Although exploitation of dual interconnected fluidized bed systems (DIFB) is currently being explored in various fields (1,2), DIFBs present some criticalities, mainly related to effective control of solids recirculation and to avoidance of gas leakage between the beds, extremely critical in chemical looping reforming (CLR) for hydrogen production. For the latter, the choice of the degree of oxygen carrier oxidation/reduction, operation temperature and loop design makes the design even more challenging. This paper aims at quantitative assessment of the influence of design variables by means of the numerical simulation of a DIFB-CLR process operated at steady state. The model couples a simple hydrodynamic simulation of a DIFB system equipped with non-mechanical valves for bed solids circulation with a 1D, dynamic and non-isothermal CLR model developed to determine temperature and oxidation degree of solids and gaseous species concentrations at the exit of both air and fuel reactors. The DIFB (Fig. 1), consisting of a riser and of a bubbling fluidized bed (BFB) as air and fuel reactors respectively, was modelled as a combination of interconnected blocks (riser, cyclone, downcomers, L-valve, BFB, loop-seal) after selection of constitutive equations. Methane and Nickel(II) oxide were selected as fuel and oxygen carrier.

Results corresponding to steady operation are presented and the effects on the expected process performance of operating conditions are assessed. It is concluded that an appropriate choice of both operating temperature and oxidation/reduction degree of oxygen carrier is an essential prerequisite in order to achieve auto-thermal regimes while assuring process feasibility and good performances in terms of CH4 conversion and H2 selectivity.

REFERENCES
Fig. 1 - Schematic representation of the CLR-DIFB system