(pillar shape, porosity, form factor), thermal constraints (low temperature range, thermal efficiency during heat accumulation/restitution) and fluidic constraints (flow regime, pressure drop, compressibility). In this study, we tested only nitrogen as a working fluid. In the future, we will test other gases (helium, hydrogen), other forms of pillars (rhombus, elongated and rectangular). We have started a numerical study (CFD) of the oscillating flow inside a milli-regenerator and we will compare the numerical and experimental results in order to optimize a Stirling machine at small scale and small temperature gradient.

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Nomenclature

a, b, c	constants
BCD	Bottom Dead Center
c_p	specific heat ($J.kg^{-1}.K^{-1}$)
C	factor
CHX	Cold Heat eXchanger
D	diameter (m)
E	effusivity ($J.K^{-1}.m^{-2}.s^{-1/2}$)
f	frequency (Hz)
F	inertial coefficient
FF	form factor
GUM	Guide to the expression of Uncertainty in Measurement
h	height (m)
HHX	Hot Heat eXchanger
K	permeability (m^2)
L	length (m)
P	pressure (bar)
Re	Reynolds number
S	stroke (m)
T	temperature (°C)
TDC	Top Dead Center
V	velocity ($m.s^{-1}$)
w	width (m)

Subscripts

atm	atmospheric
h	hydraulic diameter
f	friction
max	maximal value
osc	oscillating
p	pillar
std	steady

Greek Symbols

Δ	difference
ε	porosity
λ	thermal conductivity ($W.m^{-1}.K^{-1}$)
μ	dynamic viscosity (Pa.s)
ν	cinematic viscosity ($m^2.s^{-1}$)
ρ	density ($kg.m^{-3}$)
ω	angular frequency ($rad.s^{-1}$)