

# Commissioning of LArGe Gas / Liquid



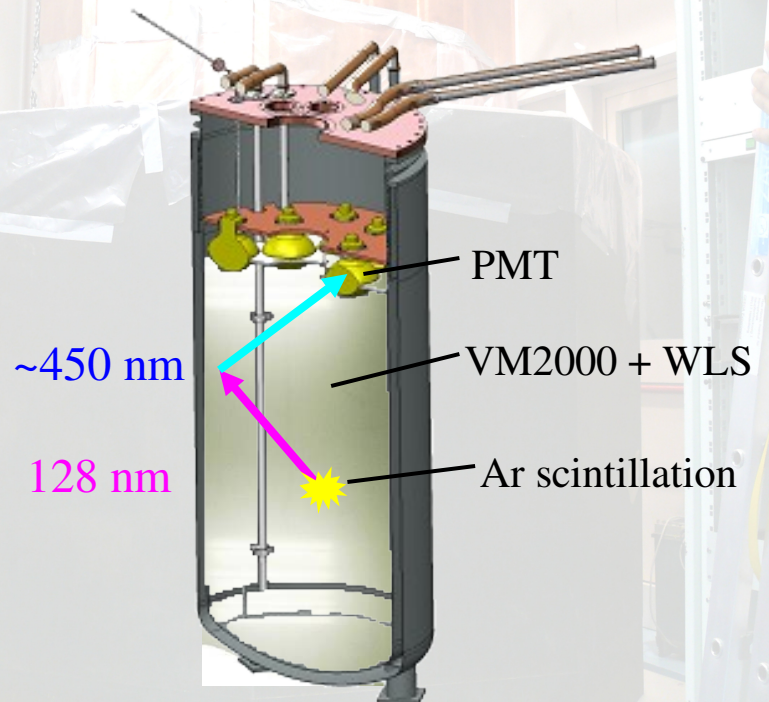
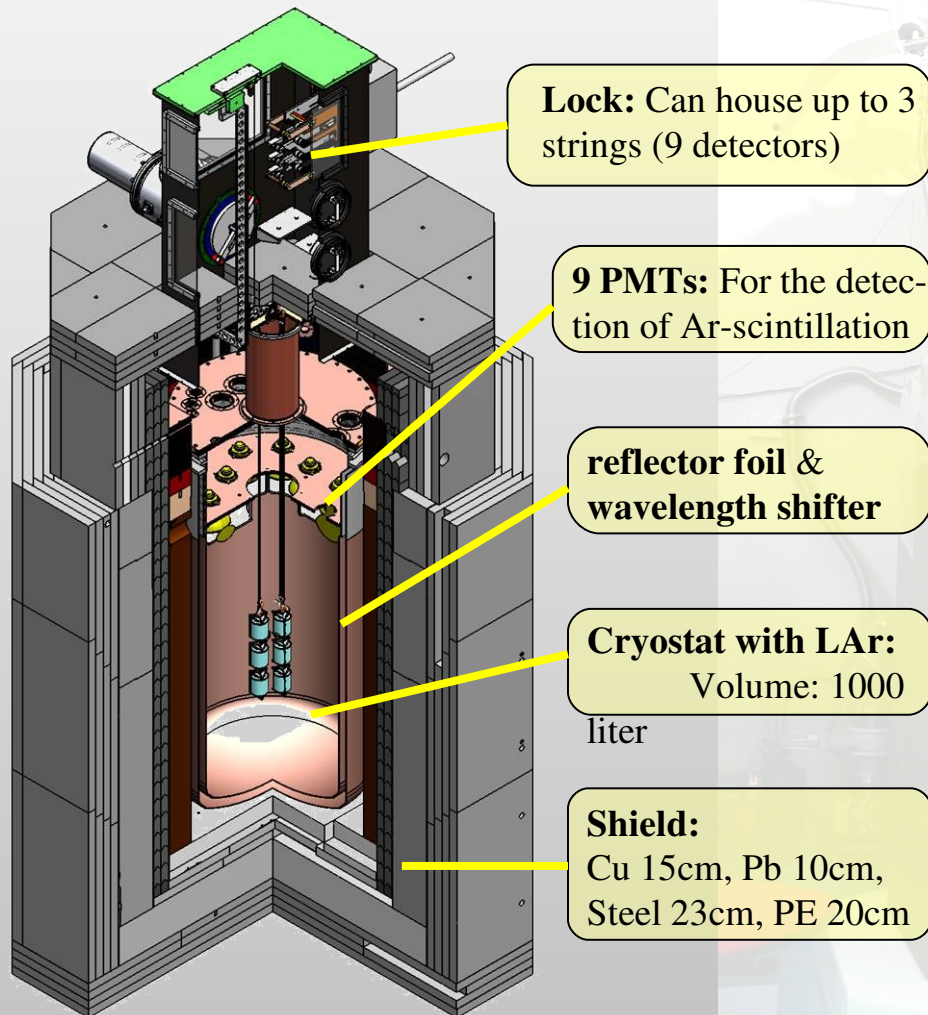
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GERDA Collaboration Meeting,  
LNGS, 1-3 March 2010



# Reminder: The LArGe Setup

operation of naked HPGe-crystals in LAr using Ar-scintillation light as veto & for background diagnostics:



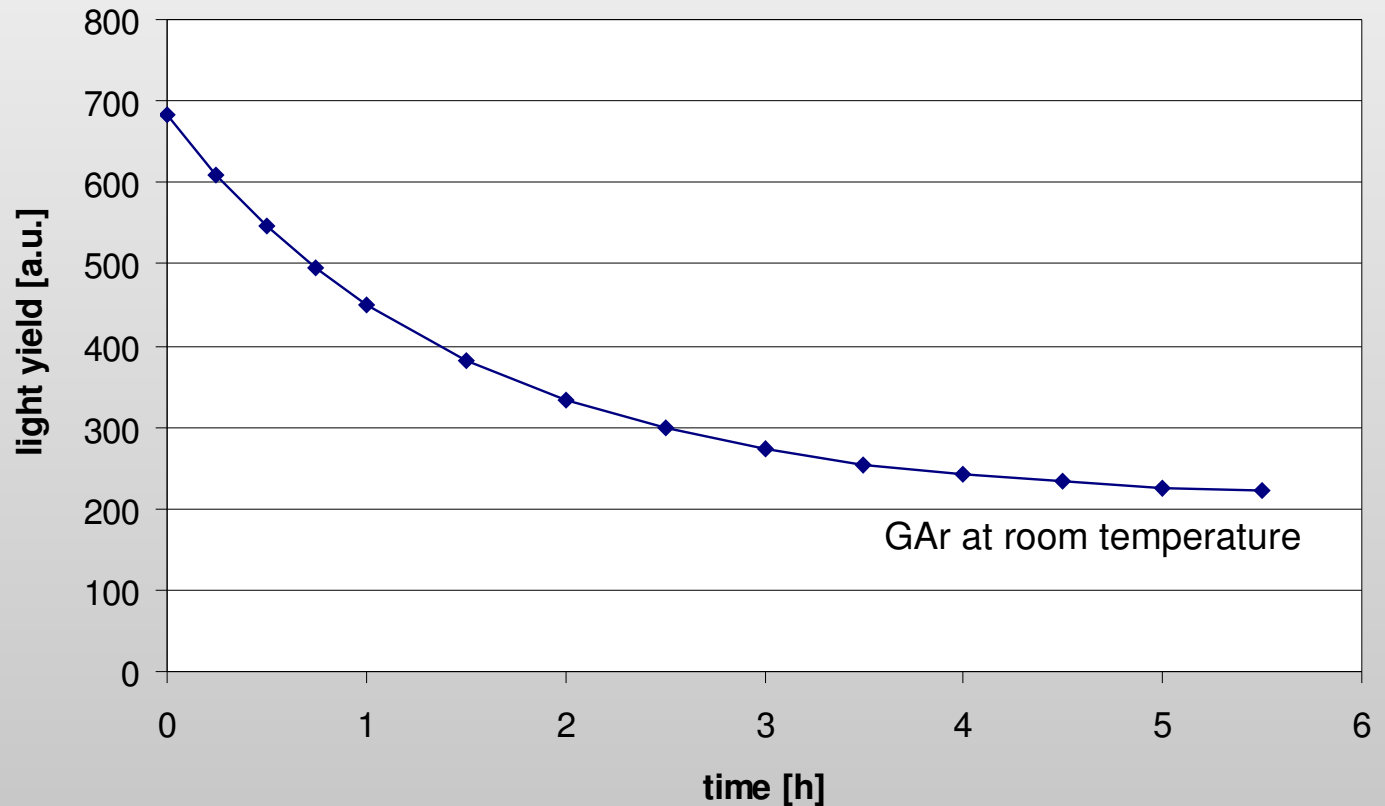
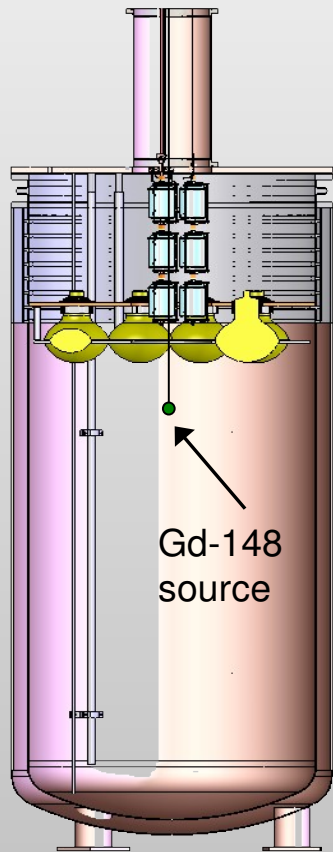
# History Overview

## Since Last Meeting

- last meeting: first scintillation light in GAr presented  
→ light degradation discovered
- nov 09: 1st LAr filling of cryostat  
→ light quenched
- nov - jan 10: investigations & cryostat modifications
- feb 10 2nd LAr filling  
→ light is stable!

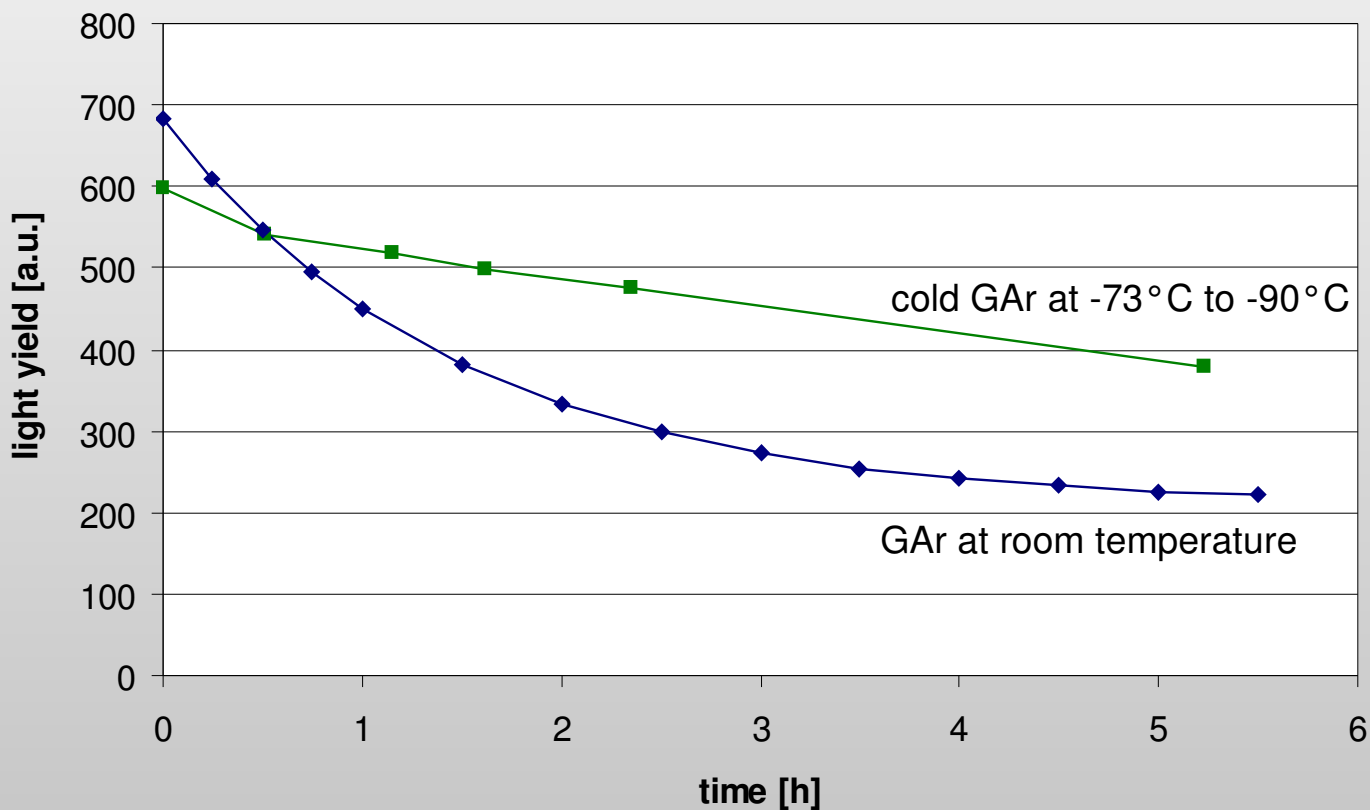
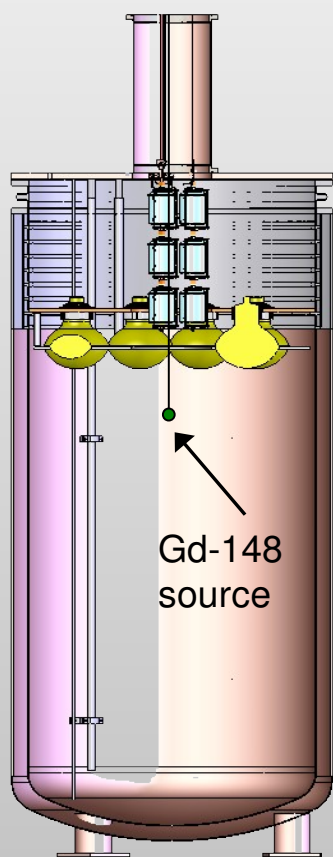
# Light Degradation Measurements in GAr

october `09: after last meeting



# Light Degradation Measurements in GAr

october `09: prior to 1st filling with LAr



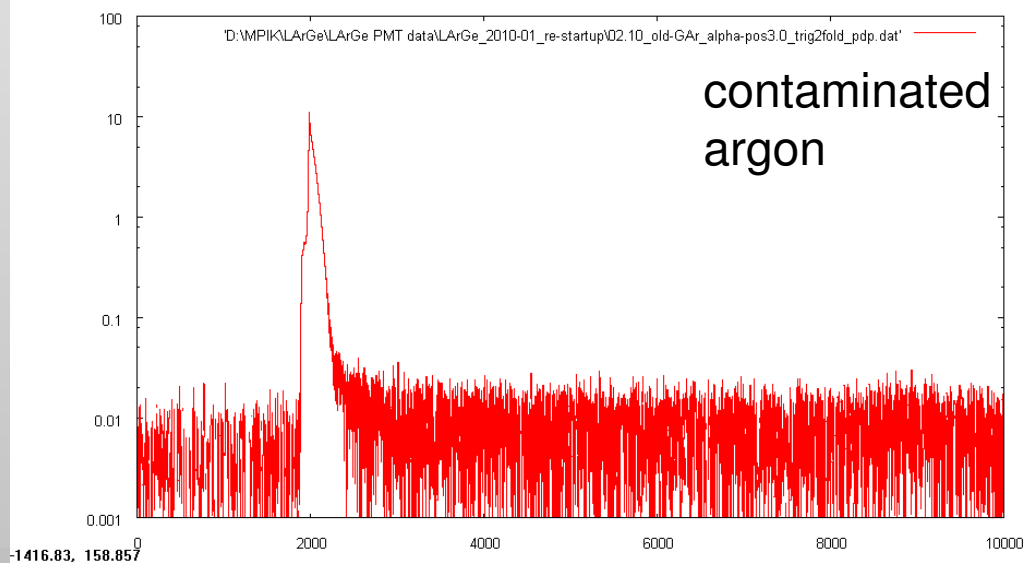
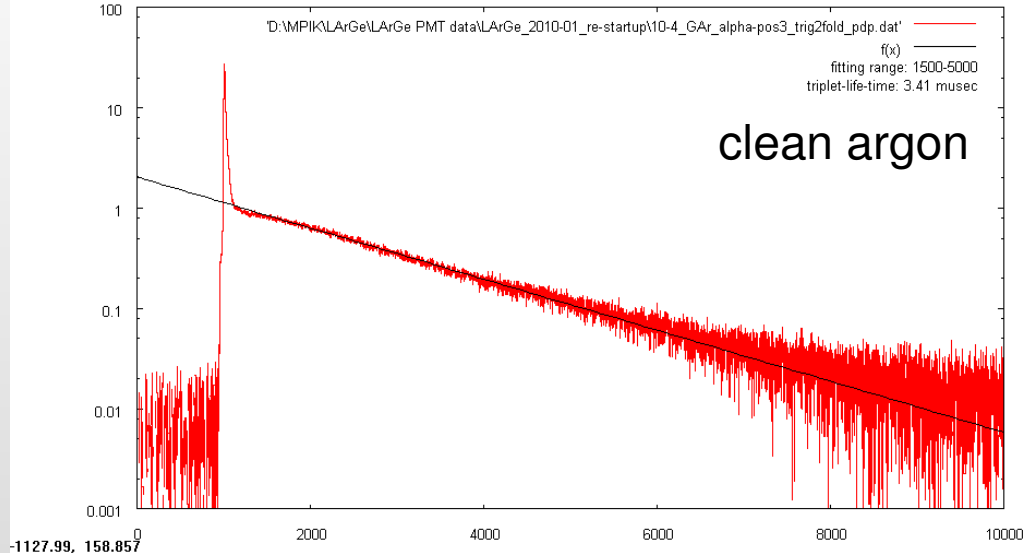
# 1st LAr Filling

- light yield lower by factor ~60
  - 0.03 pe/keV - measured with Th-228 & Am-241
  - 1.8 pe/keV - in Mini-LArGe
- slow component strongly quenched
  - triplet-lifetime:  $\tau_{\text{trip}} = 66 \text{ ns}$  (lit.  $\tau_{\text{trip}} = 1.1 \text{ to } 1.7 \mu\text{s}$ )
- mass spectrometer measurements:
  - N<sub>2</sub>: 7 ppm
  - O<sub>2</sub>: <4 ppm
  - no other trace contaminations found due to the limited sensitivity of the mass spectrometer

# Triplet Lifetime (Slow Component) as an Indicator for Impurities

pulse shape average over 10000 pulses:

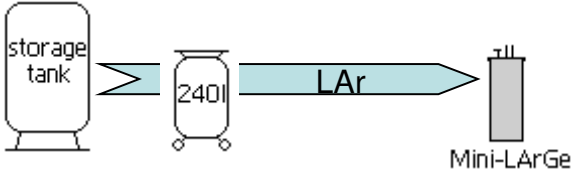
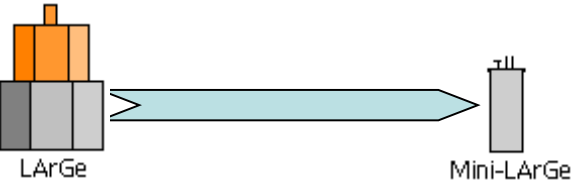
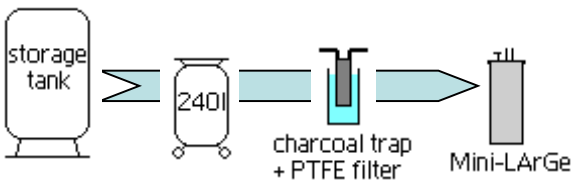
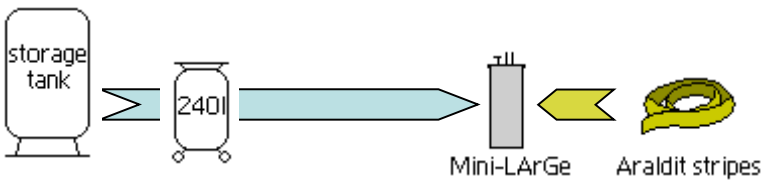
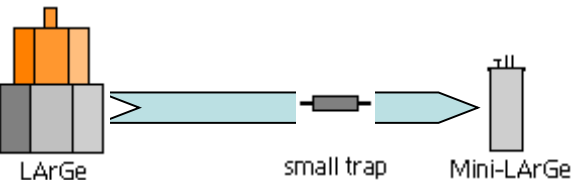
amplitude ↑



(example from GAr)

time →

# What is the Origin of the Contamination? Mini-LArGe Investigations...

configuration	triplet lifetime	conclusion
	873 ns	LAr in LArGe is contaminated, instrumental reasons excluded
	112 ns	
	775 ns	charcoal & PTFE filter are clean
	733 ns stable for 3 days	Araldit is no problem
	74 ns	activated charcoal did not remove contamination

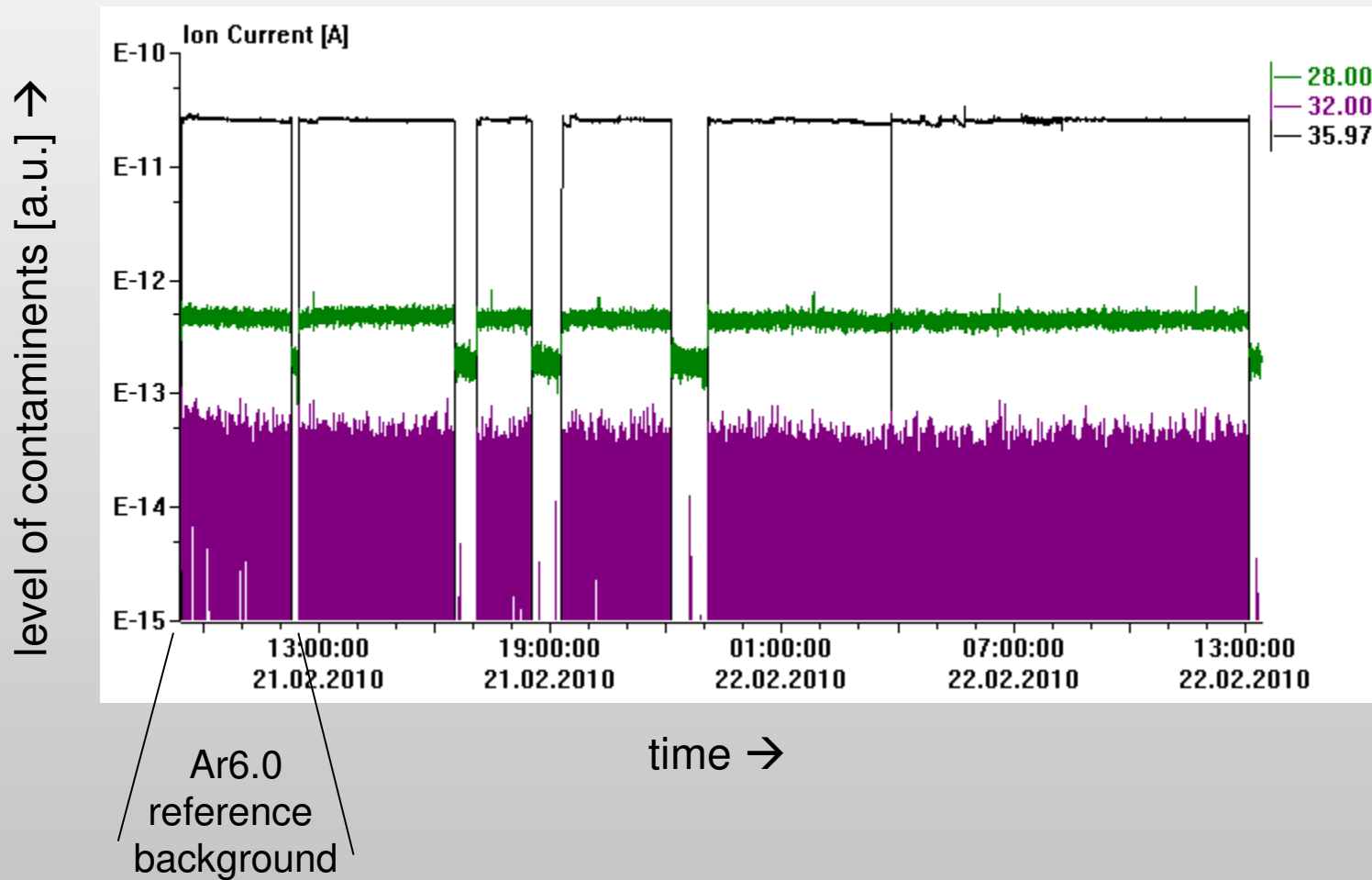


# Modifications on LArGe Cryostat

jan-feb `10:

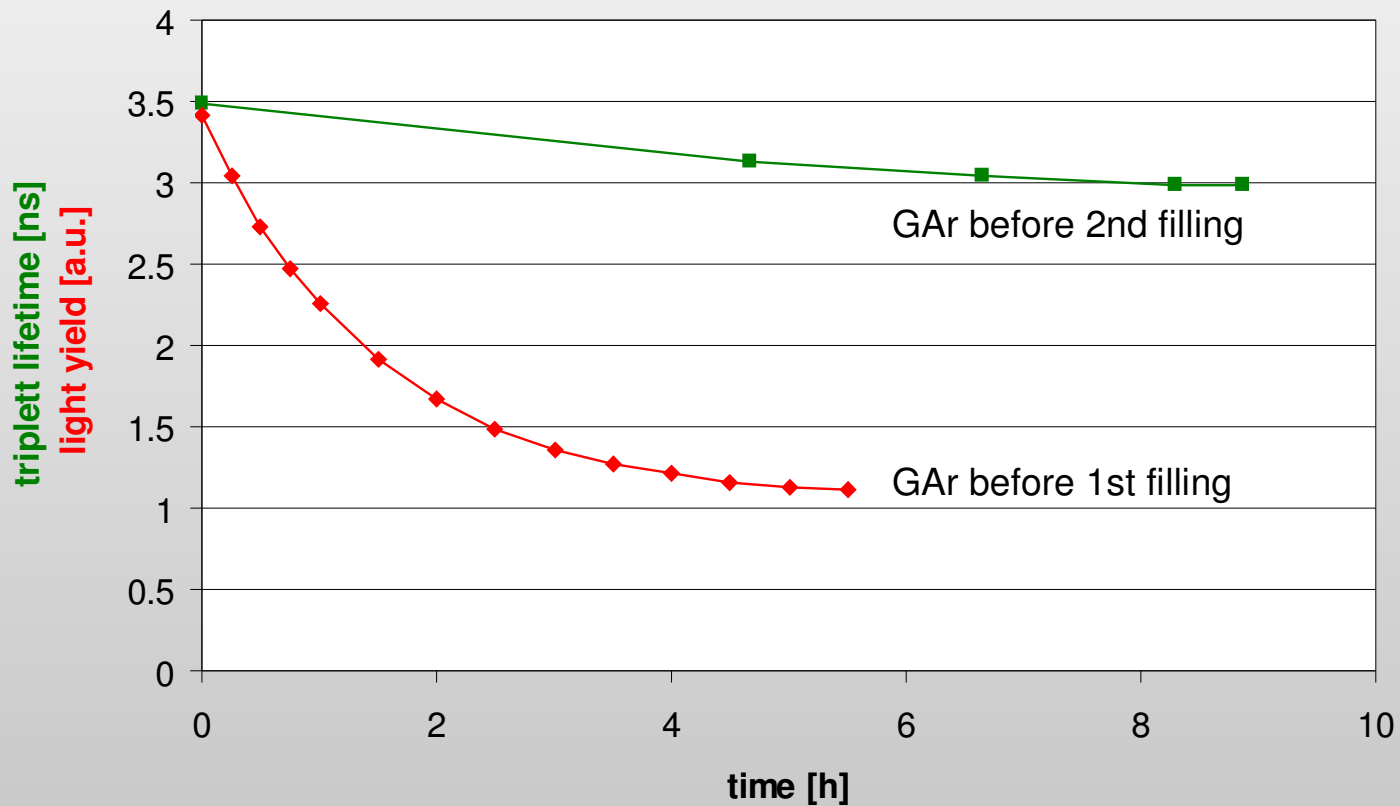
- cryostat with GAr again
- support compensator to allow for pumping the cryostat
- degass from air residues by
  - heating up cryostat ( $15^{\circ}\text{C} \rightarrow 40^{\circ}\text{C}$ )
  - & perform flushing-pumping cycles

# After Modifications: N<sub>2</sub> and O<sub>2</sub> constant vs. time

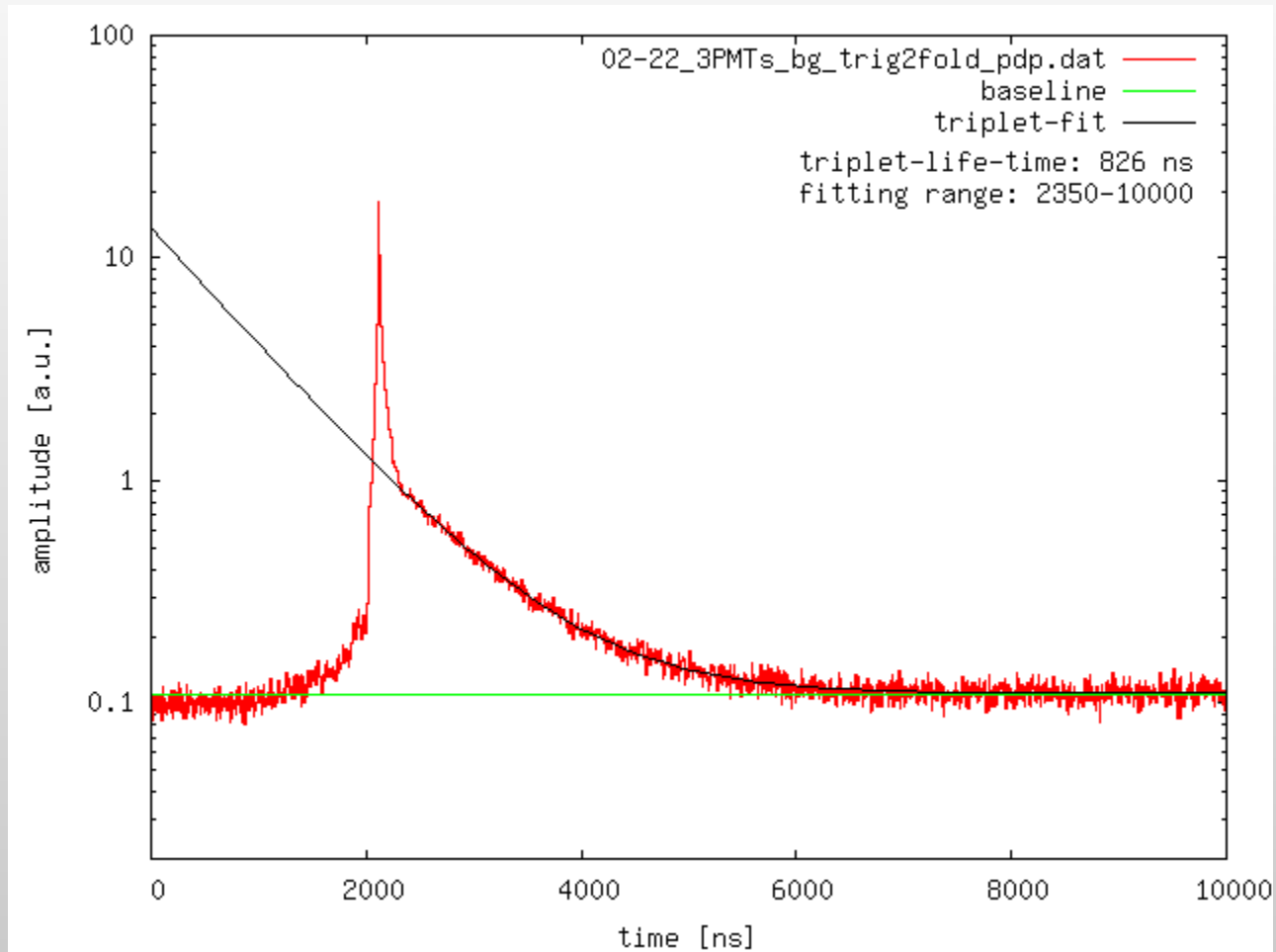


# Light Degradation Measurements in GAr (2)

february `10: triplet lifetime in GAr is much more stable than before 1st filling



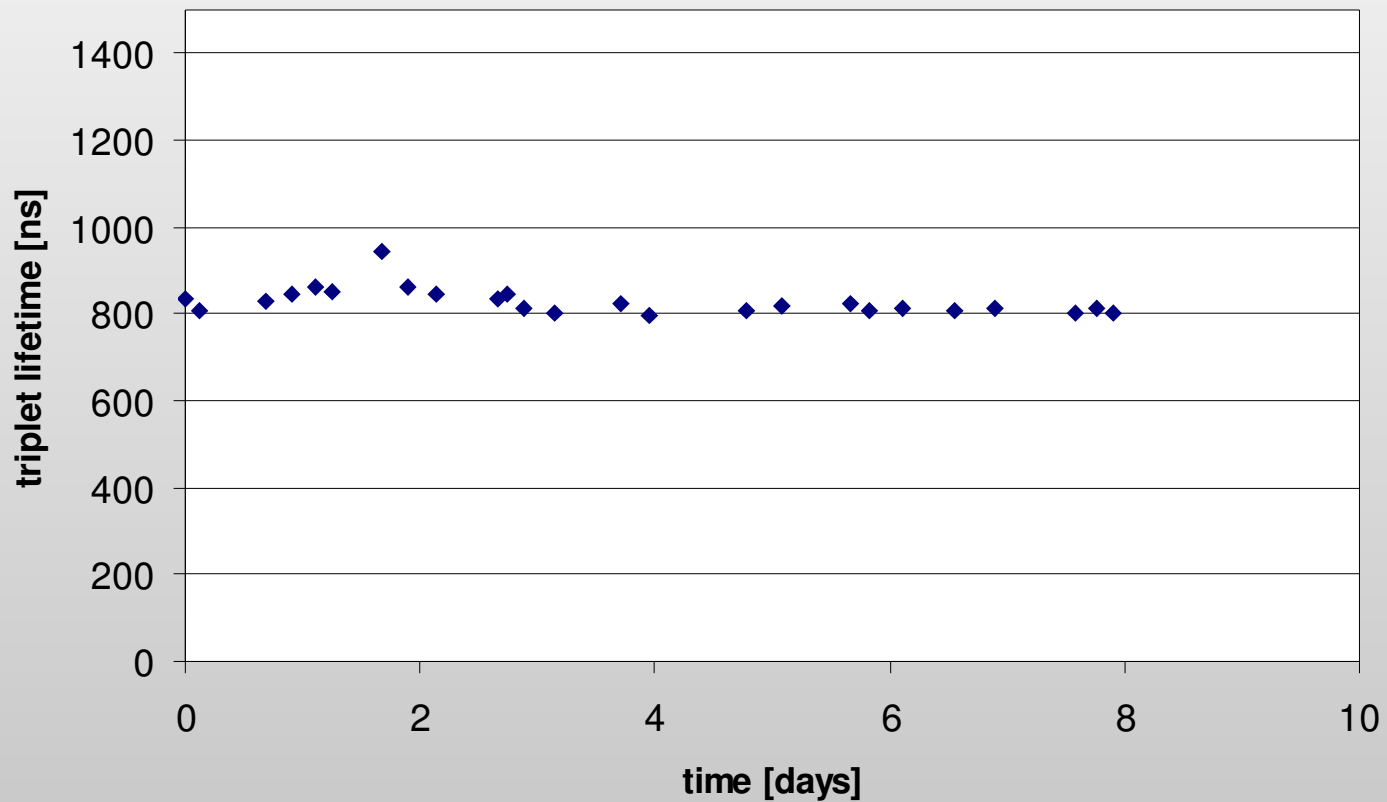
# 2nd Filling: Average Pulse Shape in LAr



3 PMTs, 2-fold trigger, no source

## 2nd Filling: Triplet Lifetime Stability in LAr

feb-mar `10: triplet lifetime in LAr is stable since 8 days



# Conclusions & Outlook

- LArGe is filled with LAr & the scintillation light is stable since 8 days
- the triplet lifetime is
  - GAr: 3.5  $\mu\text{s}$  @ 950 mbar (ref. 3.2  $\mu\text{s}$  @ 1100 mbar)
  - LAr: 829 ns (lit. 1.1 to 1.7  $\mu\text{s}$ )
  - Mini-LArGe result: ~790 ns (@LNGS with Ar5.0),  
1.2  $\mu\text{s}$  (@MPIK with Ar5.4)
- active cooling with LN runs very smooth  
→ good control over pressure & stable LAr filling level
- now we can start to study spectral properties of scintillation light in LArGe (light yield, resolution...)
- eventually (april?): mount lock and enter BEGe's