

STATUS OF SNS PROTON POWER UPGRADE SRF CAVITIES PRODUCTION QUALIFICATION



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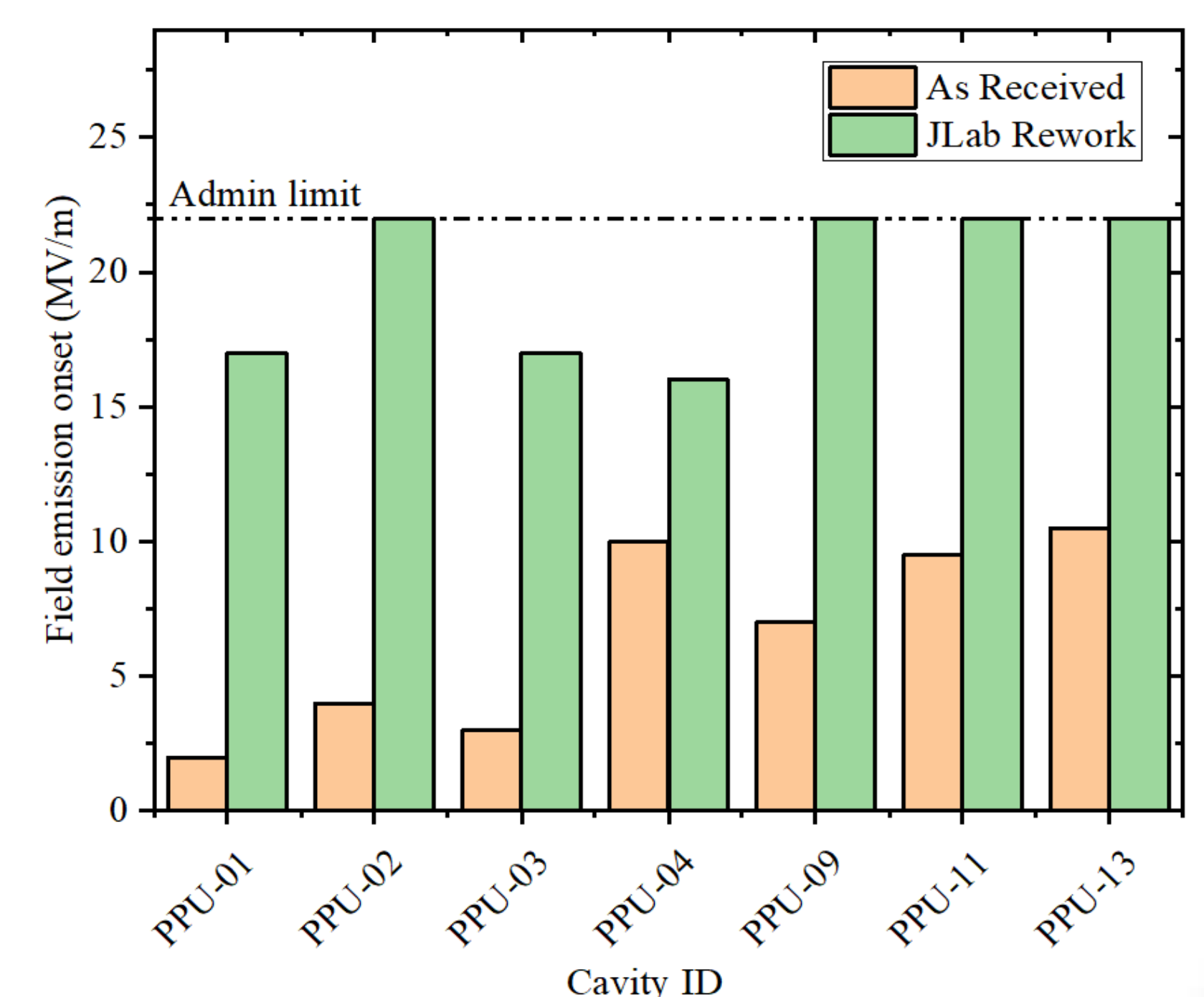
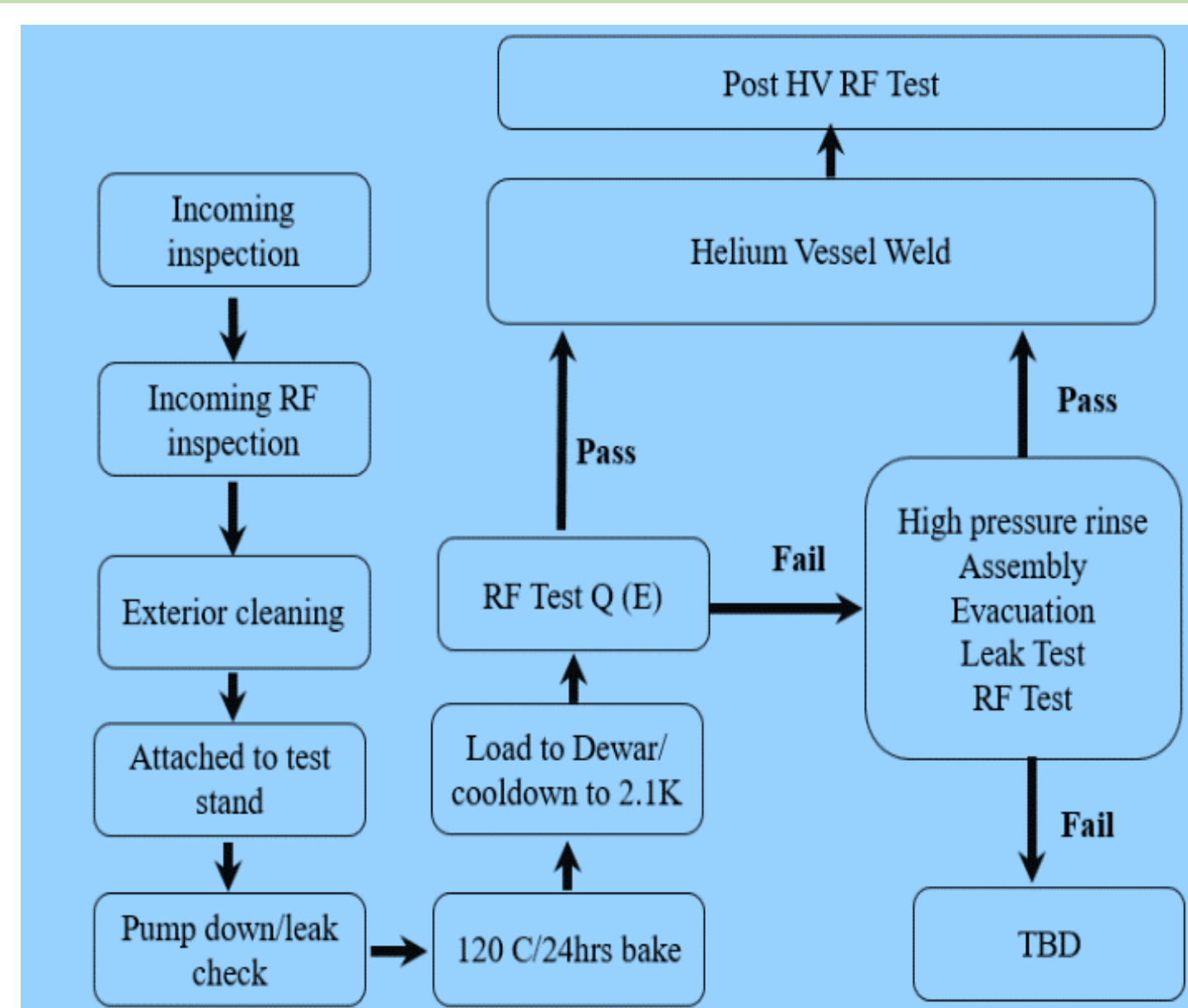
Abstract

The Proton Power Upgrade project at Oak Ridge National Lab's Spallation Neutron Source (SNS PPU) currently being constructed will double the proton beam power from 1.4 to 2.8 MW by adding 7 additional cryomodules, each contains four six-cell high beta ($\beta = 0.81$) superconducting radio frequency cavities. The cavities were built by Research Instruments, Germany, with all the cavity processing done at the vendor site, including electropolishing as the final active chemistry step. All 28 cavities needed for 7 cryomodules were delivered to Jefferson Lab, ready to be tested. The cryogenic RF qualifications and helium vessel welding were done at Jefferson Lab. The performance largely exceed the requirements, and greatly exceeded the performance of the original SNS cavity production series. Here, we present the summary of RF test on production cavities to this date.

All PPU cavities were built by Research Instruments, Germany, with all the cavity processing done at the vendor site, including electropolishing as the final active chemistry step. The improvement on performance of cavities are expected due to electropolishing compared to buffer chemical polishing that was applied in original SNS cavities. To this date, all cavities needed for 7 cryomodules were delivered at Jefferson Lab, ready for RF test. The cavities goes through incoming mechanical and RF inspection followed by the RF test at 2.1 K.

RF acceptance criteria for PPU cavities at 2.1K

Test conducted	Acceptance Value
Gradient limit	>18 MV/m
Q_0	$> 8 \times 10^9$ at 16 MV/m
Field Emission	< 20 mrem/hr at 16 MV/m
Field probe coupling	$7 \times 10^{11} - 2 \times 10^{12}$
Fundamental frequency	805.6 ± 0.25 MHz

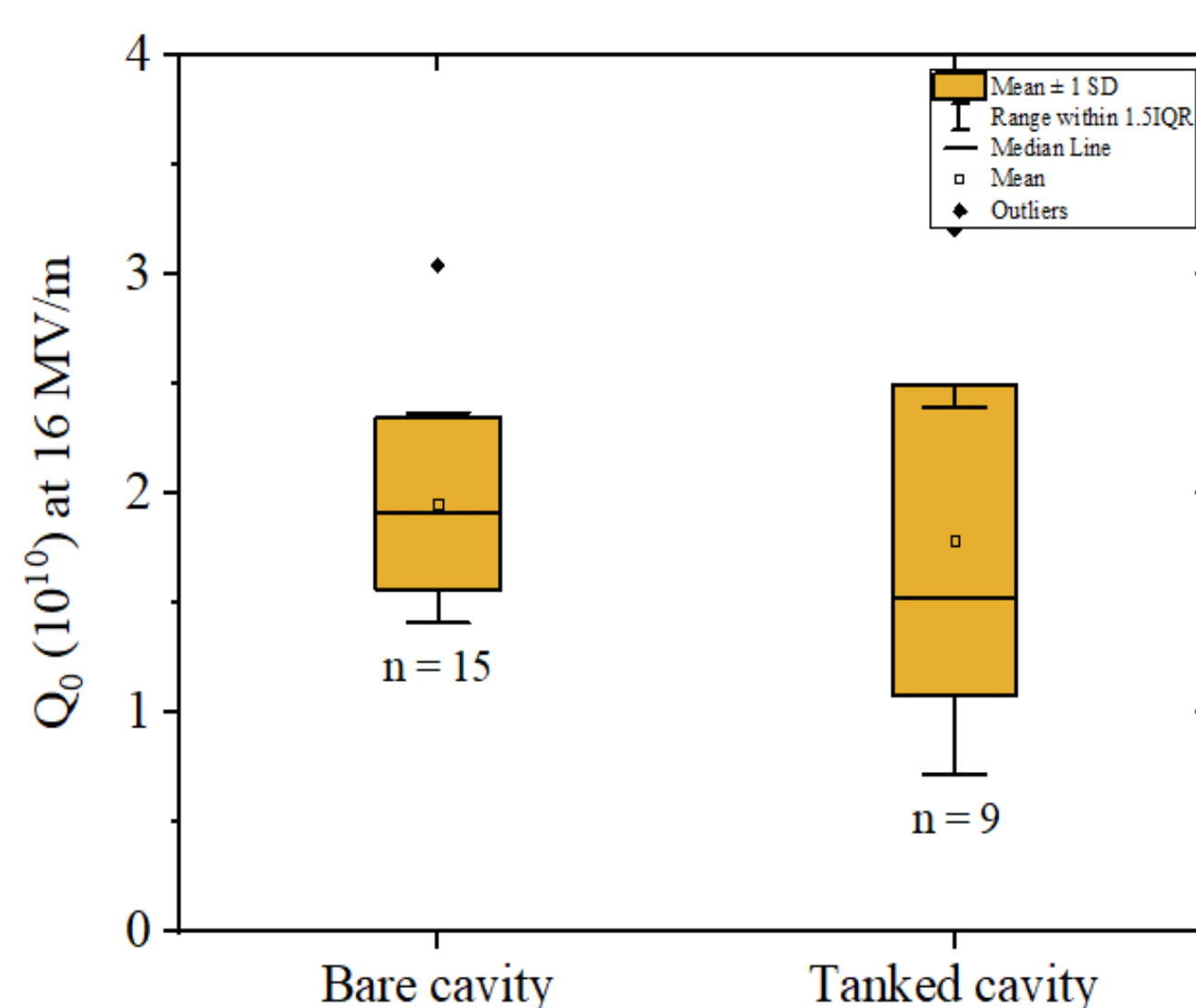
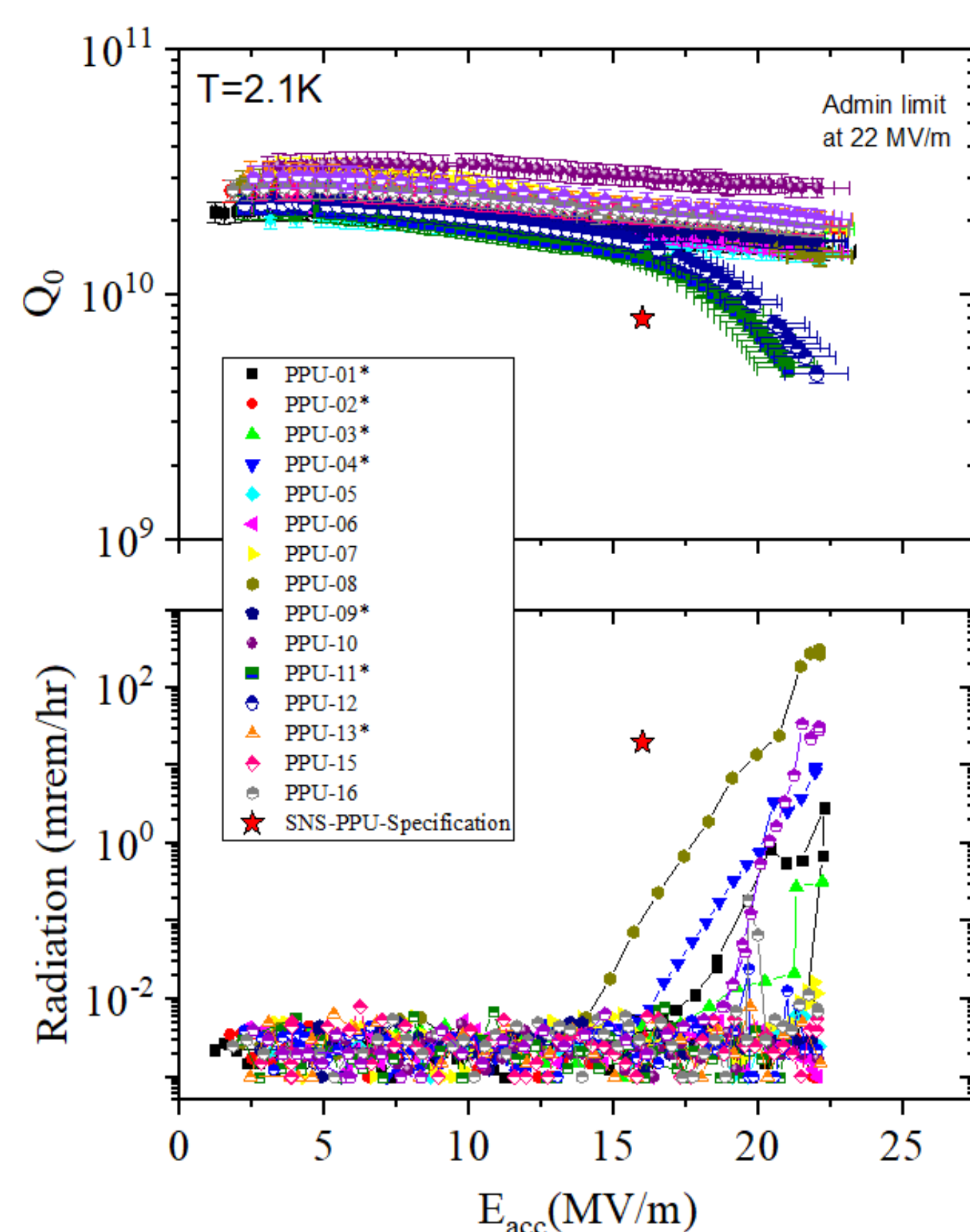


Flow chart of cavity qualification prior to cryomodules assembly.

Final FE onset on bare cavity as received from vendor and JLab reprocessing with HPR.



First string assembly in clean room



Summary

Jefferson lab received 30 PPU cavities from vendor, ready to be RF tested. To this data ~50% of cavities were qualified from vertical RF test as received from vendor and rest of the cavities needed reprocessing with high pressure rinse. All cavities reached well above acceptance criteria for gradient (> 18 MV/m) with average quality factor $\sim 2 \times 10^{10}$. First string assembly was completed during the month of March and it is in track to complete the cryomodules assembly and preliminary test before the end of 2021. During the production run, additional two cavities were order from vendor with total cavities being 32 and additional cryomodules (8th) was planned to be added to PPU upgrade as a spare.

Acknowledgements

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