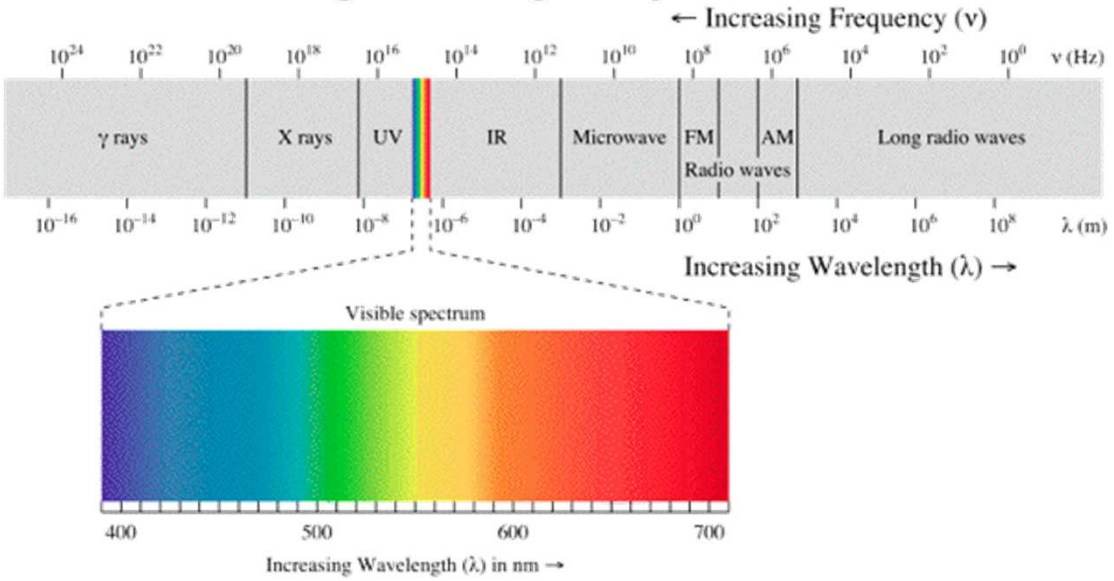
SAND2016-3832D

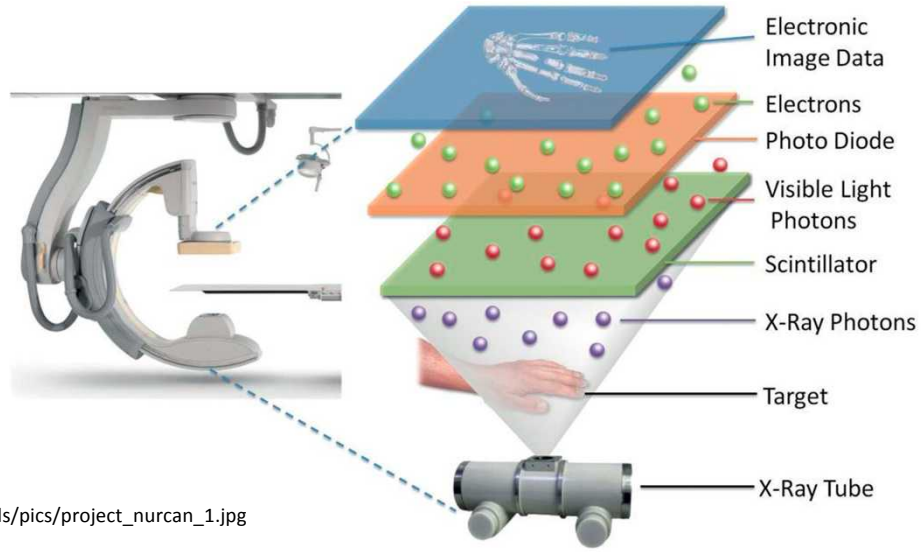
What are X-Rays?

- X-rays are a type of light your eyes can't see and can go through objects



https://upload.wikimedia.org/wikipedia/commons/thumb/f/f1/EM_spectrum.svg/1280px-EM_spectrum.svg.png

- To see X-rays we need special detectors that are similar to a digital camera



https://static.tue.nl/uploads/pics/project_nurcan_1.jpg

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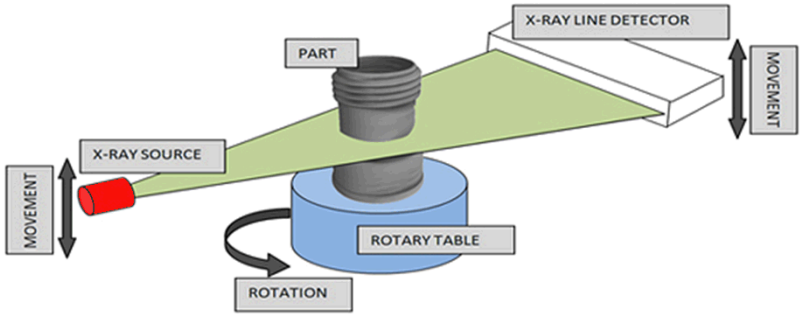
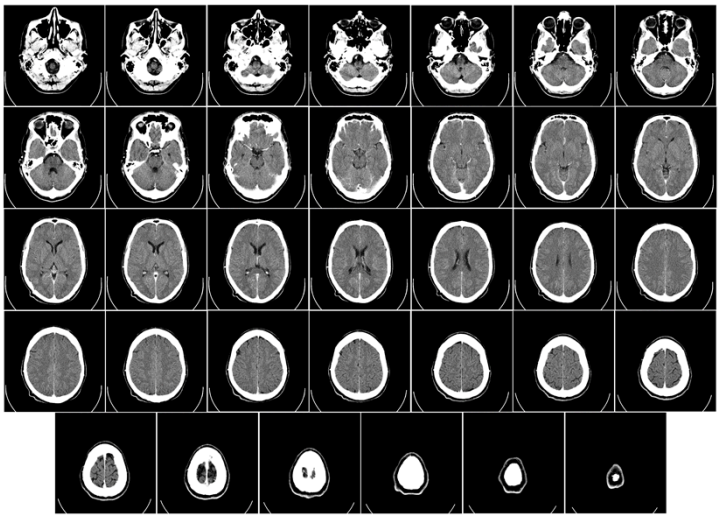
What is Computed Tomography?

- Multiple x-rays are taken by moving the x-ray source, detector, and/or the part being examined in a very controlled manner:



https://jgarantmc.com/wp-content/uploads/2014/02/ct_scanner_line_beam.jpg

- Sophisticated algorithms combine the information contained in many different 2D images to create a 3D volume.
- The 3D volume is often displayed as a sequence of slices through an object.



Can you guess what these slices are from?

https://upload.wikimedia.org/wikipedia/commons/5/50/Computed_tomography_of_XXX_-_large.png

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What is a GPU?

- Computers use a “Graphics Processing Unit”, or GPU, to show pictures, movies, and other graphics on your screen. This is actually very hard for a regular computer processor to do.

Why do you think this GPU uses two large fans?

http://techreport.com/r.x/2015_4_6_Asus_limitededition_GTX_980_claims_highest_GPU_clocks/asusgold-card.jpg

- GPUs for video games:
  - 2048 Cores (separate small computers)
  - Each core runs at 1216 Mhz.
    (so 1,216,000,000 cycles/sec) Why?
    (less than one billionth of a second per cycle)
    (in each cycle, 16 triangles can be rendered)
  - For 3D graphics, the GPU draws lots of triangles! Why?

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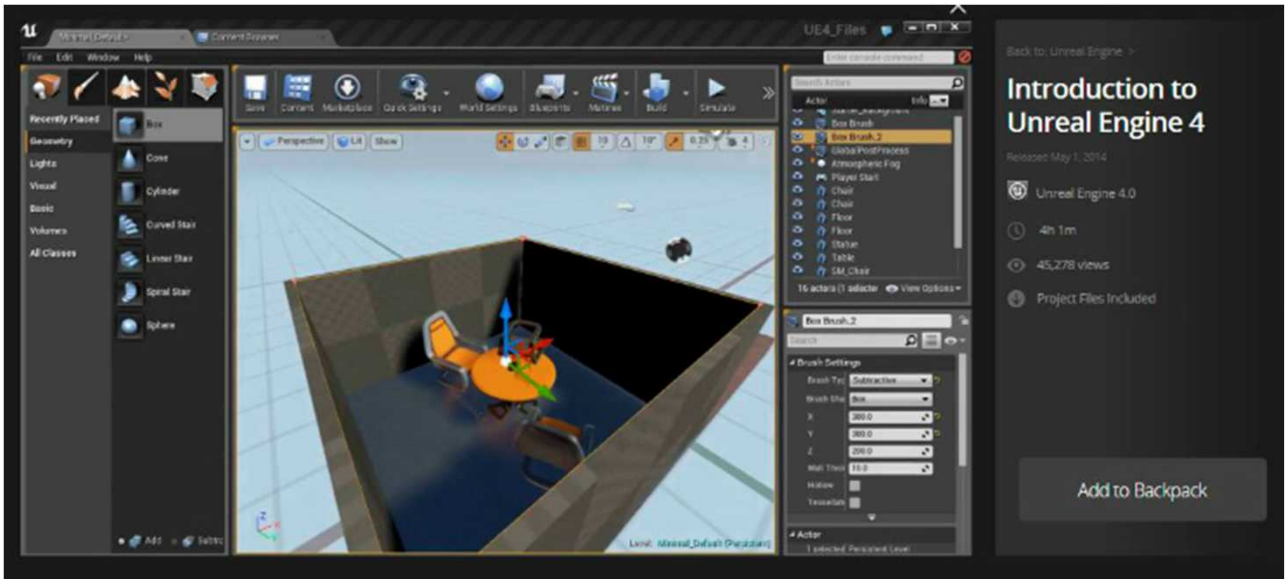
What is a Game Development Engine?

- Building computer games from scratch takes a lot of work. Especially for “3D virtual worlds”
  - visual effects like lighting, and texturing,
  - physics effects like gravity,
  - game effects like artificial intelligence,
- “Engines” simplify this allowing game developers to spend more time on their ‘world’ and less time on the programming.



http://cdn.skilledup.com/wp-content/uploads/2014/12/Unreal-digital-tutors-screenshot.jpg

- The engines are very complex tools. Beginning users can do a lot quickly. Expert users with appropriate knowledge and skills can create amazing things

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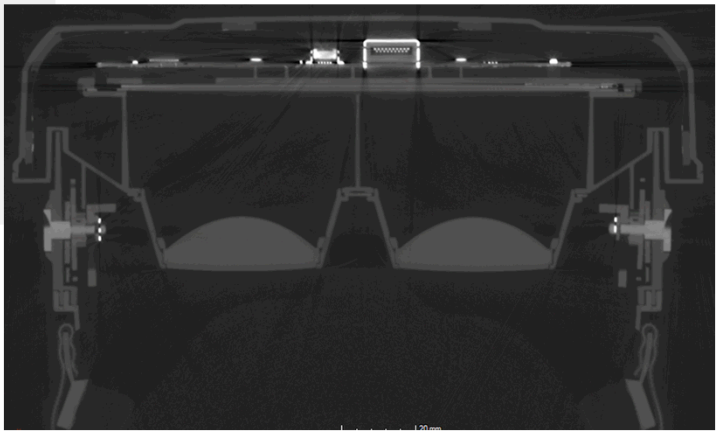
What is the Oculus Rift?

- Goggles restrict your vision
  - present separate images to each eye.
- Camera and sensors receive input
  - “Adjacent Reality Tracker” runs at 1000Hz and uses 3-axis gyros, accelerometers, magnetometers.
  - Infrared LED sensor in camera, LEDs on goggles.
  - A lot of information about where you are looking!
- Applications use input to adjust images.
- Result is “Virtual Reality”:
  - ”immersion” – you are immersed in a virtual world
  - “presence” – you feel like you are there, because what you see is based on where you are looking.

How did we create the image below?



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How to Join in on the Fun?

- Playing games and using technology is fun.
- Building things and Scientific Discovery even better!
  - Especially if its your job and you get paid to do it.
- A diverse team of people with different skills is often essential and results in the best outcomes.
- Our team:

  Ph.D. Computer Science,
  Ph.D. Applied Mathematics,
  M.S. Material Science

Realize that everything you learn and study is important and might some day be useful, even if you don't see how today!

The "STEM" fields (science, technology, engineering and mathematics) give you a foundation to work in other domains and pursue your individual interests.

What happens next?

http://www.edutopia.org/sites/default/files/styles/responsive_620px/public/cover_media/resourceroundup_site_stemtosteam_620x349-01-01.jpg?itok=sIjuwxij&timestamp=1408723900

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