

**STATEMENT OF WORK (SOW)**  
**for the**  
**sPHENIX TPC END CAPS (WAGON WHEELS)**

QA Category: A-3

**Brookhaven National Laboratory**  
**Upton, New York**

**Version 2**  
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**sPHENIX Project**

**Approved by:**



John Cozzolino  
sPHENIX TPC Project Engineer  
Brookhaven National Laboratory

Date

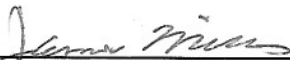
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Donald Lynch  
sPHENIX Chief Mechanical Engineer  
Brookhaven National Laboratory

Date

4-23-2018



James Mills  
sPHENIX Project Engineer  
Brookhaven National Laboratory

Date

4-23-2018



Edward O'Brien  
sPHENIX Project Director  
Brookhaven National Laboratory

Date

4/23/2018



Chuck Gortakowski  
sPHENIX Quality Assurance Representative  
Brookhaven National Laboratory

Date

4/24/2018

### VERSION CONTROL SHEET

VERSION	DESCRIPTION	DATE	AUTHOR	APPROVED BY
1	Draft	03/29/2018	J. Cozzolino	See cover page.
2	Initial release version	04/20/2018	J. Cozzolino	See cover page.
3	Revised			

## TABLE OF CONTENTS

1	SCOPE .....	4
1.1	Background .....	4
2	APPLICABLE DOCUMENTS .....	4
3	REQUIREMENTS.....	4
3.1	Contractor Responsibilities.....	5
3.1.1	Tooling/Fixtures/Test Equipment.....	5
3.1.2	Chemical Surface Treatment.....	5
3.2	Packaging, Crating, and Shipment.....	5
3.2.1	Authorization to Ship .....	5
3.2.2	Shipping Crate.....	5
4	QUALITY ASSURANCE.....	5
4.1	Quality Assurance Requirements.....	5
4.2	Material Certification.....	6
4.3	Inspection Requirements.....	6
5	SUBMITTALS .....	6

# 1 SCOPE

This Statement of Work (SOW) will be the basis for procurement of the two sPHENIX “Wagon Wheels” for Brookhaven National Laboratory (BNL). These parts are critical components forming the end structures of the Time Projection Chamber (TPC). They house the array of Gas Electron Multiplier (GEM) detectors and support the inner and outer field cages. Utilities such as high voltage leads, gas ports, and instrumentation are introduced into the TPC through the wagon wheels. Their radial spokes and over a thousand mounting holes give them a distinctive appearance. They must be fabricated to exacting standards and tight manufacturing tolerances. The TPC is an experimental apparatus which will be used to upgrade the tracking capabilities of experimental equipment at the Relativistic Heavy Ion Collider (RHIC) at BNL. This document outlines the Contractor’s responsibilities and obligations necessary for completing the requirements as set forth herein.

## 1.1 Background

The sPHENIX experimental concept includes the design, construction, installation, and commissioning of hardware, civil construction, and facilities required to produce upgraded experimental equipment with new detection capabilities. The concept includes several detector subsystems and a superconducting solenoid magnet which will track and characterize properties of particles generated by heavy ion and/or polarized proton collisions. These include Hadron and Electro-Mechanical Calorimeters, Silicon tracking detectors, event trigger detectors and the TPC, a component of which is the subject of this SOW.

# 2 APPLICABLE DOCUMENTS

In the event of a conflict between the Technical Drawings and the SOW, the Contractor shall immediately notify the BSA Contractual Representative who shall in each instance determine which document takes precedence and advise the Contractor accordingly. Failure to notify BSA of a document conflict shall not relieve the Contractor’s responsibility to ensure full compliance to all requirements.

The following documents are an integral part of the SOW; the applicable revision level will be the latest that is in effect at the time of award unless stated otherwise herein:

Document Number	Document Title
BNL QA-101	Supplier Quality Assurance Requirements
205-0300-0012 (5 sheets)	TPC End Cap (Wagon Wheel)
20503000012(rev).STP	3-D CAD Solid Model File in STEP or another acceptable industry standard format

# 3 REQUIREMENTS

In accordance with the applicable specifications, referenced documents, and instructions as defined in this Statement of Work, the Contractor shall be responsible for the purchase of all materials, build to print manufacturing, inspection, and delivery of two TPC Wagon Wheels per BNL engineering drawing No. 205-0300-0012.

### **3.1 Contractor Responsibilities**

#### **3.1.1 Tooling/Fixtures/Test Equipment**

The Contractor shall be responsible for supplying all materials, including (but not limited to) the construction of all tools, jigs, fixtures, and test equipment required to fabricate the two wagon wheels.

#### **3.1.2 Chemical Surface Treatment**

The Contractor shall be responsible for having the chemical surface treatment applied to the wagon wheels in accordance with the engineering drawing. A Certificate of Conformance for the surface shall be made available to BNL upon request.

### **3.2 Packaging, Crating, and Shipment**

#### **3.2.1 Authorization to Ship**

The Contractor shall not ship prior to obtaining written authorization from BNL to do so. See paragraph 4.3 below for further details

#### **3.2.2 Shipping Crate**

For protection during transport, each item shall be firmly fastened to a 3/4 inch thick plate of MIC-6 (aluminum jig plate or equivalent), either square or circular with an O.D. measuring no less than 65 inches. The reinforced assemblies shall in-turn be packed into a sturdy crate made from 3/4 inch thick plywood, suitably reinforced with 2x4 and or 2x3 Douglas Fir or Spruce framing, which must offer suitable protection against shock, abrasion, crushing, bending, or twisting. The underside of the crate shall be fitted with parallel 4x4 wooden rails to enable forklift access from two opposing sides. Installation of both finished items into a single crate is an acceptable option.

## **4 QUALITY ASSURANCE**

The Contractor shall maintain and apply an effective QA program for the design, manufacture, and testing of all systems and equipment provided. The system shall be in general conformance with the requirements of the ISO-9001 Standard, "Quality Management System Requirements" or equivalent acceptable to BNL QA management. The Contractor shall supply the necessary documentation to demonstrate this.

### **4.1 Quality Assurance Requirements**

As set forth in BSA Form BNL-QA-101, "Brookhaven National Laboratory Supplier Quality Assurance Requirements," as amended herein, forms a part of this statement of work. Specifically, this includes the following sections: 3.1.2, 3.2 through 3.7, 4.2, 4.10, 4.10.1, 4.10.4, 4.16, 4.19, 4.23 and 4.39.

## **4.2 Material Certification**

Upon purchase of the material to make the Wagon Wheels, the Contractor shall promptly forward a copy of the Material Certification Report to BNL.

## **4.3 Inspection Requirements**

The Contractor shall be responsible for performing a 100% dimensional inspection of each completed wagon wheel to demonstrate conformance to the dimensional requirements as indicated on the applicable engineering drawing. The Contractor's inspection report shall then be forwarded to BNL for review and approval. BNL shall not take delivery of the wagon wheels without first having approved this inspection report in writing.

## **5 SUBMITTALS**

The Contractor shall submit to BNL the proposed fabrication schedule, material certification, inspection reports, shipping details, and material and application information pertaining to the chemical surface treatment.