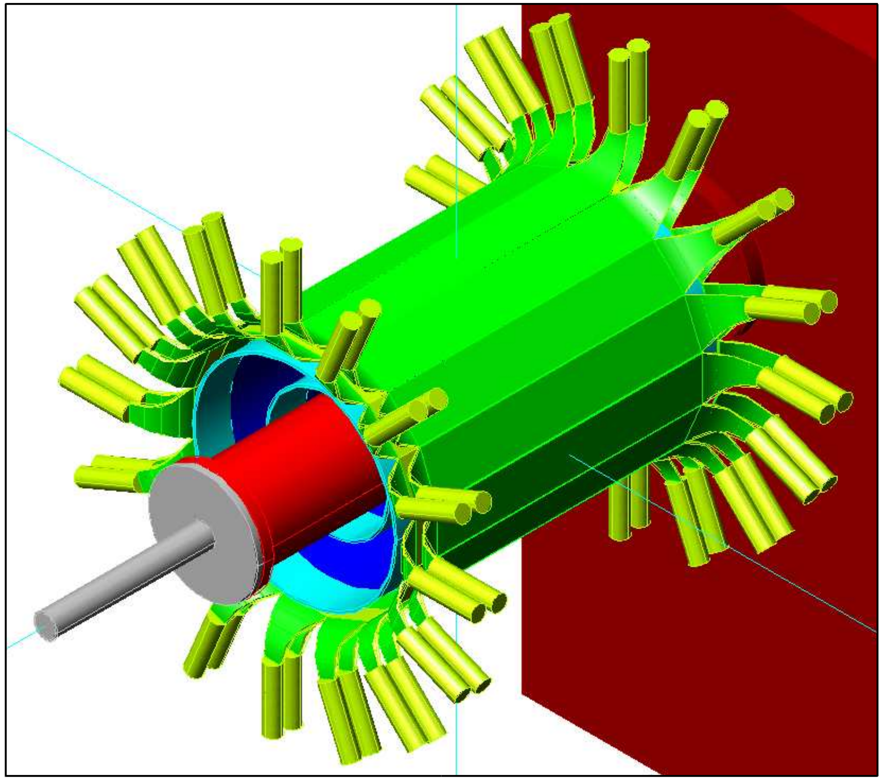
MuCap Run8: Impurity Report



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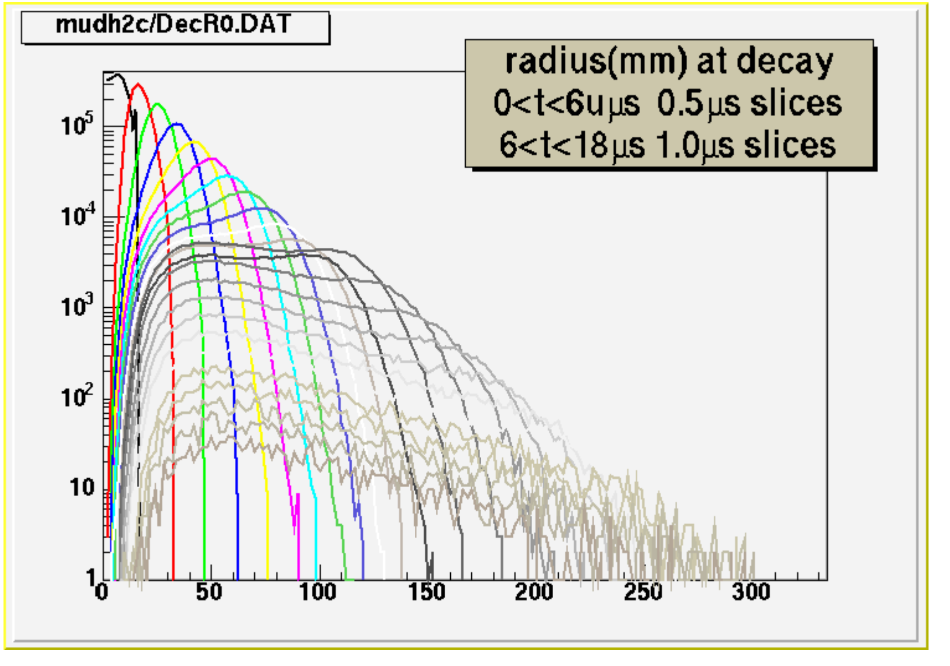
Impurity Types

- Deuterium
- High-Z impurities

Deuterium: Overview

Deuterium is problematic primarily because of the mu-d atom's rapid diffusion away from the muon stopping point. This can lead to wall captures and (especially when impact parameter cuts are used) produce time-dependent distortions in the muon lifetime histogram, which, hopefully, can be corrected for.

I *think* mu-d fusion effects are sufficiently small that no correction is necessary for that particular process.



Deuterium: Protium c_d Measurements

The hydrogen gas in MuCap Run7 (Fall 2003) and Run8 (Fall 2004) was produced from 5 liters of deuterium-depleted water. This water was originally purchased from Ontario Hydro in August 2002 (specs?).

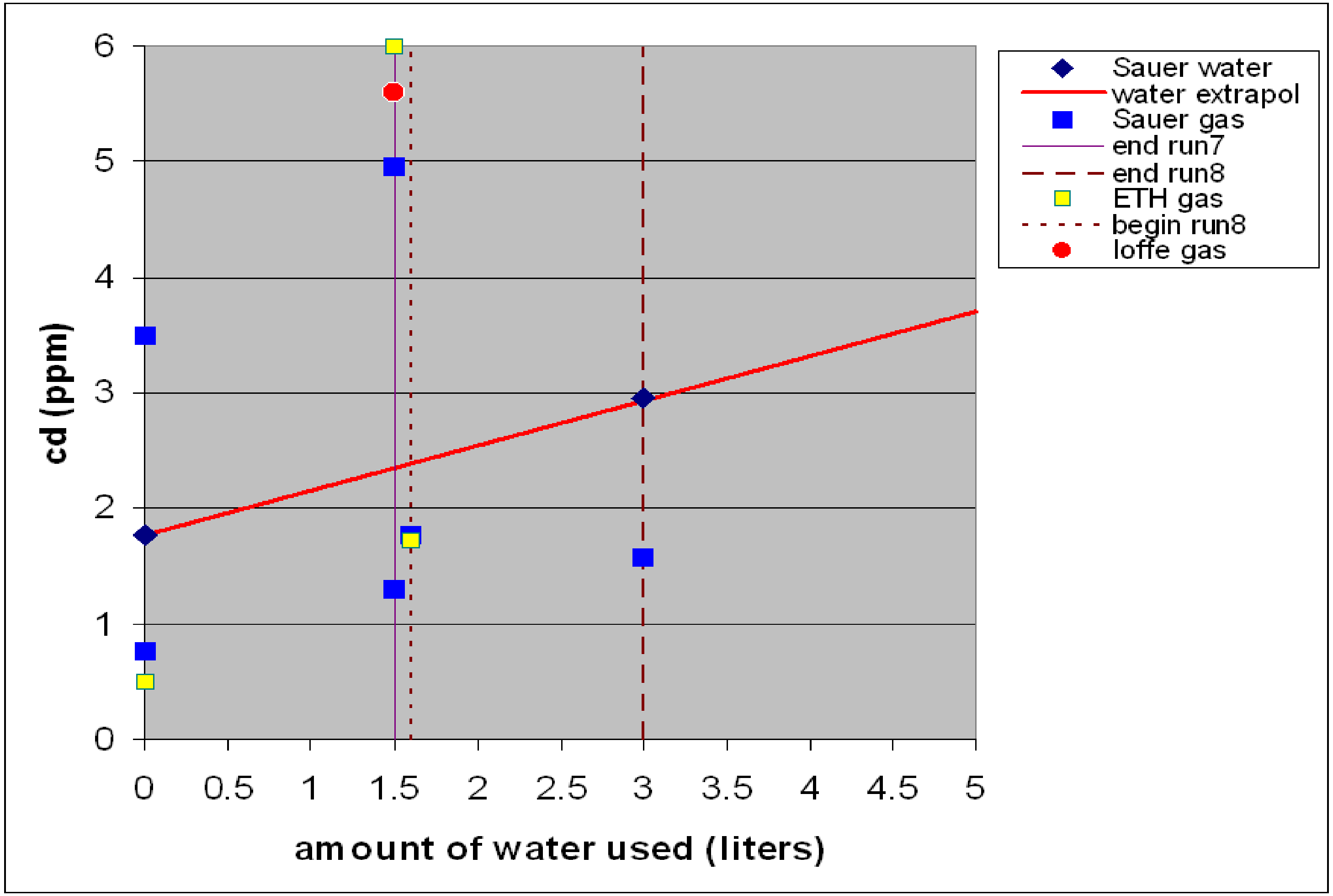
We have commissioned several measurements of the Ontario Hydro water's deuterium concentration, but the results have been inconclusive. These results are summarized in 2 Analysis-Run8 ELOG entries:

Francoise's summary of Claude's reports:
http://kaon.physics.berkeley.edu:8080/analysis-run8/35

Peter's graphical summary of Francoise's and Claude's reports:
http://kaon.physics.berkeley.edu:8080/analysis-run8/36

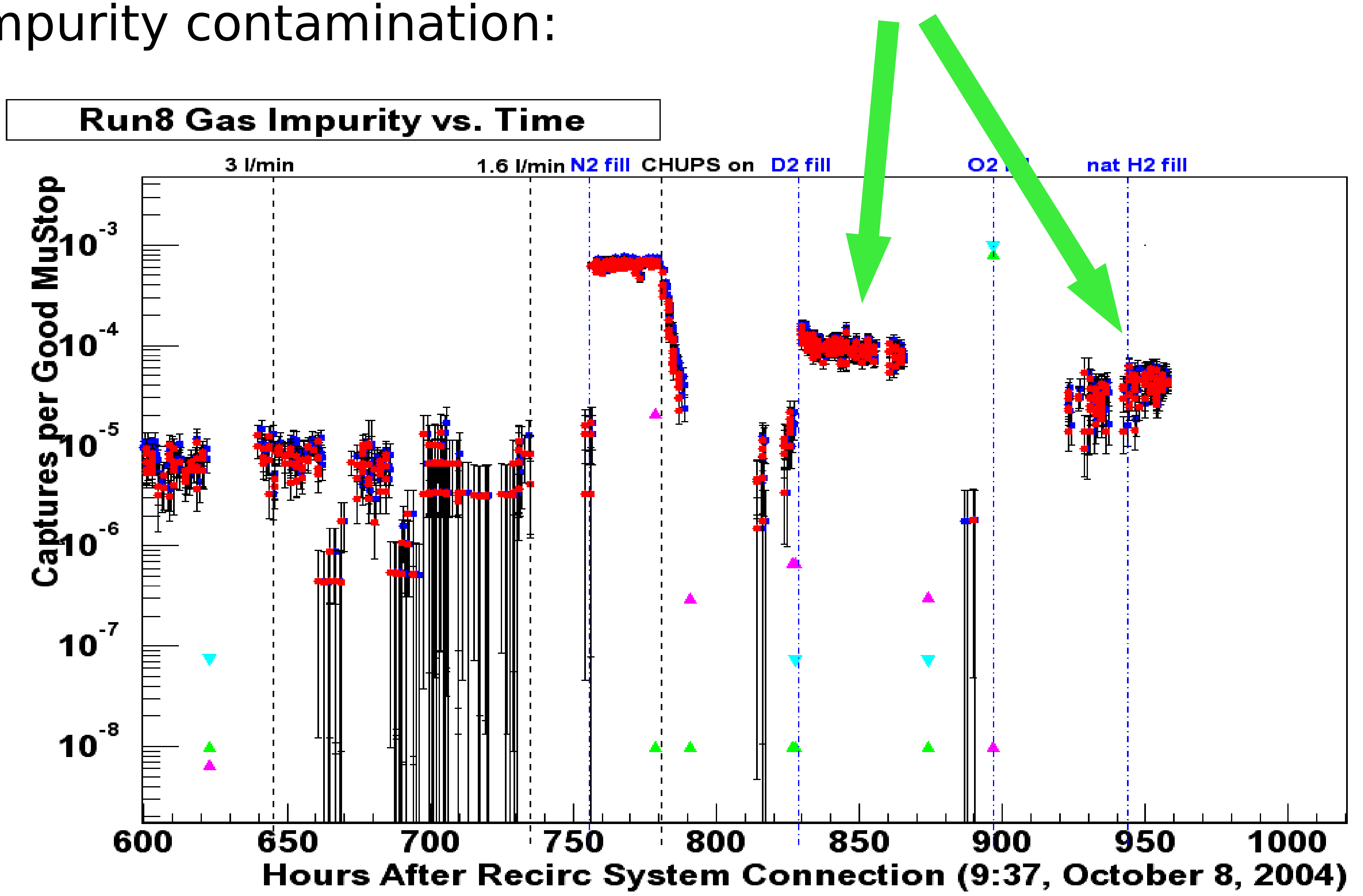
Deuterium: Protium c_d Measurements

Here is Peter's graphical summary of the deuterium concentration measurements (from Analysis-Run8 ELOG #36):



Deuterium

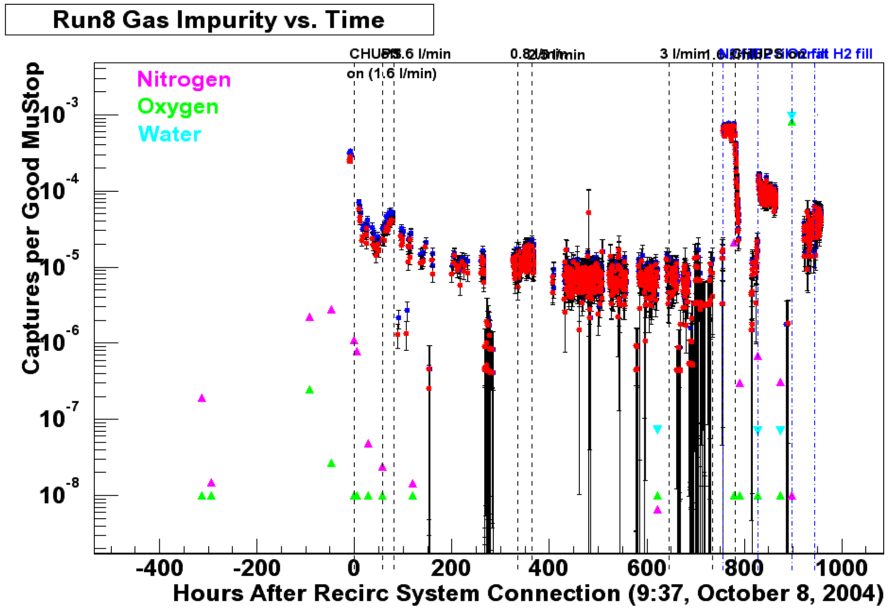
The run8 deuterium calibration runs suffered from high-Z impurity contamination:



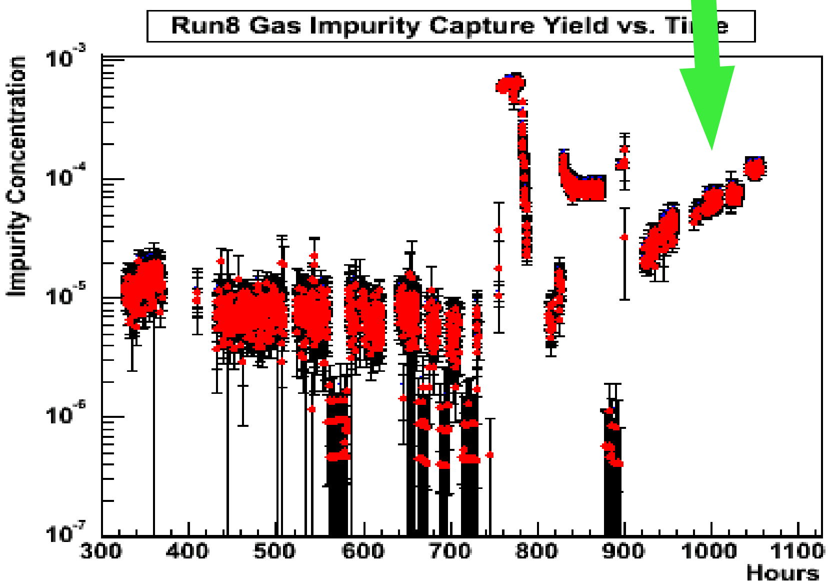
Impurities: High-Z

The compiled results from our impurity analyses (software and chromatographic) at the end of Run8 are shown in the plot below. We know about as much now as we did then (maybe less).

(from http://kaon.physics.berkeley.edu:8080/run8/1112)



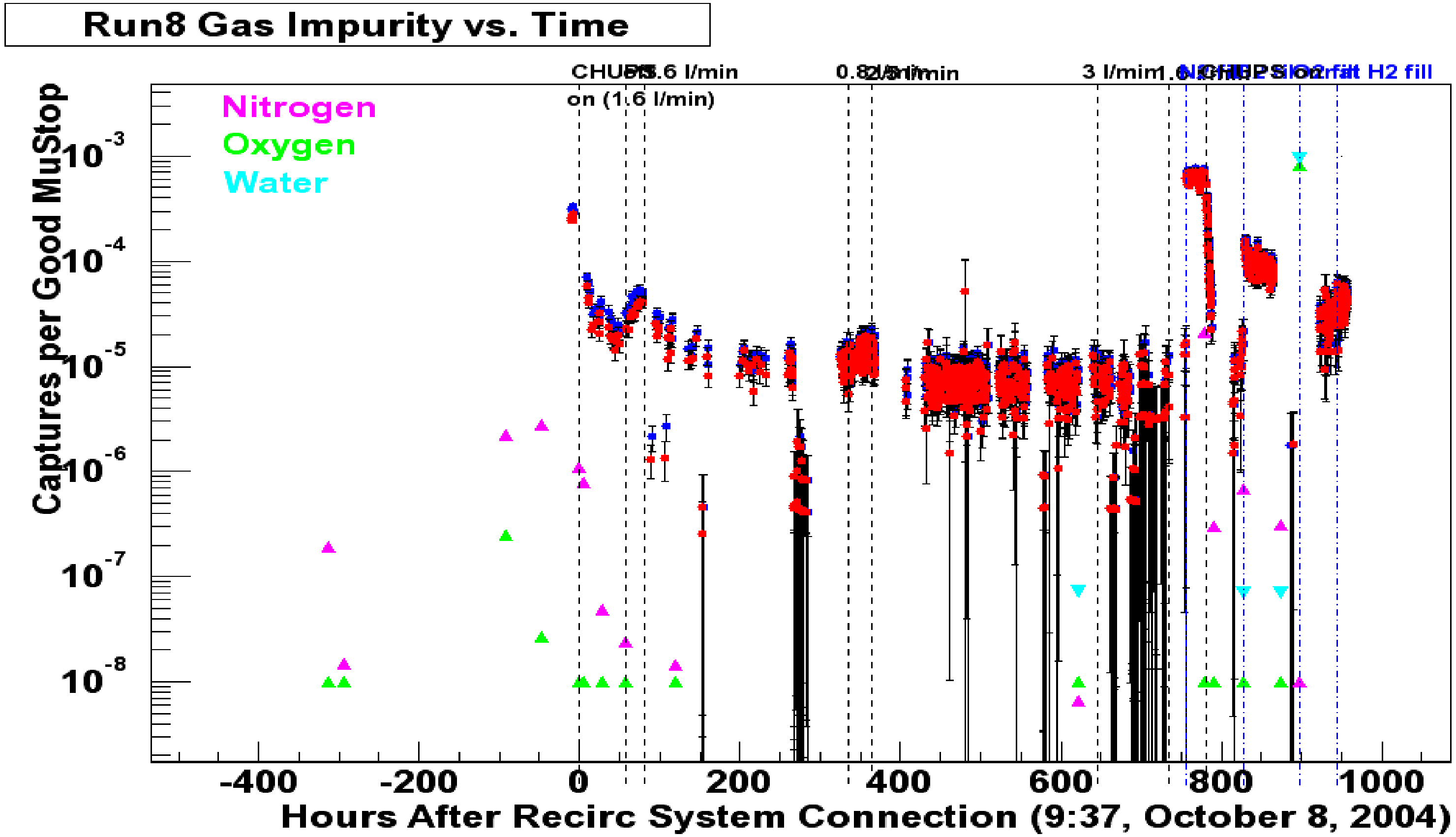
New H20-fill points from pass0 analysis



Impurities: High-Z

I should mention that I recently realized that, due to misordering of my fiducial cuts and electron suppression, my impurity yield ratios are underestimated by ~ 30%.

(from http://kaon.physics.berkeley.edu:8080/run8/1112)



Impurities: High-Z

Some documents of interest:

1. *Bernhard's summary of our Run8 impurity information (Dec. 10, 2004),*
   http://kaon.physics.berkeley.edu:8080/analysis-run8/3
   followed by some comments from Malte:
   http://kaon.physics.berkeley.edu:8080/analysis-run8/4

2. *Bernhard's report on outsourced gas sample analysis results (Jan. 14, 2005):*
   http://kaon.physics.berkeley.edu:8080/analysis-run8/14

3. *Oleg's reports on his Run8 FADC impurity analysis:*
   http://kaon.physics.berkeley.edu:8080/analysis-run8/7 *(Dec. 16, 2004)*
   http://kaon.physics.berkeley.edu:8080/analysis-run8/15 *(Jan. 20, 2005)*

Impurities: High-Z Questions

- How do we reconcile the inconsistent impurity measurements? Just make a decision to stick with one or another?
- Where does our clean run set “begin”? (i.e. at what time after CHUPS was turned on?)
- Can we determine the dominant impurity by the EH/EVH ratio?
- We need to flesh out the correction mechanism more thoroughly (see systematics presentation).