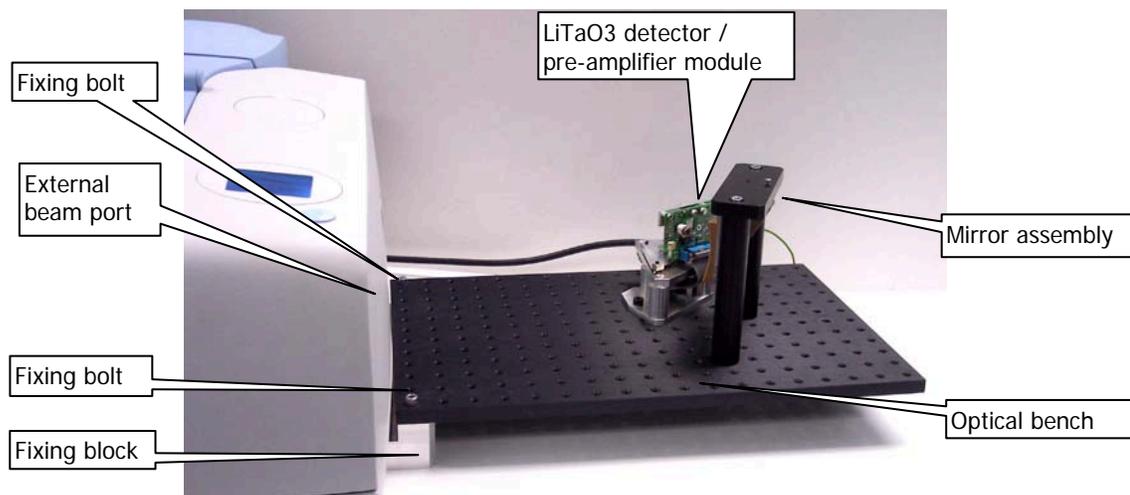


## *General Purpose Optical Bench with External LiTaO<sub>3</sub> Detector Accessory*

A Spectrum 100 Series or Spectrum 400 Series FT-IR instrument can be fitted with a General Purpose Optical Bench. The optical bench is supplied with a parabolic mirror assembly, and an external LiTaO<sub>3</sub> detector/pre-amplifier module. The optical bench is bolted to the external accessory bracket, which is fitted in the handhold on the right of the instrument.



**Figure 1 General Purpose Optical Bench with External LiTaO<sub>3</sub> Detector**

This document describes how to:

- Install a window in the right-hand external beam port;
- Fit, and remove, the optical bench;
- Fit the mirror and detector/pre-amplifier modules to the optical bench;
- Configure Spectrum or Spectrum Express software to use an external detector;
- Use Spectrum or Spectrum Express software to select the accessory;
- Optimizing the performance of the detector/pre-amplifier;
- Connect another type of detector/pre-amplifier to the instrument.



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**Produced in the UK.**

## *Warnings and Safety Information*

### *Electrical safety*

Fitting the external beam port window requires you to open the main cover of the spectrometer.



*Switch off the mains power supply to the spectrometer, wait 60 seconds, and disconnect the power cable before you open the cover of the spectrometer. This makes sure that you are safe from electrical shock and laser radiation.*

### **CAUTION**

*Some components when mounted on the optical bench may need to be connected to instrument earth. Connect earth leads to the underside of the optical bench at a position in the 3 x 3 block of mounting points in the far right corner, where the anodized surface of the underside of the bench has been removed. No other position is suitable.*

The detector/pre-amplifier module is powered by the instrument; no separate power supply is required. The instrument has no provision for powering any other component. If necessary, you must provide a separate power supply and ensure that the arrangement meets all the applicable safety standards.

### *External electromagnetic interference and electromagnetic compatibility*

### **CAUTION**

*Disconnection of a protective earth terminal could damage the pre-amplifier/detector module.*

The General Purpose Optical Bench with External LiTaO<sub>3</sub> Detector accessory is supplied for use as an experimental test bed. The user-configurable nature of this product means that PerkinElmer cannot guarantee the level of immunity to external electromagnetic interference (EMI) or the possibility that the product may itself cause interference to other nearby equipment. It is therefore the responsibility of the user to consider Electromagnetic Compatibility (EMC) issues when selecting a suitable site for the system and to install any additional EMC protection that may be required for that location.

***Radiation emitted by the Spectrum 100/400 source*****CAUTION**

*Caution should be exercised when the beam from an NIR source is directed onto the external  $\text{LiTaO}_3$  detector. Unless there is a suitable attenuator in place, the detector could be permanently damaged.*

**CAUTION**

*The NIR source is a quartz halogen bulb that emits ultraviolet, visible and infrared radiation. The majority of this energy is in the infrared region. Do not stare into the beam produced by this bulb. For further safety and warning information see the Spectrum 100 Series User's Guide (L1050021) or Spectrum 400 Series User's Guide (L1050056). These are distributed as .pdf files on the Spectrum Manuals CD (L1050002).*

***Humidity*****CAUTION**

*Never remove the window in the external beam and leave this port open to atmosphere. If the spectrometer is fitted with KBr optics, do not exchange the window if the humidity is >45% relative humidity.*

*The humidity sensitive optics will be damaged if subjected to a relative humidity in excess of the specified level.*

***Contamination*****CAUTION**

*Be careful not to touch, or otherwise contaminate, sensitive optical components such as the parabolic mirror assembly.*

*These precision optical devices are easily scratched and may not be easy to clean.*

***Safe handling*****WARNING**

*The spectrometer is a heavy precision instrument, so two people are required for safe handling.*

**CAUTION**

*Do not attempt to lift the instrument, or to move it to another location, when the optical bench, or any other external accessory, is attached.*

*The optical alignment of the external accessory bracket may be disturbed.*

## ***Fitting and Removing the Optical Bench***

In the first instance, the General Purpose Optical Bench is installed by a PerkinElmer Service Engineer, who will install: a right-hand beam moveable mirror and any other internal parts required; a KBr window; and an external accessory bracket in the handhold on the right of the instrument (if not already fitted). This external accessory bracket should not be removed.



**Figure 2 Handhold with external accessory bracket fitted**

The optical bench should not be removed unless:

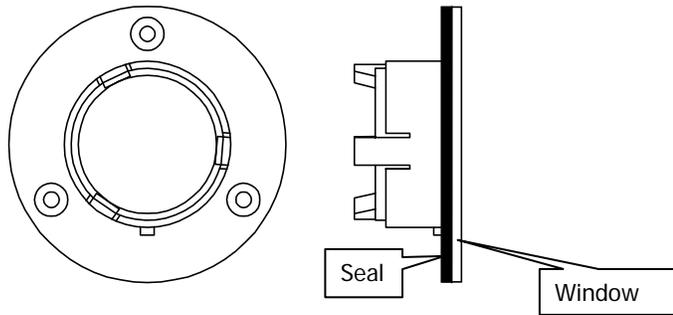
- You want to use the external beam port on the right of the instrument with a different external accessory;
- The spectrometer must be moved to a new location.  
For information about moving your spectrometer, refer to the *Spectrum 100 Series User's Guide* (L1050021) or *Spectrum 400 Series User's Guide* (L1050056). These are distributed as .pdf files on the *Spectrum Manuals CD* (L1050002).

Before you begin, make sure you have read and understood the "Warnings and Safety Information" beginning on page 2.

### ***Fitting a Window in the Right-hand External Beam Port***

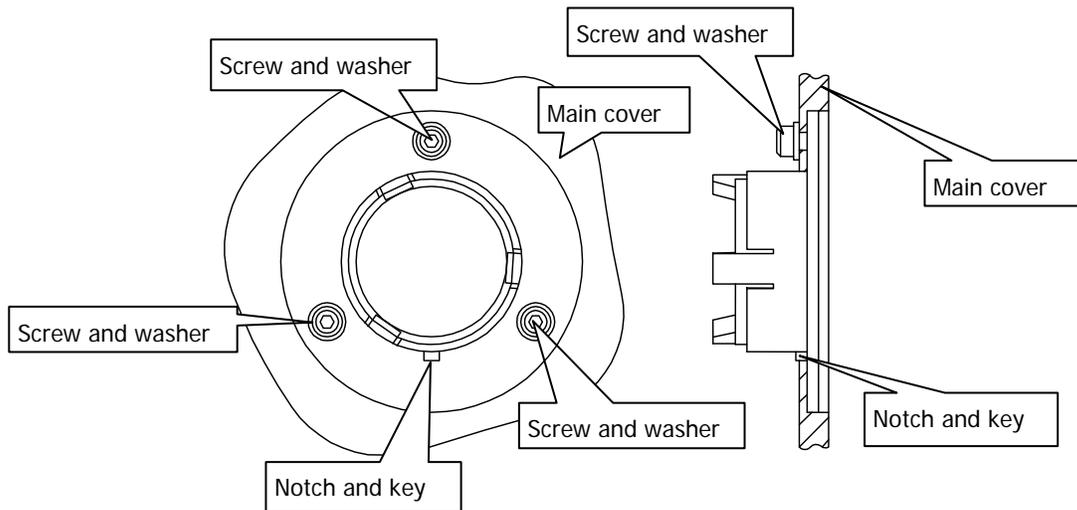
1. Switch off the spectrometer, and then remove the power cable.
2. Undo the locks on the front of the spectrometer, and then open the main cover.  
For detailed instructions, refer to the *Advanced Maintenance* section of the *Spectrum 100 Series User's Guide* (L1050021) or *Spectrum 400 Series User's Guide* (L1050056). These are distributed as .pdf files on the *Spectrum Manuals CD* (L1050002).
3. Using the hexagonal wrench supplied, slacken and remove the M2.5 screws securing the right-hand external beam port cover to the main cover.
4. Remove the beam port cover and seal. Retain for further use.

5. Ensure the seal is fitted to the window and is correctly seated (Figure 3).



**Figure 3 Seal fitted to window**

6. Fit the window to the main cover from the outside in.  
Ensure the seal is fully seated and the key on the window lines up with the notch in the main cover.



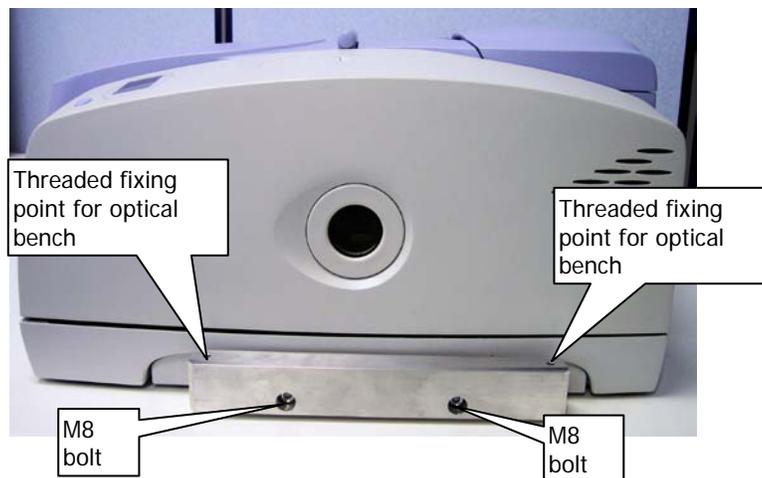
**Figure 4 Window installed in main cover**

7. Secure the window to the main cover by fitting the screws and washers and tightening the screws using the hexagonal wrench (Figure 4).
8. Close and secure the main cover.
9. Plug in and switch on the instrument.

## *Fitting the optical bench*

Before you begin, make sure that:

- The instrument's external beam port is fitted with a suitable window;
  - There is at least 500 mm (18 inches) of free bench space to the right of the instrument;
  - An external accessory bracket is fitted in the handhold on the right of the instrument;
  - The spectrometer is switched off and disconnected from the power supply.
1. If necessary, remove the fixing block from the underside of the left edge of the optical bench.  
Use a suitable hexagonal key to undo the two M6 socket head bolts from the threaded fixing positions at the near left and far left corners of the optical bench until the fixing block is free.
  2. Place a spring washer and then a plain washer on each bolt, push the M8 bolts supplied through the plain holes in the fixing block, and then carefully align the bolts with the threaded holes in the external accessory bracket.

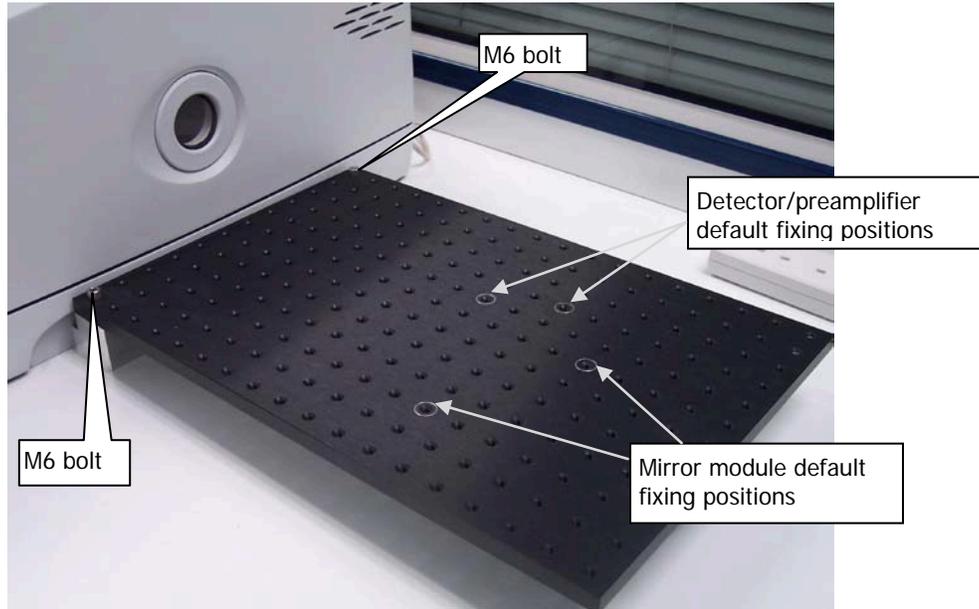


**Figure 5 Attaching the fixing block to the external accessory bracket**

3. Use a 6 mm hexagonal key to turn each bolt until it engages in the external accessory bracket, make sure the bolts are perpendicular to the bracket, and then carefully and evenly tighten the bolts.

**NOTE:** If these bolts engage incorrectly, the accessory may be misaligned or its fixings damaged.

4. Screw the two M6 socket head bolts into the threaded fixing positions at the near-left and far-left corners of the optical bench, align the optical bench with the fixing block, and then carefully and evenly tighten the bolts.



**Figure 6 Bench fitted to fixing block**

**NOTE:** If these bolts engage incorrectly, the accessory may be misaligned or its fixings damaged.

### ***Removing the optical bench***

Before you begin, make sure that:

- The spectrometer is switched off and disconnected from the power supply;
  - All the components associated with the optical bench are disconnected from the spectrometer, and that no component is powered.
1. Use a hexagonal key to carefully and evenly undo the two M6 socket head bolts from the threaded fixing positions at the near-left and far-left corners of the optical bench until the bench is free of the fixing block.
  2. Lift the optical bench off the fixing block and carefully place it to one side.
  3. Using a 6 mm hexagonal key, undo the two M8 socket head bolts that attach the fixing block to the external accessory bracket.  
The fixing block is attached to the external accessory bracket using two M8 socket head bolts, two plain washers and two spring washers.  
Do not attempt remove the accessory bracket itself.

It may be convenient to refit the fixing block to the optical bench for safe storage.

## *Fitting the Detector/Pre-amplifier and Mirror Modules*

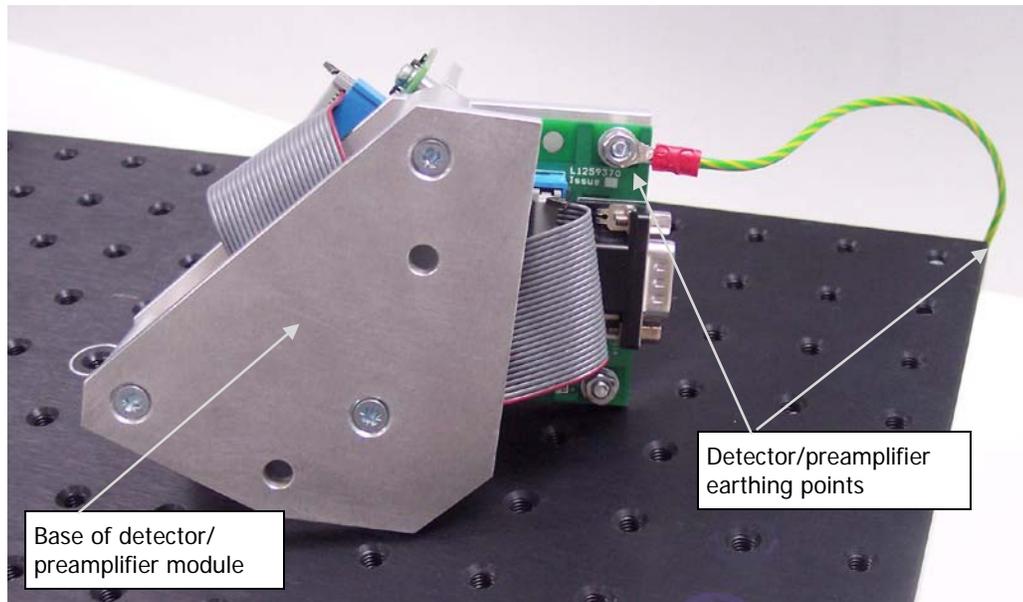
Both modules are fixed to the optical bench using M6 bolts. The default fixing positions for the pillars are marked on the optical bench; see Figure 6.

### *Detector/pre-amplifier module*

#### **CAUTION**

*Take care not to touch the detector window or any of the circuit-board components of the detector/preamplifier module, as they may be damaged by static electricity.*

1. Connect the earth lead from the optical bench to the detector/pre-amplifier module.



**Figure 7 Detector/pre-amplifier earthing points**

The earth should be connected to the underside bench at a position in the 3 x 3 block of mounting points in the far right corner where the anodized surface has been removed. No other position is suitable.

It should be connected to the detector/pre-amplifier module via the underside of the circuit board on the base of the module.

See Figure 7.

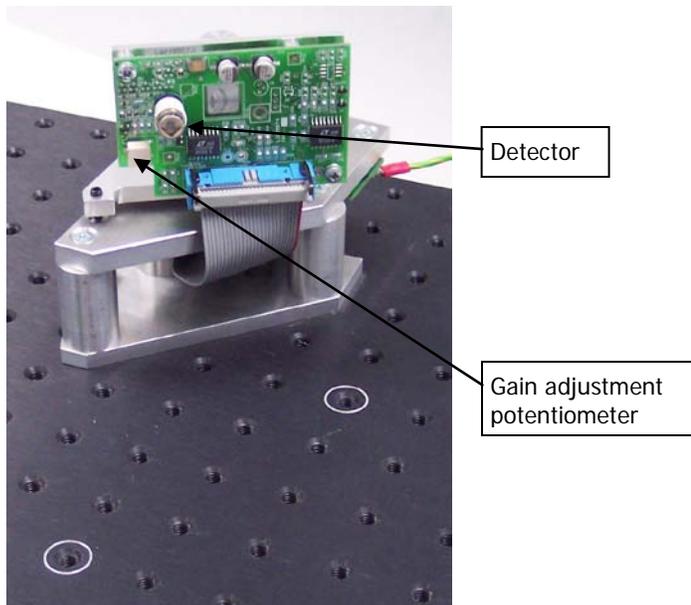
2. Bolt the detector module sub-base to the optical bench using two M6 bolts.

**NOTE:** One of the bolt holes is easily accessible on the left side of the detector/preamplifier module. The other is accessed through a hole drilled in the upper plate, behind the circuit board. You should fit the bolt into the lower plate and then secure with an Allen key, through the top plate, as shown in Figure 8.



**Figure 8 Fixing the detector/preamplifier module to the bench**

3. Ensure that the detector/preamplifier module is fixed to the bench so that the detector is facing the position on the bench where you will fit the mirror module.



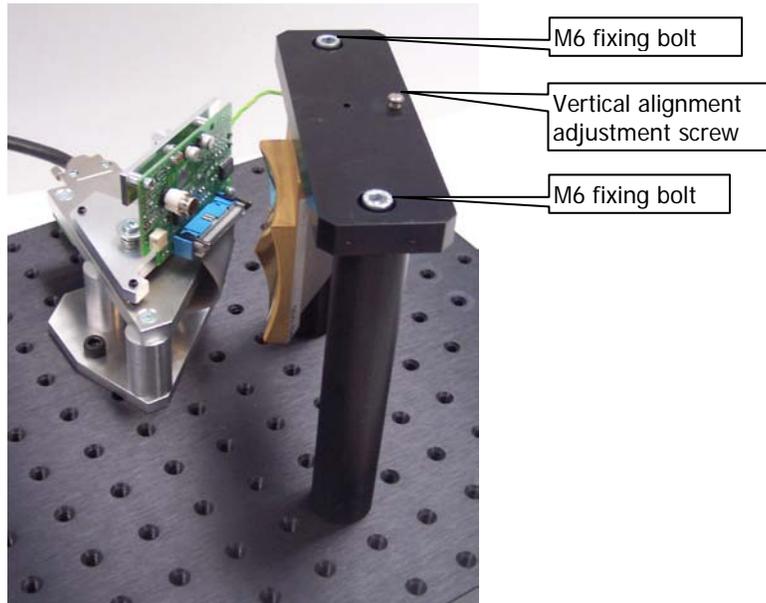
**Figure 9 Detector/preamplifier fitted to the bench**

4. The gain adjustment potentiometer (Figure 9) allows adjustment to give an acceptable signal level.  
To ensure that some signal is present but the pre-amplifier is not overloaded when the power is applied, turn the gain potentiometer screw fully counter-clockwise until it "clicks" (its minimum setting) and then give it two turns clockwise.
5. Connect the detector/pre-amplifier module to the instrument EXT.R connector.

For more information about aligning the detector and adjusting the gain potentiometer setting, see "Optimizing Performance" on page 16.

### *Mirror module*

Bolt the two pillars and cross-bar that support the parabolic mirror to the optical bench, oriented to that the mirror faces the detector. See Figure 6 for details of fixing position.



**Figure 10** Mirror assembly fitted to bench

Later, you can adjust the vertical alignment of the parabolic mirror to the detector using the adjustment screw in the cross bar. See “Optimizing Performance” on page 16.

### *Configuring Spectrum or Spectrum Express Software to Use an External Detector*

The General Purpose Optical Bench with External LiTaO<sub>3</sub> Detector accessory is supported by Spectrum version 6.3.5 (or later) for the Spectrum 400 Series Spectrometers, or Spectrum version 6.3.3 (or later), or Spectrum Express version 1.2 (or later), for the Spectrum 100 Series Spectrometers.

This section describes how to create a modified instrument configuration file for use with an external detector.

**NOTE:** It is not necessary to power the instrument to complete this procedure.

1. Browse to C:\pel\_apps\bin\  
The instrument configuration file is named C\*\*\*\*\*.cfg, where \*\*\*\*\* is the five-digit serial number of the instrument.  
The spectrometer serial number is located on its base casting, in the sample compartment, under the sample accessory baseplate.
2. Copy the appropriate C\*\*\*\*\*.cfg file and save it as, for example, C\*\*\*\*\*.intdet

**NOTE:** Make sure you save this backup of the original instrument configuration file. If you remove the optical bench, you will re-instate this file.

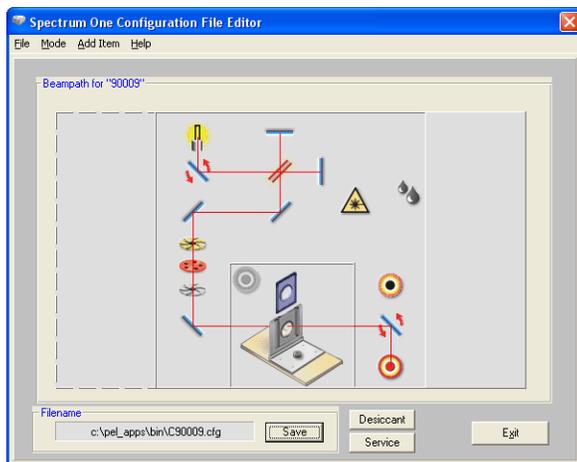
- Browse to C:\Program Files\PerkinElmer\ServiceIR

**CAUTION**

*The ServiceIR folder contains a number of utilities, many of which are for use solely by a PerkinElmer Service Engineer.*

*If used incorrectly, some utilities could damage the instrument.*

- Double-click **S1\_Config.exe**.  
The Configuration File Editor utility opens.

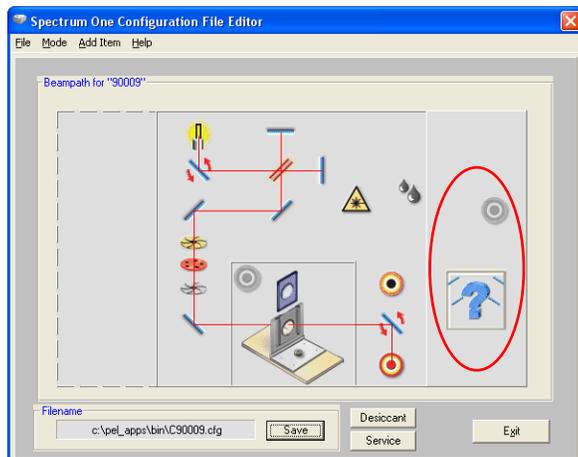


- Click **Load** in the File menu, and then select the instrument serial number.  
The configuration file is opened for editing.
- Right-click in the external accessory area to the right of the beampath diagram.  
The Add Port dialog is displayed.

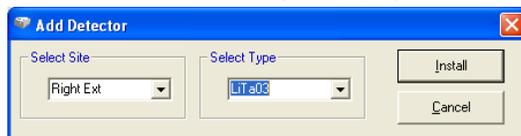


7. Select **Right Mid** in the Select Site pane, select **Baseplate** in the Select Type pane, and then click **Install**.

The Add Port dialog closes and the external accessory area in the Configuration File Editor is refreshed.



8. Right-click  in the right external accessory area. The Add Detector dialog is displayed.



9. Select **Right Ext** in the Select Site pane, select **LiTaO3** in the Select Type pane, and then click **Install**.

The selection in the Select Type pane defines the default wavenumber range of the detector.

The default range for the supplied LiTaO<sub>3</sub> detector is 10 000 cm<sup>-1</sup> to 370 cm<sup>-1</sup>.

The Add Detector dialog closes and  becomes .

10. Right click .

The Add mirror dialog is displayed.



11. Select **Moveable** in the Select Type pane, and then click **Install**.

The Add mirror dialog closes.

12. Click **Save**.

The configuration file is updated.

13. Click **Exit**.

### *Re-instating the configuration file*

To revert to a standard instrument configuration file:

1. Browse to C:\pel\_apps\bin\  
The instrument configuration file is named C\*\*\*\*\*.cfg, where \*\*\*\*\* is the five-digit serial number of the instrument.  
The spectrometer serial number is located on its base casting, in the sample compartment, under the sample accessory baseplate.
2. Copy the appropriate C\*\*\*\*\*.cfg file, and save it as, for example C\*\*\*\*\*.extdet

**NOTE:** Make sure that you save this backup of the external detector configuration file. You may want to re-instate, or edit, this file when you use an external detector on another occasion.

3. Rename C\*\*\*\*\*.intdet (the backup of your original internal detector configuration file) as C\*\*\*\*\*.cfg

**NOTE:** If a backup of the original configuration file was not made, uninstall the instrument and then re-install it using the configuration disk supplied with the instrument.

### *Selecting the External Detector using Spectrum or Spectrum Express Software*

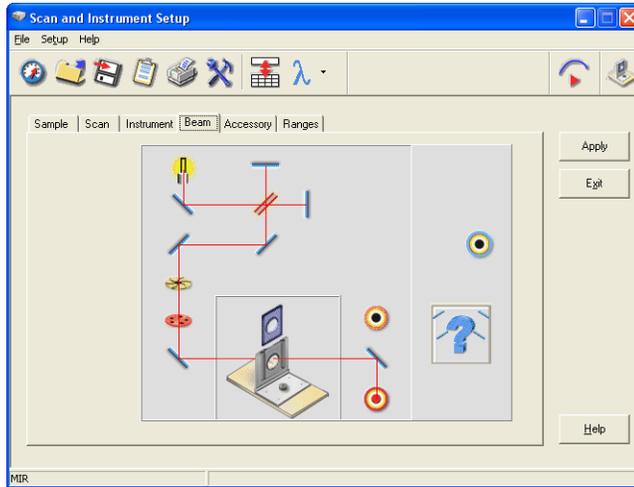
Before you begin, make sure that:

- The required version of Spectrum or Spectrum Express software is installed and configured.  
See "Configuring Spectrum or Spectrum Express Software to Use an External Detector" on page 10.
- The instrument is powered and has been allowed to stabilize.

To select the external detector in Spectrum software:

1. Start Spectrum, select the **Setup** menu and then click **Instrument**.  
The Scan and Instrument Setup dialog is displayed, showing the Instrument tab.

2. Select the **Beam** tab.

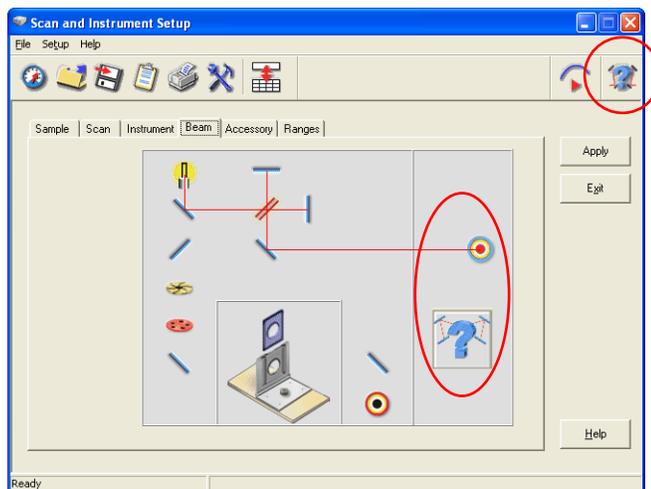


3. In the external detector area, click the  symbol, so that it becomes .

**NOTE:** If an NIR source is being used and the detector type is not either a Custom type or NIR, a warning message is displayed informing you that the detector may be damaged by the NIR beam.

You should only select the **Yes** option, to continue, if an attenuator has been fitted in the beam or you are confident that the detector can withstand the infrared energy that will be directed at it.

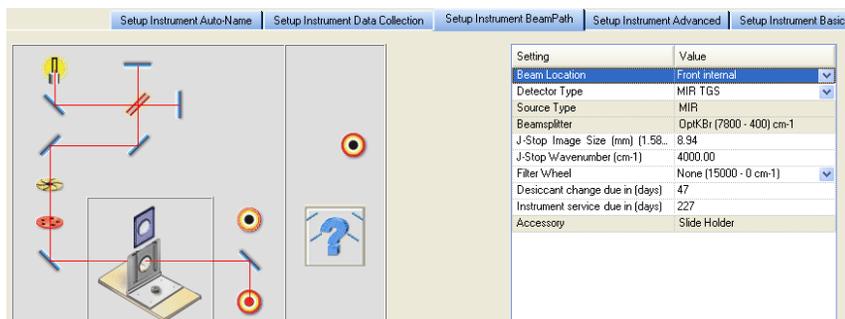
The external detector is selected.



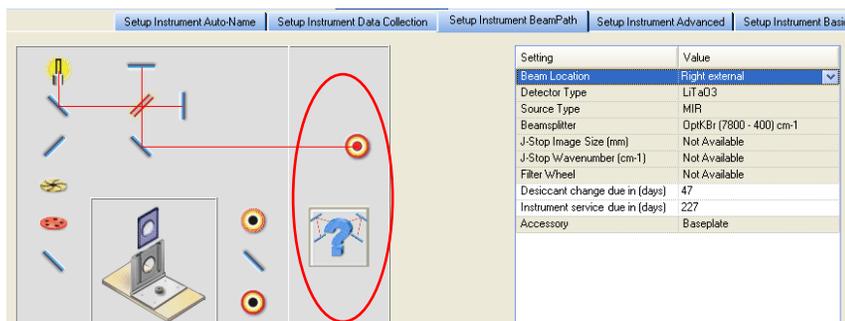
The optical bench is indicated by the baseplate icon  at the top right of the Scan and Instrument Setup dialog.

To select the external detector in Spectrum Express software:

1. Start Spectrum Express, select the **Setup** menu and then click **Instrument**.
2. Select the **Setup Instrument BeamPath** tab.



3. Select **Right external** as the **Beam Location** from the drop-down list. The external  $\text{LiTaO}_3$  detector is selected.



**NOTE:** The **Beam Location** field is displayed in the settings table only when an external detector is configured.

## Optimizing Performance

This section describes adjusting the detector alignment and pre-amplifier gain setting and for optimum performance.

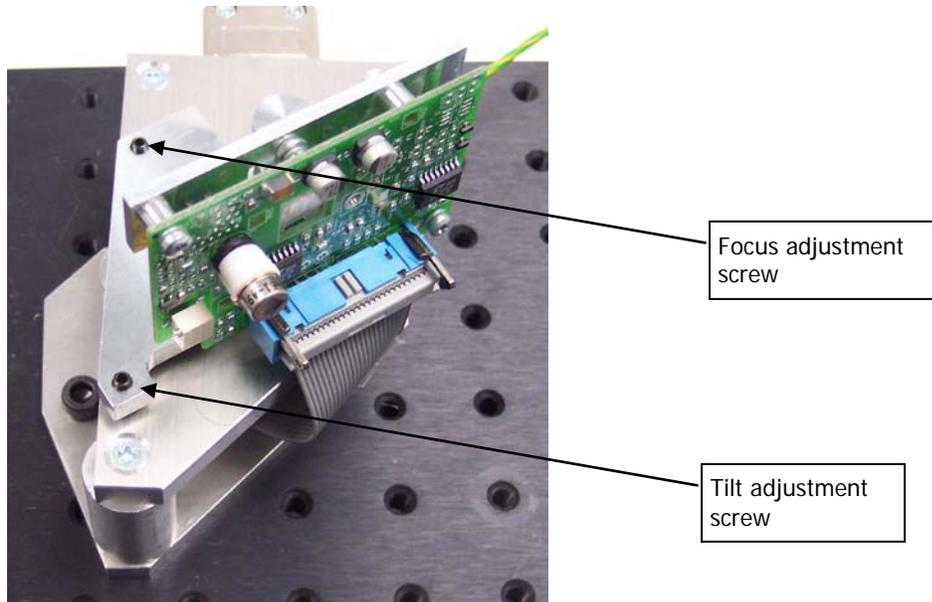
1. Start Spectrum, select the Setup menu and then click **Instrument**.
2. Ensure that the external detector is selected on the beam path tab.
3. If you have Spectrum software, click the "monitor – energy" icon  on the Scan and Instrument Setup dialog to display the signal detected by the detector. The Display tab is displayed.

OR

If you have Spectrum Express software, switch to **Monitor** by clicking  on the Measurement toolbar, and then click **Energy** to display the signal detected by the detector.

The Live tab is displayed.

4. To obtain the maximum energy value use:
  - The mirror module vertical adjustment screw (Figure 10).
  - The detector tilt and focus screws (Figure 11).



**Figure 11 Detector tilt and focus adjustment screws**

5. Display the interferogram, and then adjust the pre-amplifier gain potentiometer (Figure 9) so that the height of the interferogram is about +0.7 units (or –0.7 if the interferogram is inverted).

## ***Connecting Another Type of Detector/Pre-amplifier to the Instrument***

For details of how to use another type of detector/preamplifier module with the General Purpose Optical Bench, refer to the leaflet *Spectrum 100 and 400 Series Right-hand External Beam Option* (L1050069A) provided on the *Spectrum Manuals* CD (L1050002).