



# **Range Profile Synthesis**

**SAMPL Group Meeting  
10 October 2000**

**By Gerald Dalley**





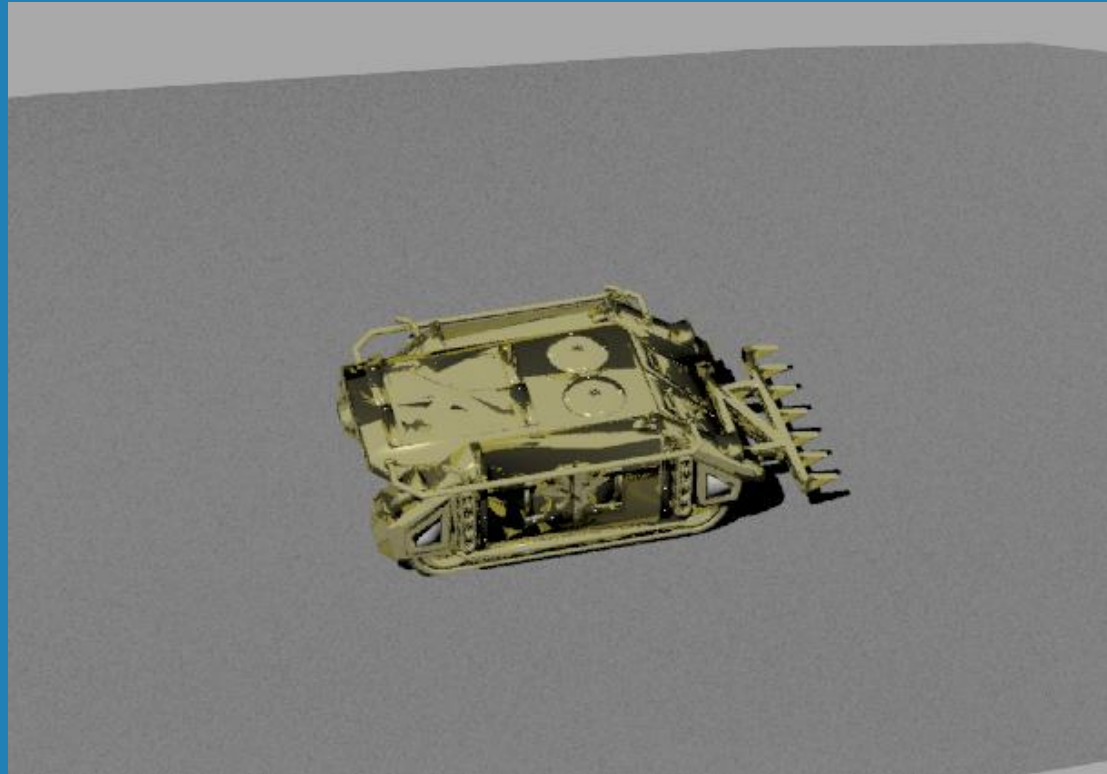
# Overview

---

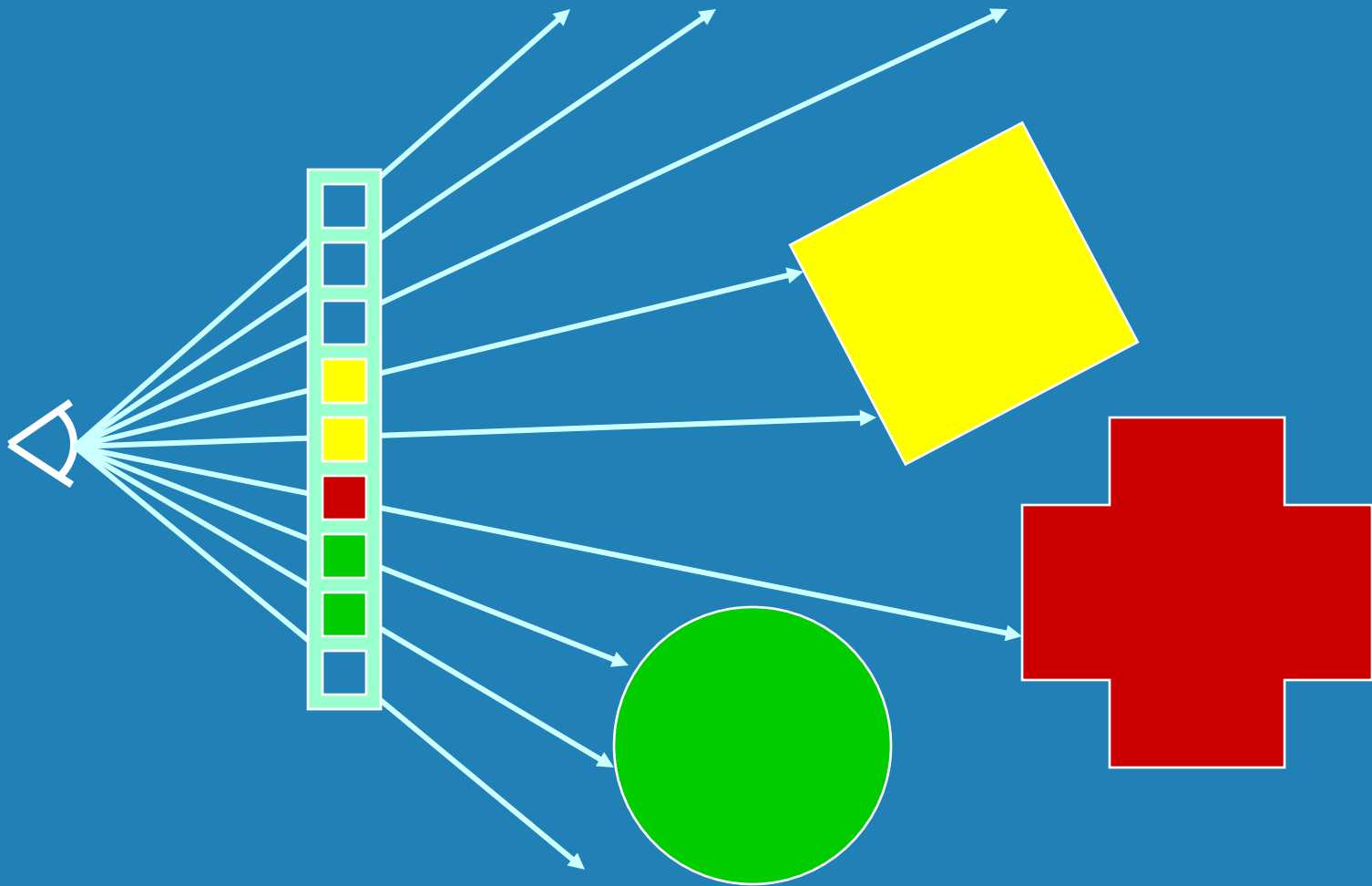
- **Project Goal**
- **Ray Tracing**
- **Range Profiles and Range Images**
- **Lighting Models**
- **POV-Range**

# Project Goal

## ☉ “Tanks Under Trees”

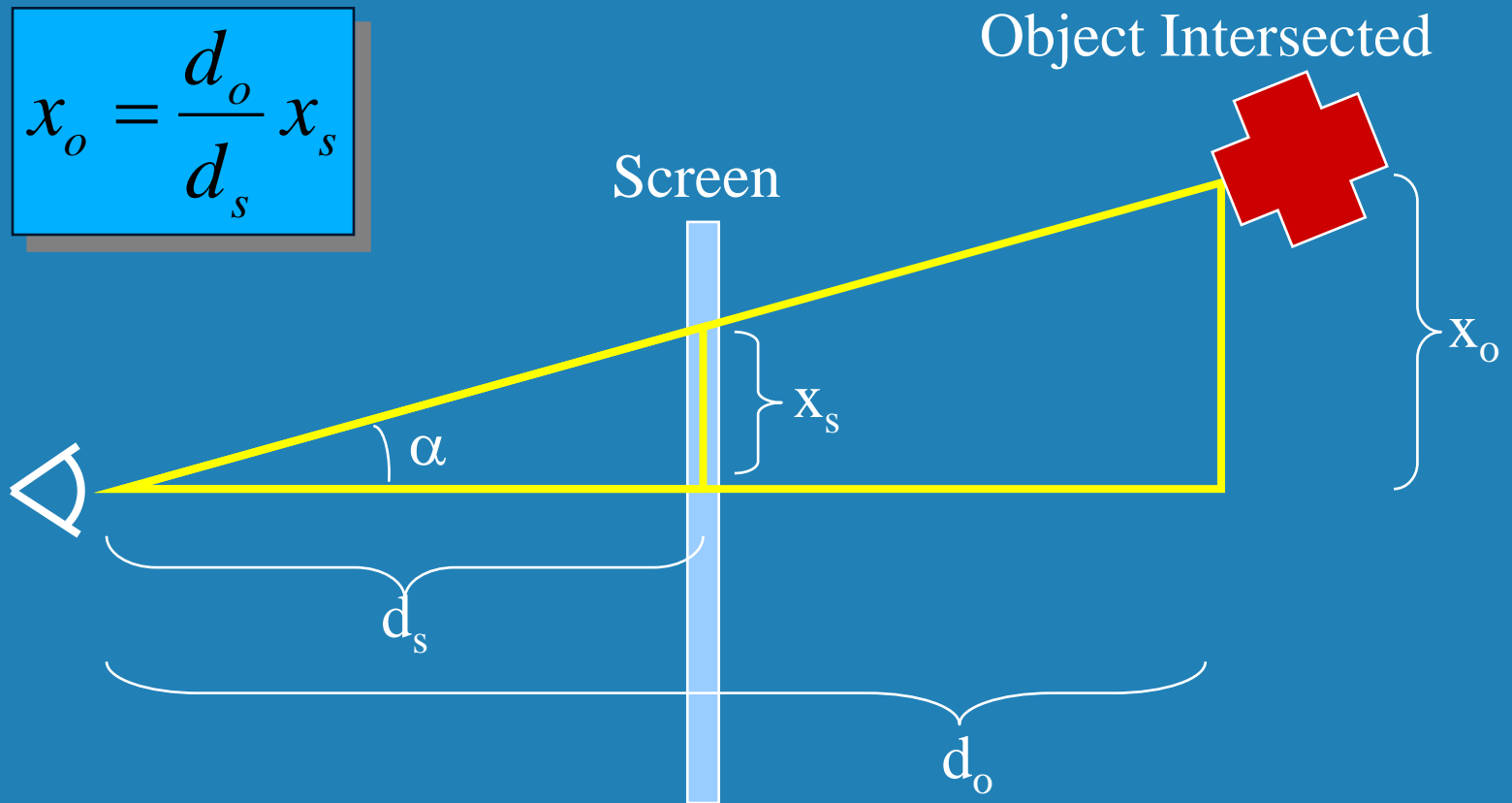


# Ray Tracing -- 2D

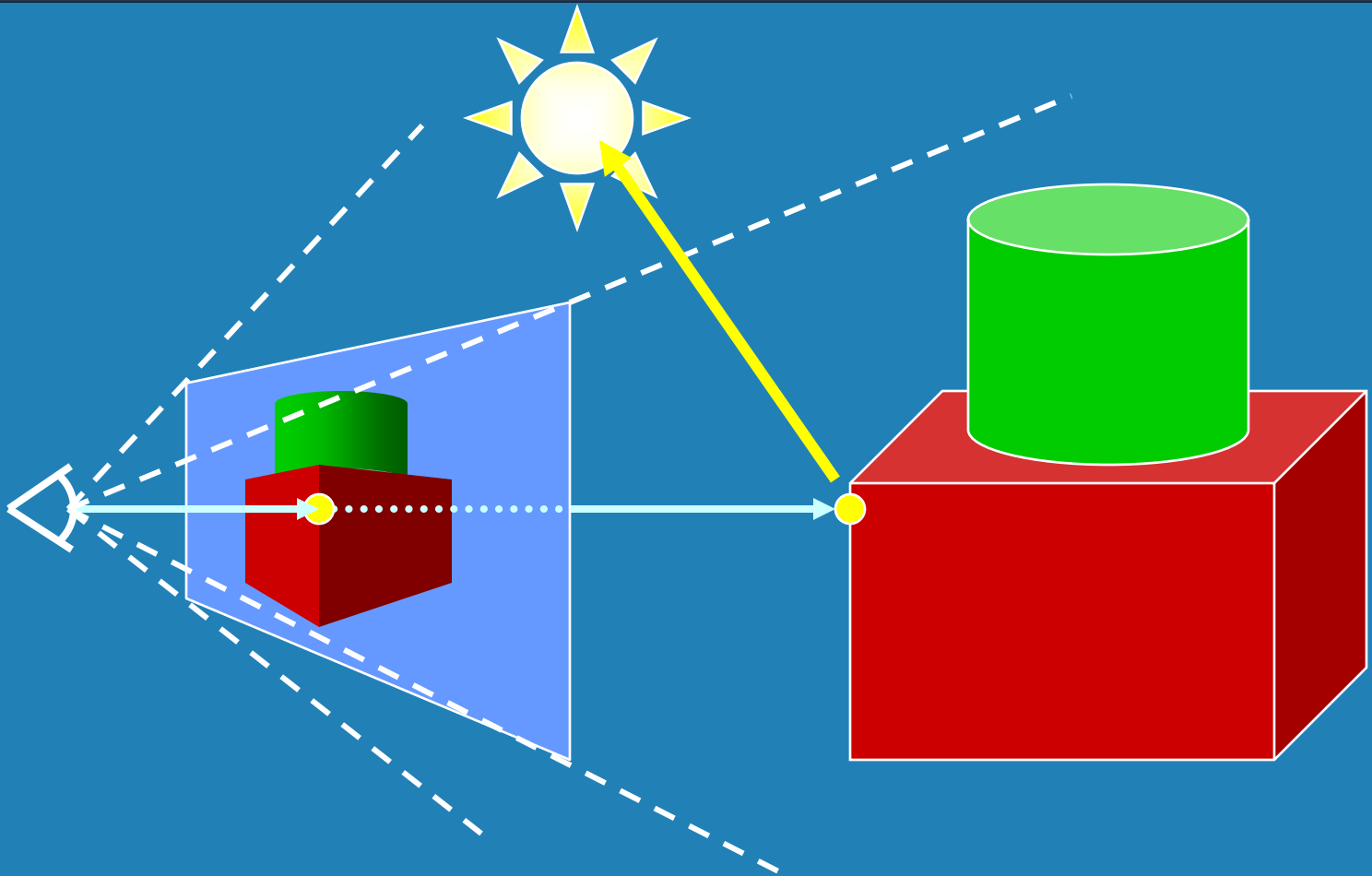


# Ray Tracing -- Math in 2D

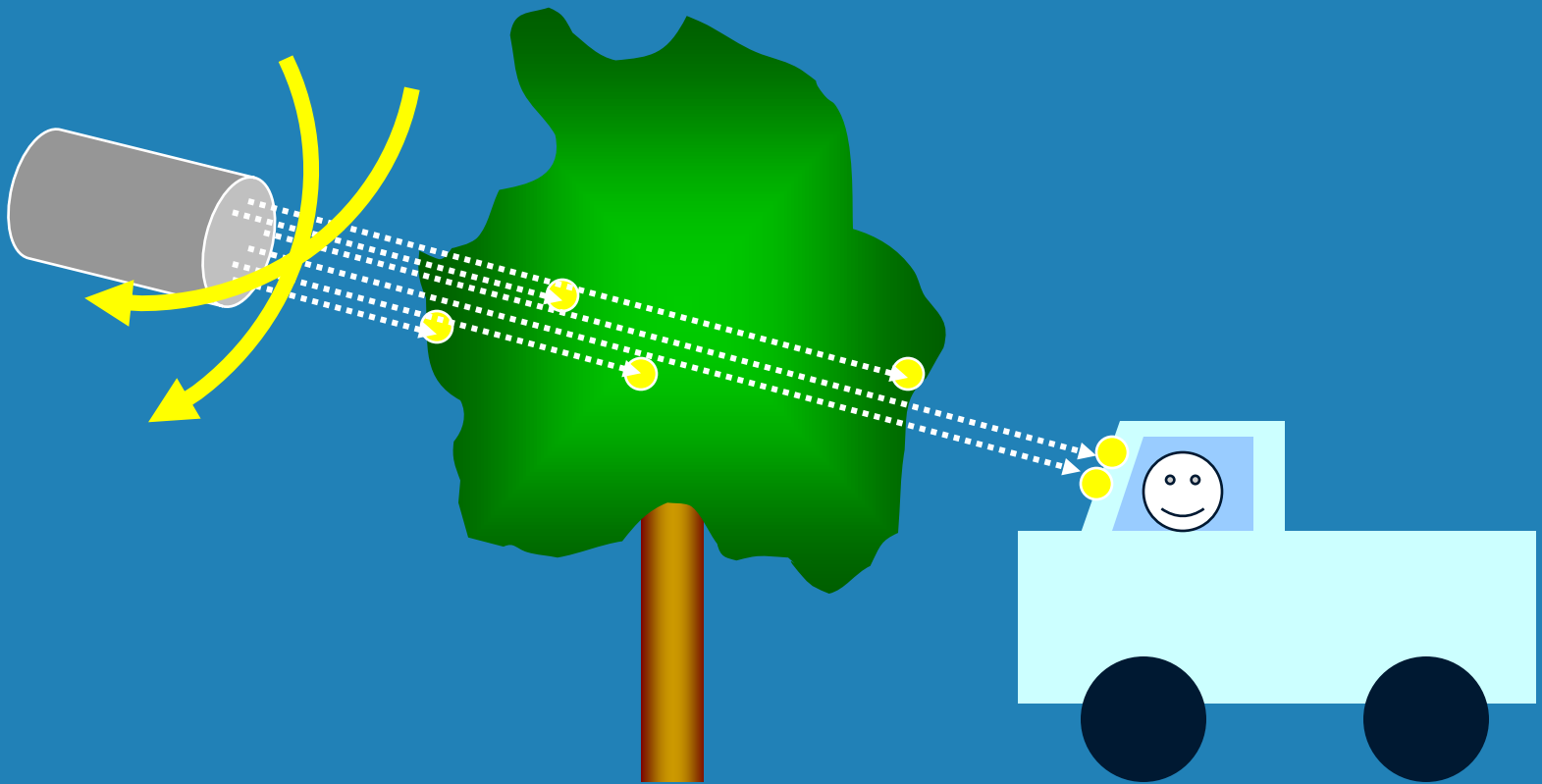
$$x_o = \frac{d_o}{d_s} x_s$$



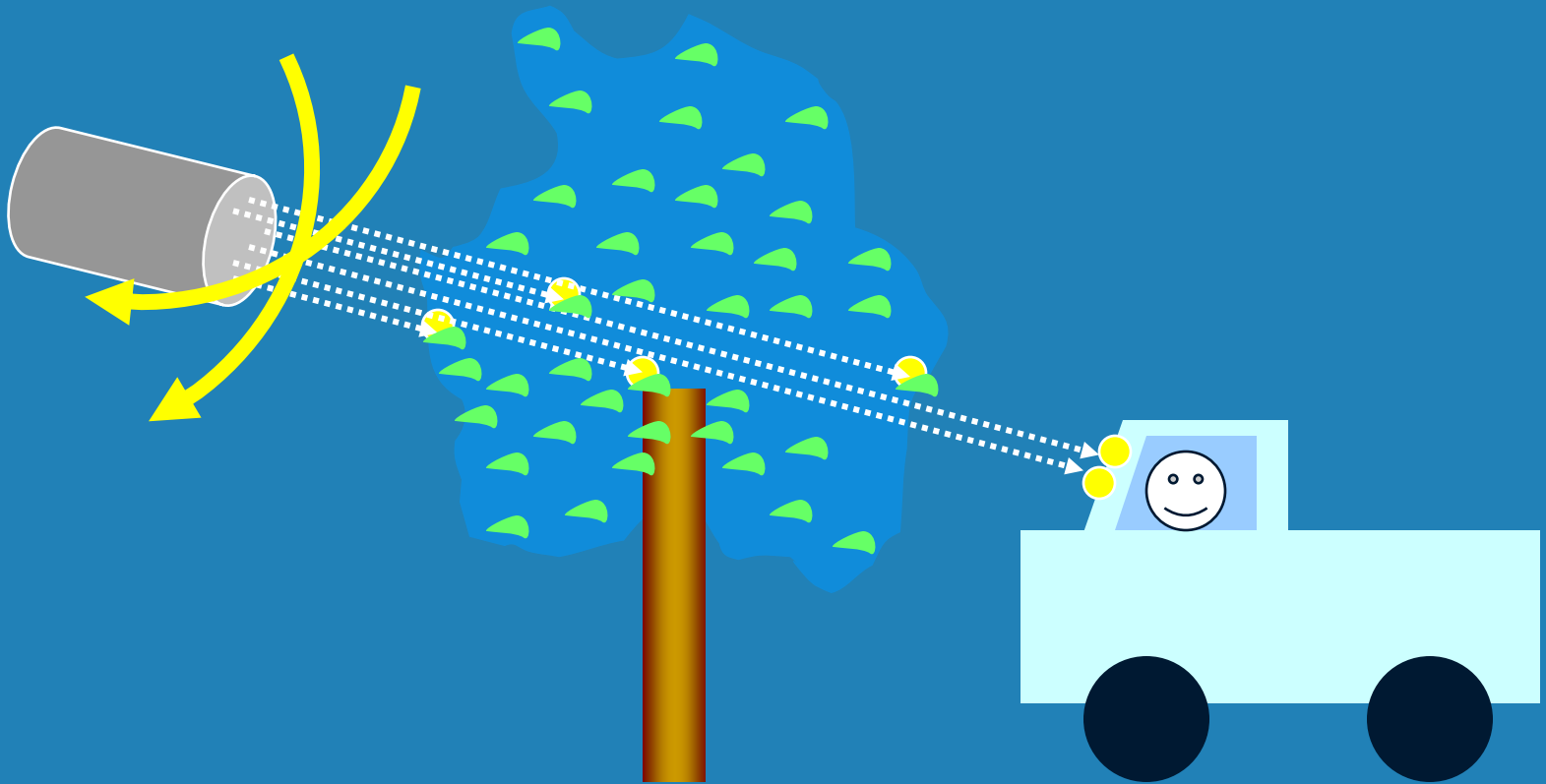
# Ray Tracing -- 3D



# Range Profiles -- Theory

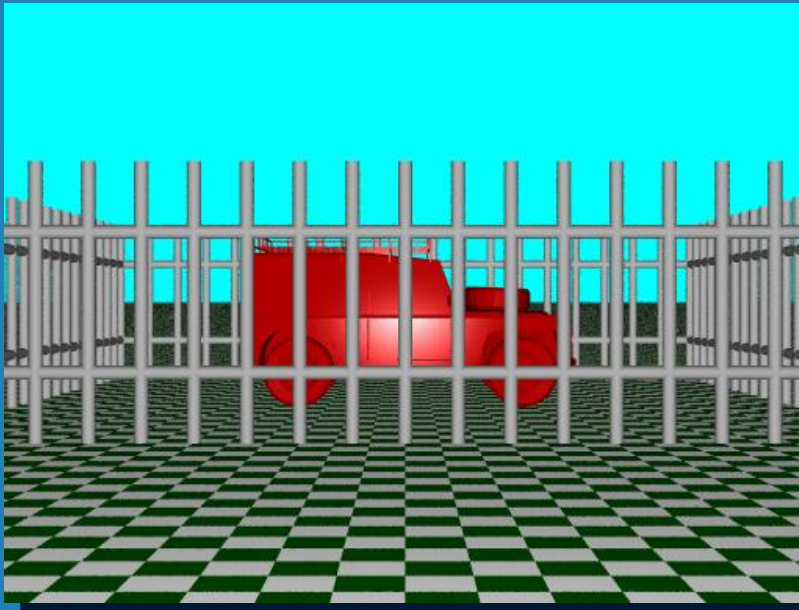


# Range Profiles -- Current Implementation

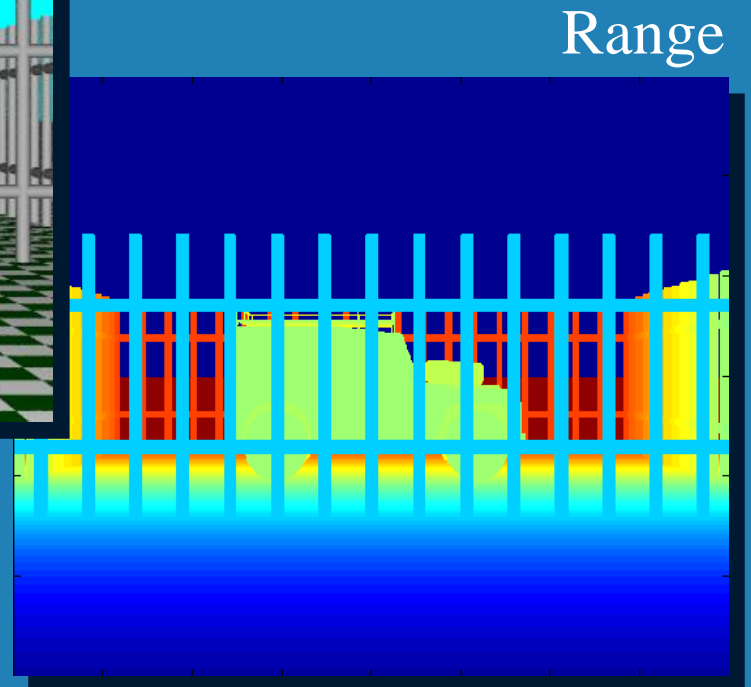




# Range Images



Intensity



Range

# Typical Lighting Model

## • Ambient

- Background light level

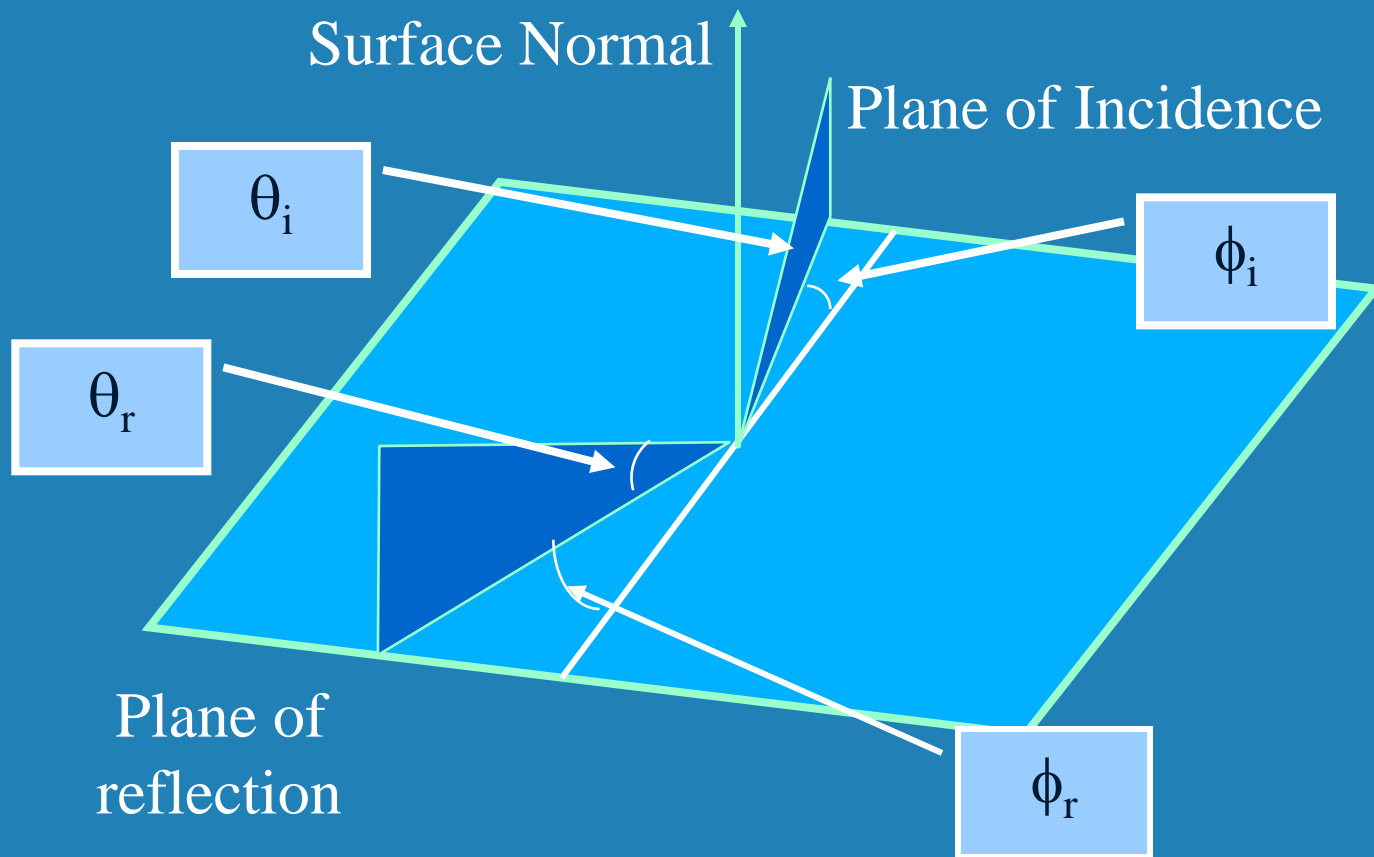
## • Diffuse

- Matte surface

## • Specular

- The window on the apple

# Bidirectional Radiance Distribution Functions (BRDFs)



# BRDFs Cont.

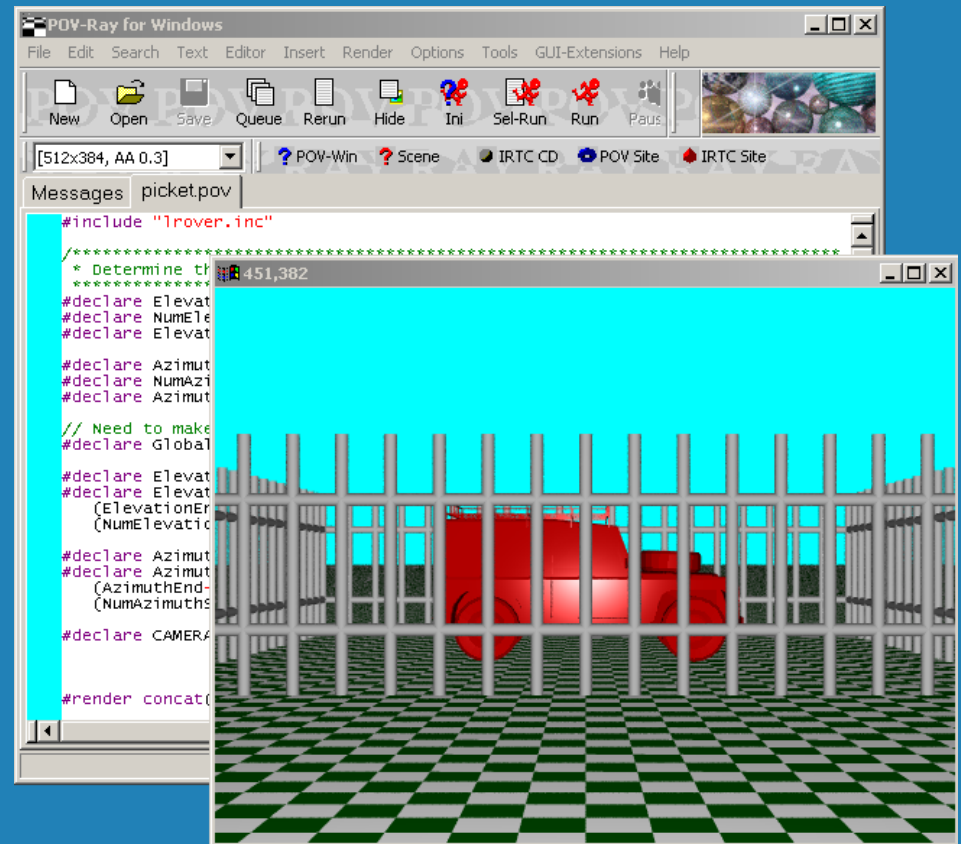
- **Physics-based lighting**
  - **Polarized light**
- **Example: Wet pavement**
  - $\phi_i \approx \phi_r$
  - $\theta_i$  and  $\theta_r$  both small

# BRDF Simplifications

- ☉ Intensity independent of:
  - $\phi_i$  (no polarization on incoming light)
  - $\phi_r$  (no polarization on outgoing light)
- ☉  $\theta_i = \theta_r$  (light source and camera at same point)
- ☉  $I(\phi_i, \phi_r, \theta_i, \theta_r) \rightarrow I(\theta)$

# POV-Range

- **What is it?**
- **What platforms?**
- **Performance?**
  - **800x600:**  
*20 min. / 72 frames*
  - **8192x8192:**  
*6.5 hrs. / 1 frame*





# Demo

---

- **“POV-Range”**
- **View range image in Matlab**

# Further Information...

- **Foley, Van Dam, Feiner, Hughes. *Computer Graphics: Principles and Practice***
- **Watt, Watt. *Advanced Animation and Rendering Techniques***
- **[www.povray.org](http://www.povray.org)**
- **[comp.graphics.rendering.raytracing](http://comp.graphics.rendering.raytracing)**