

TUP030

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Abstract

Foreign particulates residing on high electric field surfaces of accelerator cavities present sources for field emission of electrons that limit the useful dynamic range of that cavity. Developing the methods and tools for collecting and characterizing particulates found in an accelerator enables process development towards creating and maintaining field emission free SRF cavities. Methods are presented for sampling assemblies, components, processes, and environmental conditions utilizing forensic techniques with specialized tooling. Sampling activities to date have produced an inventory of over 850 samples. Traditional SEM + EDS analysis of this volume of spindles is challenged by labor investment, spindle sampling methods, and the subsequent data pipeline which ultimately results in a statically inadequate dataset for any particulate distribution characterization. A complete systematic analysis of the spindles is enabled by third party software controlling SEM automation for EDS data acquisition. Details of spindle creation, collection equipment, component sampling, automating particle assessment, and data analysis used to characterize samples from beamline elements in CEBAF are presented.

Automated Data Collection

Location Image

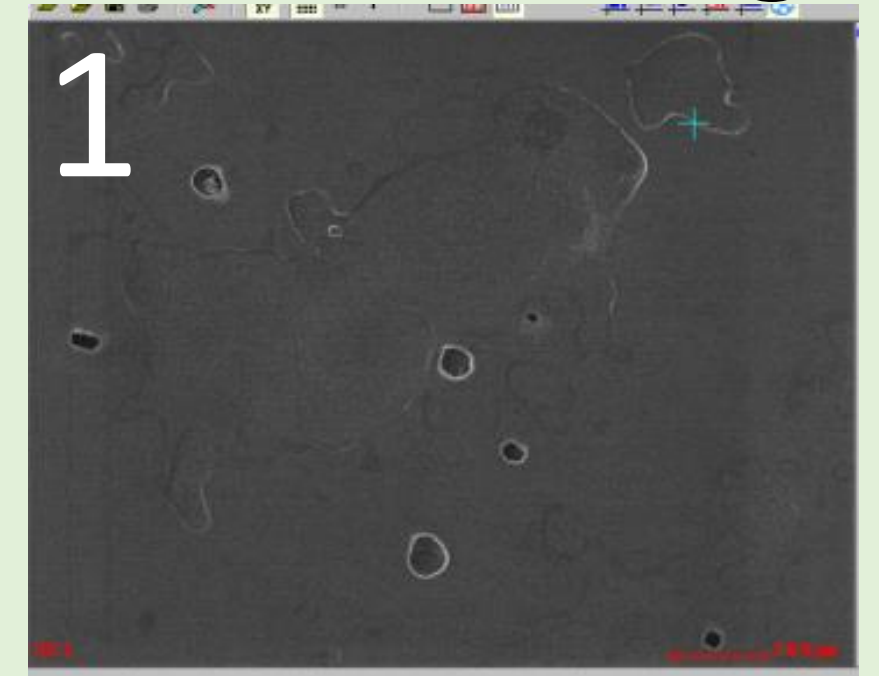
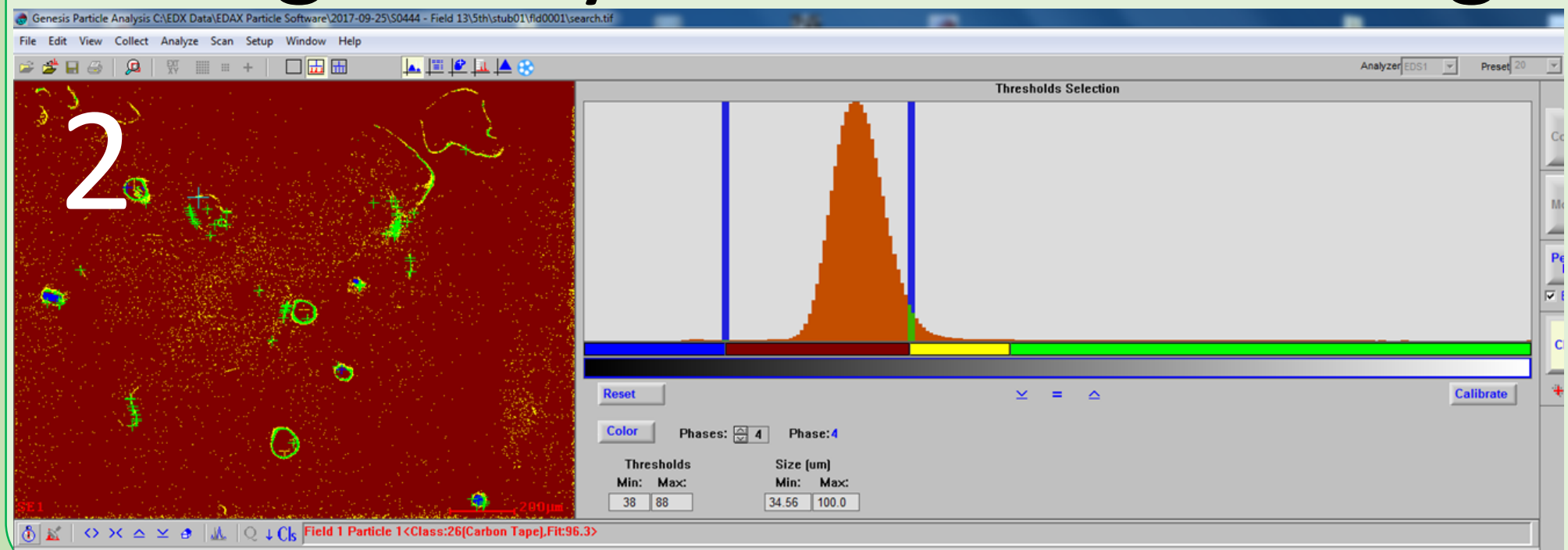
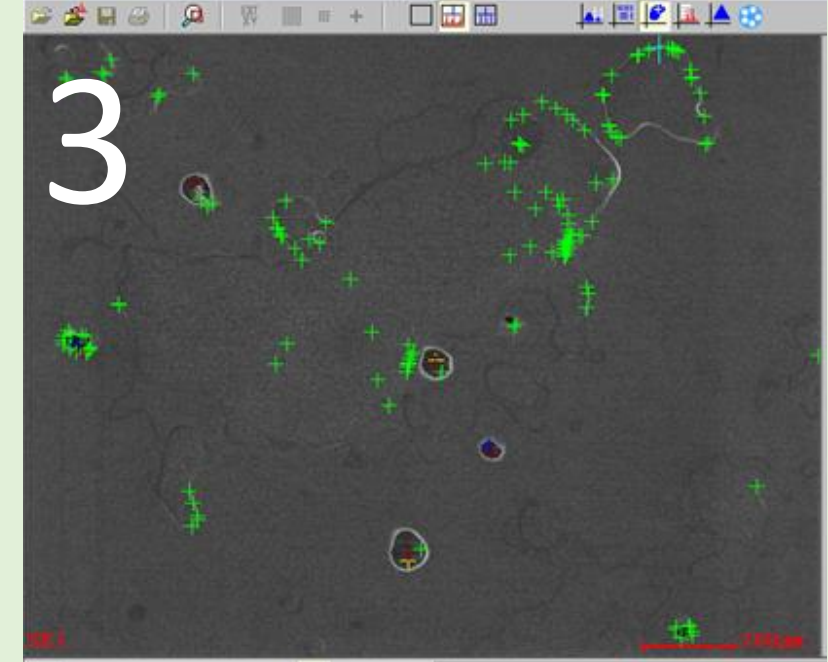


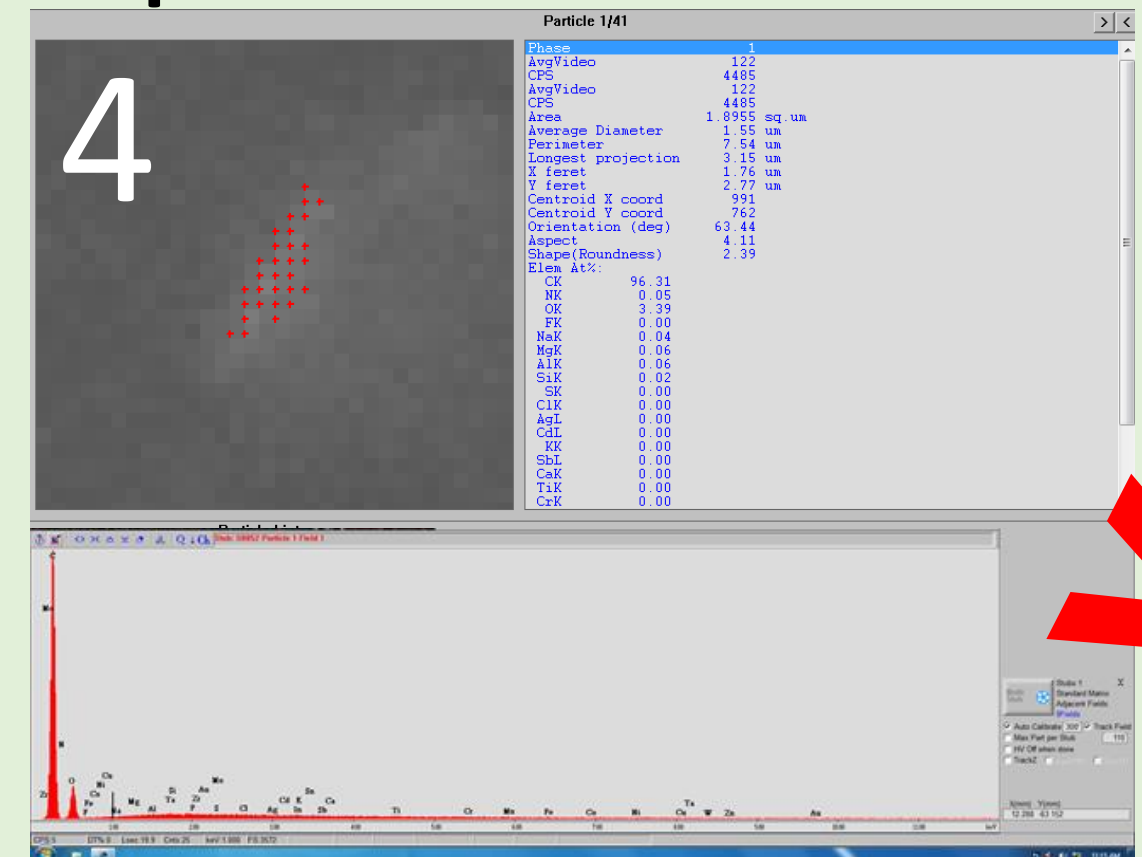
Image Grey Scale Thresholding



Particulate Selection

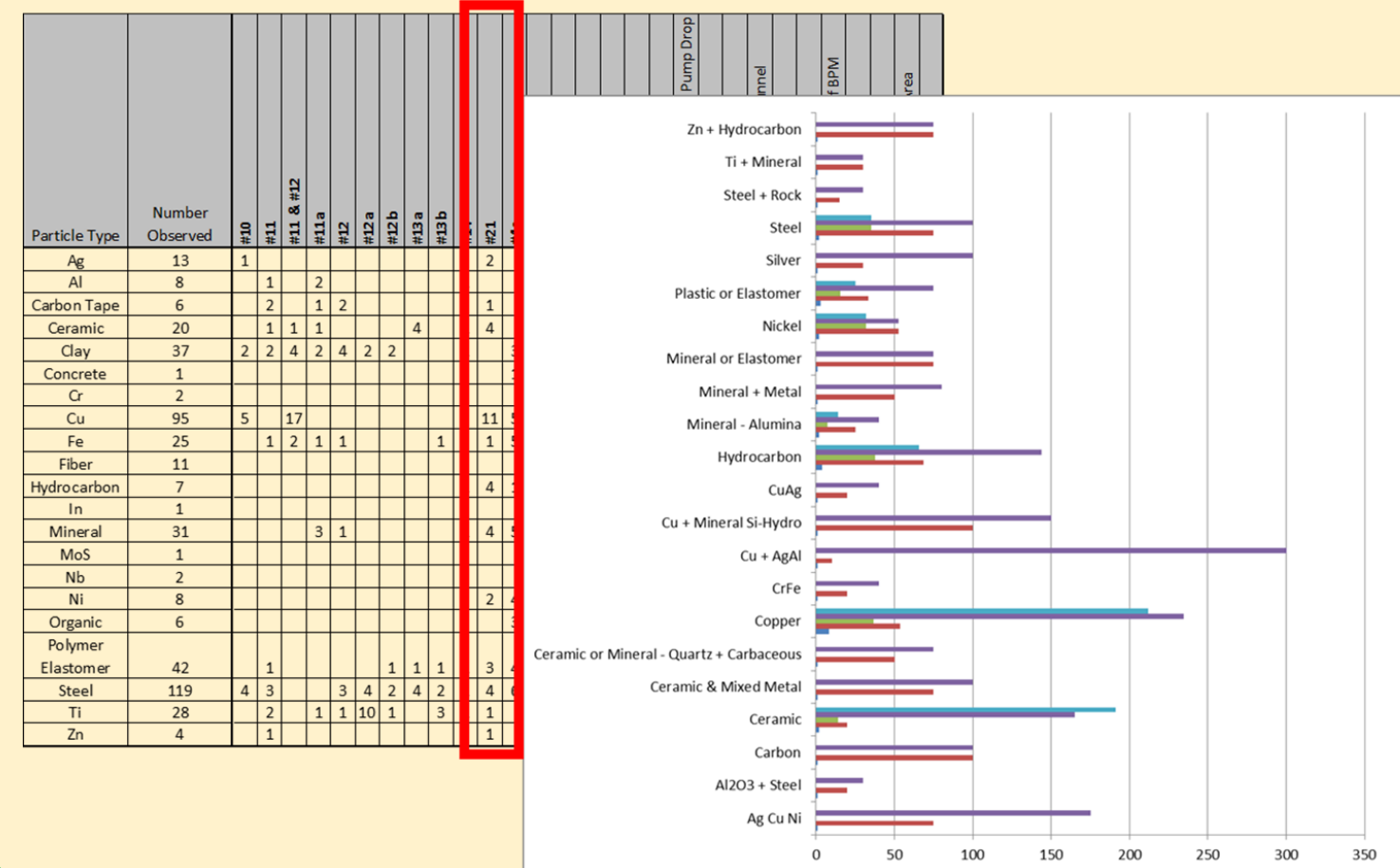


Spectra Collection

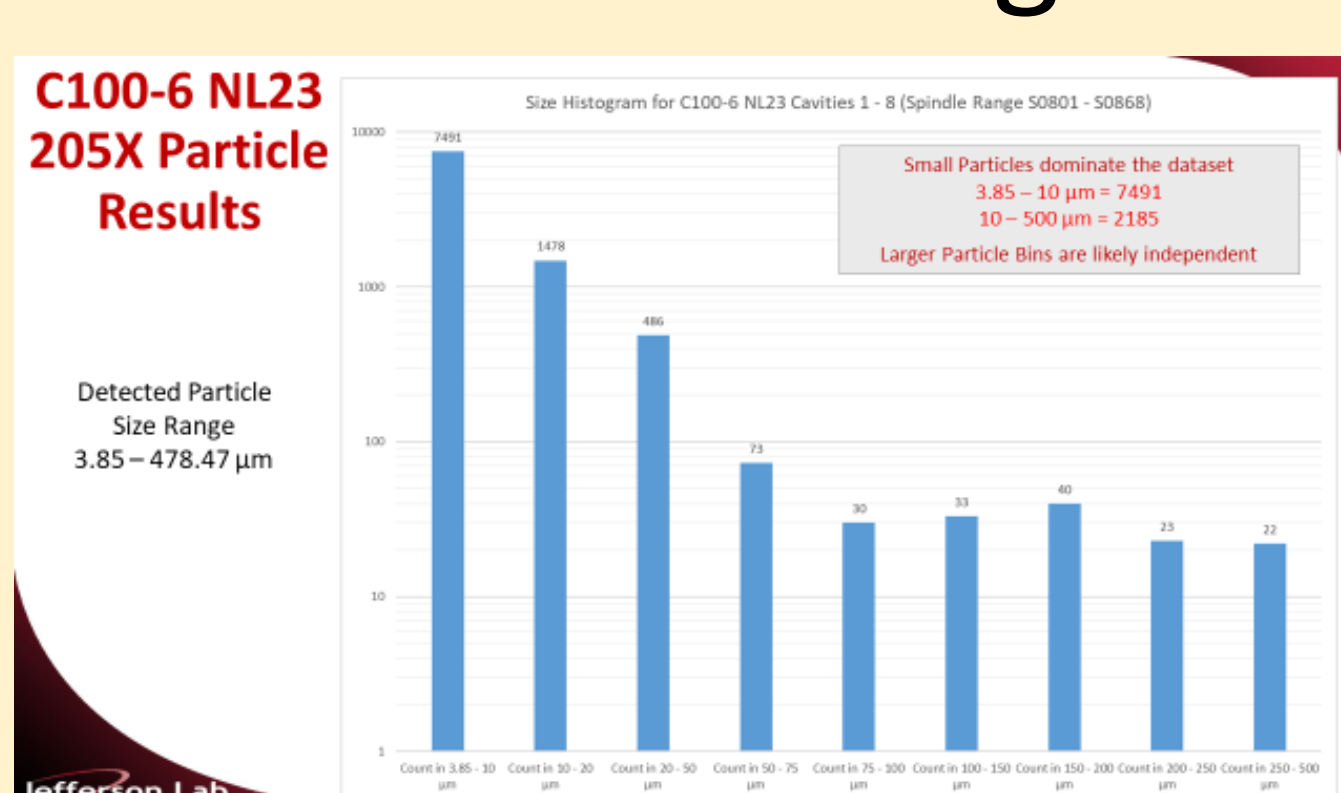


Assembly Particulate Typing Report

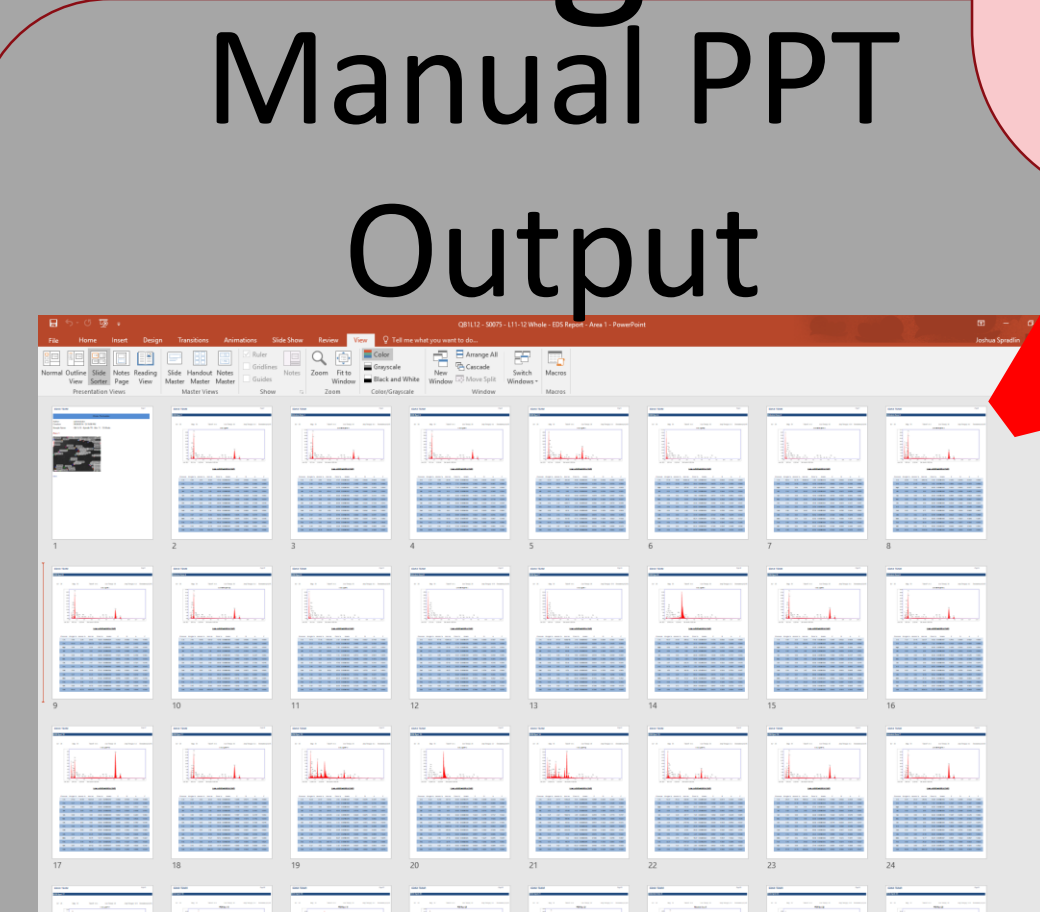
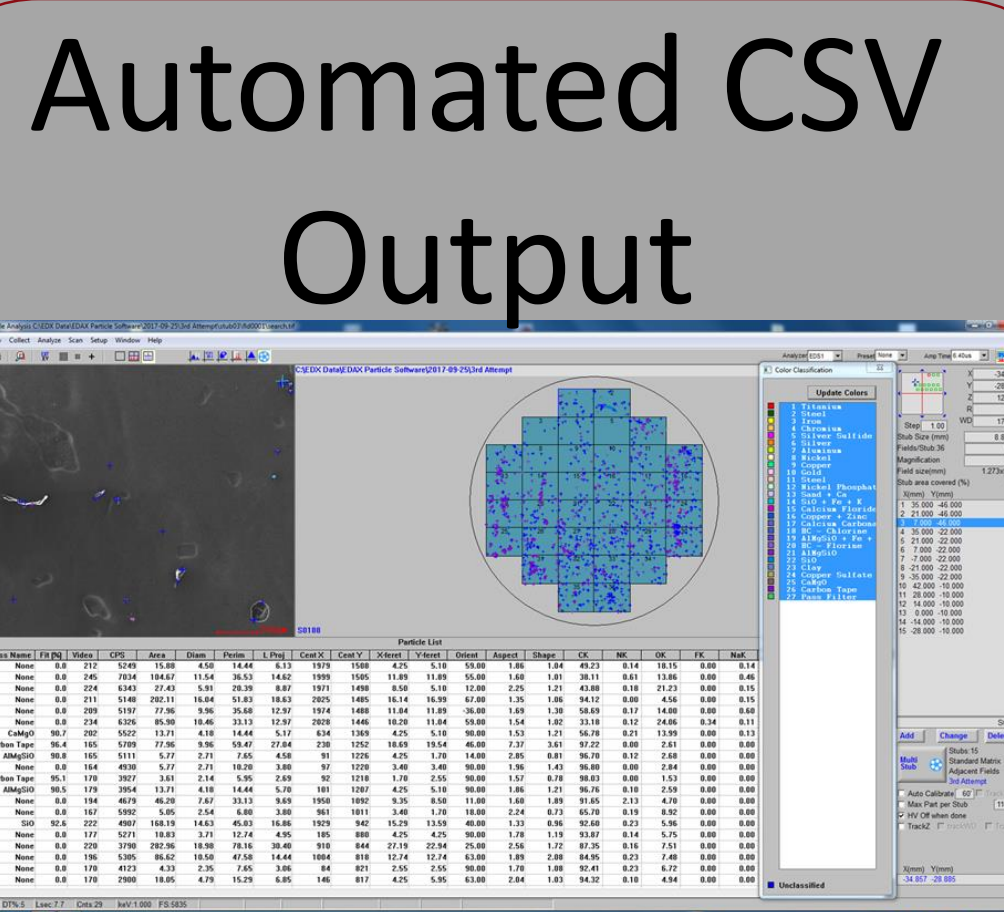
Girder NL13 Site #21 Breakdown



Dimension Histogram

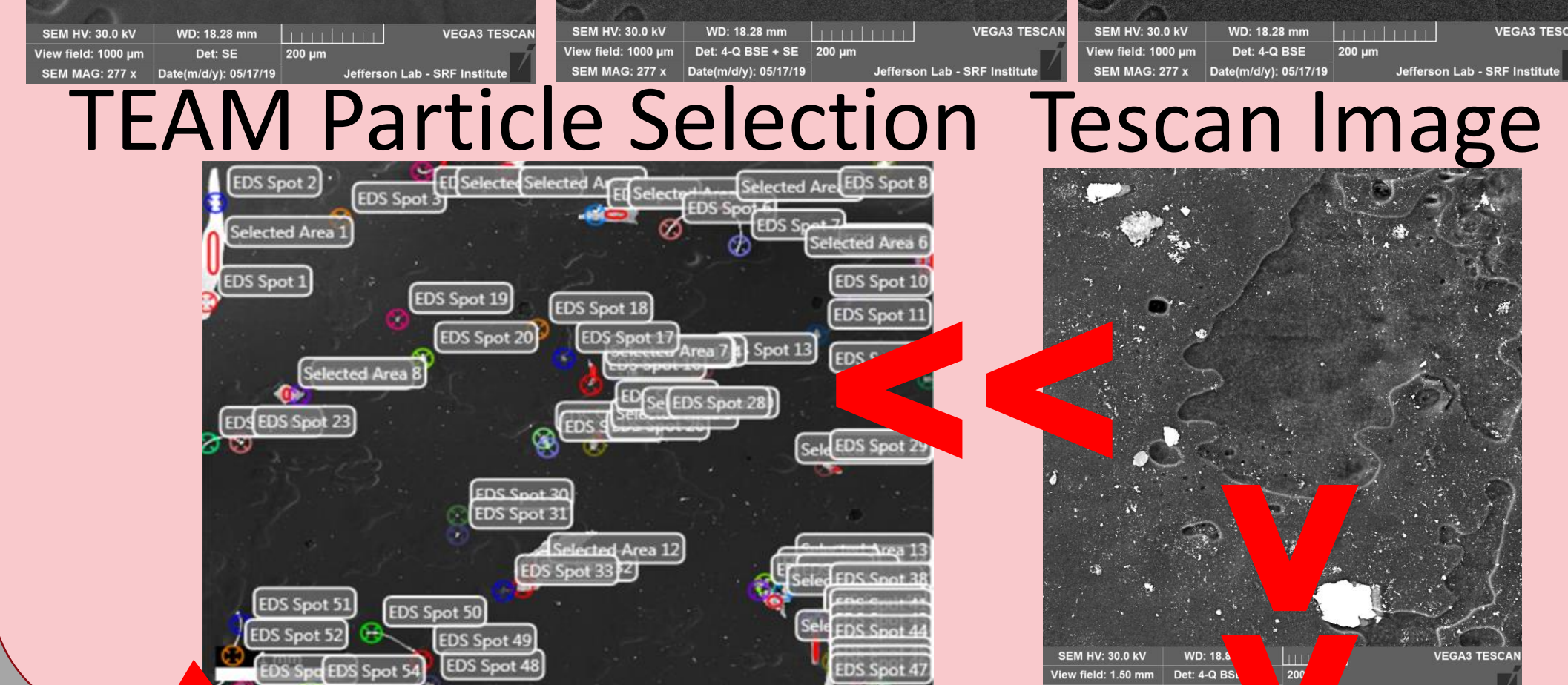
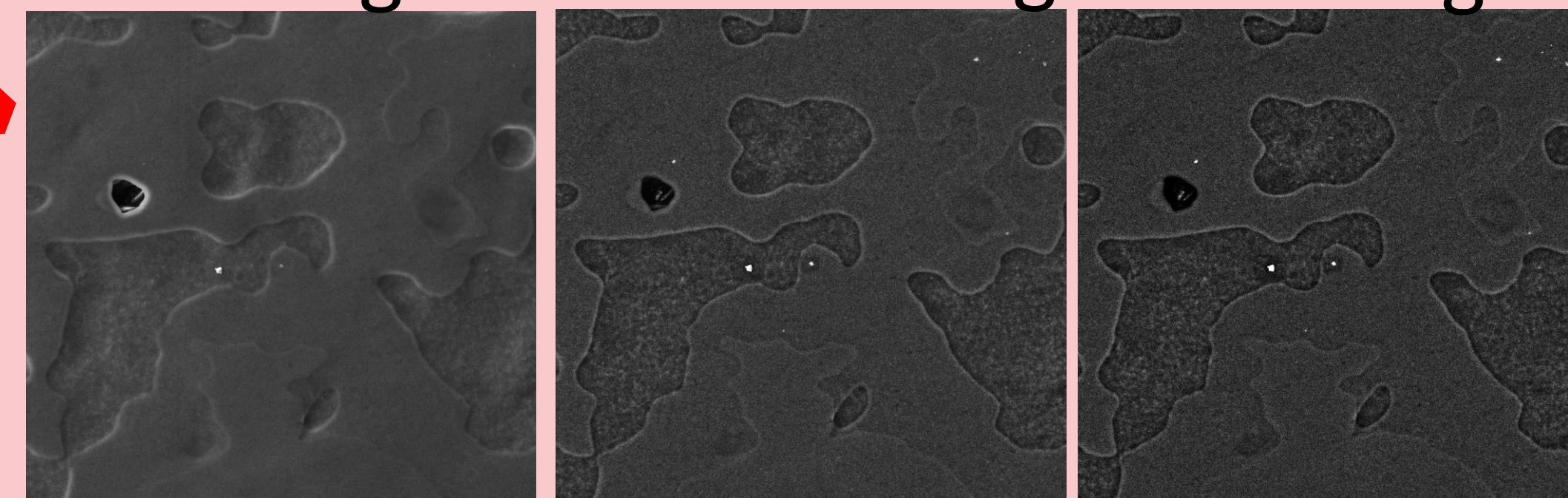


Data Processing

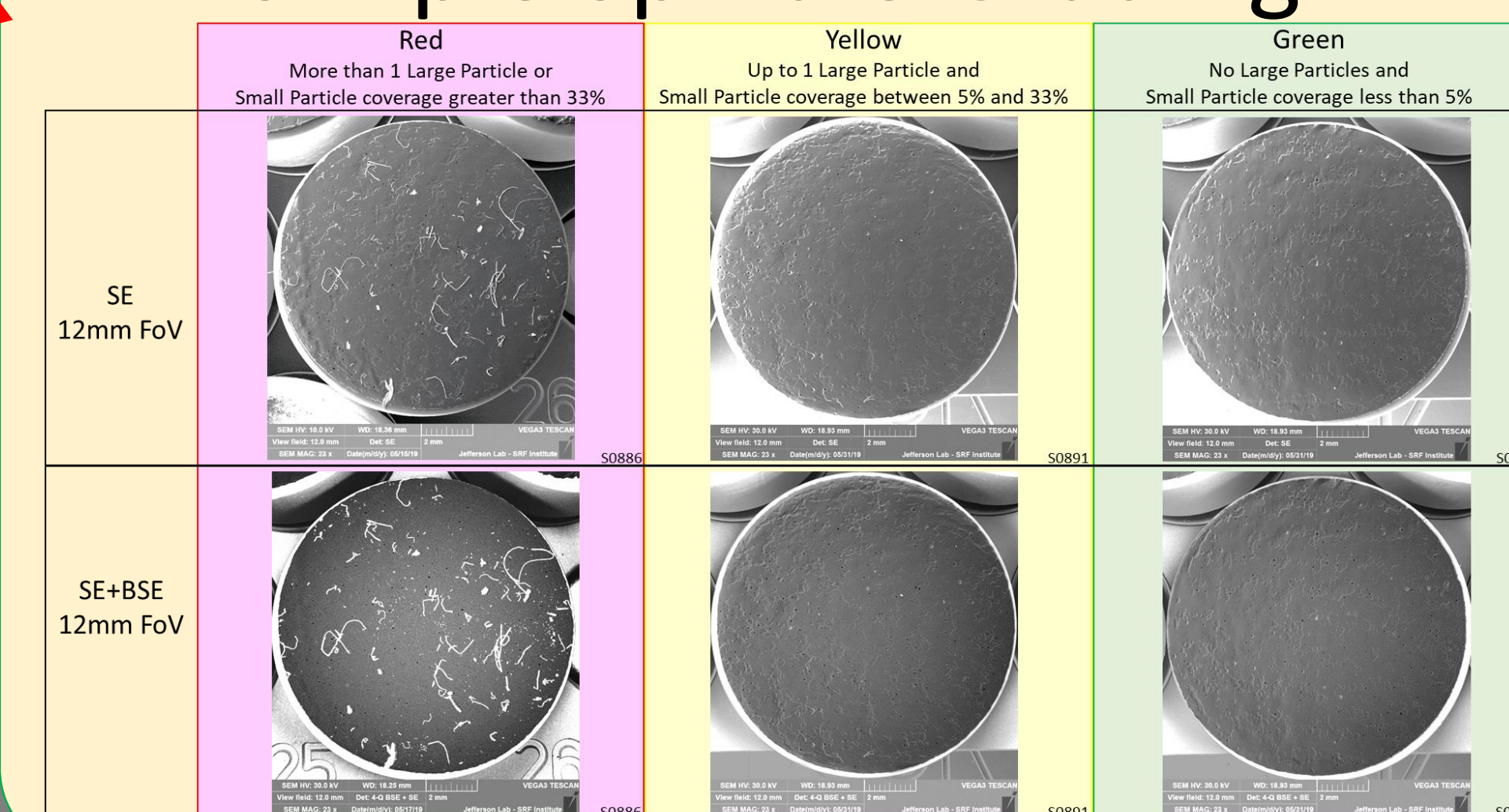


Manual Data Collection

SE Image SE + BSE Image BSE Image



Simple Spindle Grading



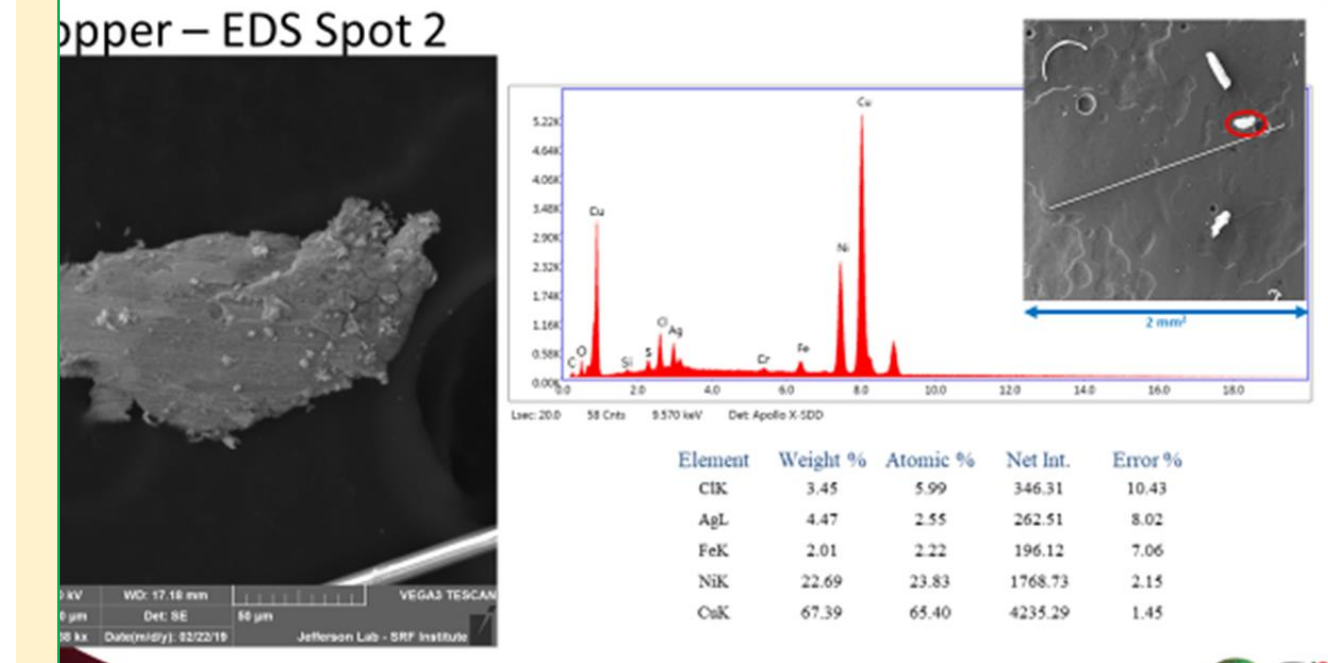
Dimension Data

LCLS-II JCM3 Site's Particle Dimensions

Category	Major Monomers					Minor Monomers					Type Count
	Rank	Average	Standard Deviation	Variance	Average	Standard Deviation	Variance	Average	Standard Deviation	Variance	
Polystyrene	Carbon Tetrachloride	28.1	12.3	225.1	27.7	28.1	225.8	27.8	28.4	31	
	Styrene	21.6	4.8	5.8	21.6	4.8	5.8	21.6	4.8	5.8	
	Isobutylene	20.2	12.4	206.9	48.4	52.6	2768.5	17.7	17.7	31	
	Acrylonitrile	18.8	4.8	5.8	18.8	4.8	5.8	18.8	4.8	5.8	
	Copper	16.8	7.7	59.4	4.3	80.3	6442.2	30	30	30	
	Aluminum	6.7	6.7	44.8	6.7	6.7	44.8	6.7	6.7	44.8	
	Iron	5.8	5.8	33.6	5.8	5.8	33.6	5.8	5.8	33.6	
	Aluminum	5.8	5.8	33.6	5.8	5.8	33.6	5.8	5.8	33.6	
	Iron	5.8	5.8	33.6	5.8	5.8	33.6	5.8	5.8	33.6	
	Aluminum	5.8	5.8	33.6	5.8	5.8	33.6	5.8	5.8	33.6	
Methyl	Styrene	12.4	1.4	1.2	5.5	5.7	32.5	2.3	2.3	2	
	Aluminum	12.4	1.4	1.2	5.5	5.7	32.5	2.3	2.3	2	
	Super Alloy	8.5	8.5	13.5	13.5	9.2	8.5	2	2	2	
	Aluminum	8.5	8.5	13.5	13.5	9.2	8.5	2	2	2	
	Iron	8.5	8.5	13.5	13.5	9.2	8.5	2	2	2	
	Aluminum	8.5	8.5	13.5	13.5	9.2	8.5	2	2	2	
	Iron	8.5	8.5	13.5	13.5	9.2	8.5	2	2	2	
	Aluminum	8.5	8.5	13.5	13.5	9.2	8.5	2	2	2	
	Iron	8.5	8.5	13.5	13.5	9.2	8.5	2	2	2	
	Aluminum	8.5	8.5	13.5	13.5	9.2	8.5	2	2	2	
	Iron	8.5	8.5	13.5	13.5	9.2	8.5	2	2	2	
Material or History	Cerium	8.4	5.5	30.3	16.8	17.4	302.5	5	5	5	
	Copper	8.4	5.5	30.3	16.8	17.4	302.5	5	5	5	
	Material	8.2	5.8	33.6	16.8	17.4	302.5	5	5	5	
	Aluminum	8.2	5.8	33.6	16.8	17.4	302.5	5	5	5	
	Iron	8.2	5.8	33.6	16.8	17.4	302.5	5	5	5	
	Aluminum	8.2	5.8	33.6	16.8	17.4	302.5	5	5	5	
	Iron	8.2	5.8	33.6	16.8	17.4	302.5	5	5	5	
	Aluminum	8.2	5.8	33.6	16.8	17.4	302.5	5	5	5	
	Iron	8.2	5.8	33.6	16.8	17.4	302.5	5	5	5	
	Aluminum	8.2	5.8	33.6	16.8	17.4	302.5	5	5	5	
	Iron	8.2	5.8	33.6	16.8	17.4	302.5	5	5	5	
Organic	Silver	17.5	5.8	33.6	16.8	17.4	302.5	12.2	14.4	12	
	Aluminum	17.5	5.8	33.6	16.8	17.4	302.5	12.2	14.4	12	
	Iron	17.5	5.8	33.6	16.8	17.4	302.5	12.2	14.4	12	
	Aluminum	17.5	5.8	33.6	16.8	17.4	302.5	12.2	14.4	12	
	Iron	17.5	5.8	33.6	16.8	17.4	302.5	12.2	14.4	12	
	Aluminum	17.5	5.8	33.6	16.8	17.4	302.5	12.2	14.4	12	
	Iron	17.5	5.8	33.6	16.8	17.4	302.5	12.2	14.4		
Salt	Iron	17.5	5.8	33.6	16.8	17.4	302.5	12.2	14.4	12	
	NaCl	17.5	5.8	33.6	16.8	17.4	302.5	12.2	14.4	12	
	NaCl	17.5	5.8	33.6	16.8	17.4	302.5	12.2	14.4	12	
	NaCl	17.5	5.8	33.6	16.8	17.4	302.5	12.2	14.4	12	
	NaCl	17.5	5.8	33.6	16.8	17.4	302.5	12.2	14.4	12	
Inert/Gases	NaCl	17.5	5.8	33.6	16.8	17.4	302.5	12.2	14.4	12	
	NaCl	17.5	5.8	33.6	16.8	17.4	302.5	12.2	14.4	12	

Location Report

100-6 NL23 Representative Particles – EDS Area 1



Integrated Database Reporting

Summary

An automated particulate identification system has been developed. This system will target particulate reduction in SRF cavities to reduce field emission.

Acknowledgements

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