

LIGO Laboratory / LIGO Scientific Collaboration

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Advanced LIGO

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**AOS Initial Alignment System
Conceptual Design**

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Abstract

The purpose of this document is to describe the conceptual design for the Initial Alignment System (IAS) subsystem of Advanced LIGO, which is a component of the Auxiliary Optics System (AOS).

1 Introduction

1.1 Purpose

The purpose of this document is to describe a conceptual design for the Initial Alignment System (IAS) subsystem of Advanced LIGO, which is a component of the Auxiliary Optics System (AOS).

1.2 Scope

The Initial Alignment System (IAS) comprises the necessary metrology equipment and procedures for setting the initial positions and the angular alignments of all suspended optics and for establishing the input beam direction.

1.3 Referenced Documents

T952007-04, Alignment Sensing/Control Design Requirements Document

T970151-C2, ASC Initial Alignment Procedures

T980072-01, COS IR Autocollimator Alignment System

T980019-00, ASC Initial Alignment Subsystem Final Design

T000065-05, COS 4K IFO Alignment Procedure

T080307-00, AOS Initial Alignment System Design Requirements

2 Input to the Design Requirements

2.1 Mirror Suspension Actuator Dynamic Range

Table 1: Triple Suspension Range

Suspension	DOF	Angle Bias Range
HSTS	Pitch	+/- 11 mrad
	Yaw	+/- 8.8 mrad
HLTS	Pitch	+/- 3.4 mrad
	Yaw	+/- 1.7 mrad

Table 2: Quadruple Suspension Range

Suspension	DOF	Angle Bias Range
Quad	Pitch	+/- TBD mrad
	Yaw	+/- TBD mrad

Table 3: BS/FM Suspension Range

Suspension	DOF	Angle Bias Range
BS/FM	Pitch	+/- TBD mrad
	Yaw	+/- TBD mrad

3 Conceptual Design

The conceptual design for the Initial Alignment System (IAS) will combine the elements of the LIGO-1 initial alignment system, as described in the final design document T980019-00, ASC Initial Alignment Subsystem Final Design; and the IR autocollimator alignment techniques described in T980072-01, COS IR Autocollimator Alignment System and T000065-05, COS 4K IFO Alignment Procedure.

Revisions may be required to accommodate changes in suspension designs, core optic materials, and the active seismic isolation system.

3.1 Transverse and Axial positioning, and Angular Pointing

The requirements for transverse and axial positioning, and angular pointing for the suspended optics are stated in T080307-00, AOS Initial Alignment System Design Requirements.

The transverse and axial positioning, and the angular pointing of the ITM HR and ETM HR surfaces will be established using the procedures described in T970151-C2, ASC Initial Alignment Procedures.

The transverse and axial positioning, and the angular pointing of all other suspended mirrors in the recycling cavities will be established relative to the ITM HR and ETM HR reference surfaces using procedures similar to those described in T000065-05, COS 4K IFO Alignment Procedure.

3.2 Non-contamination of COC Mirrors

Appropriate safeguards will be used to protect the cleanliness of the COC mirrors during alignment. TBD