Results and Plans for February 2014

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S2E Meeting

DESY

10.02.2014

The plan for last month

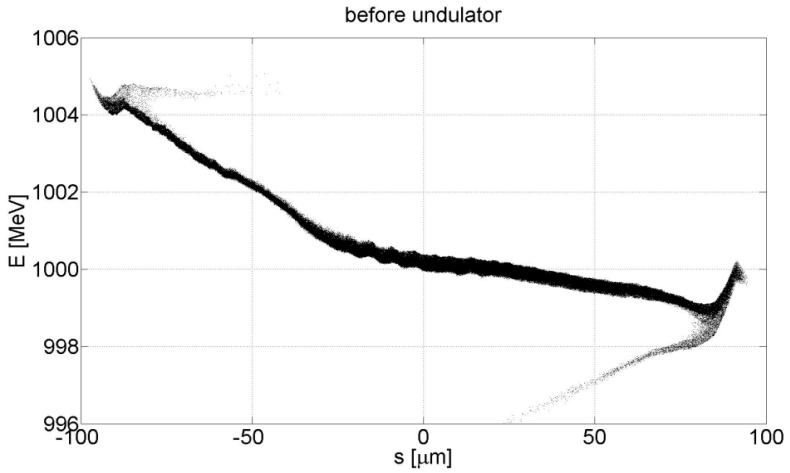
- Internal report of beam dynamics simulations for FLASH II (100%)

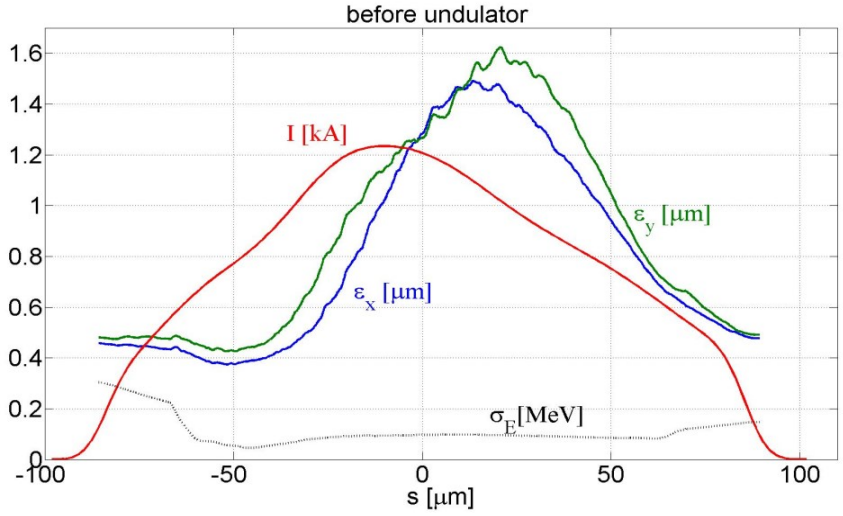
- Radiation calculation for FLASH II HGHG option with Genesis 1.3 (20%)

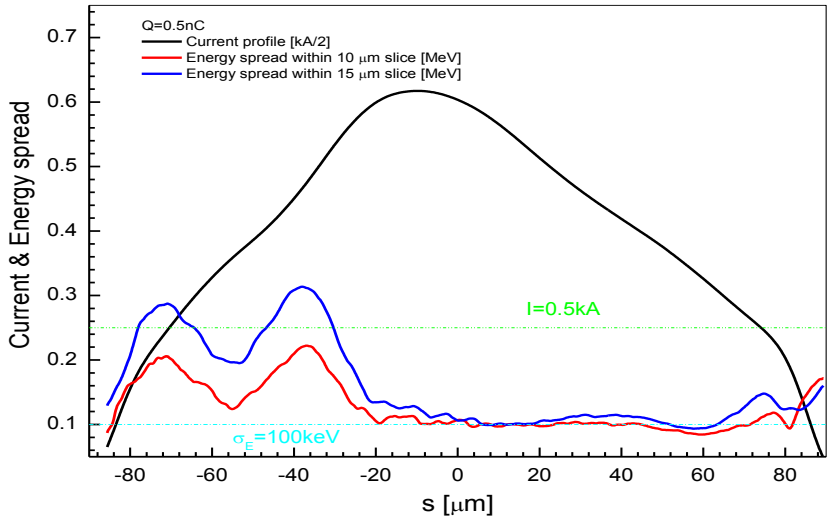
Achieved progress

1. Radiation calculation for FLASH II HGHG option (20%)

Beam properties at the entrance of undulator for 0.5nC





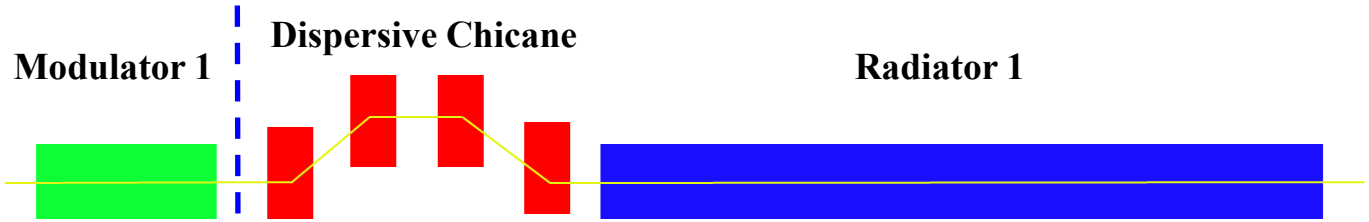


5% bad particles are removed

Energy spread within 15μm and 10μm slice length

Radiation calculation for FLASH II HGHG (Q=0.5nC)

Modulator and Chicane + Radiator are calculated separately with Genesis



Modulator run

1. Integrating through modulator with a seed.

2. Dumping particle distribution

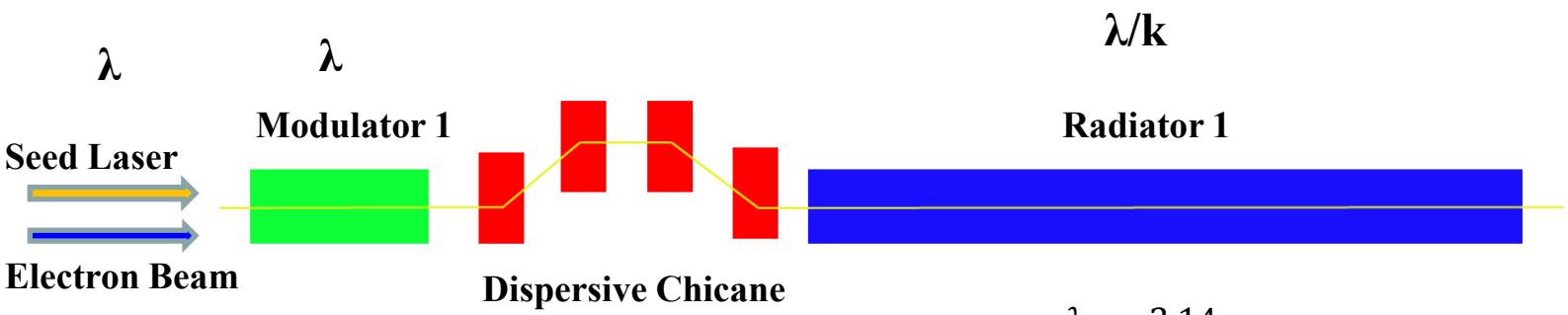
```
$newrun
nbins = 32
nharm = 7
npart = 56448
Idmppar = 1
outputfile='modulator.out'
```

Chicane + Radiator run

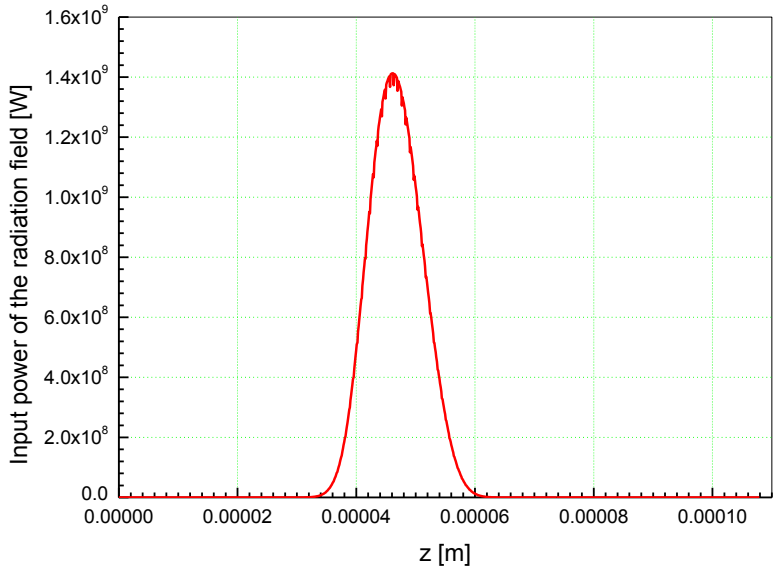
1. **Importing particle distribution.**
2. **Up converting the particle distribution to a higher harmonic.**
3. **Tracking through the dispersive chicane.**
4. **Integrating through the radiator.**

```
 $newrun
partfile='modulator.out.dpa,
convharm=  7
```

Radiation calculation for FLASH II HGHG (Q=0.5nC)



Seed Laser



Chicane defined in Genesis input file

trama= 1
itram11= -0.9924
itram12= -0.0037
itram13= 0.000000D+00
:
:
:
itram66= 1.000000D+00

Radiation calculation for FLASH II HGHG (Q=0.5nC)

Just a calculation. No parameters optimization for the modulator and radiator.

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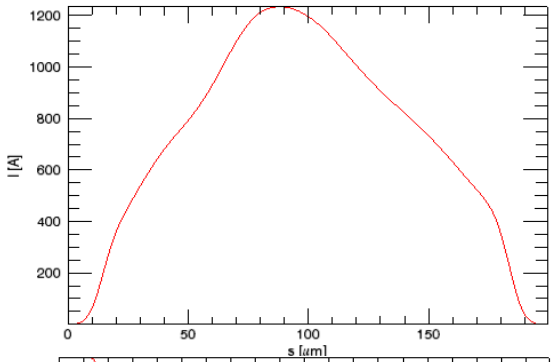
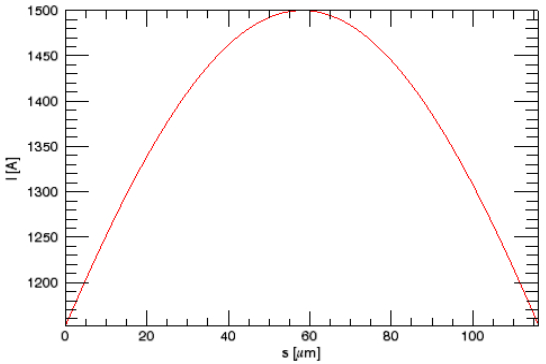
Radiation calculation for FLASH II HGHG (Q=0.5nC)

CASE 1: With particle distribution file genereted from Astra simulation

CASE 2: Using beam parameters definition in Genesis main input file

Current profile

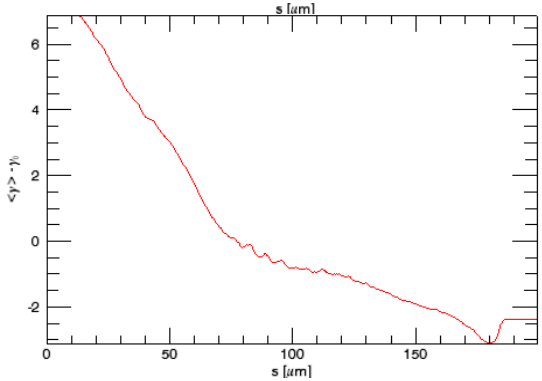


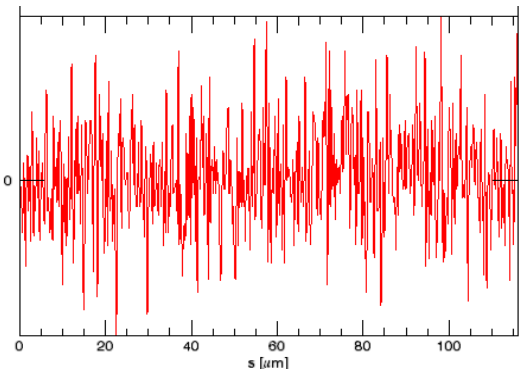


Gaussian distribution

$\sigma_s = 80$ μm

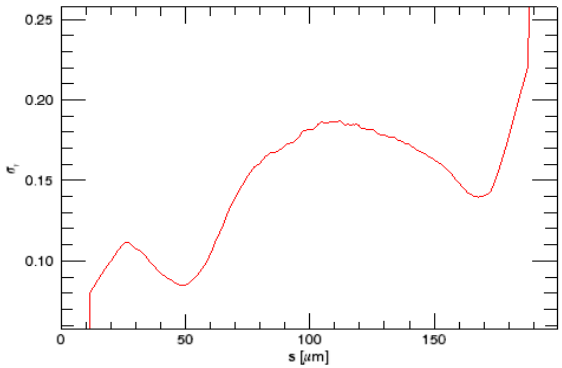
Initial energy distribution

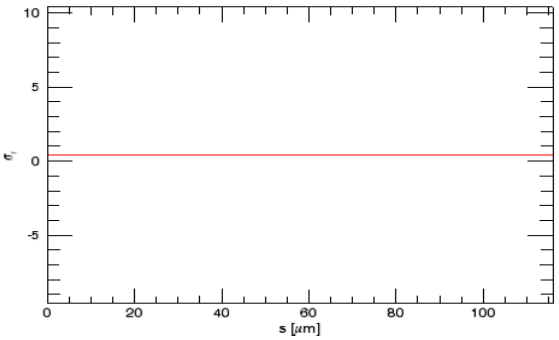




no energy chirp

Initial slice energy spread

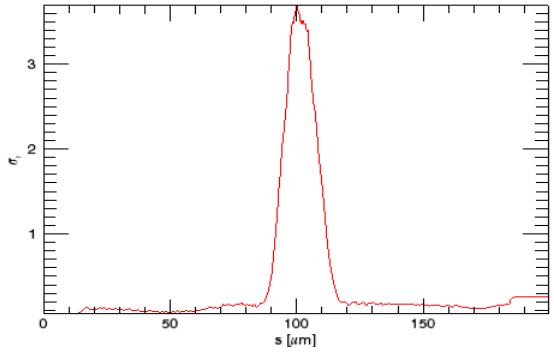


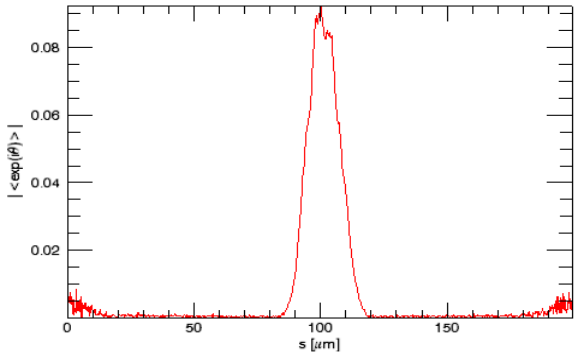


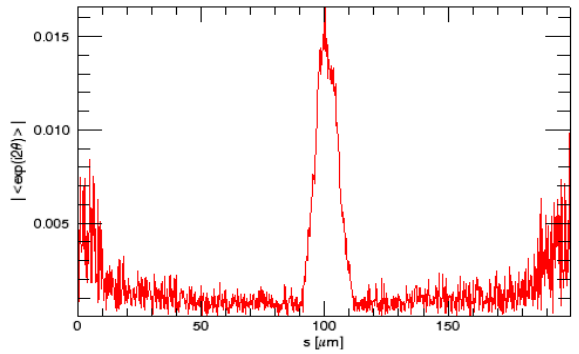
$\sigma_\gamma = 0.4$

Modulator calculation for FLASH II HGHG (Q=0.5nC)

CASE 1





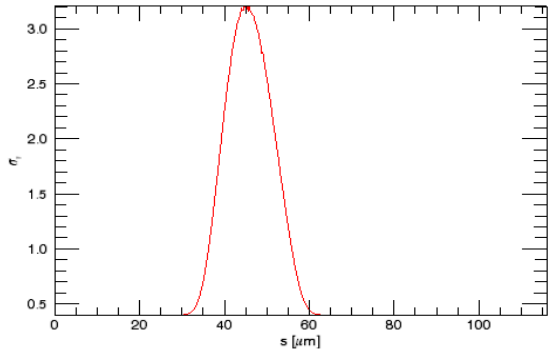


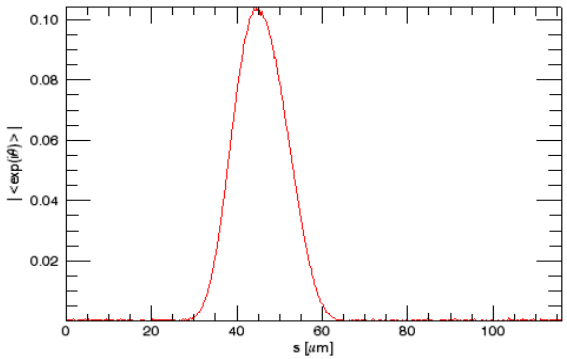
Energy spread after modulator

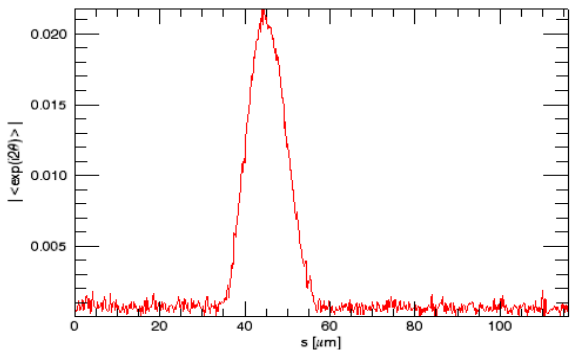
Bunching at fundamental after modulator

Bunching at 2nd Ham. after modulator

CASE 2

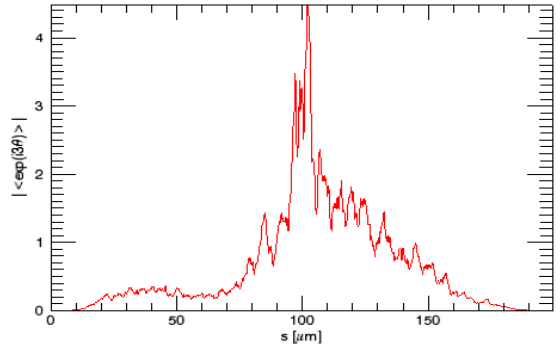




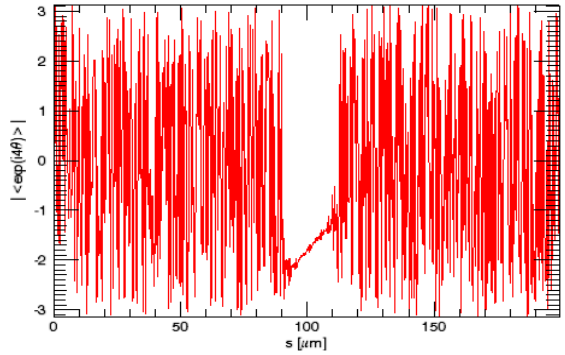


Modulator calculation for FLASH II HGHG (Q=0.5nC)

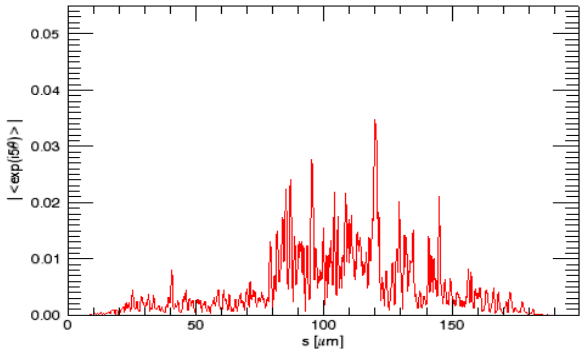
CASE 1



Bunching at 3rd Ham. after modulator

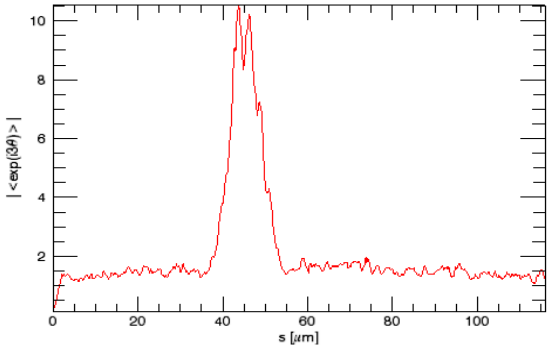


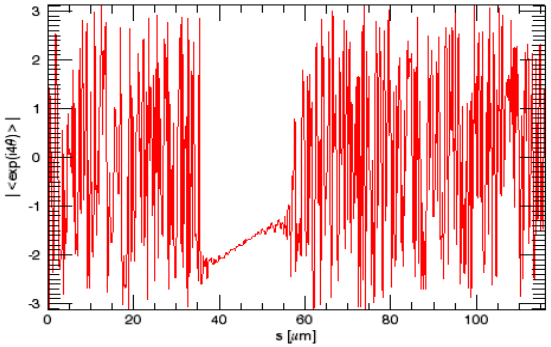
Bunching at 4th Ham. after modulator

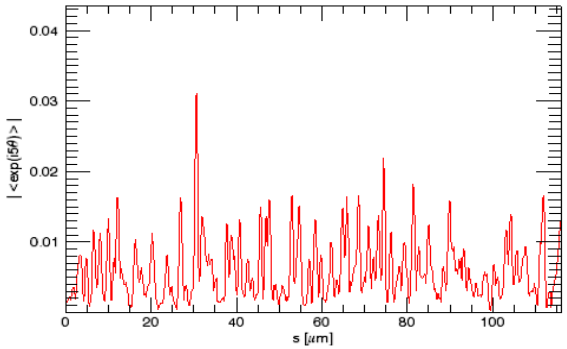


Bunching at 5th Ham. after modulator

CASE 2



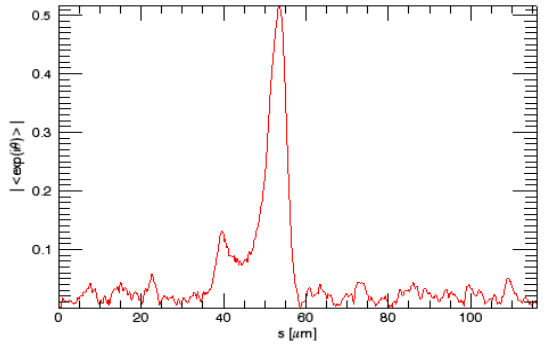




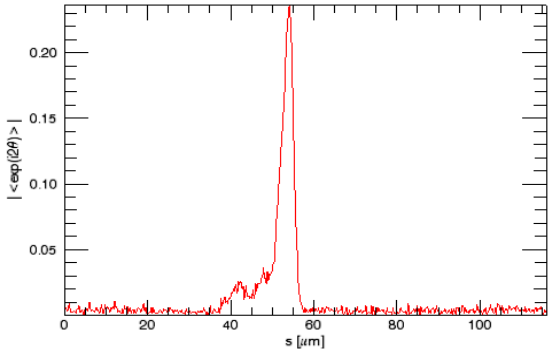
Radiator calculation for FLASH II HGHG (Q=0.5nC)

CASE 2

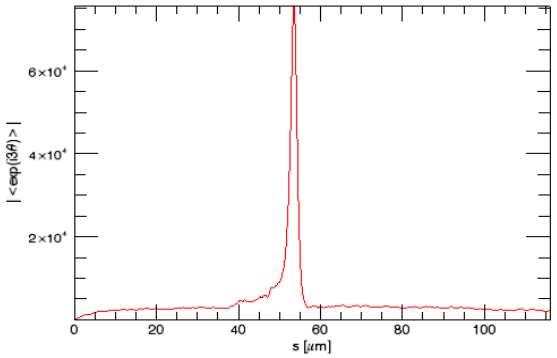
Bunching at fundamental



Bunching at 2nd Ham.



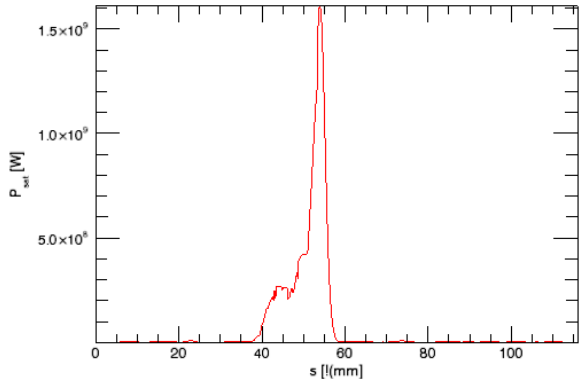
Bunching at 3rd Ham.



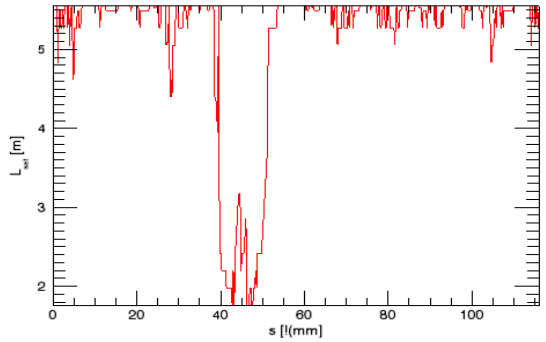
Radiator calculation for FLASH II HGHG (Q=0.5nC)

CASE 2

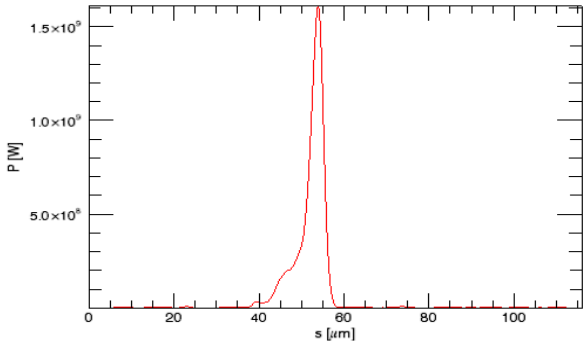
Saturation power



Saturation length



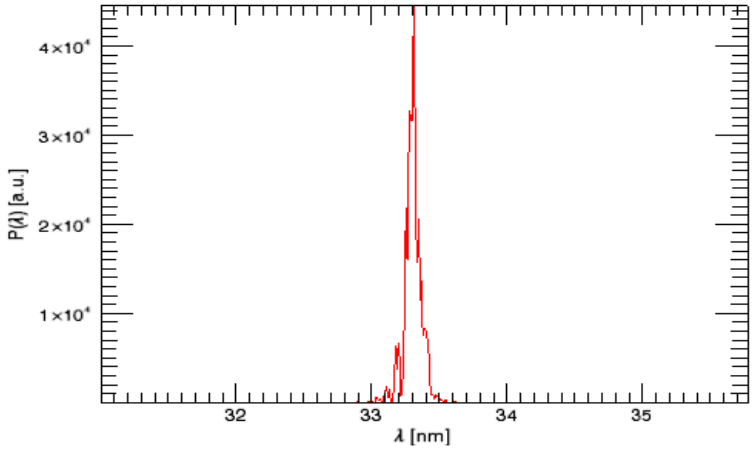
Radiation **power**



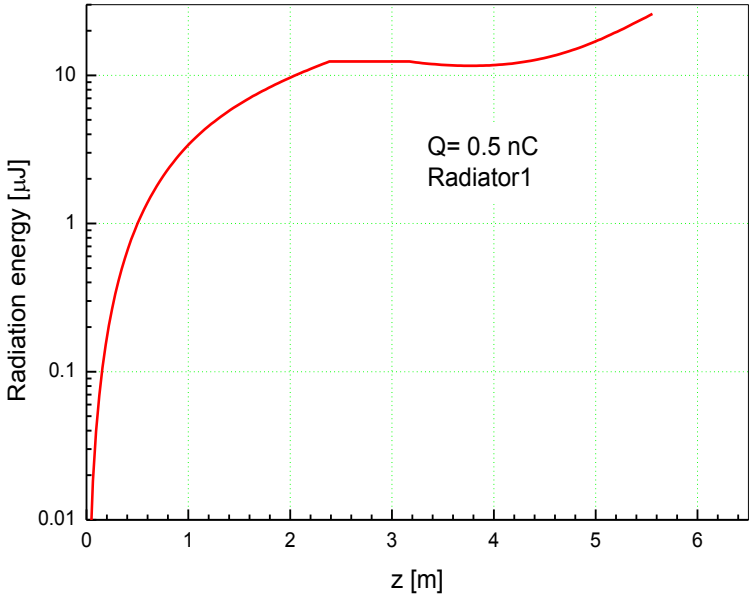
Radiator calculation for FLASH II HGHG (Q=0.5nC)

CASE 2

Spectrum



Radiation Energy



The plan for this work

1. Parameters optimization for modulator and radiator.

2. At the end of modulator 1, doing particle distribution conversion from Genesis output to CSRTrack with matlab script.

3. Writing a CSRTrack input file for the dispersive chicane and doing calculation including CSR impact.

4. Importing particle distributions for Genesis calculation for radiator 1.

5. Integrating through the radiator 1.

6. Radiation calculation for different bunch charge cases.

7. Cascaded HGHG calculation (Modulator1 + Dispersive chicane + Radiator1 + Fresh bunch chicane + Modulator2 + Dispersive chicane + Radiator 2)

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