



Full wwPDB X-ray Structure Validation Report ⓘ

Oct 8, 2024 – 09:23 AM EDT

PDB ID : 4LXR
Title : Structure of the Toll - Spatzle complex, a molecular hub in Drosophila development and innate immunity
Authors : Stelter, M.; Parthier, C.; Breithaupt, C.; Stubbs, M.T.
Deposited on : 2013-07-30
Resolution : 2.20 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 : 4.02b-467
Mogul : 2022.3.0, CSD as543be (2022)
Xtriage (Phenix) : 1.20.1
EDS : 3.0
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4 : 9.0.003 (Gargrove)
Density-Fitness : 1.0.11
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.39

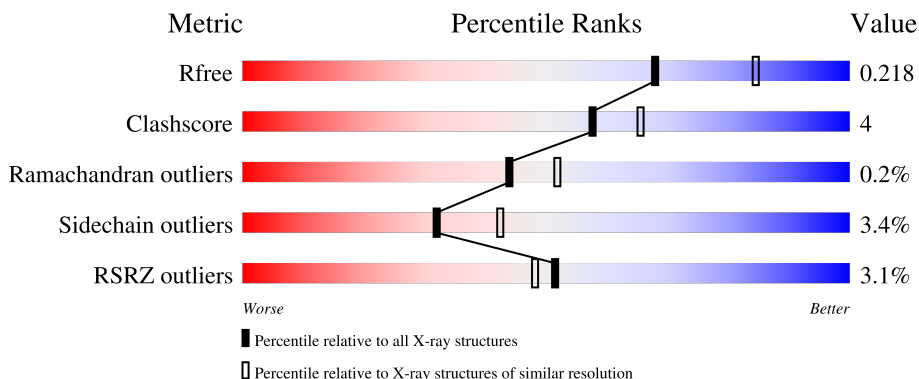
1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.20 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.



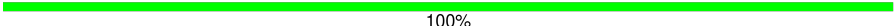
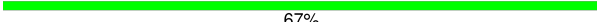
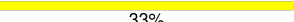
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	164625	5791 (2.20-2.20)
Clashscore	180529	6634 (2.20-2.20)
Ramachandran outliers	177936	6560 (2.20-2.20)
Sidechain outliers	177891	6561 (2.20-2.20)
RSRZ outliers	164620	5791 (2.20-2.20)

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	783	 2% 84% 11%
2	J	114	 2% 48% 7% 44%
2	K	114	 5% 52% 5% 42%
3	B	5	 60% 40%
4	C	2	 100%

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Mol	Chain	Length	Quality of chain
4	E	2	 100%
5	D	3	 67%  33%

2 Entry composition [i](#)

There are 8 unique types of molecules in this entry. The entry contains 7862 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 Protein toll.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	755	6084	3811	1107	1125	41	0	4	0

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	803	THR	-	expression tag	UNP P08953
A	804	GLY	-	expression tag	UNP P08953
A	805	HIS	-	expression tag	UNP P08953
A	806	HIS	-	expression tag	UNP P08953
A	807	HIS	-	expression tag	UNP P08953
A	808	HIS	-	expression tag	UNP P08953
A	809	HIS	-	expression tag	UNP P08953
A	810	HIS	-	expression tag	UNP P08953

- Molecule 2 is a protein called Protein spaetzle C-106.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	J	64	509	317	91	94	7	0	0	0
2	K	66	510	317	90	96	7	0	0	0

There are 16 discrepancies between the modelled and reference sequences:

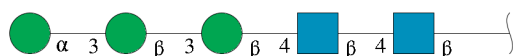
Chain	Residue	Modelled	Actual	Comment	Reference
J	107	LEU	-	expression tag	UNP P48607
J	108	GLU	-	expression tag	UNP P48607
J	109	HIS	-	expression tag	UNP P48607
J	110	HIS	-	expression tag	UNP P48607
J	111	HIS	-	expression tag	UNP P48607
J	112	HIS	-	expression tag	UNP P48607

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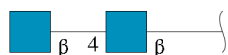
Chain	Residue	Modelled	Actual	Comment	Reference
J	113	HIS	-	expression tag	UNP P48607
J	114	HIS	-	expression tag	UNP P48607
K	107	LEU	-	expression tag	UNP P48607
K	108	GLU	-	expression tag	UNP P48607
K	109	HIS	-	expression tag	UNP P48607
K	110	HIS	-	expression tag	UNP P48607
K	111	HIS	-	expression tag	UNP P48607
K	112	HIS	-	expression tag	UNP P48607
K	113	HIS	-	expression tag	UNP P48607
K	114	HIS	-	expression tag	UNP P48607

- Molecule 3 is an oligosaccharide called alpha-D-mannopyranose-(1-3)-beta-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.



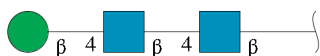
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
3	B	5	61	34	2	25	0	0	0

- Molecule 4 is an oligosaccharide called 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose.



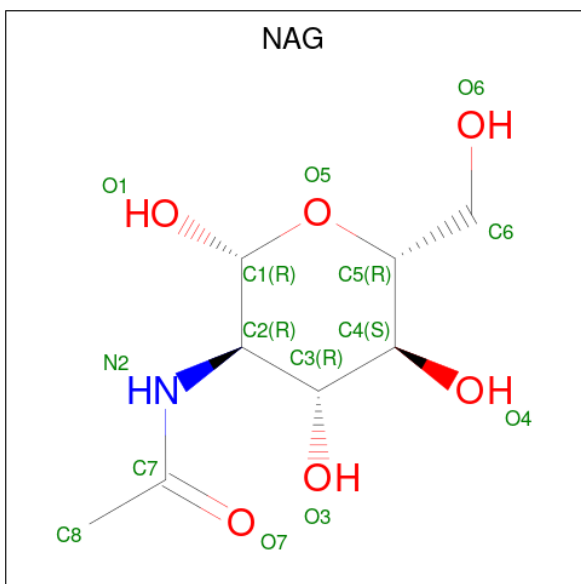
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
4	C	2	28	16	2	10	0	0	0
4	E	2	28	16	2	10	0	0	0

- Molecule 5 is an oligosaccharide called beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose.



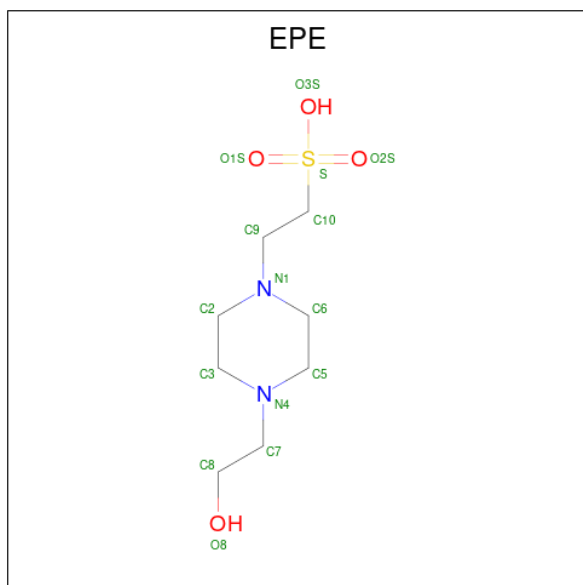
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
5	D	3	39	22	2	15	0	0	0

- Molecule 6 is 2-acetamido-2-deoxy-beta-D-glucopyranose (three-letter code: NAG) (formula: C₈H₁₅NO₆).



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

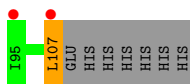
- Molecule 7 is 4-(2-HYDROXYETHYL)-1-PIPERAZINE ETHANESULFONIC ACID (three-letter code: EPE) (formula: C₈H₁₈N₂O₄S).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	S		
7	A	1	15	8	2	4	1	0	0

- Molecule 8 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
8	A	436	Total	O	0	0
			436	436		
8	J	32	Total	O	0	0
			32	32		
8	K	36	Total	O	0	0
			36	36		



- Molecule 3: alpha-D-mannopyranose-(1-3)-beta-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: 60% 40%



- Molecule 4: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain C: 100%



- Molecule 4: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain E: 100%



- Molecule 5: beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain D: 67% 33%



4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	172.03Å 78.17Å 124.45Å 90.00° 126.30° 90.00°	Depositor
Resolution (Å)	42.68 – 2.20 42.68 – 2.20	Depositor EDS
% Data completeness (in resolution range)	99.3 (42.68-2.20) 99.4 (42.68-2.20)	Depositor EDS
R_{merge}	0.05	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.87 (at 2.20Å)	Xtrriage
Refinement program	PHENIX 1.8.2_1309	Depositor
R, R_{free}	0.176 , 0.218 0.178 , 0.218	Depositor DCC
R_{free} test set	3366 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å ²)	41.3	Xtrriage
Anisotropy	0.156	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 52.8	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	7862	wwPDB-VP
Average B, all atoms (Å ²)	46.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.76% 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: EPE, MAN, BMA, NAG

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	0.40	0/6200	0.56	0/8416
2	J	0.39	0/518	0.50	0/694
2	K	0.38	0/517	0.52	0/692
All	All	0.40	0/7235	0.56	0/9802

There are no bond length outliers.

There are no bond angle outliers.

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	6084	0	6061	55	0
2	J	509	0	485	7	0
2	K	510	0	496	6	0
3	B	61	0	52	0	0
4	C	28	0	25	0	0
4	E	28	0	25	0	0
5	D	39	0	34	2	0
6	A	84	0	78	0	0
7	A	15	0	17	1	0
8	A	436	0	0	9	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
8	J	32	0	0	0	0
8	K	36	0	0	1	0
All	All	7862	0	7273	64	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 (64) 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:339:GLU:OE1	8:A:2479:HOH:O	2.04	0.74
1:A:481:ARG:NH2	5:D:1:NAG:O6	2.23	0.72
1:A:743:TRP:HE1	1:A:745:SER:HB2	1.55	0.71
1:A:377:ARG:NH2	8:A:2399:HOH:O	2.23	0.71
1:A:44:GLN:HG2	1:A:55:ILE:HG12	1.77	0.67
1:A:48:ILE:HD12	2:K:16:LEU:HD21	1.77	0.66
1:A:51:GLU:OE2	8:A:2511:HOH:O	2.12	0.66
2:J:73:THR:HG22	2:J:95:ILE:HG22	1.79	0.65
1:A:759:ALA:HB3	1:A:798:ILE:HD11	1.79	0.64
1:A:174[A]:ARG:NH1	1:A:197:GLU:OE1	2.30	0.64
1:A:614:GLN:HB2	1:A:640:ARG:HD3	1.78	0.64
2:J:74:GLN:H	2:K:43:GLN:HG2	1.63	0.63
1:A:783:ASN:ND2	8:A:2501:HOH:O	2.32	0.62
1:A:79:CYS:HB3	1:A:81:LEU:HD13	1.82	0.61
1:A:665:HIS:HB2	1:A:668:MET:HG2	1.83	0.60
1:A:743:TRP:HA	1:A:772:ARG:HH12	1.67	0.59
1:A:543:VAL:HA	1:A:582:PRO:HB3	1.85	0.58
2:J:6:GLU:OE2	2:K:69:LYS:NZ	2.39	0.55
1:A:280:LEU:HD23	1:A:304:ARG:HB2	1.89	0.54
1:A:667:ASN:O	1:A:667:ASN:ND2	2.42	0.53
1:A:214:ARG:NH1	1:A:240:ASP:OD1	2.43	0.52
8:A:2306:HOH:O	2:J:109:HIS:HE1	1.93	0.51
1:A:696:SER:HB2	8:A:2517:HOH:O	2.11	0.51
1:A:576:VAL:HG11	1:A:608:VAL:HG12	1.93	0.50
1:A:784:ALA:HB3	1:A:787:PRO:N	2.27	0.50
2:K:51:ASP:OD1	8:K:216:HOH:O	2.20	0.50
1:A:713:PRO:HG2	1:A:716:LEU:HD13	1.94	0.49
8:A:2466:HOH:O	5:D:1:NAG:H83	2.13	0.49
1:A:150:HIS:HE1	8:A:2489:HOH:O	1.95	0.48
1:A:481:ARG:NH1	1:A:503:ASP:OD2	2.45	0.48
1:A:418:THR:HB	1:A:442:HIS:HB2	1.94	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:398:GLU:HB3	1:A:420:VAL:HG12	1.97	0.47
1:A:650:CYS:HB2	1:A:675:LEU:HD23	1.97	0.47
1:A:174[A]:ARG:HG2	1:A:195:ASP:O	2.14	0.47
1:A:432:ARG:O	1:A:435:VAL:HG12	2.16	0.46
1:A:743:TRP:C	1:A:744:ARG:HG2	2.36	0.46
1:A:425:ARG:NH2	1:A:449:ASP:OD2	2.49	0.46
1:A:727:GLN:HG3	8:A:2451:HOH:O	2.16	0.46
1:A:50:SER:HB2	1:A:70:GLN:HE22	1.81	0.45
1:A:603:LEU:HD11	1:A:615:THR:HG21	1.97	0.45
1:A:744:ARG:H	1:A:772:ARG:NH1	2.15	0.44
1:A:446:ASP:OD1	1:A:446:ASP:N	2.49	0.44
1:A:712:LEU:HA	1:A:713:PRO:HD2	1.90	0.44
1:A:110:PRO:O	1:A:113:THR:HB	2.18	0.43
1:A:582:PRO:HG2	1:A:585:SER:HB3	2.00	0.43
1:A:238:LYS:HB2	1:A:263:ASP:O	2.18	0.43
1:A:322:GLN:HA	1:A:344:ILE:HA	2.00	0.42
1:A:454:GLN:HG2	1:A:459:ILE:HD11	2.00	0.42
1:A:454:GLN:HA	1:A:455:PRO:HD2	1.94	0.42
1:A:48:ILE:O	1:A:51:GLU:HG2	2.19	0.42
1:A:756:ASP:OD1	1:A:758:THR:HG22	2.19	0.42
1:A:567:CYS:HB2	1:A:641:THR:HG23	2.02	0.41
1:A:640:ARG:HD2	1:A:643:ASP:OD1	2.21	0.41
1:A:630:LYS:HA	1:A:662:PRO:HB3	2.01	0.41
2:J:7:ARG:HD2	2:K:107:LEU:HD13	2.01	0.41
1:A:94:LEU:HD23	1:A:94:LEU:HA	1.82	0.41
1:A:603:LEU:O	1:A:606:THR:HG23	2.20	0.41
1:A:631:CYS:HA	1:A:632:PRO:HD3	1.92	0.41
1:A:716:LEU:O	1:A:744:ARG:HD3	2.21	0.41
2:J:9:LEU:HD11	2:K:9:LEU:HD22	2.03	0.41
1:A:230:SER:O	7:A:2019:EPE:H51	2.21	0.41
1:A:230:SER:HA	1:A:254:ASP:O	2.22	0.40
2:J:95:ILE:HA	2:J:96:PRO:HD3	1.91	0.40
1:A:575:LEU:HD21	1:A:585:SER:HB2	2.02	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	749/783 (96%)	701 (94%)	46 (6%)	2 (0%)	37	42
2	J	58/114 (51%)	55 (95%)	3 (5%)	0	100	100
2	K	60/114 (53%)	58 (97%)	2 (3%)	0	100	100
All	All	867/1011 (86%)	814 (94%)	51 (6%)	2 (0%)	44	52

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	579	VAL
1	A	582	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	703/723 (97%)	679 (97%)	24 (3%)	32	42
2	J	57/101 (56%)	55 (96%)	2 (4%)	31	41
2	K	57/101 (56%)	55 (96%)	2 (4%)	31	41
All	All	817/925 (88%)	789 (97%)	28 (3%)	32	42

All (28) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	44	GLN

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Mol	Chain	Res	Type
1	A	49	MET
1	A	59	ASN
1	A	84	THR
1	A	90	LEU
1	A	175	ASN
1	A	273	ASP
1	A	418	THR
1	A	427	ARG
1	A	481	ARG
1	A	497	LEU
1	A	508	ASN
1	A	542	ASP
1	A	577	ARG
1	A	603	LEU
1	A	608	VAL
1	A	621	ASP
1	A	667	ASN
1	A	696	SER
1	A	714	THR
1	A	729	LEU
1	A	744	ARG
1	A	746	VAL
1	A	757	CYS
2	J	73	THR
2	J	107	LEU
2	K	1	VAL
2	K	107	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (12) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	44	GLN
1	A	70	GLN
1	A	150	HIS
1	A	232	GLN
1	A	239	HIS
1	A	583	GLN
1	A	610	GLN
1	A	677	ASN
2	J	52	GLN
2	J	109	HIS
2	K	43	GLN

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Mol	Chain	Res	Type
2	K	65	ASN

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](#)

12 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
3	NAG	B	1	1,3	14,14,15	0.42	0	17,19,21	0.49	0
3	NAG	B	2	3	14,14,15	0.60	0	17,19,21	0.50	0
3	BMA	B	3	3	11,11,12	1.54	3 (27%)	15,15,17	1.42	2 (13%)
3	BMA	B	4	3	11,11,12	0.84	0	15,15,17	0.61	0
3	MAN	B	5	3	11,11,12	0.81	0	15,15,17	1.03	1 (6%)
4	NAG	C	1	4,1	14,14,15	0.50	0	17,19,21	0.45	0
4	NAG	C	2	4	14,14,15	0.41	0	17,19,21	0.44	0
5	NAG	D	1	5,1	14,14,15	0.58	0	17,19,21	0.55	0
5	NAG	D	2	5	14,14,15	0.21	0	17,19,21	0.60	0
5	BMA	D	3	5	11,11,12	0.89	0	15,15,17	0.74	0
4	NAG	E	1	4,1	14,14,15	0.44	0	17,19,21	0.56	0
4	NAG	E	2	4	14,14,15	0.22	0	17,19,21	0.40	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. '2' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	NAG	B	1	1,3	-	0/6/23/26	0/1/1/1
3	NAG	B	2	3	-	2/6/23/26	0/1/1/1
3	BMA	B	3	3	-	2/2/19/22	0/1/1/1
3	BMA	B	4	3	-	0/2/19/22	0/1/1/1
3	MAN	B	5	3	-	2/2/19/22	0/1/1/1
4	NAG	C	1	4,1	-	0/6/23/26	0/1/1/1
4	NAG	C	2	4	-	0/6/23/26	0/1/1/1
5	NAG	D	1	5,1	-	2/6/23/26	0/1/1/1
5	NAG	D	2	5	-	2/6/23/26	0/1/1/1
5	BMA	D	3	5	-	2/2/19/22	0/1/1/1
4	NAG	E	1	4,1	-	2/6/23/26	0/1/1/1
4	NAG	E	2	4	-	2/6/23/26	0/1/1/1

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	3	BMA	O3-C3	2.96	1.50	1.43
3	B	3	BMA	C2-C3	2.57	1.56	1.52
3	B	3	BMA	C4-C5	2.03	1.57	1.53

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	3	BMA	O3-C3-C2	4.15	118.53	110.05
3	B	3	BMA	C1-O5-C5	2.98	116.18	112.19
3	B	5	MAN	C1-O5-C5	2.77	115.90	112.19

There are no chirality outliers.

All (16) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	E	1	NAG	O5-C5-C6-O6
3	B	5	MAN	C4-C5-C6-O6
3	B	3	BMA	O5-C5-C6-O6
5	D	3	BMA	O5-C5-C6-O6
4	E	1	NAG	C4-C5-C6-O6
3	B	5	MAN	O5-C5-C6-O6
3	B	3	BMA	C4-C5-C6-O6
5	D	3	BMA	C4-C5-C6-O6
3	B	2	NAG	C8-C7-N2-C2

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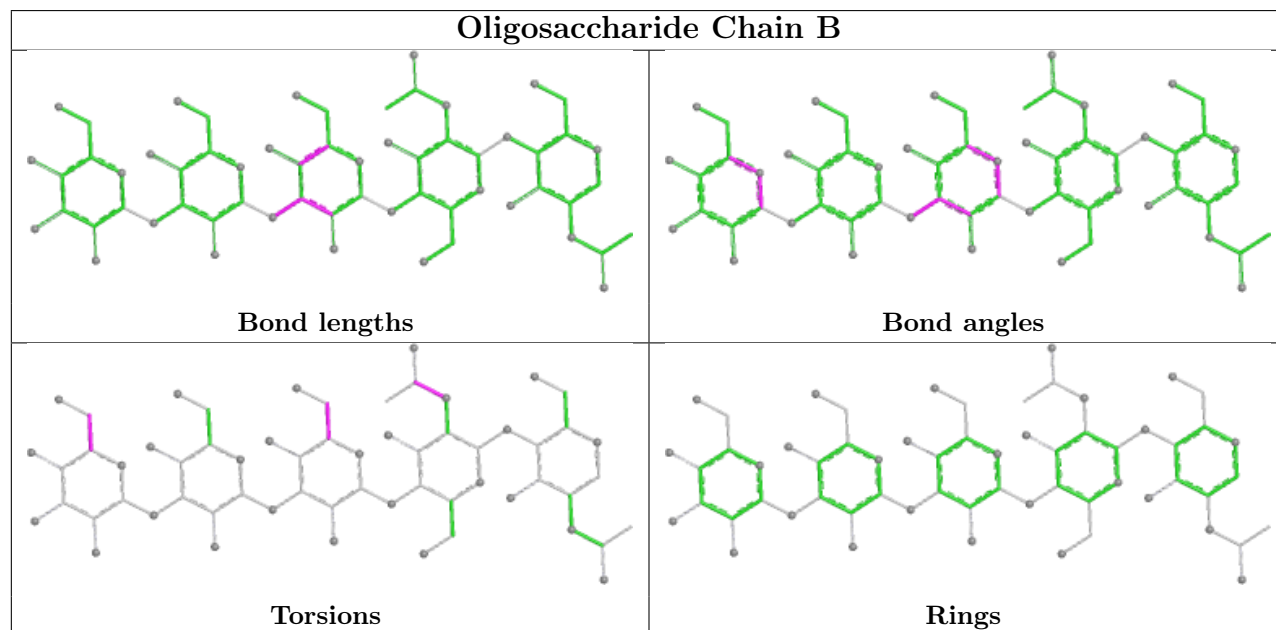
Mol	Chain	Res	Type	Atoms
3	B	2	NAG	O7-C7-N2-C2
4	E	2	NAG	C8-C7-N2-C2
4	E	2	NAG	O7-C7-N2-C2
5	D	1	NAG	C8-C7-N2-C2
5	D	1	NAG	O7-C7-N2-C2
5	D	2	NAG	O5-C5-C6-O6
5	D	2	NAG	C4-C5-C6-O6

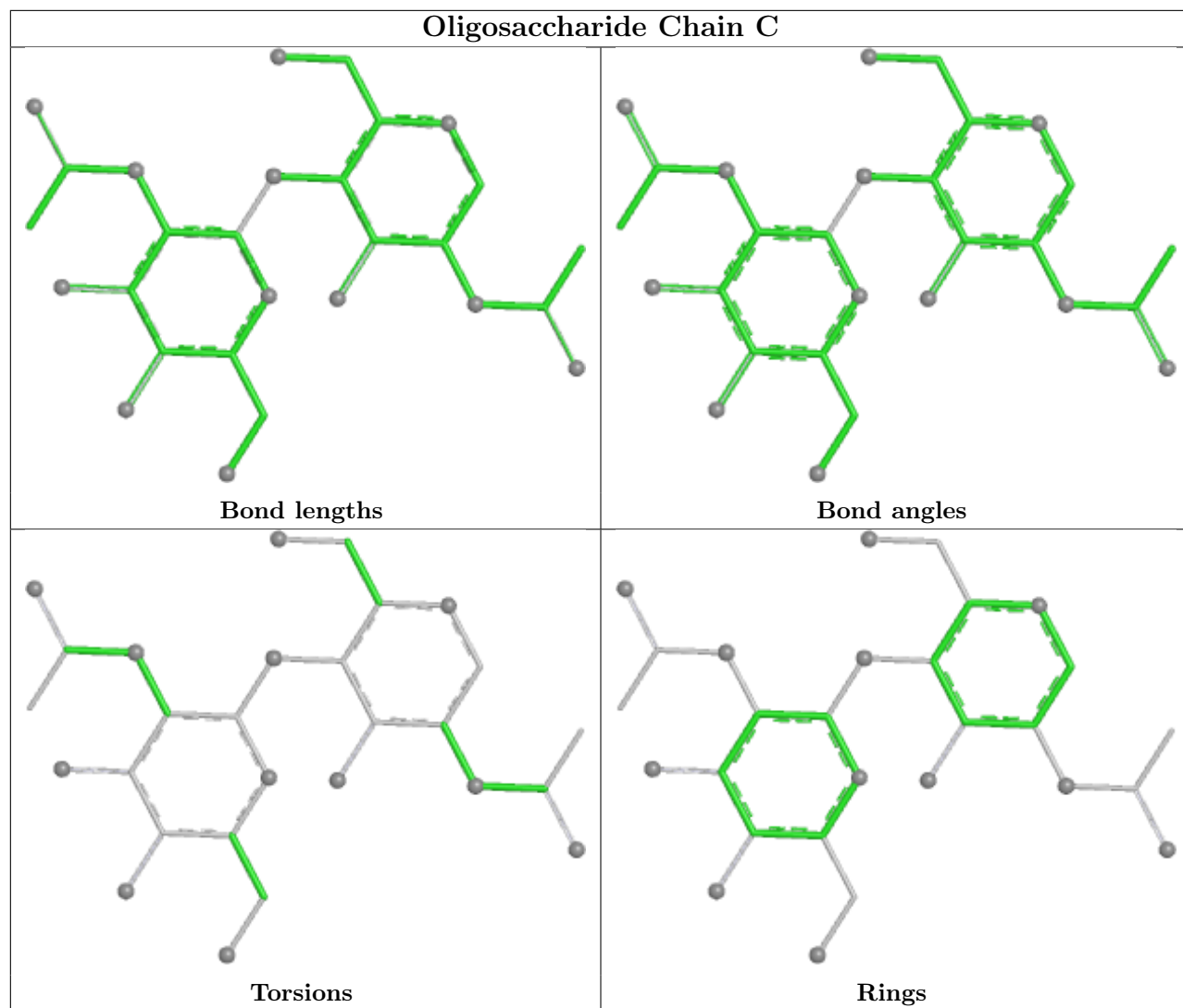
There are no ring outliers.

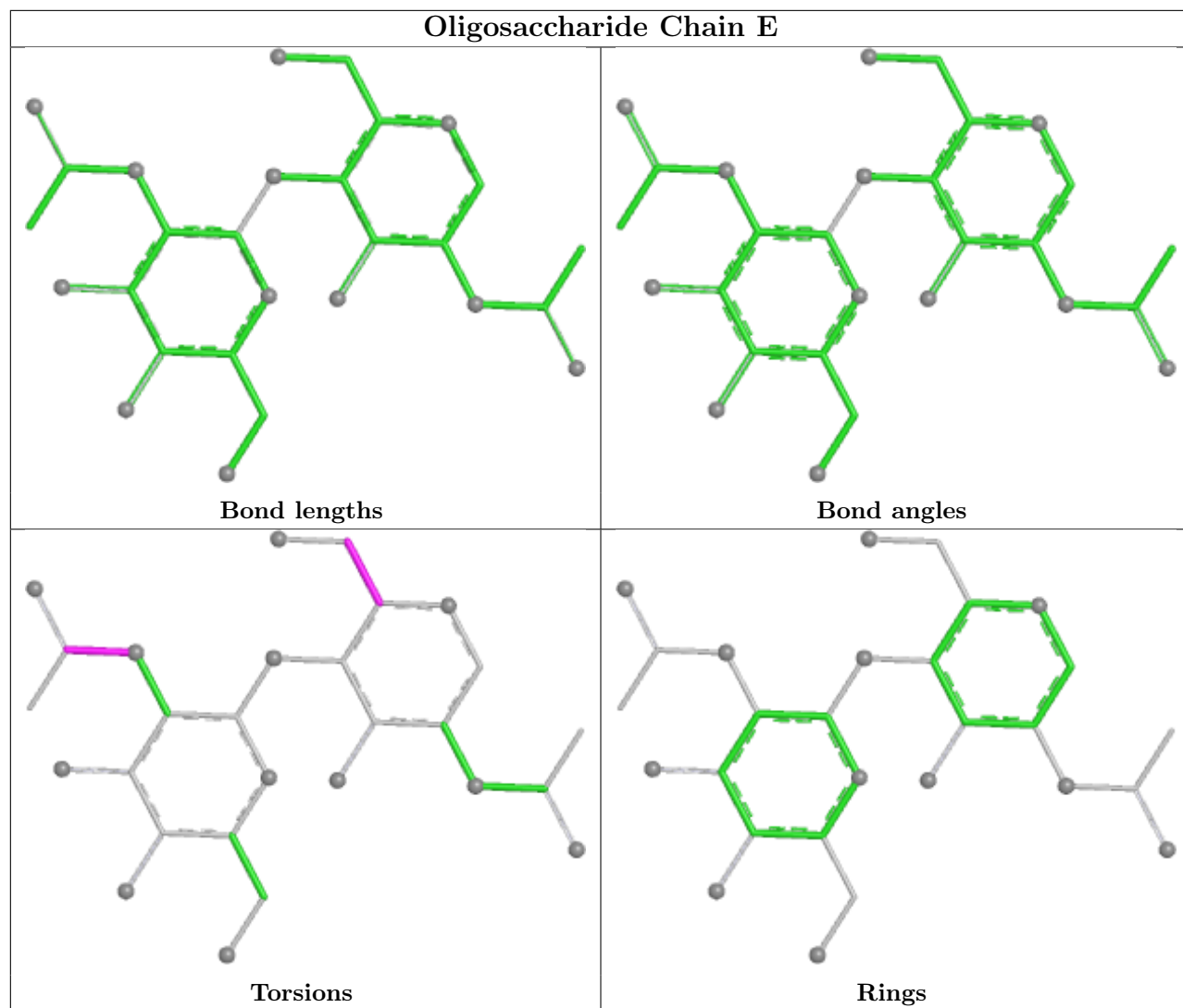
1 monomer is involved in 2 short contacts:

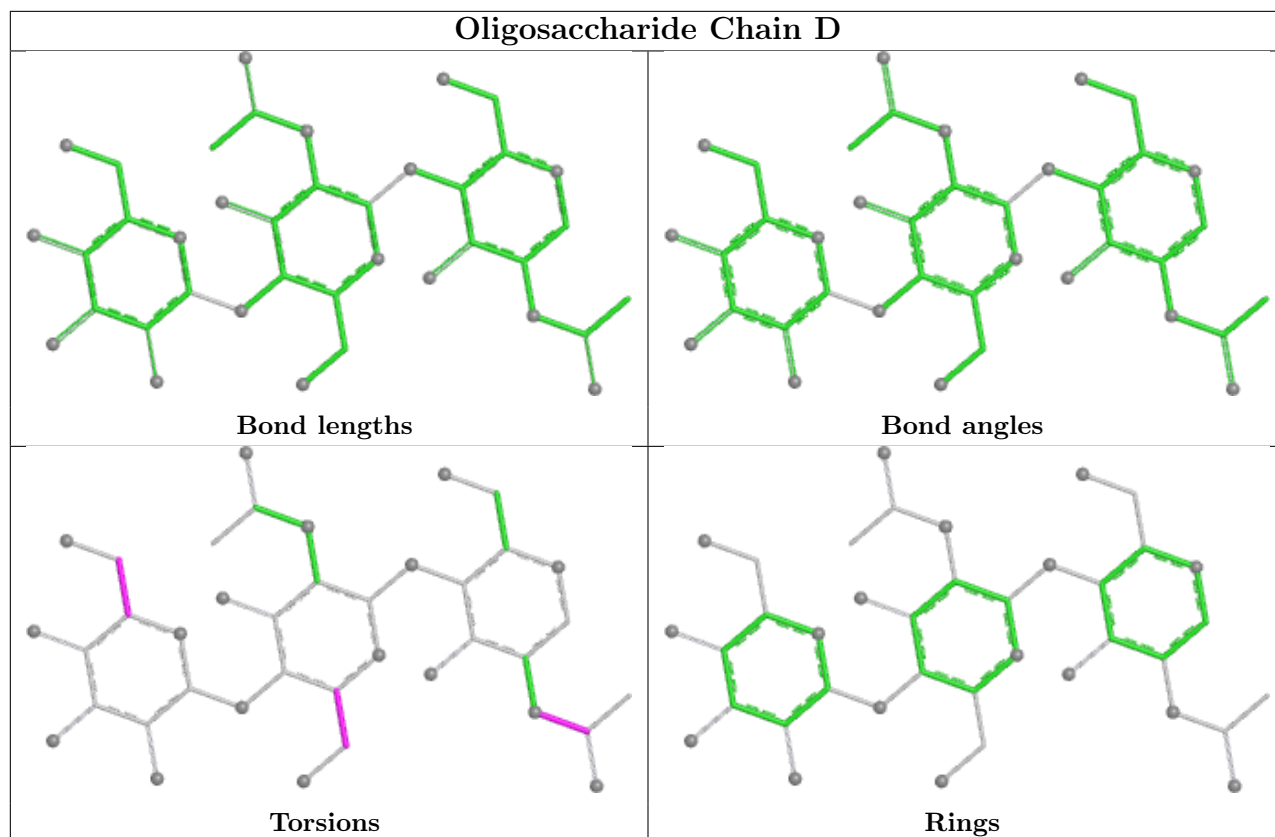
Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	D	1	NAG	2	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for oligosaccharide.









5.6 Ligand geometry [i](#)

7 ligands 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$
6	NAG	A	2017	1	14,14,15	0.80	1 (7%)	17,19,21	0.87	1 (5%)
6	NAG	A	2006	1	14,14,15	0.33	0	17,19,21	0.54	0
6	NAG	A	2012	1	14,14,15	0.41	0	17,19,21	0.47	0
6	NAG	A	2014	1	14,14,15	0.27	0	17,19,21	0.57	0
6	NAG	A	2018	1	14,14,15	0.77	0	17,19,21	0.55	0
7	EPE	A	2019	-	15,15,15	0.97	1 (6%)	19,20,20	2.12	6 (31%)
6	NAG	A	2013	1	14,14,15	0.39	0	17,19,21	0.70	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	NAG	A	2017	1	-	2/6/23/26	0/1/1/1
6	NAG	A	2006	1	-	2/6/23/26	0/1/1/1
6	NAG	A	2012	1	-	4/6/23/26	0/1/1/1
6	NAG	A	2014	1	-	2/6/23/26	0/1/1/1
6	NAG	A	2018	1	-	0/6/23/26	0/1/1/1
7	EPE	A	2019	-	-	5/9/19/19	0/1/1/1
6	NAG	A	2013	1	-	2/6/23/26	0/1/1/1

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
7	A	2019	EPE	C10-S	3.32	1.82	1.77
6	A	2017	NAG	C1-C2	2.70	1.56	1.52

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
7	A	2019	EPE	C5-N4-C3	5.77	121.27	108.84
7	A	2019	EPE	C6-C5-N4	3.16	117.02	110.65
7	A	2019	EPE	O1S-S-C10	2.68	110.78	106.73
6	A	2017	NAG	C1-O5-C5	2.64	115.72	112.19
7	A	2019	EPE	C7-N4-C3	2.63	118.25	111.24
7	A	2019	EPE	C5-C6-N1	2.44	115.57	110.65
7	A	2019	EPE	C9-N1-C6	-2.18	105.42	111.24

There are no chirality outliers.

All (17) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
7	A	2019	EPE	C9-C10-S-O2S
7	A	2019	EPE	C9-C10-S-O3S
6	A	2012	NAG	O5-C5-C6-O6
6	A	2012	NAG	C4-C5-C6-O6
6	A	2012	NAG	C8-C7-N2-C2
6	A	2012	NAG	O7-C7-N2-C2
6	A	2006	NAG	C4-C5-C6-O6
6	A	2006	NAG	O5-C5-C6-O6

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Mol	Chain	Res	Type	Atoms
7	A	2019	EPE	C10-C9-N1-C2
7	A	2019	EPE	C10-C9-N1-C6
6	A	2013	NAG	C4-C5-C6-O6
6	A	2017	NAG	C1-C2-N2-C7
7	A	2019	EPE	C9-C10-S-O1S
6	A	2014	NAG	C4-C5-C6-O6
6	A	2017	NAG	C3-C2-N2-C7
6	A	2014	NAG	O5-C5-C6-O6
6	A	2013	NAG	O5-C5-C6-O6

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
7	A	2019	EPE	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

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	755/783 (96%)	-0.35	19 (2%) 58 55	13, 40, 84, 125	4 (0%)
2	J	64/114 (56%)	0.01	2 (3%) 51 48	19, 50, 96, 107	0
2	K	66/114 (57%)	0.14	6 (9%) 16 14	18, 50, 83, 101	0
All	All	885/1011 (87%)	-0.29	27 (3%) 51 48	13, 41, 86, 125	4 (0%)

All (27) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	K	107	LEU	5.3
1	A	622	PHE	3.2
1	A	39	ILE	3.1
1	A	800	PRO	3.1
2	J	110	HIS	3.0
1	A	543	VAL	2.7
1	A	584	TYR	2.7
1	A	38	SER	2.5
1	A	542	ASP	2.5
2	K	41	ALA	2.5
1	A	59	ASN	2.4
2	K	1	VAL	2.4
1	A	660	ARG	2.4
1	A	754	MET	2.3
1	A	579	VAL	2.3
1	A	784	ALA	2.3
2	J	41	ALA	2.3
1	A	462	GLN	2.3
1	A	42	LEU	2.2
2	K	17	VAL	2.2
1	A	654	ASN	2.2
2	K	49	GLY	2.1
1	A	743	TRP	2.1

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Mol	Chain	Res	Type	RSRZ
1	A	50	SER	2.1
1	A	787	PRO	2.0
1	A	665	HIS	2.0
2	K	95	ILE	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](#)

SUGAR-RSR INFOmissingINFO

6.4 Ligands [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
6	NAG	A	2018	14/15	0.68	0.15	62,84,96,96	0
6	NAG	A	2013	14/15	0.80	0.14	53,69,83,86	0
6	NAG	A	2014	14/15	0.81	0.11	53,66,77,79	0
6	NAG	A	2012	14/15	0.82	0.12	52,60,64,67	0
6	NAG	A	2017	14/15	0.86	0.10	47,60,67,75	0
6	NAG	A	2006	14/15	0.88	0.10	50,62,71,73	0
7	EPE	A	2019	15/15	0.96	0.08	30,40,47,50	0

6.5 Other polymers [i](#)

There are no such residues in this entry.