



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 06:26 AM UTC

PDB ID : 2WIF / pdb_00002wif
Title : AGED FORM OF HUMAN BUTYRYLCHOLINESTERASE INHIBITED BY TABUN ANALOGUE TA1
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Deposited on : 2009-05-11
Resolution : 2.25 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
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

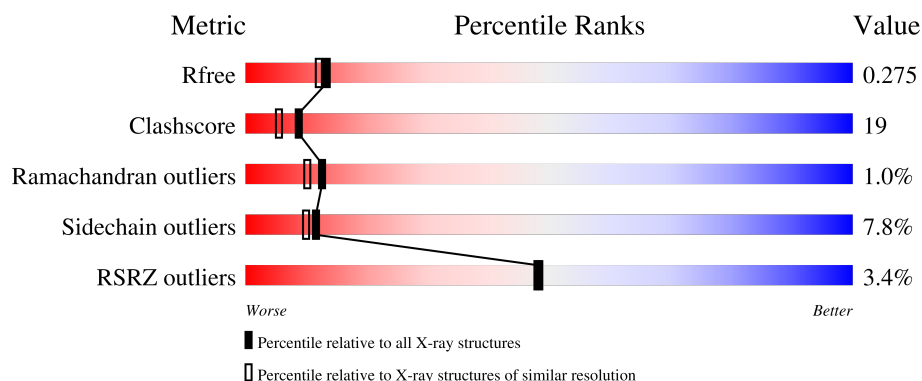
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.25 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	1898 (2.26-2.26)
Clashscore	190562	2005 (2.26-2.26)
Ramachandran outliers	187476	1965 (2.26-2.26)
Sidechain outliers	187428	1966 (2.26-2.26)
RSRZ outliers	180081	1898 (2.26-2.26)

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	529	 3% 60% 31% 7%
2	B	3	 100%
2	D	3	 67% 33%
3	C	2	 100%

2 Entry composition [i](#)

There are 9 unique types of molecules in this entry. The entry contains 4747 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.

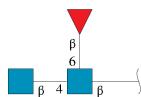
- Molecule 1 is a protein called CHOLINESTERASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	527	Total	C	N	O	S	7	2	0
			4213	2720	710	768	15			

There are 3 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	17	GLN	ASN	engineered mutation	UNP P06276
A	455	GLN	ASN	engineered mutation	UNP P06276
A	481	GLN	ASN	engineered mutation	UNP P06276

- Molecule 2 is an oligosaccharide called 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-[beta-L-fucopyranose-(1-6)]2-acetamido-2-deoxy-beta-D-glucopyranose.



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
2	B	3	Total	C	N	O	0	0	0
			38	22	2	14			
2	D	3	Total	C	N	O	0	0	0
			38	22	2	14			

- Molecule 3 is an oligosaccharide called beta-L-fucopyranose-(1-6)-2-acetamido-2-deoxy-beta-D-glucopyranose.



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
3	C	2	Total	C	N	O	0	0	0
			24	14	1	9			

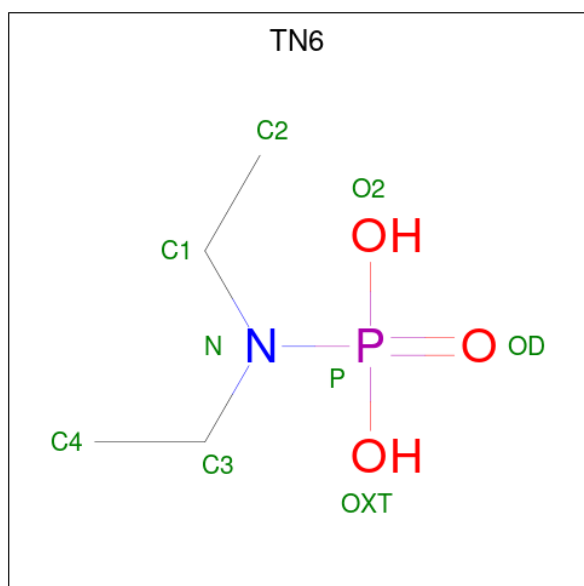
- Molecule 4 is SODIUM ION (CCD ID: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	1	Total	Na	0	0
			1	1		

- Molecule 5 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	3	Total	Cl	0	0
			3	3		

- Molecule 6 is diethylphosphoramidic acid (CCD ID: TN6) (formula: C₄H₁₂NO₃P).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
6	A	1	Total	C	N	O	P	0	0
			8	4	1	2	1		

- Molecule 7 is SULFATE ION (CCD ID: SO4) (formula: O₄S).



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

- Molecule 8 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula: $C_8H_{15}NO_6$).



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

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

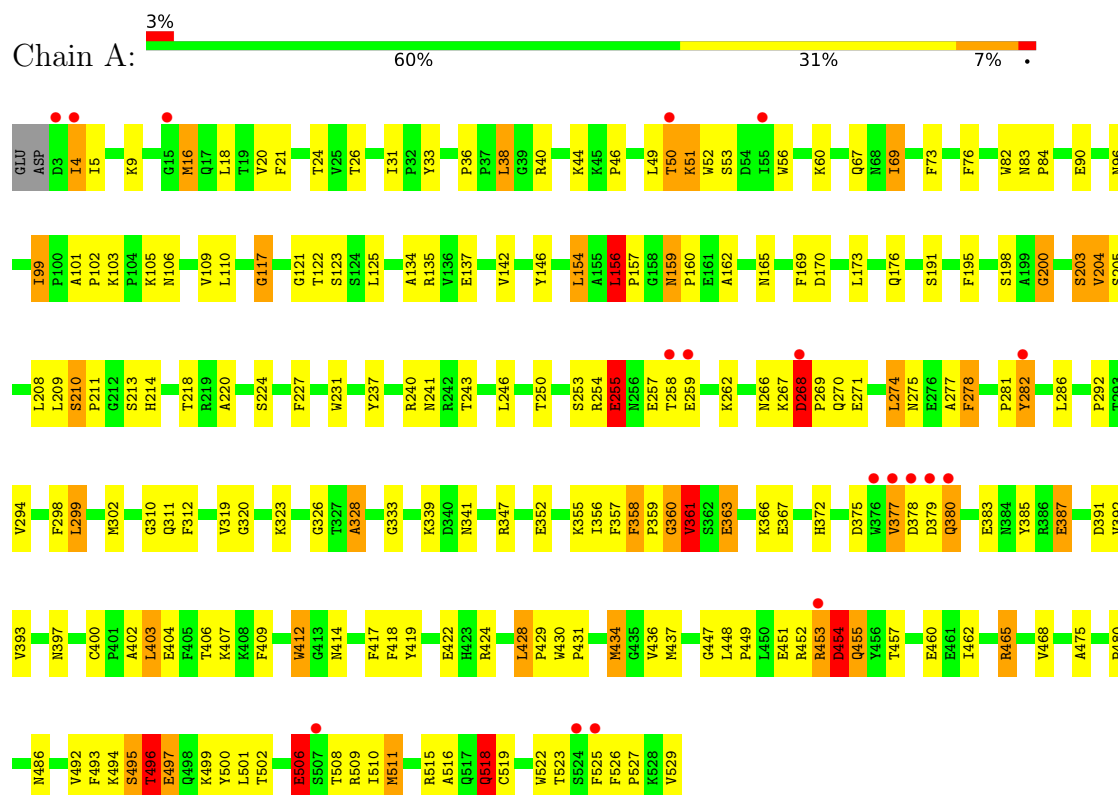
- Molecule 9 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
9	A	370	Total	O	0	0
			370	370		

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: CHOLINESTERASE



• Molecule 2: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-[beta-L-fucopyranose-(1-6)]2-acetamido-2-deoxy-beta-D-glucopyranose



• Molecule 2: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-[beta-L-fucopyranose-(1-6)]2-acetamido-2-deoxy-beta-D-glucopyranose



MAG1
MAG2
FOL3

- Molecule 3: beta-L-fucopyranose-(1-6)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain C:

100%

MAG1
FOL2

4 Data and refinement statistics

Property	Value	Source
Space group	I 4 2 2	Depositor
Cell constants a, b, c, α , β , γ	154.39Å 154.39Å 126.42Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	47.67 – 2.25 47.67 – 2.25	Depositor EDS
% Data completeness (in resolution range)	100.0 (47.67-2.25) 96.8 (47.67-2.25)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.88 (at 2.24Å)	Xtriage
Refinement program	REFMAC 5.4.0069	Depositor
R, R_{free}	0.207 , 0.275 0.206 , 0.275	Depositor DCC
R_{free} test set	1410 reflections (4.00%)	wwPDB-VP
Wilson B-factor (Å ²)	35.1	Xtriage
Anisotropy	0.116	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.38 , 58.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.51$, $\langle L^2 \rangle = 0.35$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	4747	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 3.12% 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: FUL, NAG, TN6, NA, CL, 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	1.44	22/4340 (0.5%)	1.40	42/5892 (0.7%)

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

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	1	1

All (22) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	518	GLN	CA-C	-7.76	1.43	1.52
1	A	237	TYR	CB-CG	-7.30	1.35	1.51
1	A	496	THR	CA-CB	6.88	1.65	1.53
1	A	36	PRO	CA-C	6.47	1.58	1.52
1	A	121	GLY	N-CA	-6.25	1.39	1.45
1	A	468	VAL	CA-CB	6.05	1.61	1.54
1	A	204	VAL	CA-CB	5.95	1.61	1.54
1	A	412	TRP	C-O	-5.94	1.16	1.24
1	A	294	VAL	CA-CB	5.84	1.60	1.53
1	A	403	LEU	C-O	-5.77	1.17	1.24
1	A	393	VAL	CA-CB	5.70	1.61	1.54
1	A	515	ARG	CA-C	-5.63	1.45	1.53
1	A	122	THR	CA-CB	5.49	1.62	1.53
1	A	465	ARG	CA-CB	5.38	1.61	1.53
1	A	195	PHE	CA-C	-5.36	1.46	1.52
1	A	117	GLY	C-O	-5.32	1.16	1.23
1	A	82	TRP	C-O	5.21	1.30	1.24
1	A	218	THR	CA-C	5.12	1.57	1.52

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	480	PRO	CA-CB	5.08	1.57	1.53
1	A	203	SER	C-O	-5.08	1.18	1.24
1	A	82	TRP	N-CA	5.04	1.52	1.46
1	A	516	ALA	CA-CB	5.04	1.61	1.53

All (42) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	328	ALA	N-CA-C	-11.82	98.23	112.89
1	A	525	PHE	N-CA-C	10.00	122.13	111.03
1	A	302	MET	CA-C-N	-9.12	110.35	119.56
1	A	302	MET	C-N-CA	-9.12	110.35	119.56
1	A	255	GLU	N-CA-C	-8.53	104.00	114.75
1	A	400	CYS	CA-C-N	-8.52	110.16	119.19
1	A	400	CYS	C-N-CA	-8.52	110.16	119.19
1	A	360	GLY	CA-C-N	7.37	134.97	121.70
1	A	360	GLY	C-N-CA	7.37	134.97	121.70
1	A	50	THR	N-CA-C	7.00	119.94	111.82
1	A	495	SER	N-CA-C	-6.95	101.33	110.43
1	A	358	PHE	CA-C-N	6.49	127.95	119.84
1	A	358	PHE	C-N-CA	6.49	127.95	119.84
1	A	156	LEU	CA-C-N	6.27	127.68	119.84
1	A	156	LEU	C-N-CA	6.27	127.68	119.84
1	A	109	VAL	N-CA-C	6.19	116.78	107.80
1	A	497	GLU	N-CA-C	6.17	118.98	111.82
1	A	31	ILE	CA-C-N	-6.08	113.70	120.14
1	A	31	ILE	C-N-CA	-6.08	113.70	120.14
1	A	83	ASN	CA-C-N	6.02	125.98	119.78
1	A	83	ASN	C-N-CA	6.02	125.98	119.78
1	A	454	ASP	N-CA-C	6.01	120.63	112.88
1	A	275	ASN	N-CA-C	5.96	120.55	113.28
1	A	146	TYR	N-CA-C	-5.87	100.38	109.24
1	A	204	VAL	N-CA-C	-5.75	104.76	110.62
1	A	397	ASN	N-CA-C	5.69	119.40	112.23
1	A	268	ASP	CB-CA-C	5.68	117.30	108.61
1	A	326	GLY	N-CA-C	5.39	120.60	113.37
1	A	402	ALA	N-CA-C	-5.38	105.08	111.69
1	A	176	GLN	N-CA-C	5.37	117.82	111.33
1	A	84	PRO	CB-CA-C	-5.29	104.46	111.23
1	A	159	ASN	CA-C-N	5.28	125.36	119.87
1	A	159	ASN	C-N-CA	5.28	125.36	119.87
1	A	200	GLY	N-CA-C	-5.28	106.30	113.37

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	123	SER	N-CA-C	5.19	119.23	113.01
1	A	422	GLU	CB-CA-C	-5.19	101.72	110.64
1	A	125	LEU	CA-C-N	5.18	127.22	120.28
1	A	125	LEU	C-N-CA	5.18	127.22	120.28
1	A	434	MET	N-CA-C	-5.14	107.02	113.28
1	A	526	PHE	CA-C-N	-5.08	114.85	119.82
1	A	526	PHE	C-N-CA	-5.08	114.85	119.82
1	A	210	SER	CA-C-O	5.04	123.05	119.32

All (1) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
1	A	361	VAL	CA

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	360	GLY	Peptide

5.2 Too-close contacts ⓘ

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

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	4213	0	4110	156	0
2	B	38	0	34	0	0
2	D	38	0	34	1	0
3	C	24	0	22	2	0
4	A	1	0	0	0	0
5	A	3	0	0	1	0
6	A	8	0	11	3	0
7	A	10	0	0	0	0
8	A	42	0	39	5	0
9	A	370	0	0	25	0
All	All	4747	0	4250	161	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 (161) 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:377:VAL:O	1:A:377:VAL:HG23	1.62	0.99
1:A:320:GLY:HA3	1:A:419:TYR:CE1	1.96	0.99
1:A:282:TYR:O	1:A:282:TYR:HD1	1.45	0.97
1:A:51:LYS:N	9:A:701:HOH:O	1.96	0.96
1:A:518:GLN:HE21	1:A:518:GLN:H	1.00	0.96
1:A:320:GLY:HA3	1:A:419:TYR:CZ	2.06	0.91
1:A:509:ARG:HH11	1:A:509:ARG:HG2	1.36	0.88
1:A:361:VAL:O	1:A:366:LYS:NZ	2.11	0.83
1:A:380:GLN:HB2	5:A:604:CL:CL	2.16	0.83
1:A:367:GLU:HB3	9:A:847:HOH:O	1.79	0.83
1:A:518:GLN:H	1:A:518:GLN:NE2	1.77	0.81
1:A:328:ALA:HA	1:A:434:MET:CE	2.13	0.79
1:A:377:VAL:O	1:A:377:VAL:CG2	2.31	0.77
1:A:282:TYR:O	1:A:282:TYR:CD1	2.37	0.76
1:A:509:ARG:HG2	1:A:509:ARG:NH1	1.97	0.76
1:A:117:GLY:HA2	6:A:603:TN6:H22C	1.68	0.76
1:A:250:THR:HB	1:A:267:LYS:HE2	1.67	0.76
1:A:454:ASP:O	1:A:455:GLN:HB2	1.85	0.75
1:A:495:SER:HA	9:A:704:HOH:O	1.87	0.75
1:A:50:THR:O	1:A:51:LYS:HG2	1.88	0.74
1:A:452:ARG:HD2	9:A:714:HOH:O	1.88	0.74
1:A:4:ILE:HD12	1:A:4:ILE:N	2.04	0.73
1:A:156:LEU:HD13	1:A:243:THR:HG21	1.72	0.72
1:A:494:LYS:NZ	9:A:706:HOH:O	2.22	0.71
1:A:267:LYS:HE3	1:A:271:GLU:OE1	1.89	0.71
1:A:270:GLN:O	1:A:274:LEU:HB2	1.91	0.71
1:A:424:ARG:NH1	1:A:428:LEU:HD12	2.05	0.70
1:A:24:THR:O	1:A:101:ALA:HB3	1.92	0.70
1:A:451:GLU:OE1	1:A:453:ARG:HG2	1.92	0.70
1:A:428:LEU:HD13	1:A:430:TRP:HB2	1.73	0.69
1:A:452:ARG:C	1:A:454:ASP:H	1.99	0.69
1:A:518:GLN:HE21	1:A:518:GLN:N	1.83	0.69
1:A:257:GLU:OE1	9:A:702:HOH:O	2.14	0.66
1:A:522:TRP:O	1:A:527:PRO:HD3	1.96	0.65
1:A:4:ILE:HD12	1:A:4:ILE:H	1.63	0.63
1:A:277:ALA:HB2	9:A:885:HOH:O	1.98	0.63
1:A:191:SER:HB2	3:C:2:FUL:H3	1.82	0.62
1:A:495:SER:CA	9:A:704:HOH:O	2.46	0.61
1:A:320:GLY:HA3	1:A:419:TYR:CD1	2.36	0.61
1:A:383:GLU:O	1:A:387:GLU:HG2	2.01	0.60

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:452:ARG:O	1:A:454:ASP:N	2.34	0.60
1:A:154:LEU:HD23	1:A:162:ALA:HB1	1.84	0.60
1:A:403:LEU:O	1:A:407:LYS:HG3	2.02	0.60
1:A:452:ARG:C	1:A:454:ASP:N	2.58	0.59
1:A:404:GLU:HG2	9:A:914:HOH:O	2.01	0.59
1:A:198:SER:HA	1:A:224:SER:O	2.03	0.59
1:A:496:THR:N	9:A:704:HOH:O	2.21	0.59
1:A:434:MET:HE2	1:A:437:MET:HE3	1.84	0.58
1:A:428:LEU:CD1	1:A:430:TRP:HB2	2.32	0.58
1:A:500:TYR:CZ	1:A:511:MET:HB2	2.38	0.58
1:A:358:PHE:N	1:A:359:PRO:HD3	2.19	0.58
1:A:357:PHE:C	1:A:359:PRO:HD3	2.28	0.58
8:A:615:NAG:H62	9:A:1013:HOH:O	2.03	0.57
1:A:417:PHE:CE2	1:A:492:VAL:HG12	2.38	0.57
1:A:372[A]:HIS:CE1	9:A:781:HOH:O	2.58	0.56
1:A:497:GLU:CD	1:A:499:LYS:HE3	2.30	0.56
1:A:319:VAL:O	1:A:418:PHE:HA	2.06	0.56
1:A:378:ASP:C	1:A:380:GLN:H	2.13	0.56
1:A:255:GLU:N	1:A:255:GLU:CD	2.64	0.55
1:A:500:TYR:CE1	1:A:511:MET:HB2	2.41	0.55
1:A:110:LEU:HD21	1:A:475:ALA:CB	2.36	0.55
1:A:495:SER:O	1:A:496:THR:OG1	2.19	0.55
1:A:4:ILE:N	1:A:4:ILE:CD1	2.67	0.55
1:A:378:ASP:CG	1:A:379:ASP:H	2.14	0.55
1:A:274:LEU:O	1:A:278:PHE:CE2	2.61	0.54
1:A:383:GLU:OE2	1:A:383:GLU:N	2.39	0.54
1:A:204:VAL:CG1	1:A:220:ALA:HB1	2.38	0.53
1:A:208:LEU:O	1:A:214[B]:HIS:HE1	1.91	0.53
1:A:428:LEU:HD22	1:A:429:PRO:HD2	1.92	0.52
8:A:613:NAG:C6	9:A:960:HOH:O	2.56	0.52
8:A:613:NAG:H61	9:A:960:HOH:O	2.08	0.52
1:A:96:ASN:O	1:A:142:VAL:HA	2.10	0.52
1:A:209:LEU:HD23	1:A:312:PHE:HB3	1.92	0.52
1:A:277:ALA:CB	9:A:885:HOH:O	2.55	0.51
1:A:157:PRO:HD2	1:A:240:ARG:HD3	1.92	0.51
1:A:60:LYS:HE3	9:A:1007:HOH:O	2.09	0.51
1:A:208:LEU:O	1:A:214[B]:HIS:CE1	2.64	0.50
1:A:414:ASN:HB2	9:A:734:HOH:O	2.12	0.50
1:A:40:ARG:NH1	9:A:711:HOH:O	2.33	0.50
1:A:227:PHE:CD2	1:A:227:PHE:C	2.89	0.50
1:A:110:LEU:HD21	1:A:475:ALA:HB2	1.94	0.50

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:282:TYR:CD1	1:A:282:TYR:C	2.83	0.49
1:A:383:GLU:O	1:A:387:GLU:CG	2.60	0.49
1:A:406:THR:HG22	1:A:493:PHE:CD1	2.48	0.49
1:A:52:TRP:CD1	1:A:52:TRP:O	2.66	0.48
1:A:282:TYR:HD1	1:A:282:TYR:C	2.13	0.48
1:A:339:LYS:O	1:A:431:PRO:HG3	2.13	0.48
1:A:40:ARG:HB2	9:A:946:HOH:O	2.13	0.48
1:A:231:TRP:CE3	6:A:603:TN6:H21C	2.48	0.48
8:A:613:NAG:H83	9:A:956:HOH:O	2.14	0.48
1:A:352:GLU:HA	1:A:355:LYS:HE3	1.95	0.48
1:A:16:MET:HE2	1:A:18:LEU:HD21	1.95	0.48
1:A:253:SER:O	1:A:254:ARG:HD3	2.13	0.47
1:A:26:THR:HB	1:A:99:ILE:HG12	1.95	0.47
1:A:448:LEU:N	1:A:449:PRO:CD	2.77	0.47
1:A:50:THR:O	1:A:51:LYS:CG	2.60	0.47
1:A:377:VAL:N	1:A:378:ASP:HA	2.29	0.47
1:A:355:LYS:HD3	9:A:881:HOH:O	2.15	0.47
1:A:378:ASP:O	1:A:380:GLN:N	2.48	0.47
1:A:496:THR:OG1	9:A:703:HOH:O	2.20	0.47
1:A:341:ASN:OD1	1:A:341:ASN:C	2.57	0.46
1:A:347:ARG:HB2	1:A:385:TYR:CZ	2.50	0.46
1:A:56:TRP:CD1	1:A:56:TRP:C	2.93	0.46
1:A:495:SER:O	1:A:496:THR:CB	2.64	0.46
1:A:240:ARG:O	1:A:241:ASN:C	2.54	0.46
1:A:424:ARG:CZ	1:A:428:LEU:HD12	2.46	0.46
1:A:253:SER:C	1:A:254:ARG:HD3	2.41	0.46
1:A:205:SER:O	1:A:208:LEU:HB2	2.15	0.46
1:A:267:LYS:HA	1:A:267:LYS:HD2	1.60	0.46
1:A:159:ASN:OD1	1:A:159:ASN:C	2.58	0.45
1:A:452:ARG:O	1:A:453:ARG:C	2.58	0.45
1:A:38:LEU:HD23	1:A:90:GLU:HB2	1.97	0.45
1:A:67:GLN:O	1:A:69:ILE:HD12	2.16	0.45
1:A:268:ASP:O	1:A:269:PRO:C	2.59	0.45
1:A:49:LEU:HD12	1:A:49:LEU:HA	1.75	0.45
1:A:519:CYS:O	1:A:523:THR:HB	2.16	0.45
1:A:255:GLU:CD	1:A:255:GLU:H	2.25	0.45
1:A:333:GLY:O	1:A:356:ILE:HG13	2.17	0.45
1:A:363:GLU:O	1:A:367:GLU:HG3	2.17	0.45
1:A:102:PRO:O	1:A:103:LYS:C	2.60	0.44
1:A:159:ASN:HA	1:A:160:PRO:HD3	1.89	0.44
1:A:320:GLY:CA	1:A:419:TYR:CE1	2.86	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:328:ALA:HA	1:A:434:MET:HE3	1.97	0.44
1:A:246:LEU:HD12	1:A:246:LEU:HA	1.80	0.44
8:A:613:NAG:H83	8:A:613:NAG:H2	1.78	0.44
1:A:391:ASP:O	1:A:392:VAL:C	2.59	0.44
1:A:311:GLN:NE2	9:A:723:HOH:O	2.44	0.43
1:A:462:ILE:HD12	1:A:462:ILE:HG23	1.80	0.43
1:A:38:LEU:CD2	1:A:90:GLU:HB2	2.48	0.43
1:A:323:LYS:HB3	1:A:436:VAL:HB	1.99	0.43
1:A:106:ASN:HB2	3:C:1:NAG:H83	1.99	0.43
1:A:447:GLY:O	1:A:448:LEU:C	2.59	0.43
1:A:46:PRO:HB2	1:A:173:LEU:HD23	2.01	0.43
1:A:274:LEU:O	1:A:278:PHE:HE2	1.97	0.43
1:A:281:PRO:HG3	2:D:1:NAG:H83	2.00	0.43
1:A:231:TRP:CD2	6:A:603:TN6:H21C	2.54	0.43
1:A:502:THR:O	1:A:508:THR:HB	2.18	0.43
1:A:210:SER:HA	1:A:211:PRO:HD2	1.70	0.43
1:A:457:THR:OG1	1:A:460:GLU:HG3	2.19	0.42
1:A:44:LYS:HB3	1:A:44:LYS:HE3	1.93	0.42
1:A:209:LEU:HD23	1:A:209:LEU:HA	1.80	0.42
1:A:200:GLY:O	1:A:203:SER:HB2	2.20	0.42
1:A:266:ASN:HB3	9:A:998:HOH:O	2.19	0.42
1:A:33:TYR:OH	1:A:170:ASP:HB3	2.20	0.42
1:A:157:PRO:HD2	1:A:240:ARG:CD	2.49	0.42
1:A:501:LEU:HD12	1:A:510:ILE:HD13	2.02	0.42
1:A:169:PHE:CE1	1:A:298:PHE:HB2	2.55	0.41
1:A:20:VAL:O	1:A:21:PHE:C	2.63	0.41
1:A:137:GLU:OE2	1:A:465:ARG:NH2	2.51	0.41
1:A:299:LEU:HA	1:A:299:LEU:HD23	1.68	0.41
1:A:506:GLU:H	1:A:506:GLU:HG3	1.66	0.41
1:A:358:PHE:N	1:A:359:PRO:CD	2.84	0.41
1:A:214[A]:HIS:NE2	9:A:713:HOH:O	2.37	0.41
1:A:73:PHE:O	1:A:76:PHE:HB3	2.21	0.40
1:A:310:GLY:HA3	1:A:412:TRP:CE2	2.56	0.40
1:A:169:PHE:CZ	1:A:298:PHE:HB2	2.57	0.40
1:A:378:ASP:C	1:A:380:GLN:N	2.77	0.40
1:A:134:ALA:O	1:A:135:ARG:C	2.65	0.40
1:A:165:ASN:OD1	1:A:292:PRO:HA	2.22	0.40
1:A:312:PHE:CD1	1:A:409:PHE:CE1	3.10	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	527/529 (100%)	489 (93%)	33 (6%)	5 (1%)	14 12

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	361	VAL
1	A	453	ARG
1	A	496	THR
1	A	506	GLU
1	A	51	LYS

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	453/454 (100%)	418 (92%)	35 (8%)	12 10

All (35) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	4	ILE
1	A	5	ILE
1	A	9	LYS
1	A	16	MET
1	A	38	LEU
1	A	53	SER

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Mol	Chain	Res	Type
1	A	69	ILE
1	A	99	ILE
1	A	105	LYS
1	A	154	LEU
1	A	156	LEU
1	A	255	GLU
1	A	258	THR
1	A	259	GLU
1	A	262	LYS
1	A	268	ASP
1	A	274	LEU
1	A	278	PHE
1	A	282	TYR
1	A	286	LEU
1	A	299	LEU
1	A	361	VAL
1	A	363	GLU
1	A	375	ASP
1	A	377	VAL
1	A	380	GLN
1	A	387	GLU
1	A	428	LEU
1	A	454	ASP
1	A	455	GLN
1	A	486	ASN
1	A	506	GLU
1	A	511	MET
1	A	518	GLN
1	A	529	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (8) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	119	GLN
1	A	172	GLN
1	A	176	GLN
1	A	275	ASN
1	A	289	ASN
1	A	380	GLN
1	A	498	GLN
1	A	518	GLN

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 ⓘ

8 monosaccharides are modelled in this entry.

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$
2	NAG	B	1	1,2	14,14,15	1.21	2 (14%)	17,19,21	1.58	4 (23%)
2	NAG	B	2	2	14,14,15	0.87	1 (7%)	17,19,21	1.75	5 (29%)
2	FUL	B	3	2	10,10,11	0.95	0	14,14,16	3.50	5 (35%)
3	NAG	C	1	1,3	14,14,15	0.88	1 (7%)	17,19,21	2.44	8 (47%)
3	FUL	C	2	3	10,10,11	0.88	0	14,14,16	2.34	5 (35%)
2	NAG	D	1	1,2	14,14,15	0.82	0	17,19,21	2.35	4 (23%)
2	NAG	D	2	2	14,14,15	0.44	0	17,19,21	1.83	4 (23%)
2	FUL	D	3	2	10,10,11	0.77	0	14,14,16	2.54	5 (35%)

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	NAG	B	1	1,2	-	5/6/23/26	0/1/1/1
2	NAG	B	2	2	-	4/6/23/26	0/1/1/1
2	FUL	B	3	2	-	-	0/1/1/1
3	NAG	C	1	1,3	-	4/6/23/26	0/1/1/1

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	FUL	C	2	3	-	-	0/1/1/1
2	NAG	D	1	1,2	-	4/6/23/26	0/1/1/1
2	NAG	D	2	2	-	2/6/23/26	0/1/1/1
2	FUL	D	3	2	-	-	0/1/1/1

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	1	NAG	O5-C1	-2.79	1.39	1.43
3	C	1	NAG	C1-C2	2.50	1.55	1.52
2	B	1	NAG	C2-N2	-2.40	1.42	1.46
2	B	2	NAG	O5-C1	-2.35	1.39	1.43

All (40) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	3	FUL	C1-C2-C3	-10.62	94.19	109.64
2	D	3	FUL	C1-C2-C3	-5.80	101.20	109.64
2	D	1	NAG	C1-O5-C5	5.59	119.67	112.19
2	D	1	NAG	O5-C1-C2	-5.05	103.47	111.29
2	D	2	NAG	C1-O5-C5	4.76	118.56	112.19
2	B	2	NAG	C1-O5-C5	-4.66	105.95	112.19
2	D	3	FUL	C1-O5-C5	-4.65	102.00	112.97
3	C	1	NAG	C8-C7-N2	4.33	123.29	116.12
2	D	1	NAG	C1-C2-N2	4.28	117.18	110.43
2	B	3	FUL	C1-O5-C5	-4.18	103.11	112.97
3	C	2	FUL	C1-O5-C5	-4.17	103.14	112.97
3	C	2	FUL	C3-C4-C5	4.09	116.04	109.81
2	B	1	NAG	O5-C1-C2	-4.04	105.04	111.29
3	C	1	NAG	C3-C4-C5	-3.99	103.00	110.23
3	C	2	FUL	C1-C2-C3	-3.76	104.17	109.64
3	C	1	NAG	O4-C4-C5	3.58	118.14	109.32
2	B	3	FUL	O2-C2-C1	3.40	117.01	109.22
3	C	1	NAG	C2-N2-C7	3.39	127.44	122.90
3	C	1	NAG	O5-C5-C6	3.28	114.05	107.66
3	C	2	FUL	C2-C3-C4	-3.23	105.18	110.86
2	B	3	FUL	C6-C5-C4	3.06	118.67	113.08
2	D	2	NAG	C2-N2-C7	2.85	126.72	122.90
2	B	1	NAG	C2-N2-C7	2.71	126.53	122.90
2	B	2	NAG	O5-C5-C6	2.58	112.68	107.66
2	D	3	FUL	O5-C1-C2	-2.54	104.73	110.79
3	C	1	NAG	O7-C7-C8	-2.52	117.57	122.05

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	C	1	NAG	C6-C5-C4	2.50	119.15	113.02
2	D	3	FUL	C3-C4-C5	2.49	113.59	109.81
2	B	2	NAG	C2-N2-C7	2.45	126.19	122.90
2	D	1	NAG	O7-C7-C8	-2.41	117.76	122.05
2	D	3	FUL	O2-C2-C3	2.40	115.12	110.15
2	B	1	NAG	C1-C2-N2	2.37	114.17	110.43
2	B	1	NAG	C3-C4-C5	-2.34	105.99	110.23
3	C	1	NAG	O5-C1-C2	-2.30	107.72	111.29
2	D	2	NAG	O3-C3-C2	2.28	114.15	109.40
2	B	2	NAG	O6-C6-C5	-2.18	103.91	111.33
3	C	2	FUL	O2-C2-C3	2.16	114.63	110.15
2	B	3	FUL	O5-C1-C2	-2.06	105.87	110.79
2	D	2	NAG	C6-C5-C4	-2.02	108.06	113.02
2	B	2	NAG	C4-C3-C2	2.01	113.97	111.02

There are no chirality outliers.

All (19) torsion outliers are listed below:

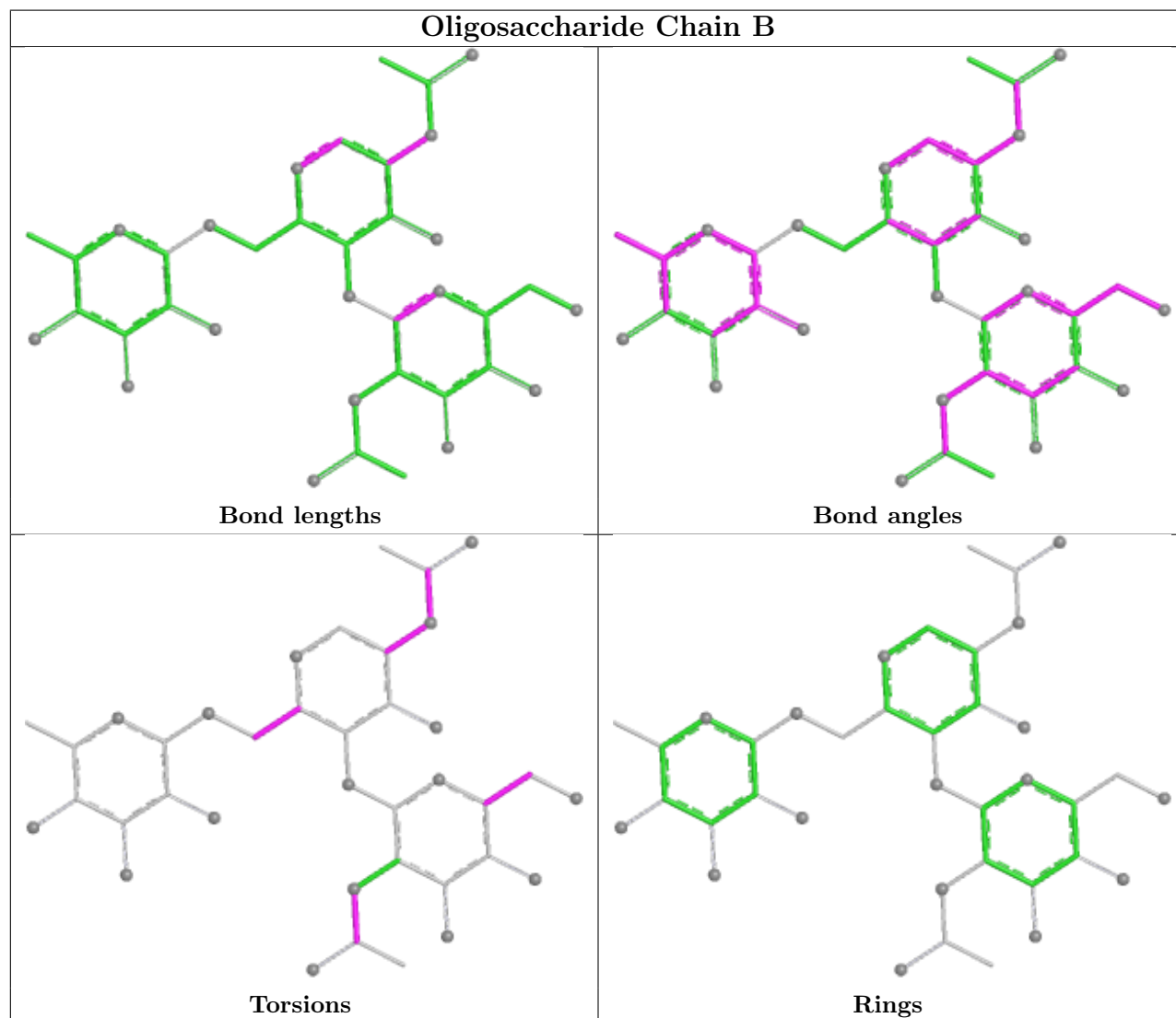
Mol	Chain	Res	Type	Atoms
2	B	1	NAG	C8-C7-N2-C2
2	B	1	NAG	O7-C7-N2-C2
2	B	2	NAG	C8-C7-N2-C2
2	B	2	NAG	O7-C7-N2-C2
2	D	1	NAG	C8-C7-N2-C2
2	D	1	NAG	O7-C7-N2-C2
2	D	1	NAG	C4-C5-C6-O6
3	C	1	NAG	C8-C7-N2-C2
2	B	2	NAG	C4-C5-C6-O6
3	C	1	NAG	O5-C5-C6-O6
2	D	1	NAG	O5-C5-C6-O6
2	B	2	NAG	O5-C5-C6-O6
2	B	1	NAG	C4-C5-C6-O6
3	C	1	NAG	O7-C7-N2-C2
2	D	2	NAG	O5-C5-C6-O6
2	D	2	NAG	C4-C5-C6-O6
3	C	1	NAG	C4-C5-C6-O6
2	B	1	NAG	O5-C5-C6-O6
2	B	1	NAG	C1-C2-N2-C7

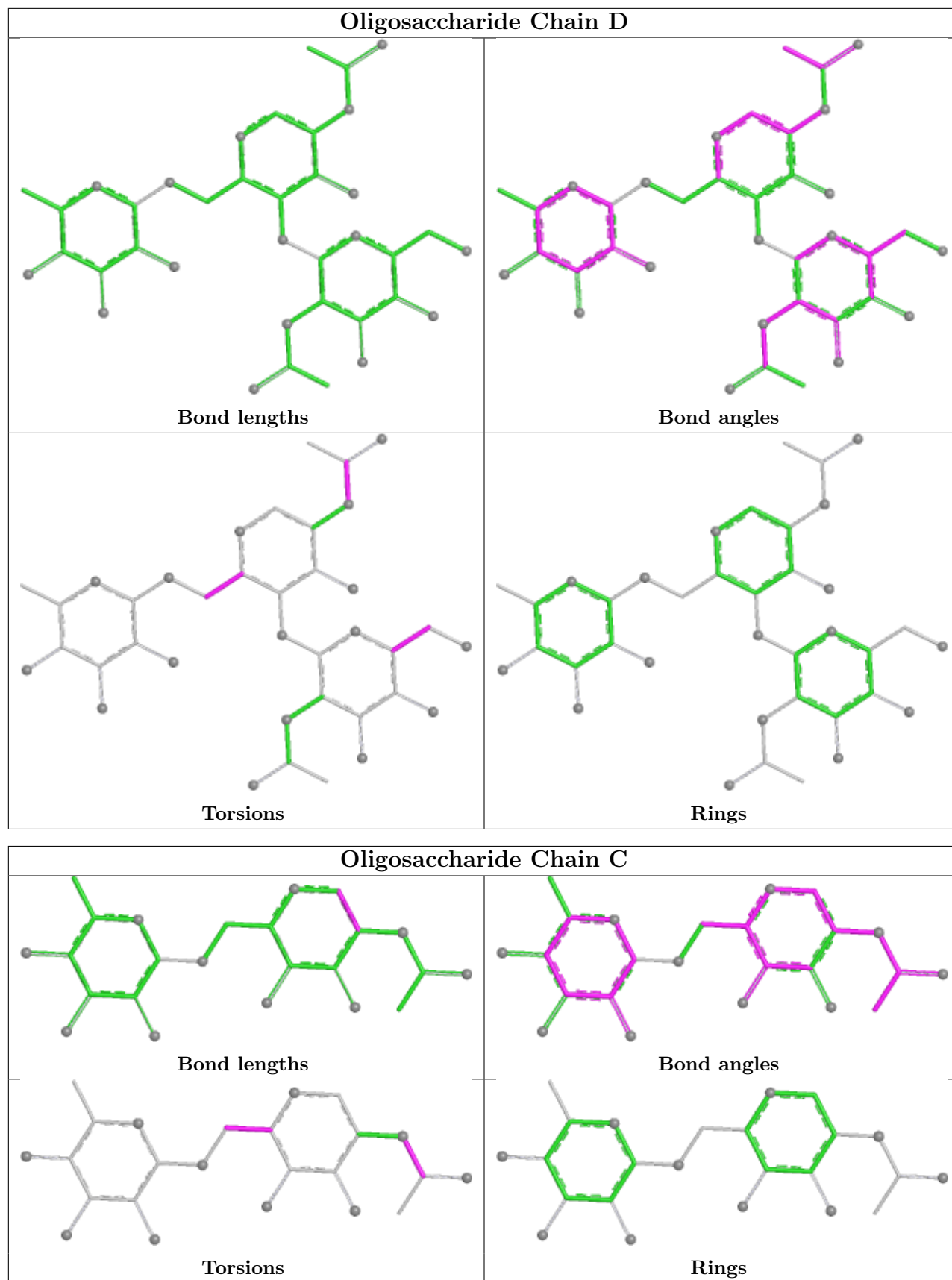
There are no ring outliers.

3 monomers are involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	C	2	FUL	1	0
3	C	1	NAG	1	0
2	D	1	NAG	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 oligosaccharide.





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
6	TN6	A	603	1	2,7,8	1.91	1 (50%)	1,8,11	0.67	0
8	NAG	A	613	1	14,14,15	0.58	0	17,19,21	1.96	5 (29%)
8	NAG	A	615	1	14,14,15	0.47	0	17,19,21	1.93	4 (23%)
8	NAG	A	614	1	14,14,15	0.87	0	17,19,21	1.91	2 (11%)
7	SO4	A	605	-	4,4,4	0.25	0	6,6,6	0.28	0
7	SO4	A	607	-	4,4,4	0.37	0	6,6,6	0.44	0

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
6	TN6	A	603	1	-	1/4/8/10	-
8	NAG	A	614	1	-	2/6/23/26	0/1/1/1
8	NAG	A	615	1	-	3/6/23/26	0/1/1/1
8	NAG	A	613	1	-	4/6/23/26	0/1/1/1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	A	603	TN6	C4-C3	2.51	1.63	1.50

All (11) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
8	A	614	NAG	C1-O5-C5	6.41	120.78	112.19
8	A	613	NAG	C2-N2-C7	-4.08	117.44	122.90
8	A	615	NAG	C1-O5-C5	-3.90	106.96	112.19

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
8	A	615	NAG	C3-C4-C5	3.64	116.84	110.23
8	A	613	NAG	O5-C1-C2	-3.59	105.73	111.29
8	A	615	NAG	O5-C1-C2	-3.55	105.80	111.29
8	A	613	NAG	C3-C4-C5	3.44	116.48	110.23
8	A	615	NAG	O5-C5-C6	2.99	113.48	107.66
8	A	613	NAG	C4-C3-C2	2.92	115.29	111.02
8	A	614	NAG	C4-C3-C2	2.55	114.76	111.02
8	A	613	NAG	C1-C2-N2	2.03	113.63	110.43

There are no chirality outliers.

All (10) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
8	A	613	NAG	C8-C7-N2-C2
8	A	615	NAG	C8-C7-N2-C2
8	A	615	NAG	O7-C7-N2-C2
8	A	613	NAG	O7-C7-N2-C2
8	A	613	NAG	O5-C5-C6-O6
8	A	614	NAG	O5-C5-C6-O6
8	A	614	NAG	C4-C5-C6-O6
8	A	615	NAG	O5-C5-C6-O6
8	A	613	NAG	C4-C5-C6-O6
6	A	603	TN6	C4-C3-N-C1

There are no ring outliers.

3 monomers are involved in 8 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
6	A	603	TN6	3	0
8	A	613	NAG	4	0
8	A	615	NAG	1	0

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	527/529 (99%)	0.16	18 (3%) 48 48	16, 33, 57, 76	11 (2%)

All (18) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	258	THR	4.5
1	A	50	THR	3.7
1	A	282	TYR	3.7
1	A	377	VAL	3.5
1	A	378	ASP	2.8
1	A	379	ASP	2.6
1	A	3	ASP	2.5
1	A	259	GLU	2.4
1	A	268	ASP	2.4
1	A	4	ILE	2.3
1	A	525	PHE	2.3
1	A	380	GLN	2.2
1	A	507	SER	2.2
1	A	15	GLY	2.1
1	A	55	ILE	2.1
1	A	376	TRP	2.1
1	A	524	SER	2.1
1	A	453	ARG	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

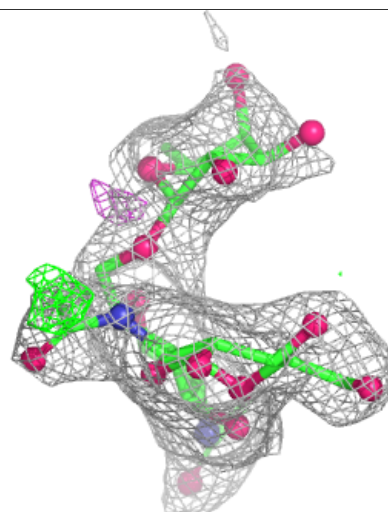
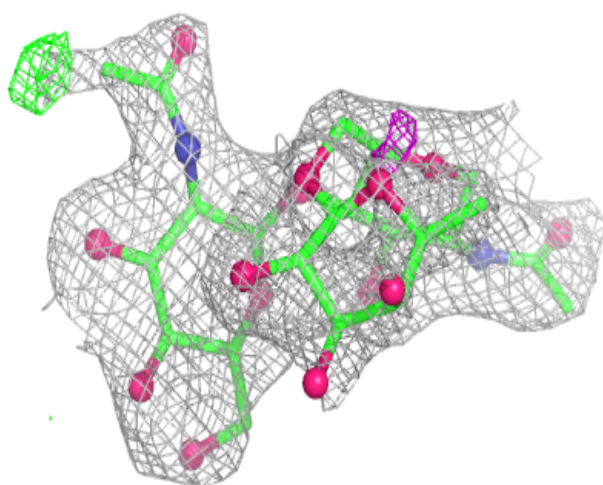
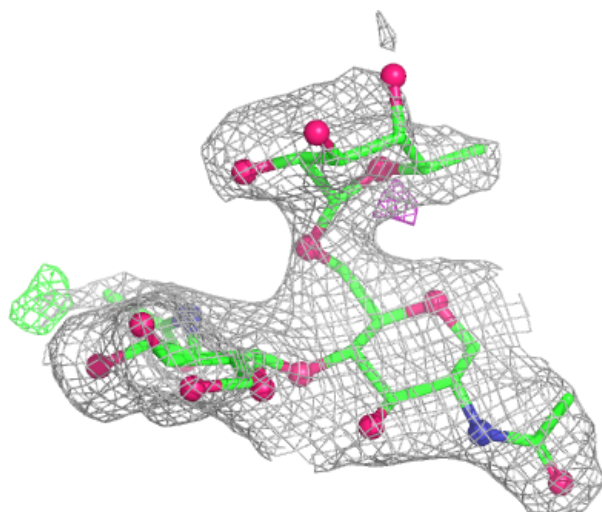
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists 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
2	NAG	D	2	14/15	0.71	0.16	65,76,78,78	0
2	FUL	B	3	10/11	0.72	0.18	65,69,73,73	0
3	FUL	C	2	10/11	0.76	0.32	40,46,47,49	10
2	NAG	D	1	14/15	0.77	0.16	67,72,79,79	0
2	NAG	B	2	14/15	0.78	0.15	62,67,70,70	0
3	NAG	C	1	14/15	0.79	0.16	54,59,61,64	0
2	FUL	D	3	10/11	0.84	0.16	71,73,75,77	0
2	NAG	B	1	14/15	0.93	0.11	46,52,58,64	0

The following is a graphical depiction of the model fit to experimental electron density for oligosaccharide. Each fit is shown from different orientation to approximate a three-dimensional view.

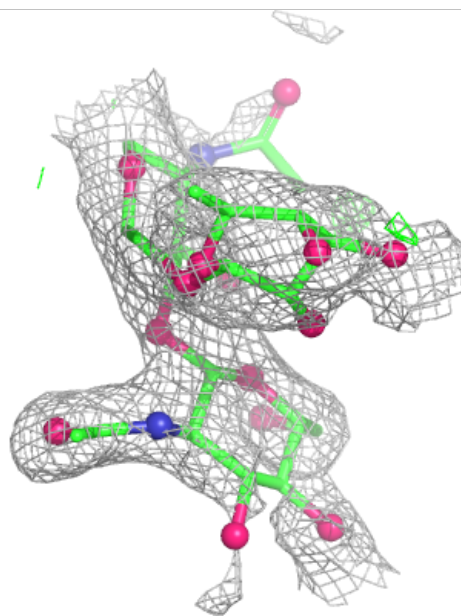
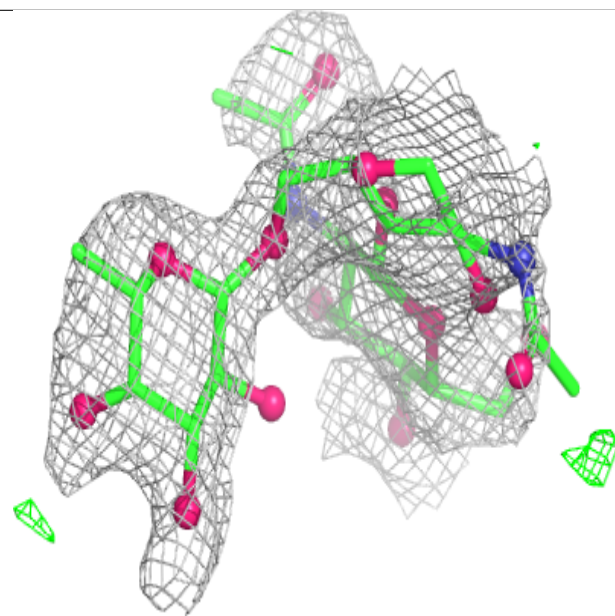
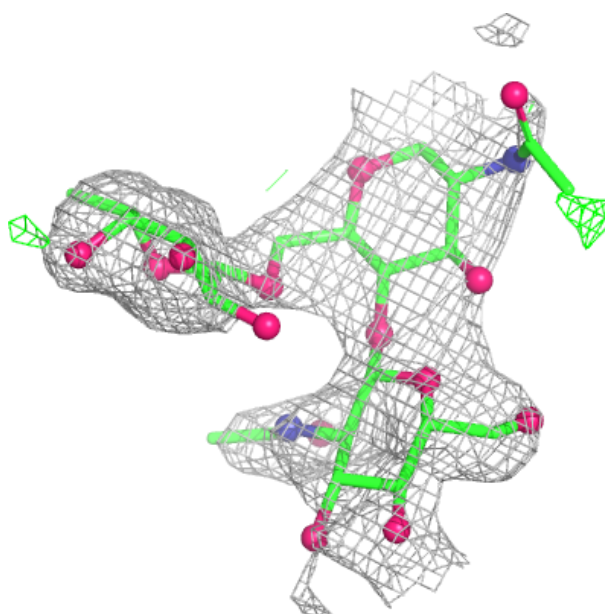
Electron density around Chain B:

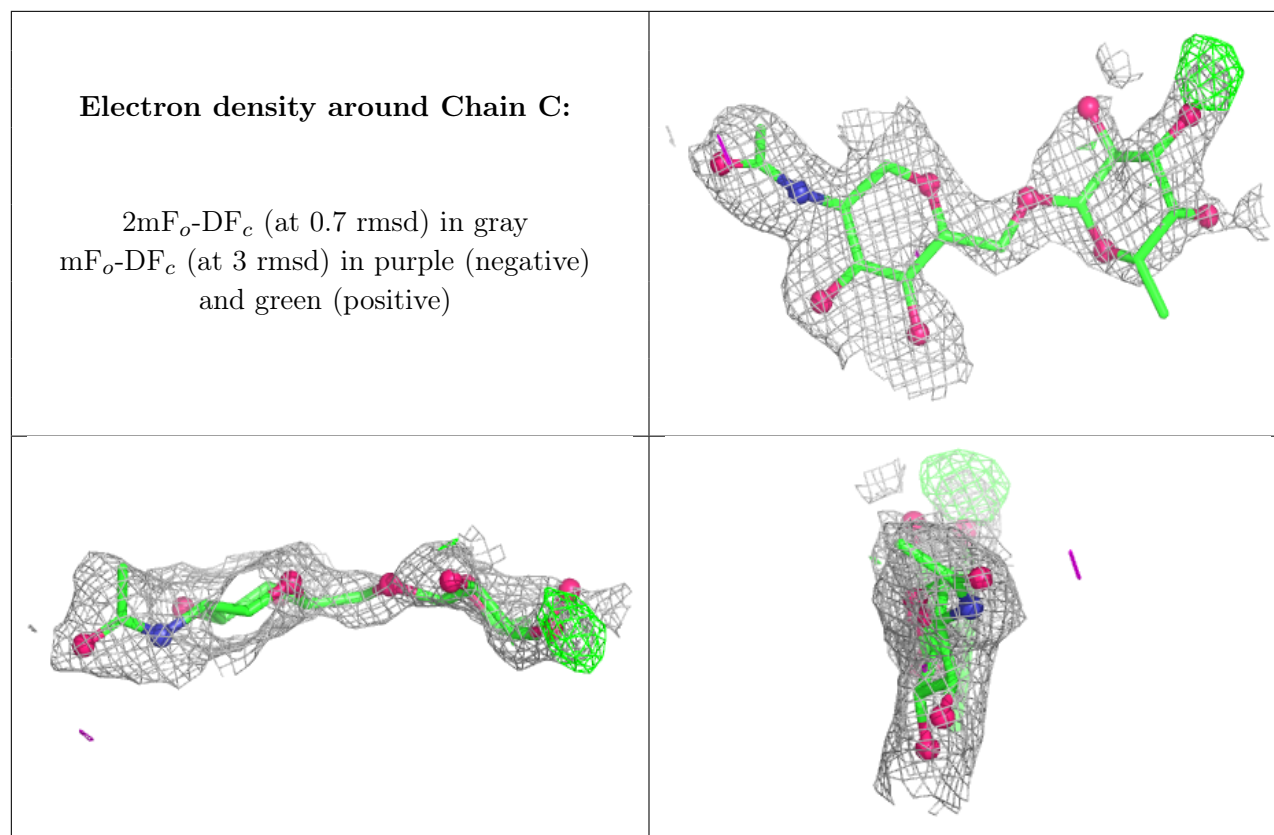
$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



Electron density around Chain D:

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





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
8	NAG	A	613	14/15	0.58	0.17	73,77,79,82	0
8	NAG	A	615	14/15	0.72	0.14	82,85,88,88	0
8	NAG	A	614	14/15	0.73	0.16	45,60,64,66	0
5	CL	A	604	1/1	0.89	0.14	71,71,71,71	0
5	CL	A	606	1/1	0.91	0.10	62,62,62,62	0
7	SO4	A	605	5/5	0.92	0.10	52,52,57,58	5
5	CL	A	602	1/1	0.93	0.12	58,58,58,58	0
7	SO4	A	607	5/5	0.94	0.12	40,42,43,45	5
6	TN6	A	603	8/9	0.98	0.07	24,27,28,29	0
4	NA	A	601	1/1	0.98	0.13	41,41,41,41	1

6.5 Other polymers [i](#)

There are no such residues in this entry.