FLUKA VMC Interface discontinued

The fluka-vmc interface has been developed starting around 2003 by the Alice offline group. More generally, the VMC interface(s) are aimed at providing the same geometrical description, input interface and output interface for different Monte Carlo codes. In its practical implementation to FLUKA, however, this philosophy leads to a complete hindrance of the FLUKA input to the user. The user has therefore access only to a limited subset of the FLUKA physics and transport settings, those usually applied to GEANT3/GEANT4 simulation for event-by-event analysis of experimental apparatus. The fluka-vmc interface tends to give the user feeling of a simple access to FLUKA running, whereas it is just ignoring the necessary stage of identifying the proper settings of the current simulation. Indeed the intrinsic differences among different Monte Carlo's render a generic virtual interface *de facto* impossible.

The unavailability of the proper setting options can lead in many cases to inaccurate or even wrong results.

Moreover, the excessive simplification prevents the user from accessing many of the FLUKA features that are not common to other codes, biasing being only the first example.

The necessary customization would imply direct handling of the FLUKA input file, so contradicting the idea itself of the interface. Moreover direct access to the input is cumbersome because the interface is generating it automatically run time.

Below there is a non-exhaustive list of critical features which are badly or not at all supported by fluka-vmc:

1. All card PHYSICS options are not supported. Some of them are essential to set precision treatment of nuclear interaction, required for instance for activation studies and precise neutronics.
2. Activation, decay, and residual dose rate calculations are impossible
3. Association of materials with specific low neutron data sets is not supported. In summary no precise neutronics can be performed, particularly when moderators and/or massive shielding are present
4. Most FLUKA scoring options are not supported
5. As a consequence of the above points, no DPA, residual nuclei, and/or gas production calculations are possible
6. Biasing is not supported. FLUKA has one of the most extensive sets of biasing features among the existing Monte Carlo codes: none of them is supported by fluka-vmc, making shielding calculations *de facto* impossible.
7. The new Compton treatment (important for low-energy studies) is not supported
8. Single scattering, essential for gases or thin interfaces or very low energies is not supported.
9. Step length control by regions is not supported.
10. Cards related to fine tuning of material properties, of relevance for many problems, and essential for Hadron Therapy, are not supported
11. Photoproduction of muons is not supported
12. Electromagnetic dissociation, essential for heavy ions at LHC, is not supported
13. Online quenching of the signal is not supported
14. Low energy neutron kerma-like energy deposition events are treated like all other energy deposition events, without recognizing their peculiar nature

15. Non standard isotopic compositions (i.e. 10B enriched neutron absorber) are not supported by fluka-vmc
16. Voxel geometries are not supported
17. FLAIR and all postprocessing tools cannot be used together with fluka-vmc
18. Moving geometries (eg rotating wheels, variable aperture collimators) are not supported
19. The possibility to proceed with several runs along a random number sequence and the possibility to restart from a given random number seed are not supported. Both statistical analysis and debugging are therefore impossible.
20. The NEW-DEFA setting is used. This is the lowest level (minimal accuracy) default setting for FLUKA, it is completely inappropriate for event-by-event calculations and in general for precision calculations.
21. There is no support for the pointwise treatment and explicit recoils on Hydrogen. Applications to scintillator materials are severely affected.
22. Transport of ions, including alphas and deuterons, is set to the most basic level unless heavy ion interactions are requested
23. There is no possibility to control the accuracy parameters for transport in magnetic fields. In specific situations this can cause severe tracking errors.
24. There is evidence of several serious bugs and obsolete features in the interface.

It is evident from the above list that the use of FLUKA through the VMC interface is preventing the user from exploiting the full capabilities of the code, and is exposing the user to the possibility to obtain incorrect or even wrong results.

We as the FLUKA collaboration wish to do our best in order to ensure the success of CERN with its flagship LHC and the experiments like ALICE. Therefore we would like to ensure that we will continue to give our support to ALICE for the FLUKA-VMC interface.

However the interface in its present state is adapted only for the needs of ALICE, assuming the bugs are corrected, but not of a generic user. To bring it to a state compatible with the standards of FLUKA, would require significant resources and a complete reworking of the interface that would result in an inefficient duplication of work presently done at FLUKA for the Flair interface.