W O R L D W I D E

wwPDB

P R O T E I N   D A T A   B A N K

Full wwPDB X-ray Structure Validation Report ⓘ

Dec 12, 2024 – 08:58 PM EST

PDB ID	:	7G58
Title	:	Crystal Structure of rat Autotaxin in complex with 2-[(3,3-dimethyl-6-propan-2-yl-1,2-dihydroinden-5-yl)oxy]-1-[rac-(3aR,8aS)-2-(1H-benzotriazole-5-carbonyl)-1,3,3a,4,5,7,8,8a-octahydropyrrolo[3,4-d]azepin-6-yl]ethanone, i.e. SMILES N1(CC[C@@H]2[C@H](CC1)CN(C2)C(=O)c1cc2c(cc1)NN=N2)C(=O)COc1c(cc2c(c1)C(CC2)(C)C)C(C)C with IC50=0.00121852 microM
Authors	:	Stihle, M.; Benz, J.; Hunziker, D.; Rudolph, M.G.
Deposited on	:	2023-06-05
Resolution	:	1.91 Å(reported)

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 1.91 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.
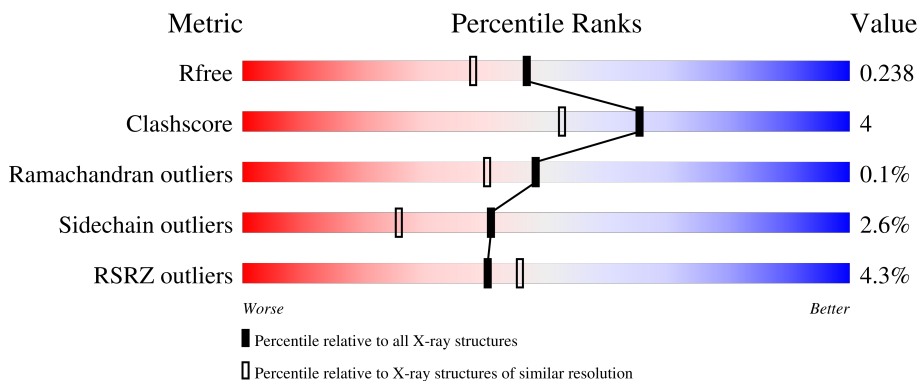
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	164625	1028 (1.92-1.92)
Clashscore	180529	1100 (1.92-1.92)
Ramachandran outliers	177936	1087 (1.92-1.92)
Sidechain outliers	177891	1087 (1.92-1.92)
RSRZ outliers	164620	1028 (1.92-1.92)

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 <=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	4% 83% 11% • 5%
2	B	8	100%

2 Entry composition ⓘ

There are 9 unique types of molecules in this entry. The entry contains 7148 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
1	A	806	Total 6568	C 4168	N 1128	O 1222	S 50	0	10	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 94	C 52	N 2	O 40	0	0	0

- Molecule 3 is 1-[(3aR,8aS)-2-(1H-benzotriazole-5-carbonyl)octahydropyrrolo[3,4-d]azepin-6(1H)-yl]-2-{[3,3-dimethyl-6-(propan-2-yl)-2,3-dihydro-1H-inden-5-yl]oxy}ethan-1-one (three-letter code: YG6) (formula: $C_{31}H_{39}N_5O_3$).
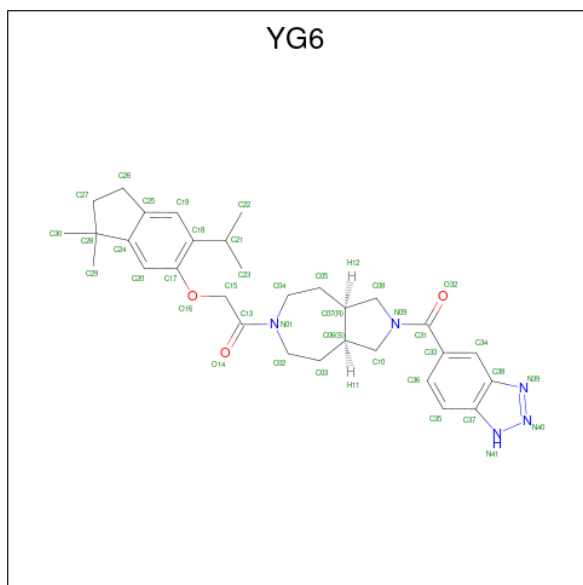
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total 39	C 31	N 5	O 3	0	0

- Molecule 4 is ACETATE ION (three-letter code: ACT) (formula: $C_2H_3O_2$).
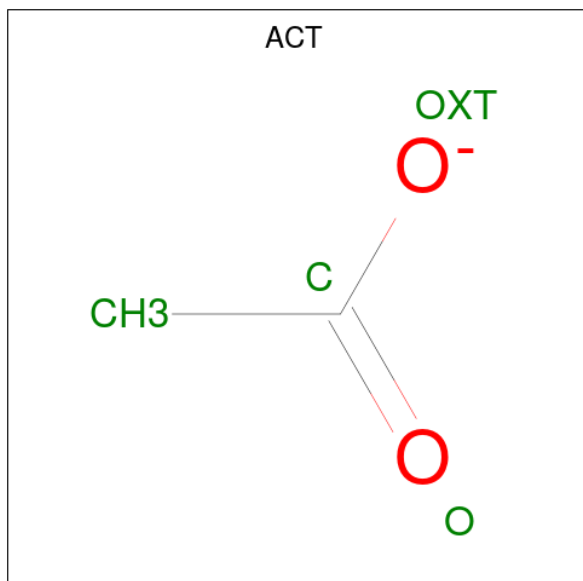
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total 4	C 2	O 2	0	0

• Molecule 5 is ZINC ION (three-letter code: ZN) (formula: Zn).

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

• Molecule 6 is SODIUM ION (three-letter code: NA) (formula: Na).

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

• Molecule 7 is CALCIUM ION (three-letter code: CA) (formula: Ca).

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

• Molecule 8 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

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

• Molecule 9 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
9	A	438	Total 438	O 438	0	0

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

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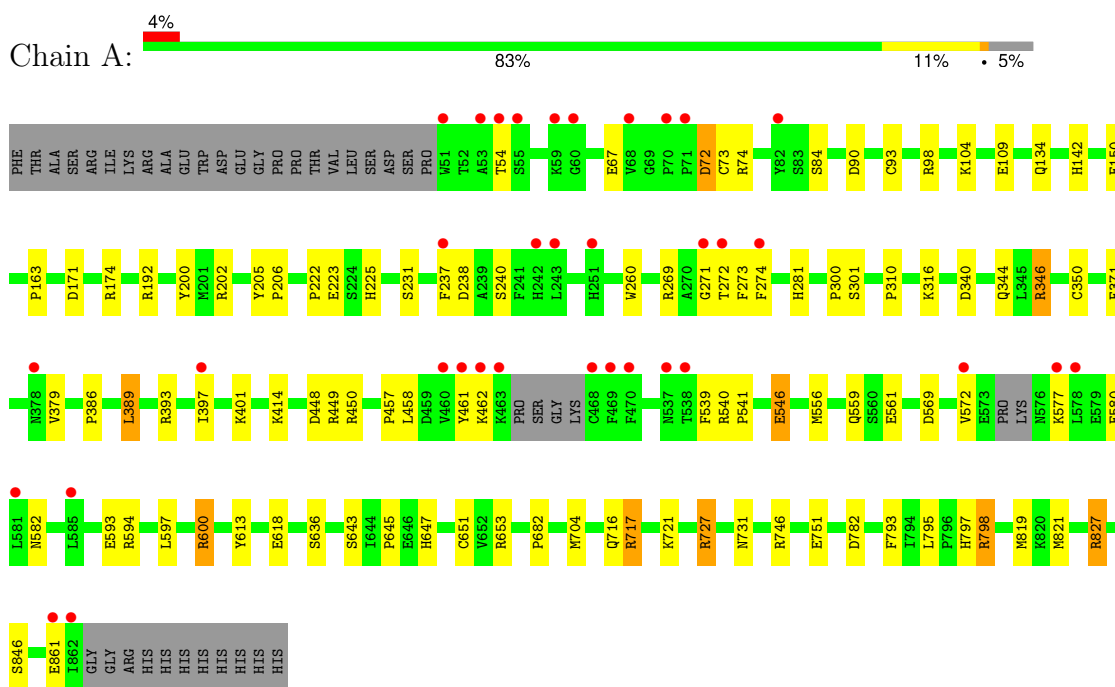
• Molecule 2: alpha-D-mannopyranose-(1-2)-alpha-D-mannopyranose-(1-3)-alpha-D-mannopyranose-(1-6)-[alpha-D-mannopyranose-(1-2)-alpha-D-mannopyranose-(1-3)]beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain B:

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	84.32Å 91.93Å 119.74Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	45.97 – 1.91 45.97 – 1.91	Depositor EDS
% Data completeness (in resolution range)	95.1 (45.97-1.91) 95.1 (45.97-1.91)	Depositor EDS
R_{merge}	0.12	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.28 (at 1.91Å)	Xtriage
Refinement program	REFMAC 5.8.0411	Depositor
R, R_{free}	0.182 , 0.231 0.191 , 0.238	Depositor DCC
R_{free} test set	3674 reflections (5.04%)	wwPDB-VP
Wilson B-factor (Å^2)	29.5	Xtriage
Anisotropy	0.264	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.32 , 31.3	EDS
L-test for twinning[2]	$< |L| > = 0.49, < L^2 > = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	7148	wwPDB-VP
Average B, all atoms (Å^2)	39.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.30% of the height of the origin peak. No significant pseudotranslation is detected.*

---

[1]Intensities estimated from amplitudes.
[2]Theoretical values of $< |L| >$, $< L^2 >$ 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: NAG, MAN, CL, NA, CA, ZN, ACT, BMA, YG6

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	0.72	5/6781 (0.1%)	1.03	10/9194 (0.1%)

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	0	6

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	546	GLU	CD-OE1	8.54	1.35	1.25
1	A	561	GLU	CD-OE2	-7.18	1.17	1.25
1	A	223	GLU	CD-OE1	7.04	1.33	1.25
1	A	150	GLU	CD-OE1	-5.09	1.20	1.25
1	A	240	SER	CA-CB	-5.02	1.45	1.52

All (10) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	174	ARG	NE-CZ-NH2	-7.56	116.52	120.30
1	A	653	ARG	NE-CZ-NH1	7.03	123.81	120.30
1	A	393	ARG	NE-CZ-NH2	-6.86	116.87	120.30
1	A	202	ARG	NE-CZ-NH2	-6.33	117.13	120.30
1	A	346	ARG	NE-CZ-NH1	6.16	123.38	120.30
1	A	200	TYR	CB-CG-CD2	-6.15	117.31	121.00
1	A	827	ARG	CG-CD-NE	-6.13	98.92	111.80
1	A	798	ARG	NE-CZ-NH2	-5.96	117.32	120.30

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	727	ARG	NE-CZ-NH1	-5.67	117.47	120.30
1	A	98	ARG	NE-CZ-NH2	5.66	123.13	120.30

There are no chirality outliers.

All (6) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	192	ARG	Sidechain
1	A	346	ARG	Sidechain
1	A	600	ARG	Sidechain
1	A	717	ARG	Sidechain
1	A	798	ARG	Sidechain
1	A	827	ARG	Sidechain

5.2 Too-close contacts (i)

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

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	6568	0	6330	48	0
2	B	94	0	79	0	0
3	A	39	0	0	0	0
4	A	4	0	3	0	0
5	A	1	0	0	0	0
6	A	1	0	0	0	0
7	A	2	0	0	0	0
8	A	1	0	0	0	0
9	A	438	0	0	9	0
All	All	7148	0	6412	48	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 4.

All (48) 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:751:GLU:HG2	9:A:1400:HOH:O	1.90	0.71

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:539:PHE:O	1:A:541:PRO:HD3	2.00	0.62
1:A:556:MET:HG2	9:A:1431:HOH:O	1.99	0.61
1:A:371:PHE:CE1	1:A:457:PRO:HA	2.36	0.60
1:A:448:ASP:OD2	9:A:1004:HOH:O	2.16	0.60
1:A:237:PHE:O	1:A:238:ASP:C	2.38	0.59
1:A:134[B]:GLN:NE2	1:A:344:GLN:HA	2.16	0.59
1:A:569:ASP:OD2	1:A:647:HIS:HB2	2.04	0.57
1:A:461[A]:TYR:CD1	1:A:462:LYS:HG2	2.41	0.55
1:A:449:ARG:O	1:A:450:ARG:HB2	2.06	0.54
1:A:577:LYS:HA	1:A:580:GLU:HB2	1.89	0.54
1:A:269:ARG:HB3	1:A:300:PRO:HA	1.91	0.53
1:A:643:SER:O	1:A:645:PRO:HD3	2.08	0.53
1:A:389:LEU:HD23	1:A:389:LEU:N	2.25	0.52
1:A:727:ARG:HD2	9:A:1002:HOH:O	2.11	0.51
1:A:795:LEU:HD21	1:A:819:MET:HG2	1.92	0.51
1:A:613:TYR:HA	1:A:618[B]:GLU:OE1	2.12	0.49
1:A:74:ARG:HD3	1:A:84:SER:OG	2.13	0.49
1:A:281:HIS:ND1	9:A:1010:HOH:O	2.35	0.48
1:A:54:THR:HA	1:A:73:CYS:HB3	1.96	0.47
1:A:540:ARG:HD3	1:A:540:ARG:HA	1.70	0.47
1:A:746:ARG:NH2	9:A:1003:HOH:O	2.15	0.47
1:A:134[B]:GLN:HE22	1:A:344:GLN:HA	1.78	0.46
1:A:821:MET:HA	1:A:821:MET:HE2	1.97	0.46
1:A:727:ARG:CD	9:A:1002:HOH:O	2.63	0.46
1:A:163:PRO:HB3	1:A:350:CYS:O	2.15	0.45
1:A:222:PRO:HA	1:A:225:HIS:CE1	2.50	0.45
1:A:594:ARG:HH22	1:A:636:SER:HB3	1.81	0.45
1:A:594:ARG:NH1	1:A:782:ASP:OD2	2.50	0.45
1:A:142:HIS:ND1	1:A:340:ASP:OD2	2.42	0.44
1:A:72:ASP:N	1:A:72:ASP:OD1	2.45	0.44
1:A:205:TYR:CD1	1:A:206:PRO:HA	2.52	0.44
1:A:414:LYS:HD3	1:A:414:LYS:HA	1.55	0.44
1:A:260:TRP:CH2	1:A:274:PHE:HZ	2.37	0.43
1:A:717:ARG:NH2	9:A:1005:HOH:O	2.22	0.43
1:A:559:GLN:O	1:A:559:GLN:HG3	2.19	0.42
1:A:271:GLY:O	1:A:272:THR:C	2.58	0.42
1:A:397:ILE:O	1:A:397:ILE:HG13	2.20	0.42
1:A:546:GLU:CD	1:A:600:ARG:HH22	2.23	0.42
1:A:458:LEU:HA	1:A:461[A]:TYR:CE2	2.55	0.42
1:A:597:LEU:HD12	1:A:731:ASN:HB2	2.01	0.41
1:A:704:MET:HA	1:A:797:HIS:NE2	2.35	0.41

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:171:ASP:O	1:A:310:PRO:HD2	2.21	0.41
1:A:93:CYS:C	9:A:1020:HOH:O	2.58	0.41
1:A:682:PRO:HB3	1:A:716:GLN:HB3	2.02	0.41
1:A:237:PHE:O	1:A:238:ASP:O	2.39	0.41
1:A:449:ARG:O	1:A:450:ARG:CB	2.69	0.41
1:A:793:PHE:CD1	1:A:793:PHE:C	2.94	0.41

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	810/846 (96%)	776 (96%)	33 (4%)	1 (0%)	48	40

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	109	GLU

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	739/765 (97%)	719 (97%)	20 (3%)	40	24

All (20) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	67	GLU
1	A	72	ASP
1	A	90	ASP
1	A	104	LYS
1	A	231[A]	SER
1	A	231[B]	SER
1	A	273	PHE
1	A	301	SER
1	A	316	LYS
1	A	379	VAL
1	A	386	PRO
1	A	389	LEU
1	A	401	LYS
1	A	572	VAL
1	A	582	ASN
1	A	593	GLU
1	A	651	CYS
1	A	721	LYS
1	A	846	SER
1	A	861	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	118	HIS
1	A	419	HIS
1	A	436	ASN
1	A	582	ASN
1	A	586	HIS

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	0.62	0	17,19,21	0.97	1 (5%)
2	NAG	B	2	2	14,14,15	0.76	1 (7%)	17,19,21	1.29	2 (11%)
2	BMA	B	3	2	11,11,12	1.18	1 (9%)	15,15,17	1.69	5 (33%)
2	MAN	B	4	2	11,11,12	1.26	2 (18%)	15,15,17	1.57	6 (40%)
2	MAN	B	5	2	11,11,12	1.44	3 (27%)	15,15,17	1.41	2 (13%)
2	MAN	B	6	2	11,11,12	1.70	2 (18%)	15,15,17	1.67	4 (26%)
2	MAN	B	7	2	11,11,12	1.39	1 (9%)	15,15,17	1.66	2 (13%)
2	MAN	B	8	2	11,11,12	1.21	1 (9%)	15,15,17	1.68	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	-	0/6/23/26	0/1/1/1
2	BMA	B	3	2	-	0/2/19/22	0/1/1/1
2	MAN	B	4	2	-	2/2/19/22	0/1/1/1
2	MAN	B	5	2	-	0/2/19/22	0/1/1/1
2	MAN	B	6	2	-	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	-	1/2/19/22	0/1/1/1

All (11) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	6	MAN	O5-C5	4.25	1.51	1.43
2	B	7	MAN	C2-C3	3.78	1.58	1.52

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	8	MAN	C2-C3	3.22	1.57	1.52
2	B	3	BMA	C2-C3	3.12	1.57	1.52
2	B	5	MAN	O5-C5	2.61	1.48	1.43
2	B	4	MAN	O5-C5	2.51	1.48	1.43
2	B	5	MAN	C2-C3	2.45	1.56	1.52
2	B	6	MAN	O5-C1	2.30	1.47	1.43
2	B	4	MAN	C4-C5	2.17	1.57	1.53
2	B	5	MAN	C4-C5	2.08	1.57	1.53
2	B	2	NAG	O6-C6	2.08	1.51	1.42

All (24) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	B	7	MAN	C1-C2-C3	4.83	116.68	109.64
2	B	8	MAN	O3-C3-C2	4.28	118.78	110.05
2	B	6	MAN	O2-C2-C3	-4.09	101.68	110.15
2	B	3	BMA	C1-O5-C5	3.79	117.27	112.19
2	B	2	NAG	C1-O5-C5	3.79	117.27	112.19
2	B	5	MAN	C1-C2-C3	3.23	114.34	109.64
2	B	4	MAN	C1-O5-C5	2.84	115.99	112.19
2	B	2	NAG	C2-N2-C7	2.73	126.56	122.90
2	B	5	MAN	O4-C4-C3	-2.57	104.31	110.38
2	B	6	MAN	O3-C3-C2	-2.51	104.94	110.05
2	B	8	MAN	O2-C2-C3	2.49	115.31	110.15
2	B	7	MAN	C2-C3-C4	2.43	115.13	110.86
2	B	6	MAN	C1-C2-C3	2.41	113.16	109.64
2	B	6	MAN	C1-O5-C5	2.37	115.36	112.19
2	B	3	BMA	O2-C2-C3	2.36	115.05	110.15
2	B	1	NAG	O5-C1-C2	-2.35	107.66	111.29
2	B	3	BMA	O4-C4-C3	2.33	115.87	110.38
2	B	3	BMA	O4-C4-C5	-2.29	103.67	109.32
2	B	3	BMA	C2-C3-C4	-2.23	106.93	110.86
2	B	4	MAN	O4-C4-C5	2.22	114.80	109.32
2	B	4	MAN	C1-C2-C3	2.20	112.84	109.64
2	B	4	MAN	O6-C6-C5	2.14	118.61	111.33
2	B	4	MAN	O3-C3-C2	2.10	114.33	110.05
2	B	4	MAN	C6-C5-C4	2.00	117.94	113.02

There are no chirality outliers.

All (5) 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	4	MAN	C4-C5-C6-O6
2	B	4	MAN	O5-C5-C6-O6
2	B	8	MAN	O5-C5-C6-O6

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 oligosaccharide.

Oligosaccharide Chain B

Bond lengths

Bond angles

Torsions

Rings
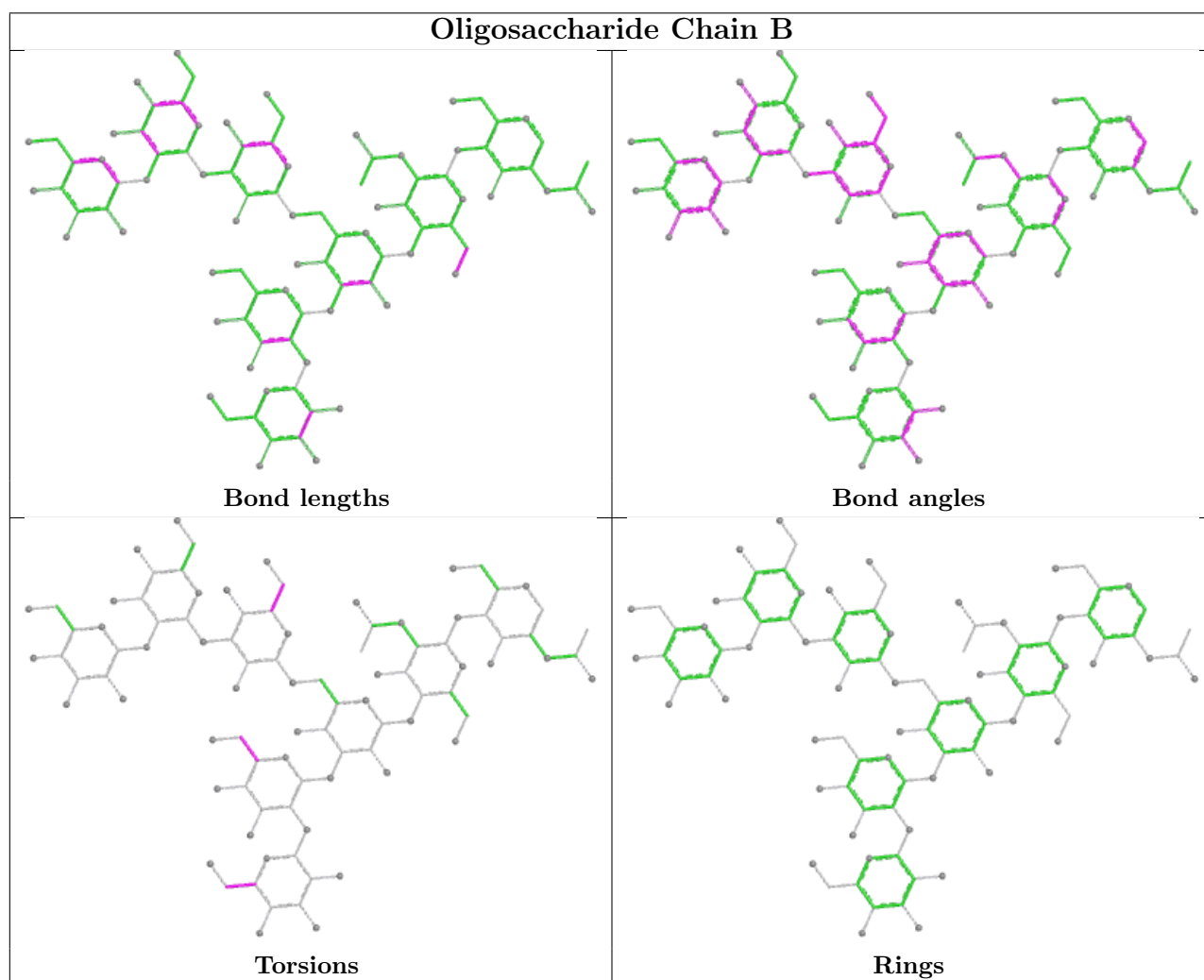
5.6 Ligand geometry ⓘ

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	1.78	1 (33%)	3,3,3	0.67	0
3	YG6	A	901	5	40,44,44	0.78	2 (5%)	55,66,66	1.30	8 (14%)

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	YG6	A	901	5	-	4/19/55/55	0/6/6/6

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	902	ACT	CH3-C	2.59	1.59	1.49
3	A	901	YG6	O16-C15	2.34	1.48	1.42
3	A	901	YG6	C34-C33	2.22	1.41	1.37

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	A	901	YG6	C04-C05-C07	4.01	119.57	115.24
3	A	901	YG6	C03-C06-C07	-2.77	113.25	116.47
3	A	901	YG6	C03-C02-N01	2.30	117.77	113.42
3	A	901	YG6	C35-C37-N41	2.29	133.92	130.19
3	A	901	YG6	C06-C10-N09	2.22	106.37	103.02
3	A	901	YG6	N41-N40-N39	-2.21	108.39	111.25
3	A	901	YG6	C23-C21-C22	-2.19	105.70	110.23
3	A	901	YG6	C08-C07-C06	2.15	106.63	103.56

There are no chirality outliers.

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	901	YG6	O32-C31-N09-C10
3	A	901	YG6	C33-C31-N09-C10
3	A	901	YG6	O32-C31-N09-C08
3	A	901	YG6	C33-C31-N09-C08

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 then 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.

Ligand YG6 A 901

Bond lengths

Bond angles

Torsions

Rings
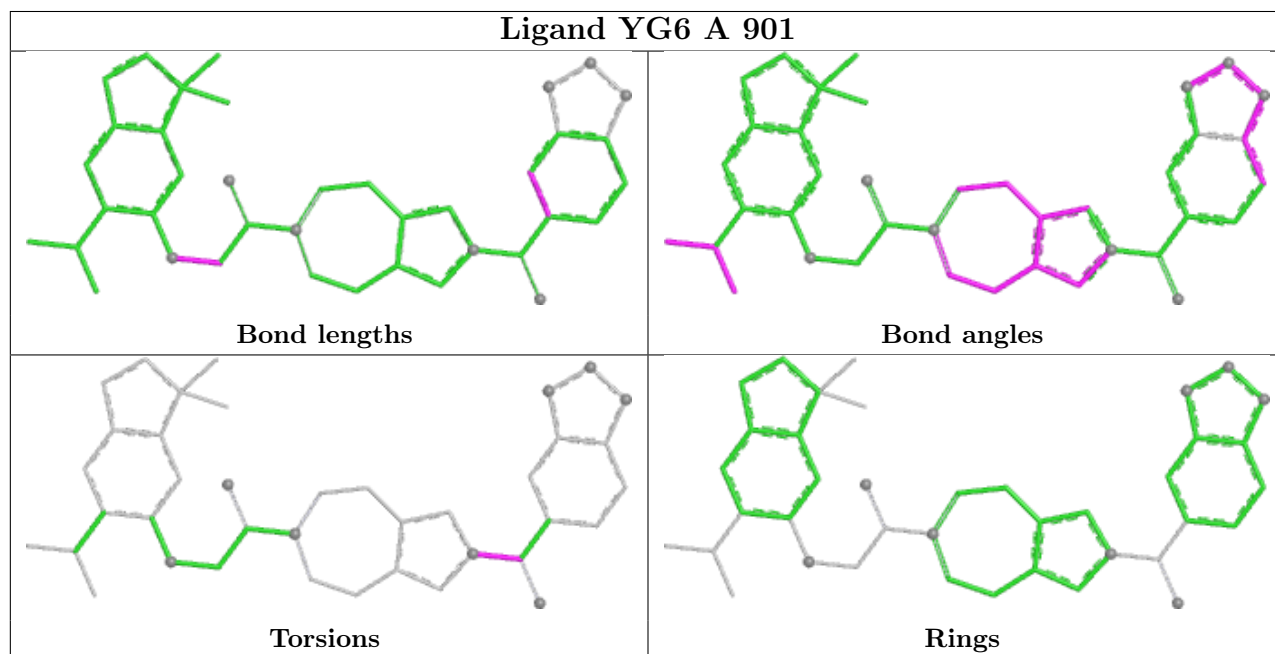
5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

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	806/846 (95%)	0.04	35 (4%)	40	46	16, 33, 76, 159	10 (1%)

All (35) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	469	PHE	6.3
1	A	51	TRP	5.6
1	A	578	LEU	4.9
1	A	572	VAL	4.8
1	A	862	ILE	4.7
1	A	68	VAL	4.1
1	A	468	CYS	4.0
1	A	71	PRO	3.7
1	A	581	LEU	3.3
1	A	237	PHE	3.3
1	A	397	ILE	3.2
1	A	251	HIS	3.1
1	A	378	ASN	3.0
1	A	53	ALA	2.9
1	A	272	THR	2.8
1	A	70	PRO	2.8
1	A	274	PHE	2.7
1	A	271	GLY	2.7
1	A	243	LEU	2.6
1	A	585	LEU	2.6
1	A	463	LYS	2.6
1	A	54	THR	2.5
1	A	577	LYS	2.4
1	A	82	TYR	2.3
1	A	60	GLY	2.2
1	A	538	THR	2.2
1	A	537	ASN	2.1

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	A	861	GLU	2.1
1	A	55	SER	2.1
1	A	59	LYS	2.1
1	A	470	PHE	2.1
1	A	462	LYS	2.1
1	A	460	VAL	2.1
1	A	461[A]	TYR	2.1
1	A	242	HIS	2.0

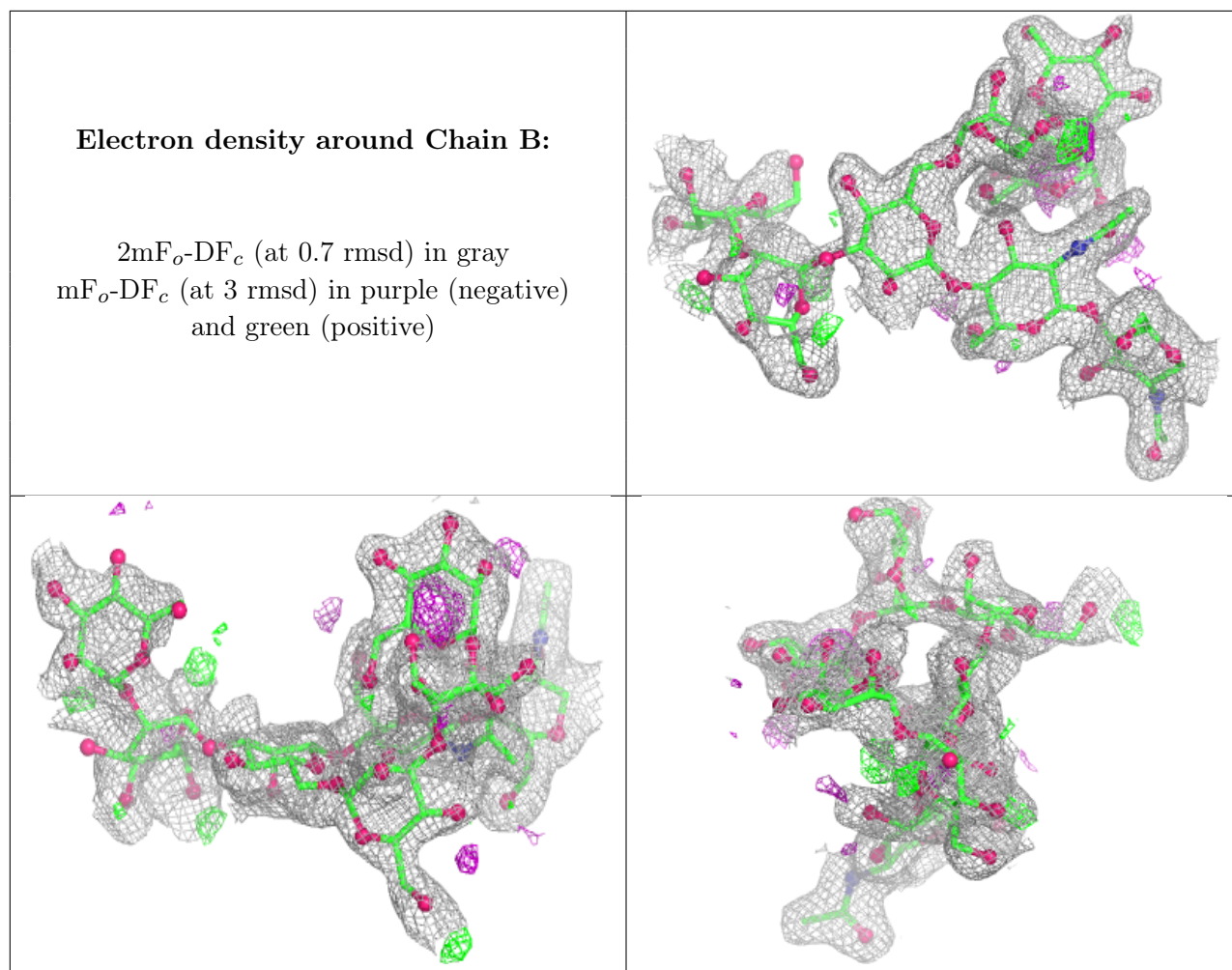## 6.2 Non-standard residues in protein, DNA, RNA chains (i)

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, 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	0.41	0.18	72,102,110,110	0
2	BMA	B	3	11/12	0.68	0.13	63,74,85,102	0
2	MAN	B	8	11/12	0.72	0.14	50,91,103,116	0
2	MAN	B	4	11/12	0.78	0.13	57,69,74,79	0
2	MAN	B	5	11/12	0.85	0.12	47,62,69,70	0
2	MAN	B	6	11/12	0.86	0.15	41,55,63,64	0
2	NAG	B	2	14/15	0.92	0.09	30,36,50,69	0
2	NAG	B	1	14/15	0.96	0.06	22,24,27,29	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.
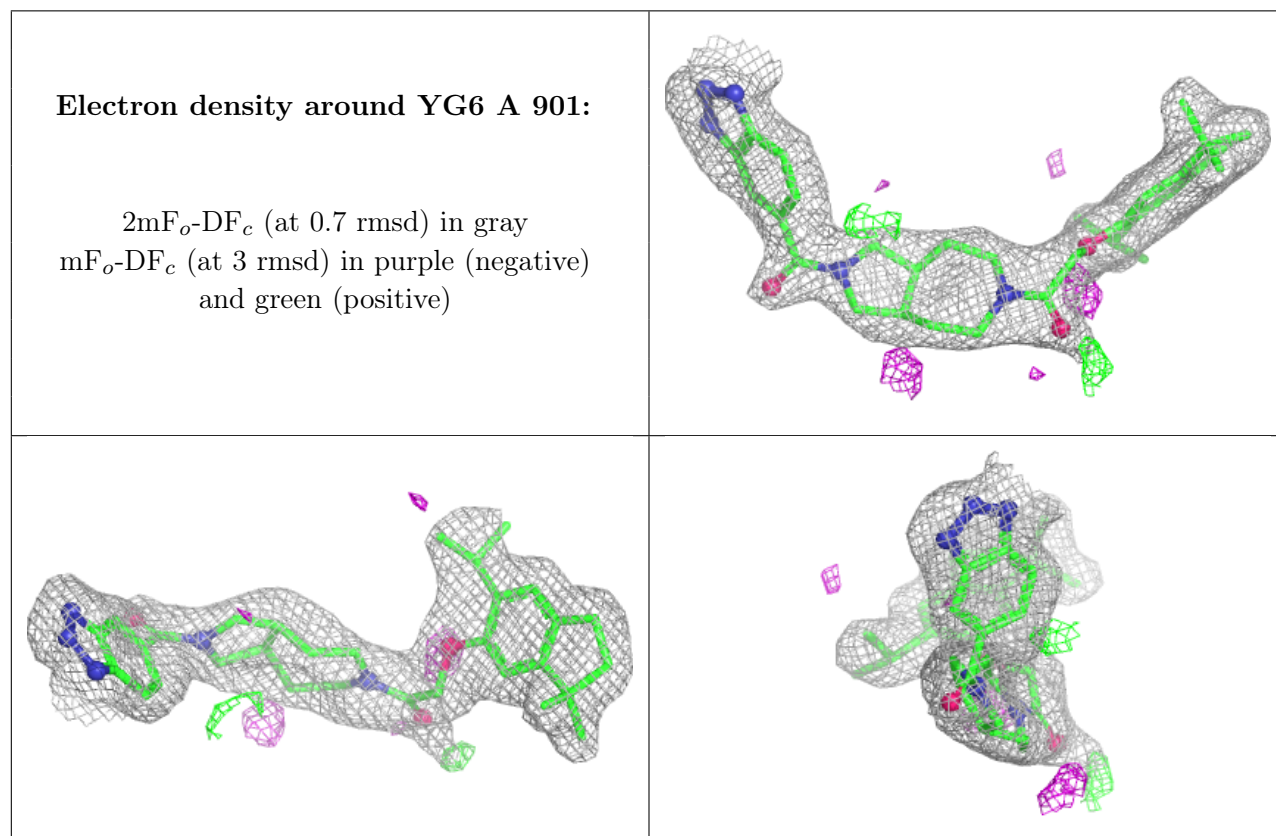
Electron density around Chain B:

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

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(Å²)	Q<0.9
4	ACT	A	902	4/4	0.90	0.11	35,39,40,41	0
3	YG6	A	901	39/39	0.94	0.09	27,38,53,62	0
8	CL	A	907	1/1	0.95	0.07	37,37,37,37	0
7	CA	A	905	1/1	0.97	0.05	40,40,40,40	0
6	NA	A	904	1/1	0.98	0.04	37,37,37,37	0
7	CA	A	906	1/1	0.99	0.03	24,24,24,24	0
5	ZN	A	903	1/1	1.00	0.02	30,30,30,30	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.

Electron density around YG6 A 901:

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

6.5 Other polymers ⓘ

There are no such residues in this entry.