# Refactoring transportation

- The "transportation" is a Geant4 process
- It manages the navigation in the geometry:
  - It cares about volume boundaries
  - It takes into account the fields in the propagation of particles sensitive to such fields
- Currently, only one transportation object exists in the memory:
  - Either G4Transportation, G4CoupledTransportation or G4ITTransportation
  - It deals with all particle types:
    - neutral and charged particles, optical photons, phonons, etc.
  - Resulting in frequent "if" branches
    - on the charge to decide to apply field computation or not,
    - to use group velocity or not
    - …
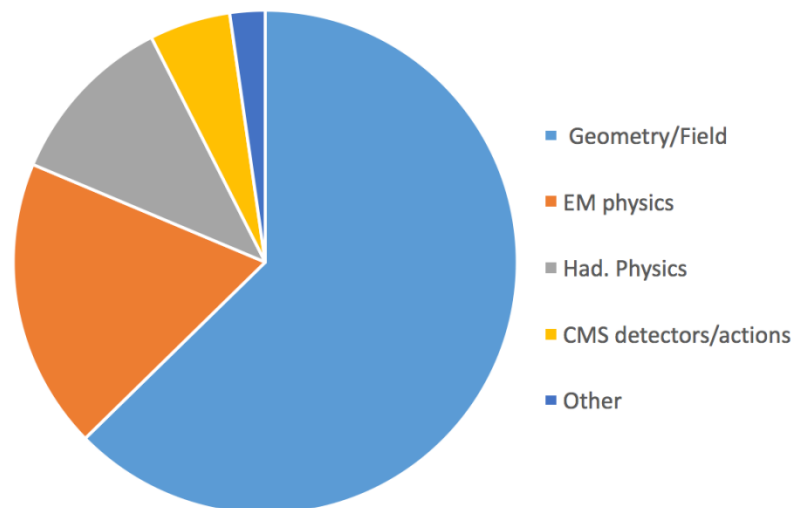
Sources of CPU consumption Geant4 CMS simulation
Courtesy of Vladimir Ivanchenko

Idea

- Idea is to provide at least two flavors of transportation that co-exist:
  - One for charged particles, one for neutral particles
  - Eventually one also for optical photons
    - As velocity calculations differ from other particles
  - On-the-fly switching of steppers could also be considered.
- Case of other fields -e.g. gravitation- may be treated with more transportation flavors
  - N.B. Spin tracking requires neutron to be magnetic field sensitive
- Further extensions/specializations to be also considered:
  - VecGeom navigation: optimized/vectorized, implementation with modern C++
  - À la DagMC: direct and efficient navigation in CAD geometries
  - DNA navigation: better serve the case of radicals
- Revision extended to "Coupled Transportation":
  - Transportation process dealing with several parallel geometries simultaneously
  - Has many use-cases: e.g. layered-mass geometry: allows to switch between several representation of a same detector, depending on particle
- Study in progress. Plan to deliver first implementations in 2019 as an option in G4VModularPhysicsList::AddTransportation().