Solution: Source

Advanced FLUKA Course 2019

Initialize

Inside the LFIRST block

```
*  |  Now the parameters for the cylindrical volume source, supposed
*  |  to be centered on X/Y/Zbeam (beam position as per BEAMPOS card)
*  |     a) cylinder height: Whasou(2)
*  |     b) cylinder radius: Whasou(3)
*  |  be careful to SAVE the variables
         RCYLND = WHASOU (2)
         HCYLND = WHASOU (3)
```

Sampling

Sampling of the position uniformly inside a Cylindrical volume:
Start with a cylinder centered in the origin, can move later.
We must have dN/dV = constant (V=volume)
→ go to cylindrical variables : r,phi,z
→ unit VOLUME =2 pi r dr dphi dz = pi **d(r^2)** dphi dz

→ means that we have to sample, through random numbers R_j
Uniform z => z_i = -H/2. + R_i * H (H is the cylinder height from WHASOU)
Uniform phi => phi_i = R_i * 2 pi
Uniform r^2 => $\mathbf{r^2_k = R_k * r^2_{max}}$ (Rmax is from whasou)
Go back to x,y,z
x=r cos (phi)
y=r sin(phi)

Move to the position of the source volume, centered on XBEAm, YBEAM ZBEAM : x=x+BEAM etc

Use R= FLRNDM (x)
So that you stay in the fluka random sequence

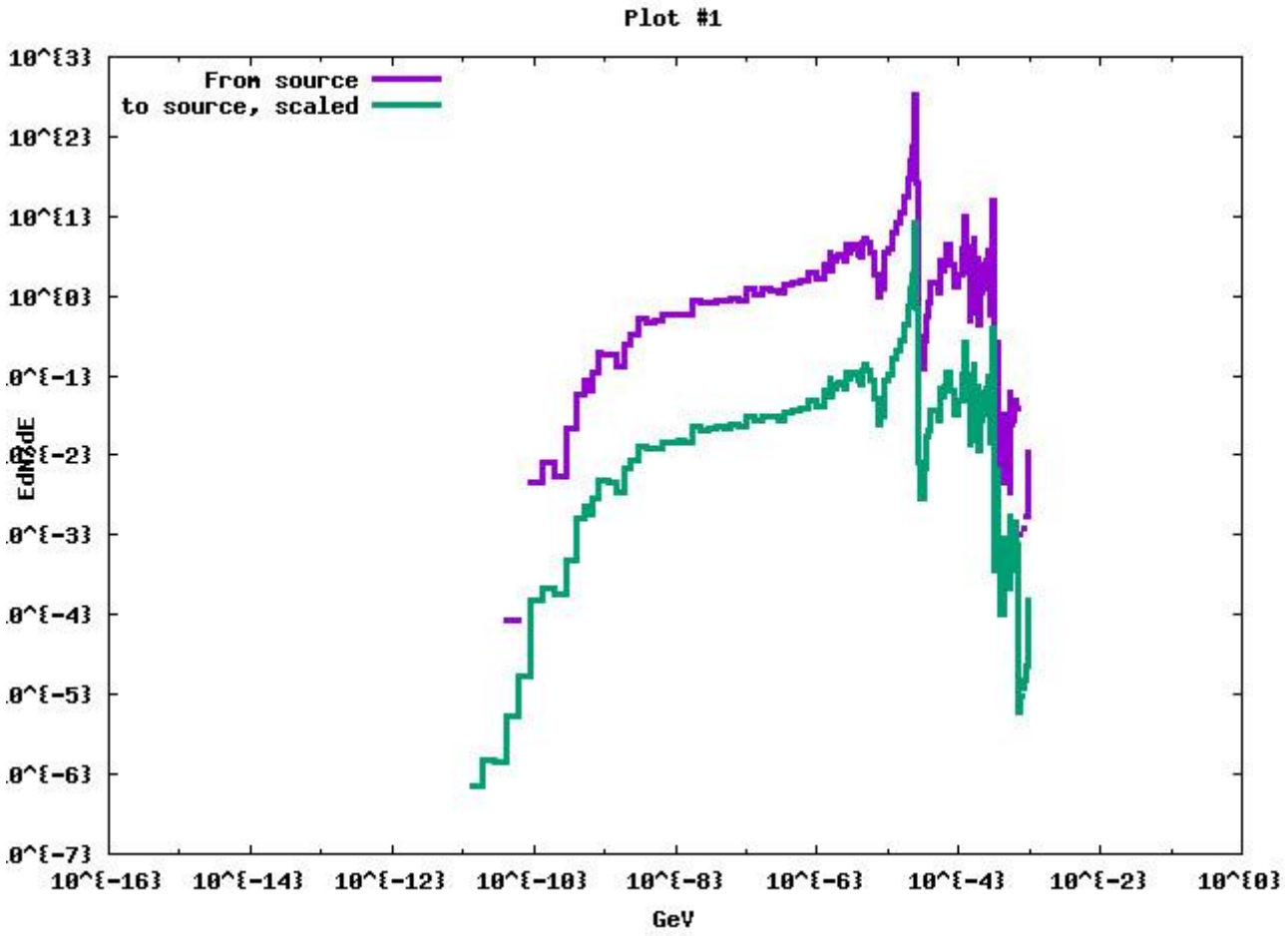
Sampling

```
*  Sample the radius of the starting point:
     RNDCUM = FLRNDM (RNDCUM)
     RADIUS = RCYLND * SQRT (RNDCUM)
*  Sample the azimuthal angle of the starting point:
     RNDCUM = FLRNDM (RNDCUM)
     PHIPHI = TWOPIP * RNDCUM
*  Sample the height of the starting point:
     RNDCUM = FLRNDM (RNDCUM)
     HEIGHT = RNDCUM * HCYLND
     XFLK   (NPFLKA) = XBEAM + RADIUS * COS (PHIPHI)
     YFLK   (NPFLKA) = YBEAM + RADIUS * SIN (PHIPHI)
     ZFLK   (NPFLKA) = ZBEAM + HEIGHT - HCYLND / TWOTWO
```

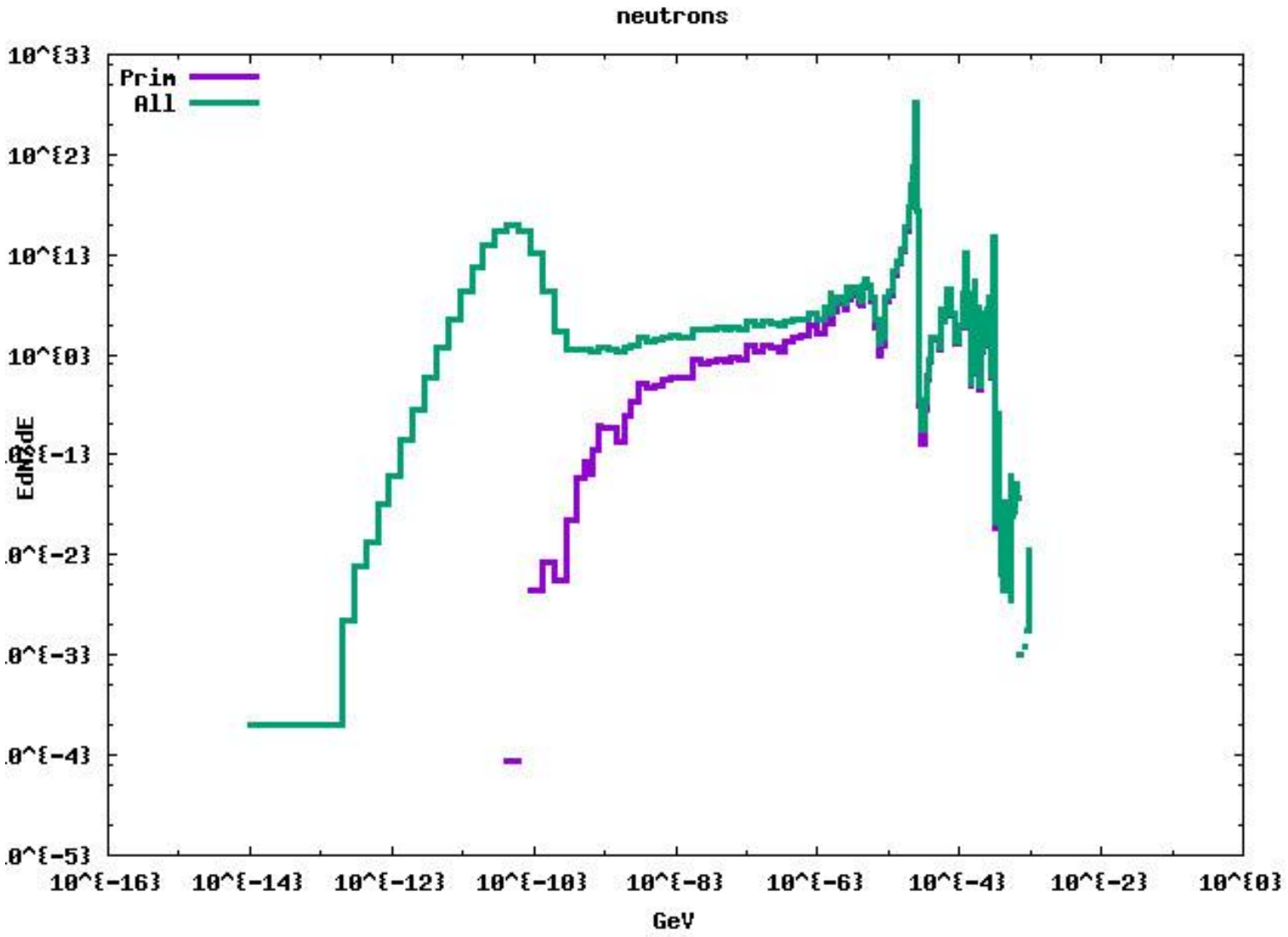
Scoring

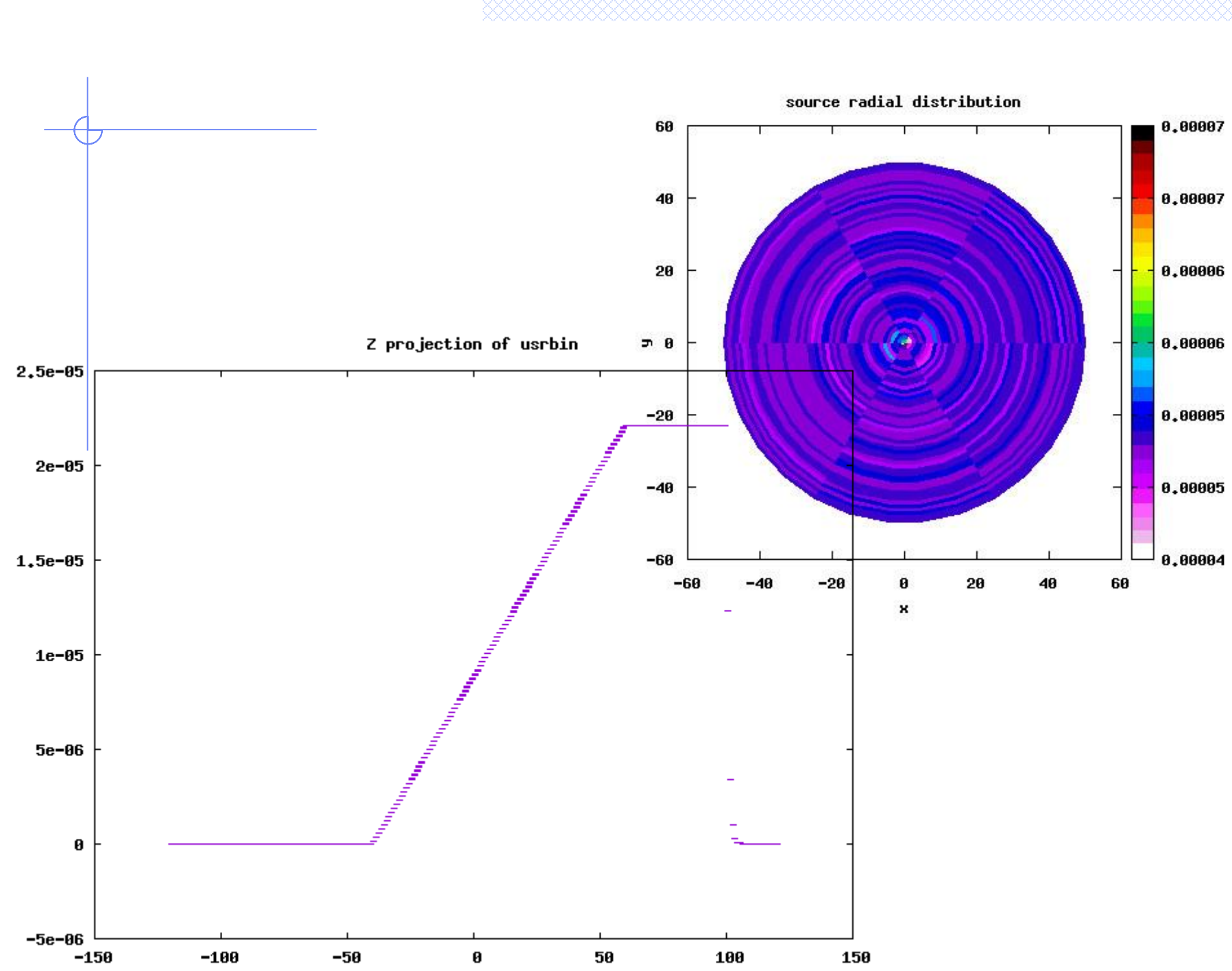
```
* Track length fluence
USRTRACK       -1.0  BEAMPART    -48.0    regSRC          130.0neutPrim
USRTRACK       0.10    1.E-14                             &
USRTRACK       -1.0   NEUTRON    -48.0    regSRC          130.0neutAll
USRTRACK       0.10    1.E-14                             &
* Cylindrical binning of primary fluence
USRBIN         11.0  BEAMPART    -50.0     120.0           120.0prFluence
USRBIN          0.0              -120.0     120.0      6.0     240.0   &
* Cylindrical binning of neutron fluence
USRBIN         11.0   NEUTRON     -50.0     120.0           120.0neFluence
USRBIN          0.0              -120.0     120.0           240.0   &
*...+....1....+....2....+....3....+....4....+....5....+....6....+....7....+....8
USERDUMP       100.              1.                         dump
```

Results


Plot #1
From source
to source, scaled
10^{3}
10^{2}
10^{1}
10^{0}
.0^{-1}
.0^{-2}
.0^{-3}
.0^{-4}
.0^{-5}
.0^{-6}
.0^{-7}
EdN/dE
10^{-16}
10^{-14}
10^{-12}
10^{-10}
10^{-8}
10^{-6}
10^{-4}
10^{-2}
10^{0}
GeV

Results


neutrons
Prim
All
10^{3}
10^{2}
10^{1}
10^{0}
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
EdN/dE
10^{-16}
10^{-14}
10^{-12}
10^{-10}
10^{-8}
10^{-6}
10^{-4}
10^{-2}
10^{0}
GeV


source radial distribution
60
40
20
0
-20
-40
-60
y
-60
-40
-20
0
20
40
60
x
0.00007
0.00007
0.00006
0.00006
0.00005
0.00005
0.00004
Z projection of usrbin
2.5e-05
2e-05
1.5e-05
1e-05
5e-06
0
-5e-06
-150
-100
-50
0
50
100
150