Commissioning of Plane Grating Monochromator beamline

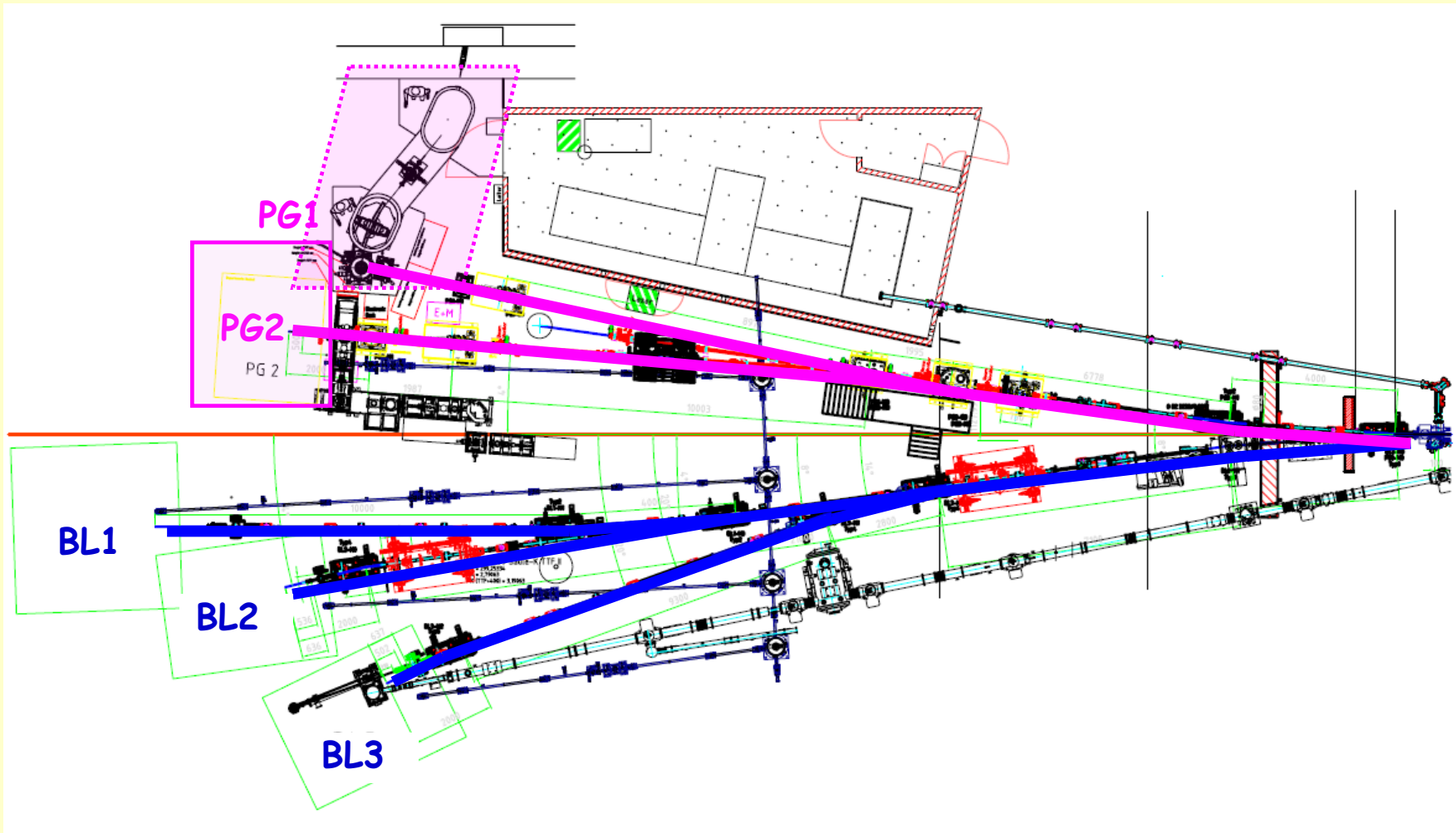
Natalia Guerassimova, Rolf Treusch, Holger Weigelt

DESY

Michael Rübhausen, Arne Goos, Ann-Kathrin Pagenkopp, Pelangi Saichu, Andreas Eich, Stephan Binder, Ben Schulz, Andrivo Rusydi

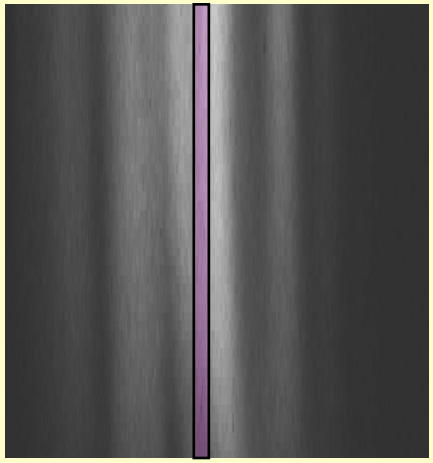
Institut für Angewandte Physik, University of Hamburg

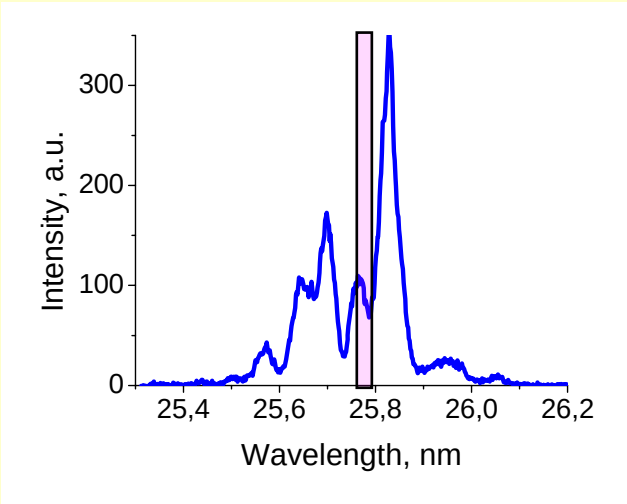
Plane Grating Monochromator Beamline



Plane Grating Monochromator Beamline

Beam at focal plane



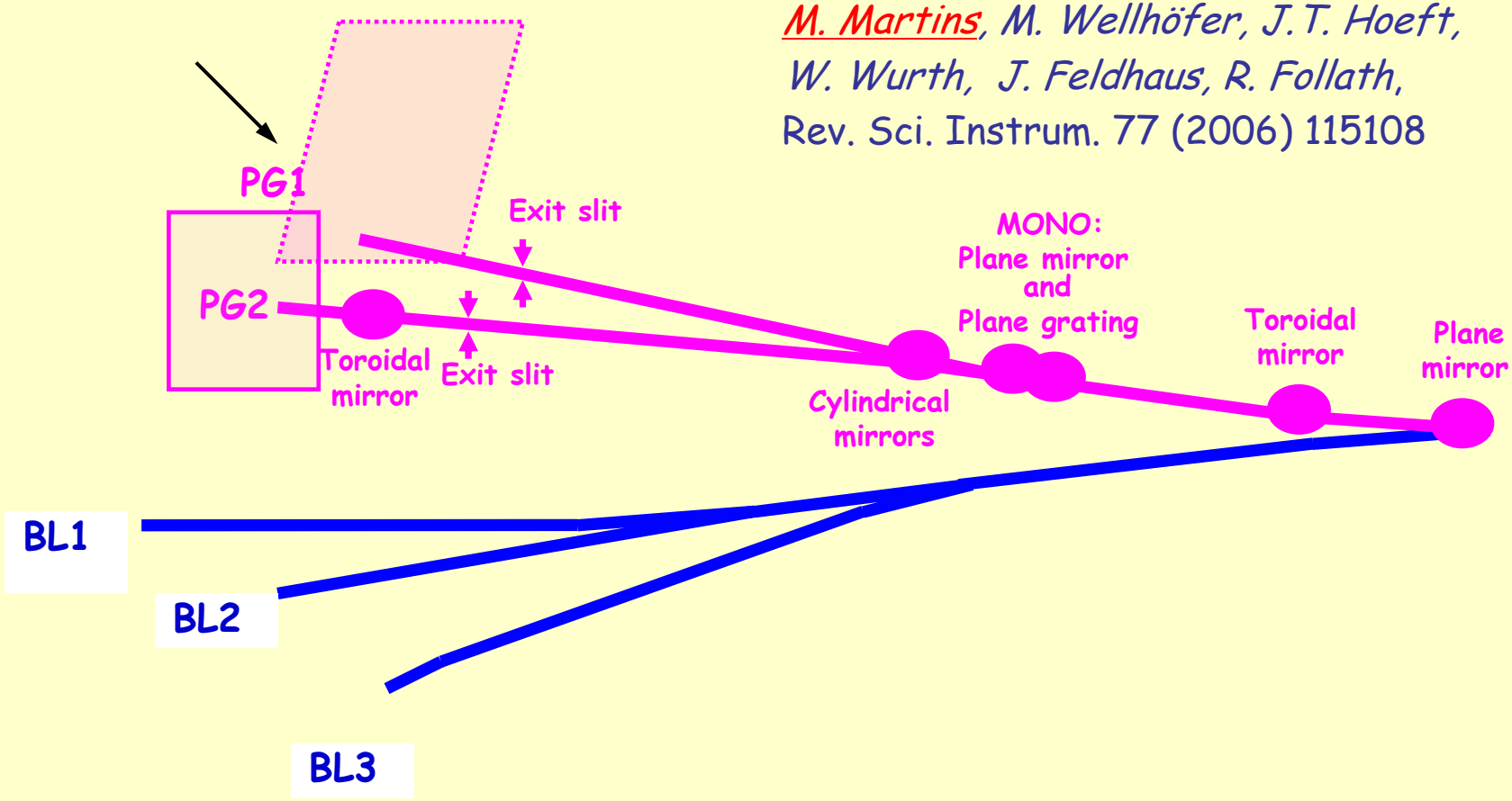


- High resolution experiments

Plane Grating Monochromator Beamline

M. Rübhausen et al.

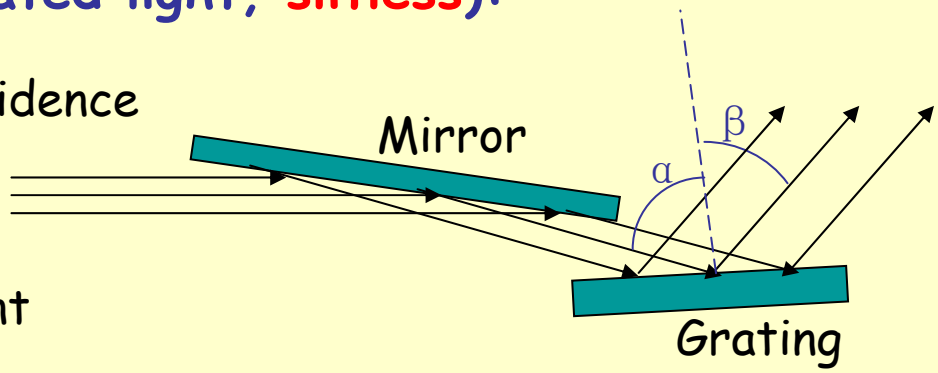
M. Martins, M. Wellhöfer, J.T. Hoeft, W. Wurth, J. Feldhaus, R. Follath, Rev. Sci. Instrum. 77 (2006) 115108



Plane Grating Monochromator Beamline

SX-700 design (in collimated light, slitless):

- Free choice of angle of incidence and angle of diffraction



- Can be operated in different modes:
  - High Resolution (high cff value)
  - High flux (low cff value)
  - Use 0-th order beam
  - Use simultaneously 0-th order beam and dispersed beam
- Gratings: 200 l/mm and 1200 l/mm

Fix-focus constant

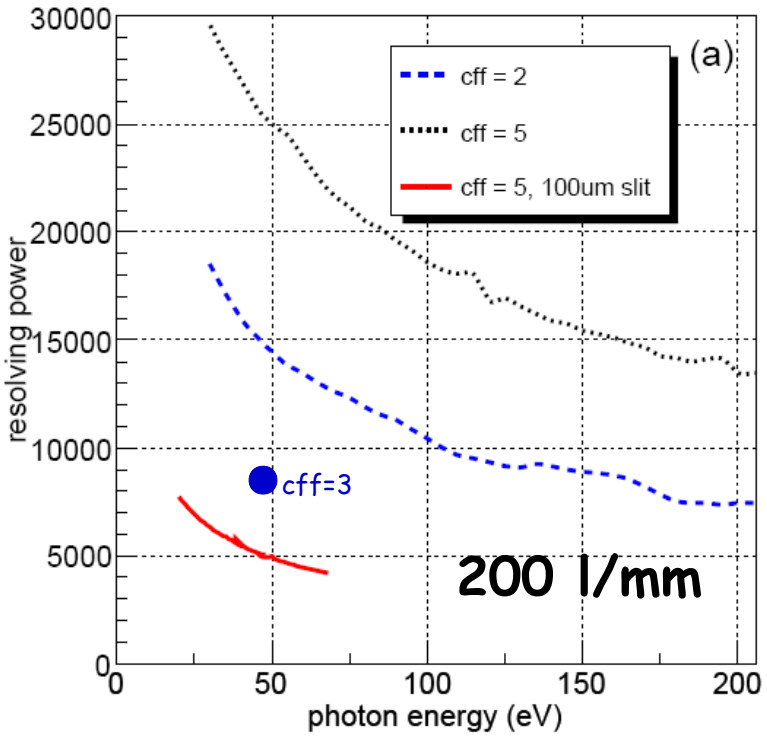
cff = cos β /cos α

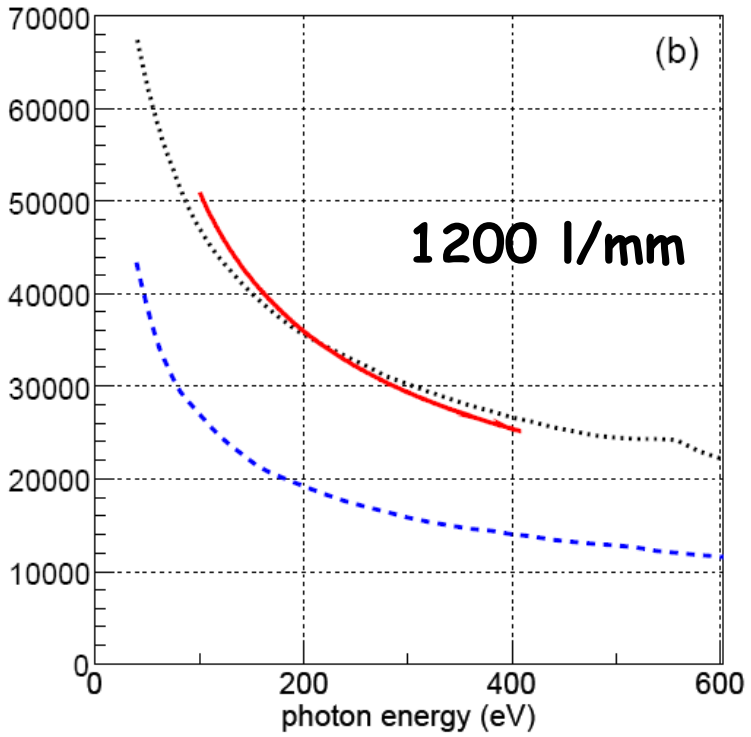
PG2 performance

	September 2006	February 2008	September 2008
Resolving power (measured at 48 eV in spectrometer mode)	1500	3500	8000 (limited by measurement technique)
PG2 focus size	150 – 250 um	150 – 250 um	50 – 100 um

Plane Grating Monochromator Beamline

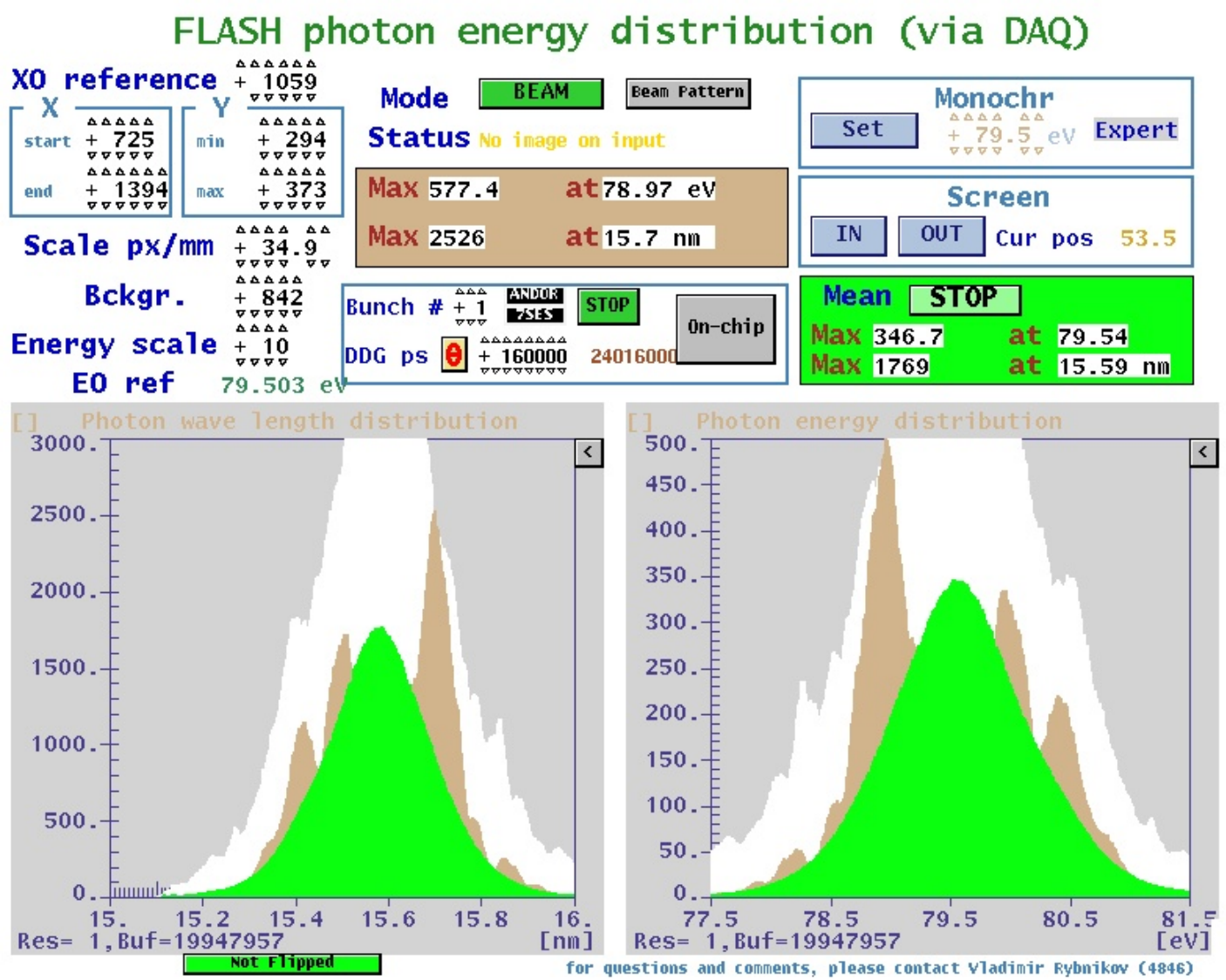
Resolving power





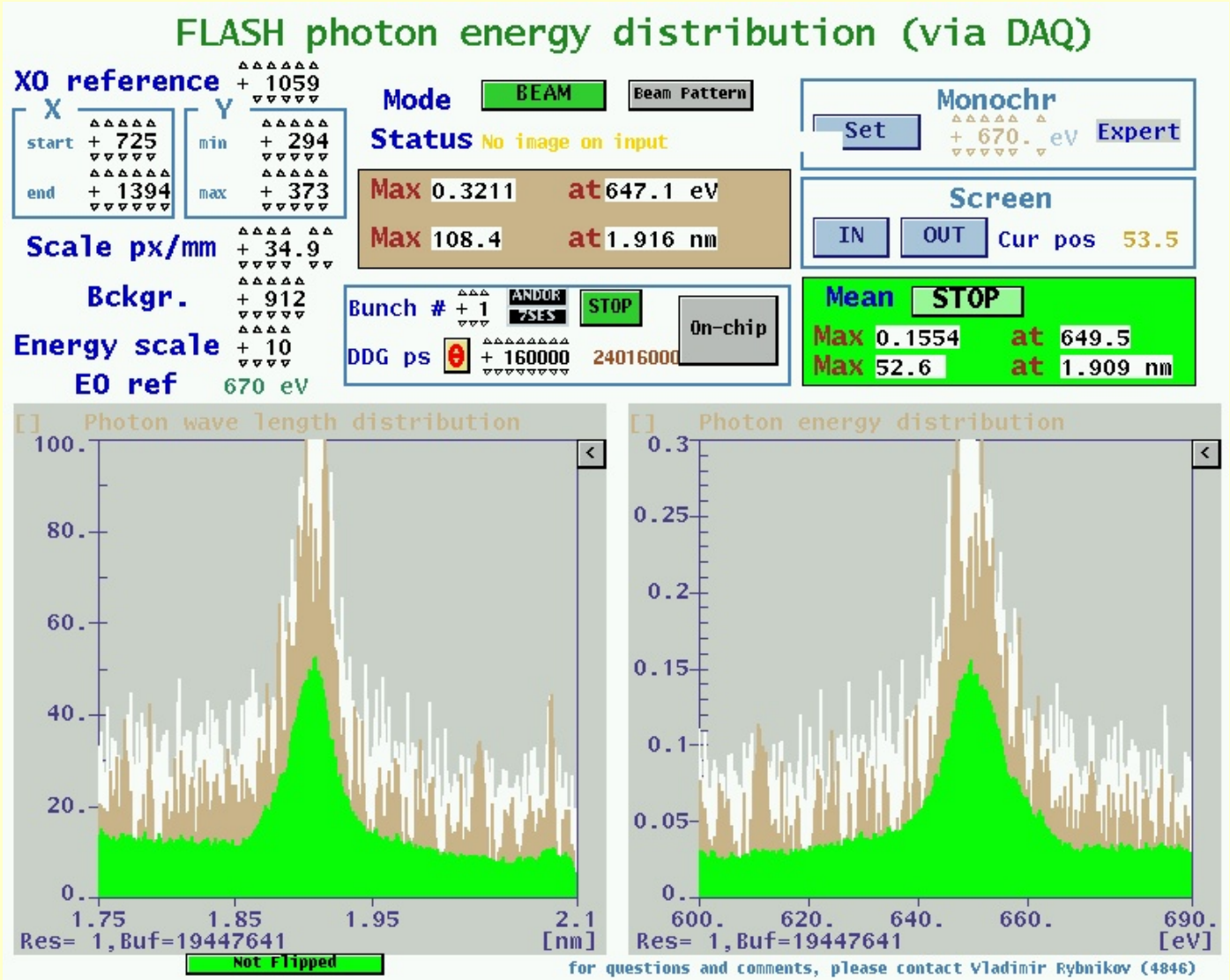
M. Martins, M. Wellhöfer, J.T. Hoeft, W. Wurth, J. Feldhaus, R. Follath,
Rev. Sci. Instrum. 77 (2006) 115108

PG2 as spectrometer



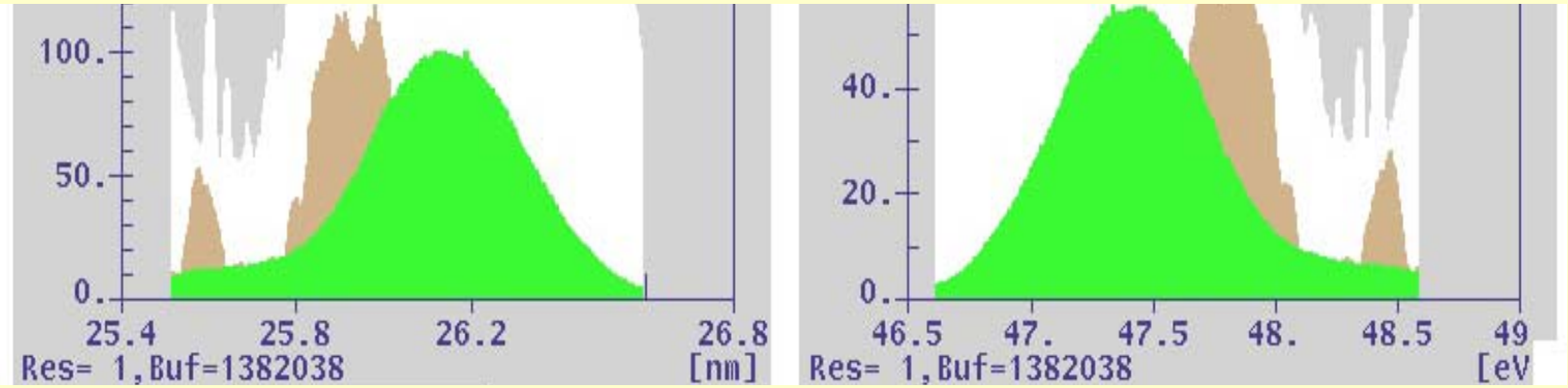
Vladimir Rybnikov

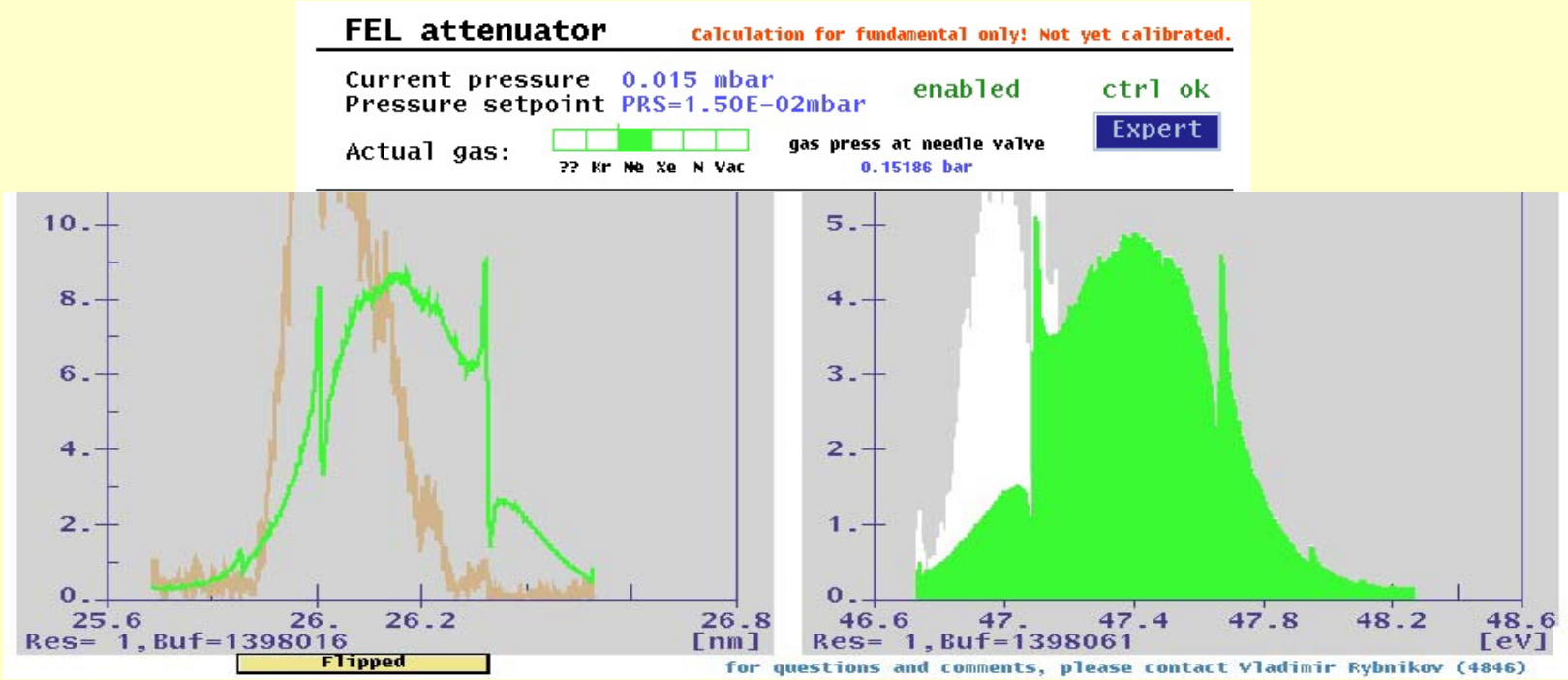
PG2 as spectrometer



Vladimir Rybnikov

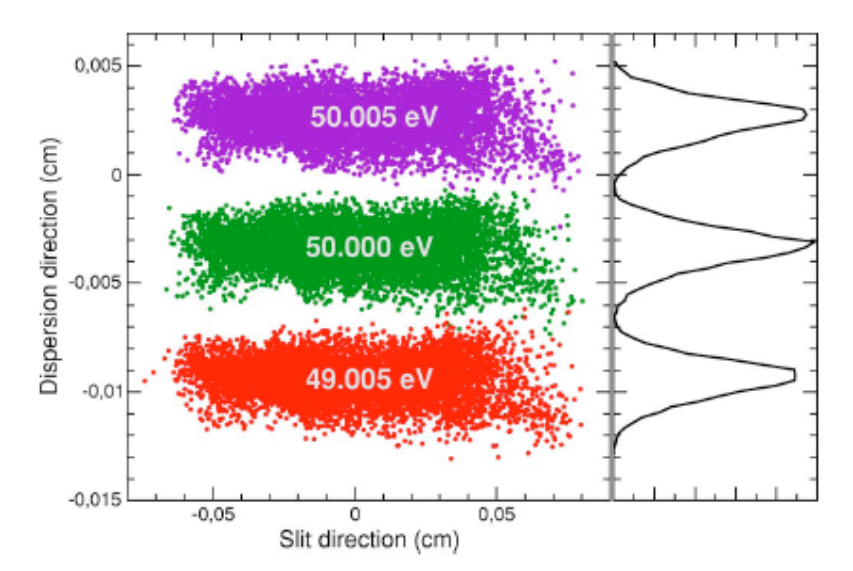
Resolution measurements





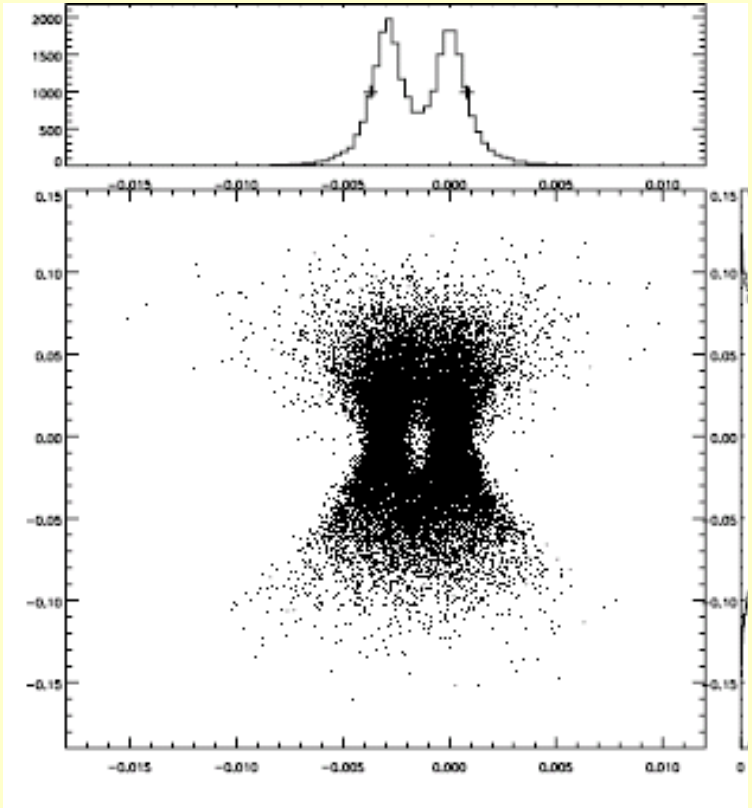
Plane Grating Monochromator Beamline

Ray-tracing



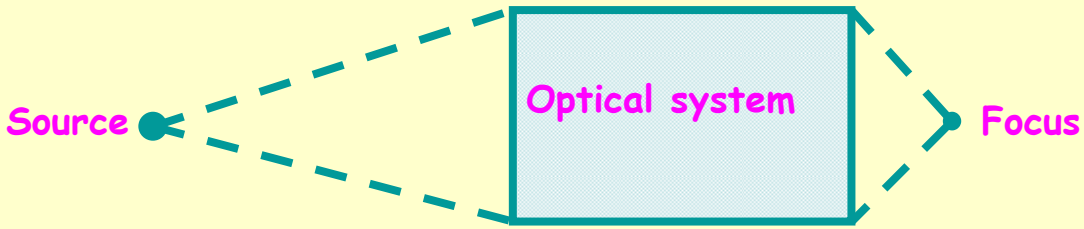
M. Martins, M. Wellhöfer, J.T. Hoeft, W. Wurth, J. Feldhaus, R. Follath,
Rev. Sci. Instrum. 77 (2006) 115108

Aberration effect



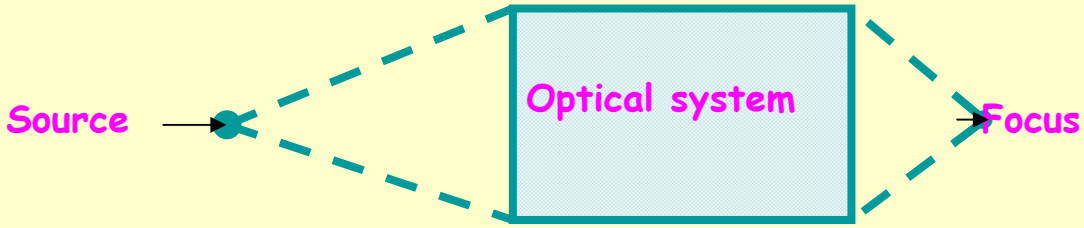
Plane Grating Monochromator Beamline

Source



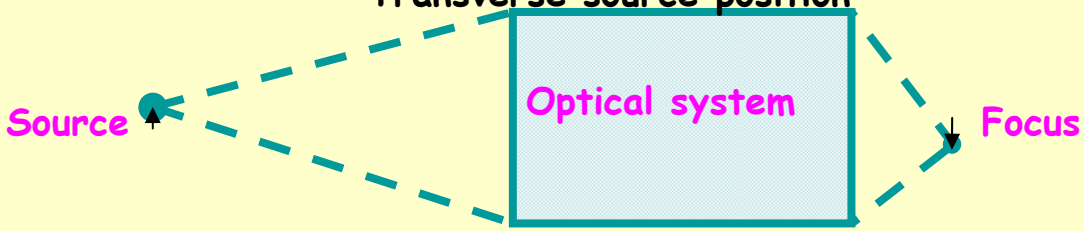
- Resolution depends on source size

Longitudinal source position



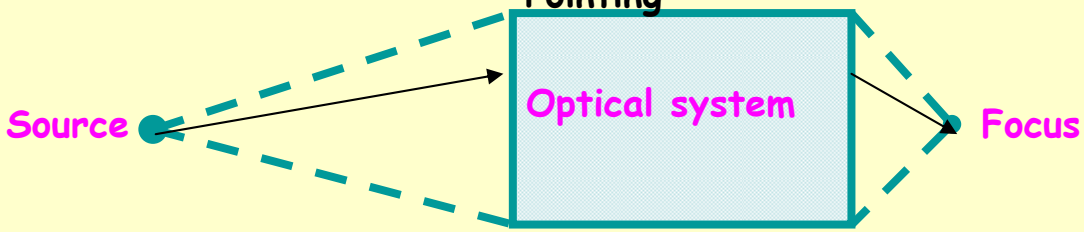
- Different longitudinal focus position
- Shot-to-shot jitter affects resolution

Transverse source position



- Affects calibration
- Shot-to-shot jitter affects resolution

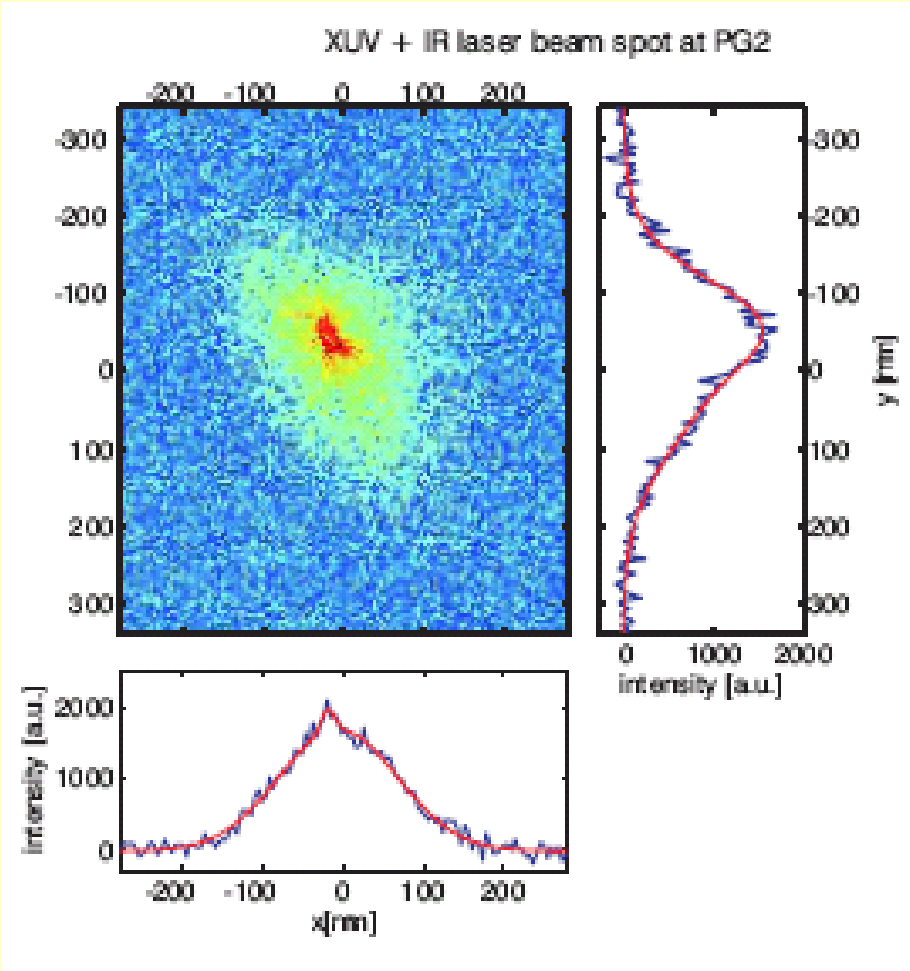
Pointing



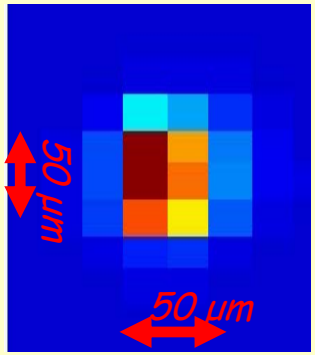
- Should be within acceptance of optics
- Aberrations

Focus at PG2

November 2006



July 2008

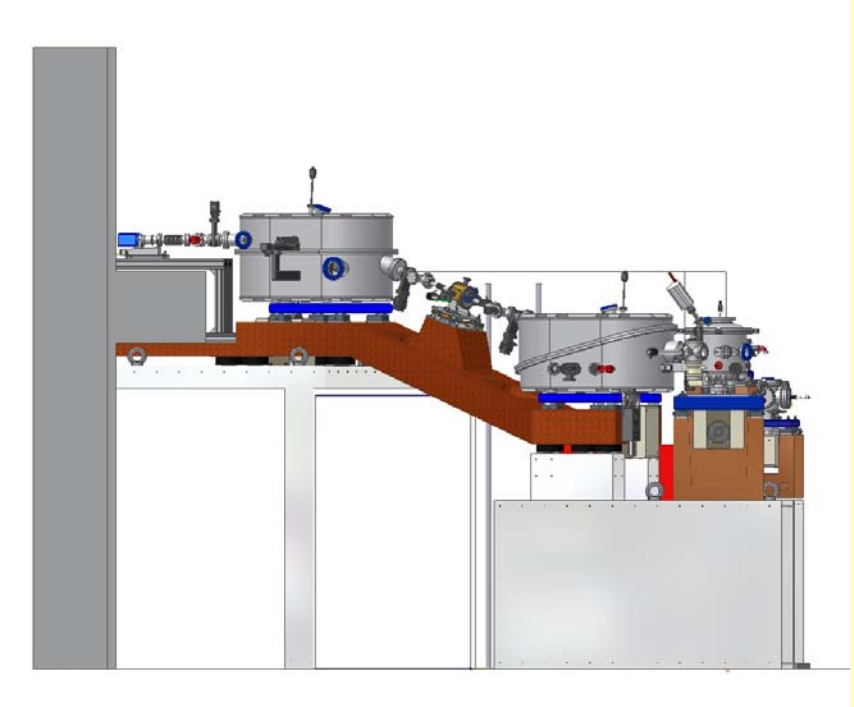


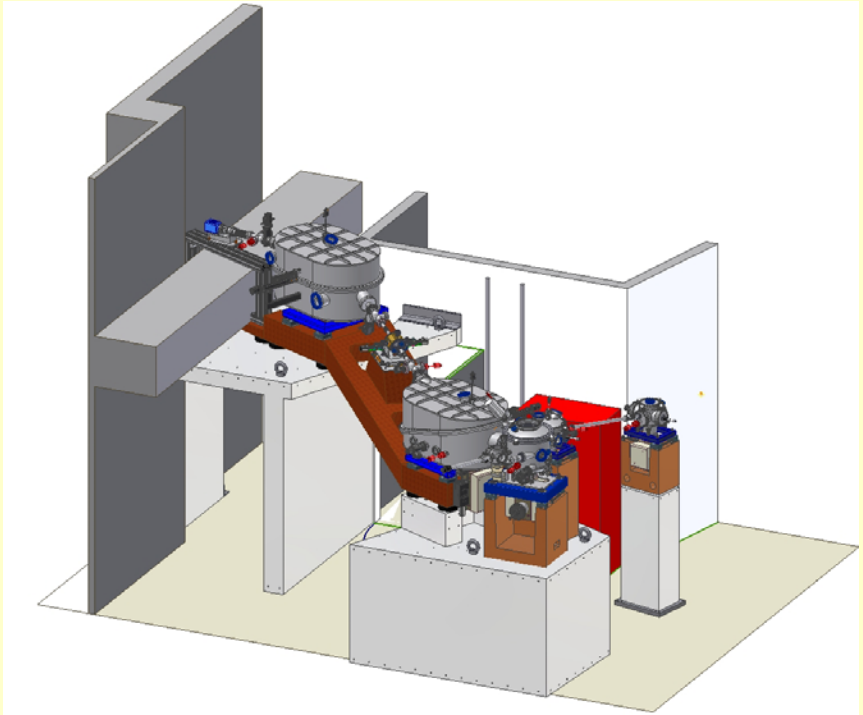
- Focus size 50 – 100 µm

VUV-Raman Instrument at FLASH (PG1)

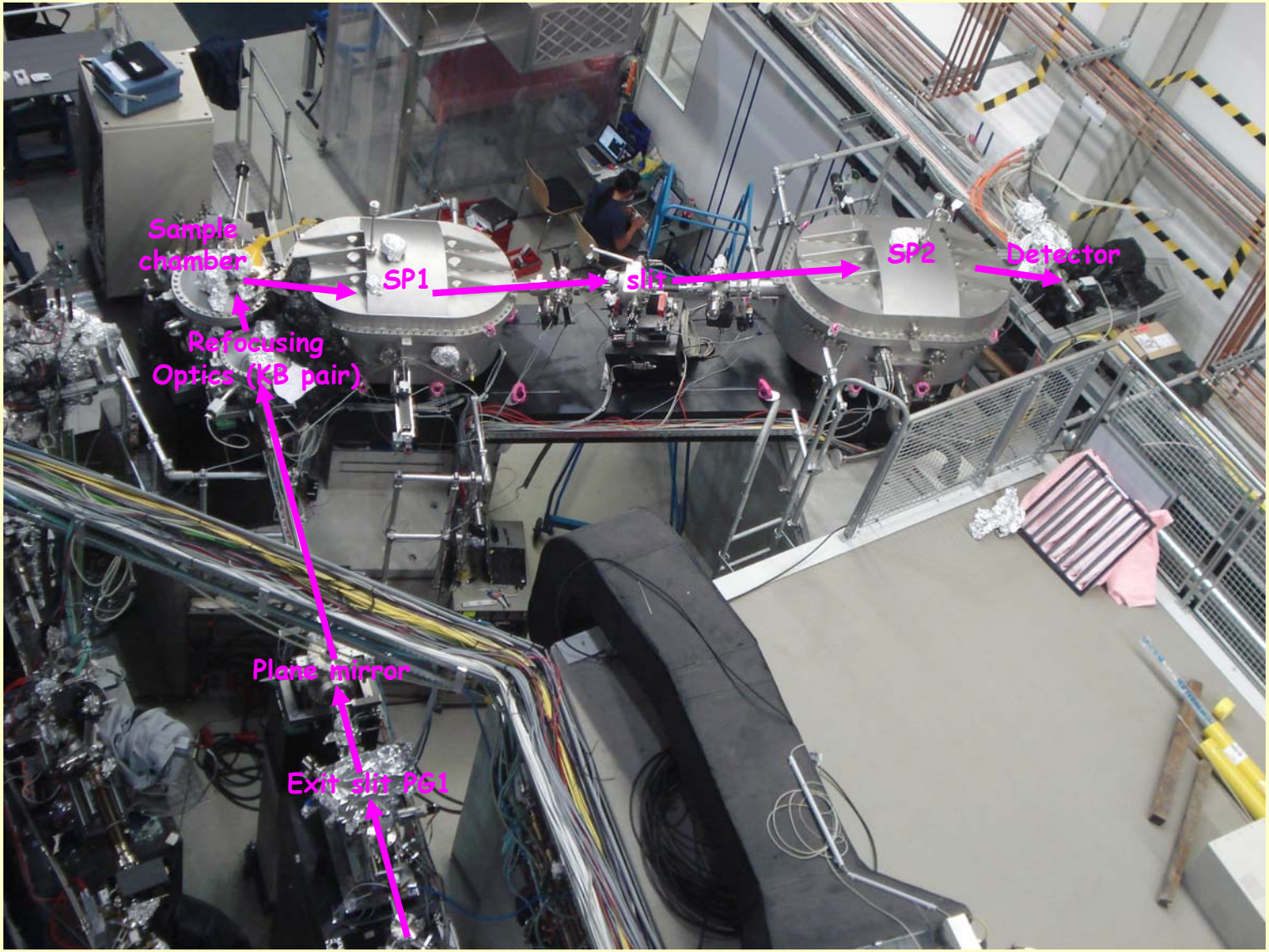
M. Rübhausen, B. Schulz, K. Buth, J. Bäckström, J. Kunze, R. Reininger, J. Nordgren, J. Söderström, J.-E. Rubensson, L. Börjesson, P.Abbamonte, S.L. Cooper, M. Martins, A. Föhlisch, W. Wurth, J. Feldhaus, J. Schneider -

High Resolution Double Monochromator at the VUV-FEL, Technical Design Report, 2004





VUV-Raman Instrument at FLASH (PG1)

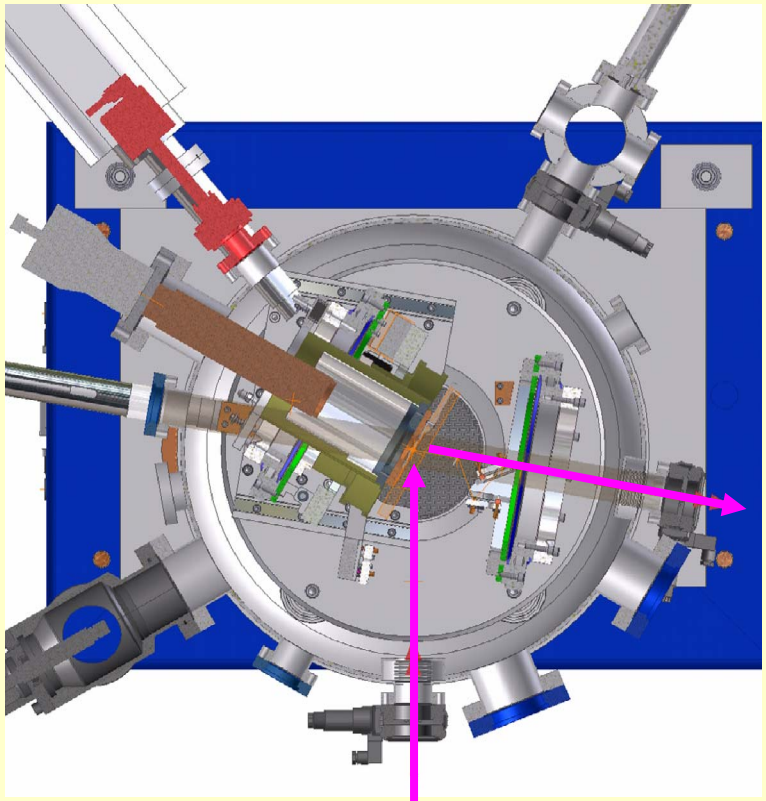


PG1

- Vacuum chambers for Raman spectrometer and refocusing optics installed – January
- Vacuum up to exit slit – May
- First commissioning with FEL up to exit slit – June
- SMU vented to make possible beam transport to PG1 - July
- Refocusing optics and optics in spectrometer installed - July
- Commissioning with FEL – August/September

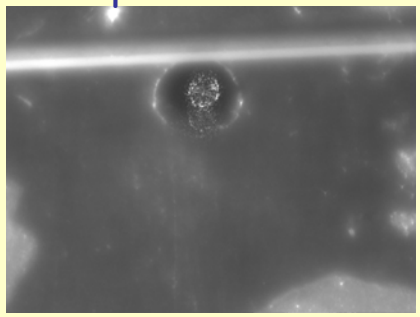
VUV-Raman Instrument at FLASH (PG1)

Sample chamber



KB-Pair demangnification: 1:4.7
Current limit on spot size: 25 um
Further improvements to below 10 um

LUPI in pinhole behind screen



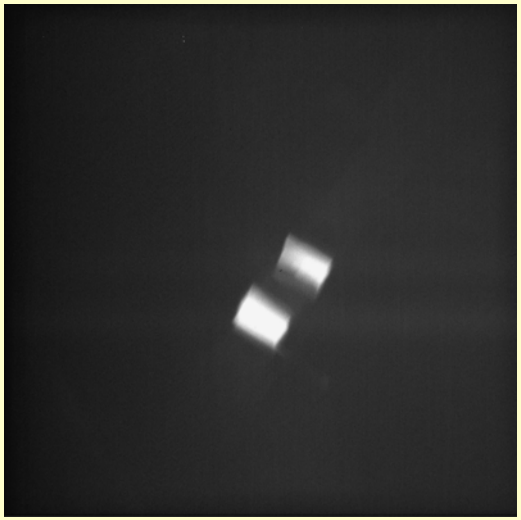
FLASH on screen (1mm slit)

FLASH on screen on top of LUPI
(0.1 mm slit)

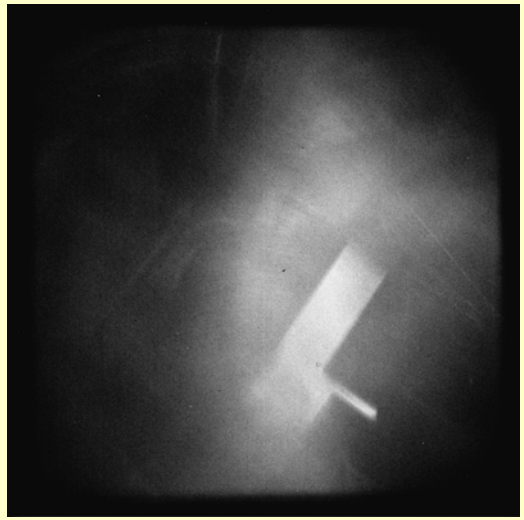
VUV-Raman Instrument at FLASH (PG1)

Energy: 129 eV, 30 uJ, 30 bunches, doped spin ladder compound

SP1 and SP2 in zeroth order



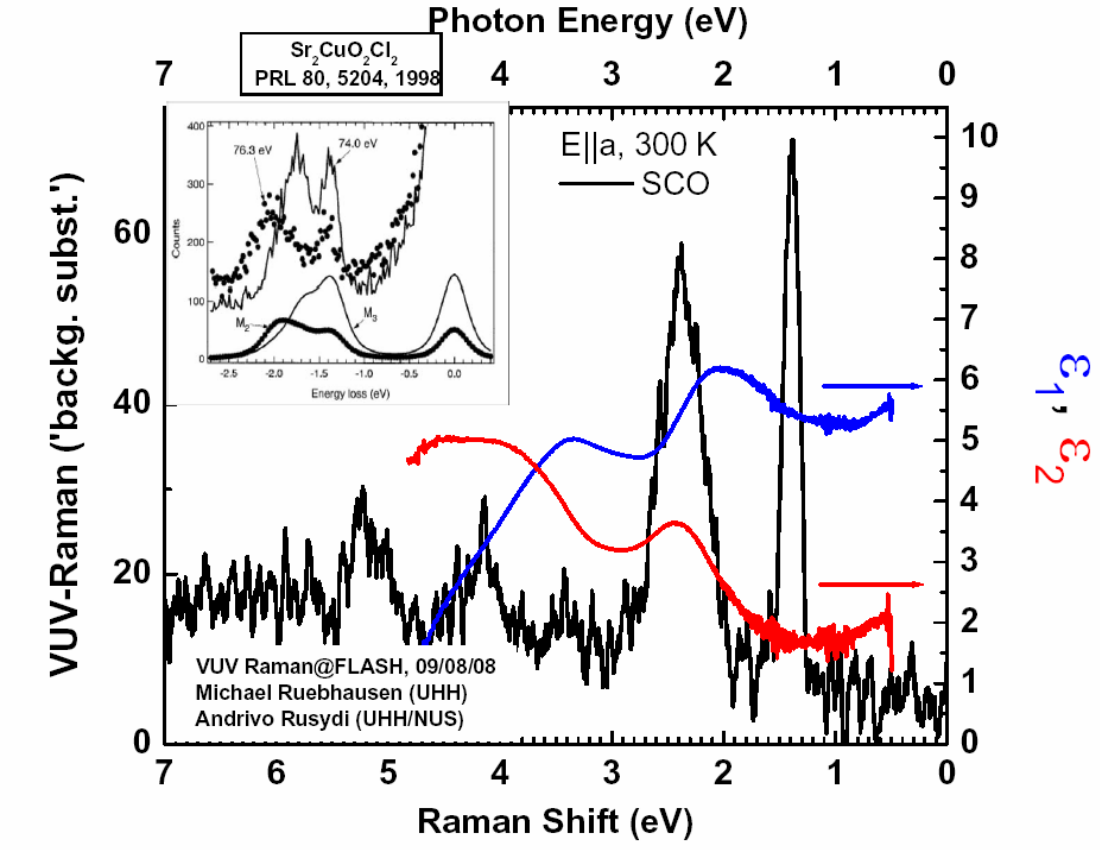
SP1 in 1'st order, SP2 in 0'th order



SP2 well aligned, SP1 needs improvements

VUV-Raman Instrument at FLASH (PG1)

Energy: 79 eV, 20 uJ, 30 bunches, SP1 in zeroth order, SP2 in first order, 500 um Slit
1200 sec. integration time, 1 accumulation, Monday 08.09 0:30



Better signal than in previous studies. Better resolution, no stray light.

want more photons, 90 bunches and more

Results

- **Resolution improved** significantly
- **Refocusing optics PG2 aligned**
- **Less time** needed for **fine alignment** of beamline for new established lasing
- **Beam** transported to **PG1 branch correctly** up to exit slit
- First steps in **alignment** of **Refocusing optics PG1** done
- **First spectra** taking at **PG1 Raman spectrometer**

Next Steps

- Look for beamline optics alignment when **no** (less) **fine realignment** for new established lasing **needed** (if possible)
- Measure **resolution** with **better magnification**
- Measure **resolution after exit slit PG2** (gas cell) for **different wavelength**.
  Investigate **longitudinal focus position** for **different wavelength**
- Look for **longitudinal focus position** at **PG1**
- **Better alignment** of **refocusing optics PG1**
- **Better alignment** of **Raman spectrometer**

Acknowledgments

- Vladimir Rybnikov, Teresa Nunez
- HASYLAB @ DESY
- AG Wurth @ University of Hamburg
- Operators

Thank you