Update on the 2021 SVT alignment

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Introduction

- Upgraded to official FEE triggered datasets
- Attempted alignment of run in ~middle of dataset
- Studied run-by-run alignment and devised run dependent alignment corrections

Upgrade FEE dataset

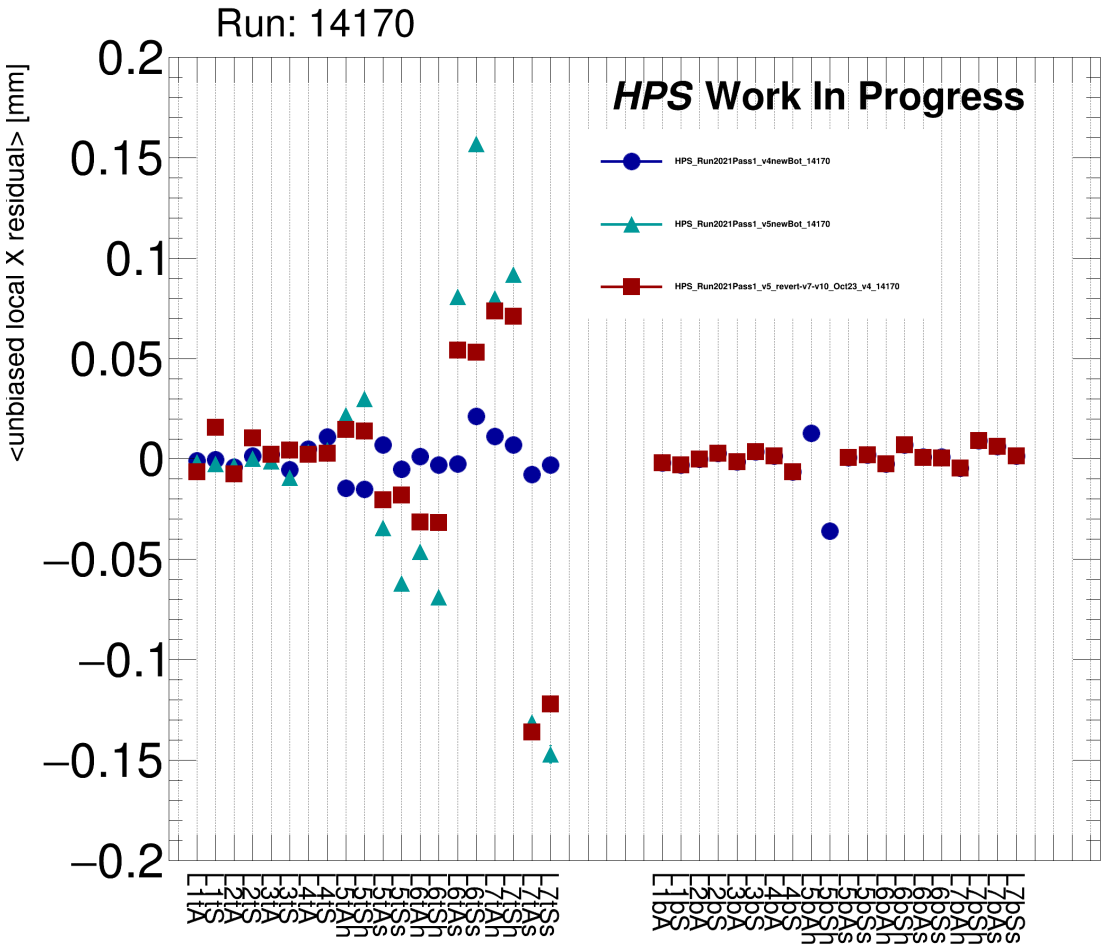
- Rory helped to retrieve FEE triggered datasets from JLab and transfer to them SLAC (thanks!!)
  - Previous FEE filtered datasets that I produced and reported on last time were contaminated by a lot of non-FEE events (non-optimal selection on my end)
- Transformed from EVIO to SLIC, and ran the momentum constrained alignment driver over SLIC files
- Compare performance of the v4 and v5 detectors as a function of run number, along with an additional detector that I have been tuning on the middle dataset run over the last weeks

Tuning on Run 14432

- Attempted an alignment using an existing FEE dataset, where neither the v4 and v5 detectors gave satisfactory performance (in terms of u-residuals)
- Started with the v5 detector as input, however:
  - Many residuals showed slopes which seemed to be related to existing Rw's — decided to set these to zero and restart from scratch (kept the tu's)
- In the plots, this new detector goes by the name
  - "*HPS Run2021Pass1_v5-revert-v7-v10_Oct23_v4*"

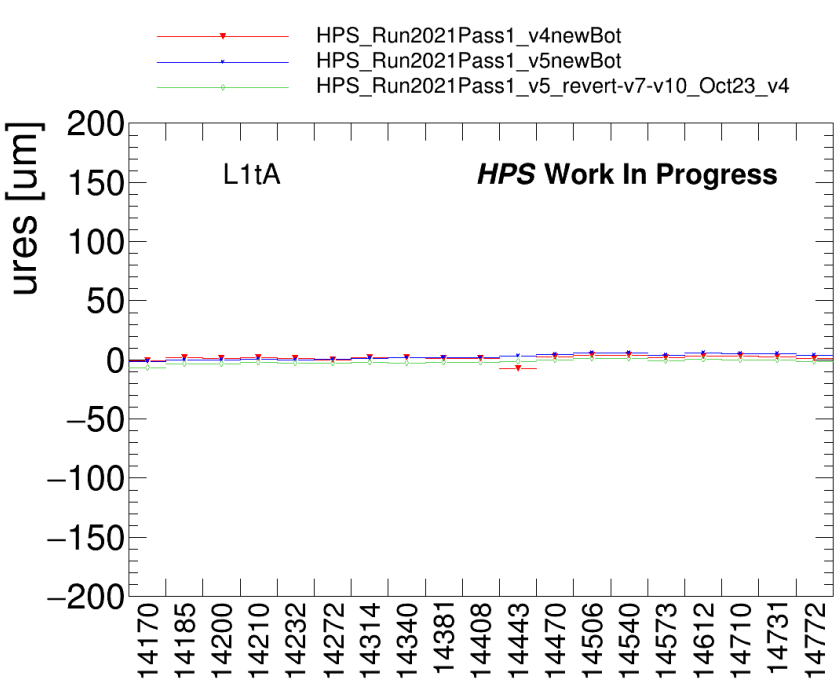
Unbiased residuals

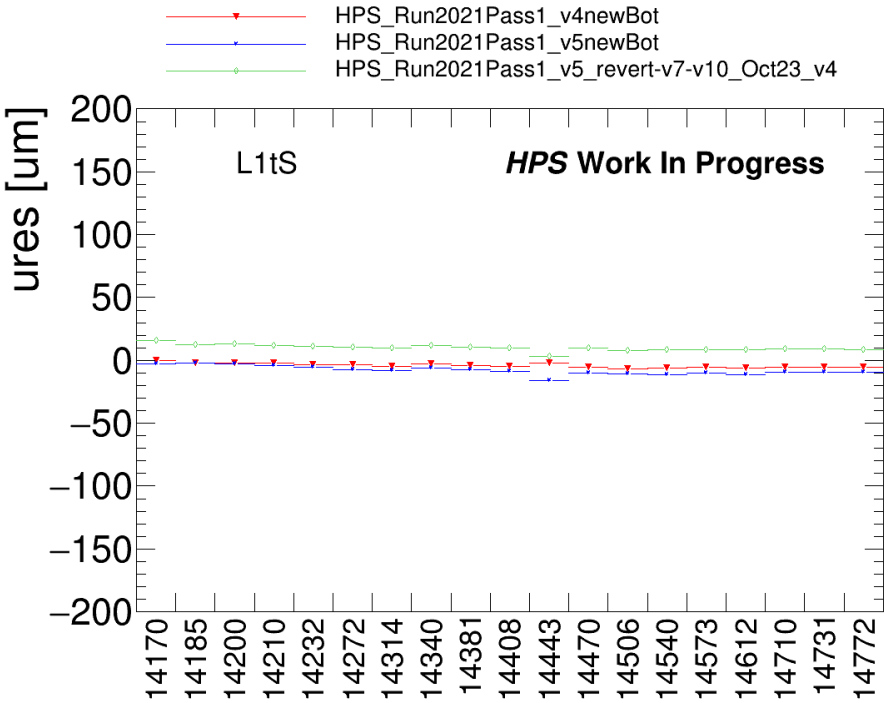
- Considerable movement of the detector run-by-run



Run-by-run dependency

- Inner layers are mostly fixed





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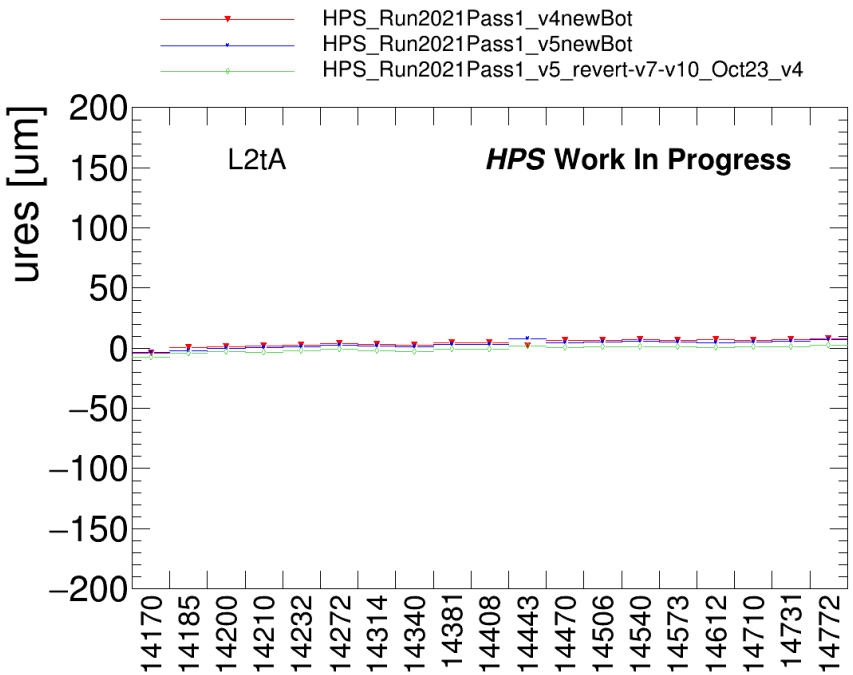

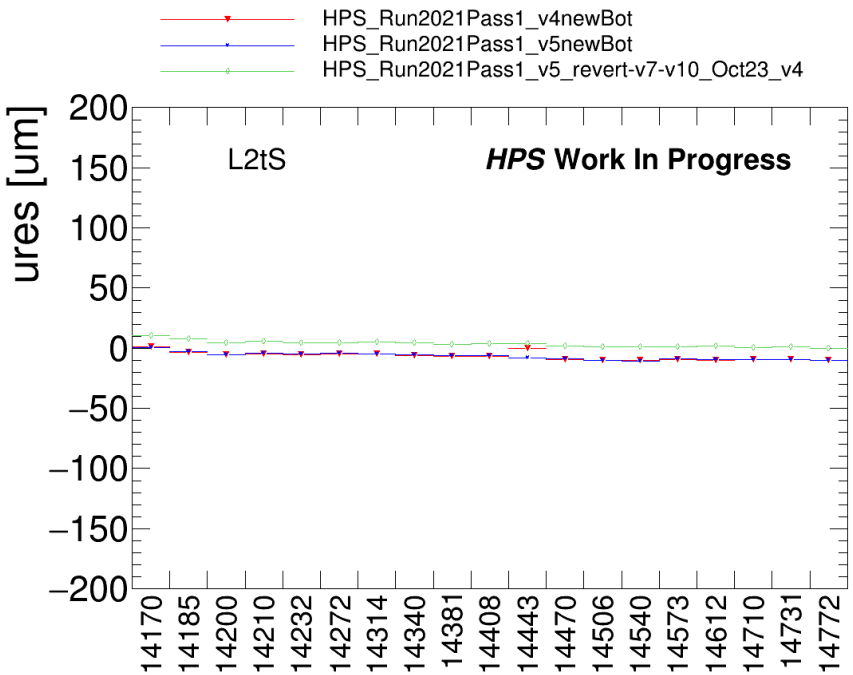

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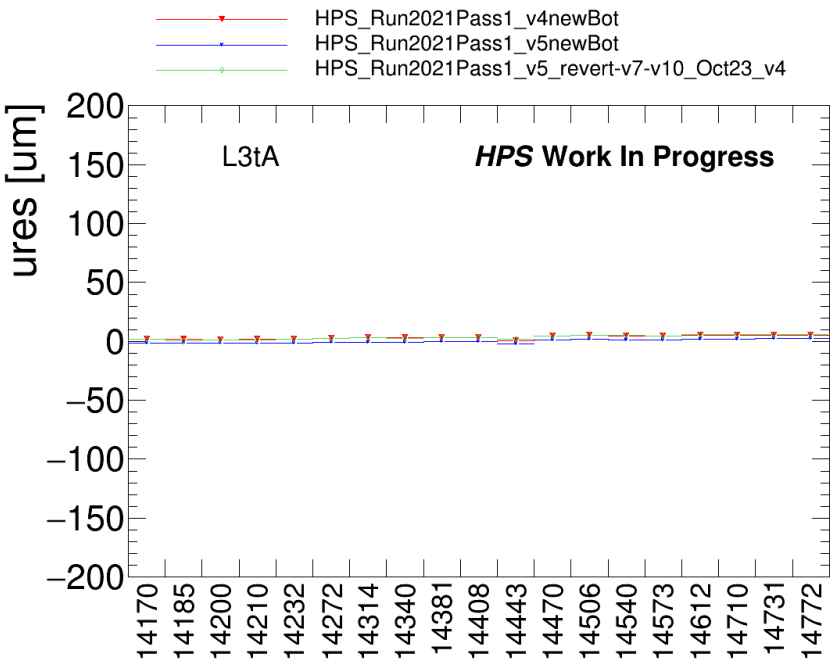

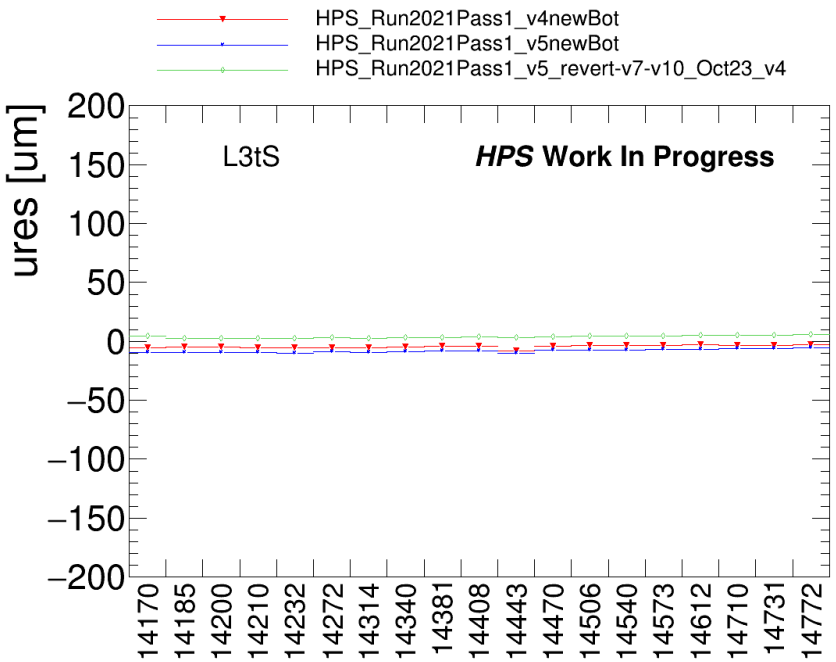

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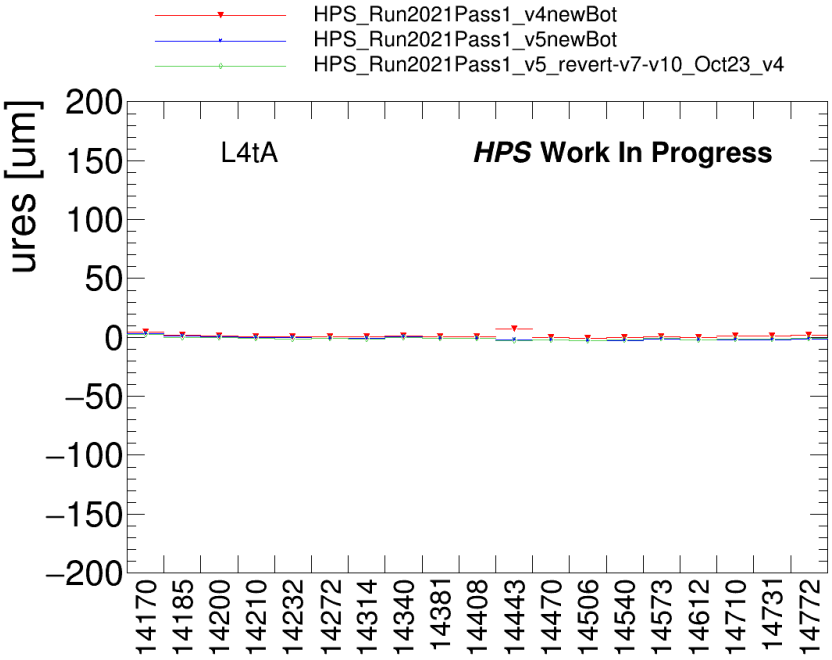
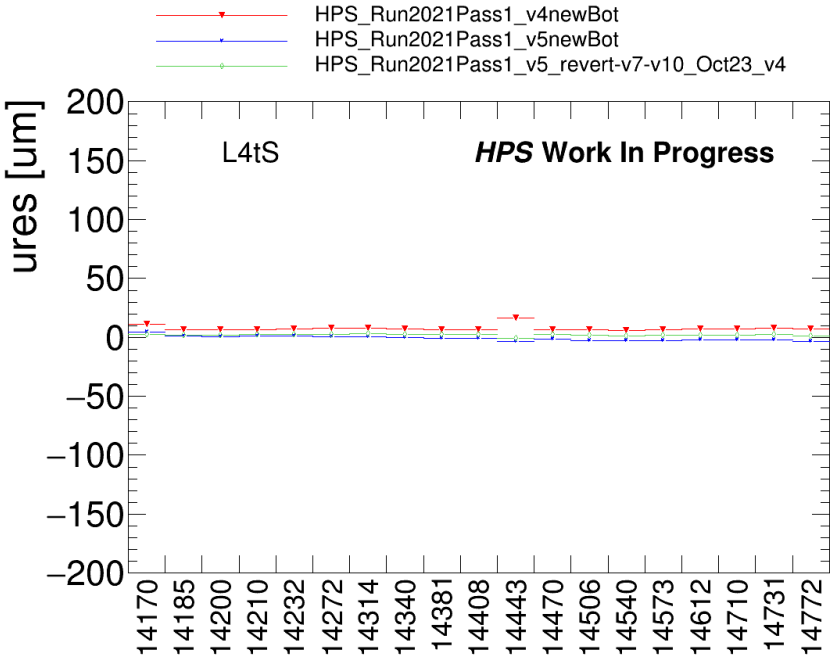
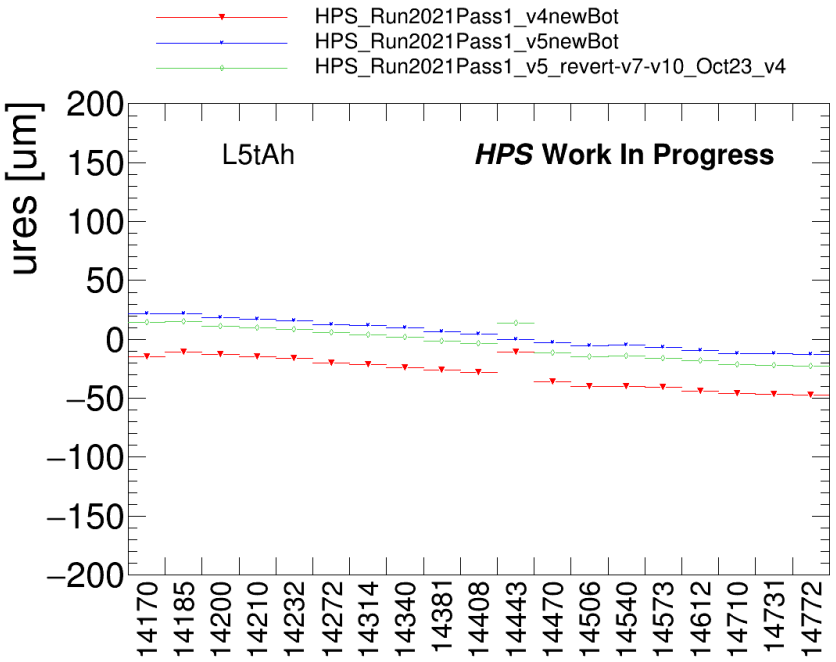
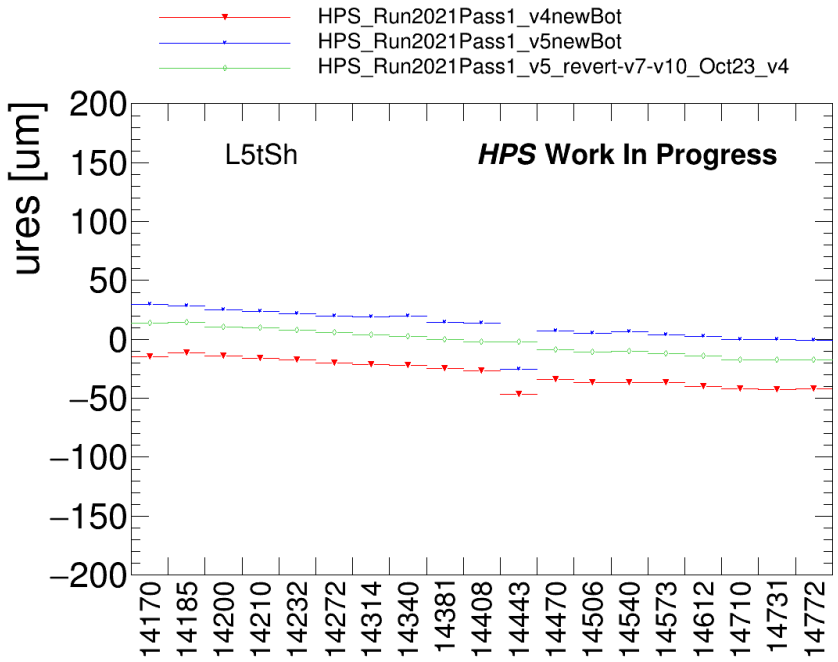




Run-by-run dependency

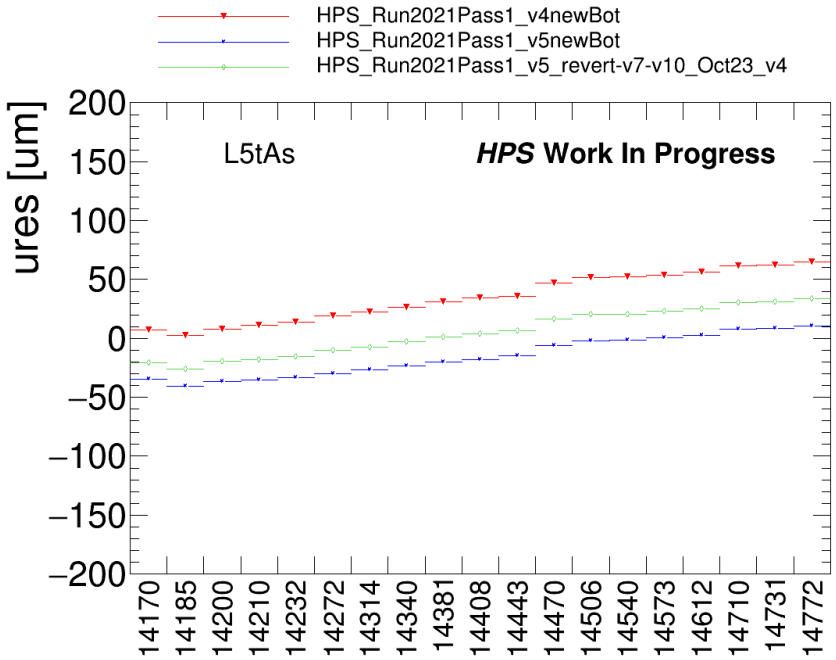
- Mild run-by-run dependency in L5 hole-side

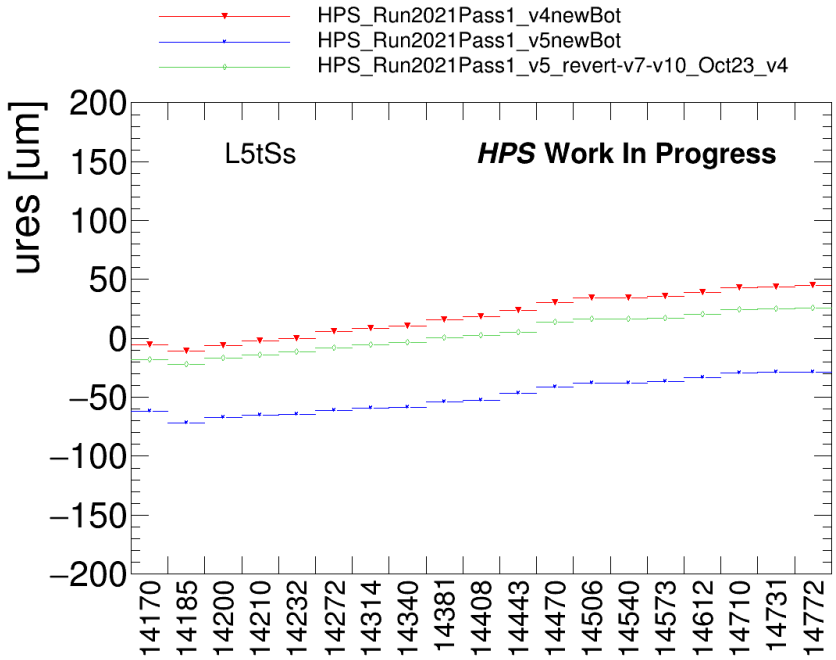




Run-by-run dependency

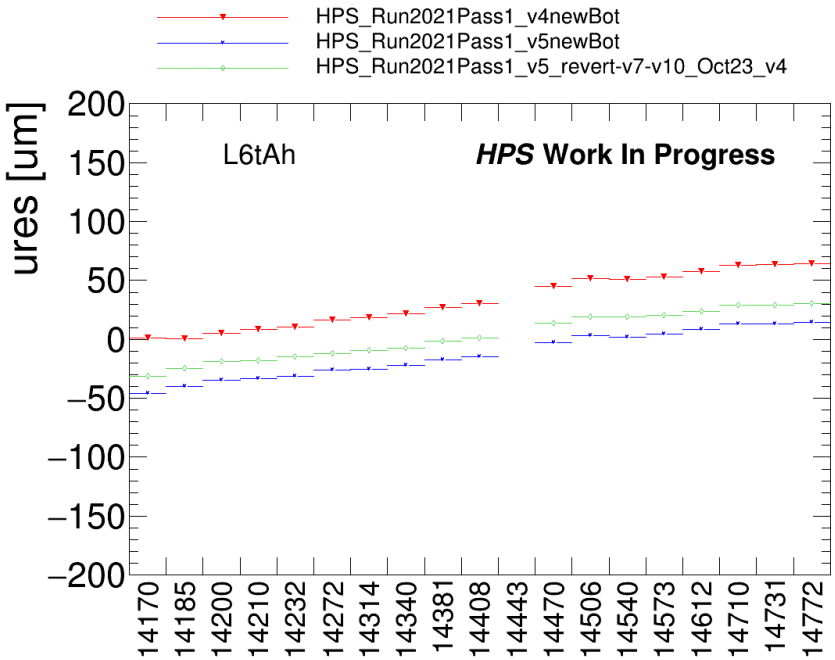
- Stronger run-by-run dependency in L5 slot-side

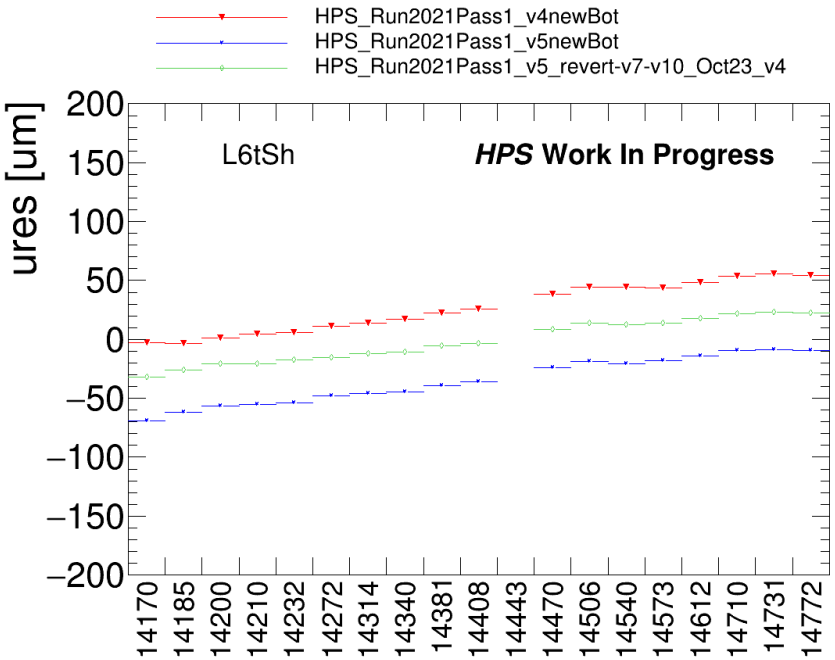




Run-by-run dependency

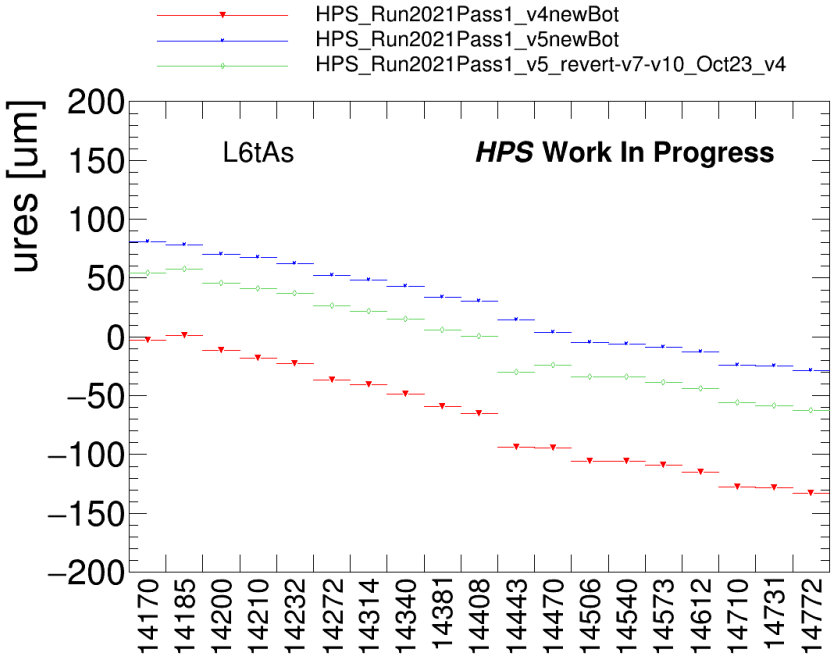
- Stronger run-by-run dependency in L6 hole-side

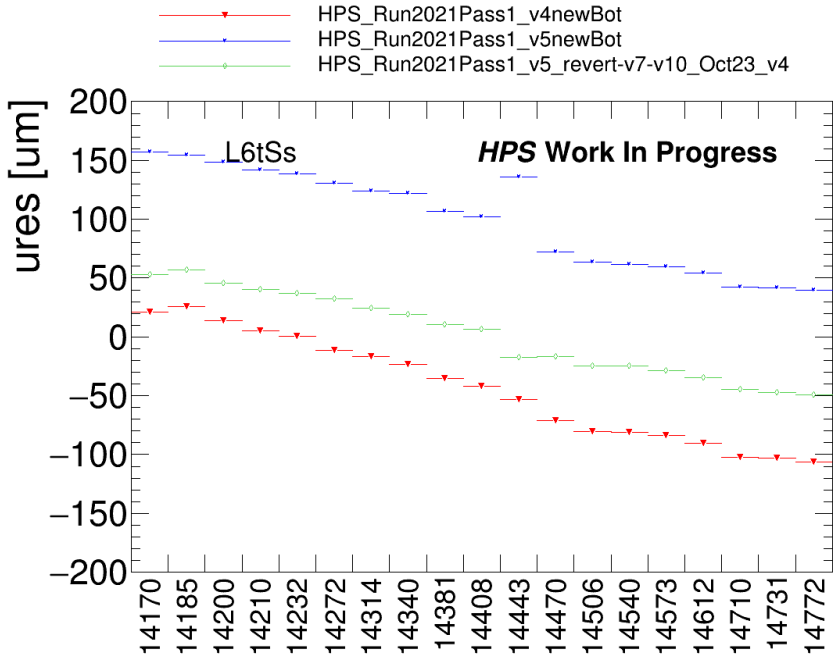




Run-by-run dependency

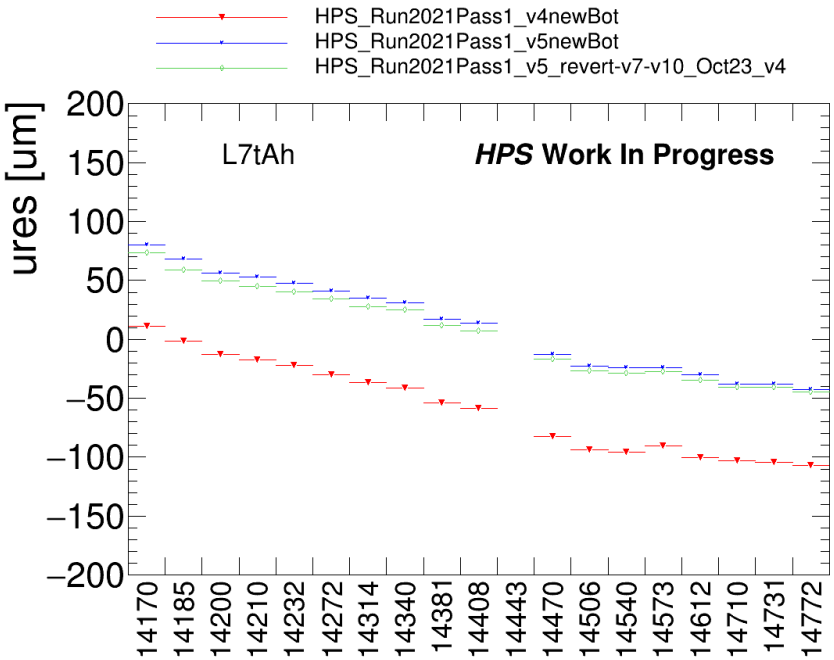
- Very strong run-by-run dependency in L6 slot-side

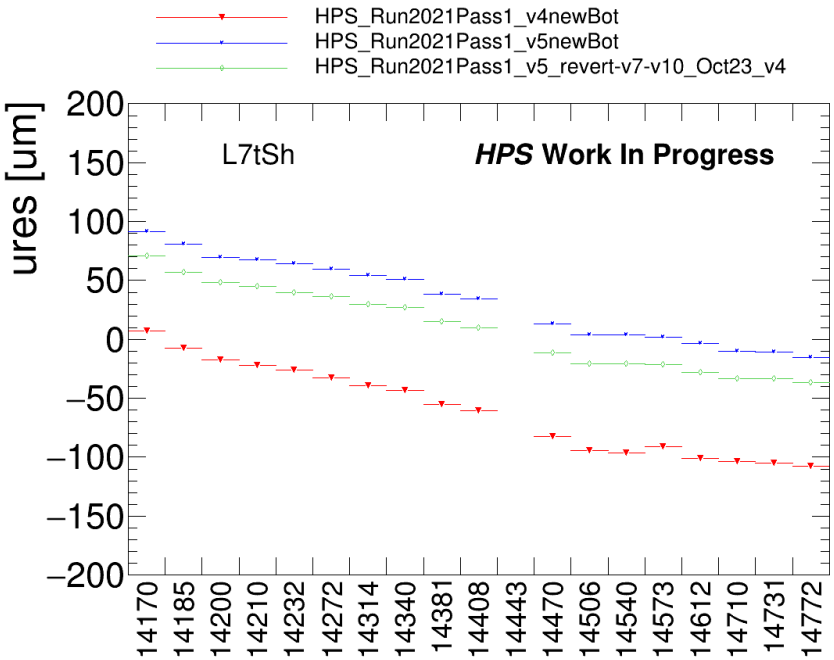




Run-by-run dependency

- Very strong run-by-run dependency in L7 hole-side





Run-by-run dependency

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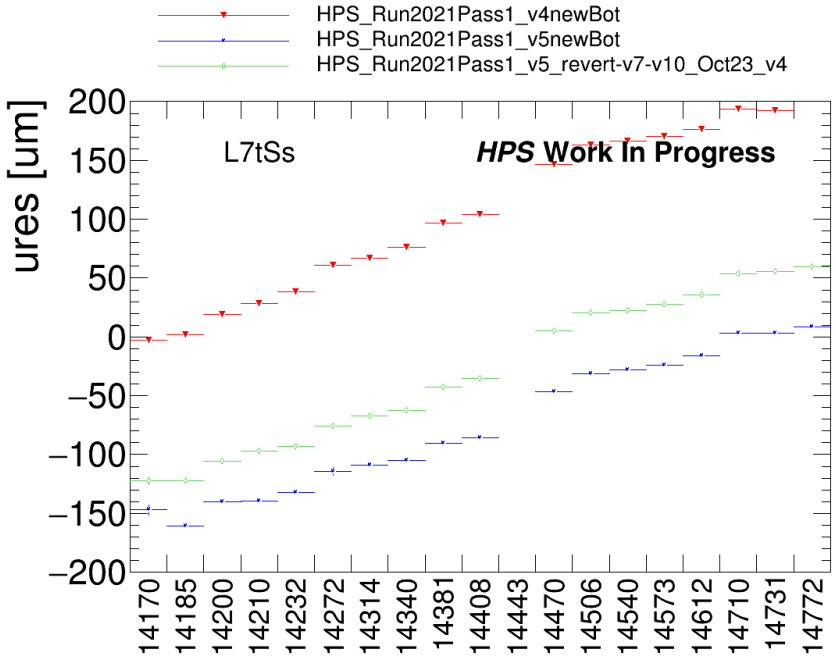
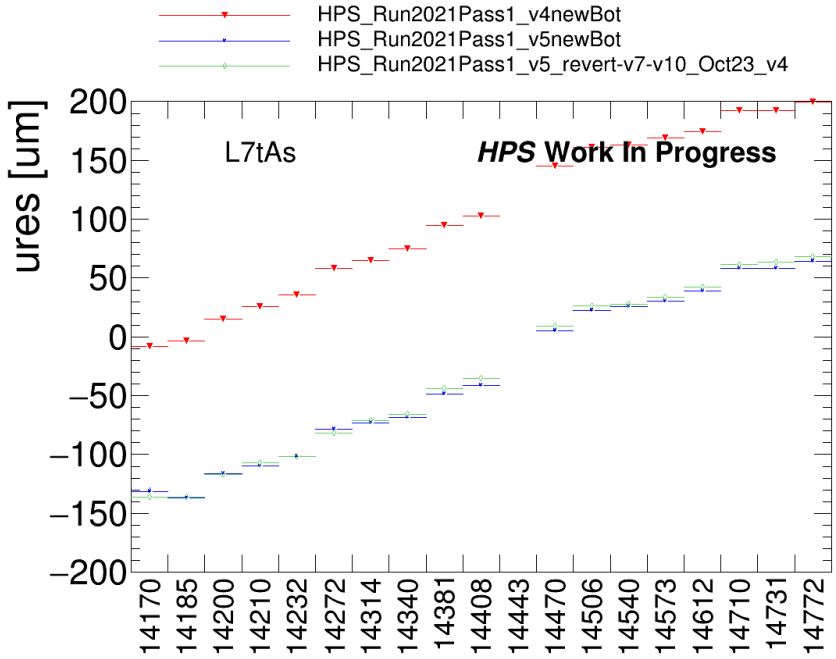
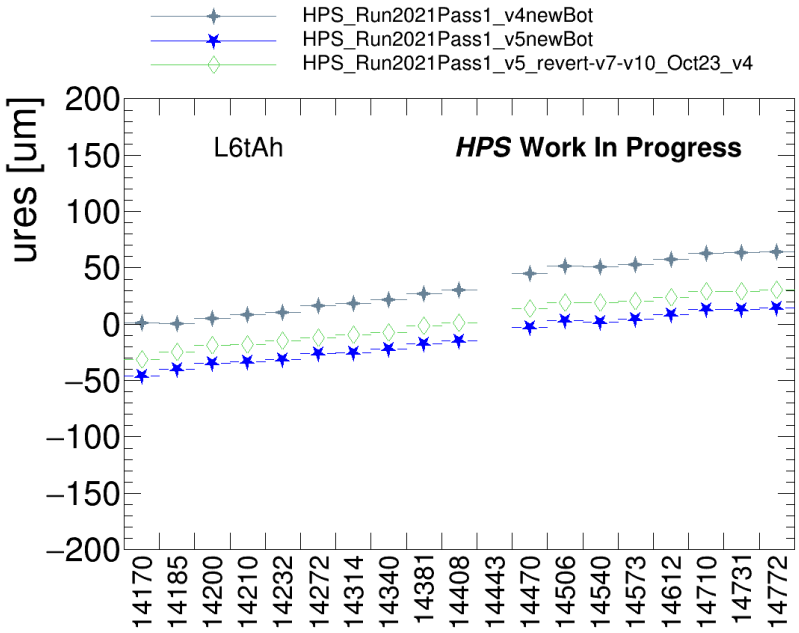
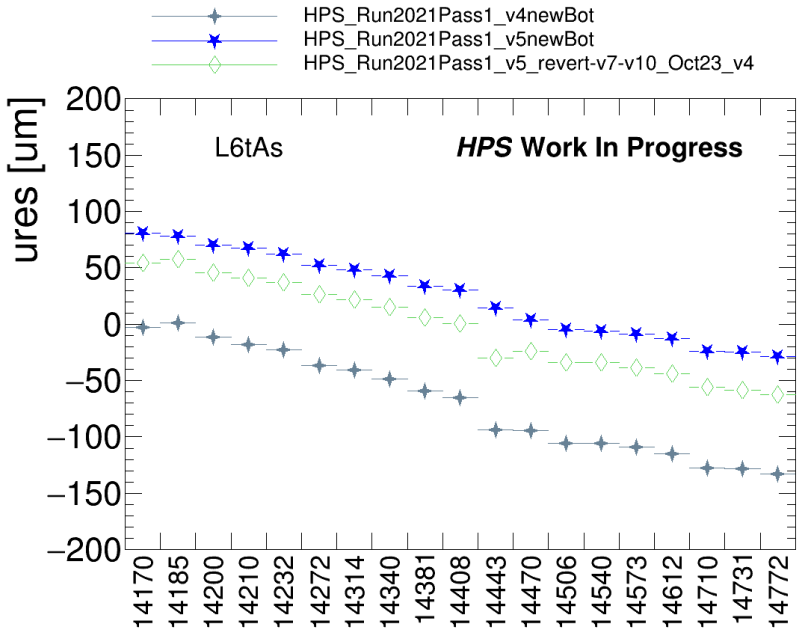




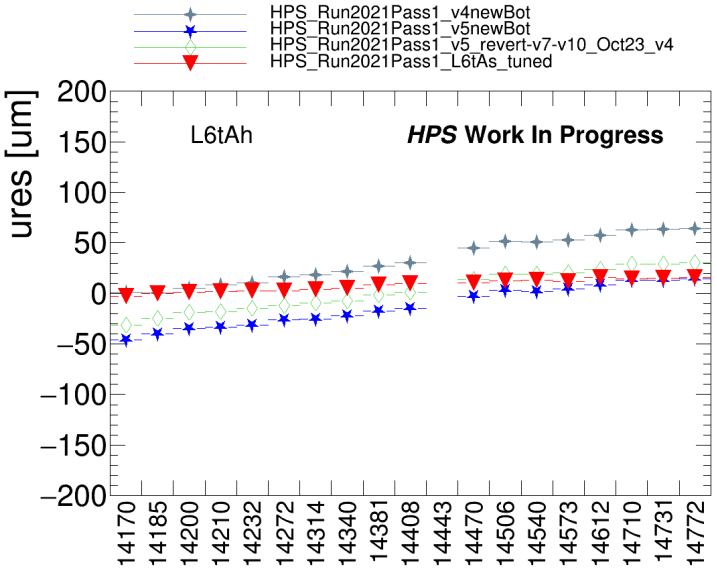
Tuning run-by-run

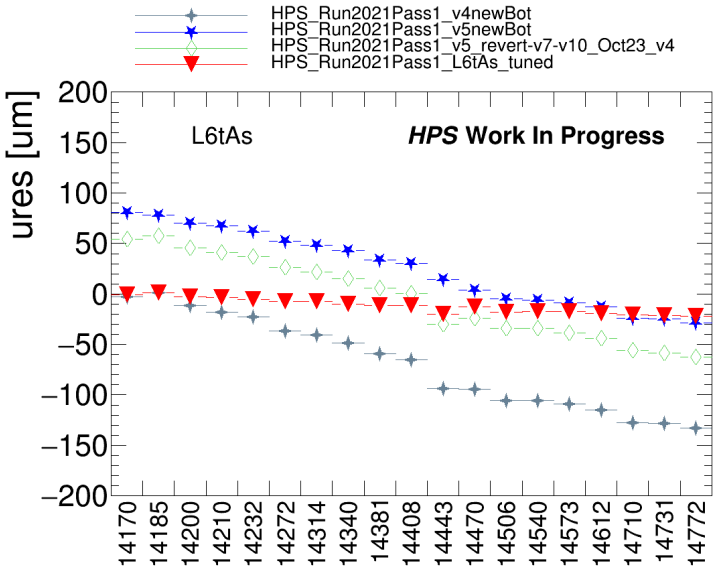
- Simple minded approach: take the residuals from previous slides, starting with one obviously misaligned layer (L6t) and apply offsets directly from histogram as tu's
  - Checked a few runs, and millepede finds something similar to the histogram values if I float just that single layer

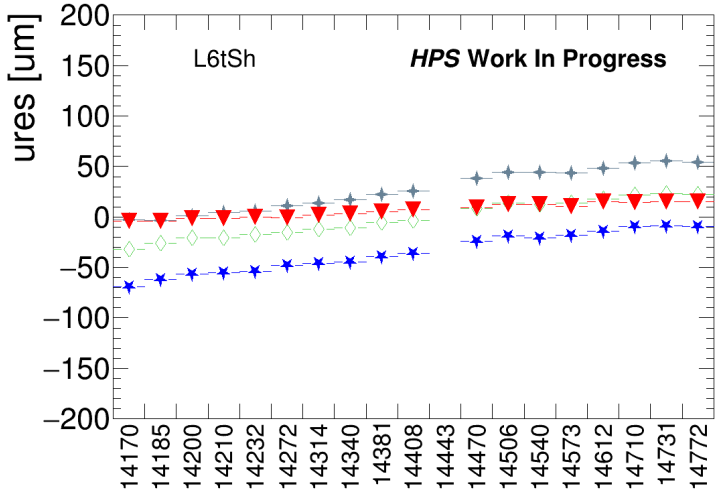


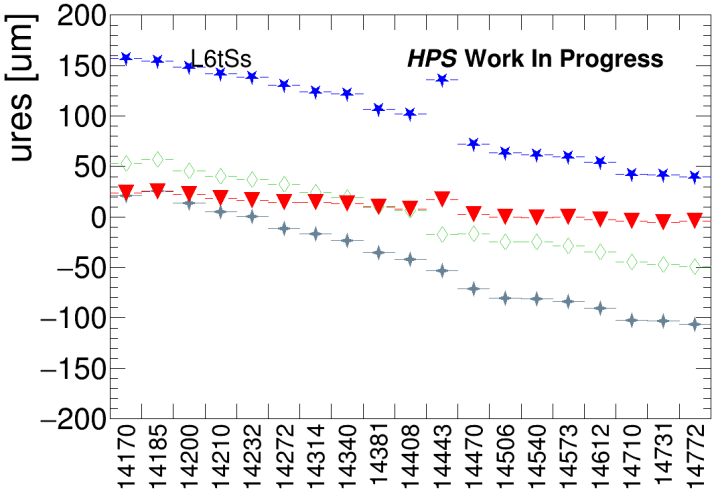


Tuning run-by-run: L6 “closure”

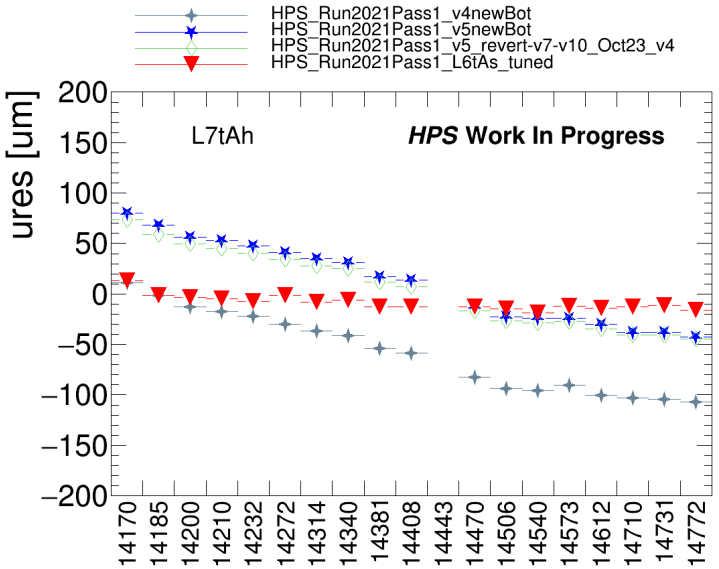


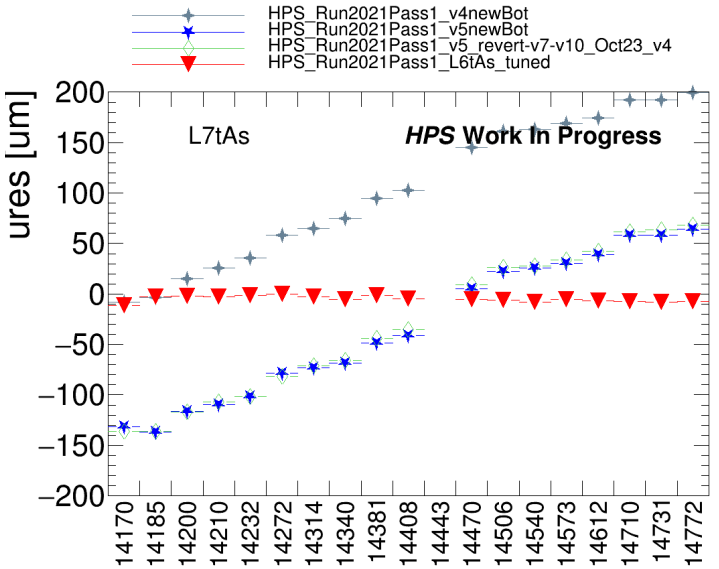


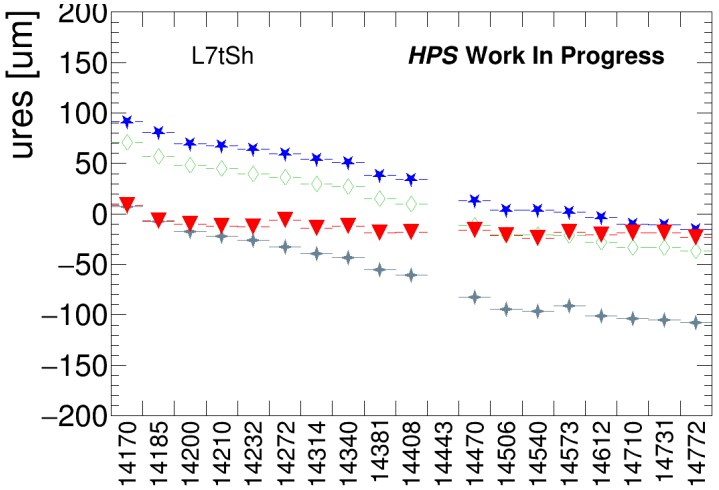


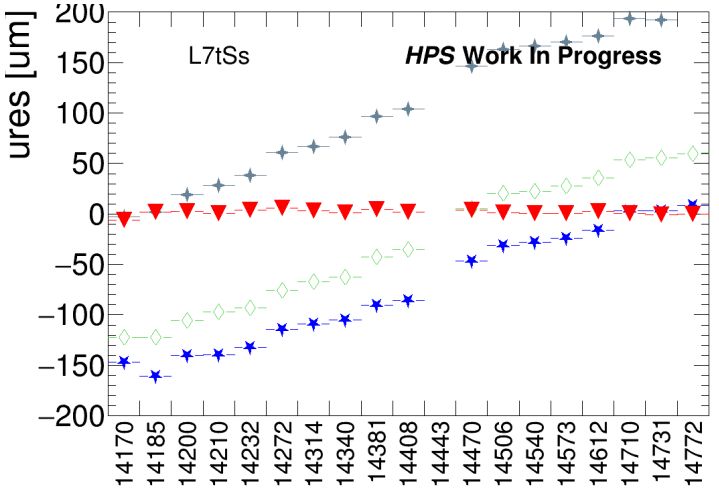


Effect on run-by-run alignment on L7

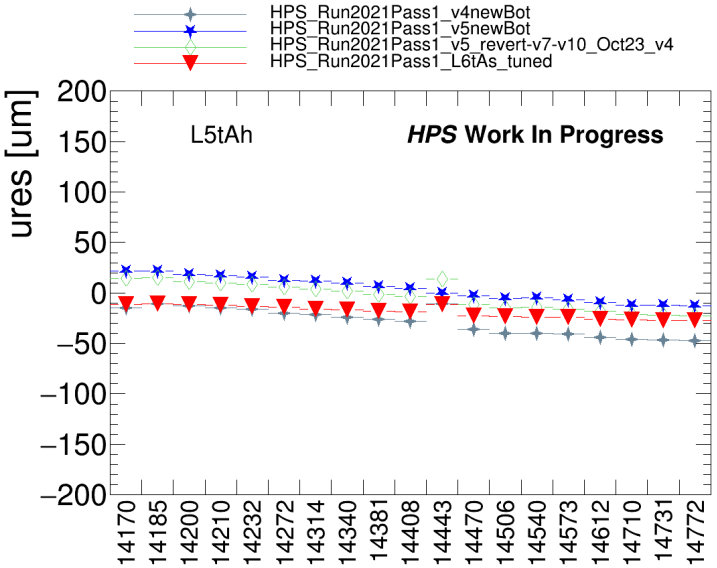


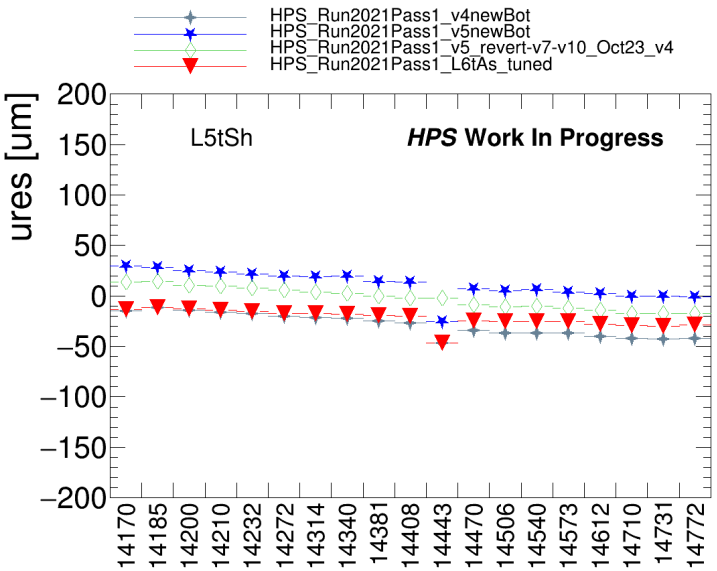


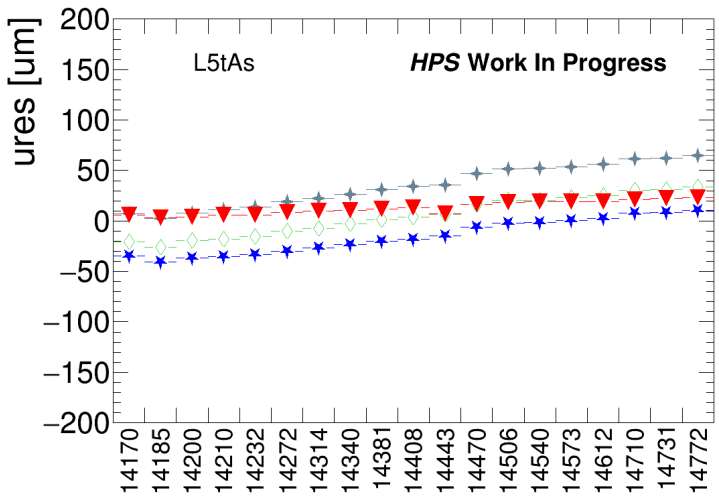


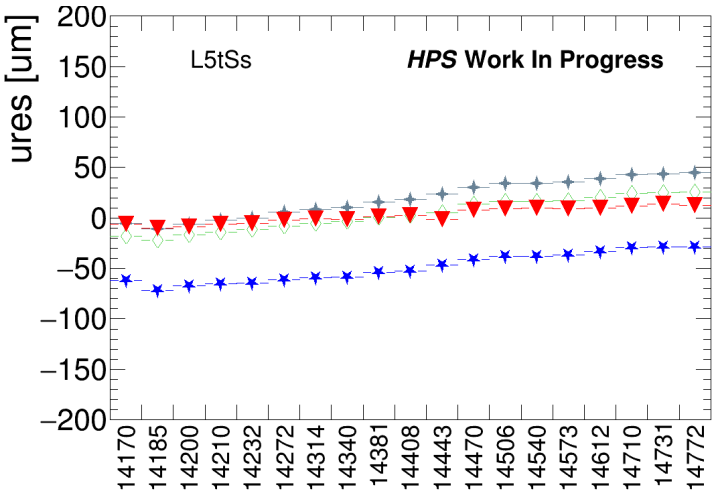


Effect on run-by-run alignment on L5



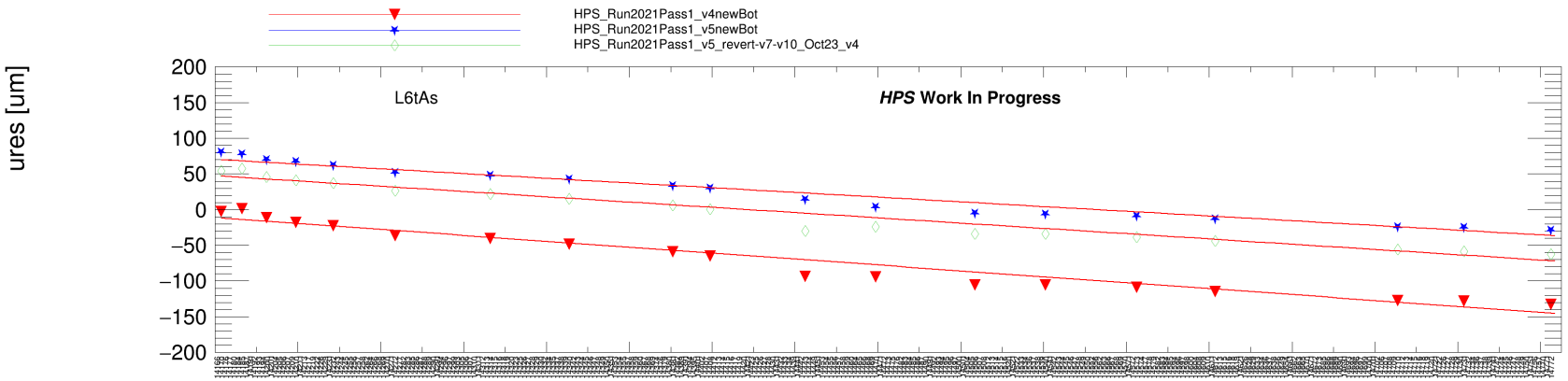






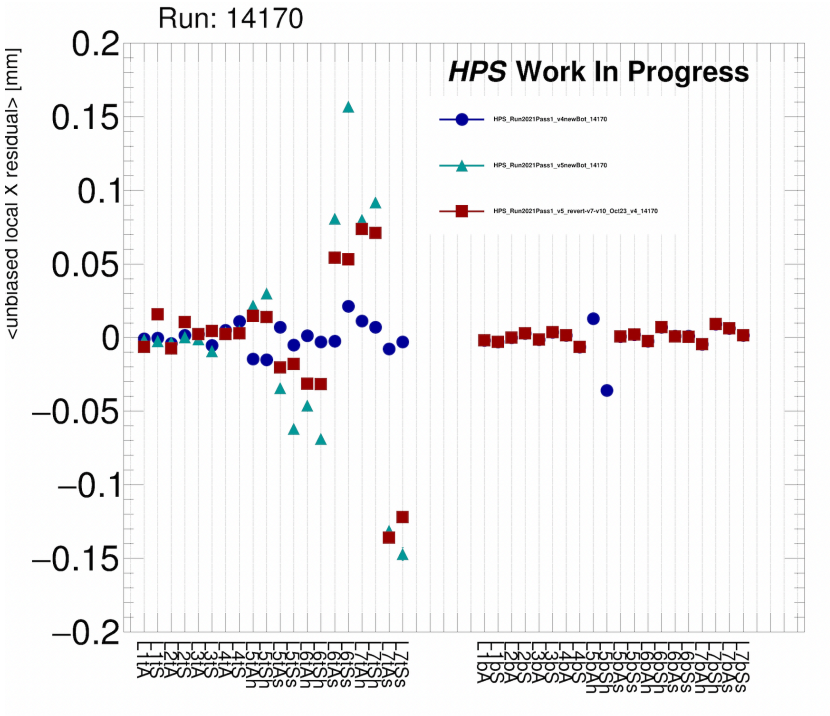
Ideas to align entire dataset run-by-run

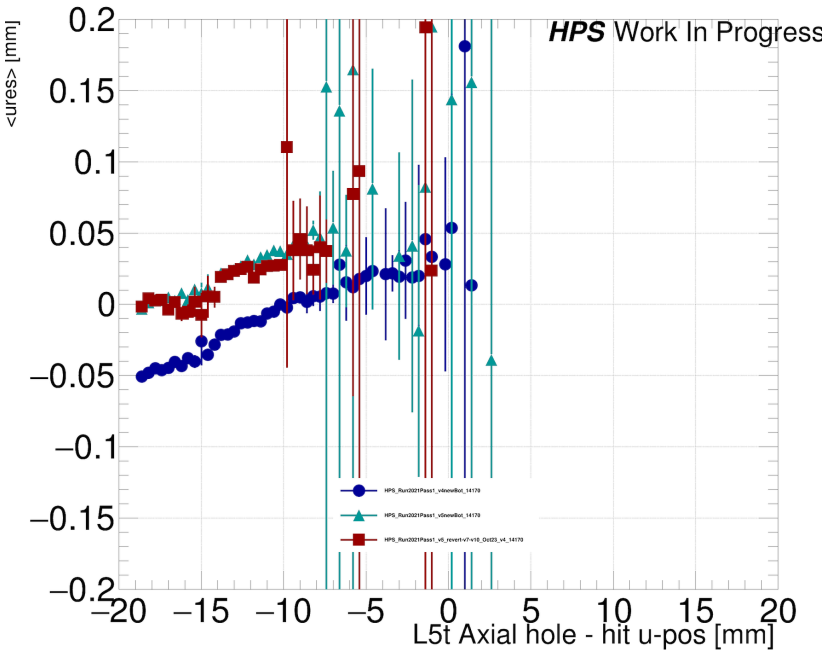
- One possibility to address run dependency: devise L6t correction based upon fit to partial dataset, and provide run-by-run detector conditions
  - Would likely make more sense to parameterize as a function of time rather than run number
- Include all runs from 2021 on the x-axis, data points only where I have FEE datasets here at SLAC



Improving v4 detector in early runs

- Run-by-run detectors started from v4 detector. While v4 looks pretty good, there is room for improvement
- Tried Rw for L5t, but with not much success. Ideas?





Conclusions

- Switched to “official” FEE dataset for 2021 alignment
- Attempt at aligning run in ~middle of dataset
- Checking alignment with three detectors across dataset
  - Inner layers (L1-L4) are mostly fixed run-by-run
  - Outer layers (L5-L7) show very strong dependency on run
    - Multiple detectors will be needed model this movement
- Attempted crude run-by-run alignment using L6t u-residuals
  - Surprisingly successful at first glance: nearly fixed L7t mis-alignment and significantly improved L5t

Questions