Industrial Applications of Synchrotron Radiation in Korea

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On behalf of the PAL Staff

Pohang Accelerator Laboratory
Outline

- **Introduction to Pohang Light Source (PLS)**
- **Three Types of Industrial Involvement**
  (PRT member, Direct use, Indirect use)
- **The PAL Industrial Technology Support Center**
- **Industrial Applications**
- **Industrial Beamlines Proposed**
- **Medical Cluster and Drug Discovery Center**
- **Future of PLS**
  - Major upgrade current PLS facility (PLS-II)
  - PLS X-FEL project
- **Summary**
Pohang Light Source
(2.5 GeV: 3rd Generation Facility)
I. PLS

- Project started: Apr. 1, 1988
- Ground-breaking: Apr. 1, 1991
- 2-GeV Linac commissioning: June 30, 1994
- Storage ring commissioning: Dec. 24, 1994
- User’s service started: Sept. 1, 1995
- 1st PLS Upgrade Complete: Nov. 1, 2002
  - Energy ramping to 2.5 GeV: Sept. 1, 2000
  - 2.5-GeV injection: Nov. 1, 2002

II. 2nd Major Upgrade of the PLS (PLS-II)

- 3.0 GeV PLS-II Upgrade begin: Jan. 2009
- 3.0 GeV PLS-II Upgrade Complete: Dec. 2011

III. PAL XFEL Proposal

- 10GeV Linac Based 0.1 nm x-ray FEL Proposal: 2009
Pohang Light Source

2.5 GeV Linac

Beam energy (GeV) 2.5
RF (MHz) 2856
Klystron power (MW), max 80
Bunch length (ps) 13
Normalized emittance (nm.mrad) 150
Beam current (A) 1
Energy spread (%), FWHM 0.6
Total length (m) 160

2.5 GeV Storage Ring

Beam energy (GeV) 2.5
Circumference(m) 280.56
Natural emittance (nm) 18.9
RF (MHz) 500.082
RF voltage (MV) 1.6
Tunes 14.28/8.18
Super-periods 12

Beamlines and Exp. Stations

28 B/L (7 IDs) 3 construction
January 2009

PLS Beamline Status

Storage Ring

Operation  
28 beamlines

Construction  
3 beamlines

* fs-THz BL : Technical Building II
Massive Increase of PLS Proposals

837 Proposals (2007)

- Materials (35%)
- Chemistry (22%)
- Mechanical Engineering (3%)
- Semiconductors (1%)

- Bio-Science (15%)
- Physics (10%)
- Process (4%)
- Medicals (4%)
- Environmental Science (4%)
- Surface Science (4%)
- Iron/Steel (1%)
- Physics (32%)
- Chemistry (36%)
- Materials (23%)
- Bio-Science (1%)

69 과제 ('96년)
Iron/Steel (1%)
Mechanical Engineering (3%)
Materials (23%)
Bio-Science (1%)
Chemistry (36%)
Physics (32%)
Summary

- More than 2,000 PLS users per year.
- Total 5,213 accumulated experiments (total 17,524 accumulated users) from 1995 opening to 2007.
- More than 20% yearly increase since Yr 2000.
Yearly Publication Statistics

Collecting '07-'08 publication statistics are still under collection.
Average Impact Factor (IF) of Publications

Impact Factor

Year of Publication

'96년 '97 '98 '99 '00 '01 '02 '03 '04 '05 '06 '07 '08
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• The PAL Industrial Technology Support Center
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• Industrial Beamlines Proposed
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• Future of PLS
  ✓ Major upgrade current PLS facility (PLS-II)
  ✓ PLS X-FEL project
• Summary
Industrial Utilizations of PLS

January 2009

Storage Ring

Operation 28 beamlines
Construction 3 beamlines

Industry Demanded Beamlines

* fs-THz BL : Technical Building II
Participating Research Teams (PRT) 
Beamlines from Korean Industry

- 1 POSCO Beamline (8C1)
- 2 Keumho Company Beamline (5C1 & 5C2)
- 1 LG Company Beamline (11B)  
  (changed to an EUV consortium beamline)
### Number of Proposals by Affiliation (2000~2007)

<table>
<thead>
<tr>
<th>Affiliation</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
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<tr>
<td>University</td>
<td>183</td>
<td>209</td>
<td>251</td>
<td>317</td>
<td>407</td>
<td>523</td>
<td>597</td>
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<td>63</td>
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<td>13</td>
<td>13</td>
<td>12</td>
<td>18</td>
<td>17</td>
<td>15</td>
<td>126</td>
</tr>
<tr>
<td>Industry</td>
<td>19 (8.0%) [16%]</td>
<td>21 (7.8%) [15.6%]</td>
<td>20 (6.5%) [13.0%]</td>
<td>21 (5.5%) [13.0%]</td>
<td>27 (5.5%) [13.0%]</td>
<td>44 (6.8%) [13.6%]</td>
<td>33 (4.6%) [14.5%]</td>
<td>48 (5.7%) [16.0%]</td>
<td>233 (6.0%) [14.3%]</td>
</tr>
<tr>
<td>Total</td>
<td>237</td>
<td>270</td>
<td>310</td>
<td>382</td>
<td>489</td>
<td>648</td>
<td>711</td>
<td>837</td>
<td>3,884</td>
</tr>
</tbody>
</table>

### Percentage of Proposals by Affiliation (2000~2007)

- University: 82%
- Research Institute: 9%
- Foreign: 3%
- Industry: 6% [14.3%] Industry including indirect use.