

An outlook of HP synchrotron research with DAC

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A few firsts – HP synchrotron

DAC experiments

- Diffraction: Buras, et al, J Appl Cryst (1977) DESY
- XAFS: Ingalls et al, PRL (1978) (SSRL)
- XES: Rueff et al, PRL (1999) (NSLS)
- IXS: Schell et al, PRL (1995) (DESY)
- NRIXS: Lübbbers et al, Science (2000) (ESRF)
- NFS: Nasu et al, High Pressure Res (1996) (Japan)

HP synchrotron techniques

- Diffraction
 - Scattering
 - Spectroscopy
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- Imaging (space)
 - Dynamics (time)

Diffraction

- Powder, widely used
 - Single crystal, under development
 - Nano-crystal, few, e.g., full PDF
 - Amorphous, active
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- Diffraction resolution, $\Delta d/d \sim 10^{-3}$ (10^{-4})
 - Intensity information, used (abused)
 - Q-coverage, typical $\sim 10 \text{ \AA}^{-1}$, (20 \AA^{-1})
 - E tunability, e.g., anomalous diffraction

Spectroscopy

- XAS (XANES, XAFS, XMCD)
 - Beginning to be used
 - High quality data
 - E down to 4 keV
- XES, RXES
 - Active
- IR
 - Unique

Scattering

- IXS, RIXS
 - Lattice dynamics: ~ 1 meV
 - Charge dynamics: 0.1 – 1 eV
- NRIXS
 - HP becomes a major component at NRIXS beamlines
- NFS
 - Synchrotron Mossbauer
- Compton Scattering
 - Becoming active

Imaging - New

- Mapping with any probes
 - Coherent x-ray diffraction
 - Radiography/tomography
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- Small beam (sub-micron)

Time-resolved - New

- Shock wave
 - Dynamic DAC
 - Pulsed heating
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- Diffraction
 - IR
 - Imaging

HP technology

- P-T generation and control
- Sample environment
- Special geometry
- X-ray windows
- Dynamics

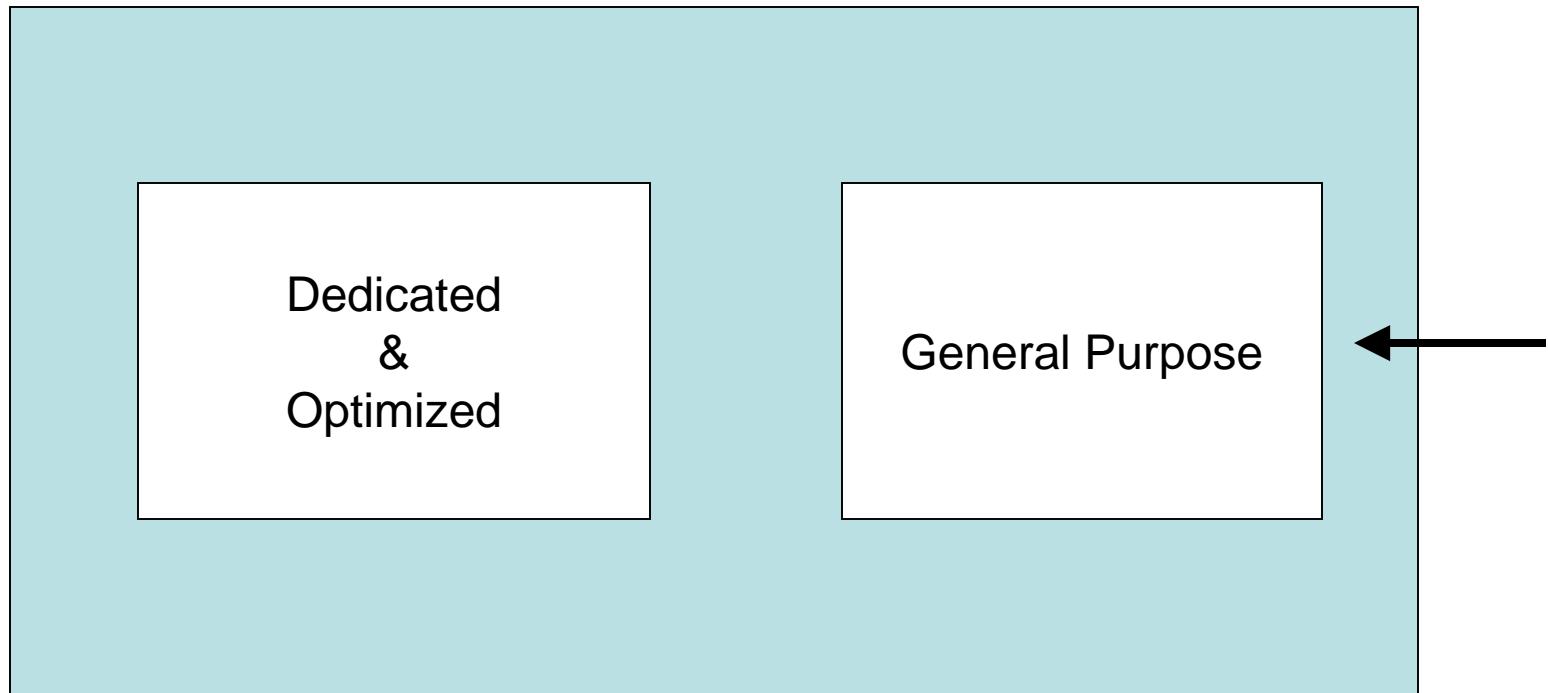
An Outlook ...

Integrated and Compatible
Dedicated and Optimized
Portable and Flexible

Operation modes of HP synchrotron facility

	Dedicated Optimized	Integrated Compatible	Portable Flexible
Cutting-edge	✓ ✓	✓	✓ ✓
Efficiency	✓ ✓	✓	✗
Productivity	✓ ✓	✓ ✓	✓
Applications	✗	✓ ✓	✓
User growth	✓ ✓	✓	✓
User community	✗	✓ ✓	✓
Operation	✓ ✓	✗	✗
Staffing	✓ ✓	✗	✗
Budget	✓	✗	✓ ✓

Dedicated and optimized



Portable systems

- X-ray focusing device
- Ruby/Raman
- Laser heating
- Cryostat
- Collimation
- Precise sample stages
- Detectors

For discussion

- Scientific disciplines
- High P - T vessels
- Analytic probes