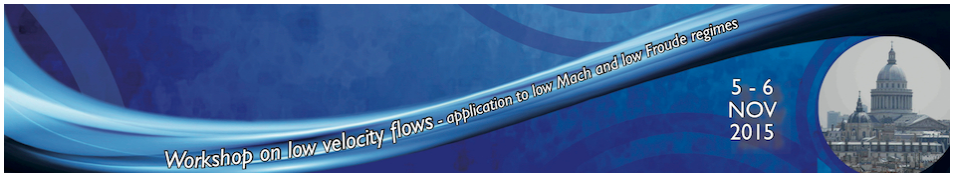

ID de Contribution: **23** Type: **Non spécifié**

An explicit second order scheme on staggered finite volume meshes for reactive flows with stiff kinetics

In hydrogen safety issues distinct physical phenomena, following each other, have to be addressed. The typical process yielding an hydrogen-oxygen explosion starts with the mixing of the reactants (subsonic, low speed), the ignition and propagation of a flame front (subsonic, high speed) which eventually turns into a detonation wave (supersonic). Simulating the entire process from end to end may involve different flow solvers, in which case the use of a common mesh discretization becomes an important feature, since it drastically simplifies code-to-code communications. This is the strategy followed for the development of the P2REMICS (Partially PREMIxed Combustion Solver) software at IRSN.

The choice of staggered finite volumes is interesting for its inferred stability properties in the incompressible limit. An explicit second order finite volume scheme on staggered grids for solving the compressible Euler equations was previously introduced. We now extend this numerical scheme to the reactive Euler equations in the ZND framework (finite reaction rate) for detonation problems. Consistent results are obtained on 1D problems as long as the space and time scales of the chemical reaction are well resolved, which may require unreasonably fine discretizations.

Indeed on coarser discretizations, a small amount of diffusion can have a dramatic impact on the computation of the reaction rate and unphysical solutions are likely to appear. We use a local reconstruction with Harten's subcell resolution technique similar to [Wang, Shu, Yee, Sjogreen, '12] in order to improve the accuracy of the source term and prevent an early transition from an intermediate chemical state to the burnt state. Solutions obtained from 1D numerical tests feature a consistent wave pattern and the correct wave propagation speed.

Orateur: ZAZA, Chady (IRSN, France)