# airpointer® PM module: Metone BAM 1020

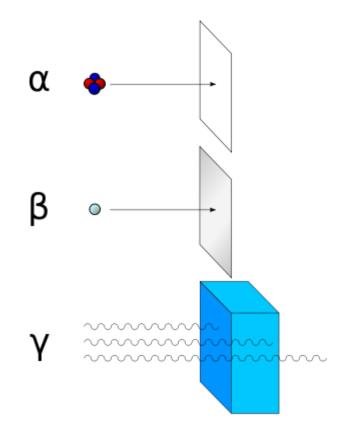


BAM 1020



# $\beta$ - decay (electron emission)

 Alpha radiation consists of helium nuclei and is readily stopped by a sheet of paper. Beta radiation, consisting of electrons or positrons, is halted by an aluminum plate. Gamma radiation is dampened by lead.







# $\beta$ -decay of Carbon-14

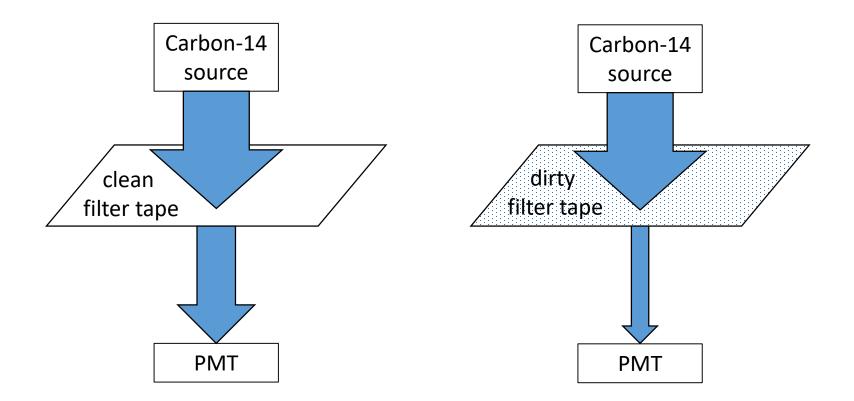
Carbon-14 is radioactive: it decays into Nitrogen-14, emitting a  $\beta$ - particle (an electron).

$$^{14}_{6}C \rightarrow ^{14}_{7}N + e^{-}$$

Half-life > 5000 years





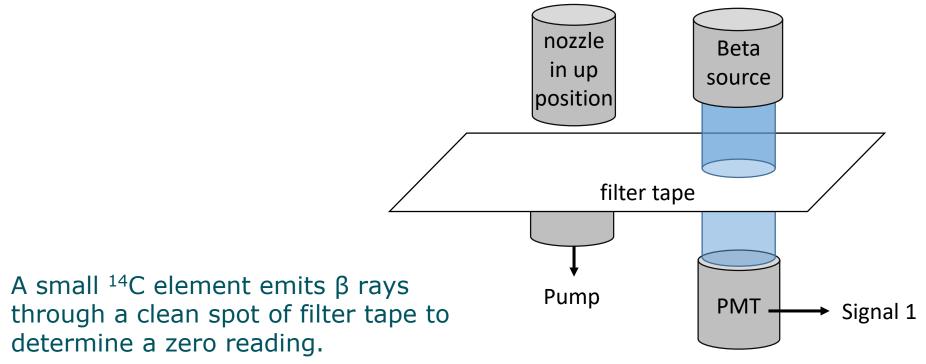


The particles adsorbed on the filter tape attenuate the signal detected by the PhotoMultiplier Tube (PMT)





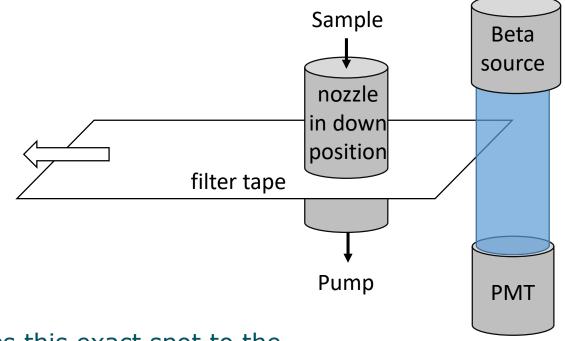
• From t = 0 minute to t = 8 minutes







• From t = 8 minutes to t = 50 minutes

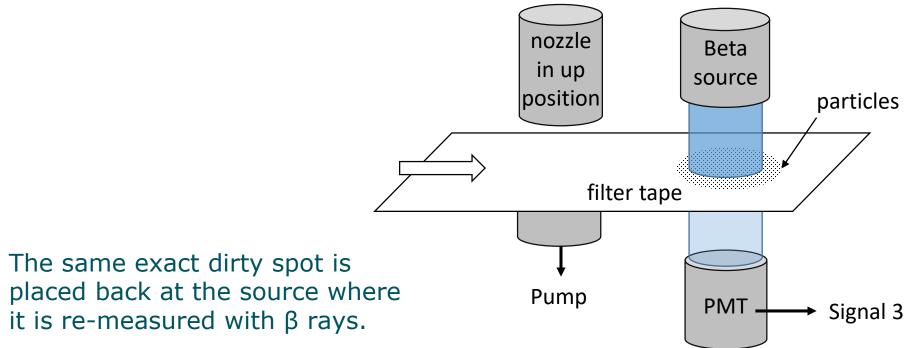


The BAM advances this exact spot to the sample nozzle where air containing particulate is sampled onto the filter tape.





• From t = 50 minute to t = 58 minutes

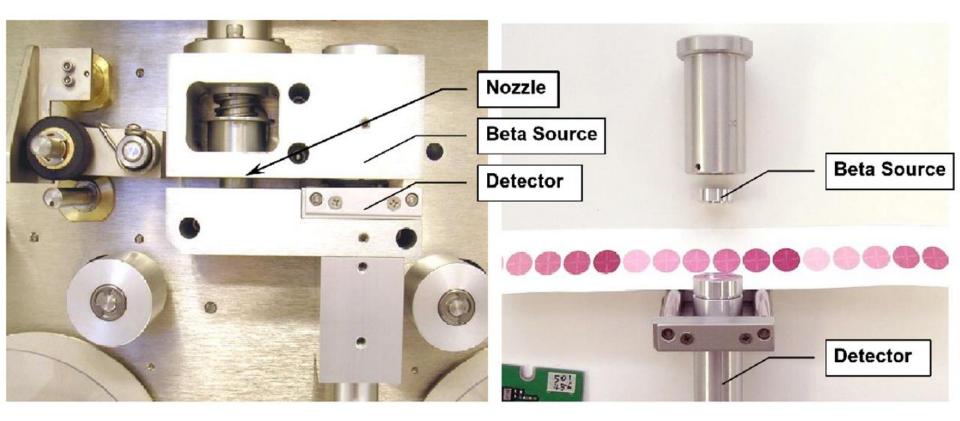


The dirty tape absorbs more beta rays than the clean spot did. The difference between the two measurements is related to the mass concentration by a variation of Beer's Law.



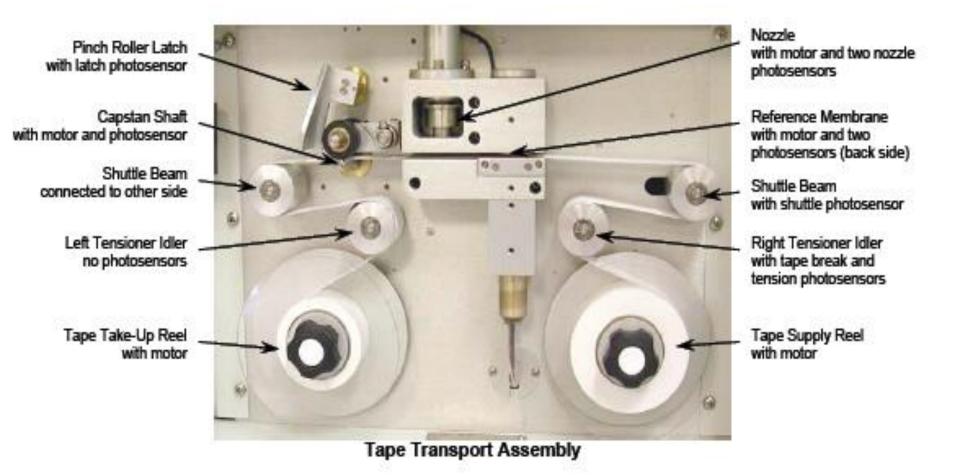


## Source and detector



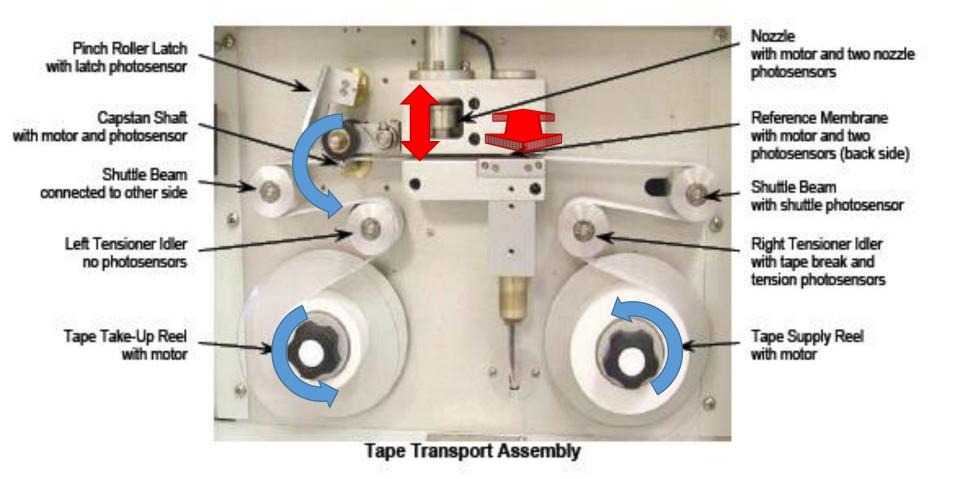






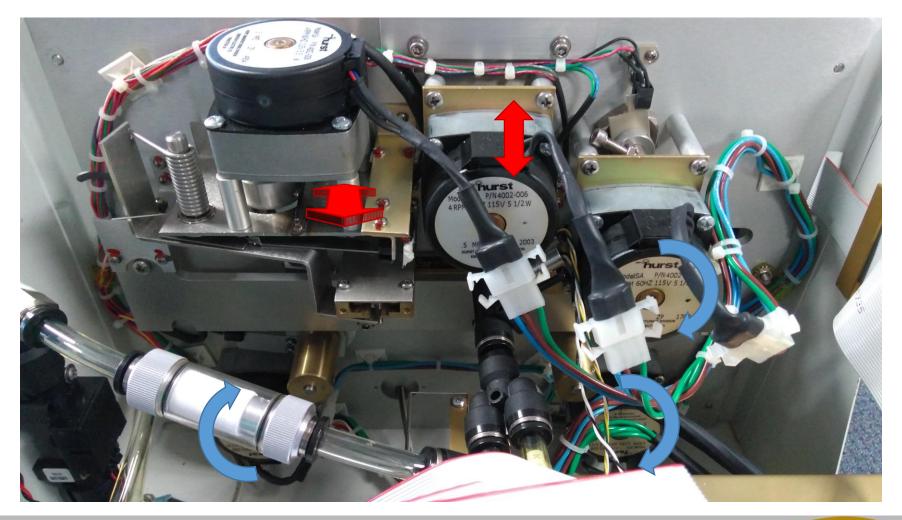






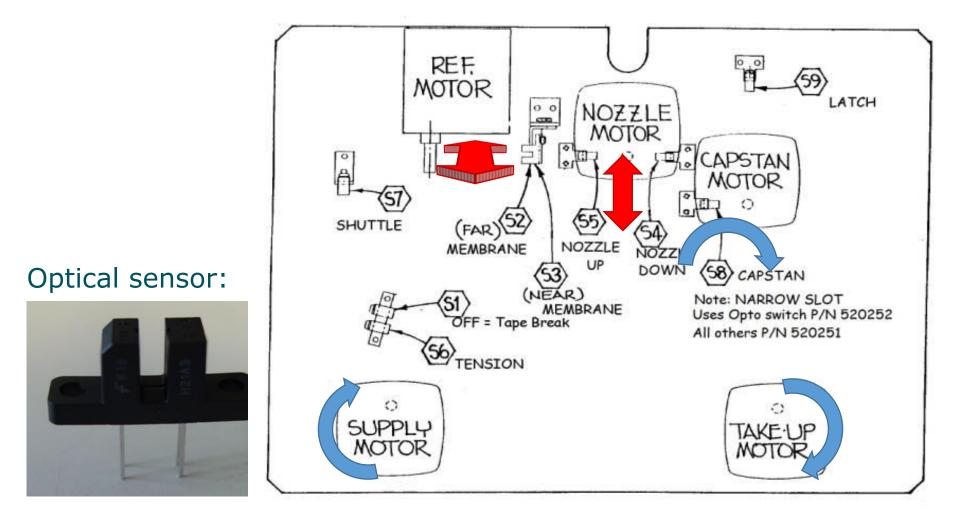








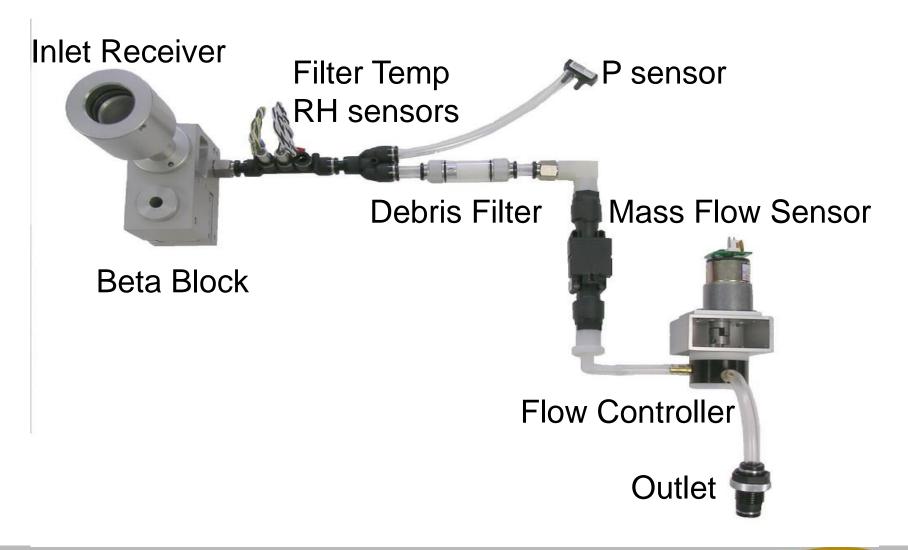








### Pneumatics







### Parameters

Parameter	Value	Unit
Conc	66.000	microg/m3
Qtot	0.834	m3
RH	11.0	%
Delta	20.600	°C
AT	-3.2	°C





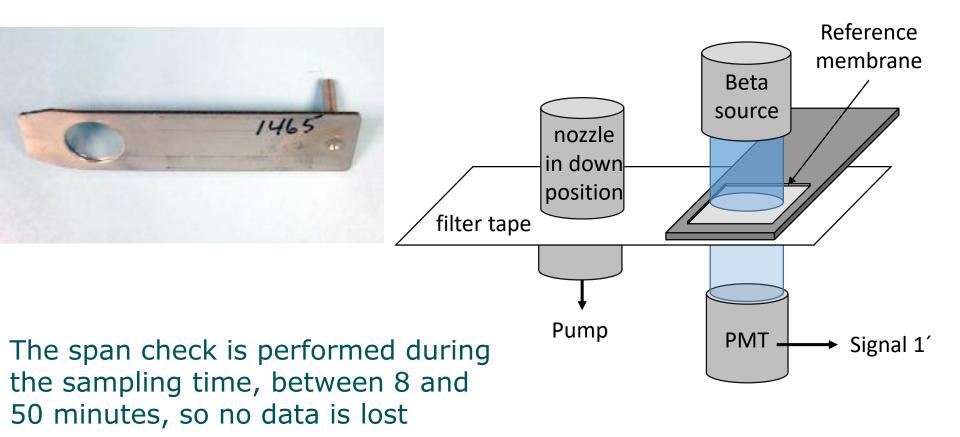
### Calibration

#### The $\beta$ -attenuation monitors can be calibrated by comparison with a "primary standard", i-e: a calibrated $\beta$ -attenuation monitor





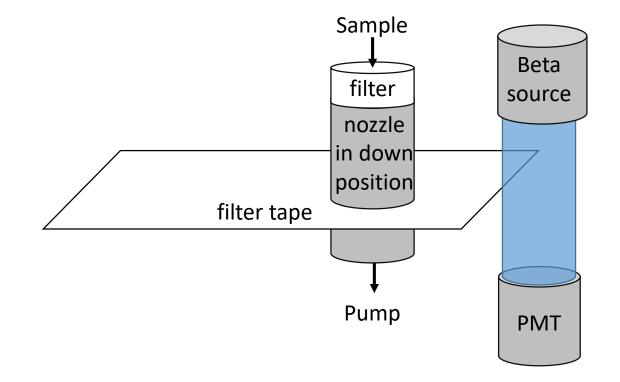
# Daily span check







### Zero check



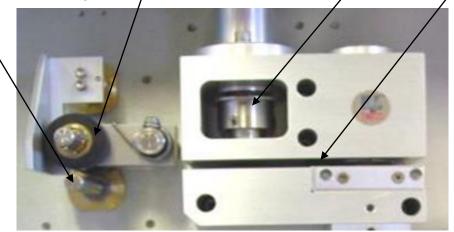




### Maintenance

Monthly: check the real-time clock, leak check, flow system check

Monthly cleaning: PM inlet trap, nozzle, vanes, capstan, and pinch roller tires



Maintenance schedule: manual rev.N page 53





## Maintenance

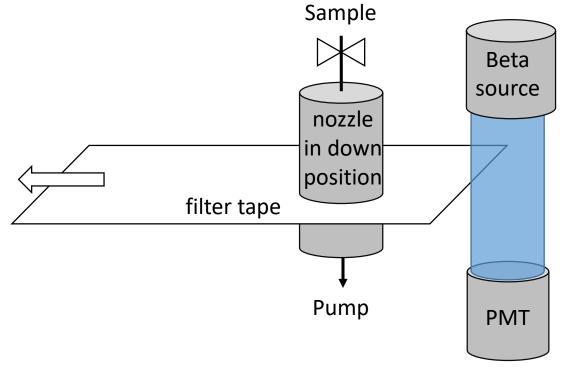
- Every 2 months: replace filter tape roll, run self-test function
- Every 3 months: check settings, calibrate flows, clean PM inlets
- Every 6 months: Replace pump muffler, test smart heater and RH and T sensors
- Every year: replace debris filter and battery, check reference membrane,  $\beta$ -count and dark count, clean the inlet tube
- Every 2 years: Rebuild vacuum pump, replace nozzle o-ring

Maintenance schedule: manual rev.N page 53





### Leak check

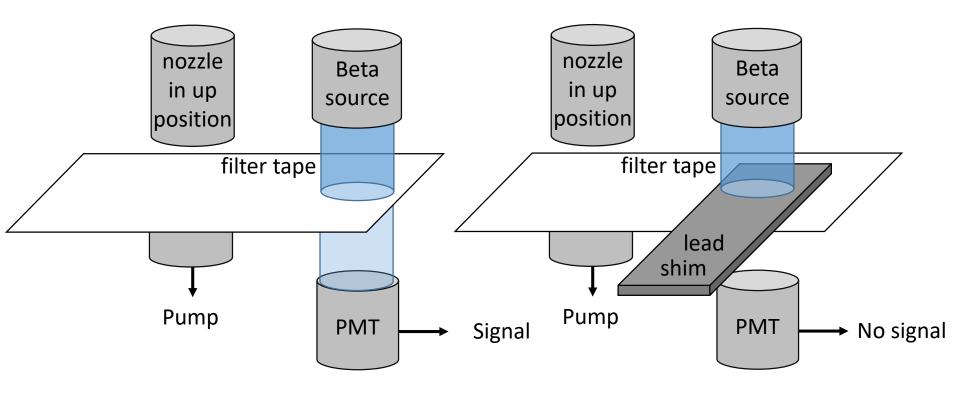


#### $\rightarrow$ Flow should be ~0L/min





## $\beta\text{-}count$ and Dark count







# Troubleshooting

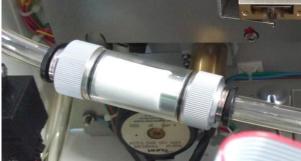
- The analyzer doesn't start → It starts at the full hour (e-g: 14:00).
  Check that the clock is accurate and wait!
- No data from the BAM  $\rightarrow$  The BAM should be in the "main" menu, otherwise RS232 is inactive
- No flow  $\rightarrow$  Pump check, Leak check, Flow audit
- Flow < 16L/min  $\rightarrow$  Check that the pump muffler isn't clogged





## Pneumatics

- Debris filter turns yellow  $\rightarrow$  too high humidity
- Debris filter turns black  $\rightarrow$  punctured tape





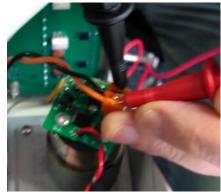


# Voltages

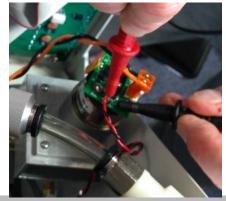
#### - On the board, from the flow sensor:

Flow (L/min)	Corresponding voltage (V)
0	1
15	3,6
16	4
18	4,2
Max (~20)	5,25

 On the flow controller power supply: -15V DC



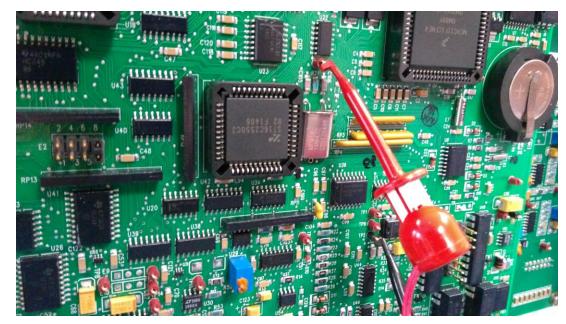
On the Flow controller control:
 ≠0V when the flow is stabilizing,
 =0V when the flow is stable







# Stack board assembly



- Check that TP13- TP2 (GND) =  $5,25 \pm 0,05 \text{ V}$ If necessary, adjust with the blue potentiometer on the power board

- No display  $\rightarrow$  Use a full spare board to test the BAM

Clock freezes, no flow control → Check the battery
 ■airpointer



# Thank you for your attention!



