sPHENIX Director's Review

August 2-4, 2017

BNL

Engineering Management and Coordination

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Scope of Presentation

This presentation will:

Provide a general overview of Engineering Management for sPHENIX. Engineering Staff will be listed, Standing Meetings discussed, Design and the Design Review process will be discussed.

Engineering Management

sPHENIX Senior Engineering Staff*

- J. Mills – Project Engineer
- D. Lynch – Chief Mechanical Engineer
- P. Giannotti – Safety Engineering
- J. Eng – Quality Assurance
- R. Ruggiero – Chief Design Engineer

Departmental Engineering Management (Support)

- J. Tuozzolo – Chief Mechanical Engineer – CAD
- J. Sandberg – Chief Electrical Engineer – CAD
- M. Anerella – Chief Mechanical Engineer – SMD

* Reports directly to the sPHENIX Project Director

sPHENIX Engineering Staff

- Most support staff has 25+ years of experience
- Senior Engineers from SMD, CAD, Instrumentation, and PHYSICS
- Responsible for technical content to sPHENIX Project Director

WBS No.	Detector Element	Engineering Lead	Institution/Dept.	Support Engineering
1.2	TPC	J. Cozzolino/J. Mead	BNL - SMD/BNL - ID	S. Bellavia (CAD), M. Anerella (SMD), J. Kuczewski (ID)
1.3	EMCal	S. Stoll	BNL - PH	D. Cacace (PH), A. Gordeev (PH), D. Lynch (PH)
1.4	Hcal	A. Gordeev	BNL - PH	D. Lynch (PH)
1.5	CalElect	S. Boose	BNL - PH	
1.6	DAQ/Trigger	S. Boose	BNL - PH	
1.7	Min-Bias	N/A	N/A	N/A
1.8	Magnet	M. Anerella	BNL - SMD	R. Than (CAD), C. Schultheiss (CAD), P. Orfin (CAD), P. Rosas (CAD), T. Tallerico (CAD)
1.9	Infrastructure	P. Giannotti	BNL - PH	J. Hock (CAD), B. Streckenbach (CAD), J. Mills (CAD)
1.10	Installation and Integration	D. Lynch	BNL - PH	D. Phillips (CAD), R. Ruggiero (CAD)
	Safety Engineering	P. Giannotti	BNL - PH	B. Streckenbach (CAD)
	Q/A	J. Eng	BNL - PP&QM	
	ID	Instrumentation Division		
	CAD	Collider Accelerator Department		
	PH	Physics Department		
	PP&QM	Planning, Performance and Quality Management		
	SMD	Superconducting Magnet Division		

- Many engineers are assigned on a varying P/T basis with other responsibilities outside of sPHENIX
- Still need to fill Senior EMCal ME and Inner Detector Integration Eng.

Engineering Controls

- Documentation –
  - Drawing Numbering Plan and Revision Control is documented in procedure. Procedure requires final review, discussion, and adoption by project office (plan to release in late summer, 2017). We are unofficially releasing blocks of drawing numbers (following the guidelines in the draft procedure) for use by subsystem engineering leads.
  - Archiving of all Engineering Documents to be at sPHENIX Project office.
  - Final approval to be from the sPHENIX Project Office, applicable L2 Manager, and CAD Safety/CAD OPS.
  - Design changes will follow change control procedures, requiring approvals as appropriate and as designated by project office.
  - Documents to comply with BNL SBMS requirements.

- Autodesk Vault to be used for sPHENIX released drawing and document revision control. Training for engineers and designers tentatively planned for beginning of September, 2017. Addresses the potential for the simultaneous modification to a drawing or document. Provides version control.

Design Software

CAD/3D modelling software to be used by engineers and designers consistent with their respective departmental requirements. Final Released Drawings to be delivered to sPHENIX project office as PDF's with the corresponding 3D model and electronics simulation files to be supplied in industry standard exchange format (i.e. STEP file for mechanical solid model).

Department/Institution	Mechanical Computer Aided Design	Finite Element Analysis	Electronics	Electrical One-Lines*	Gas Systems*	Safety Systems*
Collider Accelerator Department	PTC Creo	ANSYS, ABAQUS	N/A	Autodesk AutoCAD	Autodesk AutoCAD	Autodesk AutoCAD
Superconducting Magnet Division	PTC Creo	ANSYS	N/A	N/A	N/A	N/A
PHYSICS Department	Autodesk Inventor	ANSYS	ORCAD/PADS	N/A	Autodesk AutoCAD	Autodesk AutoCAD
Instrumentation Division	N/A	N/A	ORCAD/PADS	N/A	N/A	N/A
Columbia University	N/A	N/A	ORCAD/PADS	N/A	N/A	N/A
	* Final Documentation to be approved and reside at Collider Accelerator Department					

Engineering Meetings

- Regularly scheduled subsystem-specific engineering status meetings – attended by subsystem lead engineer (designer and support engineers), sPHENIX Chief Mechanical Engineer and Project Engineer, and L2/L3 scientists when appropriate.
- Bi-weekly sPHENIX Project Engineering Meeting – all engineers meet to review progress, problems, and to discuss technical issues. General interface issues are discussed with follow-up meetings scheduled. Chaired by sPHENIX Project Engineer.
- Weekly Construction Coordination and Safety Meeting – technical staff and project management meet to review ongoing scheduled work and planned future work. Safety related issues and schedule discussed. Chaired by sPHENIX L2 Installation and Integration Manager.
- Meetings are formally documented via INDICO and conducted using BlueJeans video conferencing. INDICO documents are accessible for reference to all sPHENIX staff.

Design/Readiness Review Process

Engineering Design Reviews will be starting shortly:

- **Each subsystem design will be formally reviewed prior to issue of major procurements (Design Review/Safety Review).**
- **System Readiness and Safety Reviews to be conducted for all subsystems prior to the start of assembly/construction.**
  - chaired by sPHENIX Project Management (either sPHENIX PM, PE, or CE).
  - Attended by subsystem lead engineer, scientific and design staff, L2 Manager, sPHENIX Project Director, sPHENIX Project Manager, sPHENIX Project Engineer, sPHENIX Chief Mechanical Engineer, sPHENIX Senior Design Engineer, sPHENIX Safety Coordinator, Subject Matter Experts, CAD Safety Group/CAD Liaison Engineering and sPHENIX Lead Construction Technician.
  - Review design for fabrication, safety, constructability, and operational effectiveness.
  - More complicated systems may have separate design and safety reviews.
  - Meeting notes, recommendations and requirements will be generated. Findings/Recommendations from Reviews to be entered into the sPHENIX Comment Resolution Database.

Comment Resolution Database

ID	Status (by L2)	Approval by PMT	WBS	WBS name	Originating Review	Recommenda	Originator	Responsible	Re C
						Continue with plan for the			

	Responsible	Resolution Comment	Resolved on	Link	Last Updated	Note	Fiscal Year	Level	Assigned on
1	K. Yip	Sphenix has developed a plan for performing Low Field/High Field testing in B9112. Presentation of this plan to lab senior management will be done by 4/30/2015						nternal	2014-12-16
2		Design of a yoke return							

Findings/Recommendations from Reviews to be entered into the sPHENIX Comment Resolution Database

Engineering Project Controls and Work Management Documents

1. sPHENIX Procedure Guidelines
2. sPHENIX Configuration Management
3. sPHENIX Document Control
4. sPHENIX Quality Assurance Plan
5. sPHENIX Work Planning
6. sPHENIX Awareness Training
7. sPHENIX Bottom's-Up Contingency Guidelines
8. Interface Control Document/Interface Design Drawing
9. Integrated Safety Management Plan/Safety Analysis Document/CAD Conduct of Operations
10. Comment Resolution Database
11. Industry and Society standards and guides
12. BNL SBMS Design Standard

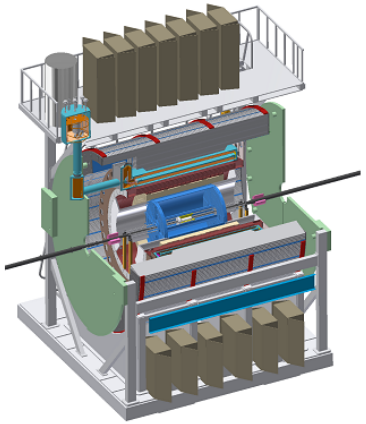
All documents to comply with BNL SBMS

Interface Control Document (ICD)

1.1 Project Management	1.2 TPC	1.3 EMCal	1.4 HCal	1.5 Calorimeter Electronics	1.6 DAQ/ Trigger	1.7 Min Bias	1.8 SC Magnet	1.9 Infrastructure	1.10 Integration & Installation	1.11 INTT	1.12 MVTX	
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.1 Project Management
	N/A	N/A	N/A	N/A	sP.SE-ICD-004	N/A	N/A	sP.SE-ICD-009	sP.SE-ICD-016	N/A	N/A	1.2 TPC
		N/A	sP.SE-ICD-001	sP.SE-ICD-002	sP.SE-ICD-005	N/A	N/A	sP.SE-ICD-010	sP.SE-ICD-017	N/A	N/A	1.3 EMCal
			N/A	sP.SE-ICD-003	sP.SE-ICD-006	N/A	N/A	sP.SE-ICD-011	sP.SE-ICD-018	N/A	N/A	1.4 HCal
				N/A	sP.SE-ICD-007	N/A	N/A	sP.SE-ICD-012	sP.SE-ICD-019	N/A	N/A	1.5 Calorimeter Electronics
					N/A	sP.SE-ICD-008	N/A	sP.SE-ICD-013	sP.SE-ICD-020	sP.SE-ICD-024	sP.SE-ICD-027	1.6 DAQ/ Trigger
						N/A	N/A	sP.SE-ICD-014	sP.SE-ICD-021	N/A	N/A	1.7 Min Bias
							N/A	sP.SE-ICD-015	sP.SE-ICD-022	N/A	N/A	1.8 SC Magnet
								N/A	sP.SE-ICD-023	sP.SE-ICD-025	sP.SE-ICD-01628	1.9 Infrastructure
									N/A	sP.SE-ICD-026	sP.SE-ICD-029	1.10 Integration & Installation
										N/A	sP.SE-ICD-030	1.11 INTT
											N/A	1.12 MVTX

sPEHNIX ICD Matrix

ICD Links 2 and only 2 Subsystems



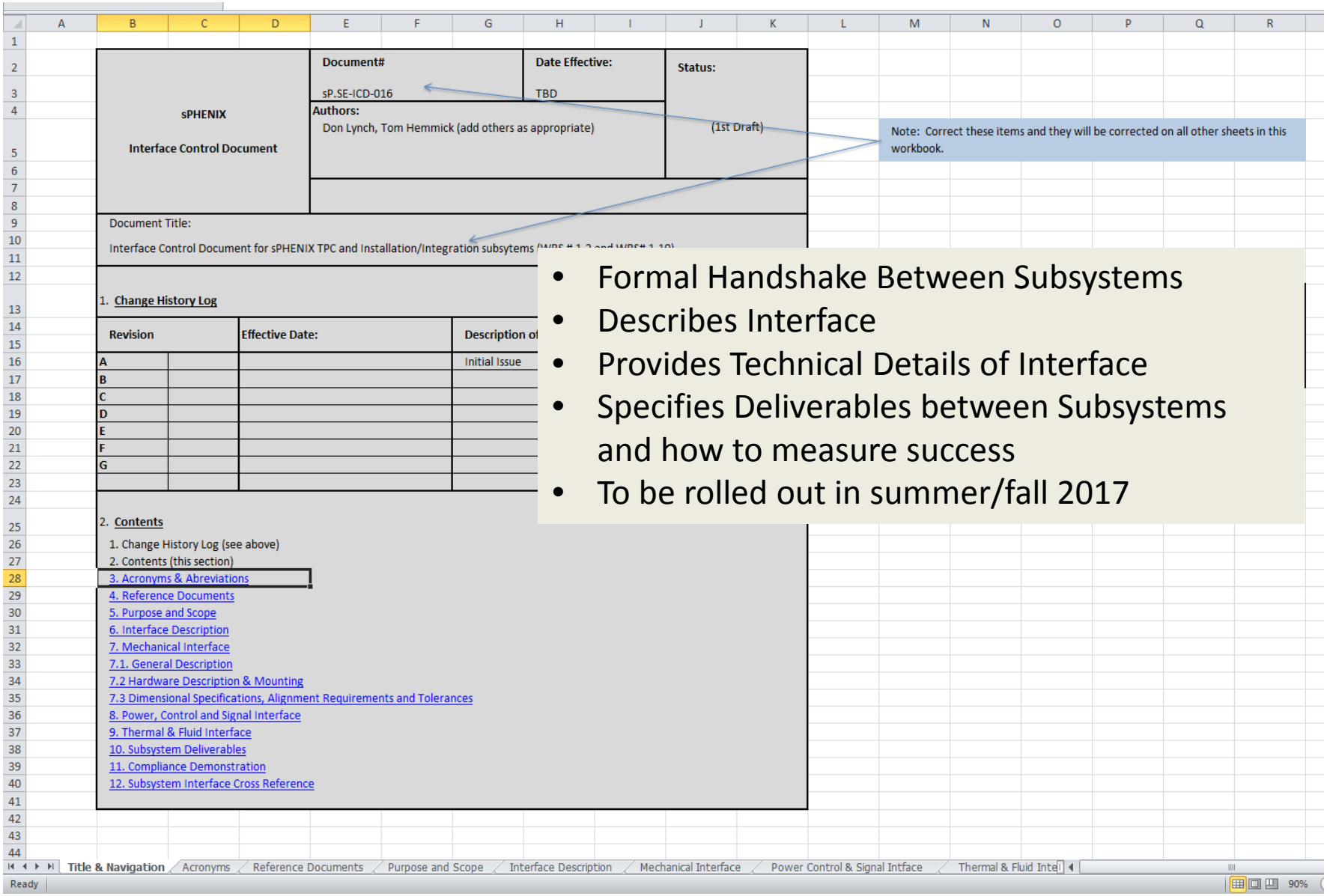
WBS	sPHENIX MIE Project Elements
1.1	Project Management
1.2	Time Projection Chamber
1.3	Electromagnetic Calorimeter
1.4	Hadron Calorimeter
1.5	Calorimeter Electronics
1.6	DAQ-Trigger
1.7	Minimum Bias Trigger Detector

WBS	Infrastructure & Facility Upgrade
1.8	SC-Magnet
1.9	Infrastructure
1.10	Installation-Integration

WBS	Parallel Activities
1.11	Intermediate Silicon Strip Tracker
1.12	Monolithic Active Pixel Sensors

Documents which subsystems require a formal technical Interface to another subsystem. Total of 30 required for sPHENIX.

Interface Control Document (ICD)



sPHENIX Interface Control Document	Document# sP.SE-ICD-016	Date Effective: TBD	Status: (1st Draft)
	Authors: Don Lynch, Tom Hemmick (add others as appropriate)		

Note: Correct these items and they will be corrected on all other sheets in this workbook.

Document Title:

Interface Control Document for sPHENIX TPC and Installation/Integration subsytems (WBS # 1.2 and WBS# 1.10)

1. Change History Log

Revision		Effective Date:	Description of
A			Initial Issue
B			
C			
D			
E			
F			
G			

2. Contents

1. Change History Log (see above)
2. Contents (this section)
3. Acronyms & Abreviations
4. Reference Documents
5. Purpose and Scope
6. Interface Description
7. Mechanical Interface
7.1. General Description
7.2 Hardware Description & Mounting
7.3 Dimensional Specifications, Alignment Requirements and Tolerances
8. Power, Control and Signal Interface
9. Thermal & Fluid Interface
10. Subsystem Deliverables
11. Compliance Demonstration
12. Subsystem Interface Cross Reference

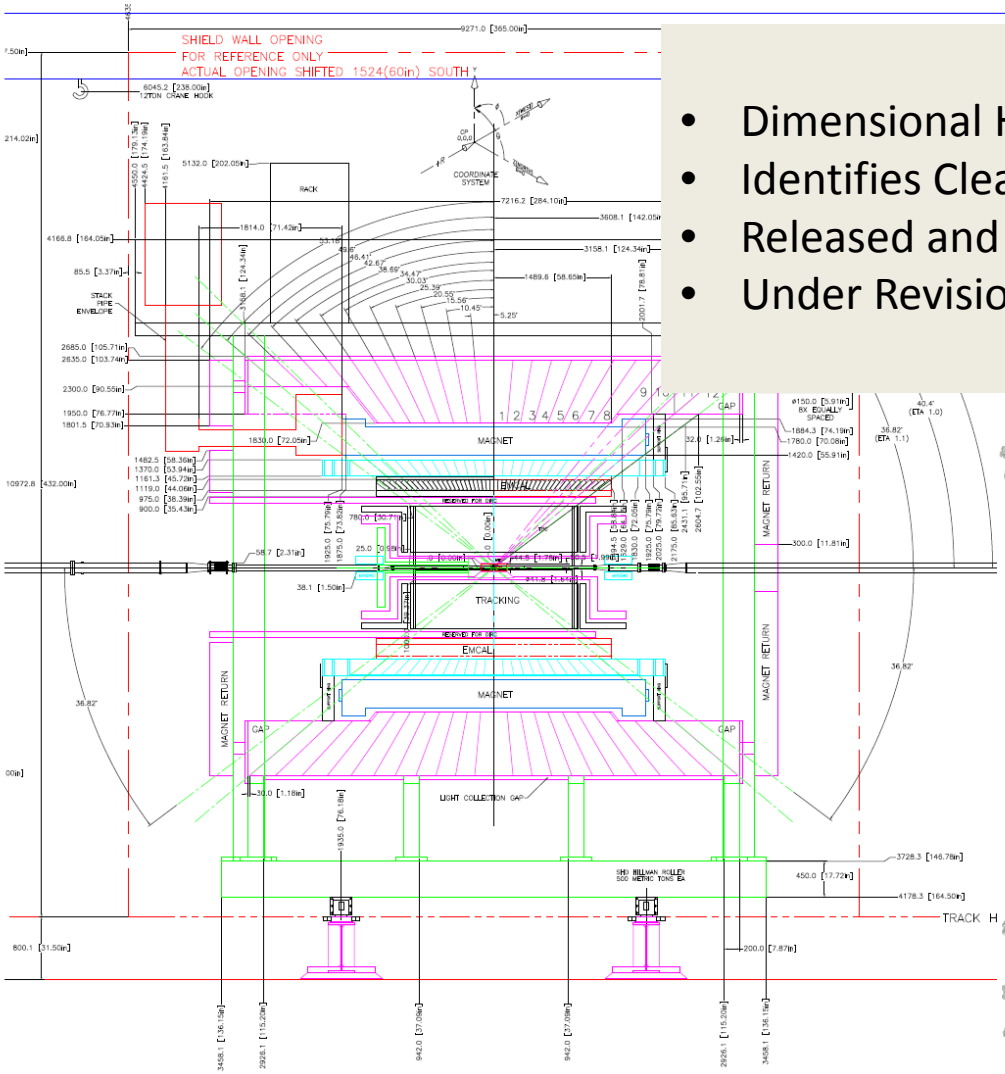
Title & Navigation | Acronyms | Reference Documents | Purpose and Scope | Interface Description | Mechanical Interface | Power Control & Signal Intface | Thermal & Fluid Inte

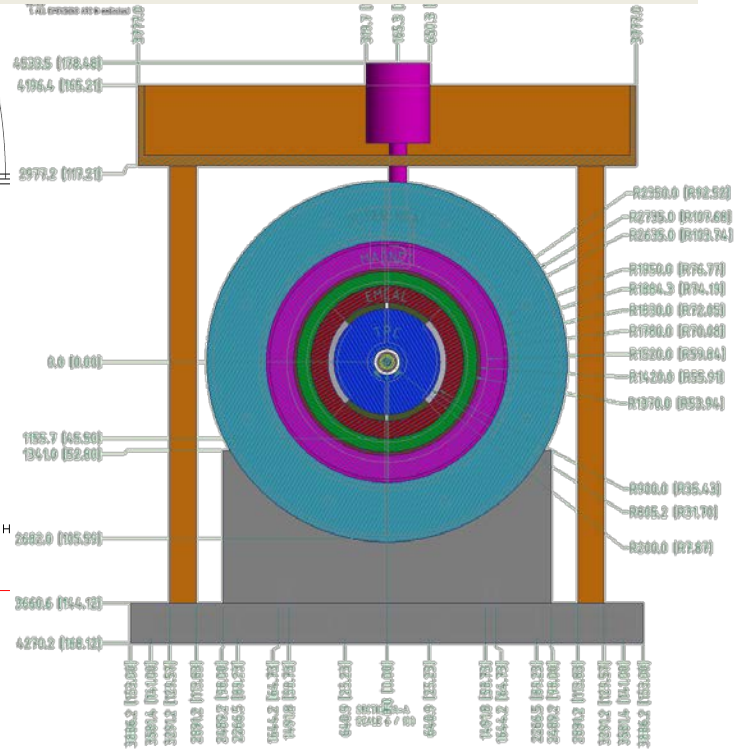
Ready 90%

- Formal Handshake Between Subsystems
- Describes Interface
- Provides Technical Details of Interface
- Specifies Deliverables between Subsystems and how to measure success
- To be rolled out in summer/fall 2017

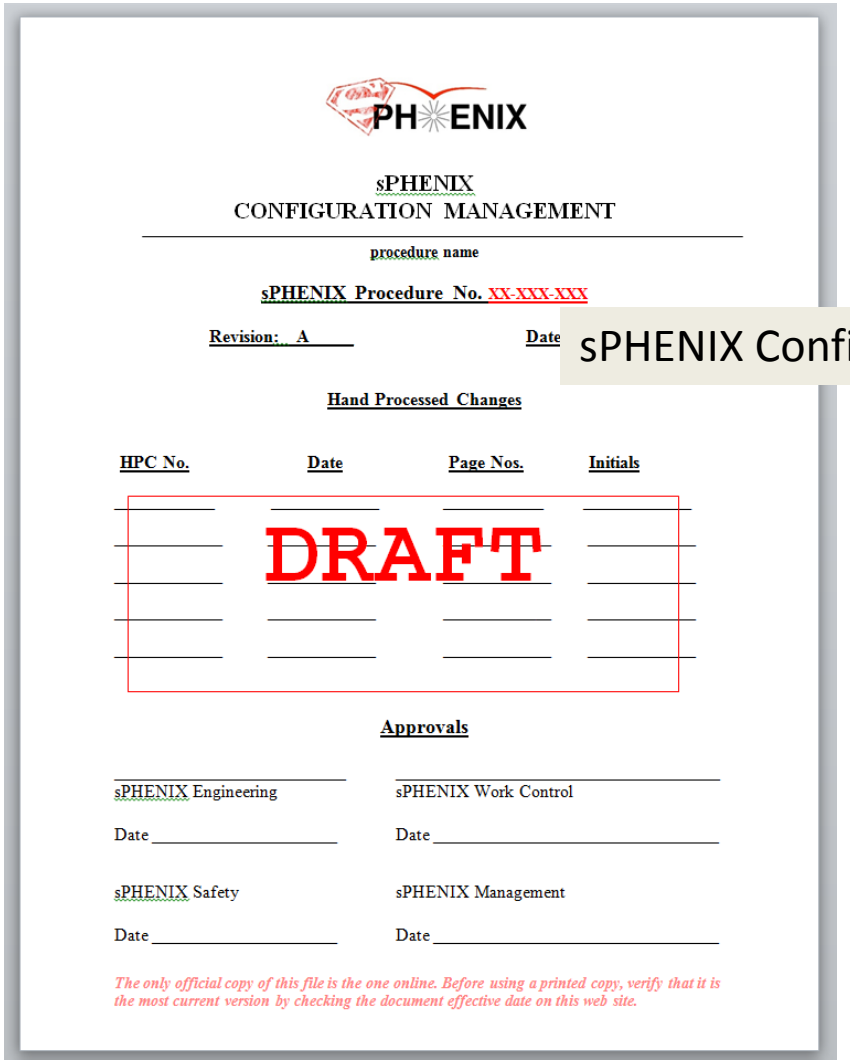
Interface Design Drawing (IDD)

- Dimensional Handshake Between Subsystems
- Identifies Clearances and Stay Clear Zones
- Released and Available to L2 Managers
- Under Revision Control





sPHENIX Engineering Procedures



sPHENIX
CONFIGURATION MANAGEMENT

procedure name

sPHENIX Procedure No. XX-XXX-XXX

Revision: A Date

Hand Processed Changes

HPC No.	Date	Page Nos.	Initials

DRAFT

Approvals

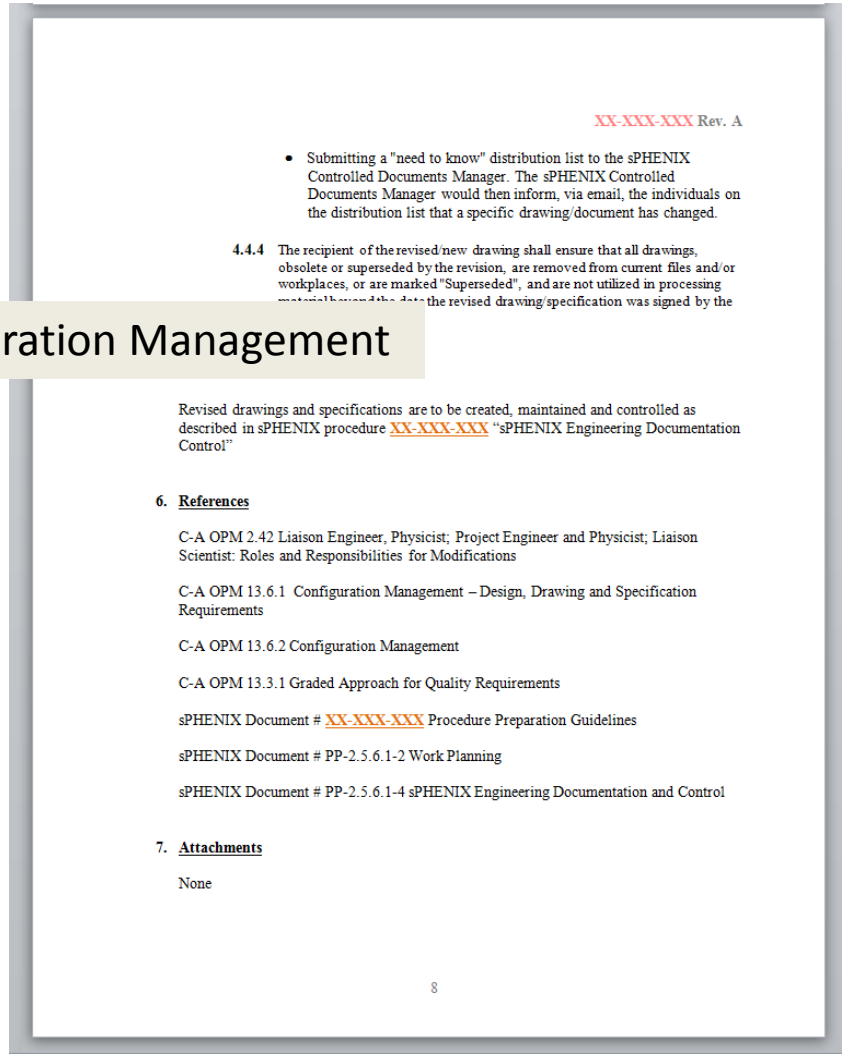
sPHENIX Engineering — Date

sPHENIX Work Control — Date

sPHENIX Safety — Date

sPHENIX Management — Date

The only official copy of this file is the one online. Before using a printed copy, verify that it is the most current version by checking the document effective date on this web site.



- Submitting a "need to know" distribution list to the sPHENIX Controlled Documents Manager. The sPHENIX Controlled Documents Manager would then inform, via email, the individuals on the distribution list that a specific drawing/document has changed.

4.4.4 The recipient of the revised/new drawing shall ensure that all drawings, obsolete or superseded by the revision, are removed from current files and/or workplaces, or are marked "Superseded", and are not utilized in processing material beyond the date the revised drawing/specification was signed by the

Revised drawings and specifications are to be created, maintained and controlled as described in sPHENIX procedure XX-XXX-XXX "sPHENIX Engineering Documentation Control"

6. References

C-A OPM 2.42 Liaison Engineer, Physicist; Project Engineer and Physicist; Liaison Scientist: Roles and Responsibilities for Modifications

C-A OPM 13.6.1 Configuration Management – Design, Drawing and Specification Requirements

C-A OPM 13.6.2 Configuration Management

C-A OPM 13.3.1 Graded Approach for Quality Requirements

sPHENIX Document # XX-XXX-XXX Procedure Preparation Guidelines

sPHENIX Document # PP-2.5.6.1-2 Work Planning

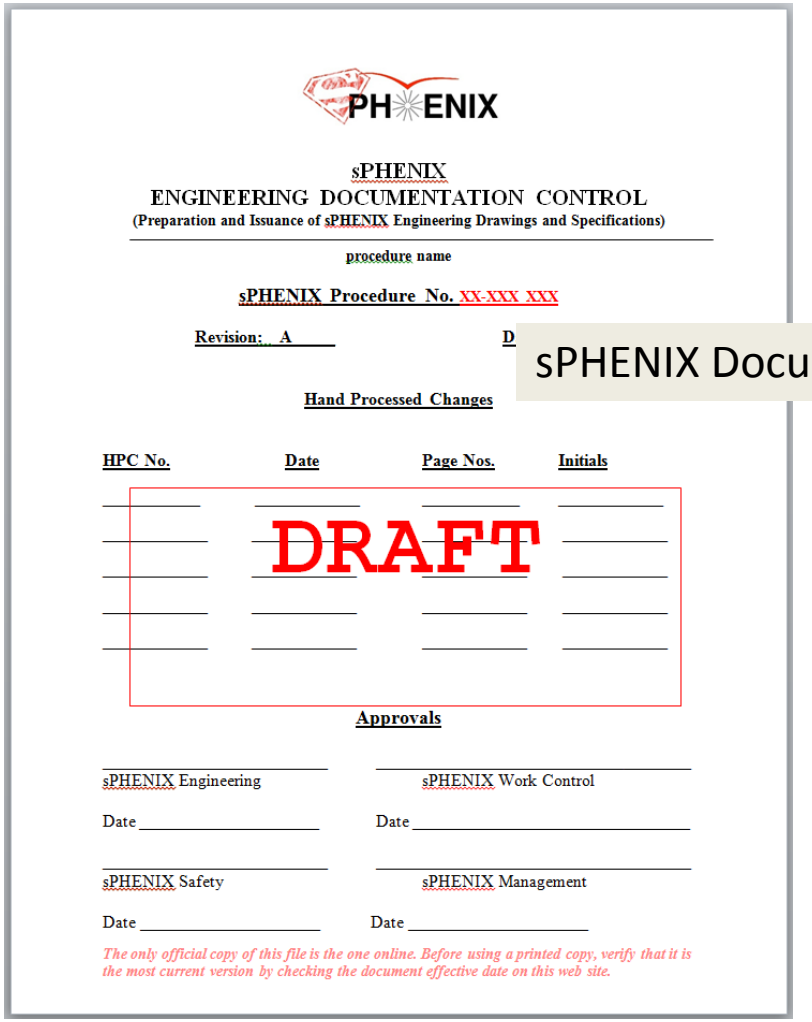
sPHENIX Document # PP-2.5.6.1-4 sPHENIX Engineering Documentation and Control

7. Attachments

None

sPHENIX Configuration Management

sPHENIX Engineering Procedures



sPHENIX
ENGINEERING DOCUMENTATION CONTROL
(Preparation and Issuance of sPHENIX Engineering Drawings and Specifications)

procedure name

sPHENIX Procedure No. XX-XXX XXX

Revision: A D

Hand Processed Changes

HPC No.	Date	Page Nos.	Initials

DRAFT

Approvals

sPHENIX Engineering — sPHENIX Work Control

Date Date

sPHENIX Safety — sPHENIX Management

Date Date

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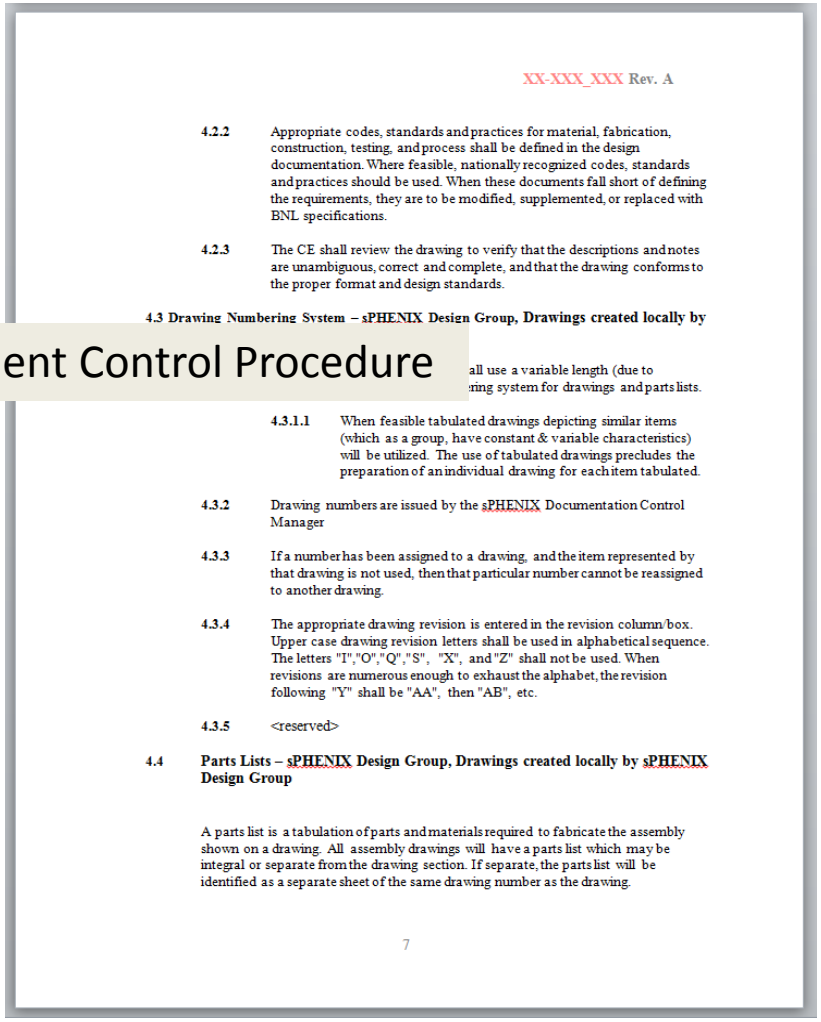


XX-XXX_XXX Rev. A

4.2.2 Appropriate codes, standards and practices for material, fabrication, construction, testing, and process shall be defined in the design documentation. Where feasible, nationally recognized codes, standards and practices should be used. When these documents fall short of defining the requirements, they are to be modified, supplemented, or replaced with BNL specifications.

4.2.3 The CE shall review the drawing to verify that the descriptions and notes are unambiguous, correct and complete, and that the drawing conforms to the proper format and design standards.

4.3 Drawing Numbering System – sPHENIX Design Group, Drawings created locally by

all use a variable length (due to
ring system for drawings and parts lists.

4.3.1.1 When feasible tabulated drawings depicting similar items (which as a group, have constant & variable characteristics) will be utilized. The use of tabulated drawings precludes the preparation of an individual drawing for each item tabulated.

4.3.2 Drawing numbers are issued by the sPHENIX Documentation Control Manager

4.3.3 If a number has been assigned to a drawing, and the item represented by that drawing is not used, then that particular number cannot be reassigned to another drawing.

4.3.4 The appropriate drawing revision is entered in the revision column/box. Upper case drawing revision letters shall be used in alphabetical sequence. The letters "I","O","Q","S", "X", and "Z" shall not be used. When revisions are numerous enough to exhaust the alphabet, the revision following "Y" shall be "AA", then "AB", etc.

4.3.5 <reserved>

4.4 Parts Lists – sPHENIX Design Group, Drawings created locally by sPHENIX Design Group

A parts list is a tabulation of parts and materials required to fabricate the assembly shown on a drawing. All assembly drawings will have a parts list which may be integral or separate from the drawing section. If separate, the parts list will be identified as a separate sheet of the same drawing number as the drawing.

7

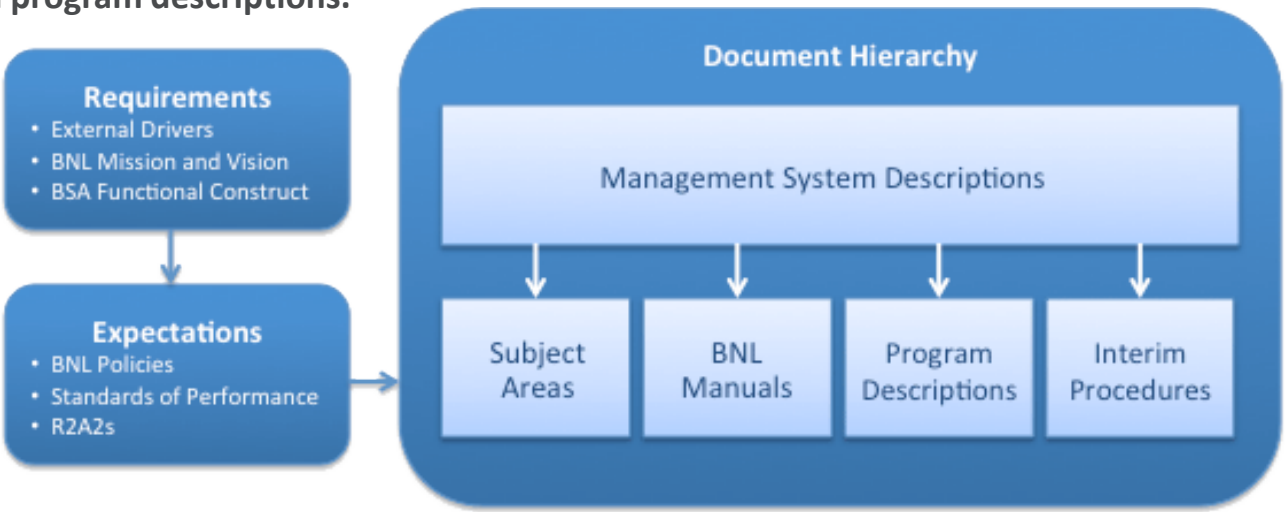
sPHENIX Document Control Procedure

Back Up

Standards Based Management (SBMS)

Brookhaven National Laboratory SBMS

The Standards-Based Management System (SBMS) provides Laboratory-wide procedures and guidelines for performing work safely and in compliance with requirements. All work at the Laboratory must comply with the minimum requirements specified in SBMS documents, including management system descriptions, subject areas, interim procedures, BNL manuals, and program descriptions.



sPHENIX Engineering Project Controls and Work Management Documents will meet all SBMS requirements but will be tailored to address complex multiple institutional and departmental collaborations.

Subject Area: Engineering Design

Introduction

This subject area describes how to create, modify, distribute, and review engineering calculations, drawings and specifications, and establish configuration control (see the Configuration Management Program Description, or contact the Configuration Management Subject Matter Expert) for both equipment used for scientific purposes and facility construction. It provides for the verification and validation of design adequacy by Technical Authorities (i.e., competent individuals, approved by management, other than those who performed the work), before the approval and implementation of the design. It uses a process that fosters the use of sound engineering/scientific principles, risk management, and standards for design work.

Work Planning (SBMS)

Subject Area:
Work Planning and Control for Experiments and Operations

Introduction

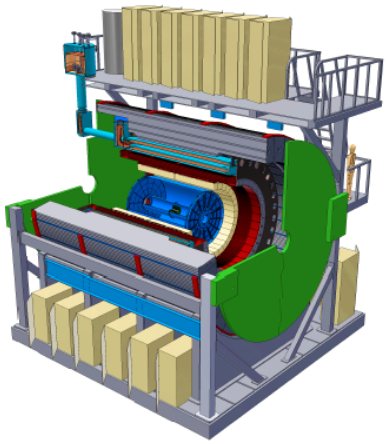
This subject area uses the Integrated Safety Management core functions and guiding principles to establish a process for ensuring all work, operational and experimental, is properly planned and implemented to prevent accidents, injuries, and regulatory violations. It establishes requirements at Brookhaven National Laboratory (BNL) so that all work is properly managed by using a level of planning and control commensurate to the Environment, Safety, Security, and Health (ESSH) hazards, job complexities, and work coordination needs. Line management is directly responsible for the protection of the public, the workers, and the environment.

Conceptual Design Report

sPHENIX Conceptual Design Report

DRAFT VERSION 1.51 FOR COLLABORATION REVIEW

June 1, 2017



Bookmarks

- Scientific Objective and Performance
- Detector Overview
- TPC
- Electromagnetic Calorimeter
- Hadronic Calorimeter
- Calorimeter Electronics
- Minimum Bias Trigger Detector
- Data Acquisition and Trigger
- Superconducting Magnet
- Infrastructure
- Installation and Integration
- Intermediate Silicon Strip Tracker
- Monolithic Active Pixel Detector
- List of Tables
- List of Figures
- References

Executive Summary

sPHENIX[1] is a proposal for a major upgrade to the PHENIX experiment at RHIC capable of measuring jets, jet correlations and upsilons to determine the temperature dependence of transport coefficients of the quark-gluon plasma. The detector needed to make these measurements require electromagnetic and hadronic calorimetry for measurements of jets, a high resolution and low mass tracking system for reconstruction of the Upsilon states, and a high speed data acquisition system.

This document describes a design for a detector capable of carrying out this program of measurements built around the BaBar solenoid. As much as possible, the mechanical, electrical, and electronic infrastructure developed for the PHENIX experiment from 1992-2016 is reused for sPHENIX. The major new systems are the superconducting magnet, a high precision tracking system, and electromagnetic and hadronic calorimeters.

Several alternatives for tracking technologies have been explored, and the conceptual design has converged on studying the physics capability of a reference design consisting of a small Time Projection Chamber with a silicon strip detector and a Monolithic Active Pixel (MAPS) detector within the inner radius. The feasibility of the detector and electronics has been evaluated through simulation, design, and prototyping.

The electromagnetic calorimeter is a compact tungsten-scintillating fiber design located inside the solenoid. There are two sections of hadronic calorimeter, one inside the solenoid and the other outside made of steel-scintillator in a somewhat novel arrangement in which scintillator tiles with light collected by wavelength shifting fiber are sandwiched between tapered absorber plates that project nearly radially from the interaction point. The calorimeters use a common set of silicon photomultiplier photodetectors and amplifier and digitizer electronics.

The detector design has been evaluated by means of GEANT4 simulation and measurements with prototypes of some of the detectors. Additional simulation and testing of components is being pursued to finalize the design.