



Full wwPDB X-ray Structure Validation Report ⓘ

Aug 19, 2023 – 06:22 PM EDT

PDB ID : 2FYD
Title : catalytic domain of bovine beta 1, 4-galactosyltransferase in complex with alpha-lactalbumin, glucose, Mn, and UDP-N-acetylgalactosamine
Authors : Ramakrishnan, B.; Ramasamy, V.; Qasba, P.K.
Deposited on : 2006-02-07
Resolution : 2.00 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 : 4.02b-467
Mogul : 1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix) : 1.13
EDS : 2.35
buster-report : 1.1.7 (2018)
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac : 5.8.0158
CCP4 : 7.0.044 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.35

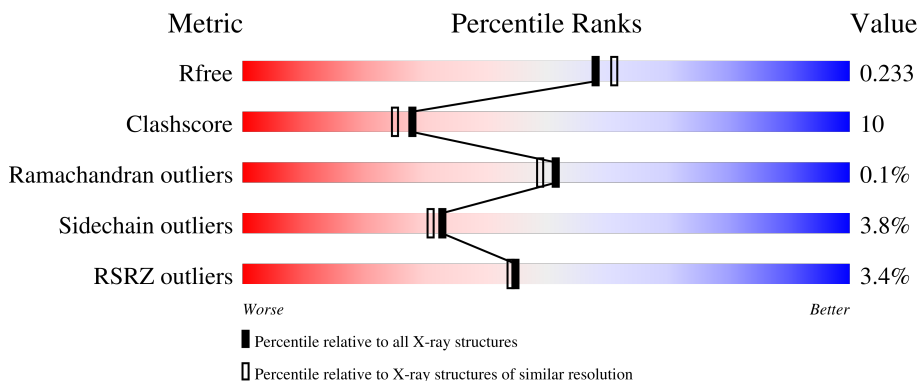
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

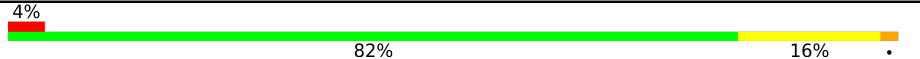
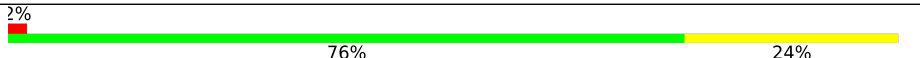
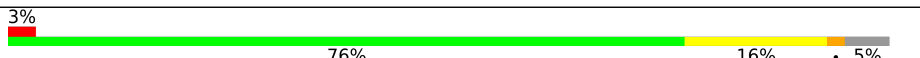
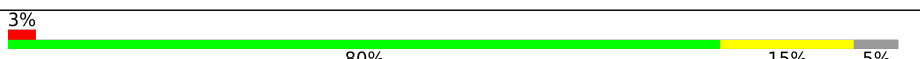
The reported resolution of this entry is 2.00 Å.

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}	130704	8085 (2.00-2.00)
Clashscore	141614	9178 (2.00-2.00)
Ramachandran outliers	138981	9054 (2.00-2.00)
Sidechain outliers	138945	9053 (2.00-2.00)
RSRZ outliers	127900	7900 (2.00-2.00)

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	123	
1	C	123	
2	B	286	
2	D	286	

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard

residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
7	NGA	B	404	-	-	X	X
7	NGA	D	529	-	-	X	-

2 Entry composition [i](#)

There are 10 unique types of molecules in this entry. The entry contains 7045 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 Alpha-lactalbumin.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	123	980	620	156	195	9	0	0	0
1	C	123	980	620	156	195	9	0	0	0

- Molecule 2 is a protein called beta-1,4-galactosyltransferase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	272	2210	1415	381	399	15	2	0	0
2	D	272	2210	1415	381	399	15	2	0	0

There are 32 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	117	ALA	-	cloning artifact	GB 21450879
B	118	SER	-	cloning artifact	GB 21450879
B	119	MET	-	cloning artifact	GB 21450879
B	120	THR	-	cloning artifact	GB 21450879
B	121	GLY	-	cloning artifact	GB 21450879
B	122	GLY	-	cloning artifact	GB 21450879
B	123	GLN	-	cloning artifact	GB 21450879
B	124	GLN	-	cloning artifact	GB 21450879
B	125	MET	-	cloning artifact	GB 21450879
B	126	GLY	-	cloning artifact	GB 21450879
B	127	ARG	-	cloning artifact	GB 21450879
B	128	GLY	-	cloning artifact	GB 21450879
B	129	SER	-	cloning artifact	GB 21450879
B	312	CYS	TRP	engineered mutation	GB 21450879
B	342	THR	CYS	engineered mutation	GB 21450879
B	401	CYS	PRO	engineered mutation	GB 21450879

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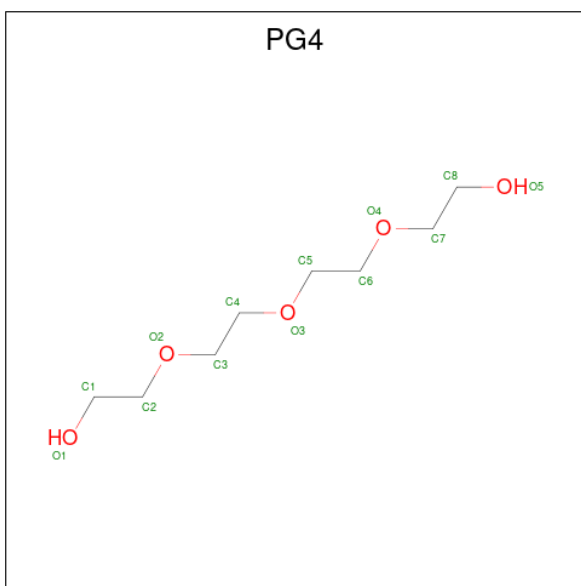
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Chain	Residue	Modelled	Actual	Comment	Reference
D	117	ALA	-	cloning artifact	GB 21450879
D	118	SER	-	cloning artifact	GB 21450879
D	119	MET	-	cloning artifact	GB 21450879
D	120	THR	-	cloning artifact	GB 21450879
D	121	GLY	-	cloning artifact	GB 21450879
D	122	GLY	-	cloning artifact	GB 21450879
D	123	GLN	-	cloning artifact	GB 21450879
D	124	GLN	-	cloning artifact	GB 21450879
D	125	MET	-	cloning artifact	GB 21450879
D	126	GLY	-	cloning artifact	GB 21450879
D	127	ARG	-	cloning artifact	GB 21450879
D	128	GLY	-	cloning artifact	GB 21450879
D	129	SER	-	cloning artifact	GB 21450879
D	312	CYS	TRP	engineered mutation	GB 21450879
D	342	THR	CYS	engineered mutation	GB 21450879
D	401	CYS	PRO	engineered mutation	GB 21450879

- Molecule 3 is CALCIUM ION (three-letter code: CA) (formula: Ca).

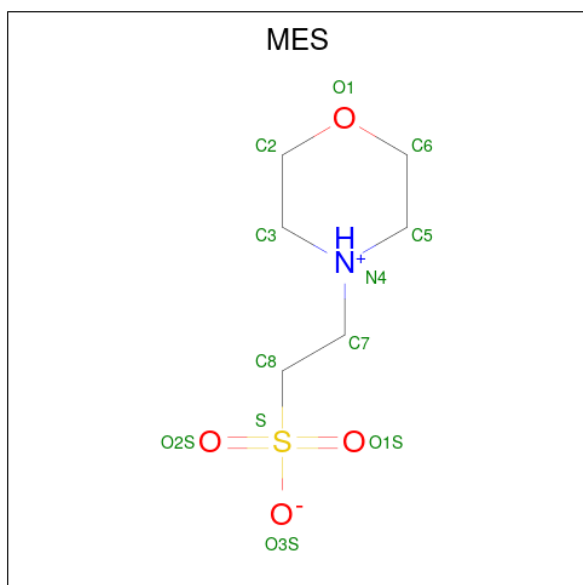
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total Ca 1 1	0	0
3	C	1	Total Ca 1 1	0	0

- Molecule 4 is TETRAETHYLENE GLYCOL (three-letter code: PG4) (formula: C₈H₁₈O₅).



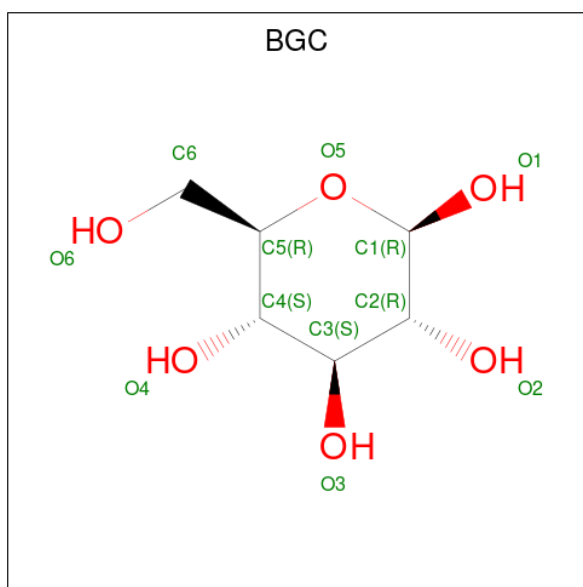
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	C	O	0	0
			13	8	5		
4	C	1	Total	C	O	0	0
			13	8	5		

- Molecule 5 is 2-(N-MORPHOLINO)-ETHANESULFONIC ACID (three-letter code: MES) (formula: C₆H₁₃NO₄S).



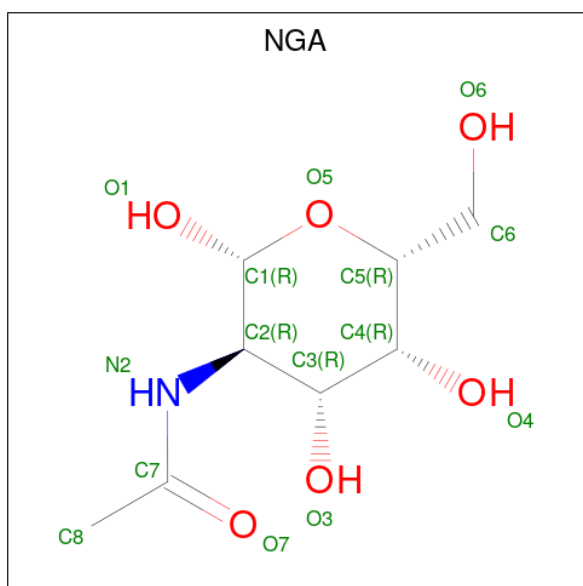
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
5	A	1	Total	C	N	O	S	0	0
			12	6	1	4	1		
5	C	1	Total	C	N	O	S	0	0
			12	6	1	4	1		

- Molecule 6 is beta-D-glucopyranose (three-letter code: BGC) (formula: C₆H₁₂O₆).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	B	1	Total	C	O	0	0
			12	6	6		
6	D	1	Total	C	O	0	0
			12	6	6		

- Molecule 7 is 2-acetamido-2-deoxy-beta-D-galactopyranose (three-letter code: NGA) (formula: C₈H₁₅NO₆).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
7	B	1	Total	C	N	O	0	0
			14	8	1	5		

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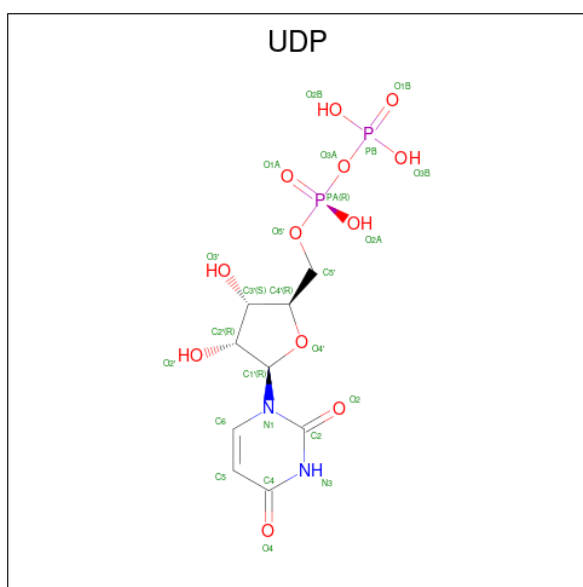
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Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
7	D	1	Total	C	N	O	0	0
			14	8	1	5		

- Molecule 8 is MANGANESE (II) ION (three-letter code: MN) (formula: Mn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
8	B	1	Total	Mn	0	0
			1	1		
8	D	1	Total	Mn	0	0
			1	1		

- Molecule 9 is URIDINE-5'-DIPHOSPHATE (three-letter code: UDP) (formula: C₉H₁₄N₂O₁₂P₂).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
9	B	1	Total	C	N	O	P	0	0
			25	9	2	12	2		
9	D	1	Total	C	N	O	P	0	0
			25	9	2	12	2		

- Molecule 10 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
10	A	90	Total	O	0	0
			90	90		
10	B	153	Total	O	0	0
			153	153		

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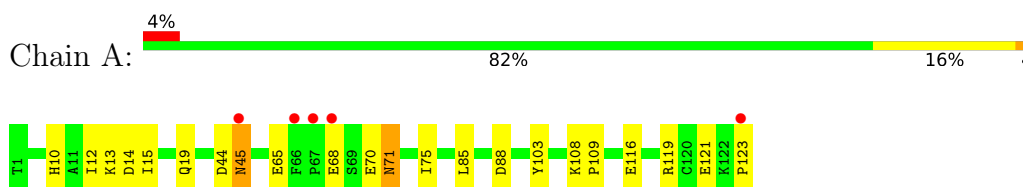
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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
10	C	101	Total 101	O 101	0	0
10	D	165	Total 165	O 165	0	0

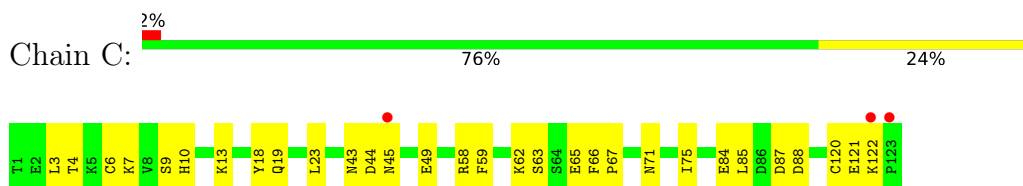
3 Residue-property plots i

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.

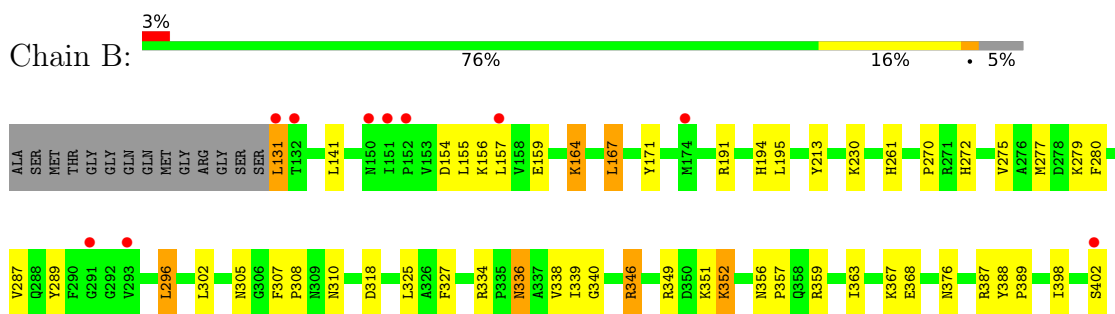
- Molecule 1: Alpha-lactalbumin



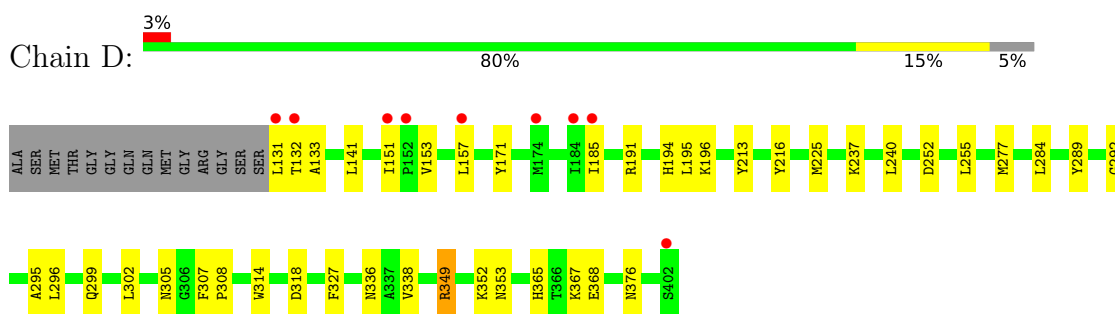
- Molecule 1: Alpha-lactalbumin



- Molecule 2: beta-1,4-galactosyltransferase



- Molecule 2: beta-1,4-galactosyltransferase



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	58.07Å 95.38Å 100.39Å 90.00° 101.33° 90.00°	Depositor
Resolution (Å)	32.08 – 2.00 32.08 – 2.00	Depositor EDS
% Data completeness (in resolution range)	94.9 (32.08-2.00) 94.8 (32.08-2.00)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.10	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.31 (at 2.00Å)	Xtrriage
Refinement program	CNS 1.0	Depositor
R, R_{free}	0.201 , 0.242 0.191 , 0.233	Depositor DCC
R_{free} test set	6971 reflections (10.12%)	wwPDB-VP
Wilson B-factor (Å ²)	30.1	Xtrriage
Anisotropy	0.321	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 57.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	7045	wwPDB-VP
Average B, all atoms (Å ²)	32.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.44% 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: MN, UDP, MES, BGC, CA, PG4, NGA

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	0.62	0/1001	0.74	0/1350
1	C	0.61	0/1001	0.79	1/1350 (0.1%)
2	B	0.53	0/2267	0.74	1/3068 (0.0%)
2	D	0.58	0/2267	0.76	1/3068 (0.0%)
All	All	0.57	0/6536	0.75	3/8836 (0.0%)

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	87	ASP	CB-CG-OD1	6.25	123.93	118.30
2	B	296	LEU	CA-CB-CG	5.48	127.91	115.30
2	D	284	LEU	CA-CB-CG	5.11	127.06	115.30

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	980	0	936	15	0
1	C	980	0	936	26	0
2	B	2210	0	2178	49	0
2	D	2210	0	2178	33	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	A	1	0	0	0	0
3	C	1	0	0	0	0
4	A	13	0	18	0	0
4	C	13	0	18	1	0
5	A	12	0	13	1	0
5	C	12	0	13	1	0
6	B	12	0	12	1	0
6	D	12	0	12	2	0
7	B	14	0	12	8	0
7	D	14	0	12	10	0
8	B	1	0	0	0	0
8	D	1	0	0	0	0
9	B	25	0	11	1	0
9	D	25	0	11	2	0
10	A	90	0	0	1	0
10	B	153	0	0	2	0
10	C	101	0	0	3	0
10	D	165	0	0	2	0
All	All	7045	0	6360	128	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 10.

All (128) 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)
7:D:529:NGA:H82	9:D:528:UDP:O3B	1.58	1.02
2:B:310:ASN:ND2	2:B:402:SER:H	1.61	0.97
1:A:10:HIS:HA	1:A:13:LYS:HE2	1.48	0.95
1:C:62:LYS:HE3	1:C:63:SER:O	1.73	0.87
2:B:310:ASN:HD22	2:B:402:SER:H	1.27	0.82
2:D:225:MET:HE2	2:D:352:LYS:HE3	1.60	0.82
1:A:121:GLU:O	1:A:123:PRO:HD3	1.80	0.80
1:A:71:ASN:HD21	1:A:75:ILE:H	1.28	0.78
2:B:346:ARG:HH11	2:B:346:ARG:HA	1.49	0.76
2:B:191:ARG:HH11	2:B:194:HIS:HD2	1.34	0.75
2:D:305:ASN:HD21	2:D:376:ASN:H	1.35	0.74
1:C:4:THR:HG23	1:C:7:LYS:HE2	1.70	0.74
2:D:252:ASP:OD2	7:D:529:NGA:H83	1.89	0.72
2:B:336:ASN:HD22	2:B:338:VAL:H	1.38	0.70
2:D:349:ARG:HH11	2:D:349:ARG:HG2	1.57	0.69

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:71:ASN:HD21	1:C:75:ILE:H	1.38	0.68
2:B:349:ARG:HD3	10:B:1034:HOH:O	1.94	0.67
1:A:44:ASP:O	1:A:45:ASN:HB2	1.94	0.67
2:D:151:ILE:HG13	2:D:151:ILE:O	1.95	0.66
2:B:336:ASN:ND2	2:B:339:ILE:HG22	2.11	0.65
1:C:4:THR:H	1:C:7:LYS:HE3	1.62	0.64
2:B:327:PHE:CZ	2:B:367:LYS:HB2	2.33	0.63
1:C:4:THR:H	1:C:7:LYS:CE	2.11	0.62
2:B:351:LYS:O	2:B:352:LYS:HB2	1.98	0.62
2:D:314:TRP:CD1	7:D:529:NGA:H61	2.35	0.61
2:D:327:PHE:CZ	2:D:367:LYS:HB2	2.34	0.61
2:B:336:ASN:ND2	2:B:338:VAL:H	1.99	0.61
2:B:305:ASN:HD21	2:B:376:ASN:H	1.48	0.61
2:D:349:ARG:HH11	2:D:349:ARG:CG	2.14	0.60
1:C:6:CYS:SG	1:C:122:LYS:HB2	2.41	0.60
2:D:225:MET:CE	2:D:352:LYS:HE3	2.30	0.59
2:B:131:LEU:HD12	2:B:131:LEU:N	2.18	0.59
2:B:164:LYS:HG3	10:B:1395:HOH:O	2.03	0.58
1:A:10:HIS:O	1:A:13:LYS:HG2	2.03	0.57
2:B:191:ARG:NH1	2:B:194:HIS:HD2	2.02	0.57
2:B:272:HIS:HB3	2:B:334:ARG:HG2	1.87	0.57
1:C:13:LYS:HD3	1:C:23:LEU:CD1	2.35	0.57
2:B:336:ASN:HD22	2:B:336:ASN:C	2.08	0.56
2:B:191:ARG:HD2	2:B:194:HIS:CD2	2.42	0.54
1:C:84:GLU:HG3	10:C:1121:HOH:O	2.08	0.54
1:C:120:CYS:SG	1:C:122:LYS:HB2	2.47	0.54
1:C:58:ARG:HD2	1:C:59:PHE:CE2	2.42	0.54
2:B:279:LYS:HE2	7:B:404:NGA:H81	1.90	0.54
2:D:336:ASN:HD22	2:D:338:VAL:H	1.56	0.54
2:D:295:ALA:O	2:D:296:LEU:HD12	2.07	0.53
2:B:277:MET:CE	2:B:279:LYS:HD3	2.38	0.53
2:D:185:ILE:HD13	2:D:216:TYR:HB2	1.90	0.53
2:D:255:LEU:HD11	7:D:529:NGA:H81	1.90	0.52
1:A:68:GLU:HG2	1:A:68:GLU:O	2.10	0.52
2:B:336:ASN:ND2	2:B:339:ILE:H	2.07	0.52
1:A:108:LYS:HB3	1:A:109:PRO:HD3	1.90	0.52
2:B:277:MET:HE1	7:B:404:NGA:O7	2.10	0.52
2:B:277:MET:SD	7:B:404:NGA:O7	2.69	0.51
2:B:307:PHE:HB3	2:B:308:PRO:HD2	1.91	0.51
2:B:336:ASN:HD22	2:B:338:VAL:N	2.06	0.51
2:D:349:ARG:HD2	2:D:353:ASN:O	2.09	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:D:327:PHE:CE2	2:D:367:LYS:HD2	2.47	0.50
1:A:14:ASP:CG	1:A:14:ASP:O	2.48	0.50
1:A:116:GLU:OE1	1:A:119:ARG:NH2	2.45	0.50
1:C:9:SER:O	1:C:13:LYS:HG2	2.12	0.49
2:D:365:HIS:HD2	2:D:368:GLU:OE1	1.95	0.49
2:D:132:THR:CG2	2:D:133:ALA:N	2.74	0.49
2:B:289:TYR:OH	7:B:404:NGA:N2	2.46	0.49
2:B:310:ASN:HD22	2:B:402:SER:N	2.04	0.49
2:D:153:VAL:HG22	2:D:196:LYS:HB3	1.94	0.49
2:D:277:MET:HE1	7:D:529:NGA:O7	2.13	0.49
2:B:261:HIS:O	2:B:339:ILE:HD11	2.14	0.48
2:B:289:TYR:OH	7:B:404:NGA:C7	2.61	0.48
4:C:851:PG4:H11	6:D:530:BGC:O6	2.14	0.48
2:D:307:PHE:HB3	2:D:308:PRO:HD2	1.95	0.48
1:C:13:LYS:HD3	1:C:23:LEU:HD13	1.96	0.47
1:A:108:LYS:HB3	1:A:109:PRO:CD	2.44	0.47
1:C:66:PHE:HB2	10:C:1017:HOH:O	2.13	0.47
2:D:132:THR:HG22	2:D:133:ALA:N	2.28	0.47
2:B:191:ARG:HH11	2:B:194:HIS:CD2	2.23	0.47
6:D:530:BGC:O4	7:D:529:NGA:C1	2.62	0.47
2:B:191:ARG:NH1	2:B:194:HIS:CD2	2.83	0.46
2:D:237:LYS:HD2	10:D:1403:HOH:O	2.14	0.46
1:C:13:LYS:HD3	1:C:23:LEU:HD11	1.97	0.46
2:D:191:ARG:HH11	2:D:194:HIS:HD2	1.63	0.46
2:D:252:ASP:OD2	7:D:529:NGA:C8	2.62	0.46
2:B:336:ASN:ND2	2:B:336:ASN:C	2.69	0.46
2:B:230:LYS:HD3	2:B:398:ILE:HB	1.98	0.45
1:A:70:GLU:HG3	10:A:1402:HOH:O	2.16	0.45
2:B:279:LYS:HE3	2:B:280:PHE:CZ	2.51	0.45
1:C:49:GLU:OE1	5:C:806:MES:H52	2.16	0.45
2:D:314:TRP:NE1	7:D:529:NGA:H61	2.32	0.45
1:C:19:GLN:HG3	1:C:19:GLN:O	2.17	0.45
2:D:132:THR:HG22	2:D:133:ALA:O	2.17	0.45
2:B:155:LEU:O	2:B:159:GLU:HG3	2.16	0.45
2:B:336:ASN:HD21	2:B:339:ILE:H	1.63	0.45
1:C:10:HIS:HA	1:C:13:LYS:HE2	1.99	0.45
7:B:404:NGA:H83	9:B:406:UDP:PB	2.57	0.44
1:A:116:GLU:OE2	1:A:119:ARG:HD2	2.17	0.44
2:B:388:TYR:HB3	2:B:389:PRO:HD2	1.99	0.44
2:D:194:HIS:HE1	10:D:982:HOH:O	2.00	0.44
2:B:327:PHE:CE1	2:B:367:LYS:HB2	2.51	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
6:B:403:BGC:O4	7:B:404:NGA:C1	2.65	0.44
2:B:261:HIS:C	2:B:339:ILE:HD11	2.38	0.44
1:C:121:GLU:O	1:C:122:LYS:C	2.56	0.44
2:D:171:TYR:HB3	2:D:213:TYR:CE2	2.52	0.44
2:B:277:MET:CE	7:B:404:NGA:O7	2.65	0.44
1:C:3:LEU:HA	1:C:7:LYS:HE3	2.00	0.44
2:D:318:ASP:N	2:D:318:ASP:OD1	2.50	0.43
1:A:12:ILE:O	1:A:15:ILE:HG22	2.18	0.43
2:D:292:GLY:HA2	7:D:529:NGA:H83	2.01	0.43
1:C:58:ARG:HB3	10:C:1261:HOH:O	2.18	0.43
2:B:167:LEU:HD13	2:B:387:ARG:HB3	2.00	0.42
2:D:289:TYR:OH	7:D:529:NGA:N2	2.52	0.42
1:A:103:TYR:CE2	5:A:805:MES:H51	2.54	0.42
2:B:359:ARG:O	2:B:363:ILE:HG23	2.20	0.42
1:A:65:GLU:CD	1:A:65:GLU:H	2.23	0.42
2:B:275:VAL:HG22	2:B:340:GLY:HA3	2.00	0.42
1:C:4:THR:H	1:C:7:LYS:HE2	1.83	0.41
1:C:18:TYR:O	1:C:19:GLN:HB3	2.20	0.41
2:B:368:GLU:H	2:B:368:GLU:HG2	1.66	0.41
2:B:318:ASP:N	2:B:318:ASP:OD1	2.50	0.41
2:D:252:ASP:HB3	9:D:528:UDP:O3'	2.21	0.41
2:B:356:ASN:HA	2:B:357:PRO:HD3	1.88	0.41
1:C:4:THR:N	1:C:7:LYS:CE	2.81	0.41
1:C:43:ASN:HD21	1:C:45:ASN:HA	1.86	0.41
2:B:351:LYS:O	2:B:352:LYS:CB	2.67	0.41
1:C:65:GLU:O	1:C:67:PRO:HD3	2.21	0.41
2:D:349:ARG:CG	2:D:349:ARG:NH1	2.82	0.40
2:B:171:TYR:HB3	2:B:213:TYR:CE2	2.56	0.40
2:B:270:PRO:HG2	2:B:325:LEU:HD22	2.03	0.40
2:B:154:ASP:OD1	2:B:156:LYS:HB2	2.22	0.40
1:C:10:HIS:HA	1:C:13:LYS:HG2	2.02	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	121/123 (98%)	118 (98%)	2 (2%)	1 (1%)	19	13
1	C	121/123 (98%)	115 (95%)	6 (5%)	0	100	100
2	B	270/286 (94%)	265 (98%)	5 (2%)	0	100	100
2	D	270/286 (94%)	265 (98%)	5 (2%)	0	100	100
All	All	782/818 (96%)	763 (98%)	18 (2%)	1 (0%)	51	49

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	45	ASN

5.3.2 Protein sidechains [i](#)

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	109/109 (100%)	105 (96%)	4 (4%)	34	32
1	C	109/109 (100%)	106 (97%)	3 (3%)	43	44
2	B	245/254 (96%)	233 (95%)	12 (5%)	25	21
2	D	245/254 (96%)	237 (97%)	8 (3%)	38	37
All	All	708/726 (98%)	681 (96%)	27 (4%)	33	31

All (27) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	19	GLN
1	A	71	ASN
1	A	85	LEU
1	A	88	ASP
2	B	131	LEU
2	B	141	LEU
2	B	157	LEU

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Mol	Chain	Res	Type
2	B	164	LYS
2	B	167	LEU
2	B	195	LEU
2	B	287	VAL
2	B	296	LEU
2	B	302	LEU
2	B	336	ASN
2	B	346	ARG
2	B	352	LYS
1	C	44	ASP
1	C	85	LEU
1	C	88	ASP
2	D	131	LEU
2	D	141	LEU
2	D	157	LEU
2	D	195	LEU
2	D	240	LEU
2	D	299	GLN
2	D	302	LEU
2	D	349	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (18) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	71	ASN
2	B	160	GLN
2	B	161	GLN
2	B	194	HIS
2	B	210	GLN
2	B	305	ASN
2	B	310	ASN
2	B	336	ASN
1	C	43	ASN
1	C	71	ASN
2	D	161	GLN
2	D	194	HIS
2	D	207	GLN
2	D	299	GLN
2	D	305	ASN
2	D	310	ASN
2	D	336	ASN
2	D	365	HIS

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 monosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 14 ligands modelled in this entry, 4 are monoatomic - leaving 10 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
9	UDP	D	528	8	24,26,26	1.55	4 (16%)	37,40,40	1.79	11 (29%)
6	BGC	B	403	-	12,12,12	0.37	0	17,17,17	0.47	0
5	MES	C	806	-	12,12,12	1.14	0	14,16,16	1.04	1 (7%)
9	UDP	B	406	8	24,26,26	1.38	2 (8%)	37,40,40	1.75	9 (24%)
5	MES	A	805	-	12,12,12	1.49	3 (25%)	14,16,16	1.09	2 (14%)
4	PG4	A	850	-	12,12,12	0.40	0	11,11,11	0.47	0
7	NGA	B	404	-	14,14,15	2.52	5 (35%)	17,19,21	3.83	10 (58%)
4	PG4	C	851	-	12,12,12	0.47	0	11,11,11	0.37	0
6	BGC	D	530	-	12,12,12	0.39	0	17,17,17	0.36	0
7	NGA	D	529	-	14,14,15	2.51	5 (35%)	17,19,21	4.08	13 (76%)

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
9	UDP	D	528	8	-	5/16/32/32	0/2/2/2
6	BGC	B	403	-	-	0/2/22/22	0/1/1/1
5	MES	C	806	-	-	2/6/14/14	0/1/1/1
9	UDP	B	406	8	-	5/16/32/32	0/2/2/2
5	MES	A	805	-	-	2/6/14/14	0/1/1/1
4	PG4	A	850	-	-	3/10/10/10	-
7	NGA	B	404	-	-	4/6/23/26	0/1/1/1
4	PG4	C	851	-	-	3/10/10/10	-
6	BGC	D	530	-	-	0/2/22/22	0/1/1/1
7	NGA	D	529	-	-	4/6/23/26	0/1/1/1

All (19) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
7	D	529	NGA	O5-C1	-6.90	1.32	1.43
7	B	404	NGA	O5-C5	5.31	1.54	1.43
7	B	404	NGA	O5-C1	-5.17	1.35	1.43
7	D	529	NGA	O5-C5	3.24	1.50	1.43
9	D	528	UDP	PB-O3B	-3.03	1.43	1.54
7	B	404	NGA	C2-N2	2.91	1.51	1.46
5	A	805	MES	C7-N4	2.69	1.53	1.47
7	D	529	NGA	C3-C2	2.60	1.58	1.52
7	D	529	NGA	O4-C4	-2.58	1.36	1.43
7	B	404	NGA	C8-C7	2.48	1.55	1.50
9	D	528	UDP	C2-N1	2.48	1.42	1.38
5	A	805	MES	C5-N4	2.45	1.53	1.46
9	B	406	UDP	PB-O1B	2.34	1.58	1.50
5	A	805	MES	C3-N4	2.27	1.53	1.46
9	D	528	UDP	PB-O1B	2.25	1.57	1.50
7	B	404	NGA	O4-C4	-2.22	1.37	1.43
9	B	406	UDP	C2-N1	2.22	1.42	1.38
9	D	528	UDP	O5'-C5'	-2.17	1.36	1.44
7	D	529	NGA	C4-C3	2.15	1.57	1.52

All (46) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
7	B	404	NGA	C1-C2-N2	7.77	123.76	110.49
7	D	529	NGA	O5-C5-C6	-7.08	96.10	107.20
7	D	529	NGA	C6-C5-C4	6.80	128.93	113.00
7	D	529	NGA	C1-O5-C5	6.80	121.40	112.19

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
7	D	529	NGA	C2-N2-C7	6.55	132.22	122.90
7	B	404	NGA	C2-N2-C7	6.17	131.69	122.90
7	B	404	NGA	O5-C1-C2	6.05	120.84	111.29
7	D	529	NGA	O5-C1-C2	5.95	120.69	111.29
7	B	404	NGA	C6-C5-C4	5.58	126.06	113.00
7	B	404	NGA	C1-O5-C5	5.32	119.39	112.19
9	B	406	UDP	O4'-C4'-C3'	-4.42	96.37	105.11
9	D	528	UDP	PA-O5'-C5'	4.27	146.72	121.68
7	D	529	NGA	O3-C3-C2	4.08	117.90	109.47
9	B	406	UDP	PA-O5'-C5'	4.06	145.51	121.68
9	D	528	UDP	O4'-C4'-C3'	-4.06	97.08	105.11
7	B	404	NGA	O3-C3-C2	3.96	117.66	109.47
7	B	404	NGA	O4-C4-C5	-3.19	101.37	109.30
9	D	528	UDP	O5'-PA-O1A	-3.19	96.61	109.07
9	B	406	UDP	O5'-PA-O1A	-2.94	97.60	109.07
9	D	528	UDP	O3A-PB-O1B	-2.89	95.18	111.19
9	D	528	UDP	O2A-PA-O5'	2.86	121.04	107.75
9	B	406	UDP	O2-C2-N1	-2.80	119.06	122.79
9	B	406	UDP	O3B-PB-O1B	2.79	121.59	110.68
9	D	528	UDP	O2-C2-N1	-2.76	119.11	122.79
9	D	528	UDP	O3B-PB-O3A	2.73	113.81	104.64
7	D	529	NGA	O4-C4-C5	-2.71	102.58	109.30
7	D	529	NGA	O3-C3-C4	-2.64	104.25	110.35
9	B	406	UDP	O3A-PB-O1B	-2.63	96.61	111.19
7	B	404	NGA	C8-C7-N2	2.61	120.52	116.10
7	D	529	NGA	C1-C2-N2	2.59	114.91	110.49
7	D	529	NGA	C8-C7-N2	2.59	120.48	116.10
5	A	805	MES	O1S-S-C8	2.54	109.98	106.92
9	D	528	UDP	O3B-PB-O1B	2.51	120.52	110.68
7	B	404	NGA	O3-C3-C4	-2.49	104.58	110.35
5	C	806	MES	O2S-S-C8	-2.48	103.93	106.92
9	D	528	UDP	C2'-C1'-N1	2.39	119.99	113.22
7	D	529	NGA	O6-C6-C5	2.33	119.29	111.29
9	B	406	UDP	O2A-PA-O5'	2.32	118.52	107.75
7	D	529	NGA	O7-C7-C8	-2.30	117.78	122.06
9	B	406	UDP	O2-C2-N3	2.27	125.73	121.50
9	B	406	UDP	O3B-PB-O3A	2.25	112.18	104.64
9	D	528	UDP	O2-C2-N3	2.24	125.68	121.50
5	A	805	MES	O2S-S-C8	-2.15	104.32	106.92
7	B	404	NGA	C4-C3-C2	2.09	114.08	111.02
9	D	528	UDP	O2B-PB-O1B	2.07	118.80	110.68
7	D	529	NGA	O5-C5-C4	2.01	115.71	110.83

There are no chirality outliers.

All (28) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	A	805	MES	C8-C7-N4-C3
5	A	805	MES	C8-C7-N4-C5
5	C	806	MES	C8-C7-N4-C3
5	C	806	MES	C8-C7-N4-C5
7	B	404	NGA	C1-C2-N2-C7
7	D	529	NGA	C3-C2-N2-C7
9	B	406	UDP	C5'-O5'-PA-O1A
9	B	406	UDP	C5'-O5'-PA-O2A
9	B	406	UDP	C5'-O5'-PA-O3A
9	D	528	UDP	C5'-O5'-PA-O1A
9	D	528	UDP	C5'-O5'-PA-O2A
9	D	528	UDP	C5'-O5'-PA-O3A
9	B	406	UDP	C3'-C4'-C5'-O5'
9	D	528	UDP	C3'-C4'-C5'-O5'
7	B	404	NGA	C8-C7-N2-C2
7	B	404	NGA	O7-C7-N2-C2
7	D	529	NGA	C8-C7-N2-C2
7	D	529	NGA	O7-C7-N2-C2
7	B	404	NGA	O5-C5-C6-O6
9	B	406	UDP	O4'-C4'-C5'-O5'
9	D	528	UDP	O4'-C4'-C5'-O5'
4	C	851	PG4	O3-C5-C6-O4
7	D	529	NGA	O5-C5-C6-O6
4	C	851	PG4	C8-C7-O4-C6
4	A	850	PG4	C8-C7-O4-C6
4	C	851	PG4	C1-C2-O2-C3
4	A	850	PG4	O4-C7-C8-O5
4	A	850	PG4	O1-C1-C2-O2

There are no ring outliers.

9 monomers are involved in 22 short contacts:

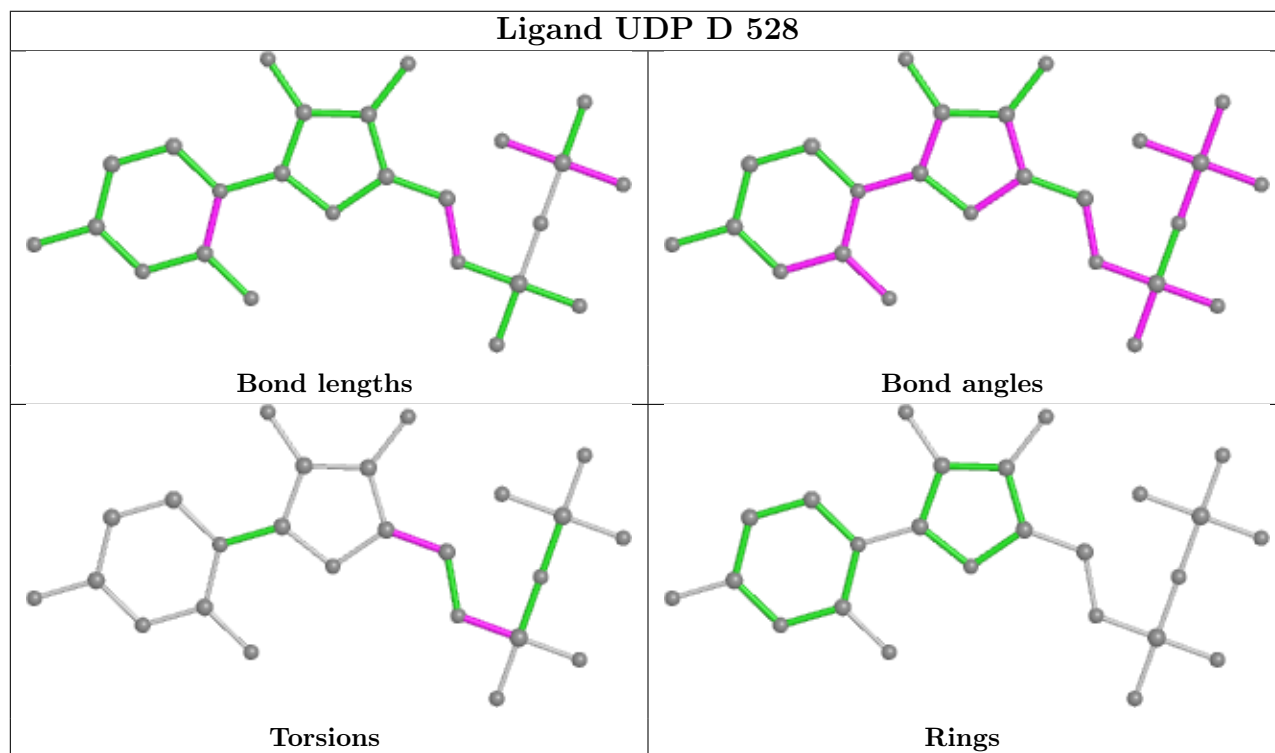
Mol	Chain	Res	Type	Clashes	Symm-Clashes
9	D	528	UDP	2	0
6	B	403	BGC	1	0
5	C	806	MES	1	0
9	B	406	UDP	1	0
5	A	805	MES	1	0
7	B	404	NGA	8	0
4	C	851	PG4	1	0

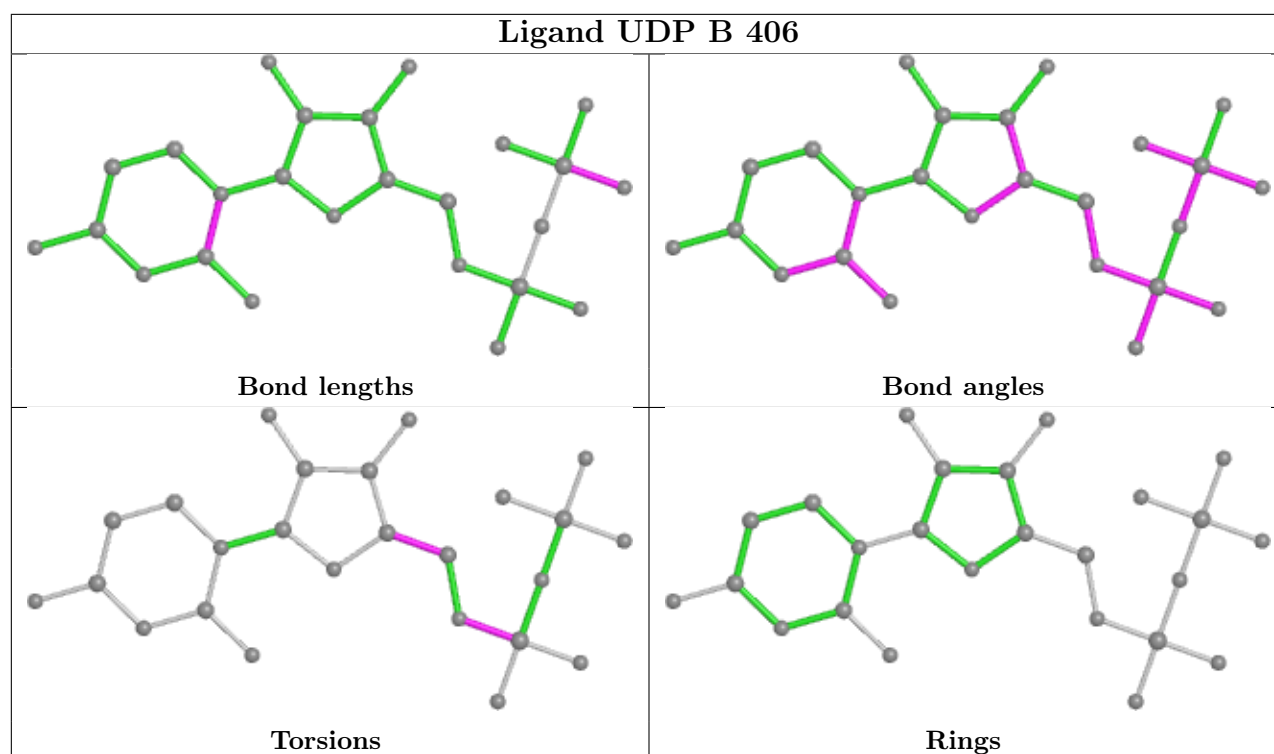
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Mol	Chain	Res	Type	Clashes	Symm-Clashes
6	D	530	BGC	2	0
7	D	529	NGA	10	0

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	123/123 (100%)	-0.31	5 (4%) 37 36	20, 28, 51, 65	0
1	C	123/123 (100%)	-0.24	3 (2%) 59 57	18, 28, 49, 82	0
2	B	272/286 (95%)	-0.09	10 (3%) 41 41	21, 31, 50, 63	2 (0%)
2	D	272/286 (95%)	-0.10	9 (3%) 46 45	20, 29, 47, 62	2 (0%)
All	All	790/818 (96%)	-0.15	27 (3%) 45 44	18, 29, 50, 82	4 (0%)

All (27) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	123	PRO	11.6
1	C	122	LYS	6.4
1	A	123	PRO	6.2
2	D	131	LEU	4.0
2	D	402	SER	3.9
2	B	151	ILE	3.9
2	B	131	LEU	3.7
2	D	132	THR	3.5
1	A	66	PHE	3.4
2	B	152	PRO	3.4
2	B	157	LEU	3.4
2	D	151	ILE	3.3
1	A	68	GLU	3.3
1	C	45	ASN	3.3
1	A	45	ASN	3.1
2	B	174	MET	2.9
2	B	402	SER	2.8
2	D	152	PRO	2.7
2	D	174	MET	2.6
1	A	67	PRO	2.6
2	B	293	VAL	2.2

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Mol	Chain	Res	Type	RSRZ
2	B	291	GLY	2.2
2	D	157	LEU	2.1
2	B	150	ASN	2.1
2	D	184	ILE	2.0
2	B	132	THR	2.0
2	D	185	ILE	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 monosaccharides in this entry.

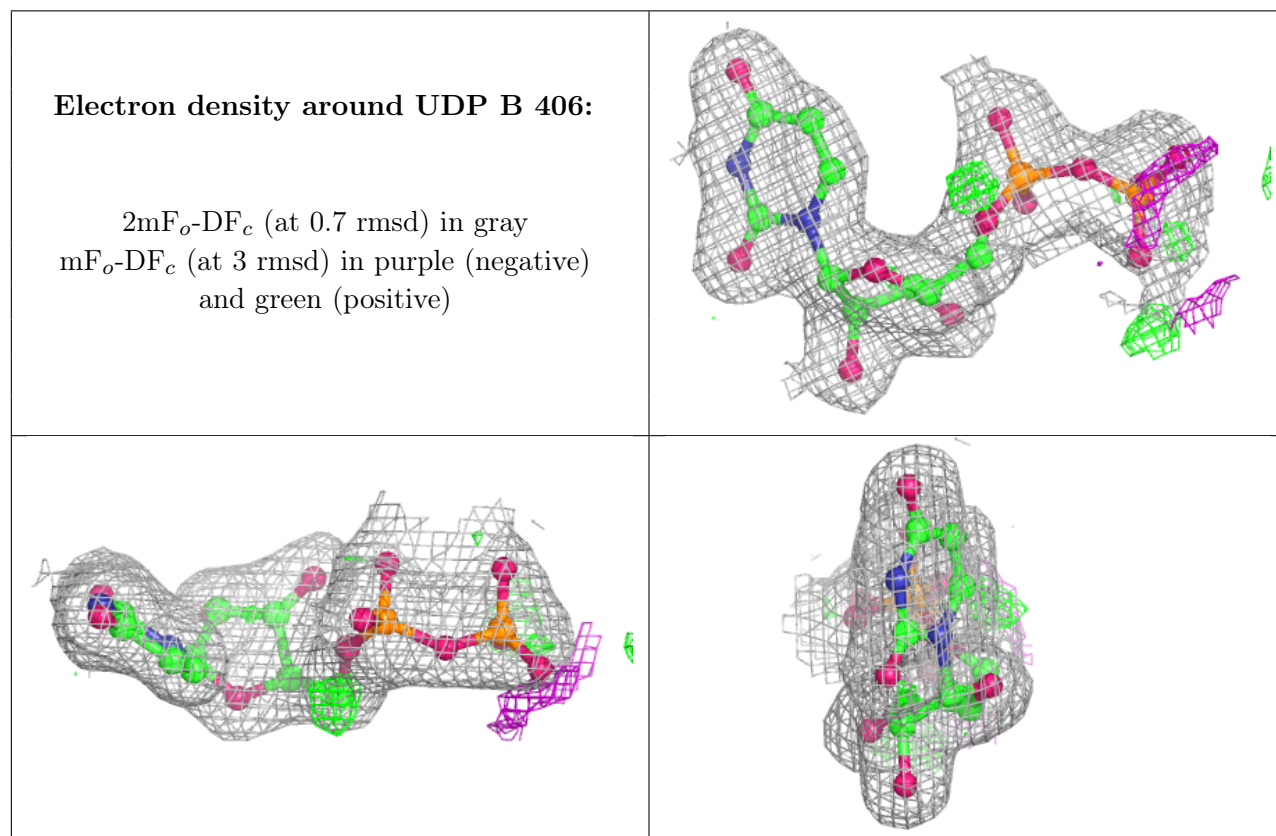
6.4 Ligands [i](#)

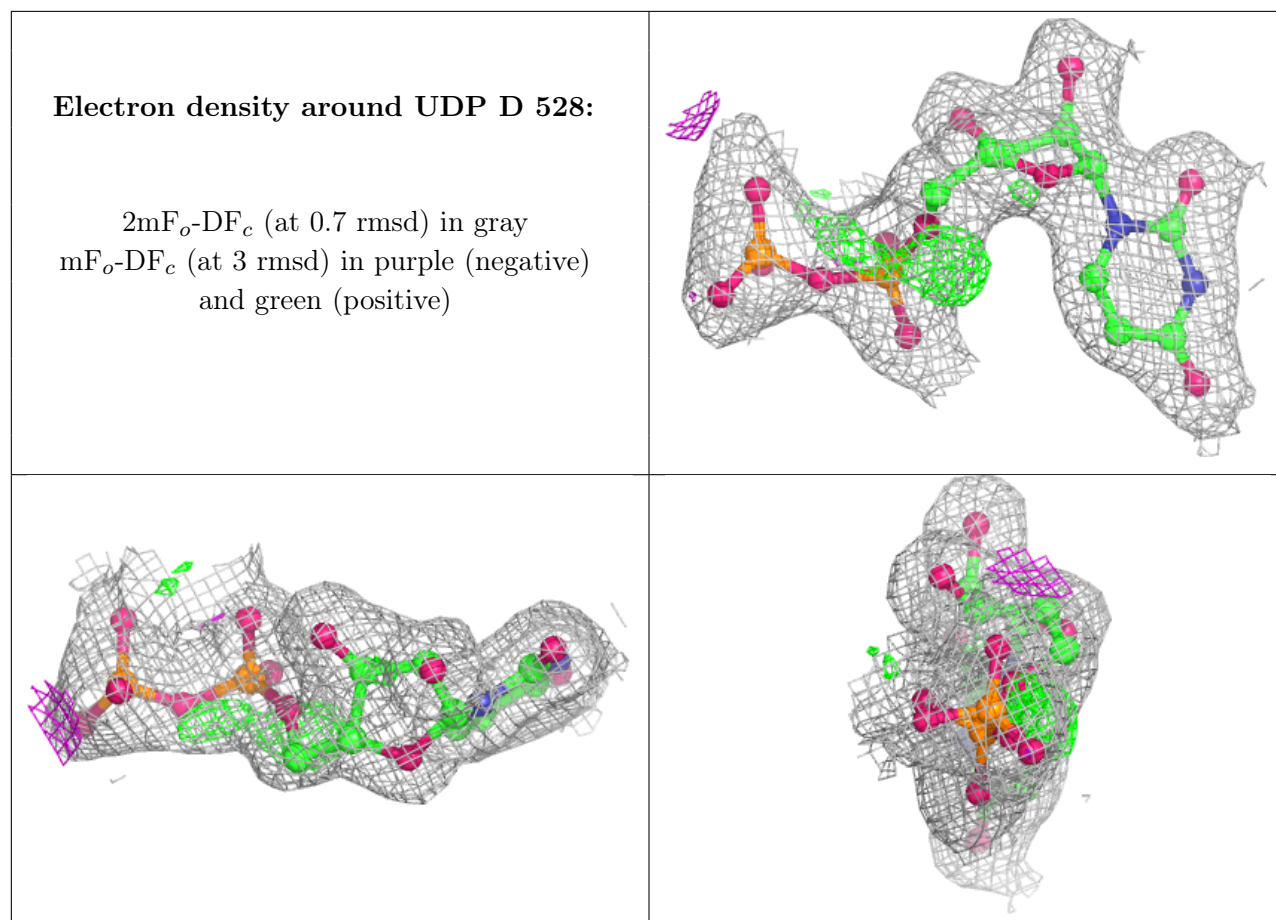
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
7	NGA	B	404	14/15	0.55	0.45	40,54,72,72	0
7	NGA	D	529	14/15	0.74	0.35	31,53,72,72	0
4	PG4	C	851	13/13	0.77	0.22	44,49,57,59	0
5	MES	C	806	12/12	0.78	0.23	54,56,65,65	0
4	PG4	A	850	13/13	0.86	0.20	45,46,53,55	0
5	MES	A	805	12/12	0.89	0.19	52,55,61,61	0
6	BGC	B	403	12/12	0.94	0.14	42,45,48,48	0
6	BGC	D	530	12/12	0.96	0.08	27,32,33,35	0
9	UDP	B	406	25/25	0.96	0.13	25,28,37,61	0
9	UDP	D	528	25/25	0.96	0.10	21,24,30,32	0
3	CA	C	526	1/1	0.98	0.06	27,27,27,27	0
3	CA	A	124	1/1	0.99	0.07	23,23,23,23	0
8	MN	D	527	1/1	0.99	0.09	27,27,27,27	0
8	MN	B	405	1/1	1.00	0.09	28,28,28,28	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.





6.5 Other polymers [i](#)

There are no such residues in this entry.