TABLE I. Description of phases and processes as they occur based on the overview plots of each scenario, Figures (2a-f) for experiment N57 and Figures (3a-d) for experiment N58.

APT Phases (I, II and III)

Previous investigations showed that for the same set-up conditions and same vent geometry, the dynamics of the ejecta is quite similar from experiment to experiment (Alatorre-Ibargüengoitia et al., 2010; 2011; Cigala, PhD Thesis 2017). Therefore, APT phases I, II and III are representative of the ejecta of both scenarios, N57 and N58. These phases are illustrated with selected frames taken with the CT camera (see Figure 1 and SM videos N57 and N58). The times correspond to the overview of the N57 scenario (Figs. 2a).
Phase I comprises the period when diaphragms open. The 1st diaphragm opens releasing the gas between both diaphragms. At about 0.4 s the lower diaphragm opens generating a compression wave front that moves upwards, followed by the gas stored above the sample (see 1st image in Fig.2a). This emission causes a pressure increase at the vent.
Phase II corresponds to the emission of the particles derived from the ejection of the upper three layers into the APT, which are propelled by the expansion of the gas (see 3rd image in Fig. 2a). The vent pressure returned to atmospheric pressure. The maximum ejection velocity observed reached 56 m/s at the front of the gas-particle mixture and decays rapidly through time. During this phase the number of particles flowing into the APT remains relatively high, lasting until 0.433 s; time that marks the beginning of the following phase.
Phase III includes the period when the ascent of particles significantly decreases. This decrement is controlled by permeable flow through the jammed layers. This can be seen in the last two images in figure (2a).

HPA Phases (A,B,C and D)

The composite dynamic of gas expansion, fragmentation and mass flux indicate	**N57 Discontinuous dynamic**	**N58 Continuous dynamic**
Phase A Comprises the first 0.020 s while the sample keeps still and prior to the opening of the lower diaphragm (Fig.1).		
Initial pressure (P_i)	6 MPa	10 MPa
The upper diaphragm opens at	0.399 s	0.398 s
The 0.12 cm^3 of Ar, stored between the upper and lower diaphragms releases and the 1st shock wave can be seen in the SM videos N57 and N58.	0.399 – 0.4 s	0.398 to 0.399 s

The sustained initial pressure and decompression cause irregular elastic deformation of the HPA's walls. The sketches show the circumferential deformation ($\varepsilon_{\theta\theta}$) delineated in orange and dark green. Inside the HPA, light blue indicates Ar and dimmed gray colors the sample. These changes last for about 0.017 s and up to phase C.	 Figs. 2c and 5c	 Figs. 3b and 5d
Sample´s top high is at	49 mm, Fig. 2c	65 mm, Fig.3b
The dimed low-frequency oscillations (< 200 Hz), shown in the spectrogram before the aperture of the 1st diaphragm, are due to the pressurization of the HPA.	from 0.386 to 0.399 s, see Fig. 2e	from 0.386 to 0.3995 s see Fig. 3c
Phase B It is characterized by sudden decompression and fragmentation of the sample. In both scenarios the lower diaphragm opens at about t=0.4 s.		
Slight dust is noticeable on top of the sample at about	0.40045 s	0.399 s
The first crack can be observed in the middle of the sample at	0.40050 s, at ca. 40 mm height, see 2nd image in Fig.2b	0.4007 s, at ca. 26 mm height, see 2nd image in Fig.3a
More cracks spread upward and downward, ending completely developed at about (for details see the videos in SM)	0.40155 s, see 3th image in Fig. 2b and see Fig. 5a	0.40138 s see 3th image in Fig.3a and see Fig. 5b
Layer-by-layer fragmentation generates	10 thick irregular layers in 0.001 s move upwards. Fig. 5a	uncountable thin regular layers continuously move upward in 0.007 s, Fig. 5b
HPA bears maximum circumferential deformation $\varepsilon_{\theta\theta}$ along the autoclave length from	Up to -8 μm	Up to -5 μm
The maximum peak-to-trough velocity depicted in the S1 sensor represents the expansion waves that propagate down from the neck of the HPA, and reach the sample´s surface at	0.15 μm/s Figs. 2d	Maximum amplitude occurs up to phase C Figs. 3c
Sample's fragmentation correlates with the main train of oscillations which gradually increases in amplitude, and whose spectral frequencies shown in the spectrograms are distributed in two ranges.	Below 200 Hz and between 600 and 1500 Hz. Figs.2d and 2e	Below 800 Hz and above 1200 Hz. Figs.2c and 2d
75% of pressure (PT) drops	in 0.0014 s Fig. 5e	in 0.0016 s Fig.5f

Phase C It is the longer phase and comprises gas expansion, layer separation and acceleration upwards along the HPA.		
runs from	0.40155 s to 0.4068 s Figs. 2b, c and e.	0.40138 to 0.415 s Fig.3a, b, d.
Layers disintegrate into small particles and are expulsed by gas expansion.	Only the first three layers escape, and very few bursts are appreciable while ascending.	All layers escape, and bursting is appreciable while ascending.
Layers displace type (observe in the videos SM)	in a stick-slip manner from 3 to 5 ms,	continuous upwards
The mass flux is	Interrupted, gas flow declines until pressure again recharges at about 0.401 s. Fig. 5e	Mass flux is continuous.
HPA behaves elastically and bears maximum circumferential deformation $\varepsilon_{\theta\theta}$ along its length (in the elastic-response plots cold colors indicate tension, and warm colors compression in elasto-response plots see figures 2,3 and 4)	from bottom to 150 mm high, all tension is released and slowly passes from maximum tension to maximum compression Fig. 5c	from the first 20 mm up to 180 mm high. Tension rapidly passes to compression Fig. 5d
In the spectrograms, the oscillations above 600 Hz, reach their maximum amplitude and progressively decrease lasting	ca. 10 ms (Fig. 2d and 2e)	ca. 11 ms (Figs. 3c and 3d.)
Pressure PT continuously decreases to P_a from	See Fig. 5e	See Fig. 5f
Phase D- Mass flux and expulsion dynamics		
Starts from	0.4068 s. Fig. 2b	0.415 s Fig. 3a
Jammed layers interrupt mass flux	7 distinct layers jam at different time intervals and heights from 10 to110 mm Fig. 2b	Only two layers at the bottom look jammed
Trapped particles ping-pong between jammed layers	Many along the HPA	Non
Permeable layers allow gas and tiny particles to escape	Some between 70 mm and 120 mm	unnoticeable
HPA elastically contracts	sluggishly and irregularly between 100-150 mm	Since phase C has not changed
In the spectrogram oscillations concentrated below 250 Hz (Fig. 2f).	Last for the rest of the experiment, (Fig. 2e).	Last 80 ms (Figs. 3e).