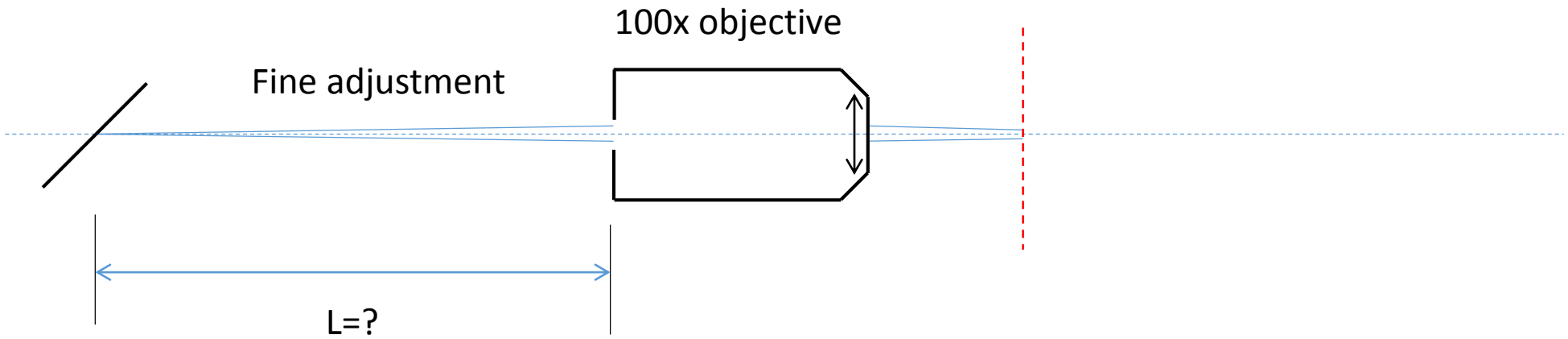
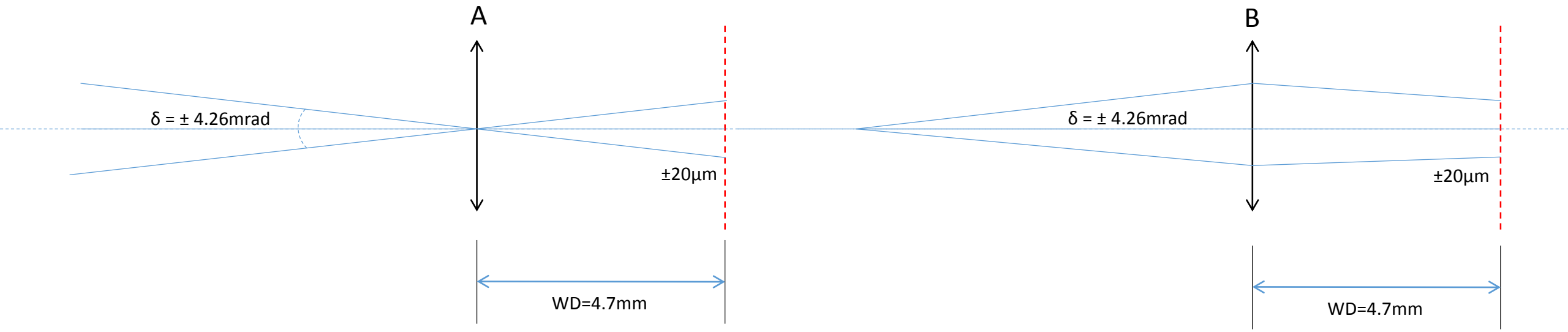
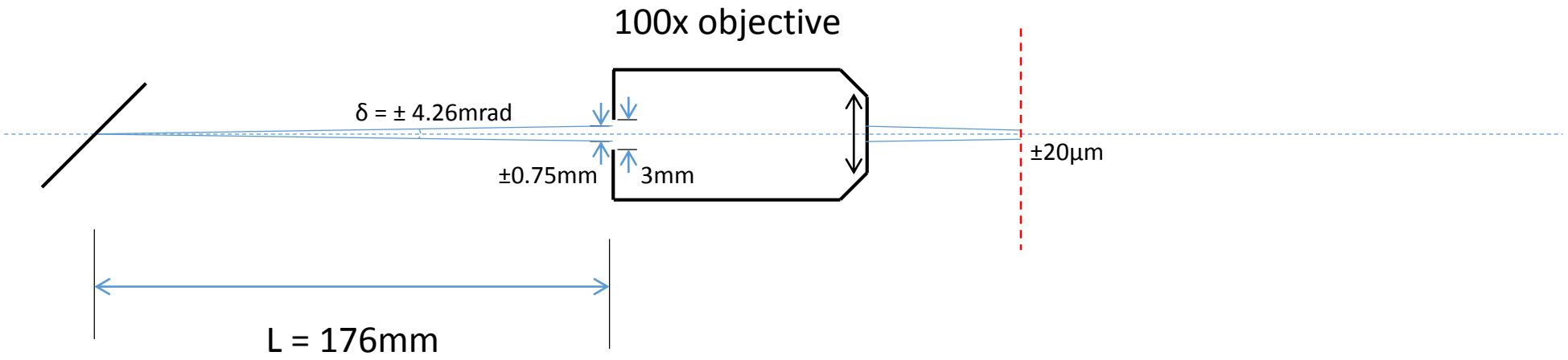
For coarse adjustment we definitely need two mirrors. For the fine adjustment, now I’m trying to calculate how the distance L between mirror II and the objective should be, so that the beam spot can move freely in a 40µm x 40µm range by rotating only one mirror.

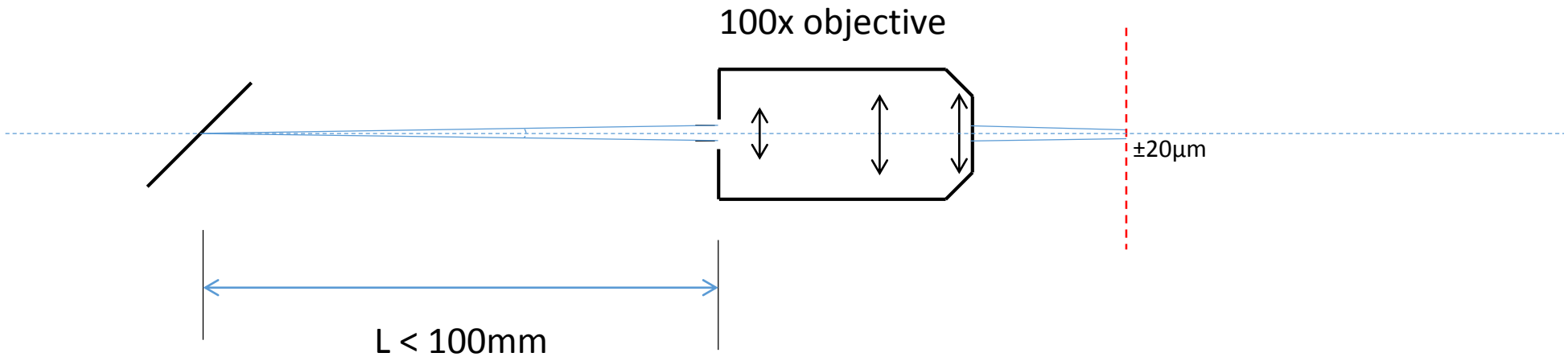




Suppose the beam is paraxial, then the beam spot on the canvas is only dependent on the incident angle. For a 40μm x 40μm beam spot range there is a corresponding incident angle range δ. For setup A, δ = ±20μm/4.7mm = ±4.26mrad. Setup B will have the same beam spot range if the incident angle range is the same as A.

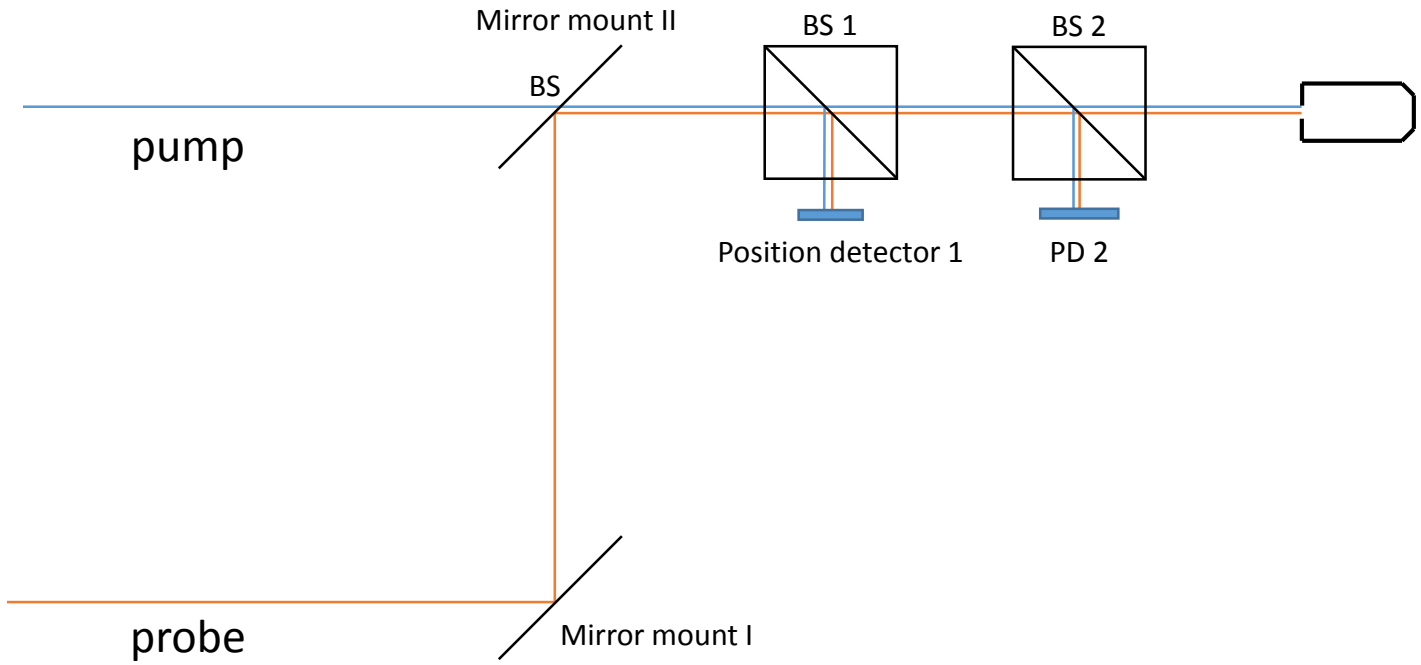


The aperture size of the 100x objective is about 3mm. Now try to calculate the distance L between the mirror and aperture, so that the incident angle range from the mirror is also δ = ± 4.26mrad. The beam spot range on the aperture is considered to be ±0.75mm, then it will always be in the 3mm aperture and be paraxial. Then L = 0.75mm/4.26mrad = 176mm. A distance smaller than that will work.

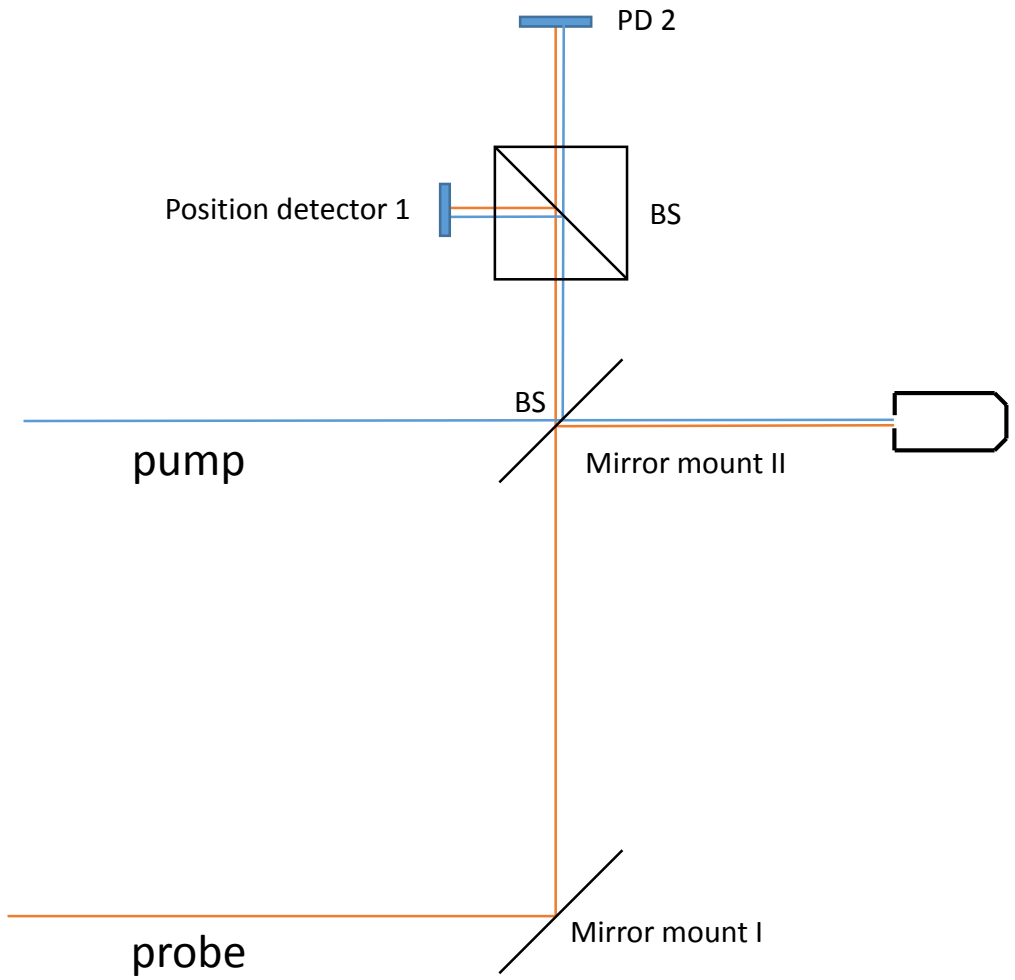


If consider the effect of other lenses in the objective, the longest distance allowed will be smaller than L=176mm because the beam will be more concentrated and incident angle on the last lens will be greater than the angle from the mirror. Maybe less than 100mm will be safe. (This distance on THz 1 can be 40mm so I guess it's enough for the one-mirror-fine-scanning setup, with ±20μm range.)

For the coarse adjustment, one way to automize it is to use a beam stabilizer setup. The goal of adjustment is to make the probe and pump beams parallel. In this setup the two beam splitters and position detectors are like a pair of irises. Probe laser can be adjusted by beam walking. If the pump and probe laser are on the same positions on the position detector, they are parallel to each other.



The problem with the previous setup was that, the last motorized mirror should be close to the objective so there might not be enough space for the beam splitter. In this case we can put the beam splitter on the mirror positions, as shown below.



The position detector can be replaced by a piece of paper, and beam can be adjusted manually, because the space is quite limited for THz 1 setup.

For THz 2, I'm thinking if we can make fine adjustment on the Jenis cryostat position, then coarse adjustment on the beams won't be needed, and fine adjustment can be done by the objective and mirror mount II.