
TRT Detector Status Report

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After a successful run 1,
the TRT subsystems are getting
ready for run 2

Covered in this talk:

- Active gas
- High voltage
- DCS
- DAQ
- Radiation damage





During 2012 run, large leaks appeared in pipes due to stress corrosion+ozone

- thanks to excellent work by TRT gas team, data quality was not affected
- all accessible leaks are now fixed
- if the worst offending lines are run with Argon, hope to reach design loss (100 l per day)
- final configuration to be decided end of next year

Modifications of the gas system

- more precise pressure control to get the pressure around the leaks close to atmospheric pressure (valve repairs, feedback, tuning of regulation algorithm)
- remote control via DCS (no access to the racks needed if adjustments necessary)
- implement Argon-mix flow in addition to Xenon-mix flow (racks, pipes)
- general maintenance and upgrades for safety/reliability

Work in progress but for some tests the full system is needed (hopefully can start these using Argon-mix in February)

Work synchronized with the CERN gas group



Work by the gas group follows two objectives

- run as much of the detector with Xenon-mix for as long as possible in run 2
- be prepared to run parts of the detector for Argon-mix

Studies *ongoing* for Argon-mix:

- tested combined running mode in 2013
- tracking not affected
- of course, no transition radiation (important for electron-jet discrimination)
- pulse shapes
- MC simulations to optimize the detector configuration and running parameters for minimum impact on physics
- offline performance (see next talk)



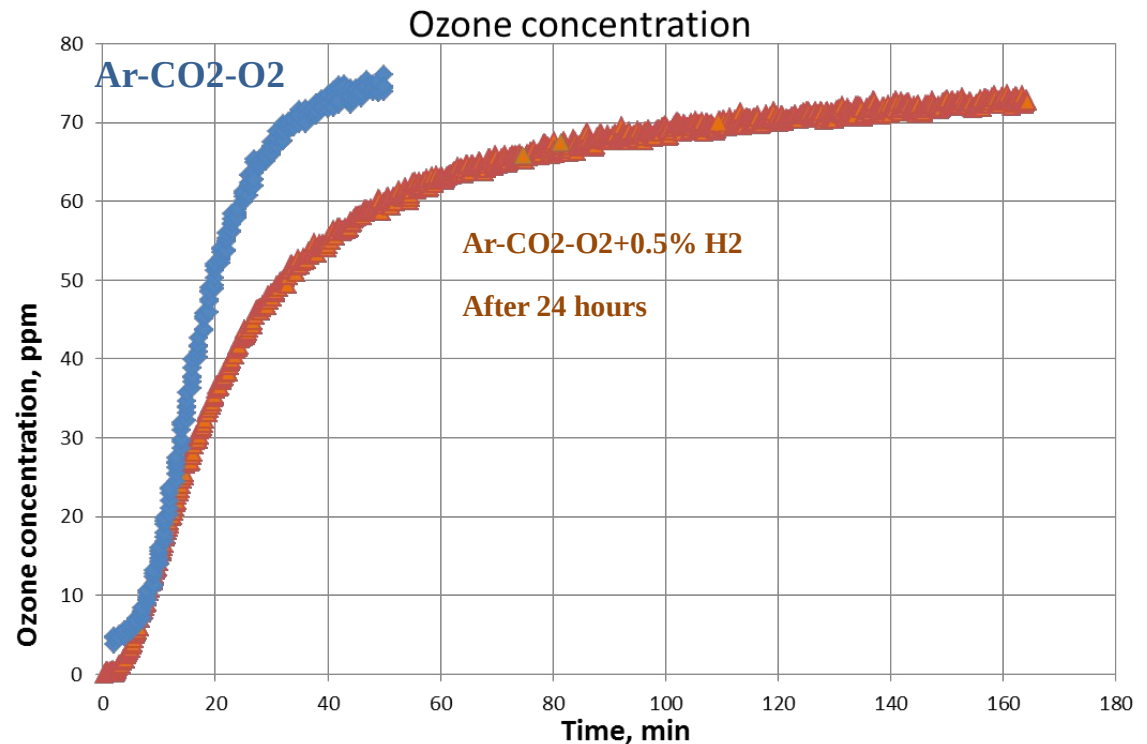
Can we add a gas to the mixture to reduce the ozone concentration at the detector exit?

- need to make sure that operation stability not compromised (ozone processes complicated)
- studies in progress, tested gases so far: N₂O, H₂
- N₂O has no affect
- H₂ affects ozone concentration, but no long-term improvement seen

---> more checks

---> test other gases

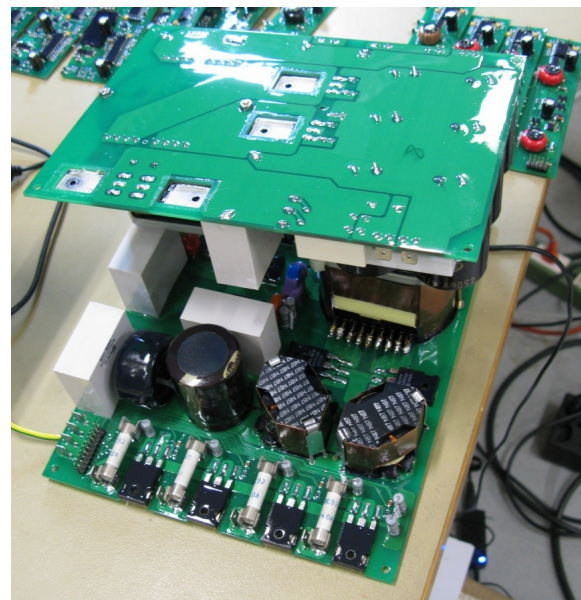
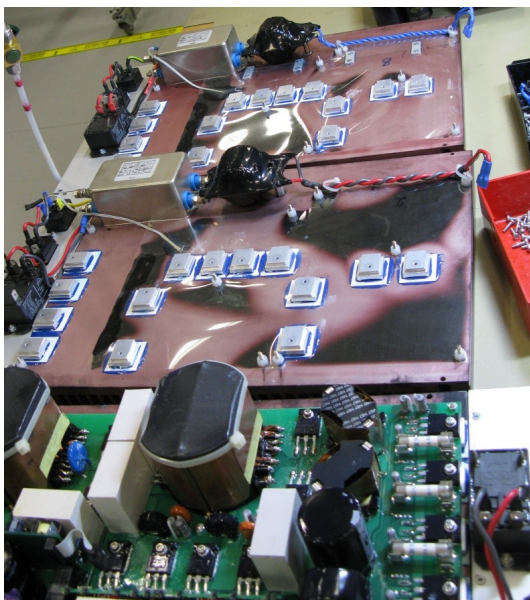
Development of ozone concentration over time when irradiated with x-rays, for two gas mixtures





Maintenance and upgrades

- protective lacquer applied to boards in high voltage power supply crates against dust to avoid shortcuts *done*
- test of all crates/spares *done, all ok*
- installment of a filtering system to prevent dust flow *to be done*
- firmware upgrade to increase operation speed *done*
- high voltage calibration *this year*



Disassembling of HV crates, and covering with lacquer



Low Voltage and Temperatures:

- new communication protocol *implemented/tested*
- TRT Framework Component modifications *well advanced*
- final tests on 1/4 of detector, full system migration *this year*

High Voltage:

- new HV controller firmware *implemented/tested*
- OPC server development (TRT-HV specific) *work in progress*
- final tests on 1/3 of detector, performance optimization and full system migration *this year*

Infrastructure Local Control Station (for Low/High voltage etc.):

- tests with new hardware in USA15 *implemented/tested*
- full system migration *this year*

Subdetector Control Station:

- Linux SLC5 now , migration to SLC6 *this year*
- implementation for new hardware in gas system *pending other updates*

Gas Gain Stabilization System:

- Commissioning of the new system (with new hardware) in Cracow *work in progress*
- commissioning at CERN *this year*



Tackling the front-end – ROD bandwidth limit

- reduced readout (chop off last 4 of 27 data bits per straw word)
allows 105 kHz rates *implemented/tested*
- minimal impact on tracking (leading edge not affected)

Tackling the ROD processing limit (event processing time proportional to occupancy due to compression)

- application of validity gate (straw considered empty if no signal in certain time window) reduces occupancy *implemented/tested*
- clock speed update on ROD board *to be done*
- hard-coding of most common straw patterns to increase speed of compression *to be done*



Hardware

- crate power supplies: new fans, higher current limits for endcap in preparation for higher load in run 2 *done*
- low voltage power supplies: rolling upgrade in progress to improve voltage stability by gold-plating the connectors *on schedule for run 2*
- recovering of spares where possible

Software

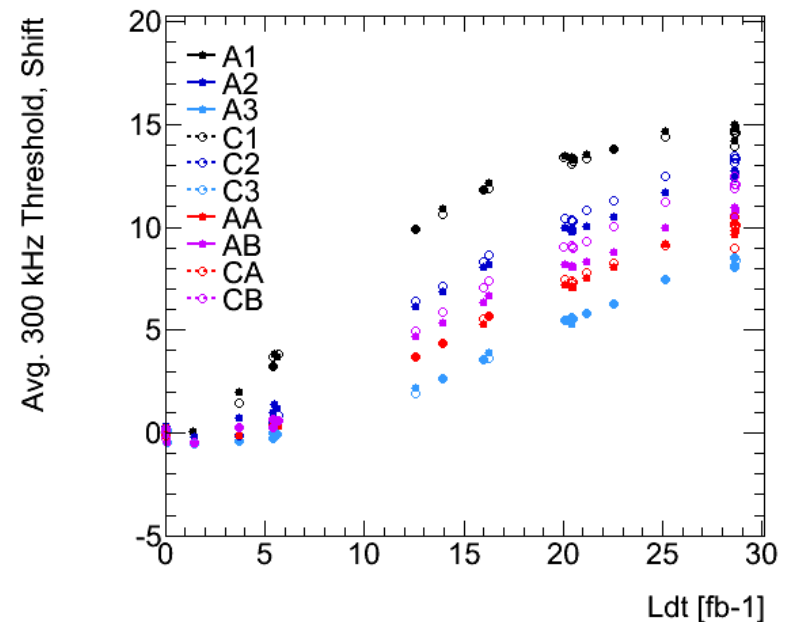
- migration to SLC6 *according to central schedule*
- migration to new TDAQ release *planned for January*



Radiation damage of front-end electronics

- effects seen at lower total ionizing doses than expected
- flattening off
- to check if initial effects were missed during earlier tests, new irradiation tests of front-end board (lower rates, lower total doses) *work in progress*
- first thoughts about high threshold calibration to react to radiation effects during run 2 *to be done*

Absolute change in the threshold needed for a 300 kHz noise rate, vs integrated luminosity in 2011+2012





- preparations for run 2 well under way in all subsystems
 - general system maintenance
 - upgrades in reaction to problems seen in run 1
 - upgrades to improve general stability
- lots of work still to be done
- planning to be included into second milestone run (end of March)