



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 09:45 PM UTC

PDB ID : 3NKN / pdb_00003nkn
Title : Crystal structure of mouse autotaxin in complex with 14:0-LPA
Authors : Nishimasu, H.; Ishitani, R.; Mihara, E.; Takagi, J.; Aoki, J.; Nureki, O.
Deposited on : 2010-06-20
Resolution : 1.80 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

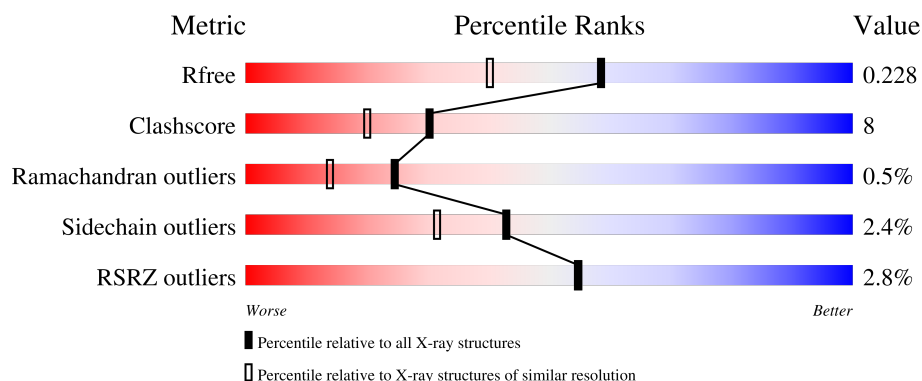
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

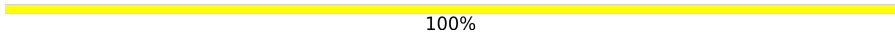
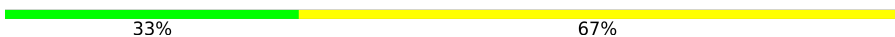
The reported resolution of this entry is 1.80 Å.

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	7662 (1.80-1.80)
Clashscore	190562	8479 (1.80-1.80)
Ramachandran outliers	187476	8391 (1.80-1.80)
Sidechain outliers	187428	8390 (1.80-1.80)
RSRZ outliers	180081	7663 (1.80-1.80)

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	831	
2	B	2	
2	D	2	
3	C	6	

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard

residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
10	EDO	A	1012	-	-	X	-
10	EDO	A	1025	-	-	X	-
10	EDO	A	1026	-	-	X	-
10	EDO	A	1027	-	-	X	-
10	EDO	A	1029	-	-	X	-

2 Entry composition

There are 11 unique types of molecules in this entry. The entry contains 7189 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 Ectonucleotide pyrophosphatase/phosphodiesterase family member 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	782	Total	C	N	O	S	0	3	0
			6268	3981	1068	1169	50			

There are 12 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	?	-	LYS	SEE REMARK 999	UNP Q9R1E6
A	?	-	VAL	SEE REMARK 999	UNP Q9R1E6
A	?	-	GLU	SEE REMARK 999	UNP Q9R1E6
A	?	-	PRO	SEE REMARK 999	UNP Q9R1E6
A	859	SER	-	expression tag	UNP Q9R1E6
A	860	ARG	-	expression tag	UNP Q9R1E6
A	861	GLU	-	expression tag	UNP Q9R1E6
A	862	ASN	-	expression tag	UNP Q9R1E6
A	863	LEU	-	expression tag	UNP Q9R1E6
A	864	TYR	-	expression tag	UNP Q9R1E6
A	865	PHE	-	expression tag	UNP Q9R1E6
A	866	GLN	-	expression tag	UNP Q9R1E6

- Molecule 2 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
2	B	2	Total	C	N	O	0	0	0
			28	16	2	10			
2	D	2	Total	C	N	O	0	0	0
			28	16	2	10			

- Molecule 3 is an oligosaccharide called alpha-D-mannopyranose-(1-2)-alpha-D-mannopyranose-(1-3)-alpha-D-mannopyranose-(1-6)-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
3	C	6	Total	C	N	O	0	0	0
			72	40	2	30			

- Molecule 4 is ZINC ION (CCD ID: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	2	Total	Zn	0	0
			2	2		

- Molecule 5 is CALCIUM ION (CCD ID: CA) (formula: Ca).

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

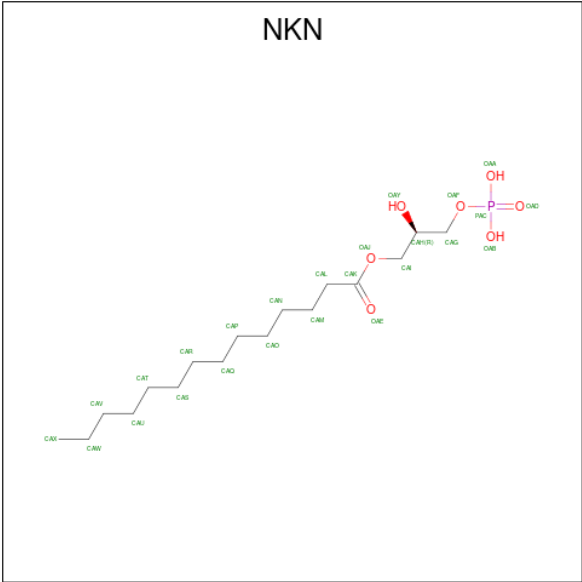
- Molecule 6 is SODIUM ION (CCD ID: NA) (formula: Na).

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

- Molecule 7 is POTASSIUM ION (CCD ID: K) (formula: K).

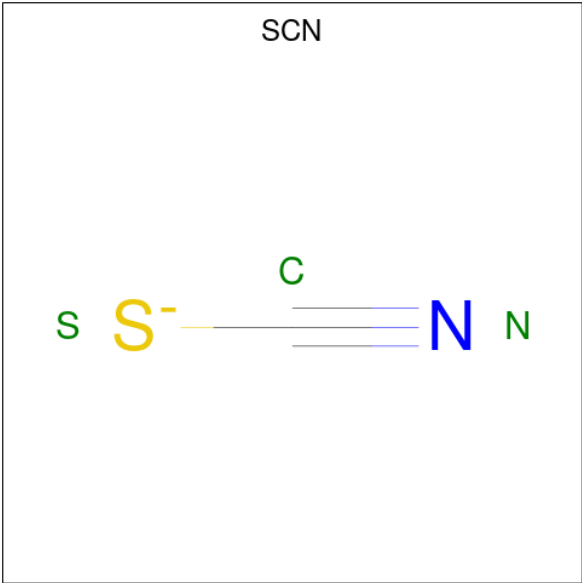
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	1	Total	K	0	0
			1	1		

- Molecule 8 is (2R)-2-hydroxy-3-(phosphonoxy)propyl tetradecanoate (CCD ID: NKN) (formula: C₁₇H₃₅O₇P).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
8	A	1	Total	C	O	P	0	0
			25	17	7	1		
8	A	1	Total C				0	0
			8 8					

- Molecule 9 is THIOCYANATE ION (CCD ID: SCN) (formula: CNS).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
9	A	1	Total	C	N	S	0	0
			3	1	1	1		
9	A	1	Total	C	N	S	0	0
			3	1	1	1		

- Molecule 10 is 1,2-ETHANEDIOL (CCD ID: EDO) (formula: $C_2H_6O_2$).



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

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

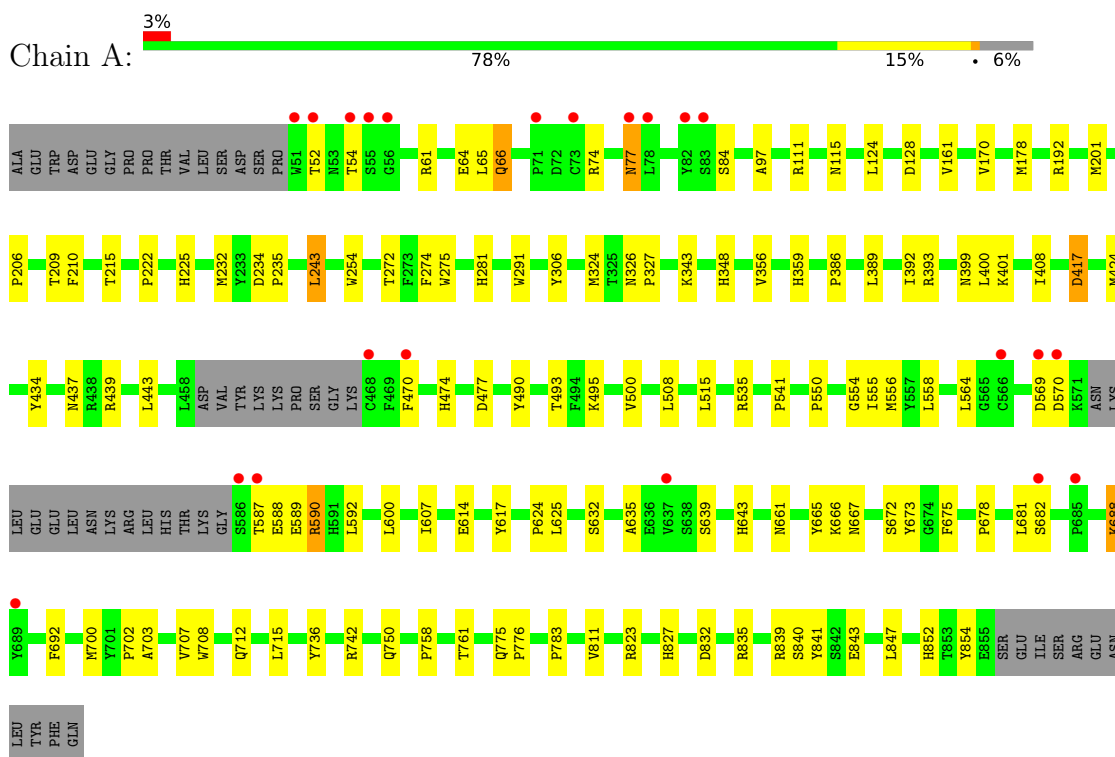
- Molecule 11 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
11	A	665	Total O 665 665	0	0

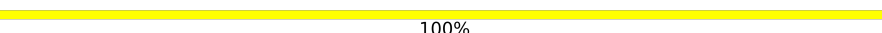
3 Residue-property plots

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: Ectonucleotide pyrophosphatase/phosphodiesterase family member 2



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

Chain B: 

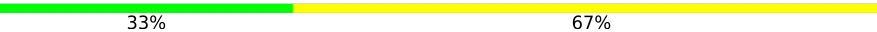


- Molecule 2: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain D: 



- Molecule 3: α -D-mannopyranose-(1-2)- α -D-mannopyranose-(1-3)- α -D-mannopyranose-(1-6)- β -D-mannopyranose-(1-4)-2-acetamido-2-deoxy- β -D-glucopyranose-(1-4)-2-acetamido-2-deoxy- β -D-glucopyranose

Chain C:  33% 67%

NAG1	NAG2	BMA3	MAN4	MAN5	MAN6
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4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	61.58Å 94.62Å 75.37Å 90.00° 94.86° 90.00°	Depositor
Resolution (Å)	32.85 – 1.80 32.85 – 1.80	Depositor EDS
% Data completeness (in resolution range)	98.0 (32.85-1.80) 98.0 (32.85-1.80)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.78 (at 1.79Å)	Xtriage
Refinement program	PHENIX 1.6_289	Depositor
R, R_{free}	0.184 , 0.234 0.179 , 0.228	Depositor DCC
R_{free} test set	3925 reflections (5.03%)	wwPDB-VP
Wilson B-factor (Å ²)	24.8	Xtriage
Anisotropy	0.136	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.37 , 46.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	7189	wwPDB-VP
Average B, all atoms (Å ²)	32.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.68% 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 [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: ZN, NAG, EDO, BMA, NKN, CA, SCN, NA, MAN, K

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	0.57	0/6458	0.81	5/8781 (0.1%)

There are no bond length outliers.

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	209	THR	N-CA-C	6.07	117.76	111.03
1	A	715	LEU	N-CA-C	5.70	117.57	111.36
1	A	625	LEU	N-CA-C	-5.06	106.61	112.89
1	A	500	VAL	CA-C-N	-5.05	115.17	120.38
1	A	500	VAL	C-N-CA	-5.05	115.17	120.38

There are no chirality outliers.

There are no planarity outliers.

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	6268	0	5949	104	0
2	B	28	0	25	1	0
2	D	28	0	25	0	0
3	C	72	0	61	0	0
4	A	2	0	0	0	0
5	A	1	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
6	A	1	0	0	0	0
7	A	1	0	0	0	0
8	A	33	0	48	2	0
9	A	6	0	0	0	0
10	A	84	0	126	36	0
11	A	665	0	0	8	0
All	All	7189	0	6234	107	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 8.

All (107) 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:675:PHE:H	10:A:1012:EDO:H11	1.02	1.10
1:A:835:ARG:HE	10:A:1027:EDO:H22	1.11	1.07
1:A:702:PRO:HB2	10:A:1028:EDO:H22	1.42	1.00
1:A:272:THR:HG22	1:A:274:PHE:H	1.25	0.97
1:A:424:MET:HG3	11:A:1296:HOH:O	1.67	0.95
1:A:675:PHE:N	10:A:1012:EDO:H11	1.83	0.94
1:A:495:LYS:HG2	10:A:1030:EDO:H12	1.49	0.93
1:A:852:HIS:HD2	1:A:854:TYR:CZ	1.90	0.89
1:A:835:ARG:NE	10:A:1027:EDO:H22	1.92	0.81
1:A:570:ASP:HB2	1:A:643:HIS:CD2	2.17	0.79
1:A:675:PHE:H	10:A:1012:EDO:C1	1.90	0.77
1:A:742:ARG:HH21	10:A:1021:EDO:H11	1.49	0.76
1:A:437:ASN:HD21	10:A:1025:EDO:H22	1.51	0.73
1:A:667:ASN:HB2	11:A:1524:HOH:O	1.89	0.72
1:A:835:ARG:HE	10:A:1027:EDO:C2	1.98	0.70
1:A:535:ARG:CZ	10:A:1030:EDO:H22	2.23	0.68
1:A:535:ARG:NH2	10:A:1030:EDO:H22	2.08	0.68
1:A:111:ARG:NH2	1:A:128:ASP:OD2	2.27	0.68
1:A:678:PRO:HB3	1:A:712:GLN:HB3	1.78	0.66
1:A:439:ARG:CZ	10:A:1025:EDO:H21	2.27	0.65
1:A:600:LEU:HD11	1:A:832:ASP:HB2	1.79	0.64
1:A:742:ARG:NH2	10:A:1021:EDO:H11	2.12	0.64
1:A:399:ASN:HA	11:A:1399:HOH:O	1.97	0.63
1:A:570:ASP:HB2	1:A:643:HIS:HD2	1.62	0.61
1:A:852:HIS:CD2	1:A:854:TYR:CZ	2.82	0.60
1:A:417:ASP:HB3	11:A:1510:HOH:O	2.00	0.59
1:A:437:ASN:ND2	10:A:1025:EDO:H22	2.17	0.58

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:111:ARG:HH22	1:A:128:ASP:CG	2.11	0.58
1:A:541:PRO:HG2	1:A:841:TYR:CD2	2.40	0.57
1:A:222:PRO:HA	1:A:225:HIS:CE1	2.41	0.56
1:A:823:ARG:CZ	10:A:1010:EDO:H22	2.35	0.56
1:A:682:SER:OG	1:A:688:LYS:NZ	2.40	0.55
1:A:570:ASP:CB	1:A:643:HIS:CD2	2.90	0.55
1:A:77:ASN:ND2	1:A:274:PHE:O	2.41	0.54
1:A:54:THR:O	1:A:54:THR:HG22	2.08	0.54
1:A:306:TYR:HB2	8:A:1006:NKN:HARA	1.89	0.53
1:A:839:ARG:HE	10:A:1029:EDO:C2	2.23	0.52
1:A:839:ARG:NE	10:A:1029:EDO:H21	2.25	0.52
1:A:550:PRO:HB2	1:A:607:ILE:HG12	1.92	0.51
1:A:742:ARG:HH21	10:A:1021:EDO:C1	2.20	0.51
1:A:281:HIS:ND1	10:A:1026:EDO:C2	2.73	0.51
1:A:210:PHE:CE1	1:A:243:LEU:HD22	2.45	0.51
1:A:758:PRO:HD3	10:A:1019:EDO:H22	1.93	0.50
1:A:688:LYS:HG2	1:A:692:PHE:HE1	1.76	0.50
1:A:672:SER:OG	1:A:673:TYR:N	2.44	0.50
1:A:400:LEU:O	11:A:1498:HOH:O	2.19	0.50
1:A:437:ASN:HD21	10:A:1025:EDO:C2	2.21	0.49
1:A:493:THR:HG21	1:A:515:LEU:HD23	1.93	0.49
1:A:703:ALA:N	10:A:1028:EDO:H21	2.27	0.49
1:A:700:MET:HE1	1:A:708:TRP:CD1	2.47	0.49
1:A:77:ASN:OD1	1:A:275:TRP:HA	2.13	0.49
1:A:281:HIS:ND1	10:A:1026:EDO:H21	2.26	0.49
1:A:97:ALA:HB3	1:A:115:ASN:HA	1.95	0.49
1:A:281:HIS:CE1	10:A:1026:EDO:H12	2.48	0.49
1:A:678:PRO:HG2	1:A:681:LEU:HD12	1.95	0.48
1:A:736:TYR:OH	1:A:750:GLN:HB3	2.13	0.48
1:A:541:PRO:HG2	1:A:841:TYR:HD2	1.78	0.48
1:A:470:PHE:CD1	1:A:470:PHE:C	2.91	0.48
1:A:178:MET:HE3	1:A:192:ARG:HD3	1.96	0.48
1:A:588:GLU:O	1:A:589:GLU:C	2.55	0.48
1:A:343:LYS:HA	1:A:348:HIS:CD2	2.49	0.48
1:A:490:TYR:CD1	10:A:1011:EDO:H12	2.49	0.47
1:A:839:ARG:HE	10:A:1029:EDO:H21	1.78	0.47
1:A:840:SER:OG	1:A:843:GLU:HG3	2.14	0.47
1:A:201:MET:HE1	1:A:356:VAL:CG2	2.44	0.47
1:A:392:ILE:HD12	1:A:443:LEU:HG	1.96	0.47
1:A:707:VAL:HG13	1:A:811:VAL:HG13	1.97	0.47
10:A:1027:EDO:H11	11:A:1419:HOH:O	2.13	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:65:LEU:HD21	1:A:291:TRP:CE2	2.50	0.46
1:A:272:THR:CG2	1:A:274:PHE:O	2.64	0.46
1:A:206:PRO:HB3	1:A:389:LEU:HD13	1.98	0.45
1:A:326:ASN:HB3	1:A:327:PRO:HD3	1.98	0.45
1:A:210:PHE:CD1	1:A:243:LEU:HD22	2.52	0.45
1:A:590:ARG:HH22	1:A:632:SER:HB3	1.80	0.45
1:A:61:ARG:HD2	1:A:64:GLU:OE1	2.18	0.44
1:A:272:THR:HG21	1:A:274:PHE:O	2.17	0.44
1:A:617:TYR:HA	1:A:624:PRO:HA	1.99	0.44
1:A:839:ARG:HG3	10:A:1029:EDO:H21	1.99	0.44
10:A:1027:EDO:H21	11:A:1338:HOH:O	2.17	0.44
1:A:64:GLU:OE1	1:A:66:GLN:NE2	2.50	0.44
1:A:77:ASN:ND2	1:A:272:THR:HG21	2.33	0.44
1:A:348:HIS:CD2	1:A:348:HIS:H	2.36	0.44
1:A:827:HIS:HE1	11:A:906:HOH:O	2.00	0.44
1:A:54:THR:O	1:A:54:THR:CG2	2.66	0.43
1:A:564:LEU:O	1:A:661:ASN:HB2	2.18	0.43
1:A:761:THR:HA	10:A:1015:EDO:H12	2.01	0.43
1:A:74:ARG:HD3	1:A:84:SER:OG	2.18	0.43
1:A:783:PRO:HB3	10:A:1029:EDO:H12	2.01	0.43
1:A:206:PRO:HD3	1:A:434:TYR:CE1	2.54	0.43
1:A:359:HIS:CE1	1:A:474:HIS:CE1	3.06	0.43
1:A:852:HIS:CD2	1:A:854:TYR:CE1	3.07	0.42
1:A:324:MET:C	1:A:327:PRO:HD2	2.44	0.42
1:A:665:TYR:O	1:A:666:LYS:C	2.63	0.42
1:A:847:LEU:HD12	10:A:1020:EDO:H11	2.02	0.42
1:A:708:TRP:CD1	10:A:1012:EDO:H12	2.54	0.42
1:A:775:GLN:HA	1:A:776:PRO:HD3	1.90	0.42
1:A:281:HIS:HE1	10:A:1026:EDO:H12	1.85	0.42
1:A:555:ILE:O	1:A:556:MET:HG3	2.20	0.42
1:A:592:LEU:HD23	1:A:614:GLU:OE1	2.20	0.42
1:A:554:GLY:H	1:A:556:MET:HE3	1.85	0.41
1:A:708:TRP:O	1:A:712:GLN:HG2	2.20	0.41
2:B:1:NAG:H83	2:B:1:NAG:H2	1.91	0.41
1:A:508:LEU:HA	1:A:508:LEU:HD23	1.83	0.41
1:A:234:ASP:HA	1:A:235:PRO:HD3	1.93	0.41
1:A:254:TRP:HB2	8:A:1007:NKN:HATA	2.03	0.41
1:A:393:ARG:HA	10:A:1017:EDO:H21	2.02	0.41
1:A:678:PRO:CG	1:A:681:LEU:HD12	2.51	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	779/831 (94%)	745 (96%)	30 (4%)	4 (0%)	24	14

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	569	ASP
1	A	477	ASP
1	A	635	ALA
1	A	386	PRO

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	699/756 (92%)	682 (98%)	17 (2%)	43	31

All (17) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	52	THR
1	A	66	GLN
1	A	77	ASN
1	A	124	LEU
1	A	161	VAL
1	A	170	VAL
1	A	215	THR

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Mol	Chain	Res	Type
1	A	232	MET
1	A	243	LEU
1	A	401	LYS
1	A	408	ILE
1	A	417	ASP
1	A	558	LEU
1	A	587	THR
1	A	590	ARG
1	A	639	SER
1	A	688	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (14) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	66	GLN
1	A	242	HIS
1	A	337	GLN
1	A	348	HIS
1	A	374	ASN
1	A	378	ASN
1	A	471	GLN
1	A	484	GLN
1	A	643	HIS
1	A	646	ASN
1	A	667	ASN
1	A	802	ASN
1	A	827	HIS
1	A	852	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 ⓘ

10 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	0.55	0	17,19,21	0.74	0
2	NAG	B	2	2	14,14,15	0.43	0	17,19,21	1.08	1 (5%)
3	NAG	C	1	3,1	14,14,15	0.69	0	17,19,21	1.30	2 (11%)
3	NAG	C	2	3	14,14,15	0.67	0	17,19,21	0.87	2 (11%)
3	BMA	C	3	3	11,11,12	0.68	0	15,15,17	1.02	1 (6%)
3	MAN	C	4	3	11,11,12	0.59	0	15,15,17	0.81	0
3	MAN	C	5	3	11,11,12	0.61	0	15,15,17	0.87	0
3	MAN	C	6	3	11,11,12	0.52	0	15,15,17	1.13	2 (13%)
2	NAG	D	1	2,1	14,14,15	0.65	0	17,19,21	1.06	0
2	NAG	D	2	2	14,14,15	0.75	0	17,19,21	0.99	1 (5%)

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	-	2/6/23/26	0/1/1/1
2	NAG	B	2	2	-	2/6/23/26	0/1/1/1
3	NAG	C	1	3,1	-	0/6/23/26	0/1/1/1
3	NAG	C	2	3	-	0/6/23/26	0/1/1/1
3	BMA	C	3	3	-	0/2/19/22	0/1/1/1
3	MAN	C	4	3	-	0/2/19/22	0/1/1/1
3	MAN	C	5	3	-	0/2/19/22	0/1/1/1
3	MAN	C	6	3	-	0/2/19/22	0/1/1/1
2	NAG	D	1	2,1	-	0/6/23/26	0/1/1/1
2	NAG	D	2	2	-	2/6/23/26	0/1/1/1

There are no bond length outliers.

All (9) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	2	NAG	C1-O5-C5	3.60	117.01	112.19
3	C	1	NAG	C1-C2-N2	2.56	114.46	110.43
3	C	6	MAN	O2-C2-C1	2.45	114.83	109.22
3	C	6	MAN	O2-C2-C3	-2.26	105.47	110.15
3	C	3	BMA	C2-C3-C4	-2.17	107.04	110.86
2	D	2	NAG	C4-C3-C2	2.17	114.20	111.02
3	C	2	NAG	C1-C2-N2	-2.08	107.15	110.43
3	C	1	NAG	O7-C7-C8	-2.06	118.39	122.05
3	C	2	NAG	O7-C7-C8	-2.03	118.45	122.05

There are no chirality outliers.

All (6) torsion outliers are listed below:

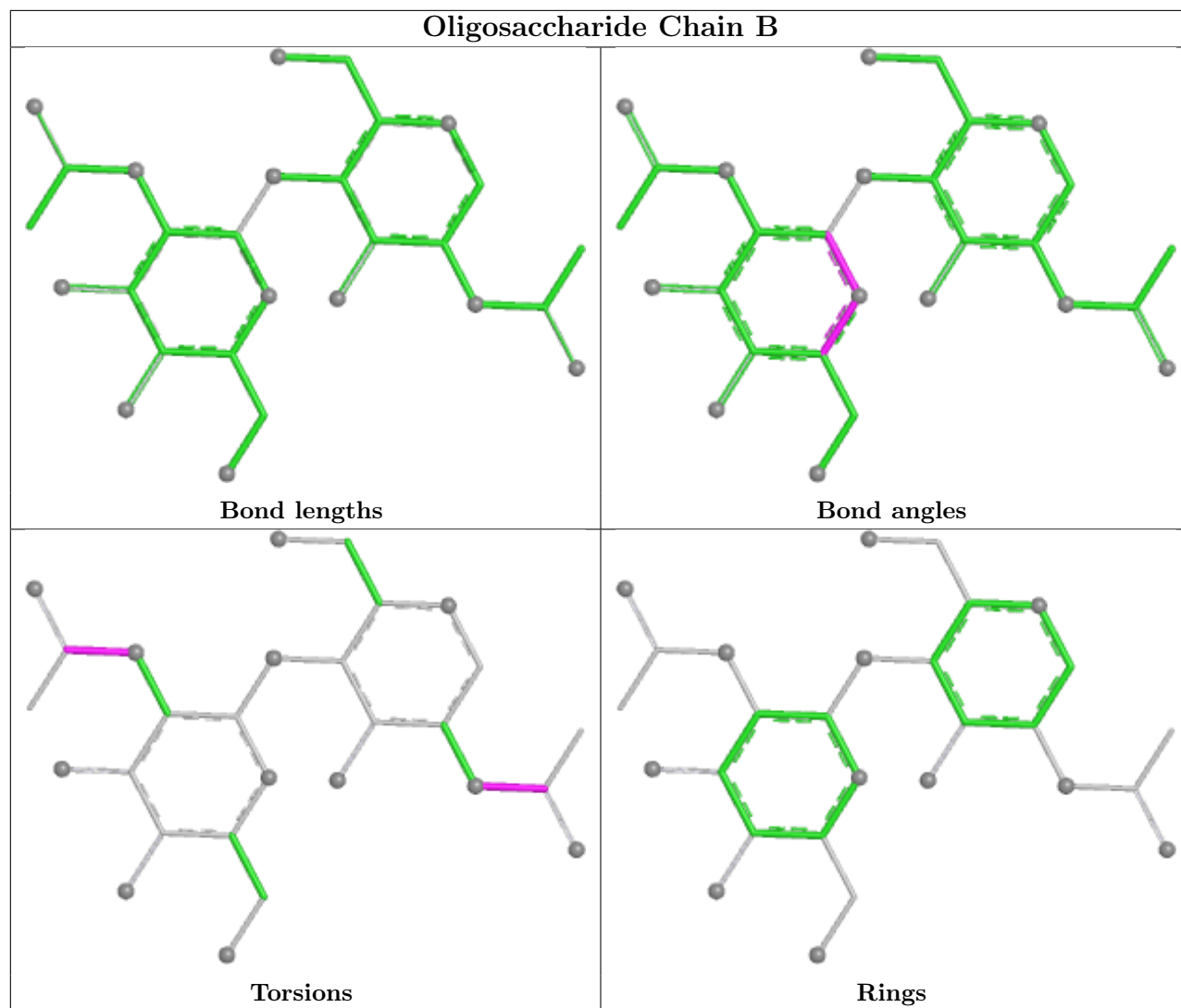
Mol	Chain	Res	Type	Atoms
2	B	1	NAG	C8-C7-N2-C2
2	B	1	NAG	O7-C7-N2-C2
2	D	2	NAG	O5-C5-C6-O6
2	D	2	NAG	C4-C5-C6-O6
2	B	2	NAG	C8-C7-N2-C2
2	B	2	NAG	O7-C7-N2-C2

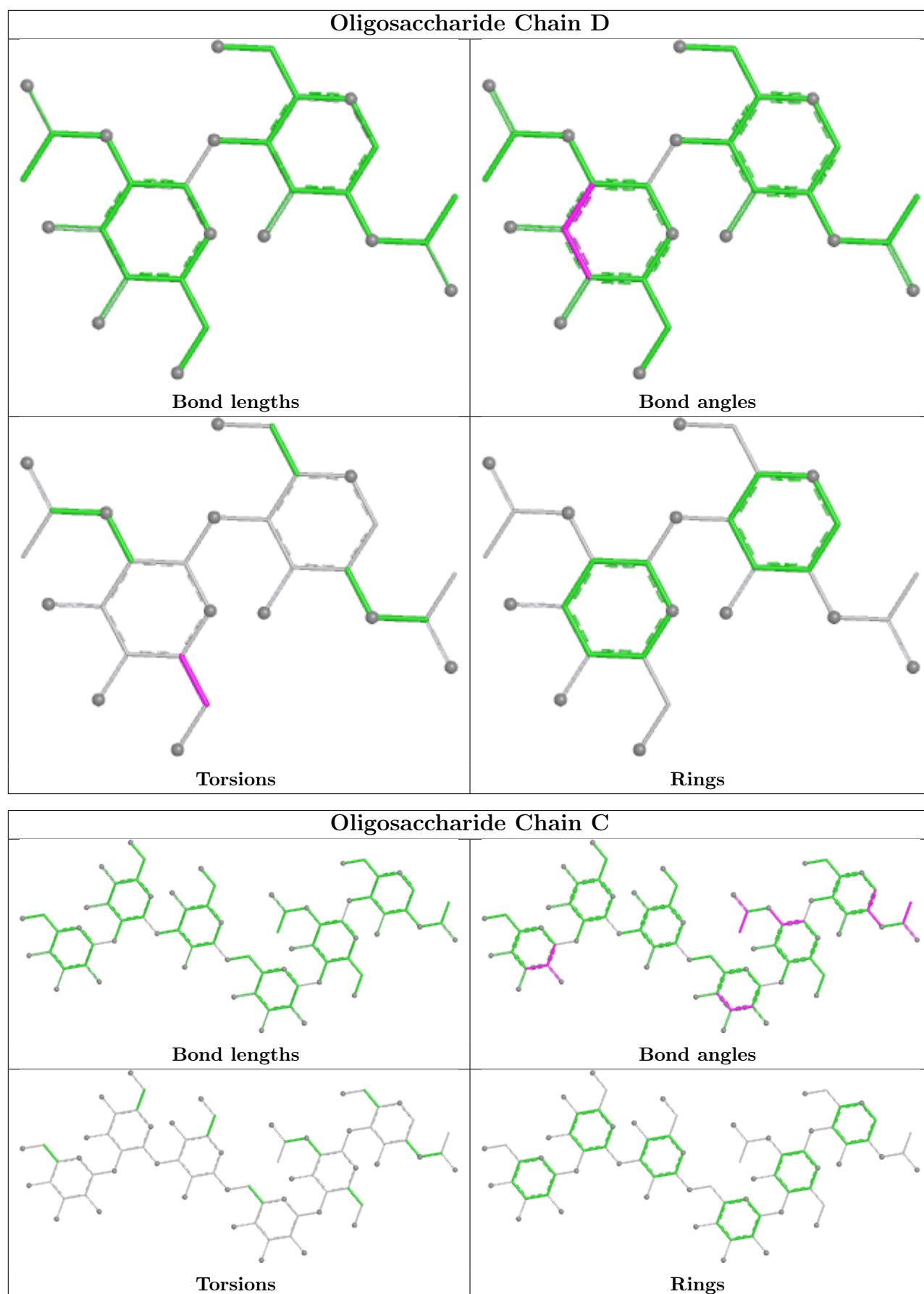
There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	1	NAG	1	0

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





5.6 Ligand geometry

Of 30 ligands modelled in this entry, 5 are monoatomic - leaving 25 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$
10	EDO	A	1025	-	3,3,3	0.41	0	2,2,2	0.29	0
10	EDO	A	1029	-	3,3,3	0.31	0	2,2,2	0.44	0
9	SCN	A	1008	-	1,2,2	1.24	0	0,1,1	-	-
10	EDO	A	1011	-	3,3,3	0.70	0	2,2,2	0.09	0
10	EDO	A	1028	-	3,3,3	0.41	0	2,2,2	0.37	0
10	EDO	A	1017	-	3,3,3	0.49	0	2,2,2	0.31	0
10	EDO	A	1019	-	3,3,3	0.41	0	2,2,2	0.60	0
8	NKN	A	1007	-	7,7,24	0.25	0	6,6,28	0.88	0
10	EDO	A	1013	-	3,3,3	0.49	0	2,2,2	0.48	0
10	EDO	A	1027	-	3,3,3	0.50	0	2,2,2	0.23	0
10	EDO	A	1016	-	3,3,3	0.50	0	2,2,2	0.42	0
10	EDO	A	1020	-	3,3,3	0.46	0	2,2,2	0.34	0
8	NKN	A	1006	4	24,24,24	0.64	0	26,28,28	1.71	4 (15%)
10	EDO	A	1018	-	3,3,3	0.64	0	2,2,2	0.27	0
10	EDO	A	1026	-	3,3,3	0.42	0	2,2,2	0.68	0
10	EDO	A	1010	-	3,3,3	0.53	0	2,2,2	0.36	0
10	EDO	A	1021	-	3,3,3	0.51	0	2,2,2	0.37	0
9	SCN	A	1009	-	1,2,2	0.95	0	0,1,1	-	-
10	EDO	A	1030	-	3,3,3	0.42	0	2,2,2	0.16	0
10	EDO	A	1022	-	3,3,3	0.51	0	2,2,2	0.35	0
10	EDO	A	1015	-	3,3,3	0.39	0	2,2,2	0.48	0
10	EDO	A	1014	-	3,3,3	0.54	0	2,2,2	0.14	0
10	EDO	A	1024	-	3,3,3	0.55	0	2,2,2	0.39	0
10	EDO	A	1012	-	3,3,3	0.29	0	2,2,2	0.69	0
10	EDO	A	1023	-	3,3,3	0.46	0	2,2,2	0.66	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
10	EDO	A	1025	-	-	0/1/1/1	-
10	EDO	A	1029	-	-	0/1/1/1	-
10	EDO	A	1011	-	-	0/1/1/1	-
10	EDO	A	1028	-	-	0/1/1/1	-
10	EDO	A	1017	-	-	0/1/1/1	-
10	EDO	A	1019	-	-	1/1/1/1	-
8	NKN	A	1007	-	-	0/5/5/24	-
10	EDO	A	1013	-	-	0/1/1/1	-
10	EDO	A	1027	-	-	0/1/1/1	-
10	EDO	A	1016	-	-	0/1/1/1	-
10	EDO	A	1020	-	-	0/1/1/1	-
8	NKN	A	1006	4	-	0/24/24/24	-
10	EDO	A	1018	-	-	0/1/1/1	-
10	EDO	A	1026	-	-	0/1/1/1	-
10	EDO	A	1010	-	-	1/1/1/1	-
10	EDO	A	1021	-	-	0/1/1/1	-
10	EDO	A	1030	-	-	0/1/1/1	-
10	EDO	A	1022	-	-	0/1/1/1	-
10	EDO	A	1015	-	-	0/1/1/1	-
10	EDO	A	1014	-	-	0/1/1/1	-
10	EDO	A	1024	-	-	1/1/1/1	-
10	EDO	A	1012	-	-	0/1/1/1	-
10	EDO	A	1023	-	-	0/1/1/1	-

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed($^{\circ}$)	Ideal($^{\circ}$)
8	A	1006	NKN	OAF-PAC-OAD	5.08	120.16	106.44
8	A	1006	NKN	CAI-OAJ-CAK	-3.40	104.69	117.12
8	A	1006	NKN	CAU-CAT-CAS	-2.56	101.42	114.37
8	A	1006	NKN	OAJ-CAK-CAL	2.02	118.01	111.83

There are no chirality outliers.

All (3) torsion outliers are listed below:

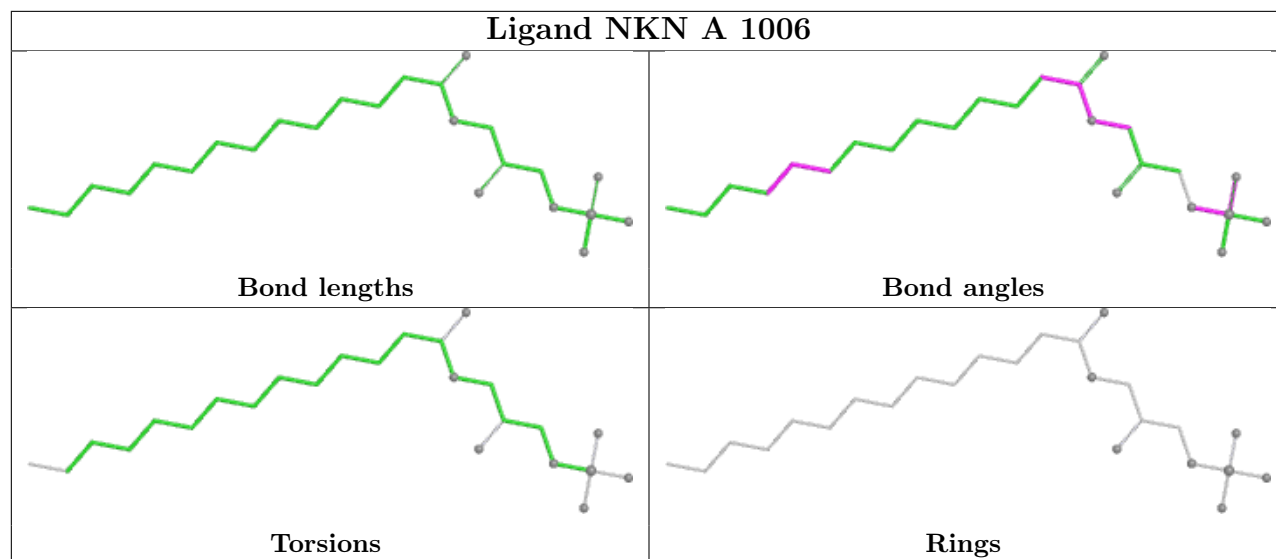
Mol	Chain	Res	Type	Atoms
10	A	1024	EDO	O1-C1-C2-O2
10	A	1010	EDO	O1-C1-C2-O2
10	A	1019	EDO	O1-C1-C2-O2

There are no ring outliers.

16 monomers are involved in 38 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
10	A	1025	EDO	4	0
10	A	1029	EDO	5	0
10	A	1011	EDO	1	0
10	A	1028	EDO	2	0
10	A	1017	EDO	1	0
10	A	1019	EDO	1	0
8	A	1007	NKN	1	0
10	A	1027	EDO	5	0
10	A	1020	EDO	1	0
8	A	1006	NKN	1	0
10	A	1026	EDO	4	0
10	A	1010	EDO	1	0
10	A	1021	EDO	3	0
10	A	1030	EDO	3	0
10	A	1015	EDO	1	0
10	A	1012	EDO	4	0

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 [i](#)

6.1 Protein, DNA and RNA chains [i](#)

In the following table, the column labelled ‘#RSRZ> 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q< 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	782/831 (94%)	0.09	22 (2%) 55 55	11, 29, 56, 73	3 (0%)

All (22) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	587	THR	3.7
1	A	77	ASN	3.1
1	A	51	TRP	2.8
1	A	566	CYS	2.6
1	A	52	THR	2.5
1	A	54	THR	2.5
1	A	71	PRO	2.5
1	A	685	PRO	2.5
1	A	689	TYR	2.4
1	A	78	LEU	2.4
1	A	56	GLY	2.4
1	A	569	ASP	2.2
1	A	682	SER	2.2
1	A	83	SER	2.2
1	A	82	TYR	2.1
1	A	468	CYS	2.1
1	A	55	SER	2.1
1	A	637	VAL	2.1
1	A	470	PHE	2.1
1	A	586	SER	2.1
1	A	73	CYS	2.1
1	A	570	ASP	2.1

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

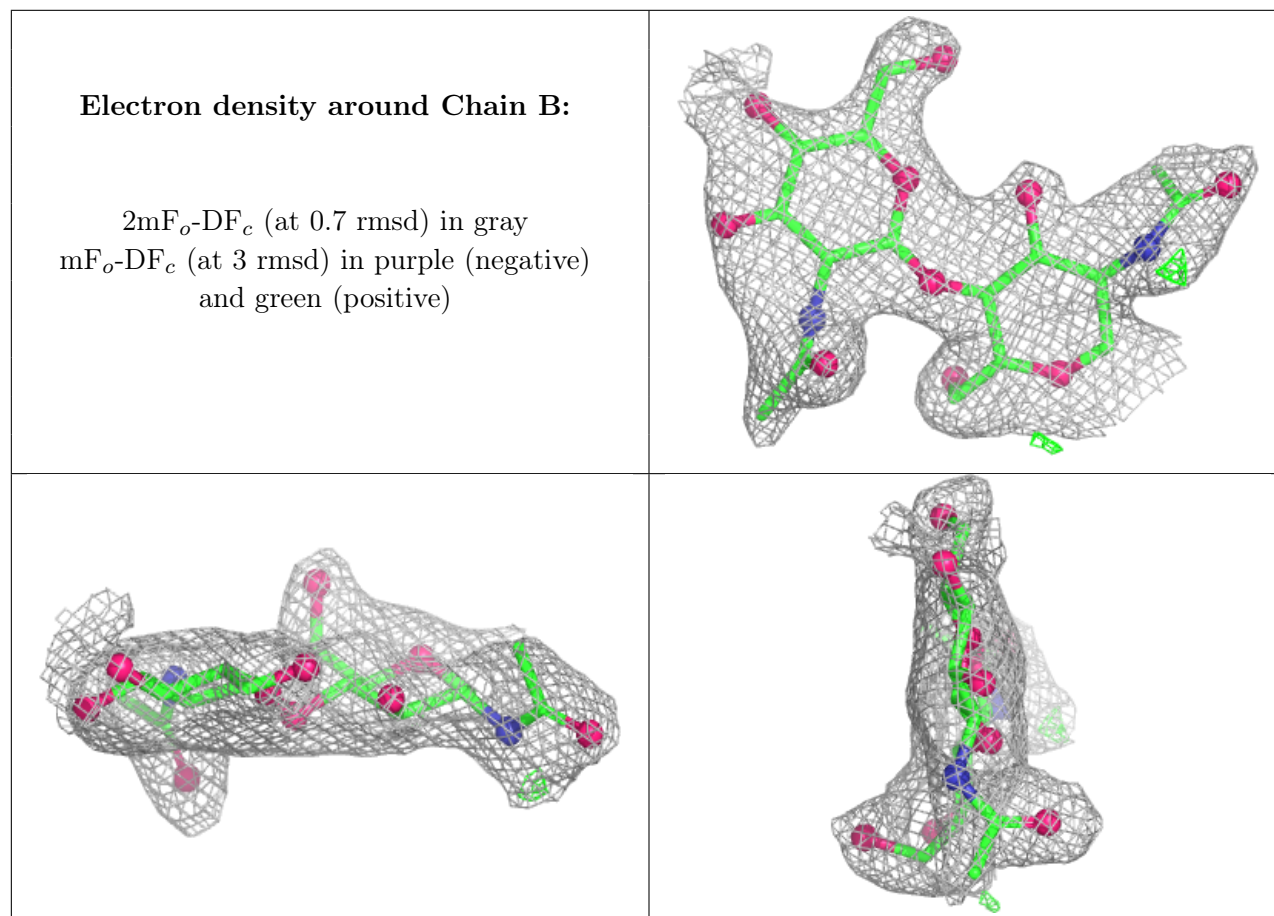
There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates ⓘ

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

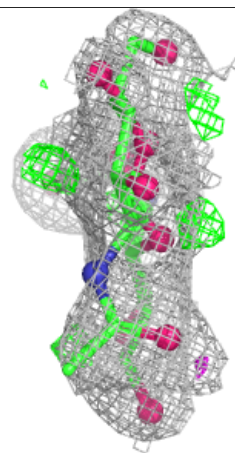
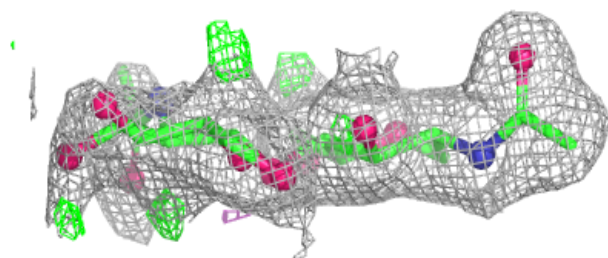
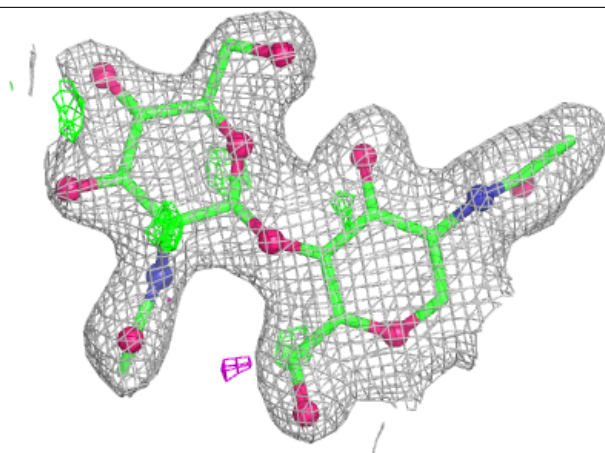
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
2	NAG	B	2	14/15	0.77	0.12	61,64,67,71	0
2	NAG	B	1	14/15	0.78	0.12	56,61,63,63	0
2	NAG	D	2	14/15	0.78	0.13	47,52,55,56	0
3	MAN	C	4	11/12	0.82	0.10	36,38,42,49	0
3	BMA	C	3	11/12	0.84	0.10	37,40,46,47	0
3	MAN	C	5	11/12	0.88	0.13	31,34,40,49	0
2	NAG	D	1	14/15	0.92	0.09	25,32,40,47	0
3	MAN	C	6	11/12	0.93	0.09	23,31,36,37	0
3	NAG	C	2	14/15	0.95	0.08	24,28,33,38	0
3	NAG	C	1	14/15	0.98	0.06	16,18,22,22	0

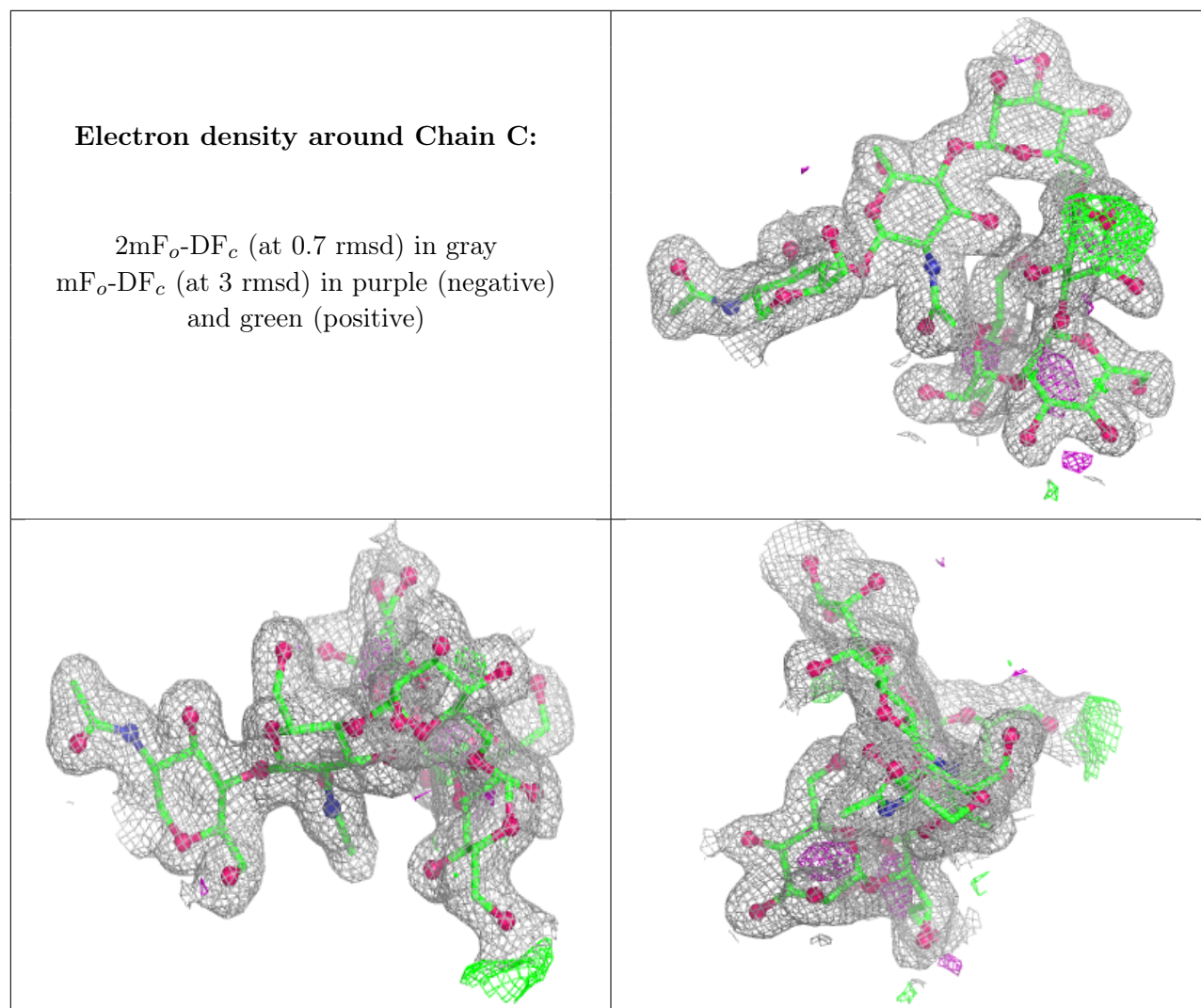
The following is a graphical depiction of the model fit to experimental electron density for oligosaccharide. Each fit is shown from different orientation to approximate a three-dimensional view.



Electron density around Chain D:

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





6.4 Ligands [i](#)

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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
10	EDO	A	1011	4/4	0.84	0.18	26,30,30,36	0
10	EDO	A	1027	4/4	0.86	0.12	41,43,45,47	0
10	EDO	A	1022	4/4	0.87	0.11	34,36,36,45	0
7	K	A	1005	1/1	0.87	0.13	46,46,46,46	0
10	EDO	A	1018	4/4	0.90	0.15	21,27,29,39	0
10	EDO	A	1020	4/4	0.90	0.14	28,31,38,41	0
10	EDO	A	1010	4/4	0.90	0.15	34,34,34,36	0
8	NKN	A	1007	8/25	0.90	0.10	31,33,39,41	0

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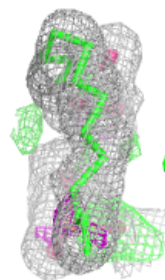
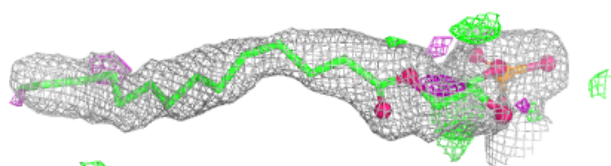
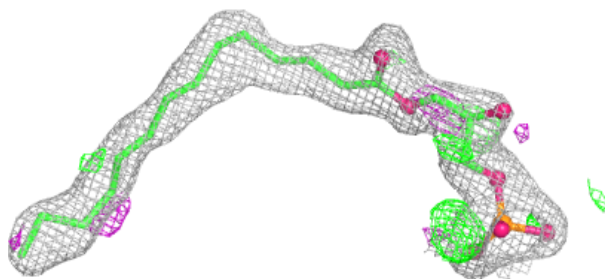
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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
10	EDO	A	1026	4/4	0.91	0.10	22,28,30,36	0
10	EDO	A	1021	4/4	0.91	0.11	33,36,41,42	0
10	EDO	A	1014	4/4	0.92	0.10	31,31,33,35	0
10	EDO	A	1016	4/4	0.92	0.10	28,29,29,31	0
10	EDO	A	1025	4/4	0.92	0.10	22,26,31,36	0
8	NKN	A	1006	25/25	0.92	0.11	19,35,40,45	0
10	EDO	A	1012	4/4	0.92	0.12	33,34,36,37	0
10	EDO	A	1028	4/4	0.92	0.12	32,33,34,39	0
10	EDO	A	1013	4/4	0.93	0.11	29,30,31,31	0
10	EDO	A	1017	4/4	0.94	0.12	23,25,28,29	0
10	EDO	A	1024	4/4	0.94	0.07	25,26,27,34	0
10	EDO	A	1019	4/4	0.94	0.07	35,35,36,41	0
10	EDO	A	1015	4/4	0.95	0.10	26,27,31,33	0
10	EDO	A	1030	4/4	0.95	0.09	33,34,35,38	0
10	EDO	A	1029	4/4	0.96	0.08	22,31,32,38	0
9	SCN	A	1008	3/3	0.96	0.11	32,32,33,39	0
6	NA	A	1004	1/1	0.97	0.05	25,25,25,25	0
10	EDO	A	1023	4/4	0.98	0.04	19,22,22,24	0
9	SCN	A	1009	3/3	0.99	0.06	23,23,33,40	0
5	CA	A	1003	1/1	0.99	0.02	22,22,22,22	0
4	ZN	A	1001	1/1	1.00	0.01	19,19,19,19	0
4	ZN	A	1002	1/1	1.00	0.01	17,17,17,17	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 NKN A 1006:

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



6.5 Other polymers [i](#)

There are no such residues in this entry.