



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 09:44 PM UTC

PDB ID : 7G3X / pdb_00007g3x
Title : Crystal Structure of rat Autotaxin in complex with (2S)-1-[2-(2,1,3-benzothia
diazol-4-yloxy)acetyl]azetidine-2-carboxamide
Authors : Stihle, M.; Benz, J.; Hunziker, D.; Cai, J.; Rudolph, M.G.
Deposited on : 2023-06-05
Resolution : 1.82 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

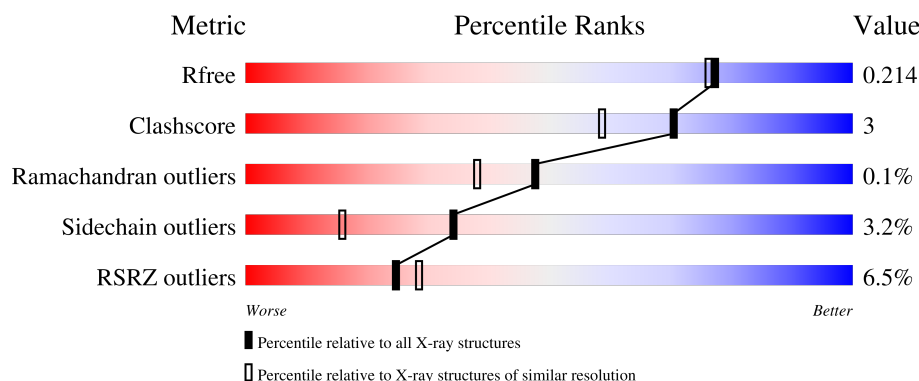
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.82 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	1112 (1.82-1.82)
Clashscore	190562	1148 (1.82-1.82)
Ramachandran outliers	187476	1140 (1.82-1.82)
Sidechain outliers	187428	1140 (1.82-1.82)
RSRZ outliers	180081	1112 (1.82-1.82)

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	846	6% 84% 9% • 5%
2	B	8	75% 25%

2 Entry composition [i](#)

There are 9 unique types of molecules in this entry. The entry contains 7336 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 Isoform 2 of Ectonucleotide pyrophosphatase/phosphodiesterase family member 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	805	6614	4202	1137	1222	53	0	20	0

There are 14 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	53	ALA	ASN	engineered mutation	UNP Q64610
A	410	ALA	ASN	engineered mutation	UNP Q64610
A	591	THR	ARG	engineered mutation	UNP Q64610
A	863	GLY	-	expression tag	UNP Q64610
A	864	GLY	-	expression tag	UNP Q64610
A	865	ARG	-	expression tag	UNP Q64610
A	866	HIS	-	expression tag	UNP Q64610
A	867	HIS	-	expression tag	UNP Q64610
A	868	HIS	-	expression tag	UNP Q64610
A	869	HIS	-	expression tag	UNP Q64610
A	870	HIS	-	expression tag	UNP Q64610
A	871	HIS	-	expression tag	UNP Q64610
A	872	HIS	-	expression tag	UNP Q64610
A	873	HIS	-	expression tag	UNP Q64610

- Molecule 2 is an oligosaccharide called alpha-D-mannopyranose-(1-2)-alpha-D-mannopyranose-(1-3)-alpha-D-mannopyranose-(1-6)-[alpha-D-mannopyranose-(1-2)-alpha-D-mannopyranose-(1-3)]beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose.



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
2	B	8	Total	C	N	O	0	0	0
			94	52	2	40			

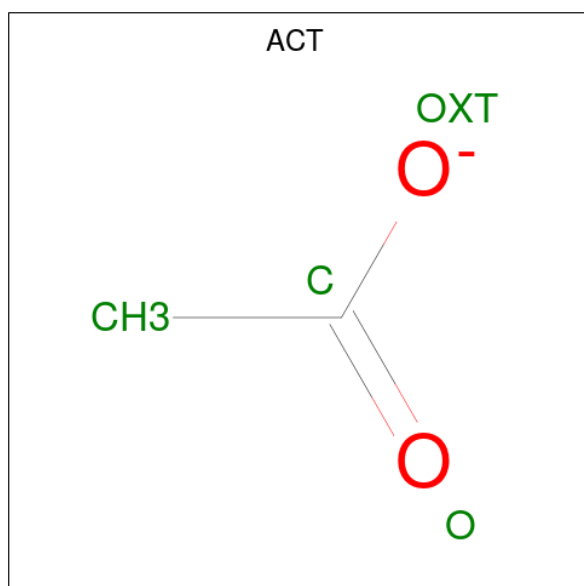
- Molecule 3 is CALCIUM ION (CCD ID: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	2	Total	Ca	0	0
			2	2		

- Molecule 4 is POTASSIUM ION (CCD ID: K) (formula: K).

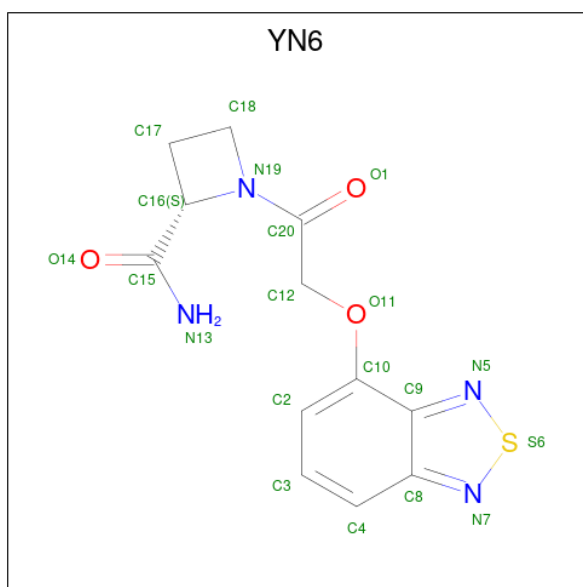
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	1	Total	K	0	0
			1	1		

- Molecule 5 is ACETATE ION (CCD ID: ACT) (formula: C₂H₃O₂).



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

- Molecule 6 is (2R)-1-{[(2,1,3-benzothiadiazol-4-yl)oxy]acetyl}azetidine-2-carboxamide (CCD ID: YN6) (formula: C₁₂H₁₂N₄O₃S) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
6	A	1	Total	C	N	O	S	0	0
			20	12	4	3	1		

- Molecule 7 is ZINC ION (CCD ID: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	1	Total	Zn	0	0
			1	1		

- Molecule 8 is SODIUM ION (CCD ID: NA) (formula: Na).

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

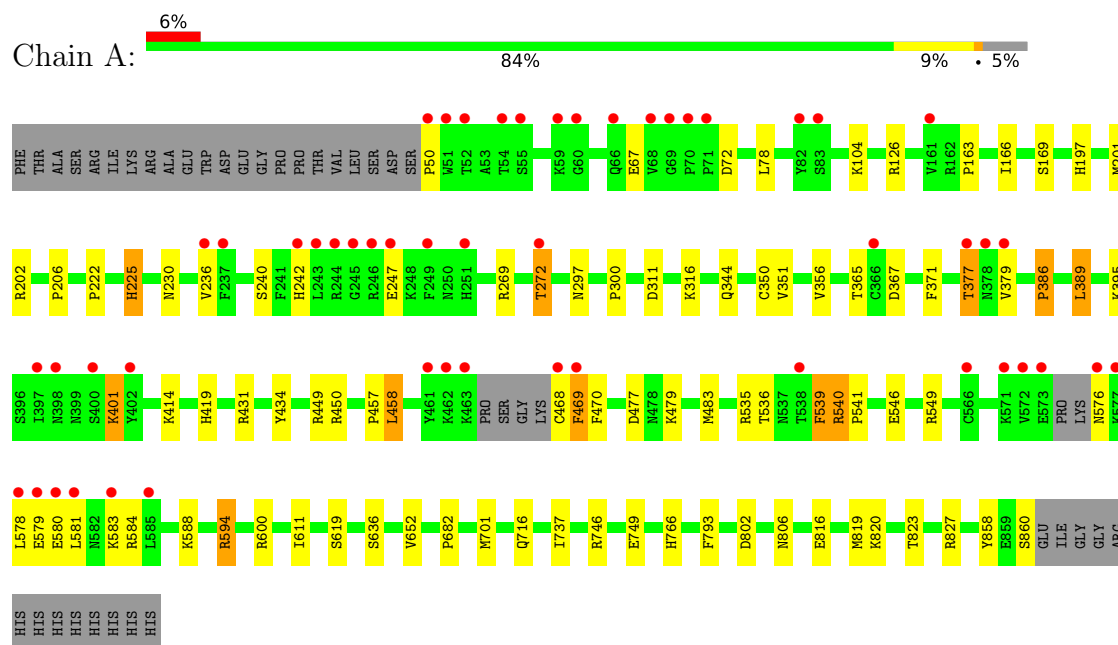
- Molecule 9 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
9	A	594	Total	O	0	1
			595	595		

3 Residue-property plots

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

- Molecule 1: Isoform 2 of Ectonucleotide pyrophosphatase/phosphodiesterase family member 2



- Molecule 2: alpha-D-mannopyranose-(1-2)-alpha-D-mannopyranose-(1-3)-alpha-D-mannopyranose-(1-6)-[alpha-D-mannopyranose-(1-2)-alpha-D-mannopyranose-(1-3)]beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain B: 



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	84.13Å 92.07Å 120.46Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	68.97 – 1.82 68.97 – 1.82	Depositor EDS
% Data completeness (in resolution range)	89.8 (68.97-1.82) 90.4 (68.97-1.82)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.38 (at 1.82Å)	Xtriage
Refinement program	REFMAC 5.8.0232	Depositor
R, R_{free}	0.170 , 0.207 0.180 , 0.214	Depositor DCC
R_{free} test set	3881 reflections (4.56%)	wwPDB-VP
Wilson B-factor (Å ²)	25.2	Xtriage
Anisotropy	0.050	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.30 , 27.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	7336	wwPDB-VP
Average B, all atoms (Å ²)	33.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.38% 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: CA, NAG, K, YN6, NA, MAN, ZN, BMA, ACT

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	1.16	8/6849 (0.1%)	1.31	12/9281 (0.1%)

All (8) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	539	PHE	C-O	6.58	1.31	1.24
1	A	197	HIS	CE1-NE2	6.45	1.39	1.32
1	A	619	SER	C-O	6.36	1.31	1.23
1	A	225	HIS	CE1-NE2	6.27	1.38	1.32
1	A	389	LEU	C-O	5.83	1.31	1.23
1	A	546	GLU	CD-OE1	5.50	1.35	1.25
1	A	236	VAL	C-O	5.31	1.30	1.24
1	A	419	HIS	CE1-NE2	5.28	1.37	1.32

All (12) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	540	ARG	CB-CA-C	7.98	118.95	110.65
1	A	272	THR	CB-CA-C	7.71	122.40	109.84
1	A	827	ARG	CG-CD-NE	-7.68	95.10	112.00
1	A	377	THR	CB-CA-C	7.00	122.55	110.79
1	A	225	HIS	CA-CB-CG	6.60	120.40	113.80
1	A	546	GLU	CB-CG-CD	6.03	122.85	112.60
1	A	311	ASP	CA-CB-CG	5.99	118.59	112.60
1	A	50	PRO	N-CA-CB	5.86	109.44	103.00
1	A	344	GLN	CB-CA-C	-5.60	101.50	110.79
1	A	377	THR	N-CA-C	-5.52	104.67	111.40
1	A	202	ARG	CA-C-O	5.27	123.52	119.46
1	A	386	PRO	N-CA-CB	-5.26	97.73	103.25

There are no chirality outliers.

There are no planarity outliers.

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	6614	0	6405	44	0
2	B	94	0	79	1	0
3	A	2	0	0	0	0
4	A	1	0	0	0	0
5	A	8	0	6	0	0
6	A	20	0	0	0	0
7	A	1	0	0	0	0
8	A	1	0	0	0	0
9	A	595	0	0	7	0
All	All	7336	0	6490	45	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 3.

All (45) 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:479[A]:LYS:NZ	9:A:1004:HOH:O	2.29	0.65
1:A:539:PHE:O	1:A:541:PRO:HD3	1.96	0.64
1:A:746:ARG:NH2	9:A:1001:HOH:O	2.13	0.61
1:A:468:CYS:SG	1:A:469:PHE:N	2.74	0.60
1:A:600[B]:ARG:HH21	1:A:600[B]:ARG:HG3	1.67	0.59
1:A:652:VAL:HG21	1:A:701[B]:MET:HE1	1.85	0.59
1:A:600[B]:ARG:HD2	1:A:611:ILE:HD11	1.87	0.56
1:A:535:ARG:HG2	1:A:536:THR:HG23	1.90	0.52
1:A:576:ASN:HD21	1:A:578:LEU:HD12	1.73	0.52
1:A:682:PRO:HB3	1:A:716:GLN:HB3	1.93	0.50
1:A:163:PRO:HB3	1:A:350:CYS:O	2.12	0.49
1:A:126:ARG:HD3	9:A:1289:HOH:O	2.13	0.48
1:A:458:LEU:C	1:A:458:LEU:HD12	2.39	0.48
1:A:371:PHE:CE1	1:A:457:PRO:HA	2.48	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:201:MET:HE1	1:A:356:VAL:CG2	2.43	0.47
1:A:450[B]:ARG:NH2	9:A:1018:HOH:O	2.43	0.47
1:A:269:ARG:HB3	1:A:300:PRO:HA	1.96	0.47
1:A:594:ARG:HH12	1:A:636:SER:HB3	1.80	0.46
1:A:401:LYS:HA	1:A:401:LYS:HE3	1.98	0.46
1:A:540:ARG:HD3	1:A:540:ARG:HA	1.80	0.46
1:A:222:PRO:HA	1:A:225:HIS:CE1	2.51	0.45
1:A:820:LYS:HE2	1:A:858[B]:TYR:CD2	2.52	0.45
1:A:483:MET:HA	1:A:483:MET:HE2	1.98	0.45
1:A:652:VAL:CG2	1:A:701[B]:MET:HE1	2.47	0.45
1:A:600[B]:ARG:CG	1:A:600[B]:ARG:NH2	2.78	0.44
1:A:230:ASN:ND2	9:A:1005:HOH:O	2.30	0.43
1:A:470:PHE:C	1:A:470:PHE:CD1	2.96	0.43
1:A:365:THR:OG1	1:A:367:ASP:OD1	2.26	0.43
1:A:584:ARG:O	1:A:588:LYS:HG2	2.18	0.43
1:A:166:ILE:HD12	1:A:351:VAL:HG11	1.99	0.43
1:A:449:ARG:O	1:A:450[A]:ARG:HB2	2.18	0.43
1:A:802:ASP:HA	9:A:1078:HOH:O	2.19	0.42
1:A:793:PHE:CE2	1:A:819:MET:HE3	2.55	0.42
1:A:600[B]:ARG:HH21	1:A:600[B]:ARG:CG	2.30	0.42
1:A:169:SER:HA	1:A:356:VAL:O	2.19	0.41
1:A:78:LEU:HD23	1:A:78:LEU:HA	1.84	0.41
1:A:816:GLU:HG2	1:A:820:LYS:HE3	2.02	0.41
1:A:737:ILE:HB	1:A:766:HIS:HB2	2.03	0.41
1:A:240:SER:O	1:A:247:GLU:HG2	2.21	0.41
2:B:2:NAG:H83	2:B:4:MAN:O4	2.21	0.41
1:A:600[B]:ARG:HG3	1:A:600[B]:ARG:NH2	2.33	0.41
1:A:206:PRO:HD3	1:A:434:TYR:CE1	2.56	0.40
1:A:576:ASN:ND2	1:A:579:GLU:OE1	2.55	0.40
1:A:806:ASN:HB2	9:A:1477:HOH:O	2.21	0.40
1:A:431:ARG:HD3	1:A:823:THR:O	2.22	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	819/846 (97%)	789 (96%)	29 (4%)	1 (0%)	48	38

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	477	ASP

5.3.2 Protein sidechains ⓘ

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

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

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	747/765 (98%)	724 (97%)	23 (3%)	35	17

All (23) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	67	GLU
1	A	72	ASP
1	A	104	LYS
1	A	242	HIS
1	A	272	THR
1	A	297	ASN
1	A	316	LYS
1	A	377	THR
1	A	379	VAL
1	A	386	PRO
1	A	389	LEU
1	A	395	LYS
1	A	401	LYS
1	A	414	LYS
1	A	458	LEU
1	A	469	PHE
1	A	549	ARG
1	A	580	GLU

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Mol	Chain	Res	Type
1	A	581	LEU
1	A	583	LYS
1	A	594	ARG
1	A	749	GLU
1	A	860	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	134	GLN
1	A	257	GLN
1	A	398	ASN
1	A	436	ASN
1	A	471	GLN
1	A	484	GLN
1	A	576	ASN

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	1.09	0	17,19,21	1.26	2 (11%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
2	NAG	B	2	2	14,14,15	1.26	2 (14%)	17,19,21	3.41	4 (23%)
2	BMA	B	3	2	11,11,12	1.31	1 (9%)	15,15,17	3.21	9 (60%)
2	MAN	B	4	2	11,11,12	1.51	1 (9%)	15,15,17	2.18	3 (20%)
2	MAN	B	5	2	11,11,12	1.12	0	15,15,17	1.25	1 (6%)
2	MAN	B	6	2	11,11,12	1.53	3 (27%)	15,15,17	1.18	1 (6%)
2	MAN	B	7	2	11,11,12	1.75	4 (36%)	15,15,17	3.12	6 (40%)
2	MAN	B	8	2	11,11,12	1.39	2 (18%)	15,15,17	1.88	2 (13%)

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	-	0/6/23/26	0/1/1/1
2	NAG	B	2	2	-	2/6/23/26	0/1/1/1
2	BMA	B	3	2	-	0/2/19/22	0/1/1/1
2	MAN	B	4	2	-	1/2/19/22	0/1/1/1
2	MAN	B	5	2	-	2/2/19/22	0/1/1/1
2	MAN	B	6	2	-	0/2/19/22	0/1/1/1
2	MAN	B	7	2	-	2/2/19/22	0/1/1/1
2	MAN	B	8	2	-	0/2/19/22	0/1/1/1

All (13) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	8	MAN	C2-C3	3.08	1.57	1.52
2	B	7	MAN	O2-C2	2.98	1.49	1.43
2	B	7	MAN	O5-C5	2.81	1.48	1.43
2	B	4	MAN	C2-C3	2.79	1.56	1.52
2	B	2	NAG	C6-C5	2.65	1.60	1.51
2	B	6	MAN	O5-C1	2.55	1.48	1.43
2	B	3	BMA	O3-C3	2.48	1.49	1.43
2	B	6	MAN	O5-C5	2.41	1.48	1.43
2	B	7	MAN	O5-C1	2.28	1.47	1.43
2	B	8	MAN	C1-C2	2.26	1.57	1.52
2	B	2	NAG	O6-C6	2.23	1.51	1.42
2	B	7	MAN	C1-C2	2.16	1.57	1.52
2	B	6	MAN	C4-C3	2.09	1.57	1.52

All (28) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	2	NAG	C1-O5-C5	11.94	128.19	112.19
2	B	7	MAN	C1-O5-C5	8.96	124.19	112.19
2	B	3	BMA	C1-O5-C5	8.66	123.79	112.19
2	B	4	MAN	C1-O5-C5	6.44	120.81	112.19
2	B	8	MAN	O3-C3-C2	5.67	121.62	110.05
2	B	7	MAN	C1-C2-C3	-4.29	103.40	109.64
2	B	2	NAG	C3-C4-C5	4.02	117.51	110.23
2	B	1	NAG	O5-C1-C2	-3.72	105.53	111.29
2	B	3	BMA	C2-C3-C4	-3.59	104.55	110.86
2	B	3	BMA	C1-C2-C3	3.56	114.83	109.64
2	B	4	MAN	O3-C3-C2	3.50	117.19	110.05
2	B	2	NAG	C2-N2-C7	3.41	127.47	122.90
2	B	7	MAN	O2-C2-C1	3.37	116.95	109.22
2	B	7	MAN	O3-C3-C2	3.33	116.85	110.05
2	B	7	MAN	C2-C3-C4	-3.30	105.06	110.86
2	B	3	BMA	O2-C2-C1	-3.26	101.75	109.22
2	B	3	BMA	O4-C4-C5	-3.00	101.94	109.32
2	B	3	BMA	O3-C3-C4	2.86	117.12	110.38
2	B	2	NAG	O5-C5-C6	2.85	113.21	107.66
2	B	6	MAN	O5-C5-C6	2.64	112.80	107.66
2	B	5	MAN	O2-C2-C1	2.53	115.02	109.22
2	B	3	BMA	O5-C1-C2	2.47	116.68	110.79
2	B	1	NAG	O5-C5-C6	2.46	112.46	107.66
2	B	7	MAN	O5-C5-C4	2.41	116.68	110.83
2	B	3	BMA	O6-C6-C5	-2.35	103.34	111.33
2	B	4	MAN	O4-C4-C5	2.26	114.90	109.32
2	B	8	MAN	C2-C3-C4	-2.24	106.92	110.86
2	B	3	BMA	O2-C2-C3	2.10	114.49	110.15

There are no chirality outliers.

All (7) torsion outliers are listed below:

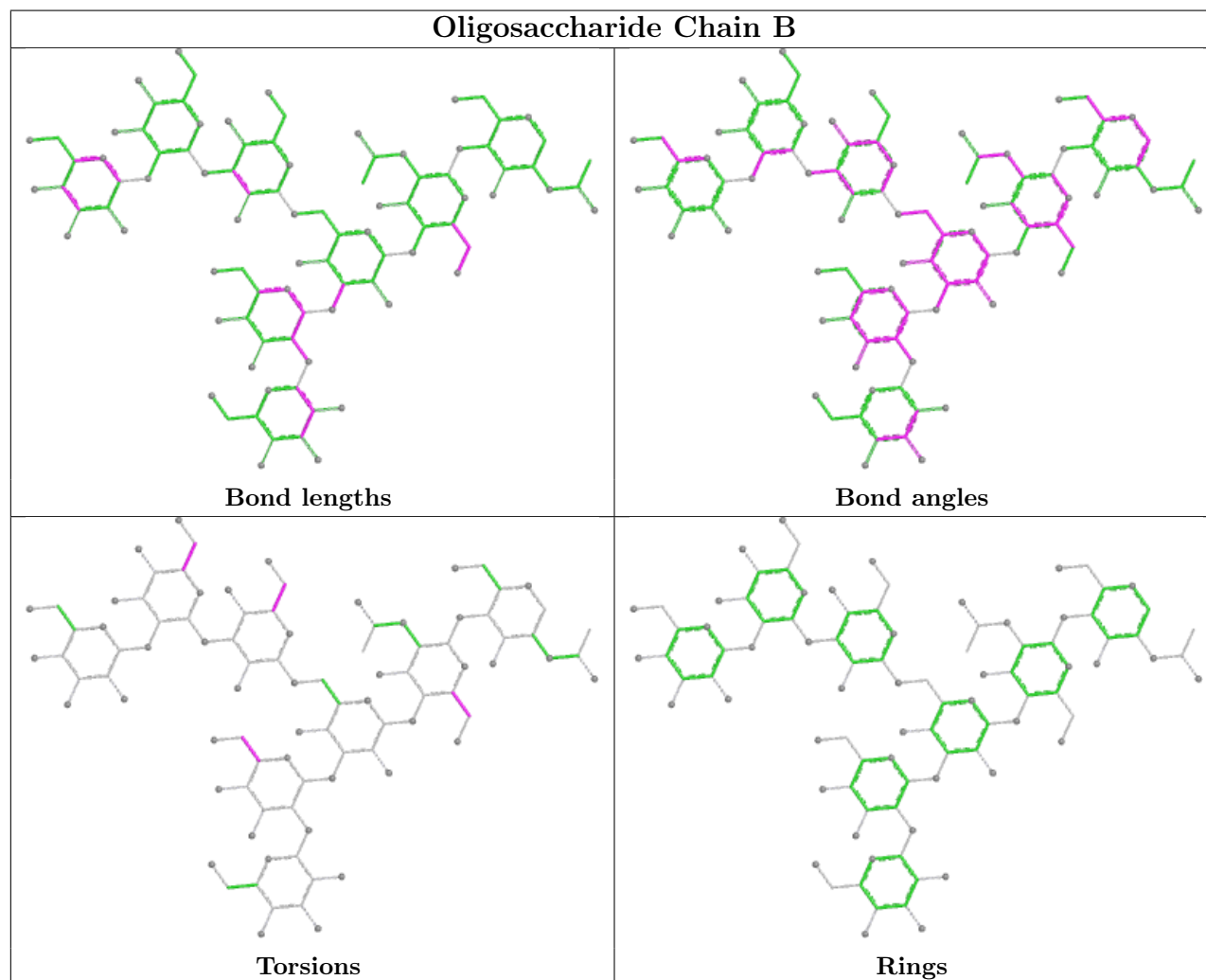
Mol	Chain	Res	Type	Atoms
2	B	7	MAN	O5-C5-C6-O6
2	B	7	MAN	C4-C5-C6-O6
2	B	5	MAN	C4-C5-C6-O6
2	B	5	MAN	O5-C5-C6-O6
2	B	2	NAG	C4-C5-C6-O6
2	B	2	NAG	O5-C5-C6-O6
2	B	4	MAN	O5-C5-C6-O6

There are no ring outliers.

2 monomers are involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	2	NAG	1	0
2	B	4	MAN	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 [i](#)

Of 8 ligands modelled in this entry, 5 are monoatomic - leaving 3 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	YN6	A	905	-	21,22,22	3.02	10 (47%)	23,31,31	2.61	8 (34%)
5	ACT	A	904	-	3,3,3	1.20	0	3,3,3	0.56	0
5	ACT	A	903	-	3,3,3	1.67	1 (33%)	3,3,3	0.84	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	YN6	A	905	-	-	4/8/22/22	0/3/3/3

All (11) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	A	905	YN6	S6-N7	7.49	1.74	1.62
6	A	905	YN6	S6-N5	6.50	1.73	1.62
6	A	905	YN6	C12-C20	3.64	1.60	1.52
6	A	905	YN6	C20-N19	3.55	1.45	1.35
6	A	905	YN6	C4-C8	3.42	1.44	1.40
6	A	905	YN6	C2-C10	-3.31	1.35	1.41
6	A	905	YN6	C9-N5	3.14	1.39	1.35
6	A	905	YN6	C17-C18	2.82	1.58	1.54
6	A	905	YN6	C3-C2	2.57	1.43	1.38
6	A	905	YN6	C8-C9	2.50	1.52	1.45
5	A	903	ACT	CH3-C	2.25	1.57	1.49

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	A	905	YN6	C9-N5-S6	6.13	108.05	104.58
6	A	905	YN6	C8-N7-S6	5.43	109.88	106.23
6	A	905	YN6	C15-C16-N19	-5.11	106.21	115.11
6	A	905	YN6	O11-C10-C9	-4.48	107.18	115.25
6	A	905	YN6	N5-S6-N7	-3.59	96.61	100.70
6	A	905	YN6	O11-C10-C2	3.07	130.63	123.95
6	A	905	YN6	C2-C3-C4	2.07	122.90	120.24
6	A	905	YN6	O11-C12-C20	-2.02	104.30	109.83

There are no chirality outliers.

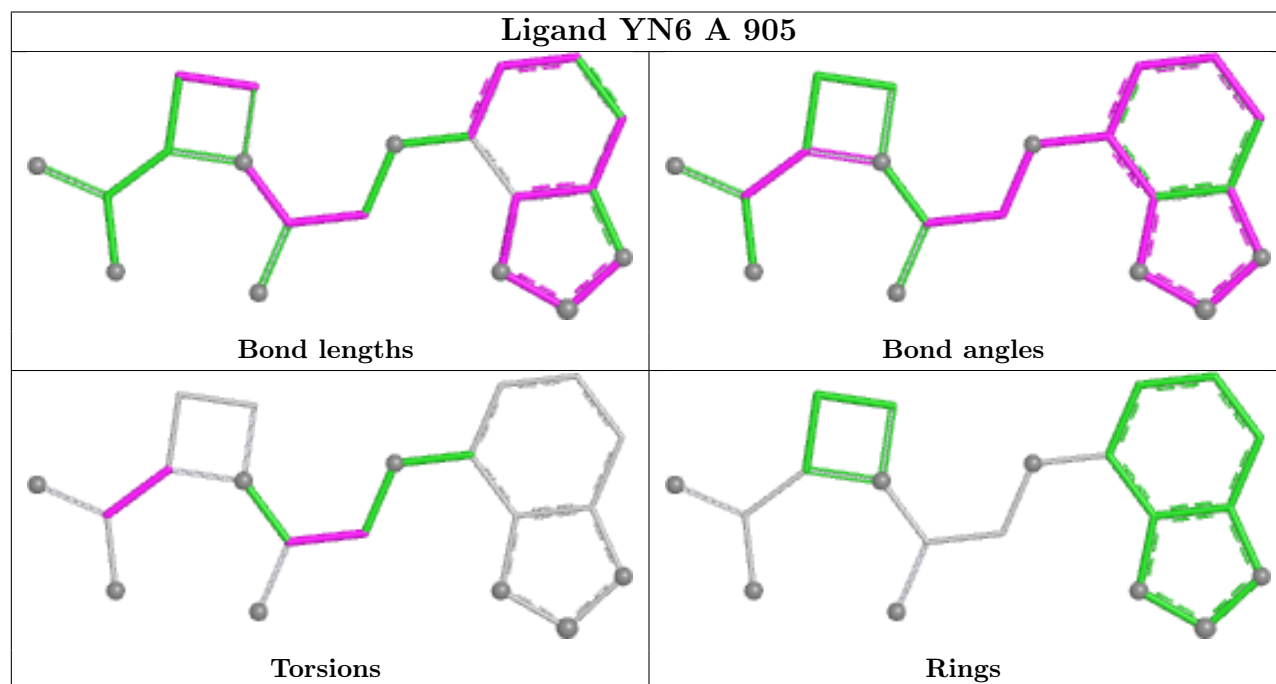
All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
6	A	905	YN6	O14-C15-C16-N19
6	A	905	YN6	O11-C12-C20-N19
6	A	905	YN6	O11-C12-C20-O1
6	A	905	YN6	O14-C15-C16-C17

There are no ring outliers.

No monomer is involved in short contacts.

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	805/846 (95%)	0.06	52 (6%) 25 28	12, 27, 63, 127	20 (2%)

All (52) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	572	VAL	6.4
1	A	70	PRO	6.2
1	A	578	LEU	5.9
1	A	468	CYS	5.2
1	A	68	VAL	5.2
1	A	469	PHE	4.9
1	A	51	TRP	4.7
1	A	463	LYS	4.5
1	A	50	PRO	4.3
1	A	71	PRO	4.2
1	A	397	ILE	4.1
1	A	581	LEU	4.0
1	A	573	GLU	3.9
1	A	242	HIS	3.4
1	A	249	PHE	3.4
1	A	577	LYS	3.2
1	A	571	LYS	3.0
1	A	272	THR	3.0
1	A	378	ASN	2.9
1	A	462	LYS	2.8
1	A	69	GLY	2.8
1	A	244	ARG	2.8
1	A	251	HIS	2.8
1	A	576	ASN	2.8
1	A	398	ASN	2.7
1	A	366	CYS	2.7
1	A	60	GLY	2.6

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Mol	Chain	Res	Type	RSRZ
1	A	54	THR	2.6
1	A	585	LEU	2.6
1	A	59	LYS	2.6
1	A	237[A]	PHE	2.6
1	A	402	TYR	2.5
1	A	246	ARG	2.5
1	A	161	VAL	2.5
1	A	245	GLY	2.5
1	A	243	LEU	2.4
1	A	538	THR	2.4
1	A	247	GLU	2.4
1	A	82	TYR	2.2
1	A	66	GLN	2.2
1	A	55	SER	2.2
1	A	579	GLU	2.2
1	A	83	SER	2.2
1	A	580	GLU	2.2
1	A	583	LYS	2.1
1	A	377	THR	2.1
1	A	400	SER	2.1
1	A	566	CYS	2.1
1	A	52	THR	2.1
1	A	379	VAL	2.1
1	A	461	TYR	2.0
1	A	236	VAL	2.0

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

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

6.3 Carbohydrates ⓘ

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.

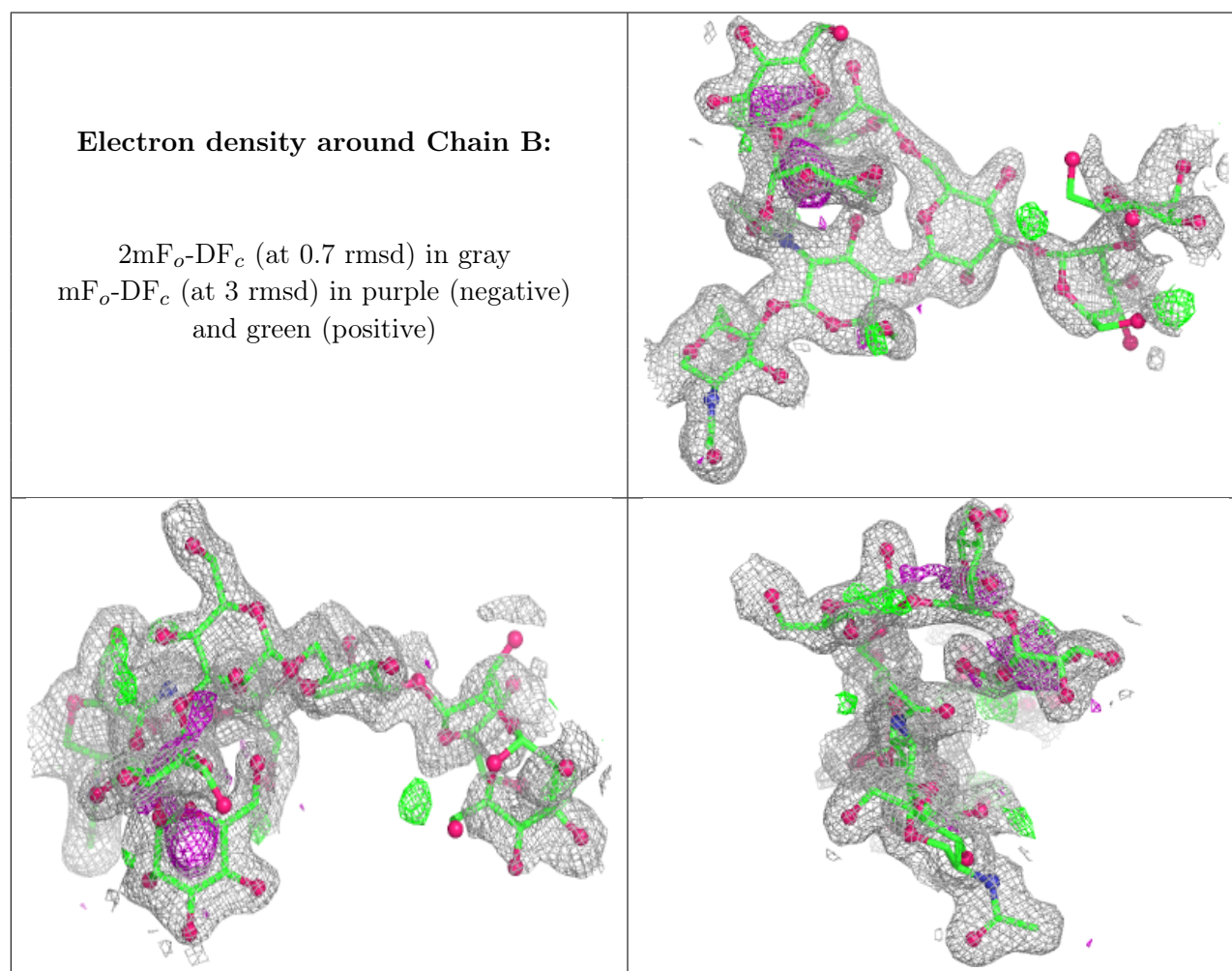
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
2	MAN	B	7	11/12	0.33	0.19	97,104,109,111	0
2	MAN	B	8	11/12	0.57	0.17	52,91,107,118	0
2	BMA	B	3	11/12	0.69	0.14	55,66,75,89	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
2	MAN	B	4	11/12	0.76	0.14	56,61,65,66	0
2	MAN	B	5	11/12	0.85	0.15	45,55,60,62	0
2	MAN	B	6	11/12	0.87	0.15	36,48,56,57	0
2	NAG	B	2	14/15	0.88	0.11	28,37,42,57	0
2	NAG	B	1	14/15	0.97	0.06	18,20,23,25	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.

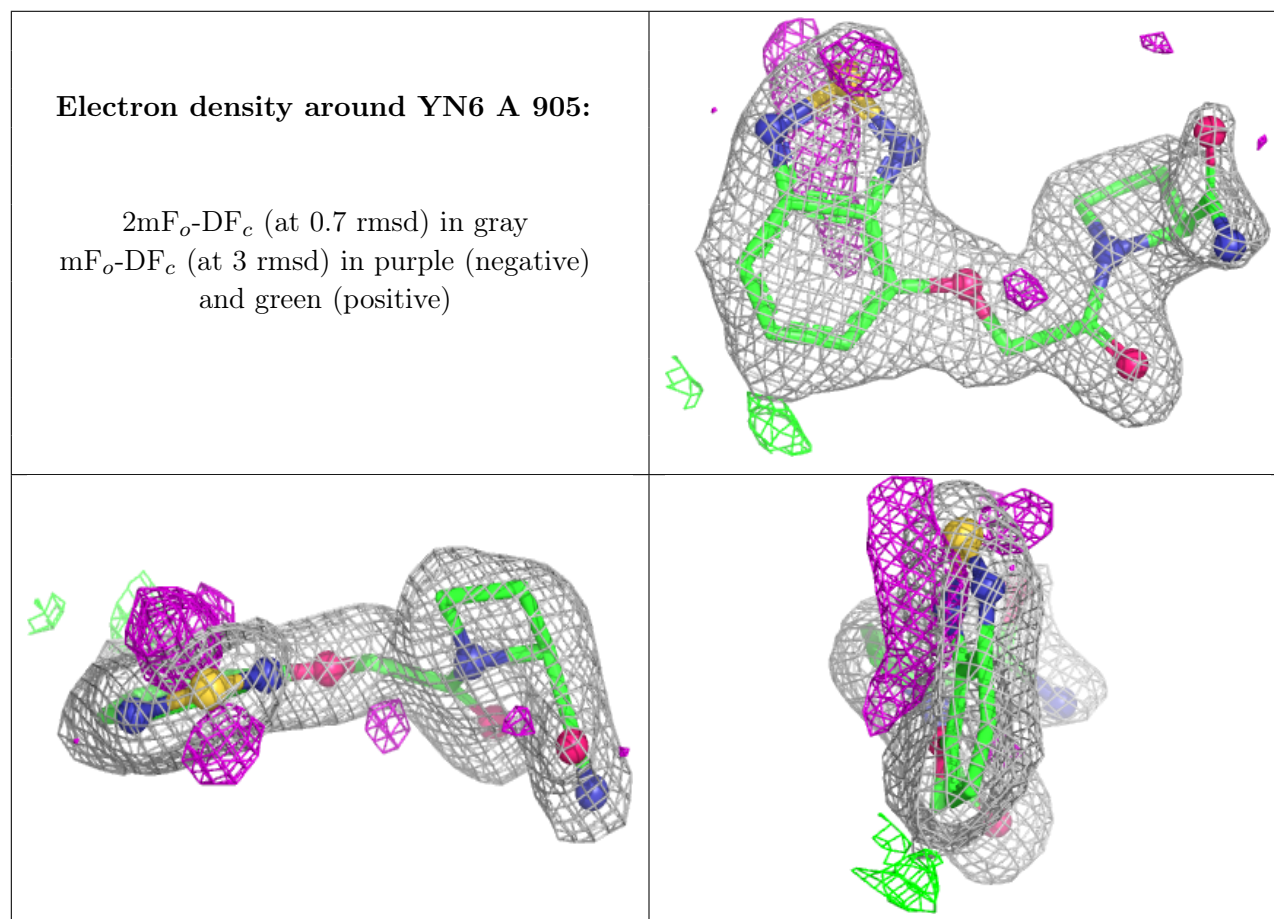


6.4 Ligands ⓘ

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
5	ACT	A	903	4/4	0.86	0.16	34,35,37,42	0
6	YN6	A	905	20/20	0.88	0.11	31,41,55,55	0
5	ACT	A	904	4/4	0.93	0.11	35,42,50,55	0
8	NA	A	907	1/1	0.94	0.07	45,45,45,45	0
4	K	A	902	1/1	0.97	0.05	29,29,29,29	0
3	CA	A	908	1/1	0.99	0.03	18,18,18,18	0
7	ZN	A	906	1/1	1.00	0.01	22,22,22,22	0
3	CA	A	901	1/1	1.00	0.02	21,21,21,21	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 ⓘ

There are no such residues in this entry.