# Detector Shields and Absorbers Reference Design

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**Abstract**

This document contains the requirements and basic design parameters for the Detector Shields and Neutron Absorbers in and around the Detector Solenoid. These serve to reduce rates in the Tracker and Calorimeter from protons and reduce the rate of neutron interactions in the Cosmic Ray Shield counters respectively.

| **History of Changes** | | | |
|---|---|---|---|
| Rev. No. | Date | Sections | Description of changes |
| 1.00 | 4/24/03 | All | Initial version containing a few mechanical parameters and some 3D CAD modelling sketches. |

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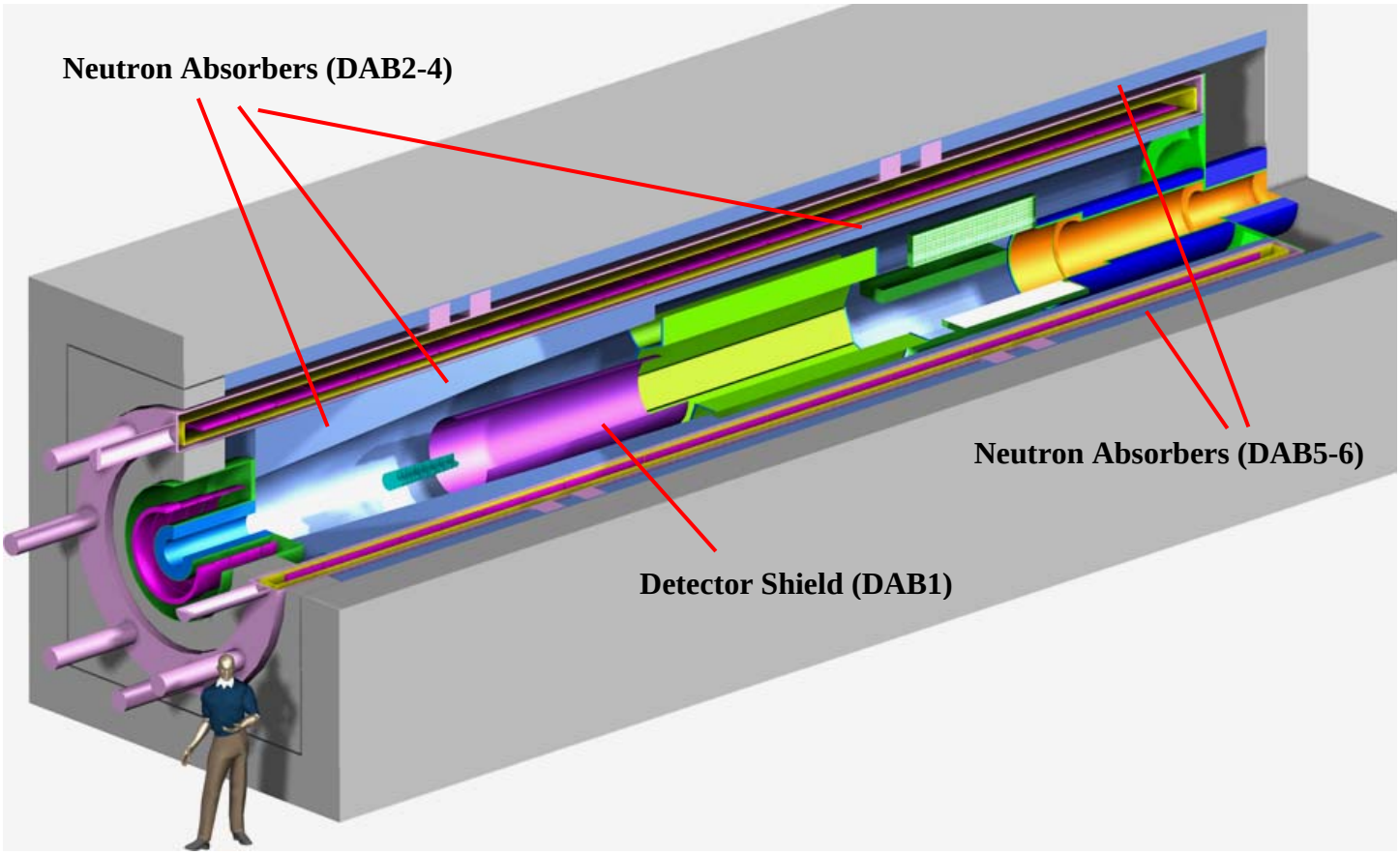


**Figure 1 – Overview of the Detector Shield (violet) and the Neutron Absorbers (light blue) in the vicinity of the DS. Volumes DAB1-4 are inside the DS, while volumes DAB5-6 are outside.**

# 1. INTRODUCTION

This document contains the requirements and basic design parameters for the Detector Shields and Neutron Absorbers in and around the Detector Solenoid. These serve to reduce rates in the Tracker and Calorimeter from protons and reduce the rate of neutron interactions in the Cosmic Ray Shield counters respectively.

# 2. REQUIREMENTS

## 2.1 Limit Tracker, Calorimeter, and Cosmic Ray Shield Counter Rates

Need to spell out acceptable rates for each detector element here.

## 2.2 Minimize Energy Loss of Candidate Electrons in Shield Materials

Need to spell out maximum acceptable electron candidate loss rate to achieve the aforementioned rate reductions in the detectors.

## 2.3 Support off of the Detector Solenoid Cryostat

The gravity loads of the proton absorber (DAB1) and the neutron absorbers within the DS (DAB2-4) must be supported off of the DS cryostat wall.

## 2.4 Support off of the Cosmic Ray Shield Steel

The gravity loads of neutron absorbers DAB5-6 must be supported off of the passive steel shielding for the Cosmic Ray Shield.

### 2.5 Outgassing Rates

## 3. DESIGN

### 3.1 Component Volumes from the Physics Simulation

The volumes that comprise the shield are described in the MECO Standard Coordinate System (MECO-Standards-03-001). Dimensions are given in cm and angles are in degrees. The volume names from the simulation code are given in parentheses.

**Conical Sheet (DAB1)**

| Position of Center | Inner Radius @ -z end | Outer Radius @ -z end | Inner Radius @ +z end | Outer Radius @ +z end |
|---|---|---|---|---|
| (-390.4, 0.0, 765.0) | 33.47 | 33.52 | 38.47 | 38.52 |

| Length | Material |
|---|---|
| 250.0 | Polyethylene |

**Cone Cutout of a Cylinder (DAB2)**

| Position of Center | Inner Radius @ -z end | Inner Radius @ +z end | Outer Radius | Length | Material |
|---|---|---|---|---|---|
| (-390.4, 0.0, 541.5) | 46.0 | 66.0 | 94.0 | 297.0 | Polyethylene |

**Cone Cutout of a Cylinder (DAB3)**

| Position of Center | Inner Radius @ -z end | Inner Radius @ +z end | Outer Radius | Length | Material |
|---|---|---|---|---|---|
| (-390.4, 0.0, 785.0) | 66.0 | 71.0 | 94.0 | 190.0 | Polyethylene |

**Cylinder (DAB4)**

| Position of Center | Inner Radius | Outer Radius | Length | Material |
|---|---|---|---|---|
| (-390.4, 0.0, 1214.55) | 85.0 | 94.0 | 669.1 | Polyethylene |

Note that the DAB5 and DAB6 volumes, which lie outside the DS cryostat, are interrupted at several points by the DS support structure. This aspect will be addressed in a later version of this document.

**Rectangular Boxes (DAB5)**

| Position of Center | Dimensions (x, y, z) | Material |
|---|---|---|
| (-390.4, 147.5, 992.1) | (310.0, 15.0, 1268.0) | Polyethylene |
| (-390.4, -147.5, 992.1) | (310.0, 15.0, 1268.0) | Polyethylene |

**Rectangular Boxes (DAB6)**

| Position of Center | Dimensions (x, y, z) | Material |
|---|---|---|
| (-242.9, 0.0, 992.1) | (15.0, 280.0, 1268.0) | Polyethylene |
| (-537.9, 0.0, 992.1) | (15.0, 280.0, 1268.0) | Polyethylene |

### 3.2 Mechanical Design

This will include drawings, masses, and COG coordinates for each component piece. This must also include allowance for thermal expansion and some indication of tolerances on the pieces. In the next version, this will include the mass and COG data to fill out the table below.

**Table 1 – Estimated masses of each of the shield components used in the physics simulation**

| Volume Name | Mass (metric tons) | Center of Gravity (cm) |
|---|---|---|
| **DAB1** | | |
| **DAB2** | | |
| **DAB3** | | |
| **DAB4** | | |
| **DAB5** | | |
| **DAB6** | | |

### 3.3 Installation and Removal After Activation

A plan for installation including any special fixtures (external track mating to rails on the inner wall of the PS cryostat ala the DS?) and a plan for minimizing personnel exposure during dismantling and removal.

## 4. INTERFACES

TBD.

## 5. EXPECTED PERFORMANCE

TBD.

## 6. REFERENCES

TBD.