Notes on executing and analyzing runs of SYNRAD3D to produce radiation intensity output for use in electron cloud simulations

G. Dugan

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1 Directory structure on CESR Linux machines

The base directory used for the simulations is defined by the environment variable $Synrad3dBASE. Within this directory, a subdirectory named in the environment variable $Synrad3dFILES is called the "Lattice file" directory. It contains subdirectories with the control files and the output for the simulation runs for various lattices. Also within $Synrad3dBASE is the subdirectory named by the environment variable $Synrad3dLATT: this is the Bmad lattice directory, which contains the .lat files for each lattice. $Synrad3dBASE also contains the subdirectory named by the environment variable $Synrad3dGLOB, which holds the global lattice parameter files; the subdirectory named by the environment variable $Synrad3dSHELL, which holds the Unix shell scripts, and the subdirectory named by the environment variable $Synrad3dRUN, which holds a file containing details of the SYNRAD3D runs to be performed for each lattice.

Finally, the subdirectory "Code directory" named in the environment variable $Synrad3dCODE contains the code and binaries for SYNRAD3D and presynrad, the pre-processor.

See Table 1.

Directory name	Contents	Example
$Synrad3dBASE	Base directory	/nfs/ilc/sim2/dugan/Photons
$Synrad3dFILES	Lattice file directory	$Synrad3dBASE/Lattice_directories
$Synrad3dLATT	Bmad lattice directory	$Synrad3dBASE/lattice/cesr/bmad
$Synrad3dGLOB	Global parameter files	$Synrad3dBASE/Global_dir
$Synrad3dSHELL	Unix shell scripts	$Synrad3dBASE/Shell_files
$Synrad3dRUN	SYNRAD3D run lists	$Synrad3dBASE/Run_files
$Synrad3dCODE	Code directory	/nfs/acc/user/dugan/Photons/Code

Table 1: Directory structure

2 Updating SYNRAD3D

The local version of the SYNRAD3D executable is located in $Synrad3dCODE/bin. To update to the latest version, go into the directory $Synrad3dCODE and run the script photon_update_production.sh.

3 Preprocessor: presynrad

3.1 FORTRAN program

The FORTRAN program presynrad has been written to prepare the initialization and script files needed to execute a set of SYNRAD3D runs for a given lattice.

The program must be executed from within a directory called the lattice_spec directory. "Lattice" refers to the lattice name, and "spec" refers to the particle species for which the SYNRAD3D runs will be made. For example, if the latticename is 4000mev_23nm_20090916, and positron radiation is to be simulated then the name of the lattice_spec directory would be 4000mev_23nm_20090916_positron. This directory should be a subdirectory of the $Synrad3dFILES directory described in Section 1.

Program execution does the following:

1. Copies the file Globals_lattice.dat from the directory $Synrad3dGLOB to the lattice_spec directory.
2. Reads this file to get global lattice parameter information.
3. Reads the file Runlist_lattice_spec.dat to get a list of runs and corresponding SYNRAD3D parameters to be set up for this lattice.
4. Creates init and start files for, and then executes, the tao program (using the standard system executable, not a local copy), to create a file (called lattice_latticename.dat) containing a listing of the lattice element parameters for this lattice. To do this, the tao program must access the .lat Bmad file located in $Synrad3dLATT.
5. Reads this file and uses the information to create a series of init files to be used for SYNRAD3D runs.
6. Writes a Unix script file submit_synrad3d_latticename_spec.sh to be used to submit these runs to the batch job queue.
7. Writes a report to presynrad.out.

3.2 Unix script

The Unix script `presyn.sh`, which resides in `$Synrad3dSHELL`, should be used to execute `presynrad`. The usage is

```
presyn.sh latticename_spec runlist
```

The file `runlist` must be in the `$Synrad3dRUN` directory. This script

- makes a subdirectory `lattice_spec` in the `$Synrad3dFILES` directory
- makes a `Log` subdirectory there
- Copies the files `form.txt` needed by `tao` and `synrad3d.wall` needed by `SYNRAD3D` from `$Synrad3dGLOB`.
- Copies the file `$Synrad3D/runlist` to `Runlist_lattice_spec.dat`.
- Runs presynrad, which sets up the init files for `SYNRAD3D`
- Makes an `S3run` subdirectory, and copies all `SYNRAD3D` init and wall files there
- Copies the `submit_synrad3d_latticename_spec.sh` file to the `$Synrad3dSHELL` directory
- Moves the `tao.out` and `presynrad.out` files to the `Log` subdirectory

In order for this script to succeed, the file `Globals_lattice.dat` must exist in the `$Synrad3dGLOB`. Also, in the first line of this file, the name of the `.lat` file for this lattice is given. This file must exist in the directory `$Synrad3dLATT`.

4 Running SYNRAD3D

For a given `lattice_spec`, the Unix script file `submit_synrad3d_latticename_spec.sh` in `$Synrad3dSHELL` will send a group of batch jobs to the Unix farm queue. This must be done on a processor connected to the farm, such as `ILC201`. The usage is

```
submit_synrad3d_latticename_spec.sh
```

After issuing the command, each job which is started will appear in the batch queue, which can be monitored using the `QMON` process. The output from each job appears in a file in the `Log` subdirectory of the `lattice_spec` directory. The files are named by the `lattice_spec`, to which is appended a string designating the `runname` (typically the name of the RFA, or "Total" for the ringwide survey. Once a job has been completed, the output file should be checked to be sure that no errors have been reported. The job running times vary from tens of minutes to several hours.

5 Archiving the output

The output from each run appears as a file in the subdirectory S3Run of the lattice_spec directory. The file name designation is lattice_spec_runname.dat. These files can be large and typically may need to be moved to another computer for post-processing, so they should be archived. This can be done by running the script arch_dat.sh in $Synrad3dSHELL. The usage is

```
arch_dat.sh  latticename_spec
```

This script will move all the lattice_spec_runname.dat files in S3Run , together with the files Globals_lattice_spec.dat, Runlist_lattice_spec.dat and lattice_latticename.dat, into a directory, and then make an archive named Synrad3d_data_lattice_spec.tgz. Included in this archive (as sub-directories) will also be copies of the .init and .wall files used for the SYNRAD3D runs, as well as the Log subdirectory which contains output from presynrad and from the SYNRAD3D runs.

6 Post processing

Post processing involves analysis of the information in Synrad3d_data_lattice_spec.tgz to obtain the radiation intensities at RFA's and averaged around the ring, for use in electron cloud simulation programs. Post-processing is done using two Mathematica programs:

- phot_scatt_latdat_ringwide.nb, which analyses the ringwide photon data in the file lattice_spec_Total.dat; and
- phot_scatt_latdat_RFA.nb, which analyses the photon data at each of the RFA's, using the RFA-specific files with names of the form lattice_spec_RFAname.dat.

6.1 Directory structure for post-processing

The Mathematica programs use the directory structure shown in Table 2. The base directory is defined by the environment variable $Synrad3dBASE_ANAL. An example of this is /nfs/ilc/sim2/dugan/Photons/Analysis. The directory $Synrad3dFILES_ANAL contains the SYNRAD3D simulation results and the post-processor output, in a separate directory for each lattice named lattice_spec. An example of $Synrad3dFILES_ANAL is /nfs/ilc/sim2/dugan/Photons/Analysis/Lattice_directories.

6.2 Unarchiving

To begin the post-processing for a lattice with designation lattice_spec, a subdirectory named lattice_spec, must be created in the $Synrad3dFILES_ANAL, and the archive containing the SYNRAD3D data, Synrad3d_data_lattice_spec.tgz, must be unarchived, which will

Directory name	Contents
$Synrad3dBASE_ANAL	Base directory
$Synrad3dFILES_ANAL	Lattice file directory
$Synrad3dBASE_ANAL/Start_files	Nominal starting fit parameters
$Synrad3dBASE_ANAL/Math_files	Mathematica notebook files
$Synrad3dFILES_ANAL/lattice_spec/Output/Ringwide	Post-processor output files, ringwide analysis
$Synrad3dFILES_ANAL/lattice_spec/Output/RFA	Post-processor output files, RFA analysis
$Synrad3dFILES_ANAL/lattice_spec/Start_files	Starting fit parameters for this lattice_spec

Table 2: Directory structure for post-processing

create the directory Synrad3d_data_lattice_spec within $Synrad3dFILES_ANAL/lattice_spec.

6.3 Ringwide analysis

Ringwide analysis is carried out using the program phot_scatt_latdat_ringwide.nb. Each main section of this program is listed below, together with its principal function. The output text and plot files are placed in the directory $Synrad3dFILES_ANAL/lattice_spec/Output/Ringwide.

1. **Set lattice file**. This section allows the choice of the lattice and particle species to be analyzed. One of the lattice_spec choices in the toggler bar in the last statement in this section must be selected by clicking on it.

2. **Set I/O files**. This section setups up the directories and files

3. **Read globals and lattice file**. This section reads global lattice parameters and the lattice element file, and sets up arrays for the lattice functions.

4. **Read simulated photon scatters**. This section reads the SYNRAD3D data.

5. **Histogram and process simulated photons-initialization**. This section initializes routines and arrays to be used in creating histograms and plots of the photon intensities.

6. **Plot distributions**. This section makes the plots tabulated in Table 3. In all cases, these refer to photons absorbed at each element type. The spectra are raw simulated counts vs. the indicated quantities.

   In addition to these one-dimensional plots, two-dimensional plots showing the correlation between energy and normalized angle, for each element type, are provided. These files are named Type_plot_energy_angle_correlation_TYPE_lattice.pdf , in which TYPE refers to the element type (i.e., DRIFT, SBEND, etc.)

File	Description
Type_plot_energy_lattice.pdf	Element type photon energy spectrum
Type_plot_reflection_lattice.pdf	Element type reflection number spectrum
Type_plot_xinitial_lattice.pdf	Element type initial x position spectrum
Type_plot_xpinitial_lattice.pdf	Element type initial x' angle spectrum
Type_plot_yinitial_lattice.pdf	Element type initial y position spectrum
Type_plot_ypinitial_lattice.pdf	Element type initial y' angle spectrum
Type_plot_sinitial_lattice.pdf	Element type initial s position spectrum
Type_plot_sfinal_lattice.pdf	Element type final s position spectrum
Type_plot_polar_angle_lattice.pdf	Element type angular spectrum

Table 3: Photon one-dimensional spectrum files

7. **Counting photons in types**. This section makes the plots and tables tabulated in Table 4.

File	Description
Type_plot_photinten_lattice.pdf	Plots of mean photon energy, number of reflections, and azimuth-integrated, beta-weighted photon intensity, for each element type
Type_tab_photinten_lattice.csv	Tables of mean photon energy, number of reflections and azimuth-integrated, beta-weighted photon intensity, for each element type

Table 4: Photon averages files

8. **Variation in intensity across elements in the lattice**. This section makes the plots and tables tabulated in Table 5.

9. **Lorentzian fits (a), Gaussian fits (b)**. These section fits the element-averaged and beta-weighted photon intensity distributions as a function of chamber perimeter to a pair of Lorentzians or Gaussians, plus a background described by a fifth-order polynomial;

$$F(p) = L_a(p) + L_b(p) + B(p),$$

in which,

$$B(p) = c_1 + c_2 p + c_3 p^2 + c_4 p^3 + c_5 p^4 + c_6 p^5.$$

and, for the case of a Lorentzian fit,

$$L_a(p) = \frac{a_0}{p^2 + \sigma_a^2},$$

File	Description
Type_plot_svartot_lattice.pdf	Plots of unweighted element-averaged total intensities $\langle J_{x(y),tot}\rangle_{(k,r)}$ for each element r, for each element type k.
Type_plot_svartb_lattice.pdf	Plots of unweighted element-averaged top-bottom intensities $\langle J_{x(y),tb}\rangle_{(k,r)}$ for each element r, for each element type k.
Type_tab_svartot_lattice.csv	Tables of $J_{x(y),tot}(k)$ and $J^2_{x(y),tot}(k)$ for total perimeter, for each element type k
Type_tab_svartb_lattice.csv	Tables of $J_{x(y),tb}(k)$ and $J^2_{x(y),tb}(k)$ for $0.45 < p < 0.55$, for each element type k

Table 5: Longitudinal variation plots and tables

$$L_b(p) = \frac{b_0}{(p-1)^2 + \sigma_b^2};$$

for a Gaussian fit,

$$L_a(p) = \frac{a_0}{\sqrt{2\pi}\sigma_a} \mathrm{e}^{-\frac{p^2}{2\sigma_a^2}},$$

$$L_b(p) = \frac{b_0}{\sqrt{2\pi}\sigma_b} \mathrm{e}^{-\frac{(p-1)^2}{2\sigma_b^2}},$$

The parameter tables and plots showing the fits are summarized in Table 6.

10. **Numerical tabulation of the angular distributions.** This section produces tables of the beta-weighted angular distribution function for each element type. These tables are named Type_tab_energy_ang_dist_x_TYPE_lattice.csv or Type_tab_energy_ang_dist_y_TYPE_lattice.csv , in which TYPE refers to the element type (i.e., DRIFT, SBEND, etc.) The angles are given in unnormalized form (i.e., range is from 0 to 2π). Top-bottom symmetry is imposed. The angular intervals are not equal: the intervals are smaller in angular regions where the distribution is changing rapidly.

    The data given in the tables is also plotted. The plots are given in the files Type_plot_angular_distribution_x_lattice.csv and Type_plot_angular_distribution_y_lattice.csv.

11. **Numerical tabulation of the energy-angular correlation.** This section produces tables of the differential number of photons per unit energy absorbed on the vacuum chamber wall per unit angle, for each element type, in 5 angular bins. These tables are named Type_tab_photon_number_energy_angle_correlation_TYPE_lattice.csv, in which TYPE refers to the element type (i.e., DRIFT, SBEND, etc.)

File	Description
Type_plot_fits_x_Lorentz_lattice.pdf	Plots of perimeter data and Lorentzian fits for β_x-weighted distributions
Type_tab_fits_x_Lorentz_lattice.csv	Tables of Lorentzian perimeter fit parameters for β_x-weighted distributions
Type_plot_fits_y_Lorentz_lattice.pdf	Plots of perimeter data and Lorentzian fits for β_y-weighted distributions
Type_tab_fits_y_Lorentz_lattice.csv	Tables of Lorentzian perimeter fit parameters for β_y-weighted distributions
Type_plot_fits_x_Gauss_lattice.pdf	Plots of perimeter data and Gaussian fits for β_x-weighted distributions
Type_tab_fits_x_Gauss_lattice.csv	Tables of Gaussian perimeter fit parameters for β_x-weighted distributions
Type_plot_fits_y_Gauss_lattice.pdf	Plots of perimeter data and Gaussian fits for β_y-weighted distributions
Type_tab_fits_y_Gauss_lattice.csv	Tables of Gaussian perimeter fit parameters for β_y-weighted distributions

Table 6: Photon perimeter fit files.

12. **Compute POSINST parameters (a: x and b: y)** From the Gaussian fits, this section computes the x and y POSINST parameters for use with POSINSTv15c. The plots and tables are shown in Table 7.

File	Description
Type_plot_POSINST_x_lattice.pdf	Plots of x-POSINST parameters from Gaussian fits
Type_tab_POSINST_x_lattice.csv	Tables of x-POSINST parameters from Gaussian fits
Type_plot_POSINST_y_lattice.pdf	Plots of y-POSINST parameters from Gaussian fits
Type_tab_POSINST_y_lattice.csv	Tables of y-POSINST parameters from Gaussian fits

Table 7: POSINST photon parameter files.

13. **Check of fits** This section checks that the (Gaussian) fits obtained in section 9b agrees with the results of section 7, which come from direct integration. The plots are shown in Table 8.

14. **Estimates of quantum efficiency** This section produces estimates of the relative quantum efficiency for each element type, for 5 angular intervals. The results are given in the file Type_tab_PEY_lattice.csv. Related plots are shown in the file Type_plot_PEY_lattice.pdf. The average energy, for each element type, for 5 angular intervals, is given in

File	Description
Type_plot_checkabs_lattice.pdf	Plots of photon intensities from Gaussian fits compared to direct integration-absolute scale
Type_plot_checkrel_lattice.pdf	Plots of photon intensities from Gaussian fits compared to direct integration-relative scale

Table 8: Check plots

Type_tab_avg_energy_lattice.csv. These files are placed in the subdirectory named Ringwide/PEY.

15. **Comparison with SYNRAD2D (optional)** This section compares selected results from SYNRAD2D with SYNRAD3D. The SYNRAD2D files must be available in the directory $Synrad3dFILES_ANAL/lattice_spec/Synrad2d_lattice_spec. The plots with the results are given in Table 9.

File	Description
Syn23comp_RW_int_lattice.pdf	Plots of SYNRAD2D and SYNRAD3D total photon intensities
Syn23comp_RW_fg1_lattice.pdf	Plots of SYNRAD2D and SYNRAD3D POSINST fgaus1 parameter
Syn23comp_RW_fg2_lattice.pdf	Plots of SYNRAD2D and SYNRAD3D POSINST fgaus2 parameter
Syn23comp_RW_ref_lattice.pdf	Plots of SYNRAD2D and SYNRAD3D POSINST reflectivity parameter
Syn23comp_RW_intref_lattice.pdf	Plots of SYNRAD2D and SYNRAD3D total photon intensities in $p = 0.45 - 0.55$ region

Table 9: Check plots

To execute this analysis, start an interactive session with the Mathematica notebook file phot_scatt_latdat_ringwide.nb. Select the cells in section 1 and evaluate them. Then select the lattice_spec to be analyzed in the toggler bar in the last statement in this section by clicking on it.

Then simply select all the cells, section by section, in sections 2 through 15, and evaluate them. After each section completes, check to see that there have been no errors flagged by Mathematica, and that the output described in the tables above for that section has been placed in the directory $Synrad3dFILES_ANAL/lattice_spec/Output/Ringwide. Open each plot or table and check to make sure nothing looks screwy (tables without numbers, or plots without data, for example).

6.4 RFA analysis

RFA analysis is carried out using the program `phot_scatt_latdat_RFA.nb`. Each main section of this program is listed below, together with its principal function. The output text and plot files are placed in the directory `$Synrad3dFILES_ANAL/lattice_spec/Output/RFA`.

1. **Set lattice file**. This section allows the choice of the lattice and particle species to be analyzed. One of the `lattice_spec` choices in the toggler bar in the last statement in this section must be selected by clicking on it.

2. **Set I/O files**. This section setups up the directories and files

3. **Read globals and lattice file**. This section reads global lattice parameters and the lattice element file, and sets up arrays for the lattice functions.

4. **Read simulated photon scatters**. This section reads the `SYNRAD3D` data.

5. **Process and fit simulated photons-initialization**. This section initializes routines and arrays to be used in creating histograms and plots of the photon intensities.

6. **Plot distributions**. This section makes the plots tabulated in Table 10. The spectra are raw simulated counts vs. the indicated quantities.

   In addition to these one-dimensional plots, two-dimensional plots showing the correlation between energy and normalized angle, for each RFA, are provided. These files are named `RFA_plot_energy_angle_correlation_RFAName_lattice.pdf` , in which `RFAName` refers to the name of the RFA as given in `RFAlist.csv`.

File	Description
`RFA_plot_energy_lattice.pdf`	RFA photon energy spectrum
`RFA_plot_reflection_lattice.pdf`	RFA reflection number spectrum
`RFA_plot_xinitial_lattice.pdf`	RFA initial x position spectrum
`RFA_plot_xpinitial_lattice.pdf`	RFA initial x' angle spectrum
`RFA_plot_yinitial_lattice.pdf`	RFA initial y position spectrum
`RFA_plot_ypinitial_lattice.pdf`	RFA initial y' angle spectrum
`RFA_plot_sinitial_lattice.pdf`	RFA initial s position spectrum
`RFA_plot_sfinal_lattice.pdf`	RFA final s position spectrum
`RFA_plot_polar_angle_lattice.pdf`	RFA angular spectrum

Table 10: Photon spectrum files

7. **Counting photons in RFA regions**. This section makes the plots and tables tabulated in Table 11.

File	Description
RFA_plot_photinten_lattice.pdf	Plots of mean photon energy, number of reflections, and azimuth-integrated photon intensity, for each RFA
RFA_tab_photinten_lattice.csv	Tables of mean photon energy, number of reflections and azimuth-integrated photon intensity, for each RFA

Table 11: Photon averages files

8. **Lorentzian fits (a), Gaussian fits (b)**. These section fits the element-averaged and beta-weighted photon intensity distributions as a function of chamber perimeter to a pair of Lorentzians or Gaussians, plus a background described by a fifth-order polynomial;

$$F(p) = L_a(p) + L_b(p) + B(p),$$

in which,

$$B(p) = c_1 + c_2 p + c_3 p^2 + c_4 p^3 + c_5 p^4 + c_6 p^5.$$

and, for the case of a Lorentzian fit,

$$L_a(p) = \frac{a_0}{p^2 + \sigma_a^2},$$

$$L_b(p) = \frac{b_0}{(p-1)^2 + \sigma_b^2};$$

for a Gaussian fit,

$$L_a(p) = \frac{a_0}{\sqrt{2\pi}\sigma_a} \mathrm{e}^{-\frac{p^2}{2\sigma_a^2}},$$

$$L_b(p) = \frac{b_0}{\sqrt{2\pi}\sigma_b} \mathrm{e}^{-\frac{(p-1)^2}{2\sigma_b^2}},$$

The parameter tables and plots showing the fits are summarized in Table 12.

File	Description
RFA_plot_fits_Lorentz_lattice.pdf	Plots of perimeter data and Lorentzian fits
RFA_tab_fits_Lorentz_lattice.csv	Tables of Lorentzian perimeter fit parameters
RFA_plot_fits_Gauss_lattice.pdf	Plots of perimeter data and Gaussian fits
RFA_tab_fits_Gauss_lattice.csv	Tables of Gaussian perimeter fit parameters

Table 12: Photon perimeter fit files.

9. **Numerical tabulation of the angular distributions.** This section produces tables of the angular distribution function for each RFA, These tables are named `RFA_tab_energy_ang_dist_RFAName_lattice.csv`, in which `RFAName` refers to the name of the RFA as given in `RFAlist.csv`. The angles are given in unnormalized form (i.e., range is from 0 to 2π). Top-bottom symmetry is imposed. The angular intervals are not equal: the intervals are smaller in angular regions where the distribution is changing rapidly.

   The data given in the tables is also plotted. The plots are given in the file `RFA_plot_angular_distribution_lattice.csv`.

10. **Numerical tabulation of the energy-angular correlation.** This section produces tables of the differential number of photons per unit energy absorbed on the vacuum chamber wall per unit angle, for each RFA, in 5 angular bins. These tables are named `RFA_tab_photon_number_energy_angle_correlation_RFAName_lattice.csv`, in which `RFAName` refers to the name of the RFA as given in `RFAlist.csv`.

11. **Compute POSINST parameters** From the Gaussian fits, this section computes the `POSINST` parameters for use with `POSINSTv15c`. The plots and tables are shown in Table 13.

File	Description
`RFA_plot_POSINST_lattice.pdf`	Plots of POSINST parameters from Gaussian fits
`RFA_tab_POSINST_lattice.csv`	Tables of POSINST parameters from Gaussian fits

Table 13: POSINST photon parameter files.

12. **Check of fits** This section checks that the (Gaussian) fits obtained in section 8b agrees with the results of section 7, which come from direct integration. The plots are shown in Table 14.

File	Description
`RFA_plot_checkabs_lattice.pdf`	Plots of photon intensities from Gaussian fits compared to direct integration-absolute scale
`RFA_plot_checkrel_lattice.pdf`	Plots of photon intensities from Gaussian fits compared to direct integration-relative scale

Table 14: Check plots

13. **Estimates of quantum efficiency** This section produces estimates of the relative quantum efficiency for each element type, for 5 angular intervals. The results are given in the file

RFA_tab_PEY_lattice.csv. Related plots are shown in the file RFA_plot_PEY_lattice.pdf. The average energy, for each RFA, for 5 angular intervals, is given in RFA_tab_avg_energy_lattice.csv. These files are placed in the subdirectory named RFA/PEY.

14. **Comparison with SYNRAD2D (optional)** This section compares selected results from SYNRAD2D with SYNRAD3D. The SYNRAD2D files must be available in the directory $Synrad3dFILES_ANAL/lattice_spec/Synrad2d_lattice_spec. The plots with the results are given in Table 15.

File	Description
Syn23comp_RFA_int_lattice.pdf	Plots of SYNRAD2D and SYNRAD3D total photon intensities
Syn23comp_RFA_fg1_lattice.pdf	Plots of SYNRAD2D and SYNRAD3D POSINST fgaus1 parameter
Syn23comp_RFA_fg2_lattice.pdf	Plots of SYNRAD2D and SYNRAD3D POSINST fgaus2 parameter
Syn23comp_RFA_ref_lattice.pdf	Plots of SYNRAD2D and SYNRAD3D POSINST reflectivity parameter
Syn23comp_RFA_intref_lattice.pdf	Plots of SYNRAD2D and SYNRAD3D total photon intensities in $p = 0.45 - 0.55$ region

Table 15: Comparisons with SYNRAD2D

To execute this analysis, start an interactive session with the Mathematica notebook file phot_scatt_latdat_RFA.nb. Select the cells in section 1 and evaluate them. Then select the lattice_spec to be analyzed in the toggler bar in the last statement in this section by clicking on it.

Then simply select all the cells, section by section, and evaluate them. After each section completes, check to see that there have been no errors flagged by Mathematica, and that the output described in the tables above for that section has been placed in the directory $Synrad3dFILES_ANAL/lattice_spec Open each plot or table and check to make sure nothing looks screwy (tables without numbers, or plots without data, for example).

7 Archiving the results

The final step is to archive and store the results. To do this, issue the following command

```
arch_results.sh lattice_spec
```

This will delete the Synrad3d_data directory within lattice_spec (it is not needed since there is also an archive file of the data there), and then make an archive file of the whole directory.

It then copies the archive file to `$Synrad3dRESULTS`, which is a directory on the Cesr linux system: e.g., `$Synrad3dRESULTS` = `/nfs/ilc/sim2/dugan/Photons/Results`.