General comments on the beamline

U49/2-PGM2

(State: April 2009)

Before opening the valves at the beamline:

- **The pressures in the beamline** should be smaller than $1 \times 10^{-9}$ mBar, except the pressures in the grating chamber and in "Rohrstück Hinten A" ($<2 \times 10^{-9}$ mBar). The pressures can be seen in the rack with the ion pump controllers. The rack looks like this:

  - Ion pump controller for front pipe (top) and the WAU (Water-cooled Aperture Unit) (bottom)
  - Ion pump controller for rear pipe A (top) and rear pipe B (bottom)
  - Cold cathode pressure gauge for the grating and the focussing chamber (channel A1 = focussing chamber / channel B1 = grating chamber)
  - Ion pump controller for the grating (top) and the focussing (bottom) chamber
  - Ion pump controller for the diagnostic (top) and the exit slit (bottom) chamber

- The **pre-mirror in the SMU** (Switching Mirror Unit) must be switched to this beamline. This can be done using the panel on the X-terminal (see next picture). Therefore one has to click on the red square what directs to U492PGM2. The current position of the pre-mirror can be seen by the green circles (in the picture given below the mirror is switched to the middle position). While switching the green circle underneath „Ready“ gets yellow. Then permission for opening the beamshutter is denied. After the circle underneath „Ready“ gets green again the switching is done.
For safety the following parameters can be controlled by clicking on the button Experts:
Switch=581.000 / Right TX=550.000 / Right RX=293.400 / Right RY=550.000 / Right RZ=245.000

Please check after switching the pre-mirror whether the apertures are set correctly {The aperture should be set automatically to this values after switching the pre-mirror}:

<table>
<thead>
<tr>
<th>rel. Einstellung</th>
<th>Oben</th>
<th>Unten</th>
<th>Rechts (Mauer)</th>
<th>Links (Ring)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Referenz-Position</td>
<td>1,0</td>
<td>-1,0</td>
<td>1,0</td>
<td>-1,0</td>
</tr>
<tr>
<td></td>
<td>18,48</td>
<td>-22,71</td>
<td>23,39</td>
<td>-25,05</td>
</tr>
</tbody>
</table>

(corresponds to an aperture size of 2000x2000µm²)
The reference positions can be entered in the 4 green bordered input lines (see above image of the aperture control panel). The relative positions of the apertures can be entered in the 4 magenta bordered input lines.

- For normal operation mode: Please check that the **Undulator** is set to remote (in the Undulator control panel at „ID control“).

- For normal operation mode: Please check the following setting on the monochromator control panel **U492PGM2**:
  1. Grating1 with a line width of 1000 lines/mm and \( c_0=2.25 \)
  2. ID On must be selected, to move the Undulator (Insertion Device = ID) parallel to the Monochromator.
  3. The 7\(^{th}\) harmonic must be selected for automatic setting of the Undulator harmonic
  4. g1000c2-25x.idt must be selected as the mono drive table.

- **A Monochromator Reset is no longer needed**, after changing the setting above! The new settings are applied with the next entered photon energy.

- The settings for 1., 3., and 4. can be changed by pressing the button **Settings**. The following dialog will appear:
- Here, the **grating** (1000 lines/mm or 300 lines/mm), the **c²-Factor** (normally 2.25), and the **used Harmonic** (1 ⇒ Undulator-Harmonic 1 | 3 ⇒ Undulator-Harmonic 3 | 5 ⇒ Undulator-Harmonic 5 | 7 ⇒ automatic selection of Undulator-Harmonic 1, 3, and 5) can be selected.

- Additionally, the **ID-Table** can be selected via the button “!” . The following dialog appears:

- By clicking on the button on the right hand side of **Select Light:** , the ID-table and the Harmonic, available in the chosen table, can be selected. Please select the table according to the used grating:
  - **1000 Lines/mm:** choose **g1000c2-25x.idt** and **Harmonic 7** (for automatic adjustment of the Undulator Harmonic)
  - **300 Lines/mm:** choose **g300c2-25_20060517.idt** and the Harmonic, suitable for the desired energy (no automatic adjustment of the Undulator Harmonic is implemented).

- All panels shown above are reachable at the X-terminal from a central panel. If this window can not be found on the X-terminal or the X-terminal is crashed, this central panel appears automatically on the screen after reboot of the X-terminal:
By clicking on the buttons labelled with the following numbers it is possible to get the following panels:

1. Undulator control panel
2. Aperture control panel
3. SMU control panel
4. Monochromator control panel

Opening the valves at the beamline:
- Before opening the last valve (the valve between the exit slit and the experiment chamber) please check the pressure in the experiment chamber. The valve is not automatically interlocked to prevent opening at worse pressures in the experiment chamber.
- The opening of the valves starts with the last valve (the valve to the experiment chamber) and the last is the opening of the beamshutter. (This order is necessary because a valve up-stream {towards the storage ring} becomes permission for opening only if the previous valve {the next down-stream valve} is opened.)
- The closing of all valves must be done in the reversed order: First close the beamshutter and then all valves one after another towards the experiment chamber.
- It is to be considered that there is a hand valve between the experiment chamber and the gas cell (The gas cell is not included in the schematic beamline overview on the valve control rack). A second hand valve (what is included in the schematic beamline overview on the valve control rack) is located between the grating chamber and the focusing chamber. These hand valves must be opened manually!
- IMPORTANT: The pressure in the grating chamber must be watched while the beamshutter is opened! The pressure must not exceed $5\times10^{-8}$mBar!!

To check from time to time:
- Water level in the cooling circuit of the grating chamber

Adjust photon energy with the monochromator
- Energy can be set by EMP, or by the Monochromator Control Panel. / please check whether the Undulator moves too!
- The following energy ranges can be used in the 3 available odd harmonics of the Undulator:

**Grating 1000 l/mm:**
1. Harmonic: 85eV .. 498eV
2. Harmonic: 252eV .. 1266eV
3. Harmonic: 420eV .. 1890V

**Grating 300 l/mm:**
1. Harmonic: 85eV .. 500eV
2. Harmonic: 255eV .. 899eV
3. Harmonic: 424eV .. 873eV
- **Automatic Adjustment of the Undulator harmonic (available since July 2005)**:
  When using the table `g1000c2-25x.idt` (note the “x”!) it is possible to use the 7th harmonic. In this harmonic the beamline itself will choose the 1st, 3rd, or 5th harmonic, depending on the energy used. No choosing of the harmonic and no monochromator reset will be needed then. The energy range for the harmonics are:

  - \( 85.000 \ldots 420.000 \Rightarrow \text{Harmonic 1} \)
  - \( 420.001 \ldots 860.000 \Rightarrow \text{Harmonic 3} \)
  - \( 860.001 \ldots 1890.000 \Rightarrow \text{Harmonic 5} \)

When scanning across the harmonic borders (e.g. 420.0eV and 860.0eV) it may come to steps in the intensity in the spectrum (see upper image of a scan of the 7th harmonic). Therefore it is recommended to choose a fixed harmonic (e.g. 1st, 3rd, or 5th, depending on the center of the scan). This is still supported by this table file. Choose therefore 1, 3 or 5 instead of 7 in the input line “Harmonic” and perform a monochromator reset. Then the harmonics are available like described above.

- **Adjusting the Undulator harmonic by hand**:
  1. On the X-terminal in the monochromator control panel „U492PGM2“ press button Settings
  2. In the appearing dialog, choose the desired Undulator Harmonic and press Close button.
  3. The new Harmonic will be applied with the next photon energy adjustment (via EMP or monochromator control panel). No Monochromator Rest is needed!
Setup Zero-Order for experiment aligning with visible light:

- **ATTENTION!** If the Zero-Order light hits your sample or the GaAs-Diode in the gas cell, it will be destroyed!

- Then press the button **Zero Order**, on the Monochromator Control Panel. The following dialog will appear:

  ![Goto Zero Order dialog](image)

  - By pressing **Goto Zero Order** the monochromator moves to zero-order-light.
  - Open the exit slit to values above 140µm to avoid diffraction of the visible light at the exit slit, and hence a vertical broadening of the spot.
  - For going back to normal (first-order) Synchrotron light, you just need to ... close the Zero Order Panel ... enter a valid photon energy (86 .. 1850eV) on the Monochromator Control Panel or in EMP.

Old procedure (2):

- **ATTENTION!** If the Zero-Order light hits your sample or the GaAs-Diode in the gas cell, it will be destroyed!

- Make sure that the beamline is in normal operation mode (e.g. table drive, Undulator in remote mode, EMP is running / see Page 3). From July 2008 on, no special settings of the beamline is necessary for adjusting zero order light. The Undulator will move automatically to 50mm!

- With EMP set an energy of 4,001,000.0 eV (four million one thousand) ⇒ Zero-Order light should be visible on exit slit and in the experimental chamber.

  **Remark:** Do not take care about the values EMP is displaying, these numbers are not correct!

- Open the exit slit to values above 140µm to avoid diffraction of the visible light at the exit slit, and hence a vertical broadening of the spot.

- For going back to normal (first-order) Synchrotron light, just enter a valid photon energy (86 .. 1850eV) in EMP.

Old procedure (1):
On the X-terminal in the monochromator control panel „U492PGM2“ make sure that “table drive” is selected and set the monochromator to “MONO only”, then click “configure mono”
- perform a Monochromator reset with EMP
- put the Undulator to “local” and set it to a gap of 50mm
- Set an energy of 4,001,000.0 eV (four million one thousand) in EMP ⇒ Zero-Order light should be visible on exit slit and in the experimental chamber
**Remark:** Do not take care about the values EMP is displaying, these numbers are not correct!
- In case of no light is visible (beamline missalligned) you have to find the Zero-Order light. Therefore perform the following steps:
  - set the linear transfer at the gas cell to 40mm
  - connect the upper BNC-connector (the one *not* entitled with “diode” !) with the Keithley Picoampere-Meter 487
  - set an IEEE address of 3 for the Keithley
  - connect the Keithley with the EMP computer via IEEE cable
  - assign a channel in EMP with the Keithley (restart of EMP may be required)
  - start a CFS measurement in EMP from 3,990,000.0eV to 4,010,000.0eV (If this is not sufficient enlarge the energy scale)
  - then put the monochromator to the maximum of the scanned curve
- For return to normal operation don’t forget to ...
  ... set the linear transfer in the gas cell back to 20mm
  ... set the monochromator back to “ID and MONO”
  ... set the Undulator back to “remote” mode
If the beamline computer crashes:

In the following cases reference drive of the monochromator is needed:

- Monochromator control is not available after restart of EMP
- The input lines on the „U492PGM2“ window (see lower figure) on the X-Terminal are white

In every of these cases the beamline computer (VME-Crate) has to be restarted to perform a reference drive (see following notes).

Restart of the beamline computer (VME-Crate) and reference drive:

- Close EMP and restart the EMP computer (OS/2 computer)
- Switch of and on the beamline computer: Therefore use the marked On-Off-Button (see magenta arrow in the right hand picture of the Rack with the pump controllers of the beamline)

⇒ Beamline computer is now booting and performs a reference drive afterwards automatically.

- Wait until reference marker on the bottom left of the „U492PGM2“ window are green again (takes up to 20 minutes !)
- Restart EMP and enter an energy. Monochromator starts with a very small energy (57eV or less) and *drives across the zero order (wavelength \( \lambda = 0 \)) to the entered energy!*
# Some old beamline adjustments

## SMU:

<table>
<thead>
<tr>
<th>Datum</th>
<th>Gitter</th>
<th>Wofür</th>
<th>Switch</th>
<th>Right TX</th>
<th>Right RX</th>
<th>Right RY</th>
<th>Right RZ</th>
<th>Bemerkung</th>
</tr>
</thead>
<tbody>
<tr>
<td>30.07.2001</td>
<td>1000 l/mm</td>
<td>N₂-Messung</td>
<td>581.000</td>
<td>370.000</td>
<td>260.000</td>
<td>200.000</td>
<td>265.000</td>
<td>für Comissioning nach dem Gitterwechsel nicht geändert</td>
</tr>
<tr>
<td>05.10.2001</td>
<td>1000 l/mm</td>
<td>Comiss.</td>
<td>581.000</td>
<td>370.000</td>
<td>260.000</td>
<td>200.000</td>
<td>265.000</td>
<td>optimiert auf max. Auflösung in den N₂-Spektren</td>
</tr>
<tr>
<td>23.07.2002</td>
<td>1000 l/mm</td>
<td>Comiss.</td>
<td>581000</td>
<td>550.000</td>
<td>250.000</td>
<td>200.000</td>
<td>245.000</td>
<td>für Comissioning nach dem Gitterwechsel nicht geändert</td>
</tr>
<tr>
<td>01.09.2002</td>
<td>1000 l/mm</td>
<td>Comiss.</td>
<td>560000</td>
<td>550.000</td>
<td>261000</td>
<td>550.000</td>
<td>245000</td>
<td>optimiert auf max. Aufl. in den N₂-Spekt. und offenem PinHole</td>
</tr>
<tr>
<td>09.02.2003</td>
<td>1000 l/mm</td>
<td>Comiss. 1000er G.</td>
<td>581000</td>
<td>550.000</td>
<td>261000</td>
<td>550.000</td>
<td>245000</td>
<td>optimiert auf max. Aufl. in den N₂-Spekt. und offenem PinHole</td>
</tr>
<tr>
<td>26.07.2003</td>
<td>300 l/mm</td>
<td>Inbetriebn. 300er G.</td>
<td>581000</td>
<td>500000</td>
<td>251000</td>
<td>570000</td>
<td>241000</td>
<td>optimiert auf max. Aufl. in den N₂-Spekt. und offenem PinHole</td>
</tr>
<tr>
<td>13.05.2004</td>
<td>1000 l/mm</td>
<td>Comiss.</td>
<td>581000</td>
<td>550.000</td>
<td>261000</td>
<td>550000</td>
<td>245000</td>
<td>optimiert auf max. Aufl. in den N₂-Spekt. und offenem PinHole</td>
</tr>
<tr>
<td>12.04.2007</td>
<td>1000 l/mm</td>
<td>C. wg. SMU-Crash</td>
<td>581000</td>
<td>550.000</td>
<td>280000</td>
<td>550000</td>
<td>245000</td>
<td>nur RX opt. auf max. Auflösung bei N₂ und offenem Blenden</td>
</tr>
</tbody>
</table>

## Apertures:

<table>
<thead>
<tr>
<th>Datum</th>
<th>Wofür</th>
<th>Oben</th>
<th>Unten</th>
<th>Rechts (Mauer)</th>
<th>Links (Ring)</th>
<th>Größe (o-u x l-r)</th>
<th>Bemerkung</th>
</tr>
</thead>
<tbody>
<tr>
<td>05.10.2001</td>
<td>Comiss.</td>
<td>0,19</td>
<td>-0,31</td>
<td>0,31</td>
<td>-0,19</td>
<td>500 x 500µ</td>
<td>nach dem Comissioning zum Gitterwechsel</td>
</tr>
<tr>
<td>28.11.2001</td>
<td>Tabelle G1000.ums</td>
<td>0,8</td>
<td>-0,8</td>
<td>1,2</td>
<td>-1,2</td>
<td>1600 x 2400µ</td>
<td>für Messungen und Tabellenfahrt mit G1000.ums</td>
</tr>
<tr>
<td>23.07.2002</td>
<td>N₂-Messung</td>
<td>0,1</td>
<td>-0,1</td>
<td>1,0</td>
<td>-1,0</td>
<td>200 x 200µ</td>
<td>Einstellungen übernommen von R.Follath / für N₂-Spektren</td>
</tr>
<tr>
<td>01.09.2002</td>
<td>Comiss. 1000er G.</td>
<td>1,0</td>
<td>-1,0</td>
<td>1,0</td>
<td>-1,0</td>
<td>2000x2000 µ</td>
<td>bei 404.5eV und 36,05mm („blauen Kante“) optimiert</td>
</tr>
<tr>
<td>09.02.2003</td>
<td>Comiss.</td>
<td>1,0</td>
<td>-1,0</td>
<td>1,0</td>
<td>-1,0</td>
<td>2000x2000 µ</td>
<td>bei 131,7eV und 20,00mm („blauen Kante“) optimiert</td>
</tr>
<tr>
<td>26.07.2003</td>
<td>Inbetriebn. 300er G.</td>
<td>1,0</td>
<td>-1,0</td>
<td>1,0</td>
<td>-1,0</td>
<td>2000x2000 µ</td>
<td>&gt;&gt;&gt; keine Änderung zu vorher ! &lt;&lt;&lt;</td>
</tr>
<tr>
<td>25.04.2004</td>
<td>Optimierung an „blauer Kante“</td>
<td>1,0</td>
<td>-1,0</td>
<td>1,0</td>
<td>-1,0</td>
<td>2000x2000 µ</td>
<td>bei 131,7eV und 20,00mm („blauen Kante“) optimiert</td>
</tr>
<tr>
<td>27.06.2006</td>
<td>Optimierung an „blauer Kante“ mit PinHole</td>
<td>1,0</td>
<td>-1,0</td>
<td>1,0</td>
<td>-1,0</td>
<td>2000x2000 µ</td>
<td>bei Gap=36,05mm in der 3. Harmonischen, also bei hv=1235eV (halbe Höhe der „blauen Kante“) mit 100µm Pinhole (⇒ Maximum bei -3,34mm (horizontal) und 52,02mm (vertikal))</td>
</tr>
<tr>
<td>Datum</td>
<td>Optimierung an “blauer Kante” mit PinHole</td>
<td>1.0</td>
<td>-1.0</td>
<td>1.0</td>
<td>-1.0</td>
<td>2000x2000 µm</td>
<td>bei Gap=36,05mm in der 3. Harmonischen, also bei ( h\nu=1212\text{eV} ) mit 100µm Pinhole ( \Rightarrow ) Maximum bei -3,30mm (vertikal) und 52,65mm (horizontal)</td>
</tr>
<tr>
<td>------------</td>
<td>------------------------------------------</td>
<td>-----</td>
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<td>-------------</td>
<td>-------------------------------------------------------------</td>
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<tr>
<td>21.09.2006</td>
<td>Optimierung an “blauer Kante” mit PinHole</td>
<td>1.0</td>
<td>-1.0</td>
<td>1.0</td>
<td>-1.0</td>
<td>2000x2000 µm</td>
<td>bei Gap=36,05mm in der 3. Harmonischen, also bei ( h\nu=1212\text{eV} ) mit 100µm Pinhole ( \Rightarrow ) Maximum bei -3,25mm (vertikal) und 52,00mm (horizontal)</td>
</tr>
<tr>
<td>08.10.2007</td>
<td>Optimierung an “blauer Kante” mit PinHole</td>
<td>1.0</td>
<td>-1.0</td>
<td>1.0</td>
<td>-1.0</td>
<td>2000x2000 µm</td>
<td>bei Gap=36,05mm in der 3. Harmonischen, also bei ( h\nu=1212\text{eV} ) mit 100µm Pinhole ( \Rightarrow ) Maximum bei -3,17mm (vertikal) und 52,01mm (horizontal)</td>
</tr>
<tr>
<td>21.01.2008</td>
<td>Optimierung an “blauer Kante” mit PinHole</td>
<td>1.0</td>
<td>-1.0</td>
<td>1.0</td>
<td>-1.0</td>
<td>2000x2000 µm</td>
<td>bei Gap=36,05mm in der 3. Harmonischen, also bei ( h\nu=1212\text{eV} ) mit 100µm Pinhole ( \Rightarrow ) Maximum bei -3,22mm (vertikal) und 52,04mm (horizontal)</td>
</tr>
<tr>
<td>28.01.2008</td>
<td>Optimierung an “blauer Kante” mit PinHole Low-( \alpha )</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>bei Gap=36,05mm in der 3. Harmonischen, also bei ( h\nu=1212\text{eV} ) mit 100µm Pinhole ( \Rightarrow ) Maximum bei -3,42mm (vertikal) und 52,14mm (horizontal)</td>
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<td>14.04.2008</td>
<td>Optimierung an “blauer Kante” mit PinHole SB</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>bei Gap=36,05mm in der 3. Harmonischen, also bei ( h\nu=1212\text{eV} ) mit 100µm Pinhole ( \Rightarrow ) Maximum bei -3,16mm (vertikal) und 52,08mm (horizontal)</td>
</tr>
</tbody>
</table>
**I₀ Measurements with the Gas Cell**

*Usable I₀-Devices in the Gas Cell*

**LTM Setting:**

- ~34mm
- ~68mm  ~78mm

- Tungsten wire Ø 75µm
- Heatable ⇒ to remove C contamination ⇒ I₀ reference for C1s XAS
- Also available: Au mesh and (79% transmission ???) and GaAs diode
**I₀ Measurements with the Gas Cell**

*Connections of the I₀ Devices*

**Connections:**
- “D” ⇒ GaAs diode
- “B” ⇒ Base plate
- “F1” and “F2” ⇒ W wire
$I_0$ Measurements with the Gas Cell

$I_0$-Measurement with GaAs-Diode

**Diode:**
- “B” $\Rightarrow$ grounded
- “D” $\Rightarrow$ Current vs. ground
- “F1” and “F2” $\Rightarrow$ open
**$I_0$ Measurements with the Gas Cell**

$I_0$-Measurement with Au-Mesh

**Au mesh:**
- “B” \(\rightarrow\) Current vs. ground
- “D” \(\rightarrow\) open
- “F1” and “F2” \(\rightarrow\) open
**I₀ Measurements with the Gas Cell**

*Heating the I₀-Tungsten-Wire to remove C contaminations*

**W wire heating:**

- “B” ⇒ open
- “D” ⇒ open
- “F1” and “F2” ⇒ apply heating current (0.35A / 1.7V)
\( I_0 \) Measurements with the Gas Cell

\( I_0 \)-Measurement with Tungsten Wire

**W wire measurement:**

- “B” \( \Rightarrow \) grounded
- “D” \( \Rightarrow \) open
- “F1” \( \Rightarrow \) open
- “F2” \( \Rightarrow \) current vs. ground
  (some nA)
**Flux Grating 1000 l/mm**

1. Harmonic (calculated for $C_{ff}=2.25$)
2. 3. Harmonic (calculated for $C_{ff}=2.25$)
3. 5. Harmonic (calculated for $C_{ff}=2.25$)

**Monochromator settings:**
- Aperture: 2,0×2,0mm
- Grating: 1000 l/mm
- $C_{ff}=3.0$
- Exit slit: 140 µm

**Figure 1:** Flux curve for U49/2-PGM2 with the 1000 l/mm grating between 85 eV and 1450 eV for the 1st, 3rd, and 5th harmonic of the Undulator. Bold lines are measured data and fine lines are calculated data (from Batchelor at al.: BESSY-Jahresbericht 1997).
Monochromator settings:
- Aperture: 2.0×2.0mm
- Exit slit: 140µm

Grating 300 l/mm @ c₀=2.25:
- 1. Harmonic
- 3. Harmonic
- 5. Harmonic

Grating 1000 l/mm @ c₀=3.00:
- 1. Harmonic
- 3. Harmonic
- 5. Harmonic

Figure 2: Flux curve for U49/2-PGM2 with the 300 l/mm grating (bold lines) between 85eV and 900eV for the 1st, 3rd, and 5th harmonic of the Undulator in comparison with the 1000 l/mm grating (thin line).
Flux quality in 1\textsuperscript{st} harmonic 1000 l/mm

![Flux quality graph]

**Figure 3:** Scan of the 1\textsuperscript{st} Harmonic (black curve). The scans with fixed Undulator Gaps (red curves) show the conformity of monochromator and Undulator. The insets show the smoothness of the supplied flux while sweeping the photon energy (Signal-Noise-Ratios are obtained by dividing the numerical smoothed curve by the Standard Deviation from that smoothed curve).
Flux quality in $3^{rd}$ harmonic 1000 l/mm

Figure 4: Scan of the $3^{rd}$ Harmonic (black curve). The scans with fixed Undulator Gaps (red curves) show the conformity of monochromator and Undulator. The insets show the smoothness of the supplied flux while sweeping the photon energy (Signal-Noise-Ratios are obtained by dividing the numerical smoothed curve by the Standard Deviation from that smoothed curve).
Flux quality in 5th harmonic 1000 l/mm

**Figure 5:** Scan of the 5th Harmonic (black curve). The scans with fixed Undulator Gaps (red curves) show the conformity of monochromator and Undulator. The insets show the smoothness of the supplied flux while sweeping the photon energy (Signal-Noise-Ratios are obtained by dividing the numerical smoothed curve by the Standard Deviation from that smoothed curve).
Flux quality in 1\textsuperscript{st} harmonic 300 l/mm

Figure 6: Scan of the 1\textsuperscript{st} Harmonic (black curve). The scans with fixed Undulator Gaps (red curves) show the conformity of monochromator and Undulator The insets show the smoothness of the supplied flux while sweeping the photon energy (Signal-Noise-Ratios are obtained by dividing the numerical smoothed curve by the Standard Deviation from that smoothed curve).
**Flux quality in 3\textsuperscript{rd} harmonic 300 l/mm**

![Graph showing GaAs diode current (nA per mA ring current) vs. Photon energy (eV).]

**Figure 7:** Scan of the 3\textsuperscript{rd} Harmonic (black curve). The scans with fixed Undulator Gaps (red curves) show the conformity of monochromator and Undulator. The insets show the smoothness of the supplied flux while sweeping the photon energy (Signal-Noise-Ratios are obtained by dividing the numerical smoothed curve by the Standard Deviation from that smoothed curve).
Figure 8: Gauß broadening of the Monochromator plotted versus Photo Energy. The Gauß broadening was measured at three different photon energies using three gas absorption thresholds. The calculated resolution ($c_{ps}=2.2$ / slit width equal to source image size) is given as straight line.
Resolution vs. exit slit 1000 l/mm

Figure 9: Resolution of the Monochromator with 1000 l/mm grating plotted versus Exit Slit setting. The resolution was calculated from the measured Gauß broadening (see Figure 8).
Resolution vs. exit slit 300 l/mm

Figure 10: Resolution of the Monochromator with 300 l/mm grating plotted versus Exit Slit setting. The resolution was calculated from the measured Gauß broadening.
Figure 11: Suppression of the 2nd order measured for $c_\parallel=3.0$ at 3 different photon energies using gas absorption.
Figure 12: Suppression of the 2\textsuperscript{nd} order measured for different c\textsubscript{ff}-values at the N1s- gas absorption at 400.9eV with a fixed Undulator gap of 36.05mm for the 1000 l/mm grating.
Figure 13: Suppression of the 2\textsuperscript{nd} order measured for different c\textsubscript{ff}-values at the N1s- gas absorption at 400.9eV with a fixed Undulator gap of 36.05mm for the 300 l/mm grating.
Figure 14: Deviation of the nominal photon energy and the supplied photon energy. It should be noted that this deviations shows the sum of the errors made by the monochromator and the analyser! (photon energy set with U49/2-PGM (140µm exit slit / grating 1000 l/mm); Au-Fermi edge measured with PHOIBOS-analyser of the SoLiAS experimental station (5eV pass energy))
Spot Size vs. Undulator Appertures

1000 l/mm \( | cff=2.25 \) | Exit Slit = 140\( \mu \)m \( | h\nu=400\)eV

Figure 15: Horizontal (blue) und vertical (red) spot size (855mm behind the exit slit) versus Undulator aperture size. Normal settings with 1.0mm (top) \( | -1.0mm \) (bottom) \( | 1.0mm \) (right) \( | -1.0mm \) (left) equals 2x2mm. The settings 1.0mm (top) \( | -1.0mm \) (bottom) \( | 0.1mm \) (right) \( | -0.1mm \) (left) would equal an Undulator aperture size of 2.0mm vertical and 0.2mm horizontal.