Southern African Large Telescope
High-Resolution Spectrograph

SALT HRS

3230AE0030 Input Mechanical Design – Overview

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Issue History

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1 Scope

This document describes the input mechanical design of SALT HRS.

2 Requirements

2.1 Interface

The input mechanical design of SALT HRS will interface to the optical fibres from the telescope and to the main mechanical structure of the spectrograph. It will only interface with the intermediate injection optics.

2.2 Design Goals

The mechanical design of the input mechanics is required to meet clearly defined criteria:

1. To provide the input into the spectrograph of starlight by pairs of optical fibres;
2. To mount the optical fibres with finite adjustment to achieve maximum throughput;
3. To provide initial and future accessibility for all necessary adjustment and alignment procedures;
4. To provide a self-contained package to allow for ease of assembly and maintenance;
5. To provide a comprehensive manual outlining operation of the input mechanism;
6. To provide a safe and convenient method of maintaining and servicing this instrument;

Notes on figures in this document

All the figures in this document are generated by the following software:

Mechanical Desktop Version 5 by AutoDesk;
AutoCad 2000i by AutoDesk.

These figures are TIFF images generated directly from a full 3D solid model of the input mechanical design. The 3D model is a dimensionally and materially exact representation and is **not** in any way an artist's impression.

2D working drawings of the components are generated directly from drawings generated by AutoCad 2000i. Examples of these are included in the additional document (3230AD0032 Input Mech Spec).

3 Major Mechanical Components

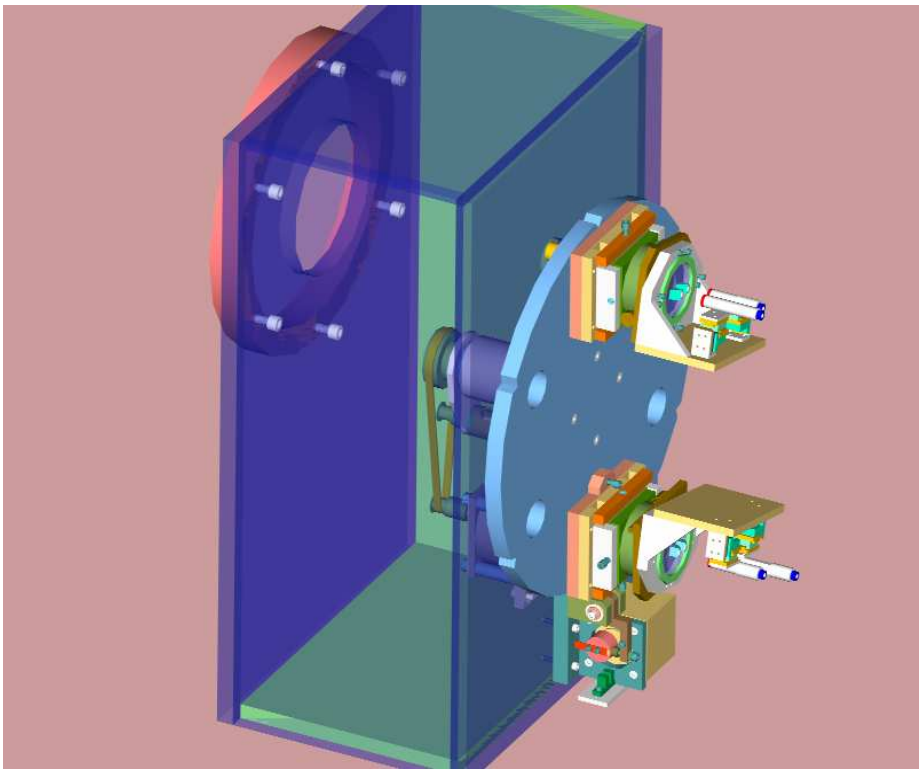

Figure 1: Layout of fibre input assembly

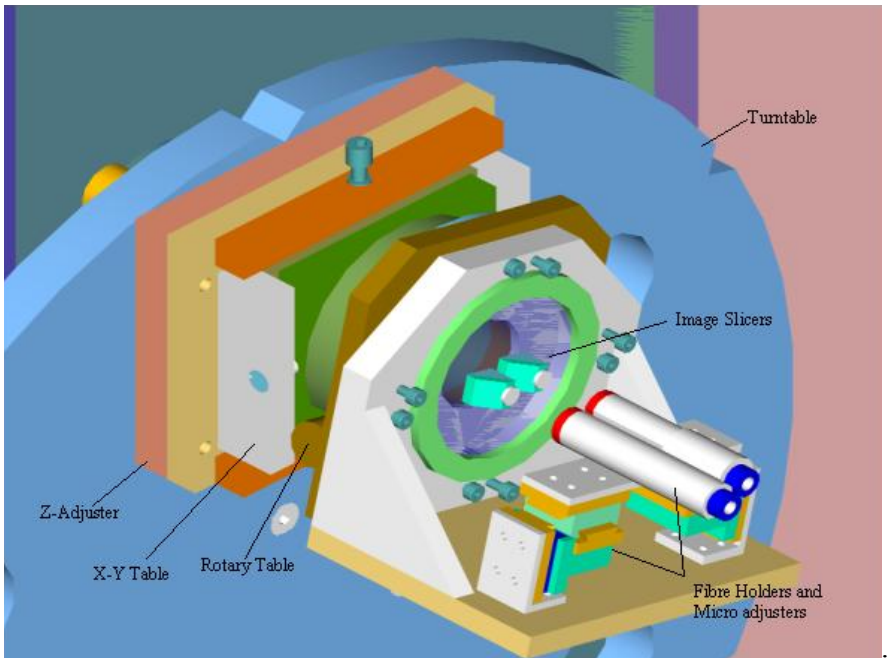

Figure 2: Complete Fibre Holder and adjustment assembly

The fibre input assembly comprises numerous component parts as shown in Figures 1 and 2. Each of these components will be discussed in the following sections under the following headings:

3.1 Fibre holder assembly;
3.2 Micro adjusters and image slicer mounting bracket;
3.3 Rotary table;
3.4 X-Y table;
3.5 Z-axis adjuster;
3.6 Turntable, stepper motor drive and bearing assembly;
3.7 Turntable detent mechanism;
3.8 Fibre assembly and tank mounting plate;
3.9 Slit-viewing optics.

3.1 Fibre holder assembly

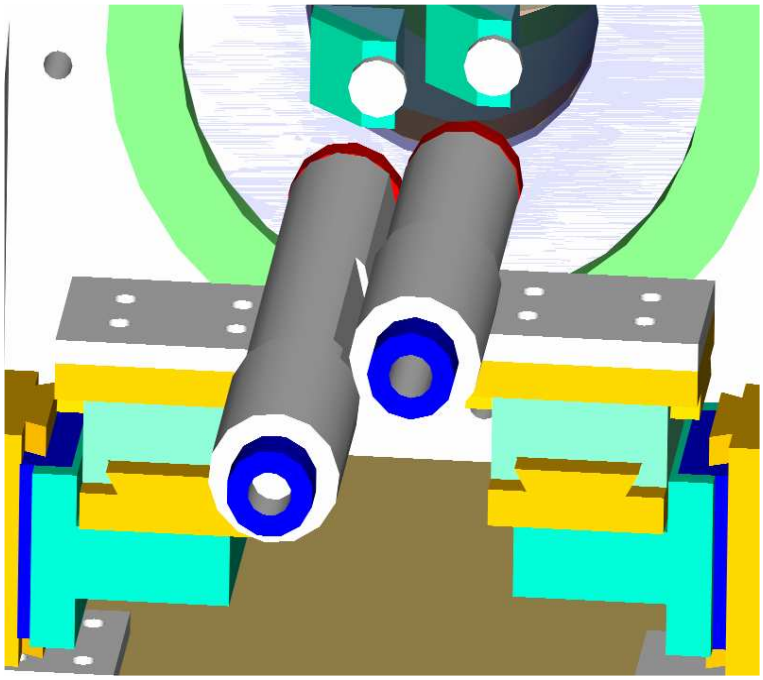

Figure 3: Fibre holder assembly.

The fibre holder assembly (Figure 3) consists of a fixed 5mm ball lens and the fibre bonded into a S.S. hypodermic needle. This needle is bonded into a brass inner bush that runs in a threaded brass outer bush (Figure 4). When assembled the fibre is adjusted in and out to focus the fibre output.

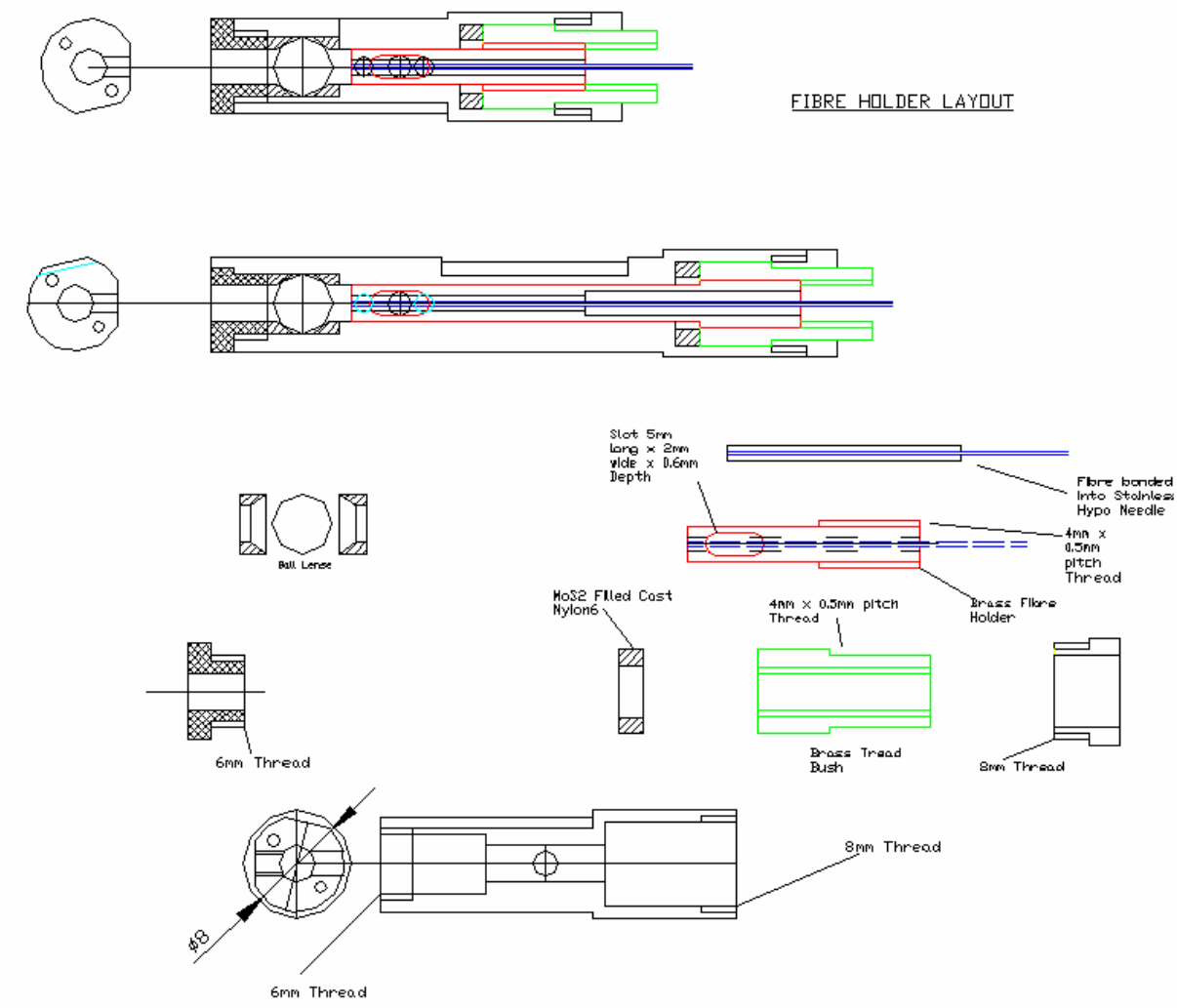

Figure 4: Fibre holder components.

3.2 Micro adjusters and image slicer mounting bracket

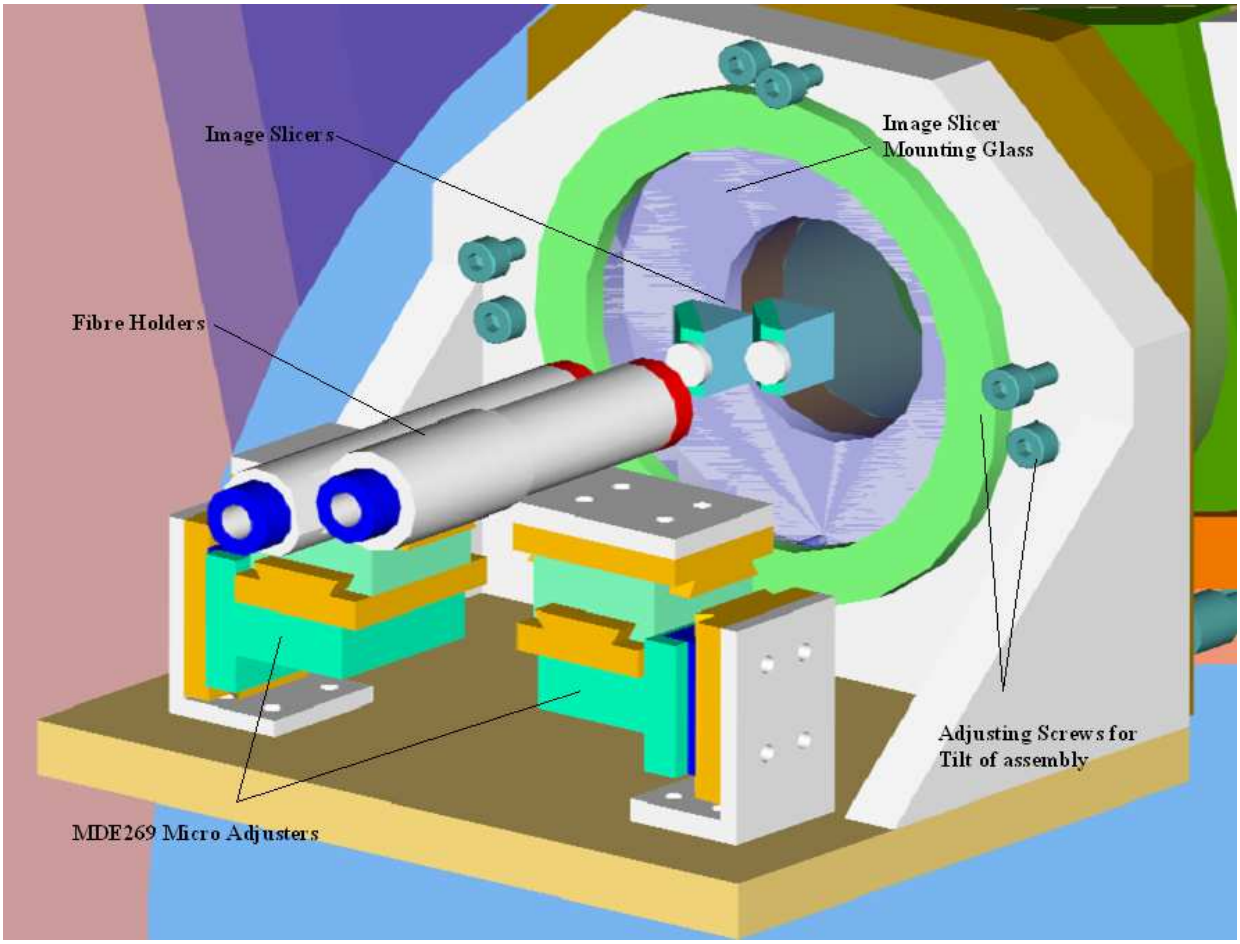

Figure 5: Fibre and micro adjuster assembly.

Figures 4 and 5 show the complete assembly of the fibre mounting bracket with the XYZ micro adjusters. These move (with 1 micron precision) the fibre independent of the image slicers that are mounted on a 40mm diameter glass plate, located on the base plate of the bracket assembly. This complete assembly is mounted onto an adapter plate using four fixed and four adjustable screws. This allows this whole assembly to be tilted. The micro adjusters are manipulated to ensure that the light from the fibres falls in the correct position on the image slicer lens. The image from the image slicer is tilted as required to move the image in line with the slit plate inside the spectrograph.

3.3 Rotary table

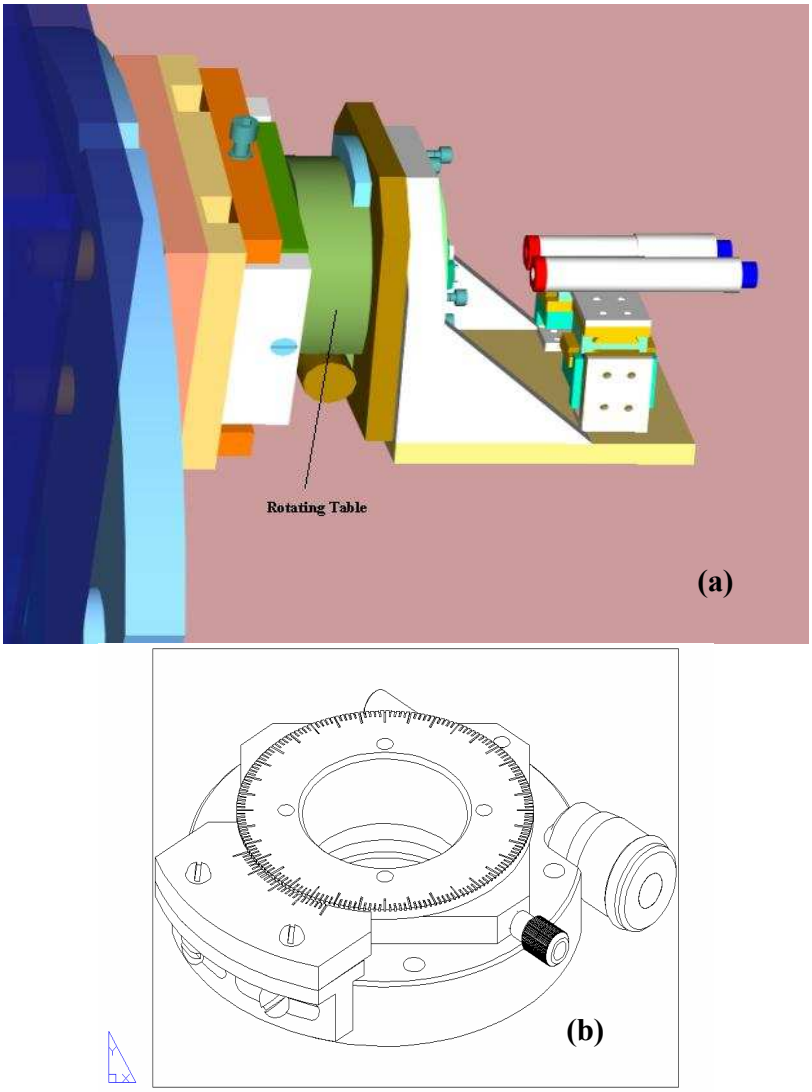

Figure 6: (a) Mounting of the rotary table. (b) Elliot Scientific MDE282 rotator.

The MDE282 rotating table supplied by Elliot Scientific enables precision rotation of the fibre and micro adjuster assembly to bring the image from the slicers in line with the slit plate (see Figure 6).

3.4 X-Y table

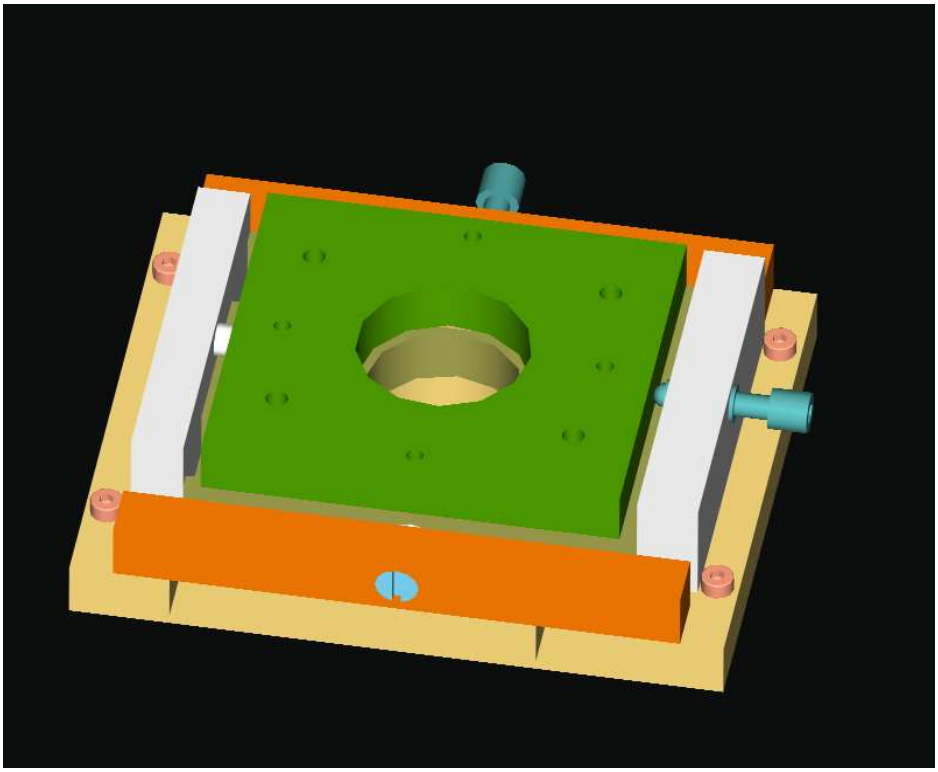

Figure 7: X-Y table.

The X-Y table shown in Figure 7 enables movement of the complete fibre and adjuster assembly in the two axes to allow alignment of the output from the image slicers relative to the slit plate in the spectrograph.

3.5 Z-axis adjuster

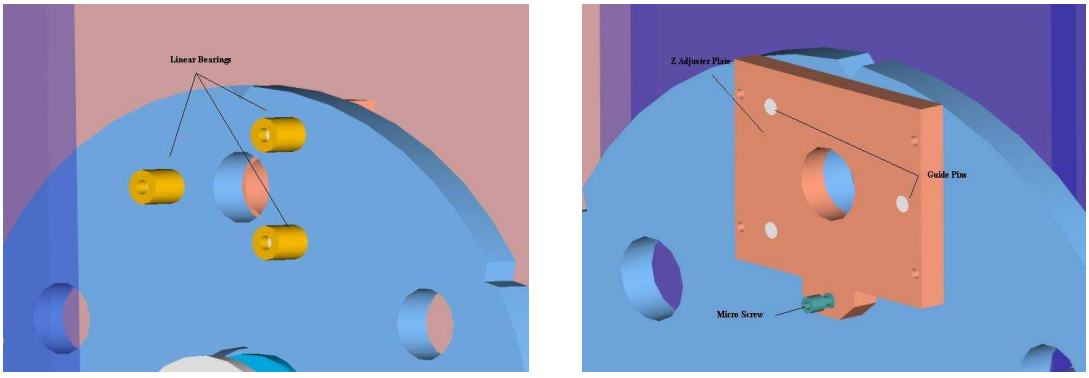

Figure 8: Z-axis adjuster.

The Z-axis adjuster shown in Figure 8 provides a focus movement for the fibre and adjuster assembly and also allows the output from the image slicers to be precisely focused relative to

the slit plate. A precision micro screw enables "Z" movement of the plate via pins inserted into the plate that run in a linear bearing.

3.6 Turntable, stepper motor drive and bearing assembly

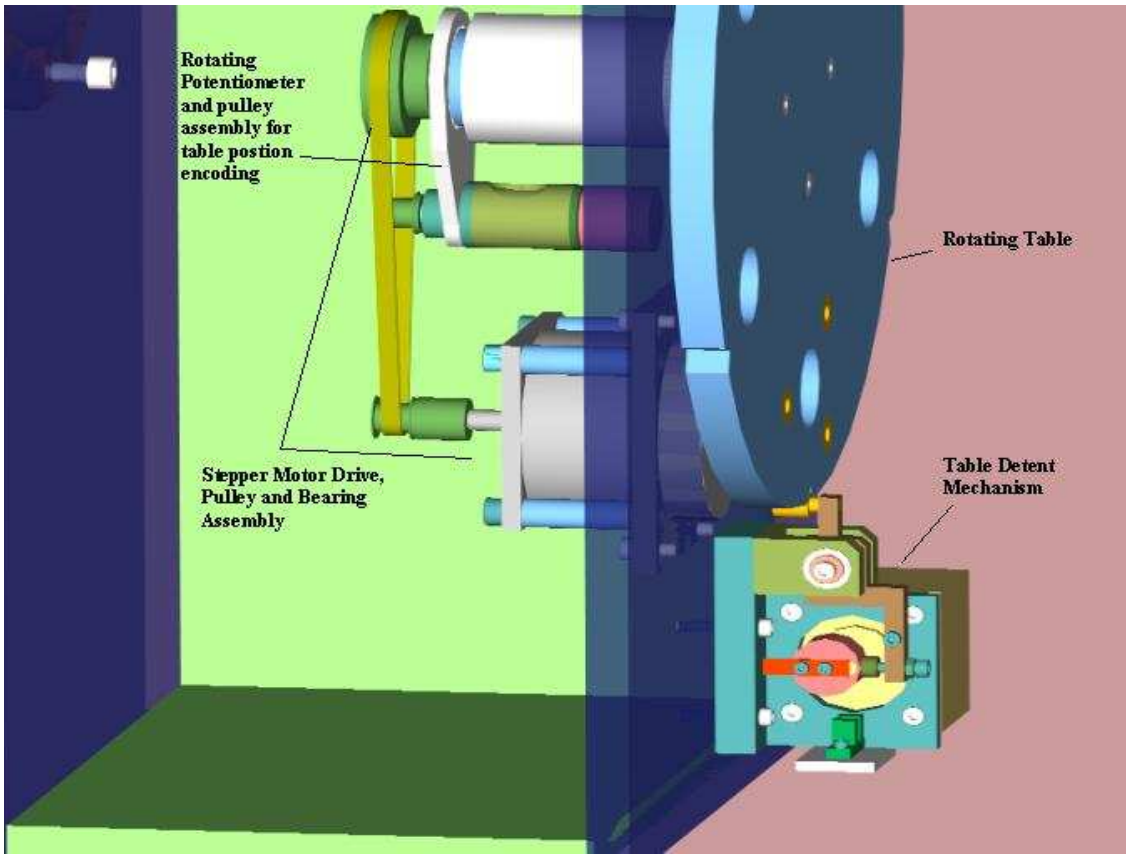

Figure 9: Rotating table with detent showing complete fibre assembly.

The fibre assemblies are mounted on a rotating table (Figure 9) that moves the selected fibre set into position in line with either the medium- or high- resolving power slits on the spectrograph slit plate. Rotation is limited to 180 degrees in either direction to safeguard the integrity of the fibres. There are two fibre sets, each with two fibres. Provision for four additional fibre positions have been included for future upgrades.

Movement of the turntable is enabled by a stepper motor and tooth pulley arrangement geared down to 6:1 to allow precise positioning of the turntable. Positioning of the turntable is achieved by a stepper motor driven detent that locks the turntable using positioning vee slots cut into the turntable. Position encoding is achieved by use a 10 turn rotating potentiometer fixed to a pulley and bearing assembly that runs on the main turntable toothed belt as shown below in Figure 10.

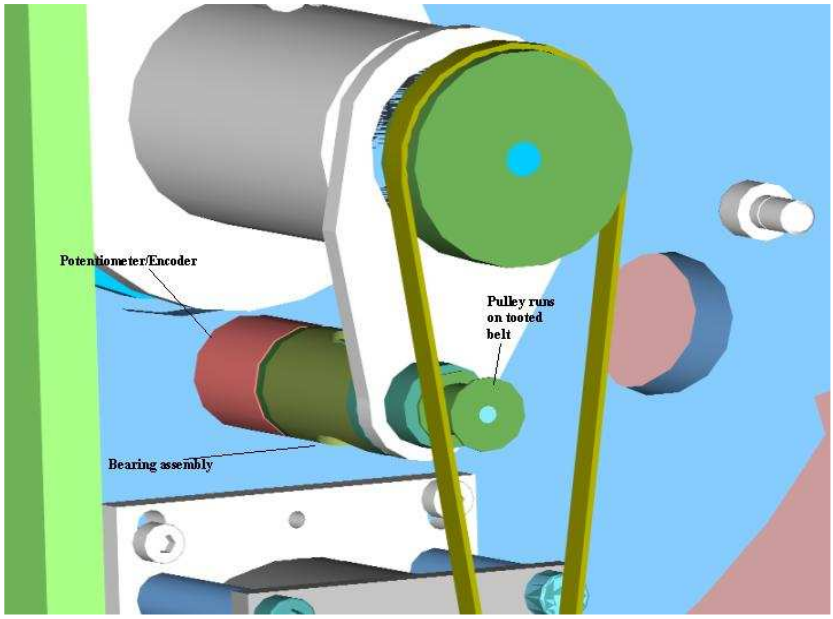

Figure 10: Pulley and bearing assembly

3.7 Turntable detent mechanism

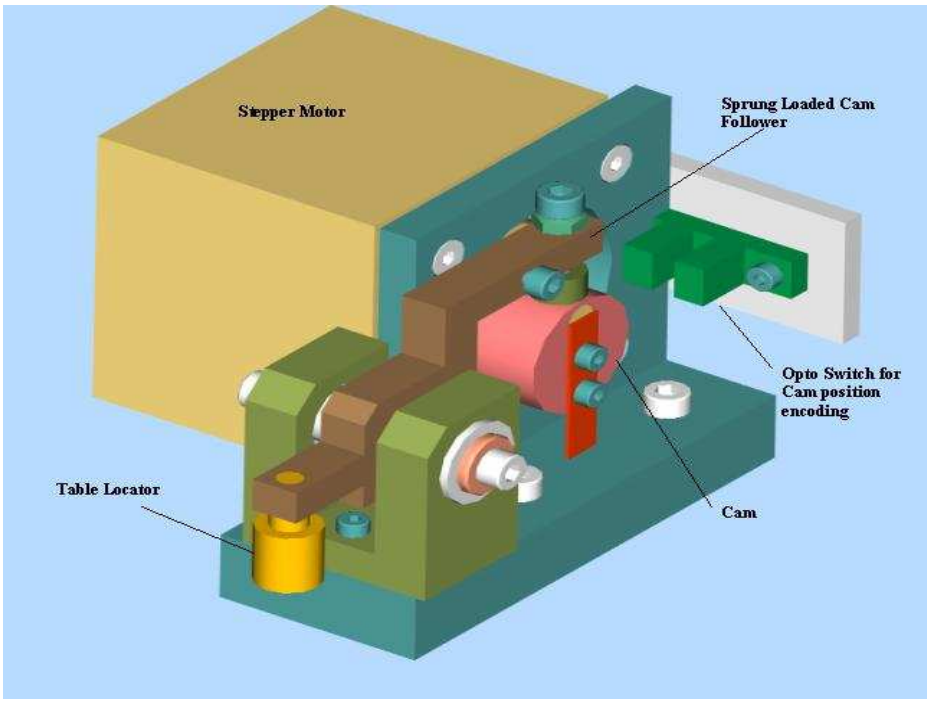

Figure 11: Table Detent Mechanism

3.8 Fibre assembly and vacuum tank mounting plate

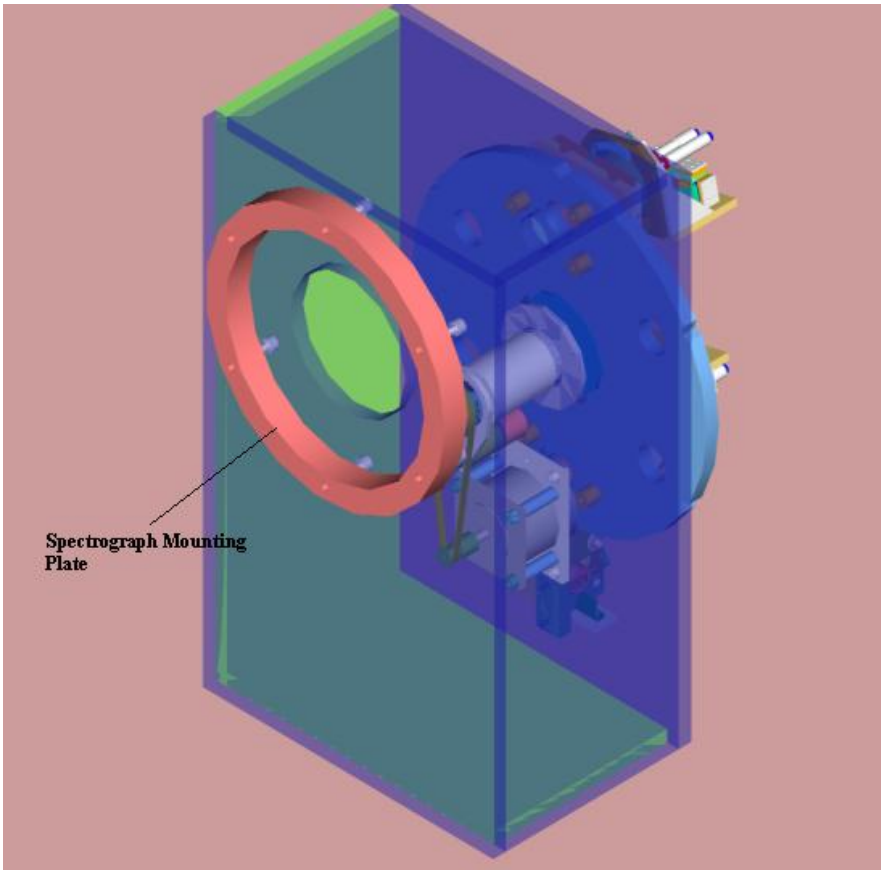

Figure 12: Fibre input mounting

3.9 Slit-viewing optics

The slit-viewing optics will be placed within the confines of the fibre input mounting shown in Figure 12. This will involve a stationary CCD camera and a moveable beam splitter [**TBC**].