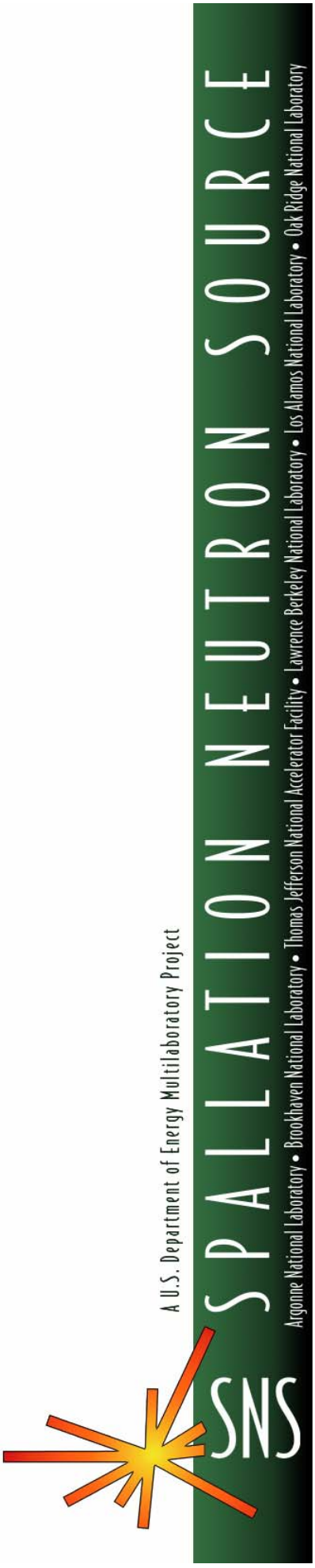
106100200-TRO???-R00

Intensity Gain from VULCAN Guide 9



April 2013

Intensity Gain from VULCAN Guide 9

E. B. Iverson A. D. Stoica W. Lu

Date Published: 26 April 2013

Prepared by Oak Ridge National Laboratory
for
UT-BATTELLE, LLC
under contract DE-AC05-00OR22725
for the
U.S. DEPARTMENT OF ENERGY

1. INTRODUCTION

VULCAN is the SNS engineering diffractometer, [1] and has been operating succesfully within the user program for some time. Guide segment 9 is being commissioned at present; this report documents the observed increase in flux attainable at the sample position with this final guide segment in place.

2. INTENSITY MEASUREMENTS

We used a calibrated beam monitor [2] and the default instrument chopper settings to characterize the spectral current passing through a small pinhole (2.32 mm in diameter) located at the nominal sample position. We performed these measurements before and after the installation of guide segment 9, with the upstream guide configuration in both the High-Intensity and High-Resolution modes. The measured intensities appear in Figure 1, and the data are embedded in the electronic version of this document.

The ratio before and after Guide 9 installation is shown in Figure 2, and again the data are attached to the electronic version of this document. Guide 9 has minimal effect in the High-Resolution mode (as intended). In High-Intensity mode, guide 9 increases the measured flux by around 25% at 1 Å and nearly 70% at 5 Å, consistent with design estimates.[1]

2.1 HISTORICAL COMPARISON

Although this study was carried out to document the performance gain due to guide segment 9, we also obtain absolute intensity numbers we can compare to earlier measurements. The initial commissioning measurements [1] quote a peak spectral intensity (measured in the High-Intensity configuration) of 2.7×10^8 n Å^{-1} MW^{-1} s^{-1}. This value integrates over the entirety of a beam spot of area 20.6 cm^2. It was not reported in [1] but was measured at the same time (using image plates and and narrow-band chopper settings) that the peak-to-average ratio of the spatial distribution across that beam spot was 3.5, giving a peak flux of 4.6×10^7 n cm^{-2} Å^{-1} MW^{-1} s^{-1}. Our new measurement, as shown in Figure 1(a) above, gives a peak flux of 4.1×10^7 n cm^{-2} Å^{-1} MW^{-1} s^{-1}. While somewhat smaller now, this reduction is consistent with other measurements showing that the intensity per unit accelerator power has some dependence on accelerator power—that is, intensity is slightly less than linear with accelerator power.

3. PEAK SHAPE MEASUREMENTS

[Put in measured increase in peak shape width?]

4. SUMMARY

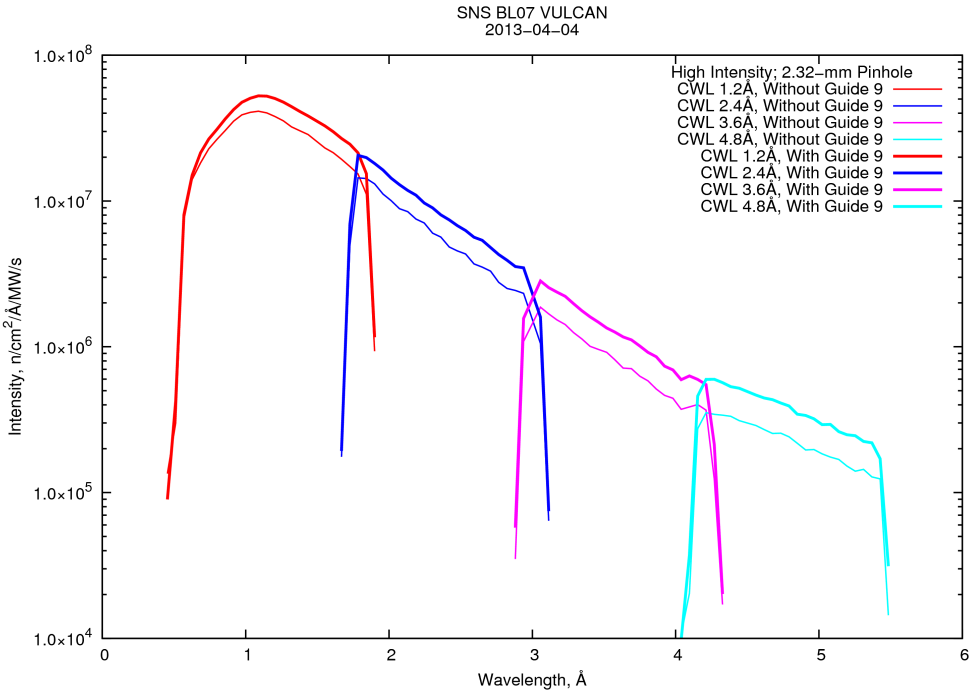
Guide segment 9 on the VULCAN instrument at SNS has been installed and characterized. It results in a flux gain of nearly 70% at long wavelengths and more than 20% at 1 Åin the VULCAN High-Intensity configuration. The absolute intensity measured in the VULCAN sample position now is comparable to the value measured at instrument commissioning, and peaks in wavelength at 4.1×10^7 n cm^{-2} Å^{-1} MW^{-1} s^{-1} when measured at 0.8 MW across a pinhole of 2.3 mm diameter.

REFERENCES

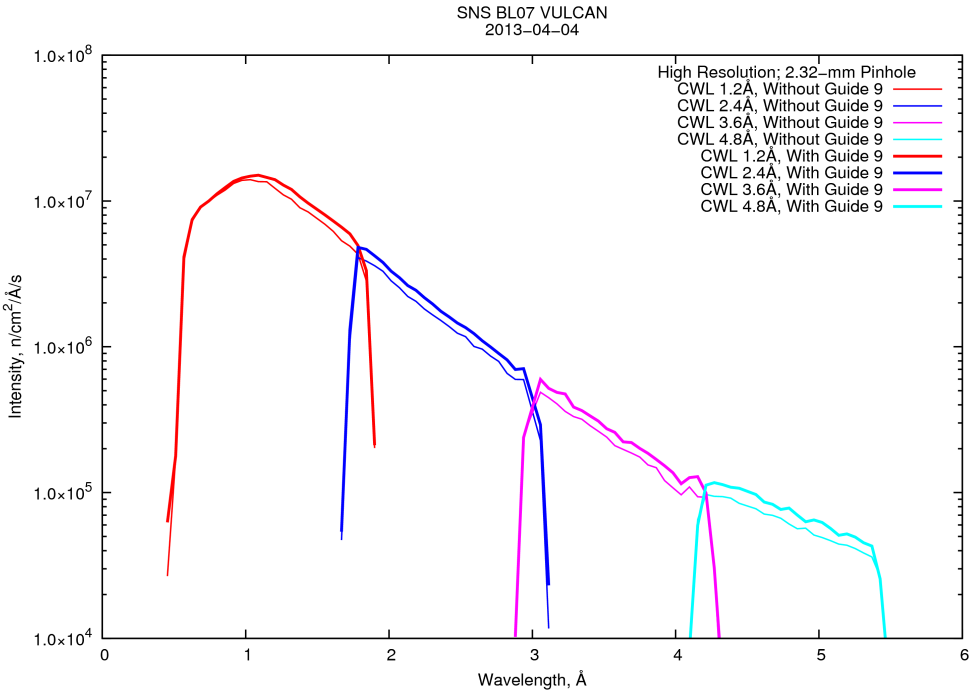
[1] X.-L. Wang, T. M. Holden, A. D. Stoica, K. An, H. D. Skorpenske, A. B. Jones, G. Q. Rennich, and E. B. Iverson, "First results from the VULCAN diffractometer at the SNS," *Materials Science Forum*, vol. 652, pp. 105–110, 2010.

[2] E. B. Iverson, B. J. Micklich, D. V. Baxter, R. G. Cooper, P. D. Ferguson, D. W. Freeman, F. X. Gallmeier, S. E. Hammons, C. M. Lavelle, and I. Popova, "Neutronic measurements to commission

[1] Need reference.



(a) High-Intensity configuration.



(b) High-Resolution configuration.

Figure 1: Spectral fluxes measured with and without guide segment 9.

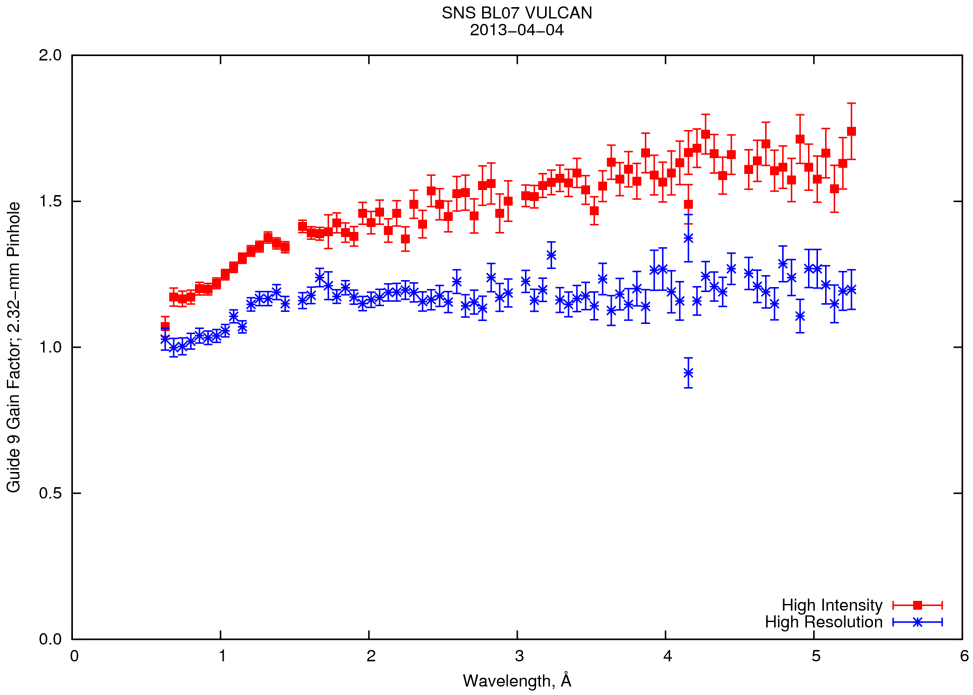


Figure 2: Intensity gain measured for guide segment 9.

the SNS," in *Proceedings of ICANS XVII, the Seventeenth Meeting of the International Collaboration on Advanced Neutron Sources*, 2005.