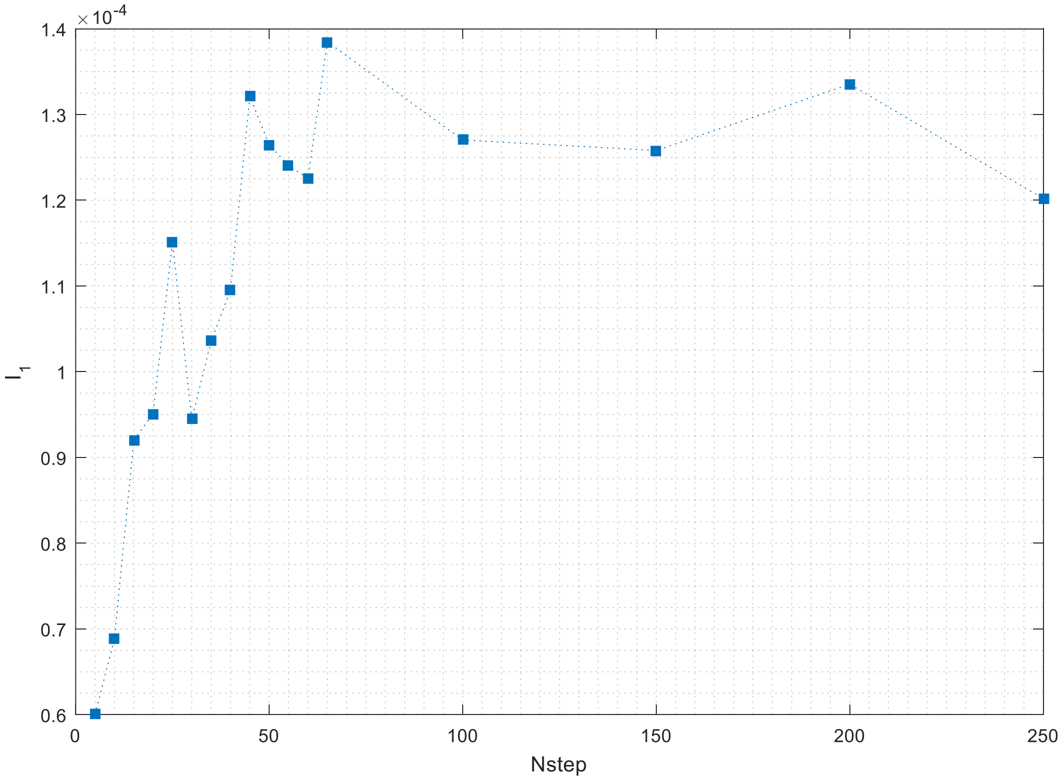
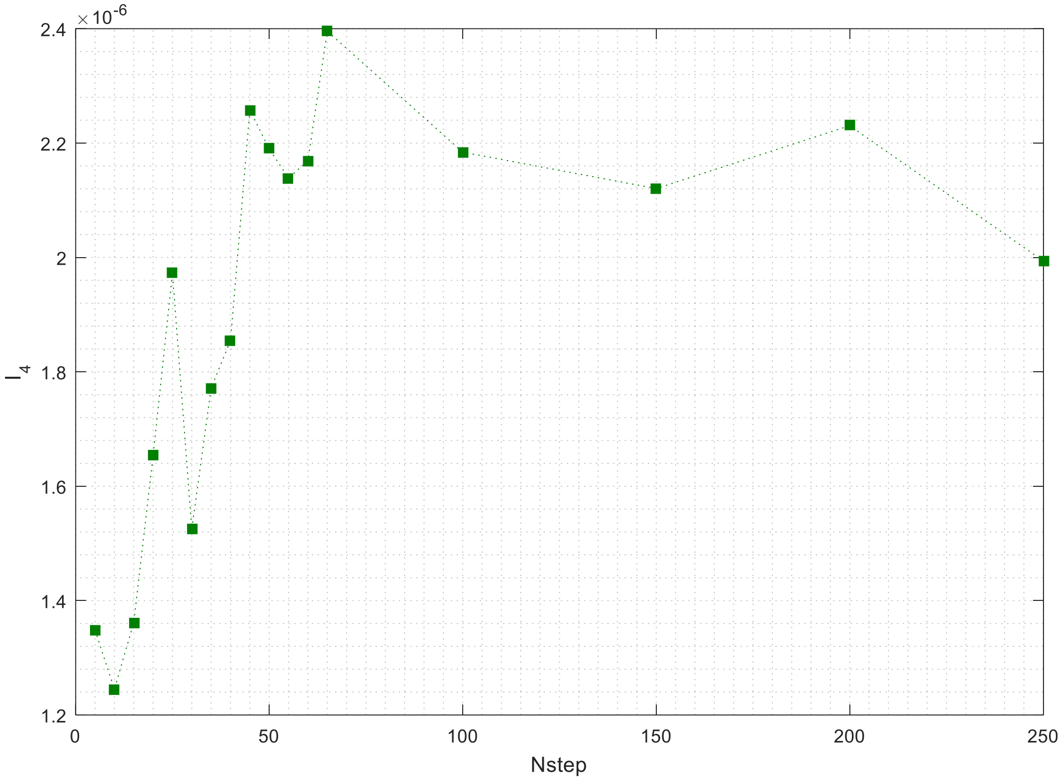
RadIntegral Debug

Lattice: ILSF storage ring lattice include one horizontal wiggler. (SR_02_01)

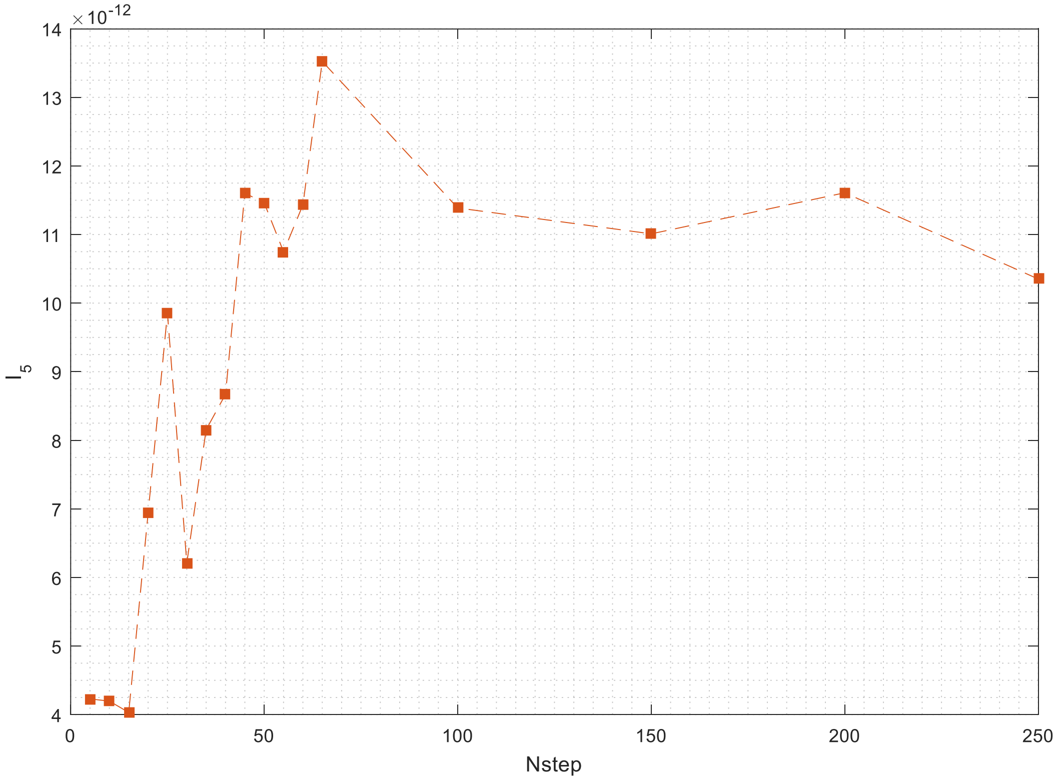
First Guess: Convergence issue

Radiation integrals computations are based on numerical integration, so the Integration interval which is equivalent to Nstep*Npole can affect the accuracy of the results. Therefore, I scanned the Nstep to find the convergence threshold of the results. The I2 and I3 integrals are independent of dispersion so the variation of Nstep doesn't change them. The following figures show the variation of I1, I4, and I5 with respect to Nstep.





×10^-6
2.4
2.2
2
1.8
1.6
1.4
1.2
I_4
0
50
100
150
200
250
Nstep



×10^-12
14
13
12
11
10
9
8
7
6
5
4
I_5
0
50
100
150
200
250
Nstep

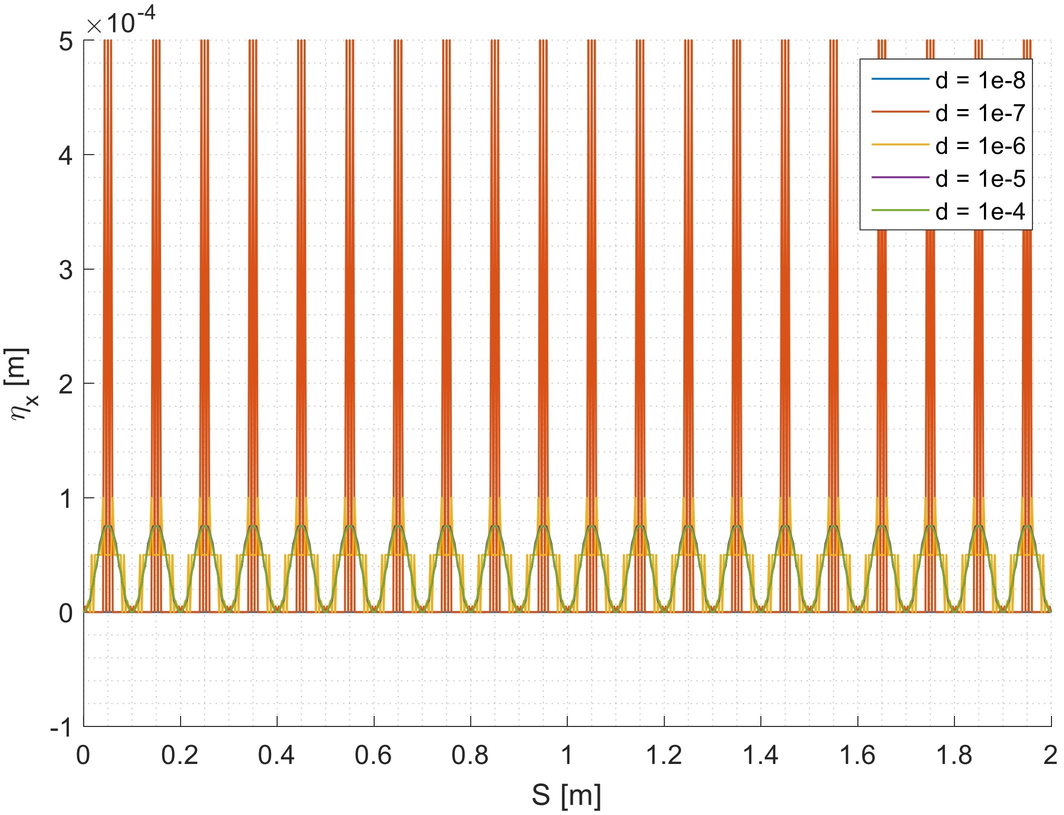
Unfortunately, the results do not converge to certain values even for a large number of Nstep. As a result, there should be a problem with the computation of the dispersion.

Second Guess: Initial value for calculation of dispersion are incorrect

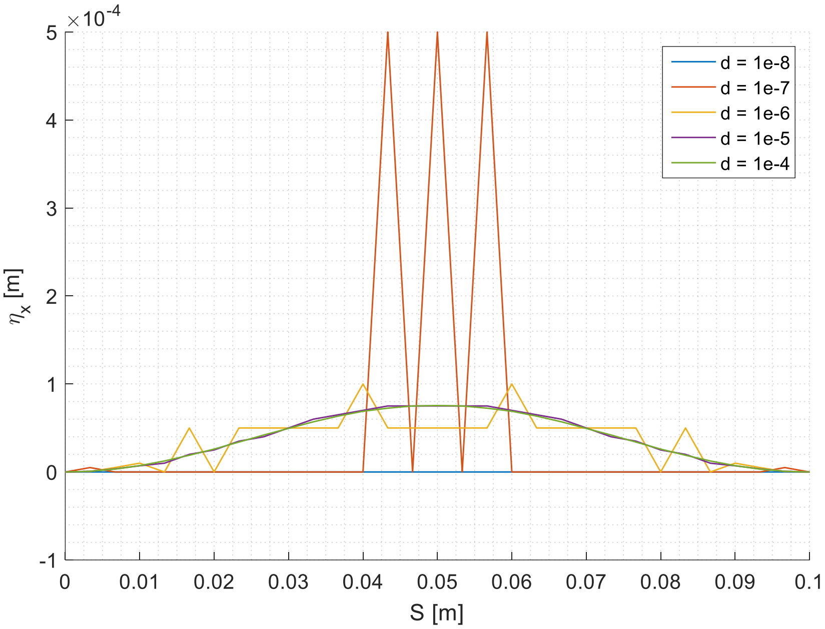
The initial value used for computing dispersion are:

```
d=1e-6;
Oplus =[ d*Dis0(1);  d*Dis0(2);  d*Dis0(3);  d*Dis0(4);  d;0];
Ominus=[-d*Dis0(1); -d*Dis0(2); -d*Dis0(3); -d*Dis0(4); -d;0];
```

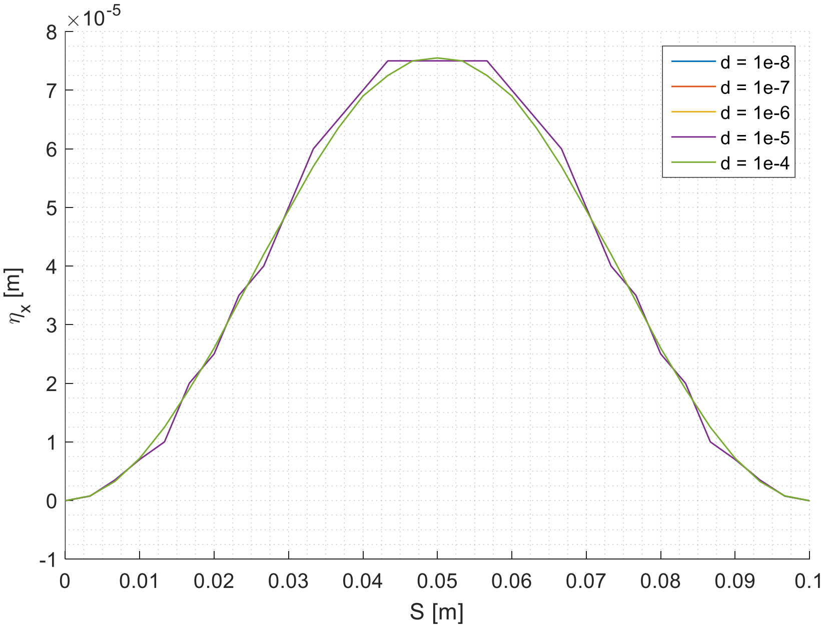
First, I fixed the Nstep on 30 and change the “d” and here is the result:



for more resolution, the x-axis is restricted to one period.

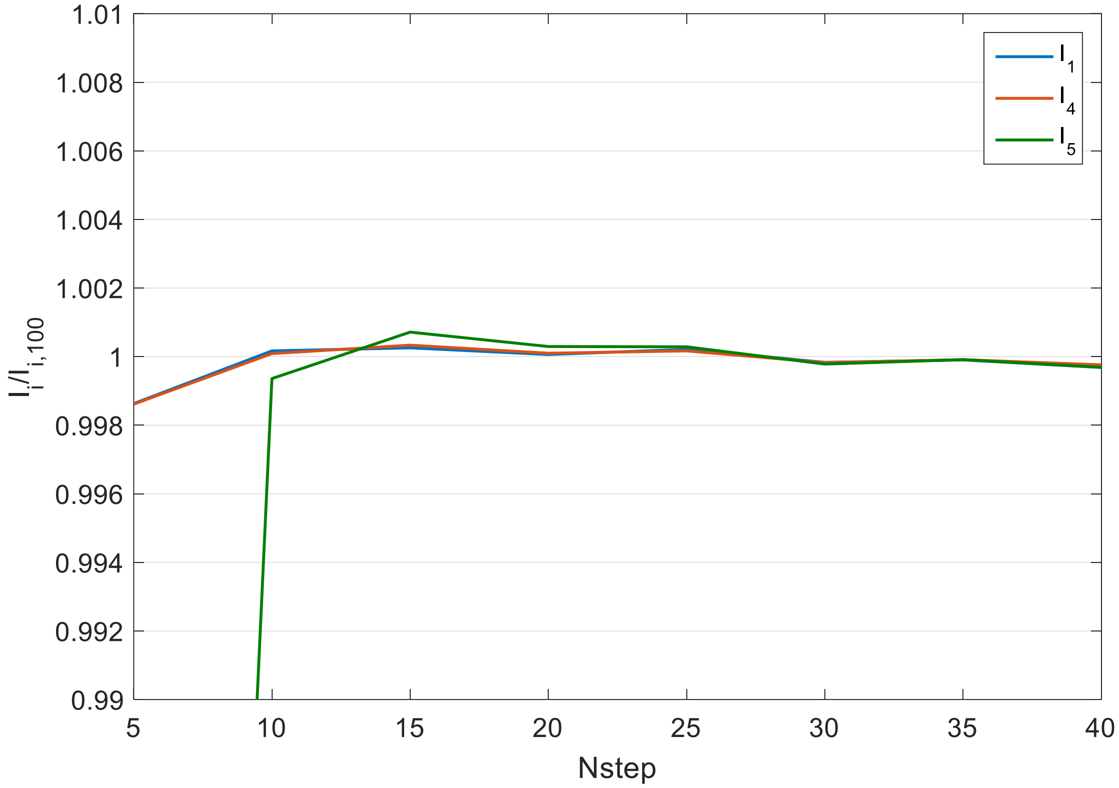


The dispersion for cases d=1e-5 and d=1e-4 seems to be correct. For better comparison, I kept just these two cases.



The dispersion for d=1e-4 is smother and I think it could be a proper choice for "d".

To ensure this choice, I scanned the Nstep again with this new "d".



The result shows that the convergence issue could be solved by choosing Nstep 20 or 25.

Another Bug!

In the previous version of RadIntegral, the dispersion was computed with the Finite Difference Method by using the dispersion at the entrance as a boundary condition in one period of a wiggler. Therefore, the integrals were multiplied by the number of periods (Npole). I forgot to wipe this coefficient in the new version. This bug is fixed now.