Calculation of 2D Synchrotron radiation wall flux for ILC damping rings

Kiran Sonnad

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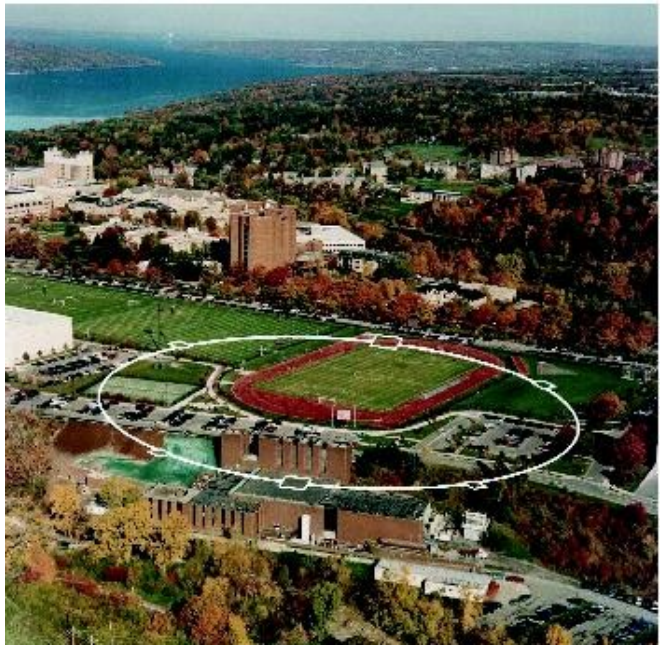
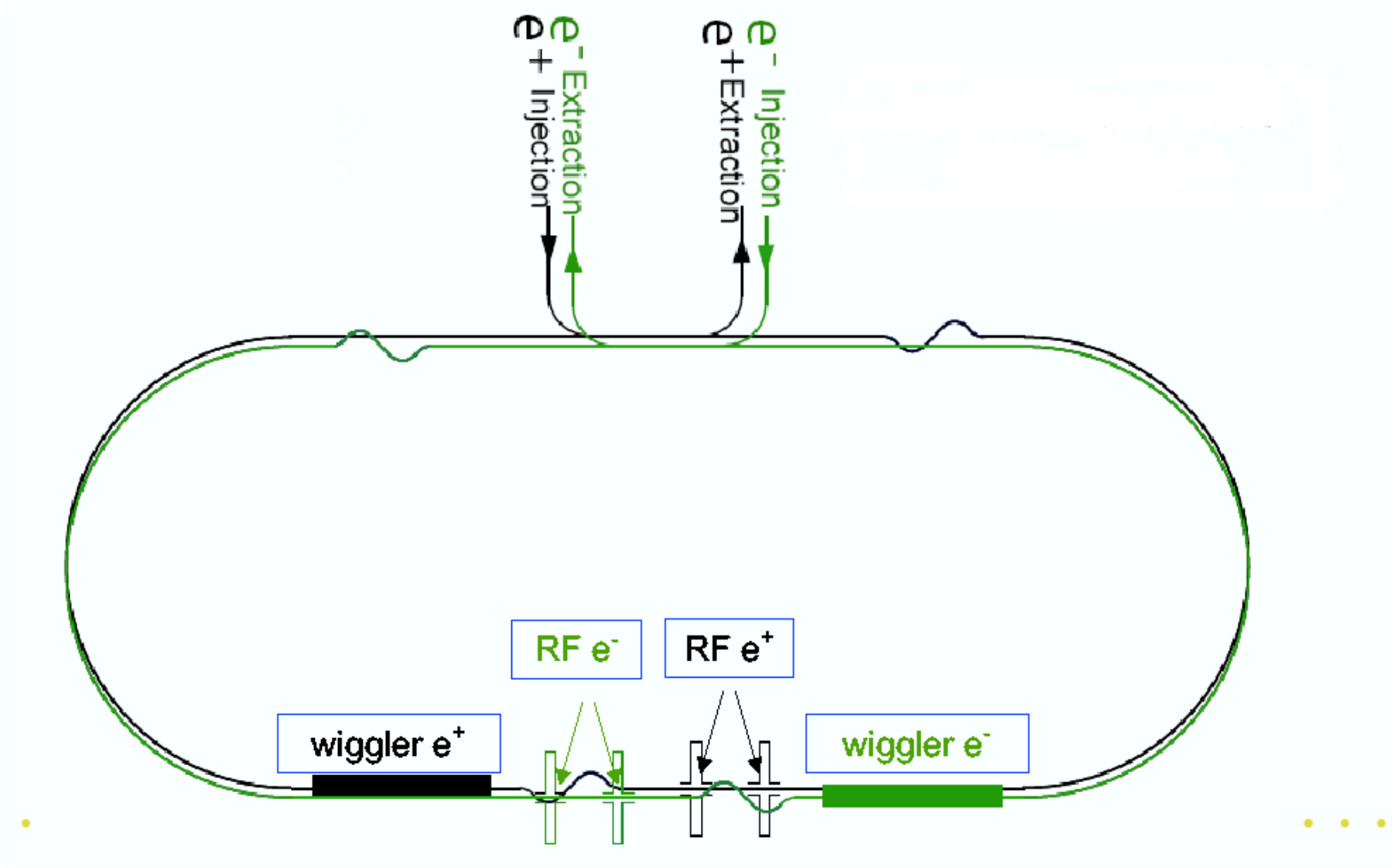


Introduction

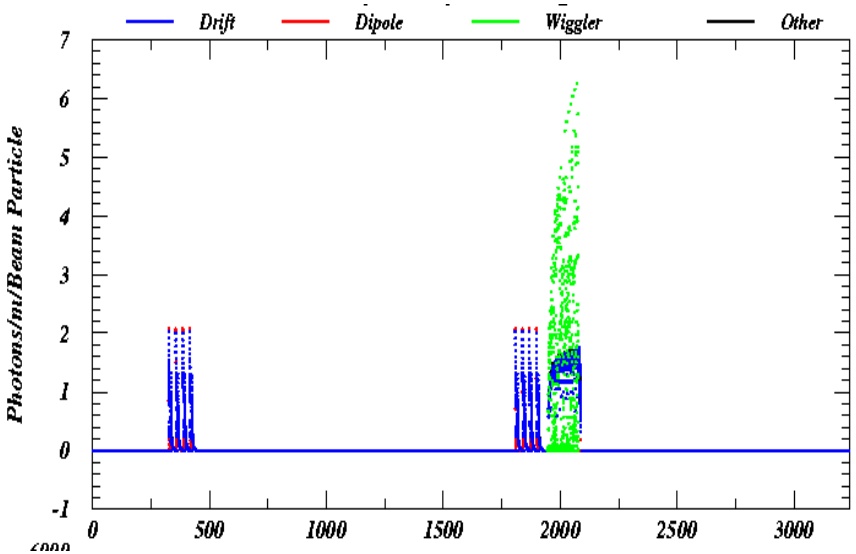
- Using the 2D version of SYNRAD, program developed by David Sagan.
- Augmented by post processing and data analysis programs developed by Jim Crittenden
- Uses Bmad to determine magnet element (type and strength) and beam size at each segment.
- Calculates photon flux and power impinging upon each segment of the chamber wall.
- 2D version calculates photon flux rates in the horizontal plane – along -ve and -ve *x*.
- A 3D version of SYNRAD is avaliable – currently calculations are being made for for CesrTA by Gerry Dugan.

Layout of 3.2 and 6.4 km rings

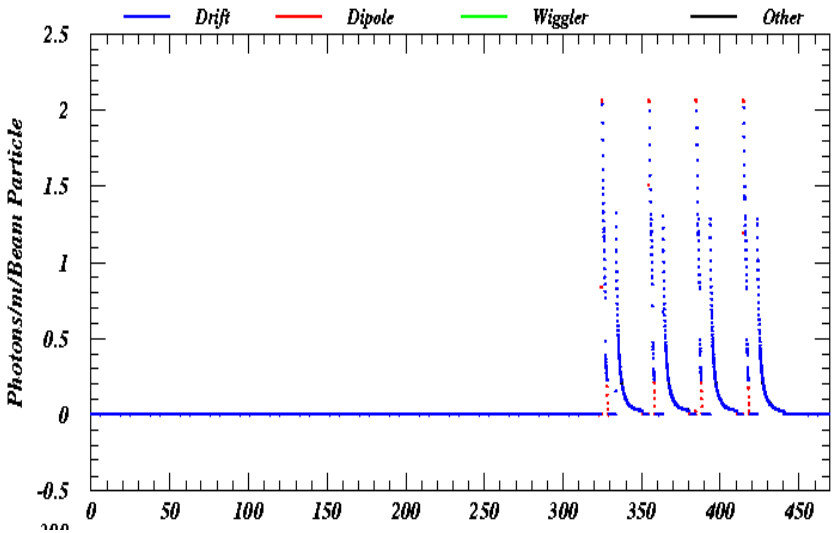


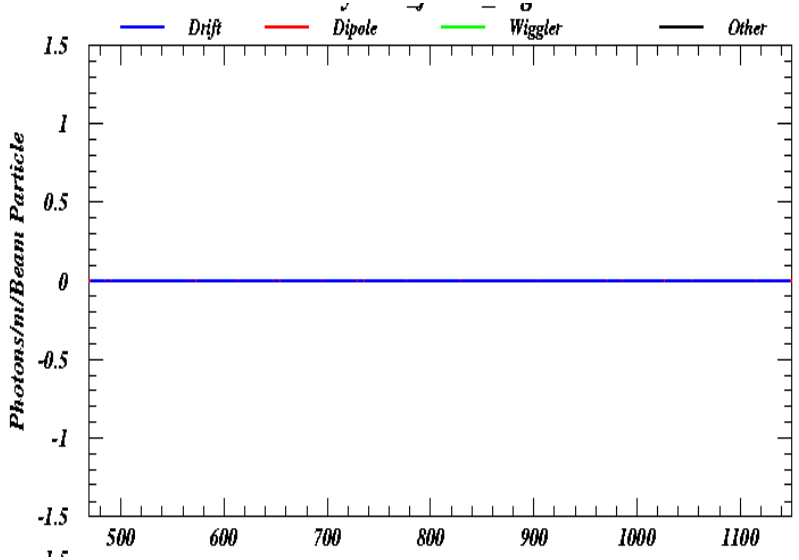
3.2 km DSB3 lattice (-ve side)

- No photons from straight sections.
- No photons from regular bends along -ve x.
- Photons produced in Wiggler and S - shape bends along -ve x.

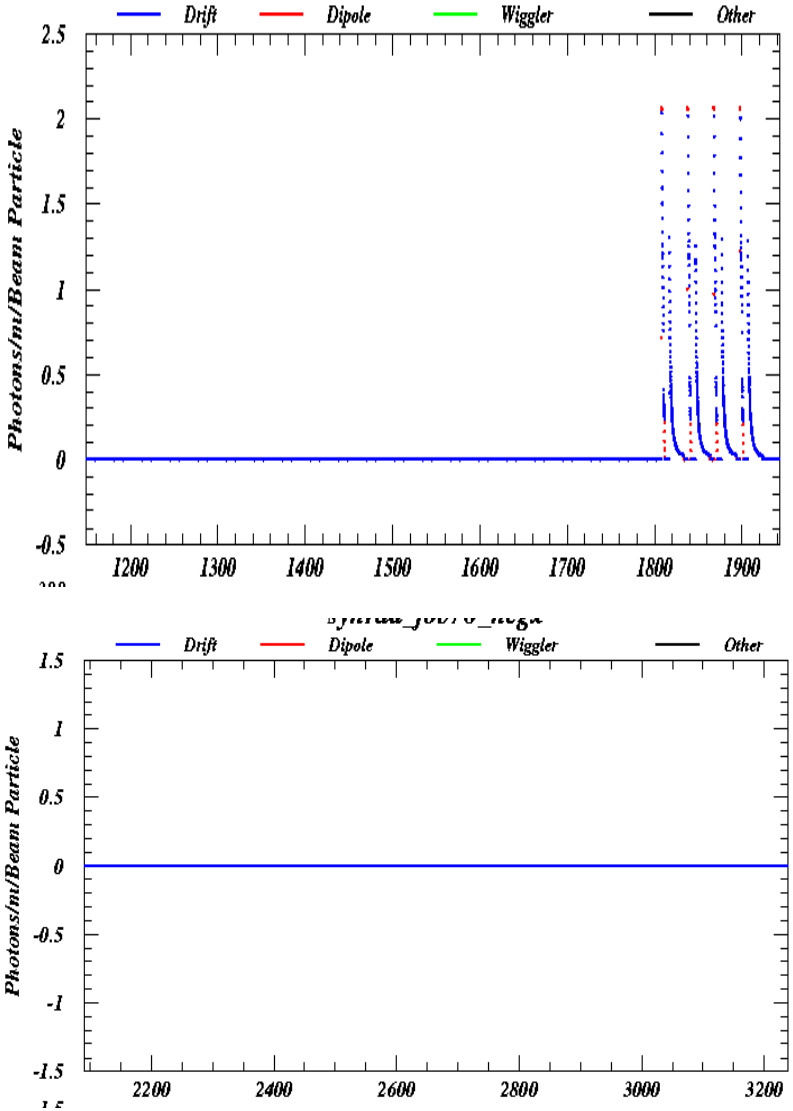


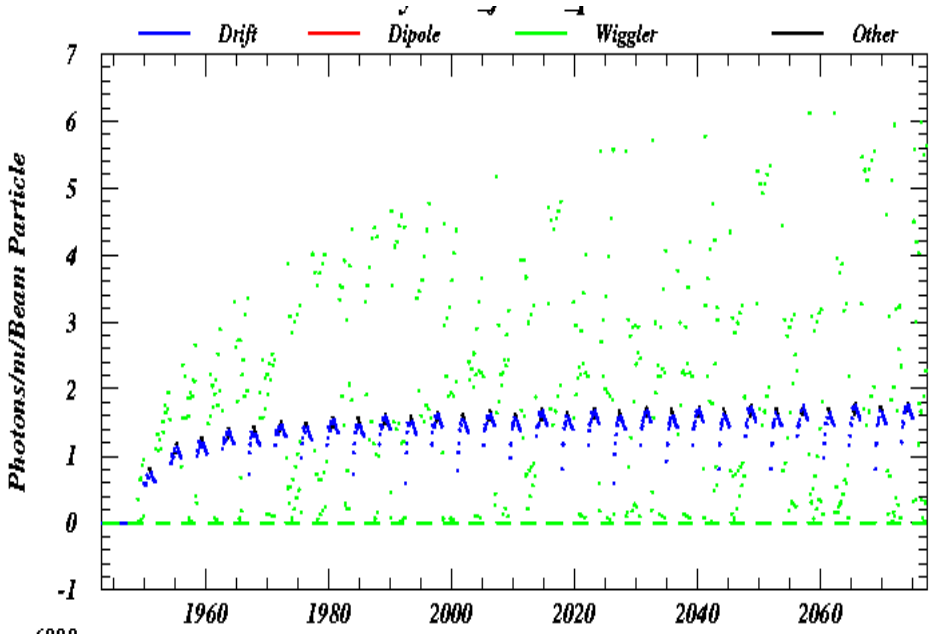
Along whole ring





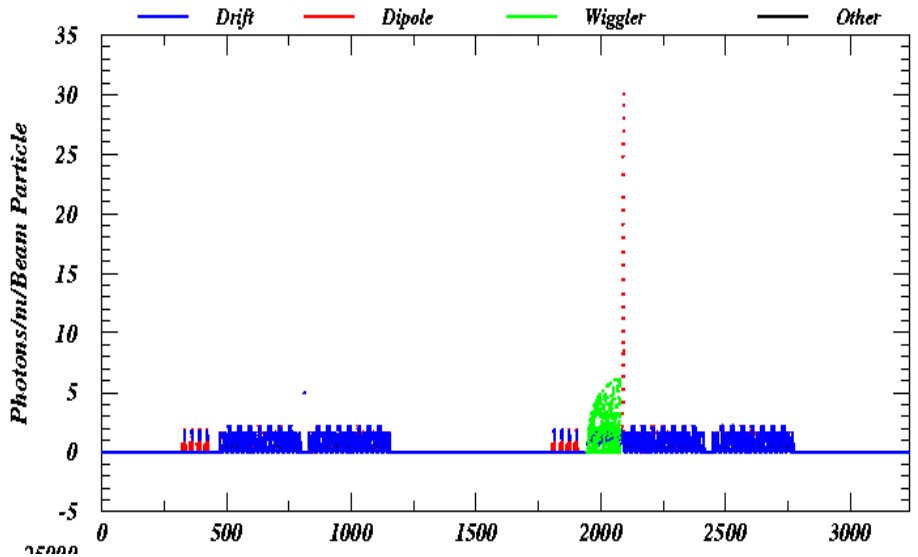
DSB3 -ve side continued

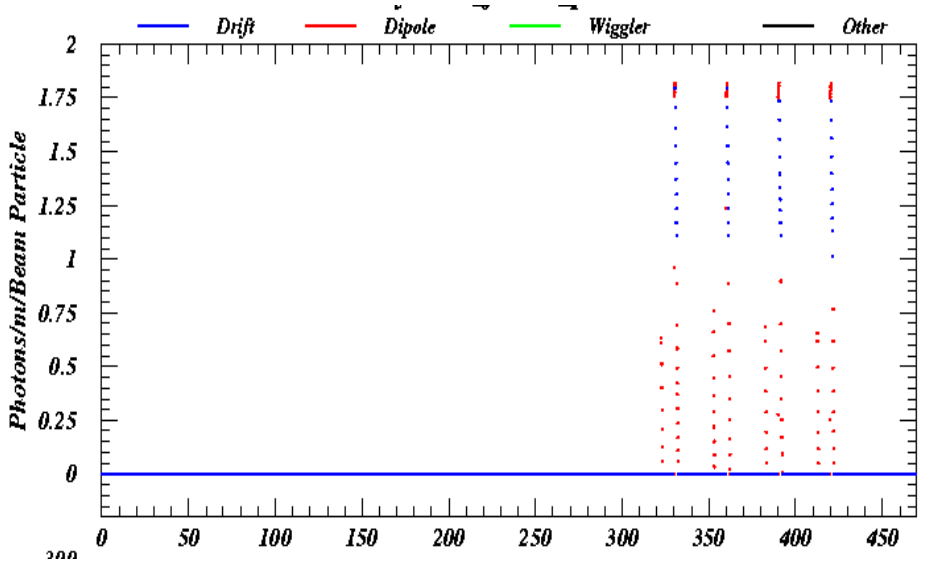


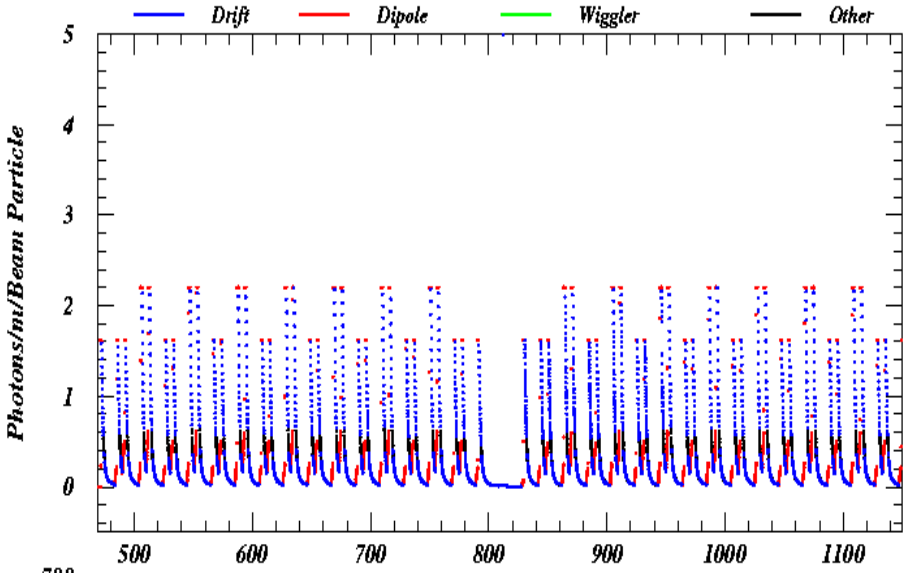


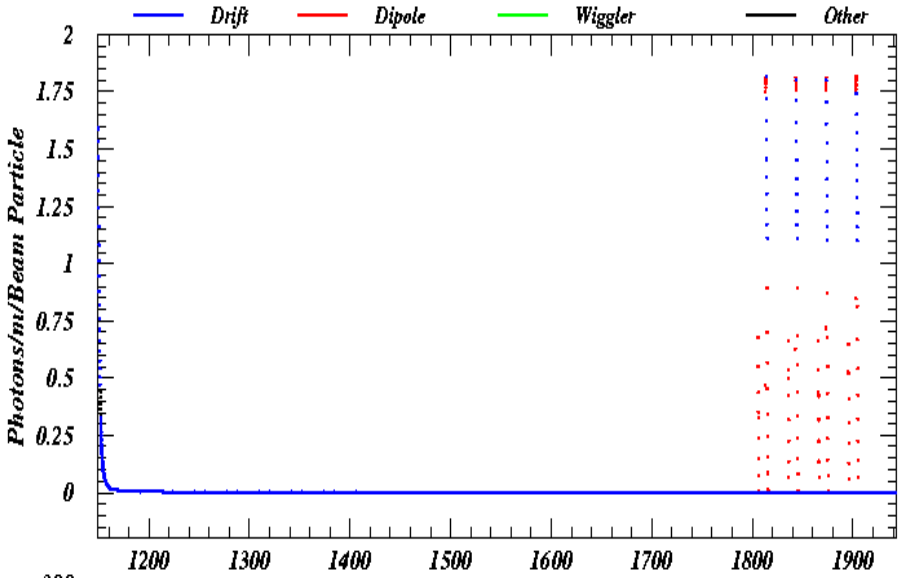
Wiggler Region

DSB3 +ve side

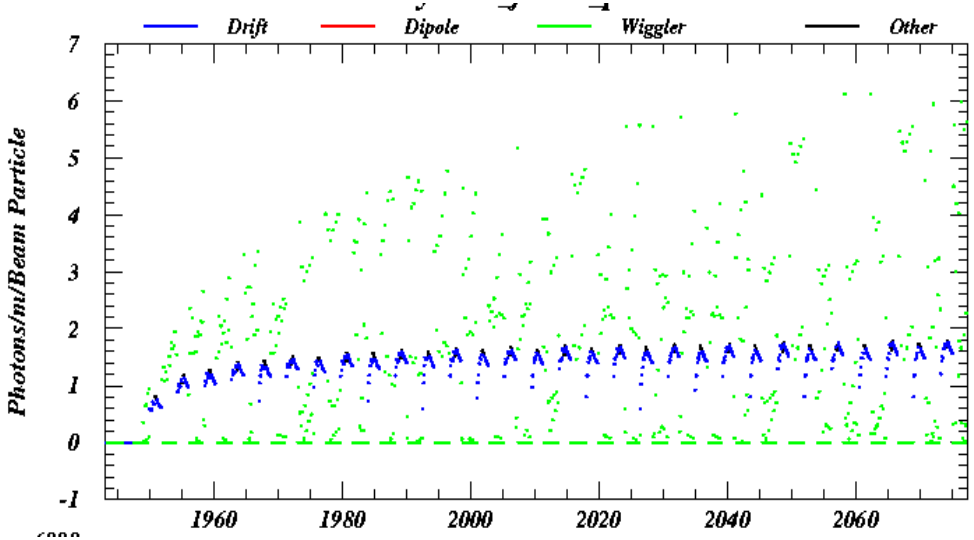

Drift
Dipole
Wiggler
Other
Photons/m/Beam Particle
35
30
25
20
15
10
5
0
-5
0
500
1000
1500
2000
2500
3000


Drift
Dipole
Wiggler
Other
Photons/m/Beam Particle
2
1.75
1.5
1.25
1
0.75
0.5
0.25
0
0
50
100
150
200
250
300
350
400
450

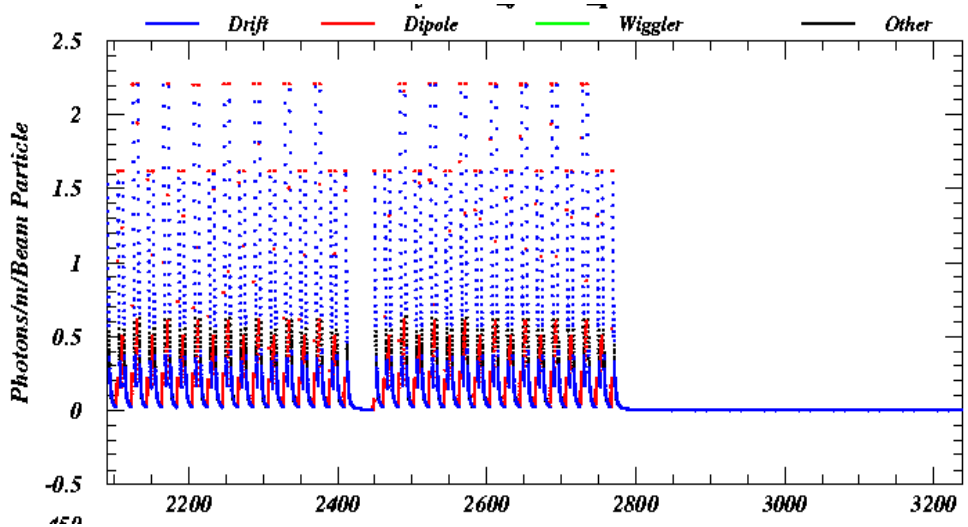

Drift
Dipole
Wiggler
Other
Photons/m/Beam Particle
5
4
3
2
1
0
500
600
700
800
900
1000
1100


Drift
Dipole
Wiggler
Other
Photons/m/Beam Particle
2
1.75
1.5
1.25
1
0.75
0.5
0.25
0
1200
1300
1400
1500
1600
1700
1800
1900

DSB3 +ve side continued

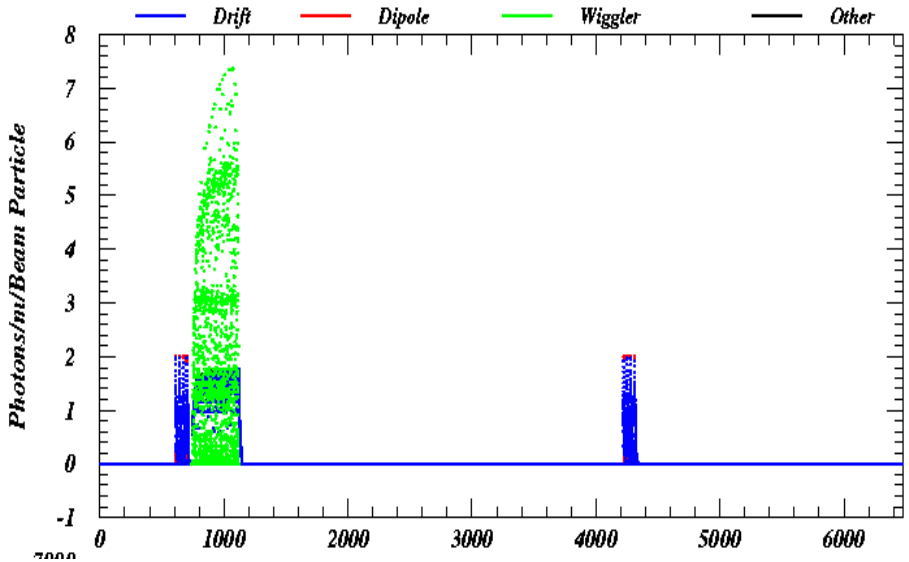


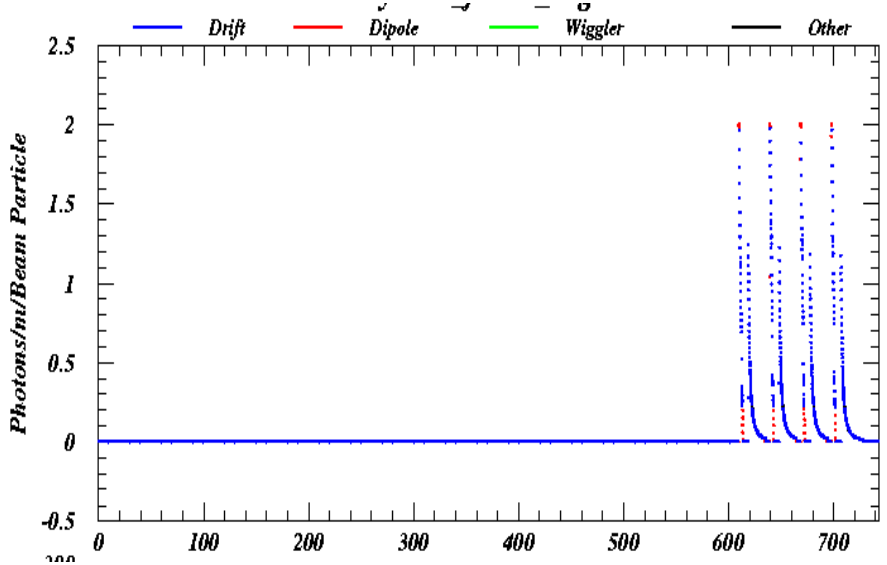
Wiggler Region

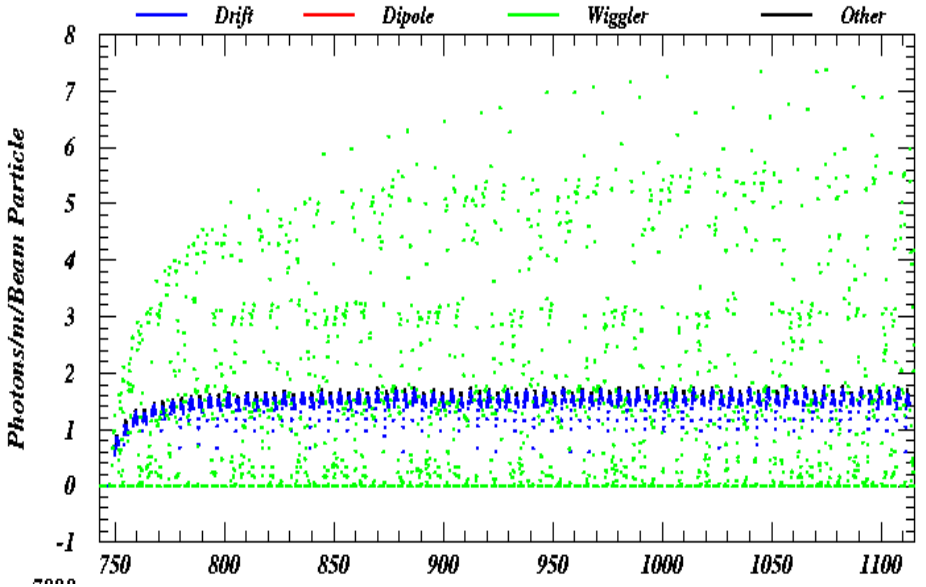


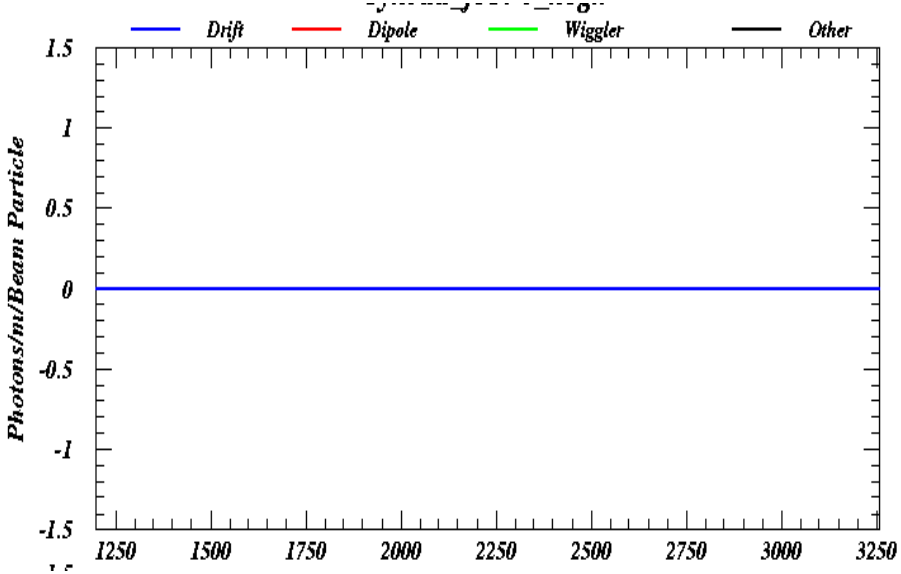
- photons are produced in regular bends on +ve side
- no photons from straights

6.4km DCO4 lattice -ve side

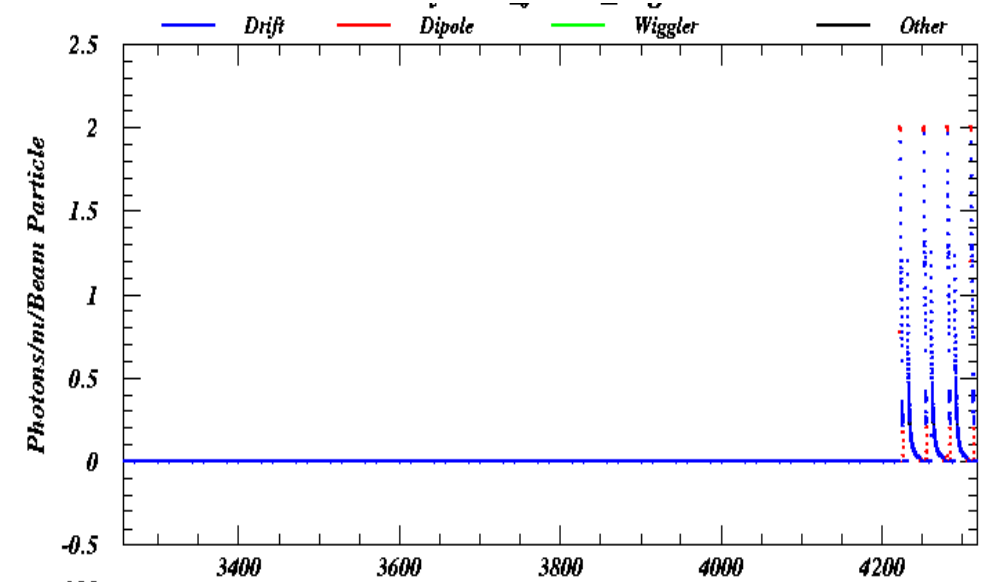


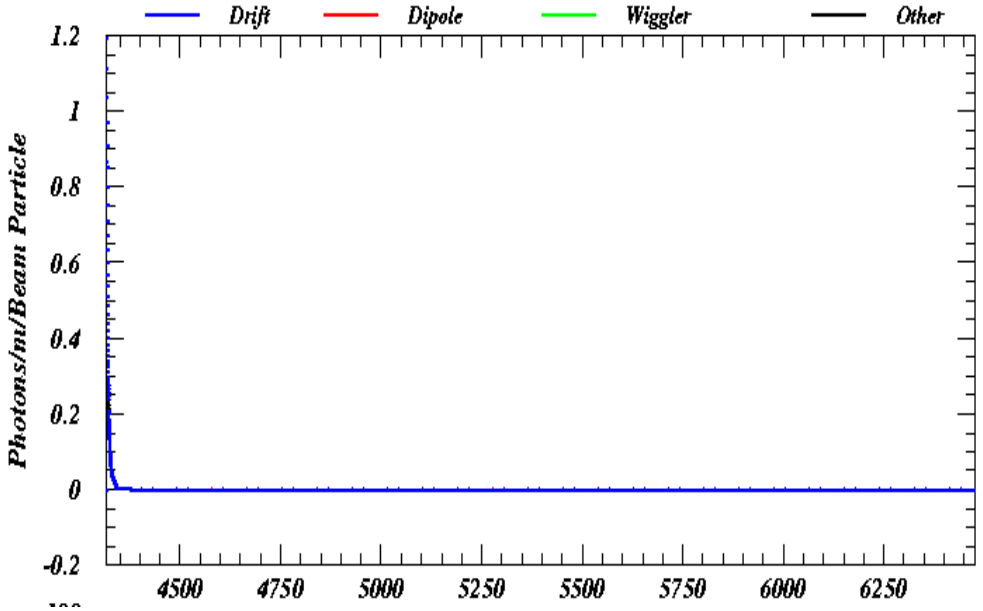






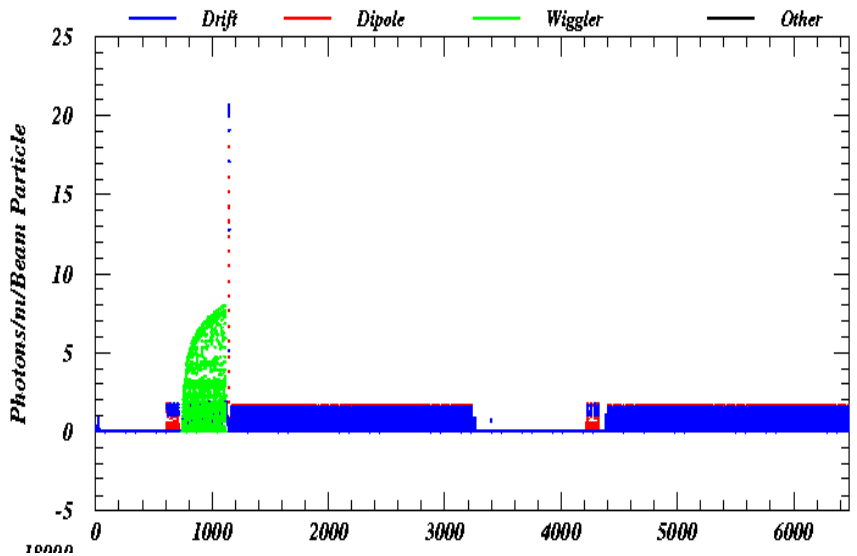
DCO4 -ve side (continued)

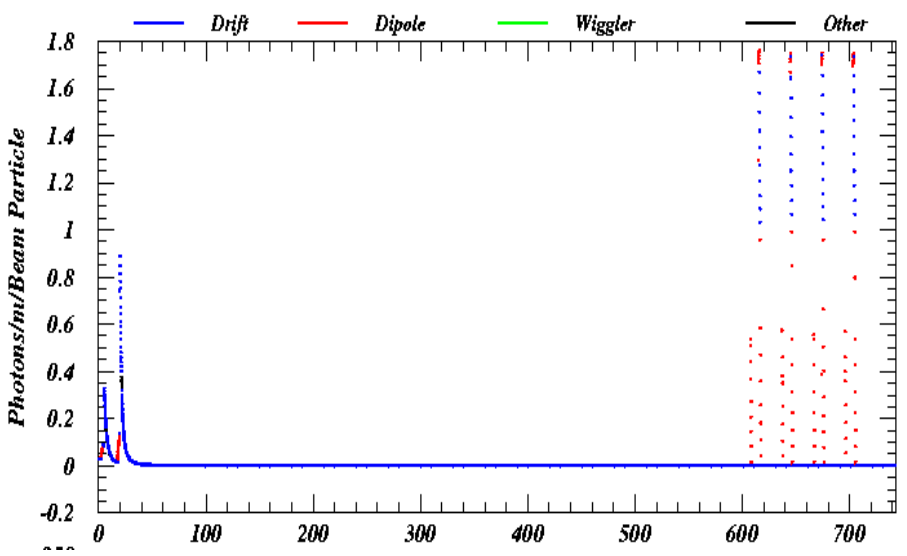


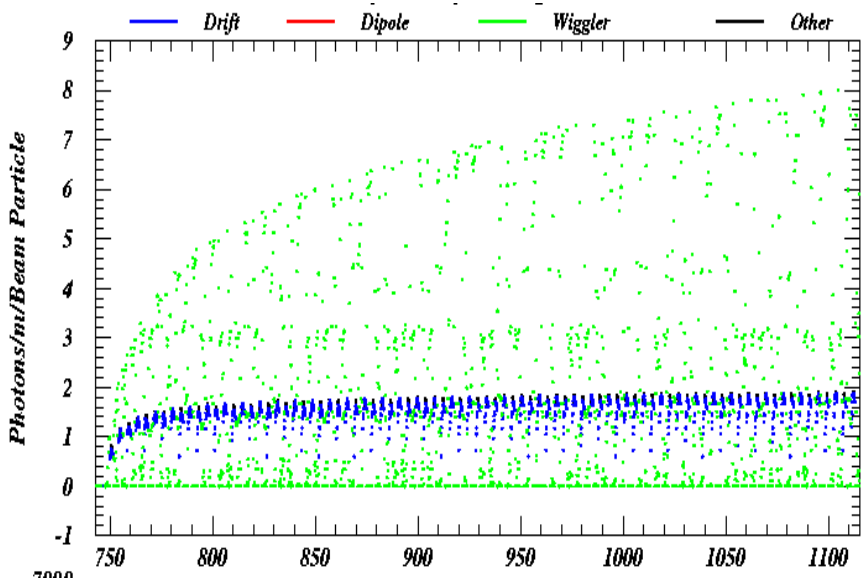


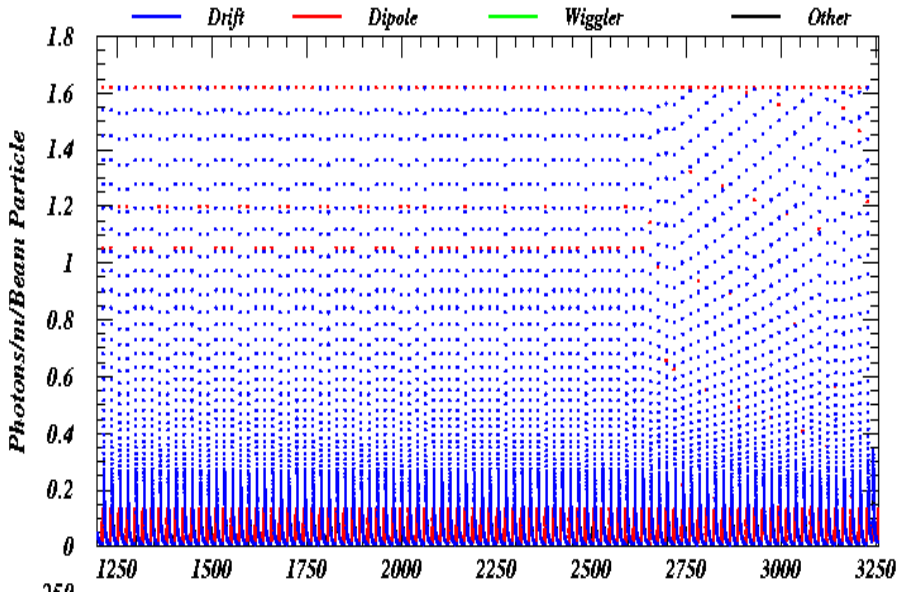
Note: Starting point of DCO4 lattice is different from DSB3!

DCO4 +ve side

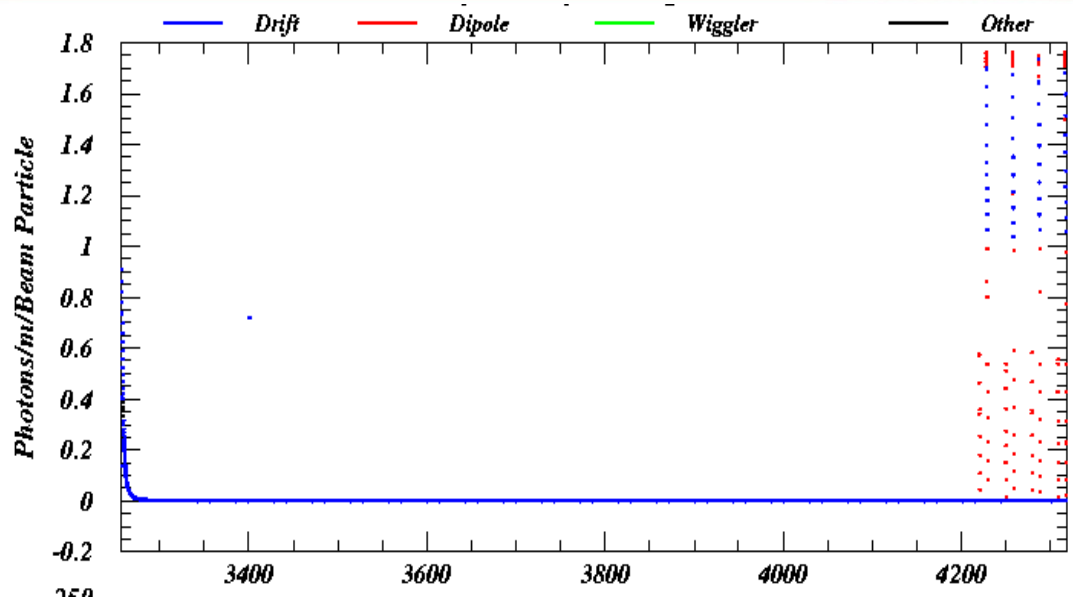

Drift
Dipole
Wiggler
Other
Photons/m/Beam Particle
25
20
15
10
5
0
-5
0
1000
2000
3000
4000
5000
6000

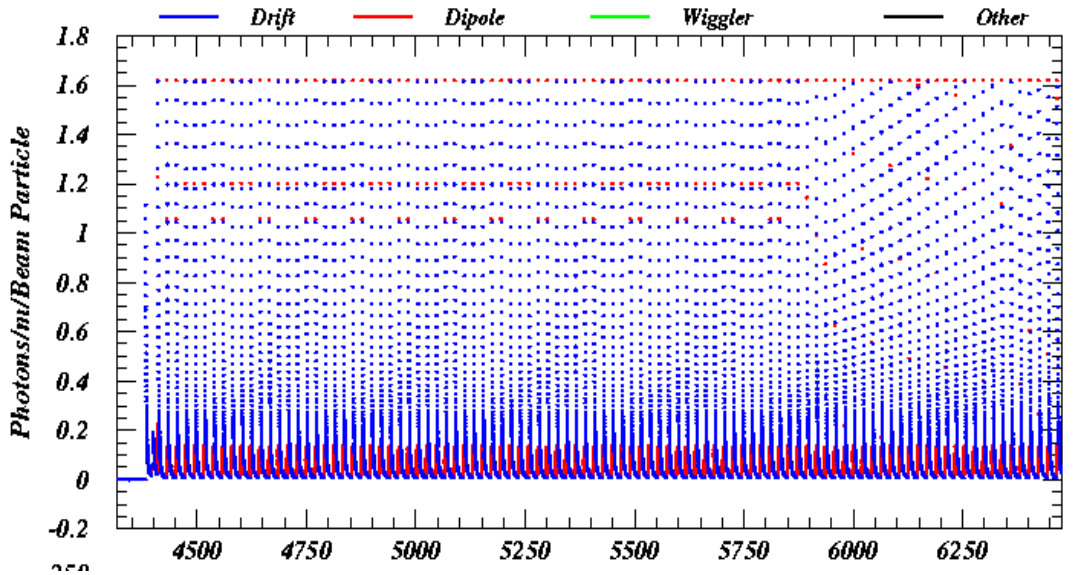

Drift
Dipole
Wiggler
Other
Photons/m/Beam Particle
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
0
100
200
300
400
500
600
700


Drift
Dipole
Wiggler
Other
Photons/m/Beam Particle
9
8
7
6
5
4
3
2
1
0
-1
750
800
850
900
950
1000
1050
1100


Drift
Dipole
Wiggler
Other
Photons/m/Beam Particle
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1250
1500
1750
2000
2250
2500
2750
3000
3250

DCO4 +ve side (continued)





Some useful numbers

DSB3 lattice – average values

Element	Flux (Photon/m/e)	fraction (length)
Dipole	0.024	12.1%
Drift	0.049	76.6%
Wiggler	1.234	2.4%
Quadrupole	0.066	7.4%

DCO4 lattice – average values

Element	Flux (Photon/m/e)	fraction (length)
Dipole	0.019	7%
Drift	0.047	83.4%
Wiggler	1.404	3.3%
Quadrupole	0.147	4.6%

Some details

- We were able to estimate photon flux for the DSB3 and DCO4 (90 deg) lattices.
- The MAD08 lattice files were first changed to xsif format and then parsed to BMAD files.
- Wigglers are defined as alternating bends and drifts in the original lattice files.
- Wall files were generated using MAD08 by Mauro Pivi.
- Synrad3D calculations are planned (Kathy Harkay and Laura Boon)
- Thanks to Jim Crittenden and David Sagan for help.