Small-strip thin gap chambers (sTGCs) will be used to track muons in the ATLAS experiment at CERN. For precision tracking, the position of the internal electrodes must be known to within 100 μm.

**GOAL:** Validate measurements of strip electrode positions using cosmic muon data.

### sTGCs
- **Multiwire ionization chambers** that hold thin gas volumes held under $E$
- Strip electrodes pick up signal caused by a muon’s ionization avalanche
- Four sTGCs are glued into a **quadruplet** so muon tracks can be reconstructed locally (see fig. 2)

![Fig. 1: sTGC internal structure.](image)

### Cosmic Muon Data
- Quadruplets are characterized using cosmic muons
- Scintillator + PMT array provides trigger to readout quadruplet
- See fig. 2 for how cosmics data can be used to study relative strip positions

### Effect of Misalignments
- Local offsets between strip layers shift the reconstructed muon position
- Track residuals are a measure of relative strip offsets between layers

![Fig. 2 Abstraction of sTGC quadruplet and effect of local strip offsets on track residuals.](image)

### Results
- Compare x-ray residuals to mean cosmics residuals for each quadruplet and all choices of reference layers

![Fig. 3 Mean cosmics residuals on layer 2 w.r.t layers 1 and 4 for quadruplet QL2.C.4. The x-ray residuals (in mm) are represented by the annotated black points.](image)

### X-ray method for strip positions
- Measure local strip position w.r.t alignment platform by reconstructing x-ray beam profile centroid
- Compare to perfect geometry
- To compare to cosmics, calculate residuals in same way as fig. 2

![Fig. 4 Mean cosmics residuals compared to corresponding x-ray residual for all reference layer choices for QL2.C.4.](image)

### Summary
- Relative strip positions measured using cosmics data are correlated with x-ray position measurements
- Next step: Use cosmics data to further constrain strip positions