



Full wwPDB X-ray Structure Validation Report ⓘ

Apr 19, 2026 – 12:11 AM UTC

PDB ID : 5LL9 / pdb_00005ll9
Title : Crystal structure of human carbonic anhydrase isozyme XII with 4-(1H-benzimidazol-1-ylacetyl)-2-chlorobenzenesulfonamide
Authors : Smirnov, A.; Manakova, E.; Grazulis, S.
Deposited on : 2016-07-27
Resolution : 1.45 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

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A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

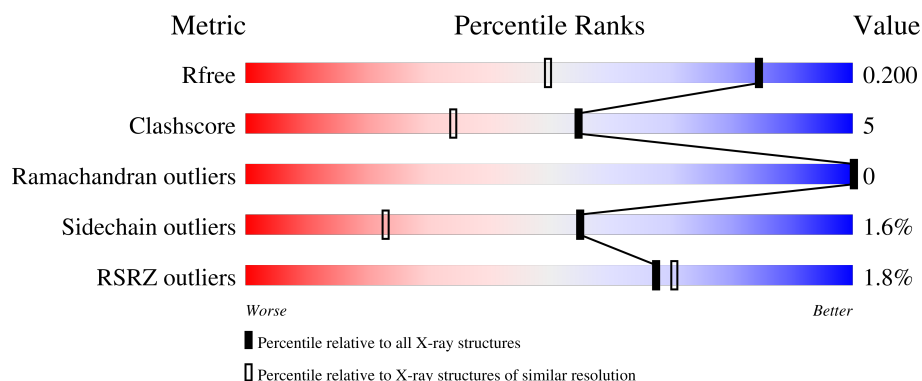
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.45 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	180053	1756 (1.46-1.46)
Clashscore	190562	1795 (1.46-1.46)
Ramachandran outliers	187476	1776 (1.46-1.46)
Sidechain outliers	187428	1776 (1.46-1.46)
RSRZ outliers	180081	1756 (1.46-1.46)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions $\leq 5\%$. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	263	2% 80% 17% ..
1	B	263	2% 83% 14% ..
1	C	263	4% 84% 14% ..
1	D	263	85% 14% ..

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 9959 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called Carbonic anhydrase 12.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	261	Total	C	N	O	S	0	6	0
			2142	1360	363	411	8			
1	B	261	Total	C	N	O	S	0	4	0
			2130	1350	364	409	7			
1	C	261	Total	C	N	O	S	0	10	0
			2178	1383	374	413	8			
1	D	261	Total	C	N	O	S	0	5	0
			2143	1359	365	412	7			

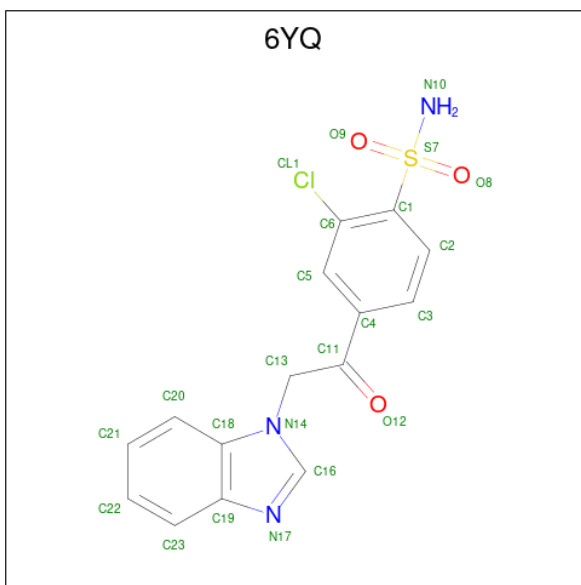
There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	MET	-	initiating methionine	UNP O43570
B	1	MET	-	initiating methionine	UNP O43570
C	1	MET	-	initiating methionine	UNP O43570
D	1	MET	-	initiating methionine	UNP O43570

- Molecule 2 is ZINC ION (CCD ID: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	1	Total	Zn	0	0
			1	1		
2	B	1	Total	Zn	0	0
			1	1		
2	C	1	Total	Zn	0	0
			1	1		
2	D	1	Total	Zn	0	0
			1	1		

- Molecule 3 is 4-[2-(benzimidazol-1-yl)ethanoyl]-2-chloranyl-benzenesulfonamide (CCD ID: 6YQ) (formula: C₁₅H₁₂ClN₃O₃S).



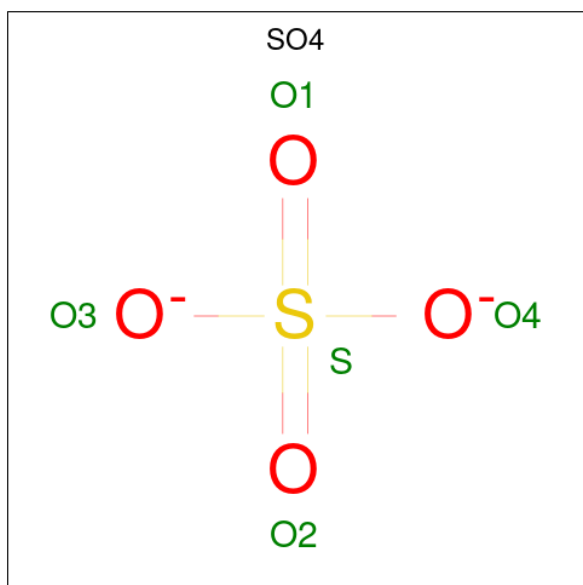
Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
3	A	1	Total 23	C 15	Cl 1	N 3	O 3	S 1	0	0
3	B	1	Total 23	C 15	Cl 1	N 3	O 3	S 1	0	0
3	C	1	Total 23	C 15	Cl 1	N 3	O 3	S 1	0	0
3	D	1	Total 23	C 15	Cl 1	N 3	O 3	S 1	0	0

- Molecule 4 is 1,2-ETHANEDIOL (CCD ID: EDO) (formula: C₂H₆O₂).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	1	Total C O 4 2 2	0	0
4	A	1	Total C O 4 2 2	0	0
4	A	1	Total C O 4 2 2	0	0
4	A	1	Total C O 4 2 2	0	0
4	B	1	Total C O 4 2 2	0	0
4	B	1	Total C O 4 2 2	0	0
4	C	1	Total C O 4 2 2	0	0
4	C	1	Total C O 4 2 2	0	0
4	D	1	Total C O 4 2 2	0	0
4	D	1	Total C O 4 2 2	0	0
4	D	1	Total C O 4 2 2	0	0

- Molecule 5 is SULFATE ION (CCD ID: SO4) (formula: O₄S).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	B	1	Total O S 5 4 1	0	0

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	C	1	Total	O	S	0	0
			5	4	1		
5	D	1	Total	O	S	0	0
			5	4	1		

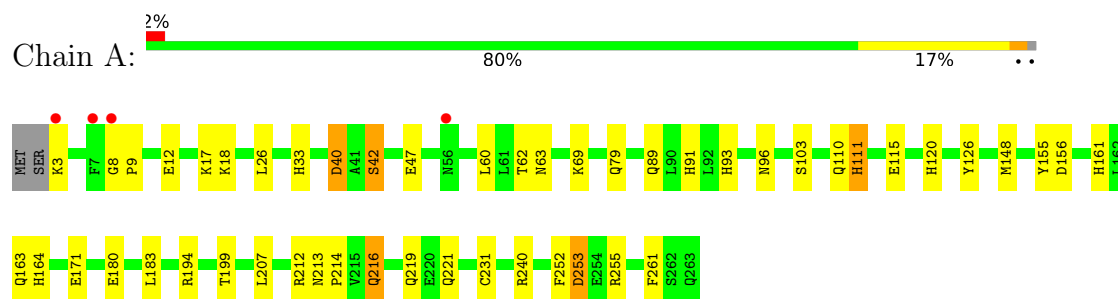
- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	277	Total	O	0	0
			277	277		
6	B	334	Total	O	0	0
			334	334		
6	C	276	Total	O	0	0
			276	276		
6	D	324	Total	O	0	0
			324	324		

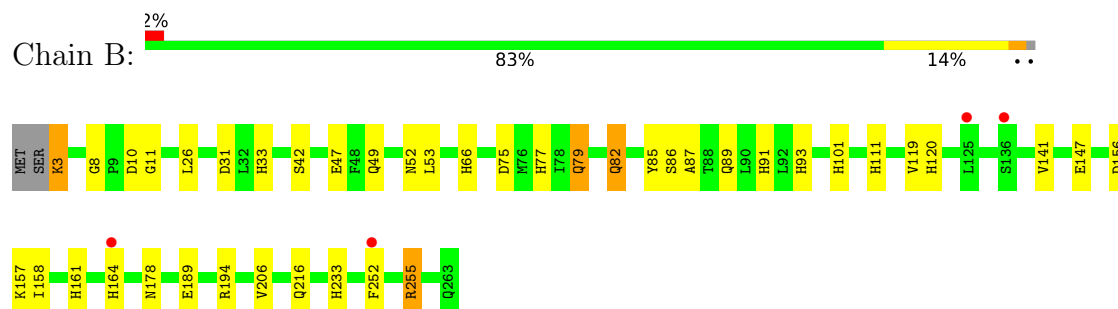
3 Residue-property plots

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density ($RSRZ > 2$). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

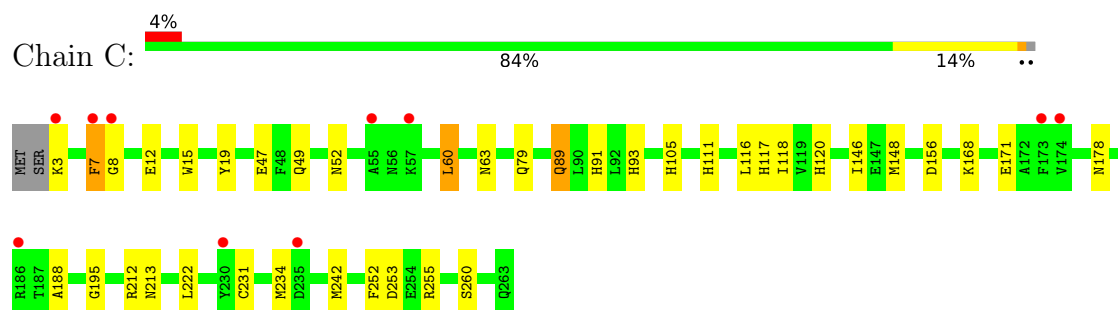
• Molecule 1: Carbonic anhydrase 12



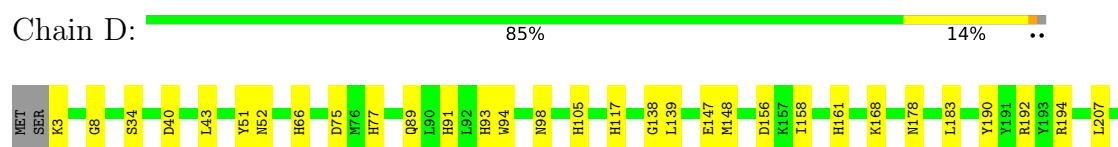
• Molecule 1: Carbonic anhydrase 12

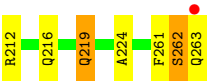


• Molecule 1: Carbonic anhydrase 12



• Molecule 1: Carbonic anhydrase 12





4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	77.30Å 73.89Å 91.28Å 90.00° 108.76° 90.00°	Depositor
Resolution (Å)	73.19 – 1.45 73.19 – 1.45	Depositor EDS
% Data completeness (in resolution range)	99.0 (73.19-1.45) 99.0 (73.19-1.45)	Depositor EDS
R_{merge}	0.04	Depositor
R_{sym}	0.04	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.80 (at 1.45Å)	Xtriage
Refinement program	REFMAC 5.6.0117	Depositor
R, R_{free}	0.171 , 0.204 0.167 , 0.200	Depositor DCC
R_{free} test set	16964 reflections (9.86%)	wwPDB-VP
Wilson B-factor (Å ²)	13.4	Xtriage
Anisotropy	0.283	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 36.0	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.97	EDS
Total number of atoms	9959	wwPDB-VP
Average B, all atoms (Å ²)	17.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 47.48 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 9.8578e-05. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality i

5.1 Standard geometry i

Bond lengths and bond angles in the following residue types are not validated in this section: SO4, 6YQ, EDO, ZN

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	# Z >5	RMSZ	# Z >5
1	A	1.57	17/2206 (0.8%)	1.34	10/3004 (0.3%)
1	B	1.64	20/2193 (0.9%)	1.37	10/2985 (0.3%)
1	C	1.59	17/2243 (0.8%)	1.28	4/3050 (0.1%)
1	D	1.63	23/2206 (1.0%)	1.35	2/3001 (0.1%)
All	All	1.61	77/8848 (0.9%)	1.34	26/12040 (0.2%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	D	0	1

All (77) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	117	HIS	ND1-CE1	13.25	1.45	1.32
1	D	77	HIS	ND1-CE1	8.77	1.41	1.32
1	D	117	HIS	ND1-CE1	8.26	1.40	1.32
1	D	66	HIS	ND1-CE1	8.04	1.40	1.32
1	D	91	HIS	CE1-NE2	7.83	1.40	1.32
1	B	85	TYR	CA-C	-7.49	1.43	1.52
1	C	146	ILE	N-CA	7.49	1.55	1.46
1	B	120	HIS	CE1-NE2	7.48	1.40	1.32
1	B	91	HIS	CE1-NE2	7.34	1.39	1.32
1	B	101	HIS	ND1-CE1	7.30	1.39	1.32
1	A	120	HIS	CG-CD2	7.30	1.43	1.35
1	A	93	HIS	ND1-CE1	7.07	1.39	1.32
1	A	96	ASN	N-CA	7.04	1.53	1.46
1	B	91	HIS	CG-CD2	6.92	1.43	1.35

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	D	105	HIS	ND1-CE1	6.88	1.39	1.32
1	C	93	HIS	ND1-CE1	6.87	1.39	1.32
1	D	194	ARG	N-CA	6.82	1.54	1.46
1	A	33	HIS	ND1-CE1	6.73	1.39	1.32
1	A	91	HIS	ND1-CE1	6.62	1.39	1.32
1	B	8	GLY	N-CA	6.42	1.53	1.44
1	B	87	ALA	N-CA	6.34	1.53	1.46
1	A	216	GLN	CA-C	-6.34	1.44	1.52
1	A	120	HIS	CE1-NE2	6.33	1.38	1.32
1	D	93	HIS	N-CA	6.30	1.53	1.46
1	C	188	ALA	CA-C	6.22	1.61	1.52
1	D	139	LEU	N-CA	6.18	1.53	1.45
1	B	11	GLY	N-CA	6.14	1.52	1.45
1	C	118	ILE	C-O	6.13	1.30	1.24
1	A	33	HIS	CG-CD2	6.13	1.42	1.35
1	B	93	HIS	CD2-NE2	6.00	1.44	1.37
1	D	77	HIS	CG-CD2	5.95	1.42	1.35
1	B	189	GLU	C-O	5.94	1.31	1.24
1	D	91	HIS	CG-CD2	5.89	1.42	1.35
1	B	33	HIS	ND1-CE1	5.89	1.38	1.32
1	A	111	HIS	CE1-NE2	5.87	1.38	1.32
1	D	40	ASP	CA-C	-5.86	1.45	1.52
1	A	126	TYR	CA-CB	5.84	1.62	1.54
1	A	40	ASP	C-O	-5.81	1.17	1.24
1	A	115	GLU	C-O	5.78	1.30	1.23
1	B	141	VAL	C-O	5.77	1.29	1.24
1	C	19	TYR	C-O	5.76	1.31	1.24
1	B	255	ARG	CA-C	5.75	1.60	1.52
1	C	105	HIS	ND1-CE1	5.66	1.38	1.32
1	D	34	SER	N-CA	5.63	1.53	1.46
1	B	161	HIS	CE1-NE2	5.61	1.38	1.32
1	C	120	HIS	N-CA	5.60	1.52	1.45
1	A	17	LYS	N-CA	5.58	1.53	1.46
1	C	116	LEU	C-O	5.57	1.30	1.23
1	C	60	LEU	C-O	5.57	1.30	1.24
1	A	161	HIS	ND1-CE1	5.53	1.38	1.32
1	D	117	HIS	CE1-NE2	5.50	1.38	1.32
1	B	53	LEU	CA-C	5.47	1.59	1.52
1	B	93	HIS	ND1-CE1	5.45	1.38	1.32
1	C	242	MET	N-CA	5.45	1.53	1.46
1	A	155	TYR	N-CA	5.44	1.53	1.46
1	B	111	HIS	CE1-NE2	5.38	1.38	1.32

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	66	HIS	ND1-CE1	5.38	1.38	1.32
1	D	94	TRP	N-CA	5.34	1.52	1.45
1	A	214	PRO	CA-C	5.27	1.58	1.52
1	C	63	ASN	N-CA	-5.27	1.39	1.46
1	D	161	HIS	CE1-NE2	5.23	1.37	1.32
1	D	51	TYR	N-CA	5.23	1.53	1.46
1	D	138	GLY	N-CA	-5.23	1.39	1.45
1	A	33	HIS	CA-C	-5.23	1.46	1.52
1	C	195	GLY	N-CA	5.22	1.50	1.45
1	B	77	HIS	ND1-CE1	5.20	1.37	1.32
1	D	168	LYS	C-O	5.19	1.30	1.23
1	C	7[A]	PHE	C-N	5.17	1.41	1.33
1	C	7[B]	PHE	C-N	5.17	1.41	1.33
1	D	93	HIS	CG-CD2	5.17	1.41	1.35
1	D	8	GLY	N-CA	5.14	1.51	1.44
1	D	190	TYR	CA-C	-5.07	1.46	1.52
1	C	111	HIS	CD2-NE2	-5.06	1.32	1.37
1	D	43	LEU	CA-C	-5.05	1.47	1.53
1	B	79	GLN	N-CA	5.05	1.52	1.46
1	C	105	HIS	CE1-NE2	5.04	1.37	1.32
1	D	224	ALA	N-CA	5.02	1.52	1.46

All (26) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	157	LYS	N-CA-C	-6.18	105.00	112.54
1	B	206	VAL	N-CA-C	5.89	116.41	108.17
1	B	194	ARG	CA-C-N	-5.45	117.96	122.16
1	B	194	ARG	C-N-CA	-5.45	117.96	122.16
1	A	221	GLN	O-C-N	5.41	127.86	122.12
1	A	12	GLU	N-CA-C	5.41	117.93	111.71
1	A	253	ASP	N-CA-C	5.38	118.58	109.91
1	B	119	VAL	O-C-N	5.37	129.07	122.95
1	B	86	SER	O-C-N	5.36	129.26	123.10
1	A	110	GLN	N-CA-C	5.34	117.94	109.24
1	A	8	GLY	CA-C-N	-5.33	114.53	120.45
1	A	8	GLY	C-N-CA	-5.33	114.53	120.45
1	A	261	PHE	CA-C-N	-5.31	113.76	122.79
1	A	261	PHE	C-N-CA	-5.31	113.76	122.79
1	A	199	THR	O-C-N	5.30	125.86	121.35
1	D	262	SER	N-CA-C	-5.28	105.90	112.93
1	B	158	ILE	N-CA-C	-5.26	106.55	111.45

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	222	LEU	N-CA-C	5.26	116.70	111.07
1	C	117	HIS	ND1-CG-CD2	5.25	111.35	106.10
1	D	158	ILE	N-CA-C	-5.22	106.60	111.45
1	B	10	ASP	O-C-N	5.14	128.58	122.26
1	C	260	SER	N-CA-C	-5.13	106.97	113.18
1	C	49	GLN	CA-CB-CG	-5.08	103.95	114.10
1	B	164	HIS	CA-C-O	5.05	125.26	119.35
1	A	8	GLY	N-CA-C	-5.05	102.05	112.34
1	B	233	HIS	N-CA-C	5.01	116.99	110.43

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	D	262	SER	Peptide

5.2 Too-close contacts

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	2142	0	2018	29	0
1	B	2130	0	2013	14	0
1	C	2178	0	2056	23	0
1	D	2143	0	2023	14	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
2	C	1	0	0	0	0
2	D	1	0	0	0	0
3	A	23	0	0	0	0
3	B	23	0	0	1	0
3	C	23	0	0	0	0
3	D	23	0	0	0	0
4	A	16	0	24	2	0
4	B	8	0	12	1	0
4	C	8	0	12	0	0
4	D	12	0	18	2	0
5	B	5	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
5	C	5	0	0	0	0
5	D	5	0	0	0	0
6	A	277	0	0	7	0
6	B	334	0	0	6	0
6	C	276	0	0	8	0
6	D	324	0	0	3	0
All	All	9959	0	8176	81	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 5.

All (81) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
6:A:629:HOH:O	1:B:252:PHE:CD1	1.81	1.30
1:D:212:ARG:HH12	1:D:263:GLN:HB3	1.27	0.99
1:C:168:LYS:HB2	1:C:231[A]:CYS:O	1.62	0.97
1:B:3:LYS:HA	6:B:644:HOH:O	1.66	0.93
1:C:89:GLN:HE22	1:C:91:HIS:HD1	1.19	0.89
1:A:216:GLN:HG3	6:A:616:HOH:O	1.74	0.87
6:A:629:HOH:O	1:B:252:PHE:CE1	2.10	0.87
1:C:234:MET:HE3	6:C:570:HOH:O	1.75	0.84
1:B:3:LYS:N	1:B:3:LYS:HD3	1.93	0.84
1:A:3:LYS:HA	6:A:617:HOH:O	1.78	0.82
1:B:82:GLN:OE1	6:B:402:HOH:O	1.97	0.82
1:C:148:MET:HB3	6:C:625:HOH:O	1.83	0.77
1:D:212:ARG:NH1	1:D:263:GLN:HB3	1.99	0.77
1:B:75:ASP:OD2	6:B:403:HOH:O	2.03	0.77
1:B:82:GLN:CD	6:B:402:HOH:O	2.28	0.76
1:D:98:ASN:OD1	6:D:401:HOH:O	2.04	0.74
1:D:261:PHE:HB2	1:D:263:GLN:HB2	1.73	0.70
1:C:89:GLN:NE2	1:C:91:HIS:HD1	1.89	0.70
1:C:253[A]:ASP:OD2	6:C:401:HOH:O	2.09	0.69
1:C:253[A]:ASP:OD1	6:C:402:HOH:O	2.10	0.69
1:A:212:ARG:HH11	1:A:213:ASN:HD21	1.39	0.68
1:B:42:SER:OG	6:B:401:HOH:O	1.95	0.67
1:C:7[A]:PHE:CD1	1:C:8:GLY:N	2.63	0.65
1:A:253:ASP:OD2	6:A:401:HOH:O	2.13	0.65
1:B:3:LYS:N	1:B:3:LYS:CD	2.60	0.64
1:C:253[B]:ASP:OD2	6:C:403:HOH:O	2.15	0.64
1:A:69:LYS:NZ	4:A:304:EDO:H21	2.13	0.64

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:194:ARG:NE	1:A:207:LEU:HD13	2.12	0.63
1:A:252[A]:PHE:CE1	1:A:255:ARG:NH1	2.69	0.61
1:D:148:MET:HE2	1:D:219[A]:GLN:OE1	2.02	0.60
1:A:164:HIS:HD2	6:A:481:HOH:O	1.86	0.59
1:C:7[A]:PHE:HD1	1:C:8:GLY:N	2.00	0.58
1:A:148:MET:SD	1:A:219:GLN:HA	2.44	0.57
1:C:234:MET:CE	6:C:570:HOH:O	2.42	0.56
1:D:147[A]:GLU:HG2	1:D:216:GLN:HG2	1.89	0.55
1:C:212:ARG:HH11	1:C:213:ASN:HD21	1.55	0.54
1:A:148:MET:SD	1:A:219:GLN:CA	2.97	0.53
1:A:9:PRO:HB3	6:B:694:HOH:O	2.08	0.52
1:D:183:LEU:O	4:D:306:EDO:H11	2.08	0.52
1:A:231[B]:CYS:SG	1:A:240:ARG:HB2	2.50	0.52
1:B:26:LEU:HD22	1:B:255:ARG:HD3	1.92	0.51
1:A:26:LEU:HD22	1:A:255:ARG:NH1	2.26	0.51
1:D:212:ARG:HH12	1:D:263:GLN:CB	2.12	0.50
1:A:252[A]:PHE:CE1	1:A:255:ARG:CZ	2.94	0.50
1:D:148:MET:CE	1:D:219[A]:GLN:OE1	2.60	0.50
1:A:18:LYS:HG3	6:A:648:HOH:O	2.12	0.49
1:A:26:LEU:HD22	1:A:255:ARG:CZ	2.44	0.48
1:D:263:GLN:HA	6:D:600:HOH:O	2.13	0.48
1:A:148:MET:SD	1:A:219:GLN:N	2.87	0.48
1:C:47:GLU:HB2	1:C:79:GLN:HB3	1.97	0.47
1:C:252[B]:PHE:CE1	1:C:255:ARG:NH1	2.83	0.47
1:A:148:MET:HB3	1:A:148:MET:HE3	1.32	0.47
1:C:253[A]:ASP:CG	6:C:401:HOH:O	2.57	0.46
1:A:47:GLU:HB2	1:A:79:GLN:HB3	1.98	0.46
1:D:3:LYS:N	6:D:406:HOH:O	2.48	0.46
1:C:7[A]:PHE:HD1	1:C:8:GLY:CA	2.28	0.46
1:A:62[A]:THR:HG22	1:A:63:ASN:N	2.31	0.46
1:A:40:ASP:OD1	1:A:42:SER:HB3	2.16	0.45
1:A:60:LEU:HD11	1:A:171[B]:GLU:HB2	1.99	0.45
1:C:60:LEU:HD11	1:C:171:GLU:HB3	1.98	0.45
1:D:52:ASN:HA	1:D:178:ASN:HA	1.97	0.45
1:A:60:LEU:HD11	1:A:171[A]:GLU:HB3	1.99	0.45
1:C:7[A]:PHE:CD1	1:C:7[A]:PHE:C	2.94	0.44
1:B:47:GLU:HB2	1:B:79:GLN:HB3	1.99	0.44
1:A:148:MET:HE3	1:A:148:MET:C	2.43	0.44
1:C:252[B]:PHE:CE1	1:C:255:ARG:CZ	3.00	0.44
1:A:103:SER:O	1:A:111:HIS:HD2	2.01	0.44
1:A:252[A]:PHE:HE1	1:A:255:ARG:NH1	2.15	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:52:ASN:HA	1:B:178:ASN:HA	2.00	0.43
1:C:89:GLN:C	1:C:89:GLN:HE21	2.27	0.43
1:D:183:LEU:O	4:D:306:EDO:C1	2.66	0.43
1:A:180:GLU:HG3	1:A:183:LEU:HD12	2.01	0.43
3:B:302:6YQ:C3	4:B:304:EDO:H12	2.50	0.42
1:C:52:ASN:HA	1:C:178:ASN:HA	2.03	0.41
1:D:192:ARG:HD2	1:D:207:LEU:HD11	2.03	0.41
1:B:31:ASP:O	1:B:252:PHE:HZ	2.04	0.41
1:A:69:LYS:HZ3	4:A:304:EDO:H21	1.84	0.41
1:B:147[A]:GLU:HG3	1:B:216:GLN:HG2	2.02	0.41
1:C:12:GLU:HA	1:C:15:TRP:CE2	2.56	0.40
1:A:207:LEU:HD12	1:A:207:LEU:HA	1.91	0.40
1:C:3:LYS:N	6:C:415:HOH:O	2.53	0.40

There are no symmetry-related clashes.

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	265/263 (101%)	258 (97%)	7 (3%)	0	100	100
1	B	263/263 (100%)	258 (98%)	5 (2%)	0	100	100
1	C	269/263 (102%)	263 (98%)	6 (2%)	0	100	100
1	D	264/263 (100%)	259 (98%)	5 (2%)	0	100	100
All	All	1061/1052 (101%)	1038 (98%)	23 (2%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains ⓘ

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	239/235 (102%)	235 (98%)	4 (2%)	53	21
1	B	237/235 (101%)	232 (98%)	5 (2%)	47	14
1	C	242/235 (103%)	240 (99%)	2 (1%)	73	50
1	D	238/235 (101%)	233 (98%)	5 (2%)	47	14
All	All	956/940 (102%)	940 (98%)	16 (2%)	55	21

All (16) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	42	SER
1	A	89	GLN
1	A	156	ASP
1	A	163	GLN
1	B	3	LYS
1	B	49	GLN
1	B	82	GLN
1	B	89	GLN
1	B	156	ASP
1	C	89	GLN
1	C	156	ASP
1	D	75	ASP
1	D	89	GLN
1	D	156	ASP
1	D	219[A]	GLN
1	D	219[B]	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (22) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	13	ASN
1	A	33	HIS
1	A	58	GLN

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Mol	Chain	Res	Type
1	A	111	HIS
1	A	163	GLN
1	A	164	HIS
1	A	213	ASN
1	B	79	GLN
1	B	101	HIS
1	B	250	GLN
1	C	13	ASN
1	C	49	GLN
1	C	66	HIS
1	C	89	GLN
1	C	213	ASN
1	C	250	GLN
1	C	263	GLN
1	D	13	ASN
1	D	79	GLN
1	D	98	ASN
1	D	101	HIS
1	D	250	GLN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 22 ligands modelled in this entry, 4 are monoatomic - leaving 18 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the

expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
3	6YQ	C	302	2	25,25,25	1.56	7 (28%)	36,37,37	2.11	12 (33%)
5	SO4	B	303	-	4,4,4	0.78	0	6,6,6	0.75	0
4	EDO	D	305	-	3,3,3	0.35	0	2,2,2	0.79	0
5	SO4	D	303	-	4,4,4	0.91	0	6,6,6	0.50	0
3	6YQ	D	302	2	25,25,25	2.31	14 (56%)	36,37,37	1.81	10 (27%)
3	6YQ	A	302	2	25,25,25	2.41	9 (36%)	36,37,37	2.12	11 (30%)
4	EDO	B	305	-	3,3,3	0.67	0	2,2,2	0.49	0
4	EDO	A	304	-	3,3,3	0.32	0	2,2,2	1.29	0
4	EDO	A	305	-	3,3,3	0.48	0	2,2,2	0.10	0
4	EDO	A	306	-	3,3,3	0.59	0	2,2,2	0.07	0
5	SO4	C	303	-	4,4,4	0.65	0	6,6,6	0.64	0
4	EDO	D	304	-	3,3,3	0.78	0	2,2,2	0.97	0
4	EDO	C	304	-	3,3,3	0.46	0	2,2,2	0.38	0
4	EDO	D	306	-	3,3,3	0.84	0	2,2,2	0.77	0
4	EDO	B	304	-	3,3,3	0.57	0	2,2,2	0.23	0
3	6YQ	B	302	2	25,25,25	1.84	6 (24%)	36,37,37	2.41	13 (36%)
4	EDO	A	303	-	3,3,3	0.39	0	2,2,2	0.66	0
4	EDO	C	305	-	3,3,3	0.92	0	2,2,2	0.52	0

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	6YQ	C	302	2	-	1/14/14/14	0/3/3/3
4	EDO	D	305	-	-	0/1/1/1	-
3	6YQ	D	302	2	-	2/14/14/14	0/3/3/3
3	6YQ	A	302	2	-	1/14/14/14	0/3/3/3
4	EDO	B	305	-	-	1/1/1/1	-
4	EDO	A	304	-	-	1/1/1/1	-
4	EDO	A	305	-	-	0/1/1/1	-
4	EDO	A	306	-	-	1/1/1/1	-
4	EDO	D	304	-	-	1/1/1/1	-
4	EDO	C	304	-	-	0/1/1/1	-
4	EDO	D	306	-	-	1/1/1/1	-
4	EDO	B	304	-	-	0/1/1/1	-
3	6YQ	B	302	2	-	1/14/14/14	0/3/3/3
4	EDO	A	303	-	-	1/1/1/1	-

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
4	EDO	C	305	-	-	1/1/1/1	-

All (36) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	302	6YQ	O8-S7	5.49	1.53	1.43
3	A	302	6YQ	C2-C1	5.46	1.45	1.39
3	D	302	6YQ	C1-S7	4.67	1.83	1.77
3	B	302	6YQ	C1-S7	4.01	1.82	1.77
3	A	302	6YQ	C5-C6	3.92	1.45	1.38
3	B	302	6YQ	C2-C3	3.79	1.44	1.38
3	B	302	6YQ	O12-C11	3.65	1.28	1.22
3	D	302	6YQ	O8-S7	3.51	1.49	1.43
3	D	302	6YQ	C13-N14	3.44	1.50	1.46
3	D	302	6YQ	C6-C1	3.42	1.44	1.40
3	A	302	6YQ	C16-N17	3.35	1.38	1.31
3	C	302	6YQ	C1-S7	3.29	1.81	1.77
3	A	302	6YQ	C5-C4	-3.29	1.34	1.39
3	D	302	6YQ	C16-N17	3.15	1.37	1.31
3	A	302	6YQ	C6-C1	2.98	1.44	1.40
3	D	302	6YQ	C5-C6	-2.92	1.34	1.38
3	B	302	6YQ	C16-N17	2.91	1.37	1.31
3	C	302	6YQ	C21-C20	2.82	1.43	1.38
3	D	302	6YQ	C13-C11	-2.82	1.47	1.52
3	D	302	6YQ	C21-C20	2.67	1.43	1.38
3	C	302	6YQ	S7-N10	2.50	1.65	1.60
3	C	302	6YQ	C19-N17	-2.46	1.35	1.39
3	D	302	6YQ	C5-C4	-2.44	1.35	1.39
3	C	302	6YQ	O9-S7	2.44	1.48	1.43
3	D	302	6YQ	C2-C3	2.37	1.42	1.38
3	A	302	6YQ	C2-C3	2.29	1.42	1.38
3	B	302	6YQ	C22-C21	2.29	1.43	1.38
3	D	302	6YQ	C22-C21	2.20	1.43	1.38
3	B	302	6YQ	C21-C20	2.19	1.42	1.38
3	D	302	6YQ	O12-C11	2.18	1.26	1.22
3	D	302	6YQ	C2-C1	2.18	1.41	1.39
3	C	302	6YQ	C18-N14	-2.13	1.35	1.39
3	A	302	6YQ	C1-S7	2.11	1.80	1.77
3	C	302	6YQ	C16-N17	2.10	1.35	1.31
3	A	302	6YQ	S7-N10	-2.10	1.56	1.60
3	D	302	6YQ	S7-N10	2.09	1.64	1.60

All (46) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	302	6YQ	O9-S7-N10	5.62	115.46	107.35
3	B	302	6YQ	C1-C6-CL1	5.27	125.33	121.52
3	C	302	6YQ	C13-N14-C18	4.73	130.94	126.32
3	C	302	6YQ	O12-C11-C4	-4.70	114.45	120.73
3	B	302	6YQ	C19-C18-N14	4.63	108.17	105.40
3	D	302	6YQ	C19-C18-N14	4.63	108.17	105.40
3	C	302	6YQ	C13-N14-C16	-4.36	122.95	127.27
3	A	302	6YQ	C13-N14-C18	4.28	130.50	126.32
3	A	302	6YQ	C13-N14-C16	-4.21	123.10	127.27
3	D	302	6YQ	C4-C5-C6	4.15	123.88	120.26
3	A	302	6YQ	C3-C4-C5	4.10	123.99	119.25
3	B	302	6YQ	C6-C1-S7	-3.84	118.86	123.47
3	A	302	6YQ	C5-C6-C1	-3.69	117.79	121.36
3	C	302	6YQ	C23-C19-C18	3.66	124.34	120.24
3	C	302	6YQ	C19-C18-N14	3.60	107.56	105.40
3	B	302	6YQ	N14-C16-N17	-3.58	110.85	114.16
3	A	302	6YQ	O9-S7-N10	3.54	112.45	107.35
3	C	302	6YQ	O8-S7-O9	-3.49	113.44	118.80
3	A	302	6YQ	O12-C11-C13	3.48	125.02	120.28
3	B	302	6YQ	O8-S7-C1	-3.39	102.33	107.26
3	B	302	6YQ	C2-C3-C4	-3.37	117.20	120.80
3	A	302	6YQ	C19-C18-N14	3.35	107.41	105.40
3	B	302	6YQ	C4-C5-C6	3.32	123.16	120.26
3	A	302	6YQ	O12-C11-C4	-3.26	116.37	120.73
3	B	302	6YQ	C23-C19-C18	3.20	123.82	120.24
3	D	302	6YQ	C13-N14-C18	3.17	129.42	126.32
3	A	302	6YQ	N14-C16-N17	-3.16	111.23	114.16
3	A	302	6YQ	C5-C4-C11	-2.99	113.68	120.18
3	D	302	6YQ	C6-C1-S7	-2.94	119.94	123.47
3	D	302	6YQ	O12-C11-C13	2.89	124.22	120.28
3	D	302	6YQ	C2-C1-S7	2.88	121.44	117.52
3	B	302	6YQ	C5-C6-C1	-2.88	118.57	121.36
3	C	302	6YQ	C13-C11-C4	2.80	121.17	117.67
3	B	302	6YQ	C13-N14-C18	2.76	129.02	126.32
3	C	302	6YQ	O12-C11-C13	2.68	123.93	120.28
3	C	302	6YQ	O9-S7-C1	2.61	111.06	107.26
3	B	302	6YQ	C2-C1-S7	2.61	121.07	117.52
3	D	302	6YQ	N14-C16-N17	-2.55	111.81	114.16
3	D	302	6YQ	O9-S7-N10	2.53	111.00	107.35
3	C	302	6YQ	C22-C21-C20	2.48	123.29	120.24
3	C	302	6YQ	N14-C16-N17	-2.47	111.88	114.16
3	B	302	6YQ	C13-N14-C16	-2.46	124.83	127.27

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	D	302	6YQ	C13-N14-C16	-2.38	124.91	127.27
3	D	302	6YQ	O8-S7-C1	-2.34	103.85	107.26
3	C	302	6YQ	C20-C18-C19	-2.25	119.64	122.23
3	A	302	6YQ	C6-C1-S7	-2.23	120.80	123.47

There are no chirality outliers.

All (12) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	C	305	EDO	O1-C1-C2-O2
4	A	304	EDO	O1-C1-C2-O2
4	D	306	EDO	O1-C1-C2-O2
4	A	303	EDO	O1-C1-C2-O2
3	A	302	6YQ	C2-C1-S7-N10
3	D	302	6YQ	C2-C1-S7-N10
4	D	304	EDO	O1-C1-C2-O2
4	A	306	EDO	O1-C1-C2-O2
4	B	305	EDO	O1-C1-C2-O2
3	B	302	6YQ	C2-C1-S7-N10
3	C	302	6YQ	C6-C1-S7-N10
3	D	302	6YQ	C6-C1-S7-N10

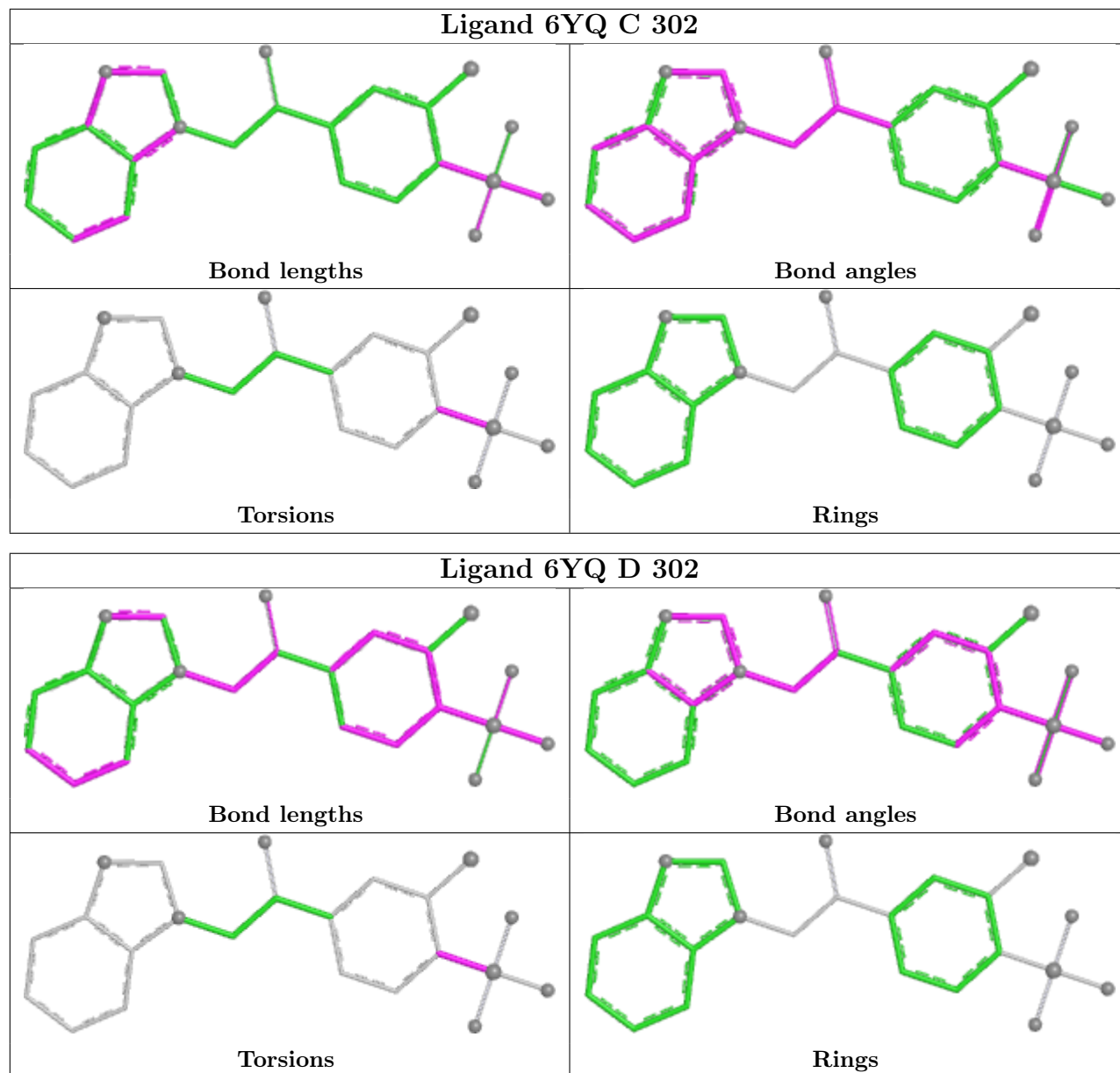
There are no ring outliers.

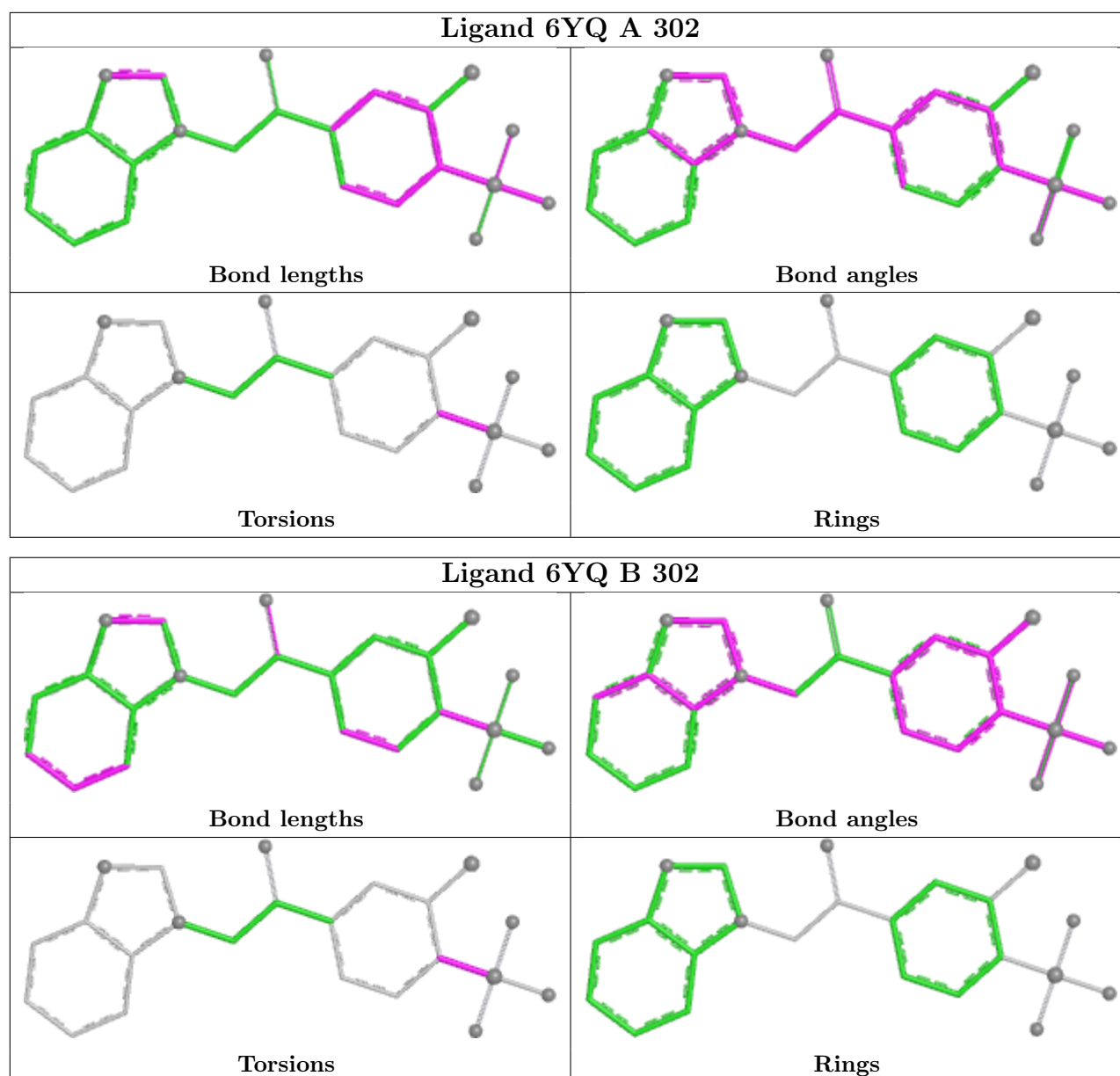
4 monomers are involved in 5 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	304	EDO	2	0
4	D	306	EDO	2	0
4	B	304	EDO	1	0
3	B	302	6YQ	1	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient

equivalents in the CSD to analyse the geometry.





5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data

6.1 Protein, DNA and RNA chains

In the following table, the column labelled ‘#RSRZ> 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q< 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2		OWAB(Å ²)	Q<0.9
1	A	261/263 (99%)	-0.15	4 (1%)	72 75	7, 14, 30, 46	6 (2%)
1	B	261/263 (99%)	-0.24	4 (1%)	72 75	6, 12, 28, 42	4 (1%)
1	C	261/263 (99%)	0.19	10 (3%)	44 47	5, 17, 31, 50	10 (3%)
1	D	261/263 (99%)	-0.44	1 (0%)	88 91	6, 12, 23, 51	5 (1%)
All	All	1044/1052 (99%)	-0.16	19 (1%)	67 70	5, 13, 29, 51	25 (2%)

All (19) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	252	PHE	5.8
1	C	55	ALA	4.4
1	C	7[A]	PHE	4.2
1	C	3	LYS	2.9
1	A	7	PHE	2.9
1	A	3	LYS	2.9
1	D	263	GLN	2.8
1	B	136	SER	2.8
1	C	174	VAL	2.6
1	C	8	GLY	2.4
1	B	125	LEU	2.4
1	C	173	PHE	2.3
1	C	230	TYR	2.2
1	C	57	LYS	2.1
1	A	56	ASN	2.1
1	C	235	ASP	2.1
1	B	164	HIS	2.1
1	C	186[A]	ARG	2.0
1	A	8	GLY	2.0

6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

6.4 Ligands [i](#)

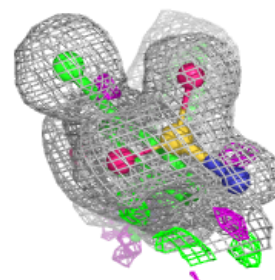
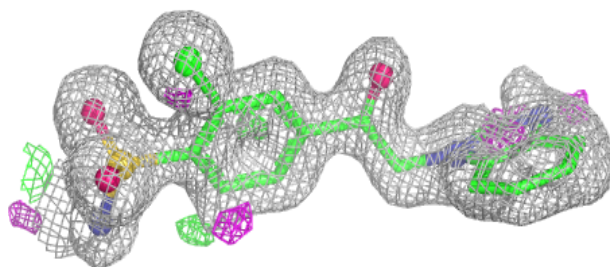
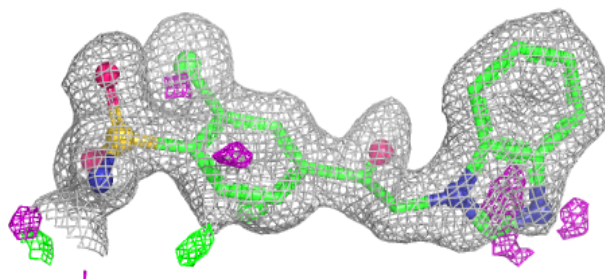
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
4	EDO	D	306	4/4	0.78	0.14	28,32,34,36	0
5	SO4	C	303	5/5	0.78	0.14	48,52,68,69	0
4	EDO	A	304	4/4	0.83	0.14	28,30,36,37	0
5	SO4	B	303	5/5	0.85	0.12	28,33,43,43	0
4	EDO	C	305	4/4	0.85	0.13	29,32,33,35	0
5	SO4	D	303	5/5	0.89	0.11	28,32,35,40	0
4	EDO	A	303	4/4	0.90	0.10	22,24,28,29	0
4	EDO	D	305	4/4	0.91	0.09	22,24,26,32	0
4	EDO	D	304	4/4	0.92	0.11	19,20,20,28	0
4	EDO	C	304	4/4	0.92	0.10	17,23,24,24	0
4	EDO	A	305	4/4	0.94	0.07	22,25,25,26	0
4	EDO	B	304	4/4	0.95	0.09	19,21,22,22	0
4	EDO	B	305	4/4	0.95	0.07	18,20,23,27	0
4	EDO	A	306	4/4	0.96	0.07	17,26,29,36	0
3	6YQ	C	302	23/23	0.98	0.08	10,20,33,40	0
3	6YQ	D	302	23/23	0.98	0.07	8,15,23,26	0
3	6YQ	A	302	23/23	0.98	0.08	9,19,30,36	0
3	6YQ	B	302	23/23	0.98	0.08	7,16,34,37	0
2	ZN	C	301	1/1	0.99	0.02	10,10,10,10	0
2	ZN	B	301	1/1	1.00	0.01	6,6,6,6	0
2	ZN	A	301	1/1	1.00	0.01	8,8,8,8	0
2	ZN	D	301	1/1	1.00	0.00	7,7,7,7	0

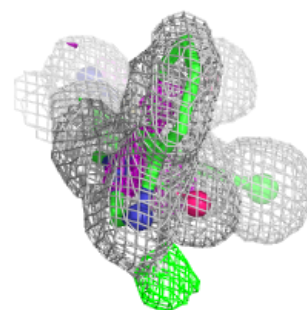
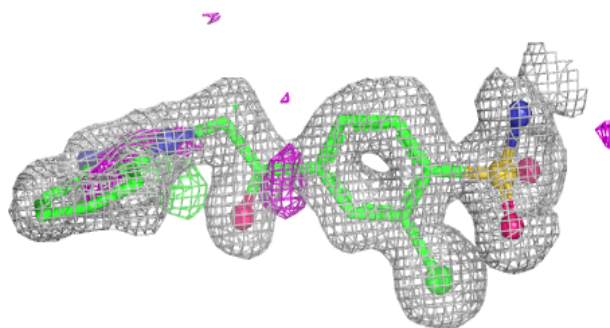
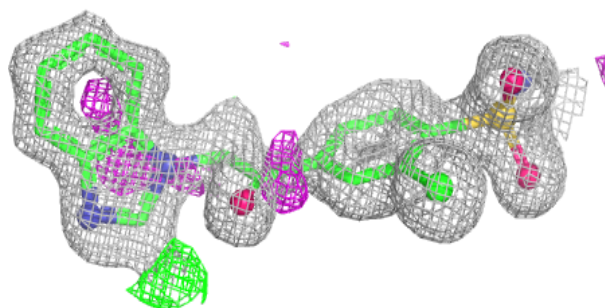
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.

Electron density around 6YQ C 302:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

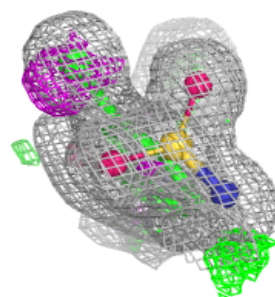
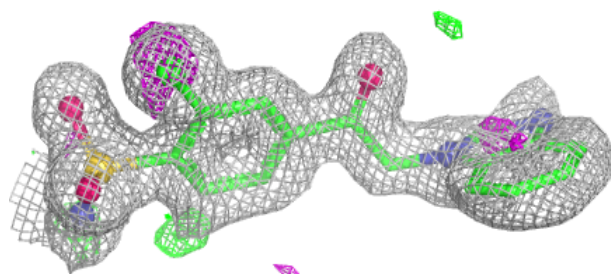
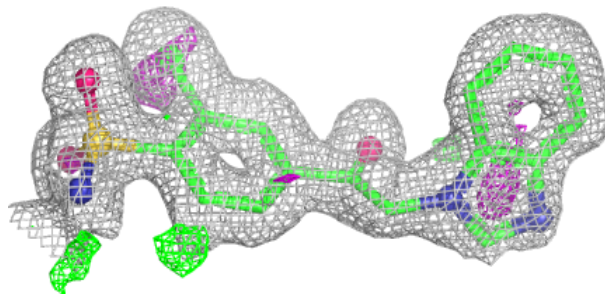
**Electron density around 6YQ D 302:**

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

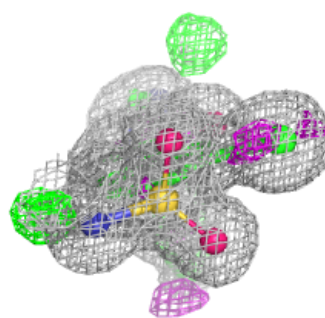
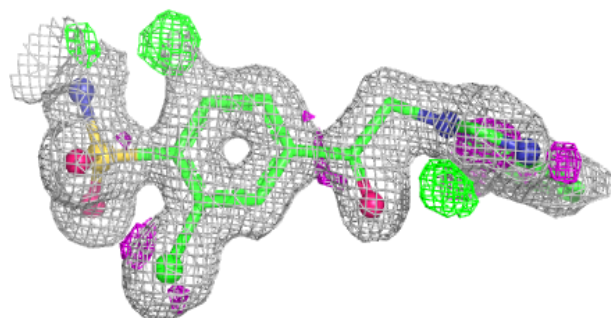
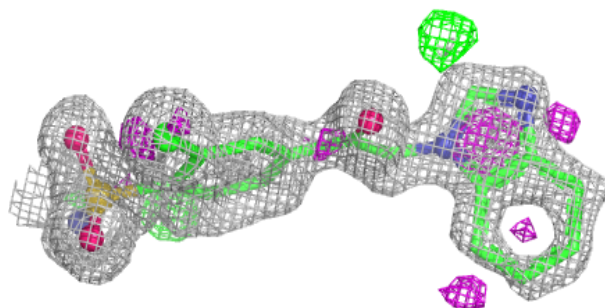


Electron density around 6YQ A 302:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

**Electron density around 6YQ B 302:**

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



6.5 Other polymers [i](#)

There are no such residues in this entry.