



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 7, 2026 – 02:52 AM UTC

PDB ID : 4XC6 / pdb_00004xc6
Title : Isobutyryl-CoA mutase fused with bound adenosylcobalamin, GDP, and Mg (holo-IcmF/GDP)
Authors : Jost, M.; Drennan, C.L.
Deposited on : 2014-12-17
Resolution : 3.35 Å(reported)

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

We welcome your comments at validation@mail.wwpdb.org

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

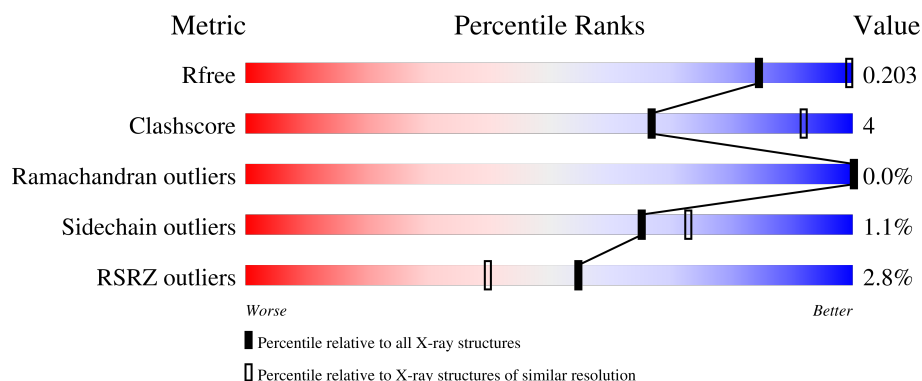
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

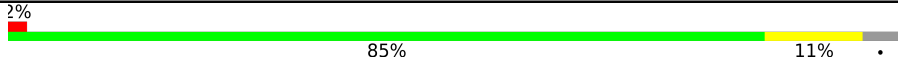
The reported resolution of this entry is 3.35 Å.

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	1099 (3.40-3.32)
Clashscore	190562	1116 (3.40-3.32)
Ramachandran outliers	187476	1101 (3.40-3.32)
Sidechain outliers	187428	1101 (3.40-3.32)
RSRZ outliers	180081	1099 (3.40-3.32)

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	1113	
1	B	1113	

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 16546 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 Isobutyryl-CoA mutase fused.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	1067	Total	C	N	O	S	0	0	0
			8166	5100	1465	1564	37			
1	B	1061	Total	C	N	O	S	0	0	0
			8116	5061	1469	1549	37			

There are 40 discrepancies between the modelled and reference sequences:

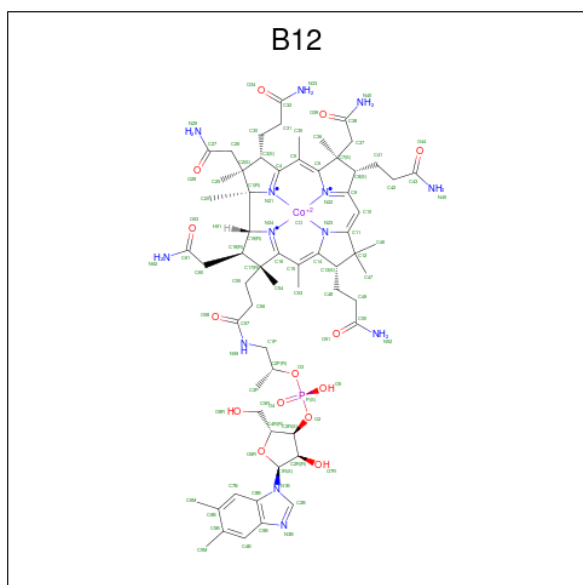
Chain	Residue	Modelled	Actual	Comment	Reference
A	-19	MET	-	initiating methionine	UNP Q1LRY0
A	-18	GLY	-	expression tag	UNP Q1LRY0
A	-17	SER	-	expression tag	UNP Q1LRY0
A	-16	SER	-	expression tag	UNP Q1LRY0
A	-15	HIS	-	expression tag	UNP Q1LRY0
A	-14	HIS	-	expression tag	UNP Q1LRY0
A	-13	HIS	-	expression tag	UNP Q1LRY0
A	-12	HIS	-	expression tag	UNP Q1LRY0
A	-11	HIS	-	expression tag	UNP Q1LRY0
A	-10	HIS	-	expression tag	UNP Q1LRY0
A	-9	SER	-	expression tag	UNP Q1LRY0
A	-8	SER	-	expression tag	UNP Q1LRY0
A	-7	GLY	-	expression tag	UNP Q1LRY0
A	-6	LEU	-	expression tag	UNP Q1LRY0
A	-5	VAL	-	expression tag	UNP Q1LRY0
A	-4	PRO	-	expression tag	UNP Q1LRY0
A	-3	ARG	-	expression tag	UNP Q1LRY0
A	-2	GLY	-	expression tag	UNP Q1LRY0
A	-1	SER	-	expression tag	UNP Q1LRY0
A	0	HIS	-	expression tag	UNP Q1LRY0
B	-19	MET	-	initiating methionine	UNP Q1LRY0
B	-18	GLY	-	expression tag	UNP Q1LRY0
B	-17	SER	-	expression tag	UNP Q1LRY0
B	-16	SER	-	expression tag	UNP Q1LRY0
B	-15	HIS	-	expression tag	UNP Q1LRY0

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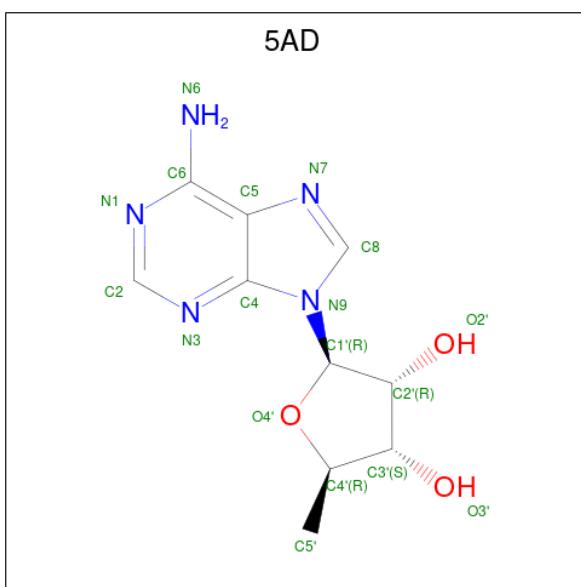
Chain	Residue	Modelled	Actual	Comment	Reference
B	-14	HIS	-	expression tag	UNP Q1LRY0
B	-13	HIS	-	expression tag	UNP Q1LRY0
B	-12	HIS	-	expression tag	UNP Q1LRY0
B	-11	HIS	-	expression tag	UNP Q1LRY0
B	-10	HIS	-	expression tag	UNP Q1LRY0
B	-9	SER	-	expression tag	UNP Q1LRY0
B	-8	SER	-	expression tag	UNP Q1LRY0
B	-7	GLY	-	expression tag	UNP Q1LRY0
B	-6	LEU	-	expression tag	UNP Q1LRY0
B	-5	VAL	-	expression tag	UNP Q1LRY0
B	-4	PRO	-	expression tag	UNP Q1LRY0
B	-3	ARG	-	expression tag	UNP Q1LRY0
B	-2	GLY	-	expression tag	UNP Q1LRY0
B	-1	SER	-	expression tag	UNP Q1LRY0
B	0	HIS	-	expression tag	UNP Q1LRY0

- Molecule 2 is COBALAMIN (CCD ID: B12) (formula: $C_{62}H_{89}CoN_{13}O_{14}P$).



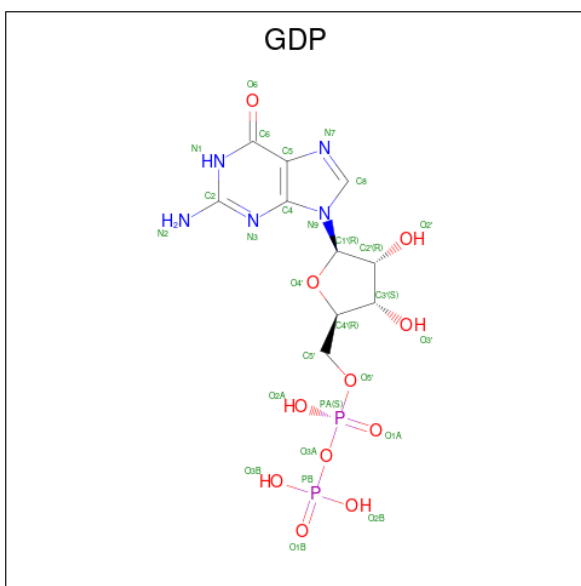
Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
2	A	1	Total	C	Co	N	O	P	0	0
			91	62	1	13	14	1		
2	B	1	Total	C	Co	N	O	P	0	0
			91	62	1	13	14	1		

- Molecule 3 is 5'-DEOXYADENOSINE (CCD ID: 5AD) (formula: $C_{10}H_{13}N_5O_3$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	N	O	0	0
			18	10	5	3		

- Molecule 4 is GUANOSINE-5'-DIPHOSPHATE (CCD ID: GDP) (formula: $C_{10}H_{15}N_5O_{11}P_2$).

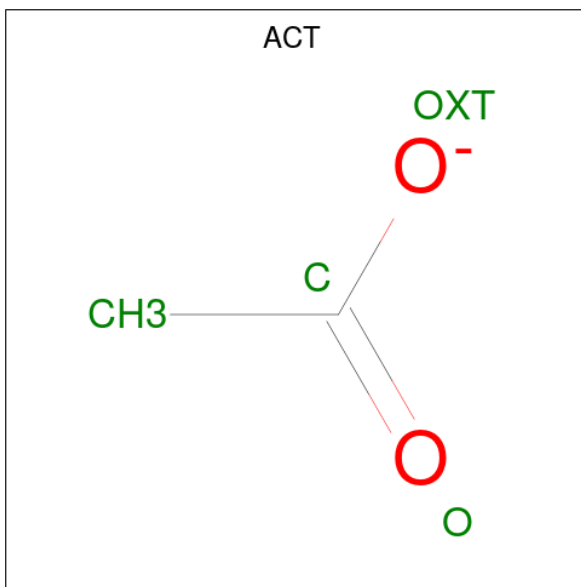


Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
4	A	1	Total 28	C 10	N 5	O 11	P 2	0	0
4	B	1	Total 28	C 10	N 5	O 11	P 2	0	0

- Molecule 5 is MAGNESIUM ION (CCD ID: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	2	Total	Mg	0	0
			2	2		
5	B	2	Total	Mg	0	0
			2	2		

- Molecule 6 is ACETATE ION (CCD ID: ACT) (formula: $C_2H_3O_2$).

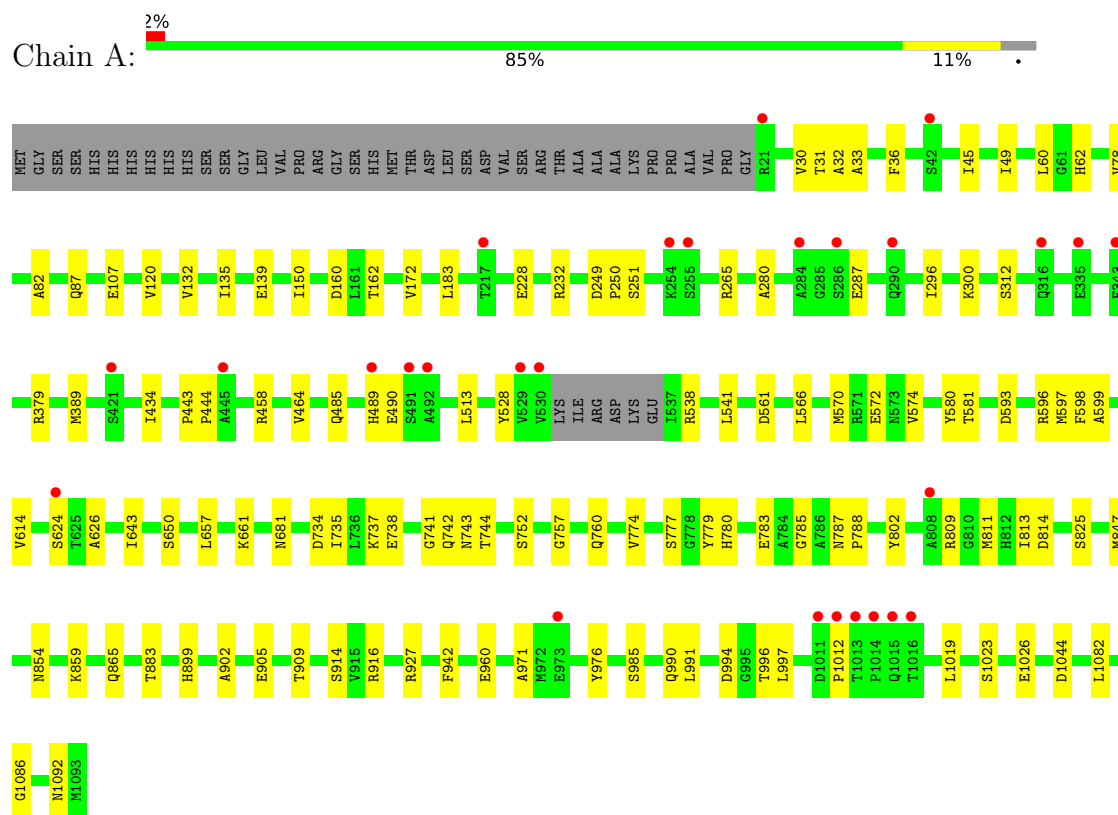


Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	A	1	Total	C	O	0	0
			4	2	2		

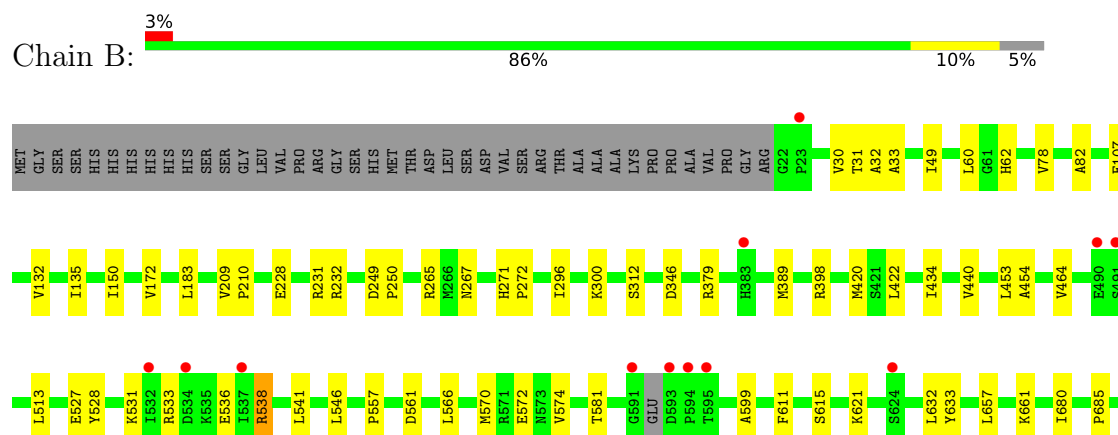
3 Residue-property plots [i](#)

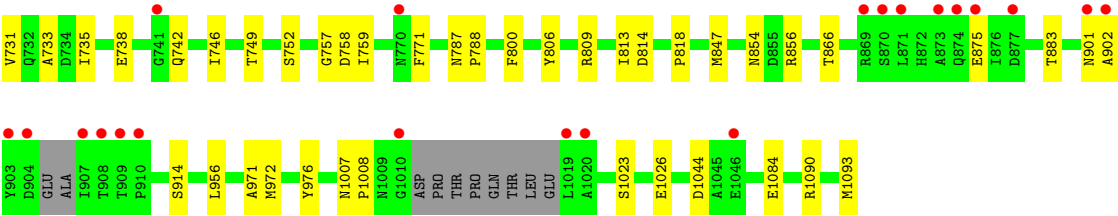
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. 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: Isobutyryl-CoA mutase fused



• Molecule 1: Isobutyryl-CoA mutase fused





4 Data and refinement statistics

Property	Value	Source
Space group	H 3 2	Depositor
Cell constants a, b, c, α , β , γ	318.76Å 318.76Å 343.52Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	48.69 – 3.35 48.69 – 3.35	Depositor EDS
% Data completeness (in resolution range)	99.2 (48.69-3.35) 99.1 (48.69-3.35)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.13	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.41 (at 3.33Å)	Xtriage
Refinement program	PHENIX (phenix.refine: dev_1760)	Depositor
R, R_{free}	0.180 , 0.198 0.186 , 0.203	Depositor DCC
R_{free} test set	4765 reflections (4.94%)	wwPDB-VP
Wilson B-factor (Å ²)	82.4	Xtriage
Anisotropy	0.259	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 57.9	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	0.94	EDS
Total number of atoms	16546	wwPDB-VP
Average B, all atoms (Å ²)	82.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 1.96% of the height of the origin peak. No significant pseudotranslation is detected.*

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: 5AD, B12, MG, ACT, GDP

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	0.28	0/8311	0.71	3/11258 (0.0%)
1	B	0.29	0/8254	0.72	3/11168 (0.0%)
All	All	0.29	0/16565	0.71	6/22426 (0.0%)

There are no bond length outliers.

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	538	ARG	NE-CZ-NH2	8.04	126.43	119.20
1	A	538	ARG	NE-CZ-NH1	-7.36	114.14	121.50
1	A	538	ARG	CD-NE-CZ	5.64	132.29	124.40
1	B	538	ARG	NE-CZ-NH2	-5.63	114.13	119.20
1	B	538	ARG	CD-NE-CZ	5.24	131.74	124.40
1	B	533	ARG	CB-CA-C	-5.05	110.36	117.23

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts [i](#)

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	8166	0	7934	62	0
1	B	8116	0	7884	55	0
2	A	91	0	88	8	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	B	91	0	88	4	0
3	A	18	0	13	1	0
4	A	28	0	12	1	0
4	B	28	0	12	1	0
5	A	2	0	0	0	0
5	B	2	0	0	0	0
6	A	4	0	3	0	0
All	All	16546	0	16034	120	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 4.

All (120) 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)
1:A:783:GLU:HB3	2:A:1101:B12:H532	1.64	0.78
1:A:87:GLN:HE22	2:A:1101:B12:H421	1.52	0.74
1:B:454:ALA:HA	1:B:956:LEU:HD22	1.80	0.63
1:A:31:THR:HG22	1:A:82:ALA:HB3	1.81	0.62
1:B:31:THR:HG22	1:B:82:ALA:HB3	1.82	0.61
1:A:735:ILE:HG13	1:A:752:SER:HB3	1.83	0.60
1:A:760:GLN:HG3	1:A:811:MET:HE1	1.83	0.60
1:B:615:SER:O	1:B:621:LYS:NZ	2.37	0.57
1:A:990:GLN:O	1:A:994:ASP:HB2	2.04	0.56
1:A:251:SER:HB2	1:A:280:ALA:HB1	1.87	0.56
1:A:599:ALA:O	1:A:626:ALA:N	2.37	0.55
1:A:942:PHE:CZ	1:B:557:PRO:HB3	2.42	0.55
1:B:265:ARG:NH1	4:B:1102:GDP:O2A	2.40	0.55
1:A:265:ARG:NH1	4:A:1103:GDP:O1A	2.41	0.54
1:A:779:TYR:CD2	1:A:825:SER:HB2	2.43	0.54
1:A:737:LYS:HD3	1:A:777:SER:HB2	1.90	0.54
1:A:250:PRO:HD3	1:A:312:SER:HB2	1.89	0.54
1:A:458:ARG:NH1	1:A:960:GLU:OE2	2.40	0.54
1:A:916:ARG:NH1	1:B:875:GLU:OE2	2.40	0.53
1:A:991:LEU:HD22	1:A:996:THR:HB	1.91	0.53
1:A:780:HIS:HA	2:A:1101:B12:H461	1.90	0.53
1:A:62:HIS:CE1	1:A:743:ASN:HB3	2.44	0.53
1:A:814:ASP:CG	1:A:854:ASN:HD22	2.17	0.53
1:A:787:ASN:HB2	1:A:788:PRO:HD2	1.91	0.53
1:B:30:VAL:HG23	1:B:78:VAL:HG11	1.91	0.52
1:A:30:VAL:HG23	1:A:78:VAL:HG11	1.91	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:513:LEU:HD21	1:B:566:LEU:HB2	1.91	0.52
1:B:814:ASP:CG	1:B:854:ASN:HD22	2.17	0.52
1:A:513:LEU:HD21	1:A:566:LEU:HB2	1.91	0.51
1:A:813:ILE:HD11	1:A:847:MET:HE1	1.92	0.51
1:A:561:ASP:HB2	1:B:561:ASP:HB2	1.92	0.51
1:A:596:ARG:HG2	1:A:624:SER:HB2	1.91	0.51
1:B:250:PRO:HD3	1:B:312:SER:HB2	1.92	0.51
1:A:865:GLN:HG3	1:A:899:HIS:HD2	1.75	0.51
1:A:1082:LEU:O	1:A:1086:GLY:N	2.42	0.50
1:B:787:ASN:HB2	1:B:788:PRO:HD2	1.92	0.50
1:A:33:ALA:HB3	1:A:62:HIS:HA	1.94	0.50
1:A:296:ILE:O	1:A:300:LYS:HG3	2.11	0.50
1:B:33:ALA:HB3	1:B:62:HIS:HA	1.94	0.50
1:B:818:PRO:HB3	1:B:856:ARG:HG2	1.94	0.50
1:B:296:ILE:O	1:B:300:LYS:HG3	2.12	0.50
1:A:593:ASP:OD2	1:A:927:ARG:NH2	2.41	0.49
1:B:735:ILE:HD12	1:B:752:SER:HB3	1.93	0.49
1:B:32:ALA:HB2	1:B:60:LEU:HB2	1.95	0.48
1:B:749:THR:HG21	1:B:972:MET:HE1	1.95	0.48
1:A:32:ALA:HB2	1:A:60:LEU:HB2	1.96	0.48
1:A:905:GLU:O	2:A:1101:B12:N29	2.34	0.48
2:A:1101:B12:H261	3:A:1102:5AD:H3'	1.96	0.47
1:A:485:GLN:HG2	1:A:490:GLU:HG2	1.96	0.47
1:A:650:SER:HB3	2:A:1101:B12:H353	1.97	0.47
1:A:681:ASN:ND2	1:A:742:GLN:OE1	2.47	0.47
1:B:599:ALA:HB3	1:B:611:PHE:CE1	2.50	0.47
1:A:139:GLU:HG3	1:A:1012:PRO:HG3	1.96	0.46
1:B:813:ILE:HD11	1:B:847:MET:HE1	1.96	0.46
1:A:757:GLY:HA3	1:A:809:ARG:NH1	2.30	0.46
1:B:231:ARG:NH2	1:B:1084:GLU:HA	2.31	0.46
1:B:228:GLU:OE2	1:B:232:ARG:NH1	2.49	0.46
1:A:49:ILE:HB	1:A:150:ILE:HG13	1.99	0.45
1:B:132:VAL:HG11	1:B:135:ILE:HG13	1.99	0.45
1:B:420:MET:HE2	1:B:422:LEU:HD21	1.98	0.45
1:A:228:GLU:OE2	1:A:232:ARG:NH1	2.49	0.45
1:B:379:ARG:HD2	1:B:389:MET:HE1	1.98	0.45
1:B:757:GLY:HA2	1:B:806:TYR:HE1	1.82	0.45
1:A:464:VAL:HG22	1:A:570:MET:HE2	1.98	0.45
1:A:902:ALA:HB1	1:A:914:SER:OG	2.16	0.45
1:B:464:VAL:HG22	1:B:570:MET:HE2	1.98	0.45
1:B:1093:MET:HE2	1:B:1093:MET:HB3	1.86	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:132:VAL:HG11	1:A:135:ILE:HG13	1.99	0.45
1:B:902:ALA:HB1	1:B:914:SER:OG	2.16	0.45
1:A:379:ARG:HD2	1:A:389:MET:HE1	1.98	0.44
1:A:597:MET:HB2	1:A:614:VAL:HG11	1.99	0.44
1:A:735:ILE:HA	1:A:738:GLU:HG2	1.99	0.44
1:B:107:GLU:H	1:B:107:GLU:CD	2.26	0.44
1:B:572:GLU:HG2	1:B:581:THR:HG21	2.00	0.44
1:A:737:LYS:HE3	1:A:780:HIS:CE1	2.52	0.44
1:A:572:GLU:HG2	1:A:581:THR:HG21	2.00	0.44
1:B:971:ALA:HB1	1:B:976:TYR:HB3	2.00	0.44
1:A:160:ASP:OD1	1:A:162:THR:OG1	2.25	0.43
1:A:580:TYR:CE1	1:A:859:LYS:HE2	2.53	0.43
1:B:738:GLU:OE1	1:B:742:GLN:NE2	2.51	0.43
2:A:1101:B12:H601	2:A:1101:B12:H252	2.00	0.43
1:B:49:ILE:HB	1:B:150:ILE:HG13	1.99	0.43
1:B:172:VAL:HG21	1:B:183:LEU:HD22	2.00	0.43
1:A:107:GLU:H	1:A:107:GLU:CD	2.27	0.43
1:A:785:GLY:HA3	1:A:985:SER:HB2	2.00	0.42
1:A:971:ALA:HB1	1:A:976:TYR:HB3	2.00	0.42
1:B:731:VAL:HG23	1:B:771:PHE:CE1	2.54	0.42
1:A:172:VAL:HG21	1:A:183:LEU:HD22	2.00	0.42
1:A:120:VAL:HG11	1:A:1019:LEU:HD11	2.01	0.42
2:B:1101:B12:H253	2:B:1101:B12:H301	1.69	0.42
2:A:1101:B12:H552	2:A:1101:B12:H531	2.02	0.42
1:B:531:LYS:HA	1:B:536:GLU:HA	2.01	0.41
1:B:633:TYR:HD2	1:B:746:ILE:HD13	1.85	0.41
1:B:453:LEU:HD13	1:B:800:PHE:CD2	2.56	0.41
1:B:758:ASP:OD1	1:B:809:ARG:NH2	2.41	0.41
1:A:36:PHE:HE2	1:A:643:ILE:HG23	1.86	0.41
1:B:1023:SER:HB3	1:B:1026:GLU:HG3	2.02	0.41
2:B:1101:B12:H601	2:B:1101:B12:H262	2.03	0.41
1:B:398:ARG:NH1	1:B:440:VAL:HA	2.36	0.41
1:B:528:TYR:HB2	1:B:541:LEU:HD21	2.02	0.41
1:B:209:VAL:HA	1:B:210:PRO:HD3	1.89	0.41
1:B:527:GLU:OE2	1:B:538:ARG:NH1	2.44	0.41
1:A:734:ASP:OD1	1:A:802:TYR:OH	2.29	0.41
1:B:731:VAL:O	1:B:733:ALA:N	2.54	0.41
1:A:997:LEU:HD22	1:B:546:LEU:HD11	2.02	0.41
1:A:1023:SER:HB3	1:A:1026:GLU:HG3	2.02	0.41
1:B:267:ASN:HD21	1:B:1090:ARG:HA	1.86	0.41
1:B:657:LEU:HG	1:B:661:LYS:HE3	2.03	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:528:TYR:HB2	1:A:541:LEU:HD21	2.03	0.41
1:B:271:HIS:CG	1:B:272:PRO:HD2	2.56	0.41
1:A:443:PRO:HA	1:A:444:PRO:HD3	1.89	0.40
1:B:632:LEU:HD23	1:B:680:ILE:HD12	2.04	0.40
2:B:1101:B12:H531	2:B:1101:B12:H552	2.03	0.40
1:A:657:LEU:HG	1:A:661:LYS:HE3	2.02	0.40
1:B:866:THR:O	1:B:901:ASN:ND2	2.55	0.40
2:B:1101:B12:H353	2:B:1101:B12:H311	2.04	0.40
1:A:45:ILE:O	1:A:49:ILE:HG12	2.22	0.40
1:B:685:PRO:HB3	1:B:759:ILE:HD11	2.03	0.40
1:B:731:VAL:HG23	1:B:771:PHE:HE1	1.86	0.40
1:B:1007:ASN:HA	1:B:1008:PRO:HD2	1.94	0.40

There are no symmetry-related clashes.

5.3 Torsion angles

5.3.1 Protein backbone

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	1063/1113 (96%)	1015 (96%)	47 (4%)	1 (0%)	48	76
1	B	1053/1113 (95%)	1015 (96%)	38 (4%)	0	100	100
All	All	2116/2226 (95%)	2030 (96%)	85 (4%)	1 (0%)	100	100

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	741	GLY

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	836/906 (92%)	824 (99%)	12 (1%)	59	69
1	B	826/906 (91%)	820 (99%)	6 (1%)	76	77
All	All	1662/1812 (92%)	1644 (99%)	18 (1%)	65	73

All (18) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	249	ASP
1	A	287	GLU
1	A	434	ILE
1	A	489	HIS
1	A	574	VAL
1	A	598	PHE
1	A	744	THR
1	A	774	VAL
1	A	883	THR
1	A	909	THR
1	A	1044	ASP
1	A	1092	ASN
1	B	249	ASP
1	B	346	ASP
1	B	434	ILE
1	B	574	VAL
1	B	883	THR
1	B	1044	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (6) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	62	HIS
1	A	707	ASN
1	A	865	GLN
1	A	1080	HIS

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Mol	Chain	Res	Type
1	B	707	ASN
1	B	1080	HIS

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

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

5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 10 ligands modelled in this entry, 4 are monoatomic - leaving 6 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	5AD	A	1102	-	20,20,20	0.08	0	28,30,30	0.27	0
2	B12	B	1101	1	94,101,101	0.75	4 (4%)	149,166,166	1.03	12 (8%)
2	B12	A	1101	1	94,101,101	0.76	4 (4%)	149,166,166	1.09	14 (9%)
4	GDP	A	1103	5	29,30,30	2.51	11 (37%)	45,47,47	1.66	9 (20%)
6	ACT	A	1106	-	3,3,3	0.86	0	3,3,3	1.31	0
4	GDP	B	1102	5	29,30,30	2.53	11 (37%)	45,47,47	1.67	10 (22%)

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	5AD	A	1102	-	-	0/4/20/20	0/3/3/3
2	B12	B	1101	1	-	16/56/223/223	0/3/11/11
2	B12	A	1101	1	-	16/56/223/223	0/3/11/11
4	GDP	A	1103	5	-	0/16/32/32	0/3/3/3
4	GDP	B	1102	5	-	0/16/32/32	0/3/3/3

All (30) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	B	1102	GDP	O6-C6	7.12	1.37	1.23
4	A	1103	GDP	O6-C6	7.10	1.37	1.23
4	A	1103	GDP	C2-N2	6.05	1.48	1.34
4	B	1102	GDP	C2-N2	6.01	1.48	1.34
2	B	1101	B12	C14-N23	4.41	1.41	1.35
2	A	1101	B12	C14-N23	3.97	1.40	1.35
4	A	1103	GDP	O5'-C5'	-3.90	1.29	1.44
4	B	1102	GDP	O5'-C5'	-3.89	1.29	1.44
4	B	1102	GDP	C8-N9	-3.89	1.28	1.37
4	A	1103	GDP	C2-N1	-3.88	1.28	1.37
4	A	1103	GDP	C8-N9	-3.85	1.28	1.37
4	B	1102	GDP	C2-N1	-3.82	1.28	1.37
2	B	1101	B12	C16-C15	3.08	1.53	1.44
2	A	1101	B12	C9-N22	2.91	1.37	1.30
4	B	1102	GDP	C2'-C3'	-2.76	1.45	1.53
2	A	1101	B12	C16-C15	2.70	1.52	1.44
4	B	1102	GDP	PA-O2A	-2.69	1.42	1.55
4	A	1103	GDP	C2'-C3'	-2.64	1.46	1.53
4	B	1102	GDP	C2-N3	2.44	1.39	1.33
4	A	1103	GDP	C2-N3	2.43	1.39	1.33
2	B	1101	B12	C9-N22	2.39	1.36	1.30
4	B	1102	GDP	C5-N7	-2.38	1.34	1.39
2	B	1101	B12	C1P-C2P	2.31	1.57	1.51
2	A	1101	B12	C1P-C2P	2.30	1.57	1.51
4	A	1103	GDP	C5-N7	-2.26	1.34	1.39
4	A	1103	GDP	PA-O1A	-2.26	1.43	1.50
4	B	1102	GDP	PB-O3B	-2.23	1.46	1.54
4	A	1103	GDP	PB-O3B	-2.17	1.46	1.54
4	A	1103	GDP	C6-N1	-2.16	1.34	1.38
4	B	1102	GDP	C6-N1	-2.15	1.34	1.38

All (45) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	B	1102	GDP	C5-C4-N3	-5.42	119.76	128.39
4	A	1103	GDP	C5-C4-N3	-5.37	119.84	128.39
4	B	1102	GDP	C2-N3-C4	4.68	120.36	112.30
4	A	1103	GDP	C2-N3-C4	4.67	120.35	112.30
4	A	1103	GDP	N9-C4-N3	3.68	133.30	125.95
4	B	1102	GDP	N9-C4-N3	3.64	133.23	125.95
2	A	1101	B12	C30-C3-C2	-3.33	111.66	119.00
2	B	1101	B12	C9-N22-C6	3.32	109.27	105.28
2	A	1101	B12	C19-C1-N21	3.26	105.49	102.14
2	B	1101	B12	C30-C3-C2	-2.99	112.41	119.00
2	A	1101	B12	C15-C16-N24	-2.83	118.40	122.42
2	A	1101	B12	C9-N22-C6	2.80	108.65	105.28
4	A	1103	GDP	C2-N1-C6	-2.77	120.09	125.11
2	A	1101	B12	C8-C9-C10	-2.76	117.45	123.33
4	B	1102	GDP	C2-N1-C6	-2.72	120.17	125.11
4	A	1103	GDP	O6-C6-C5	-2.61	119.65	126.53
4	A	1103	GDP	C5-C6-N1	2.58	119.83	113.25
2	B	1101	B12	C15-C16-N24	-2.55	118.80	122.42
4	B	1102	GDP	C5-C6-N1	2.50	119.62	113.25
4	B	1102	GDP	O6-C6-C5	-2.50	119.94	126.53
2	B	1101	B12	C10-C9-N22	2.49	128.58	125.74
2	A	1101	B12	C55-C17-C16	2.42	121.33	116.59
2	B	1101	B12	C8-C9-C10	-2.41	118.20	123.33
2	B	1101	B12	C19-N24-C16	2.38	109.89	107.29
2	A	1101	B12	C20-C1-C19	-2.38	107.06	109.35
2	B	1101	B12	C55-C17-C18	-2.37	106.60	111.12
2	A	1101	B12	C10-C9-N22	2.37	128.44	125.74
2	A	1101	B12	C19-N24-C16	2.36	109.86	107.29
2	B	1101	B12	C35-C5-C6	2.35	126.20	122.41
2	A	1101	B12	C41-C8-C9	2.30	115.20	111.19
2	B	1101	B12	C35-C5-C4	-2.29	112.15	116.79
4	B	1102	GDP	N9-C8-N7	-2.27	109.19	113.40
4	A	1103	GDP	N9-C8-N7	-2.24	109.25	113.40
2	A	1101	B12	C8B-N1B-C1R	-2.23	121.64	125.41
2	B	1101	B12	P-O3-C2P	2.18	128.56	121.10
2	A	1101	B12	C2-C1-C19	-2.17	115.24	118.61
4	A	1103	GDP	C6-C5-N7	2.16	134.23	130.29
4	B	1102	GDP	C6-C5-N7	2.16	134.22	130.29
4	B	1102	GDP	C8-N7-C5	2.14	108.07	104.26
2	B	1101	B12	C20-C1-C19	-2.06	107.36	109.35
4	B	1102	GDP	C4-C5-N7	-2.06	107.40	110.67
2	A	1101	B12	C2-C1-N21	2.05	104.62	101.78
4	A	1103	GDP	C8-N7-C5	2.04	107.90	104.26

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	1101	B12	C35-C5-C4	-2.04	112.66	116.79
2	B	1101	B12	O3-P-O4	2.01	116.22	109.81

There are no chirality outliers.

All (32) torsion outliers are listed below:

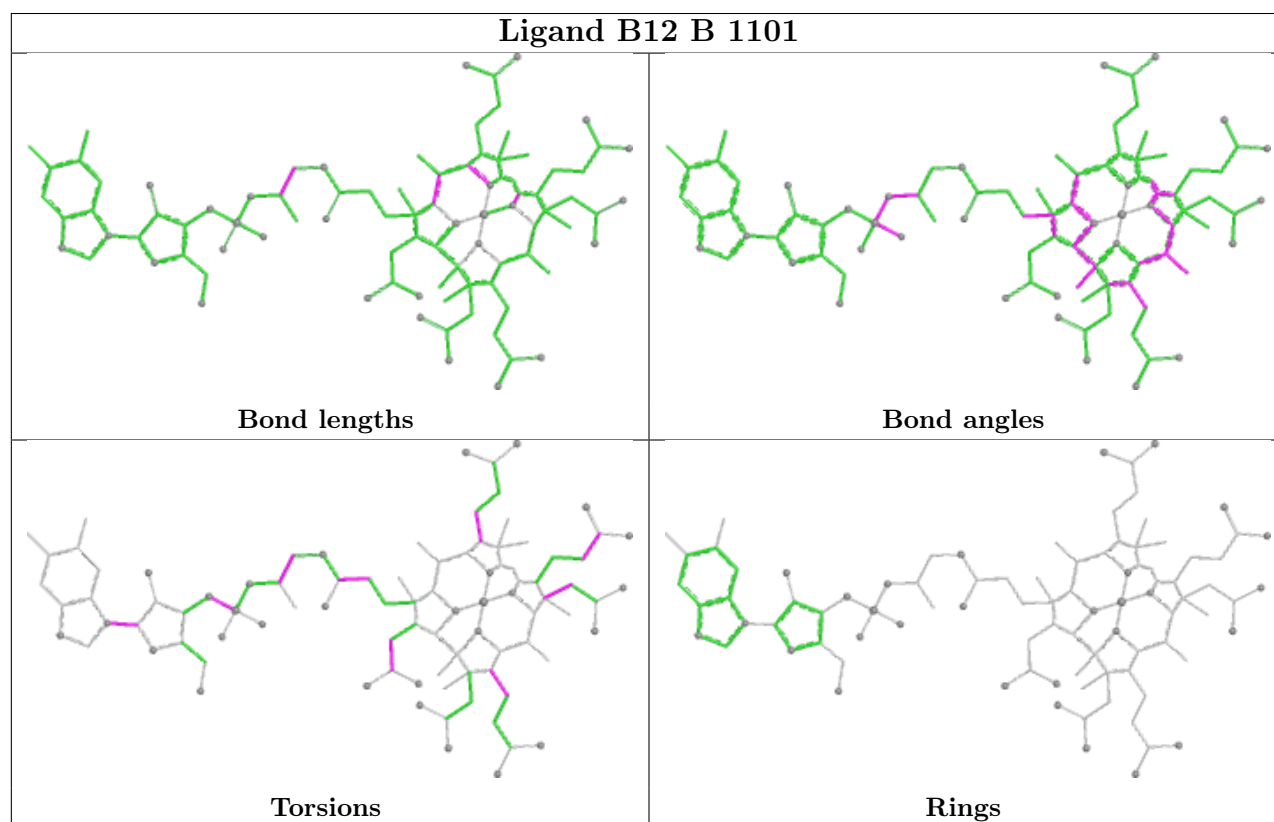
Mol	Chain	Res	Type	Atoms
2	A	1101	B12	C42-C41-C8-C9
2	A	1101	B12	C1P-C2P-O3-P
2	A	1101	B12	C3P-C2P-O3-P
2	B	1101	B12	C38-C37-C7-C36
2	B	1101	B12	C4-C3-C30-C31
2	B	1101	B12	C2-C3-C30-C31
2	A	1101	B12	C4-C3-C30-C31
2	A	1101	B12	C2-C3-C30-C31
2	B	1101	B12	C18-C60-C61-N62
2	B	1101	B12	C38-C37-C7-C8
2	B	1101	B12	C38-C37-C7-C6
2	B	1101	B12	C41-C42-C43-N45
2	B	1101	B12	C12-C13-C48-C49
2	B	1101	B12	C41-C42-C43-O44
2	B	1101	B12	C18-C60-C61-O63
2	A	1101	B12	C12-C13-C48-C49
2	A	1101	B12	C30-C31-C32-O34
2	A	1101	B12	C18-C60-C61-O63
2	A	1101	B12	C18-C60-C61-N62
2	A	1101	B12	C2R-C1R-N1B-C8B
2	A	1101	B12	O6R-C1R-N1B-C8B
2	B	1101	B12	C2R-C1R-N1B-C8B
2	B	1101	B12	O6R-C1R-N1B-C8B
2	A	1101	B12	C30-C31-C32-N33
2	B	1101	B12	C55-C56-C57-O58
2	A	1101	B12	N59-C1P-C2P-O3
2	A	1101	B12	C55-C56-C57-O58
2	B	1101	B12	C55-C56-C57-N59
2	A	1101	B12	C55-C56-C57-N59
2	A	1101	B12	C3R-O2-P-O5
2	B	1101	B12	N59-C1P-C2P-O3
2	B	1101	B12	C3R-O2-P-O5

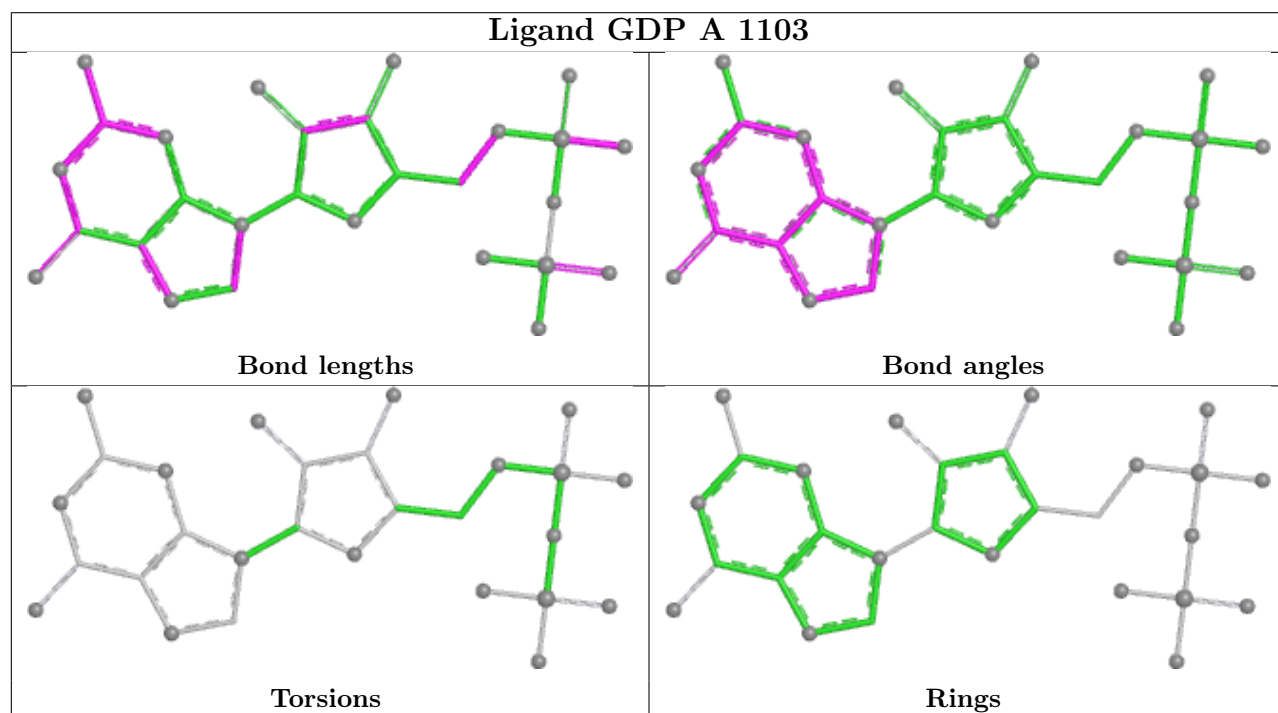
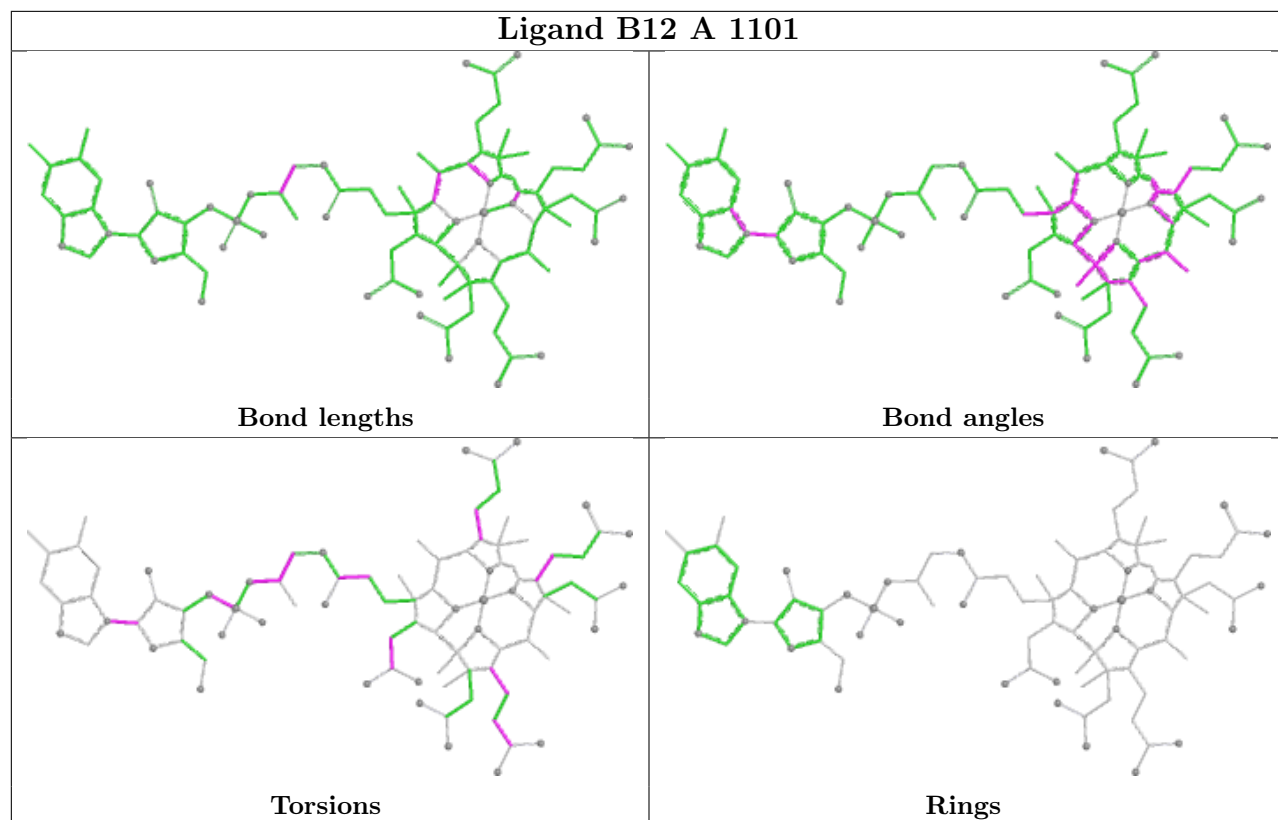
There are no ring outliers.

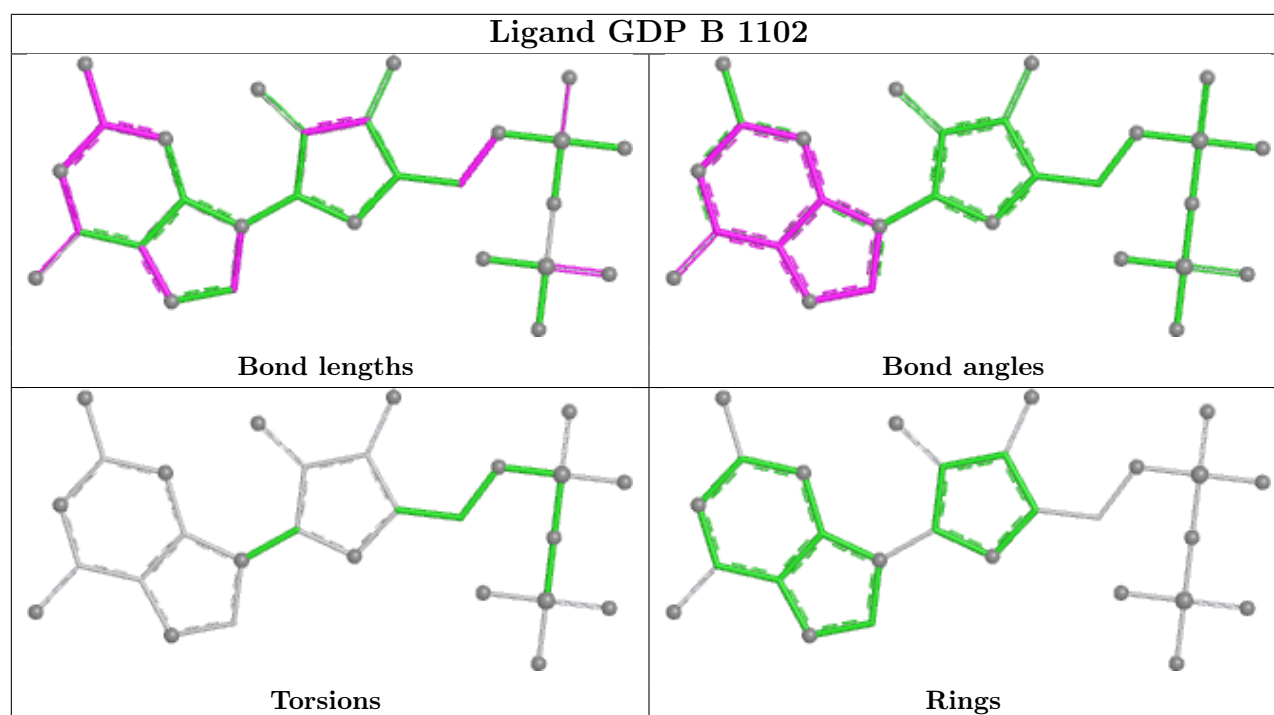
5 monomers are involved in 14 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	1102	5AD	1	0
2	B	1101	B12	4	0
2	A	1101	B12	8	0
4	A	1103	GDP	1	0
4	B	1102	GDP	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	1067/1113 (95%)	-0.01	27 (2%) 58 43	53, 81, 130, 204	0
1	B	1061/1113 (95%)	-0.06	33 (3%) 51 38	51, 74, 124, 185	0
All	All	2128/2226 (95%)	-0.04	60 (2%) 55 40	51, 78, 129, 204	0

All (60) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	1011	ASP	6.9
1	B	904	ASP	6.4
1	A	1014	PRO	6.0
1	A	316	GLN	5.9
1	B	909	THR	5.9
1	B	877	ASP	5.2
1	B	595	THR	5.0
1	B	903	TYR	5.0
1	B	908	THR	5.0
1	B	907	ILE	5.0
1	B	1020	ALA	5.0
1	B	910	PRO	4.6
1	B	593	ASP	4.5
1	B	490	GLU	4.4
1	A	217	THR	4.3
1	A	1012	PRO	4.3
1	A	529	VAL	4.0
1	B	591	GLY	3.8
1	B	1019	LEU	3.7
1	B	873	ALA	3.5
1	A	284	ALA	3.5
1	A	1013	THR	3.4
1	B	491	SER	3.3
1	B	741	GLY	3.3

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Mol	Chain	Res	Type	RSRZ
1	A	290	GLN	3.2
1	A	255	SER	3.2
1	A	1015	GLN	3.2
1	A	808	ALA	3.1
1	B	534	ASP	3.1
1	B	532	ILE	3.1
1	B	901	ASN	3.0
1	A	491	SER	3.0
1	B	537	ILE	2.9
1	A	445	ALA	2.9
1	B	594	PRO	2.8
1	B	874	GLN	2.8
1	B	869	ARG	2.8
1	A	530	VAL	2.7
1	B	624	SER	2.7
1	A	254	LYS	2.7
1	B	902	ALA	2.7
1	B	383	HIS	2.7
1	A	421	SER	2.6
1	A	492	ALA	2.6
1	B	1046	GLU	2.6
1	B	1010	GLY	2.5
1	B	23	PRO	2.4
1	B	871	LEU	2.4
1	B	870	SER	2.3
1	A	21	ARG	2.3
1	A	489	HIS	2.3
1	A	624	SER	2.3
1	B	875	GLU	2.2
1	B	770	ASN	2.2
1	A	286	SER	2.1
1	A	973	GLU	2.1
1	A	1016	THR	2.1
1	A	42	SER	2.0
1	A	335	GLU	2.0
1	A	343	GLU	2.0

6.2 Non-standard residues in protein, DNA, RNA chains ⓘ

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](#)

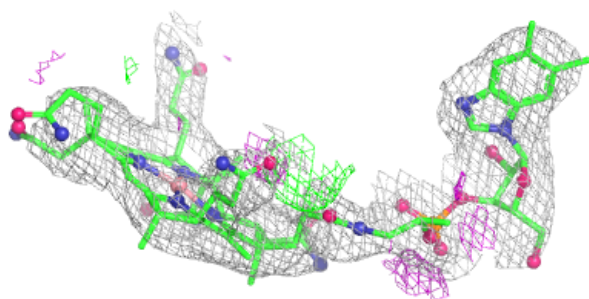
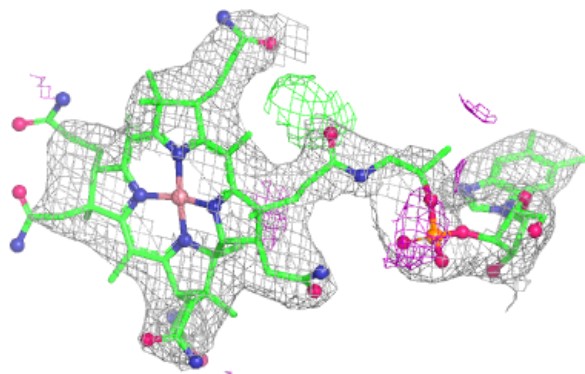
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists 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
6	ACT	A	1106	4/4	0.86	0.24	83,85,86,88	0
3	5AD	A	1102	18/18	0.91	0.17	96,104,106,108	0
2	B12	B	1101	91/91	0.96	0.11	78,98,125,134	0
4	GDP	B	1102	28/28	0.97	0.07	51,60,76,79	0
2	B12	A	1101	91/91	0.98	0.08	45,62,77,80	0
5	MG	A	1105	1/1	0.98	0.06	73,73,73,73	0
4	GDP	A	1103	28/28	0.98	0.05	65,79,84,87	0
5	MG	B	1103	1/1	0.99	0.07	39,39,39,39	0
5	MG	B	1104	1/1	0.99	0.04	38,38,38,38	0
5	MG	A	1104	1/1	0.99	0.04	60,60,60,60	0

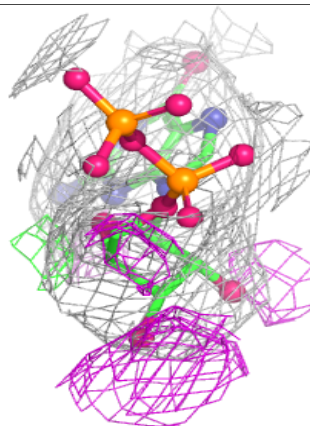
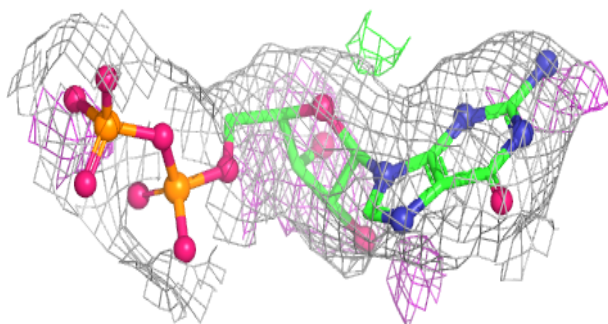
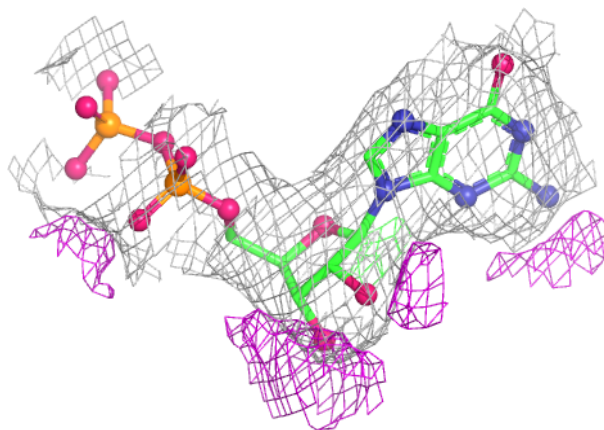
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around B12 B 1101:

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

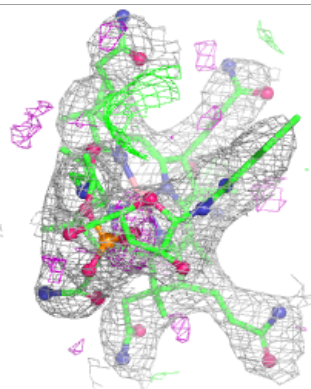
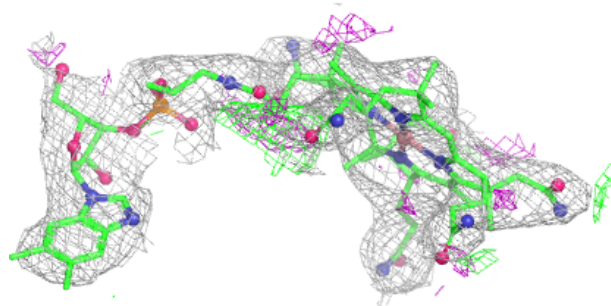
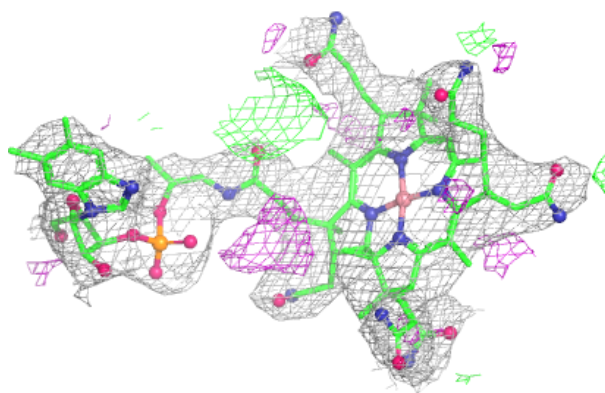
**Electron density around GDP B 1102:**

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

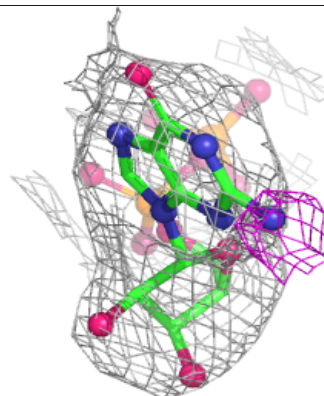
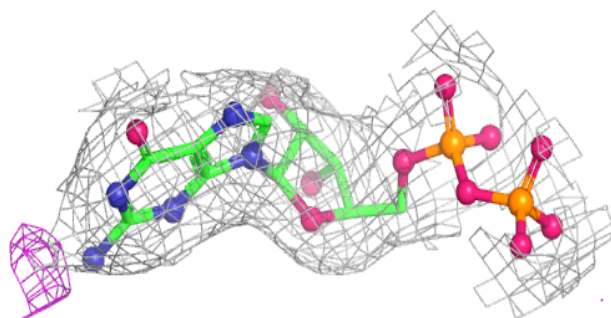
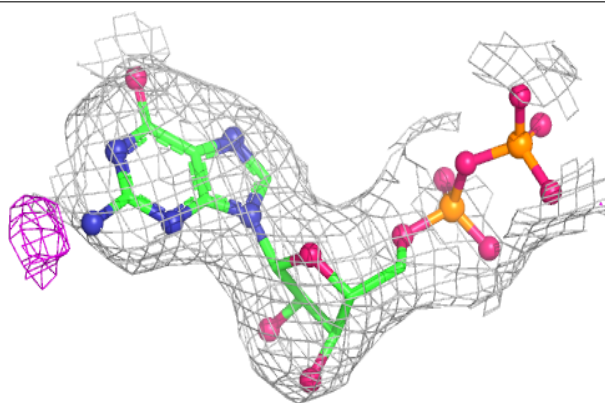


Electron density around B12 A 1101:

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

**Electron density around GDP A 1103:**

$2mF_o-DF_c$ (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.