



# open.PAPR

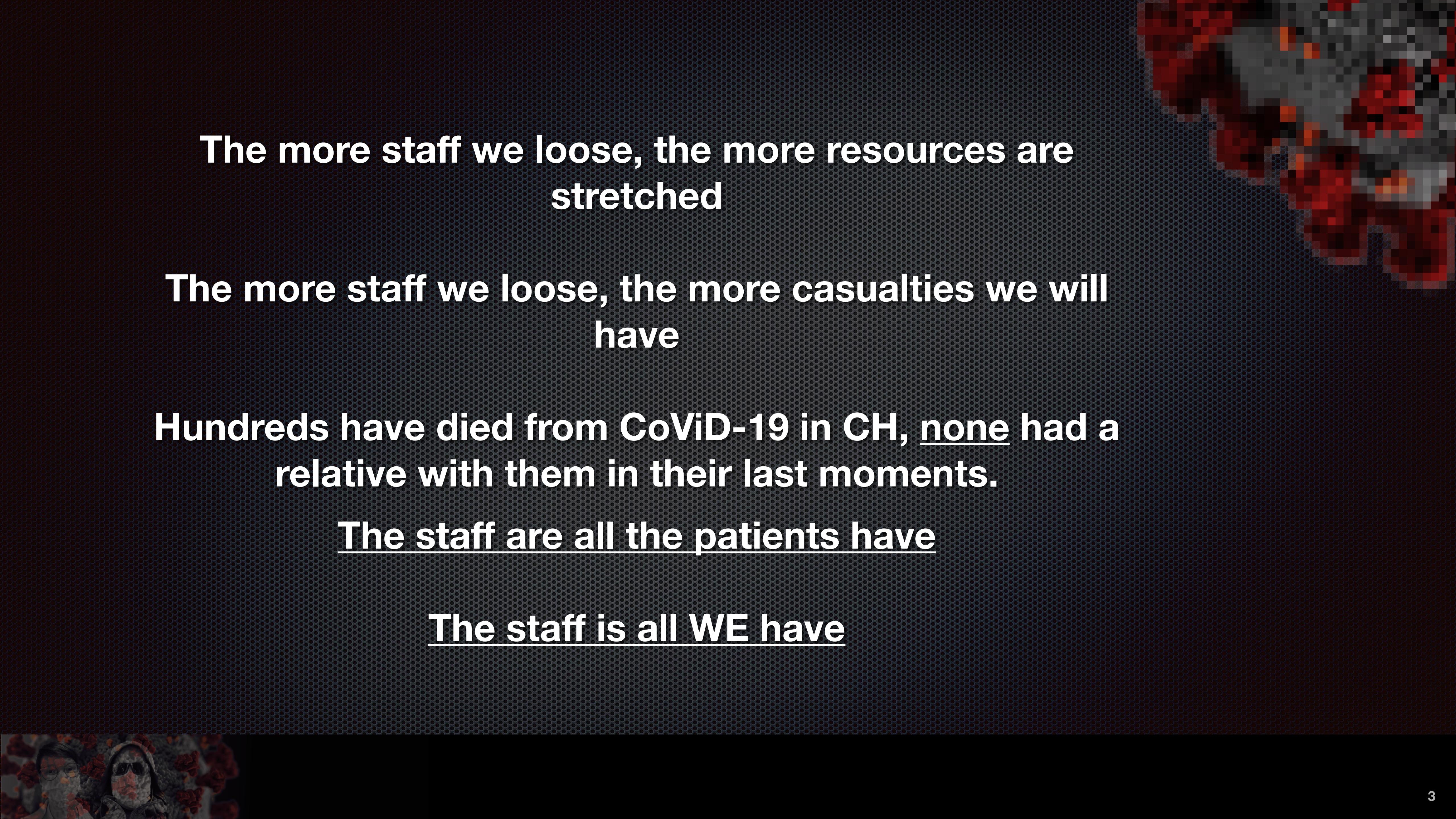
## Project pitch

Ralph Lawrence Wunderlin. 16. April 2020

# Executive summary

- Personal protection equipment is not sufficient and in short supply
- Provide medical staff with the protection they need not just what we have
- Greatly reduces risk of contamination for the medical staff
- Decontamination after leaving the red-zone can be implemented

This is a spin-off of project #103 How to get local and reusable masks



**The more staff we loose, the more resources are stretched**

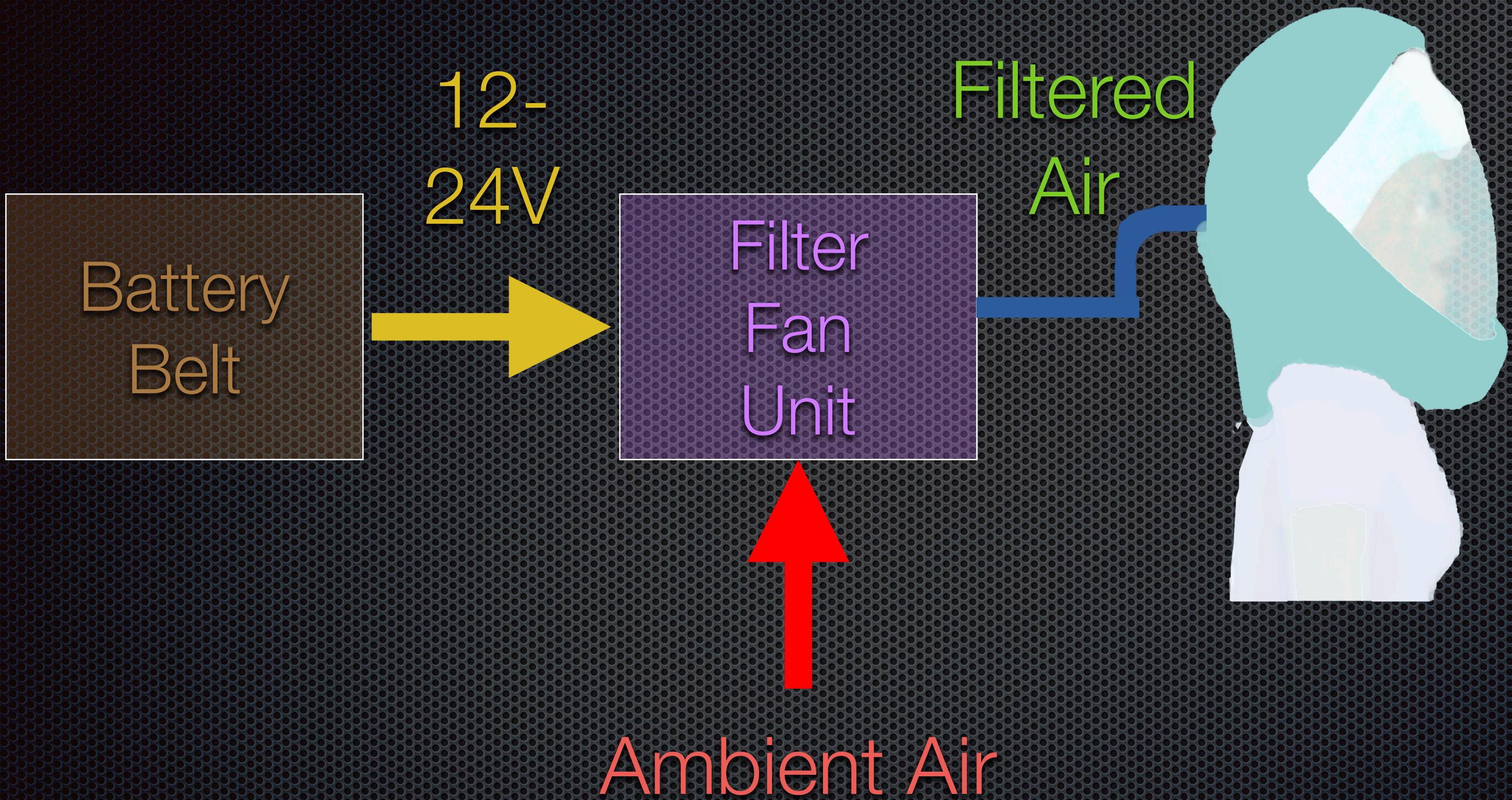
**The more staff we loose, the more casualties we will have**

**Hundreds have died from CoViD-19 in CH, none had a relative with them in their last moments.**

**The staff are all the patients have**

**The staff is all WE have**

# Overview



# Facts

- **More and more Front-Line Helpers are being infected:**
  - China: About **6%** of all CoViD-19 cases were helpers
  - Italy: **20%** of all CoViD-19 cases were helpers
  - Spain: Over **16%** of all CoViD-19 cases were helpers
  - Germany: Over **2'300** Helpers infected, at least one hospital shut down due to infected staff
  - Switzerland: More than **2.6%** of the CoViD-19 patients are healthcare workers and doctors
- **In Switzerland PPE for medical staff is driven by availability instead of capability**

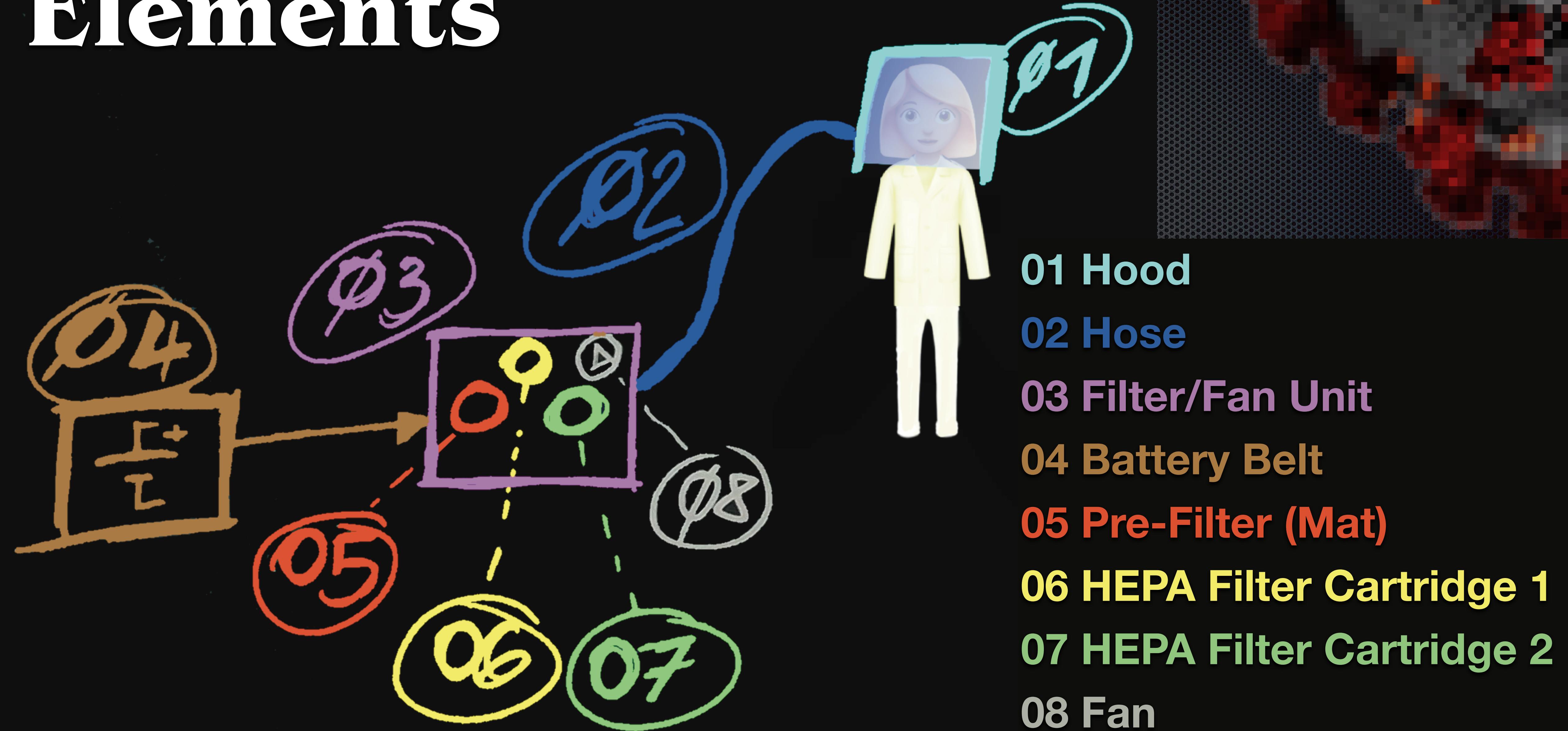
# Why

- **SARS-CoV-2 is transmitted by droplets & aerosol. Mucus tissue is the entry point (Mouth, Nose, Eyes)**
- **De-Contamination is not implemented (Shower/Wiping down)**
- **With current PPE:**
  - **High risk of transmission**
  - **Masks are inadequate**
  - **Mask handling is critical (Gowning, During use, Removal)**
  - **Neck or other open skin is visible**

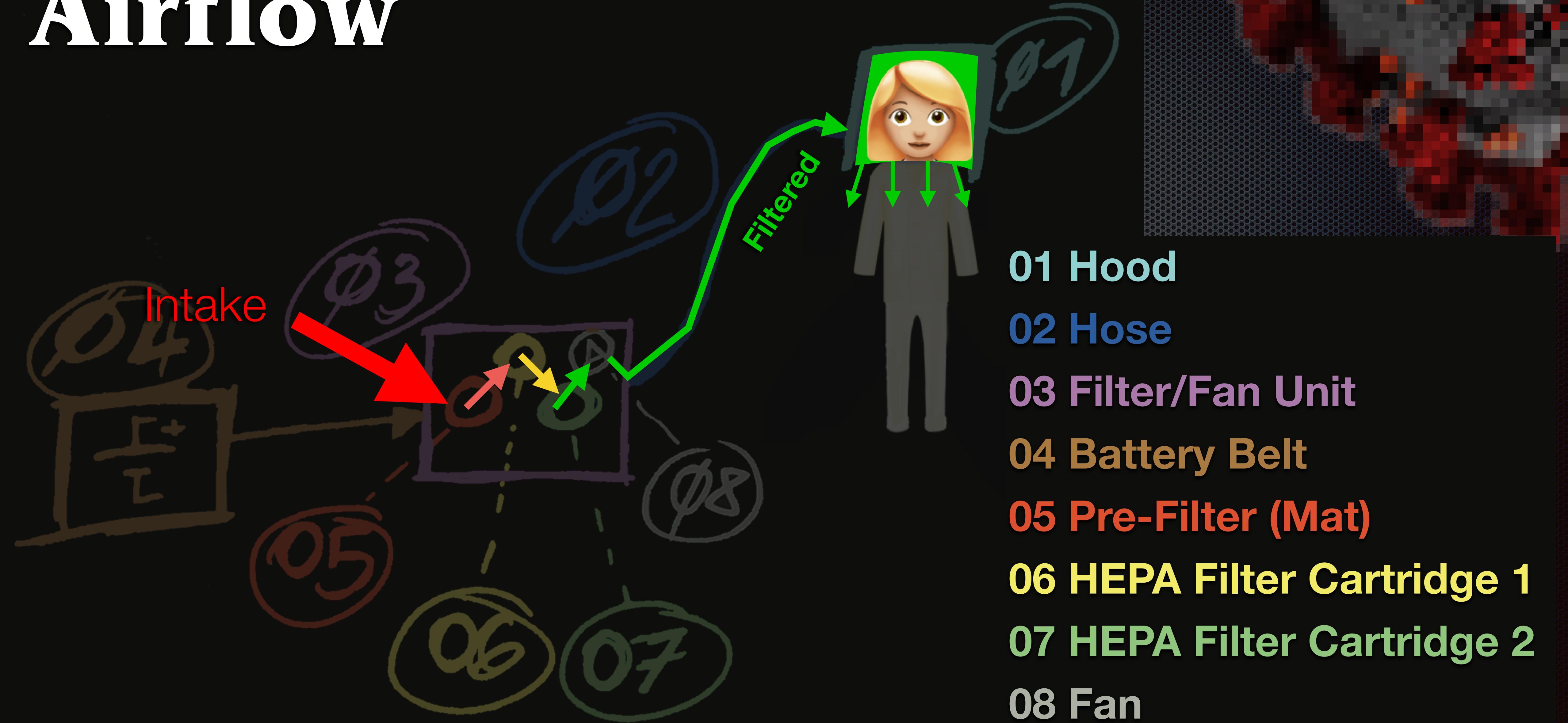
# What can we do?

- Develop re-useable, washable hood (decontamination shower possible)
- Develop lightweight active filter unit with a pre-filter and two HEPA's (two HEPA's for cleaning and safety)
- A battery pack with rechargeable batteries (standardized)
- Use as many standard components as possible, 3 different filter capsules shall be possible
- There are commercial products (3M Jupiter), but they are not available in numbers - so we need our own, and it must accept at least 3 different types of filter cartridges

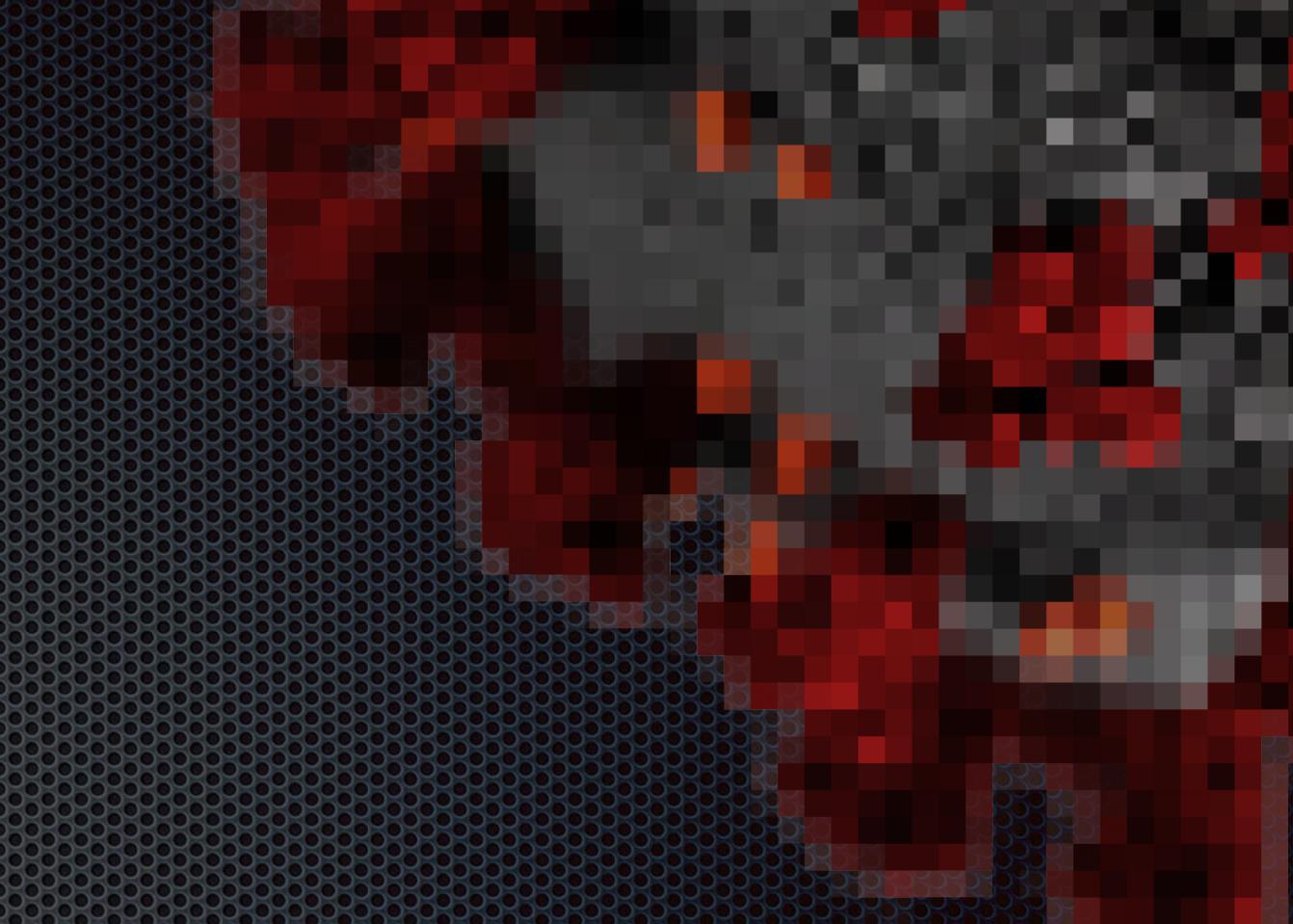
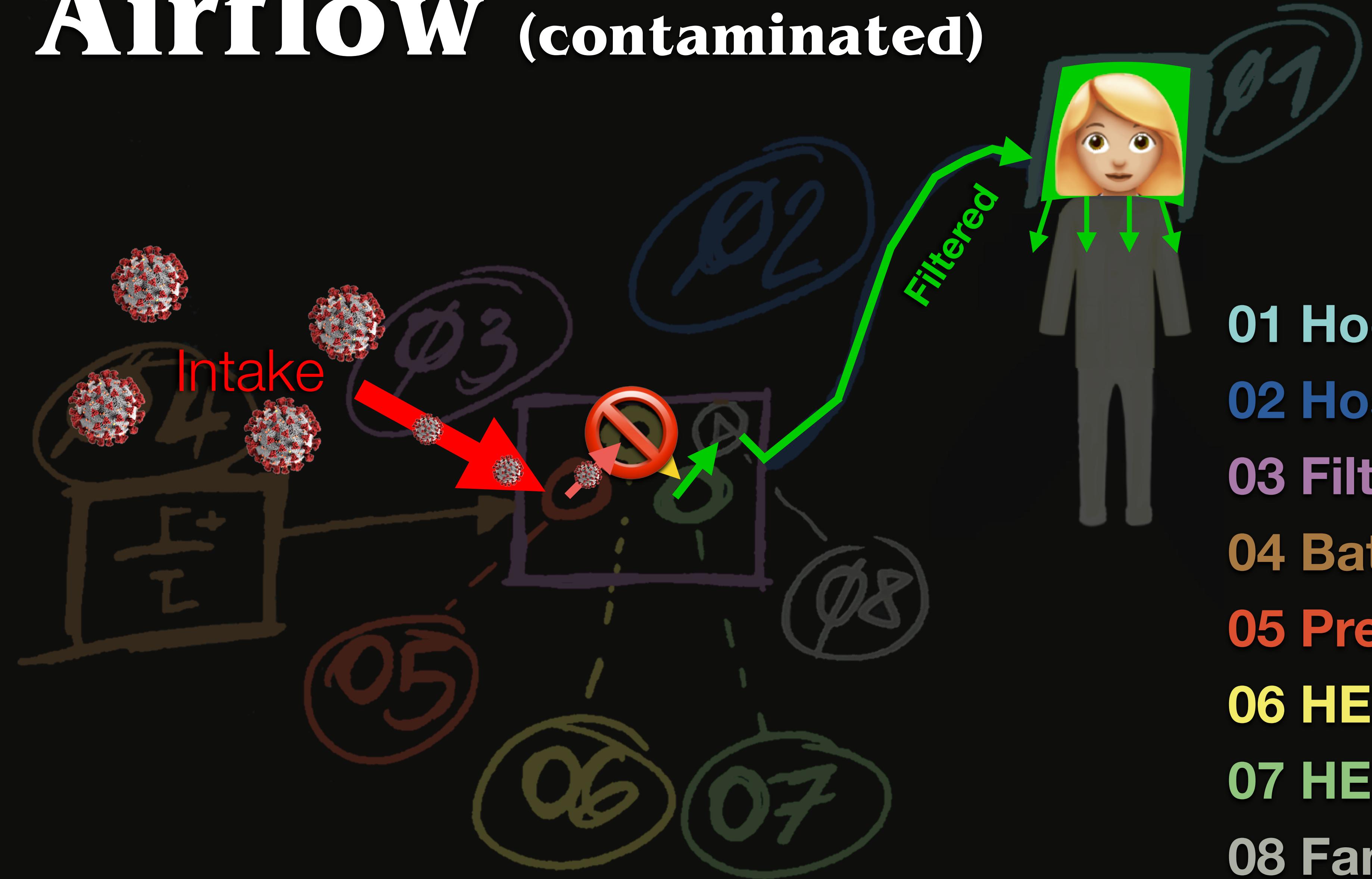
# Elements



# Airflow

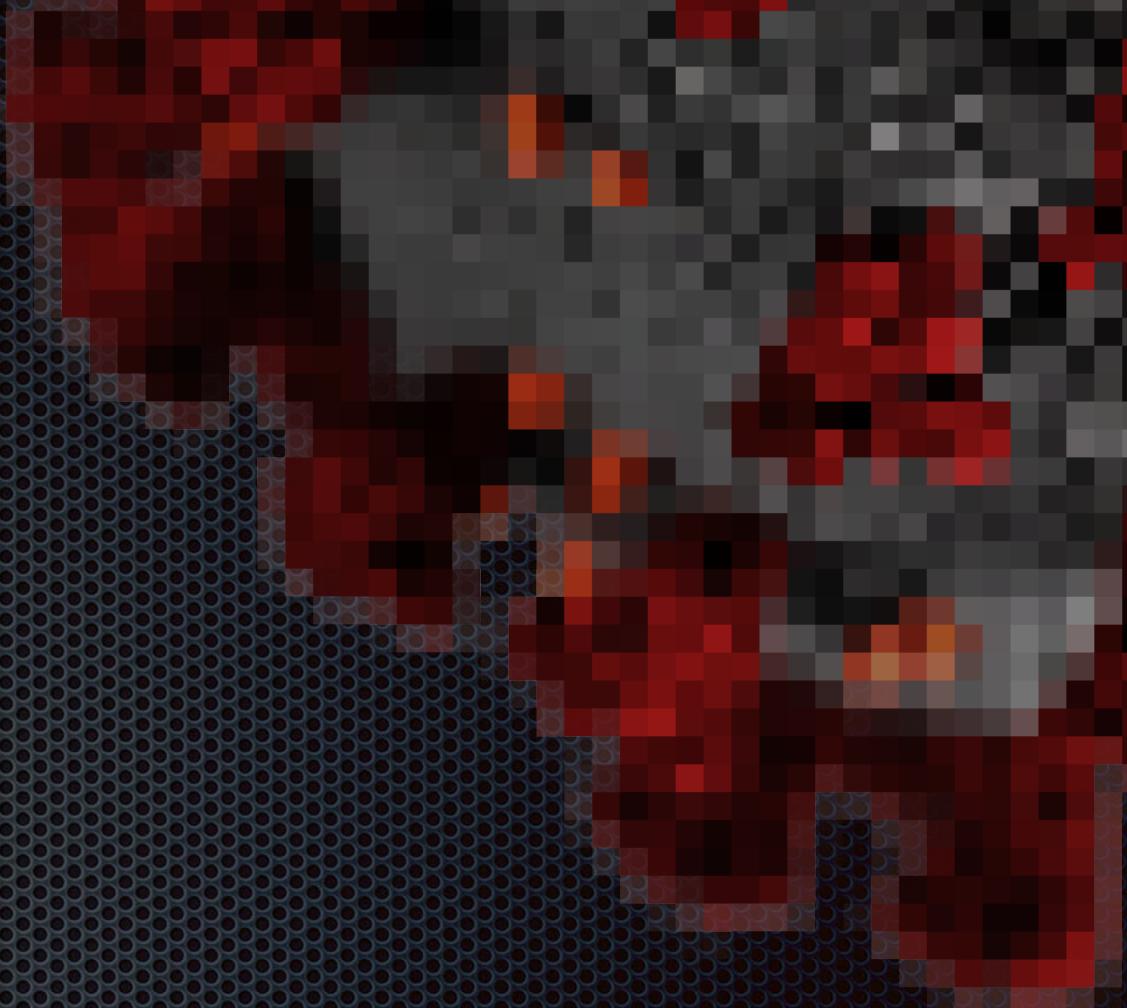


# Airflow (contaminated)



# How

- Brake down in to Work-Packages
- Battery Belt / Filter-Fan Unit / Hood
- Use standard parts (e.g. 18650 batteries, box-HEPA's, etc)
- Who: Small design team, experienced System Engineers, Electronics Engineers, 3D-Designers and Support (Procurement, Compliance)
- Rapid prototyping and first batches could even be partially 3D-printed as this is an urgent project
- Move on to pressure moulded plastic parts as soon as available, test thoroughly
- Use alternatives for hood (textile clean-room hood, „snorkel“)



**„Tu erst das Notwendige, dann das Mögliche,  
und plötzlich schaffst du das Unmögliche.“**

*–Franz von Assisi*