

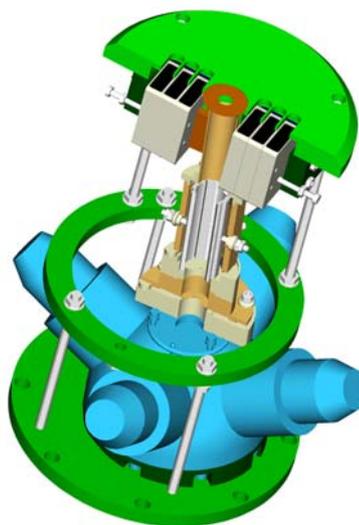
Surface Analysis  
Technology

Vacuum  
Components

S P E C S<sup>®</sup>

Surface Analysis  
System Software

Computer  
Technology



# Spin Detector

Version 1.5

All rights reserved. No part of this manual may be reproduced without the prior permission of SPECS GmbH.

User Manual for [Spin Detector](#).

Version 1.5 dated 1<sup>st</sup> August 2008.

SPECS GmbH - Surface Analysis  
and Computer Technology  
Voltastrasse 5  
D-13355 Berlin, GERMANY

PHONE:+49 (0)30 46 78 24 -0  
FAX: +49(0)30 4 64 20 83  
<http://www.specs.de>  
[support@specs.de](mailto:support@specs.de)

---

Chapter

**T**

# Table of Contents

---

<b>1</b>	<b>Introduction</b>	<b>1</b>
	1.1 SPECS Spin detector for PHOIBOS 150 .....	1
	1.2 Safety Instructions .....	1
	1.3 Unpacking .....	2
<b>2</b>	<b>Installation</b>	<b>5</b>
<b>3</b>	<b>Quick Start</b>	<b>11</b>
<b>4</b>	<b>Principles of Operation</b>	<b>15</b>
<b>5</b>	<b>Spin Detector Software Details</b>	<b>23</b>
<b>6</b>	<b>Troubleshooting</b>	<b>27</b>
<b>7</b>	<b>List of Figures</b>	<b>I</b>
<b>8</b>	<b>Index</b>	<b>I</b>



---

# Chapter

# 1

# Introduction

---

## 1.1 SPECS Spin detector for PHOIBOS 150

This manual describes the SPECS Spin detector for the PHOIBOS 150 hemispherical analyzer. Please refer as well to the manuals of the SpecsLab data acquisition software and of the PHOIBOS analyzer.

## 1.2 Safety Instructions

### Caution!



**Beware! Lethal high voltages of up to 30 kV is applied to the instrument. Hazardous voltages are present, therefore only trained, qualified personnel are allowed to carry out the installation, adjustment and repair works.**



**All national, federal, state, and company or department internal regulations, restrictions, codes, and rules for protection against radiation sources have to be observed during installation and operation of the instrument at its site! Consult your safety inspector for the initial installation and in case of any doubt. The users are responsible for correctly labelling the source and its power supplies, and providing safety instructions in their native language, if required by law!**



Before any electric or electronic operations please consult „SPECS Safety Instructions“ and follow them strictly.

Some tests which might have to be carried out according to this manual are dangerous. These parts are indicated by the warning label:

## !!Warning!!



The tests described in the following have to be performed at connectors of the electronics not plugged into the source. Hazardous voltages are present, therefore only trained, qualified personnel are allowed to do the job.

Perform the measurements only with specially insulated tools designed for voltages up to 30 kV.

## Thorium Disposal Considerations

The target in the SPECS spin detector is a thorium foil. Be sure to read the Thorium Safety Data Sheet properly. Whatever part of the Thorium foil that cannot be saved for recovery or recycling should be sent to an appropriate and approved waste facility. Disposal must be in accordance with federal, state and local requirements.

### 1.3 Unpacking

The SPECS Spin detector upgrade package consists of the following components :

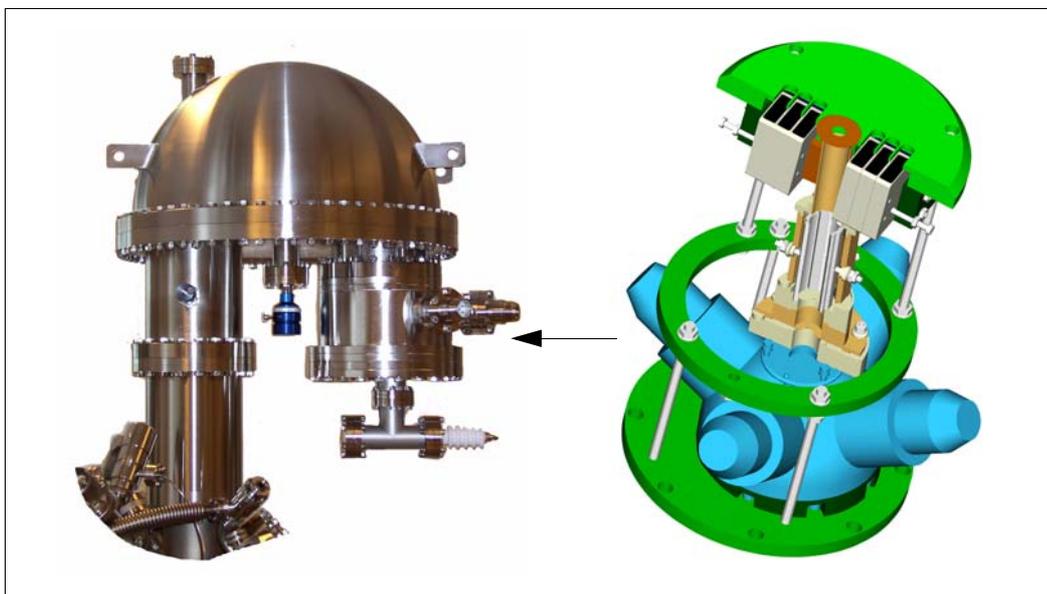


Figure 1

Spin detector

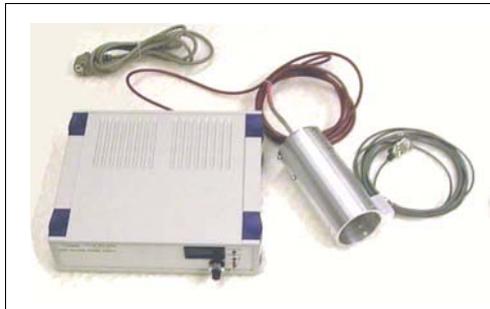


Figure 2 30 kV power supply  
(Manufacturer: iseg)



Figure 3 'Cables and accessories:'  
(see below)



Figure 4 PCU 300 MCD 9 ,  
PCU SPIN  
1 x lens voltage cable with 2  
filter boxes labelled "LENS"  
and "MOTT"



Figure 5 HSA3500 power supply

and here as a list:

- Spin detector hardware on a NW150CF (8") flange, ready to bolt onto the PHOIBOS 150 analyzer
- Power supply HSA 3500 for controlling the lens voltages in the detector

- 30 kV power supply (Manufacturer: iseg) to deliver the 25 kV Mott acceleration voltage
- PCU 300 MCD 9 pulse counting unit for counting pulses on the 6 standard detector channels, labelled with "MCD"
- PCU 300 SPIN pulse counting unit for counting pulses on the 4 spin channeltrons labelled with "SPIN"
- Cables and accessories:
  - 3 x CAN-bus
  - 1 x SHV cable "Channel HV SPIN"
  - 1 x SHV cable "Channel Base SPIN"
  - 2 x power cord
  - 3 x 7-pin short circuit plugs (black plugs with cable and crocodile clips)
  - 1 x lens voltage cable with 2 filter boxes labelled "LENS" and "MOTT"
  - 2 x CAN-bus terminators
  - 3 x connector shields for 7-pin feedthroughs (Copper combs + cable clips; will be replaced soon)
- Manuals (this manual and a 30 kV power supply manual)

Please check the contents of the shipment carefully.

---

## Chapter

# 2

## Installation

---

Please read this section completely before starting to install the detector.

The Spin detector is delivered under vacuum and with a transport lock installed. Vent the detector hardware with dry nitrogen to prevent dust from entering the 25 kV high voltage section.



### **Use dry nitrogen for venting the detector hardware!**

Remove the transport lock and loosen the screws holding the aluminium locking bars. Remove the locking bars and store them together with the protective hood.

Install all bolts on the PHOIBOS NW150CF (8") detector flange according to figure 6, "Bolt installation," page 6. Put a copper gasket on the detector flange. Insert the detector into the PHOIBOS with all feedthroughs facing away from the PHOIBOS lens (see figure 7, "Side view," page 6 and figure 8, "Back view," page 7). The detector is equipped with a pin that locks the rotational orientation of the detector. This pin needs to be positioned in a groove in the analyzer base plate. At the same time the detector entrance plate has to lie flat on the PHOIBOS base plate.

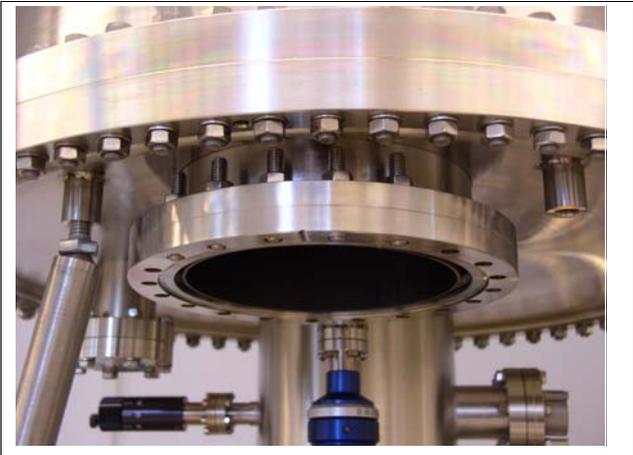


Figure 6 Bolt installation



Figure 7 Side view



Figure 8 Back view

Ensure the correct fit of the detector by carefully moving and slightly rotating the detector assembly relative to the analyzer. When you feel that the detector is locked in place, completely push the detector flange on the PHOIBOS flange. The detector is mounted on springs. When inserting the detector completely, these springs are compressed and press the detector against the base plate.

**Pump down the system and bake the system at a temperature between 150 and 200° C for at least 12 hours.**



**Wait for 24 hours after switching off the bakeout before operating the channeltrons.**

**A cool down period of 24 hours after bakeout is mandatory before using the channeltrons in the detector!**



**Before normal operation of the analyzer, the 25 kV section of the Micro-Mott detector needs to be ramped up slowly to operating voltage. In case of doubt, please contact Specs support (support@specs.de) for advice.**

Do not connect any cables or pulse counting electronics. Only install the 3 grounding plugs to the 7 pin feedthroughs on the Spin detector and connect the 25 kV plug with the Spin detector (see figure 9, "25kV and grounding plugs," page 8). The grounding plugs have crocodile clips which need to be clamped onto the chamber.

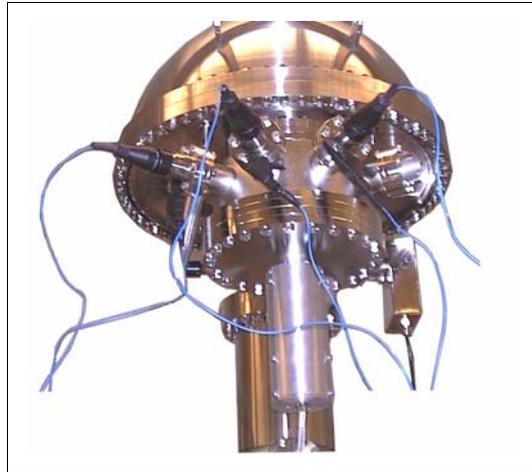


Figure 9 25kV and grounding plugs



**The 30 kV power supply can deliver lethal voltages. Only operate the power supply when the 30 kV plug is installed on the Spin detector. Make sure that the 9-pin Sub-D interlock connector is connected to the 30 kV power supply. Never remove the plugs when the 30 kV power supply is still on!**

Ramp up the target voltage to 28 kV within a period of 20 minutes. Watch the pressure and wait for a few minutes if any arcing occurs. Hold the target voltage at 28 kV for 1 hour. Turn down the target voltage before installation of the other cables and the pulse counting units.



**Before operating the Micro-Mott detector after bakeout, follow the target voltage ramp up procedure described in this section!**

Connect all cables and pulse counting units to the analyzer according to figure 10, "Connections," page 9 and figure 11, "View of Boxes (a)," page 9, figure 12, "View of Boxes (b)," page 10. Install the electrical shielding combs on the feedthroughs "SPIN", "MOTT" and "LENS" according to figure 13, "Electrical shield," page 10.

Fix each copper comb with two cable clips. These shielding combs are a temporary solution. SPECS will provide proper shields soon.





Figure 12 View of Boxes (b)

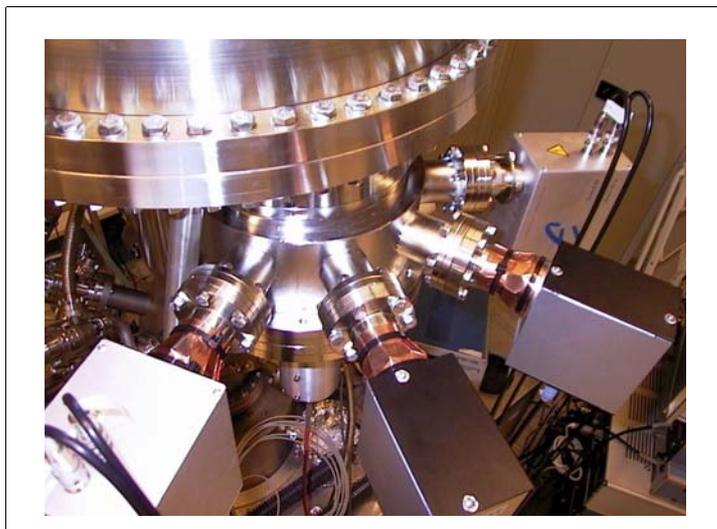


Figure 13 Electrical shield

Switch on both HSA 3500 units. Ramp up the target voltage to 25 kV. Start SpecsLab and connect with the hardware "Phoibos-HSA3500-RiceSpin". Now the equipment is ready to measure standard and spin resolved spectra. Refer to the SpecsLab manual and to "Spin Detector Software Details" in chapter 5 on page 23 in this manual for the operation of the software and the details of the Spin detector.



**The standard target voltage for the Micro-Mott detector is 25 kV. Do not exceed 28 kV!**

---

# Chapter

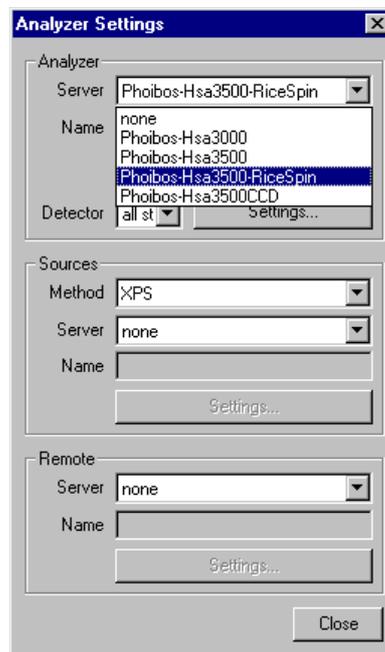
# 3

# Quick Start

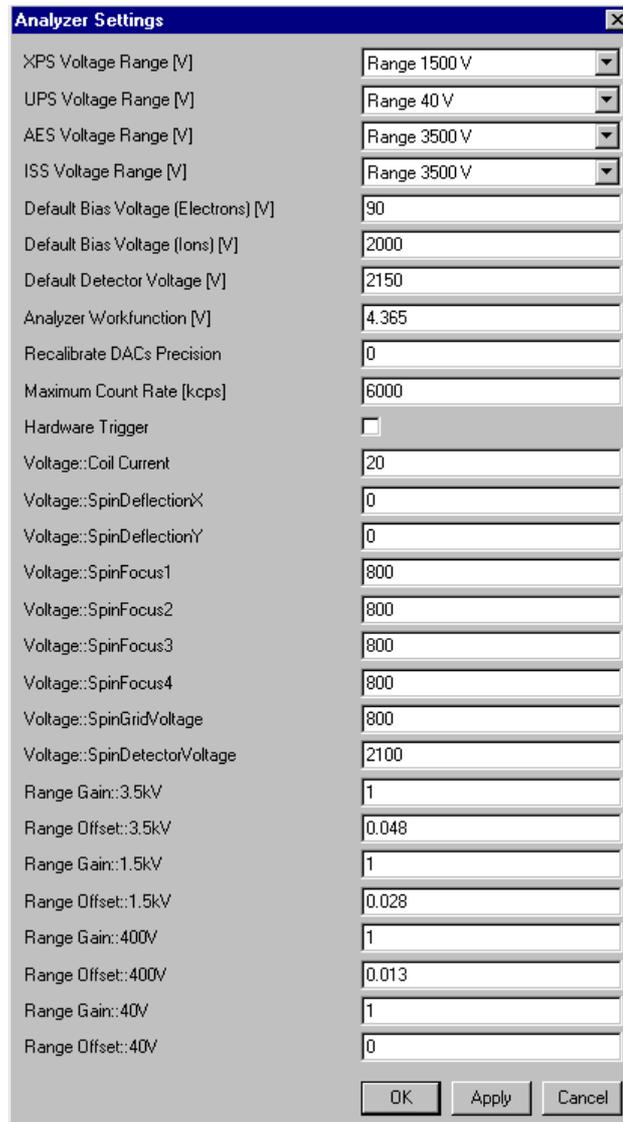
---

Please also refer to the SpecsLab manual for cross-reference. Most of the actions necessary for measuring a spin resolved spectrum are identical to the procedures using a standard detector:

- Follow the installation procedure in “Installation” on page 5
- Start SpecsLab and go to the menu “Analyzer:Settings”
- Connect to the hardware “Phoibos-HSA3500-RiceSpin”



- Open the “Settings” menu. It will look similar to what is shown here. The actual settings for your analyzer might be slightly different. The installation CD contains the proper settings for your analyzer.



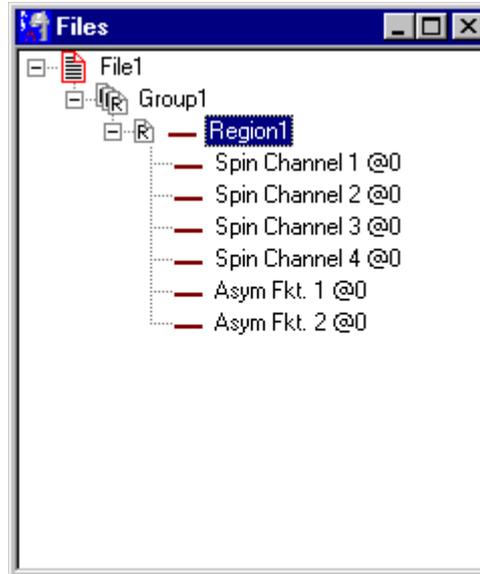
- Leave this menu
- Create a new region

- Set up the region properties with the region editor, e.g. as shown here:

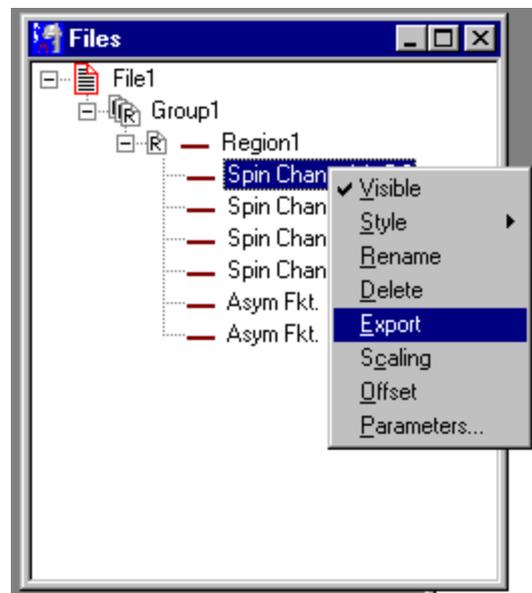
- Start the spectrum by hitting “Validate” and “Acquire”
- The display shows a standard spectrum
- The asymmetry functions have only an intensity between +1 and -1 and are thus invisible in this mode. The four spin channels also have an intensity which is typically 1500 times less than one standard channel
- To see the asymmetry functions and the spin channels, deactivate all six standard channeltrons using the controls in the tool bar shown here. Now the lower intensity spin channels are visible.



- Deactivate the four spin channels by double-clicking on the channels “Spin Channel 1 @0” to “Spin Channel 4 @0” in the file window. Now only the asymmetry functions remain visible.



- Alternatively, you can scale the asymmetry functions as well as the Spin channels by a scaling factor (and an offset). To access these factors, right-click on the channel you want to scale in the file menu. With a scaling of about 1500, the spin channels have about the same intensity as each normal channel.



- Save the data to a file
- Or export the spin channels or the asymmetry functions using a right mouse click on the according data channel. Choose "Export" from the context menu.

---

# Chapter

# 4

# Principles of Operation

---

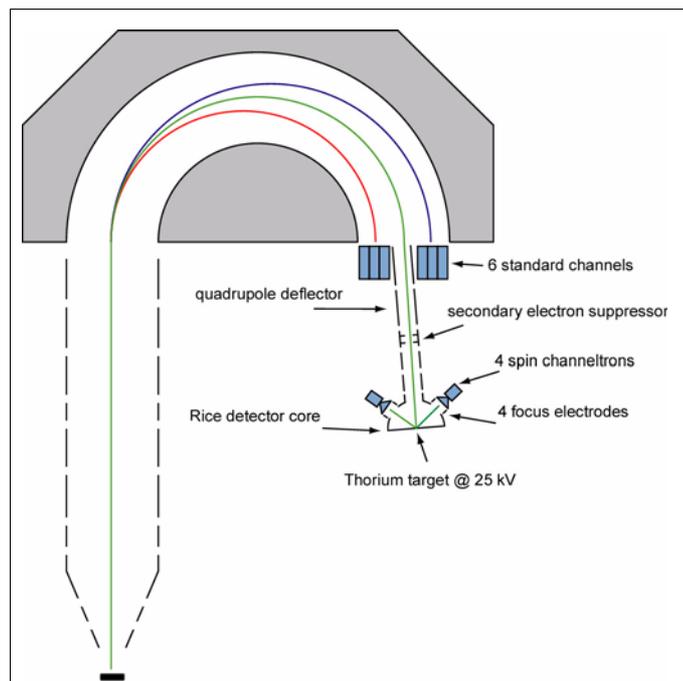


Figure 14 Principle of operation

The SPECS Spin detector is based on the proven "Rice University" design.<sup>1</sup> It is mounted on the detector flange of a PHOIBOS 150 hemispherical analyzer (see figure 14, "Principle of operation," page 15). The electrons at the exit plane of the analyzer are detected with 6 standard non-spin resolving channeltrons. Each channeltron has an

---

1. F.B.Dunning, Nucl. Instr. and Meth. in Phys. Res. A 347,152 (1994)

opening of 7 x 20 mm when the exit slit is set to "open". The electrons in the central part of the exit window are fed through a 7 mm diameter aperture into a transfer-acceleration lens. The transfer-acceleration lens leads into a Micro-Mott detector and hits a thorium target at 25 kV. The electrons scatter from this target and after decelerating to almost ground potential, they are detected by 4 channeltrons in the Mott detector. Each pair of channeltrons serves to determine one spin direction using the so-called asymmetry functions

$$A1=(S1-S2)/(S1+S2) \text{ and } A2=(S3-S4)/(S3+S4). \quad (EQ 1)$$

The spin polarization P1 and P2 is calculated according to

$$P=A/S_{\text{eff}} \quad (EQ 2)$$

Where  $S_{\text{eff}}$  is the effective Sherman function for the detector.

The value for  $S_{\text{eff}}$  depend on detector design, target voltage and quality of the target foil. The precise value has to be determined by the user using a calibrated source of polarized electrons. A good approximation value for the SPECS Spin detector is  $S_{\text{eff}} = -0.16$  for a target voltage of 25 kV and an inelastic window of 800 eV. Since the detector is identical to the design published in [Dunning<sup>1</sup>], the values in figure 15, "Inelastic loss dependency," page 17 (reproduced from the original publication) can be used to a good approximation.

---

1. G.C.Burnett,T.J.Monroe, andF.B.Dunning, Rev.Sci.Instrum. 65(6), 1893 (1994)

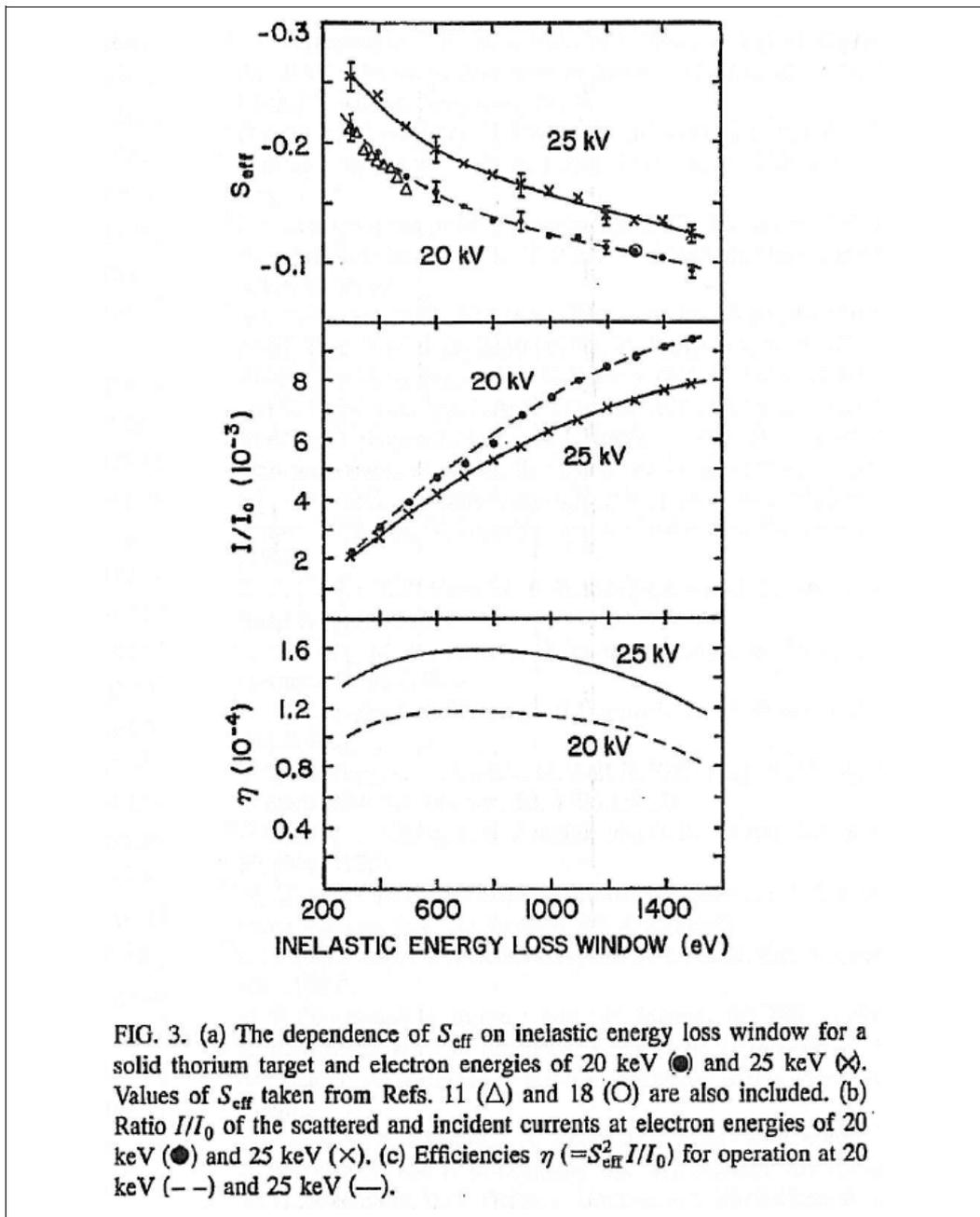


FIG. 3. (a) The dependence of  $S_{\text{eff}}$  on inelastic energy loss window for a solid thorium target and electron energies of 20 keV (●) and 25 keV (×). Values of  $S_{\text{eff}}$  taken from Refs. 11 (Δ) and 18 (○) are also included. (b) Ratio  $I/I_0$  of the scattered and incident currents at electron energies of 20 keV (●) and 25 keV (×). (c) Efficiencies  $\eta (=S_{\text{eff}}^2 I/I_0)$  for operation at 20 keV (---) and 25 keV (—).

The next paragraphs describe the Spin detector in more detail. Please also refer to the following publications for further reading:

[Dunning<sup>1</sup>], [Dunning-calib<sup>2</sup>], [Ghiringhelli<sup>3</sup>].

The hemispherical analyzer disperses the electrons from the entrance slit onto the exit plane. In this exit plane there are six channeltrons arranged in two block of three (see figure 14, "Principle of operation," page 15). The centre positions of these channeltrons are:

$x = -32, -24, -16, 16, 24, 32$  mm. For the standard non-spin resolved data acquisition, these channels are added to form a standard photoelectron spectrum. The energy positions are calculated using 6 out of 9 dispersion factors defined in the windows registry (see the SpecsLab manual).

Each channeltron has an active area of  $7 \times 20$  mm (dispersive  $\times$  non-dispersive direction). This area can be restricted to  $0.2 \times 20$  mm (or  $3 \times 20$  mm on some special releases of the PHOIBOS 150) using a different exit slit setting. The central part of the electron trajectories leaves the exit plane through a 7 mm diameter aperture and enters the transfer-acceleration lens to the Micro-Mott detector. The lens consists of sections L1, L2, L3A, L3B and L3C. L2 is segmented into four segments and forms a deflector/stigmator. The voltages "SpinDeflectionX" and "SpinDeflectionY" are fed to the deflector. SPECS recommends keeping the deflection voltages at 0 V. Using this deflector without care can lead to a spurious asymmetry of the detector. The configuration file defines the action of the deflector. The deflector can also be used as a stigmator if the configuration file "HSA3500Config.0-7.1-50.hsa" (or similar) is changed accordingly. Please refer to the SpecsLab manual or contact SPECS for further details.



**SPECS recommends keeping the spin deflector voltages at 0V!**

Lens 3A has two apertures installed. They serve to shape the beam for very high pass energies. Electrons scattered at these apertures are stopped from reaching the scattering target by a more negative potential applied to L3B. L3ABC thus serves as repeller for scattered electrons.

After the electrons have been scattered at the thorium target, they pass a focus electrode in front of each of the four channeltrons (see figure 17, "Detector principle," page 19 and figure 18, "Focus electrode," page 20 reproduced from [Dunning<sup>1</sup>]). The four focus electrodes can be independently set using the voltages SpinFocus1 to SpinFocus4. The intensity reaching the channeltron depends on the according focus voltage. The focus voltage can be used to correct instrumental asymmetries in the spin signal. A focus voltage of 800 V is recommended. The maximum difference between different focus voltages is 400 V.

- 
1. G.C.Burnett,T.J.Monroe, andF.B.Dunning, Rev.Sci.Instrum. 65(6), 1893 (1994)
  2. D.M.Oro, W.H.Butler, F.C.Tang, G.K.Walters, and F.B.Dunning, Rev.Sci.Instrum. 62), 667 (1991)
  3. G.Ghiringhelli, K.Larsson, and N.B.Brookes, Rev.Sci.Instrum. 70, 4225 (1999)

Figure 16 shows the intensity in one spin channel as a function of the according focus voltage. Two curves are shown, one for SpinGridVoltage = 500 V, one for SpinGridVoltage = 1200 V.

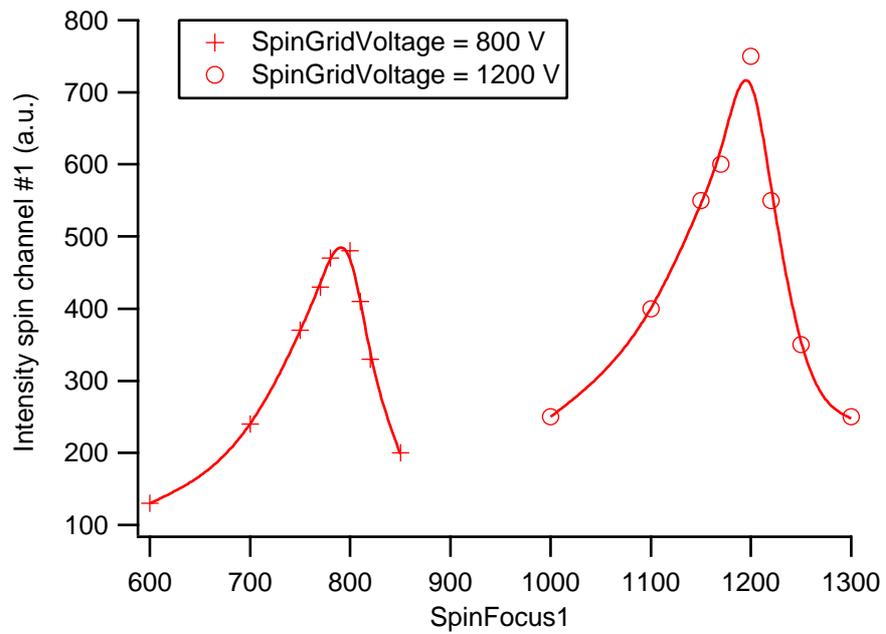


Figure 16

SpinFocusVoltage

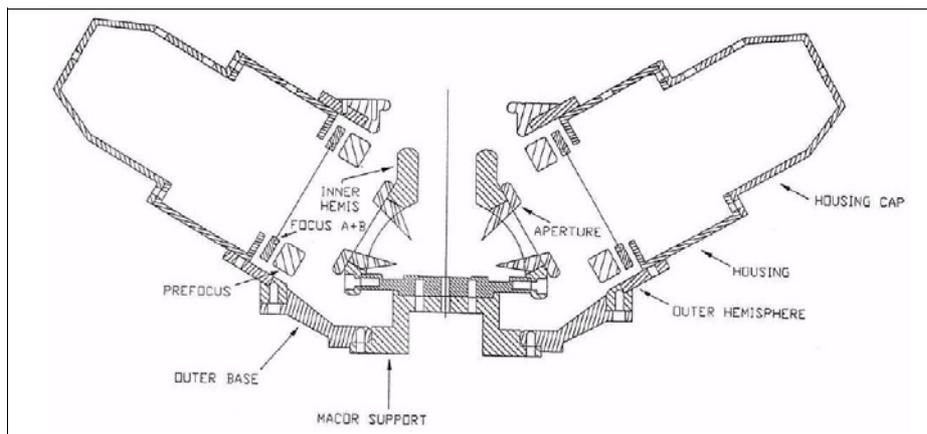


Figure 17

Detector principle

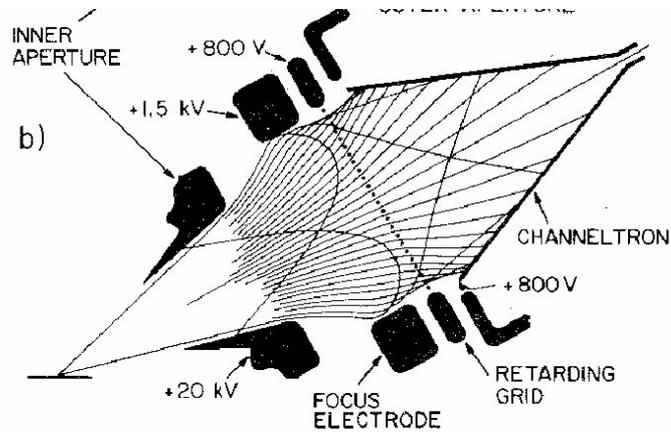


Figure 18 Focus electrode

After passing the focus electrode, the electrons are retarded by a grid in front of the channeltron. Only elastically scattered electrons or electrons which suffered an energy loss of not more than "SpinGridVoltage" can reach the channeltrons and are detected. Thus, the "SpinGridVoltage" defines the detector window for elastic scattering. All four channels have the same "SpinGridVoltage". The front of all four channeltrons is at the "SpinGridVoltage".

Please refer to figure 19, "Channels, top and side view," page 21 for the position of the different channeltrons. The Spin channels 1 and 2 are positioned along the dispersive direction. The Spin channels 3 and 4 are positioned perpendicular to the dispersive direction. Also note that the Spin detector is mounted under an angle of 5 degrees with respect to the exit plane of the analyzer.

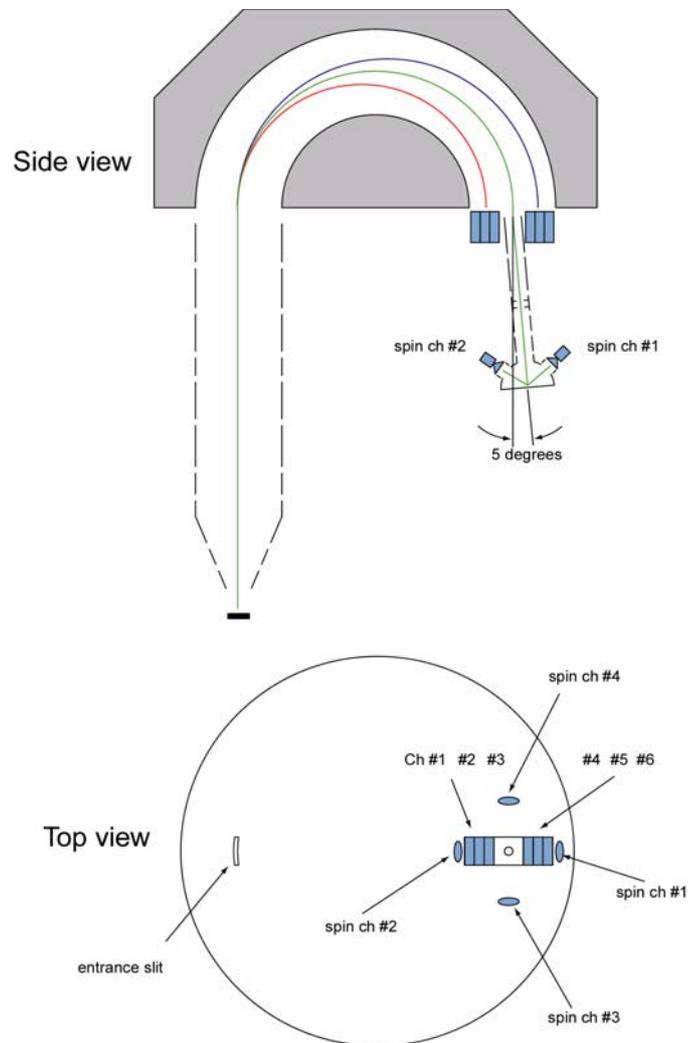


Figure 19 Channels, top and side view

The four channeltrons in the Micro-Mott detector operate with an amplification voltage of "SpinDetectorVoltage" (they are all using the same voltage). For new channeltrons, an operating voltage of 2200V is typical. This voltage needs to be increased regularly. The channeltrons need to be run in the plateau of the amplification curve. Please refer to the according section in the PHOIBOS manual. The amplification curve of the spin channeltrons can only be measured at discrete SpinDetectorVoltages. Please measure the intensity in all channels for different SpinDetectorVoltages (e.g. 1800, 1900, 2000, 2100, 2200, 2300, 2400 V) and plot the intensity versus the voltage. The correct operation voltage is the voltage where all channeltrons have reached the plateau.

The target in the SPECS spin detector is a thorium foil. Due to the very low natural radioactivity of thorium (alpha and beta decay), a dark count rate of 4 counts per second will be present in all four spin channels. If the target voltage is set to zero, a dark count

rate of up to 1000 counts per second will appear on all spin channels. This is due to the secondary electrons generated in the radioactive emission process. These electrons can not leave the target foil at target voltages higher than 800 V. Thus, at normal operation at 25 kV, these electrons will not reach the spin channeltrons.

---

## Chapter

# 5

## Spin Detector Software Details

---

The spin detector operates with the standard SpecsLab data acquisition software. The main difference is that the software connects to two power supplies and to two pulse counting units. This behaviour is initiated by connecting to a special hardware called "Phoibos-HSA3500-RiceSpin" in the "Analyzer Settings" menu. If this hardware is chosen, SpecsLab offers certain additional functionality specific to the Spin detector. This chapter describes the additional functionality. All other functions are standard and are described in the manual for SpecsLab and the standard PHOIBOS analyzer.

The Spin detector operates with two HSA3500 power supplies and two detector units (pulse counting units, PCU 300). The properties of the powersupplies are defined in a configuration file named "Hsa3500Config.0-14.1-50.hsa" or "Hsa3500Config.0-7.1-50.hsa". These configuration files are text files and can be edited. They use a powerful macro and parser language for defining lens voltages. Please refer to the SpecsLab manual for more details.

After connecting to the "Phoibos-HSA3500-RiceSpin" hardware, the "Settings" menu offers some specific options and voltages. In particular, the Spin detector properties can be set by the voltages SpinDeflectionX and SpinDeflectionY, SpinFocus1, SpinFocus2, SpinFocus3, SpinFocus4, SpinGridVoltage and SpinDetectorVoltage. Typical settings are shown above in the section 3, 'Quick Start' on page 11.

Please refer to the section 4, 'Principles of Operation' on page 15 for the description of these voltages. The only critical voltage (i.e. a voltage that can potentially lead to the destruction of the detector) is the SpinDetectorVoltage: this is the acceleration voltage applied to the 4 spin channeltrons. It should be about 2200 V for new channeltrons and needs to be increased from time to time if the channeltrons are getting old. There is a second detector voltage that is supplied to the 6 standard channels ("Default Detector Voltage"). This voltage is critical as well and needs to be set the same way. Please refer to the PHOIBOS manual for details.

The data acquisition is identical to a standard analyzer. Spin resolved and non-spin resolved channels are always measured in parallel. The data window shows the sum spectrum over all 6 standard channels, the 6 separate standard channels (if activated via the toolbar), the four spin channels and the two asymmetry functions. The display of the

standard channels and the sum channel can be activated or deactivated using the toolbar. The display of the spin channels and the asymmetry functions is controlled by double-clicking on the associated channel in the file window. (see also section 3, 'Quick Start' on page 11)

The spin data and the asymmetry functions are stored together with the standard data if a file is stored. In addition, the spin channels and the asymmetry functions can be exported as x-y table data by a right mouseclick on the associated channel in the file menu.

The formula for calculating the asymmetry functions from the spin channels is defined in the windows registry:

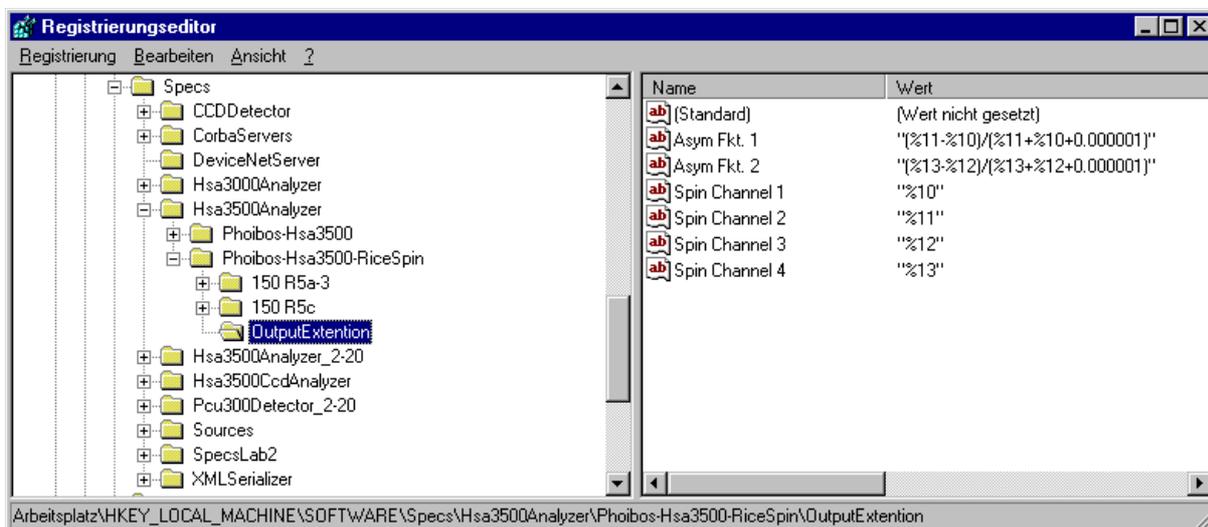


Figure 20 Registry

The geometric position of the four spin channels relative to the analyzer can be seen in figure 19, "Channels, top and side view," page 21. An experimental asymmetry can be compensated by a proper scaling of the channels in the formula. An alternative is to apply different focus voltages to the different spin channels, as described above.

In contrast to a normal multichannel detector, the Spin detector has two pulse counting electronics. The properties of these preamplifiers can be set in the "Analyzer Settings" menu:

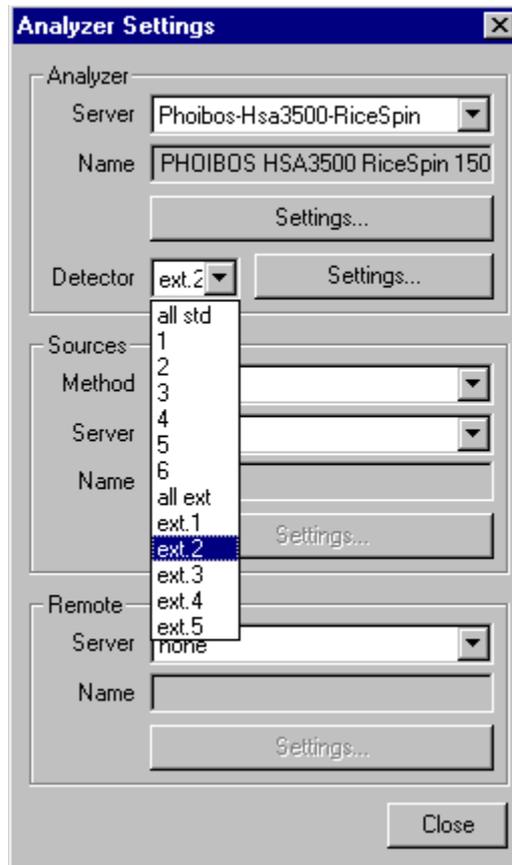


Figure 21 Analyzer settings

In addition to the 6 standard channels, the spin channels appear as “ext.” Channels in this menu. The relevant channels are “ext.1” to “ext.4”. Channel “ext.5” is not used.

For each of the standard and each of the spin channels, a threshold and a deadtime can be set (see figure 22, “Detector settings,” page 26). Typical values are between 2 and 15mV for the threshold and 0 ns for the dead time. The values are stored in the pulse counting electronics. When delivered, the boxes are properly tuned by SPECS and the menu will display these factory preset values.

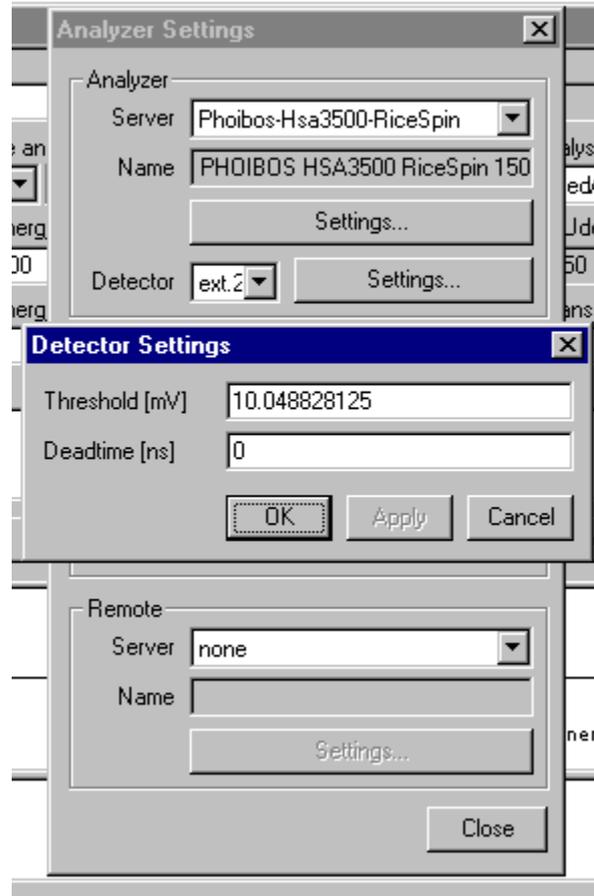


Figure 22 Detector settings

---

# Chapter

# 6

# Troubleshooting

---

The tables below show the voltages on the spin detector feedthroughs. They can be measured using a high voltage probe (Insulation better than 7 kV).

Feedthrough	Pin	30 Pin Socket	Lens	Voltage (V)	
MCD	0.1		ChBase	-97.5	
	0.2		Ch1	2002.5	
	0.3		Ch2	2002.5	
	0.4		Ch3	2002.5	
	0.5				
	0.6				
	0.7				
	0.8			Ch4	2002.5
	0.9			Ch5	2002.5
	0.10			Ch6	2002.5
	0.11				
	0.12			ChHV	1902.5
LENS	1.1	A7	L1	-97.5	
	1.2	C9	L2Xp(L2A)	212.5	
	1.3	B9	L2Xm(L2B)	212.5	
	1.4	A9	L2Yp(L2C)	222.5	
	1.5	B8	L2Ym(L2D)	202.5	
	1.6	C7	L3B	1712.5	
	1.7				
MOTT	2.1	C5	L3AC	3112.5	
	2.2	A3	FOCUS1	-100	
	2.3	B3	FOCUS2	0	
	2.4	A4	FOCUS3	100	

	2.4	A4	FOCUS3	100
	2.5	B4	FOCUS4	200
	2.6			
	2.7			
SPIN	3.1		SpinChBase	300
	3.2		SpinCh1	1300
	3.3		SpinCh2	1300
	3.4		SpinCh3	1300
	3.5		SpinCh4	1300
	3.6			
	3.7		SpinChHV	1200

**Table 1** Settings in SpecsLab: Ek=200 V, Ep=12.5 V, UCON=90 V, Udet=2100 V, Udef\_x=0 V, U\_def\_y=10 V, Ufocus1=100 V, Ufocus2=200 V, Ufocus3=300 V, Ufocus4=400 V, Ugrid=500 V, UspinDet=1000 V, WF= 0 V.

Feedthrough	Pin	30 Pin Socket	Lens	Voltage (V)	
MCD	0.1		ChBase	-685	
	0.2		Ch1	1415	
	0.3		Ch2	1415	
	0.4		Ch3	1415	
	0.5				
	0.6				
	0.7				
	0.8				
	0.8			Ch4	1415
	0.9			Ch5	1415
	0.10			Ch6	1415
	0.11				
	0.12		ChHV	1315	
LENS	1.1	A7	L1	-595	
	1.2	C9	L2Xp(L2A)	85	
	1.3	B9	L2Xm(L2B)	-35	
	1.4	A9	L2Yp(L2C)	115	
	1.5	B8	L2Ym(L2D)	-65	
	1.6	C7	L3B	1125	
	1.7				
MOTT	2.1	C5	L3AC	2525	
	2.2	A3	FOCUS1	-500	
	2.3	B3	FOCUS2	-480	
	2.4	A4	FOCUS3	-460	

---

	2.4	A4	FOCUS3	-460
	2.5	B4	FOCUS4	-440
	2.6			
	2.7			
SPIN	3.1		SpinChBase	-300
	3.2		SpinCh1	1700
	3.3		SpinCh2	1700
	3.4		SpinCh3	1700
	3.5		SpinCh4	1700
	3.6			
	3.7		SpinChHV	1600

---

**Table 2**      **Settings in SpecsLab: Ek=800 V, Ep=25 V, UCON=90 V, Udet=2100 V, Udef\_x=60 V, U\_def\_y=90 V, Ufocus1=300 V, Ufocus2=320 V, Ufocus3=340 V, Ufocus4=360 V, Ugrid=500 V, UspinDet=2000 V, WF= 0 V.**



---

# Chapter

# LF

## List of Figures

---

Figure 1	Spin detector	2
Figure 2	30 kV power supply (Manufacturer: iseg)	3
Figure 3	'Cables and accessories:'	3
Figure 4	PCU 300 MCD 9, PCU SPIN	3
Figure 5	HSA3500 power supply	3
Figure 6	Bolt installation	6
Figure 7	Side view	6
Figure 8	Back view	7
Figure 9	25kV and grounding plugs	8
Figure 10	Connections	9
Figure 11	View of Boxes (a)	9
Figure 12	View of Boxes (b)	10
Figure 13	Electrical shield	10
Figure 14	Principle of operation	15
Figure 15	Inelastic loss dependency	17
Figure 16	SpinFocusVoltage	19
Figure 17	Detector principle	19
Figure 18	Focus electrode	20
Figure 19	Channels, top and side view	21
Figure 20	Registry	24
Figure 21	Analyzer settings	25
Figure 22	Detector settings	26



---

# Chapter

# I

# Index

---

## *Numerics*

25kV plug 8

## *A*

Analyzer Settings 23  
asymmetry functions 16

## *B*

bake out 7  
Bolts installation 6

## *C*

Cables and accessories 4  
cool down 7  
Copper shield 10

## *D*

Detector principle 19  
Detector settings 26  
Dunning 16

## *F*

Focus electrode 20

## *I*

Installation 5  
iseg 3

## *M*

Micro-Mott detector 21

## *P*

Principle 15  
Pump down 7

## *Q*

Quick start 11

## *R*

ramped up 7  
Registry 24

## *S*

Safety Hints 1  
Seff 16  
Software Details 23  
spin polarization 16  
SpinDetectorVoltage 21

## *T*

target voltage 10  
thorium foil. 2, 21

## *U*

Unpacking 2

## *V*

venting 5  
voltage ramp 8