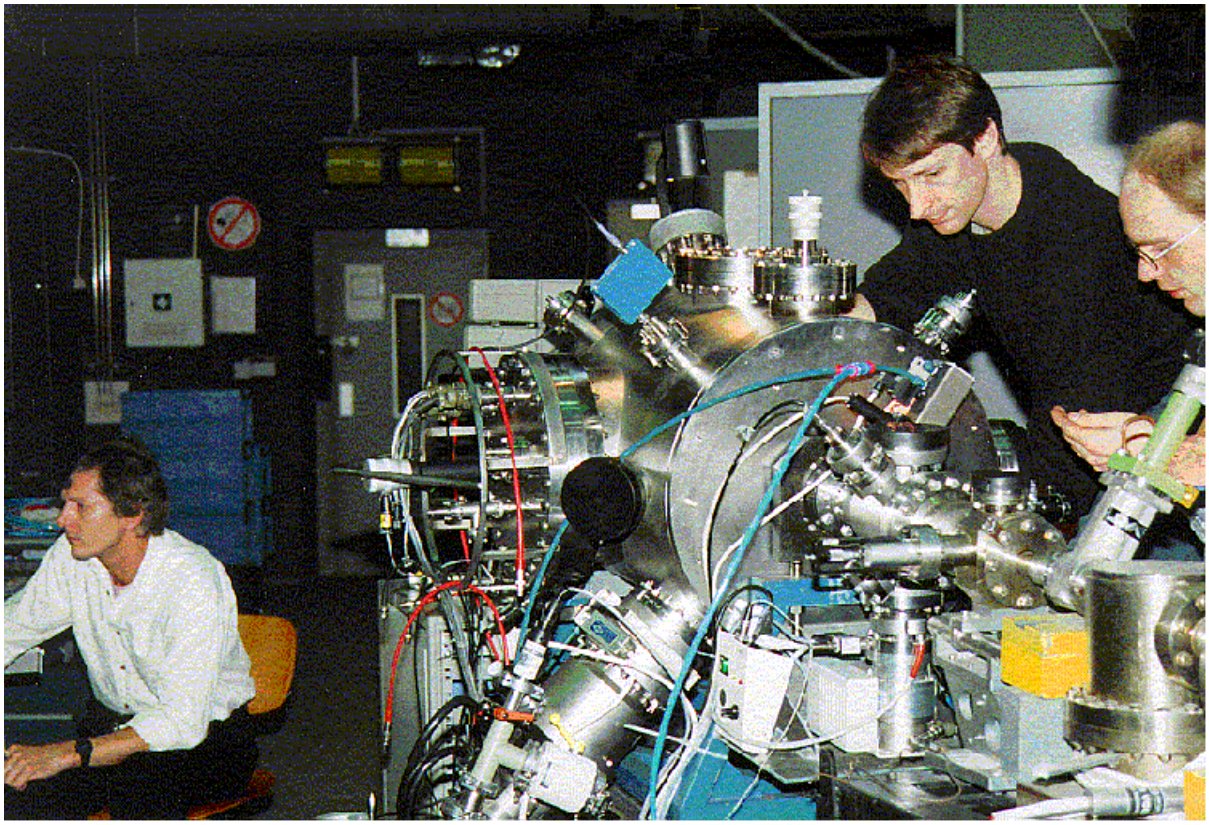
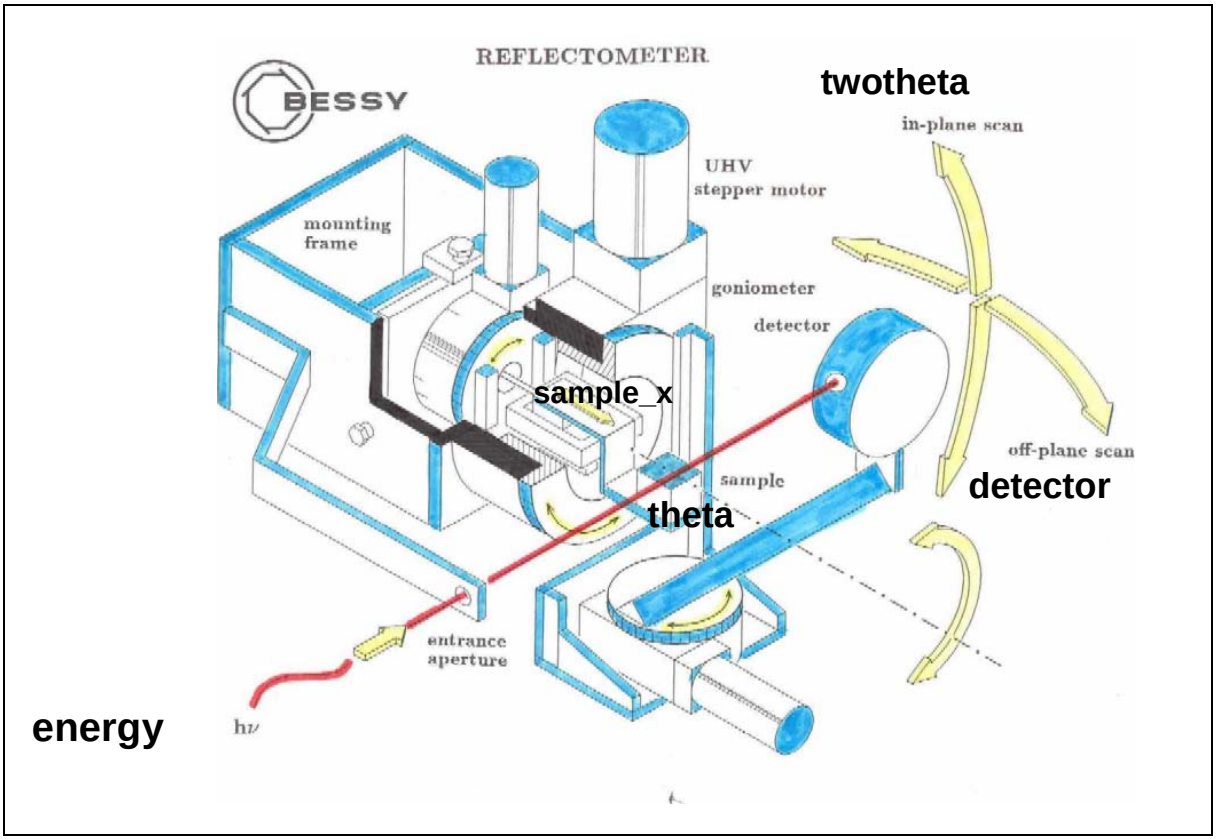
SPEC - REFLECTOMETER CONTROL





SPEC - REFLECTOMETER CONTROL

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1. Getting started

- Log-in on POLARIS.EXP.BESSY / UNIX-system as: *SPECUSR*
- Password: *brillanz*
- Open a terminal-window
- Type: *spec*
- Enter two character for your user name (case sensitive)
- To modify volume and/or file number use "*Volume*" and "*Filenumber*"
- **SPEC and UNIX are case-sensitive!!!**

2. Available Devices

Motors:	**function/device**	**mnemonic**	**name (unit)**	**hardware**	**soft limits**
1.	theta	tha	(deg.)	EPICS REFLC:h0000007 / VME #8	-20 - 140
2.	twotheta	twt	(deg.)	EPICS REFLC:h0000006 / VME #7	-45 - 230
3.	detector	det	(deg.)	EPICS REFLC:h0000005 / VME #6	-45 - 15
4.	sample	smp	(mm)	EPICS REFLC:h0000004 / VME #5	1 - 49
5.	filter	flt	(mm)	EPICS REFLC:h0000003 / VME #4	1 - 140
6.	mirror	mirror	(μrad)	EPICS Macro-Mot / PM4M1:RxAbs	-50 - 50
7.	mono	mono	(eV)	EPICS / Macro-Mot d0812pgm1:mono…	10 - 5e6
8.	V1	V1	(Volt)	Keithley #10 Voltage source Macro-Mot	-100- 100

Counters:

1.	Io Au-mesh	kth1	(A)	GPIB / Keithley 617 #10
2.	GaAsP-diode	kth2	(A)	GPIB / Keithley 617 #11
3.	ring current	rc	(mA)	EPICS
4.	Channeltron	counter1	(cts)	counter card
5.	Counter	counter2	(cts)	counter card

3. Device handling: move motors, read detectors

If nothing moves, type: ***reconfig***

mtha, mtwt, mdet, msmp, mflt, mmono, mmirror, mV1

Description: Moves motor to destination
Usage: e.g. *mmono destination* (eV)

mrtha, mrtwt, mrdet, mrsmp, mrflt, mrmono, mrmirror

Description: Moves motor relative to current position
Usage: e.g. *mrmono eV*

wa

Description: Shows the actual positions of all motors in user and dial coordinates
Usage: *wa*

read_keithley

Description: Returns the actual value read from keithley
Usage: *read_keithley kth1*

ct

Description: Reads all counter channels
Usage: *ct*

4. Scan macros

bragg

Description: Performs a Bragg scan of tha in reflection. Scans around the Bragg angle by +-delta_tha for energies in given range; d-spacing in nm.
Usage: *bragg delta_tha steps_tha start_energy stop_energy steps d-spacing*

detector

Description: Performs a detector scan
Usage: *detector start stop steps*

energy

Description: Performs an energy scan
Usage: *energy start stop steps*

Energy

Description: Performs an energy scan. Prior to scan user must determine proper position of mirror at both ends of scan
Usage: *energy start stop mirror_start mirror_stop steps*

filter

Description: Performs a scan of filter-feedthrough to find the filter positions
Usage: *filter start stop steps*

gr_onblaze

Description: Performs an on-blaze energy scan of a grating at a certain order
Usage: *gr_onblaze energy_start energy_stop steps l/mm blazeangle order*

mirrorRx

Description: Performs a scan of Rx (tilt, incidence angle) of premirror M1
Usage: *mirrorRx start stop steps*

ml_peakref

Description: Performs an energy scan on the Bragg maximum of multilayer
Usage: *ml_peakref energy_start energy_stop steps d-spacing (nm)*

sample_x

Description: Performs a sample scan in x (perpendicular to plane of reflection)

Usage: *sample_x start stop steps*

stripchart
Description: Mimics a stripchart recorder, I.e. performs a time scan
Usage: *stripchart timeperstep steps*

theta
Description: Performs a theta scan
Usage: *theta start stop steps*

twotheta
Description: Performs a two-theta scan
Usage: *twotheta start stop steps*

twotoone
Description: Performs a 2:1 scan that scans tha and twt with twt moving twice the range of tha
Usage: *twotoone theta_start stop steps*

TwoToOne
Description: Performs a 2:1 scan that scans tha, twt and det with twt moving twice the range of tha. Prior to scan user must determine proper position of detector at both ends of scan
Usage: *TwoToOne theta_start stop steps det_start stop*

Vscan1
Description: Performs a voltage scan with Keithley #10
Usage: *Vscan1 V_start V_stop steps*

5. Miscellaneous – SPEC-symbols, commands, macros (a selection)

abort, stop, resume a scan
Usage: *p* then "*r*" (resume) or "*ctrl/c*"

autosave switches autosave feature on or off
Usage: *autosave="on"* or *autosave="off"*

check_beamshutter starts scan only when beamshutter is open (set by default)

Comment Shows and sets the comment for the datafile

config only for experts, must be SPECADM
Usage: *config*
to quit: *Cntr C*, to write: *w*, to edit: ", to toggle: *c*

dwelltime Shows and sets the counter dwelltime, Keithley preamp settling time and sequence of Keithley readout.
We wait PreampSettlingTime before starting the loop for number of Readouts. The loop over Readouts also waits for PreampSettlingTime before taking any reading.

Keithley specification: 2.5 sec in 20 pA and 200 pA
15 msec in 2 nA, 20 nA, 200 nA
2 msec in microA and mA ranges

Usage: *dwelltime Dwelltime PreampSettlingTime*

delay Shows and sets the mechanical delaytime (sleep) in seconds before counters are read

Usage: *delay* or *Delay delaytime*

Detector gives info on available detectors (channel 2) and their relative position

filenumber Shows and sets file number for current user

Usage: *filenumber* or *Filenumber*

Filterinuse moves one out of 6 filters into the light beam

help Invokes the SPEC on-line help

home

Description: clears the lightpass in reflectometer for the SURICAT experiment (tha: 0, twt: 0, det: -15, smp: 49)

Usage: *home* or *reflec_home*

ignore_beamshutter starts scan without checking beamshutter

Io

Description: moves sample out of and detector into the light beam for Io measurement (smp: 49, tha: 0, twt: 0, det: 0)

Usage: *Io*

pinhole gives info on available pinholes and their position on manual feedthrough

plot Plots the last scan

plotselect Selects the chanels to plot on line (max 3)

Usage: *plotselect counters*

prdef prints definition of macro

qdo Includes macros into SPEC

Usage: *qdo usermacros.mac* or *qdo spec.mac*

quit EXIT from the program

Readouts Shows and sets the number of readouts, (de)activates Keithley, and determines readout sequence for ReadoutSequence = "sim" : reading pseudo simultaneously, ReadoutSequence = "seq" : reading sequentially (only effective for Readouts > 1).
“sim” recommended since PreampSettlingTime can be reduced by time it takes to read the Keithleys.
“seq” recommended when digitising noise etc. is dominating.

	Usage:	*readouts* or *Readouts* *ReadoutSequence = sequential* or *simultaneous*
Sample or sample		Shows and sets the sample comment/description for the datafile
Sample_info		Shows the motor-positions on sample holder
savedata		Saves the data of the last scan to POLARIS\DATA-directory (no overwriting of existing data files), auto increment of Filenumber.
	Filename:	username_ref_volume.filenumber (e.g.: fs_ref_0.1)
	Usage:	*savedata* or *save_data* or *datasave* or *data_save*
set		Redefines a motorposition in user coordinates
	Usage:	*set motor position*
set_dial		experts only
	Usage:	*set_dial motor position*
setplot		Changes plot options. Attention: Default-setting is NO PLOT and NO HIGH RESOLUTION PLOT!!!
	Usage:	*setplot*
syms		displays all SPEC symbols, arrays, strings,…
TAB		displays all 641 SPEC commands
volume		Shows and sets volume number for current user
	Usage	*volume* or *Volume*
whoami		Shows present user name
File usermacros.mac		write your own macro-routine for your measurement sequence into “usermacro.mac” e.g. according to:

```
def reflec_home '{
# moves reflectometer sample out of light beam
# to give beam to SURICAT exp. station
mtha 0
mtwt 0
mdet -15
msmp 49
}'
```

Include macro:	*qdo usermacros.mac* or *qdo spec.mac*

6. Trouble shooting

reconfig	updates current configuration (similar to new start)

7. Data transfer --- Connection to BESSY network drives

Available Networks in BESSY Experimental hall

USR (yellow label) for User computers (100 Mbit)
EXP (white label) for BESSY devices (100 Mbit)
BLC (generally not accessible)
WLAN (10 Mbit, at request only)

Login Username / Password

monop / *monop*
DIP_KMC1$ / DIP_KMC1
or: *bessyguest* / *bessyguest*
or: *teas\yourname* / *yourpassword*

Available data-drives

\\fs.exp.bessy.de\scratch	(user/password: *monop/monop*)
\\fs.exp.bessy.de\public	(*monop/monop*)
\\bessy.exp.bessy.de\monop	(*monop/monop*)
\\fs.exp.bessy.de\linse	(*yourname/passowrd*)
\\polaris.exp.bessy.de\specusr	(*specusr/brillanz* (Reflectom.))
\\speckle.exp.bessy.de\specusr	(*specusr/brillanz* (Polarimeter))

etc…
no connection to OS2-drives possible

Connection to network from

Windows	Open	*Arbeitsplatz – Extras – Netzlaufwerk verbinden* *Your workspace – Extras – Map network drive*

Windows or OS2

Open	*Eingabeaufforderung*
Check online status:	*ping bessy* (*fs, polaris, speckle*…)
Check network drives:	*net use*
Check IP-configuration:	*ipconfig*
Create new drive (e.g.):	*net use X: \\bessy\monop*

UNIX

Open	*HOME window*
Enter location e.g.:	*smb://bessy/monop*
Enter username e.g.:	*teas\monop*
Password e.g.:	*monop*

8. Connection to BESSY printers

Printer server: **\\diprint\printername** (user: teas*monop / monop*)
Windows: *START – run - \\diprint\ - user/password* - select printer from list

e.g. printer in the upper level next to KMC-1: **waz_ps** or **waz_pcl6**
UE56/2 PGM1,2: **nnn_ps** or **nnn_pcl6**
Reflectometer: **nkr.prn.bessy.de**

9. PM-4 Optics Beamline settings

for SURICAT:

Apertures:	4.8/2.0/7.0/16.0
Mirror M1 Rx -Motor 5:	0 +/- 15 μrad
Monochromator:	360 l/mm ((Pos. 74 mm on hand-operated LMD)
c_{ff}:	3
Reflectometer:	SPEC-control: reflec_home (theta=0^o, twotheta=0^o, detector=-15^o, sample_x=49 mm, filter=10 mm)
Pinhole feedthrough:	50 mm
Io-mesh feedthrough:	0 mm
Filter feedthrough:	10 mm
Vacuum:	$<2 \times 10^{-6}$ mbar

for REFLECTOMETER

Front end Apertures:	2.3/-1.0/6.5/12.5 mm (=3.3 x 19 mm^2 (v x h) @14.6 m = 0.23 x 1.3 $mrad^2$) (Offset-values:-4.5/-4.9/-3.9/-5.6)
Mirror M1 Rx - Motor 5:	0 μrad +/-15 μrad (energy-dependent)
Straylight apertures (25 mm hand-operated LMDs)	14/17 mm (top/bottom) 8 / 4 mm (left/right)
Monochromator:	1228 l/mm (Pos. 22 mm on hand-operated LMD) c_{ff}: (recommended) <= 2
Straylight apertures (25 mm hand-operated LMDs)	15/15 mm (top/bottom)
Intermediate focus apertures (25 mm hand-operated LMDs)	14/12 mm (top/bottom) 18/12 mm (left/right)

10. Sample change – Venting of Reflectometer

1. Move all motors to *HOME* position by SPEC-program. **Especially the FILTER-motor must be at home-position 10 mm for protection.**

2. Close hand-valves on both sides of reflectometer (to beamline and to SURICAT).

Note: both valves are double valves, close the inner ones, next to the chamber (labeled with "*Fenster MgF2*" and "*Fenster*", resp.) !!!

3. Press the "*STOP"*-button on the turbopump control (Turbotronik NT 340M).
Note: the valve (NW150 CF) between turbopump and chamber closes automatically.

4. Stop the roughing pump unit (DCU Pfeiffer Vacuum) on the other side of the chamber.

5. Switch off the Penning pressure gauge B1 (at BALZERS TPG 300 press buttons "*Sensor*" and "*Step*"). Change pressure reading to the pirani gauge at B2 (press button "*Sensor*").

Now you are ready to vent the chamber via the nozzle-valve with gaseous Nitrogen from the big bottle next to the chamber.

6. Open the valve on top of the N_2-bottle.

7. Open the nozzle-valve on top of the reflectometer chamber slowly while checking the pressure in the chamber. It should increase up to approximately 700 mbar (is not calibrated).
Note: check vacuum of last beamline section in the yellow beamline rack (Ion pump power supply labelled "*Austrittspalt*"). Vacuum should stay in 10^{-9} mbar range. If not, you have a leak to the beamline. stop venting immediately, close the nozzle valve.

8. Release latches at the load-lock door (CF 150 Window) on the chamber. At atmospheric pressure the door opens automatically.

9. Close the valve on top of the N_2-bottle. Close the nozzle-valve at the chamber.

Now you can change sample

11. Sample change – Pump down of Reflectometer

1. Close nozzle valve tightly. Close load-lock door and fix the latches tightly.

2. Start both the roughing pump unit (DCU Pfeiffer) and the Scroll-roughing pump (VARIAN). Change the 3-way cross between turbopump and roughing pump section to position 2 to pump down with the Scroll-pump.

3. Press the "*START*"-button on the turbopump control (TURBOTRONIK), then open the valve between turbopump and chamber by pressing the black knob on the valve control (Ventilsteuerung) next to the turbopump control.

4. Wait until the pressure reading B2 at BALZERS TPG 300 shows 10^{-3} mbar and until the turbopump has come to full speed. If so, only three green lights remain shining on the control unit. This may take up to 15-30 minutes.

5. Check whether the roughing pump unit has come to full speed (1500 Hz). If so, change 3-way cross to position 1 to further pump with roughing pump unit. Switch off Scroll-pump.

6. Switch on pressure gauge B1 (on BALZERS TPG 300 press buttons "*Sensor*" and "*func*"). Should show 10^{-4} mbar or better.

7. Wait 3 to 4 hours until vacuum is better than 5 times 10^{-6} mbar. Now you can open the valve to the beamline.
Note: Check beamline vacuum (Austrittspalt). Should stay in the 10^{-9} or 10^{-8} mbar range.

Now you can start to measure