

Simulation of sources and experiments - taking time into account

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What do I try to tell you...

- Showing how to take “wall-clock time” into account
- Example of this with sources+ADF+femul
- Simulation of RDDS after fusion-fission with background
- Coulex+DSSD+Radioactive decay+ADF+femul

(what I will not talk about)

- “-AddOn” option (allows adding detectors and event generators without changing main code)
- “-Test” option, to allow the use of geant4 “gun”.
- “-g 3” option. Test geometry (hollow shell with 100% det. eff.) to check physics.

Running against the clock - why

- Count rates and background inside coincidence gates are important
- If we want to “learn” to analyse data using simulations this is needed

Running against the clock - how

- For each event geant4 takes care of the time
- Between events we have to keep track of the time
- This is done by keeping track of at which of day, hour, minute, and finally nanosecond the event started.

Running against the clock - how

Lets run an example...

```
/Agata/file/enableLM
/Agata/file/info/enableTime
/Agata/file/WriteToFifo true
/Agata/file/info/enableNSeg
/Agata/file/verbose 1
/tracking/verbose 0
/Agata/detector/enableAncillary
/Agata/detector/traslateArray 0. 0. 0.
/Agata/detector/solidFile /Users/joa/AGATA/agataganil/A180/A180solid.list
/Agata/detector/angleFile /Users/joa/AGATA/agataganil/A180/A180euler5T.list
/Agata/detector/wallsFile /Users/joa/AGATA/agataganil/A180/A180wallsS2p.list
/Agata/detector/clustFile /Users/joa/AGATA/agataganil/A180/A180clustS2p.list
/Agata/detector/sliceFile /Users/joa/AGATA/agataganil/A180/A180slice.list
/Agata/detector/enableCapsules
/Agata/detector/wallThickness 4.0
/process/inactivate Reaction
/Agata/detector/update
/grdm/allVolumes
/Agata/generator/emitter/SetGammaRaySource 60Co 10000

/run/beamOn 1000000
```

Running against the clock - how

Lets run an example...

```
#This is a comment...
#first a line describing the geometry of the source
#Point x y z
#or
#Line x1 y1 z1 x2 y2 z2
#or
#Plane x1 y1 z1 x2 y2 z2 x3 y3 z3
#or
#Sphere x y z R1 R2
#each branch is separated by a blank line
#first line of each branch is prob
#and each decay in each branch is a line
#
# Particle tau Energy_dist_type Energy_par A-coeff.in.Ang-Corr
#
#Note that for the first particle in each branch the emissson angle
#is isotropic, and lifetime set to zero (decay time is generated)
#
Point 0 0 0

1.
gamma 0 Discrete 1172 1

gamma 8e-13 Discrete 1333 1 0 0.1020 0 0.0091
```

Running against the clock - how

Lets run an example...

- 1 Open two terminals
- 2 In both, go to `/misc/agatasimschool2013/Co60Source`
- 3 In one run `"Agata -Gen -a 1 9 -b sourceruns.mac"`
- 4 In the other one `"cat GammaEvents.fifo | ./MakeADFEvents"`
- 5 Run, in one of the terminals `"./../AgataSoftware/bin/femul Topology.conf -nothr -turns 100"`
- 6 Once done, go to `/misc/agatasimschool2013/AgataSoftware/addons/gw/demos/adf`
- 7 Do `root -l GSILoadWatchers.C
.L OfflineWatchers.C+
OfflineWatchers()`

What just happened?

- 1 The agata code writes to a FIFO (first in first out)
- 2 We, via cat, pipe this to the code MakeADFEvents
- 3 MakeADFEvents makes adf files containing data as if it came from the PSA actors of the “real” thing stored in the structure Data/[1..60][RGB]/
- 4 We call the narval emulator femul that uses the “real” tracking code and event buider (remember, we keep track of time).
- 5 We use a AGATA watcher to replay the output and look at it

Does the ^{60}Co spectrum make sense?

RDDS Fusion-Fission

Lets run an example...

```
/control/execute FFSetup.mac  
/Agata/file/enableLM  
/Agata/detector/separation 0.050 mm  
/Agata/detector/update  
/Agata/run/runNumber 0  
/tracking/verbose 0  
/Agata/generator/emitter/BeamOut/ProjectileExcitation 3443.3 1. 852.2 1.  
  
/run/beamOn 50000
```

RDDS Fusion-Fission

Lets run an example...

```
# Beam
/Agata/generator/emitter/BeamIn/Z 92
/Agata/generator/emitter/BeamIn/A 238
/Agata/generator/emitter/BeamIn/KE 1476 MeV
/Agata/generator/emitter/BeamIn/fcZ -5 cm
/Agata/generator/emitter/BeamIn/bDir 20 180
#Give reaction product "counted" from beam, this gives 114Pd
/Agata/generator/emitter/BeamOut/DZ -46
/Agata/generator/emitter/BeamOut/DA -124
#target in the following, OBS this is not the "geant4 target per se",
#but used in the reaction kinematics
/Agata/generator/emitter/BeamOut/Z 4
/Agata/generator/emitter/BeamOut/A 9
#starts at a level E* 3253.4 (12+)
/Agata/generator/emitter/BeamOut/ProjectileExcitation 4147.4 1.
/grdm/setRadioactiveDecayFile 46 114 decay114Pd
# Geometria
#Here target. G4.Be is natural Be but close enough
/Agata/detector/targetMaterial G4_Be
/Agata/detector/targetSize 20 20 2.3
/Agata/detector/degraderMaterial Vacuum
/grdm/allVolumes
/grdm/verbose 0
#This gives a "spectrometer" giving which ion was detected in the output
/Agata/detector/SetBuildSpectrometer true
#no AGATA detectors hence an empty list of detectors
/Agata/detector/angleFile A180/A180euler1P.list
```

RDDS Fusion-Fisson

Lets run an example...

```
#distribution of reaction points according to "./profile.dat"  
/Agata/generator/emitter/disableFixDepth  
/Agata/generator/emitter/enableUniformDistr  
#what kind of reactions...  
/Agata/generator/emitter/BeamOut/setPtr 0.  
/Agata/generator/emitter/BeamOut/setPfe 0.  
/Agata/generator/emitter/BeamOut/setPclx 0.  
/Agata/generator/emitter/BeamOut/setPff 1.  
#to "hit" VAMOS and not simulate a lot of junk  
/Agata/generator/emitter/BeamOut/phi 175 185  
/Agata/generator/emitter/BeamOut/theta 15 25  
#to produce a background...  
/Agata/generator/emitter/setNumberOfGammaBackground 20  
  
/Agata/generator/emitter/SetNumberOfParticlesPerReaction 1
```

RDDS Fusion-Fisson

Lets run an example...

- 1 Go to `/misc/agatasim-school2013/SimulatedExperiments/FusionFisson`
- 2 Run `"Agata -Gen -n -SN -b FF_AGATA.mac"`
- 3 Then run `"./../../OFT/standalone_gamma/tracking_simulated GammaEvents.0000 1 10000000 1 1 0 1 1"`
- 4 Run, in one of the terminals `"./../../AgataSoftware/bin/femul Topology.conf -nothr -turns 100"`
- 5 run `"gnuplot" load "PlotOFTtracked.gnuplot"`

Coulex+Ancillary+ADF+femul

Lets run an example...

```
/control/execute kryptongeometry.mac
/Agata/detector/targetMaterial G4_Pb
/Agata/detector/targetSize 20 20 1
/Agata/generator/emitter/BeamIn/Z 36
/Agata/generator/emitter/BeamIn/A 74
/Agata/generator/emitter/BeamIn/KE 347.8 MeV
/Agata/generator/emitter/BeamIn/fcZ -65 cm
/Agata/generator/emitter/BeamIn/bDir 0 0
/Agata/generator/emitter/BeamIn/opA .1
/Agata/generator/emitter/BeamIn/spotSize .05 cm
/Agata/generator/emitter/SetParticlePerSeconds .14
/Agata/generator/emitter/SetAcceleratorHF 100 MHz
/Agata/generator/emitter/SetWidthOfBeamPulse 2 ns
/Agata/generator/emitter/BeamOut/DZ -0
/Agata/generator/emitter/BeamOut/DA -0
/Agata/generator/emitter/SetNumberOfParticlesPerReaction 1
/Agata/generator/emitter/BeamOut/Z 82
/Agata/generator/emitter/BeamOut/A 208
/Agata/generator/emitter/BeamOut/ProjectileExcitation 455.8 4 1013.92 1
/grdm/setRadioactiveDecayFile 36 74 decay74Kr
/Agata/generator/emitter/BeamOut/setPtr 0.
/Agata/generator/emitter/BeamOut/setPfe 0.
/Agata/generator/emitter/BeamOut/setPclx 1.
/Agata/generator/emitter/BeamOut/setPff 0.

/Agata/generator/emitter/BeamOut/adistFile aadist
```

Coulex+Ancillary+ADF+femul

Lets run an example...

```
/Agata/detector/update  
/Agata/ScreenedElastic/SetEnergyLimitCreatedByScreenedElastic 0.01 MeV  
/Agata/ScreenedElastic/SetEnergyLimitHeavyIons 1 MeV  
/Agata/ScreenedElastic/SetEnergyLimitHeavyIonsInSensitiveVolume 1 MeV  
/run/initialize  
/Agata/file/verbose 1  
/Agata/file/enableLM  
/Agata/file/info/enableTime  
/Agata/file/WriteToFifo true  
  
/run/beamOn 1000000
```

Coulex+Ancillary+ADF+femul

Lets run an example...

- 1 Open two terminals
- 2 In both, go to
`/misc/agatasimschool2013/SimulatedExperiments/CoulexKr`
- 3 In one run “Agata -Gen -a 1 1 -SN -n -b krypton.mac”
- 4 In the other one “cat GammaEvents.fifo | PARTICLEID=-8
LD_LIBRARY_PATH=*PWD* :LD_LIBRARY_PATH
./../../Co60Source/MakeADFEvents”.
- 5 Run, in one of the terminals “./../../AgataSoftware/bin/femul
Topology.conf -nothr -turns 100”
- 6 Once done, go to `/misc/agatasim-
school2013/SimulatedExperiments/CoulexKr/Out/Global`
- 7 Do root -l
.L ./../../../../LookAtLocalSpectra.cxx+
LookAtSpectrum(“Track__1-20-16384-UI__ES.spec”,0)

What is new here

- We have an ancillary, called KOELN
- MakeADFEvents creates an anc file for it as well (.Data/Ancillary/Anc_KOELN.adf) .
 - ① If a library called libKOELN.so can be opened we can put whatever we want into a data:ranc1 frame
 - ② If no library can be opened the data is copied as is, with correct timestamp into a adf file.
- So we can create coincidences between AGATA and Ancillary using the femul event builder (or, if you like, narval)