HQ01d strain gauge data analysis

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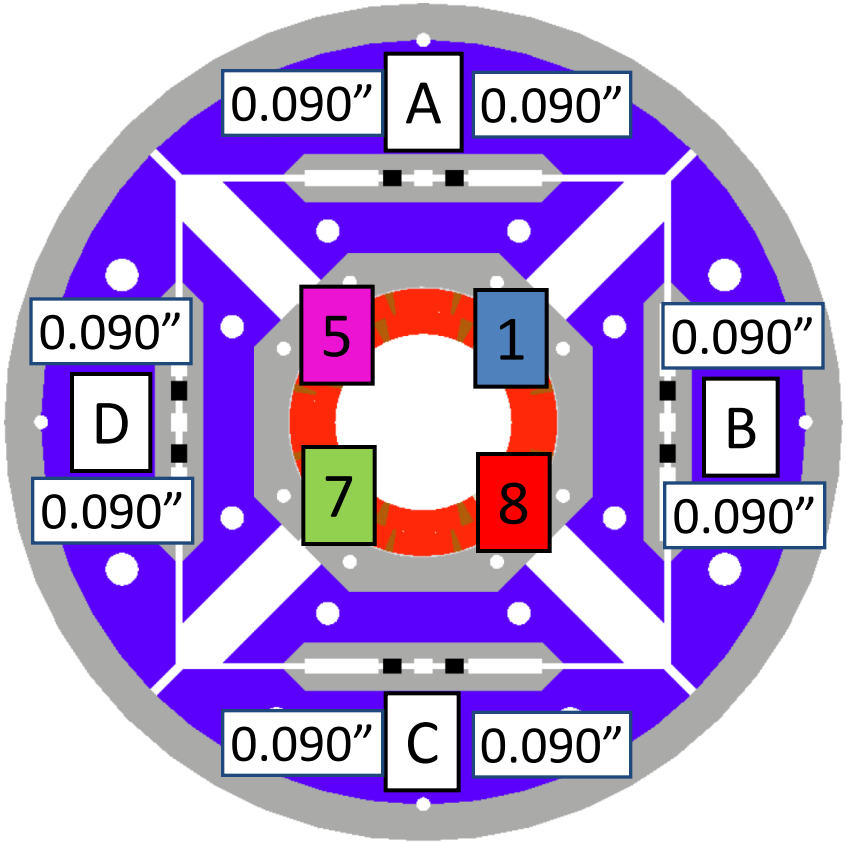
LARP Collaboration Meeting CM16
Montauk, New York
May 17, 2011

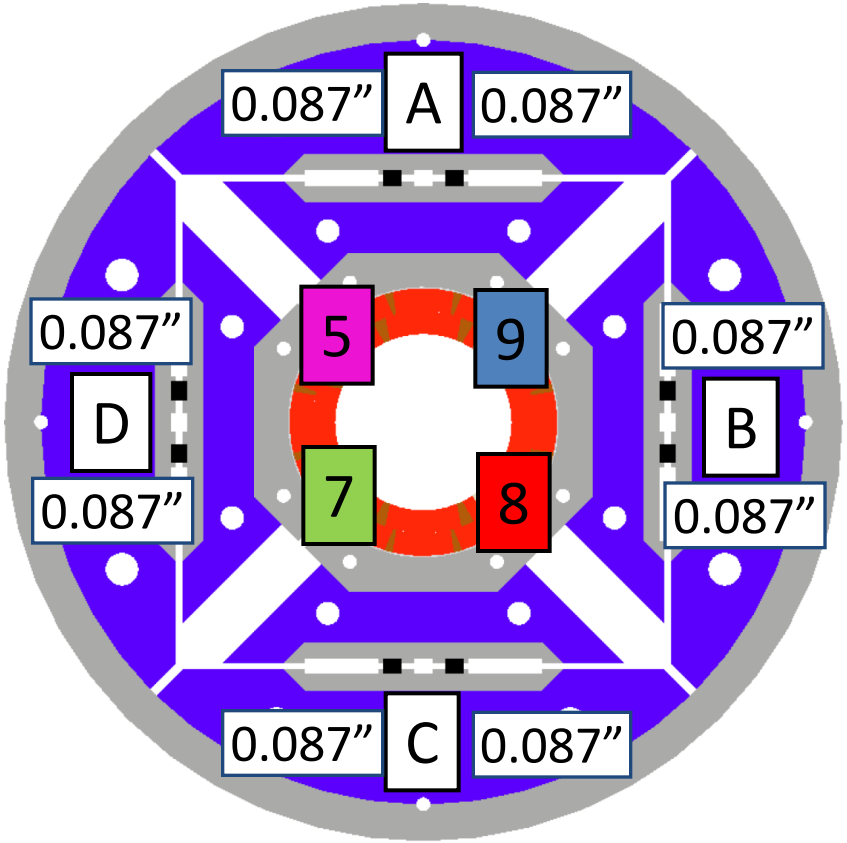
U.S. LARP

Coils, bladders and load-key shims

- HQ01c

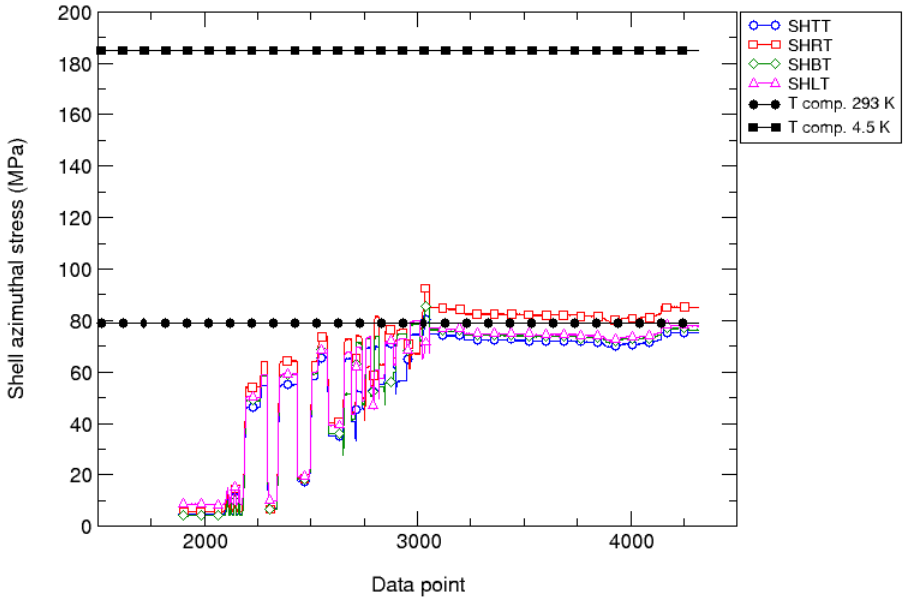


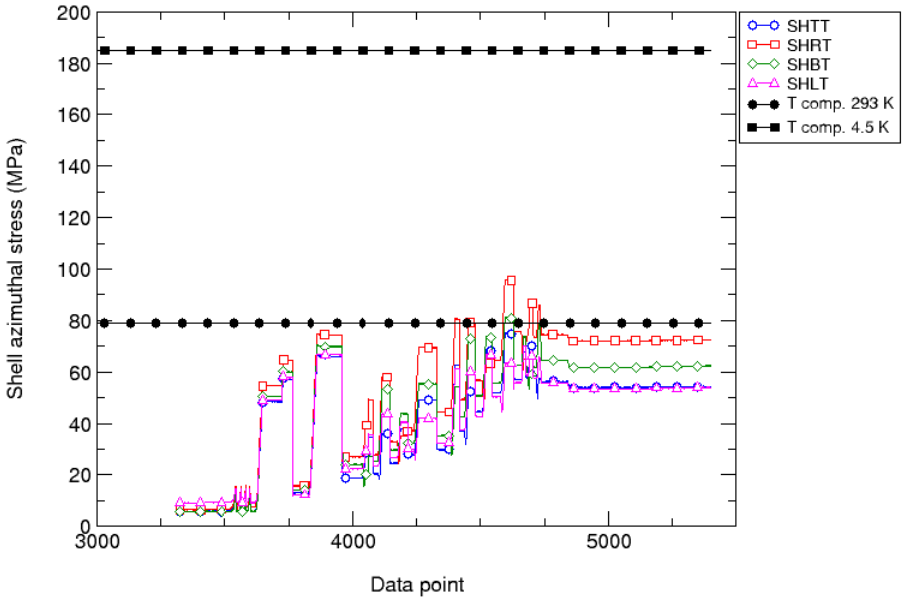
- HQ01d



HQ01c vs. HQ01d loading
Shell azimuthal stress

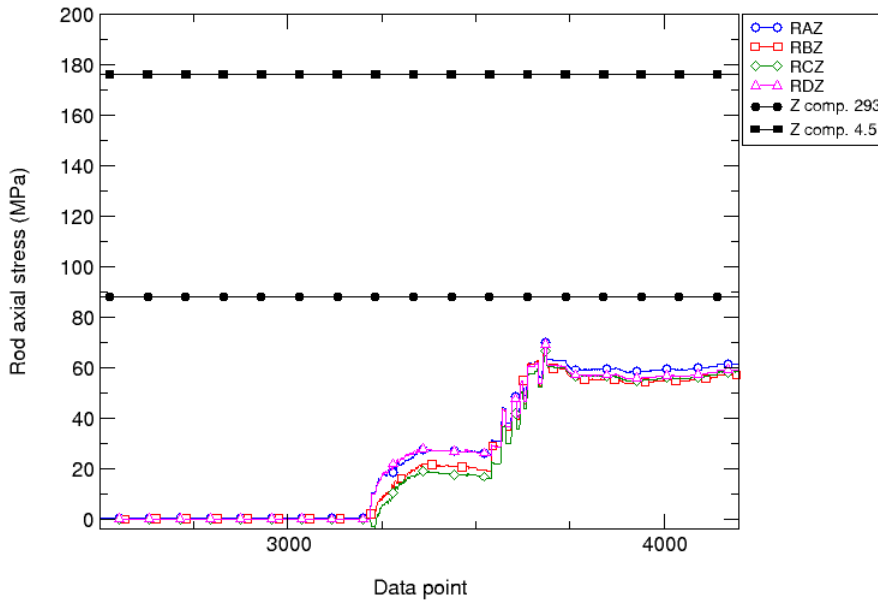
- HQ01c
  - $\sigma_\theta = +75 \pm 4$ MPa
- HQ01d
  - $\sigma_\theta = +61 \pm 9$ MPa

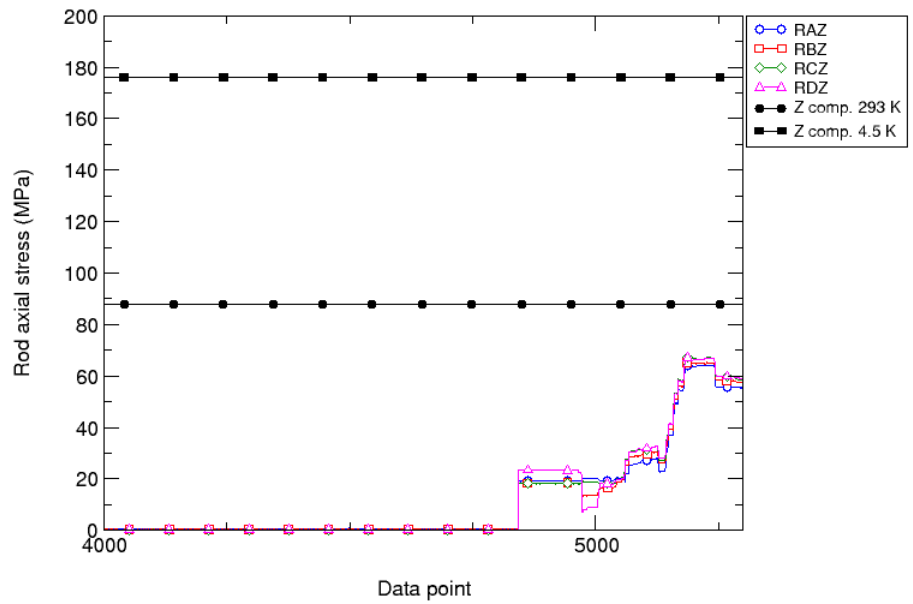




HQ01c vs. HQ01d loading
Rod axial stress

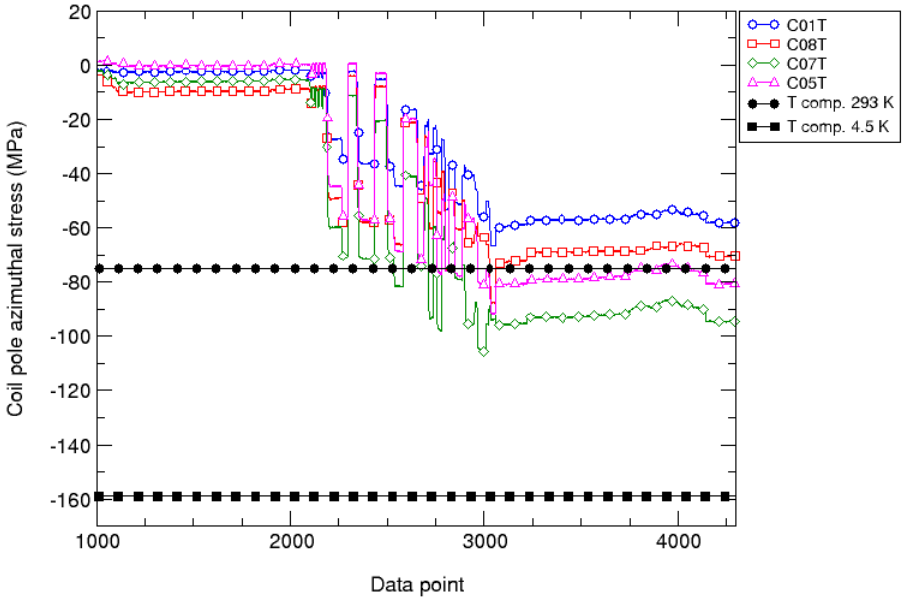
- HQ01c
  - σ_z = +57 ±2 MPa
- HQ01d
  - σ_z = +58 ±2 MPa

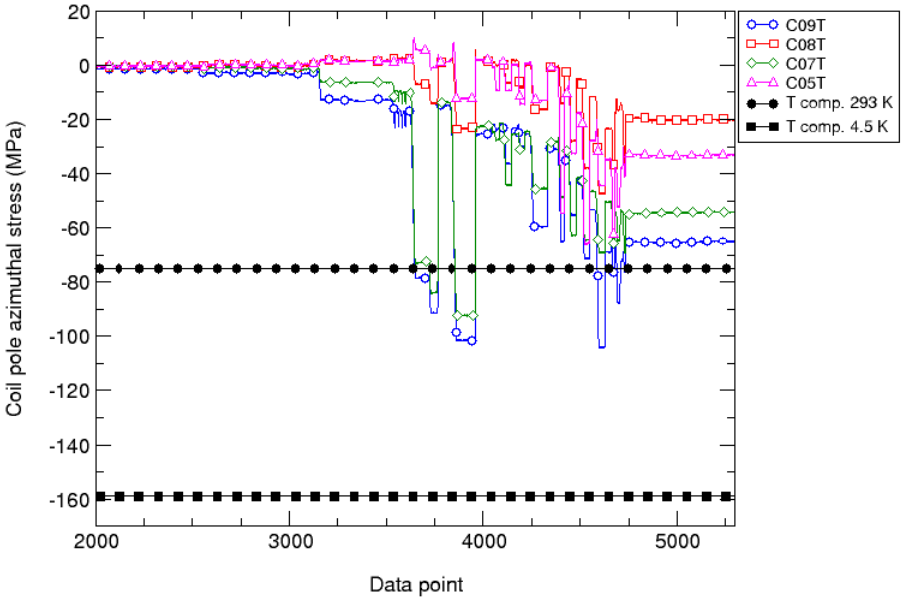




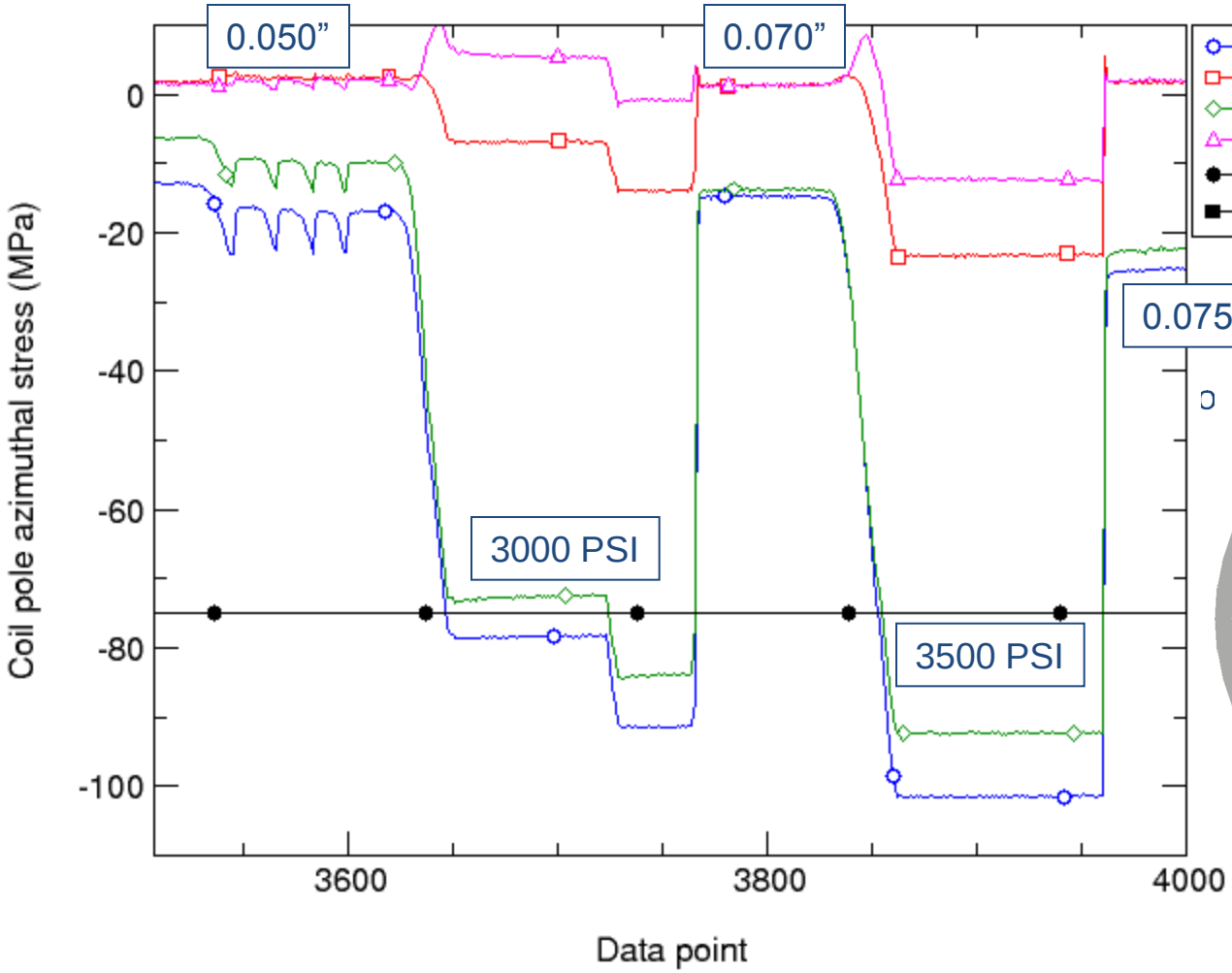
HQ01c vs. HQ01d loading
Coil azimuthal stress

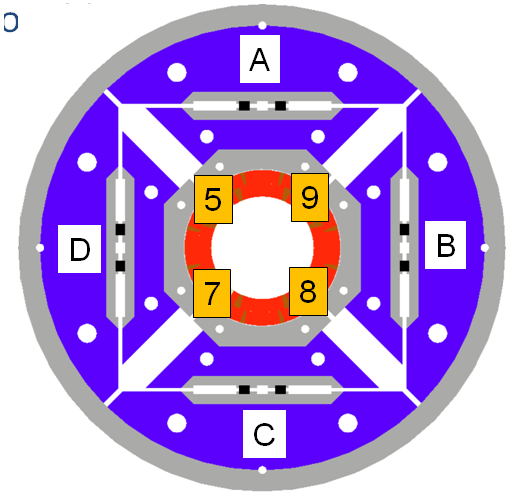
- HQ01c
  - σ_θ = -71 ±14 MPa
- HQ01d
  - σ_θ = -43 ±20 MPa
  - Expected from shell: -58 MPa



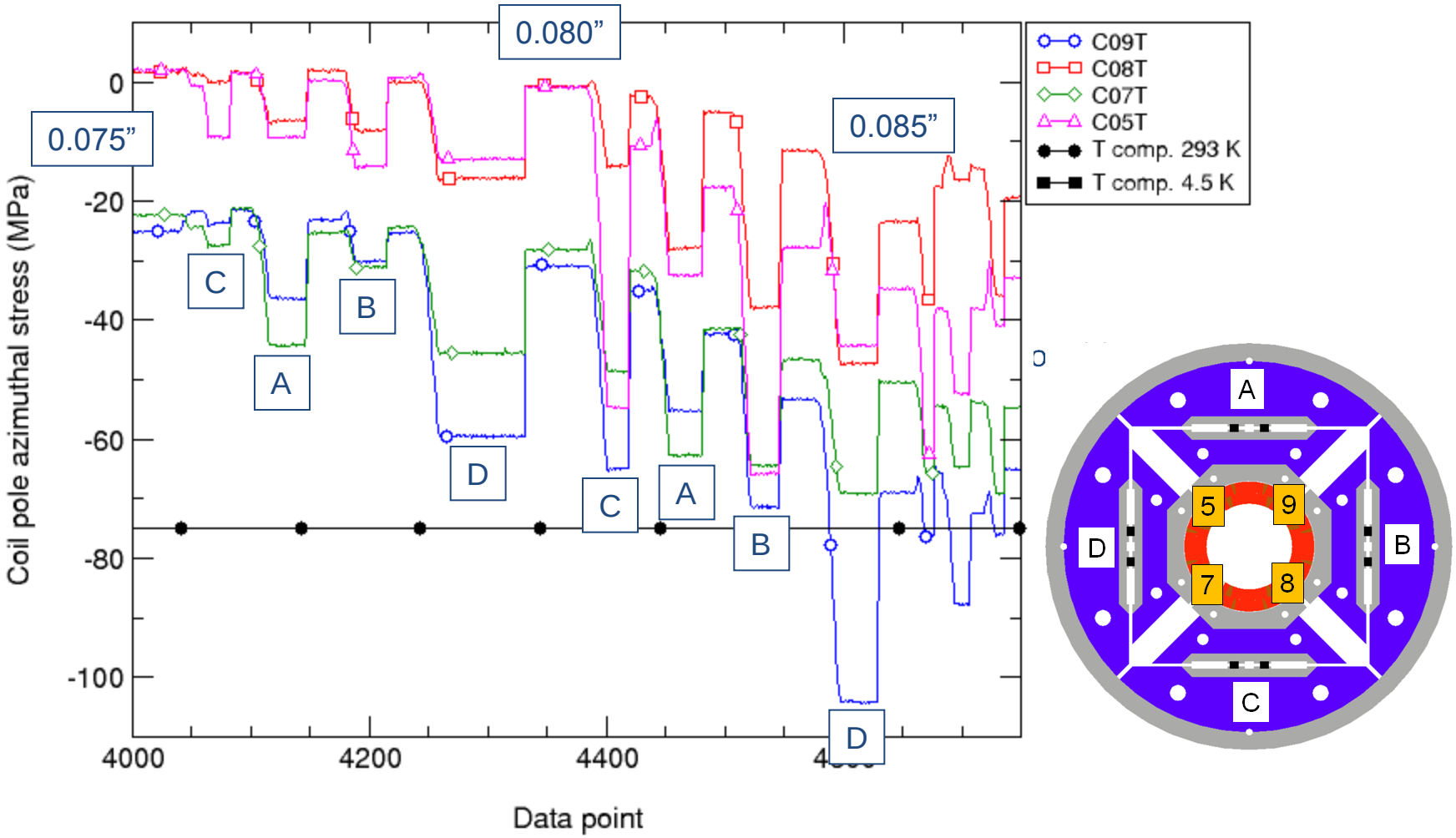


HQ01d bladder operation
All bladders inflated

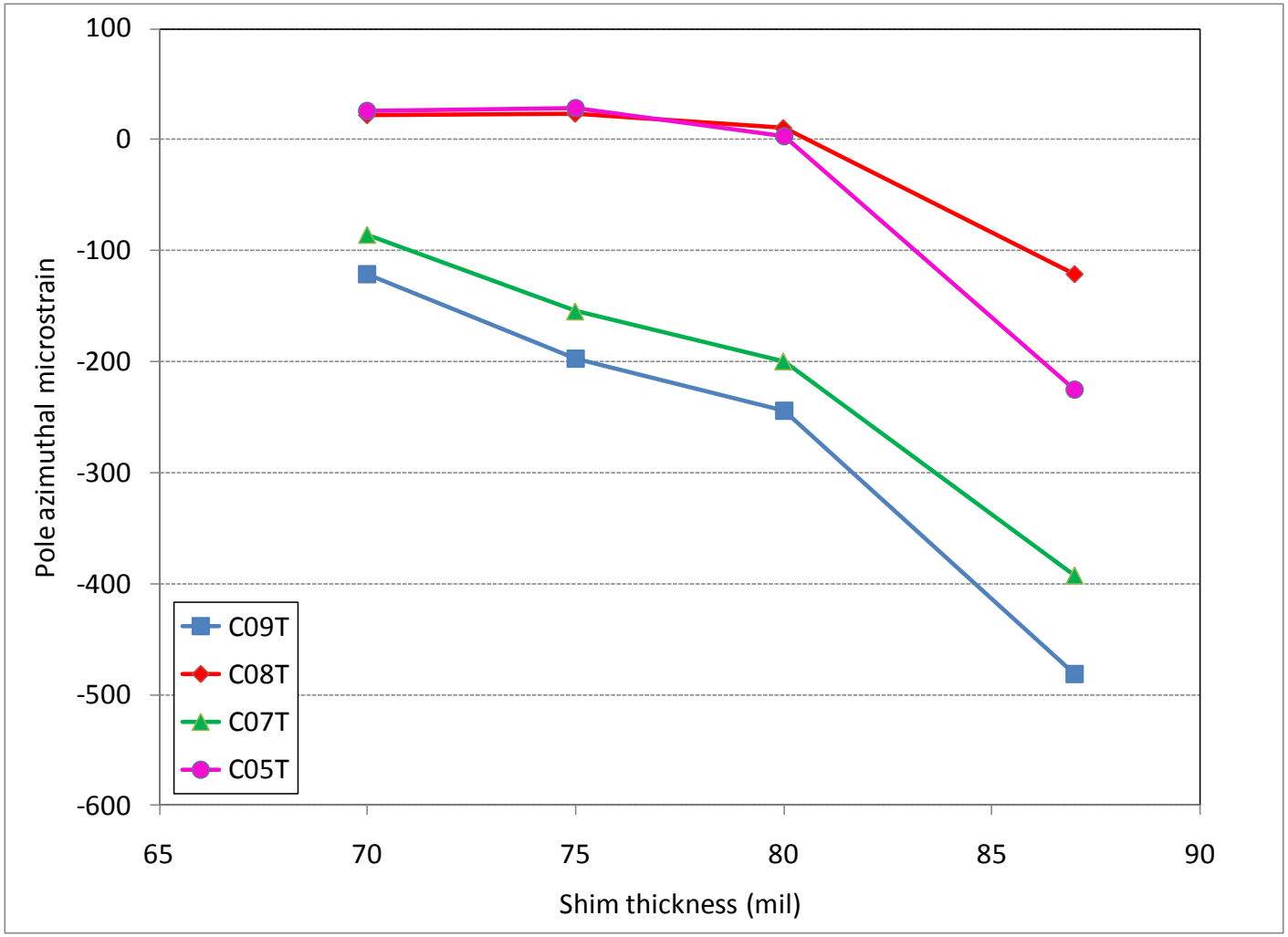




HQ01d bladder operation
Individual bladder inflated

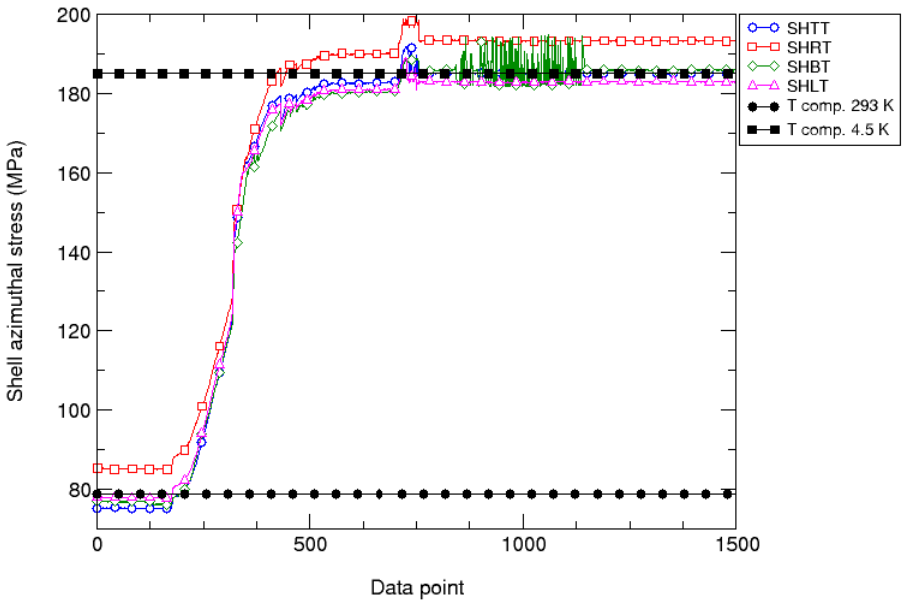


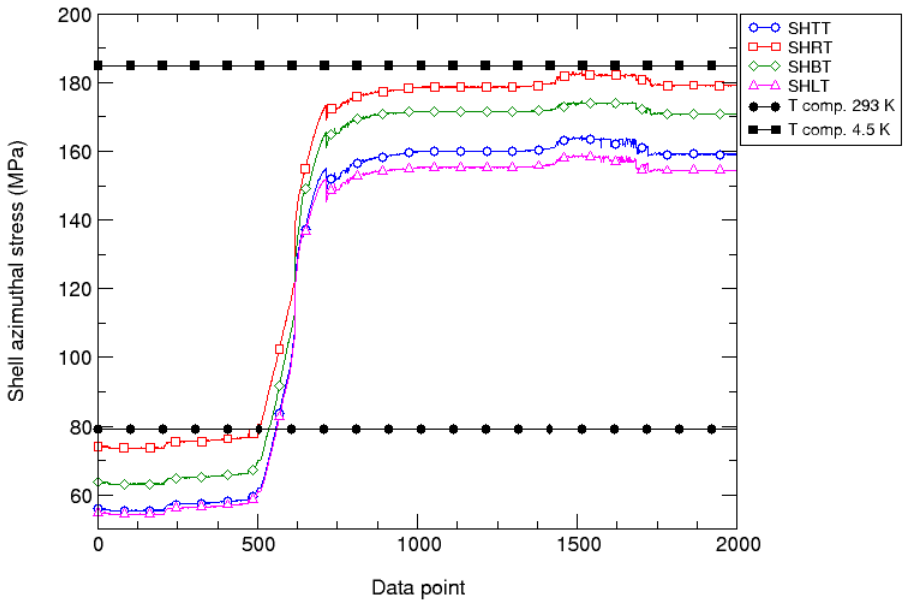
Pole stress vs. shim thickness



HQ01c vs. HQ01d cool-down
Shell azimuthal stress

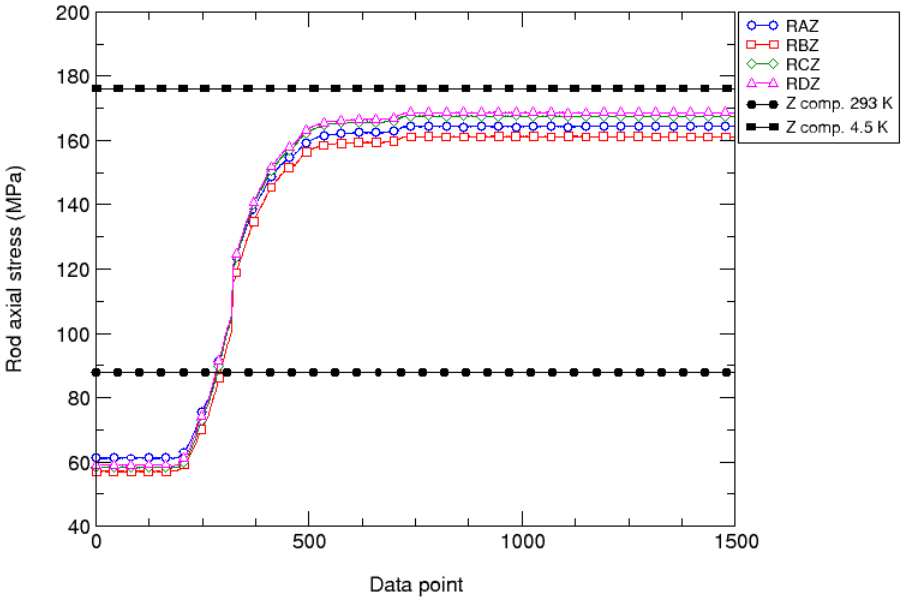
- HQ01c
  - $\sigma_\theta = +187 \pm 4$ MPa
- HQ01d
  - $\sigma_\theta = +166 \pm 11$ MPa

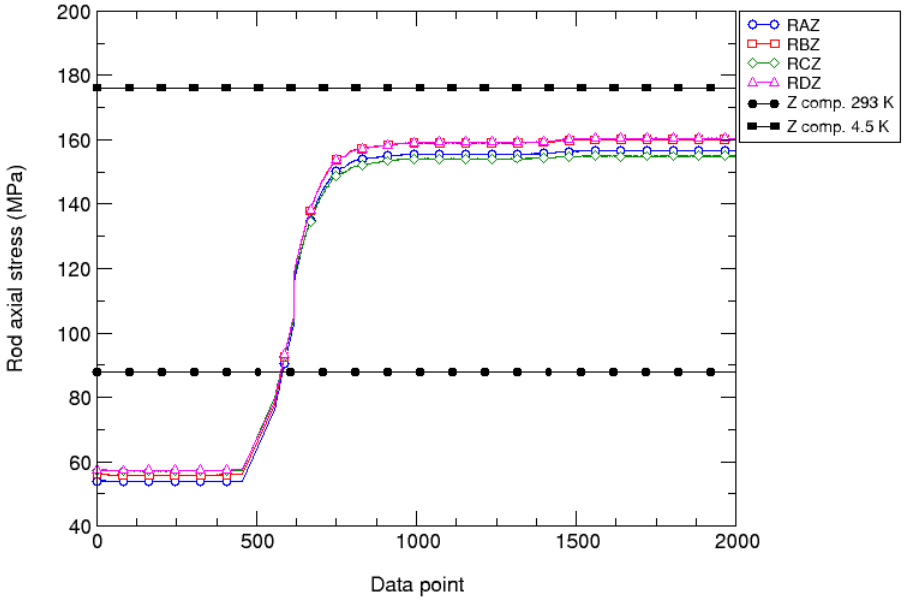




HQ01c vs. HQ01d cool-down
Rod axial stress

- HQ01c
  - σ_z = +165 ±3 MPa
- HQ01d
  - σ_z = +158 ±3 MPa





HQ01c vs. HQ01d cool-down
Coil azimuthal stress

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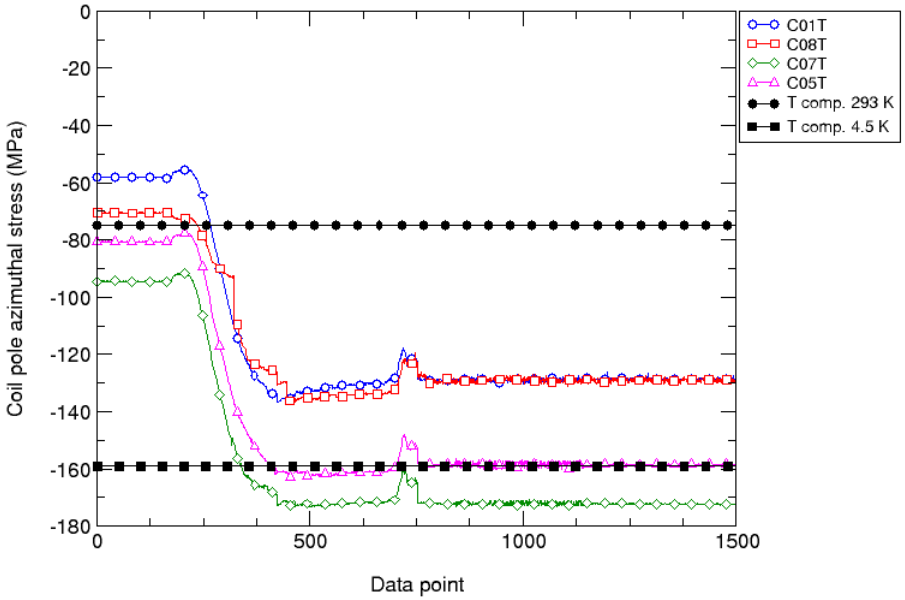
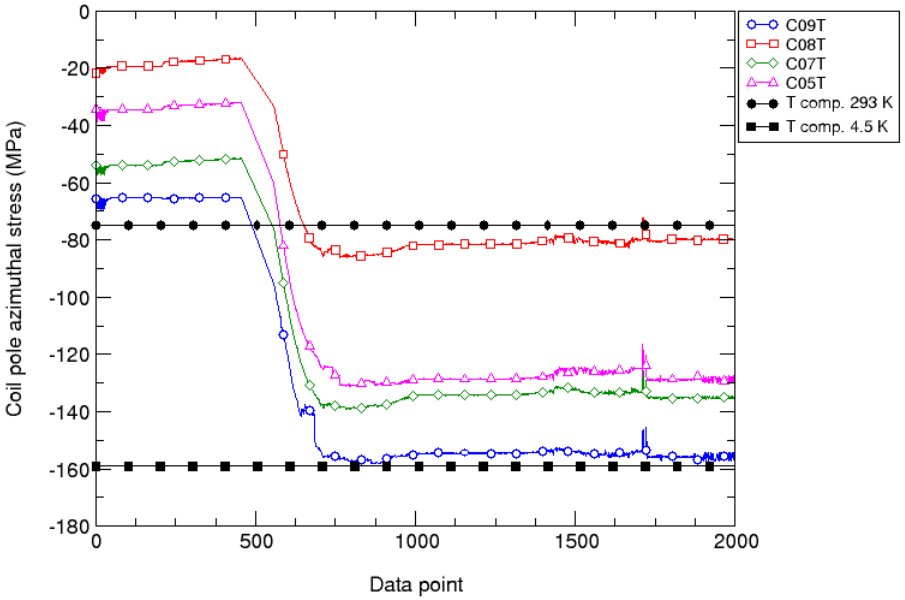
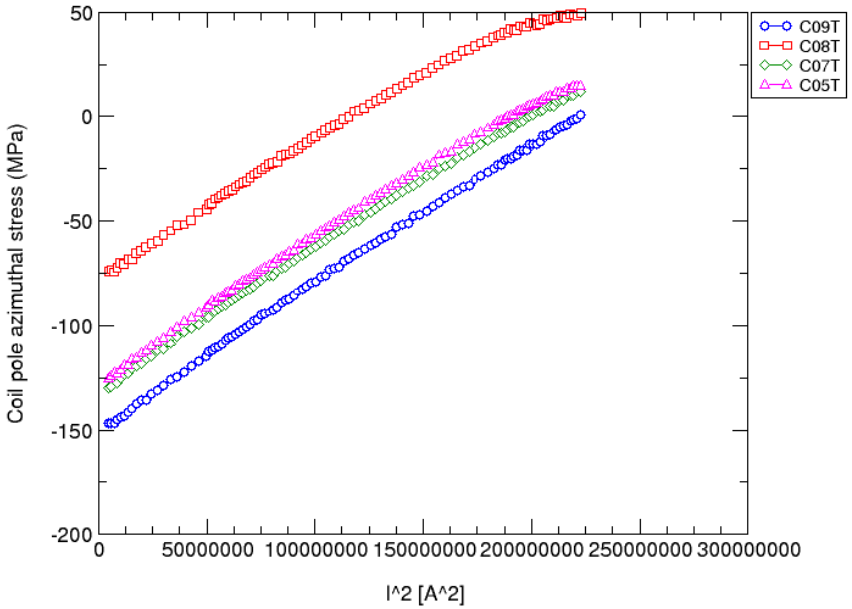
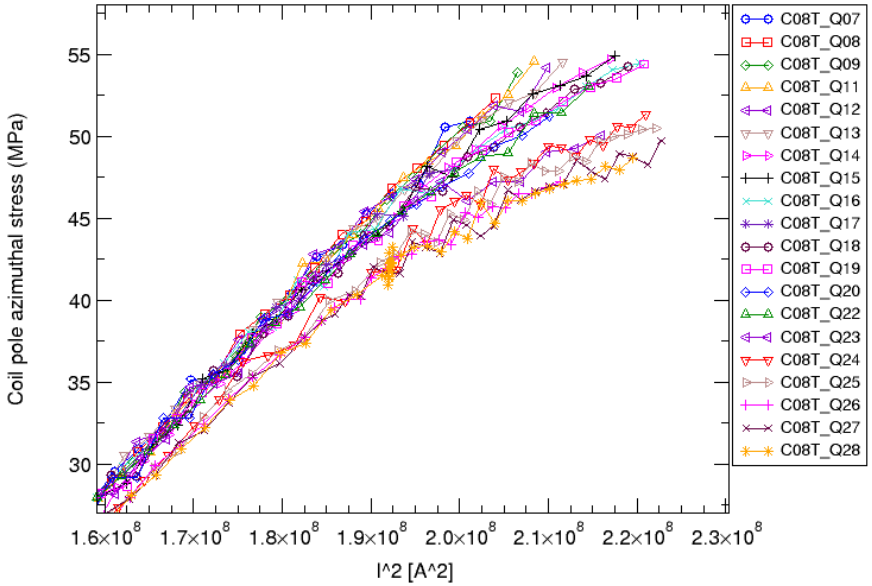
  - σ_θ = -147 ±22 MPa
- HQ01d
  - σ_θ = -125 ±32 MPa
  - Expected from shell: -130 MPa



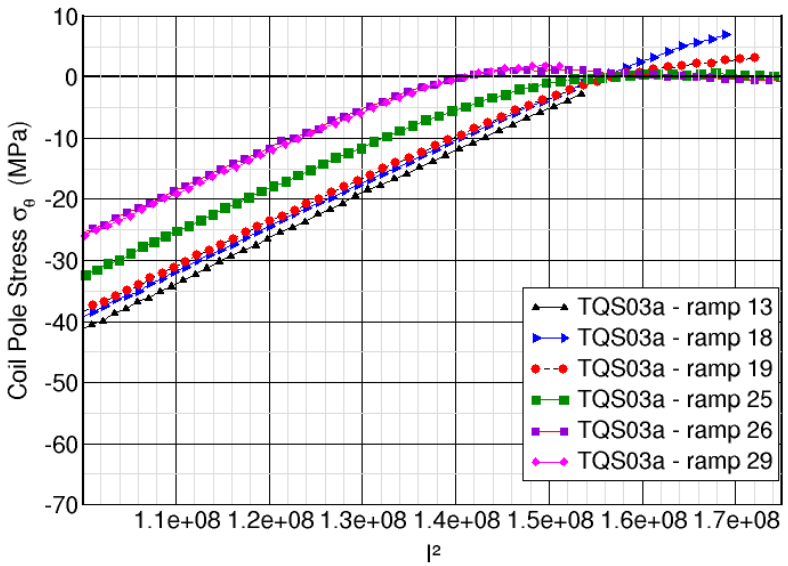


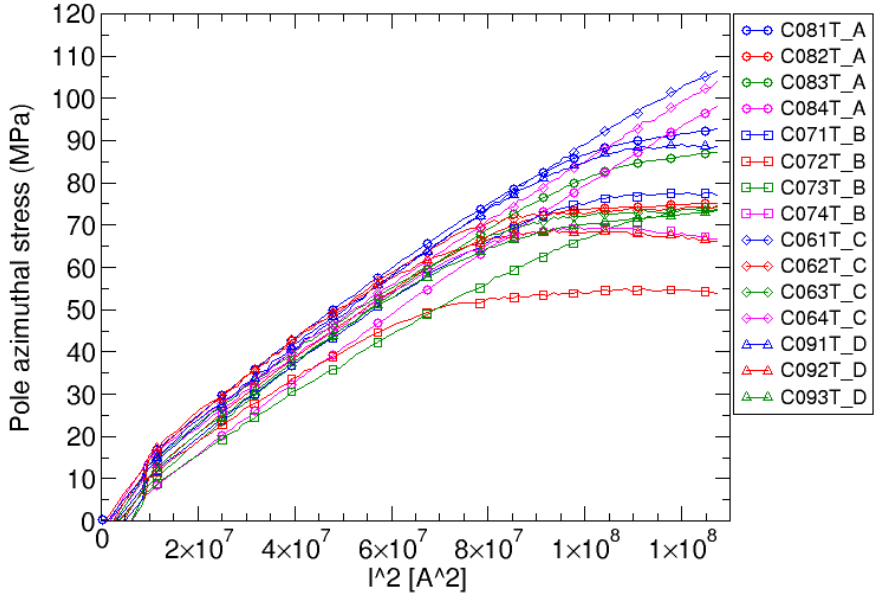
HQ01d during excitation



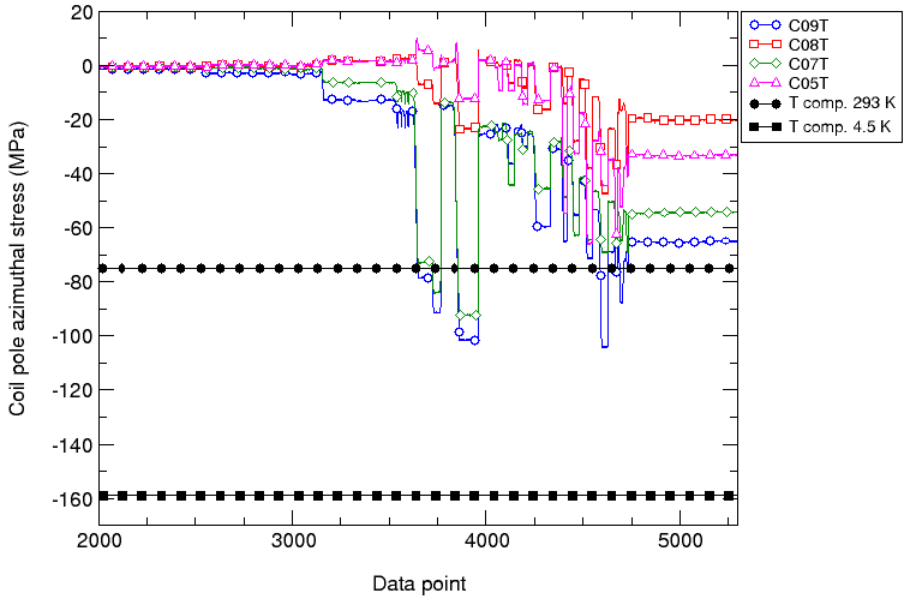


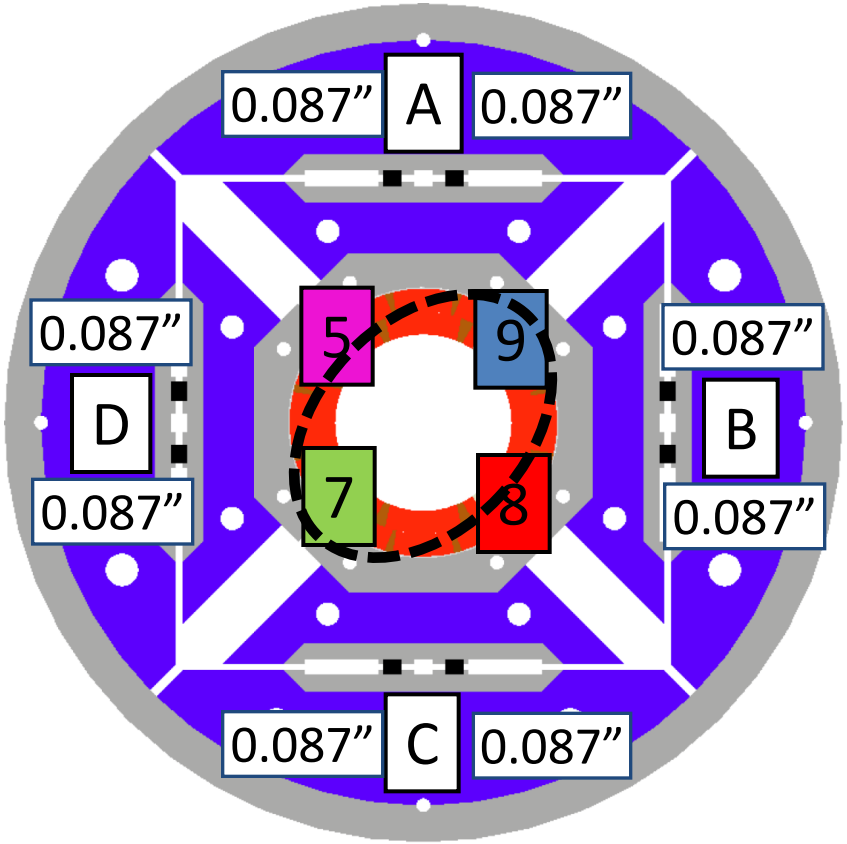
TQ and LQ case



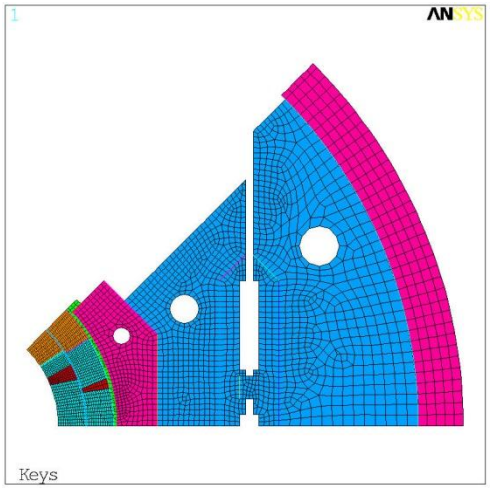


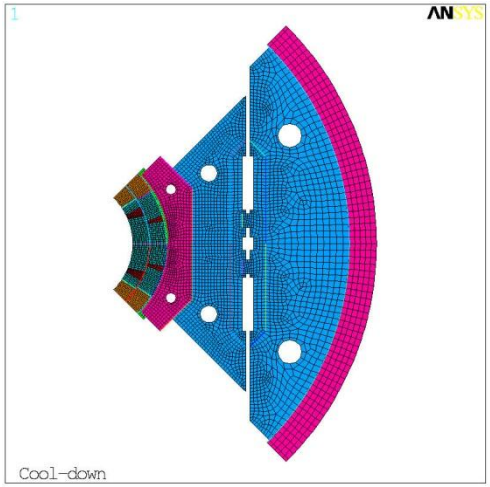
HQ01d: possible scenario

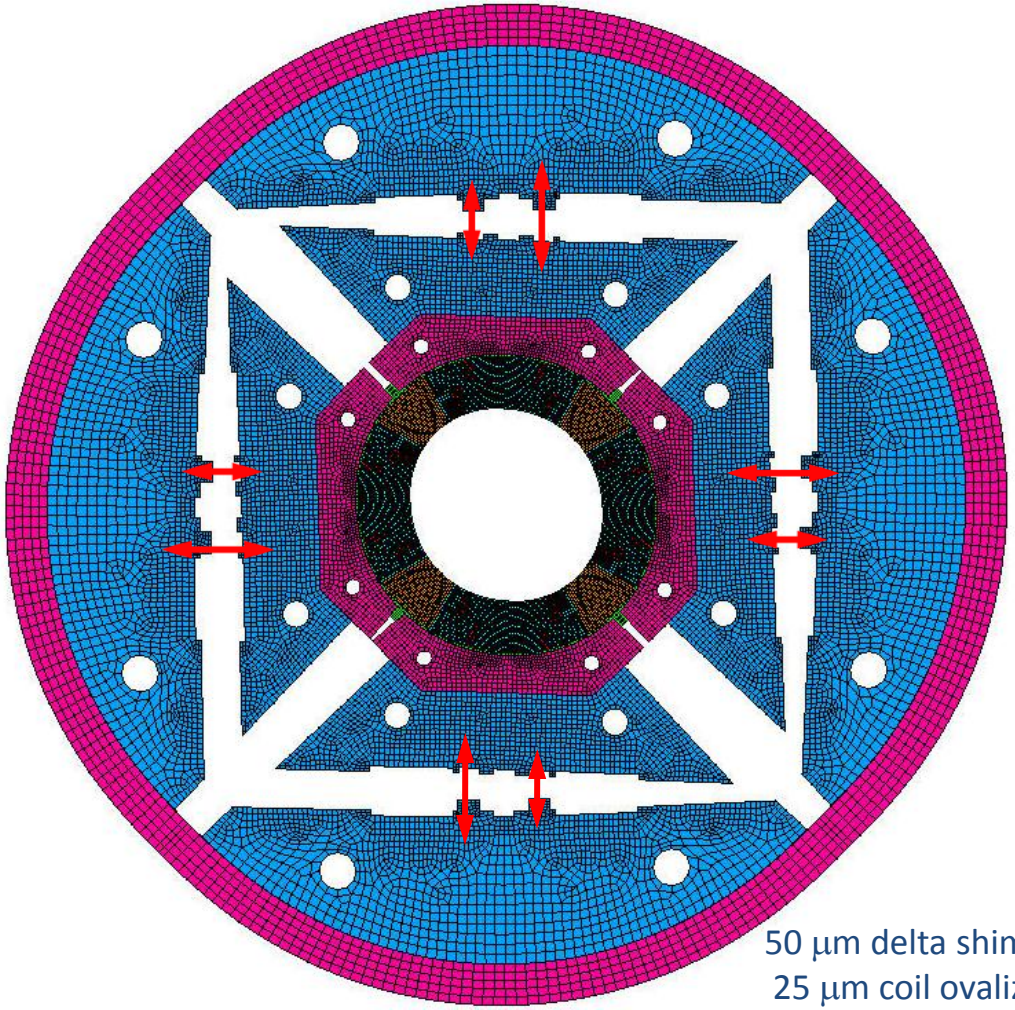




2D model

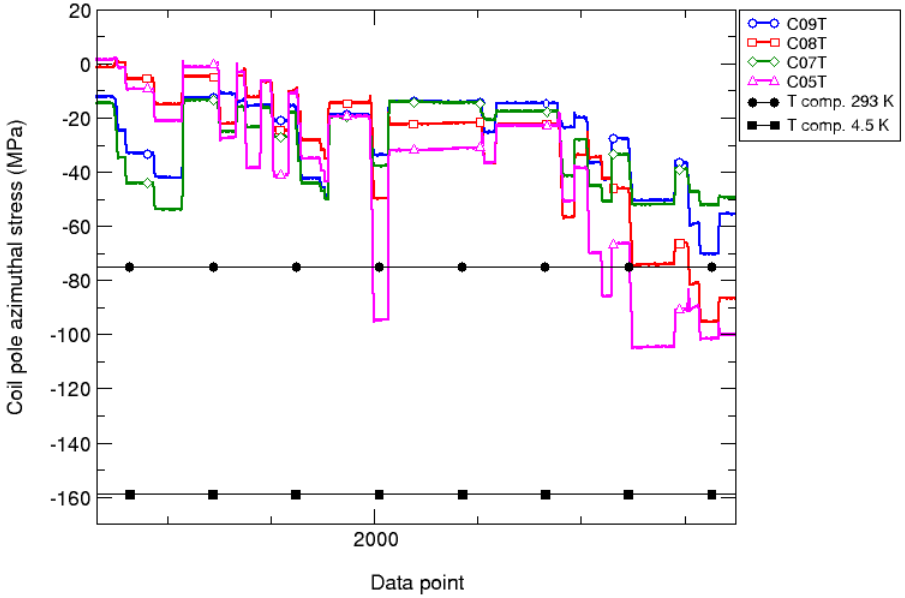


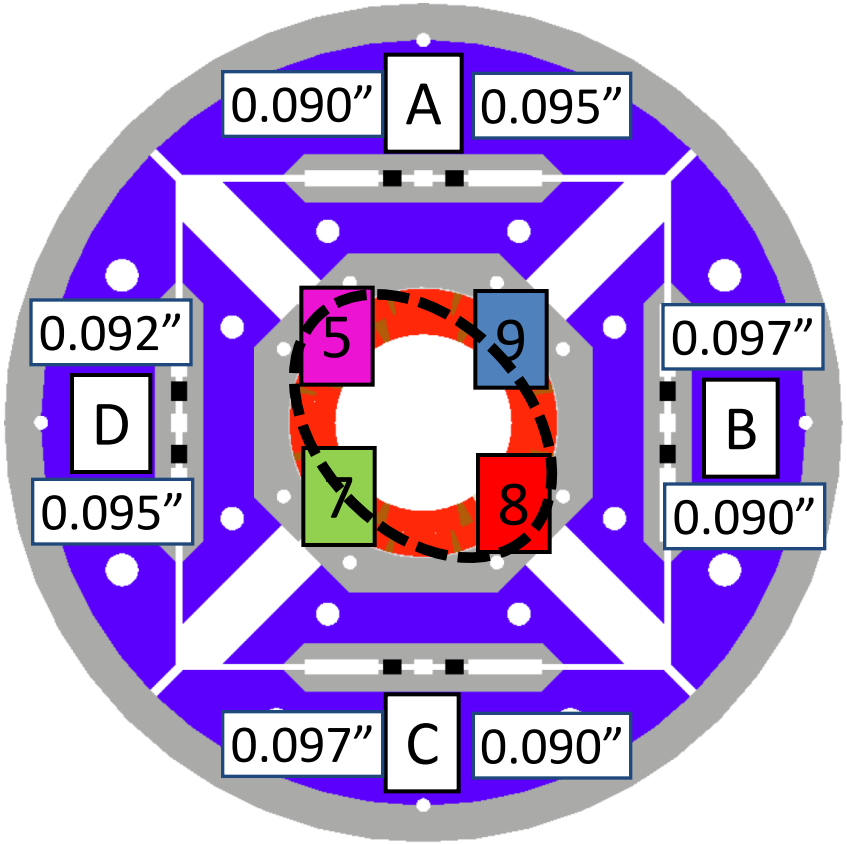




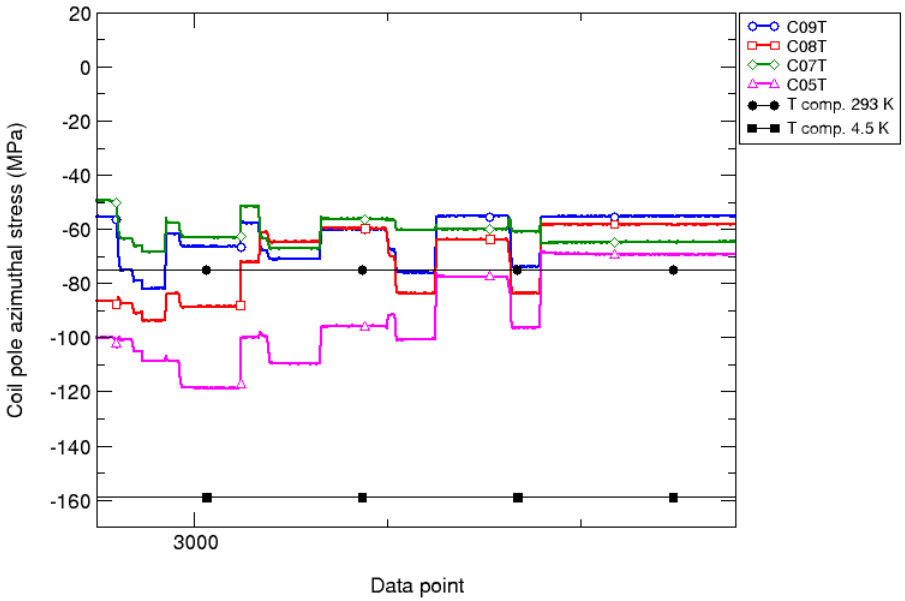
50 μm delta shim produces
25 μm coil ovalization

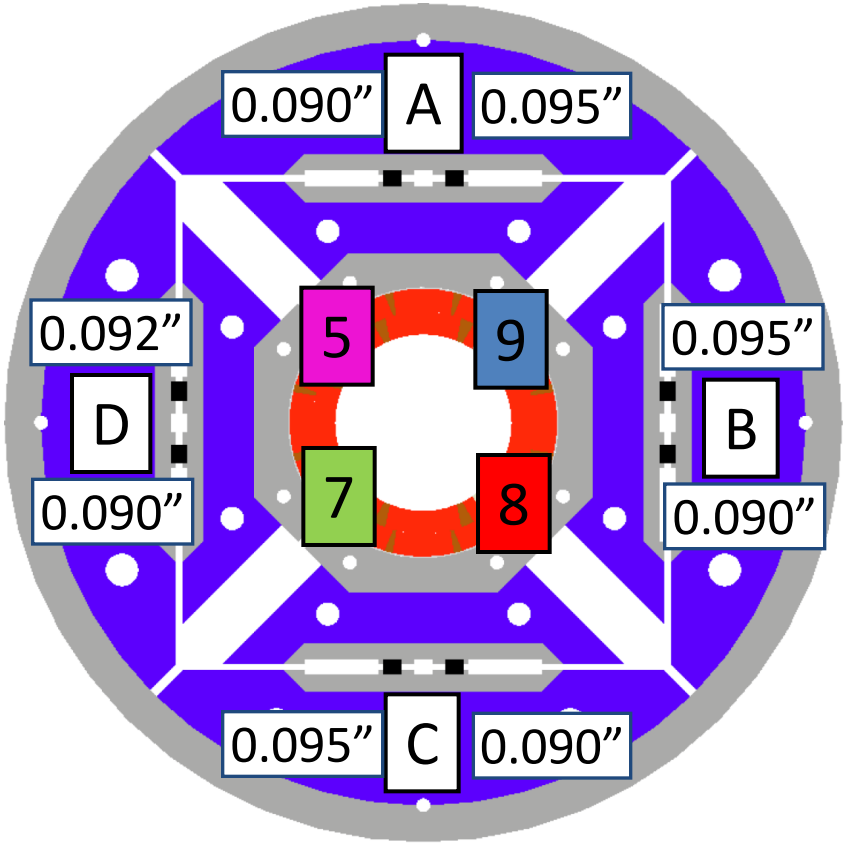
HQ01e
First part of the loading





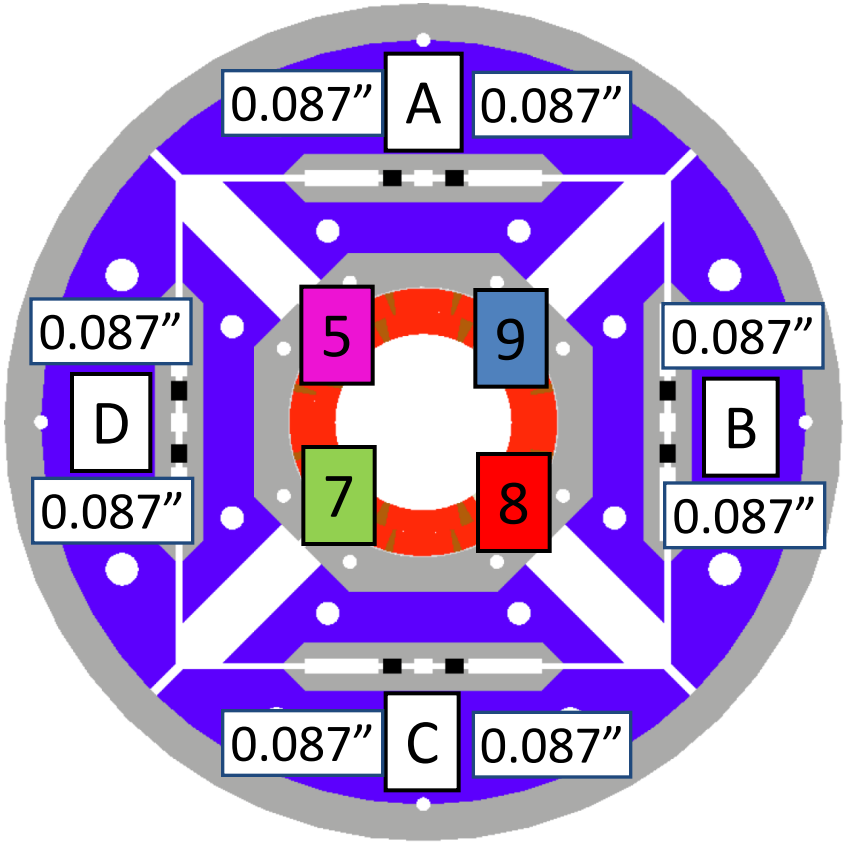
HQ01e
Second part of the loading



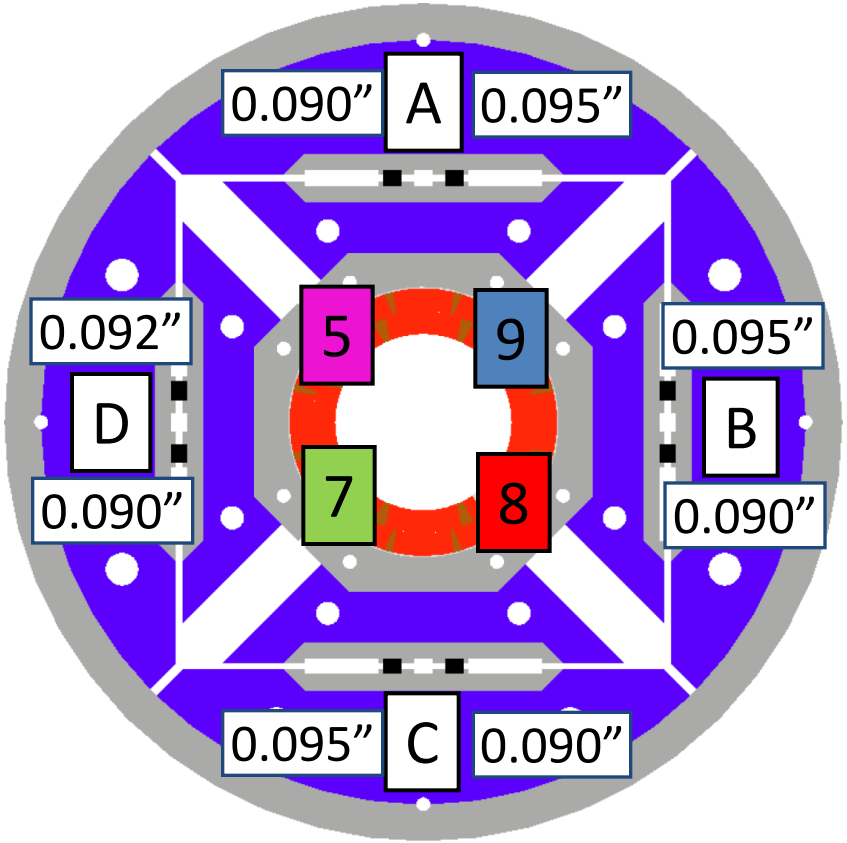


Coils, bladders and load-key shims

- HQ01d

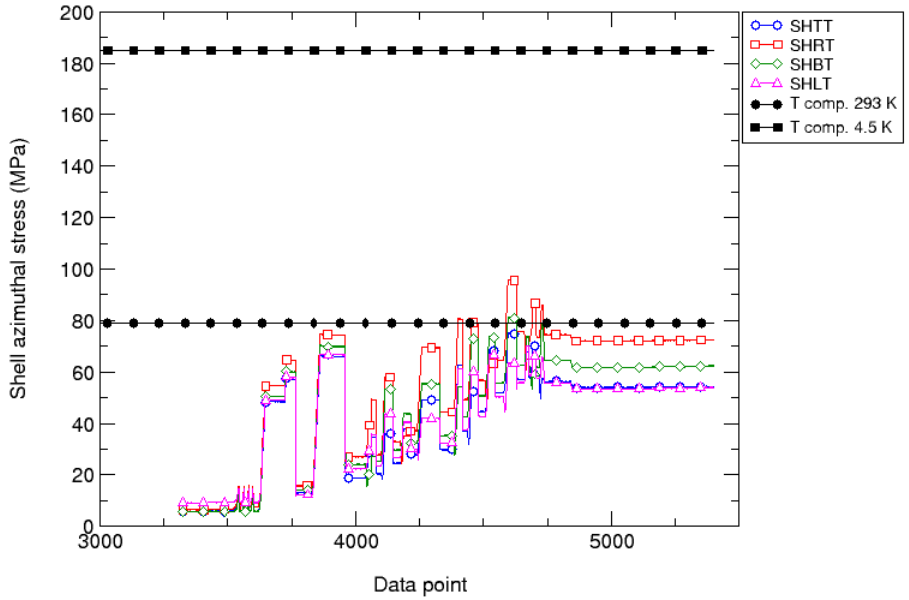


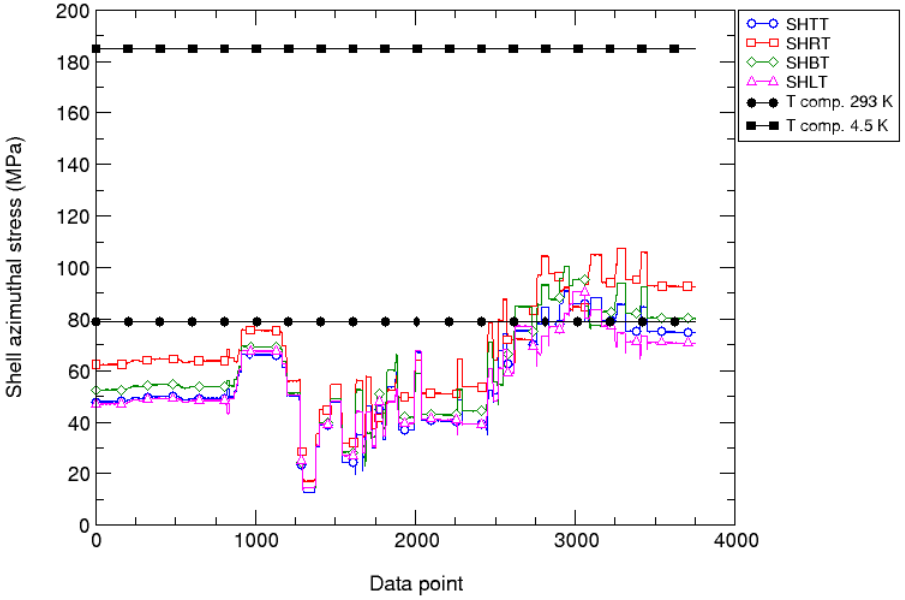
- HQ01e



HQ01d vs. HQ01e loading
Shell azimuthal stress

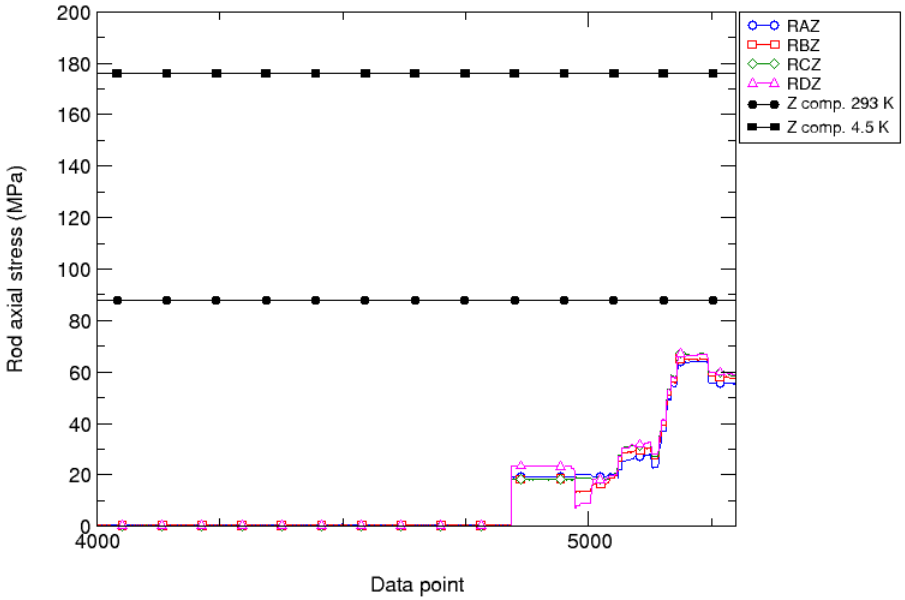
- HQ01d
  - $\sigma_\theta = +61 \pm 9$ MPa
- HQ01e
  - $\sigma_\theta = +80 \pm 10$ MPa

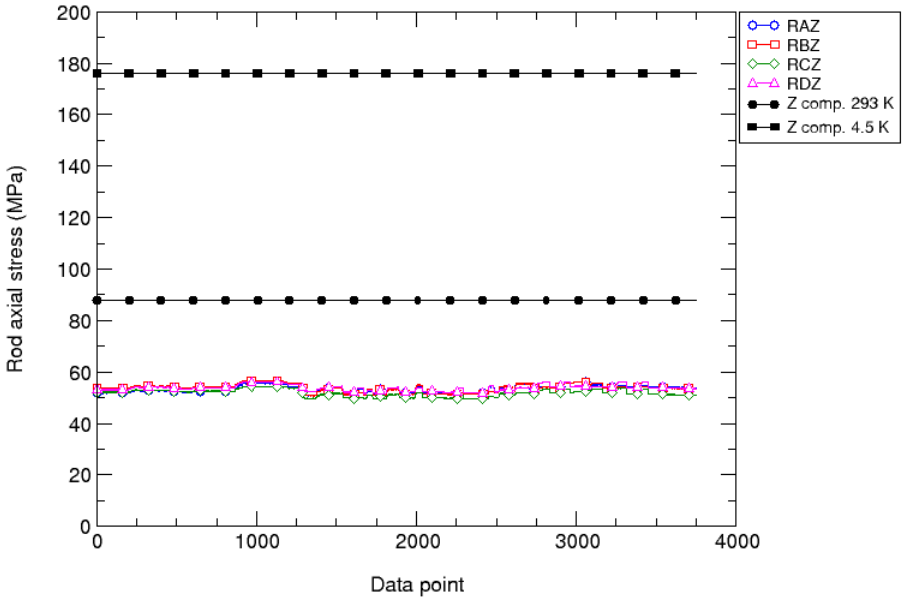




HQ01d vs. HQ01e loading
Rod axial stress

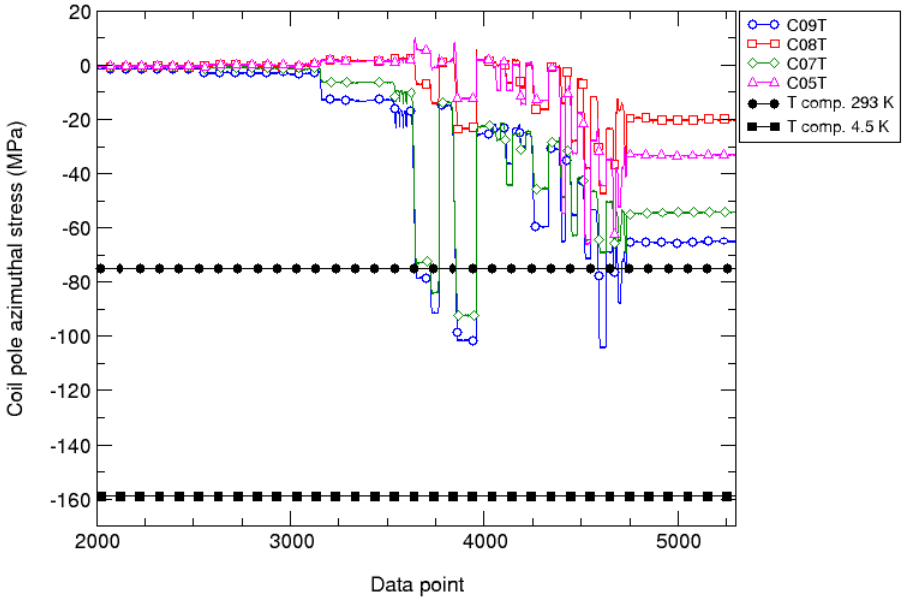
- HQ01d
  - σ_z = +58 ±2 MPa
- HQ01d
  - σ_z = +53 ±1 MPa

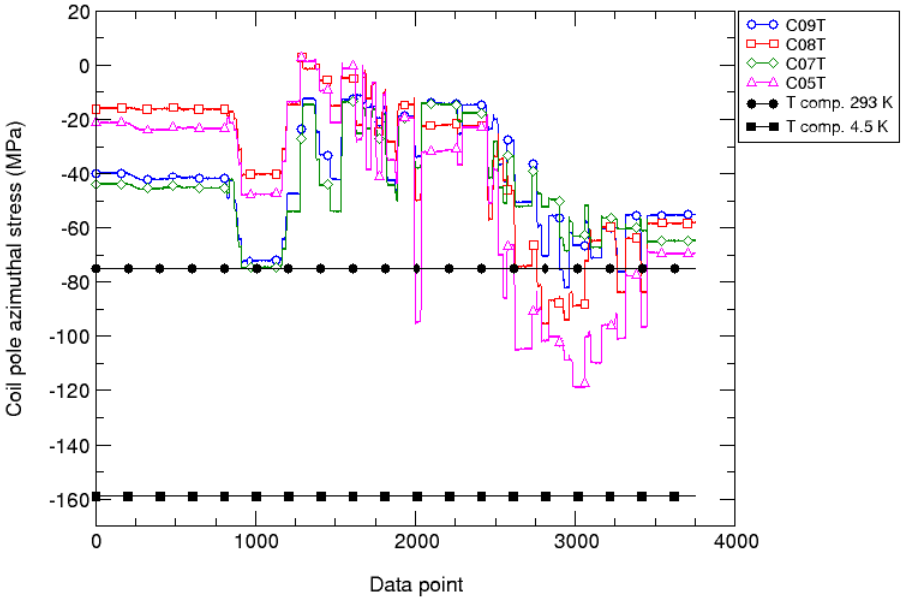




HQ01d vs. HQ01e loading
Coil azimuthal stress

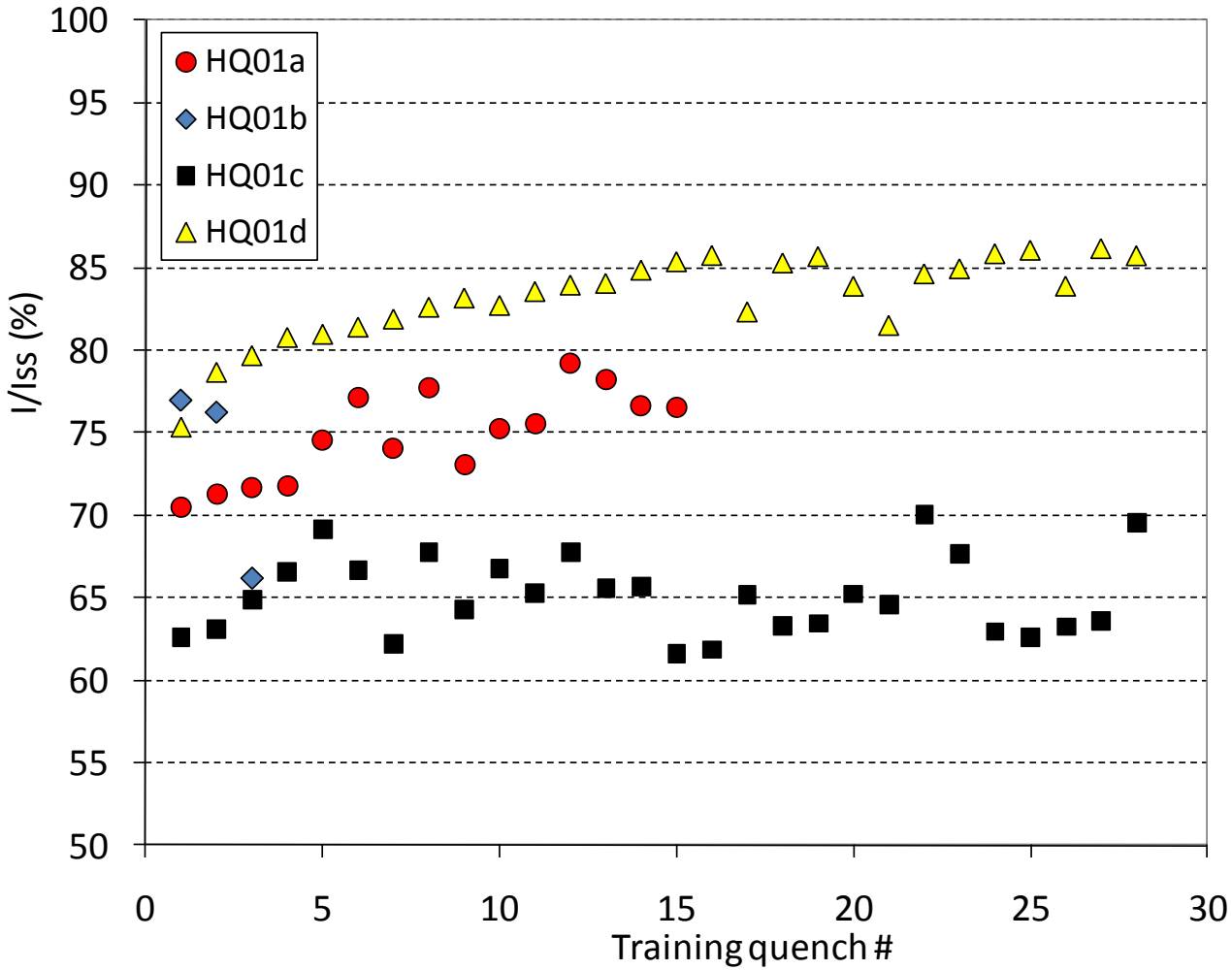
- HQ01d
  - σ_θ = -43 ±20 MPa
- HQ01e
  - σ_θ = -62 ±6 MPa



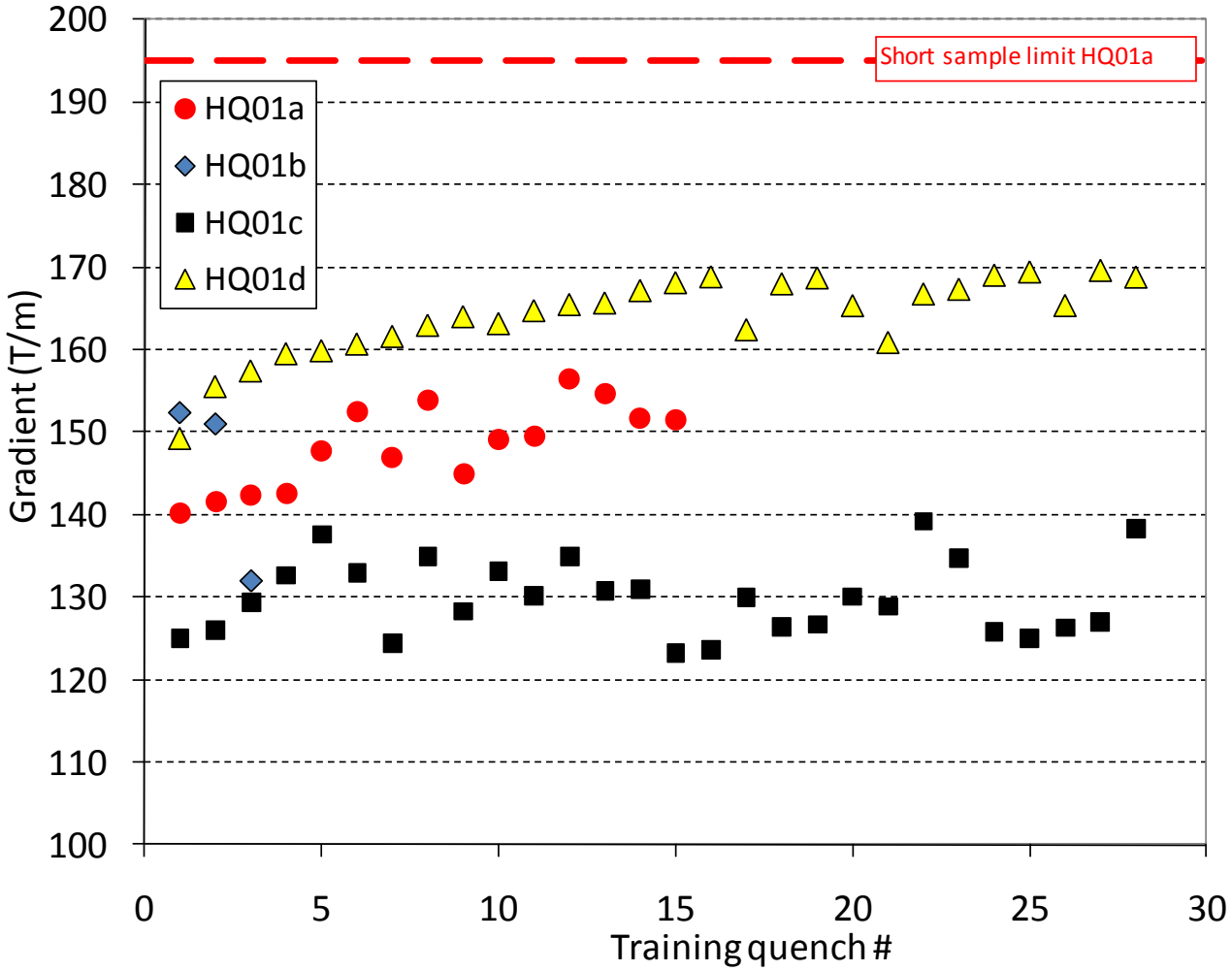


Appendix

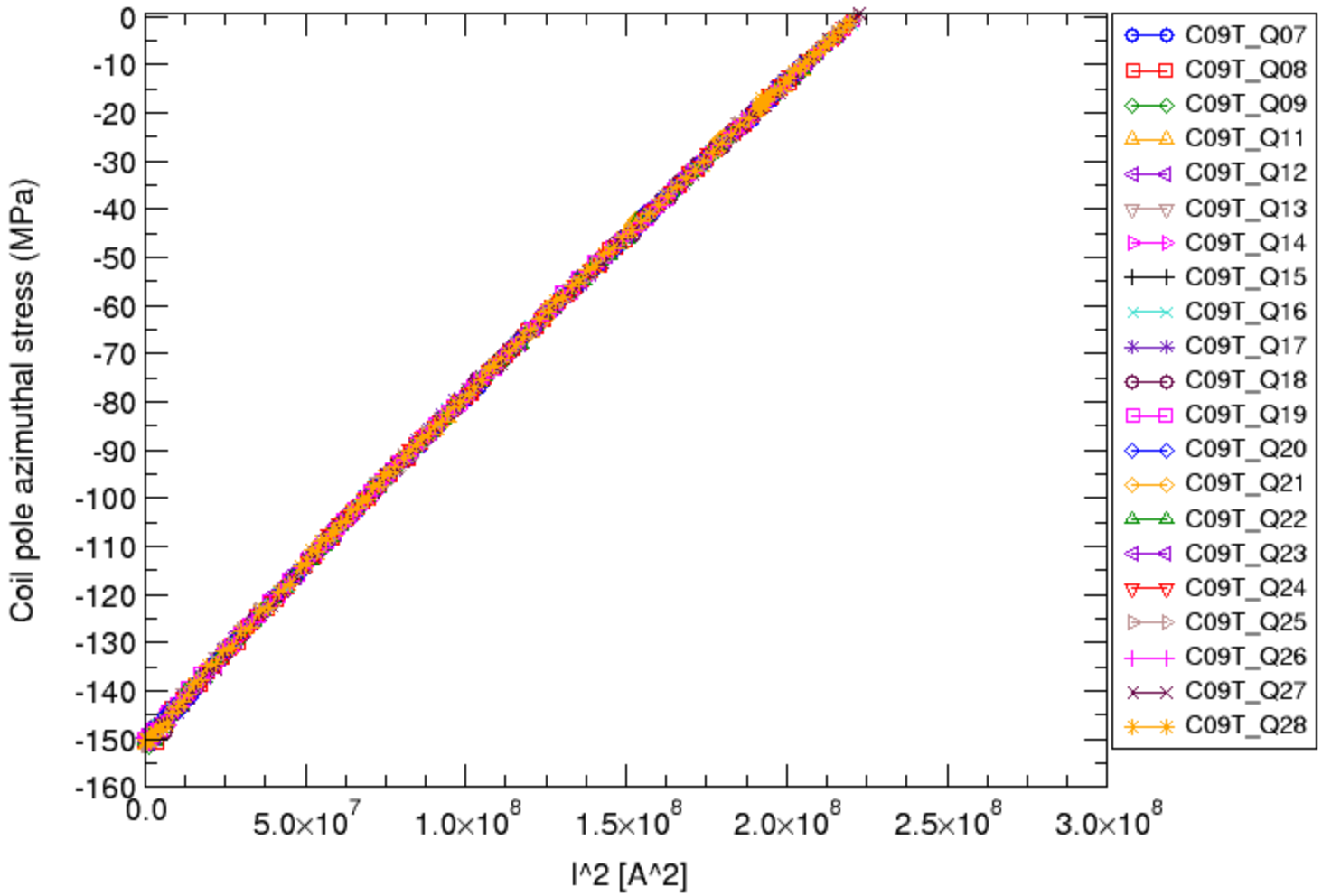
Iss % of training quenches



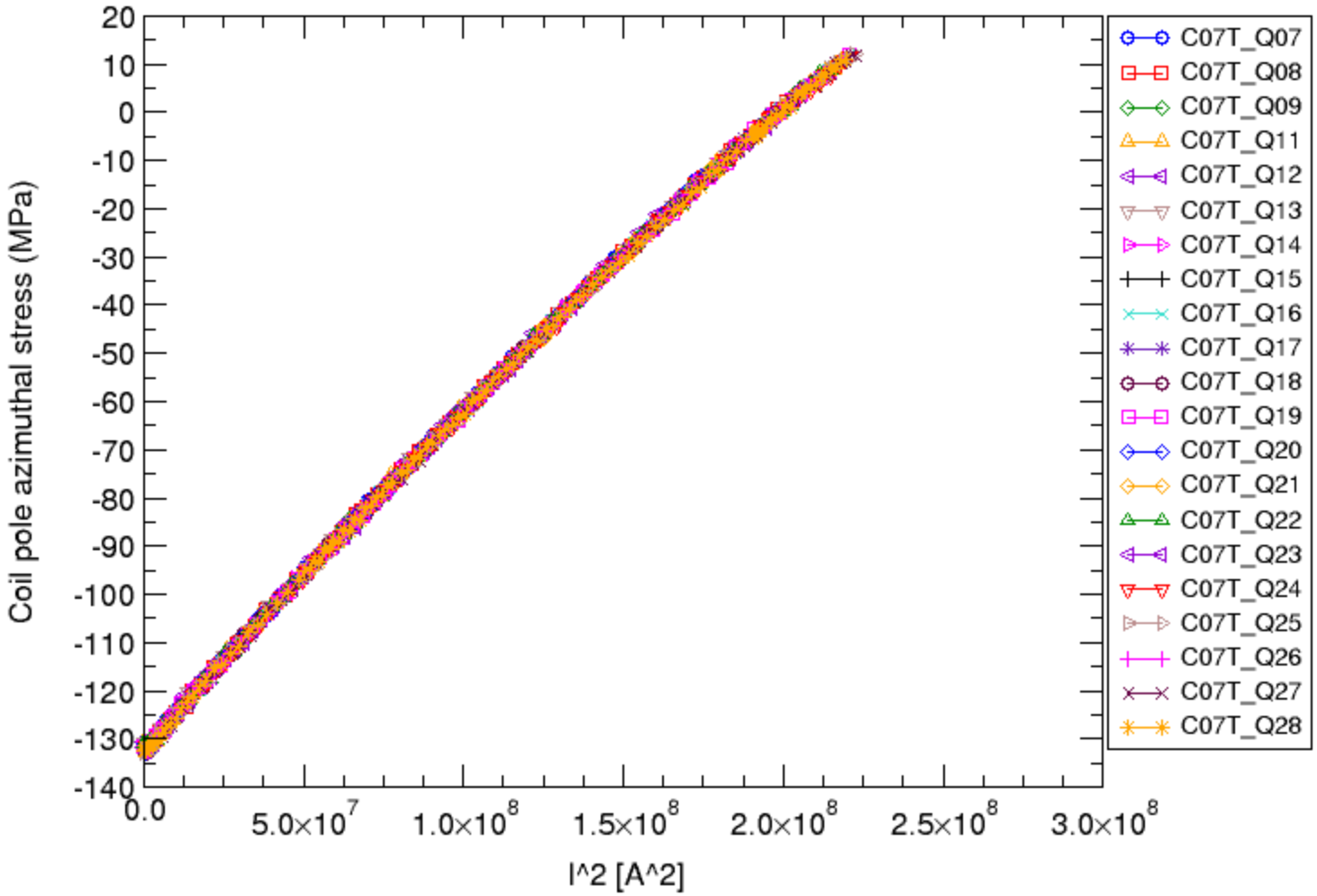
Gradient of training quenches



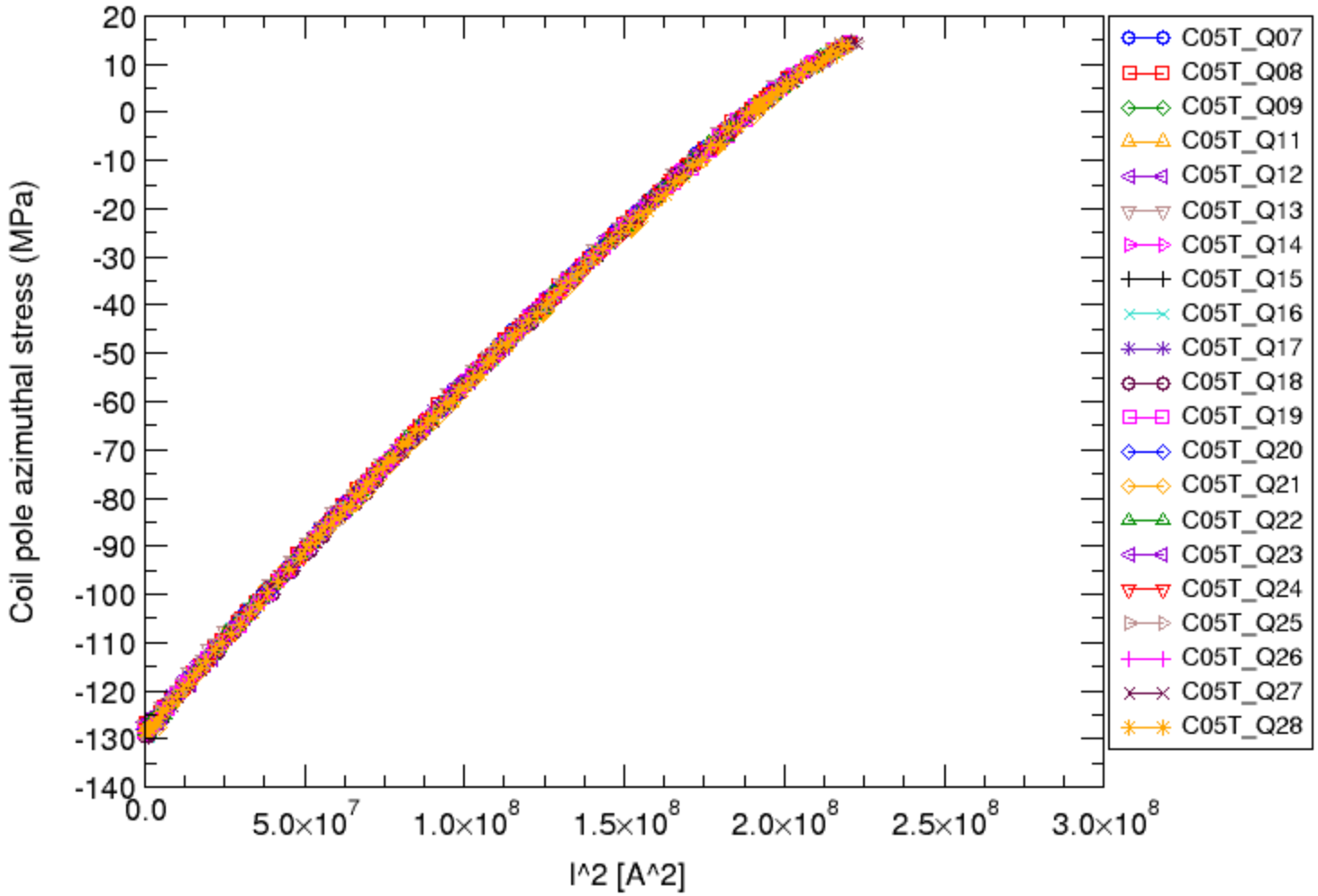
Coil 9 azimuthal stress during excitation



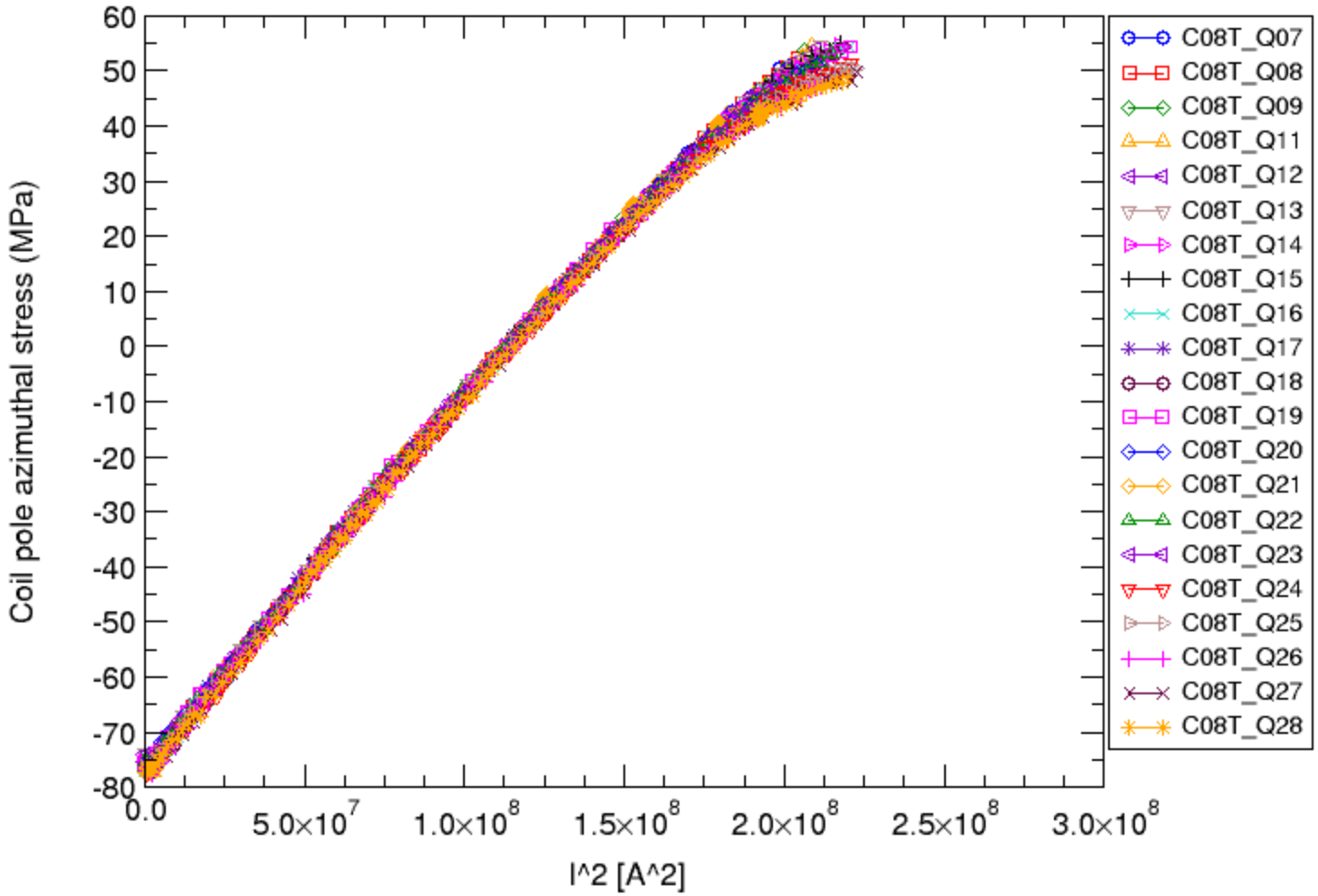
Coil 7 azimuthal stress during excitation



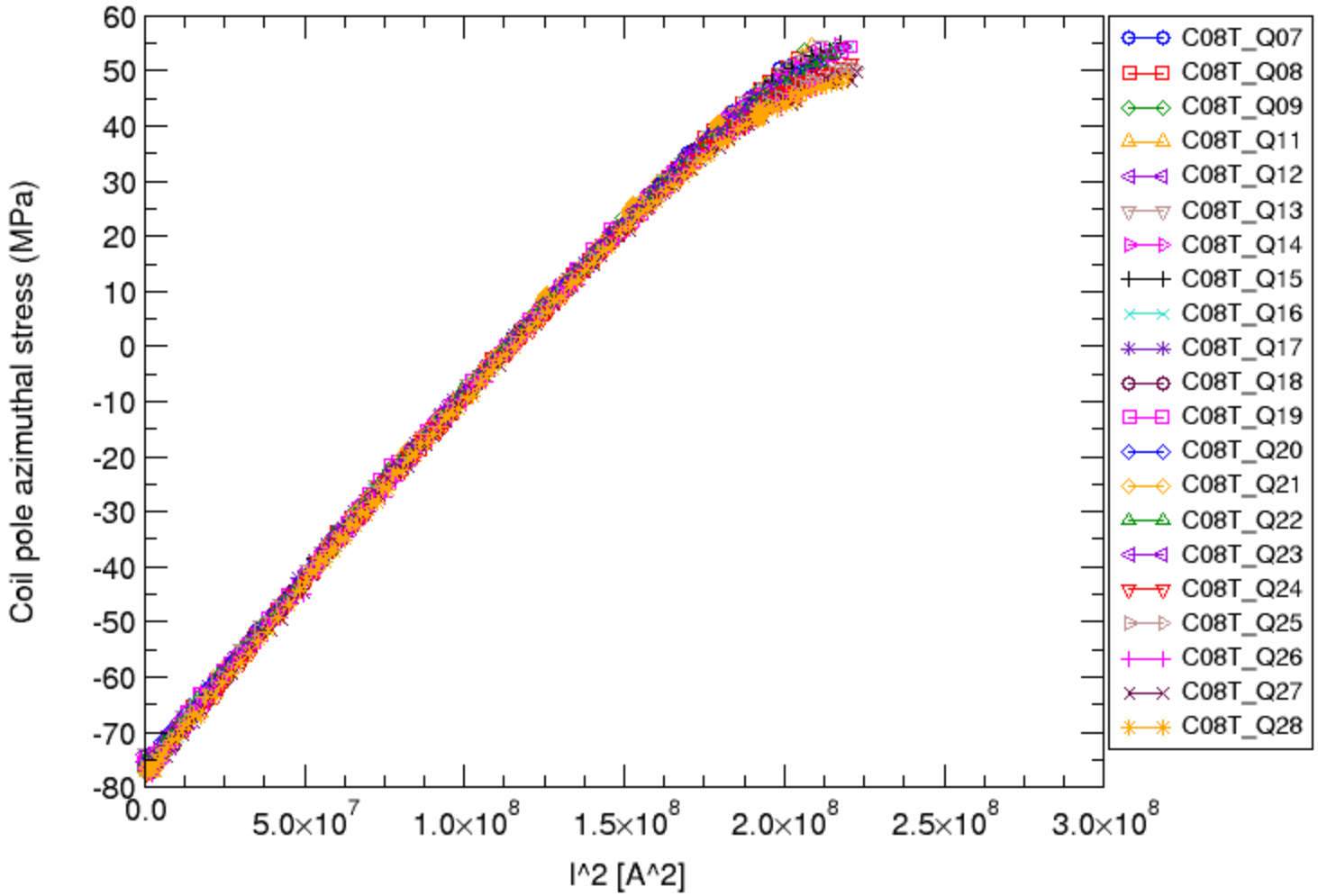
Coil 5 azimuthal stress during excitation



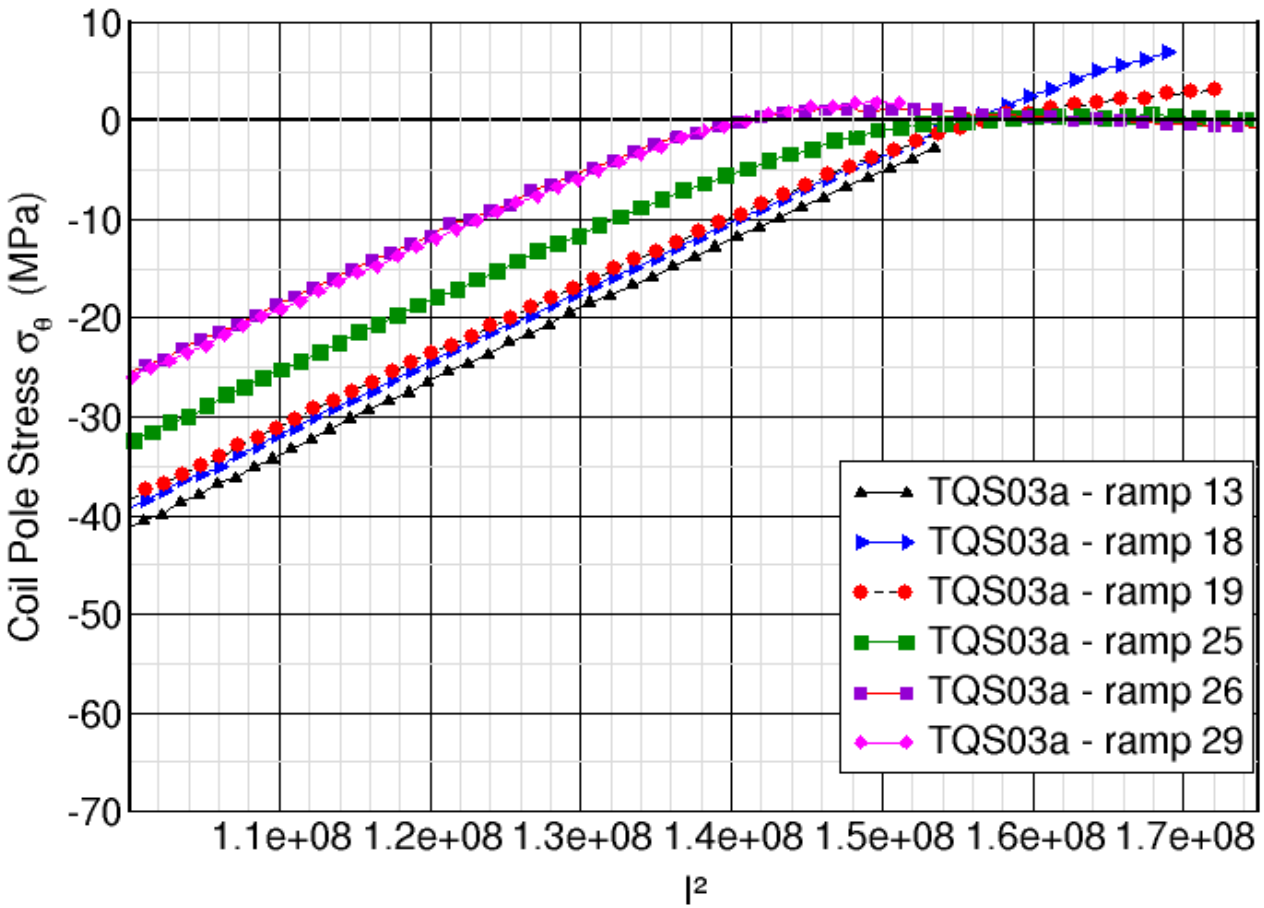
Coil 8 azimuthal stress during excitation



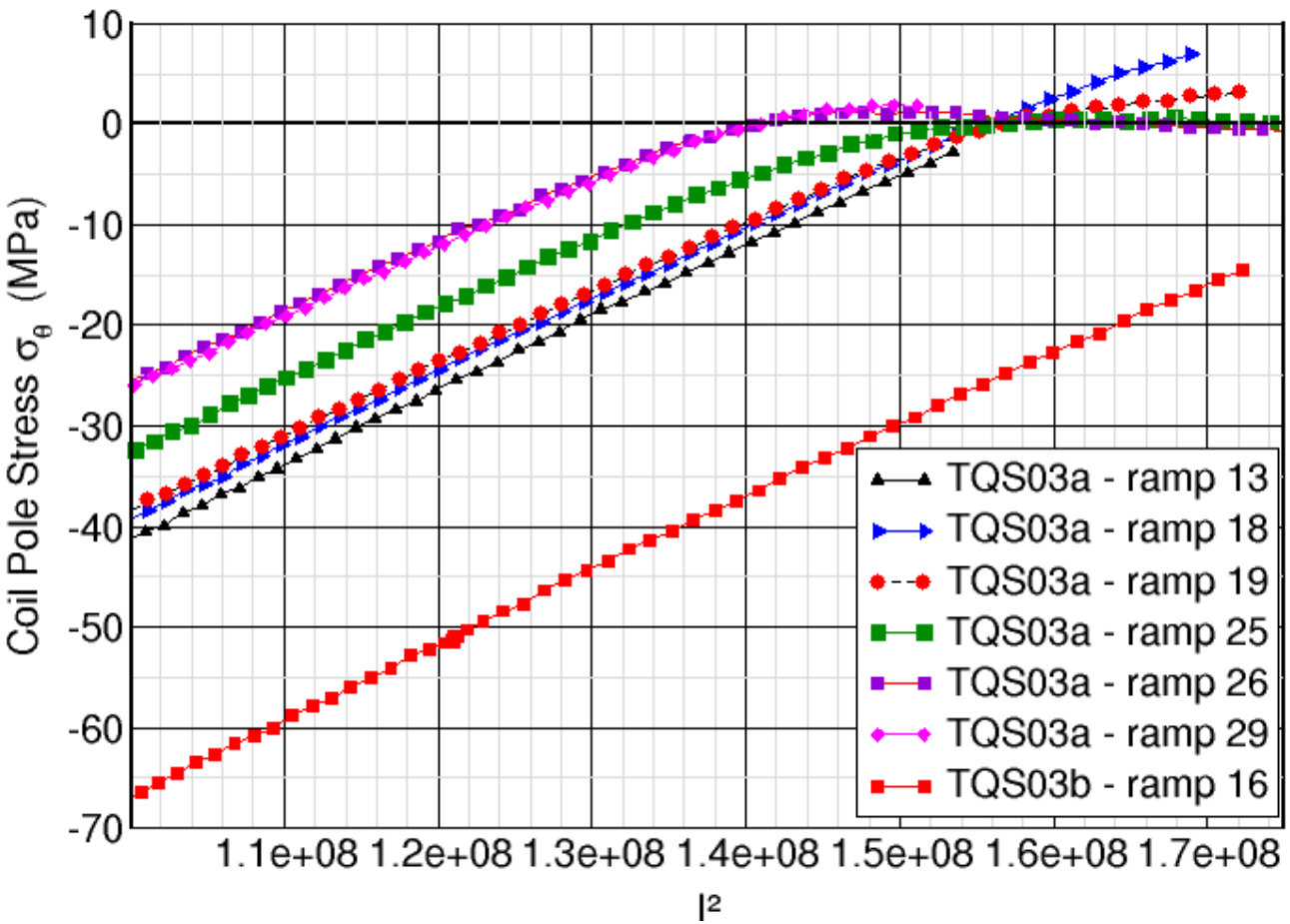
Coil 8 azimuthal stress during excitation



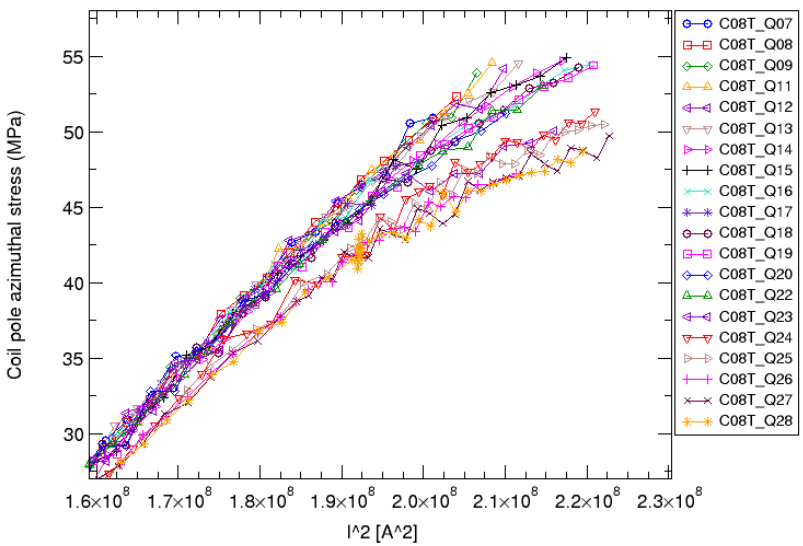
TQS03 strain gauge data

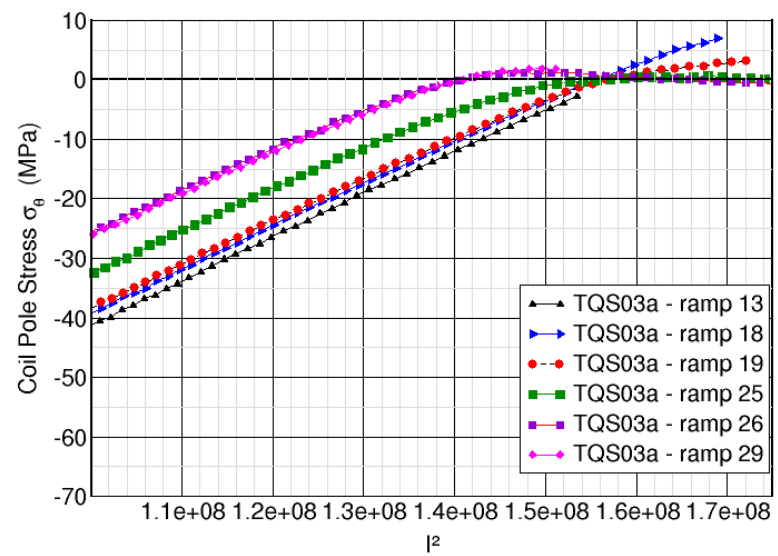


TQS03 strain gauge data

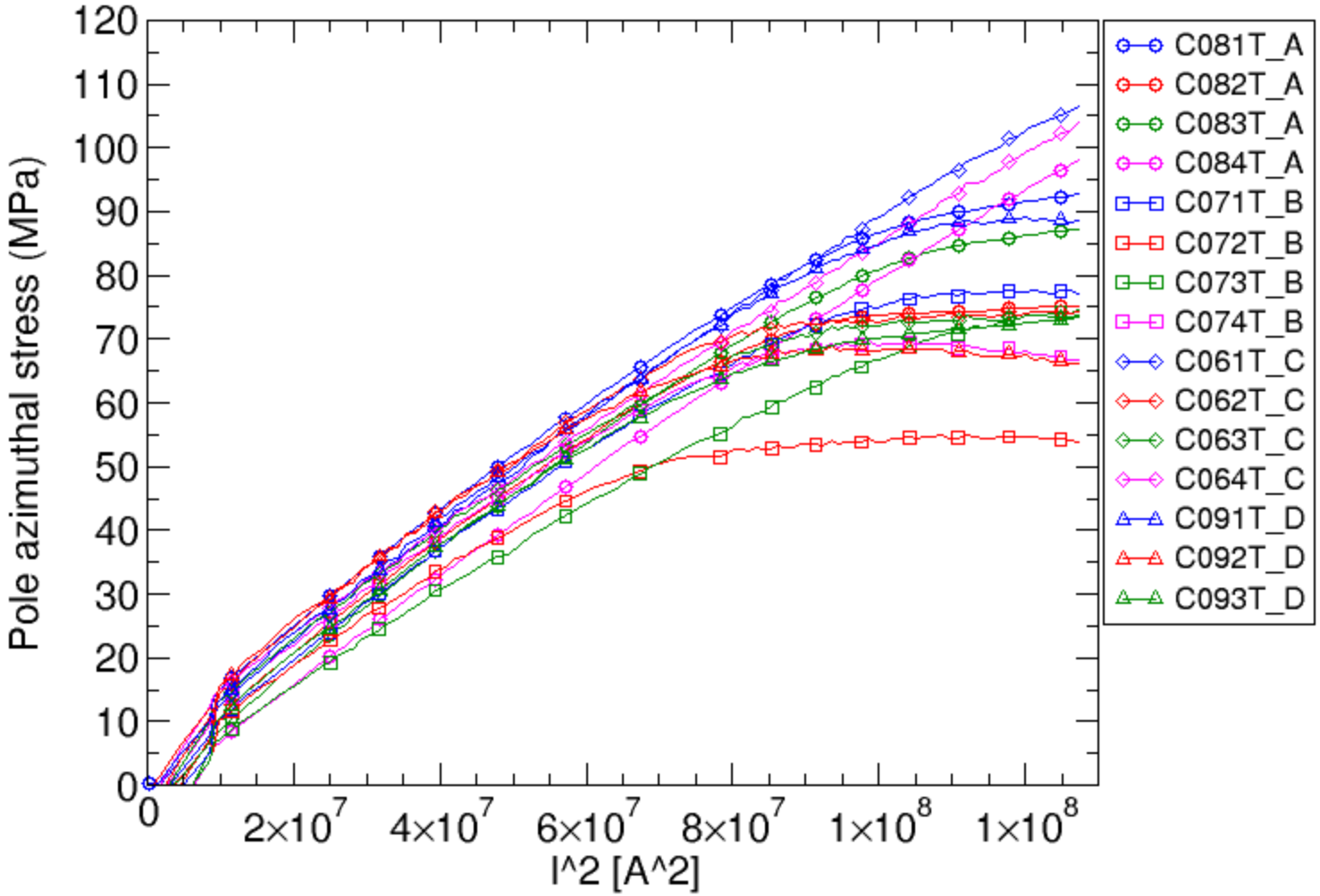


Comparison HQ01d vs. TQS03

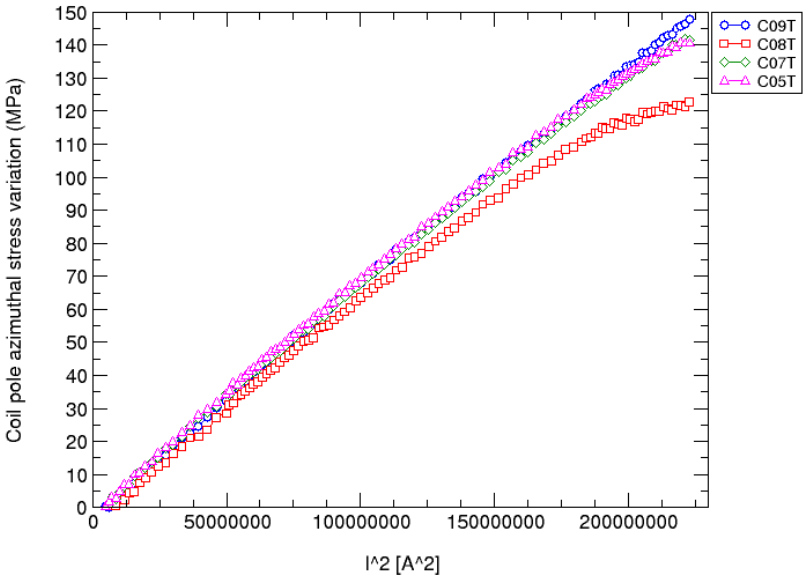


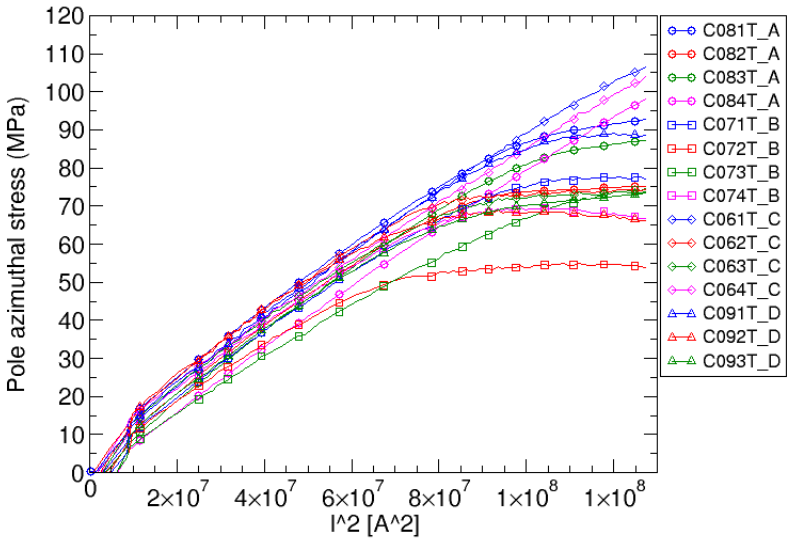


LQS01a coil azimuthal stress variation during excitation

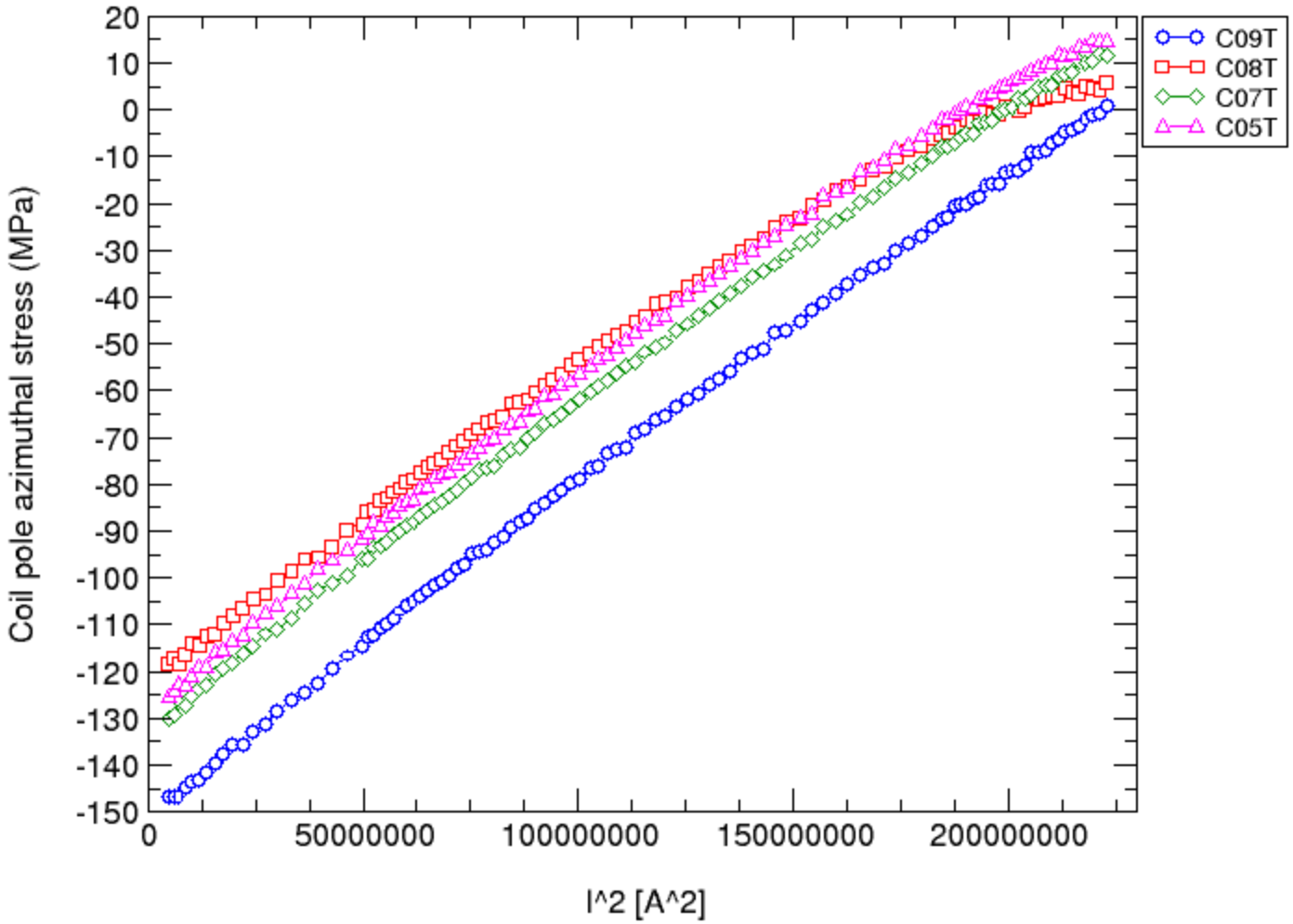


Comparison HQ01d vs. LQS01a



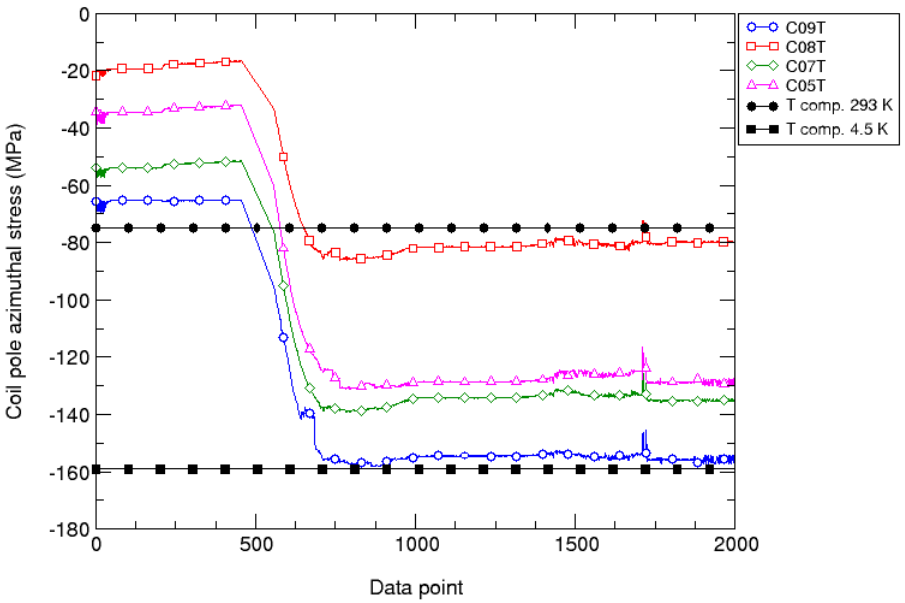


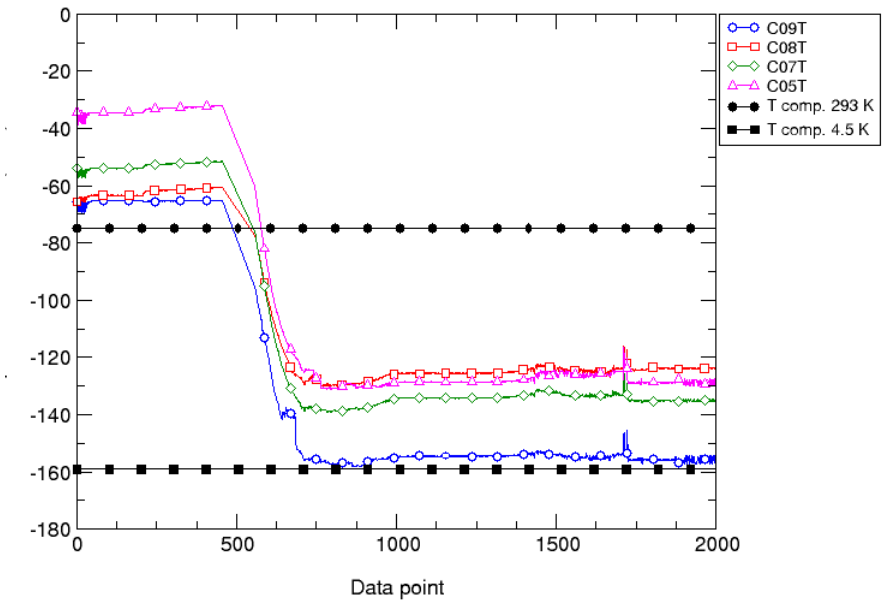
Coil 8 with corrected offset

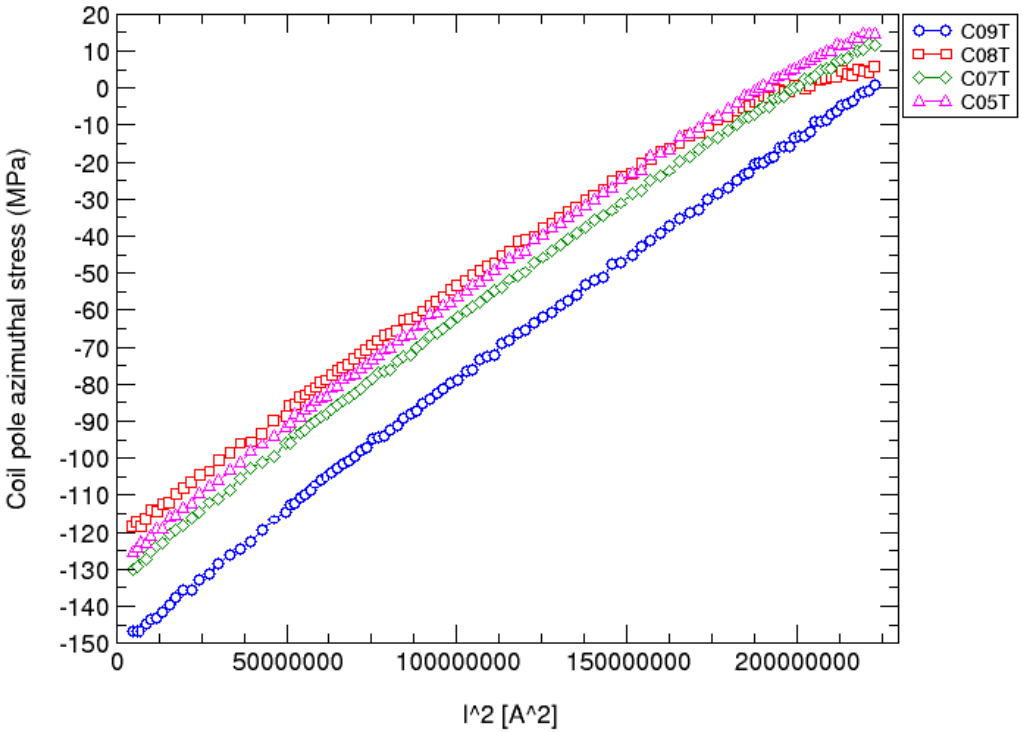


HQ01d vs. HQ01d corrected

- HQ01d
  - σ_θ = -125 ±32 MPa
  - Expected from shell: -130 MPa
- HQ01d
  - σ_θ = -136 ±14 MPa
  - Expected from shell: -130 MPa





HQ01d coil pre-load based on “absolute” values (coil 8 corrected)

- Coil pre-load
  - Coil 9
    - At least -150 MPa
  - Coil 8
    - About -120 MPa
  - Coil 7-5
    - -120/-130 MPa