



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 6, 2026 – 07:01 PM UTC

PDB ID : 1O0R / pdb_00001o0r
Title : Crystal structure of the catalytic domain of bovine beta1,4-galactosyltransferase complex with UDP-galactose
Authors : Ramakrishnan, B.; Balaji, P.V.; Qasba, P.K.
Deposited on : 2003-02-24
Resolution : 2.30 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

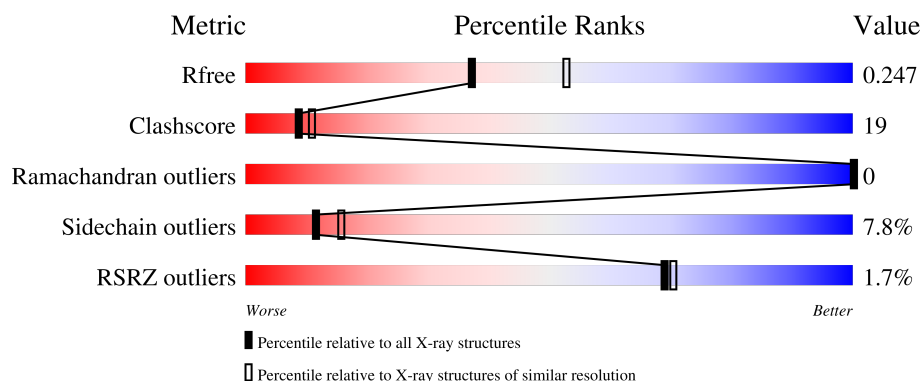
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

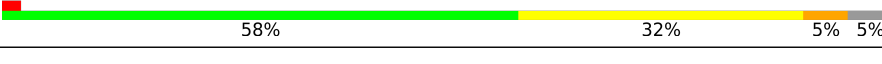
The reported resolution of this entry is 2.30 Å.

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	6319 (2.30-2.30)
Clashscore	190562	6919 (2.30-2.30)
Ramachandran outliers	187476	6854 (2.30-2.30)
Sidechain outliers	187428	6854 (2.30-2.30)
RSRZ outliers	180081	6325 (2.30-2.30)

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	286	 65% 24% 5% 5%
1	B	286	 58% 32% 5% 5%

2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 4993 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 beta-1,4-galactosyltransferase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	271	Total	C	N	O	S	0	0	0
			2211	1419	381	398	13			
1	B	273	Total	C	N	O	S	0	0	0
			2225	1428	383	401	13			

There are 28 discrepancies between the modelled and reference sequences:

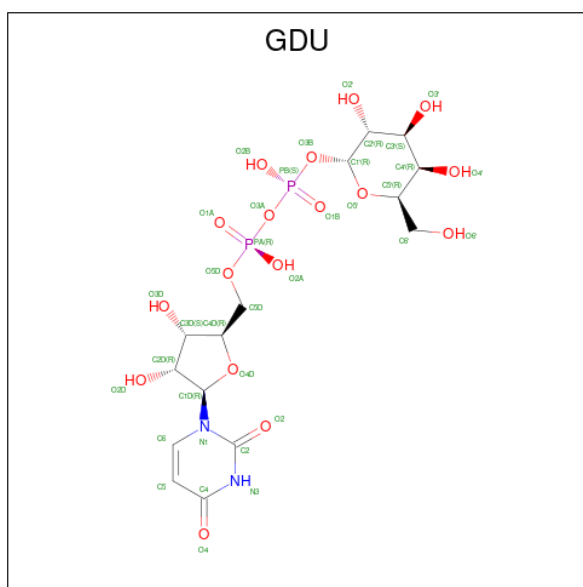
Chain	Residue	Modelled	Actual	Comment	Reference
A	117	ALA	-	SEE REMARK 999	UNP P08037
A	118	SER	-	SEE REMARK 999	UNP P08037
A	119	MET	-	SEE REMARK 999	UNP P08037
A	120	THR	-	SEE REMARK 999	UNP P08037
A	121	GLY	-	SEE REMARK 999	UNP P08037
A	122	GLY	-	SEE REMARK 999	UNP P08037
A	123	GLN	-	SEE REMARK 999	UNP P08037
A	124	GLN	-	SEE REMARK 999	UNP P08037
A	125	MET	-	SEE REMARK 999	UNP P08037
A	126	GLY	-	SEE REMARK 999	UNP P08037
A	127	ARG	-	SEE REMARK 999	UNP P08037
A	128	GLY	-	SEE REMARK 999	UNP P08037
A	129	SER	-	SEE REMARK 999	UNP P08037
A	342	THR	CYS	engineered mutation	UNP P08037
B	117	ALA	-	SEE REMARK 999	UNP P08037
B	118	SER	-	SEE REMARK 999	UNP P08037
B	119	MET	-	SEE REMARK 999	UNP P08037
B	120	THR	-	SEE REMARK 999	UNP P08037
B	121	GLY	-	SEE REMARK 999	UNP P08037
B	122	GLY	-	SEE REMARK 999	UNP P08037
B	123	GLN	-	SEE REMARK 999	UNP P08037
B	124	GLN	-	SEE REMARK 999	UNP P08037
B	125	MET	-	SEE REMARK 999	UNP P08037
B	126	GLY	-	SEE REMARK 999	UNP P08037
B	127	ARG	-	SEE REMARK 999	UNP P08037

Continued on next page...

Continued from previous page...

Chain	Residue	Modelled	Actual	Comment	Reference
B	128	GLY	-	SEE REMARK 999	UNP P08037
B	129	SER	-	SEE REMARK 999	UNP P08037
B	342	THR	CYS	engineered mutation	UNP P08037

- Molecule 2 is GALACTOSE-URIDINE-5'-DIPHOSPHATE (CCD ID: GDU) (formula: $C_{15}H_{24}N_2O_{17}P_2$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	N	O	P	0	0
			36	15	2	17	2		
2	B	1	Total	C	N	O	P	0	0
			36	15	2	17	2		

- Molecule 3 is MANGANESE (II) ION (CCD ID: MN) (formula: Mn).

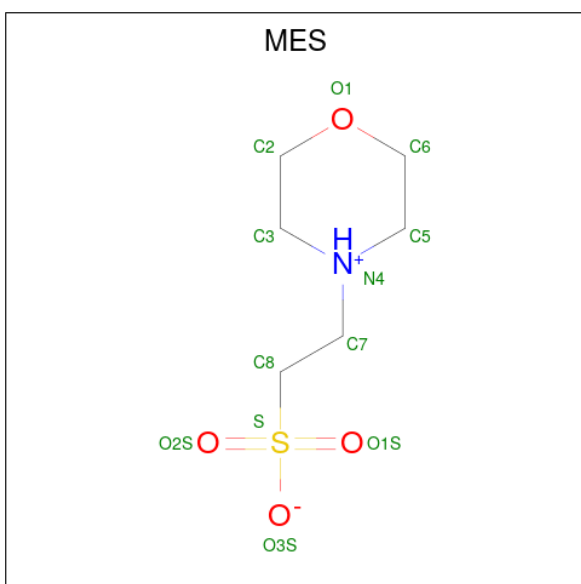
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	1	Total	Mn	0	0
			1	1		
3	B	1	Total	Mn	0	0
			1	1		

- Molecule 4 is SULFATE ION (CCD ID: SO4) (formula: O_4S).



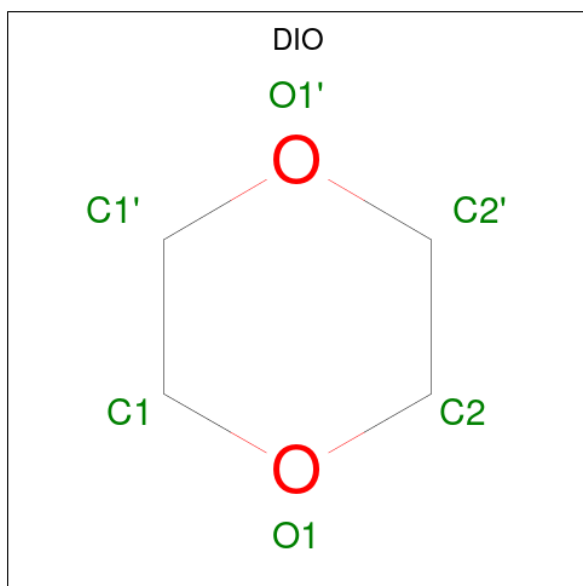
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	O	S	0	0
			5	4	1		
4	B	1	Total	O	S	0	0
			5	4	1		
4	B	1	Total	O	S	0	0
			5	4	1		
4	B	1	Total	O	S	0	0
			5	4	1		

- Molecule 5 is 2-(N-MORPHOLINO)-ETHANESULFONIC ACID (CCD ID: MES) (formula: C₆H₁₃NO₄S).



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

- Molecule 6 is 1,4-DIETHYLENE DIOXIDE (CCD ID: DIO) (formula: $C_4H_8O_2$).



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

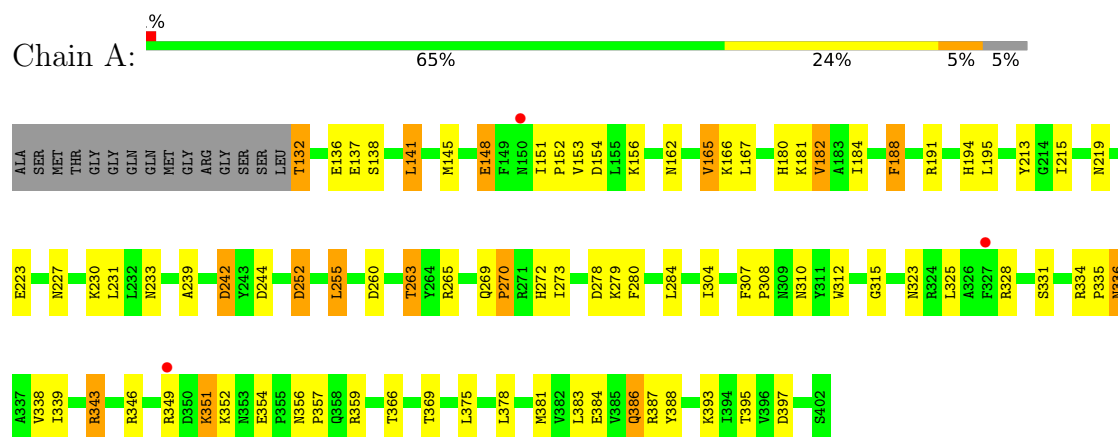
- Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	226	Total	O	0	0
			226	226		
7	B	213	Total	O	0	0
			213	213		

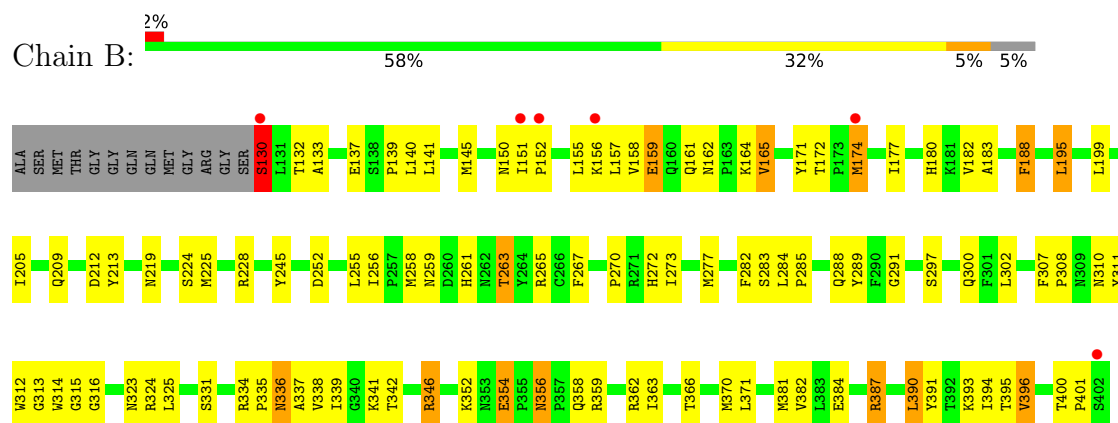
3 Residue-property plots [i](#)

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: beta-1,4-galactosyltransferase



- Molecule 1: beta-1,4-galactosyltransferase



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	50.36Å 91.78Å 142.47Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	37.53 – 2.30 37.53 – 2.30	Depositor EDS
% Data completeness (in resolution range)	98.6 (37.53-2.30) 98.6 (37.53-2.30)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.07	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.52 (at 2.29Å)	Xtriage
Refinement program	CNS 1.0	Depositor
R, R_{free}	0.203 , 0.251 0.198 , 0.247	Depositor DCC
R_{free} test set	2966 reflections (9.96%)	wwPDB-VP
Wilson B-factor (Å ²)	39.3	Xtriage
Anisotropy	0.472	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 53.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	4993	wwPDB-VP
Average B, all atoms (Å ²)	38.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.22% 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

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: MES, DIO, MN, GDU, SO4

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	0.56	0/2271	1.05	11/3076 (0.4%)
1	B	0.56	0/2285	1.09	16/3095 (0.5%)
All	All	0.56	0/4556	1.07	27/6171 (0.4%)

There are no bond length outliers.

All (27) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	315	GLY	N-CA-C	12.29	127.35	112.48
1	B	315	GLY	N-CA-C	10.62	126.06	112.68
1	A	182	VAL	N-CA-C	9.82	121.92	108.17
1	B	130	SER	N-CA-C	-8.76	86.48	111.00
1	B	130	SER	CA-CB-OG	-7.67	95.75	111.10
1	A	213	TYR	N-CA-C	7.02	120.08	109.41
1	B	335	PRO	N-CA-C	-6.82	101.67	111.22
1	B	213	TYR	N-CA-C	6.75	119.20	109.14
1	A	273	ILE	N-CA-C	6.75	117.61	111.81
1	A	188	PHE	N-CA-C	6.73	119.56	108.99
1	A	335	PRO	N-CA-C	-6.68	101.38	111.41
1	B	356	ASN	CA-C-N	6.56	126.50	119.28
1	B	356	ASN	C-N-CA	6.56	126.50	119.28
1	B	188	PHE	N-CA-C	6.34	119.59	108.75
1	A	310	ASN	N-CA-C	6.33	120.02	112.93
1	B	273	ILE	N-CA-C	5.96	117.90	111.58
1	A	252	ASP	N-CA-C	-5.88	102.78	110.53
1	B	310	ASN	N-CA-C	5.85	120.12	112.92
1	B	314	TRP	N-CA-C	5.84	118.93	110.28
1	B	182	VAL	N-CA-C	5.52	116.05	107.99
1	B	396	VAL	N-CA-C	5.39	117.64	108.86
1	B	337	ALA	N-CA-C	5.34	117.86	111.71

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	369	THR	N-CA-C	5.30	119.84	112.90
1	A	359	ARG	N-CA-C	5.26	116.70	111.07
1	B	212	ASP	N-CA-C	-5.14	98.19	107.75
1	A	263	THR	N-CA-C	5.12	117.74	110.10
1	B	371	LEU	N-CA-C	5.07	117.46	111.33

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	2211	0	2176	73	0
1	B	2225	0	2192	94	0
2	A	36	0	22	0	0
2	B	36	0	22	0	0
3	A	1	0	0	0	0
3	B	1	0	0	0	0
4	A	5	0	0	0	0
4	B	15	0	0	1	0
5	A	12	0	13	5	0
6	A	6	0	8	2	0
6	B	6	0	8	0	0
7	A	226	0	0	11	0
7	B	213	0	0	6	0
All	All	4993	0	4441	168	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 19.

All (168) 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:151:ILE:HD12	1:A:152:PRO:HD2	1.38	1.03
1:A:132:THR:HA	7:A:1010:HOH:O	1.74	0.88

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:155:LEU:O	1:B:159:GLU:HG2	1.77	0.84
1:B:384:GLU:HB3	1:B:395:THR:CG2	2.07	0.84
1:B:130:SER:OG	1:B:130:SER:O	1.97	0.82
1:B:400:THR:HG23	1:B:401:PRO:HD2	1.64	0.80
1:B:171:TYR:CE1	1:B:174:MET:HE1	2.20	0.77
1:B:352:LYS:HA	1:B:352:LYS:HE2	1.68	0.75
1:B:336:ASN:HD22	1:B:336:ASN:C	1.94	0.75
1:A:154:ASP:HA	7:A:1024:HOH:O	1.86	0.74
1:B:382:VAL:HA	1:B:396:VAL:HG12	1.68	0.74
1:A:346:ARG:NE	1:A:346:ARG:HA	2.04	0.73
1:B:387:ARG:HG2	1:B:387:ARG:HH11	1.56	0.71
1:A:167:LEU:CD1	1:A:387:ARG:HB3	2.20	0.70
1:B:258:MET:HE3	1:B:341:LYS:HB3	1.75	0.69
1:B:252:ASP:HB2	1:B:255:LEU:HD12	1.74	0.67
1:B:150:ASN:O	1:B:152:PRO:HD3	1.96	0.65
1:B:258:MET:HE1	1:B:282:PHE:HE2	1.61	0.65
1:A:151:ILE:CD1	1:A:152:PRO:HD2	2.21	0.65
1:A:227:ASN:HD22	1:A:227:ASN:C	2.06	0.64
1:B:358:GLN:O	1:B:362:ARG:HG3	1.97	0.64
1:A:181:LYS:HD3	7:A:1171:HOH:O	1.97	0.64
1:B:164:LYS:HG2	1:B:174:MET:CE	2.28	0.63
1:A:384:GLU:HB3	1:A:395:THR:CG2	2.29	0.62
1:A:343:ARG:HG3	1:A:343:ARG:HH21	1.63	0.62
1:A:252:ASP:HB2	1:A:255:LEU:HD22	1.81	0.62
1:B:258:MET:HE1	1:B:282:PHE:CE2	2.35	0.62
1:B:297:SER:OG	1:B:300:GLN:HG3	2.00	0.61
1:B:224:SER:HB2	7:B:1166:HOH:O	2.01	0.60
1:A:395:THR:HG21	5:A:900:MES:H62	1.83	0.60
1:A:233:ASN:HB3	1:A:378:LEU:HD22	1.82	0.60
1:A:167:LEU:HD11	1:A:387:ARG:HB3	1.83	0.59
1:A:191:ARG:HH21	1:A:194:HIS:HD2	1.51	0.59
1:B:156:LYS:HA	1:B:159:GLU:HG3	1.85	0.58
1:A:384:GLU:HB3	1:A:395:THR:HG21	1.84	0.58
1:A:383:LEU:HB2	1:A:395:THR:HG23	1.86	0.57
1:B:307:PHE:HB3	1:B:308:PRO:HD2	1.86	0.57
1:B:272:HIS:HB3	1:B:334:ARG:HG2	1.87	0.57
1:B:346:ARG:HG2	1:B:346:ARG:HH21	1.70	0.56
1:B:336:ASN:C	1:B:336:ASN:ND2	2.63	0.56
1:B:164:LYS:HB2	7:B:1227:HOH:O	2.06	0.56
1:A:137:GLU:HG2	7:A:1309:HOH:O	2.05	0.56
1:B:205:ILE:O	1:B:209:GLN:HG3	2.06	0.56

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:285:PRO:HG2	1:B:289:TYR:CG	2.41	0.55
1:A:395:THR:HG21	5:A:900:MES:H21	1.89	0.55
1:A:162:ASN:HB3	1:A:165:VAL:CG1	2.37	0.55
1:B:174:MET:HB2	7:B:1242:HOH:O	2.06	0.55
1:B:133:ALA:HA	1:B:177:ILE:HG22	1.89	0.55
1:B:145:MET:HE1	1:B:205:ILE:CD1	2.38	0.54
1:B:255:LEU:C	1:B:256:ILE:HD12	2.32	0.54
1:B:356:ASN:O	1:B:359:ARG:HG2	2.07	0.54
1:A:395:THR:CB	5:A:900:MES:H62	2.36	0.54
1:A:278:ASP:OD2	1:A:343:ARG:HD3	2.07	0.54
1:A:307:PHE:HB3	1:A:308:PRO:HD2	1.89	0.54
1:B:324:ARG:HG2	1:B:370:MET:HG2	1.88	0.54
1:A:154:ASP:OD1	1:A:156:LYS:HB2	2.07	0.54
1:B:336:ASN:ND2	1:B:339:ILE:H	2.04	0.53
1:A:395:THR:HG23	1:A:395:THR:O	2.08	0.53
1:B:336:ASN:HD21	1:B:339:ILE:H	1.56	0.53
1:A:270:PRO:HG2	1:A:325:LEU:HD22	1.89	0.53
1:A:351:LYS:HA	7:A:1183:HOH:O	2.09	0.52
1:B:151:ILE:O	1:B:151:ILE:HG13	2.08	0.52
1:A:269:GLN:HB3	1:A:331:SER:O	2.09	0.52
1:A:148:GLU:O	1:A:148:GLU:HG3	2.10	0.52
1:B:255:LEU:HD21	1:B:277:MET:HE3	1.90	0.52
1:B:272:HIS:HD2	1:B:334:ARG:HD3	1.75	0.52
1:A:223:GLU:O	1:A:352:LYS:HG3	2.10	0.52
1:A:138:SER:HB3	1:A:141:LEU:HD13	1.92	0.51
1:A:136:GLU:HG2	7:A:1309:HOH:O	2.10	0.51
1:A:180:HIS:CE1	1:A:265:ARG:HD2	2.46	0.51
1:B:336:ASN:ND2	1:B:338:VAL:HG22	2.25	0.51
1:A:279:LYS:HE3	1:A:280:PHE:CZ	2.46	0.50
1:A:343:ARG:HH21	1:A:343:ARG:CG	2.25	0.50
1:A:278:ASP:OD2	1:A:343:ARG:HA	2.11	0.50
1:A:336:ASN:ND2	1:A:339:ILE:H	2.10	0.50
1:B:156:LYS:HA	1:B:159:GLU:CG	2.42	0.50
1:A:312:TRP:O	1:A:356:ASN:HB2	2.12	0.50
1:A:242:ASP:OD2	1:A:387:ARG:NH2	2.46	0.49
1:B:311:TYR:HE2	1:B:363:ILE:HD12	1.77	0.49
1:A:351:LYS:O	1:A:354:GLU:OE1	2.30	0.49
1:B:133:ALA:HA	1:B:177:ILE:CG2	2.41	0.49
1:B:390:LEU:HB2	7:B:1009:HOH:O	2.11	0.49
1:B:272:HIS:HE1	1:B:291:GLY:O	1.95	0.49
1:B:346:ARG:HG2	1:B:346:ARG:NH2	2.27	0.49

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:164:LYS:HG2	1:B:174:MET:HE2	1.95	0.48
1:B:258:MET:HE3	1:B:342:THR:N	2.29	0.48
1:B:338:VAL:O	1:B:341:LYS:HG3	2.14	0.48
1:A:284:LEU:HD11	1:A:334:ARG:CZ	2.44	0.48
1:A:388:TYR:CD2	6:A:905:DIO:H12	2.49	0.48
1:B:272:HIS:CD2	1:B:334:ARG:HH21	2.31	0.48
1:B:145:MET:HE1	1:B:205:ILE:HD13	1.96	0.47
1:B:225:MET:HE3	1:B:313:GLY:CA	2.44	0.47
1:B:177:ILE:HG23	1:B:177:ILE:O	2.13	0.47
1:B:256:ILE:HD12	1:B:256:ILE:N	2.30	0.47
1:A:167:LEU:HD13	1:A:387:ARG:HB3	1.96	0.47
1:B:195:LEU:HD22	1:B:199:LEU:HG	1.96	0.47
1:B:172:THR:O	1:B:174:MET:HE3	2.14	0.47
1:B:336:ASN:HD21	1:B:338:VAL:HG22	1.79	0.47
1:B:312:TRP:O	1:B:356:ASN:HB2	2.15	0.47
1:A:162:ASN:HB3	1:A:165:VAL:HG13	1.97	0.46
1:A:162:ASN:O	1:A:165:VAL:HG13	2.16	0.46
1:A:395:THR:CG2	5:A:900:MES:H62	2.45	0.46
1:B:209:GLN:NE2	1:B:263:THR:HA	2.30	0.46
1:B:159:GLU:OE1	1:B:390:LEU:HD22	2.15	0.46
1:B:258:MET:CE	1:B:341:LYS:HB3	2.44	0.46
1:A:384:GLU:HB3	1:A:395:THR:HG22	1.97	0.46
1:A:304:ILE:HG22	1:A:328:ARG:HG3	1.97	0.45
1:B:177:ILE:HG23	7:B:1123:HOH:O	2.17	0.45
1:A:384:GLU:OE1	5:A:900:MES:O1	2.34	0.45
1:A:181:LYS:NZ	1:A:244:ASP:OD2	2.47	0.45
1:B:270:PRO:HD2	1:B:331:SER:O	2.17	0.45
1:A:191:ARG:HD2	1:A:194:HIS:CD2	2.52	0.45
1:B:158:VAL:CG1	1:B:390:LEU:HD21	2.47	0.45
1:B:258:MET:HE3	1:B:341:LYS:C	2.42	0.45
1:B:267:PHE:HA	4:B:902:SO4:O2	2.17	0.45
1:B:171:TYR:HE1	1:B:174:MET:HE1	1.77	0.44
1:A:194:HIS:HE1	7:A:1028:HOH:O	2.00	0.44
1:A:184:ILE:HD12	1:A:215:ILE:HD11	2.00	0.44
1:B:311:TYR:HE2	1:B:363:ILE:CD1	2.31	0.44
1:B:336:ASN:ND2	1:B:338:VAL:H	2.16	0.44
1:A:384:GLU:N	1:A:395:THR:CG2	2.81	0.43
1:B:312:TRP:CD2	1:B:401:PRO:HG3	2.53	0.43
1:A:154:ASP:OD2	1:A:156:LYS:HE2	2.17	0.43
1:B:180:HIS:CE1	1:B:265:ARG:HD3	2.53	0.43
1:A:343:ARG:CG	1:A:343:ARG:NH2	2.80	0.43

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:183:ALA:HB2	1:B:245:TYR:CG	2.54	0.43
1:B:258:MET:HE2	1:B:342:THR:C	2.44	0.43
1:B:316:GLY:HA3	1:B:363:ILE:HD11	2.01	0.43
1:B:139:PRO:HG2	1:B:140:LEU:HD22	2.01	0.43
1:B:270:PRO:HG2	1:B:325:LEU:HD22	1.99	0.43
1:A:227:ASN:ND2	1:A:230:LYS:H	2.17	0.43
1:A:269:GLN:O	1:A:270:PRO:C	2.62	0.43
1:B:390:LEU:O	1:B:391:TYR:HB3	2.19	0.42
1:A:145:MET:HE2	1:A:260:ASP:N	2.35	0.42
1:A:323:ASN:HB2	1:A:366:THR:HG21	2.02	0.42
1:B:387:ARG:HG2	1:B:387:ARG:NH1	2.31	0.42
1:B:132:THR:HG22	1:B:133:ALA:N	2.35	0.42
1:A:278:ASP:OD1	1:A:279:LYS:N	2.52	0.42
1:A:336:ASN:C	1:A:336:ASN:HD22	2.28	0.42
1:B:387:ARG:HH11	1:B:387:ARG:CG	2.26	0.42
1:A:166:LYS:HE2	7:A:1296:HOH:O	2.19	0.42
6:A:905:DIO:H11	7:A:1200:HOH:O	2.19	0.42
1:B:132:THR:CG2	1:B:133:ALA:N	2.83	0.42
1:B:162:ASN:HB3	1:B:165:VAL:HG13	2.01	0.42
1:B:188:PHE:O	1:B:219:ASN:HA	2.20	0.41
1:A:188:PHE:O	1:A:219:ASN:HA	2.20	0.41
1:B:400:THR:HG23	1:B:401:PRO:CD	2.43	0.41
1:A:393:LYS:HD2	7:A:1037:HOH:O	2.20	0.41
1:B:272:HIS:CD2	1:B:334:ARG:HD3	2.55	0.41
1:A:227:ASN:C	1:A:227:ASN:ND2	2.77	0.41
1:B:284:LEU:HD21	1:B:334:ARG:CZ	2.51	0.41
1:B:312:TRP:CG	1:B:401:PRO:HG3	2.55	0.41
1:A:336:ASN:ND2	1:A:338:VAL:HB	2.36	0.41
1:B:316:GLY:CA	1:B:363:ILE:HD11	2.50	0.41
1:B:354:GLU:CD	1:B:354:GLU:H	2.29	0.41
1:A:397:ASP:HA	7:A:1146:HOH:O	2.21	0.41
1:B:391:TYR:HE1	1:B:393:LYS:HB2	1.84	0.41
1:A:239:ALA:O	1:A:242:ASP:HB2	2.20	0.41
1:A:356:ASN:HA	1:A:357:PRO:HD2	1.94	0.41
1:B:387:ARG:NH1	1:B:387:ARG:CG	2.84	0.40
1:B:394:ILE:HG22	1:B:396:VAL:HG13	2.03	0.40
1:A:384:GLU:OE2	1:A:386:GLN:CD	2.64	0.40
1:A:395:THR:CG2	1:A:395:THR:O	2.69	0.40
1:B:323:ASN:HB2	1:B:366:THR:HG21	2.02	0.40
1:A:272:HIS:HB3	1:A:334:ARG:HG2	2.03	0.40
1:B:259:ASN:OD1	1:B:261:HIS:HB2	2.21	0.40

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:159:GLU:HG2	1:B:159:GLU:H	1.51	0.40
1:B:228:ARG:NH2	7:B:1340:HOH:O	2.52	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	269/286 (94%)	260 (97%)	9 (3%)	0	100	100
1	B	271/286 (95%)	264 (97%)	7 (3%)	0	100	100
All	All	540/572 (94%)	524 (97%)	16 (3%)	0	100	100

There are no Ramachandran outliers to report.

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	244/254 (96%)	225 (92%)	19 (8%)	11	16
1	B	246/254 (97%)	227 (92%)	19 (8%)	12	16
All	All	490/508 (96%)	452 (92%)	38 (8%)	11	16

All (38) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	132	THR
1	A	141	LEU
1	A	148	GLU
1	A	153	VAL
1	A	165	VAL
1	A	182	VAL
1	A	195	LEU
1	A	231	LEU
1	A	242	ASP
1	A	255	LEU
1	A	263	THR
1	A	270	PRO
1	A	336	ASN
1	A	343	ARG
1	A	349	ARG
1	A	351	LYS
1	A	375	LEU
1	A	381	MET
1	A	386	GLN
1	B	130	SER
1	B	137	GLU
1	B	141	LEU
1	B	157	LEU
1	B	159	GLU
1	B	161	GLN
1	B	165	VAL
1	B	174	MET
1	B	195	LEU
1	B	263	THR
1	B	283	SER
1	B	288	GLN
1	B	302	LEU
1	B	336	ASN
1	B	346	ARG
1	B	354	GLU
1	B	381	MET
1	B	387	ARG
1	B	390	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (16) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	161	GLN

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	A	190	ASN
1	A	192	GLN
1	A	194	HIS
1	A	219	ASN
1	A	227	ASN
1	A	336	ASN
1	B	160	GLN
1	B	180	HIS
1	B	219	ASN
1	B	272	HIS
1	B	288	GLN
1	B	299	GLN
1	B	310	ASN
1	B	336	ASN
1	B	386	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 11 ligands modelled in this entry, 2 are monoatomic - leaving 9 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
4	SO4	B	902	-	4,4,4	1.89	2 (50%)	6,6,6	0.84	0
2	GDU	A	404	3	37,38,38	1.95	10 (27%)	55,58,58	2.22	13 (23%)
4	SO4	B	904	-	4,4,4	1.84	2 (50%)	6,6,6	0.82	0
5	MES	A	900	-	12,12,12	1.33	2 (16%)	15,16,16	0.69	0
4	SO4	A	903	-	4,4,4	1.81	1 (25%)	6,6,6	0.81	0
4	SO4	B	901	-	4,4,4	1.80	2 (50%)	6,6,6	0.88	0
2	GDU	B	806	3	37,38,38	1.99	8 (21%)	55,58,58	2.23	14 (25%)
6	DIO	B	906	-	6,6,6	0.91	0	6,6,6	1.64	2 (33%)
6	DIO	A	905	-	6,6,6	0.81	0	6,6,6	1.50	2 (33%)

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
2	GDU	A	404	3	-	7/23/59/59	0/3/3/3
5	MES	A	900	-	-	0/6/14/14	0/1/1/1
2	GDU	B	806	3	-	7/23/59/59	0/3/3/3
6	DIO	B	906	-	-	-	0/1/1/1
6	DIO	A	905	-	-	-	0/1/1/1

All (27) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	806	GDU	PB-O3A	-6.34	1.52	1.59
2	A	404	GDU	PB-O3A	-5.74	1.53	1.59
2	A	404	GDU	PA-O3A	5.56	1.65	1.59
2	B	806	GDU	PA-O3A	3.93	1.63	1.59
2	B	806	GDU	PB-O3B	-3.77	1.47	1.59
2	B	806	GDU	PB-O1B	3.24	1.62	1.50
4	B	902	SO4	O1-S	3.12	1.63	1.44
2	B	806	GDU	O5'-C5'	3.04	1.51	1.44
2	A	404	GDU	PB-O3B	-3.03	1.50	1.59
4	A	903	SO4	O1-S	2.99	1.62	1.44
4	B	901	SO4	O1-S	2.96	1.62	1.44
4	B	904	SO4	O1-S	2.93	1.62	1.44
2	B	806	GDU	C5D-C4D	-2.80	1.43	1.51
5	A	900	MES	C5-N4	2.73	1.54	1.46
2	A	404	GDU	O5'-C1'	2.58	1.48	1.41

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	404	GDU	C5D-C4D	-2.55	1.43	1.51
2	A	404	GDU	C6-N1	2.55	1.44	1.38
2	A	404	GDU	O5'-C5'	2.53	1.50	1.44
2	A	404	GDU	PB-O1B	2.50	1.59	1.50
2	B	806	GDU	O5D-C5D	-2.45	1.35	1.44
5	A	900	MES	C3-N4	2.41	1.53	1.46
2	B	806	GDU	O5'-C1'	2.33	1.47	1.41
2	A	404	GDU	O5D-C5D	-2.27	1.36	1.44
2	A	404	GDU	C1D-N1	2.20	1.53	1.47
4	B	904	SO4	O3-S	-2.19	1.30	1.48
4	B	902	SO4	O3-S	-2.08	1.31	1.48
4	B	901	SO4	O3-S	-2.03	1.31	1.48

All (31) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	404	GDU	O5D-C5D-C4D	8.95	139.47	108.99
2	B	806	GDU	O5D-C5D-C4D	8.86	139.16	108.99
2	A	404	GDU	C5D-C4D-C3D	-6.19	92.93	115.21
2	B	806	GDU	C5D-C4D-C3D	-5.93	93.88	115.21
2	B	806	GDU	O3A-PB-O1B	-4.43	97.37	110.70
2	A	404	GDU	O5'-C5'-C6'	-4.12	96.23	106.44
2	B	806	GDU	O5'-C5'-C6'	-4.10	96.29	106.44
2	B	806	GDU	O3B-PB-O1B	3.88	122.22	109.81
2	A	404	GDU	O3B-PB-O1B	3.64	121.44	109.81
2	A	404	GDU	O3A-PB-O1B	-3.59	99.90	110.70
2	A	404	GDU	PA-O5D-C5D	-3.32	102.33	121.35
2	A	404	GDU	O4D-C1D-N1	-3.29	100.90	108.36
2	B	806	GDU	PA-O5D-C5D	-3.23	102.82	121.35
2	B	806	GDU	O2-C2-N1	-3.05	118.82	122.80
2	B	806	GDU	O4D-C1D-N1	-3.02	101.51	108.36
2	B	806	GDU	C2D-C3D-C4D	2.90	108.22	102.61
2	A	404	GDU	O3'-C3'-C4'	-2.80	103.78	110.38
6	B	906	DIO	C2'-O1'-C1'	2.78	118.85	109.88
2	A	404	GDU	O4D-C4D-C3D	-2.77	99.66	105.15
2	A	404	GDU	C2D-C3D-C4D	2.71	107.85	102.61
2	B	806	GDU	O4D-C4D-C3D	-2.65	99.88	105.15
6	A	905	DIO	C2'-O1'-C1'	2.64	118.43	109.88
2	A	404	GDU	O2-C2-N1	-2.62	119.39	122.80
2	B	806	GDU	C2D-C1D-N1	2.49	120.18	113.25
2	B	806	GDU	O2-C2-N3	2.30	125.73	121.49
6	B	906	DIO	C2-O1-C1	2.29	117.28	109.88

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	404	GDU	O2-C2-N3	2.27	125.67	121.49
2	A	404	GDU	C2D-C1D-N1	2.24	119.48	113.25
6	A	905	DIO	C2-O1-C1	2.05	116.52	109.88
2	B	806	GDU	O3D-C3D-C2D	2.03	118.33	111.82
2	B	806	GDU	O3'-C3'-C4'	-2.02	105.62	110.38

There are no chirality outliers.

All (14) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	404	GDU	C5D-O5D-PA-O2A
2	A	404	GDU	C5D-O5D-PA-O3A
2	A	404	GDU	C1'-O3B-PB-O3A
2	B	806	GDU	C5D-O5D-PA-O2A
2	B	806	GDU	C5D-O5D-PA-O3A
2	B	806	GDU	C1'-O3B-PB-O3A
2	B	806	GDU	O5'-C5'-C6'-O6'
2	A	404	GDU	O5'-C5'-C6'-O6'
2	A	404	GDU	PA-O3A-PB-O3B
2	B	806	GDU	PA-O3A-PB-O3B
2	A	404	GDU	C1'-O3B-PB-O2B
2	B	806	GDU	C2'-C1'-O3B-PB
2	A	404	GDU	C2'-C1'-O3B-PB
2	B	806	GDU	C2D-C1D-N1-C2

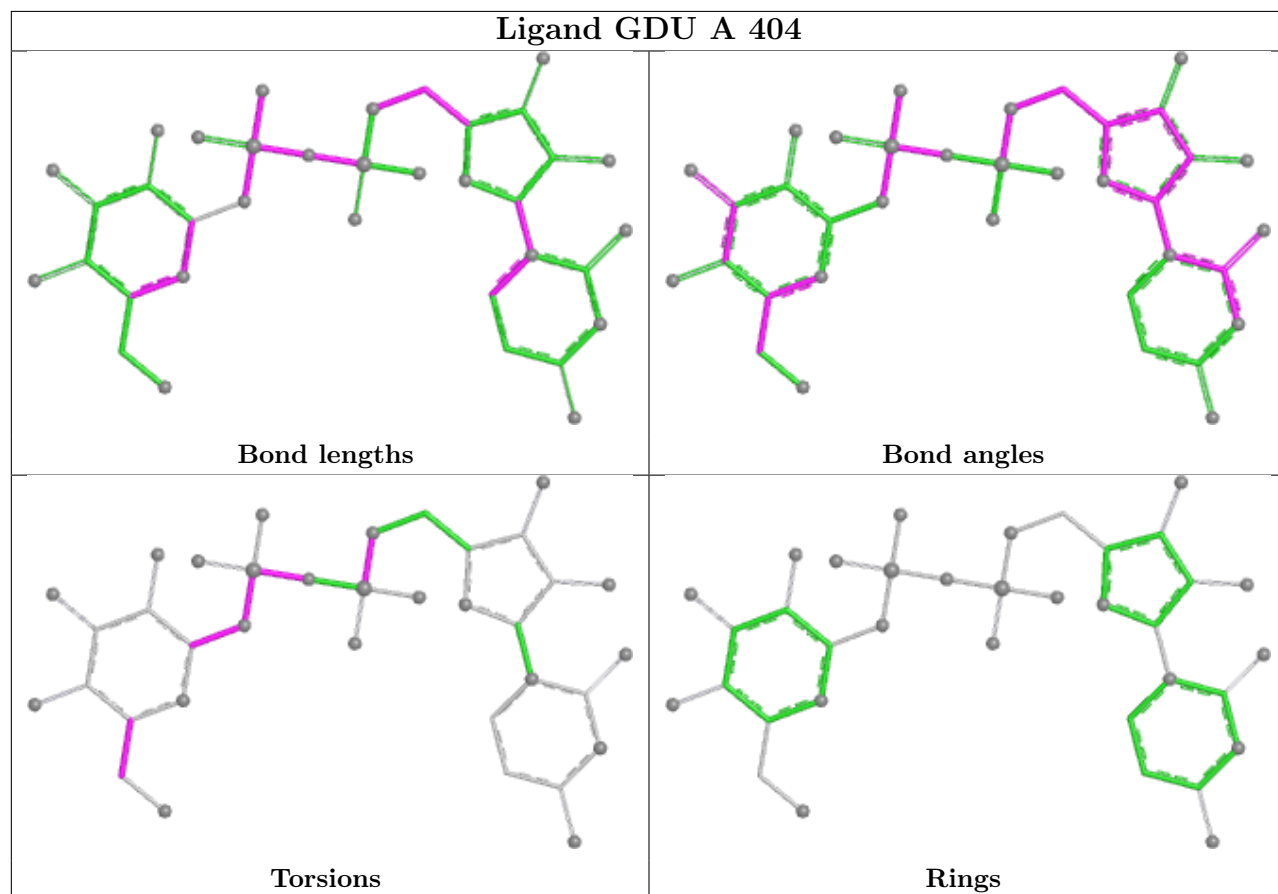
There are no ring outliers.

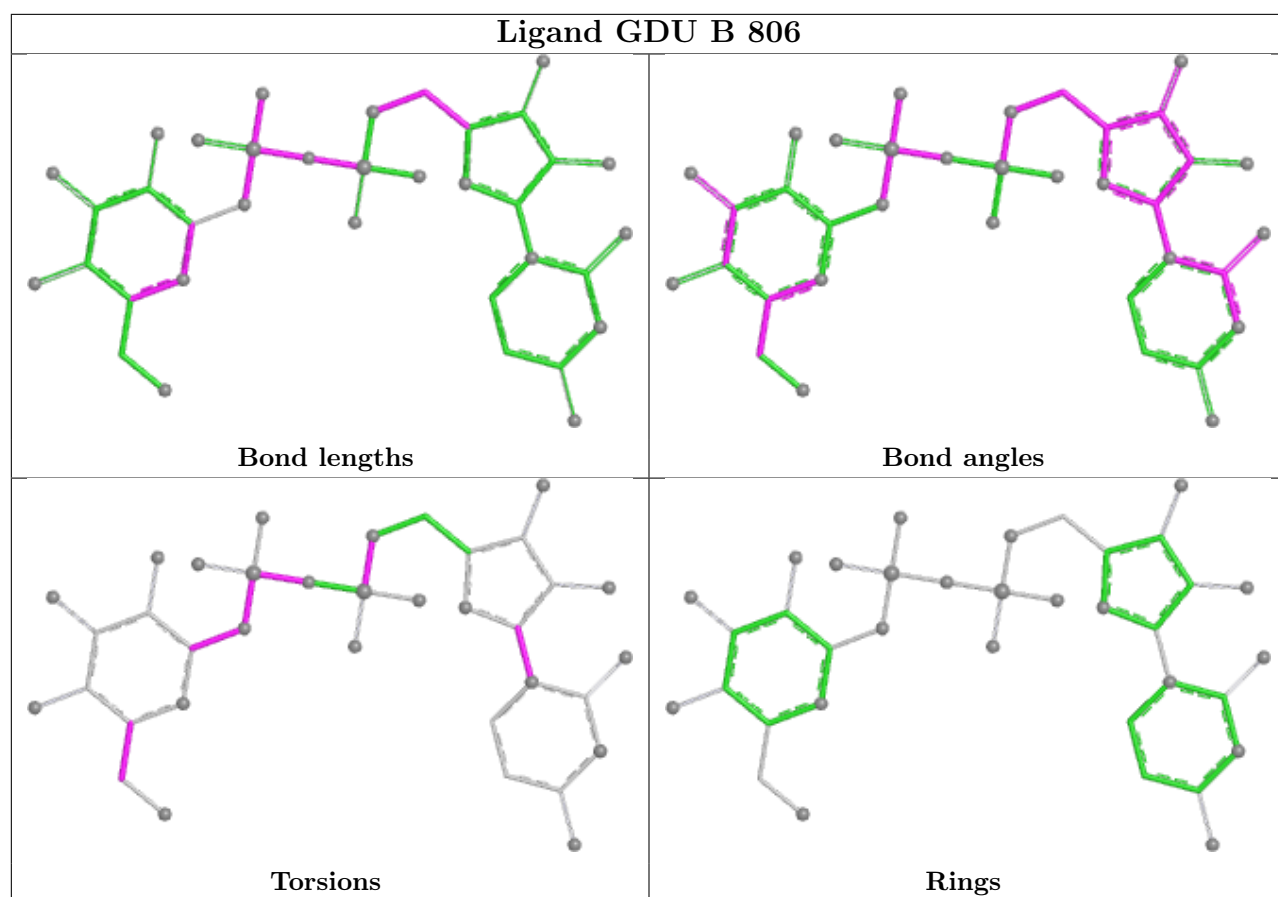
3 monomers are involved in 8 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	B	902	SO4	1	0
5	A	900	MES	5	0
6	A	905	DIO	2	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 [i](#)

6.1 Protein, DNA and RNA chains [i](#)

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	271/286 (94%)	-0.19	3 (1%) 78 79	24, 34, 52, 65	0
1	B	273/286 (95%)	-0.05	6 (2%) 62 64	24, 35, 61, 70	0
All	All	544/572 (95%)	-0.12	9 (1%) 69 70	24, 35, 57, 70	0

All (9) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	402	SER	4.0
1	B	174	MET	3.2
1	B	151	ILE	3.1
1	B	130	SER	2.6
1	B	152	PRO	2.5
1	A	327	PHE	2.4
1	A	150	ASN	2.2
1	A	349	ARG	2.1
1	B	156	LYS	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.

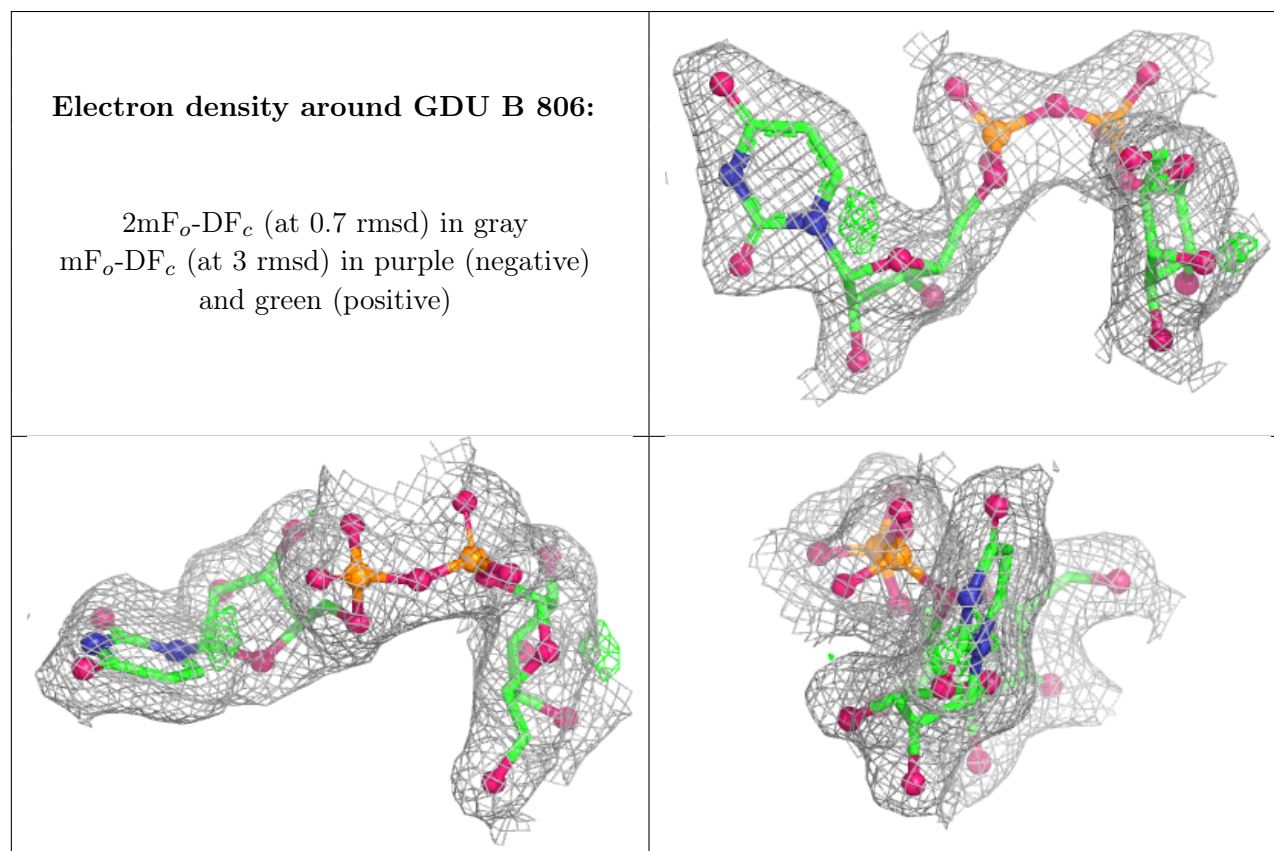
6.4 Ligands [i](#)

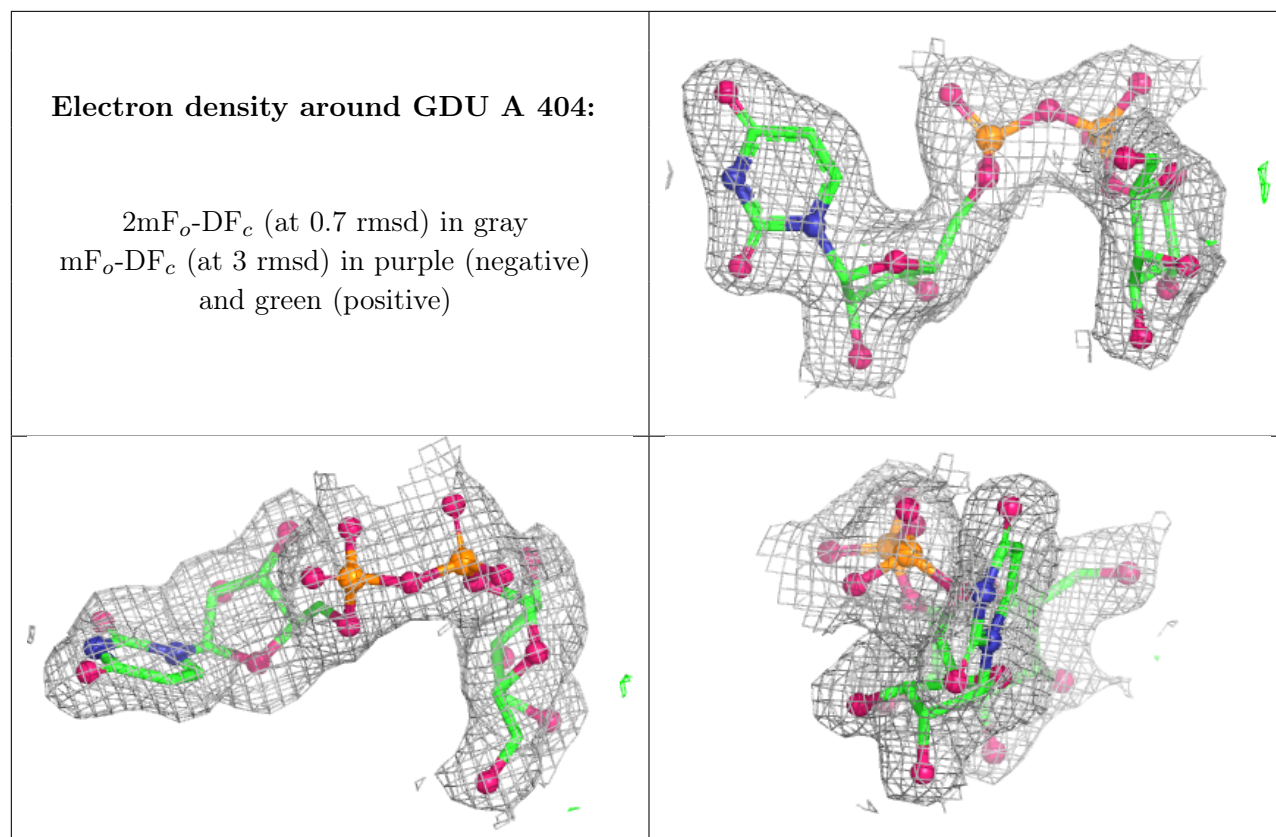
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum,

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(Å ²)	Q<0.9
6	DIO	A	905	6/6	0.71	0.17	73,74,74,74	0
6	DIO	B	906	6/6	0.79	0.16	67,68,69,69	0
5	MES	A	900	12/12	0.81	0.16	75,77,81,81	0
4	SO4	B	901	5/5	0.83	0.12	77,78,78,78	0
4	SO4	A	903	5/5	0.84	0.12	76,76,76,77	0
4	SO4	B	902	5/5	0.86	0.11	77,77,78,79	0
4	SO4	B	904	5/5	0.91	0.08	85,85,85,86	0
2	GDU	B	806	36/36	0.96	0.07	26,30,34,36	0
2	GDU	A	404	36/36	0.97	0.07	25,28,32,34	0
3	MN	B	805	1/1	1.00	0.02	31,31,31,31	0
3	MN	A	403	1/1	1.00	0.04	29,29,29,29	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.