# Bubbler readout project tasks

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ISU KLM group meeting

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Travis, ISU grad student(s)

# Commission SBC

*Tasks in blue can start with an SBC only, without the bubbler panel or the final readout board*

- Decide on SBC model

- Learn to use SBC
    - Communicate via PC (download, upload)
    - Write test code, download, execute
    - Use external input (for example, signal from pulse generator)

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# Bubble recognition & flow rate measurement

- Use sensor output voltage to detect presence of a bubble
  - Channel threshold calibration may be necessary, if pulse heights vary widely between channels. Not expected but need to measure. If yes, ADC instead of discriminator will allow us to fix problem in software.
- Are all bubbles equal (size and time)? Count or integrate over multiple readings ?
- Integrate each channel over significant time (1 – 10 min?) to reduce fluctuations in bubble count
- Calibrate channel gas flow rate to input flow rate
- Code for 52 channels will run on one SBC
  - Switch between channels, make measurement, integrate rate over time, provide time-integrated rate to backend
- Measurements in lab
  - Measure channel output voltage, and bubble pulse shape
  - Demonstrate that gas flow rate can be measured over a range of flow rates (1 channel)
  - Measure gas flow rates for all channels in the same bubbler panel

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# Backend software

- Develop script for bubbler readout computer to read flow rate from bubbler readout boards (python script?)

- Develop GUI to display gas flowrates (totals for octants sufficient?)

- Develop communication with Elastalert
  - Alarm in control room?
  - Email to KLM run coordinator?

- Develop archiving of flow rates in Mirabelle / Kibana

*Example from gas flow monitoring*



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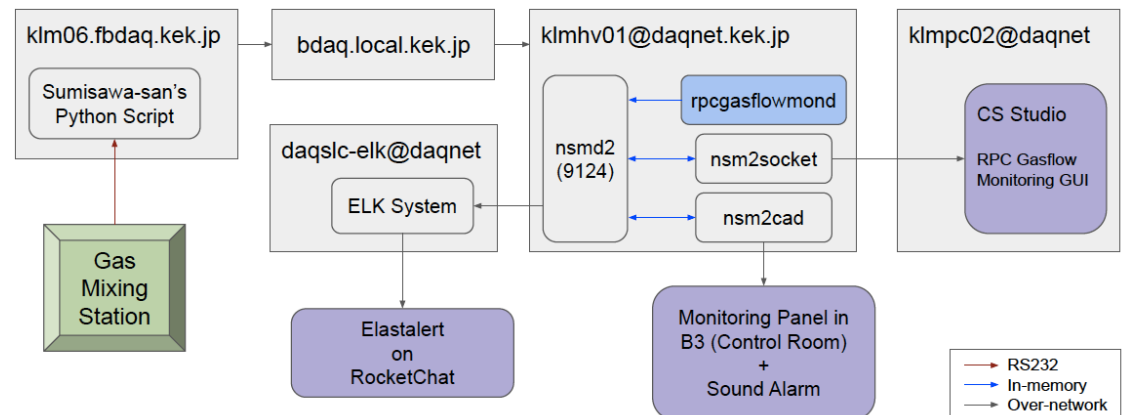
# Tasks @ KEK

- Make inventory of sensor circuits and cables for all bubbler panels
  - Do we need to replace any missing cables? Do we need more sensor circuits? If yes, how can we get them? Could we have more build? Do we need to move gas tubes to different sensors?
- Power bubbler sensors and check output pulses with scope
  - Need test board(s) to hook up on a ribbon cable. Where can one get them?
- How do we connect ribbon cables and VME board?
  - Buy new (longer) cables? Use intermediate cables/adaptors?
- Check 6U VME crates on Belle II
  - How many empty slots in each of the 16 crates? How much power available?
- Where do we put the ethernet cables from VME boards to EHut?
  - How long? Special type (shielded)?
- Which computer will communicate with VME boards?
  - Where to put it? Can we run the code on one of the existing KLM computers?

# Timeline V0.0 (rough – to be revised)

- 06-07/22   Measure output signals for all bubblers on Belle II
- 06-10/22   Commission bubbler panel in lab and measure output signal
- 06-10/22   Develop board and built 1$^{st}$ prototype
- 07/22-03/23 Develop SBC software (first with standalone SBC, then with prototype board when available)
- 07/22-03/23 Develop monitoring and archival software and interface to SBC
- 10-11/22   Test 1$^{st}$ prototype & ship 1 board to KEK for testing
- 12/22-02/23 Built 2$^{nd}$ prototype (if necessary)
- 03-04/23   Test 2$^{nd}$ prototype (if necessary) & ship 1 board to KEK for testing
- 05-06/23   Produce boards and ship to KEK
- 07-08/23   Install boards on Belle II and commission with backend