

R&D IN THE FRONTIER

DISCUSSION SESSION

PRODUCE EL FROM NOBLE GASES

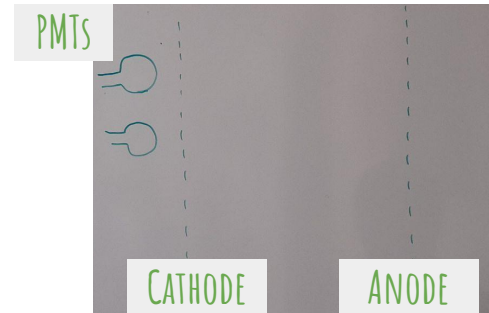
PROBLEMS

- Increased luminous activity in wire-amplification in the liquid
- Gradual HV increase leads to steep current increase
- Fast DCR increase too (needs to be quantified)
- **These are not electrons, are single pe.**
- Where do they come from? **No idea. Seems to be the anode (much smaller radius)**
- Proximity to breakdown voltage? Corona-type behaviour from an anode? *[Grenoble experts]*
- Could pe's come from ion production and recombination?
- They will be there **forever** if you do not reduce the voltage
- If you reduce a bit the HV it goes away immediately
- Some pmts have more than others. 8 pmts difficult to localise
- Cathode voltage is not changed and is similar to the pmts (so effect not related to buffer region)

SPURIOUS LIGHT EMISSION



- PMT
- 'TURNS ON' AFTER SOME VOLTAGE (EL IN LIQUID)



PRODUCE EL FROM NOBLE GASES

SUGERENCES

- Experimental indications that background activity and signal activity have different wavelengths.
Play with filters?. Is this a practical solution? (probably not)
- Corona might be easy to localise → window + camera?
- Change wire thickness? → play with this... coating defines field emission. Gold good or metals with high working function.
- Count the singles and compare with the bigger charge to discard that both process are connected.
Interesting to see how both relate.
- Try to do a similar analysis (single pe analysis) in micro-strip readouts (also reported at the conference)

[MAILING LIST TO CONTINUE THE DISCUSSION!! \(PLEASE JOIN IF INTERESTED\)](#)

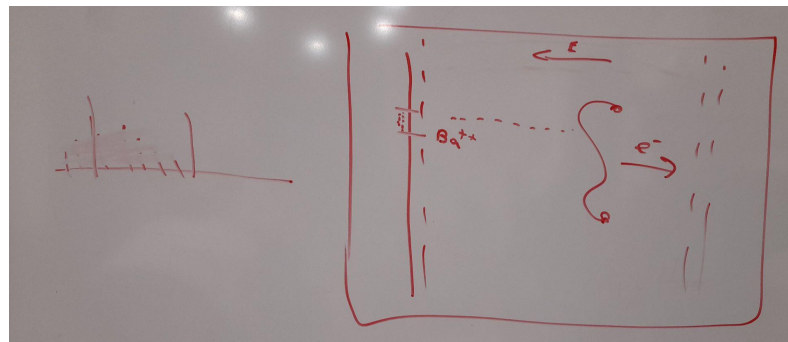
DUAL PHASE

What are the issues?

- There are more solutions than going to pure liquid but you have problems to solve too.
- R&D on this front is interesting. **See coming years:**
- electron/ion trapping at the liquid-gas interface is a problem? Depends on rate. For DM it should not be an issue, but Coherent scattering (at surface) may need to deal with it.
- Sagging of meshes?. Scalability?.
- Separation of extraction and amplification is conceivable, MPGDs at the interface?
- Turbulence in the surface and how it affects to the energy resolution → big detectors does not seem to be a big deal (sagging might be more important, though).

BARIUM TAGGING

- NEXT experiment: exploit the idea of single molecule fluorescent imaging (biology). 'Traditional' molecules are able to capture calcium, but recent developments on barium capture.
- After capturing Ba, the molecule changes its scintillating properties and can be 'interrogated' with pulsed light.
- Biology works in **water** but we don't want water in the TPC so we look for molecules that work in a **dry surface**.
- Idea: monolayer of molecules at the cathode. Understanding the optimal density of the monolayer and efficiency at capturing Ba and positively respond to interrogation.
- Understand Ba lifetime in gas and impact of impurities with a Ra^{++} source.



WLS DOPING (XE IN LAR, CF₄ IN GAR...)

- Timing in argon not very good → Xe get rids of the slow component and improves it
- Pulse shape discrimination is not not completely over. Optimize concentration of Xe to try to optimize the Ar/Xe characteristics.
- Use spectroscopic information to further enhance PID?.
- Issue of freezing Xe?, stratification?. No strong ('screaming') evidence but needs study.
- Ar/Xe is the baseline for second module of dune-fd. ~10ppm (200kg)
- ProtoDUNE-DP. 1kton LAr-Xe doping (~20ppm).