1. we have tried to use topo4 and topo10 to make correlation. They have different size, the size of topo4 is (512, 512) and the size of topo10 is (256, 256). And we find it is not good to use topo with different size. Because during the correlation, we need to decrease the pixel points in topo4, we think it may introduce artefacts.
2. So then we try to use topos with same size, such as topo7, topo8, topo9, topo10.
3. And then we start to make correlation, and by using the program of Pro.Heintzmann, we find that if we do correlation automatically, only topo9 and topo10 are good. And for topo7, and topo8, the correlation is bad. I do not understand very well about the mechanism behind the correlation even I could read every sentence of the program. But I feel the correlation made by using nip is trying to link the pixel with same intensity together, (I do not know how to express that). So if the intensity of topo changed a lot, the automatic correlation will be invalid.
4. There are also a function in program that we could set marker by ourself and let the computer compare them and then get the shift. This will solve the automatic correlation program. So I have tried set the marker on topo7 and topo8 by hand many times, and finally I think I find the best shift we should set to realise correlation. Then I apply these shifts on corresponding PiFM images, the result seems quite better and before. But not perfect. For this I think because the pixel has a minimum size, so it is hard to make the center of the pixel of PiFM images overlap perfectly with each other if we have a not good detecting process. So we only use topo9 and topo10 to do some image processing stuff.
5. After auto-correlation precess, we get the shift from topo9 and topo10 and then apply them on corresponding PiFM image. Luckily we get a pretty good result.
6. Then we try to use these two images to get some useful information.
7. We get the slope from reference topo images, here topo9, and we find the slope from it, we know the radius of needle is 7nm, so the diameter of needle is 14nm, and for 1 pixel, it is 4nm, so we use 3 points to match with it. And find increase slope and decrease slope on reference topo first. And then we could find the corresponding points on PiFM images, because we deduce the big slope on topo should have a corresponding point PiFM.
8. And we do get a lot points from PiFM image and we find a lot of points match exactly with the points we expect. And some have a small shift(1 pixel), we figure this one is reasonable because there is no perfect correlation. Only few points have shift more than two pixels.
9. Then I try to draw the position of all these points on a 2D figure.
10. And I got three new images from Dr.Daniela, and I applied same method to get a position fugure like (in 9), but topo11 seems rotate a lot, when we choose topo 8 as reference. I cannot deal with it and for another one topo8, compared with topo9, topo8 has a small rotate also. But small compared with topo11. So I think in our problem, correlation matters a lot.