

ArgonCube 2x2

Purity Module Update

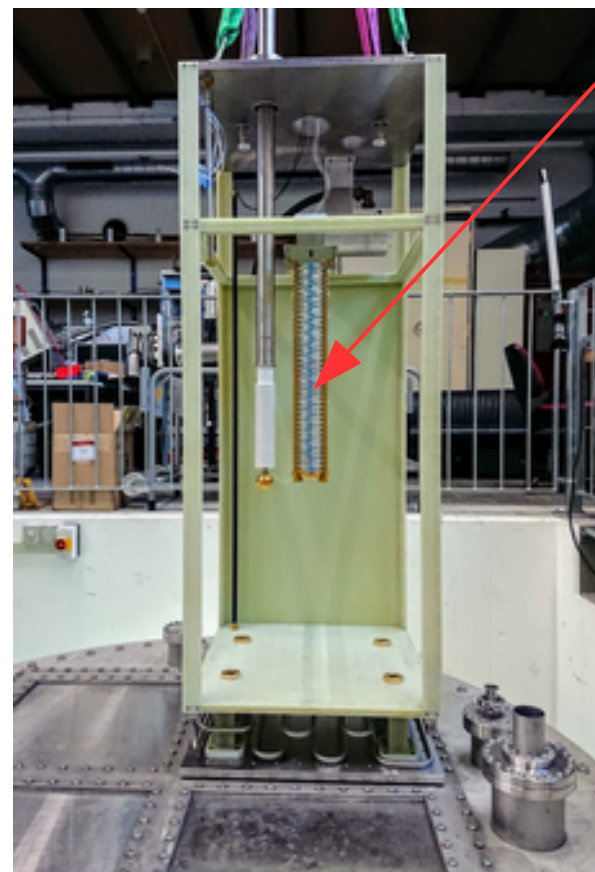
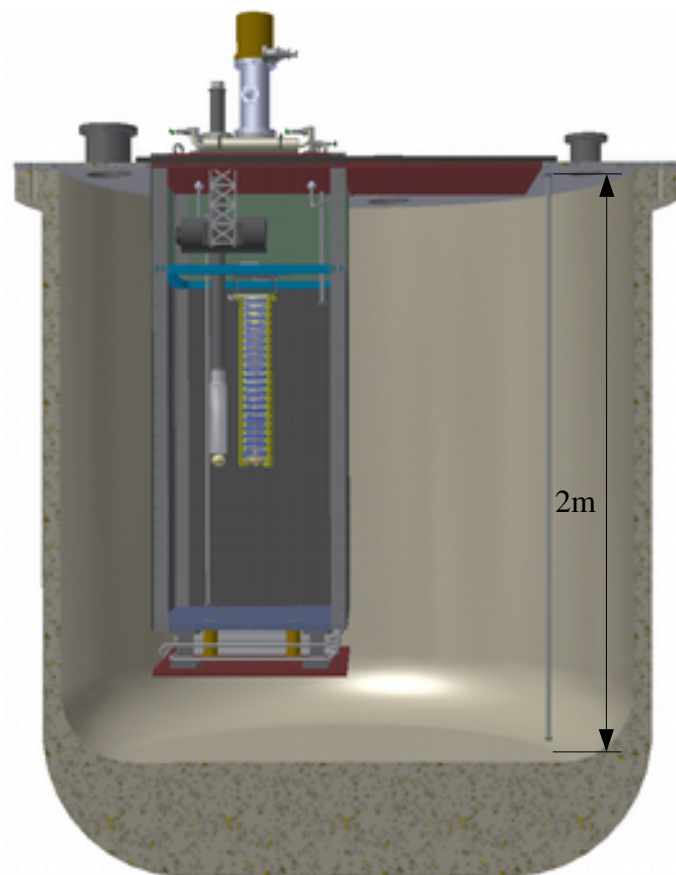
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ArgonCube Fortnightly Meeting, March 06th 2019

Purity Module

Purity module serves to test:

- recirculation & purification (cryogenics)
- module extraction & re-insertion
- mechanical construction techniques



60 cm long TPC to
measure e^- lifetime
→ LAr purity

Filling 2x2 Cryostat with LAr

Started filling 2x2 cryostat with
Liquid Argon on February 26th 2019

- Module is not properly sealed:
LAr enters through corners instead of check-valves
- At around 11:00:
First observation of a WIMP (**W**eakly **I**nteracting **M**osquito **P**article)

LAr Purification

- Purified LAr for ~50 hours
- System amazingly stable, without any input from shifters!
- Then: data taking to determine electron lifetime

Start	End	File	PS voltage	Cathode voltage	PS current	Comment
02:33	02:43	PedestalRun2019-03-04.023330.lpx	31.5 kV	30 kV	0.007 mA	pedestal run (new thr for right part of Pixel plane)
02:46	03:46	ProdRun2019-03-04.024627.lpx	31.5 kV	30 kV	0.007 mA	data run (rate 1-2 kHz, sometimes up to 25 kHz)
03:46	04:46	ProdRun2019-03-04.034636.lpx	31.5 kV	30 kV	0.007 mA	same data run as previous
04:52	05:52	ProdRun2019-03-04.045208.lpx	42 kV	40 kV	0.009 mA	data run, chip 54 cpixel 27 connected to analog monitor out.
06:09	06:19	PedestalRun2019-03-04.060906.lpx	63.1 kV	60 kV	0.014 mA	pedestal run (before the run all ASICs were reset)
06:26	07:27	ProdRun2019-03-04.062641.lpx	63.1 kV	60 kV	0.014 mA	data run, rate 4-5 kHz
07:27	08:13	ProdRun2019-03-04.072748.lpx	63.1 kV	60 kV	0.014 mA	data run, rate ~1 kHz
08:22	09:00	ProdRun2019-03-04.082232.lpx	63.1 kV	60 kV	0.014 mA	data run, Decreased Sample cycles from 8 to 1

- Electron lifetime: To be determined
→ Purity before module extraction

Module Extraction



- Extracting module, disconnecting cables and putting module away in < 3 hours
- At ~12:00: Corners start to melt \rightarrow Water flows into module \rightarrow fog within module

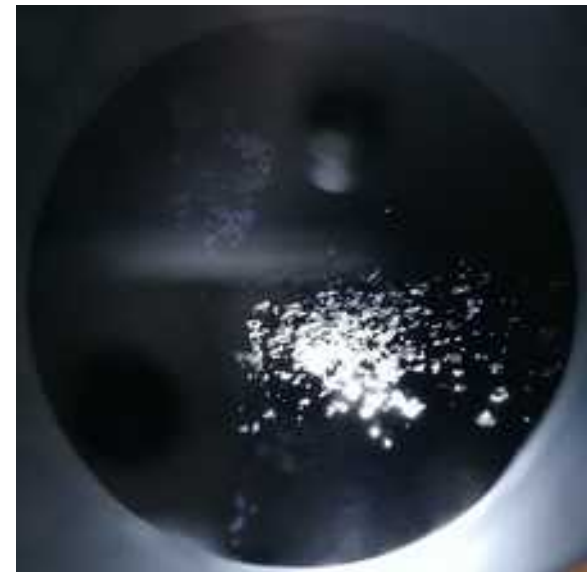
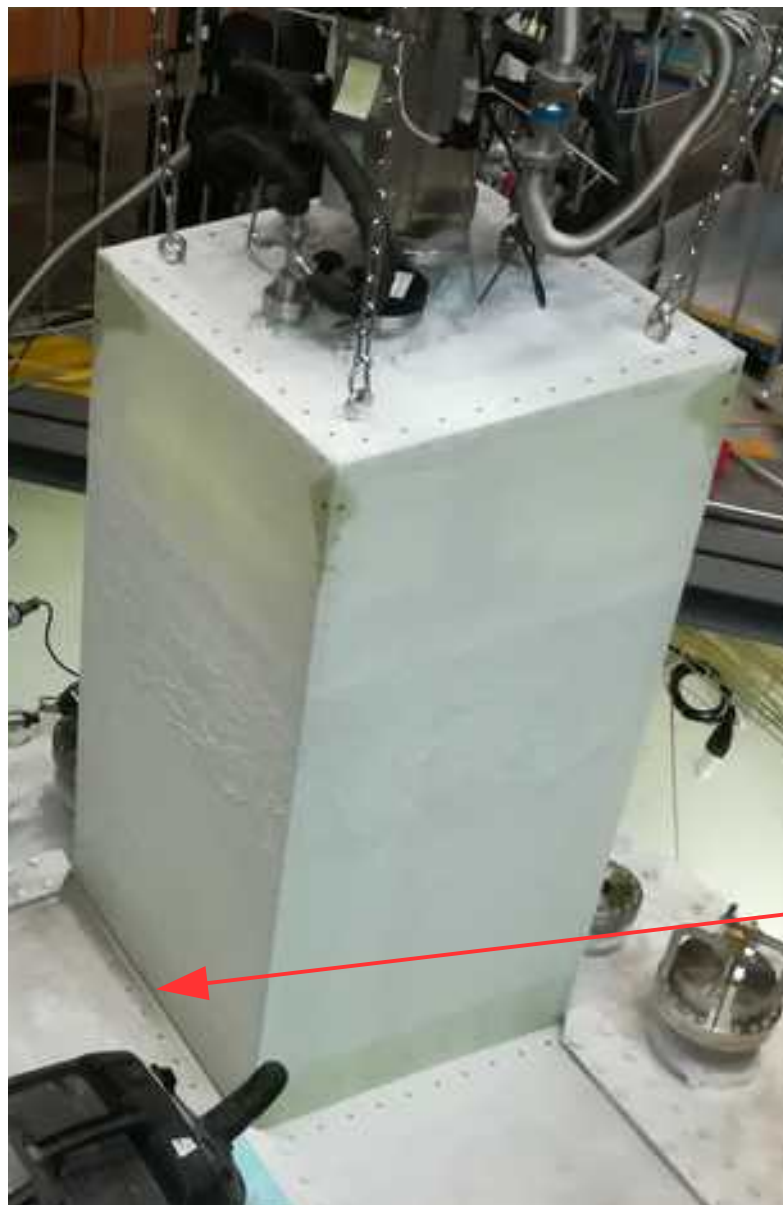
Module Extraction

After 2.5 days, the module was
extracted from the 2x2 cryostat

In this video: Time offset of 1h
[11:00 in the video corresponds to 12:00 local time]

- Extracting module, disconnecting cables and putting module away in < 3 hours
- At ~12:00: Corners start to melt \rightarrow Water flows into module \rightarrow fog within module

Cryostat Contamination after Extraction



During extraction:

Ice/snow formed at module fell through
~2mm thin **gap** into cryostat

Could be avoided with e.g. a silicon slice?

Maybe the ice is also coming from the
exhaust valve (it once got stuck!)

Module Contamination: Copper Dust



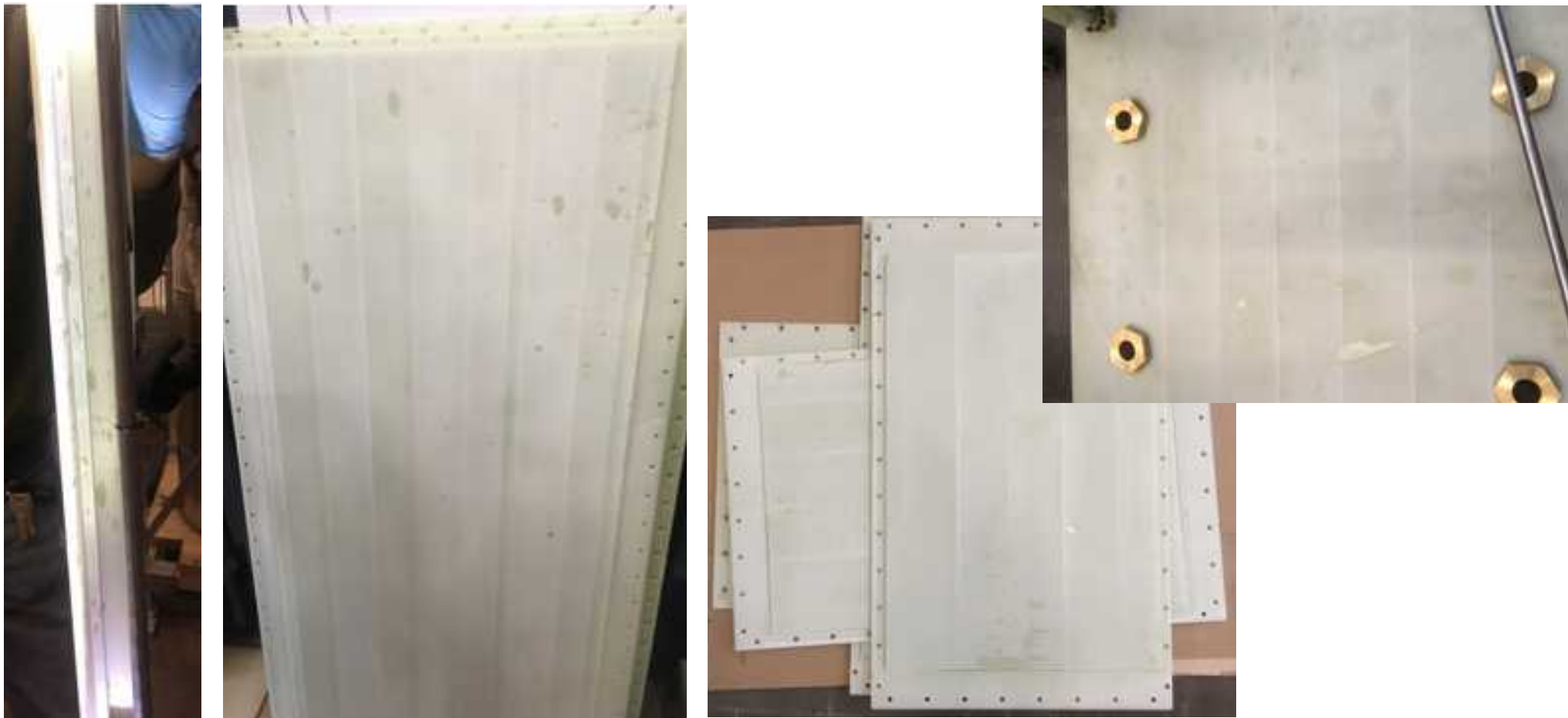
Cathode of TPC



Scintillator tile of TPC

Copper dust everywhere in module:
→ Origin: From LAr purification filters!

Module Contamination: Grease



Grease everywhere in module:

→ Origin not yet clear: From pump? Heat exchanger? G10?

Module Sealing

Sealed the module with Igor's “super-glue”

→ Doesn't look nice, but decreases the size of possible leaks



Module Insertion

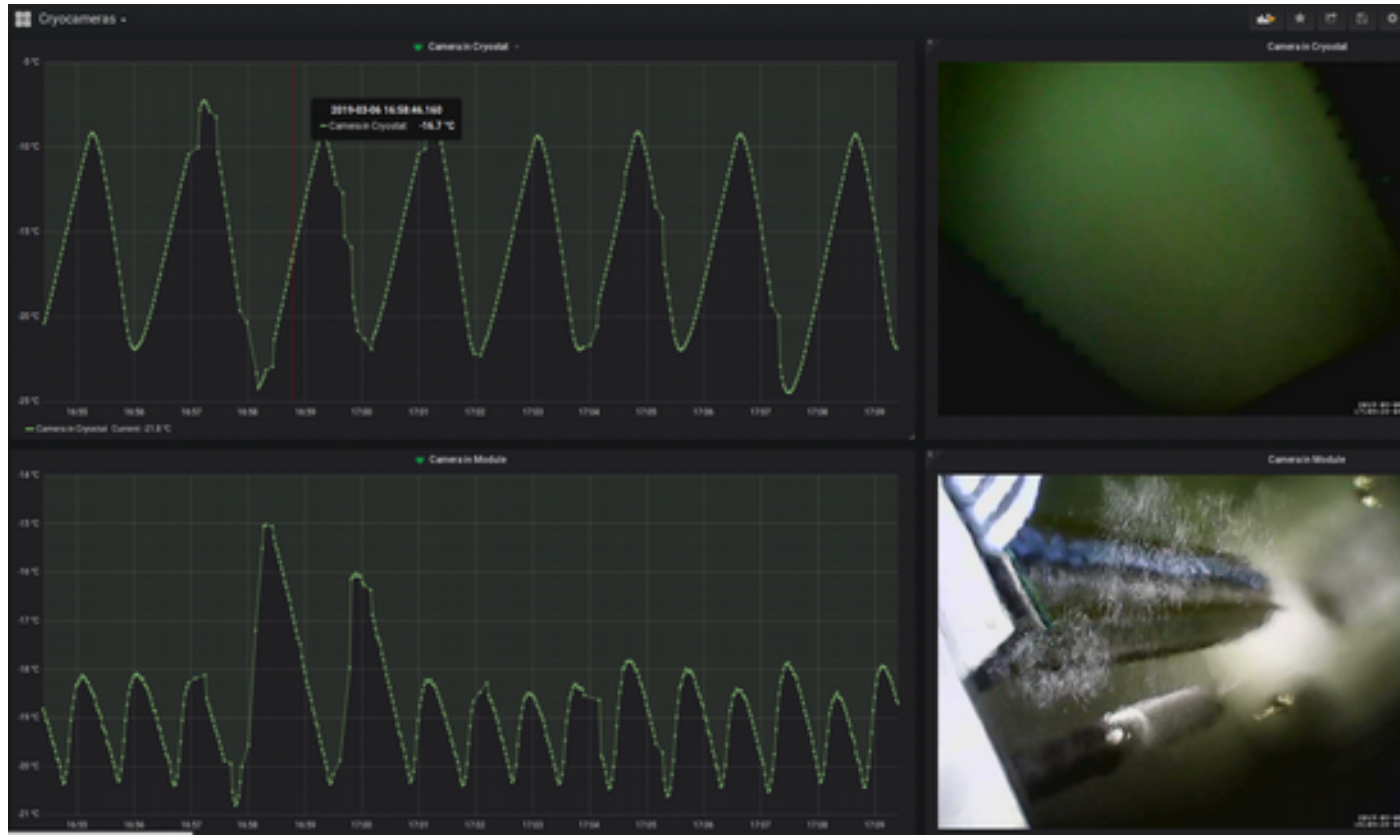
- Just finished insertion today at ~16:00
- Insertion took ~3 hours



- Plastic protected module with an Argon atmosphere
→ No condensation observed!

Outlook

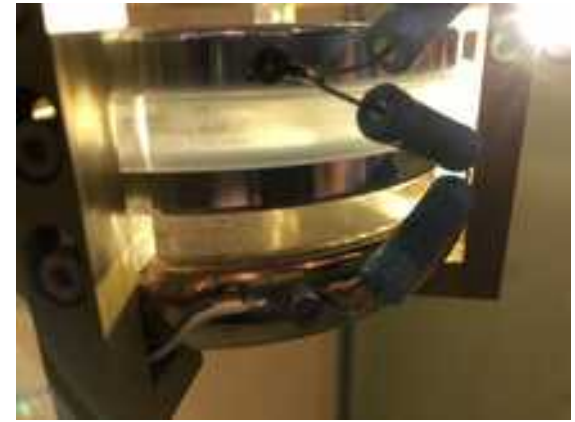
- We are refilling cryostat right now



- After refill: Take some data to determine electron lifetime
→ Purity after insertion
- Then: Purify LAr
- Take some more data to determine electron lifetime again
→ Which purity can we reach?

Lessons we already learned

- Dirt in module after extraction:
Grease and Copper dust
→ Origin of Grease: Not yet known
- Sealing module (with indium) is not easy!!
- Put silicon slice during extraction process to protect cryostat from ice falling in
- Put heater in module to increase pressure during extraction
→ Minimize humidity / fog inside module
- Insertion:
Plastic coverage is very helpful to avoid condensation



Module Insertion

- Just finished insertion today at ~16:00
- Insertion took ~3 hours



- Plastic protected module with an Argon atmosphere
→ No condensation observed!

Conclusions

- Cryogenics and 2x2 cryostat: Everything worked very well!
- Module extraction and insertion can be done within 3 hours
- Mechanical construction techniques are feasible
- Purity might be an issue, but the purity analysis and results are still outstanding

Conclusions

The results (electron lifetimes, etc.) of the Purity Module will be interesting!

If not already done: Register [here](#) for the
ArgonCube Collaboration Meeting in Bern (March 21st - 23rd)

