Description of work to be performed and the reason(s) to do it (provide attachments as needed):
MQXFA06 will need to have its axial loading undone in order to adjust position of the axial end plate at the magnet return-end. See slides in the attachment describing the situation and the plan below.

What actions need to be completed in order to bring the system back into normal work flow (be very specific, e.g. make a checklist for everything that needs to be undone/verified):
- Support axial endplates with blocking/jacking screws
- Connect SG system for continuous reads
- Connect axial loading rig, per WI SU-1011-5637 Steps 42-45
- Unload axial loads to 50% load (~470 με), check SG readings and verify
- Unload axial rods fully
- Align RE endplate; verify LE endplate is still in proper location
- Reload axial rods to 950 με, per WI SU-1011-5637 Steps 76-78
- Remove axial loading rig

How and who will verify tbe above actions before the system is put back into normal work:
- Heng Pan will verify that all SG readings from all operations show no anomalies
- Dan Cheng to sign off that both end plates are aligned properly

Other subsystems/organizations to be notified/coordinated:
None.

Estimated Cost:
$200 for parts to make up the end plate blocking and support

Associated Discrepancy Report(s) or NCR(s):
MQXFA-NCR-0164

List attachments:
Slides dated 12/9/2020

Summarize outcome of work, including verification of all actions required to put the system back into normal work:

Work Initiated/Planned By (include all names)	Date:
Dan Cheng	12/10/2020
Work Approved By:	
Giorgio Ambrosio Giorgio Ambrosio (Dec 10, 2020 15:49 CST)	
Work and Verification Completed By:	**Date Completed:**
System Approved to Return to Normal Flow By:	**Date Approved:**

This form and process are to be used when work performed on an assembly/sub-assembly is not controlled using travelers or released designs, or when non-standard tooling needs to be used. Work that needs to be redone according to the travelers (and no work is done beyond the normal work steps, and no additional tools are needed) does not require using this form, and instead would be controlled using a Discrepancy or Nonconformance Report and the standard traveler/procedure.

This form and process are invoked after the process/procedure is developed and approved in travelers/procedures (i.e. it is not used when the processes are under initial development).

1. The Initiator completes the fields highlighted in green, and shares the completed form with the Approver (e.g. L2, CAM, or System Manager).
2. The Approver reviews the request, and adds their (digital) signature if approving it.
    a. The Approver decides if the request needs to also be reviewed/approved by any other individuals.
3. Once approved, the Initiator is informed and the off-normal work shall commence.
4. Once the work is completed, including verification that the system is ready to be put back into the normal work flow, the Initiator completes/signs (digitally) the fields highlighted in orange, and shares the form with the Approver. **THE SYSTEM SHALL NOT YET BE PLACED IN NORMAL WORK FLOW.**
5. The Approver reviews the work/verification summary, and adds their (digital) signature authorizing the system to be placed back into the normal work flow. The Initiator, and any others, are notified.
6. The completed form is archived by attaching it to the appropriate traveler.

MQXFA06
RE Axial Endplate misalignment

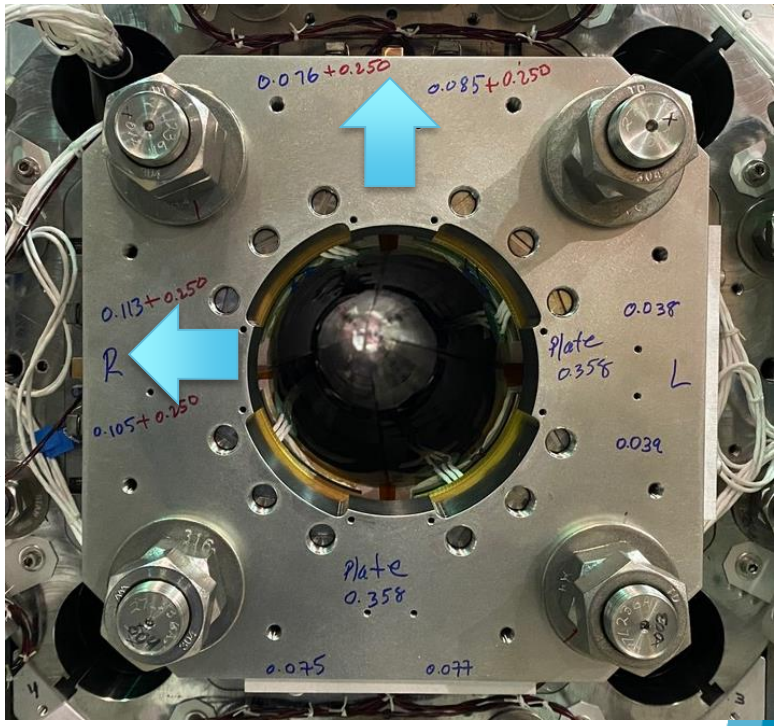
Dan Cheng, Heng Pan, et al.

12/9/2020

LBNL

RE Axial Endplate

- When restraint plates were being installed, it was noted that two of the RE plates could not fit (*when viewed from LE: Top and Right*), indicating that the plates were not aligned properly
  - *Top surface is offset about 0.060" from nominal, and Right surface is 0.025" offset from nominal*
  - *Subsequent checks showed that the bottom part of the endplate is actually inset w.r.t. to the coil ID bore surface due to the upward shift*
- LE restraint plates were installed with no issues, appears to be properly aligned



(Note: Viewing from RE)

RE Endplate Disposition

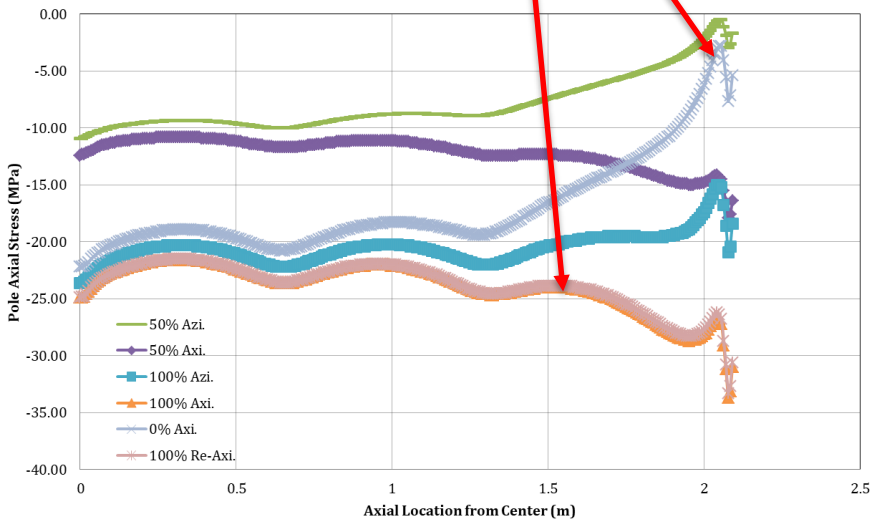
- Status
  - Magnet has been fully preloaded
    - Last step of preload operations was to increase axial load from 50% to 100% (~65 Tons of force)—not easy to shift plate now
    - Would need to reduce axial force in order to shift plate and re-align
- Preliminary causation analysis:
  - One experienced technician was on vacation when these plates were installed
    - Tooling and alignment operation was missed in this endplate setup
  - Present version of the Magnet Integration Work Instructions does not capture this radial alignment as a verification point
    - This step was dependent on a technician's experience to perform
- The following slides show the plan based on FEA analyses

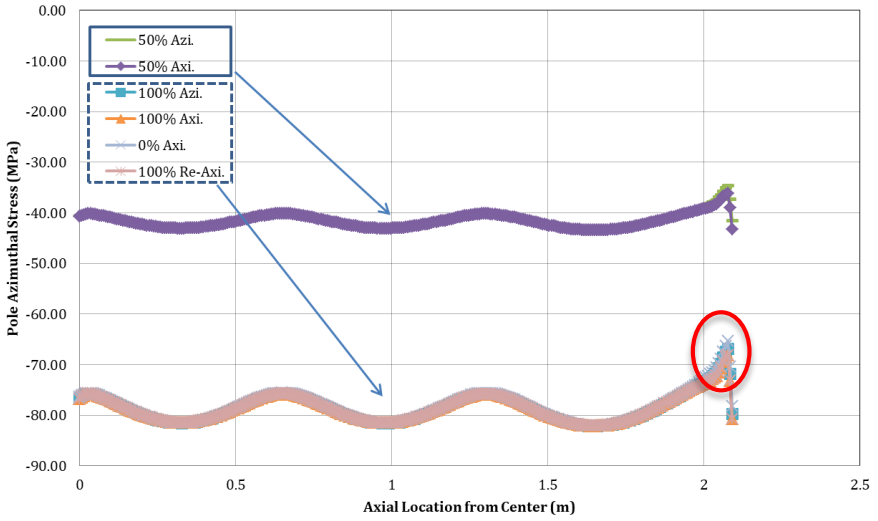
Axial Unloading FEA Load Steps

- **Analysis performed on existing FEA model, adding two load steps:**
  - Axial contact
  - 50% Azimuthal load
  - 50% Axial load
  - 100% Azimuthal load
  - 100% Axial load
  - 0% Axial load
  - 100% Axial load

Observations

- Axial unloading does not significantly affect azimuthal load, likely due to frictional effects
- Re-loading to 100% appears to achieve the same preload with very slight differences





Proposal to Shift Plate

- Design supports for both LE and RE end plates
  - So no unwanted shifting occurs when unloading plates
  - Designing brackets for shifting the RE plate
- Unload ~50% of the load (to ~470 µe)
  - Perform a SG sanity check to verify FEA model and repeatability from the start of the final operation
- If numbers are proper, reduce force to light contact (~50 µe, similar to original contact) to maintain friction
  - This still will assist with preventing excess movement of plates
  - However, all force may need to be removed
- Move RE endplate using the brackets tooling and align
- Reload to 950 µe rod strain

- **SG readings will be maintained throughout the entire process**
  - **Values will be monitored and compared to FEA and expected numbers at all steps**

NCR Triggers

- Identified changes in the WI that will prevent future occurrences
  - Present WI relies on experience—must be changed to an actual step with verification that is confirmed by QC personnel
  - WI will be revised and tooling to verify proper position prior to applying loads

Status

- Splice box has already been installed
  - Does not impact our ability to support the LE end plate
- Tooling brackets are being made up for the support/shift of the end plates
- This operation will be completed before the final magnetic measurements

Additional Slides

Signature:

Email: giorgioa@fnal.gov