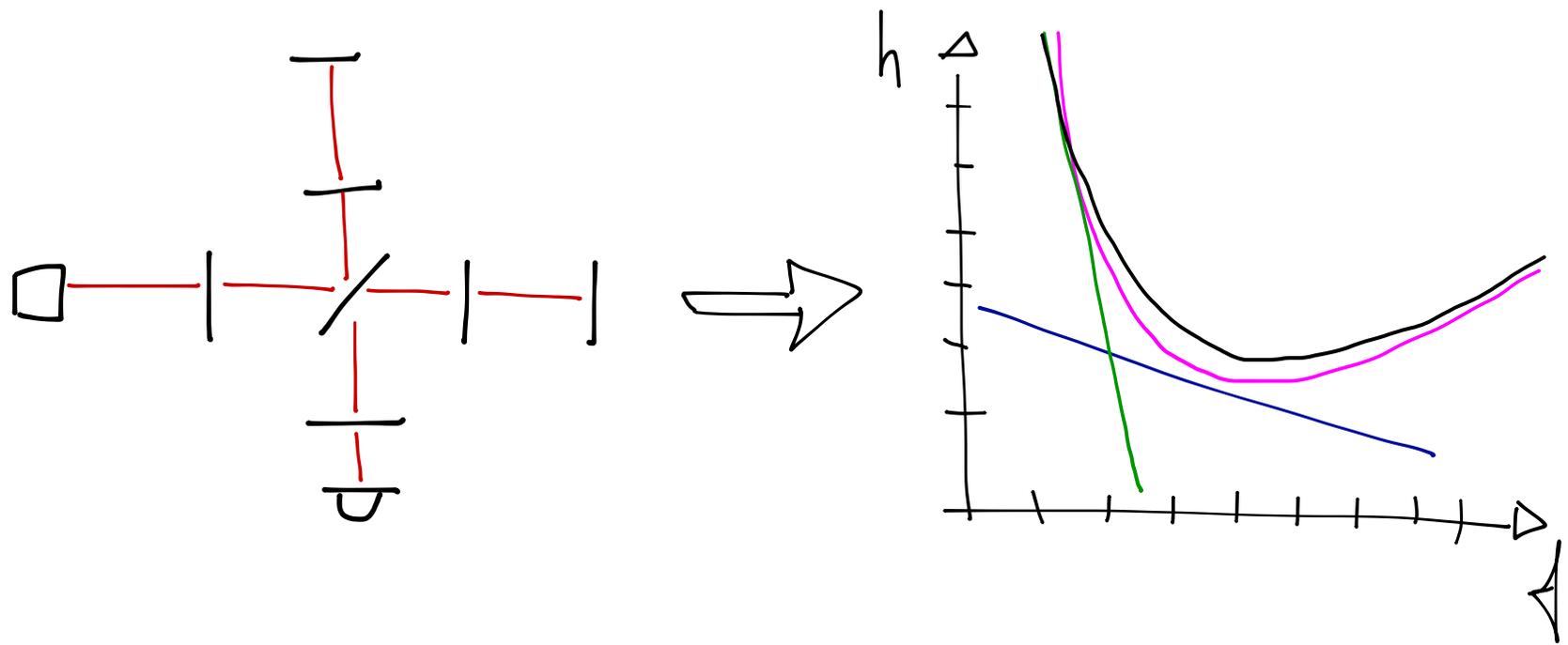


HOW TO SET UP  
A MODEL



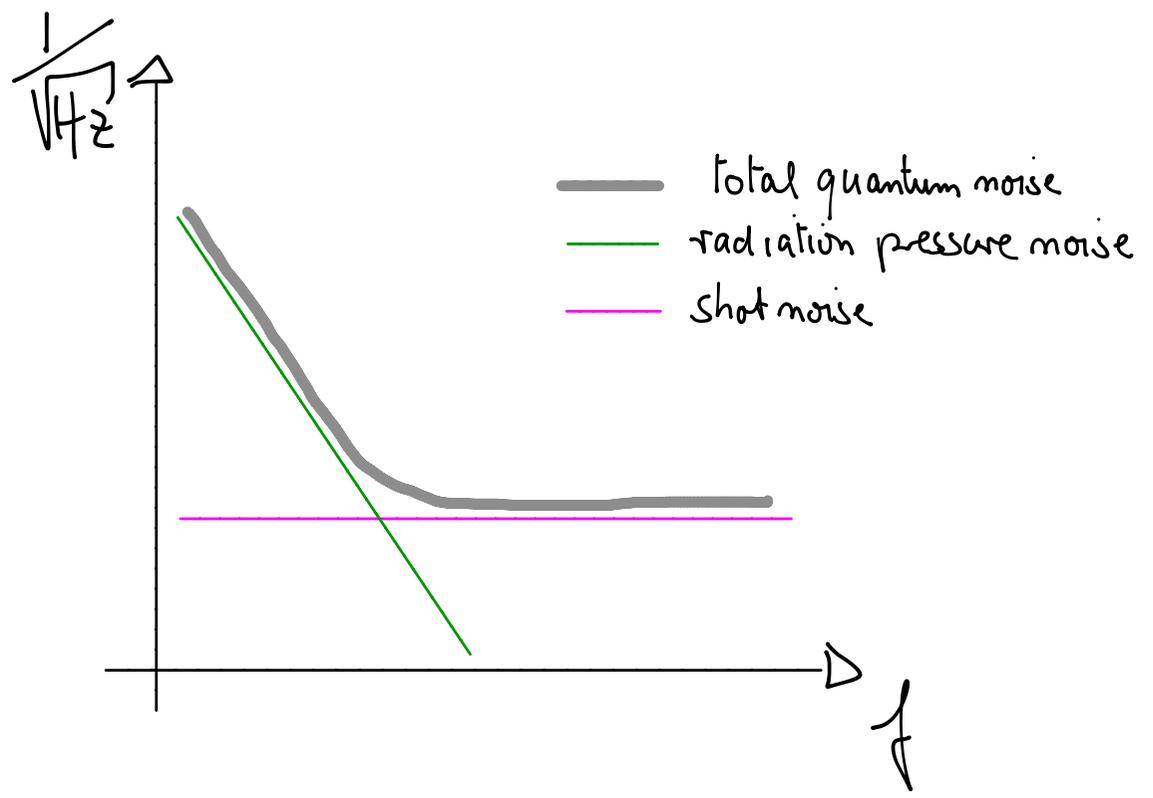
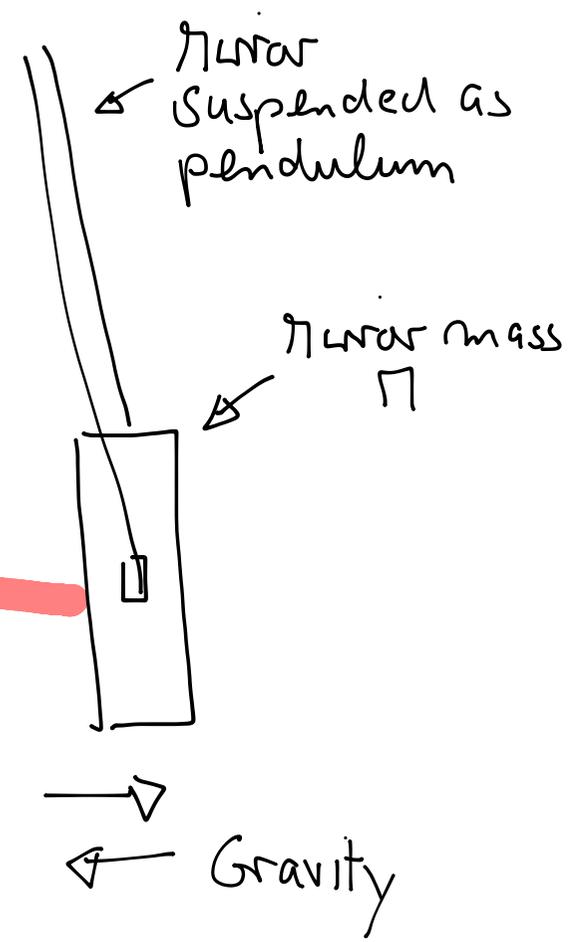
This session:

- brief extra topic:  $\sqrt{\text{radiation pressure noise}}$
- how to setup a FINESSE model for your task

L8

# Radiation pressure (noise)

Amplitude fluctuation in the beam create fluctuations in the force on the mirror, i.e. they shake the mirror.

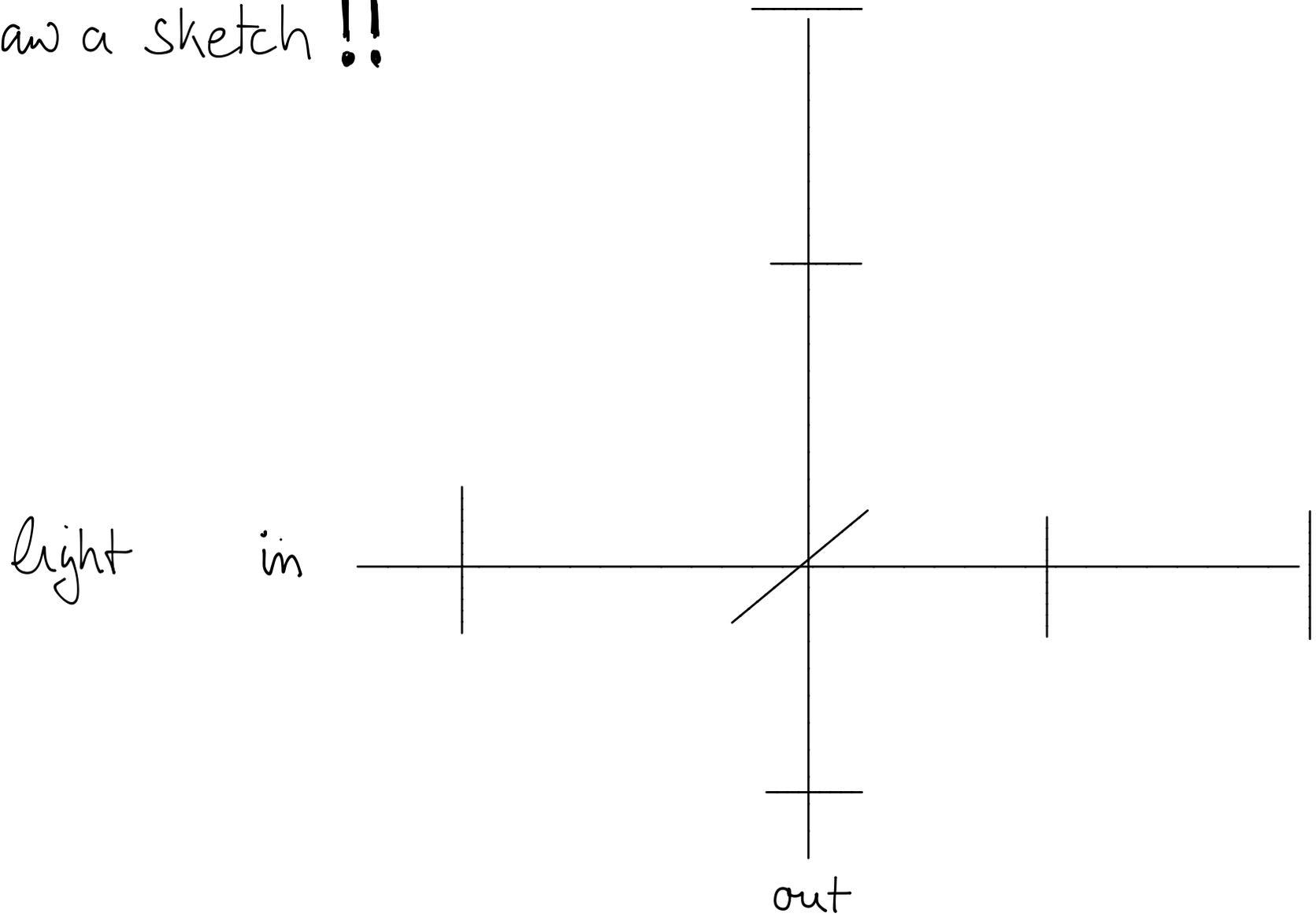


$$\Delta x \sim \frac{-1}{M \omega^2} \cdot \frac{P(\omega)}{c}$$

L8

How to set up your model?

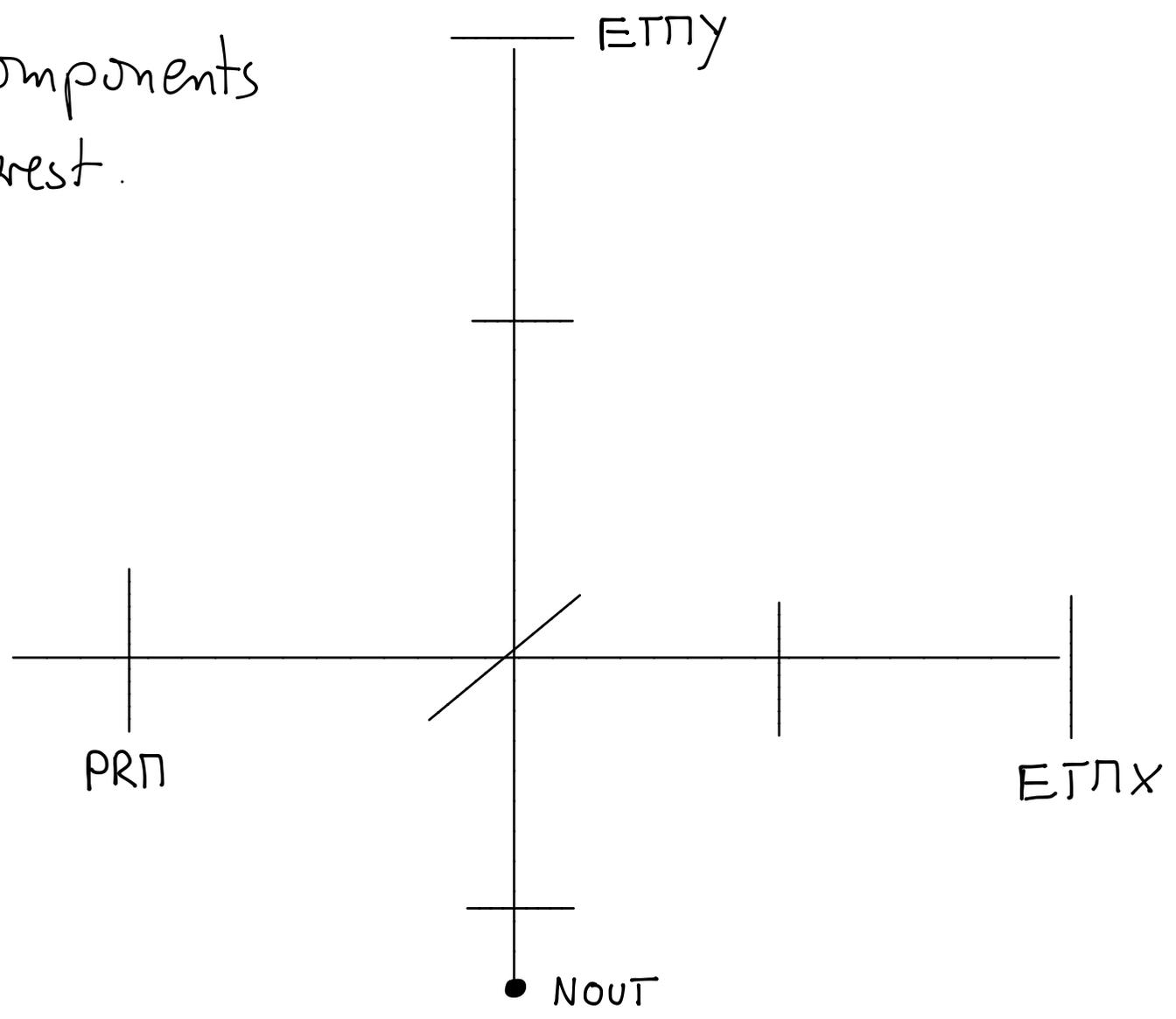
1) draw a sketch !!



L8

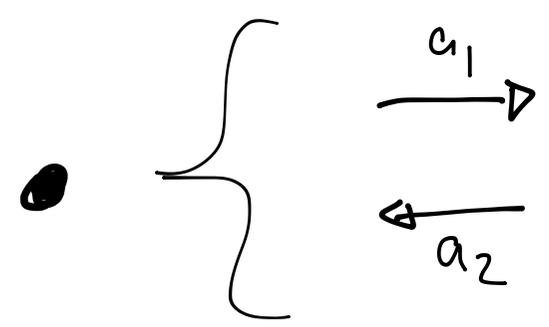
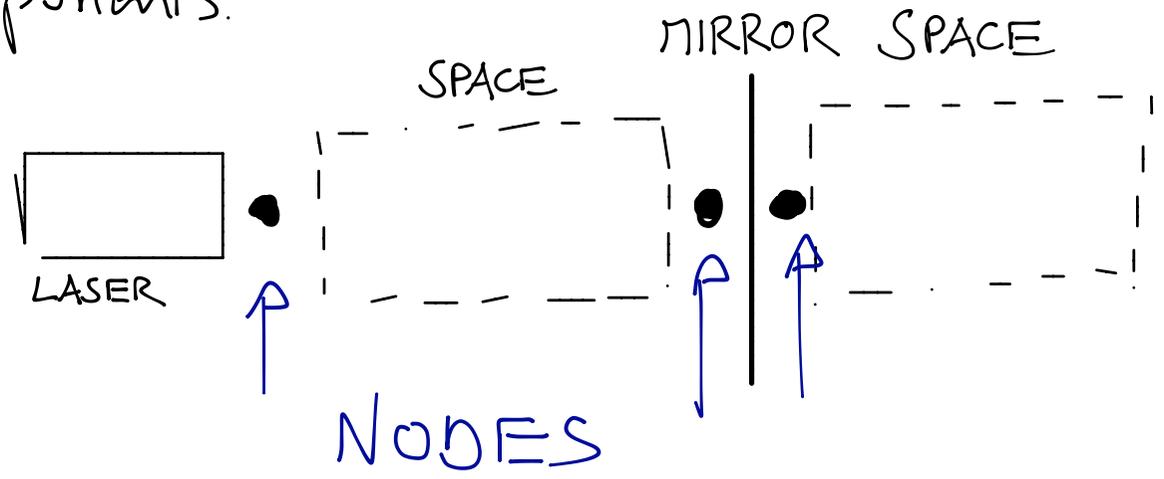
How to set up your model?

2) add names of components and nodes of interest.



What are modes?

Interferometer is composed of several optical components. Nodes are the connection points between components.

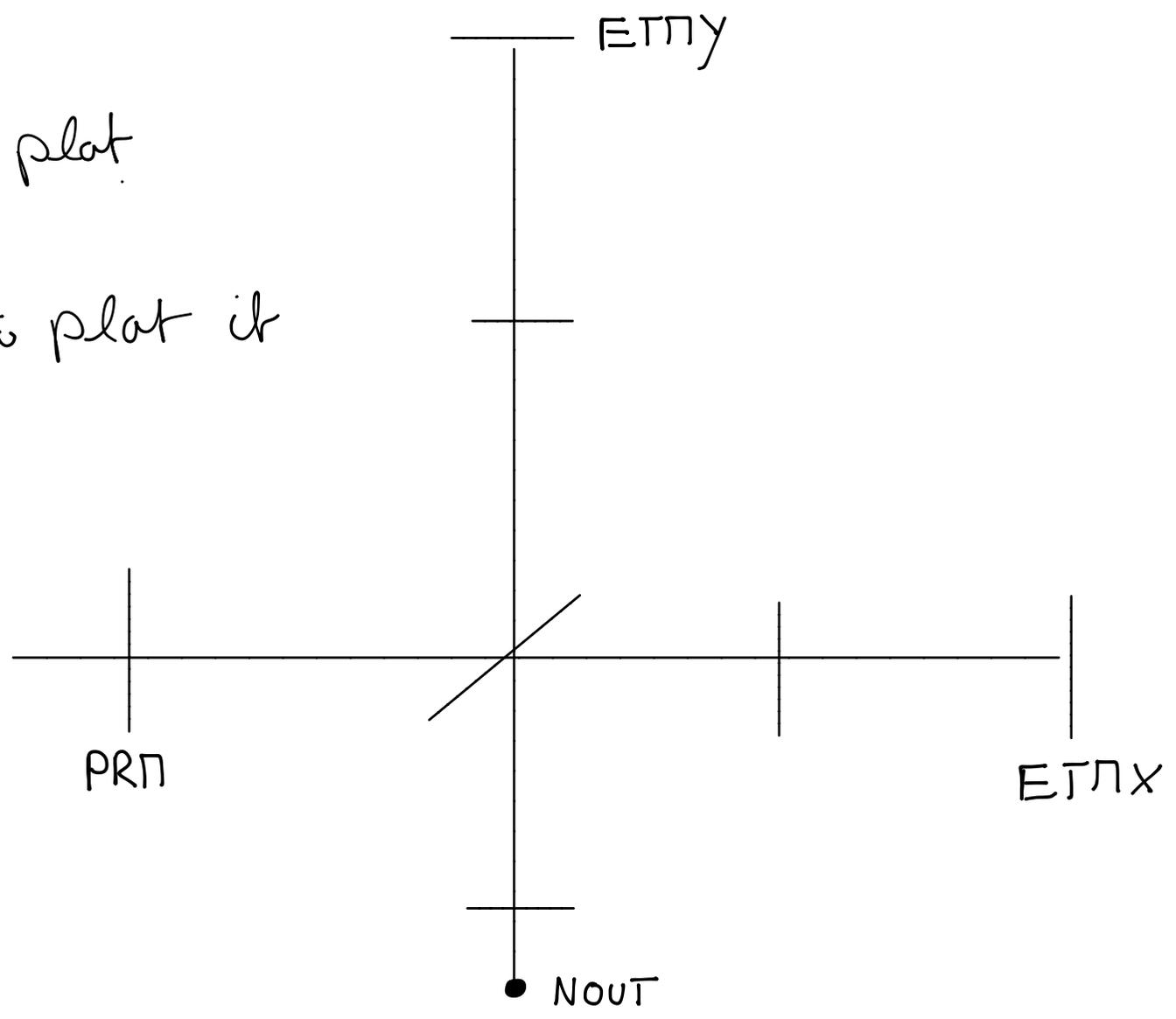


Two fields pass through every mode. The modes are the locations at which the field values are computed / stored.

L8 How to set up your model?

3) define

- what you want to plot (detectors)
- how you want to plot it (x axis)



# Common mode and differential mode

Common end mirror motion

$E_{T\pi X}$  and  $E_{T\pi Y}$  at the same time, same direction

$$\int_{sig} sig | E_{T\pi X} 1 \textcircled{0} 1 \quad \text{Phase of signal} = 0 \text{ for both}$$

$$\int_{sig} sig | E_{T\pi Y} 1 \textcircled{0} 1$$

Differential motion:

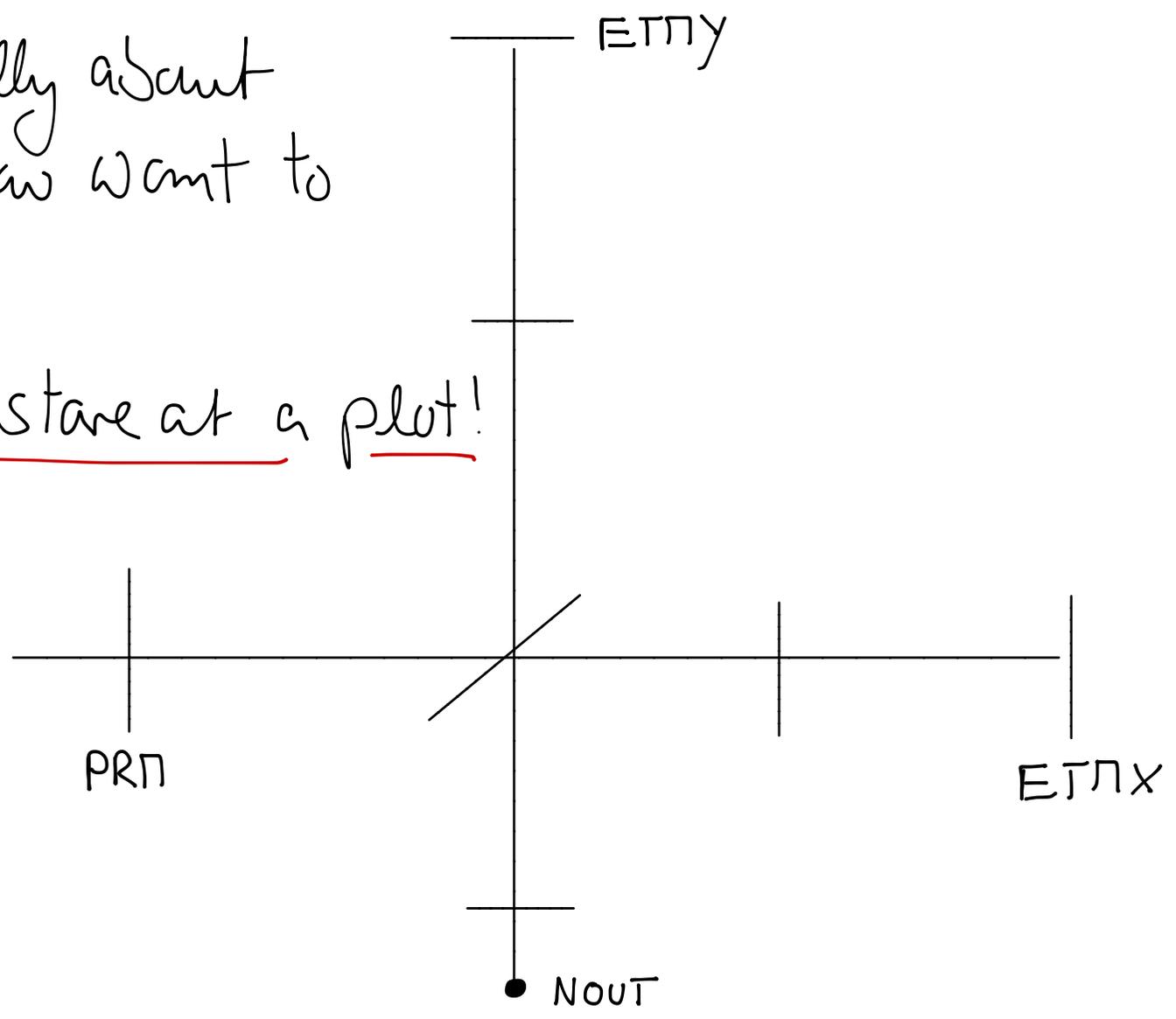
$$\int_{sig} sig | E_{T\pi X} 1 \textcircled{0} 1 \quad 180 \text{ deg out of phase}$$

$$\int_{sig} sig | E_{T\pi Y} 1 \textcircled{180} 1$$

How to set up your model?

4) Think carefully about the question you want to answer!

Do NOT just stare at a plot!



Remark :

Comparing different optical setups is tricky.

In our case make sure that the power in the arm (at  $E_{Tx}$  or  $E_{Ty}$ ) is always the same.

For example, if you change a reflectivity  $R$ , you often have to adjust the laser power to compensate.

## Summary:

- draw a sketch
- name important nodes and components
- think of the simulation as a plot (x and y-axis)
- pose a specific question before you plot anything!