



## Open requirements – HEP Intensity and Cosmic Frontier experiments

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# Outline

- Requirements currently in Jira
- Other requirements

# Current Requirements in JIRA

- UR-29 Reweightable uncertainties for systematic uncertainties estimation
  - An ability to vary model parameters (and interaction xsections), including the reweightability aspect
  - In progress; Bertini, FTF models being looked at and impact of parameter variation being studied; an API being worked on; See Julia's talk(s)
- UR-30 Validation of new versions of Geant4
  - An ability to learn what changed between two given versions
  - In progress; See e.g. Julia's talks and esp. Hans's talk on DoSSiER
- UR-31 Treatment of gamma cascades after neutron capture (Gd, Xe)
  - 10.2.p02 patch should have addressed it
    - Still waiting for feedback from the experiment (LZ still uses Geant4 9.4)
- UR-33 Need of correct pion elastic model for T2K
  - Work/follow up needed to achieve agreement with the DUET exp. data
  - The correction is needed for all neutrino oscillation experiments including e.g. DUNE, not only for T2K
- UR-32 Neutron production in muon showers at the %-level
  - Closed due to lack of resources
- UR-28 Anti-proton production from proton beam (Mu2e request)
  - Closed due to lack of resources

# Other requirements: IF experiments

- NOvA: A need for a modern treatment of Bethe-Bloch density effect (energy loss calculations for materials)
  - see [https://bugzilla-geant4.kek.jp/show\\_bug.cgi?id=1994](https://bugzilla-geant4.kek.jp/show_bug.cgi?id=1994)
    - or <https://sft.its.cern.ch/jira/browse/SIM-695>
- MINERvA would like to pass along a patch for extracting struck nucleus (in a mixture) for each hadronic interaction
  - More details to be provided
- Adam Lyon et al. (Fermilab/Muon g-2) would like to contribute a VTK based visualization driver

# Other Requirements:

## Dark Matter Experiments (per D. Wright)

- Simulation of neutron self-shielding effect
  - Neutron flux through a material can be significantly modified when the neutron energy is in the resonance region
  - The capture process can reduce the flux at one position in a crystal creating a kind of shadow in which the downstream atoms see a different background flux
    - Changes of as much as 10% can occur e.g. in Ge and Si stressing the need to calculate this as part of neutron propagation
- Simulation of gamma induced neutron background
  - Low energy gammas producing neutrons in various materials can be a significant background in dark matter experiments
    - Photo-nuclear process does not model this well below 30 MeV
      - An improved process using the G4LEND gamma models is required

# Summary

- Several requirements being worked on; several closed due to lack of resources
  - not all current needs fully specified or captured in JIRA
- Experiments in need quite often modify Geant4 locally and are willing to contribute their changes back to Geant4
  - Support/effort from the Geant4 side is still needed in such cases