



Experimental determination of the activity of a ^{252}Cf source

ANNEXES

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ROOT CODE TO CALIBRATE THE GERMANIUM DETECTOR

(Calculations, spectra and fit obtained)

```
#include "TPaveStats.h"
#include <sys/stat.h>
#include <stdio.h>
#include <string.h>
#include <fstream> //X llegir fitxer
#include <iostream> //X llegir fitxer
#include "TFile.h"
#include <fcntl.h>
#include "TCanvas.h"
#include "TMath.h"
#include "TH1.h"
#include "TF1.h"
#include "TH1L.h"
#include "TH2F.h"
#include "TRandom.h"
#include <TSpectrum>
#include "TVirtualFitter.h"
#include "TString.h"
#include "TMath.h"

//MEASUREMENTS DATE: 25/11/2009
struct run_t{
    const char *nomfile;
    int MAXCHN;
    Double_t LT; //live time
    Double_t eLT; //err live time
    Double_t RT; //real time
    Double_t eRT; //err real time
    Double_t time; //time(s) from calibration source ref
    Double_t etime; //time(s) from calibration source ref
};
struct isochar_t{
    Double_t HL; //Half Life (s)
    Double_t eHL;
    Double_t A0; //Activity in measurement time
    Double_t eA0; //Uncertainty activity in measurement time
    Double_t Act; //Activity in measurement time
    Double_t eAct; //Uncertainty activity in measurement time
};
const Int_t MAXCHN = 8192; // Maximum array size
```

```

void Cal_germani(){
const Int_t MAXCHN = 8192;
run_t Mix, BaEu, Bkg, Cfcurl, Cflong;

Mix.nomfile="ESPECTRES/Mix_JYFL30_2400s.txt";
BaEu.nomfile="ESPECTRES/BaEu_JYFL14_2400s.txt";
Bkg.nomfile="ESPECTRES/Bck_JYFL_66998s.txt";

Mix.LT=2395.0; Mix.RT=2400.0;
BaEu.LT=2300.0; BaEu.RT=2400.0;
Bkg.LT=66964.0; Bkg.RT=66998.0;
Mix.eLT=Mix.RT=1.0;
BaEu.eLT=BaEu.eRT=1.0;
Bkg.eLT=Bkg.eRT=1.0;

Mix.MAXCHN=BaEu.MAXCHN=Bkg.MAXCHN=MAXCHN;
Mix.time=5352*86400; //01/04/1995-25/11/2009 (462412800)
Mix.etime=86400;//1 dia
BaEu.time=8577*86400; //02/06/1986-25/11/2009 (741052800)
BaEu.etime=86400;//1 dia
Bkg.time=0;

isochar_t cs,co,am,eu,ba;
cs.HL=948937032; cs.eHL=946728;//30.07 years +/- 0.03 years
co.HL=166344192.0; co.eHL=12096;//1925.28 days +/- 0.14 days
am.HL=13651817760; am.eHL=18934560;//432.6 years +/- 0.6 years
eu.HL=427204382.9; eu.eHL=189345.6;//13,53729 years +/- 2,1915 days
ba.HL=331677318.7; ba.eHL=1577880;//10,51022 years +/- 18,2625 days

//Initial activity
cs.A0=2294.0; cs.eA0=cs.A0*0.04;//ref date 1-4-1995
ba.A0=109000; ba.eA0=ba.A0*0.07; //ref date 2-6-1986
eu.A0=169000; eu.eA0=eu.A0*0.07; //ref date 2-6-1986
co.A0=3760; co.eA0=co.A0*0.041;//ref date 1-4-1995
am.A0=6209; am.eA0=am.A0*0.05;//ref date 1-4-1995

```

```

//Activity during measuremnt
//INCERTESA: eX=X*sqrt((eA0/A0)^2+(ln2*timefont*eHL/(HL)^2)^2+(etimefont*ln2/HL)^2)
cs.Act=cs.A0*exp((-log(2)/cs.HL)*Mix.time);
cs.eAct=cs.Act*sqrt((cs.eA0/cs.A0)*(cs.eA0/cs.A0)+(Mix.time*log(2)*cs.eHL/(cs.HL*cs.HL))*(Mix.time*log(2)*cs.eHL/(cs.HL*cs.HL))+((Mix.etime*log(2)/cs.HL)*(Mix.etime*log(2)/cs.HL));
ba.Act=ba.A0*exp((-log(2)/ba.HL)*BaEu.time);
ba.eAct=ba.Act*sqrt((ba.eA0/ba.A0)*(ba.eA0/ba.A0)+(BaEu.time*log(2)*ba.eHL/(ba.HL*ba.HL))*(BaEu.time*log(2)*ba.eHL/(ba.HL*ba.HL))+((BaEu.etime*log(2)/ba.HL)*(BaEu.etime*log(2)/ba.HL));
eu.Act=eu.A0*exp((-log(2)/eu.HL)*BaEu.time);
eu.eAct=eu.Act*sqrt((eu.eA0/eu.A0)*(eu.eA0/eu.A0)+(BaEu.time*log(2)*eu.eHL/(eu.HL*eu.HL))*(BaEu.time*log(2)*eu.eHL/(eu.HL*eu.HL))+((BaEu.etime*log(2)/eu.HL)*(BaEu.etime*log(2)/eu.HL));
co.Act=co.A0*exp((-log(2)/co.HL)*Mix.time);
co.eAct=co.Act*sqrt((co.eA0/co.A0)*(co.eA0/co.A0)+(Mix.time*log(2)*co.eHL/(co.HL*co.HL))*(Mix.time*log(2)*co.eHL/(co.HL*co.HL))+((Mix.etime*log(2)/co.HL)*(Mix.etime*log(2)/co.HL));
am.Act=am.A0*exp((-log(2)/am.HL)*Mix.time);
am.eAct=am.Act*sqrt((am.eA0/am.A0)*(am.eA0/am.A0)+(Mix.time*log(2)*am.eHL/(am.HL*am.HL))*(Mix.time*log(2)*am.eHL/(am.HL*am.HL))+((Mix.etime*log(2)/am.HL)*(Mix.etime*log(2)/am.HL));

cout<<"ACTIVITAT"<<endl;
cout<<endl<<"Am241: "<<am.Act<<" +/- "<<am.eAct<<" "<<am.eAct/am.Act*100<<"%"<<endl;
cout<<"Cs137: "<<cs.Act<<" +/- "<<cs.eAct<<" "<<cs.eAct/cs.Act*100<<"%"<<endl;
cout<<"Co60: "<<co.Act<<" +/- "<<co.eAct<<" "<<co.eAct/co.Act*100<<"%"<<endl;
cout<<"Eu152: "<<eu.Act<<" +/- "<<eu.eAct<<" "<<eu.eAct/eu.Act*100<<"%"<<endl;
cout<<"Ba133: "<<ba.Act<<" +/- "<<ba.eAct<<" "<<ba.eAct/ba.Act*100<<"%"<<endl;

//PEAKS (ENERGY-keV)->Yield->Channel->AREA
//ESPECTRES/Mix_JYFL30_2400s.txt & BaEu_JYFL14_2400s.txt
Double_t Emix[4]={59.541,661.657,1173.228,1332.490};
Double_t eEmix[4]={0.001,0.003,0.003,0.004};
Double_t Ymix[4]={0.35900,0.85064,0.998500,0.999826};
Double_t eYmix[4]={0.005375,0.00060,0.0003,0.000006};
Double_t Xmix[4]={170.33,1922.23,3408.95,3871.45};
Double_t eXmix[4]={0.01,0.04,0.11,0.10};
//Int_t Amix[4]={35048,7984,2071,1972};
//Int_t eAmix[4]={393,217,112,104};
//AREES SENSE RESTAR BKG
//Int_t ABmix[4]={35138,8016,1975,1973};//1975 1pic+
//Int_t eABmix[4]={354,243,96,120};
//AREES x NÚMEROS
Int_t ABmix[4]={35089,7973,2079,2007};
Int_t eABmix[4]={187,90,46,65};

```

```

//AREES TRINO
//Int_t ABmix[4]={35042,8050,2079,2019};
//Int_t eABmix[4]={187,90,46,45};

Double_t Enat[3]={1460.821,1764.494,2614.532};//40K,214Bi,208Tl
Double_t eEnat[3]={0.006,0.014,0.013};
Double_t Xnat[3]={4243.66,5126.79,7591.48};
Double_t eXnat[3]={0.16,0.40,0.31};
Int_t Anat[3]={339,29,64};
Int_t eAnat[3]={28,6,7};
//Es comprova que han desaparegut. Els anteriors son utils per la calibració en energies.

Double_t Eba[6]={53.163,80.997,276.400,302.851,356.013,383.848};
Double_t eEba[6]={0.001,0.001,0.001,0.001,0.001,0.001};
Double_t Yba[6]={0.02199,0.3411,0.07164,0.1833,0.6205,0.0894};
Double_t eYba[6]={0.00022,0.0089,0.00022,0.0006,0.0019,0.0003};
Double_t Xba[6]={151.76,232.43,801.48,878.54,1033.13,1114.04};
Double_t eXba[6]={0.01,0.02,0.01,0.01,0.01,0.02};
//Int_t Aba[6]={6835,120533,16273,39151,118252,16423};
//Int_t eAba[6]={288,5660,259,366,1986,348};
//AREES SENSE RESTAR BKG
//Int_t ABba[6]={7447,124249,16989,41064,123307,17126};//79.614 -> 11082(931)ch229.14
// 80.997 -> 114888(2341)ch232.62
//Int_t eABba[6]={204,5525,236,439,1846,296};
//AREES FINALS x METODE NUMEROS
Int_t ABba[6]={7309,123404,16398,39431,118959,16425};//el 2n per Legnaro
Int_t eABba[6]={86,351,128,199,345,129};//
//AREES FINALS x TRINO
//Int_t ABba[6]={7447,120396,16072,39175,118684,16662};//el primer no modificat
//Int_t eABba[6]={204,347,127,198,344,129};//el primer no modificat

Double_t
Eeu[14]={121.782,244.697,344.278,411.116,443.965,778.904,867.373,964.079,1085.869,1089.
737,1112.069,1212.948,1299.140,1408.005};
Double_t
eEeu[14]={0.001,0.001,0.001,0.001,0.003,0.002,0.003,0.018,0.024,0.005,0.003,0.011,0.009,0.0
03};
Double_t
Yeu[14]={0.286678,0.076066,0.26558,0.022372,0.031576,0.129603,0.042584,0.146494,0.1023
79,0.017297,0.136855,0.014263,0.016254,0.210692};
Double_t
eYeu[14]={0.001456,0.000403,0.005129,0.000246,0.000297,0.001414,0.000274,0.000719,0.00
0525,0.000198,0.000676,0.000093,0.000193,0.001016};

```

```

Double_t
Xeu[14]={351.30,709.23,999.05,1193.41,1289.00,2262.72,2519.85,2800.84,3154.69,3166.31,3
230.89,3524.08,3774.46,4090.45};
Double_t eXeu[14]={0.01,0.01,0.01,0.03,0.03,0.01,0.03,0.02,0.03,0.06,0.02,0.09,0.07,0.08};
//Int_t
ABeu[14]={210760,40771,116236,8533,11346,32164,9964,31624,20381,3665,27177,2702,277
3,35218};
//Int_t eABeu[14]={1860,751,1608,152,218,632,223,755,512,168,1129,103,84,1255};
//AREES SENSE RESTAR BKG
//Int_t
ABeu[14]={219942,42725,121317,8893,11843,33605,10428,32958,21149,3712,28373,2715,29
13,36728};
//Int_t eABeu[14]={1780,626,1632,148,248,607,236,793,513,171,1154,83,89,1305};
//AREES FINALS x METODEDE NUMEROS
Int_t
ABeu[14]={211411.5,41752,116711.5,8828.5,11556,32247,10096,31812,20798,3514,26834,26
22,2816,35823.5};
Int_t eABeu[14]={460,205,342,94,108,180,102,178,145,60,862,52,53,190};
//AREES FINALS x TRINO
//Int_t
ABeu[14]={210597,41017,116805,8620,11404,32368,10094,31999,20785,3559,27747,2742,29
44,35868};
//Int_t eABeu[14]={459,202,342,93,107,180,100,179,144,60,167,52,54,189};

//Pics suma:   Eu: 121.782+1408.005=1529.787 Y=0.060401 (305,224) //NO ES TENEN EN
COMPTE ENTREN DINS L'ERROR TAMPOC ES VEUEN DE FORMA CLARA
//
Eu: 344.278+1112.069=1456.347 (525,271)

//Eficiencies calculations
cout<<endl<<"EFICIENCIES DE CADA ENERGIA MESURADES I ERRORS
ESTADÍSTICS"<<endl<<endl;
Double_t effeu[14],effBeu[14],erreu[14],errBeu[14];
Int_t i;
for(i=0;i<14;i++){
    effBeu[i]=ABeu[i]/(BaEu.LT*Yeu[i]*eu.Act);
    errBeu[i]=effBeu[i]*sqrt((eABeu[i]/ABeu[i])*(eABeu[i]/ABeu[i])+(BaEu.eLT/BaEu.LT)*(B
aEu.eLT/BaEu.LT)+(eYeu[i]/Yeu[i])*(eYeu[i]/Yeu[i])+(eu.eAct/eu.Act)*(eu.eAct/eu.Act));
    cout<<Eeu[i]<<" "<<effBeu[i]<<" +/-" <<errBeu[i]<<"
("<<errBeu[i]*100/effBeu[i]<<")"<<endl; //" - "<<effeu[i]<<" +/-" <<erreu[i]<<endl;
}
cout<<endl;
Double_t effba[6],effBba[6],errba[6],errBba[6];
for(i=0;i<6;i++){
    effBba[i]=ABba[i]/(BaEu.LT*Yba[i]*ba.Act);

```



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    errBba[i]=effBba[i]*sqrt((eABba[i]/ABba[i])*(eABba[i]/ABba[i])+(BaEu.eLT/BaEu.LT)*(B
aEu.eLT/BaEu.LT)+(eYba[i]/Yba[i])*(eYba[i]/Yba[i])+(ba.eAct/ba.Act)*(ba.eAct/ba.Act));
    cout<<Eba[i]<<" "<<effBba[i]<<"+/-"<<errBba[i]<<
(" <<errBba[i]*100/effBba[i]<<")<<endl; //" - "<<effba[i]<<"+/-"<<errba[i]<<endl;
}
cout<<endl;
Double_t
effco[2],effcs,effam,effBco[2],effBcs,effBam,errco[2],errcs,erram,errBco[2],errBcs,errBam;
for(i=0;i<2;i++){
    effBco[i]=ABmix[i+2]/(Mix.LT*Ymix[i+2]*co.Act);
    errBco[i]=effBco[i]*sqrt((eABmix[i+2]/ABmix[i+2])*(eABmix[i+2]/ABmix[i+2])+(Mix.eLT
/Mix.LT)*(Mix.eLT/Mix.LT)+(eYmix[i+2]/Ymix[i+2])*(eYmix[i+2]/Ymix[i+2])+(co.eAct/co.Act)*(c
o.eAct/co.Act));
    cout<<Emix[i+2]<<" "<<effBco[i]<<"+/-"<<errBco[i]<<
(" <<errBco[i]*100/effBco[i]<<")<<endl; //" - "<<effco[i]<<"+/-"<<errco[i]<<endl;
}

effBcs=ABmix[1]/(Mix.LT*Ymix[1]*cs.Act);

errBcs=effBcs*sqrt((eABmix[1]/ABmix[1])*(eABmix[1]/ABmix[1])+(Mix.eLT/Mix.LT)*(Mix.eLT/
Mix.LT)+(eYmix[1]/Ymix[1])*(eYmix[1]/Ymix[1])+(cs.eAct/cs.Act)*(cs.eAct/cs.Act));
cout<<Emix[1]<<" "<<effBcs<<"+/-"<<errBcs<< (" <<errBcs*100/effBcs<<")<<endl; //" -
"<<effcs<<"+/-"<<errcs<<endl;

effBam=ABmix[0]/(Mix.LT*Ymix[0]*am.Act);

errBam=effBam*sqrt((eABmix[0]/ABmix[0])*(eABmix[0]/ABmix[0])+(Mix.eLT/Mix.LT)*(Mix.eLT
/Mix.LT)+(eYmix[0]/Ymix[0])*(eYmix[0]/Ymix[0])+(am.eAct/am.Act)*(am.eAct/am.Act));
cout<<Emix[0]<<" "<<effBam<<"+/-"<<errBam<< (" <<errBam*100/effBam<<")<<endl; //" -
"<<effam<<"+/-"<<erram<<endl;

cout<<endl;
/*****ENERGIA CALIBRATION VALUES*****/
Double_t Ener[7]={Emix[0],Emix[1],Emix[2],Emix[3],Enat[0],Enat[1],Enat[2]};
Double_t eEner[7]={eEmix[0],eEmix[1],eEmix[2],eEmix[3],eEnat[0],eEnat[1],eEnat[2]};
Double_t Ch[7]={Xmix[0],Xmix[1],Xmix[2],Xmix[3],Xnat[0],Xnat[1],Xnat[2]};
Double_t eCh[7]={eXmix[0],eXmix[1],eXmix[2],eXmix[3],eXnat[0],eXnat[1],eXnat[2]};

Energy_Fit(7,Ch,Ener,eCh,eEner);
cout<<endl;

```

```

/*****EFICIENCY CALIBRATION VALUES*****/
int const k=21;
Double_t
E[k]={eEmix[0],Eba[1],Eeu[0],Eeu[1],Eba[2],Eba[3],Eeu[2],Eba[4],Eba[5],Eeu[3],Eeu[4],Emix[1],E
eu[5],Eeu[6],Eeu[7],Eeu[10],Emix[2],Eeu[11],Eeu[12],Emix[3],Eeu[13]};//Eba[0],Eeu[8],Eeu[9],
Double_t
eE[k]={eEmix[0],eEba[1],eEeu[0],eEeu[1],eEba[2],eEba[3],eEeu[2],eEba[4],eEba[5],eEeu[3],eEe
u[4],eEmix[1],eEeu[5],eEeu[6],eEeu[7],eEeu[10],eEmix[2],eEeu[11],eEeu[12],eEmix[3],eEeu[13
]};
Double_t
effB[k]={effBam,effBba[1],effBeu[0],effBeu[1],effBba[2],effBba[3],effBeu[2],effBba[4],effBba[5
],effBeu[3],effBeu[4],effBcs,effBeu[5],effBeu[6],effBeu[7],effBeu[10],effBco[0],effBeu[11],effB
eu[12],effBco[1],effBeu[13]};//effBba[0],effBeu[8],effBeu[9],effBba[1],
Double_t
errB[k]={errBam,errBba[1],errBeu[0],errBeu[1],errBba[2],errBba[3],errBeu[2],errBba[4],errBba
[5],errBeu[3],errBeu[4],errBcs,errBeu[5],errBeu[6],errBeu[7],errBeu[10],errBco[0],errBeu[11],
errBeu[12],errBco[1],errBeu[13]};

Double_t EFit[k];
Double_t eEFit[k];
Double_t effFit[k];
Double_t errFit[k];
FILE *fout;
fout = fopen("eff_grapher_In.dat","w");
cout<<"IDEM EFF VALORS ORDENATS"<<endl<<endl;
for(i=0;i<k;i++){
    EFit[i]=E[i];
    eEFit[i]=eE[i];
    effFit[i]=effB[i];
    errFit[i]=errB[i];
    cout<<EFit[i]<<" "<<effFit[i]<<" "<<errFit[i]<<" "<<errFit[i]/effFit[i]*100<<"%"<<endl;
    fprintf(fout,"%f %f %f %f\n",EFit[i],eEFit[i],effFit[i],errFit[i]);
}
cout<<endl;
fclose(fout);
Eff_Fit(k,EFit,effFit,eEFit,errFit);

```

```

/*****/
/*****ROOT FIGURES FROM SPECTRA*****/
/*****/

// Initial ROOT settings -----
gROOT->Reset();
gROOT->SetStyle("Plain");
gStyle->SetOptStat(000000);/(1001111);//PER FER APAREIXER L'ESTADÍSTICA

// Define and draw 1-D histograms to set axis
char title[20];
char fc1[100],fc2[100],fc3[100],fc4[100];
Double_t Amp1[8192];

/*****MIXTA x CANALS*****/
sprintf(fc1,Mix.nomfile);
ifstream finp(fc1);
Double_t xmin=1, xmax=MAXCHN;
sprintf(title,"Energy calibration spectrum");
hMix = new TH1F("hMix",title,MAXCHN,xmin,xmax);//NO CALIBRAT
// Read the file into arrays
Int_t i=0;
while( finp >> Amp1[i] ){
    hMix->SetBinContent(i,Amp1[i]);
    i++;
}
finp.close();

/*****RECTA ENERGIA*****/
//FIT GRAPHER: E = 0.3442753476 * Ch + 0.04422727122 (Legnaro centroide de cada peak)
//FIT ROOT: E = 0.343897 * Ch + 0.0949770
//A SACO: (xmax-iso1.Energy[1])/(8192-1922.23)*i+0.0;//Y=0.344074015x+0.571
sprintf(fc1,Mix.nomfile);
ifstream finp(fc1);
sprintf(title,"Energy calibration fit");
hMix2 = new TH1F("hMix2",title,MAXCHN,xmin,MAXCHN);//RECTA CALIBRACIO
i=0;
Double_t RE;
while( finp >> Amp1[i] ){
    RE=0.0949770 + 0.343897*i;
    hMix2->SetBinContent(i,RE);
    i++;
}
finp.close();

```

```

/*****MIXTA x CALIBRADA*****/
sprintf(fc1,Mix.nomfile);
ifstream finp(fc1);
xmin=1;
xmax=0.343897 * MAXCHN + 0.0949770;//A saco: MAXCHN*iso1.Energy[1]/1922.23;
sprintf(title,"Energy calibration");
hMix3 = new TH1F("hMix3",title,MAXCHN,xmin,xmax);//CALIBRAT
i=0;
while( finp >> Amp1[i] ){
    hMix3->SetBinContent(i,Amp1[i]);
    i++;
}
finp.close();
cout<<endl<<"Data points = "<<i<<"\n";

/*****BaEu CALIBRADA*****/
sprintf(fc2,BaEu.nomfile);
ifstream finp(fc2);
sprintf(title,"BaEu");
hBaEu = new TH1F("hBaEu",title,MAXCHN,xmin,xmax);//CALIBRAT
i=0;
while( finp >> Amp1[i] ){
    hBaEu->SetBinContent(i,Amp1[i]);
    i++;
}
finp.close();

/*****Cf CALIBRADA*****/
sprintf(fc3,"ESPECTRES/Cf252_JYFL_46061s.txt");//Cflong.nomfile);
ifstream finp(fc3);
sprintf(title,"Cf-252 Spectrum");
hCf = new TH1F("hCf",title,MAXCHN,xmin,xmax);//CALIBRAT
i=0;
while( finp >> Amp1[i] ){
    hCf->SetBinContent(i,Amp1[i]);
    i++;
}
finp.close();

/*****Bkg CALIBRADA*****/
sprintf(fc4,Bkg.nomfile);
ifstream finp(fc4);
sprintf(title,"Background");
hBkg = new TH1F("hBkg",title,MAXCHN,xmin,xmax);//CALIBRAT
i=0;

```

```

while( finp >> Amp1[i] ){
    hBkg->SetBinContent(i,Amp1[i]);
    i++;
}
finp.close();
cout<<endl<<"Data points = "<<i<<"\n";

/*****SCALES AND BKG SUBTRACTION*****/
TH1F *heff1 = (TH1F *)hMix->Clone("heff1");
TH1F *heff2 = (TH1F *)hBaEu->Clone("heff2");
TH1F *heff3 = (TH1F *)hCf->Clone("heff3");
TH1F *hBkgeff1 = (TH1F *)hBkg->Clone("hBkgeff1");
TH1F *hBkgeff2 = (TH1F *)hBkg->Clone("hBkgeff2");
TH1F *hBkgeff3 = (TH1F *)hBkg->Clone("hBkgeff3");
heff1->Scale(Mix.RT/Mix.LT);
heff2->Scale(BaEu.RT/BaEu.LT);
heff3->Scale(46061.0/44434.0);
hBkgeff1->Scale(Bkg.RT/Bkg.LT);
hBkgeff2->Scale(Bkg.RT/Bkg.LT);
hBkgeff3->Scale(Bkg.RT/Bkg.LT);
//Comparing source and background
hBkgeff1->Scale(Mix.LT/Bkg.LT);
hBkgeff2->Scale(BaEu.LT/Bkg.LT);
hBkgeff3->Scale(44434.0/Bkg.LT);
heff1->Add(hBkgeff1,-1);//No té sentit restar el background!!!
heff2->Add(hBkgeff2,-1);
heff3->Add(hBkgeff3,-1);
cout<<endl<<"JA STA!"<<endl;

/*FILE *fout;
Double_t num1,num2,num3;
fout1 = fopen("Mix_no_bkg.txt","w");
fout2 = fopen("BaEu_no_bkg.txt","w");
fout3 = fopen("Cf_no_bkg.txt","w");
for (i=0;i<MAXCHN;i++){
    num1=heff1->GetBinContent(i);
    num2=heff2->GetBinContent(i);
    num3=heff3->GetBinContent(i);
    fprintf(fout1,"%f\n",num1);
    fprintf(fout2,"%f\n",num2);
    fprintf(fout3,"%f\n",num3);
}
fclose(fout1);
fclose(fout2);
fclose(fout3);*/

```

```

/*****FIGURES ENERGIA*****/
TCanvas *c2 = new TCanvas("c2","Energy calibration",400,20,800,600);
gStyle->SetPaperSize(20,18);
c2->SetFillColor(10);
c2->Divide(1,3);
c2_1->cd();
    c2_1->SetLogx(0);
    c2_1->SetLogy(1);
    c2_1->SetGridx(1);
    c2_1->SetGridy(1);

hMix->GetXaxis()->SetTitle("Channel");
hMix->GetYaxis()->SetTitle("Counts");
//hM1->GetYaxis()->SetRangeUser(0,10000); //si no ho ajusta automàticament
//hM1->GetXaxis()->SetRangeUser(0,8192); //si no ho ajusta automàticament
hMix->SetStats(kTRUE);
hMix->SetLineColor(1);
hMix->Draw();

//heff1->SetStats(kTRUE);
//heff1->SetLineColor(2);
//heff1->Draw("same");

c2_2->cd();
    c2_2->SetLogx(0);
    c2_2->SetLogy(0);
    c2_2->SetGridx(1);
    c2_2->SetGridy(1);

hMix2->GetXaxis()->SetTitle("Channel");
hMix2->GetYaxis()->SetTitle("Energy");
hMix2->SetStats(kTRUE);
hMix2->SetLineColor(1);
hMix2->Draw();

c2_3->cd();
    c2_3->SetLogx(0);
    c2_3->SetLogy(0);
    c2_3->SetGridx(1);
    c2_3->SetGridy(1);

hMix3->GetXaxis()->SetTitle("Energy");
hMix3->GetYaxis()->SetTitle("Counts");
hMix3->SetStats(kTRUE);

```

```

hMix3->SetLineColor(1);
hMix3->Draw();

//Legend
//leg1 = new TLegend(0.71,0.74,0.90,0.88);
//leg1->AddEntry(hc1,"Gain 15x1.2", "");
//leg1->AddEntry(hc1,"RT 2.0 #mus FT 0.8 #mus", "");
//leg1->AddEntry(hc1,"NON STD conditions");
////leg1->AddEntry(hc2,"STD conditions (x10)");
//leg1->SetFillColor(10);
//leg1->Draw();

c2_1->Update();
c2_2->Update();
c2_3->Update();
//Update canvas
//CREAR *.gif
//char str_name[100];
//sprintf(str_name,"Calibration.gif");
//c2->Print(str_name);
c2->Update();

/*****ESPECTRES BaEu/Cf/Fons I RESTES*****/
TCanvas *c3 = new TCanvas("c3","BaEu, Cf and Bkg calibrated",400,20,800,600);
gStyle->SetPaperSize(20,18);
c3->SetFillColor(10);
c3->Divide(1,3);
c3_1->cd();
    c3_1->SetLogx(0); c3_1->SetLogy(0);
    c3_1->SetGridx(1); c3_1->SetGridy(1);

hBaEu->GetXaxis()->SetTitle("Energy");
hBaEu->GetYaxis()->SetTitle("Counts");
hBaEu->SetStats(kTRUE);
hBaEu->SetLineColor(1);
hBaEu->Draw();

heff2->SetStats(kTRUE);
heff2->SetLineColor(2);
heff2->Draw("same");

c3_2->cd();
    c3_2->SetLogx(0); c3_2->SetLogy(0);
    c3_2->SetGridx(1); c3_2->SetGridy(1);

```

```

hCf->GetXaxis()->SetTitle("Energy");
hCf->GetYaxis()->SetTitle("Counts");
hCf->SetStats(kTRUE);
hCf->SetLineColor(1);
hCf->Draw();

heff3->SetStats(kTRUE);
heff3->SetLineColor(2);
heff3->Draw("same");

c3_3->cd();
    c3_3->SetLogx(0); c3_3->SetLogy(0);
    c3_3->SetGridx(1); c3_3->SetGridy(1);

hBkg->GetXaxis()->SetTitle("Energy");
hBkg->GetYaxis()->SetTitle("Counts");
hBkg->SetStats(kTRUE);
hBkg->SetLineColor(1);
hBkg->Draw();

c3_1->Update();
c3_2->Update();
c3_3->Update();
c3->Update();

//*****//
TCanvas *c9 = new TCanvas("c9","Cf_252_spectrum",400,20,800,600);
gStyle->SetPaperSize(20,18);
c9->SetFillColor(10);
c9->SetLogx(0); c9->SetLogy(0);
c9->SetGridx(1); c9->SetGridy(1);

hCf->GetXaxis()->SetTitle("Energy (keV)");
hCf->GetYaxis()->SetTitle("Counts");
hCf->SetStats(kTRUE);
hCf->SetLineColor(1);
hCf->Draw();

c9->Update();
eficiencia();
calcul(EFit,effFit,errFit);
}

```



```

/*****
/*****Energy Calibration Parameters*****/
/*****

Energy_Fit(Int_t N, Double_t *Ch, Double_t *Ener, Double_t *eCh,Double_t *eEner){
    gROOT->SetStyle("Plain");
    gStyle->SetOptStat(0);
    gStyle->SetOptFit(1011);
    gStyle->SetPadRightMargin(0.1);
    gStyle->SetPadLeftMargin(0.14);

    TCanvas *c0 = new TCanvas("c0","Energy calibration Fit",450,50,800,600);
    gStyle->SetPaperSize(18,22);
    c0->SetFillColor(10);
    c0->SetGridx(1);
    c0->SetGridy(1);

    hener = new TH1F("hener","Energy fit",MAXCHN,1,MAXCHN);
    hener->GetYaxis()->SetTitle("E_{#gamma} (keV) ");
    hener->GetYaxis()->SetTitleOffset(1.4);
    hener->GetXaxis()->SetTitle("Channels");
    //hener->GetXaxis()->SetRangeUser(0,4000);
    hener->SetLineColor(1);
    hener->DrawCopy();

    fitener = new TF1("fitener",Energy,0,MAXCHN,2);
    //AQUÍ ES ON CAL CANVIAR ELS PARAMETRES
    fitener->GetXaxis()->SetTitle("Channels");
    fitener->GetYaxis()->SetTitle("Energy (keV)");
    fitener->SetParameter(0,0.0949770);//
    fitener->SetParameter(1,0.343897);
    fitener->Draw();

    // Define graphs
    // Data with errors
    gr0 = new TGraphErrors(N,Ch,Ener,eCh,eEner);
    gr0->SetMarkerColor(2);
    gr0->SetMarkerStyle(2);
    gr0->SetMarkerSize(1.5);
    gr0->Draw("P");
    gr0->Fit("fitener","p");
    c0->Update();
return;
}

```

```

// Recta Calibració
Double_t Energy(Double_t *x, Double_t *par){
    Double_t z=x[0];
    Double_t fun=par[0]+par[1]*z;
    return fun;
}

/*****Jaeckel Function eff parameters*****/

Eff_Fit(Int_t k,Double_t *E,Double_t *eff,Double_t *eE,Double_t *err){

    gROOT->SetStyle("Plain");
    gStyle->SetOptStat(0);
    gStyle->SetOptFit(1011);
    gStyle->SetPadRightMargin(0.1);
    gStyle->SetPadLeftMargin(0.14);

    TCanvas *c1 = new TCanvas("c1","",450,50,800,600);
    gStyle->SetPaperSize(18,22);
    c1->SetFillColor(10);

    c1->SetLogx(1); c1->SetLogy(1);
    c1->SetGridx(1); c1->SetGridy(1);

    // hener = new TH1F("hener","Energy fit",MAXCHN,1,MAXCHN);
    //he1 = new TH2F("he1","Linearity",100,0.0,4000.0,100,0.0,1.0);
    he1 = new TH1F("he1","Efficiency fit",8192,1,3000);
    he1->GetYaxis()->SetTitle("#epsilon_{#gamma} (au)");
    he1->GetYaxis()->SetTitleOffset(1.4);
    he1->GetXaxis()->SetTitle("E_{#gamma} (keV) ");
    he1->GetXaxis()->SetRangeUser(0,4000);
    he1->SetLineColor(1);
    he1->DrawCopy();

    TF1 *fiteff = new TF1("fiteff",efffunc,50,2000,6);
    //AQUÍ ES ON CAL CANVIAR ELS PARAMETRES
    fiteff->SetParameter(0,38.01);
    fiteff->SetParameter(1,-4.421);
    fiteff->SetParameter(2,0.2435);
    fiteff->SetParameter(3,-0.03852);
    fiteff->SetParameter(4,0.06314);
    fiteff->SetParameter(5,0.06094);

    fiteff->Draw();

```

```

// Define graphs
// Data with errors
gr1 = new TGraphErrors(k,E,eff,eE,err);
gr1->SetMarkerColor(3);
gr1->SetMarkerStyle(2);
gr1->SetMarkerSize(1.5);
gr1->Draw("P");
gr1->Fit("fiteff","p");//ep
return;
}

// Jaeckel function
Double_t effunc(Double_t *x, Double_t *par){
    int i;
    Double_t pi=TMath::Pi();
    Double_t z=TMath::Log(x[0]);
    Double_t fun=TMath::Exp(par[3]+par[4]*z+par[5]*z*z);//3,4,5 o 0,1,2
    Double_t fun=TMath::Exp((par[0]+par[1]*z+par[2]*z*z)*2/pi*(TMath::ATan(fun))-25.);
    //Double_t fun=(par[0]+par[1]*x[0]+par[2]*x[0]*x[0]);
    return fun;
}

/*****Calcul efficiency*****/
calcul(Double_t *E, Double_t *effE, Double_t *errE){
    Double_t P[6]={38.0171,-4.42073,0.243408,0.0319286,0.0663157,0.0604823};
    Double_t eP[6]={0.166969,0.0239804,0.00312862,0.0683936,0.0221555,0.00356366};
    Double_t En[3]={1435.8,1596.54};
    Double_t A,B,z;
    Double_t eff,Chi=0;
    Double_t pi=TMath::Pi();
    Int_t i;
    Double_t Maxim[21];
    Double_t PerMax[21];
    cout<<endl<<"CÀLCUL EFICIÈNCIA AMB FUNCIO AJUSTADA (ERROR MÀX superior o
inferior)"<<endl<<endl;
    for(i=0;i<21;i++){
        //CALCUL EFICIENCIA PER JACKEL:
        z=TMath::Log(E[i]);
        A=TMath::Exp(P[3]+P[4]*z+P[5]*z*z);
        B=P[0]+P[1]*z+P[2]*z*z;
        Double_t eff=TMath::Exp(B*2/pi*(TMath::ATan(A))-25);
    }
}

```

```

//INCERTESA PER JACKEL
    Double_t
Ueff1=(eff*2/pi)*(eff*2/pi)*((TMath::ATan(A))*(TMath::ATan(A))*(eP[0]*eP[0]+z*eP[1]*z*eP[
1]+z*z*eP[2]*z*z*eP[2])+((P[0]+z*P[1]+z*z*P[2])/((1+A*A)/A))*(B*A/(1+A*A))*(eP[3]*eP[3]+z
*z*eP[4]*eP[4]+z*z*z*z*eP[5]*eP[5]));
    Ueff1=sqrt(Ueff1);
    //INCERTESA PER ERROR EN ELS PUNTS
    Double_t DALT=(eff-(effE[i]+errE[i]));
    if(DALT<0) DALT=DALT*(-1);
    Double_t BAIX=(eff-(effE[i]-errE[i]));
    if(BAIX<0) BAIX=BAIX*(-1);
    //cout<<DALT<<" "<<BAIX<<endl;
    Maxim[i]=TMath::Max(DALT,BAIX);///sqrt(3);
    PerMax[i]=Maxim[i]/eff;//TANT per U de l'ERROR
    cout<<E[i]<<": "<<eff<<" +/-"<<Maxim[i]<<" ("<<PerMax[i]*100<<"%)"<<endl;
}
Long64_t Nmax;
Double_t Umax;
Nmax=TMath::LocMax(21,PerMax);
Umax=PerMax[Nmax];
cout<<endl<<"Incertesa maxima de l'ajust: "<<Umax<<endl<<endl;
for(i=0;i<2;i++){
    z=TMath::Log(En[i]);
    A=TMath::Exp(P[3]+P[4]*z+P[5]*z*z);
    B=P[0]+P[1]*z+P[2]*z*z;
    //cout<<endl<<z<<" A: "<<A<<" B: "<<B<<endl;
    Double_t eff=TMath::Exp(B*2/pi*(TMath::ATan(A))-25);
    cout<<En[i]<<": "<<eff<<" +/-"<<Umax*eff<<" ("<<Umax*100<<"%)"<<endl;
}
return;
}

```

```

/***** Jaeckel function *****/
efficiencia(){
    Double_t E[17000];
    Double_t a[6]={-25.16,0.01681,-0.0162,5.218,-0.4009,0.01145};
    //Double_t a[3]={-2.22886,-0.484899,-0.0145930};//{65.58,4.874,0.2304,-0.3816,-
0.09602,0.00118};
    Double_t pi=TMath::Pi();
    Int_t i;
    FILE *fout;
    fout = fopen("JYFL_Ge_2009_100eV.dat","w");
    for (i=0;i<16999;i++){
        E[i]=200+i*0.1;
        Double_t z=TMath::Log(E[i]);
        Double_t fun=TMath::Exp(a[3]+a[4]*z+a[5]*z*z);//3,4,5
        Double_t fun=(a[0]+a[1]*z+a[2]*z*z)*2/pi*(TMath::ATan(fun))+25.;
        fprintf(fout,"%f %f\n",E[i],fun);
        //cout <<E[i]<< "-->" << fun << endl;
    }
    fclose(fout);
    return;
}

```

1435.86 keV PEAK ANALYSIS
GAMMA RAYS CONTRIBUTION OF ^{252}Cf
FISSION PRODUCTS

TOTAL COUNTS IN THE REGION				229908	TOTAL YIELD				0.00174539			
Name	YF	eYF	E(keV)	eE(keV)	YGam	eYGam	Branch ratio	eBranch	Yield Total	eY Total	COUNTS	22908
Cs138	0.054733	0.001533	1435.86	0.09	0.763	0.015552	0.03092	8E-05	0.001291259	4.4854E-05	16947.59349	130.1829232
Sr94	0.010219	0.001635	1427.7	0.1	0.942	0.009	0.03092	8E-05	0.000297645	4.7713E-05	3906.551457	62.50241161
Nb98	0.022915	0.003666	1432.4	0.3	0.0338	0.005814	0.03092	8E-05	2.39484E-05	5.626E-06	314.3191267	17.72904754
Cd117m	0.004703	0.002116	1432.91	0.03	0.134406	0.004058	0.03092	8E-05	1.95449E-05	8.8137E-06	256.5239286	16.0163644
Cs138m	0.003008	0.001925	1436	0.2	0.19	0.02	0.03092	8E-05	1.76714E-05	1.1461E-05	231.934674	15.22940163
Ba141	0.059289	0.00166	1436.599	0.2	0.008648	0.000789	0.03092	8E-05	1.58537E-05	1.5135E-06	208.0769884	14.42487395
Cs142	0.02905	0.006681	1423.9	0.1	0.010336	0.001161	0.03092	8E-05	9.28406E-06	2.3764E-06	121.8520625	11.03866217
Tc104	0.056537	0.003392	1436.3	0.3	0.003649	0.000898	0.03092	8E-05	6.3789E-06	1.6159E-06	83.72224601	9.149986121
Tc107	0.057306	0.009169	1435.1	0.3	0.0035	0.000532	0.03092	8E-05	6.20166E-06	1.3687E-06	81.39587329	9.021966155
Ag116	0.01071	0.004819	1437.1	0.6	0.01596	0.00084	0.03092	8E-05	5.28521E-06	2.3943E-06	69.36758981	8.328720779
Mo101	0.039334	0.00236	1431.679	0.18	0.003624	0.000134	0.03092	8E-05	4.40754E-06	3.1084E-07	57.8482932	7.605806545
La148	0.010342	0.004654	1431.56	0.1	0.013344	0.000596	0.03092	8E-05	4.26707E-06	1.9297E-06	56.00474369	7.483631718
I138	0.010557	0.001689	1426.9	0.3	0.01176	0.00352	0.03092	8E-05	3.83873E-06	1.3029E-06	50.38277576	7.098082541
Ba141	0.059289	0.00166	1437.8	0.2	0.001932	0.000389	0.03092	8E-05	3.54177E-06	7.2004E-07	46.48528465	6.818011781
Y97	0.014977	0.002396	1428.899	0.5	0.00724	0.003691	0.03092	8E-05	3.35276E-06	1.7915E-06	44.00455599	6.633592992
Cd119m	0.0019	0.001216	1436.499	0.2	0.05084	0.004689	0.03092	8E-05	2.98675E-06	1.9313E-06	39.200661	6.261043124
Xe139	0.038823	0.001553	1434.13	0.24	0.002464	0.000313	0.03092	8E-05	2.9578E-06	3.9399E-07	38.82076083	6.230630853
Pm152m	0.000404	0.000258	1437.5	0.1	0.22673	0.020175	0.03092	8E-05	2.83224E-06	1.8262E-06	37.17274225	6.096945321
La148	0.010342	0.004654	1425.579	0.11	0.008896	0.000574	0.03092	8E-05	2.84472E-06	1.2933E-06	37.33649579	6.110359711
Sr93	0.00912	0.00073	1434.01	0.08	0.009044	0.000675	0.03092	8E-05	2.55032E-06	2.7919E-07	33.47261476	5.785552244
Xe139	0.038823	0.001553	1428.699	0.21	0.001848	0.000206	0.03092	8E-05	2.21835E-06	2.6279E-07	29.11557062	5.395884601
Cd117	0.010295	0.001132	1430.969	0.05	0.00558	0.000575	0.03092	8E-05	1.77623E-06	2.6771E-07	23.31281928	4.828335043
Ag114	0.033085	0.005294	1425.6	0.3	0.001489	0.000189	0.03092	8E-05	1.52323E-06	3.1113E-07	19.99217681	4.47126121
I139	0.004173	0.00096	1425.6	0.2	0.011564	0.000924	0.03092	8E-05	1.49209E-06	3.6339E-07	19.58351816	4.425326898
Sr93	0.00912	0.00073	1438.93	0.09	0.005032	0.000406	0.03092	8E-05	1.41898E-06	1.6131E-07	18.62386085	4.315537145
Xe139	0.038823	0.001553	1437.7	0.7	0.00112	0.00041	0.03092	8E-05	1.34446E-06	4.9511E-07	17.64580038	4.200690464
Mo101	0.039334	0.00236	1435.1	0.4	0.000819	0.000073	0.03092	8E-05	9.96074E-07	1.0705E-07	13.07333116	3.615706177
Cd123	0.000367	0.000235	1438.13	0.05	0.08316	0.007702	0.03092	8E-05	9.4367E-07	6.1055E-07	12.38553561	3.519308967
Rb93	0.006343	0.002854	1437.1	0.16	0.004848	0.000487	0.03092	8E-05	9.50817E-07	4.3835E-07	12.47933864	3.53261074
Ru107	0.066022	0.003961	1425.6	0.3	0.000424	0.00012	0.03092	8E-05	8.65554E-07	2.5042E-07	11.36027331	3.370500455
Y93	0.009227	0.005905	1425.4	0.1	0.002445	0.000333	0.03092	8E-05	6.97556E-07	4.5642E-07	9.155322167	3.025776292

Rb94	0.005008	0.002254	1434.4	0.2	0.004351	0.000348	0.03092	8E-05	6.73741E-07	3.0799E-07	8.842756186	2.973677216
Ag115	0.01802	0.001442	1435.9	0.7	0.0009	0.000414	0.03092	8E-05	5.01461E-07	2.3414E-07	6.581600895	2.565463096
Te135	0.019135	0.004401	1423.3	0.7	0.000837	0.000105	0.03092	8E-05	4.95215E-07	1.2974E-07	6.499623075	2.549435835
Te131	0.013306	0.001064	1427.139	0.02	0.001053	0.000035	0.03092	8E-05	4.33227E-07	3.7533E-08	5.686042972	2.384542508
Kr93	0.001314	0.000841	1435.35	0.13	0.010122	0.000797	0.03092	8E-05	4.11246E-07	2.652E-07	5.397540944	2.323260843
Cd117	0.010295	0.001132	1433.5	0.2	0.001116	0.000837	0.03092	8E-05	3.55247E-07	2.6928E-07	4.662563857	2.159297075
Nb100	0.017166	0.005493	1432	1	0.0006	0.000506	0.03092	8E-05	3.18464E-07	2.8726E-07	4.179791378	2.044453809
Ba147	0.002501	0.001601	1431.2	0.2	0.003739	0.00034	0.03092	8E-05	2.8914E-07	1.8695E-07	3.794926808	1.948057188
Cd119	0.0019	0.001216	1426.3	0.5	0.003386	0.000749	0.03092	8E-05	1.98921E-07	1.347E-07	2.610807202	1.615799245
Br88	0.002148	0.001375	1429	0.2	0.00259	0.000292	0.03092	8E-05	1.72018E-07	1.1181E-07	2.257710685	1.50256803
Ge81	0.000052	0.000033	1429.53	0.1	0.08023	0.005444	0.03092	8E-05	1.28997E-07	8.2331E-08	1.693067929	1.301179438
Kr91	0.003555	0.002275	1426.1	0.6	0.001044	0.000353	0.03092	8E-05	1.14757E-07	8.3059E-08	1.506171241	1.227261684
Nb98m	0.000054	0.000035	1432.175	0.02	0.049689	0.000479	0.03092	8E-05	8.29647E-08	5.378E-08	1.088900667	1.043504033
Cd121m	0.000489	0.000313	1433.81	0.15	0.0068	0.001009	0.03092	8E-05	1.02815E-07	6.7556E-08	1.349435152	1.161651907
Ba147	0.002501	0.001601	1436.499	0.2	0.00099	0.00009	0.03092	8E-05	7.65576E-08	4.95E-08	1.004808114	1.002401174
In118	0.00993	0.003177	1424.699	0.4	0.000202	0.000048	0.03092	8E-05	6.20212E-08	2.4718E-08	0.814019606	0.902230351
Nb98m	0.000054	0.000035	1436.42	0.05	0.025218	0.000377	0.03092	8E-05	4.2106E-08	2.7298E-08	0.552635332	0.743394466
Ag121	0.00019	0.000121	1424.899	0.3	0.002889	0.000645	0.03092	8E-05	1.69723E-08	1.1454E-08	0.222759067	0.471973587
Rb97	0.000346	0.000221	1423.2	0.5	0.00182	0.000526	0.03092	8E-05	1.94709E-08	1.3651E-08	0.255553442	0.505522939
Ga66	0	0	1425.255	0.02	0.000062	0.000005	0.03092	8E-05	0	#jDIV/0!	0	0
Ga66	0	0	1433.64	0.04	0.000018	0.000004	0.03092	8E-05	0	#jDIV/0!	0	0
As69	0	0	1430.999	0.4	0.000655	0.000437	0.03092	8E-05	0	#jDIV/0!	0	0
As69	0	0	1434.3	0.3	0.000983	0.000111	0.03092	8E-05	0	#jDIV/0!	0	0
As71	0	0	1423.579	0.025	0.000279	0.000011	0.03092	8E-05	0	#jDIV/0!	0	0
Rb79	0	0	1427.2	0.1	0.000739	0.00006	0.03092	8E-05	0	#jDIV/0!	0	0
Tc93	0	0	1424.599	0.3	0.002582	0.0002	0.03092	8E-05	0	#jDIV/0!	0	0
Ru95	0	0	1433.279	0.1	0.006444	0.000397	0.03092	8E-05	0	#jDIV/0!	0	0
Pd99	0	0	1429.4	1	0.001963	0.000728	0.03092	8E-05	0	#jDIV/0!	0	0
Ag103	0	0	1423.2	0.4	0.000646	0.000093	0.03092	8E-05	0	#jDIV/0!	0	0
Ag103	0	0	1428.599	0.4	0.00051	0.00009	0.03092	8E-05	0	#jDIV/0!	0	0
In109	0	0	1429.8	1	0.000588	0.000294	0.03092	8E-05	0	#jDIV/0!	0	0
I121	0	0	1438	0.2	0.000118	0.000017	0.03092	8E-05	0	#jDIV/0!	0	0
I128	0	0	1434.4	0.08	0.000005	0	0.03092	8E-05	0	#jDIV/0!	0	0

l128	0	0	1434.4	0.08	0.000005	0	0.03092	8E-05	0	#jDIV/0!	0	0
Cs127	0	0	1431.1	0.1	0.000038	0.000006	0.03092	8E-05	0	#jDIV/0!	0	0
Cs127	0	0	1433.7	0.1	0.000019	0.000006	0.03092	8E-05	0	#jDIV/0!	0	0
Nd141	0	0	1434.599	0.5	0.000056	0.000006	0.03092	8E-05	0	#jDIV/0!	0	0
Eu147	0	0	1427.408	0.017	0.001169	0.000061	0.03092	8E-05	0	#jDIV/0!	0	0
Tb151	0	0	1435.7	0.2	0.000085	0.000012	0.03092	8E-05	0	#jDIV/0!	0	0
Tb153	0	0	1426.599	0.3	0.000037	0.000016	0.03092	8E-05	0	#jDIV/0!	0	0
Tb153	0	0	1426.599	0.3	0.000037	0.000016	0.03092	8E-05	0	#jDIV/0!	0	0
Dy155	0	0	1427.19	0.03	0.004131	0.000082	0.03092	8E-05	0	#jDIV/0!	0	0
Dy155	0	0	1429.5	0.1	0.000219	0.000028	0.03092	8E-05	0	#jDIV/0!	0	0
Dy155	0	0	1437.97	0.04	0.002852	0.00005	0.03092	8E-05	0	#jDIV/0!	0	0
Tm165	0	0	1427.4	0.04	0.008058	0.000632	0.03092	8E-05	0	#jDIV/0!	0	0
Tm165	0	0	1427.4	0.04	0.008058	0.000632	0.03092	8E-05	0	#jDIV/0!	0	0
Tm166	0	0	1427.06	0.2	0.000265	0.000077	0.03092	8E-05	0	#jDIV/0!	0	0
Tm166	0	0	1430.2	0.3	0.001625	0.000388	0.03092	8E-05	0	#jDIV/0!	0	0
Tm166	0	0	1431.6	0.3	0.003402	0.000595	0.03092	8E-05	0	#jDIV/0!	0	0
Tm166	0	0	1433.1	0.3	0.004347	0.00079	0.03092	8E-05	0	#jDIV/0!	0	0
Tm166	0	0	1437.3	0.3	0.000567	0.000081	0.03092	8E-05	0	#jDIV/0!	0	0
Tm168	0	0	1431.7	0.4	0.000004	0.000001	0.03092	8E-05	0	#jDIV/0!	0	0
Co66	0	0	1424.799	1	1	0.1	0.03092	8E-05	0	#jDIV/0!	0	0
Co66	0	0	1424.799	1	1	0.1	0.03092	8E-05	0	#jDIV/0!	0	0
Cu68	0	0	1432.799	1.5	0.009603	0.003495	0.03092	8E-05	0	#jDIV/0!	0	0
Cu69	0	0	1429.8	0.3	0.034164	0.00567	0.03092	8E-05	0	#jDIV/0!	0	0
Cu70	0	0	1426.499	0.2	0.026	0.001	0.03092	8E-05	0	#jDIV/0!	0	0
La138	0	0	1435.795	0.01	0.656	0.005	0.03092	8E-05	0	#jDIV/0!	0	0
La138	0	0	1435.795	0.01	0.656	0.005	0.03092	8E-05	0	#jDIV/0!	0	0
Zn73	0	0	1428.3	0.5	0.0009	0.000256	0.03092	8E-05	0	#jDIV/0!	0	0
l130	0	0	1424.729	0.15	0.000208	0.00002	0.03092	8E-05	0	#jDIV/0!	0	0
Sb124	0.000001	0.000001	1436.561	0.006	0.012224	0.000083	0.03092	8E-05	3.77966E-10	3.7798E-10	0.004960753	0.070432612
Zn75	0.000001	0.000001	1427.2	0.2	0.006358	0.000655	0.03092	8E-05	1.96589E-10	1.9763E-10	0.002580208	0.050795751
Zn75	0.000001	0.000001	1433.1	0.3	0.004335	0.000615	0.03092	8E-05	1.34038E-10	1.3538E-10	0.001759233	0.041943211
Ho166m	0.000001	0.000001	1427.209	0.04	0.005038	0.000126	0.03092	8E-05	1.55775E-10	1.5582E-10	0.002044525	0.045216423
Zn77	0.000002	0.000001	1436	0.1	0.005901	0.00088	0.03092	8E-05	3.64918E-10	1.904E-10	0.004789496	0.069206188

Eu154	0.000003	0.000002	1425.6	0.6	0.000012	0.000005	0.03092	8E-05	1.11312E-12	8.751E-13	1.46095E-05	0.003822244
Pm150	0.000019	0.000012	1436.599	0.4	0.002652	0.000501	0.03092	8E-05	1.558E-09	1.0271E-09	0.020448496	0.142998237
Br84	0.000642	0.000205	1438	0.7	0.000624	0.000173	0.03092	8E-05	1.23868E-08	5.2382E-09	0.162575038	0.40320595
Gd161	0.00191	0.000153	1424.3	0.2	0.000007	0	0.03092	8E-05	4.134E-10	3.3133E-11	0.005425823	0.073660189
Gd161	0.00191	0.000153	1430.699	0.6	0.000001	0	0.03092	8E-05	5.90572E-11	4.7332E-12	0.000775118	0.027840934

**1596.21 keV PEAK ANALYSIS,
GAMMA RAYS CONTRIBUTION OF ^{252}Cf
FISSION PRODUCTS**

TOTAL COUNTS IN THE REGION				23515	TOTAL YIELD				0.001954065			
Name	YF	eYF	E(keV)	eE(keV)	YGam	eYGam	Branch ratio	eBranch	Yield Total	eY Total	COUNTS	23515
La140	0.059597	0.000834	1596.21	0.04	0.954	0.014332	0.03092	8E-05	0.001757973	3.63785E-05	21155.25058	145.4484465
Tc104	0.056537	0.003392	1596.7	0.1	0.04183	0.003829	0.03092	8E-05	7.3124E-05	8.00542E-06	879.966269	29.66422541
Y98	0.010211	0.004595	1590.9	0.2	0.14724	0.01239	0.03092	8E-05	4.64872E-05	2.12824E-05	559.4219277	23.65210197
Mo101	0.039334	0.00236	1599.26	0.05	0.017482	0.000756	0.03092	8E-05	2.12617E-05	1.57346E-06	255.8613163	15.99566555
Ru107	0.066022	0.003961	1591.6	0.1	0.004293	0.00065	0.03092	8E-05	8.76373E-06	1.42746E-06	105.461748	10.26945704
Tc104	0.056537	0.003392	1593.6	0.3	0.003382	0.000459	0.03092	8E-05	5.91216E-06	8.77427E-07	71.14620898	8.434821218
Tc106	0.061022	0.002441	1589.7	0.2	0.00279	0.001119	0.03092	8E-05	5.26417E-06	2.12185E-06	63.34845703	7.959174394
Ru109	0.035331	0.022612	1585.1	0.2	0.004048	0.001205	0.03092	8E-05	4.42217E-06	3.12139E-06	53.21595178	7.294926441
Mo101	0.039334	0.00236	1589.67	0.09	0.002713	0.000114	0.03092	8E-05	3.29957E-06	2.41844E-07	39.70665548	6.301321725
Tc104	0.056537	0.003392	1601.5	0.2	0.001869	0.000449	0.03092	8E-05	3.26724E-06	8.09059E-07	39.3176418	6.270378123
La148	0.010342	0.004654	1589.929	0.13	0.00834	0.000572	0.03092	8E-05	2.66692E-06	1.21402E-06	32.09341888	5.665105372
Pr150	0.022979	0.003677	1584.099	0.3	0.0032	0.001449	0.03092	8E-05	2.27363E-06	1.09194E-06	27.36065588	5.230741427
Ru109	0.035331	0.022612	1588.7	0.2	0.001672	0.000604	0.03092	8E-05	1.82655E-06	1.34237E-06	21.98050182	4.688336787
Y99	0.012842	0.002954	1594.5	0.5	0.003752	0.000944	0.03092	8E-05	1.48982E-06	5.07899E-07	17.92837369	4.234191031
Xe139	0.038823	0.001553	1584.7	0.4	0.001232	0.000414	0.03092	8E-05	1.4789E-06	5.00492E-07	17.79693442	4.218641301
Rb93	0.006343	0.002854	1594.61	0.12	0.006727	0.000539	0.03092	8E-05	1.31934E-06	6.02977E-07	15.87674756	3.98456366
Ru113	0.002149	0.001375	1593.8	0.7	0.018691	0.001558	0.03092	8E-05	1.24196E-06	8.01369E-07	14.94563437	3.865958402
Ba141	0.059289	0.00166	1600.6	0.2	0.000644	0.000144	0.03092	8E-05	1.18059E-06	2.66062E-07	14.20709855	3.769230499
Nb100	0.017166	0.005493	1598.7	0.3	0.0021	0.00057	0.03092	8E-05	1.11462E-06	4.67711E-07	13.41324334	3.662409499
La146	0.021981	0.014068	1587.7	0.1	0.001401	0.000143	0.03092	8E-05	9.52193E-07	6.17117E-07	11.45858477	3.385053141
Cd121	0.000679	0.000435	1584.13	0.1	0.044361	0.002674	0.03092	8E-05	9.31345E-07	5.99304E-07	11.20770012	3.347790334
Cs139	0.057084	0.002283	1591.729	0.11	0.000518	0.000111	0.03092	8E-05	9.14289E-07	1.99316E-07	11.0024539	3.316994709
Ru107	0.066022	0.003961	1589.1	0.3	0.000424	0.00012	0.03092	8E-05	8.65554E-07	2.50422E-07	10.41597511	3.227378984
Pr152	0.007712	0.004936	1591	1	0.002508	0.000837	0.03092	8E-05	5.98045E-07	4.31686E-07	7.196808613	2.682686827
Kr93	0.001314	0.000841	1596.2	0.06	0.013737	0.000855	0.03092	8E-05	5.58119E-07	3.58901E-07	6.716339856	2.591590218
Rb94	0.005008	0.002254	1594.5	0.2	0.002958	0.000261	0.03092	8E-05	4.58038E-07	2.10081E-07	5.511983265	2.34776133
Kr88	0.003124	0.000344	1603.789	0.05	0.004567	0.000348	0.03092	8E-05	4.41145E-07	5.90843E-08	5.308690877	2.304059651
In127	0.000024	0.000015	1597.7	0.3	0.49	0.07	0.03092	8E-05	3.63619E-07	2.33125E-07	4.375752224	2.091829875
Kr93	0.001314	0.000841	1586.89	0.07	0.008459	0.000558	0.03092	8E-05	3.4368E-07	2.21132E-07	4.135802493	2.033667252
La146	0.021981	0.014068	1585.2	0.4	0.00051	0.00013	0.03092	8E-05	3.46623E-07	2.3879E-07	4.171219295	2.04235631
Cs139	0.057084	0.002283	1600.7	0.5	0.000192	0.00008	0.03092	8E-05	3.38887E-07	1.41855E-07	4.078129632	2.01943795

Ag115	0.01802	0.001442	1594.8	0.5	0.000558	0.000264	0.03092	8E-05	3.10906E-07	1.49186E-07	3.741402103	1.934270432
I132	0.021511	0.013767	1592.9	0.3	0.000474	0.000039	0.03092	8E-05	3.15267E-07	2.03432E-07	3.793886572	1.947790177
Mo101	0.039334	0.00236	1594.8	0.9	0.000219	0.000055	0.03092	8E-05	2.66349E-07	6.87773E-08	3.205218411	1.790312378
I138	0.010557	0.001689	1594.7	0.5	0.000784	0.000289	0.03092	8E-05	2.55915E-07	1.0284E-07	3.079654415	1.754894417
La146	0.021981	0.014068	1595.1	0.4	0.000382	0.000129	0.03092	8E-05	2.59627E-07	1.87877E-07	3.124325041	1.767576035
Ba147	0.002501	0.001601	1588.7	0.2	0.002859	0.00026	0.03092	8E-05	2.21089E-07	1.42951E-07	2.660561165	1.63112267
Rb96	0.001291	0.000826	1592.4	0.2	0.004602	0.000483	0.03092	8E-05	1.83701E-07	1.19107E-07	2.210641186	1.486822513
Cd123	0.000367	0.000235	1599.23	0.12	0.011583	0.001938	0.03092	8E-05	1.3144E-07	8.69908E-08	1.581730616	1.257668723
Kr91	0.003555	0.002275	1589.2	0.5	0.001087	0.00031	0.03092	8E-05	1.19484E-07	8.37126E-08	1.437853204	1.199105168
Br88	0.002148	0.001375	1594.8	0.3	0.001233	0.000621	0.03092	8E-05	8.18911E-08	6.67016E-08	0.985468516	0.992707669
Cd125	0.000029	0.000019	1584.83	0.05	0.07644	0.00685	0.03092	8E-05	6.85422E-08	4.53254E-08	0.824829294	0.908201131
Rb96	0.001291	0.000826	1596.9	0.4	0.001326	0.000236	0.03092	8E-05	5.29309E-08	3.51521E-08	0.63696441	0.798100501
Kr89	0.00343	0.000549	1600.7	0.3	0.000724	0.000147	0.03092	8E-05	7.67843E-08	1.98529E-08	0.924013011	0.961255955
In126	0.00004	0.000026	1601.43	0.1	0.014	0.001	0.03092	8E-05	1.73152E-08	1.13227E-08	0.208369154	0.456474702
Kr92	0.002437	0.00156	1594.399	0.6	0.000513	0.000193	0.03092	8E-05	3.86556E-08	2.8702E-08	0.465177066	0.682038903
I133	0.031496	0.020157	1589.94	0.25	0.00003	0.000004	0.03092	8E-05	2.92157E-08	1.90993E-08	0.351578296	0.592940382
I133	0.031496	0.020157	1589.94	0.25	0.00003	0.000004	0.03092	8E-05	2.92157E-08	1.90993E-08	0.351578296	0.592940382
Xe137	0.043287	0.001731	1593.999	0.6	0.000031	0.000006	0.03092	8E-05	4.14915E-08	8.20092E-09	0.499303468	0.706614087
Ba139	0.058529	0.001171	1595.3	0.3	0.000021	0.000003	0.03092	8E-05	3.80041E-08	5.48302E-09	0.457336432	0.676266539
As71	0	0	1598.504	0.025	0.000353	0.000019	0.03092	8E-05	0	#jDIV/0!	0	0
As71	0	0	1602.739	0.14	0.000025	0.000003	0.03092	8E-05	0	#jDIV/0!	0	0
As72	0	0	1596.8	0.2	0.000239	0.000017	0.03092	8E-05	0	#jDIV/0!	0	0
Se73m	0	0	1588.5	1.2	0.000033	0.000005	0.03092	8E-05	0	#jDIV/0!	0	0
Sr83	0	0	1592.5	0.3	0.000138	0.000067	0.03092	8E-05	0	#jDIV/0!	0	0
Sr83	0	0	1597.64	0.15	0.000321	0.000152	0.03092	8E-05	0	#jDIV/0!	0	0
Pd99	0	0	1587.6	0.6	0.001236	0.000292	0.03092	8E-05	0	#jDIV/0!	0	0
Ag103	0	0	1592.6	0.3	0.000697	0.000079	0.03092	8E-05	0	#jDIV/0!	0	0
In107	0	0	1588.6	0.6	0.001038	0.000283	0.03092	8E-05	0	#jDIV/0!	0	0
In107	0	0	1601.3	0.3	0.005806	0.000709	0.03092	8E-05	0	#jDIV/0!	0	0
Te115	0	0	1589.5	0.3	0.00208	0.000382	0.03092	8E-05	0	#jDIV/0!	0	0
Te115	0	0	1599.899	0.08	0.02624	0.00345	0.03092	8E-05	0	#jDIV/0!	0	0
Cs127	0	0	1592.299	0.1	0.000126	0.000007	0.03092	8E-05	0	#jDIV/0!	0	0
Ce135	0	0	1585.3	0.2	0.000234	0.000021	0.03092	8E-05	0	#jDIV/0!	0	0

Ce135	0	0	1599.3	0.8	0.000079	0.000013	0.03092	8E-05	0	#jDIV/0!	0	0
Pm141	0	0	1596.87	0.07	0.007916	0.000564	0.03092	8E-05	0	#jDIV/0!	0	0
Eu147	0	0	1601	0.05	0.000082	0.000004	0.03092	8E-05	0	#jDIV/0!	0	0
Tb151	0	0	1584.8	0.2	0.000113	0.000012	0.03092	8E-05	0	#jDIV/0!	0	0
Tb151	0	0	1585.6	0.5	0.000057	0.000028	0.03092	8E-05	0	#jDIV/0!	0	0
Tb151	0	0	1599.6	0.04	0.002575	0.000112	0.03092	8E-05	0	#jDIV/0!	0	0
Dy155	0	0	1590.04	0.09	0.00028	0.000021	0.03092	8E-05	0	#jDIV/0!	0	0
Dy155	0	0	1594.52	0.06	0.000547	0.000029	0.03092	8E-05	0	#jDIV/0!	0	0
Dy155	0	0	1599.57	0.04	0.002654	0.000079	0.03092	8E-05	0	#jDIV/0!	0	0
Pr139	0	0	1596.579	0.02	0.000341	0.000029	0.03092	8E-05	0	#jDIV/0!	0	0
Lu172	0	0	1584.12	0.04	0.026375	0.001142	0.03092	8E-05	0	#jDIV/0!	0	0
Lu172	0	0	1602.539	0.03	0.002981	0.000152	0.03092	8E-05	0	#jDIV/0!	0	0
As74	0	0	1602.5	0.5	0.000071	0.000006	0.03092	8E-05	0	#jDIV/0!	0	0
Tm166	0	0	1586.679	0.08	0.00027	0.000048	0.03092	8E-05	0	#jDIV/0!	0	0
Tm166	0	0	1591.77	0.06	0.001535	0.000088	0.03092	8E-05	0	#jDIV/0!	0	0
Tm166	0	0	1596.7	0.5	0.000085	0.000038	0.03092	8E-05	0	#jDIV/0!	0	0
Pr140	0	0	1596.099	0.2	0.005	0.0004	0.03092	8E-05	0	#jDIV/0!	0	0
Ga72	0	0	1596.679	0.08	0.042364	0.000861	0.03092	8E-05	0	#jDIV/0!	0	0
Ga74	0.000001	0	1601.97	0.2	0.002938	0.000275	0.03092	8E-05	9.0843E-11	8.50625E-12	0.001093194	0.033063483
Ag110m	0.000001	0.000001	1592.77	0.07	0.000208	0.000028	0.03092	8E-05	6.43136E-12	6.48939E-12	7.73943E-05	0.008797401
Eu154	0.000003	0.000002	1596.495	0.018	0.017881	0.000147	0.03092	8E-05	1.65864E-09	1.10585E-09	0.019959904	0.141279526
In128	0.000017	0.000011	1587.689	0.15	0.024	0.002464	0.03092	8E-05	1.26154E-08	8.26506E-09	0.151811812	0.389630353
In126	0.00004	0.000026	1593.729	0.1	0.011	0.001	0.03092	8E-05	1.36048E-08	8.92926E-09	0.163718621	0.404621577
Nb98m	0.000054	0.000035	1585.6	0.2	0.000467	0.000187	0.03092	8E-05	7.79741E-10	5.94061E-10	0.009383309	0.096867484
Nb98m	0.000054	0.000035	1589.62	0.1	0.001401	0.000093	0.03092	8E-05	2.33922E-09	1.52411E-09	0.028149928	0.167779404
Nb98m	0.000054	0.000035	1601.999	0.4	0.000187	0.000093	0.03092	8E-05	3.1223E-10	2.55082E-10	0.003757342	0.061297164
Sn125	0.000096	0.000006	1591.4	0.2	0.000252	0.00007	0.03092	8E-05	7.48017E-10	2.12986E-10	0.009001547	0.094876485
Pm152m	0.000404	0.000258	1591.6	0.3	0.001148	0.000299	0.03092	8E-05	1.43404E-08	9.89044E-09	0.172571333	0.415417059
Ba139	0.058529	0.001171	1601.4	1	0.000001	0	0.03092	8E-05	1.80972E-09	3.65088E-11	0.021777925	0.147573457

EFFECT OF THE SOURCE ENCAPSULATING MATERIAL:

PENELOPE files of Monte Carlo simulations

- **Geometry files code**
- **Input files code for *PENTRI***

GEOMETRY FILE (WITH ENCAPSULATION)

```
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
CAPSULE
0000000000000000000000000000000000000000000000000000000000000000000000
SURFACE ( 1) PLANE Z=+0.00
INDICES=( 0, 0, 0, 1, 0)
Z-SHIFT=(+0.000000000000000E-03, 0)
0000000000000000000000000000000000000000000000000000000000000000000000
SURFACE ( 2) PLANE Z=+0.095
INDICES=( 0, 0, 0, 1, 0)
Z-SHIFT=(+0.950000000000000E-03, 0)
0000000000000000000000000000000000000000000000000000000000000000000000
SURFACE ( 3) PLANE Z=+0.184
INDICES=( 0, 0, 0, 1, 0)
Z-SHIFT=(+1.840000000000000E-03, 0)
0000000000000000000000000000000000000000000000000000000000000000000000
SURFACE ( 4) PLANE Z=+0.214
INDICES=( 0, 0, 0, 1, 0)
Z-SHIFT=(+2.140000000000000E-03, 0)
0000000000000000000000000000000000000000000000000000000000000000000000
SURFACE ( 5) PLANE Z=+0.297
INDICES=( 0, 0, 0, 1, 0)
Z-SHIFT=(+2.970000000000000E-03, 0)
0000000000000000000000000000000000000000000000000000000000000000000000
SURFACE ( 6) PLANE Z=+0.727
INDICES=( 0, 0, 0, 1, 0)
Z-SHIFT=(+7.270000000000000E-03, 0)
0000000000000000000000000000000000000000000000000000000000000000000000
SURFACE ( 7) PLANE Z=+0.802
INDICES=( 0, 0, 0, 1, 0)
Z-SHIFT=(+8.020000000000000E-03, 0)
0000000000000000000000000000000000000000000000000000000000000000000000
SURFACE ( 8) PLANE Z=+0.877
INDICES=( 0, 0, 0, 1, 0)
Z-SHIFT=(+8.770000000000000E-03, 0)
0000000000000000000000000000000000000000000000000000000000000000000000
SURFACE ( 9) PLANE Z=+0.911
INDICES=( 0, 0, 0, 1, 0)
Z-SHIFT=(+9.110000000000000E-03, 0)
0000000000000000000000000000000000000000000000000000000000000000000000
SURFACE ( 10) PLANE Z=+0.10
INDICES=( 0, 0, 0, 1, 0)
Z-SHIFT=(+1.000000000000000E-02, 0)
0000000000000000000000000000000000000000000000000000000000000000000000
SURFACE ( 11) CYLINDER1_SOURCE
INDICES=( 1, 1, 0, 0,-1)
X-SCALE=(+2.300000000000000E-03, 0)
Y-SCALE=(+2.300000000000000E-03, 0)
0000000000000000000000000000000000000000000000000000000000000000000000
```



```

SURFACE ( 2), SIDE POINTER=( 1)
0000000000000000000000000000000000000000000000000000000000000000
BODY ( 8) TAPA_EXTERIOR2
MATERIAL( 4)
SURFACE ( 18), SIDE POINTER=(-1)
SURFACE ( 10), SIDE POINTER=(-1)
SURFACE ( 9), SIDE POINTER=( 1)
0000000000000000000000000000000000000000000000000000000000000000
BODY ( 7) TAPA_EXTERIOR1
MATERIAL( 4)
SURFACE ( 17), SIDE POINTER=(-1)
SURFACE ( 9), SIDE POINTER=(-1)
SURFACE ( 8), SIDE POINTER=( 1)
0000000000000000000000000000000000000000000000000000000000000000
BODY ( 6) TAPA_EXTERIOR
MATERIAL( 3)
SURFACE ( 16), SIDE POINTER=(-1)
SURFACE ( 10), SIDE POINTER=(-1)
SURFACE ( 7), SIDE POINTER=( 1)
0000000000000000000000000000000000000000000000000000000000000000
BODY ( 9) BLINDATGE_EXT
MATERIAL( 3)
SURFACE ( 19), SIDE POINTER=(-1)
SURFACE ( 10), SIDE POINTER=(-1)
SURFACE ( 1), SIDE POINTER=( 1)
0000000000000000000000000000000000000000000000000000000000000000
BODY ( 10) DETECTOR
MATERIAL( 5)
SURFACE ( 22), SIDE POINTER=(-1)
SURFACE ( 21), SIDE POINTER=(-1)
SURFACE ( 20), SIDE POINTER=( 1)
0000000000000000000000000000000000000000000000000000000000000000
END 0000000000000000000000000000000000000000000000000000000000000000

```

GEOMETRY FILE (WITHOUT ENCAPSULATION)

```
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
CAPSULE
000000000000000000000000000000000000000000000000000000000000000000000000
SURFACE ( 1) PLANE Z=+0.00
INDICES=( 0, 0, 0, 1, 0)
Z-SHIFT=(+0.000000000000000E-01, 0)
000000000000000000000000000000000000000000000000000000000000000000000000
SURFACE ( 2) PLANE Z=+0.095
INDICES=( 0, 0, 0, 1, 0)
Z-SHIFT=(+0.950000000000000E-01, 0)
000000000000000000000000000000000000000000000000000000000000000000000000
SURFACE ( 3) PLANE Z=+0.184
INDICES=( 0, 0, 0, 1, 0)
Z-SHIFT=(+1.840000000000000E-01, 0)
000000000000000000000000000000000000000000000000000000000000000000000000
SURFACE ( 4) PLANE Z=+0.214
INDICES=( 0, 0, 0, 1, 0)
Z-SHIFT=(+2.140000000000000E-01, 0)
000000000000000000000000000000000000000000000000000000000000000000000000
SURFACE ( 5) PLANE Z=+0.297
INDICES=( 0, 0, 0, 1, 0)
Z-SHIFT=(+2.970000000000000E-01, 0)
000000000000000000000000000000000000000000000000000000000000000000000000
SURFACE ( 6) PLANE Z=+0.727
INDICES=( 0, 0, 0, 1, 0)
Z-SHIFT=(+7.270000000000000E-01, 0)
000000000000000000000000000000000000000000000000000000000000000000000000
SURFACE ( 7) PLANE Z=+0.802
INDICES=( 0, 0, 0, 1, 0)
Z-SHIFT=(+8.020000000000000E-01, 0)
000000000000000000000000000000000000000000000000000000000000000000000000
SURFACE ( 8) PLANE Z=+0.877
INDICES=( 0, 0, 0, 1, 0)
Z-SHIFT=(+8.770000000000000E-01, 0)
000000000000000000000000000000000000000000000000000000000000000000000000
SURFACE ( 9) PLANE Z=+0.911
INDICES=( 0, 0, 0, 1, 0)
Z-SHIFT=(+9.110000000000000E-01, 0)
000000000000000000000000000000000000000000000000000000000000000000000000
SURFACE ( 10) PLANE Z=+0.10
INDICES=( 0, 0, 0, 1, 0)
Z-SHIFT=(+1.000000000000000E-00, 0)
000000000000000000000000000000000000000000000000000000000000000000000000
SURFACE ( 11) CYLINDER1_SOURCE
INDICES=( 1, 1, 0, 0,-1)
X-SCALE=(+2.300000000000000E-01, 0)
Y-SCALE=(+2.300000000000000E-01, 0)
000000000000000000000000000000000000000000000000000000000000000000000000
```


INPUT FILE FOR 1435.86 keV SIMULATION

TITLE Gamma response with Stainless Steel shielding.

.
>>>>>>> Source definition.

SKPAR 2 [Primary particles: 1=electron, 2=photon, 3=positron]
1435.86keV gamma-ray spectrum (no sum effect).
SENERG 1.43586e6 [Initial energy (monoenergetic sources only)]
SBODY 1 [Coordinates of the source]
SCONE 0 0 180 [Conical beam; angles in deg]

.
>>>>>>> Material data and simulation parameters.

MFNAME GlassCf.mat [Material file, up to 20 chars]
MSIMPA 1.0e5 1.0e3 1.0e5 0.1 0.1 1e4 1e3 [EABS(1:3),C1,C2,WCC,WCR]
MFNAME 304_SST.mat [Material file, up to 20 chars]
MSIMPA 1.0e5 1.0e3 1.0e5 0.1 0.1 1e4 1e3 [EABS(1:3),C1,C2,WCC,WCR]
MFNAME 321_SST.mat [Material file, up to 20 chars]
MSIMPA 1.0e5 1.0e3 1.0e5 0.1 0.1 1e4 1e3 [EABS(1:3),C1,C2,WCC,WCR]
MFNAME AIRE.mat [Material file, up to 20 chars]
MSIMPA 1.0e5 1.0e3 1.0e5 0.1 0.1 1e4 1e3 [EABS(1:3),C1,C2,WCC,WCR]
MFNAME NaI.mat [Material file, up to 20 chars]
MSIMPA 1.0e5 1.0e3 1.0e5 0.1 0.1 1e4 1e3 [EABS(1:3),C1,C2,WCC,WCR]

.
>>>>>>> Geometry definition file.

GEOMFN CAPSULE.geo [Geometry file, up to 20 chars]

.
>>>>>>> Emerging particles. Energy and angular distributions.

NBE 5.0e5 2.0e6 100 [Energy window and no. of bins]
NBANGL 20 20 [No. of bins for the angles THETA and PHI]

.
>>>>>>> Energy deposition detectors (up to 25).

ENDETC 5.0e5 2.0e6 1000 [Energy window and number of bins]
EDSPC SIM_C_1435keV.dat
EDBODY 10 [Active body; one line for each body]

.
>>>>>>> Job properties

RESUME dump.dmp [Resume from this dump file, 20 chars]
DUMPTO dump.dmp [Generate this dump file, 20 chars]
DUMPP 60 [Dumping period, in sec]

.
NSIMSH 1e9 [Desired number of simulated showers]
TIME 1e6 [Allotted simulation time, in sec]

.
END [Ends the reading of input data]

INPUT FILE FOR 1596.21 keV SIMULATION

TITLE Gamma response with Stainless Steel shielding.

.
>>>>>>> Source definition.

SKPAR 2 [Primary particles: 1=electron, 2=photon, 3=positron]
1596.21keV gamma-ray spectrum (no sum effect).
SENERG 1.59621e6 [Initial energy (monoenergetic sources only)]
SBODY 1 [Coordinates of the source]
SCONE 0 0 180 [Conical beam; angles in deg]

.
>>>>>>> Material data and simulation parameters.

MFNAME GlassCf.mat [Material file, up to 20 chars]
MSIMPA 1.0e5 1.0e3 1.0e5 0.1 0.1 1e4 1e3 [EABS(1:3),C1,C2,WCC,WCR]
MFNAME 304_SST.mat [Material file, up to 20 chars]
MSIMPA 1.0e5 1.0e3 1.0e5 0.1 0.1 1e4 1e3 [EABS(1:3),C1,C2,WCC,WCR]
MFNAME 321_SST.mat [Material file, up to 20 chars]
MSIMPA 1.0e5 1.0e3 1.0e5 0.1 0.1 1e4 1e3 [EABS(1:3),C1,C2,WCC,WCR]
MFNAME AIRE.mat [Material file, up to 20 chars]
MSIMPA 1.0e5 1.0e3 1.0e5 0.1 0.1 1e4 1e3 [EABS(1:3),C1,C2,WCC,WCR]
MFNAME NaI.mat [Material file, up to 20 chars]
MSIMPA 1.0e5 1.0e3 1.0e5 0.1 0.1 1e4 1e3 [EABS(1:3),C1,C2,WCC,WCR]

.
>>>>>>> Geometry definition file.

GEOMFN CAPSULE.geo [Geometry file, up to 20 chars]

.
>>>>>>> Emerging particles. Energy and angular distributions.

NBE 5.0e5 2.0e6 100 [Energy window and no. of bins]
NBANGL 20 20 [No. of bins for the angles THETA and PHI]

.
>>>>>>> Energy deposition detectors (up to 25).

ENDETC 5.0e5 2.0e6 1000 [Energy window and number of bins]
EDSPC SIM_C_1596keV.dat
EDBODY 10 [Active body; one line for each body]

.
>>>>>>> Job properties

RESUME dump.dmp [Resume from this dump file, 20 chars]
DUMPTO dump.dmp [Generate this dump file, 20 chars]
DUMPP 60 [Dumping period, in sec]

.
NSIMSH 1e9 [Desired number of simulated showers]
TIME 1e6 [Allotted simulation time, in sec]

.
END [Ends the reading of input data]