Building a sample chamber for measuring the reflectivity and transparency of detector materials at VUV wavelengths.

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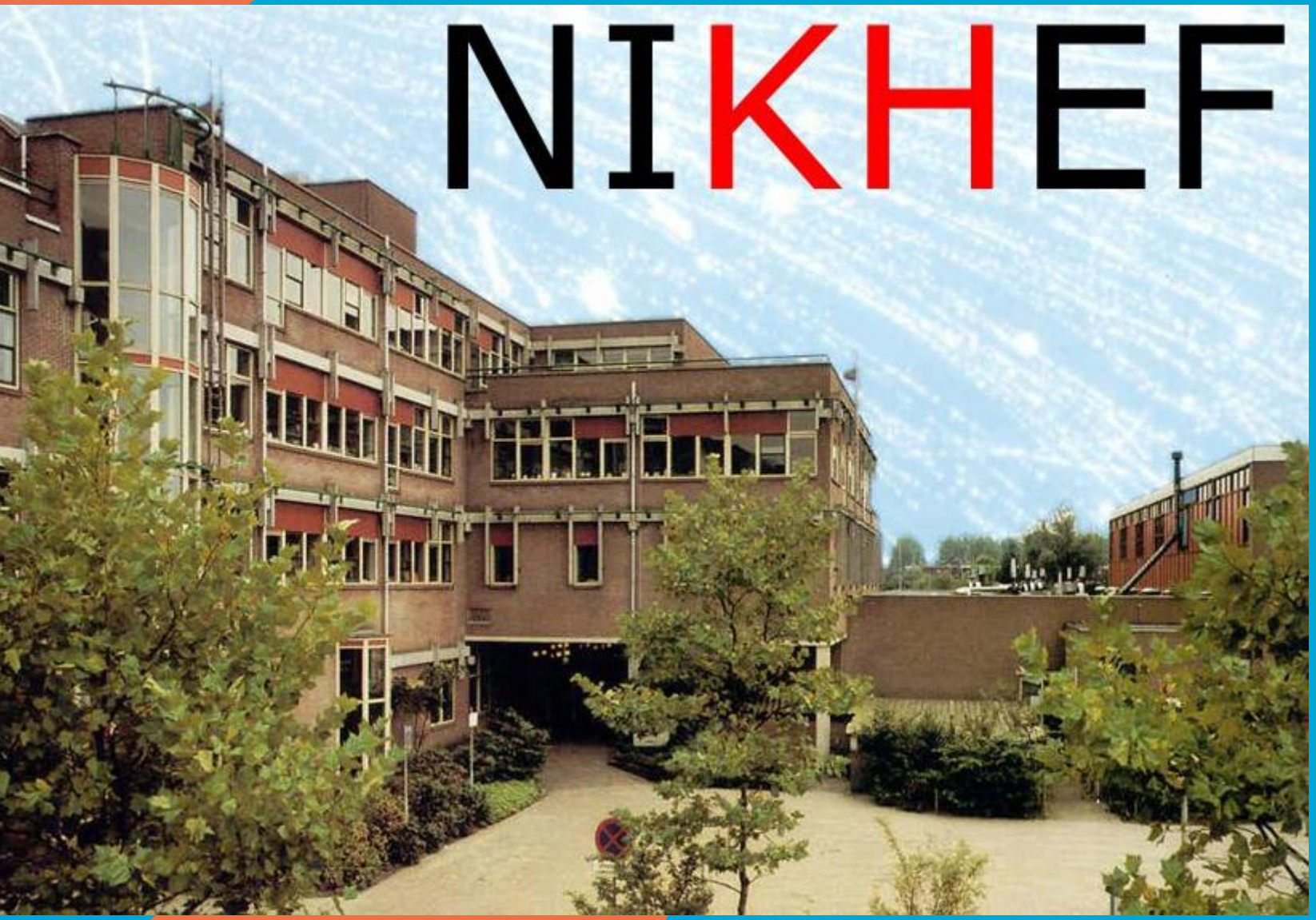

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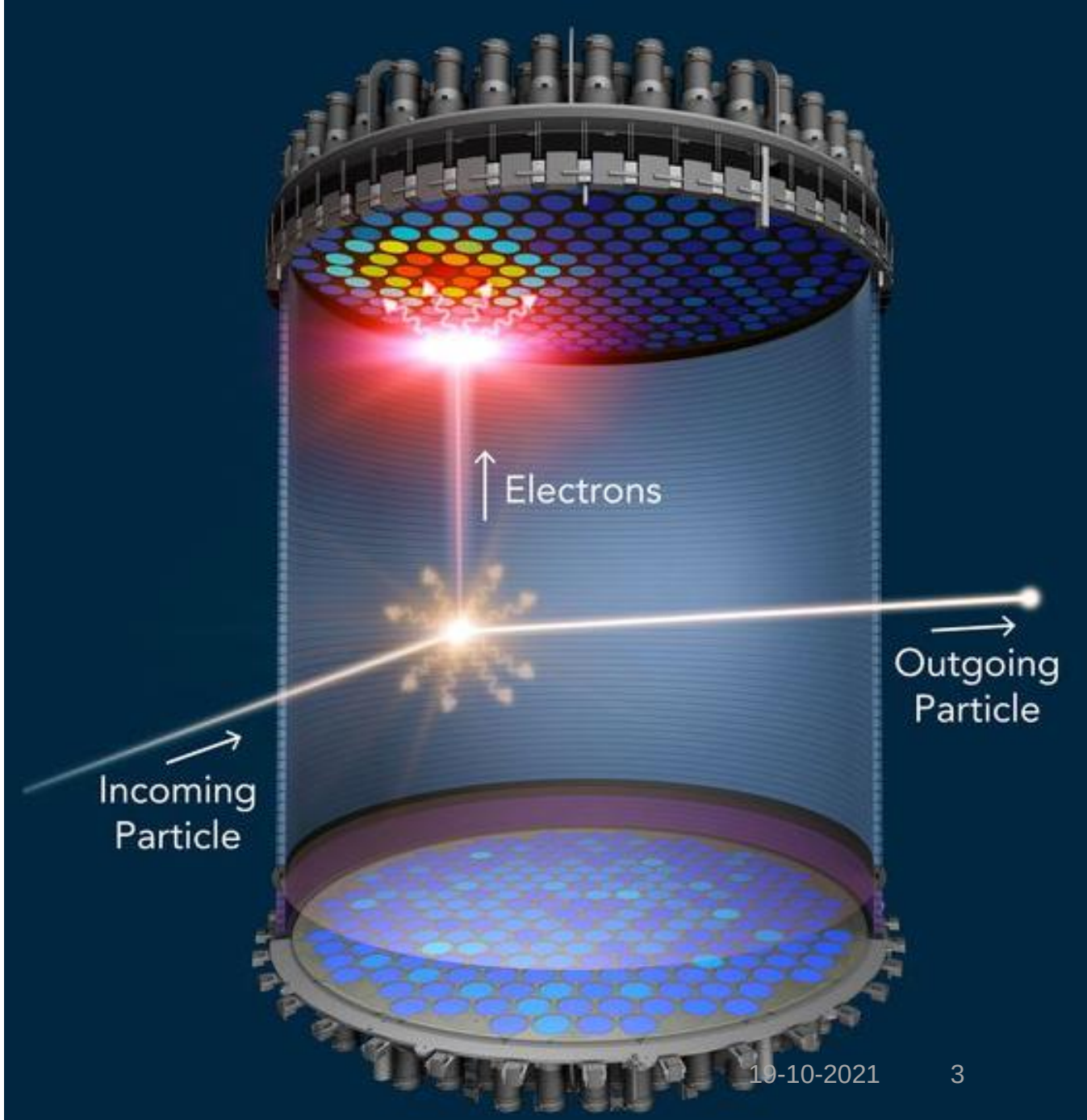
Background

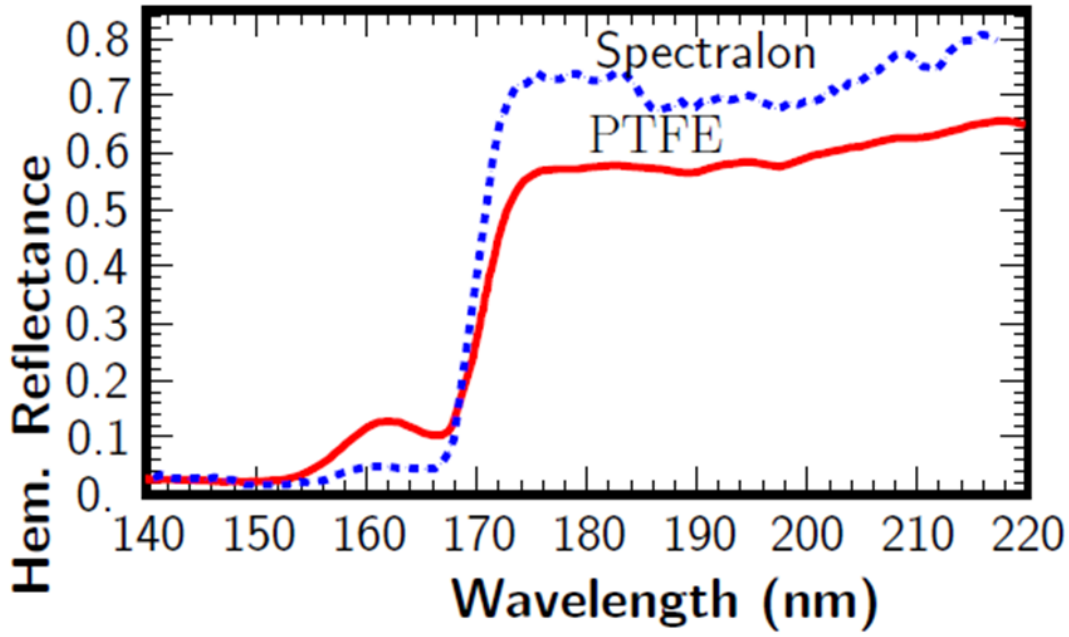
- Standard Model of particle physics
- Dark matter
- Galaxies
  - Mass from rotational velocities
  - Mass from luminosity
  - Mass from gravitational lensing
- Methods
- Interactions



https://www.smithsonianmag.com/science-nature/new-generation-dark-matter-experiments-gear-search-elusive-particle-180974111/

Goals

- Optical behaviour
- PTFE (polytetrafluoroethylene)
- Visible light
- Below 250 nm
- VUV region 175-178 nm
- Different treatments
- Reflectance and Absorbtion

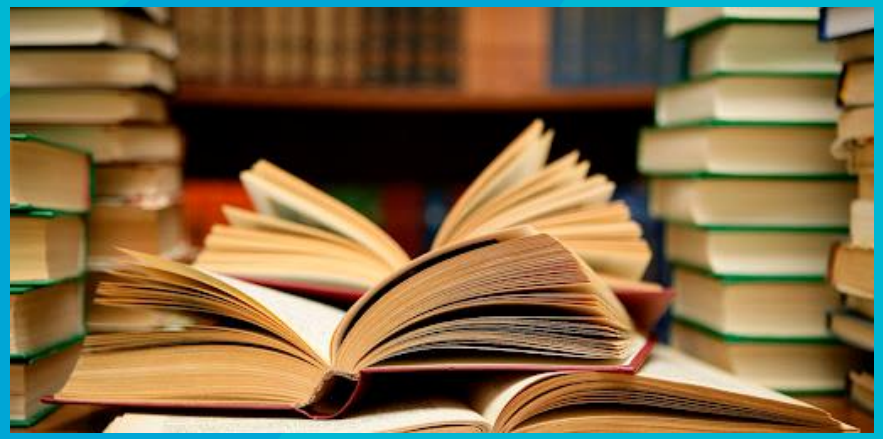


(Kadkhoda et al, SPIE, 3578, 544)

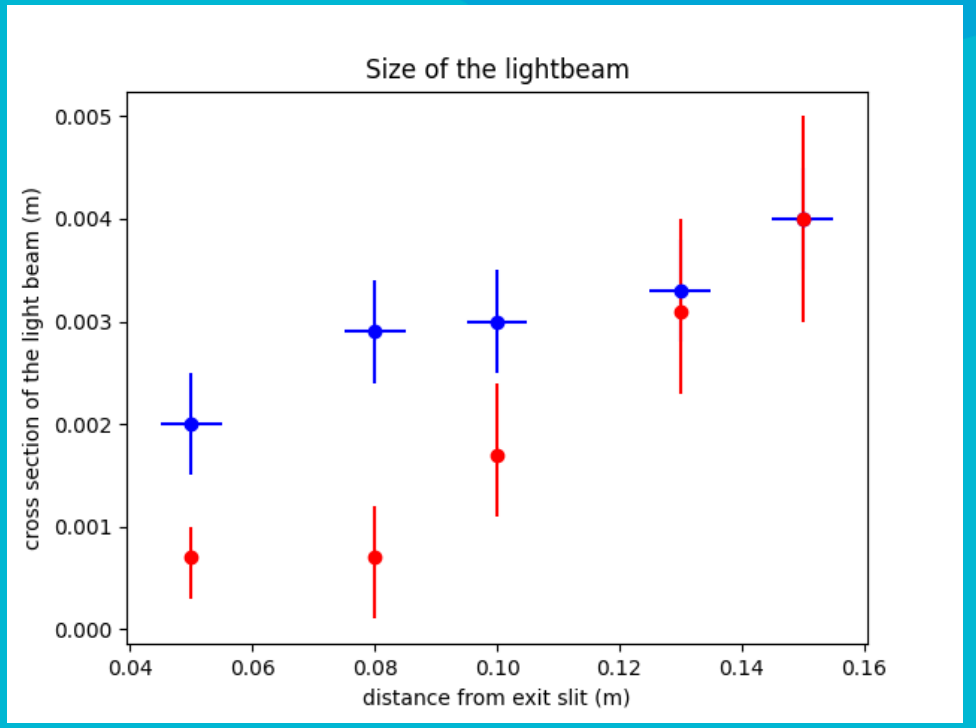
Research questions

- Are the specifications to which this experiment is designed correct?
  - Will the experiment give the same results as previously done experiments?
  - What is changed as per previous experiments that changes the outcomes of the current experiment?
- Using the standard prefabricated vacuum components, what configuration of the vacuum chamber can fulfil the specifications?
  - Do we need custom-made components?
  - If so, what must they look like?
- What is the best way to record data from temperature and photon sensors located inside the vacuum chamber?
  - What kind of data acquisition system is suitable?
- How will PTFE that is cleaned with different methods reflect or absorb VUV?
  - *Optional:*
- How will coated samples reflect or absorb VUV? (Extra? I think the focus starts with the PTFE samples)

What has been done



```python
"""
Created on 22-7-2021

@author: Casimir van der Post
"""
from mpl_toolkits import mplot3d
import matplotlib.pyplot as plt
from matplotlib.ticker import MaxNLocator
import numpy as np
import math
import random

x = np.around(np.arange(-0.01,0.4,0.00001),5)       # Global value for x rounded to 5 decimals
dSlit1 = 0.15                                       # distance from L to S1 in meters
wSlit1 = 0.003                                      # witdh of S1
dSlit2 = 0.15                                       # distance from G to S2
wSlit2 = 0.003                                      # witdh of S2
dGrat = 0.195                                       # distance from S1 to G in meters
gratAngle = math.radians(32)                        # angle of the normal of the grating to the entrance axis in radians
gratSize = 0.04                                     # size of the grating in meters
wLight = 0.004                                      # size of the light source
lightSource = [[-(wLight/2),(wLight/2)],[0,0]]      # coordinates of the light source
Slit1 = [[(-wSlit1/2),(wSlit1/2)],[dSlit1,dSlit1]]  # coordinates of S1

def grat_x(angle):
        return np.round((gratSize/2)*math.cos(angle),5)

def grat_y(angle):
        return np.round((gratSize/2)*math.sin(angle),5)

grating = [[-grat_x(gratAngle),grat_x(gratAngle)],[(dSlit1+dGrat-grat_y(gratAngle)),(dSlit1+dGrat+grat_y(gratAngle))]] # distances in x and y

"""
We will now calculate the slopes of the two crosing beams this because they create the most area inside the monochromator
the slope will be calculated according to a = (y1-y2)/(x1-x2)
Beam1 will be the light ray from the left side of the lamp
```



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What needs to be done

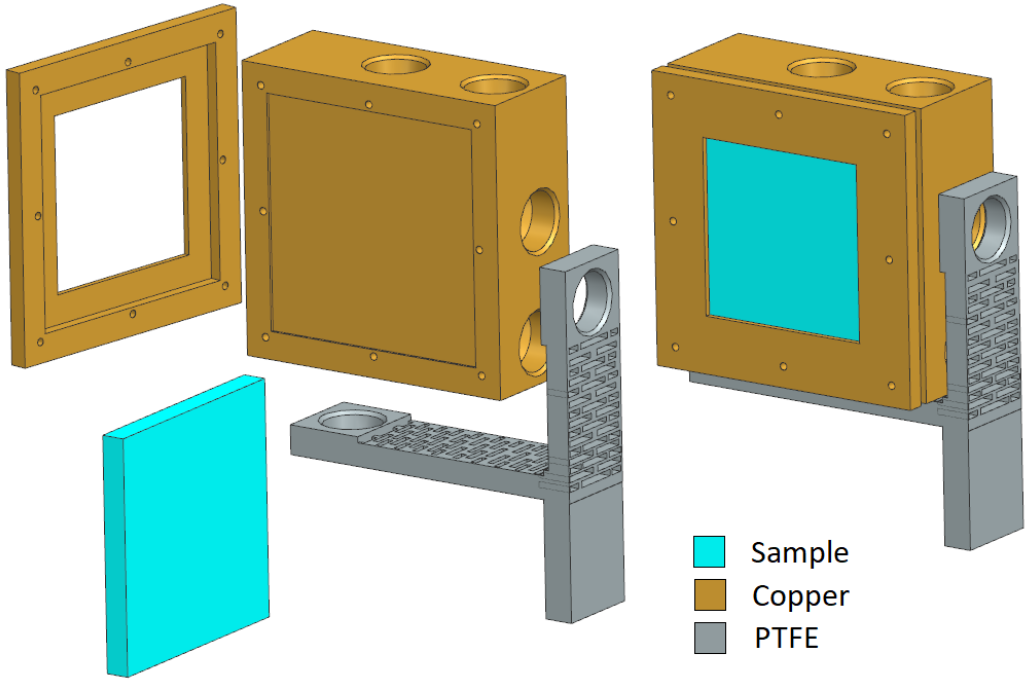
July:
- Learn how the vacuum chamber is designed and why, what are the requirements.
- Finalize design sample holder
- Understand the monochromator (Understand the path the light will take)
- Plan monochromator motor control, make a parts list for motor control

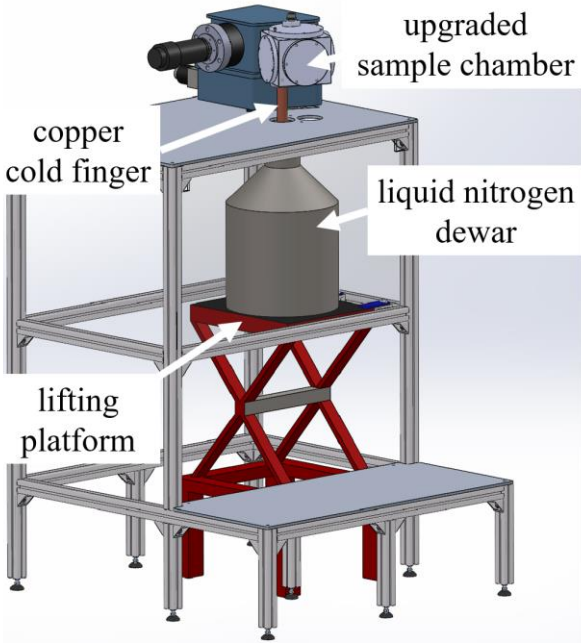
August: (Joined by a PhD)
- Assemble and test motor control
- Send CAD drawings of the sample holder to workshop, prototype
- Setup the procurement of the samples
  - What's on the shelf
  - Contact other institutions
  - Design the table for the equipment

October:
- Building
- Start commissioning

November:
- Calibration

December:
- Measuring samples
- Process results





Thank you for your attention

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