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Gamma Source Sampling Routines (KIT)

Presently 2 versions exist:

1. Using regular spaced mesh and sampling data from rdum/idum input
2. Using mesh geometry data from file

Version 1: source_gamma_meshtal1.F90

- MCNP input:
  - RDUM xmin, xmax, ymin, ymax, zmin, zmax, volume_ratio
    - volume_ratio: activated material ratio in entire sampling volume (used for source normalisation)
  - IDUM xint, yint, zint, timestep(##)
    - timestep: 2 digits for the corresponding gammas.t## file
- Gamma source file: named gammas.t##
  - Each line corresponds to the spectrum of one mesh element starting from xmin, ymin, zmin and then looping through z, y, x (as MCNP meshtal)
  - "No gammas" is indicated by "-1"
  - Otherwise: cumulative spectrum in 24 groups (FISPACT), last value gives gamma source strength (in $cm^{-3}s^{-1}$)

Version 2: source_gamma_meshtal2.F90

- MCNP input:
  - None needed
- Gamma source file: named gammas
  - First 5 lines contain mesh data and active material list
    - Number of intervals for x, y, z
    - Mesh coordinates for x direction
    - Mesh coordinates for y direction
    - Mesh coordinates for z direction
    - List of activated materials
  - For each mesh element: 24 cumulative groups
    - Gamma source normalisation should be contained in each individual spectrum during processing or FISPACT data.

Gamma source weight:

- FISPACT output is a gamma source strength density, i.e. gammas per cm^3 and s.
- FISPACT uses a material density (DENSITY keyword) to get this density!
- The R2S script averages the gamma source densities S_i over fine mesh FM
  - $S = \sum S_i c_i = \sum \frac{I_i}{V_i} \frac{V_i}{V_{mesh}}$
  - C_i relative volume share of gamma source Si in FM volume V_{mesh}
  - V_i volume of S_i in V_{mesh}

- R2Smesh uses PTRAC data to get V_i/V_{mesh} (as number of hits of particular material to total number of hits in the FM volume)
- Each FM contains then a mixed gamma source spectrum from different materials

- The gamma source routine should use the gamma source intensity as source particle weight.
- It samples from the effective (average) gamma source in each FM.
- Sampling intensity:
  - $I = S * \sum V_i = S * V_{ACT} * \sum \frac{V_i}{V_{ACT}}$
    - V_{ACT} total activated volume in sampling volume
- Source routine samples S and hits the respective volume with a probability of $sum(V_i)/V_{ACT}$. All samples from positions outside the activated volume are rejected.
- To get the final weight (=intensity) one has to multiply by V_{ACT}. This is derived from PTRAC data as sum(material hits)/(total hits).

Source position sampling and rejection:

- Source particle is sampled uniformly from rectangular volume (i.e. meshtally volume).
- Position is rejected, if in void (mat=0) or in non-activated materials (list of material numbers)
  - This factor determines the final source particle weight (see above).
- Efficiency is bad, if activated volume is small!
  - Define particular volumes for sampling
  - obtain correct weighting factor: activated volume in this volume