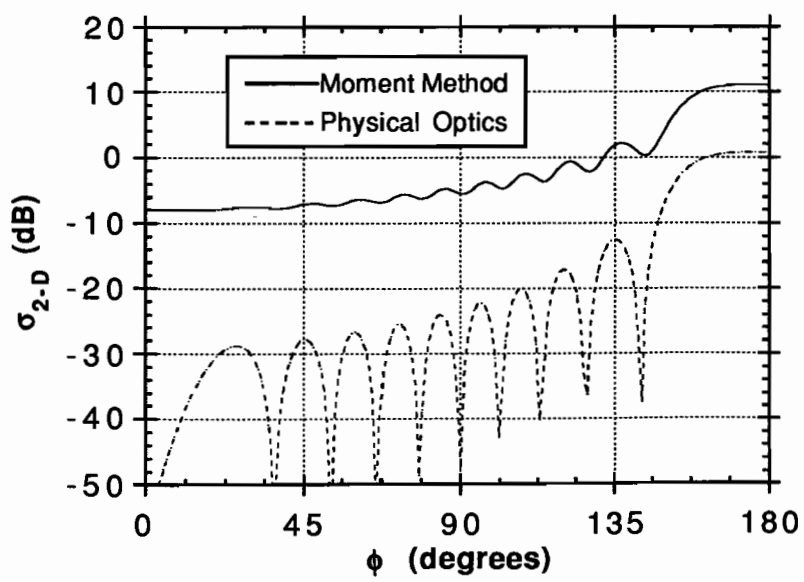
pec strip,  $\phi^i = 90^\circ$ , width =  $5\lambda$



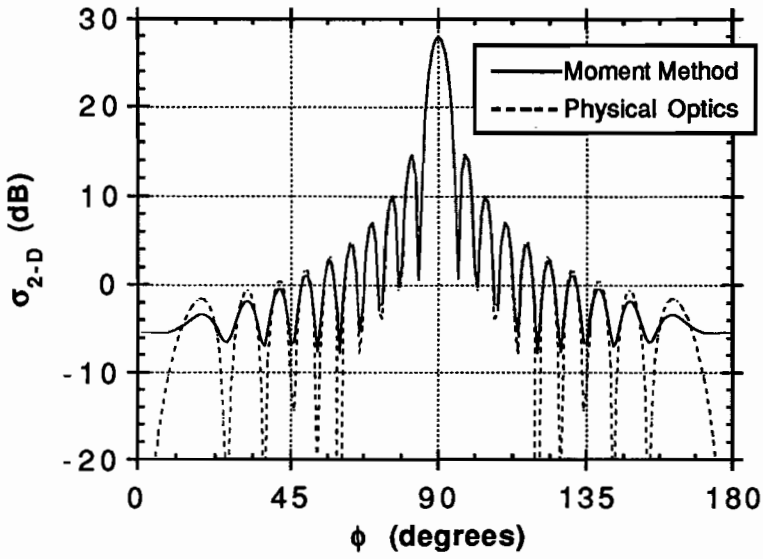
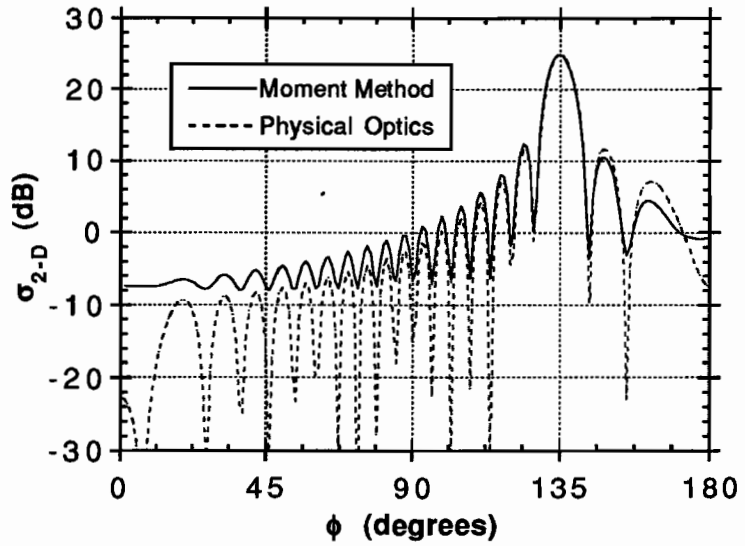
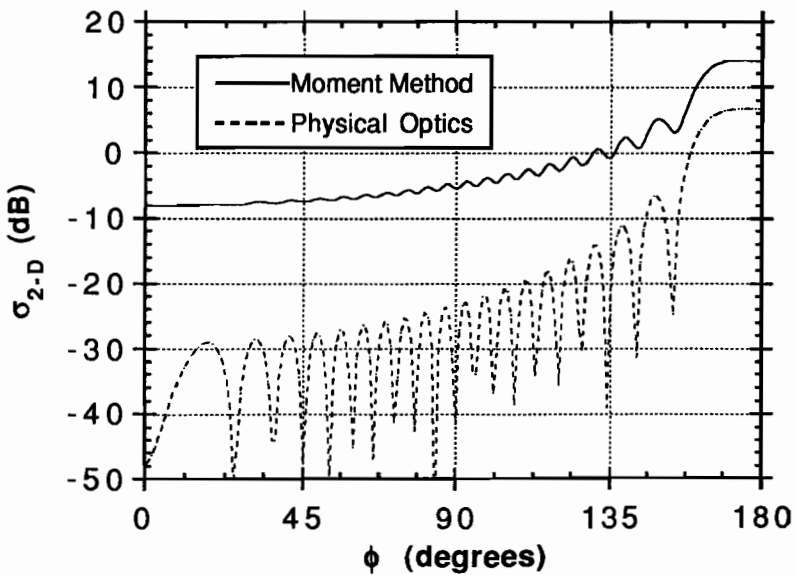
pec strip,  $\phi^i = 45^\circ$ , width =  $5\lambda$



pec strip,  $\phi^i = 5^\circ$ , width =  $5\lambda$



↑ specular

pec strip,  $\phi^i = 90^\circ$ , width =  $10\lambda$ pec strip,  $\phi^i = 45^\circ$ , width =  $10\lambda$ pec strip,  $\phi^i = 5^\circ$ , width =  $10\lambda$ 



pec strip,  $\phi^i = 90^\circ$ , width =  $10 \lambda$

