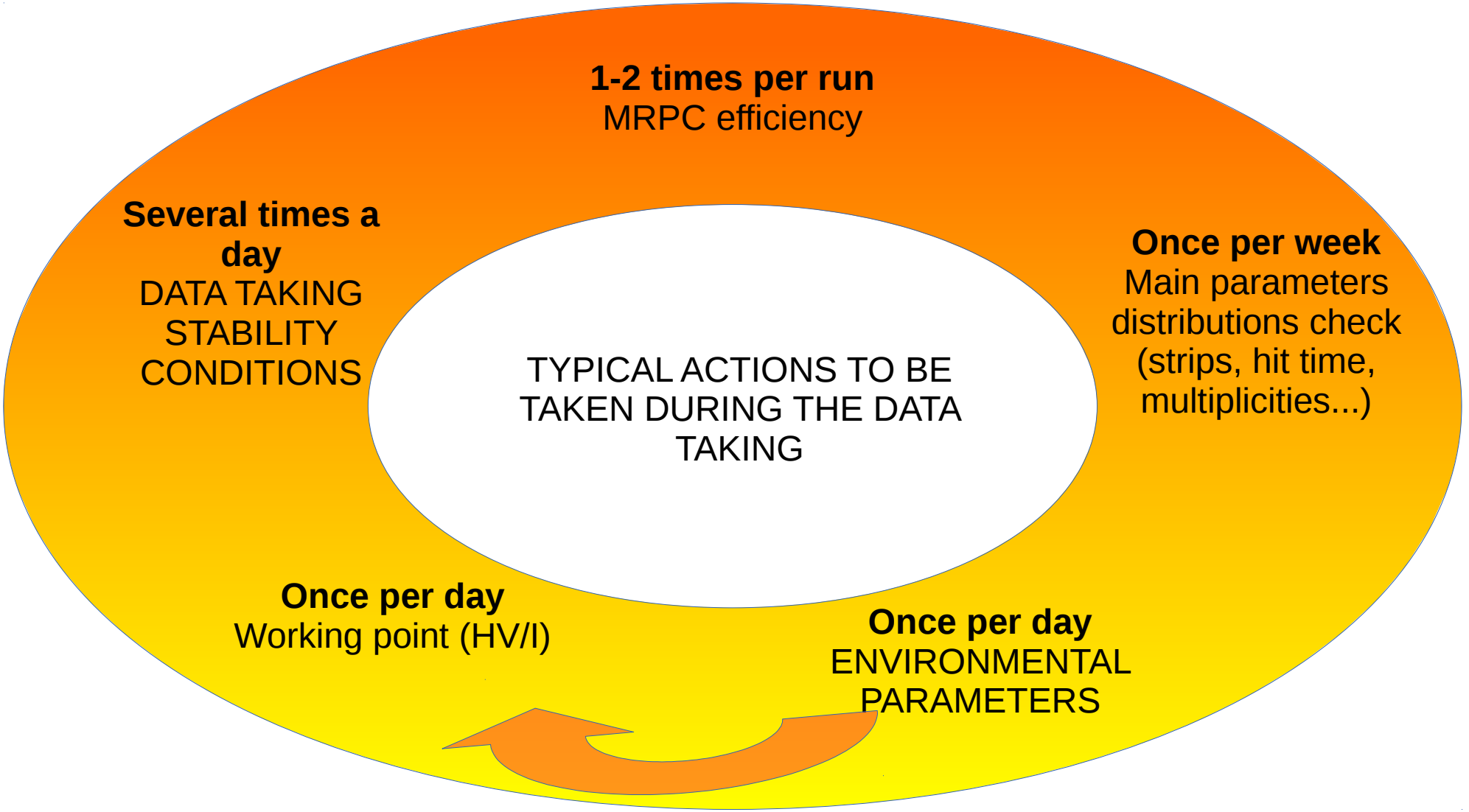
E.E.E.

GAS SYSTEM

Data Taking & ShiftList

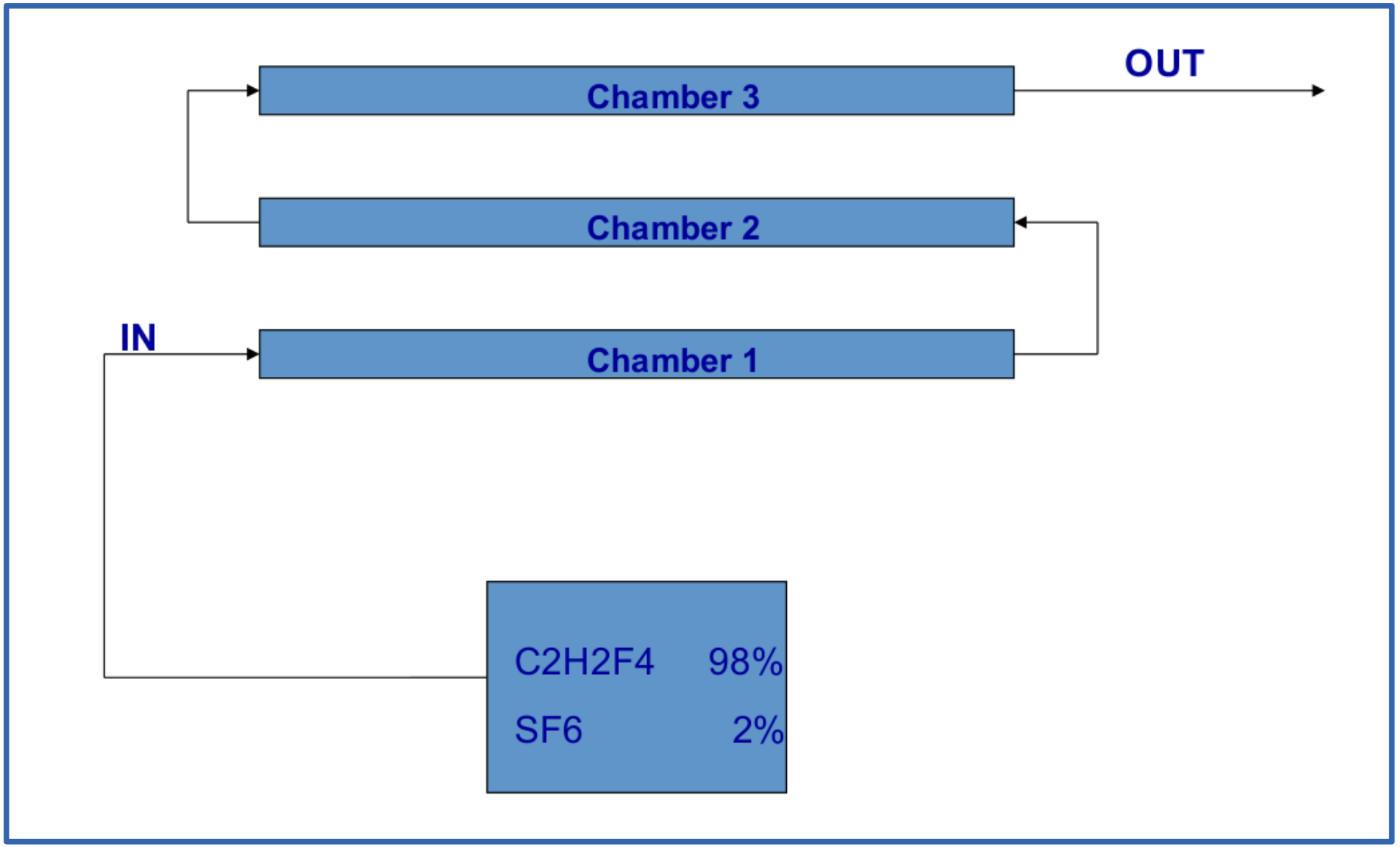
Actions to be taken during the data taking are defined in the so-called

SHIFTLIST



Data Taking & ShiftList

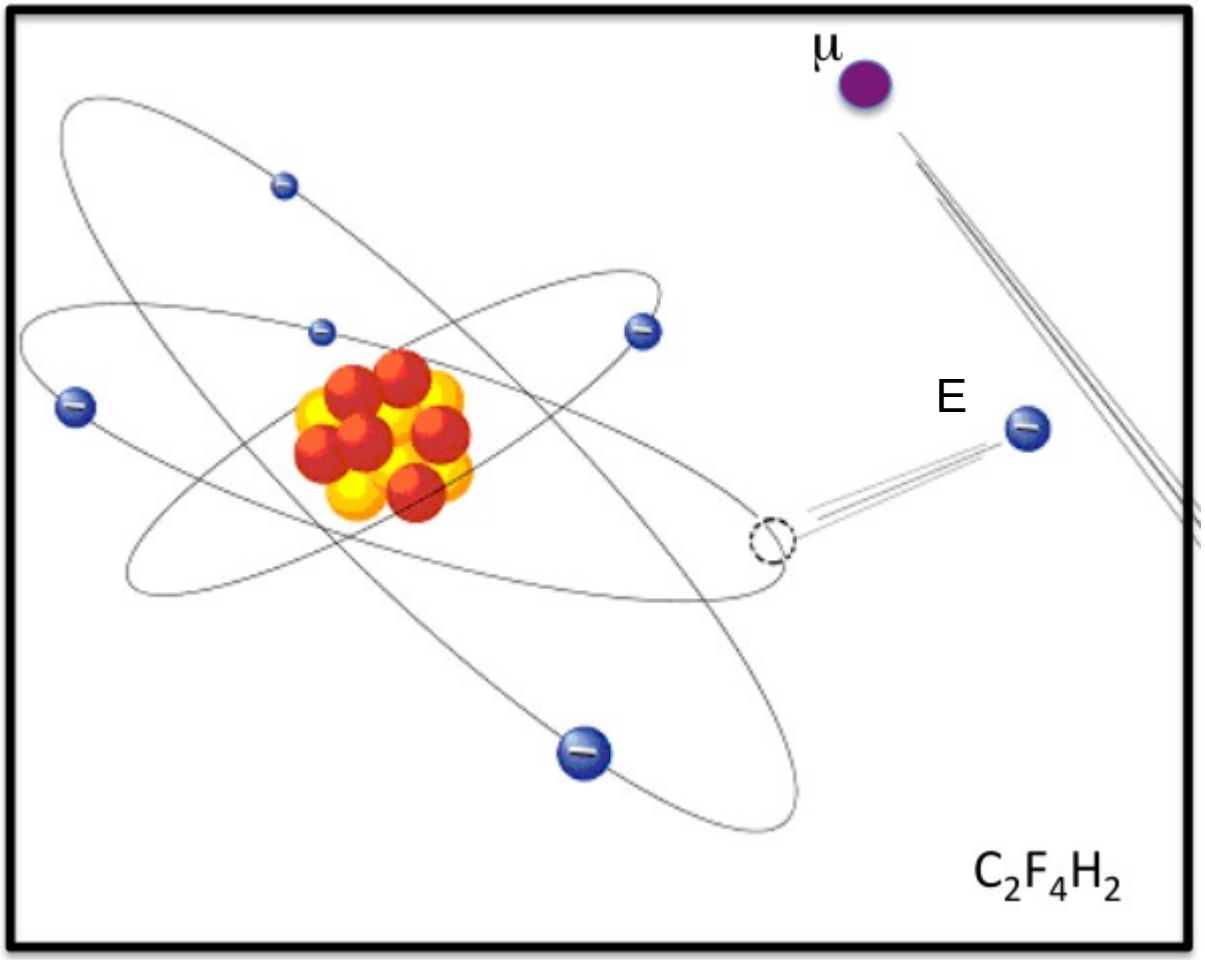
GAS SYSTEM

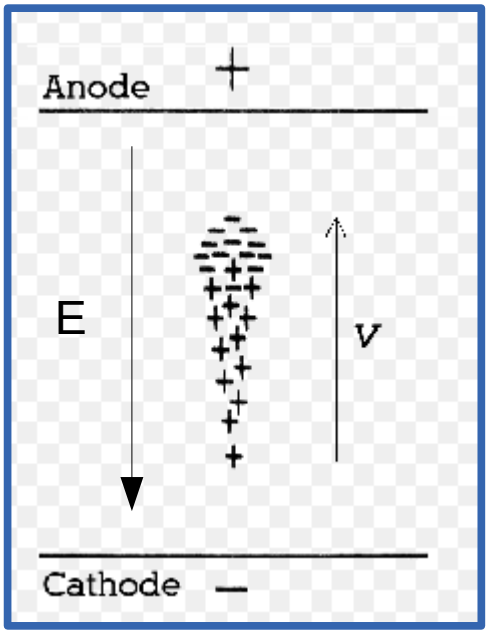


Data Taking & ShiftList

GAS SYSTEM

WHY SHOULD WE USE A GAS?





The electric field E accelerate electrons (and ions), increasing their kinetic energy

$$qE \times d = q\,V$$

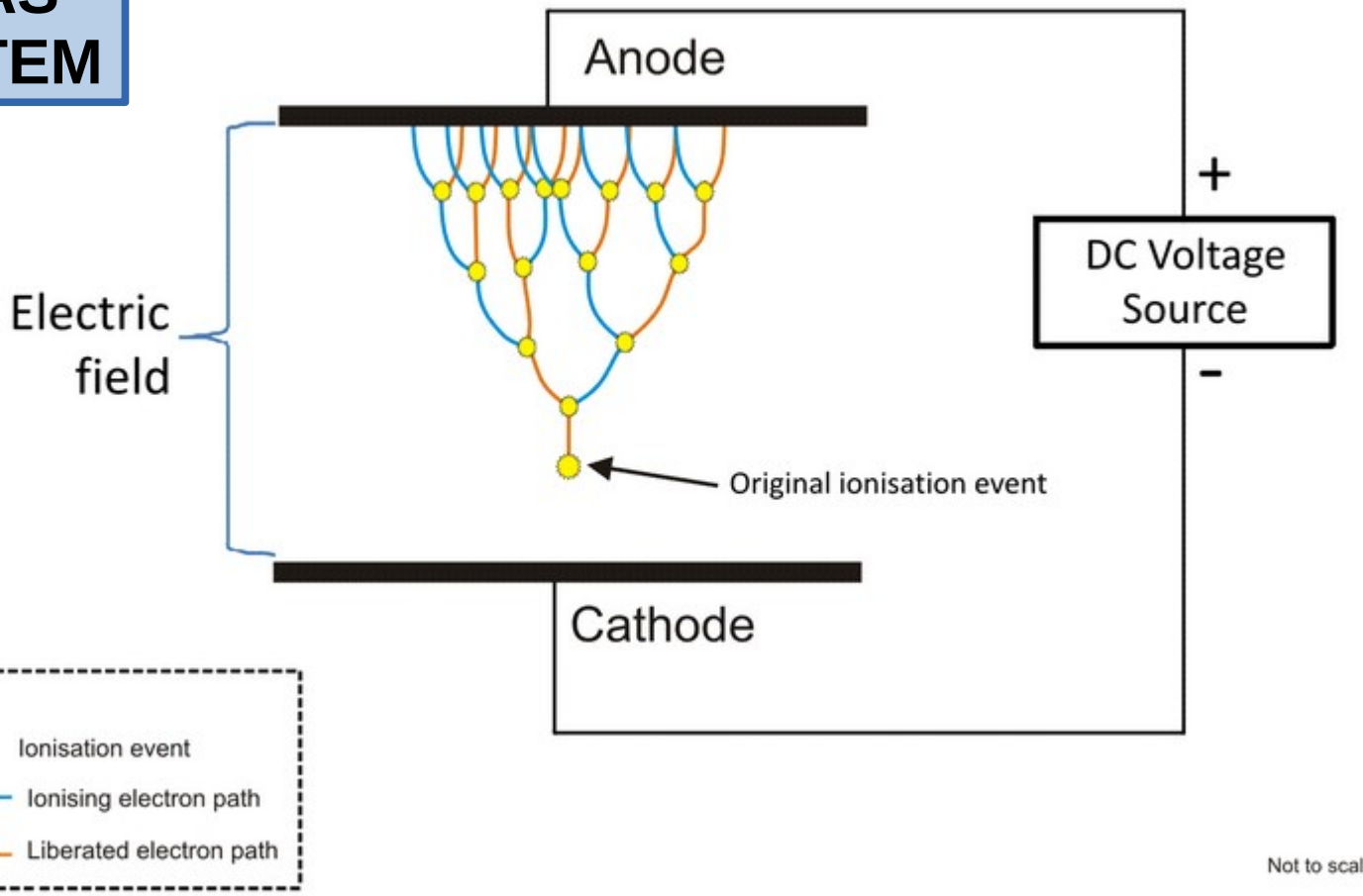
Which is the energy aquired by electron under 1 kV?

Data Taking & ShiftList

2 GAS SYSTEM

Ionized gas + HV =

Amplifier!



If each electron scattering k secondary electrons are ionized, we have

$$N=K^n$$

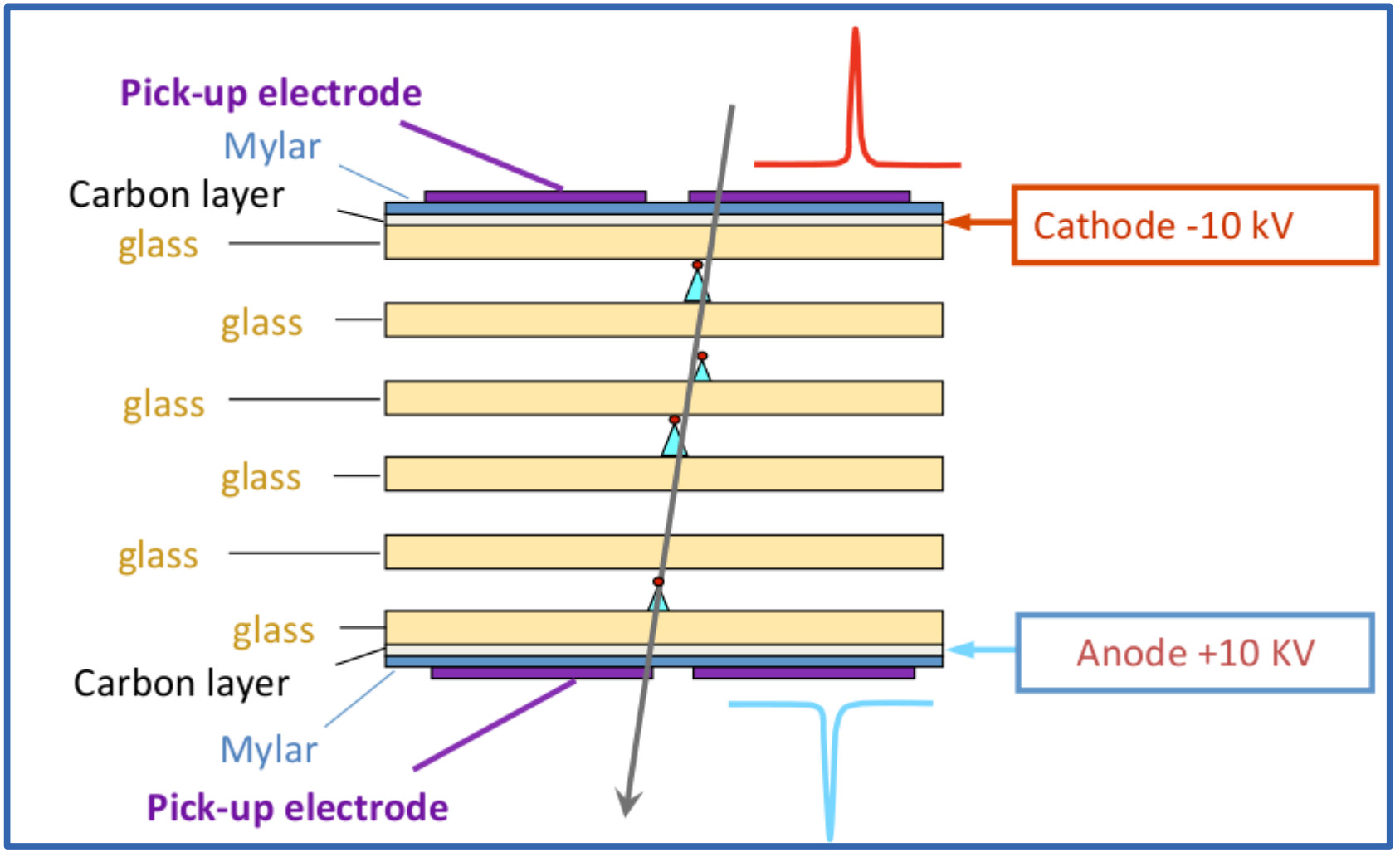
Electrons after n scatterings

How many scatterings we need if k=2 to get amplification = 10^5 ?

Which is the total charge per avalanche?

Data Taking & ShiftList

2 GAS SYSTEM



SF6 is acting as an **avalanche moderator**, thus shutting the avalanche developing throught the gas. This increases the time resolution, decreasing the time and size of the avalanche.

Data Taking & ShiftList

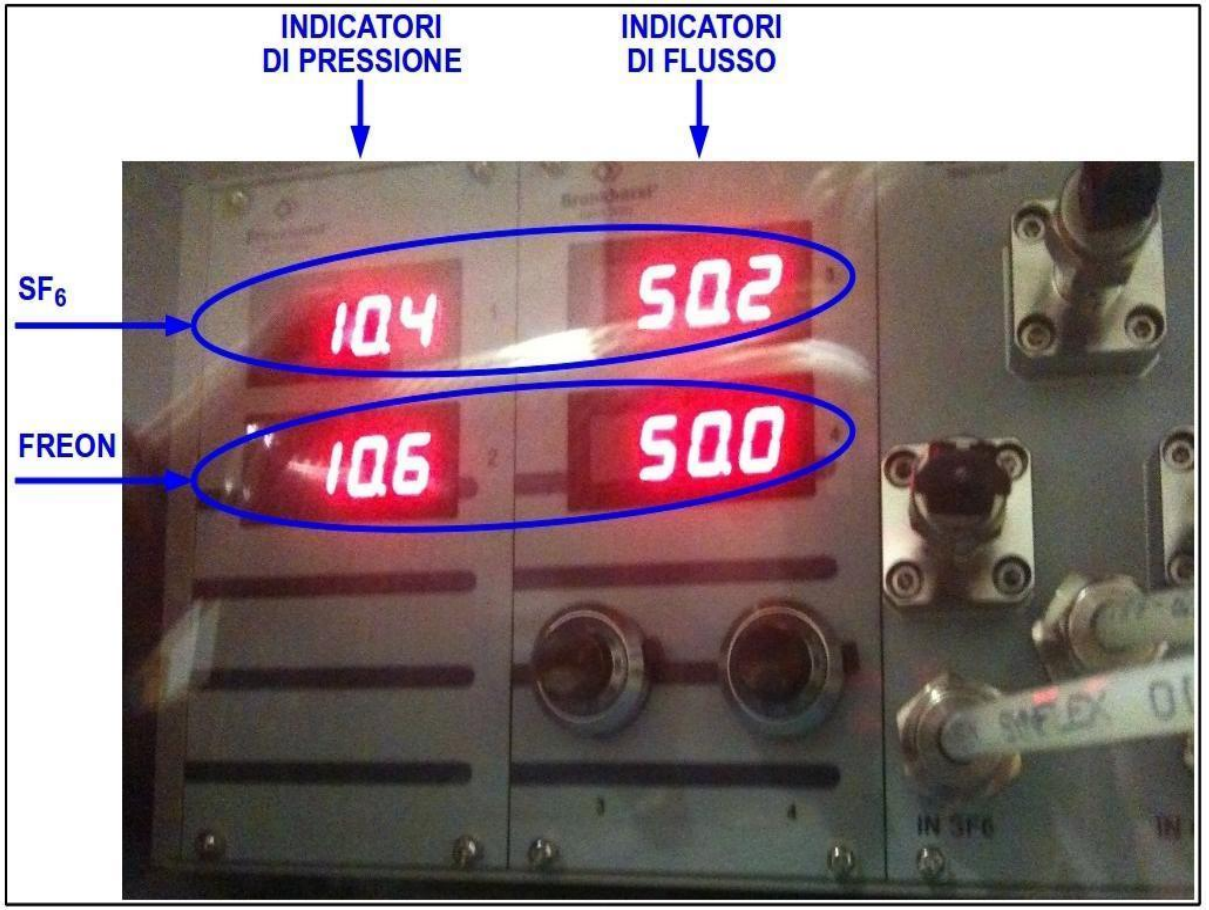
GAS SYSTEM

- Gas System parameters to be chacked

The gas mixer provides when at 100%

- **6 l/h** of freon R134a
- **0.12 l/h** of l'SF6

The mix provides
- the avalanche to be started
- and the **quenching** of the avalanche for better time and spatial resolution



The example shows:
- Input pressure at the mixer in PSI (14.7 PSI = 1 atm)
- Gas mixture flux in percentage with respect to the maxima at 100%

Freon 134a : 50.0% · 6.00 l/h = 3.0 l/h --> 98.03%

SF6 : 50.2% · 0.12 l/h = 0.06024 l/h --> 1.97%

Reasonable fluxes are

25-30%

Data Taking & ShiftList

- Bottle pressure check.

GAS SYSTEM

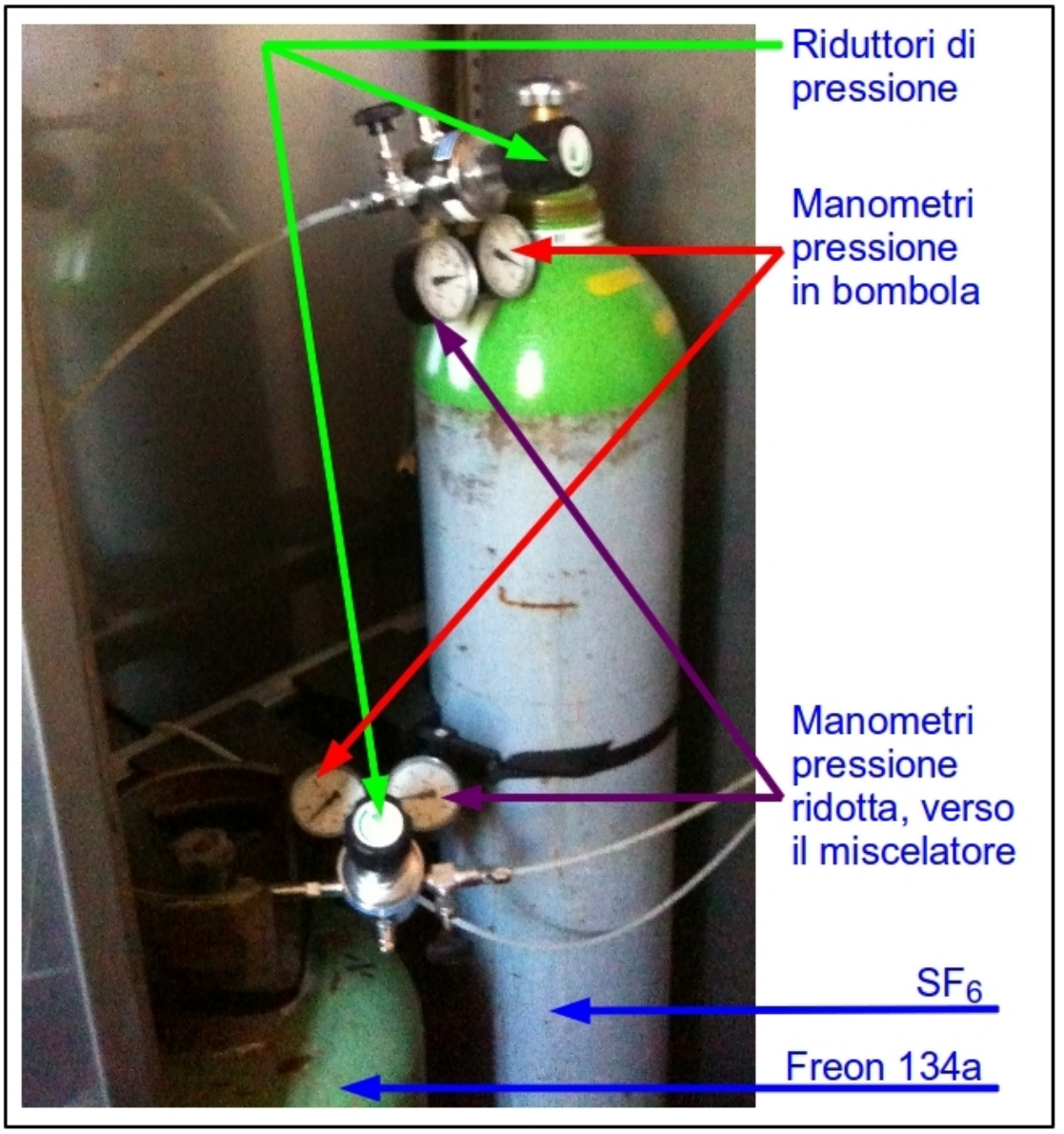
Bottle are equipped by a **pressure reducer.**
Slowly turning the valves the input pressure to the mixer can be adjusted.

The bottles is exhausted when

- SF6: Internal pressure falls (it takes several years)
- FREON: **net weight of the bottle** allows to forecast the available working days (a bottle lasts around 3-4 months at 30%)

Try to **develop a formula (e.g. in excel sheet) which gives you the forecast**

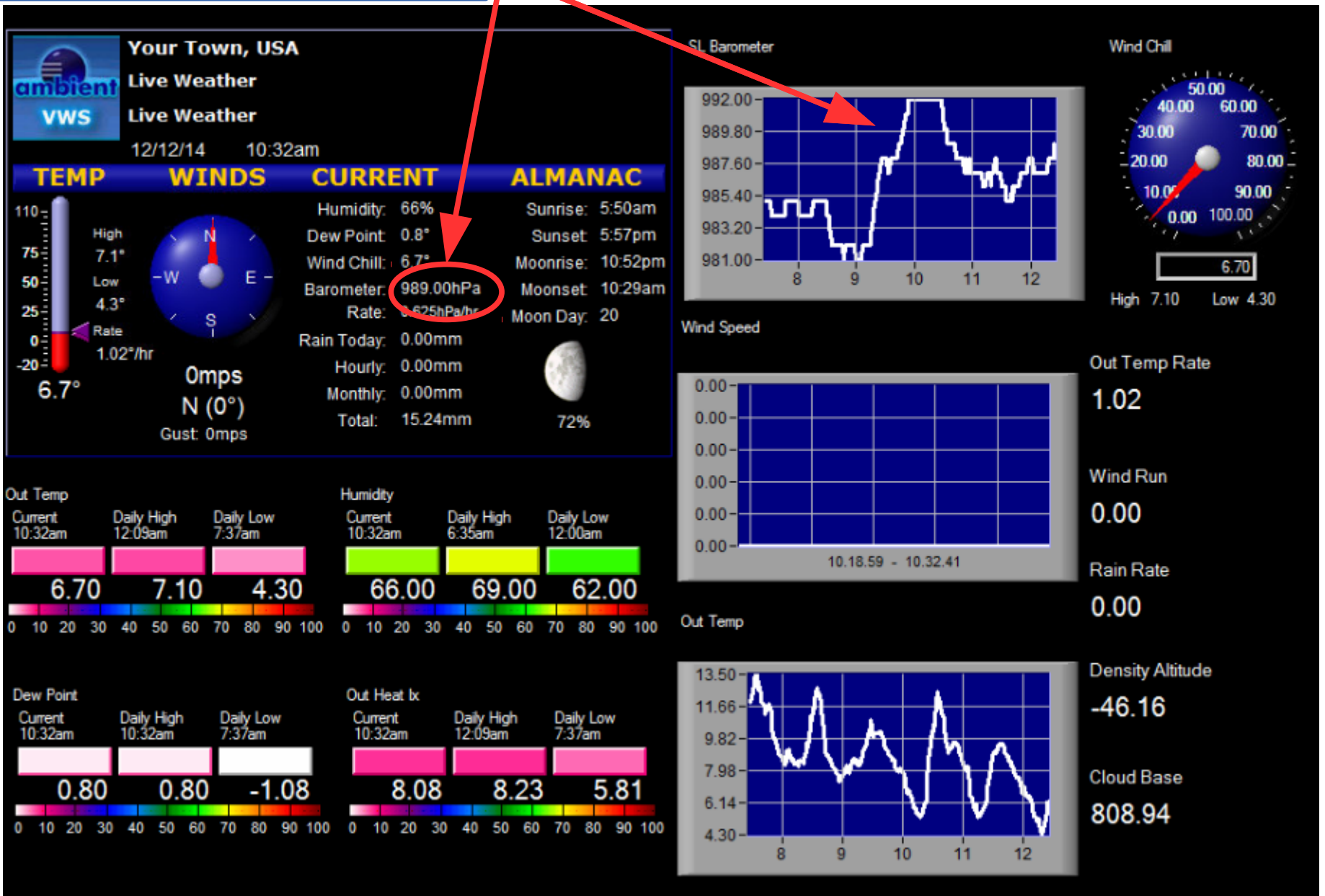
Hints: use a scale, estimate net weight of gas, daily estimate the gas amount used per day….



Data Taking & ShiftList

PRESSURE

The atmospheric pressure can be a problem for MRPCs, beeing too high or in case of mixer mulfunction can let the air get into the chambers (very rare cases anyhow)



Data Taking & ShiftList

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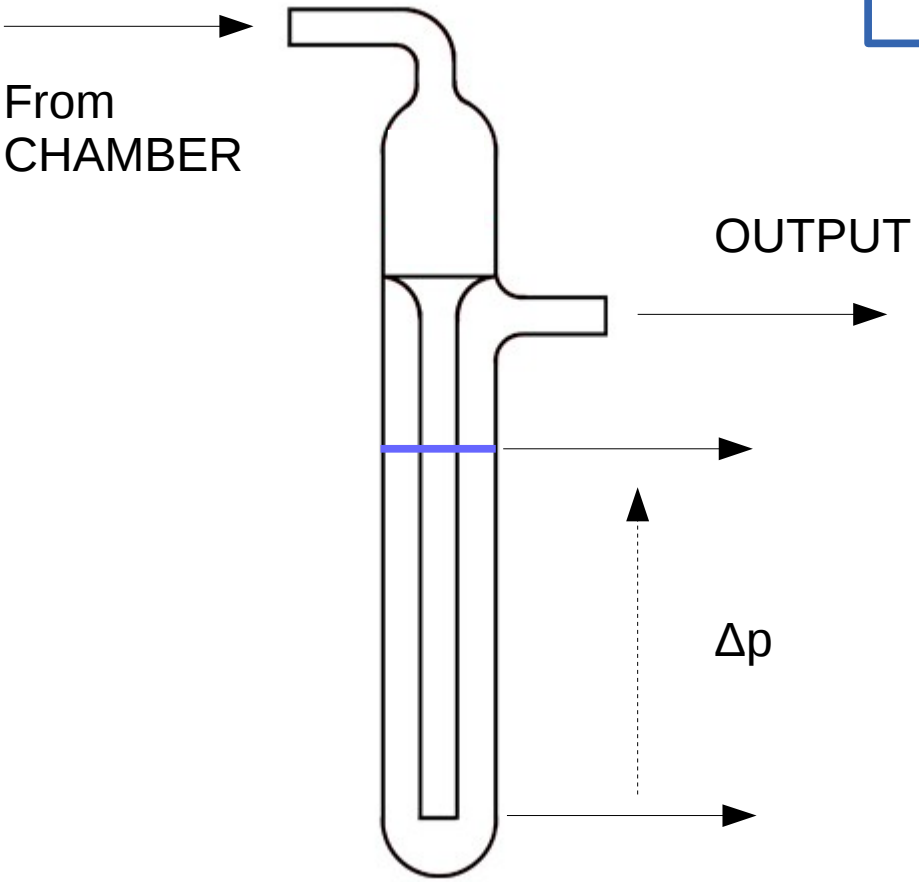


A bubbler can be useful for two reasons:

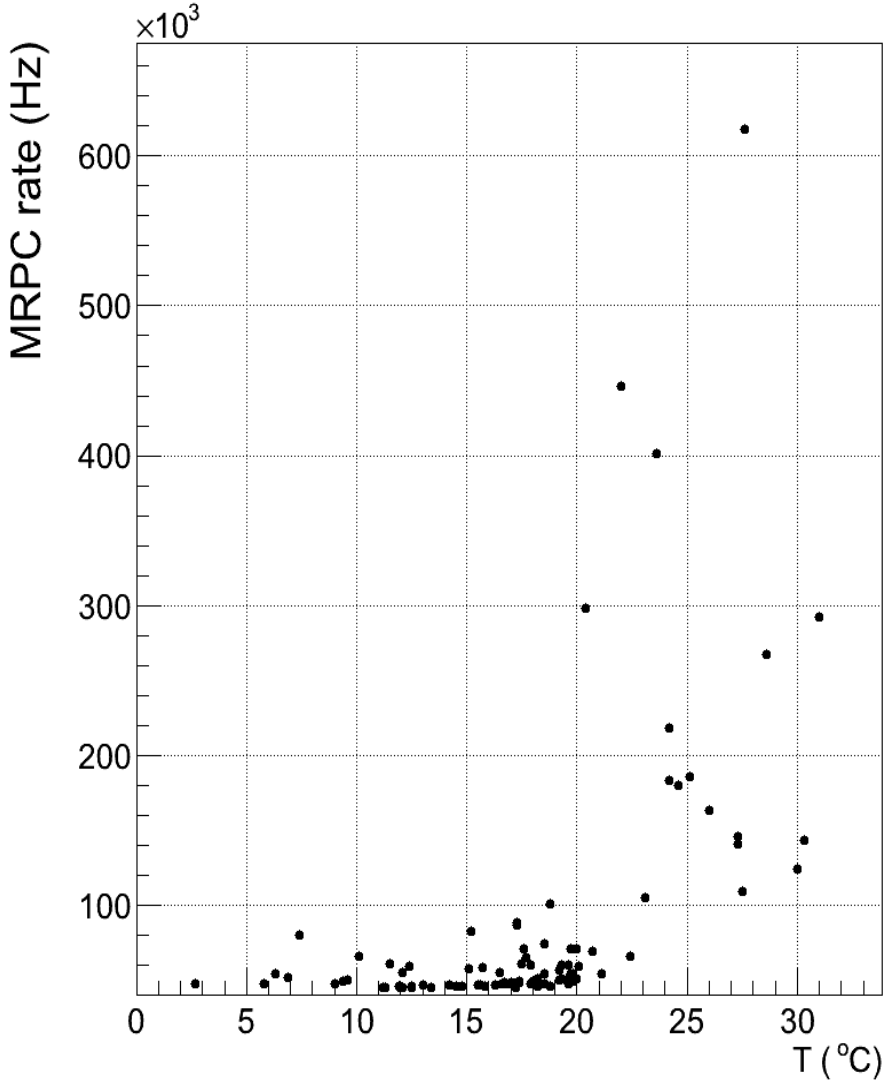
1. allows to check the gas flow

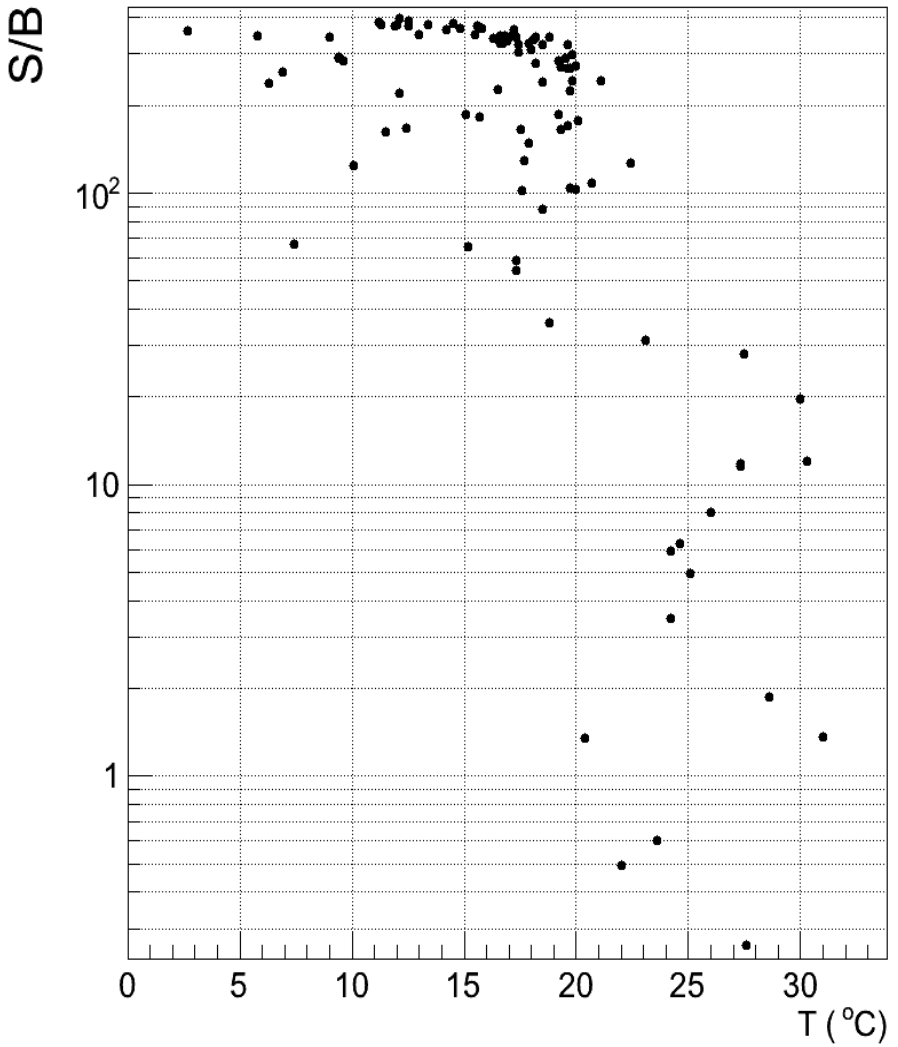
2. provide a safety pressure gradient among the chamber and the external environment (0.9 mbar/cm in case of paraffin oil)

Data Taking & ShiftList

TEMPERATURE

Temperature can be also a problem for avalanches development

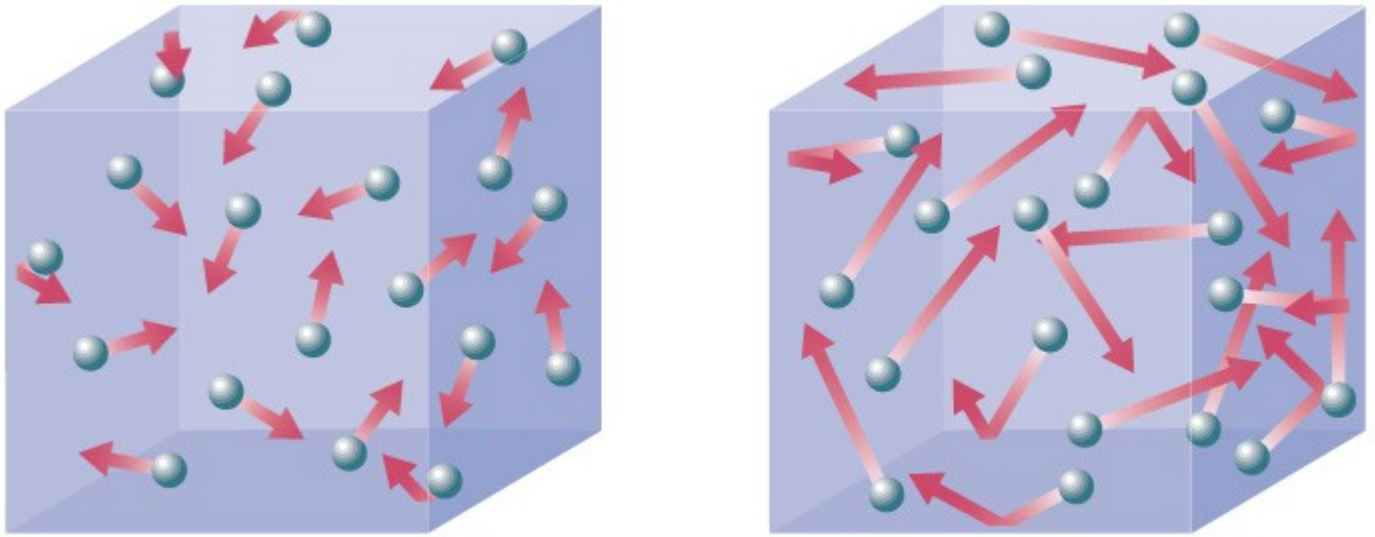




Data Taking & ShiftList

TEMPERATURE

Temperature is a measurement of the kinetic energy of the gas molecules. Thus high themperature means electrons are easier to be ionized



Longer arrows mean higher average speed.

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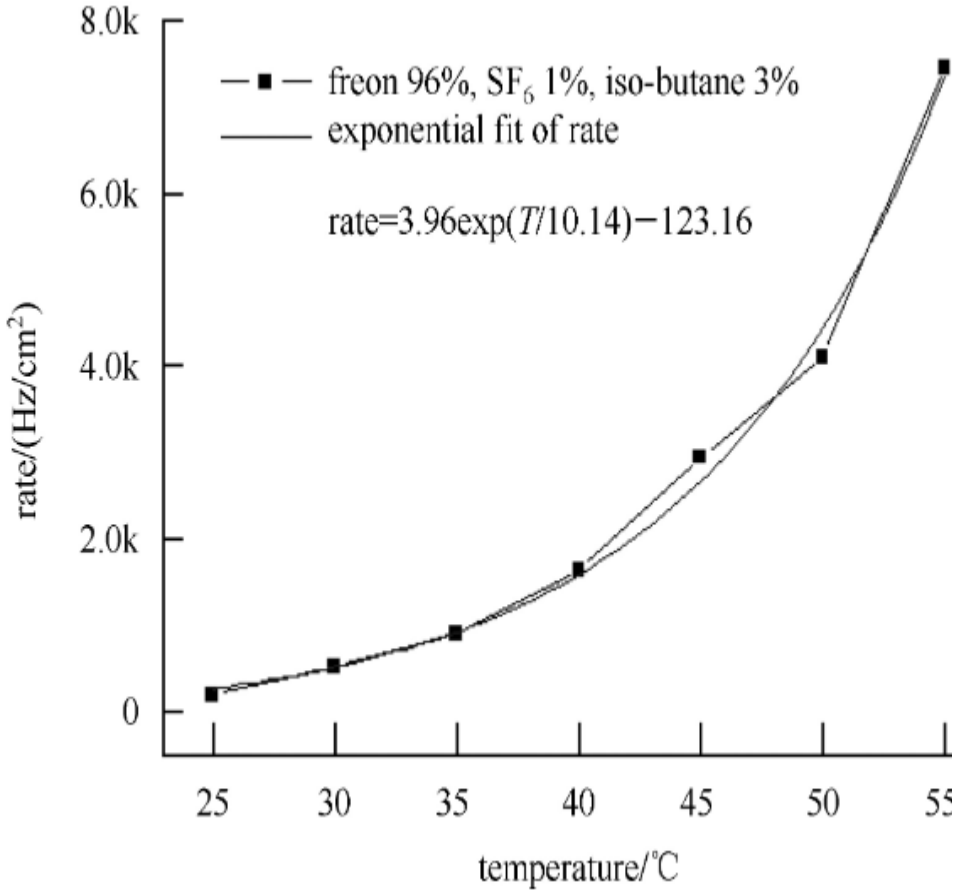
$\frac{3}{2}$ kT= $\frac{1}{2}$mV^2

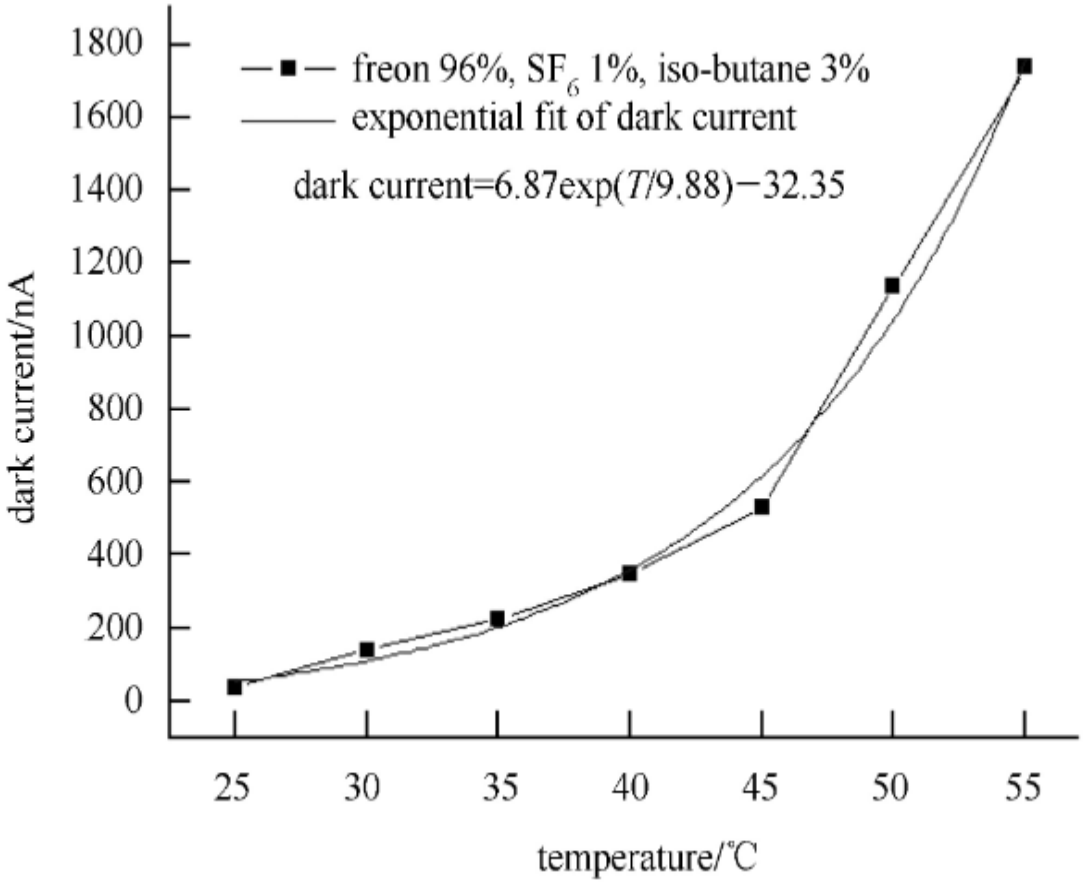
Thus let's try to guess the average speed of Hydrogen atom at:
300 K (env.), 15 MK (sun core), 10^{17} K (LHC)
- the 3rd will give you an incredible result (wrong…) Why?

Data Taking & ShiftList

TEMPERATURE

Thus the temperature of the MRPCs is fundamental to keep the noise within acceptable limits

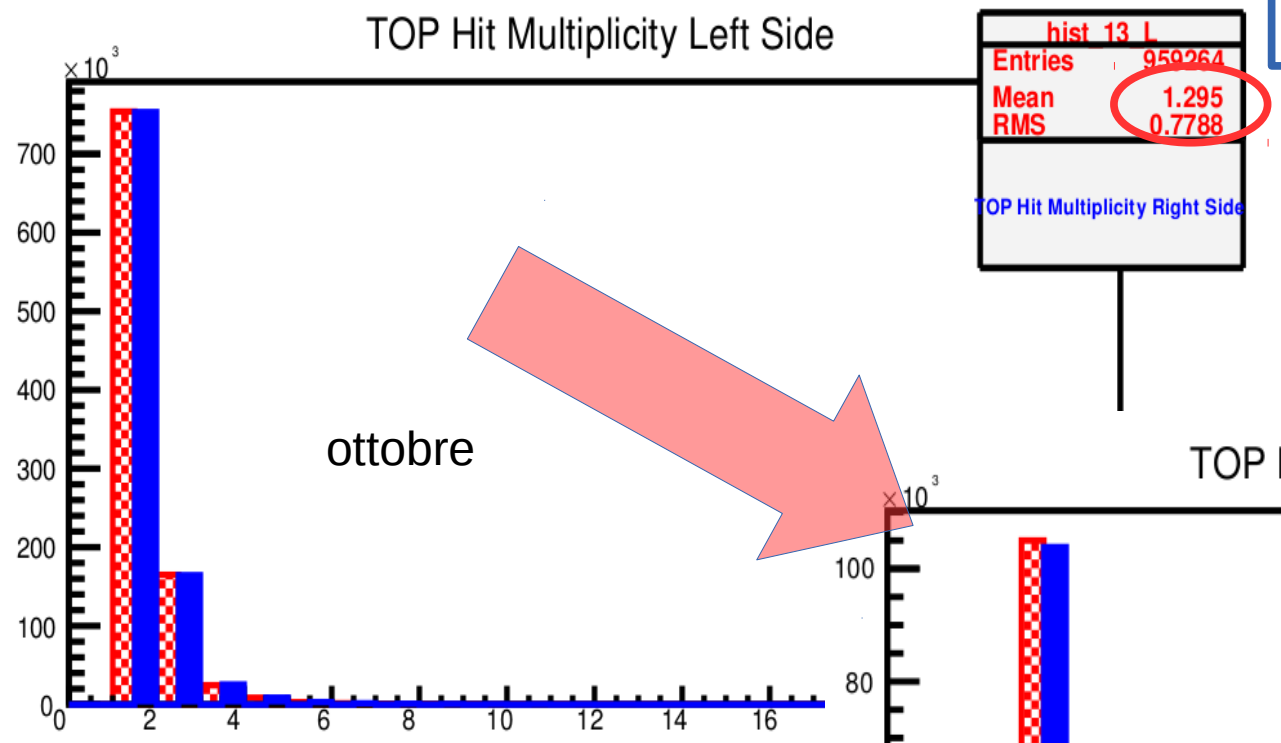


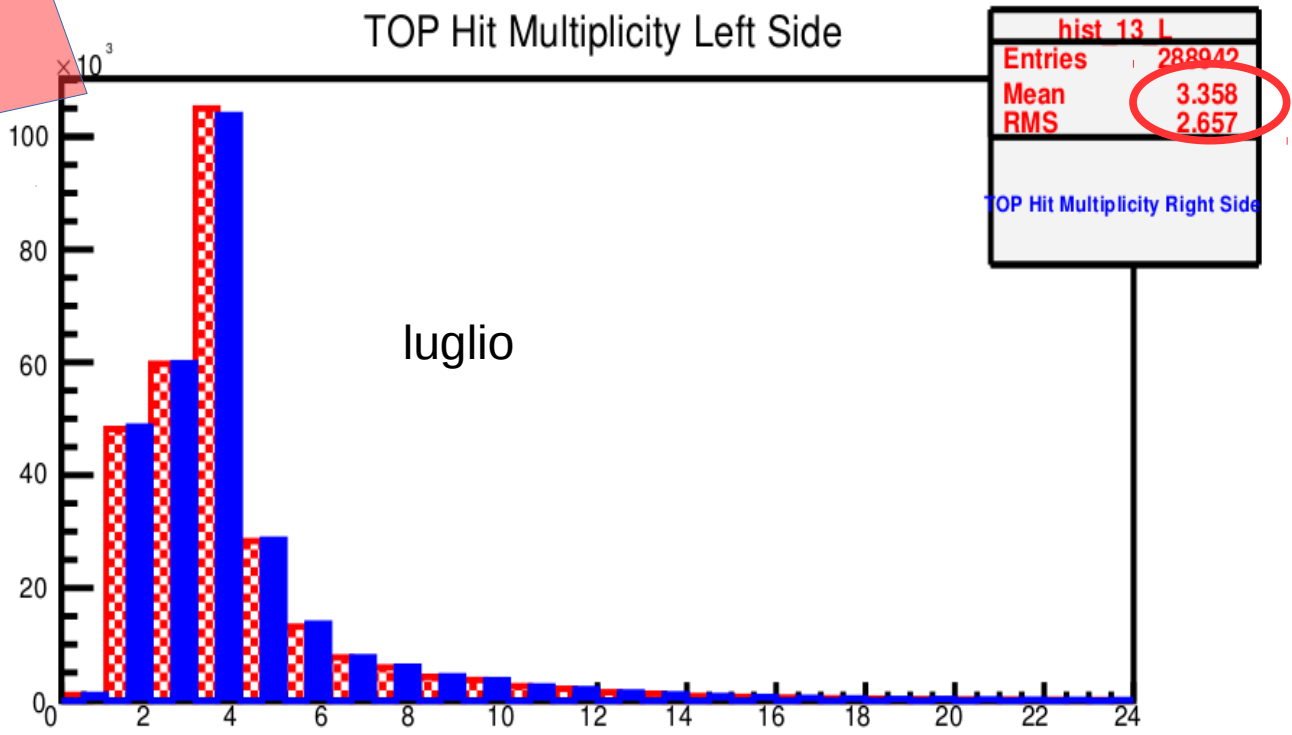


Data Taking & ShiftList

STRIPS & MULTIPLICITIES

At high temperatures the multiplicity increases (number of avalanches per event)

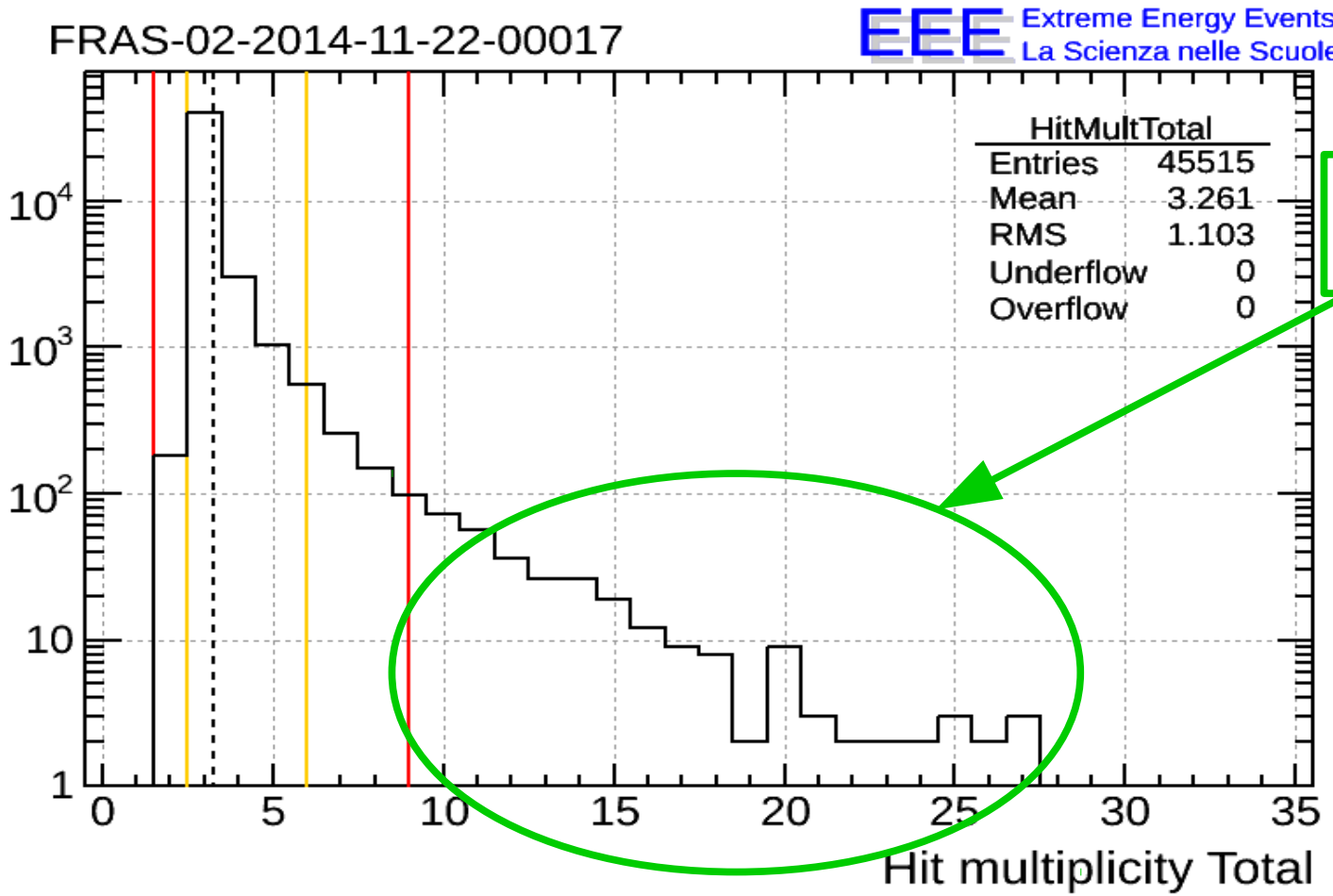




DQM

RUN DQM

You can check them on run DQM

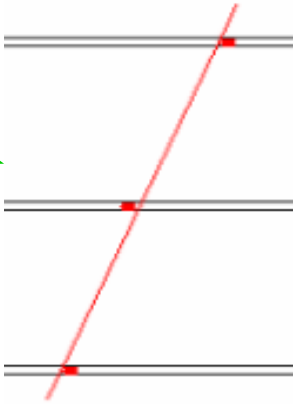


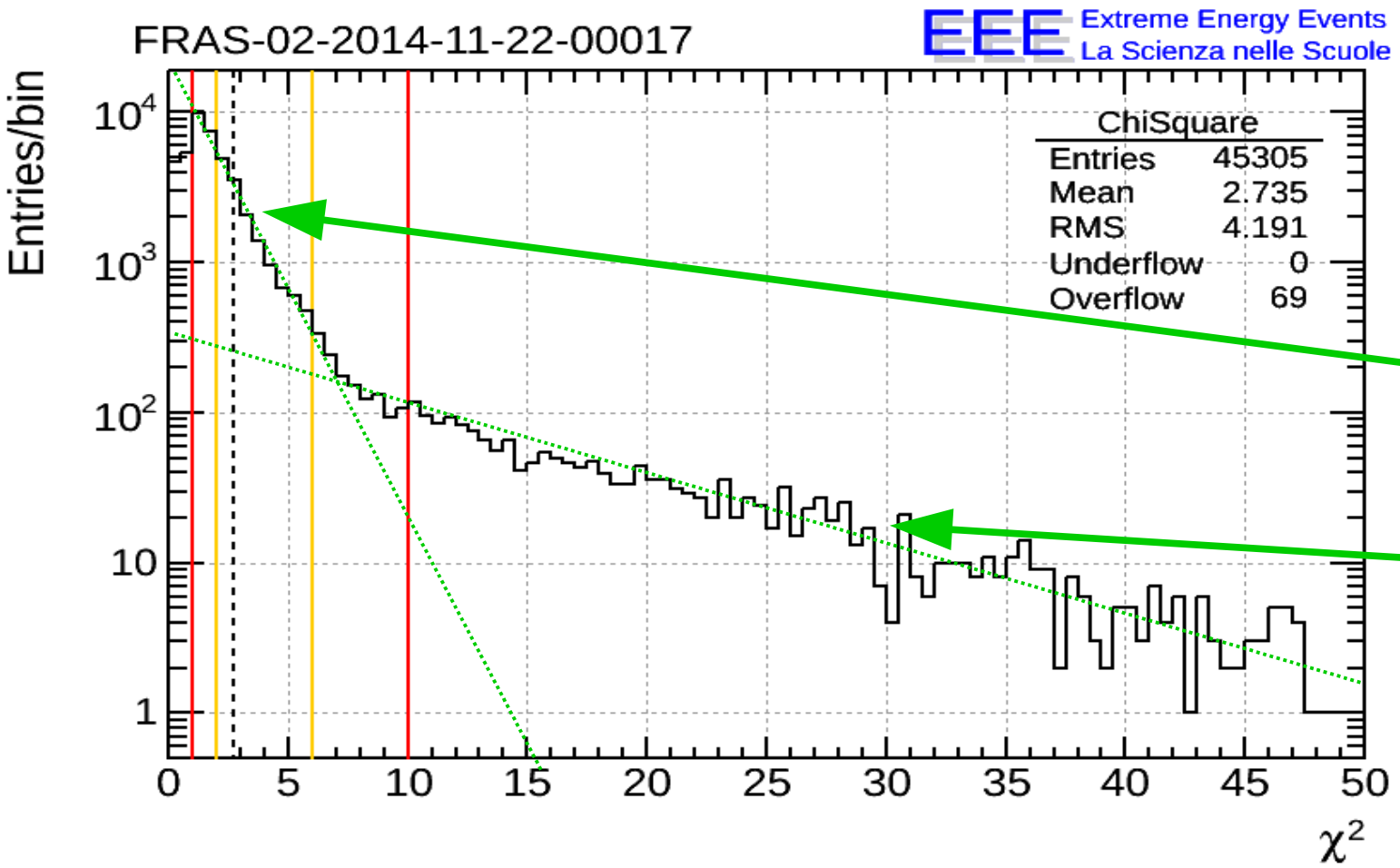
DQM

http://eee.centrofermi.it/dqm/

RUN DQM

Also **χ2 distribution of tracks** can be effected





Good tracks

Non tracks: clusters bad aligned due to casual coincidences

THUS……

TAKE CARE OF GAS SYSTEM

AND

HAVE A GOOD HUNTING FOR NUMBERS!