Summary of the Master's Thesis:

# Monitoring of a proximal neonatal flow sensor for mechanical ventilators: Adaption and Validation

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This thesis comprises the adaptation and validation of an alarm algorithm for Hamilton ventilators. The existing algorithm for compressed air driven ventilators was adapted to neonatal ventilation, characterized especially by low tidal volumes, and to turbine driven ventilators. It detects faulty measurements of the proximal flow sensor.

Clinical observations with low tidal volumes have shown a quite unsatisfactory outcome of the alarm as many false positive alarms occurred during ventilation of neonates and ventilation with the turbine driven device. Therefore, an adaption of the alarm algorithm was indispensable for aiming a robust behavior.

The alarm algorithm was reimplemented in Matlab for an offline evaluation of the recorded data. Attempts were made to reproduce the conditions and false positive alarms on bench tests involving clinical situations. Suctioning maneuvers and especially the frequent and fast changing lung mechanics of the neonates led to false alarm situations. True positive alarms could also be triggered by different maneuvers. Further, a distinction of true and false positive alarms was made on clinical and bench data. On basis of this, algorithm parameters were adapted and modifications made.

Finally, the modified algorithm was validated online in bench tests and offline on new patient data. It could be managed that the alarm algorithm works in a robust manner on the devices driven by compressed air with reducing false positive alarms and a reliable detection of true positive alarms. A precise statement of the performance of the modified algorithm for the turbine driven devices cannot be estimated yet as the validation needs further clinical data. The proposed modifications clearly improve the performance of the alarm, which guarantees precise volume measurement and increases patients safety.