



# Full wwPDB X-ray Structure Validation Report ⓘ

Dec 12, 2024 – 03:57 PM EST

PDB ID : 7G6M  
Title : Crystal Structure of rat Autotaxin in complex with [(3a*S*,6a*S*)-5-[2-cyclopropyl-6-(oxan-4-ylmethoxy)pyridine-4-carbonyl]-1,3,3a,4,6,6a-hexahydropyrrolo[3,4-*c*]pyrrol-2-yl]-(1*H*-benzotriazol-5-yl)methanone, i.e. SMILES N1(C[C@@H]2[C@@H](C1)CN(C2)C(=O)c1cc(nc(c1)OCC1CCOCC1)C1CC1)C(=O)c1ccc2c(c1)N=NN2 with IC50=0.00159445 microM  
Authors : Stihle, M.; Benz, J.; Hunziker, D.; Mattei, P.; Rudolph, M.G.  
Deposited on : 2023-06-05  
Resolution : 2.13 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](mailto: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>.

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The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467  
Mogul : 2022.3.0, CSD as543be (2022)  
Xtriage (Phenix) : 1.21  
EDS : 3.0  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)  
CCP4 : 9.0.004 (Gargrove)  
Density-Fitness : 1.0.11  
Ideal geometry (proteins) : Engh & Huber (2001)

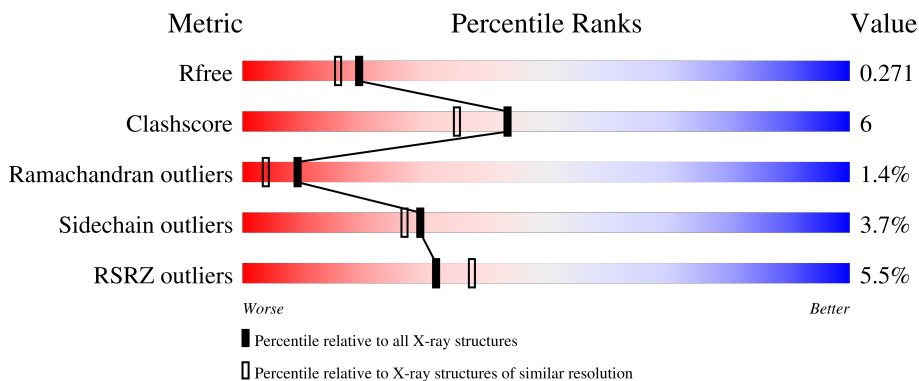
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

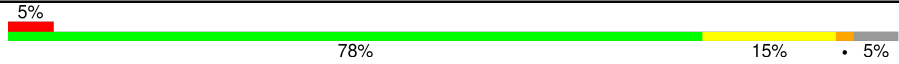

The reported resolution of this entry is 2.13 Å.

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))
$R_{free}$	164625	3336 (2.16-2.12)
Clashscore	180529	3585 (2.16-2.12)
Ramachandran outliers	177936	3554 (2.16-2.12)
Sidechain outliers	177891	3553 (2.16-2.12)
RSRZ outliers	164620	3337 (2.16-2.12)

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  $\geq 3$ , 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	
2	B	8	

Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.40

## 2 Entry composition [i](#)

There are 9 unique types of molecules in this entry. The entry contains 6867 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	6500	4120	1121	1210	49	0	0	0

There are 14 discrepancies between the modelled and reference sequences:

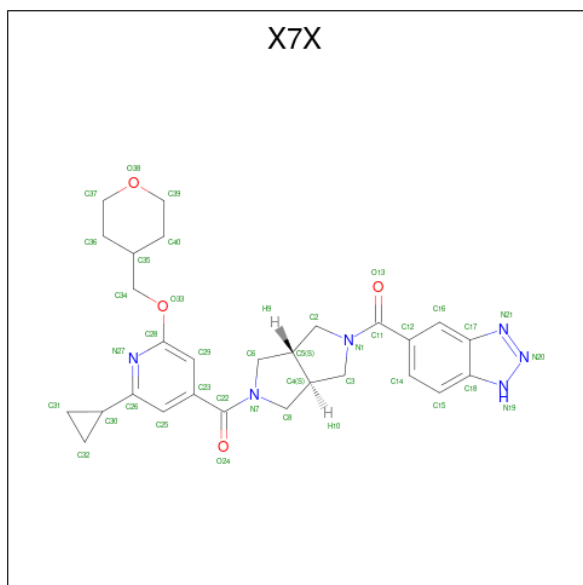
Chain	Residue	Modelled	Actual	Comment	Reference
A	53	ALA	ASN	engineered mutation	UNP Q64610
A	410	ALA	ASN	engineered mutation	UNP Q64610
A	591	THR	ARG	engineered mutation	UNP Q64610
A	863	GLY	-	expression tag	UNP Q64610
A	864	GLY	-	expression tag	UNP Q64610
A	865	ARG	-	expression tag	UNP Q64610
A	866	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.



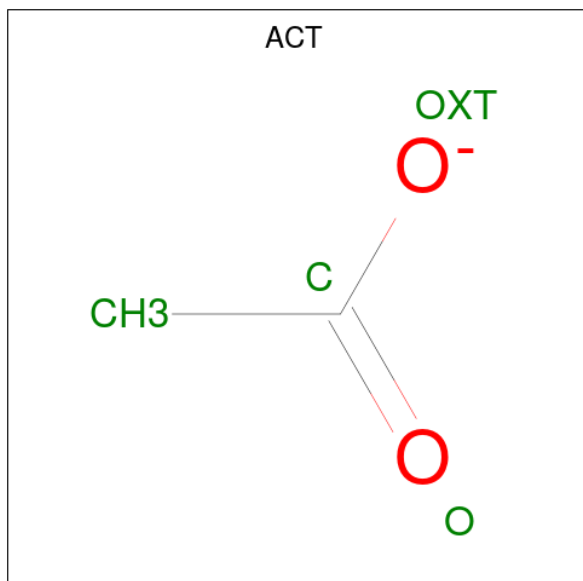
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
2	B	8	94	52	2	40	0	0	0

- Molecule 3 is [(3aR,6aS)-5-(1H-benzotriazole-5-carbonyl)hexahydropyrrolo[3,4-c]pyrrol-2(1H)-yl]{2-cyclopropyl-6-[(oxan-4-yl)methoxy]pyridin-4-yl}methanone (three-letter code: X7X) (formula: C<sub>28</sub>H<sub>32</sub>N<sub>6</sub>O<sub>4</sub>) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
3	A	1	38	28	6	4	0	0

- Molecule 4 is ACETATE ION (three-letter code: ACT) (formula: C<sub>2</sub>H<sub>3</sub>O<sub>2</sub><sup>-</sup>).



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

- Molecule 5 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	1	Total Cl 1 1	0	0

- Molecule 6 is CALCIUM ION (three-letter code: CA) (formula: Ca).

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

- Molecule 7 is ZINC ION (three-letter code: ZN) (formula: Zn).

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

- Molecule 8 is SODIUM ION (three-letter code: NA) (formula: Na).

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

- Molecule 9 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
9	A	226	Total O 226 226	0	0



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	84.69Å 92.56Å 120.72Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	46.28 – 2.13 46.28 – 2.13	Depositor EDS
% Data completeness (in resolution range)	93.0 (46.28-2.13) 93.0 (46.28-2.13)	Depositor EDS
$R_{merge}$	0.22	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.24 (at 2.14Å)	Xtrriage
Refinement program	REFMAC 5.8.0048	Depositor
R, $R_{free}$	0.214 , 0.271 0.214 , 0.271	Depositor DCC
$R_{free}$ test set	2667 reflections (4.98%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	36.0	Xtrriage
Anisotropy	0.209	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.31 , 29.3	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	6867	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	46.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.27% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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: ACT, NAG, X7X, NA, MAN, BMA, ZN, CL, CA

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	0.91	1/6682 (0.0%)	0.98	14/9062 (0.2%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	308	GLU	CD-OE2	5.04	1.31	1.25

All (14) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	581	LEU	CA-CB-CG	7.69	132.98	115.30
1	A	827	ARG	NE-CZ-NH1	-7.62	116.49	120.30
1	A	458	LEU	CA-CB-CG	6.98	131.35	115.30
1	A	174	ARG	NE-CZ-NH2	-6.75	116.92	120.30
1	A	578	LEU	CA-CB-CG	6.75	130.83	115.30
1	A	585	LEU	CA-CB-CG	6.18	129.51	115.30
1	A	539	PHE	N-CA-C	-5.87	95.16	111.00
1	A	610	ASP	CB-CG-OD1	5.79	123.52	118.30
1	A	431	ARG	NE-CZ-NH2	-5.76	117.42	120.30
1	A	393	ARG	NE-CZ-NH1	5.53	123.07	120.30
1	A	345	LEU	CA-CB-CG	5.26	127.39	115.30
1	A	171	ASP	CB-CG-OD1	-5.25	113.58	118.30
1	A	171	ASP	CB-CG-OD2	5.17	122.96	118.30
1	A	851	LEU	CB-CG-CD2	-5.02	102.47	111.00

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	6500	0	6244	78	0
2	B	94	0	79	1	0
3	A	38	0	0	0	0
4	A	4	0	3	0	0
5	A	1	0	0	0	0
6	A	2	0	0	1	0
7	A	1	0	0	0	0
8	A	1	0	0	0	0
9	A	226	0	0	7	0
All	All	6867	0	6326	78	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 6.

All (78) 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:569:ASP:OD2	1:A:647:HIS:HB2	1.67	0.93
1:A:52:THR:HB	1:A:54:THR:HG22	1.53	0.91
1:A:52:THR:HA	1:A:71:PRO:HB3	1.58	0.85
1:A:539:PHE:HA	9:A:1007:HOH:O	1.77	0.82
1:A:209:THR:OG1	6:A:904:CA:CA	1.66	0.71
1:A:576:ASN:ND2	1:A:579:GLU:HB2	2.08	0.69
1:A:269:ARG:HB3	1:A:300:PRO:HA	1.80	0.64
1:A:370:GLU:OE2	1:A:419:HIS:HD2	1.85	0.60
1:A:110:VAL:O	1:A:111:ARG:C	2.41	0.59
1:A:540:ARG:NH1	9:A:1006:HOH:O	2.35	0.59
1:A:647:HIS:CD2	1:A:648:LEU:HG	2.39	0.57
1:A:635:ILE:HD12	1:A:685:LEU:HD13	1.89	0.55
1:A:163:PRO:HB3	1:A:350:CYS:O	2.07	0.55
1:A:746:ARG:NH2	9:A:1001:HOH:O	2.10	0.55
1:A:322:PRO:O	9:A:1002:HOH:O	2.18	0.54
1:A:382:ILE:HG13	1:A:382:ILE:O	2.07	0.54
1:A:404:PRO:HB3	1:A:443:ILE:HD11	1.89	0.53
1:A:142:HIS:HB2	1:A:145:ASP:OD2	2.09	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:584:ARG:O	1:A:588:LYS:HG2	2.09	0.52
1:A:682:PRO:HB3	1:A:716:GLN:HB3	1.90	0.52
1:A:52:THR:HB	1:A:54:THR:CG2	2.34	0.52
1:A:161:VAL:HG22	1:A:161:VAL:O	2.09	0.51
1:A:54:THR:HA	1:A:73:CYS:HB3	1.93	0.51
1:A:255:GLY:HA3	2:B:5:MAN:O3	2.10	0.51
1:A:643:SER:O	1:A:645:PRO:HD3	2.10	0.51
1:A:537:ASN:O	1:A:538:THR:O	2.30	0.50
1:A:839:ARG:O	1:A:840:LYS:HD3	2.11	0.50
1:A:846:SER:HB3	9:A:1221:HOH:O	2.11	0.50
1:A:555:ILE:HG23	1:A:656:VAL:HG23	1.94	0.49
1:A:576:ASN:HD21	1:A:579:GLU:HB2	1.76	0.49
1:A:53:ALA:H	1:A:71:PRO:HB2	1.78	0.49
1:A:92:LEU:O	1:A:95:LYS:HE3	2.13	0.49
1:A:65:LEU:HD23	1:A:65:LEU:HA	1.60	0.48
1:A:698:VAL:HG23	1:A:701:MET:HE2	1.95	0.48
1:A:98:ARG:HG3	1:A:115:ASN:OD1	2.13	0.48
1:A:222:PRO:HA	1:A:225:HIS:CE1	2.48	0.48
1:A:378:ASN:O	1:A:380:ASP:N	2.47	0.48
1:A:112:ASN:OD1	1:A:114:GLU:HB2	2.13	0.47
1:A:711:VAL:HG13	1:A:815:VAL:HG13	1.95	0.47
1:A:275:TRP:CD2	1:A:284:ARG:HG2	2.50	0.47
1:A:635:ILE:CD1	1:A:685:LEU:HD13	2.45	0.46
1:A:408:ILE:HD11	1:A:443:ILE:HG12	1.98	0.46
1:A:166:ILE:HD12	1:A:351:VAL:HG11	1.98	0.46
1:A:210:PHE:HE1	1:A:243:LEU:HD23	1.82	0.45
1:A:537:ASN:O	1:A:538:THR:C	2.54	0.45
1:A:161:VAL:O	1:A:161:VAL:CG2	2.63	0.45
1:A:555:ILE:HG23	1:A:656:VAL:CG2	2.47	0.45
1:A:540:ARG:HD3	1:A:540:ARG:HA	1.66	0.45
1:A:232:MET:HE3	1:A:241:PHE:CG	2.52	0.45
1:A:237:PHE:O	1:A:238:ASP:C	2.53	0.45
1:A:70:PRO:HA	1:A:71:PRO:HA	1.69	0.44
1:A:309:GLN:HA	1:A:309:GLN:OE1	2.18	0.44
1:A:370:GLU:OE2	1:A:419:HIS:CD2	2.68	0.43
1:A:546:GLU:CD	1:A:600:ARG:HH22	2.22	0.43
1:A:704:MET:HA	1:A:797:HIS:NE2	2.33	0.43
1:A:275:TRP:CE3	1:A:284:ARG:HG2	2.54	0.43
1:A:240:SER:O	1:A:247:GLU:HG2	2.18	0.43
1:A:594:ARG:NH1	1:A:636:SER:HB3	2.34	0.43
1:A:108:GLY:O	1:A:109:GLU:O	2.36	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:205:TYR:CD1	1:A:206:PRO:HA	2.54	0.42
1:A:537:ASN:C	1:A:538:THR:O	2.56	0.42
1:A:124:LEU:N	1:A:129:CYS:SG	2.92	0.42
1:A:225:HIS:CE1	1:A:227:ILE:HB	2.54	0.42
1:A:557:TYR:O	1:A:656:VAL:HB	2.19	0.42
1:A:597:LEU:HD12	1:A:731:ASN:HB2	2.01	0.42
1:A:237:PHE:O	1:A:238:ASP:O	2.38	0.42
1:A:53:ALA:C	1:A:55:SER:H	2.23	0.42
1:A:709:LYS:HB3	1:A:709:LYS:HE2	1.85	0.41
1:A:57:SER:OG	1:A:58:CYS:N	2.53	0.41
1:A:493:THR:HG21	1:A:515:LEU:HD23	2.02	0.41
1:A:594:ARG:HH12	1:A:636:SER:HB3	1.84	0.41
1:A:698:VAL:HG22	1:A:698:VAL:O	2.20	0.41
1:A:479:LYS:O	1:A:859:GLU:HG3	2.21	0.41
1:A:414:LYS:HD3	1:A:414:LYS:HA	1.51	0.41
1:A:371:PHE:CE1	1:A:457:PRO:HA	2.56	0.40
1:A:706:PRO:HD2	9:A:1069:HOH:O	2.22	0.40
1:A:727:ARG:NH2	9:A:1005:HOH:O	2.33	0.40
1:A:123:CYS:O	1:A:124:LEU:C	2.59	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	799/846 (94%)	739 (92%)	49 (6%)	11 (1%)	<b>9</b> <b>4</b>

All (11) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	109	GLU
1	A	379	VAL

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Mol	Chain	Res	Type
1	A	64	GLU
1	A	418	GLN
1	A	579	GLU
1	A	113	GLU
1	A	238	ASP
1	A	477	ASP
1	A	60	GLY
1	A	386	PRO
1	A	71	PRO

### 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	728/765 (95%)	701 (96%)	27 (4%)	29 27

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

Mol	Chain	Res	Type
1	A	54	THR
1	A	57	SER
1	A	83	SER
1	A	103	THR
1	A	104	LYS
1	A	110	VAL
1	A	183	LYS
1	A	242	HIS
1	A	278	SER
1	A	316	LYS
1	A	333	LYS
1	A	379	VAL
1	A	389	LEU
1	A	395	LYS
1	A	401	LYS
1	A	405	LYS
1	A	458	LEU

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Mol	Chain	Res	Type
1	A	538	THR
1	A	549	ARG
1	A	572	VAL
1	A	582	ASN
1	A	583	LYS
1	A	593	GLU
1	A	594	ARG
1	A	600	ARG
1	A	846	SER
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	242	HIS
1	A	398	ASN
1	A	419	HIS
1	A	436	ASN
1	A	576	ASN
1	A	638	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](#)

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	2,1	14,14,15	0.92	0	17,19,21	2.11	3 (17%)
2	NAG	B	2	2	14,14,15	0.74	0	17,19,21	1.97	3 (17%)
2	BMA	B	3	2	11,11,12	0.98	1 (9%)	15,15,17	1.96	3 (20%)
2	MAN	B	4	2	11,11,12	1.22	1 (9%)	15,15,17	1.98	6 (40%)
2	MAN	B	5	2	11,11,12	0.79	0	15,15,17	2.05	4 (26%)
2	MAN	B	6	2	11,11,12	0.94	0	15,15,17	2.12	3 (20%)
2	MAN	B	7	2	11,11,12	1.66	2 (18%)	15,15,17	1.99	4 (26%)
2	MAN	B	8	2	11,11,12	0.97	0	15,15,17	1.11	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	2,1	-	0/6/23/26	0/1/1/1
2	NAG	B	2	2	-	0/6/23/26	0/1/1/1
2	BMA	B	3	2	-	2/2/19/22	0/1/1/1
2	MAN	B	4	2	-	1/2/19/22	0/1/1/1
2	MAN	B	5	2	-	0/2/19/22	0/1/1/1
2	MAN	B	6	2	-	1/2/19/22	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 (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	7	MAN	C2-C3	3.70	1.58	1.52
2	B	4	MAN	C2-C3	2.96	1.57	1.52
2	B	7	MAN	C1-C2	2.62	1.58	1.52
2	B	3	BMA	C2-C3	2.61	1.56	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	6.60	121.04	112.19
2	B	6	MAN	C1-O5-C5	6.41	120.78	112.19

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	1	NAG	O5-C1-C2	-6.24	101.64	111.29
2	B	5	MAN	C1-O5-C5	5.94	120.15	112.19
2	B	3	BMA	C1-O5-C5	4.66	118.44	112.19
2	B	7	MAN	C1-C2-C3	4.58	116.32	109.64
2	B	4	MAN	O3-C3-C2	3.96	118.13	110.05
2	B	7	MAN	C2-C3-C4	3.27	116.61	110.86
2	B	2	NAG	O7-C7-C8	-3.19	116.37	122.05
2	B	1	NAG	C2-N2-C7	-3.17	118.65	122.90
2	B	3	BMA	O2-C2-C3	3.07	116.50	110.15
2	B	4	MAN	C1-C2-C3	2.87	113.82	109.64
2	B	3	BMA	O4-C4-C3	2.82	117.02	110.38
2	B	4	MAN	C6-C5-C4	2.70	119.64	113.02
2	B	7	MAN	C3-C4-C5	2.65	115.03	110.23
2	B	4	MAN	O4-C4-C3	-2.59	104.27	110.38
2	B	8	MAN	C1-O5-C5	2.59	115.66	112.19
2	B	6	MAN	C2-C3-C4	2.55	115.35	110.86
2	B	6	MAN	O5-C1-C2	2.50	116.75	110.79
2	B	5	MAN	O4-C4-C5	2.33	115.06	109.32
2	B	4	MAN	C1-O5-C5	2.32	115.29	112.19
2	B	4	MAN	O6-C6-C5	2.31	119.19	111.33
2	B	5	MAN	C6-C5-C4	-2.30	107.38	113.02
2	B	1	NAG	O5-C5-C4	-2.29	105.25	110.83
2	B	7	MAN	O5-C5-C6	2.19	111.93	107.66
2	B	8	MAN	O3-C3-C2	2.11	114.37	110.05
2	B	5	MAN	O5-C5-C4	2.05	115.82	110.83
2	B	2	NAG	C8-C7-N2	2.00	119.44	116.12

There are no chirality outliers.

All (6) torsion outliers are listed below:

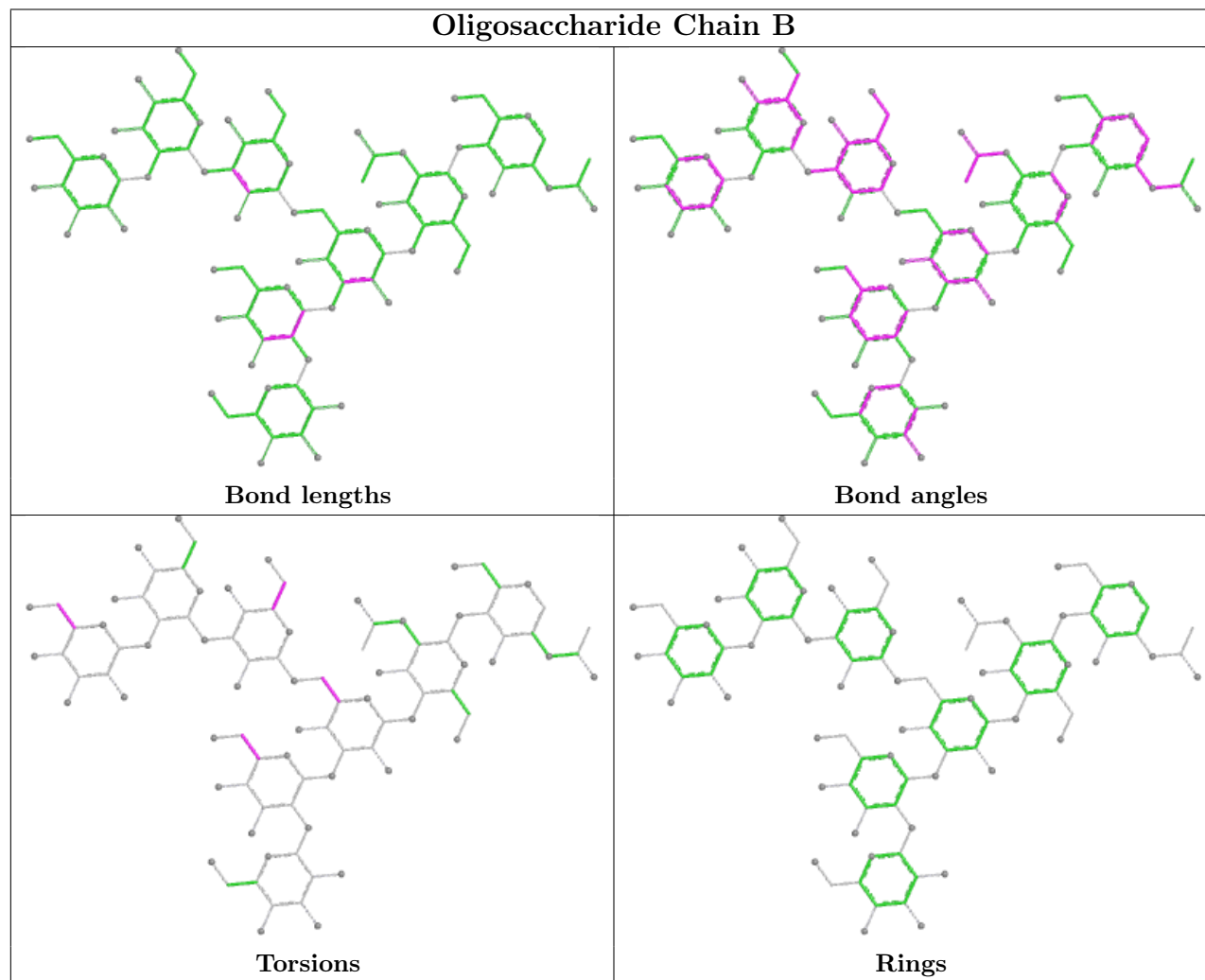
Mol	Chain	Res	Type	Atoms
2	B	7	MAN	O5-C5-C6-O6
2	B	3	BMA	O5-C5-C6-O6
2	B	3	BMA	C4-C5-C6-O6
2	B	7	MAN	C4-C5-C6-O6
2	B	6	MAN	C4-C5-C6-O6
2	B	4	MAN	O5-C5-C6-O6

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	5	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 7 ligands modelled in this entry, 5 are monoatomic - leaving 2 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	ACT	A	902	-	3,3,3	1.11	0	3,3,3	1.32	0
3	X7X	A	901	7	40,44,44	1.61	8 (20%)	54,64,64	1.92	17 (31%)

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	X7X	A	901	7	-	2/25/55/55	0/7/7/7

All (8) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	901	X7X	C26-N27	3.32	1.38	1.34
3	A	901	X7X	O33-C28	3.00	1.42	1.36
3	A	901	X7X	C2-N1	2.81	1.52	1.46
3	A	901	X7X	C28-N27	2.72	1.37	1.33
3	A	901	X7X	C8-N7	2.63	1.51	1.46
3	A	901	X7X	C25-C23	2.25	1.42	1.39
3	A	901	X7X	C3-N1	2.18	1.50	1.46
3	A	901	X7X	C16-C17	2.09	1.45	1.41

All (17) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	901	X7X	C31-C30-C26	-4.68	114.95	120.30
3	A	901	X7X	C2-C5-C4	-4.53	97.09	103.56
3	A	901	X7X	C4-C3-N1	-4.29	96.54	103.02
3	A	901	X7X	C14-C12-C16	3.78	123.78	119.21
3	A	901	X7X	C12-C16-C17	-3.46	114.53	120.47
3	A	901	X7X	C23-C25-C26	-3.09	116.30	119.77
3	A	901	X7X	C5-C2-N1	-3.02	98.46	103.02
3	A	901	X7X	C36-C35-C34	-2.57	104.58	111.42
3	A	901	X7X	C14-C12-C11	-2.44	114.03	120.28
3	A	901	X7X	C29-C23-C25	2.40	122.47	119.65
3	A	901	X7X	C25-C23-C22	-2.39	114.82	120.13
3	A	901	X7X	O13-C11-N1	-2.37	118.62	122.35
3	A	901	X7X	C8-C4-C5	-2.22	100.39	103.56
3	A	901	X7X	C34-O33-C28	-2.20	114.81	117.69
3	A	901	X7X	C37-C36-C35	-2.19	105.93	112.03
3	A	901	X7X	O38-C37-C36	-2.13	108.06	111.74

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	901	X7X	C39-O38-C37	2.02	116.40	109.88

There are no chirality outliers.

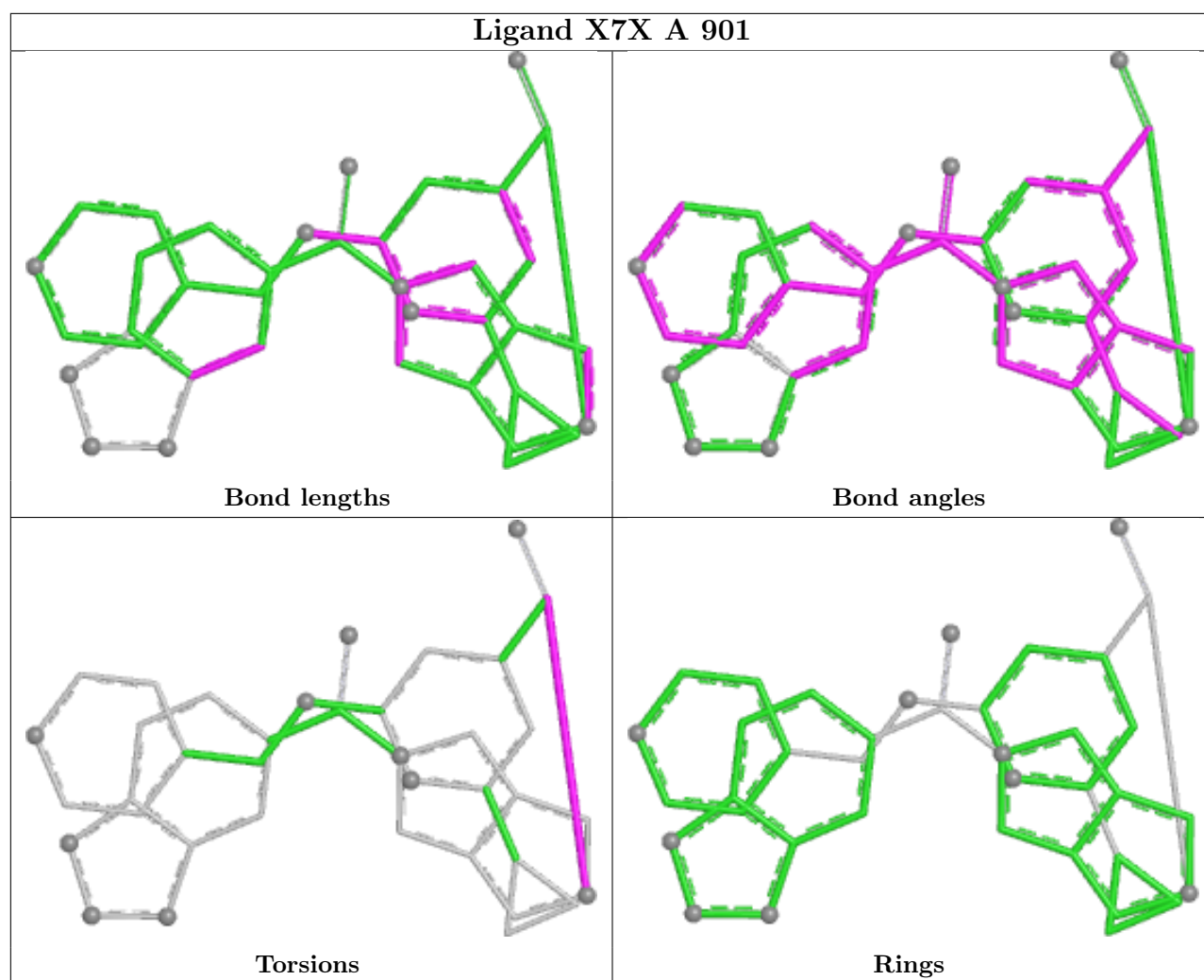
All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	901	X7X	O24-C22-N7-C8
3	A	901	X7X	C23-C22-N7-C8

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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	805/846 (95%)	0.18	44 (5%) <span style="border: 1px solid red; padding: 2px;">32</span> <span style="border: 1px solid red; padding: 2px;">38</span>	23, 42, 79, 80	0

All (44) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	51	TRP	5.9
1	A	572	VAL	5.3
1	A	578	LEU	5.1
1	A	70	PRO	4.7
1	A	469	PHE	4.1
1	A	54	THR	4.0
1	A	581	LEU	3.8
1	A	69	GLY	3.8
1	A	461	TYR	3.7
1	A	68	VAL	3.7
1	A	468	CYS	3.7
1	A	71	PRO	3.6
1	A	52	THR	3.6
1	A	397	ILE	3.5
1	A	585	LEU	3.5
1	A	243	LEU	3.0
1	A	536	THR	2.8
1	A	237	PHE	2.8
1	A	246	ARG	2.7
1	A	53	ALA	2.7
1	A	463	LYS	2.6
1	A	684	TYR	2.5
1	A	87	HIS	2.5
1	A	579	GLU	2.4
1	A	378	ASN	2.4
1	A	584	ARG	2.4
1	A	398	ASN	2.4

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Mol	Chain	Res	Type	RSRZ
1	A	56	GLY	2.3
1	A	580	GLU	2.2
1	A	60	GLY	2.2
1	A	648	LEU	2.2
1	A	239	ALA	2.1
1	A	251	HIS	2.1
1	A	236	VAL	2.1
1	A	573	GLU	2.1
1	A	571	LYS	2.1
1	A	110	VAL	2.1
1	A	366	CYS	2.1
1	A	244	ARG	2.1
1	A	417	ASP	2.1
1	A	458	LEU	2.1
1	A	402	TYR	2.0
1	A	538	THR	2.0
1	A	415	LYS	2.0

## 6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

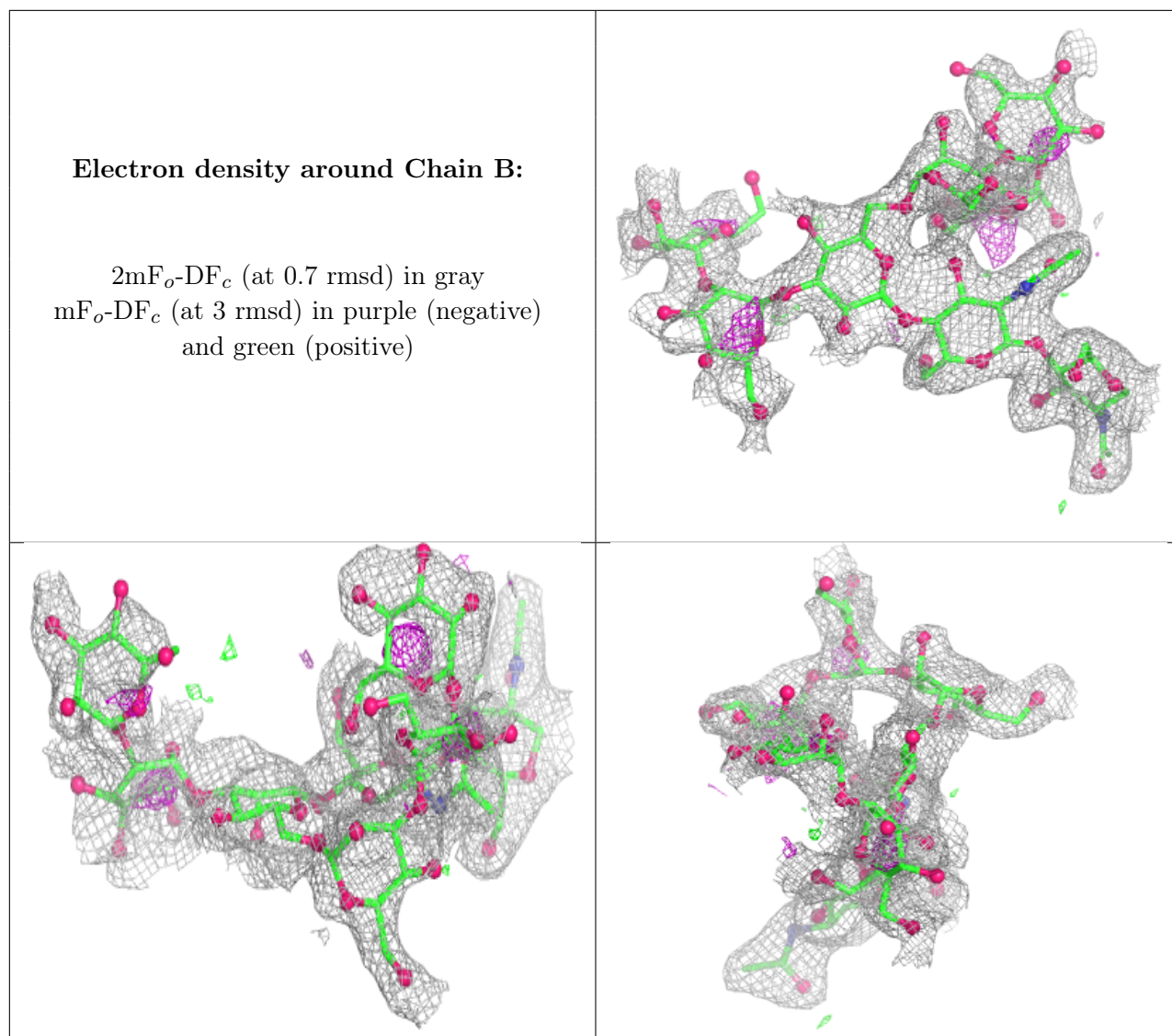
There are no non-standard protein/DNA/RNA residues in this entry.

## 6.3 Carbohydrates [i](#)

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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
2	MAN	B	7	11/12	0.45	0.16	80,80,80,80	0
2	BMA	B	3	11/12	0.62	0.14	78,80,80,80	0
2	MAN	B	8	11/12	0.63	0.14	64,80,80,80	0
2	MAN	B	4	11/12	0.74	0.12	65,78,80,80	0
2	MAN	B	5	11/12	0.75	0.17	80,80,80,80	0
2	MAN	B	6	11/12	0.81	0.16	63,76,80,80	0
2	NAG	B	2	14/15	0.91	0.09	37,49,55,64	0
2	NAG	B	1	14/15	0.95	0.07	28,31,33,36	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.

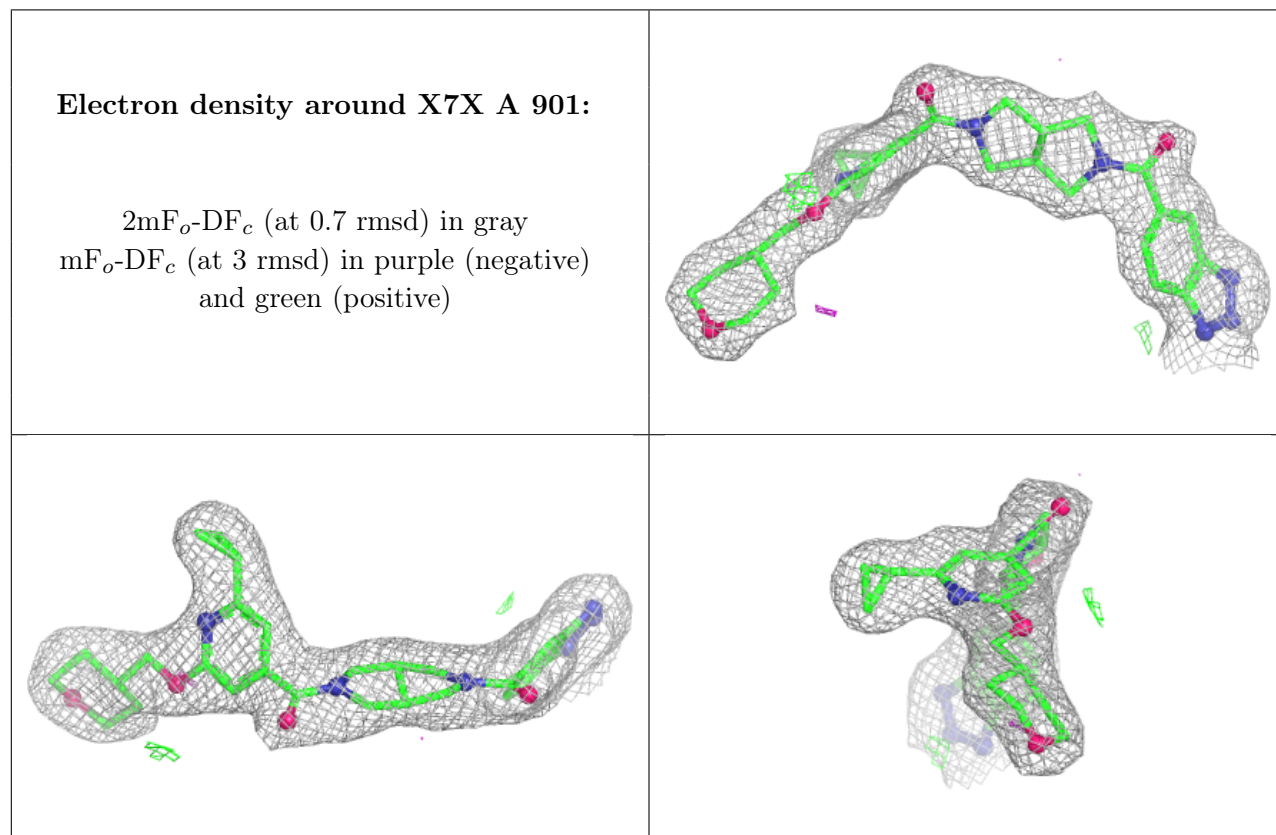


## 6.4 Ligands [i](#)

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, 95<sup>th</sup> 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
4	ACT	A	902	4/4	0.78	0.18	43,48,51,52	0
3	X7X	A	901	38/38	0.95	0.07	30,41,54,60	0
5	CL	A	903	1/1	0.96	0.07	50,50,50,50	0
6	CA	A	904	1/1	0.99	0.04	49,49,49,49	0
6	CA	A	906	1/1	0.99	0.02	34,34,34,34	0
8	NA	A	907	1/1	0.99	0.04	38,38,38,38	0
7	ZN	A	905	1/1	1.00	0.02	35,35,35,35	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.