Introduction:
Airway suctioning is common during mechanical ventilation, using either an open endotraqueal suctioning or closed endotracheal suctioning (CES). Closed circuits were developed to prevent arterial desaturation and atelectasis associated to ventilator disconnection. However, CES may cause substantial loss of lung volume. The purpose of this study was to investigate the effects of a compensation method to prevent the loss in aeration during CES.

Methods:
The suctioning technique was performed for 15 seconds, negative pressures limited at 150mmHg. Closed suction catheters with 14Fr (Halyard Health, Georgia, EUA) were used. Electrical impedance tomography (EIT) monitoring and arterial blood gas were collected. A NihonKoden Mechanical Ventilator (NKV550, California, EUA) was applied, having a newly developed algorithm for suctioning which overcomes any pressure loss during suctioning. (InlineSuction-APP). When activated, the APP delivers PCV ventilation, adding 2cmH₂O of end-expiratory pressure above PEEP, and delivering Driving Pressures of 15 cmH₂O.

Results:
Pigs (30±5.4kg) with injured lungs and mechanically ventilated. We tested the aspiration procedures using low PEEP=5cmH₂O, or high PEEP=±12.3cmH₂O with Vₜ=6ml/kg. The APP consistently attenuated the loss in functional residual capacity after the procedure(fig1). Lung compliance deteriorated under VCV modes when the APP was OFF (from 13.2±5.4 to 0.5±6 mL/cmH₂O), whereas maintenance of compliance was observed when the APP was ON (from 12.2±1.4 to 12.5±4.5 mL/cmH₂O).

Blood gas in a representative animal showed a drop in PaO₂ when APP was off (from 247, to 149 mmHg after 2min, and to 176mmHg after 10min). With APPON the PaO₂ changed from 259 (pre-suction), to 223(2 min), to 253mmHg(10min).

Conclusion:
The new NKsoftware, delivering PCV ventilation during suctioning, could prevent atelectasis and functional loss associated to the procedure.
Representative image showing the ventilation maps before and after closed endotracheal suctioning (CES). A) The drop in the EIT plethysmogram during suctioning, when no Inline Suction App was used – associated with a significant drop of lung compliance. B) A minor change in EIT ventilation map and in the plethysmogram when the Inline Suction APP was ON.