

How to use egs5 with user code written in Mortran for EGS4

Hideo Hirayama and Yosihito Namito
KEK, High Energy Accelerator Research Organization

1. Install Mortran3

Install Unix version Mortran3 at 'home/***/mortran'.

You must check Mortran3 install by using 'morurun' and check77.mor.

If you can run check77.mor without error, copy mortran3.dat to the directory that egs5run_mor exits (kek_sample directory).

2. Main difference between egs5 and EGS4

- (1) egs5 is written in Fortran 77 and the size of variables used in egs5 is defined by parameter statement in the include file.
- (2) In egs5, pegs is included as subroutines and called from user code.
It is possible to use material data created as the input data like EGS4.
- (3) In egs5, charged particle (electrons and positrons) transport is simulated without using PRESTA.
- (4) Real variables in egs5 is double precision (real*8).
- (4) 'RANECU' random number generator which has 2 seeds is used as default random number generator. RANECU has the period of in Penelope 10^{18} . This period is short compared with 10^{43} of RANMAR random number generator but far longer than RAN6 random number generator. RANECU random number can be easily controlled by using 2 seeds (iseed1 and iseed2).

3. Modifications user code written for EGS4

Following modifications are necessary.

- (1) Delete macros related random number generator if they are included in the user code.
- (2) Delete \$CALL-HOWNER related macros.
- (3) Declare all data used in COMIN macro used inside user code by a type declaration statement.
- (4) Modification of main program
4-1 Insert followings at the top of main program.

```
"Define.  egs5"
implicit none;
```

```
" Main EGS and Auxiliary 'header' file egs5"
;$MAIN-H;
$AUX-H;
```

4-2 Add INSTUF, USERSC,USERXT to COMIN and delete DEBUG from COMIN.

4-3 Declare all data used not including common in main program by a type declaration statement.

4-4 Delete \$OPEN and OPEN(12 statement.

Change fail name used in open statement to egs5job from mortran.

Due to the new feature that pegs is called inside each user code, it must be careful to the unit number used.

The unit number from 7 to 26 are used inside 'pegs' and close at the end of 'pegs'. These units, therefore, must be re-open after calling pegs. It is better not to use these unit in the user code. The unit used in the subroutine 'plotxyz' and 'geomout' used to keep and output trajectory information is changed from '9' to '39' for this reason.

Unit number related 'plotxyz' must be changed to '39' from '9' by this change.

4-5 Insert 'call region_init;' after MEDIA defining statement.

4-6 Set following optional flag for each region if necessary. 1 means 'on' and 0 means 'off'. It is not necessary set 0 if you do not want to use option.

iphter(irl)	Switches for PE-angle sampling
iedgfl(irl)	K & L-edge fluorescence
iraylr(irl)	Rayleigh scattering
lpolar(irl)	Linearly-polarized photon scattering
incohr(irl)	S/Z rejection
iprofr(irl)	Doppler broadening
impacr(irl)	Electron impact ionization

4-7 Set values of estepe, estepe2 which are new parameters used for charged particle transport.

4-8 Set 2 random number seeds, iseed1 and iseed2, as follows.

```
"Define 2 seeds befor call hatch.  egs5"
```

```
ixx=0;
```

```
jxx=0;
```

```
if (ixx .eq. 0)  ixx = 123457;
```

```
if (jxx .eq. 0) jxx = 654321;
OUTPUT ixx,jxx;
(/, ixx=',I12,5X',jxx=',I12,' (starting random-number seeds));
iseed1=ixx;
iseed2=jxx;
```

4-9 Define maximum kinetic energy of charged particle as ekein.

These modification must be done before "CALL HATCH;".

4-10 If your using PRM in your user code, change it to RM.

4-11 Delete the parts related to initialization of random number generator (IXXST, SRANG-INITIALIZATIONetc.).

4-12 Delete PRESTA related parts.

(5) AUSGAB

5-1 Insert following statement at the top of AUSGAB.

```
"Define.  egs5"
implicit none;
```

```
" Main EGS and Auxiliary 'header' file egs5"
;$MAIN-H;
$AUX-H;
```

5-2 Delete DEBUG from COMIN.

5-3 If type declaration statements for variables including COMIN macros, delete them.

5-4 Declare all data used not including common in main program by a type declaration statement.

(6) HOWFAR

6-1 Insert following statement at the top of AUSGAB.

```
"Define.  egs5"
implicit none;
```

```
" Main EGS and Auxiliary 'header' file egs5"
;$MAIN-H;
$AUX-H;
```

6-2 Delete DEBUG from COMIN if it is included.

6-3 If type declaration statements for variables including COMIN macros, delete them.

5-4 Declare all data used not including common in main program by a type declaration statement.

6-4 Change geometry related macros to 'call subroutine' like following example.

```
"$PLAN2P(NPL1,NRG1,1,NPL2,NRG2,-1);"
```

```
call PLAN2P(NPL1,NRG1,1,NPL2,NRG2,-1);
```

(7) If user code includes following subroutines, delete from user code.

- PLOTXYZ
- GEOMOUT
- ECNSV1
- NTALLY
- FIXTMX
- RMARIN

4. Make input data file for pegs (read from unit 25).

Make pegs input data. File type must be 'inp'. It is better to use same file name with user code.

5. Run program

(1) Confirm following directory and files

mortran directory : including mortran3.exe and mortran3.dat, egs4mac.mortran,
pegs5mac.mortran and pegs_hatch.mor.

egs5run_mor

(2) Modify egs5run_mor

BASKET= : change to the directory to your egs5.0 directory

MORTRAN= : change to your mortran directory

(3) Execute egs5run_mor

Key-in user code written in mortran.

Key in pegs input data file name read from unit 25. If file name of this input data is the same with user code, simply 'Enter-key' without file name.

6. Sample user code

ucsampl5.mor ucsampl5.inp ---- corresponding to ucsampl4.mor

ucnai3_5.mor ucnai3_5.mor ----- corresponding to ucnai3.mor