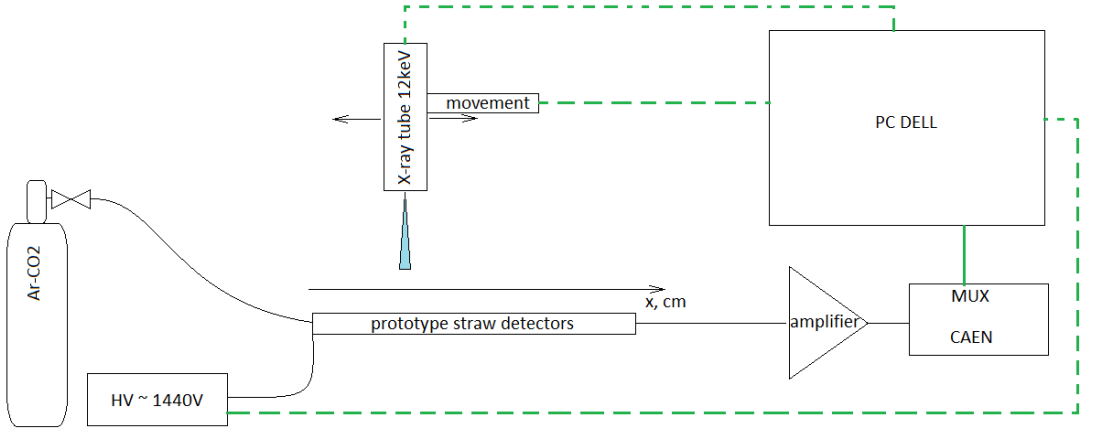
The ATLAS TRT ageing laboratory

Introduction

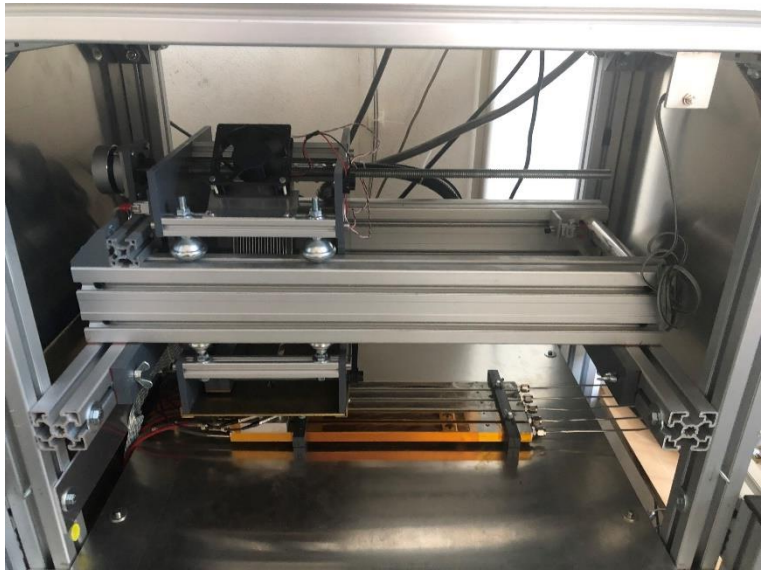
- TRT anode wires will accumulate more than 10 C/cm. Special measures are taken to avoid ageing effects.
- Lab started to operate more than 20 years ago as a detector material validation lab. on the basis of Fabio Sauli set up. It operates now in a continuous mode.
- All TRT detector components in the past and now are checked for ageing.
- Special ageing validation procedure was developed and used during tests.
- Two types of ageing effects may happen in the TRT straw chambers - silicon and organic deposition on the anode wires
- The sources of silicon or organic ageing are traces of oil, lubricants or components of used material which pollute the active gas.
- For ageing tests straws similar to the ATLAS TRT are used.
- After tests if straws showed ageing potentially can be polluted. Usually they can be are recovered after operation under radiation with Ar+CF4 + CO2 mixture.
- Now set-up works in a fully automatic mode.

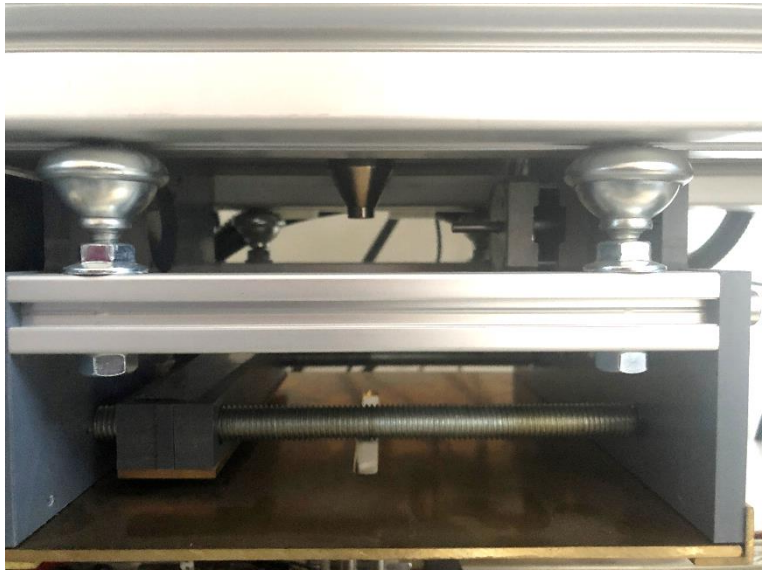
- Gas mixture Ar-CO_2 70%-30%
- Gas flow 10x nominal: 1.5 cm^3/min/straw
- Voltage V = 1440 V
- Current density: 100 nA/cm
- Exposure collimator – 10mm
- Scanning collimator – 1 mm
- Validation time: 150 - 200 h

Principal scheme of the TRT ageing setup.



TRT automated ageing setup

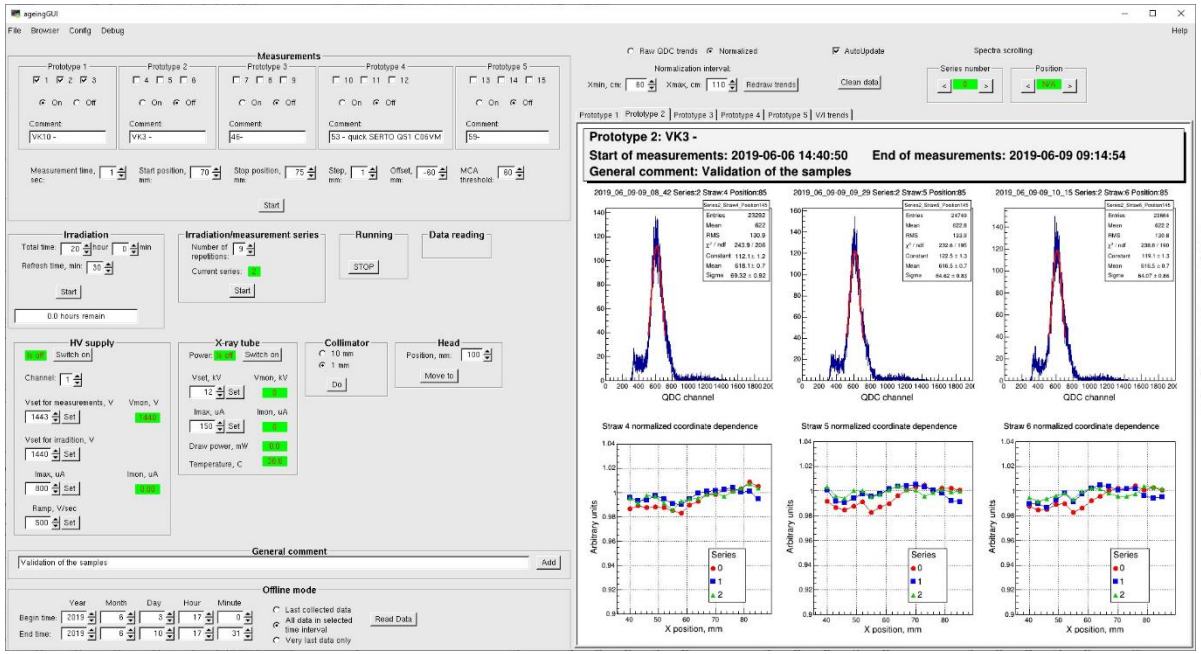




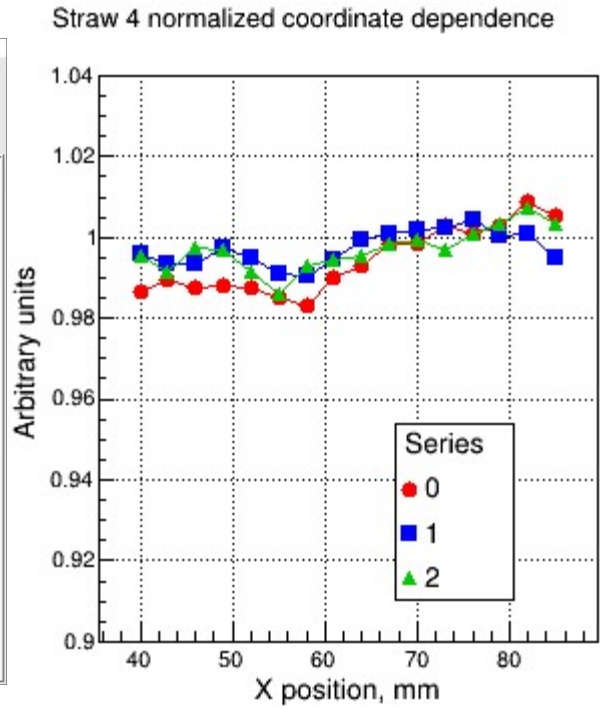
- Gas mixture: bottle -> pressure regulator -> flowmeter -> prototype
- High Voltage, power supply CAEN, remote control via USB
- Movement system & Collimator with microcontroller
- Mini-X X-ray tube
- Signal via amplification and MUX send to analyser CAEN
- Software and user interface to control the setup

TRT automated ageing setup

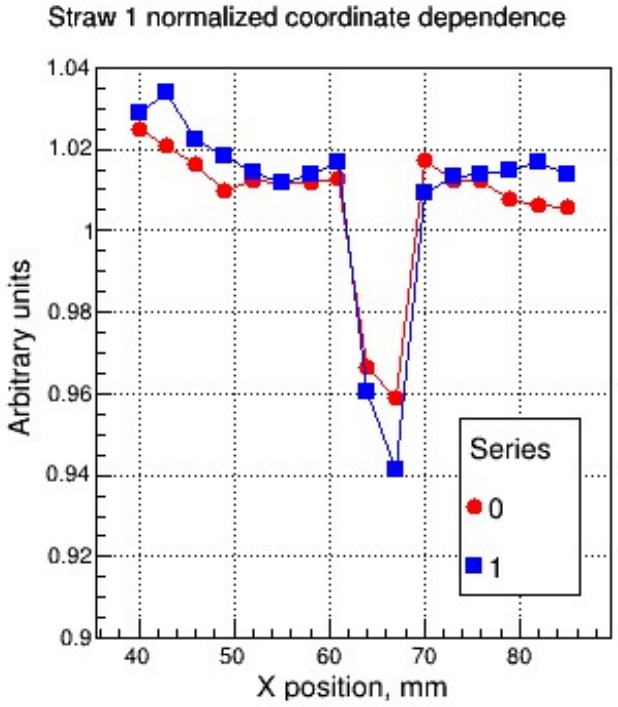
The test consists of cycles of x-ray exposure and scanning with a narrow X-ray beam along the straws.
Signal amplitude is measured during the scan. At chosen operation conditions 200h irradiation considered to be sufficient to take acceptance decision.



Expert's interface with general settings and presentation of results



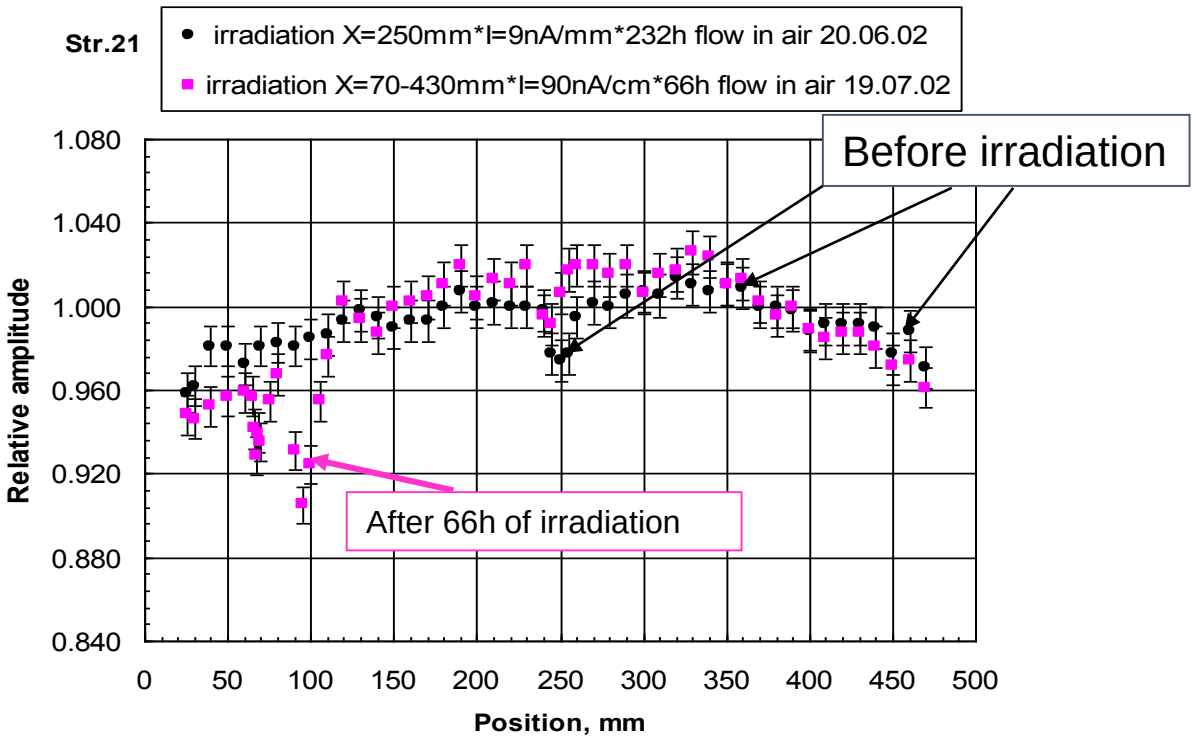
This is example of plot of amplitude scan of the straw with no Ageing seen after X-ray exposure

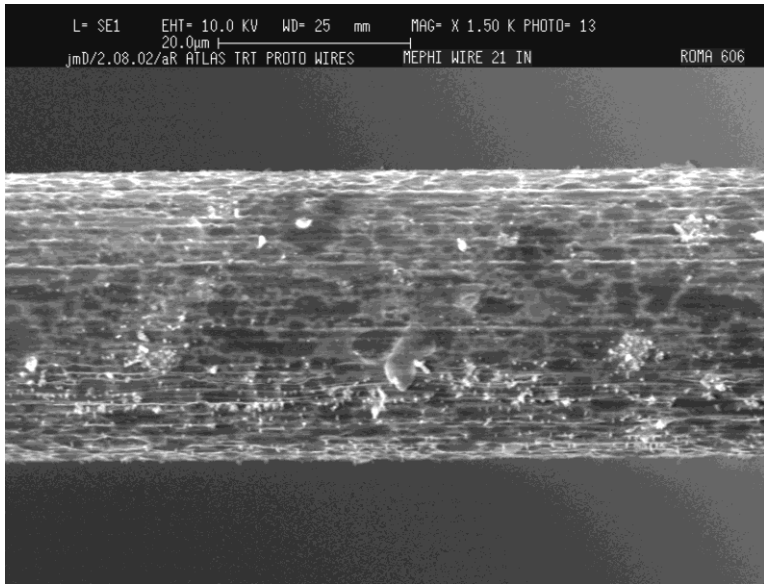


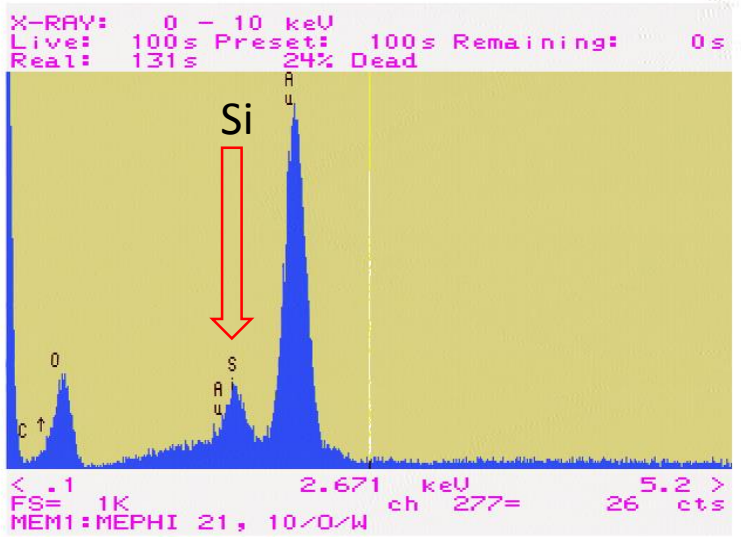
This is example of plot of amplitude scan of the straw with Ageing. It is Si - ageing seen in the exposure region of 65mm.

Back up slide

Si ageing in the Xe-CO_2-O_2 gas mixture







The most probable reason for this effect is Si pollution of the gas system components (residual of the Si-based lubricants).
Aging happens at the beginning of the irradiation area.