APS Source Parameters

Undulator A
Period: 3.30 cm
Length: 2.4 m
K_{max}: 2.74 (effective; at minimum gap)
Minimum gap: 10.5 mm
Tuning range: 3.0-13.0 keV (1st harmonic)
3.0-45.0 keV (1st-5th harmonic)
On-axis peak brilliance:
4.6×10^{19} ph/s/mrad^2/mm^2/0.1%bw at 7 keV
Source size and divergence at 8.0 keV:
Σ_x: 273 µm Σ_y: 10 µm
$\Sigma_{x'}$: 12.6 µrad $\Sigma_{y'}$: 6.6 µrad

2.70-cm Undulator (sector 3)
Period: 2.70 cm
Length: 2.4 m
K_{max}: 2.18 (effective; at minimum gap)
Minimum gap: 8.5 mm
Tuning range: 5.1-16.0 keV (1st harmonic)
5.1-60.0 keV (1st-5th harmonic)
On-axis peak brilliance:
6.4×10^{19} ph/s/mrad^2/mm^2/0.1%bw at 8 keV
Source size and divergence at 8.0 keV:
Σ_x: 273 µm Σ_y: 10 µm
$\Sigma_{x'}$: 12.6 µrad $\Sigma_{y'}$: 6.6 µrad

5.50-cm Undulator (sector 2)
Period length: 5.50 cm
Length: 2.4 m
K_{max}: 6.57 (effective; at minimum gap)
Minimum gap: 10.5 mm
Tuning range: 0.4-7.0 keV (1st harmonic)
0.4-25.0 keV (1st-5th harmonic)
On-axis peak brilliance:
1.9×10^{19} ph/s/mrad^2/mm^2/0.1%bw at 4 keV
Source size and divergence at 4.0 keV:
Σ_x: 273 µm Σ_y: 10 µm
$\Sigma_{x'}$: 13.8 µrad $\Sigma_{y'}$: 8.7µrad

APS Bending Magnet
Critical energy: 19.51 keV
Energy range: 1-100 keV
On-axis peak brilliance:
5.6×10^{15} ph/s/mrad^2/mm^2/0.1%bw at 16.3 keV
On-axis peak angular flux:
9.6×10^{13} ph/s/mrad^2/0.1%bw at 16.3 keV
On-axis peak horizontal angular flux:
1.6×10^{13} ph/s/mradh/0.1%bw at 5.6 keV
Source size and divergence at the critical energy:
Σ_x: 91 µm Σ_y: 30 µm
$\Sigma_{x'}$: 6 mrad $\Sigma_{y'}$: 47 µrad

Circularly Polarized Undulator (sector 4)
Period: 12.8 cm
Length: 2.1 m

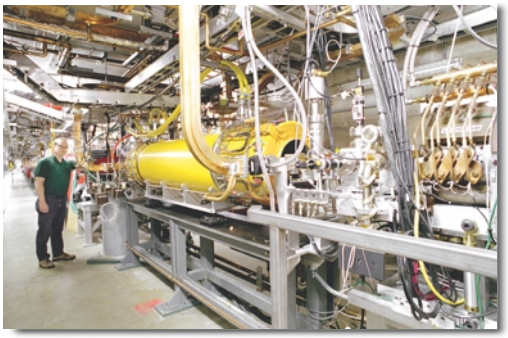
Circular mode:
K_{max}: 2.65 (effective; for both horizontal and vertical fields at maximum currents 1.2 kA horizontal and 0.34 kA vertical)
B_{max}: 0.26 T (peak fields)
Tuning range: 0.5-3.0 keV (1st harmonic)
On-axis peak circular brilliance:
3.4×10^{18} ph/s/mrad^2/mm^2/0.1%bw at 1.8 keV

Linear mode:
K_{max}: 2.80 (effective; for both horizontal and vertical fields at maximum currents 1.4 kA horizontal and 0.40 kA vertical)
B_{max}: 0.29 T (peak fields)
Tuning range: 0.8-3.0 keV (1st harmonic)
0.8-10.0 keV (1st-5th harmonic)
On-axis peak linear brilliance:
2.5×10^{18} ph/s/mrad^2/mm^2/0.1%bw at 2.1 keV

Switching frequency: 0-5 Hz
Switching rise time: 20 ms
Source size and divergence at 1.5 keV:
Σ_x: 273 µm Σ_y: 10µm
$\Sigma_{x'}$: 17.9 µrad $\Sigma_{y'}$: 14.4 µrad

Elliptical Multipole Wiggler (sector 11)
Period length: 16.0 cm
Number of poles: 34 permanent magnets,
36 electromagnets
Length: 2.8 m
$K_{x\text{-}max}$: 1.3 (effective; at maximum current 1.15 kA)
$K_{y\text{-}max}$: 14.4 (peak; at minimum gap 24.0 mm)
Switching frequency: 0-10 Hz
Critical energy: 31.4 keV (at minimum gap)
Energy range: 5-200 keV
Source size and divergence at the critical energy:
Σ_x: 273 µm Σ_y: 10 µm
$\Sigma_{x'}$: 820 µrad (FWHM 1.9 mrad; non-Gaussian; linear mode)
$\Sigma_{y'}$: 47 µrad (linear mode)

Typical APS Machine Operations Parameters



Linac

Frequency	2.856 GHz
Modulator pulse rep rate	30 Hz
Gun rep rate (1-5 pulses, 33.4 ms apart every .5 sec)	2-10 Hz
Beam pulse length	8-17 ns
Bunch length	1-10 ps FWHM
Output energy	325 MeV
Output beam charge	3 nC (max.)
Normalized emittance (mm mrad)	10 π nm mrad

Injector Synchrotron (Booster)

Circumference	368.0 m
Ramping rep rate	2 Hz
Radio frequency	351.930 MHz
Lattice structure	10 FODO cells/quadrant
Nominal extraction energy	7.0 GeV
Injection energy	325 MeV

Storage Ring System

Circumference	1104 m
Revolution frequency	272 kHz
Radio frequency	351.930 MHz
Nominal energy	7.0 GeV
Number of periods in lattice	40
Length available for insertion device	5.0 m
Nominal circulating current, multibunch	100 mA
Natural emittance	2.5×10^{-9} nm-rad

APS BEAMLINE GUIDE*

Source: http://beam.aps.anl.gov/pls/apsweb/bd_display_pkg.beamline_dir

(KEY: UA = 3.3 Undulator A; BM = Bending Magnet; CPU = Circularly Polarized Undulator; EMW = Elliptical Multipole Wiggler; GU = Accepting General Users)

Beamline		SCTR.	Discipline	Supported Techniques	Source	Status
1-BM	XOR	Physics, Materials Sci.	Powder diffraction Reflectivity	BM	Operational/GU	
1-ID	XOR	Materials Sci., Physics	Phase contrast imaging High-energy x-ray scattering	UA	Operational/GU	
2-BM	XOR	Physics, Life Sci.	Phase contrast imaging Tomography Microdiffraction General diffraction	BM	Operational/GU	
2-ID-B	XOR	Physics	Microfluorescence Phase contrast imaging Coherent x-ray scattering	5.5 Undulator	Operational/GU	
2-ID-D	XOR	Life Sci., Materials Sci.	Microfluorescence Microdiffraction Microprobe	UA	Operational/GU	
2-ID-E	XOR	Life Sci., Enviro. Sci.	Microfluorescence Imaging: X-ray fluorescence	UA	Operational/GU	
3-ID	XOR	Physics	Inelastic scattering Nuclear resonant scattering	2.7 Undulator	Operational/GU	
4-ID-C	XOR	Physics, Materials Sci.	Photoemission electron microscopy Photoemission spectroscopy X-ray magnetic circular dichroism Magnetic x-ray scattering	CPU	Operational/GU	
4-ID-D	XOR	Physics	X-ray magnetic circular dichroism Anomalous and resonant scattering Magnetic x-ray scattering	UA	Operational/GU	
5-BM-C	DND-CAT	Materials Sci., Polymer Sci.	Tomography Powder diffraction	BM	Operational/GU	
5-BM-D	DND-CAT	Materials Sci., Polymer Sci.	X-ray absorption fine structure High-energy x-ray scattering Polymer	BM	Operational/GU	
5-ID	DND-CAT	Materials Sci., Polymer Sci.	Macromolecular crystallography Powder diffraction Small-angle x-ray scattering X-ray optics development Polymer Inorganic crystallography	UA	Operational/GU	
6-ID	MU-CAT	Materials Sci.	Liquid scattering Magnetic x-ray scattering Powder diffraction Surface diffraction Liquid and solid surface scattering	UA	Operational/GU	
6-ID-D	MU-CAT	Materials Sci.	High-energy x-ray scattering Magnetic x-ray scattering Powder diffraction Time-resolved x-ray scattering	UA	Operational/GU	
7-ID	MHATT/XOR	Materials Sci.	Intensity fluctuation spectroscopy Time-resolved x-ray scattering Microprobe General diffraction	UA	Operational/GU	
8-BM	NE-CAT	Life Sci.	Macromolecular crystallography Multiwavelength anomalous dispersion	BM	Commissioning	

*As of 4.01.04

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Beamline		SCTR.	Discipline	Supported Techniques	Source	Status
8-ID	IMMY/XOR	Materials Sci.	Coherent x-ray scattering Small-angle x-ray scattering Time-resolved x-ray scattering Wide-angle x-ray scattering	UA	Operational/GU	
9-BM	CMC-CAT	Materials Sci.	X-ray absorption fine structure Surface diffraction General diffraction	BM	Commissioning	
9-ID	CMC-CAT	Materials Sci.	X-ray absorption fine structure Liquid scattering Magnetic x-ray scattering Small-angle x-ray scattering General diffraction	UA	Operational/GU	
10-ID	MR-CAT	Materials Sci., Enviro. Sci.	X-ray absorption fine structure microscopy X-ray absorption fine structure Diffraction anomalous fine structure	UA	Operational/GU	
11-ID-B	BESSRC/XOR	Materials Sci., GeoSci.	High-energy x-ray scattering	EMW	Operational/GU	
11-ID-C	BESSRC/XOR	Materials Sci., GeoSci.	High-energy x-ray scattering	EMW	Operational/GU	
11-ID-D	BESSRC/XOR	Materials Sci., GeoSci. General diffraction	X-ray absorption fine structure	EMW	Operational/GU	
12-BM	BESSRC/XOR	Materials Sci., GeoSci.	X-ray absorption fine structure Powder diffraction General diffraction	BM	Operational/GU	
12-ID	BESSRC/XOR	Materials Sci., Physics	Intensity fluctuation spectroscopy Photoemission spectroscopy Small-angle x-ray scattering	UA	Operational/GU	
13-BM	CARS-CAT	GeoSci., Enviro. Sci.	Tomography X-ray absorption fine structure Fluorescence spectroscopy Microprobe General diffraction Diamond anvil cell Multi anvil press	BM	Operational/GU	
13-ID	CARS-CAT	GeoSci., Enviro. Sci.	X-ray absorption fine structure Fluorescence spectroscopy Microdiffraction Surface diffraction Microprobe General diffraction Diamond anvil cell Multi anvil press	UA	Operational/GU	
14-BM-C	CARS-CAT	Life Sci.	Macromolecular crystallography Microdiffraction Time-resolved x-ray scattering	BM	Operational/GU	
14-BM-D	CARS-CAT	Life Sci.	Macromolecular crystallography Microdiffraction Time-resolved x-ray scattering	BM	Operational/GU	
14-ID	CARS-CAT	Life Sci.	Macromolecular crystallography Microdiffraction Multiwavelength anomalous dispersion Time-resolved x-ray scattering Laue crystallography	UA	Operational/GU	

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Beamline		SCTR.	Discipline	Supported Techniques	Source	Status
15-ID	CARS-CAT	Materials Sci., Chemistry	Anomalous and resonant scattering Liquid scattering Time-resolved x-ray scattering Wide-angle x-ray scattering Microcrystallography Liquid and solid surface scattering	UA	Operational/GU	
16-BM	HP-CAT	Materials Sci., GeoSci.	X-ray absorption fine structure Anomalous and resonant scattering Powder diffraction Single-crystal diffraction	BM	Construction	
16-ID-B	HP-CAT	Materials Sci., GeoSci.	X-ray absorption fine structure Compton scattering Inelastic scattering Microdiffraction Nuclear resonant scattering Powder diffraction Diamond anvil cell	UA	Operational/GU	
16-ID-D	HP-CAT	Materials Sci., GeoSci.	X-ray absorption fine structure Compton scattering Inelastic scattering Microdiffraction Nuclear resonant scattering Powder diffraction Diamond anvil cell	UA	Commissioning	
17-BM	IMCA-CAT	Life Sci.	Macromolecular crystallography Multiwavelength anomalous dispersion	BM	Commissioning	
17-ID	IMCA-CAT	Life Sci.	Macromolecular crystallography Multiwavelength anomalous dispersion	UA	Operational/GU	
18-ID	Bio-CAT	Life Sci.	X-ray absorption fine structure Fluorescence spectroscopy Small-angle x-ray scattering Time-resolved x-ray scattering General diffraction	UA	Operational/GU	
19-BM	SBC-CAT	Life Sci.	Macromolecular crystallography Multiwavelength anomalous dispersion	BM	Operational/GU	
19-ID	SBC-CAT	Life Sci.	Macromolecular crystallography Multiwavelength anomalous dispersion	UA	Operational/GU	
20-BM	PNC/XOR	Materials Sci., Enviro. Sci.	X-ray absorption fine structure Diffraction anomalous fine structure	BM	Operational/GU	
20-ID	PNC/XOR	Materials Sci., Enviro. Sci.	X-ray absorption fine structure microscopy Microfluorescence X-ray absorption fine structure Diffraction anomalous fine structure Microprobe General diffraction	UA	Operational/GU	
22-BM	SER-CAT	Life Sci.	Macromolecular crystallography	BM	Operational	
22-ID	SER-CAT	Life Sci.	Macromolecular crystallography Multiwavelength anomalous dispersion	UA	Operational	
31-ID	SGX-CAT	Life Sci.	Macromolecular crystallography	UA	Operational	
32-ID	COM-CAT	Materials Sci.	X-ray absorption fine structure Powder diffraction Single-crystal diffraction Small-angle x-ray scattering	UA	Operational	

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Beamline		SCTR.	Discipline	Supported Techniques	Source	Status
33-BM	UNI-CAT	Materials Sci.	Topography X-ray absorption fine structure General diffraction	BM	Operational	
33-ID	UNI-CAT	Materials Sci.	Anomalous and resonant scattering Inelastic scattering Small-angle x-ray scattering Surface diffraction Ultrasmall angle x-ray scattering General diffraction	UA	Operational/GU	
34-ID	UNI-CAT	Materials Sci.	Coherent x-ray scattering Microdiffraction Microprobe	UA	Operational/GU	

APS Techniques Directory*

Source: http://beam.aps.anl.gov/pls/apsweb/bd_display_pkg.technique_dir

Technique	Beamline
Absorption/Spectroscopy	
Fluorescence spectroscopy	13-BM, 13-ID, 18-ID
Intensity fluctuation spectroscopy	12-ID, 7-ID
Photoemission spectroscopy	12-ID, 4-ID-C
X-ray absorption fine structure	10-ID, 11-ID-D, 12-BM, 13-BM, 13-ID, 16-ID-B, 18-ID, 20-BM, 20-ID, 5-BM-D, 9-ID
X-ray magnetic circular dichroism	4-ID-C, 4-ID-D
High Pressure	
Diamond Anvil Cell	13-BM, 13-ID, 16-ID-B
Multi-Anvil Press	13-BM, 13-ID
Imaging	
X-ray absorption fine structure microscopy	10-ID, 20-ID
Microfluorescence	2-ID-B, 2-ID-D, 2-ID-E, 20-ID
Microprobe	13-BM, 13-ID, 2-ID-D, 20-ID, 34-ID, 7-ID
Phase contrast imaging	1-ID, 2-BM, 2-ID-B
Photoemission electron microscopy	4-ID-C
Tomography	13-BM, 2-BM, 5-BM-C
Protein Crystallography	
Macromolecular crystallography	14-BM-C, 14-BM-D, 14-ID, 17-ID, 19-BM, 19-ID, 5-ID
Multiwavelength anomalous dispersion	14-BM-D, 14-ID, 17-ID, 19-BM, 19-ID
Scattering	
Anomalous and resonant scattering	15-ID, 33-ID, 4-ID-D
Coherent x-ray scattering	2-ID-B, 34-ID, 8-ID
Compton Scattering	16-ID-B
Diffraction anomalous fine structure	10-ID, 20-BM, 20-ID
General diffraction	11-ID-D, 12-BM, 13-BM, 13-ID, 18-ID, 2-BM, 20-BM, 20-ID, 33-ID, 7-ID, 9-ID
High-energy x-ray scattering	1-ID, 11-ID-B, 11-ID-C, 5-BM-D, 6-ID-D
Inelastic scattering	16-ID-B, 3-ID, 33-ID
Liquid scattering	15-ID, 6-ID, 9-ID
Magnetic x-ray scattering	4-ID-C, 4-ID-D, 6-ID, 6-ID-D, 9-ID
Microdiffraction	13-ID, 14-BM-C, 14-BM-D, 14-ID, 16-ID-B, 2-BM, 2-ID-D, 34-ID
Nuclear resonant scattering	16-ID-B, 3-ID
Polymer	5-BM-D, 5-ID
Powder diffraction	1-BM, 12-BM, 16-ID-B, 5-BM-C, 5-ID, 6-ID, 6-ID-D
Reflectivity	1-BM
Small-angle x-ray scattering	12-ID, 18-ID, 33-ID, 5-ID, 8-ID, 9-ID
Surface diffraction	13-ID, 33-ID, 6-ID
Time-resolved x-ray scattering	14-BM-C, 14-BM-D, 14-ID, 15-ID, 18-ID, 6-ID-D, 7-ID, 8-ID
Ultrasmall-angle x-ray scattering	33-ID
Wide-angle x-ray scattering	15-ID, 8-ID
Miscellaneous	
X-ray optics development	

**as of 4.01.04*

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