User Experiments and Beamlines

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TTF2 Review Meeting at Salzau, January 20-22, 2003
Areas of Proposed Research


30 proposals submitted
<table>
<thead>
<tr>
<th>Experiment</th>
<th>Description</th>
<th>Energy (eV)</th>
<th>Spatial Resolution (µm)</th>
<th>Temporal Resolution (fs)</th>
<th>Temporal Range (ps)</th>
<th>Temporal Resolution (ps)</th>
<th>Temporal Range (ns)</th>
<th>Temporal Resolution (µs)</th>
<th>Temporal Range (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lebedev</td>
<td>Multiphoton Ionisation</td>
<td>28-70</td>
<td>&lt;10</td>
<td>1-20</td>
<td>&lt;50</td>
<td>1-10</td>
<td>1-100</td>
<td>1-1000</td>
<td>1-10000</td>
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<tr>
<td>Efremov</td>
<td>Single-Shot FEL Cross Correlation</td>
<td>30-70</td>
<td>3-4</td>
<td>8-20</td>
<td>30-70</td>
<td>1-2</td>
<td>1-20</td>
<td>1-200</td>
<td>1-2000</td>
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<td>Skibowski</td>
<td>FEL Radiation</td>
<td>28+14</td>
<td>1.5x1.5</td>
<td>2x5</td>
<td>0.5</td>
<td>1</td>
<td>10</td>
<td>100</td>
<td>1000</td>
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<tr>
<td>L. Kipp, R.L.</td>
<td>Scattering at the FEL Beam</td>
<td>1-20</td>
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<td>D. Schneider</td>
<td>FEL Photon Beams</td>
<td>1-20</td>
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<td>U. Becker</td>
<td>Multiphoton Ionisation</td>
<td>1-20</td>
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<tr>
<td>W. Wurth</td>
<td>Soft X-Rays with Atomic Resolution</td>
<td>1-20</td>
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<tr>
<td>K. Starke</td>
<td>Magnetisation of Films</td>
<td>1-20</td>
<td>1-2</td>
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</tbody>
</table>

Note: All experiments are run with standard operating procedures and safety measures in place.
Preferred Wavelength Range

Particular interest in energies < 20 eV:

- total: 11
- 2004: 7

TTF 2 initial range
Use of Harmonics

TTF1: 2\textsuperscript{nd} Harmonic

\begin{itemize}
\item \textbullet\hspace{2em} Intensity of 2\textsuperscript{nd} harmonic is about 0.1 \% of the fundamental
\end{itemize}

Interest in using harmonics

\begin{itemize}
\item \textbullet\hspace{2em} Average of 3100 pulses
\end{itemize}
Layout of FEL User Facility

**spot size**

<table>
<thead>
<tr>
<th>Spot Size</th>
<th>Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-5 µm</td>
<td>4</td>
</tr>
<tr>
<td>10-30 µm</td>
<td>6</td>
</tr>
<tr>
<td>100-200 µm</td>
<td>10</td>
</tr>
<tr>
<td>1-5 mm</td>
<td>4</td>
</tr>
</tbody>
</table>

**size of experimental apparatus**

<table>
<thead>
<tr>
<th>Size</th>
<th>Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>6</td>
</tr>
<tr>
<td>1.5 m²-2.5 m²</td>
<td>8</td>
</tr>
<tr>
<td>&gt;3.5 m²</td>
<td>4</td>
</tr>
</tbody>
</table>
Layout of FEL User Facility
FEL Pulse Energy Monitoring: Shot-to-Shot Fluctuations

Thermopile data

\[ 1 \text{ mV} \sim 1 \mu \text{J} \]

→ gas ionization detector
How often is a change of energy desired?

energy ranges:
- a few eV in 0.2 eV steps
- 10-20 eV
- 10-150 eV in 5 eV steps
Adjustment of FEL Intensity

- no
- 1-100%
- sever. orders of magnitude
- attenuator
- defocusing or attenuator

projects

0 1 2 3 4 5 6 7 8 9 10

no 1-100% sever. orders of magnitude attenuator defocusing or attenuator
Wavelength Calibration and Spectral Distribution

experimental spectra of TTF 1

- TTF FEL saturation
  - September, 2001

- Radiation spectrum [a.u.]
  - \( \lambda \) [nm]

- Accuracy: 1-2 %

- Projects
  - own wavelength calibration
    - high res.
    - mono.
  - spectral information useful

- Shot-to-shot
  - no
  - yes
High resolution monochromator

M. Martins et al., funded by BMBF
VLS grating spectrometer

Resolving power with 1200 l/mm grating

Ruben Reininger
Daresbury
# Pulse Properties

## Pulse Length

<table>
<thead>
<tr>
<th>&lt; 50 fs</th>
<th>100-500 fs</th>
</tr>
</thead>
<tbody>
<tr>
<td>projects</td>
<td>4</td>
</tr>
</tbody>
</table>

## Pulse Rate

### Desired Pulse Rate
- 1 Hz
- 1-10 Hz
- 10-100 Hz
- >1 KHz

### Maximum Pulse Rate
- 10 Hz
- <50 Hz
- 1-100 KHz

**projects:**
- 1 Hz: 1
- 10-100 Hz: 2
- >1 KHz: 2
- 10 Hz: 10
- <50 Hz: 0
- 1-100 KHz: 4
Allocation of Beamtime

- Shut down for maintenance and installation of large components
- LINAC driven studies
- FEL driven studies
- Dedicated FEL user time

Year:
- 2004
- 2005
- 2006
- 2007

Hours per year:
- 0
- 1000
- 2000
- 3000
- 4000
- 5000
- 6000
- 7000
- 8000

Legend:
- 9 weeks
User Beamtime

• Total beamtime requested: 98 weeks for 2004 (only one shift per day?)

• Two shifts per day: 49 weeks for 2004

• Technical projects: 6 weeks

• A1 and A2 rated groups: 22 weeks

Beamtime distribution for 2004:

• A1 groups: 2 weeks each with 1 shift per day

• A2 groups: 1 week each with 1 shift per day

=> total of 9 weeks of user beam time for 2004
Summary

- Review of VUV FEL Proposals
  - 30 proposals submitted
  - very high scientific quality

- Wide variety of requirements for FEL parameters

- Planned experiments make good use of space in experimental area of user facility

- All beamtime available for users is already filled
Areas of Proposed Research

Review of VUV FEL Proposals:
Sep. 25-27, 2002

30 proposals submitted