

Appendix E

CONTENTS OF THE EGS5 DISTRIBUTION

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This EGS5 Distribution Listing is Appendix E of a document called
SLAC-R-730/KEK-2005-8, which can be obtained from the SLAC and KEK web sites.

The EGS5 distribution archive contains six main groups of files: documentation; EGS FORTRAN source codes; PEGS FORTRAN source codes; material data files; example and tutorial run-time scripts and user codes (including FORTRAN source codes, input files and sample output); and FORTRAN source codes for auxiliary functions which users may find useful.

E.1 Documentation

Documentation has been included within the EGS5 distribution for two reasons. First, the most heavily used parts of SLAC-R-730/KEK-2005-8 are expected to be the user manuals, and so .pdf versions have been placed in the archive so that they can be accessed (or printed) at the discretion and convenience of the user. Second, it is anticipated that when changes and additions are made to the EGS5 code base, the user manuals will be updated appropriately, while SLAC-R-730/KEK-2005-8 may not be. Documentation files included with the EGS5 distribution are:

egs5_user_manual.pdf	Appendix B of SLAC-R-730/KEK-2005-8
pegs_user_manual.pdf	Appendix C of SLAC-R-730/KEK-2005-8
installation_guide.pdf	Appendix D of SLAC-R-730/KEK-2005-8
distribution_contents.pdf	Appendix E of SLAC-R-730/KEK-2005-8
Writing_HOWFAR.pdf	Presentation describing construction of user code subroutine HOWFAR

These files can be found in the subdirectory **docs** of the under the main **egs5** directory in the distribution. In addition, a complete copy of SLAC-R-730/KEK-2005-8 is included in the main **egs5** directory, as the .pdf file **slac730.pdf**.

E.2 EGS-Related FORTRAN Source Files

There are two types of files which are part of the EGS Monte Carlo shower simulation package. As described in the EGS5 User Manual (Appendix B of SLAC-R-730/KEK-2005-8), some of the utility of MORTRAN macro substitutions used in EGS4 has been retained in EGS5 by having all FORTRAN COMMON blocks be defined in the subprograms of the source code through **include** statements which reference files containing just the FORTRAN listing of each COMMON block. This makes changing variables and parameters in any COMMON block a global process, similar to what could be done with a MORTRAN macro in EGS4. Each EGS5 COMMON block is thus contained in a unique file which is named after the COMMON block as in **egs5_media.f** for the file containing the declarations for COMMON block MEDIA. All of the FORTRAN PARAMETERS used to specify array dimensions in the various COMMON blocks have been collected in a single “header” file called **egs5_h.f**, and all of the EGS5 COMMON block files have been placed in a directory called **include** under the main **egs5** directory. These files contain nothing other than the declarations of the variables in each COMMON, along with some documentation.

All of the actual FORTRAN source code files used in simulating showers have been collected in a subdirectory of **egs5** called **egs**. Each file contains the source code for one EGS5 subroutine (some source code files actually contain more than one subroutine, when groups of subprograms are very closely related), and the naming convention used with the **COMMON** block files in **include** has been followed. Descriptions of the functionality of the various subprograms of **egs** can be found both in Chapter 2 of SLAC-R-730/KEK-2005-8 and in the EGS5 User Manual. List below are the names of all of the files in **egs** and **include**, which are subdirectories of **egs5** in the EGS5 distribution.

EGS FORTRAN source files:

counters_out.f	egs5_eii.f	egs5_mscat.f
egs5_annih.f	egs5_electr.f	egs5_pair.f
egs5_aphi.f	egs5_hardx.f	egs5_photo.f
egs5_bhabha.f	egs5_hatch.f	egs5_photon.f
egs5_block_data.f	egs5_kauger.f	egs5_raylei.f
egs5_block_data_atom.f	egs5_kshell.f	egs5_rk1.f
egs5_block_set.f	egs5_kxray.f	egs5_rmsfit.f
egs5_brems.f	egs5_lauger.f	egs5_shower.f
egs5_collis.f	egs5_lshell.f	egs5_uphi.f
egs5_compt.f	egs5_lxray.f	randomset.f
egs5_edgbin.f	egs5_moller.f	rluxinit.f

EGS “included” COMMON block files:

counters.f	egs5_edge.f	egs5_mscon.f	egs5_useful.f
egs5_bcomp.f	egs5_eiicom.f	egs5_mults.f	egs5_userpr.f
egs5_bounds.f	egs5_elec.in.f	egs5_photin.f	egs5_usersc.f
egs5_brempr.f	egs5_epcont.f	egs5_scpw.f	egs5_uservr.f
egs5_cdcsep.f	egs5_h.f	egs5_stack.f	egs5_userxt.f
egs5_cdcspl.f	egs5_media.f	egs5_thresh.f	randommm.f
egs5_coefgs.f	egs5_misc.f	egs5_uphiin.f	
egs5_csplcf.f	egs5_ms.f	egs5_uphiot.f	

Also included in the **egs** subdirectory is the EGS5 copyright file, **COPYRIGHT**, in a version suitable for inclusion with FORTRAN user codes.

E.3 PEGS-Related FORTRAN Source Files

As with EGS, there are two types of files comprising PEGS, those containing actual FORTRAN source code (in a subdirectory of **egs5** called **pegs**) and those containing just **COMMON** block declara-

tions (in a subdirectory called **pegscommons**). While all of the **COMMON** blocks in PEGS are found in unique files (named after the **COMMON** block with no prefix) all of the subroutines and functions previously a part of PEGS4 are contained in one file **pegs5.f**. All of the other source code files in the **pegs** subdirectory are new to EGS5 and are either required for calculating the scattering strength and scattering power data needed for the new electron transport mechanics of EGS5, or are part of the implementation of the new multiple scattering distribution, both of which are described in Chapter 2 of SLAC-R-730/KEK-2005-8. The full lists of the PEGS-related files found in **pegs** and **pegscommons**, which are both subdirectories of **egs5** in the EGS5 distribution, are given below.

PEGS FORTRAN source files:

dcsel.f	elinit.f	gauleg.f	k1e.f	sumga.f
dcsn.f	findi.f	gscoef.f	legenp.f	wmsfit.f
dcstor.f	fitms.f	gsdist.f	makek1.f	
dcstab.f	g1dedx.f	inigrd.f	pegs5.f	
elastino.f	g1e.f	integ.f	spline.f	

PEGS “included” COMMON block files:

bcom.f	elmtb.f	lbhabm.f	mimsd.f	radlen.f
brem2.f	elmtbc.f	lbremr.f	mixdat.f	rslts.f
cohcom.f	epstar.f	lbremz.f	molvar.f	scpspl.f
cpcom.f	funcs.f	lcompm.f	mscom.f	sfcom.f
dbrpr.f	funcsc.f	legacy.f	mxdatc.f	spcomc.f
dcsstr.f	k1spl.f	lpairr.f	phpair.f	spcomm.f
dercon.f	lamolm.f	lpairz.f	pmcons.f	thres2.f
eimpact.f	lanihm.f	lspion.f	pwlfin.f	

E.4 Material Data Files

The EGS5 distribution contains six primary data files plus five subdirectories containing material dependent data files, as described below. All files and directories are found in the subdirectory **data** of **egs5**. More complete descriptions of the data contained in the files can be found in Chapter 2 of SLAC-R-730/KEK-2005-8.

Data files: The main material data files in **data** are briefly described below:

aprime.data	Data for empirical bremsstrahlung correction.
bcomp.dat	Bound total Compton cross section data (σ_{bC}) for elements $Z = 1 \sim 100$.
incoh.dat	Incoherent scattering function data ($S(x, Z)$) for all elements $Z = 1 \sim 100$.
K1.dat	Tables of optimal initial scattering strengths as a function of geometry region size at various energies for various reference materials.
pgs5form.dat	Rayleigh scattering form factor data ($F(x, Z)$), identical to pgs4form.dat from PEGS4.
pgs5phtx.dat	Photo-electric cross section data from PHOTX for all elements $Z = 1 \sim 100$.

Data subdirectories: Data subdirectories of **data** are briefly described as follows:

dcslib	Differential nuclear elastic scattering cross sections for electrons and positrons for elements $Z = 1 \sim 95$.
density_corrections	Explicit values of the density effect correction to stopping power which can be used to reproduce ICRU-37 values. Placed in two subdirectories, elements and compounds .
int_coherent_cs	Coherent scattering cross sections (with interference effects modeled) for selected materials.
int_form_factor	Form factors (including interference effects) for selected materials.
shellwise_Compton_profile	Shellwise Compton profiles for elements $Z = 1 \sim 100$.

Files in dcslib: Files containing elemental partial-wave differential elastic scattering cross section data for both electrons and positrons are included in the EGS5 distribution in subdirectory **dcslib** of **data**. A straight-forward convention has been used to name these data files, which are listed below

eeldx001.tab	eeldx039.tab	eeldx077.tab	peldx020.tab	peldx058.tab
eeldx002.tab	eeldx040.tab	eeldx078.tab	peldx021.tab	peldx059.tab
eeldx003.tab	eeldx041.tab	eeldx079.tab	peldx022.tab	peldx060.tab
eeldx004.tab	eeldx042.tab	eeldx080.tab	peldx023.tab	peldx061.tab
eeldx005.tab	eeldx043.tab	eeldx081.tab	peldx024.tab	peldx062.tab
eeldx006.tab	eeldx044.tab	eeldx082.tab	peldx025.tab	peldx063.tab
eeldx007.tab	eeldx045.tab	eeldx083.tab	peldx026.tab	peldx064.tab
eeldx008.tab	eeldx046.tab	eeldx084.tab	peldx027.tab	peldx065.tab
eeldx009.tab	eeldx047.tab	eeldx085.tab	peldx028.tab	peldx066.tab
eeldx010.tab	eeldx048.tab	eeldx086.tab	peldx029.tab	peldx067.tab
eeldx011.tab	eeldx049.tab	eeldx087.tab	peldx030.tab	peldx068.tab
eeldx012.tab	eeldx050.tab	eeldx088.tab	peldx031.tab	peldx069.tab
eeldx013.tab	eeldx051.tab	eeldx089.tab	peldx032.tab	peldx070.tab
eeldx014.tab	eeldx052.tab	eeldx090.tab	peldx033.tab	peldx071.tab

eeldx015.tab	eeldx053.tab	eeldx091.tab	peldx034.tab	peldx072.tab
eeldx016.tab	eeldx054.tab	eeldx092.tab	peldx035.tab	peldx073.tab
eeldx017.tab	eeldx055.tab	eeldx093.tab	peldx036.tab	peldx074.tab
eeldx018.tab	eeldx056.tab	eeldx094.tab	peldx037.tab	peldx075.tab
eeldx019.tab	eeldx057.tab	eeldx095.tab	peldx038.tab	peldx076.tab
eeldx020.tab	eeldx058.tab	peldx001.tab	peldx039.tab	peldx077.tab
eeldx021.tab	eeldx059.tab	peldx002.tab	peldx040.tab	peldx078.tab
eeldx022.tab	eeldx060.tab	peldx003.tab	peldx041.tab	peldx079.tab
eeldx023.tab	eeldx061.tab	peldx004.tab	peldx042.tab	peldx080.tab
eeldx024.tab	eeldx062.tab	peldx005.tab	peldx043.tab	peldx081.tab
eeldx025.tab	eeldx063.tab	peldx006.tab	peldx044.tab	peldx082.tab
eeldx026.tab	eeldx064.tab	peldx007.tab	peldx045.tab	peldx083.tab
eeldx027.tab	eeldx065.tab	peldx008.tab	peldx046.tab	peldx084.tab
eeldx028.tab	eeldx066.tab	peldx009.tab	peldx047.tab	peldx085.tab
eeldx029.tab	eeldx067.tab	peldx010.tab	peldx048.tab	peldx086.tab
eeldx030.tab	eeldx068.tab	peldx011.tab	peldx049.tab	peldx087.tab
eeldx031.tab	eeldx069.tab	peldx012.tab	peldx050.tab	peldx088.tab
eeldx032.tab	eeldx070.tab	peldx013.tab	peldx051.tab	peldx089.tab
eeldx033.tab	eeldx071.tab	peldx014.tab	peldx052.tab	peldx090.tab
eeldx034.tab	eeldx072.tab	peldx015.tab	peldx053.tab	peldx091.tab
eeldx035.tab	eeldx073.tab	peldx016.tab	peldx054.tab	peldx092.tab
eeldx036.tab	eeldx074.tab	peldx017.tab	peldx055.tab	peldx093.tab
eeldx037.tab	eeldx075.tab	peldx018.tab	peldx056.tab	peldx094.tab
eeldx038.tab	eeldx076.tab	peldx019.tab	peldx057.tab	peldx095.tab

Files in density_corrections: To access values of collision stopping powers derived from ICRU Report 37, the user must provide density effect values explicitly for each material. Files containing the appropriate data for 450 elements and compounds are provided in the EGS5 distribution in subdirectories **elements** and **compounds** of **data** subdirectory **density_corrections**. Files are titled using a unique and explicit name for each material along with a **.density** extension. The full list of elemental material files (without the **.density** extension) is given below. A list of the 345 files containing data for compounds can be found in a **README** file provided in **density_corrections**.

actinium	germanium	protactinium
aluminium	gold	radium
aluminum	hafnium	radon
americium	helium	rhenium
antimony	holmium	rhodium
argon	hydrogen	rubidium
arsenic	hydrogen_liquid	ruthenium
astatine	indium	samarium
barium	iodine	scandium
berkelium	iridium	selenium
beryllium	iron	silicon

bismuth	krypton	silver
boron	lanthanum	sodium
bromine	lead	strontium
cadmium	lithium	sulfur
calcium	lutetium	sulfur_1.92g_cm3
californium	magnesium	sulfur_2.07g_cm3
carbon_graphite_1.700g_cm3	manganese	tantalum
carbon_graphite_2.000g_cm3	mercury	technetium
carbon_graphite_2.265g_cm3	molybdenum	tellurium
cerium	neodymium	terbium
cesium	neon	thallium
chlorine	neptunium	thorium
chromium	nickel	thulium
cobalt	niobium	tin
copper	nitrogen	titanium
curium	osmium	tungsten
dysprosium	oxygen	uranium
einsteinium	palladium	vanadium
erbium	phosphorus	xenon
europium	platinum	ytterbium
fermium	plutonium	yttrium
fluorine	polonium	zinc
francium	potassium	zirconium
gadolinium	praseodymium	
gallium	promethium	

Files in int_coherent_cs: For computations in which coherent scattering is modeled with interference effects included, the user must provide the interference coherent scattering cross section data. Included in subdirectory **int_coherent_cs** of **data** in the EGS5 distribution are files of coherent scattering cross section data with interference effects for seven materials: water, PMMA, fat, muscle, kidney, liver and blood. The data files are provided are named **ics_** followed by the first letter of the material, as below.

ics_b.dat	ics_k.dat	ics_m.dat	ics_w.dat
ics_f.dat	ics_l.dat	ics_p.dat	

Files in int_form_factor: When coherent scattering interference effects are modeled, the user must also provide the appropriate form factors. Sample data files containing form factors with interference effects included are provided in subdirectory **int_form_factor** of **data** of the EGS distribution for the same seven materials in **int_coherent_cs**. The naming convention analogous to that described above is employed, and the exact EGS5 file names are listed below.

iff_b.dat	iff_k.dat	iff_m.dat	iff_w.dat
iff_f.dat	iff_l.dat	iff_p.dat	

Files in shellwise_Compton_profile: The elemental shellwise Compton profile data files included in the EGS5 distribution in subdirectory **shellwise_Compton_profile** of **data** are named as follows. This data is used in modeling Compton scattering from bound atomic electrons on a shell-by-shell basis. The naming convention employed is intuitive.

z001.dat	z019.dat	z036n.dat	z054.dat	z072.dat	z090.dat
z002.dat	z020.dat	z037.dat	z055.dat	z073.dat	z091.dat
z003.dat	z021.dat	z038.dat	z056.dat	z074.dat	z092.dat
z004.dat	z022.dat	z039.dat	z057.dat	z075.dat	z093.dat
z005.dat	z023.dat	z040.dat	z058.dat	z076.dat	z094.dat
z006.dat	z024.dat	z041.dat	z059.dat	z077.dat	z095.dat
z007.dat	z025.dat	z042.dat	z060.dat	z078.dat	z096.dat
z008.dat	z026.dat	z043.dat	z061.dat	z079.dat	z097.dat
z009.dat	z027.dat	z044.dat	z062.dat	z080.dat	z098.dat
z010.dat	z028.dat	z045.dat	z063.dat	z081.dat	z099.dat
z011.dat	z029.dat	z046.dat	z064.dat	z082.dat	z100.dat
z012.dat	z030.dat	z047.dat	z065.dat	z083.dat	z101.dat
z013.dat	z031.dat	z048.dat	z066.dat	z084.dat	z102.dat
z014.dat	z032.dat	z049.dat	z067.dat	z085.dat	
z015.dat	z033.dat	z050.dat	z068.dat	z086.dat	
z016.dat	z034.dat	z051.dat	z069.dat	z087.dat	
z017.dat	z035.dat	z052.dat	z070.dat	z088.dat	
z018.dat	z036.dat	z053.dat	z071.dat	z089.dat	

E.5 Sample User Codes and Run Scripts

The EGS5 distributions includes three sets of example user codes and two sample shell scripts for setting up and executing EGS5 simulations, as described below:

egs5run	Sample script for compiling and executing user code.
run5again	Sample script for rerunning previously compiled user code.
tutorcodes	Directory containing a series of sample problems, each in a unique subdirectory with FORTRAN source codes, input files, and output files for the step-by-step tutorials on using EGS5 found in Chapter 3 of SLAC-R-730/KEK-2005-8.
samplecodes	Directory containing subdirectories with advanced user codes and input files for example problems described in Chapter 4 of SLAC-R-730/KEK-2005-8.
extra_ucodes	Directory containing subdirectories with additional sample user codes.

The tutorial problems and advanced user codes are discussed in detail in Chapters 3 and 4 of SLAC-R-730/KEK-2005-8, respectively, while the programs (based on PEGS) included as “extra codes” are described briefly in Appendix C. Listed below are the input, source, and sample output files included in the EGS5 distribution in each of these subdirectories.

Files in subdirectories under `egs5/samplecodes`:

<code>uc_lp/uc_lp.f</code>	<code>uccyl/uccyl.out</code>	<code>ucsampl5/ucsampl5.inp</code>
<code>uc_lp/uc_lp.inp</code>	<code>ucbend/ucbend.f</code>	<code>ucsampl5/ucsampl5.out</code>
<code>uc_lp/uc_wlp.out</code>	<code>ucbend/ucbend.inp</code>	<code>ucsampcg/ucsampcg.data</code>
<code>uc_lp/uc_wolp.out</code>	<code>ucbend/ucbend.log</code>	<code>ucsampcg/ucsampcg.f</code>
<code>uccyl/uccyl.f</code>	<code>ucbend/ucbend.pic</code>	<code>ucsampcg/ucsampcg.inp</code>
<code>uccyl/uccyl.inp</code>	<code>ucsampl5/ucsampl5.f</code>	<code>ucsampcg/ucsampcg.out</code>

Files in subdirectories under `egs5/tutorcodes`:

<code>tutor1/tutor1.f</code>	<code>tutor3/tutor3.out</code>	<code>tutor6/tutor6.inp</code>
<code>tutor1/tutor1.inp</code>	<code>tutor4/tutor4.f</code>	<code>tutor6/tutor6.out</code>
<code>tutor1/tutor1.out</code>	<code>tutor4/tutor4.inp</code>	<code>tutor7/tutor7.f</code>
<code>tutor2/tutor2.f</code>	<code>tutor4/tutor4.out</code>	<code>tutor7/tutor7.inp</code>
<code>tutor2/tutor2.inp</code>	<code>tutor5/tutor5.f</code>	<code>tutor7/tutor7.w.out</code>
<code>tutor2/tutor2.out</code>	<code>tutor5/tutor5.inp</code>	<code>tutor7/tutor7_wo.out</code>
<code>tutor3/tutor3.f</code>	<code>tutor5/tutor5.out</code>	
<code>tutor3/tutor3.inp</code>	<code>tutor6/tutor6.f</code>	

Files in subdirectories under `egs5/extra_ucodes`:

<code>uc_examin/uc_examin.f</code>	<code>ucpegs/ucpegs.f</code>	<code>uctestsr/uctestsr.out</code>
<code>uc_examin/uc_examin.inp</code>	<code>ucpegs/ucpegs.inp</code>	<code>uctestsr/hplt1.inp</code>
<code>uc_examin/uc_examin.out</code>	<code>ucpegs/ucpegs.peg5dat</code>	<code>uctestsr/hplt1.peg5lst</code>
<code>uc_examin/uc_e_mfps_AL.xvgr</code>	<code>uctestsr/uctestsr.f</code>	
<code>uc_examin/uc_ph_mfp_AL.xvgr</code>	<code>uctestsr/uctestsr.inp</code>	

E.6 Auxiliary Subprogram FORTRAN Source Files

The final set of files included with the EGS5 distribution are the “auxiliary” FORTRAN source codes (in subdirectory **auxcode** of **egs5**) and files containing the **COMMON** blocks (in subdirectory **auxcommons**) associated with these codes. The auxiliary codes contain functions and subroutines

that are useful in performing input, geometry setup, distance-to-boundary, and scoring computations for many generic problems, and are referenced by some of the advanced user codes provided with the EGS5 distribution. Detailed descriptions of the functionality of the subprograms can be found in the comments in the source code and in Chapter 3 of SLAC-R-730/KEK-2005-8. Lists of the files provided with the distribution are given below.

Auxiliary FORTRAN source files found in auxcode:

cg_related.f	cyl2.f	edistr.f	plan2p.f	sph2.f
chgtr.f	cylnr.f	fintrn.f	plan2x.f	sphere.f
cone.f	decod_xyz.f	finval.f	plane1.f	sphtrn.f
cone2.f	decodeir.f	geomout.f	plotxyz.f	swatch.f
cone21.f	ecns1.f	ntally.f	rdistr.f	xyzbound.f

“Included” auxiliary COMMON block files found in auxcommons:

aux_h.f	etaly2.f	instuf.f	sphdta.f
condta.f	etaly3.f	lines.f	trndta.f
cyldta.f	geom_common.f	nfac.f	watch.f
dataconst_common.f	geortz.f	ntaly1.f	
edata.f	georz.f	pladta.f	
etaly1.f	geoxyz.f	rdata.f	