

Title: A Study on the Aging of the Straws in the ATLAS TRT

I. Introduction

- Discuss ATLAS
- The role of TRT and the issue of aging.
- Organization of the note.

II. TRT Detector

-Components

-Barrel

-Diagram of phi modules and Layers in the Barrel

-End-cap

-Diagram of the wheels and gas flow in the End-cap

-Gas

-Originally: 70% Xe 20% CF₄ 10% CO₂

-Benefit: CF₄ inhibits or removes silicone-based wire deposits

-Issue: Degradation of glass wire joints and if combined with 1000 ppm of water leads to production of hydrofluoric acid.

-Currently: 70% Xe 27% CO₂ 3% O₂

-Benefit: O₂ combined with CO₂ provide good stabilization to UV photons, and unlike hydrocarbons it doesn't tend to polymerize.

-Issue: Doesn't inhibit/remove silicone deposits as well. O₃ production and avalanches.

III. ATLAS Data

- Discuss the data used.

IV. TRT aging issues.

- Explanation of aging

- Cleaning

- Mention method of cleaning and the issues. (Anatoli)
- Create method of monitoring aging.

V. Monitoring Aging

- Explanation of Method for Barrel
 - Degradation will be most visible on HT hits
 - Define efficiency as HT/All and make a plot vs. z
 - Example Plot of HT/All*
 - Take Input A efficiency – Input C efficiency/(2* ave. efficiency) to get the percent efficiency drop in the module.
 - Fit a slope as a method of comparing the degradation in the straw.
 - Example plot of delta eff/ (2 ave eff)*
 - Discuss meaning of a positive slope.
 - Motivate studies of efficiency vs. Integrate (Instantaneous) Luminosity.

VI. Results in Barrel

- Show and example plot for a single data period Layer 1, 2, 3 (show all data periods or just have an appendix?)*
 - Discuss meaning of a positive slope (eff. Decreases along gas flow), Decrease in effect with radial position
- Show plot of slope vs. Integrated Luminosity.*
 - Discuss increase with time.
 - Does not rule out ozone because there's also been an increase in inst. Luminosity.
- Show plots of Short Straws (1 data period or all?)*
 - What can short straws tell us?
 - Effect is stronger in negative z, and resets.
 - Originally thought this was proof of aging, but ozone can decay in non-active region.
- Trend of $\langle dEdx \rangle$ vs $\langle \mu \rangle$ increasing with time

-Plot of $\langle dEdx \rangle$ vs. $\langle \mu \rangle$

-Can this explain aging?

-Aging vs. Ozone

-Motivation:

-Problem with O_2 is avalanche of O_3 .

-Effect would get worse along with gas flow, while aging might affect the input more than the output.

-Dependent on inst. lum., so with the increase in detector energy over time we would see an increase in ozone production.

- $\langle \mu \rangle$ discussion.

- $\langle \mu \rangle$ is an estimator of instantaneous luminosity.

-2 methods of estimating ozone with $\langle \mu \rangle$

-Within a data period: Compare high/low $\langle \mu \rangle$

-Same $\langle \mu \rangle$ comparison: $14 \leq \langle \mu \rangle \leq 16$

-Plots of high/low $\langle \mu \rangle$ comparisons (1 data period or all?)

-Discussion. High $\langle \mu \rangle$ is not much larger than low $\langle \mu \rangle$, less likely it is ozone.

-Plots of $14 \leq \langle \mu \rangle \leq 16$ (1 data period or all ?)

-Discussion. See a rising trend in Layer 1, 2 while Layer 3 looks constant. Does this indicate aging over ozone?

-Ozone build up discussion

-Takes ~ 30 mins for ozone to accumulate. We will look at the first 30 minutes to see if there is an effect.

-Plot of LBO, discuss first 30 mins after interactions.

-Plots of Layer 1, 2, 3 for first 30 LBN.

-There seems to be an effect. This seems to indicate aging although there could be other effects like temperature.

VII. Results in Endcaps (not finished yet)

-Follow same form as results from Barrel

-If results are different try to discuss why this might be

-Plot of HT/All vs R

-Plot of HT/All vs. Z (to increase in eff. With z)

-Plot of HT/All vs. R for individual B wheels (try to explain weird shape)

VIII. Conclusions

-There is some sort of degradation effect in the TRT straws

-In the barrel the effect gets worse along gas flow.

-Endcap statement.

-The effect is getting worse with increased luminosity.

-The $\langle \mu \rangle$ plots along with the first 30 LBN plots seem to indicate aging over ozone, although the results are not definite.

-Future plans:

-Include plots in Offline Shifter histograms as a way to monitor aging.

-See if the effect gets worse or is fixed with the turn on in 2015.

-Try to figure out the method of aging, why would it get worse along gas flow?

IX. Appendix

-Plot of all the data periods if we decide not to include this in the earlier sections.