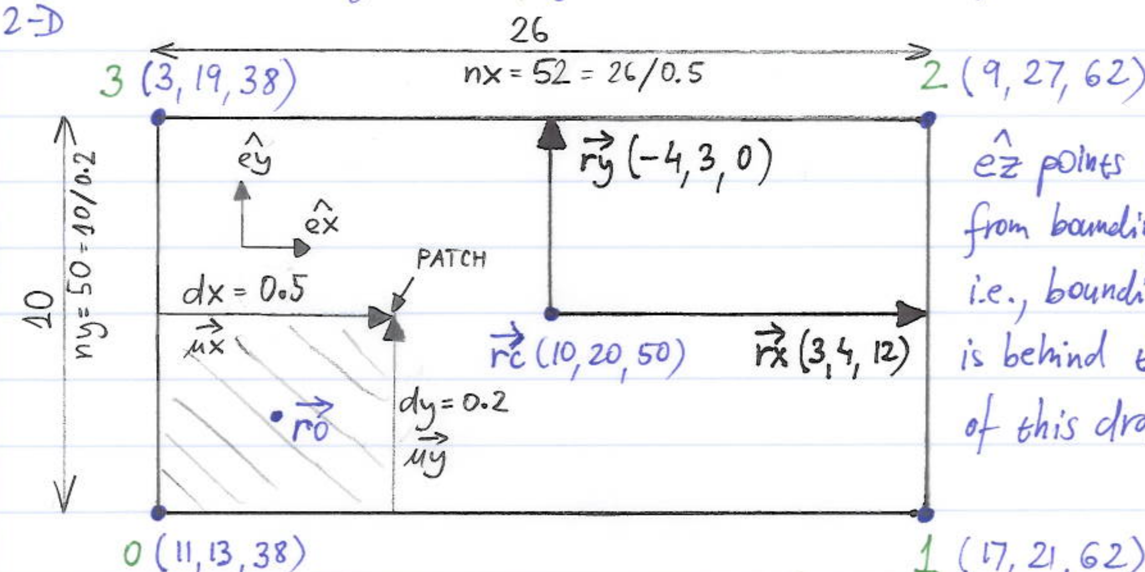
$\boxed{\text{class Detector, test\_Detector.cpp, detector\_init.cpp}}$

Detector is a rectangular Polygon on its own Grid of 4 Nodes.

2-D

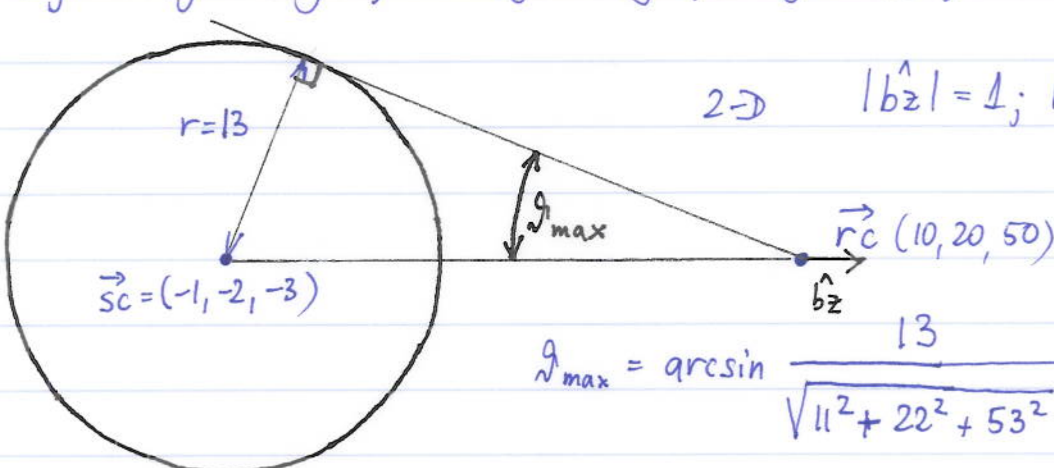


$\hat{ez}$ points away from bounding Sphere; i.e., bounding Sphere is behind the plane of this drawing

$\vec{rx} \parallel \vec{ux} \parallel \hat{ex}$; $|\vec{ux}| = dx$; $|\hat{ex}| = 1$

$\vec{ry} \parallel \vec{uy} \parallel \hat{ey}$; $|\vec{uy}| = dy$; $|\hat{ey}| = 1$; $\hat{ez} = \hat{ex} \times \hat{ey}$

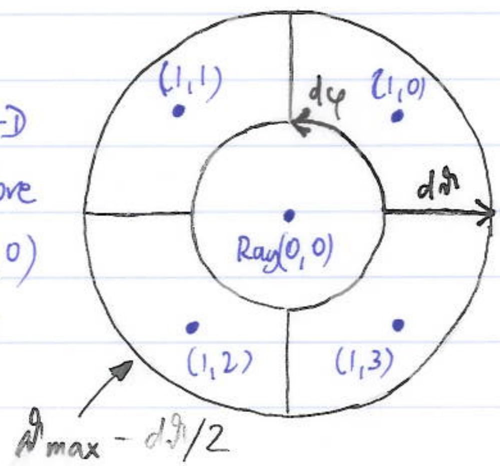
2-D $|\hat{bz}| = 1$; $\hat{bz} \parallel (\vec{rc} - \vec{sc})$

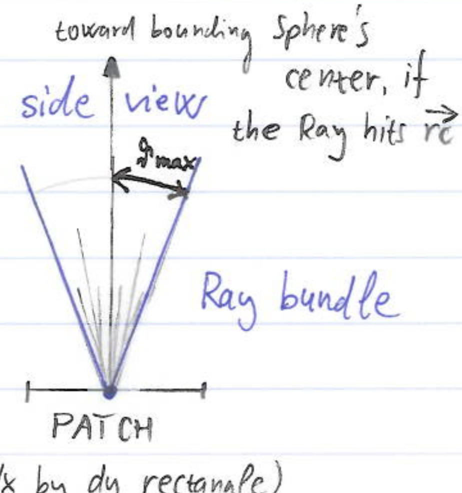


$$\vartheta_{max} = \arcsin \frac{13}{\sqrt{11^2 + 22^2 + 53^2}} \approx 0.224$$

solid angle elements 3-D view from above North Pole (0,0)

$n_\vartheta = 2$, $n_\varphi = 4$





Ray (ϑ, φ) from bundle $\rightarrow$ direction $\vec{v} = x_e \hat{ex} + y_e \hat{ey} + z_e \hat{ez}$ (local)

Since
$$\hat{ex} = bx_x \hat{x} + bx_y \hat{y} + bx_z \hat{z}$$
$$\hat{ey} = by_x \hat{x} + by_y \hat{y} + by_z \hat{z}$$
$$\hat{ez} = bz_x \hat{x} + bz_y \hat{y} + bz_z \hat{z}$$
, the local_to_global() transformation is

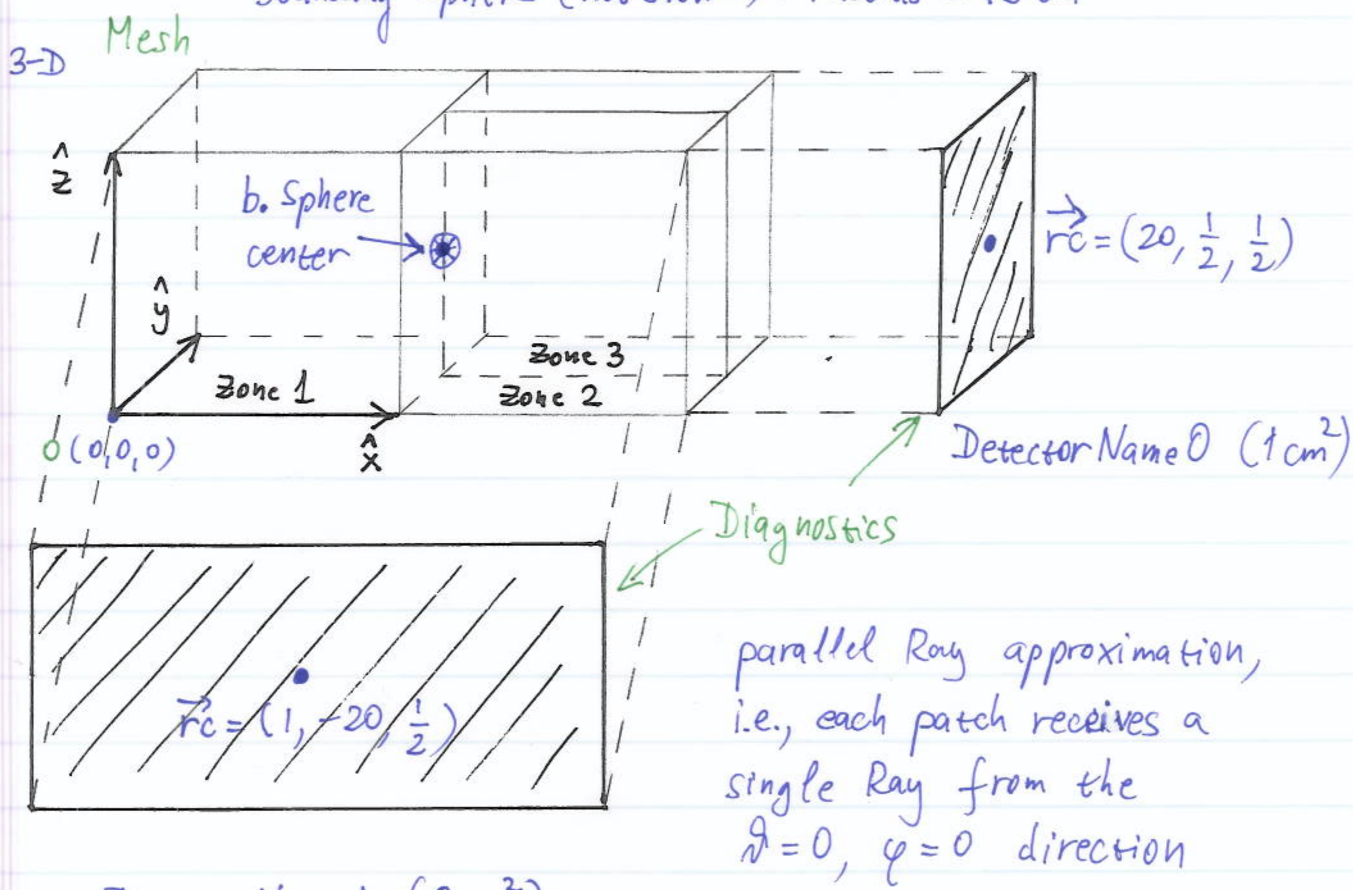
$$\begin{array}{c} \vec{xr} \rightarrow \\ \vec{yr} \rightarrow \\ \vec{zr} \rightarrow \end{array} \begin{pmatrix} bx_x & by_x & bz_x \\ bx_y & by_y & bz_y \\ bx_z & by_z & bz_z \end{pmatrix} \underbrace{\begin{pmatrix} x_e \\ y_e \\ z_e \end{pmatrix}}_{\vec{v}} = \begin{pmatrix} \vec{xr} \cdot \vec{v} \\ \vec{yr} \cdot \vec{v} \\ \vec{zr} \cdot \vec{v} \end{pmatrix} = \vec{cvec} \text{ in do\_Ray()}$$

$\boxed{\text{test\_Diagnostics.cpp}}$ using Mesh definitions from pmh_2014_1219;

1st time step: only Zones 0 and 1, bounding Sphere center at Node 8 ⊛

2nd time step: all 4 Zones, bounding Sphere center at Node $16 = (1, \frac{1}{2}, \frac{1}{2})$

bounding Sphere (not shown): radius = 13 cm



parallel Ray approximation, i.e., each patch receives a single Ray from the $\vartheta = 0$, $\varphi = 0$ direction

⊛ shifted b. Sphere center differentiates Hydro2 from Hydro1