

Title: **Shorted Turn Protection PDR**CAT: ☐ A1 ☒ A2 ☐ A3Type of Review: ☐ Peer ☐ CDR ☒ PDR ☐ FDRCognizant Individual: **F. Hoffmann**Date of Review: **9/20/19****Review Board Members &**Chair: T. Stevenson  
RE F. Hoffmann  
D. Boyer  
C. Bovet  
R. Ellis  
P. Dugan  
P. Titus  
QA A. Castenada  
ESH \_\_\_\_\_**Attendees:**P. Sichta  
C. Freeman  
G. Tchilinguirian  
J. Dellas  
R. Hawryluk  
S. Gerhardt  
D. Battaglia  
J. Corl**Attendees:**N. Rahman  
Y. Zhai  
R. Rosenblat  
W. Que  
R. Camp  
M. Kalish  
W. Gattoni<https://sites.google.com/pppl.gov/20190920rtcpshortedturnprotect/home>

<b>Items Reviewed:</b>	<b>Sat.</b>	<b>Unsat.</b>	<b>Comments or n/a if not applicable</b>
Appropriate requirements identified	<b>X</b>	<input type="checkbox"/>	GRD, SRD-08, RD-29
Development plans and schedules	<b>X</b>	<input type="checkbox"/>	Additional meeting for RP/M&RP
Reg. compliance incl. USI/USID and NEPA	<b>X</b>	<input type="checkbox"/>	N/A; NSTX-U
Disposition of CHITS from previous reviews	<b>X</b>	<input type="checkbox"/>	
Cost objectives	<b>X</b>	<input type="checkbox"/>	Chit to define RP and M&RP
Other review objectives addressed	<input type="checkbox"/>	<input type="checkbox"/>	<b>n/a</b>

**SUMMARY OF RESULTS:**

This PDR covered progress and changes since CDR. A dashboard has been provided on the Recovery page. This review addressed interconnectivity of the real time system to ascertain if shorted turn protection can be adequately supported. The capability has gelled around detecting coil-lead arc faults and protect against them with a much smaller possibility and in fact improbability of preventing coil turn to turn faults because they have to occur so as to detect them. Some requirements track with DCPS, e.g. 5 kHz clock, WDT, L1 fault output, 200 usec cycle time, etc. FPDP will be used in an arrangement amenable to minimizing latency. Additional items include FCC STP computer, updated voltage sensors, additional SADs, FIMM and other electronics. The review presented issues with the coupling between Recovery Project requirements and M&RP spares. Testing and failures were also discussed. The software algorithm overview, modelling, code, and tests show that the detectability of shorts will depend on the nature of the fault. Also, for commissioning the model will need to be calibrated to as built machine conditions. While the concept has been significantly refined the impact on Recovery and schedule was identified as a concern. Simplified versions of the PDR were discussed to improve schedule impacts, to reduce resource concerns, to allow the use of existing electronics hardware for first phase to support Recovery while still providing spares. Separate meetings were held to analyze details. Seventeen chits were generated.

**Disposition:** [check one]☒ **Acceptable pending resolution of concerns-** CHITS identified above must be resolved prior to installation.

**Design Review Chair:** \_\_\_\_\_ **Date:** \_\_\_\_\_

**Cognizant Individual Acceptance** \_\_\_\_\_ **Date:** \_\_\_\_\_

**Distribution:** Review Board Members, Operations Center, Responsible Engineer (RE), Cognizant Individuals, Project Manager, Project Director, relevant Technical Authorities (TAs), Chief Engineer (CE), Fire Protection Engineer, Attendees, QA, ES&H, Security, Requesting & Performing Dept. Head

Revised 8/10/18