

CAUG 5: MCMP Geometry Fundamentals Assignment

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Welcome to Session 5!

- Questions from Session 4
 - Advance volume construction
 - Nested Surfaces
 - Integrated Surfaces
- RSICC Application Status – should all be installed
 - Questions?
- Assignment 1: Let's do this!

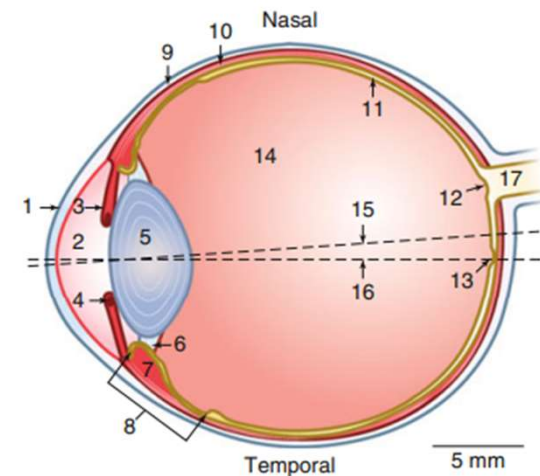


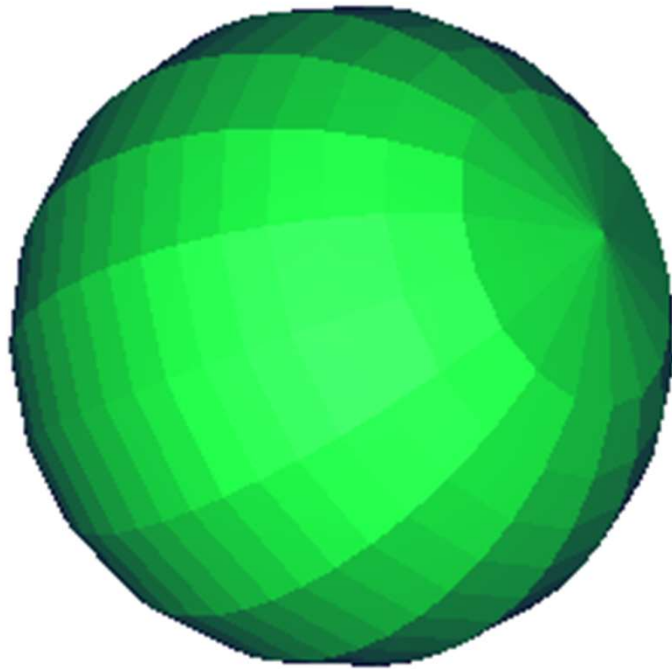
Fig. 1.7 Dimensions and details of a human eye. 1 cornea, 2 anterior chamber, 3 iris, 4 pupillary sphincter muscle, 5 lens, 6 zonules, 7 m. ciliaris, 8 ciliary body, 9 sclera, 10 choroid, 11 retina, 12 optic disc, 13 foveola, 14 vitreous body, 15–16 visual axis, 17 optic nerve

Assignment 1: The Human Eye

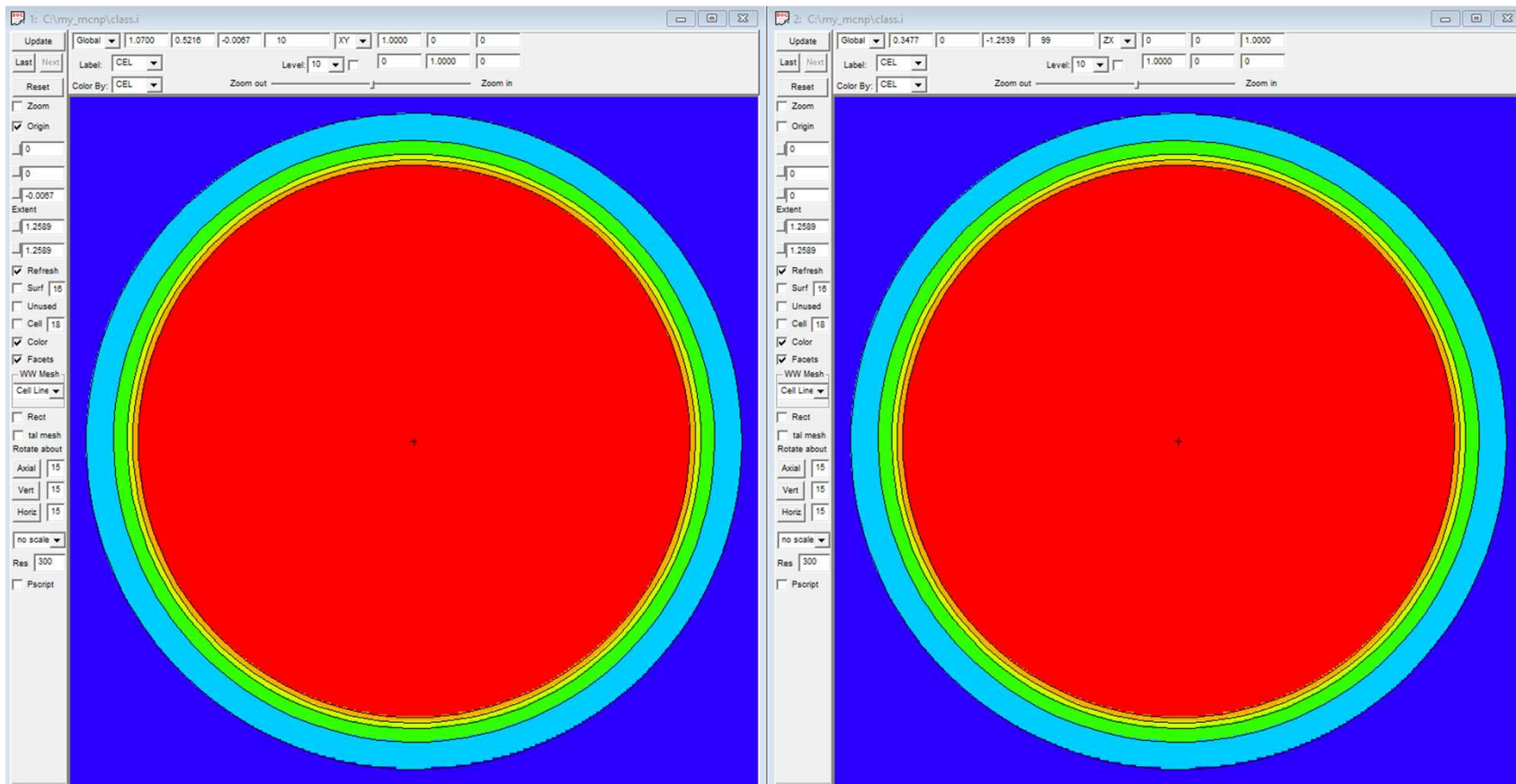
The human eye is a globe with a diameter of approximately 24 mm. There are 4 membranes; a cornea, sclera, choroid and retina, with thicknesses of 1.00mm, 0.5mm, 0.2mm and 0.2 mm, respectively. The lens of the eye functions such that the dimensions are not constant, but at rest is generally 10mm in height/width and 4mm deep, sitting just behind the pupil.

In this exercise, we will model the human eye, from simple to complex.

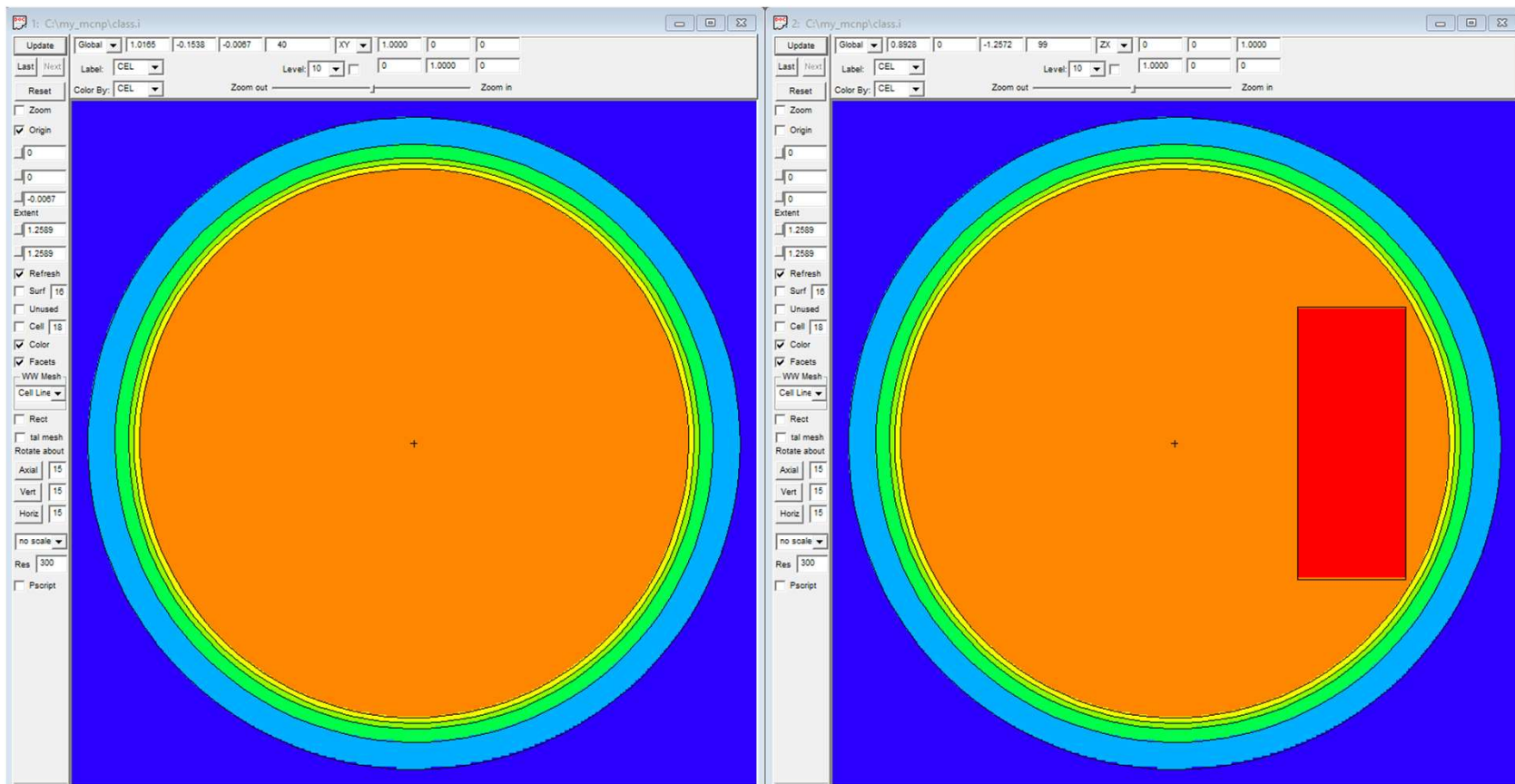
1. Model an eyeball as a simple sphere



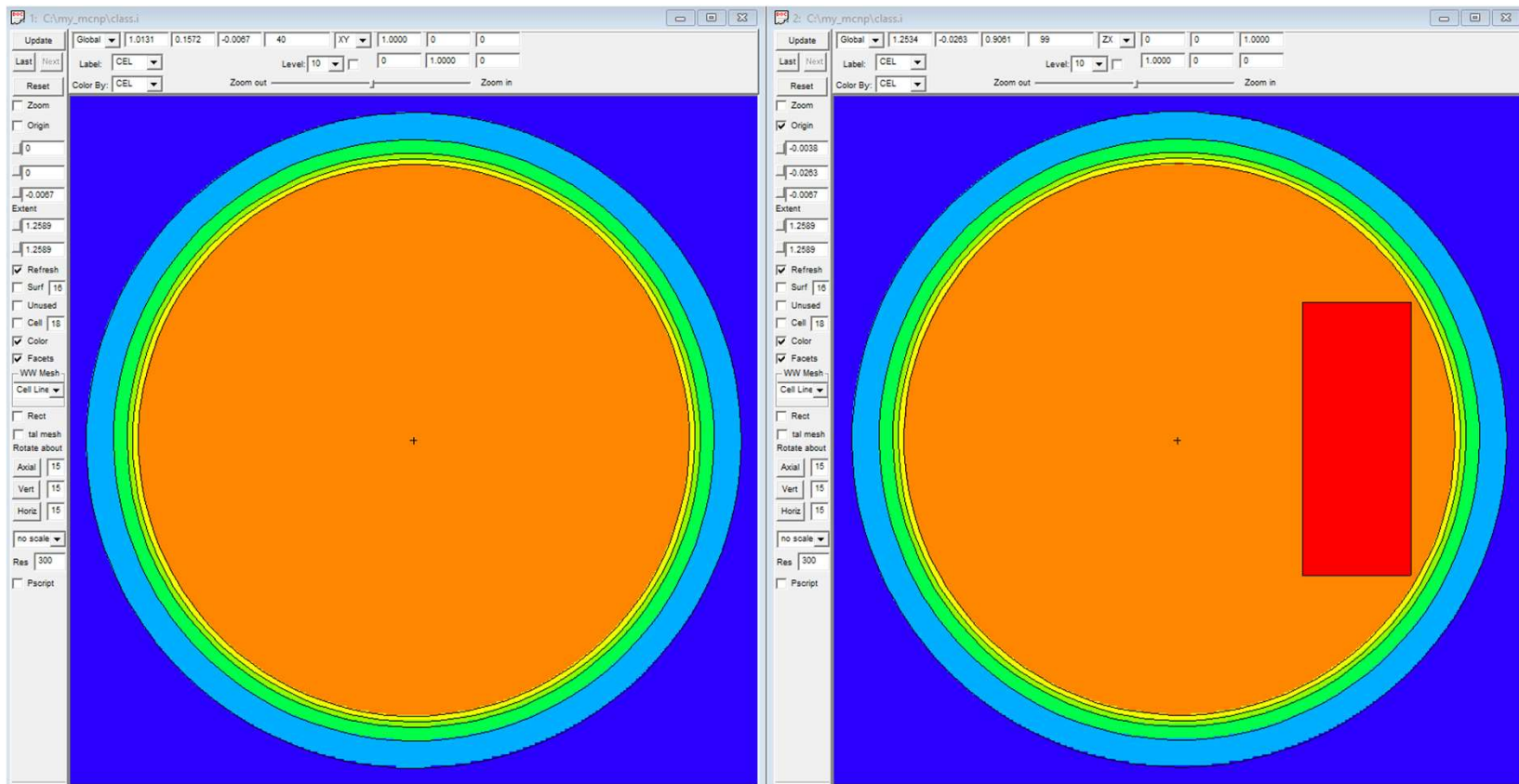
2. Model the eyeball, adding each membrane



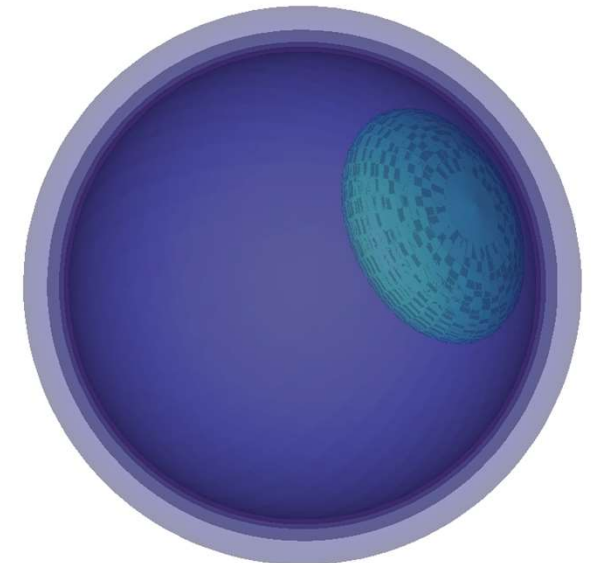
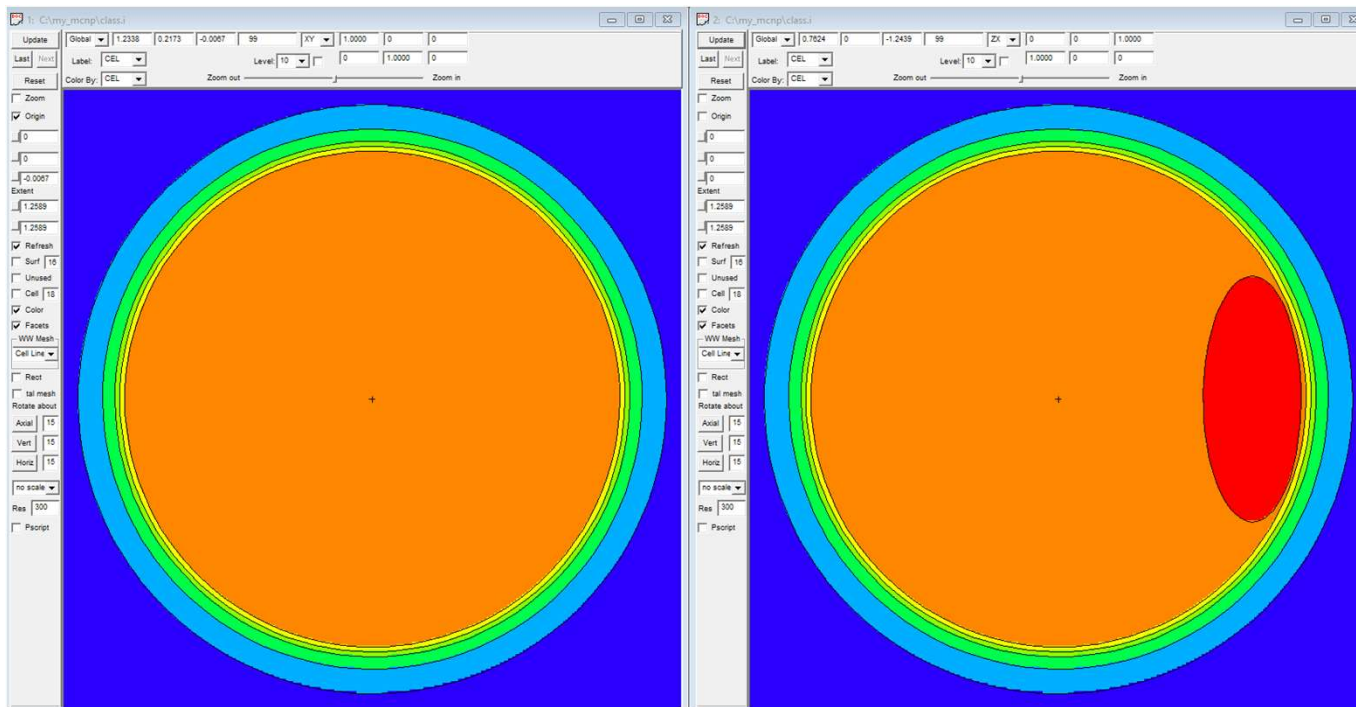
3. Add a lens as a simple rectangular macrobody



4. Add the lens using surfaces, not a macrobody (will look identical)



5. (Stretch) Add the lens as an ellipsoid with diameters 10mm, 10mm and 4 mm.



MCNP6 User Manual p. 3-9 for surface syntax description (I used SQ, but you can find what you like).

Next level: Materials, (Simple) Sources and Tallies

ANSWERS

1. Model an eyeball as a simple sphere

```
The Human Eye
C Cells
99 0 1      imp:p=1 $ outside world
10 0 -1     imp:p=1 $ cornea

C Surfaces
1 so  1.2
```

2. Model the eyeball, adding each membrane

```
The Human Eye
C Cells
99 0 1      imp:p=1 $ outside world
10 0 -1 2   imp:p=1 $ cornea
20 0 -2 3   imp:p=1 $ sclera
30 0 -3 4   imp:p=1 $ choroid
40 0 -4 5   imp:p=1 $ retina
50 0 -5     imp:p=1 $ vitreous body

C Surfaces
1 so  1.2
2 so  1.1
3 so  1.05
4 so  1.03
5 so  1.01
```

3. Add a lens as a simple rectangular macrobody

```
The Human Eye
C Cells
99 0 1      imp:p=1 $ outside world
10 0 -1 2   imp:p=1 $ cornea
20 0 -2 3   imp:p=1 $ sclera
30 0 -3 4   imp:p=1 $ choroid
40 0 -4 5   imp:p=1 $ retina
50 0 -5 10  imp:p=1 $ vitreous body
100 0 -10   imp:p=1 $ lens

C Surfaces
1 so  1.2
2 so  1.1
3 so  1.05
4 so  1.03
5 so  1.01
10 rpp -0.5 0.5 -0.2 0.2 0.45 0.85
```

4. Add the lens using surfaces, not a macrobody (will look identical)

The Human Eye

C Cells

```
99 0 1      imp:p=1 $ outside world
10 0 -1 2   imp:p=1 $ cornea
20 0 -2 3   imp:p=1 $ sclera
30 0 -3 4   imp:p=1 $ choroid
40 0 -4 5   imp:p=1 $ retina
50 0 -5 (-6:7:-8:9:-10:11) imp:p=1 $ vitreous body
100 0 6 -7 8 -9 10 -11      imp:p=1 $ lens
```

C Surfaces

```
1 so  1.2
2 so  1.1
3 so  1.05
4 so  1.03
5 so  1.01
6 px -0.5
7 px  0.5
8 py -0.2
9 py  0.2
10 pz 0.45
11 pz 0.85
```

5. (Stretch) Add the lens as an ellipsoid with diameters 10mm, 10mm and 4 mm.

```
The Human Eye
C Cells
99 0 1      imp:p=1 $ outside world
10 0 -1 2   imp:p=1 $ cornea
20 0 -2 3   imp:p=1 $ sclera
30 0 -3 4   imp:p=1 $ choroid
40 0 -4 5   imp:p=1 $ retina
50 0 -5 10  imp:p=1 $ vitreous body
100 0 -10   imp:p=1 $ lens

C Surfaces
1 so  1.2
2 so  1.1
3 so  1.05
4 so  1.03
5 so  1.01
10 SQ 4 4 25  0 0 0 -1  0 0 0.75
```