From ArgonTube to ArgonCube

The last ArgonTube run and the next R&D steps in Bern

The Last ArgonTube Run

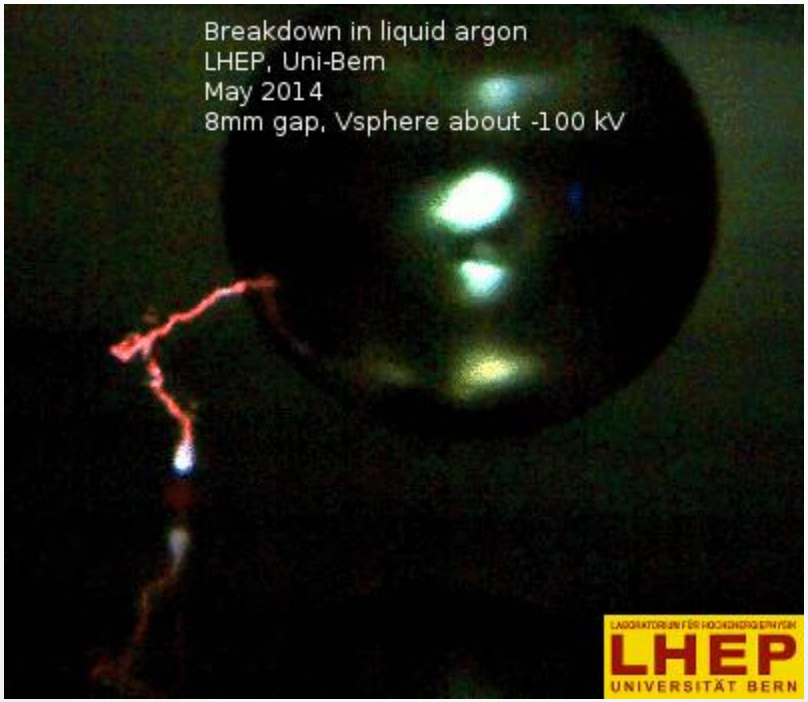
The ArgonTube project was started over 6 years ago. It has many successes to its credit:

- Longest drift distance in LAr.
- UV laser system development.
- Cold electronics advancement.
- In-situ voltage generation.

There was still one goal to achieve: the maximum voltage was never reached on the cathode. This spurred a study of breakdowns in LAr.

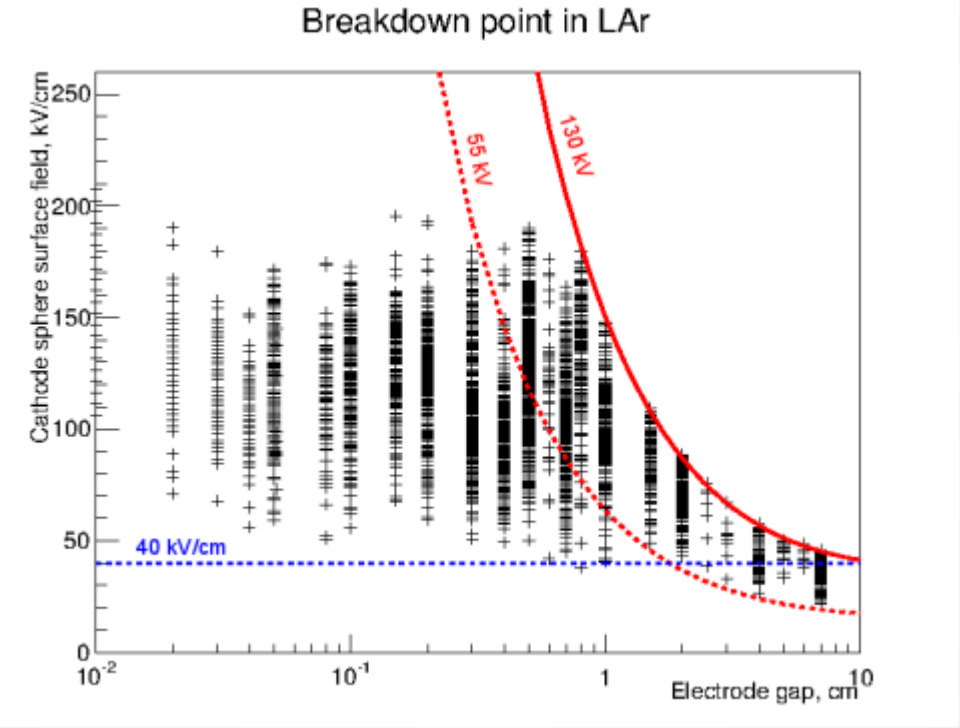
The Last ArgonTube Run - Breakdowns

Simplified setup to study breakdowns in LAr:



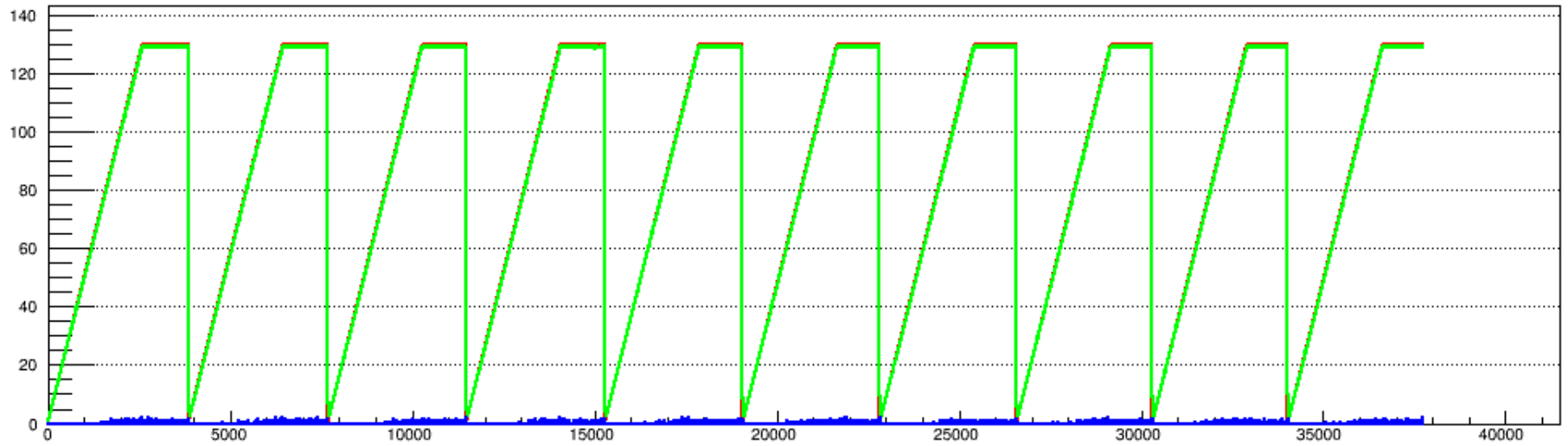
The Last ArgonTube Run - Breakdowns

Simplified setup to study breakdowns in LAr:



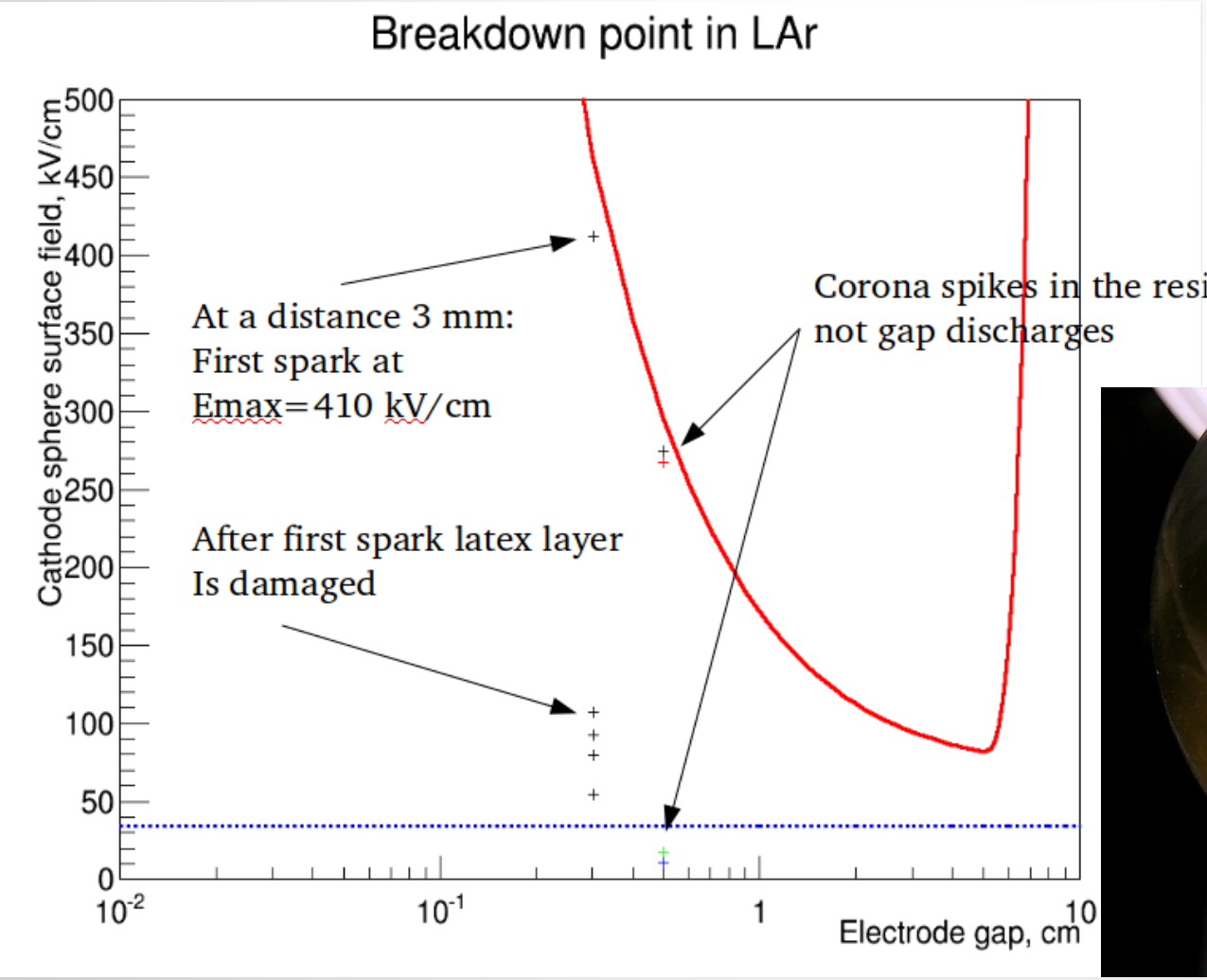
The Last ArgonTube Run - Breakdowns

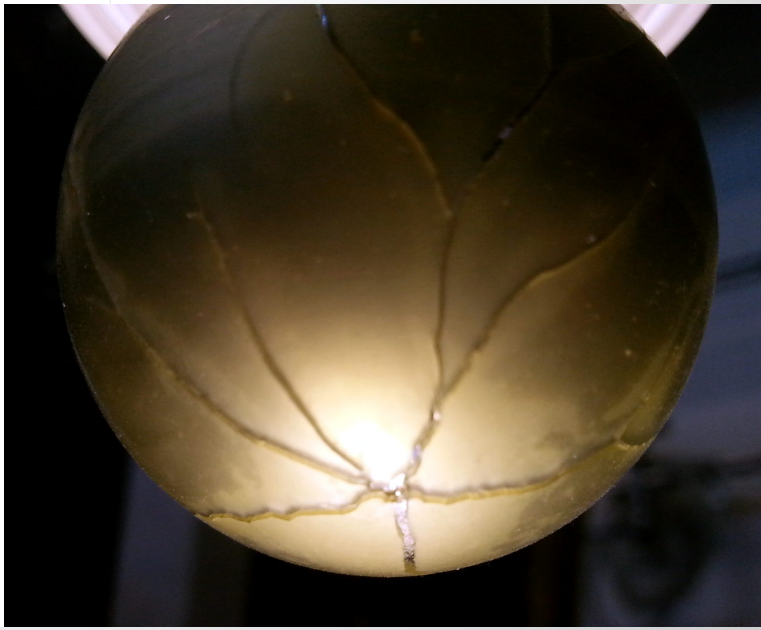
Coating the cathode in a dielectric should suppress the observed breakdowns: it did.



Anode-cathode distance: 4mm => 280kV/cm

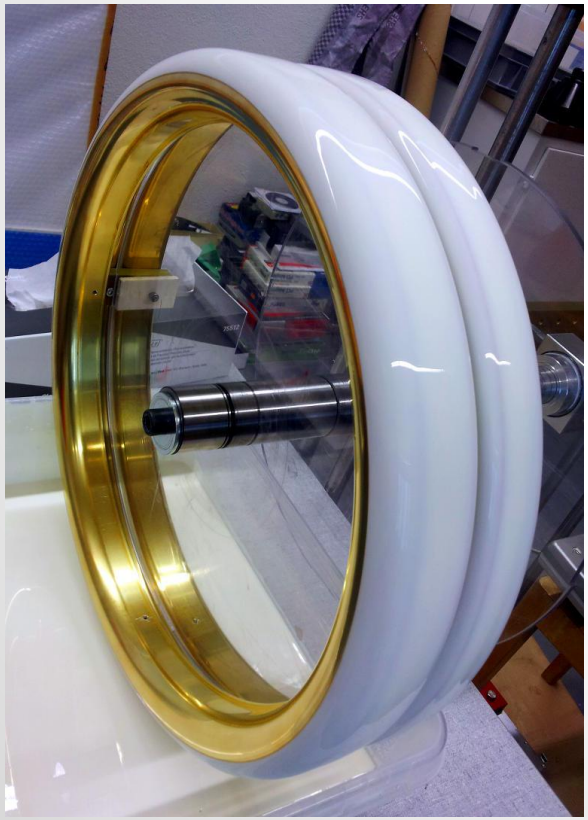
The Last ArgonTube Run - Breakdowns

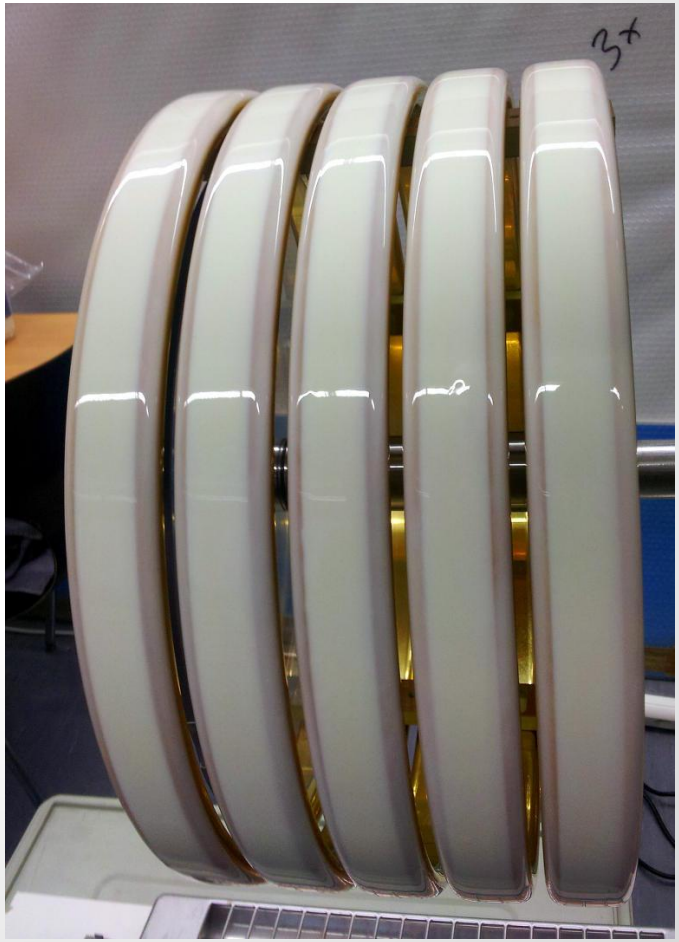




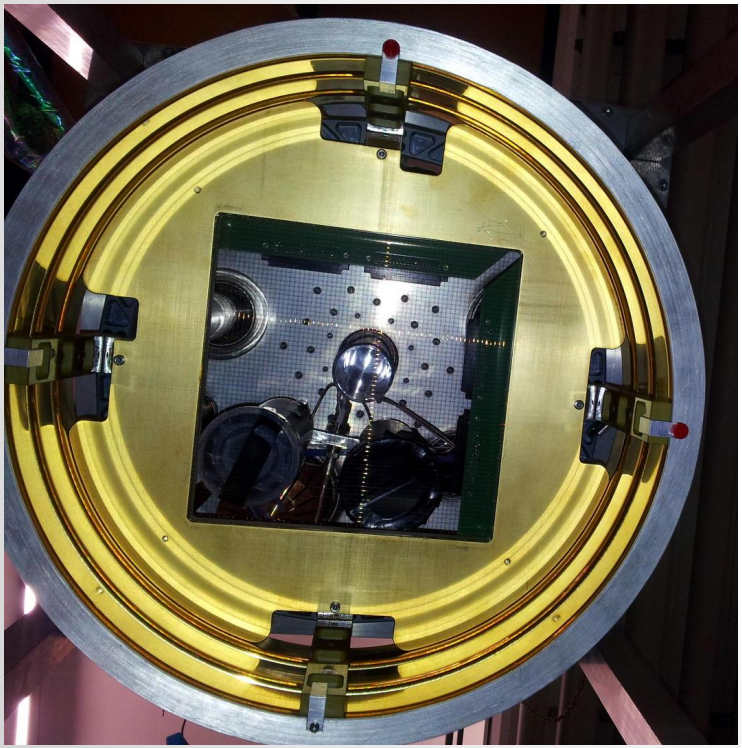
The Last ArgonTube Run - Breakdowns

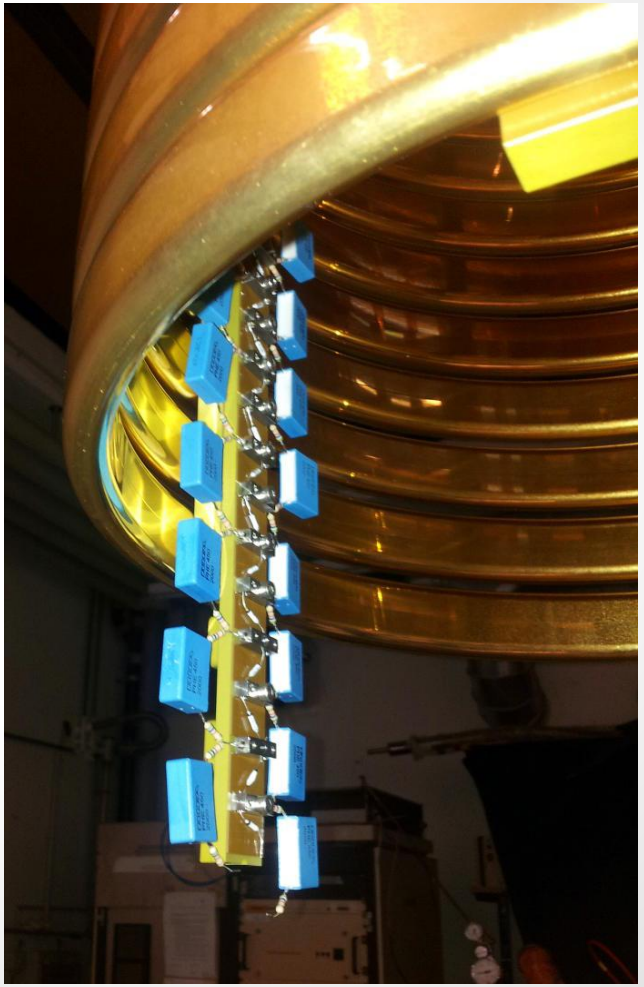
Coat the outer region of the whole ArgonTube field rings.

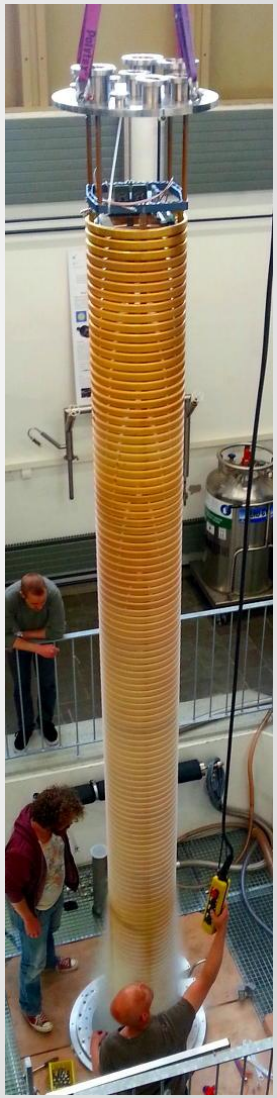




The Last ArgonTube Run - Operation

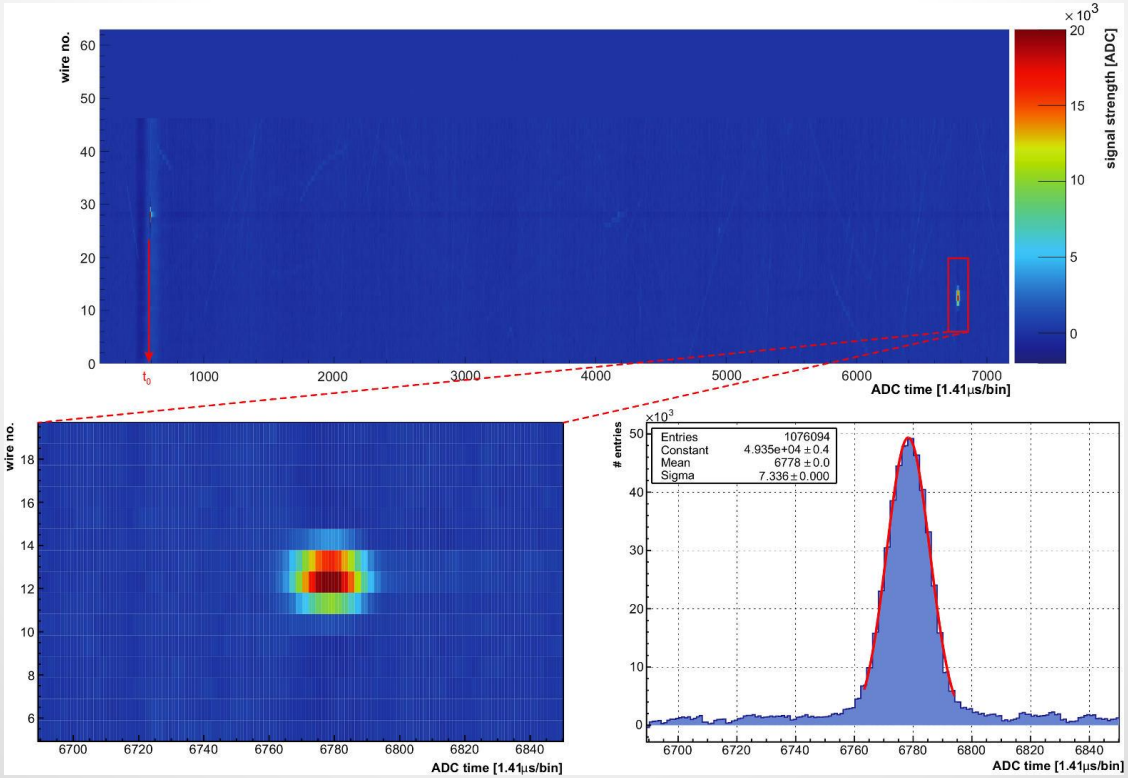




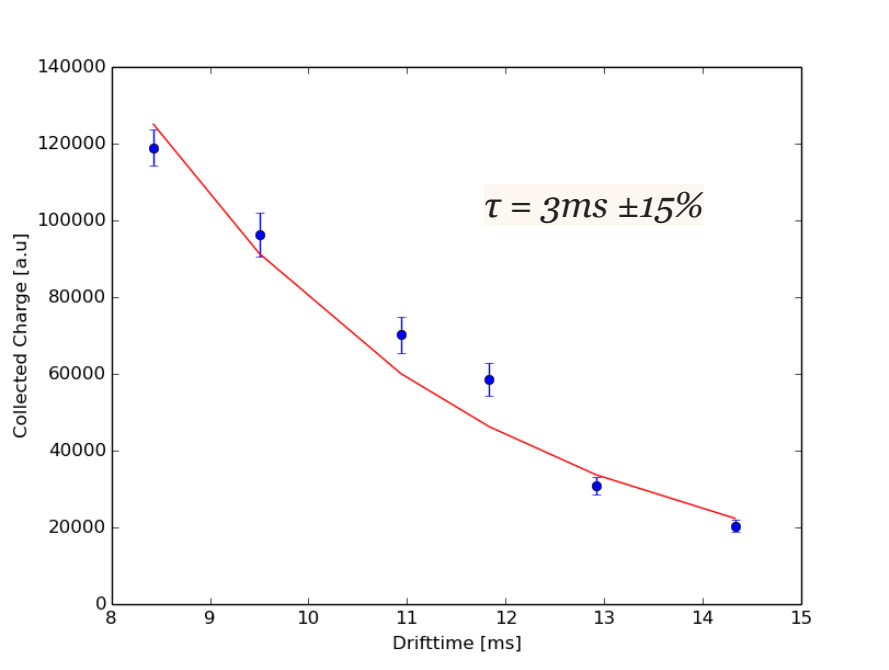


The Last ArgonTube Run - Operation - Purity

One of the fears was impurities leaching out from the latex and dirtying up the argon.

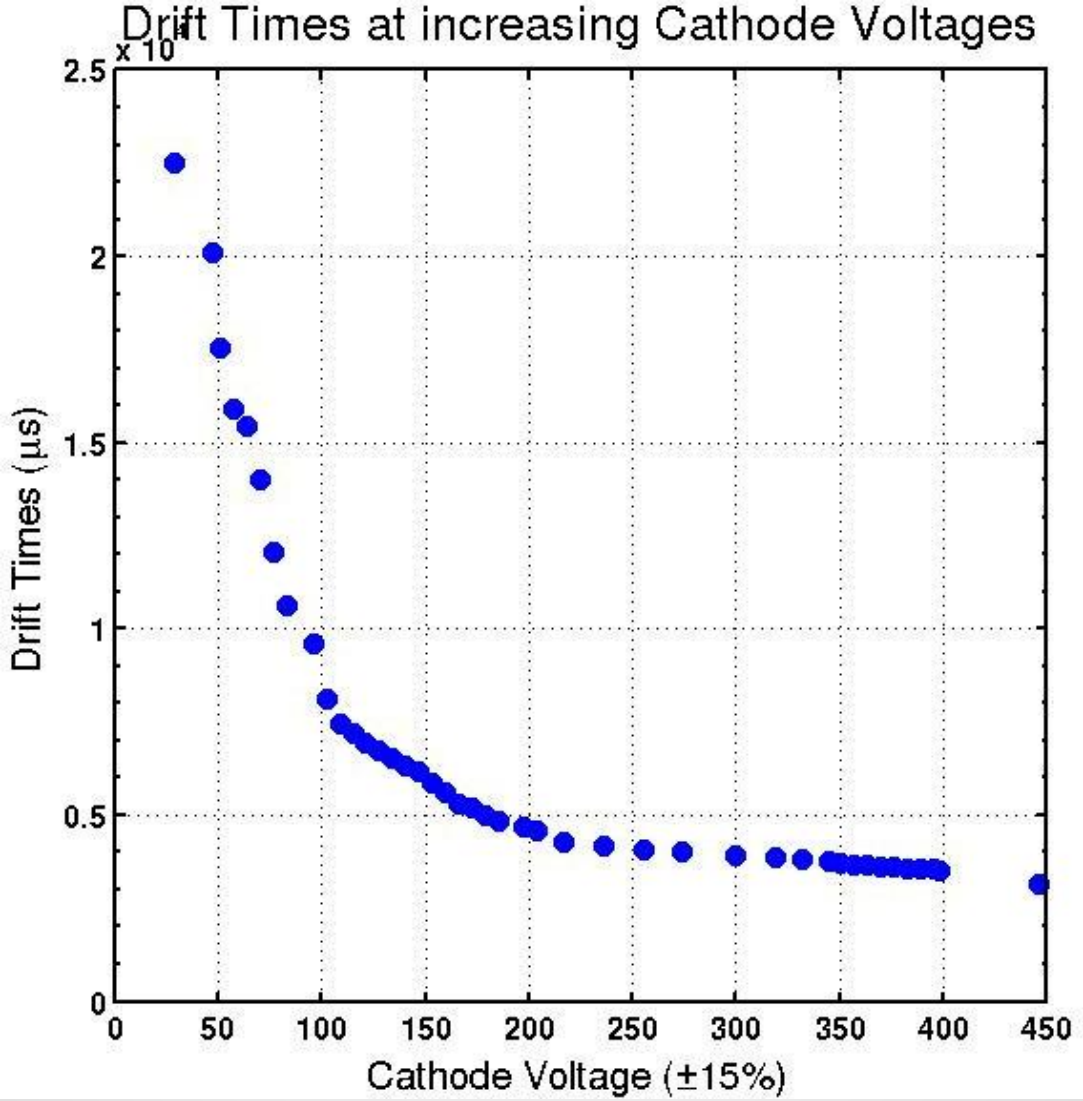


The Last ArgonTube Run - Operation - Purity

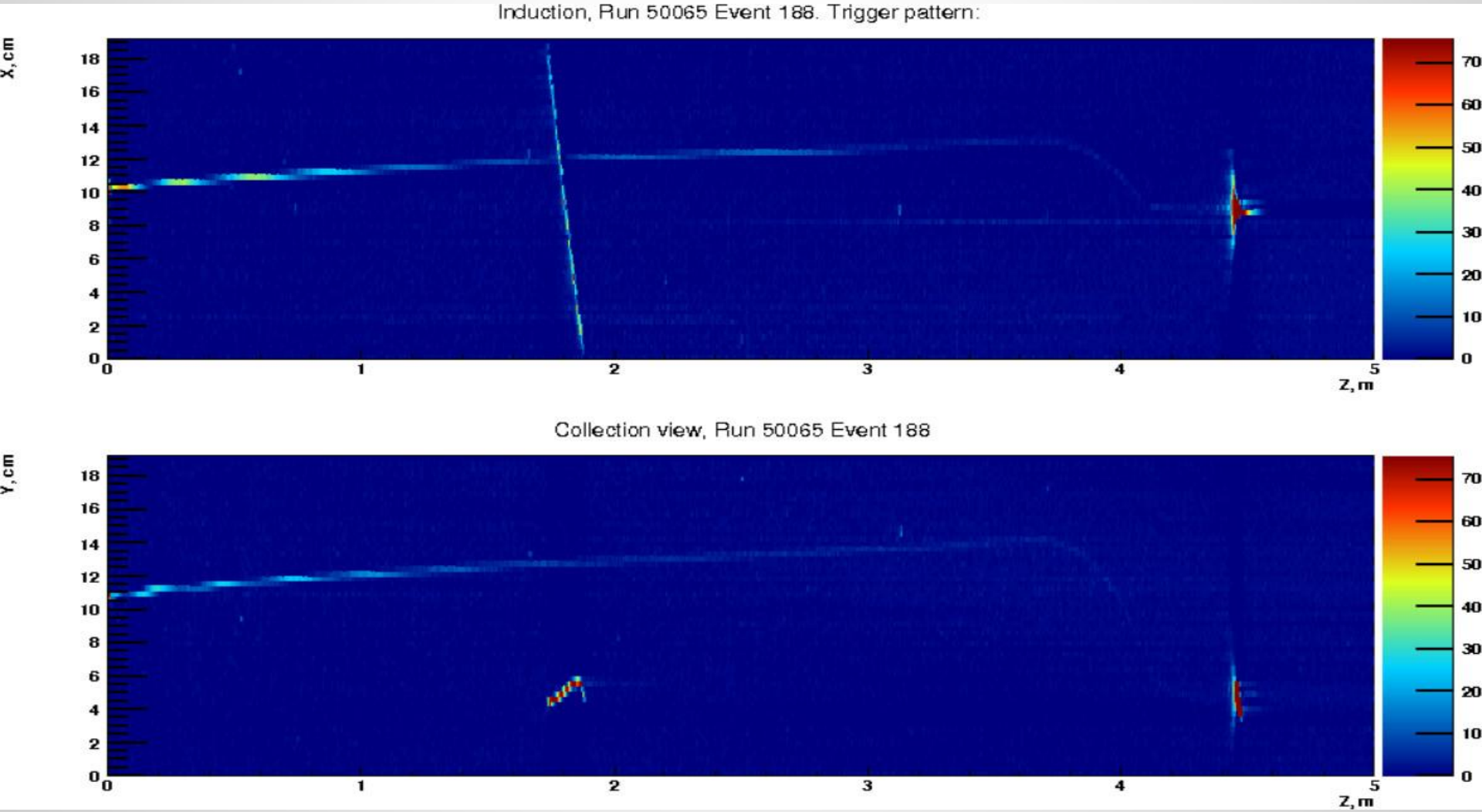


- Electron lifetime is comparable to previous uncoated runs.
- Care was taken to keep coated parts under dry argon atmosphere while in storage.

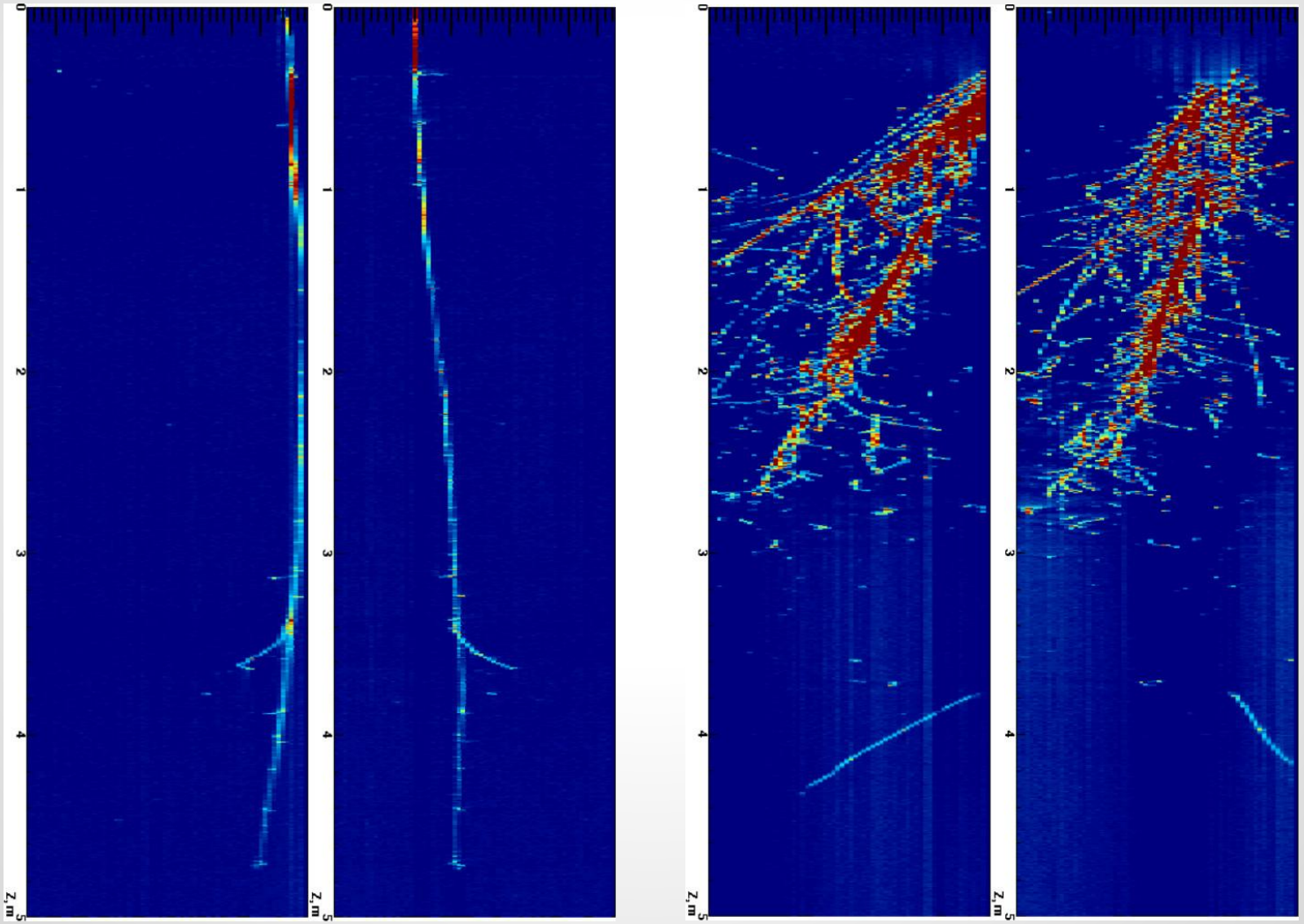
The Last ArgonTube Run - Operation - Field



The Last ArgonTube Run - Operation - End



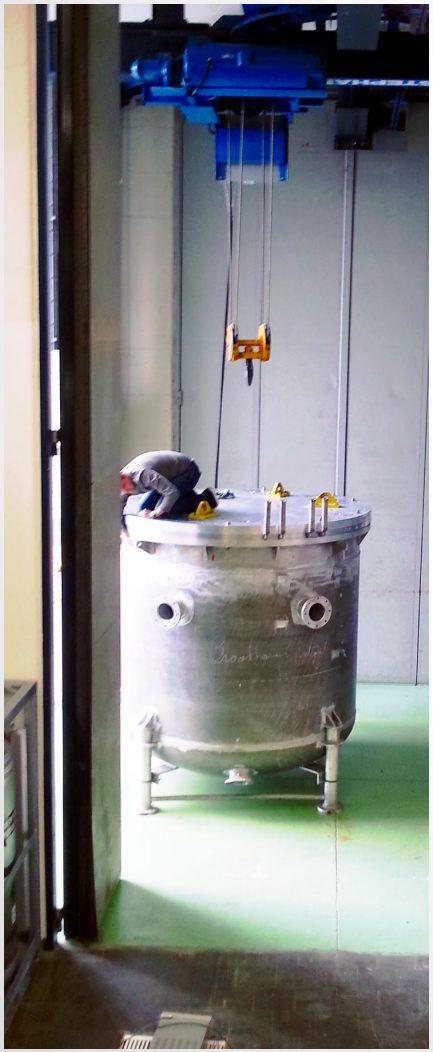
The Last ArgonTube Run - Highlights



The Last ArgonTube Run - Highlights

- The addition of a dielectric layer (here: latex) does indeed suppress electric breakdowns in LAr.
- We were able to reach the maximum potential of the ArgonTube design: 470kV ± 15% at the cathode.
- Important lesson learned: in future designs, in regions of high fields (>40kV/cm) coating with a dielectric definitely minimizes chances of a breakdown.

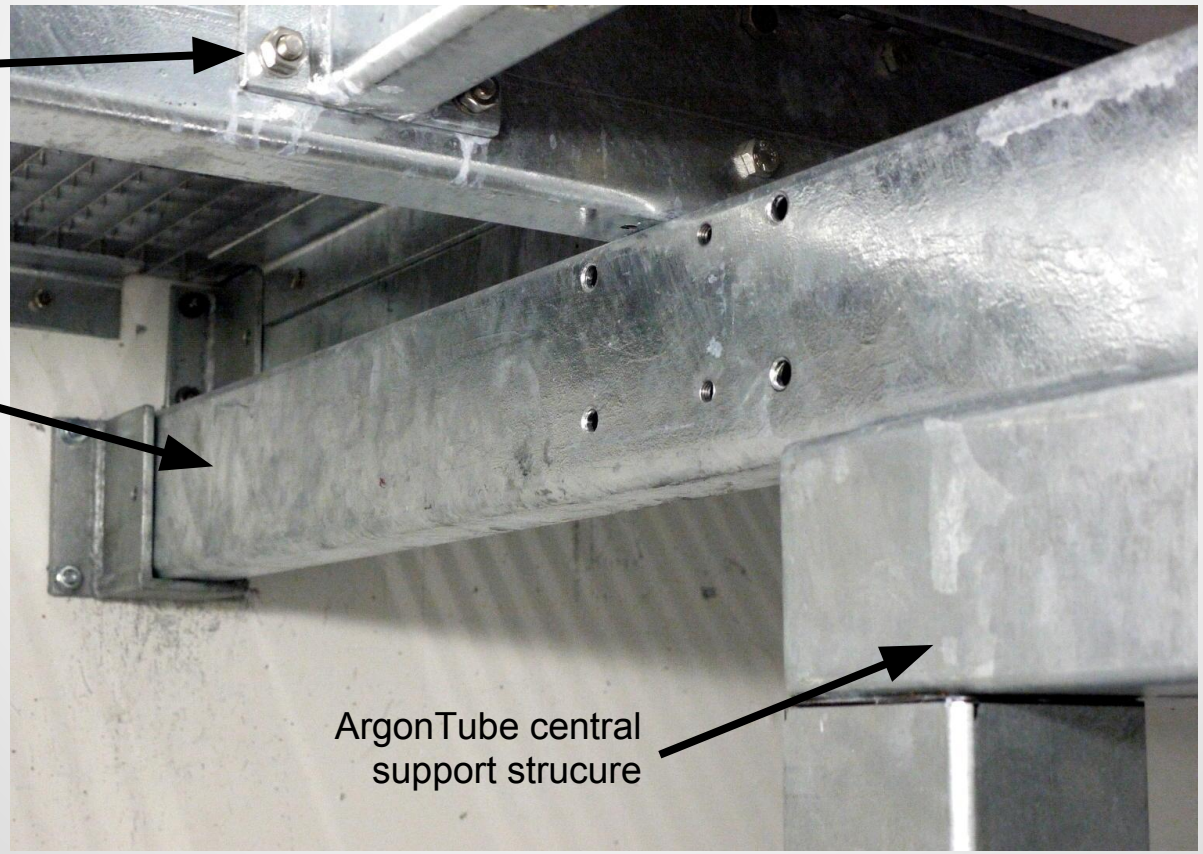
From Tube to Cube



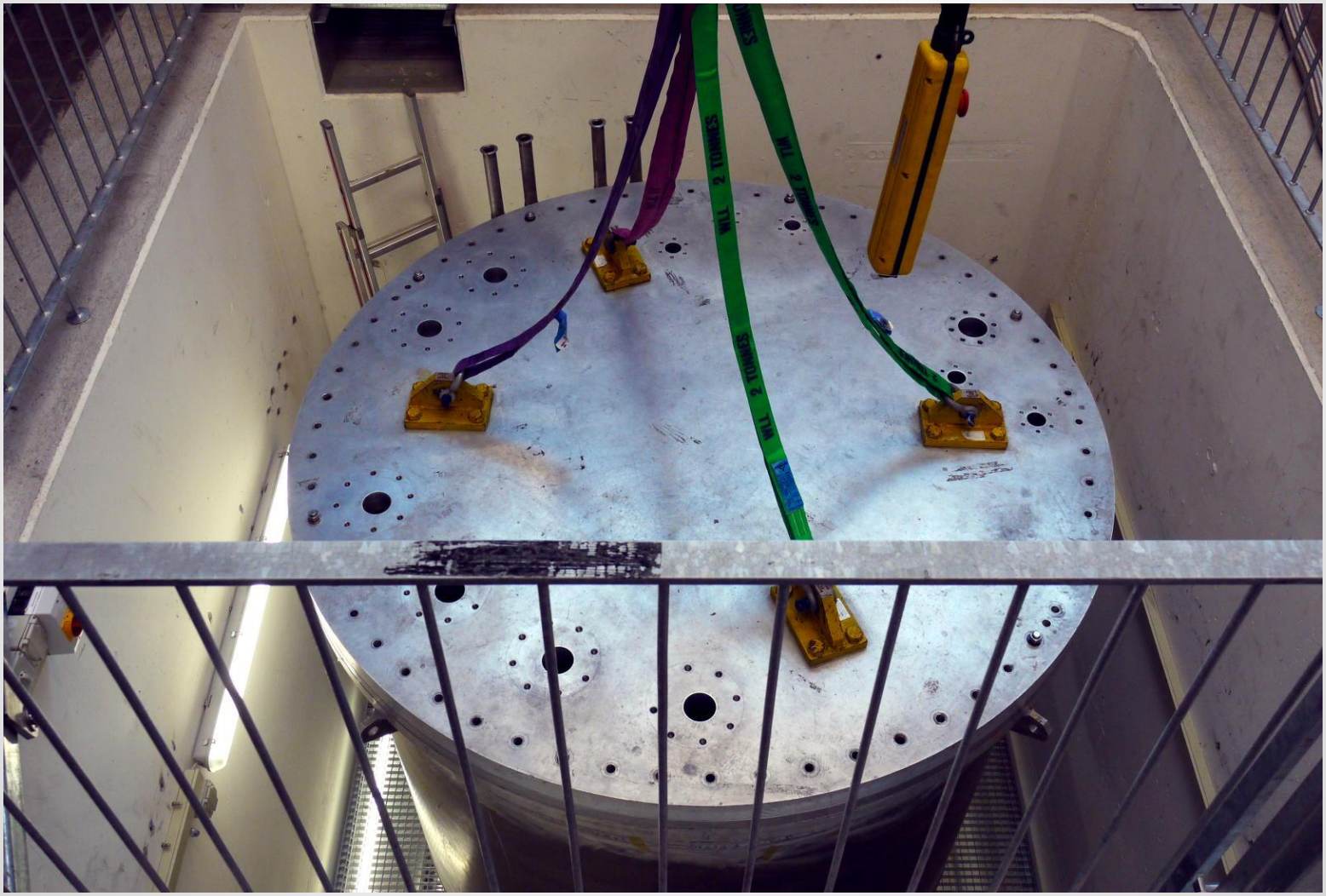
- Delivered on 07/10/2014.

From Tube to Cube

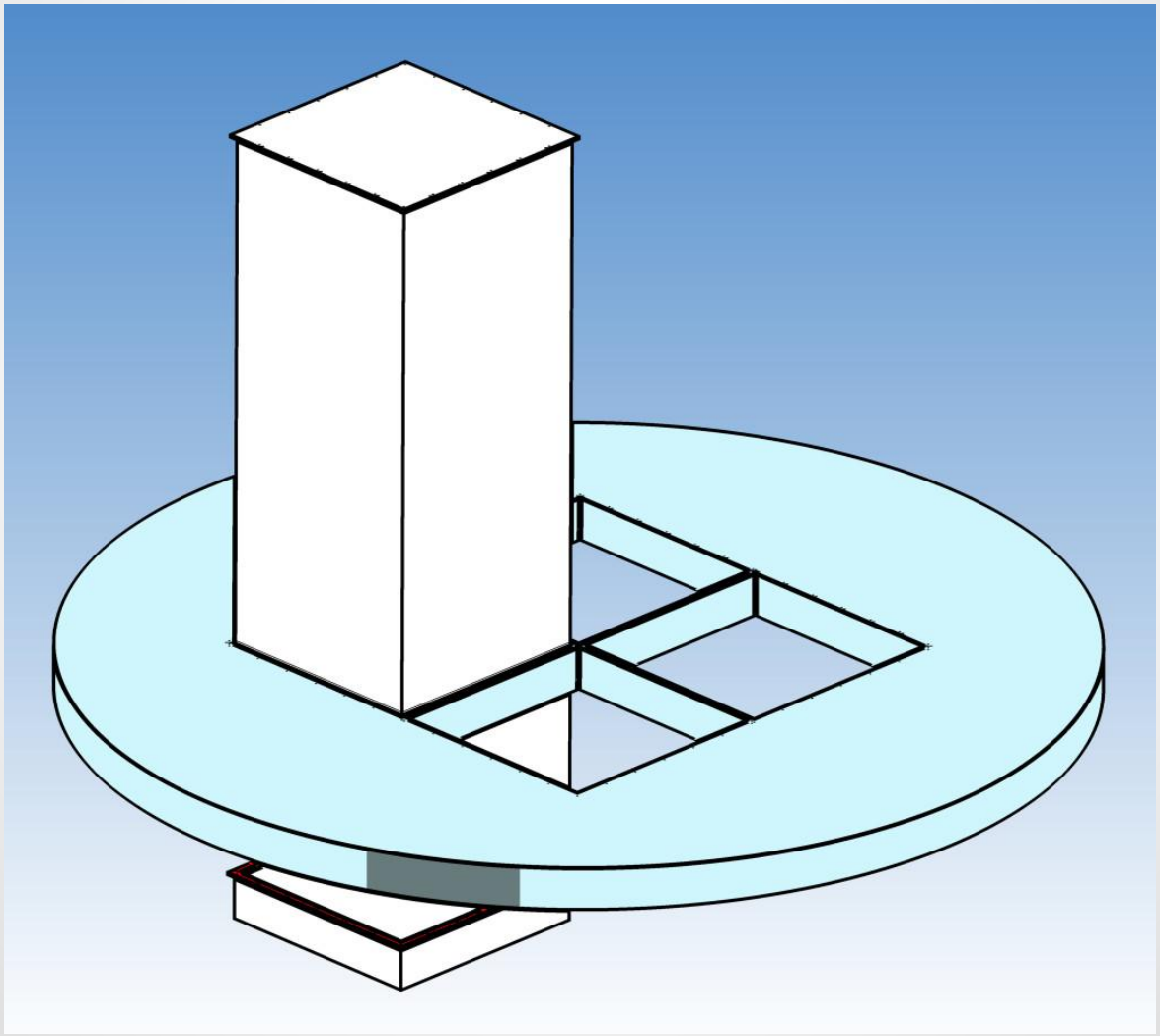
Extensive modifications to support the weight.



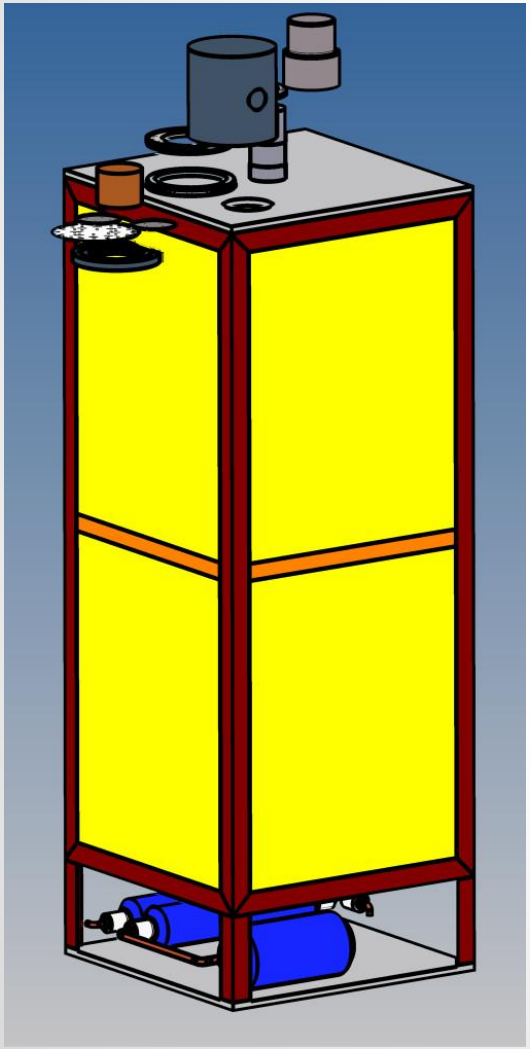
From Tube to Cube



From Tube to Cube - Near Future

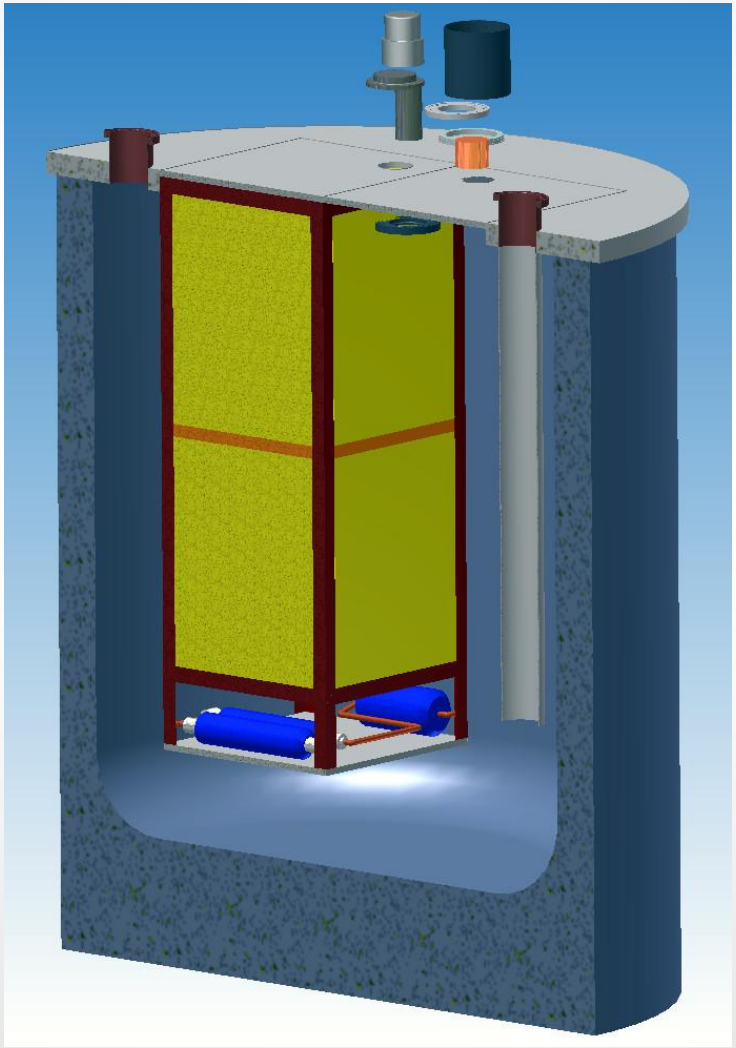


From Tube to Cube - Near Future



- 4 modules
- 67x67 cm, 1.8m high
- Argon volume ~ 0.6 m3 per module
- Argon mass ~ 820 kg per module
- Fiducial mass ~ 750 kg per module

From Tube to Cube - Near Future



From Tube to Cube - Immediate Future

Wide and varied array of ideas to investigate for the future of large-scale LAr TPCs.

- Moving away from wires.
- Pixelized readout.
- Novel connection techniques to keep readout channels under control.

Stay tuned for Damian’s talk for details on all of these.

From Tube to Cube - A legacy that lights the road ahead

- ArgonTube experimental project is over.
- Successful on all initially stated goals.
- Many valuable lessons learned for future detectors.
- Start of the ArgonCube program.
- Newer, better, faster, stronger.
- Expanded collaboration provides a diverse pool of ideas and ressources.

Always There, Alway Watching

- Continue to strive to further LAr detector technologies and the offshoots.
- Welcome new expanded collaboration.
- Forge ahead.

Thank You.