



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 9, 2026 – 11:45 AM UTC

PDB ID : 4IOP / pdb_00004iop
Title : Crystal structure of NKp65 bound to its ligand KACL
Authors : Li, Y.
Deposited on : 2013-01-08
Resolution : 3.20 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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
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

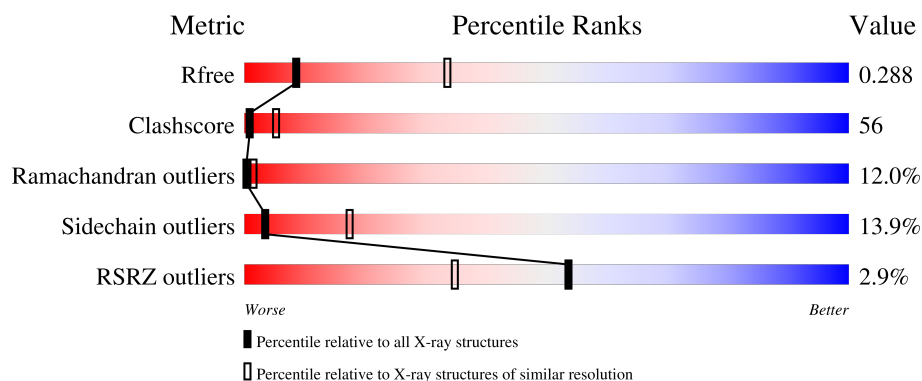
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.20 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}	180053	1466 (3.20-3.20)
Clashscore	190562	1573 (3.20-3.20)
Ramachandran outliers	187476	1548 (3.20-3.20)
Sidechain outliers	187428	1547 (3.20-3.20)
RSRZ outliers	180081	1466 (3.20-3.20)

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	142	4% 28% 41% 11% • 18%
2	B	158	% 22% 39% 15% • 23%
3	C	3	67% 33%
3	D	3	33% 67%

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 1957 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 C-type lectin domain family 2 member A.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	117	Total	C	N	O	S	0	0	0
			920	587	158	169	6			

There are 13 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	42	ASP	-	expression tag	UNP Q6UVW9
A	43	LEU	-	expression tag	UNP Q6UVW9
A	44	GLY	-	expression tag	UNP Q6UVW9
A	45	SER	-	expression tag	UNP Q6UVW9
A	175	ALA	-	expression tag	UNP Q6UVW9
A	176	ALA	-	expression tag	UNP Q6UVW9
A	177	ALA	-	expression tag	UNP Q6UVW9
A	178	HIS	-	expression tag	UNP Q6UVW9
A	179	HIS	-	expression tag	UNP Q6UVW9
A	180	HIS	-	expression tag	UNP Q6UVW9
A	181	HIS	-	expression tag	UNP Q6UVW9
A	182	HIS	-	expression tag	UNP Q6UVW9
A	183	HIS	-	expression tag	UNP Q6UVW9

- Molecule 2 is a protein called Killer cell lectin-like receptor subfamily F member 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	121	Total	C	N	O	S	0	0	0
			959	617	158	177	7			

There are 13 discrepancies between the modelled and reference sequences:

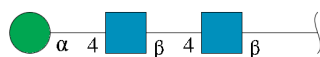
Chain	Residue	Modelled	Actual	Comment	Reference
B	59	ASP	-	expression tag	UNP D3W0D1
B	60	LEU	-	expression tag	UNP D3W0D1
B	61	GLY	-	expression tag	UNP D3W0D1

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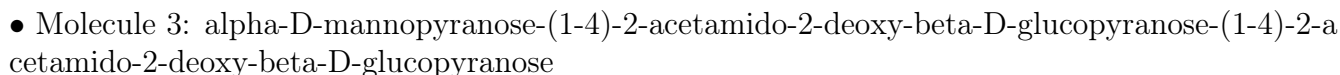
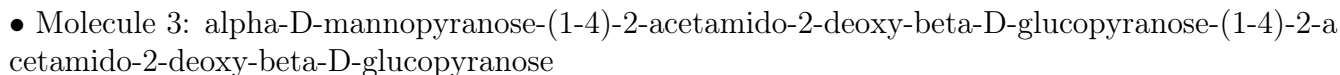
Chain	Residue	Modelled	Actual	Comment	Reference
B	62	SER	-	expression tag	UNP D3W0D1
B	208	ALA	-	expression tag	UNP D3W0D1
B	209	ALA	-	expression tag	UNP D3W0D1
B	210	ALA	-	expression tag	UNP D3W0D1
B	211	HIS	-	expression tag	UNP D3W0D1
B	212	HIS	-	expression tag	UNP D3W0D1
B	213	HIS	-	expression tag	UNP D3W0D1
B	214	HIS	-	expression tag	UNP D3W0D1
B	215	HIS	-	expression tag	UNP D3W0D1
B	216	HIS	-	expression tag	UNP D3W0D1

- Molecule 3 is an oligosaccharide called alpha-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	3	Total	C	N	O	0	0	0
			39	22	2	15			
3	D	3	Total	C	N	O	0	0	0
			39	22	2	15			

- Molecule 1: C-type lectin domain family 2 member A





4 Data and refinement statistics

Property	Value	Source
Space group	I 41 2 2	Depositor
Cell constants a, b, c, α , β , γ	74.64Å 74.64Å 271.08Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	50.00 – 3.20 50.00 – 3.20	Depositor EDS
% Data completeness (in resolution range)	99.8 (50.00-3.20) 99.7 (50.00-3.20)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$	-	Xtriage
Refinement program	CNS	Depositor
R, R_{free}	0.252 , 0.297 0.270 , 0.288	Depositor DCC
R_{free} test set	323 reflections (4.77%)	wwPDB-VP
Wilson B-factor (Å ²)	(Not available)	Xtriage
Anisotropy	(Not available)	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.28 , 92.1	EDS
L-test for twinning ¹	$\langle L \rangle =$ (Not available), $\langle L^2 \rangle =$ (Not available)	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.91	EDS
Total number of atoms	1957	wwPDB-VP
Average B, all atoms (Å ²)	99.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *(Not available)*

¹Theoretical 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: NAG, MAN

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	0.55	0/947	1.01	3/1279 (0.2%)
2	B	0.63	2/989 (0.2%)	1.03	5/1350 (0.4%)
All	All	0.59	2/1936 (0.1%)	1.02	8/2629 (0.3%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	192	ILE	CA-CB	5.50	1.61	1.54
2	B	164	ILE	CA-CB	5.40	1.60	1.53

The worst 5 of 8 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	89	GLN	N-CA-C	-7.98	102.04	113.21
2	B	128	SER	N-CA-C	-6.38	103.82	113.89
1	A	149	LEU	N-CA-C	6.36	118.89	108.52
2	B	125	ILE	N-CA-C	-5.94	104.72	110.72
2	B	176	THR	N-CA-C	-5.79	101.62	110.14

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	920	0	836	96	0
2	B	959	0	863	122	0
3	C	39	0	34	5	0
3	D	39	0	34	2	0
All	All	1957	0	1767	208	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 56.

The worst 5 of 208 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:110:GLY:HA2	1:A:151:ALA:HB2	1.35	1.03
2:B:142:THR:HG22	2:B:147:LEU:H	1.24	1.02
1:A:116:ILE:HD11	1:A:147:ALA:HB3	1.44	0.98
1:A:95:GLN:HE22	3:C:1:NAG:C6	1.80	0.93
1:A:110:GLY:HA2	1:A:151:ALA:CB	2.03	0.88

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	115/142 (81%)	82 (71%)	17 (15%)	16 (14%)	0	1
2	B	119/158 (75%)	78 (66%)	29 (24%)	12 (10%)	0	2
All	All	234/300 (78%)	160 (68%)	46 (20%)	28 (12%)	0	1

5 of 28 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	94	ALA

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Mol	Chain	Res	Type
1	A	124	ASP
1	A	130	ASN
1	A	132	THR
1	A	135	ASN

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	93/118 (79%)	83 (89%)	10 (11%)	6	27
2	B	101/140 (72%)	84 (83%)	17 (17%)	2	11
All	All	194/258 (75%)	167 (86%)	27 (14%)	3	17

5 of 27 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	B	107	THR
2	B	121	GLU
2	B	170	ARG
2	B	110	GLN
2	B	126	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 9 such sidechains are listed below:

Mol	Chain	Res	Type
2	B	178	ASN
2	B	194	GLN
2	B	108	GLN
2	B	110	GLN
2	B	126	GLN

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 ⓘ

6 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	C	1	1,3	14,14,15	0.84	0	17,19,21	0.90	1 (5%)
3	NAG	C	2	3	14,14,15	0.78	0	17,19,21	0.81	0
3	MAN	C	3	3	11,11,12	0.84	0	15,15,17	0.79	1 (6%)
3	NAG	D	1	1,3	14,14,15	0.92	0	17,19,21	1.75	4 (23%)
3	NAG	D	2	3	14,14,15	1.48	3 (21%)	17,19,21	1.91	4 (23%)
3	MAN	D	3	3	11,11,12	0.59	0	15,15,17	1.26	1 (6%)

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

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	D	2	NAG	C1-C2	3.33	1.56	1.52

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	D	2	NAG	O5-C5	2.94	1.49	1.43
3	D	2	NAG	O5-C1	2.34	1.47	1.43

The worst 5 of 11 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	D	2	NAG	C1-O5-C5	4.82	118.64	112.19
3	D	1	NAG	C4-C3-C2	-4.14	104.95	111.02
3	D	3	MAN	C1-C2-C3	3.90	115.32	109.64
3	D	2	NAG	C4-C3-C2	-3.44	105.97	111.02
3	D	2	NAG	O5-C1-C2	3.34	116.46	111.29

There are no chirality outliers.

5 of 17 torsion outliers are listed below:

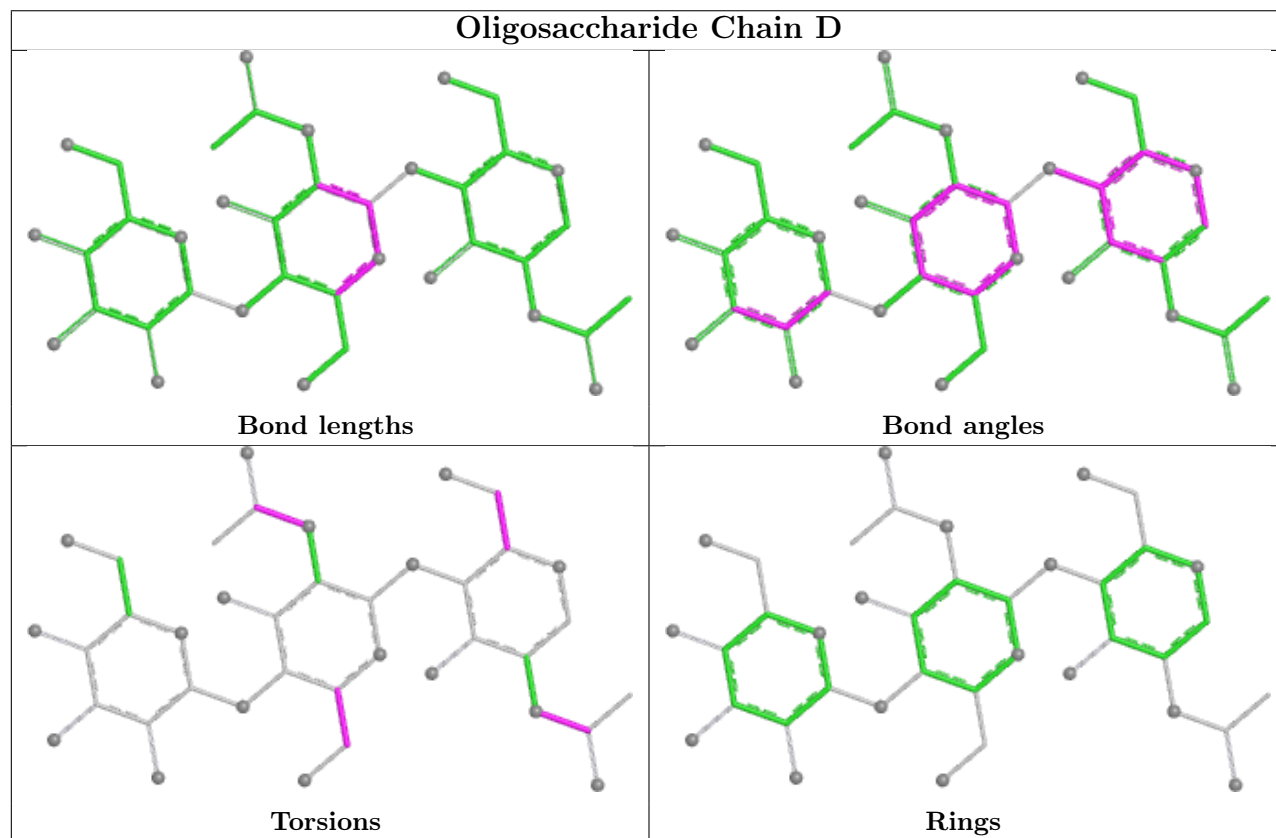
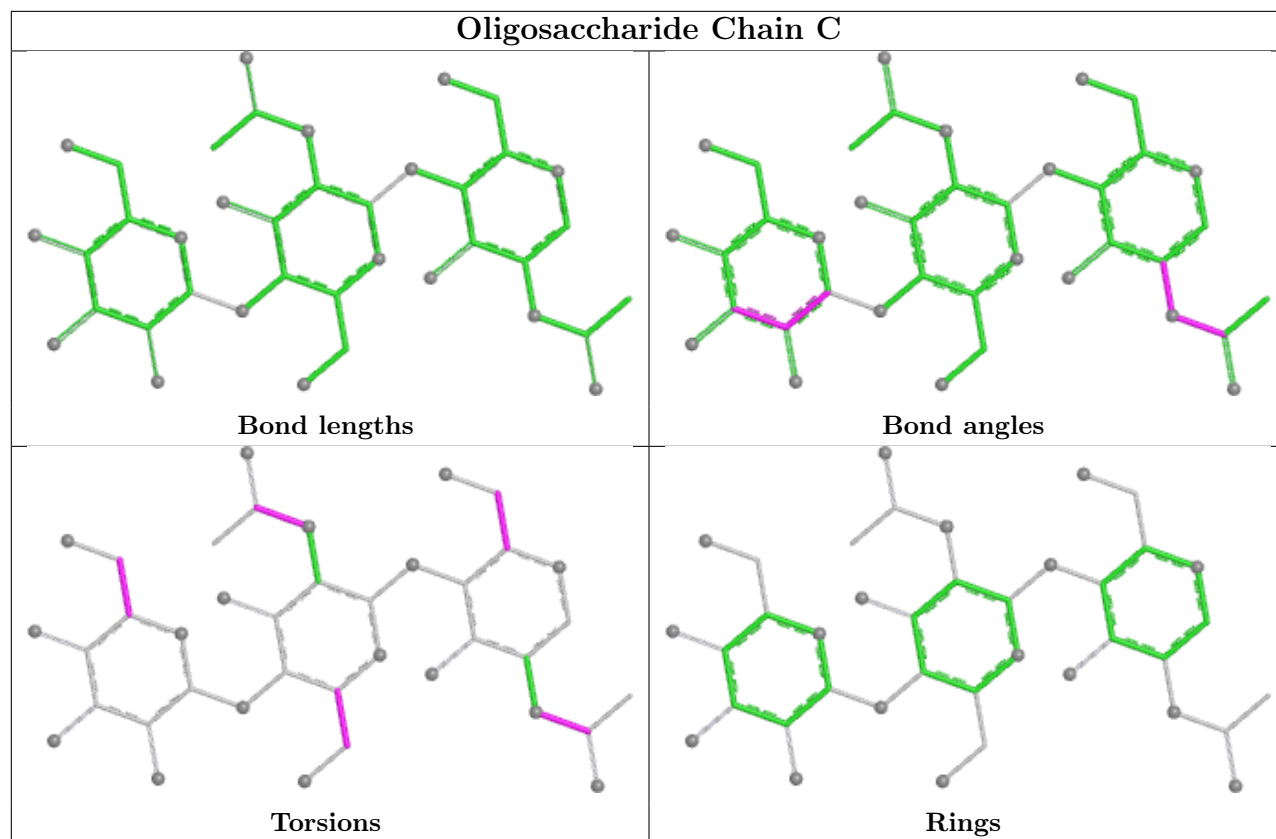
Mol	Chain	Res	Type	Atoms
3	C	1	NAG	C8-C7-N2-C2
3	C	1	NAG	O7-C7-N2-C2
3	C	2	NAG	C8-C7-N2-C2
3	C	2	NAG	O7-C7-N2-C2
3	D	1	NAG	C8-C7-N2-C2

There are no ring outliers.

4 monomers are involved in 7 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	C	2	NAG	1	0
3	D	1	NAG	2	0
3	D	2	NAG	2	0
3	C	1	NAG	5	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](#)

There are no ligands in this entry.

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	117/142 (82%)	0.19	5 (4%) 40 24	41, 96, 153, 179	0
2	B	121/158 (76%)	0.20	2 (1%) 69 49	44, 98, 133, 176	0
All	All	238/300 (79%)	0.19	7 (2%) 53 35	41, 97, 144, 179	0

The worst 5 of 7 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	116	ILE	2.4
1	A	117	GLY	2.3
2	B	92	PHE	2.3
1	A	94	ALA	2.2
1	A	118	LEU	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 [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.

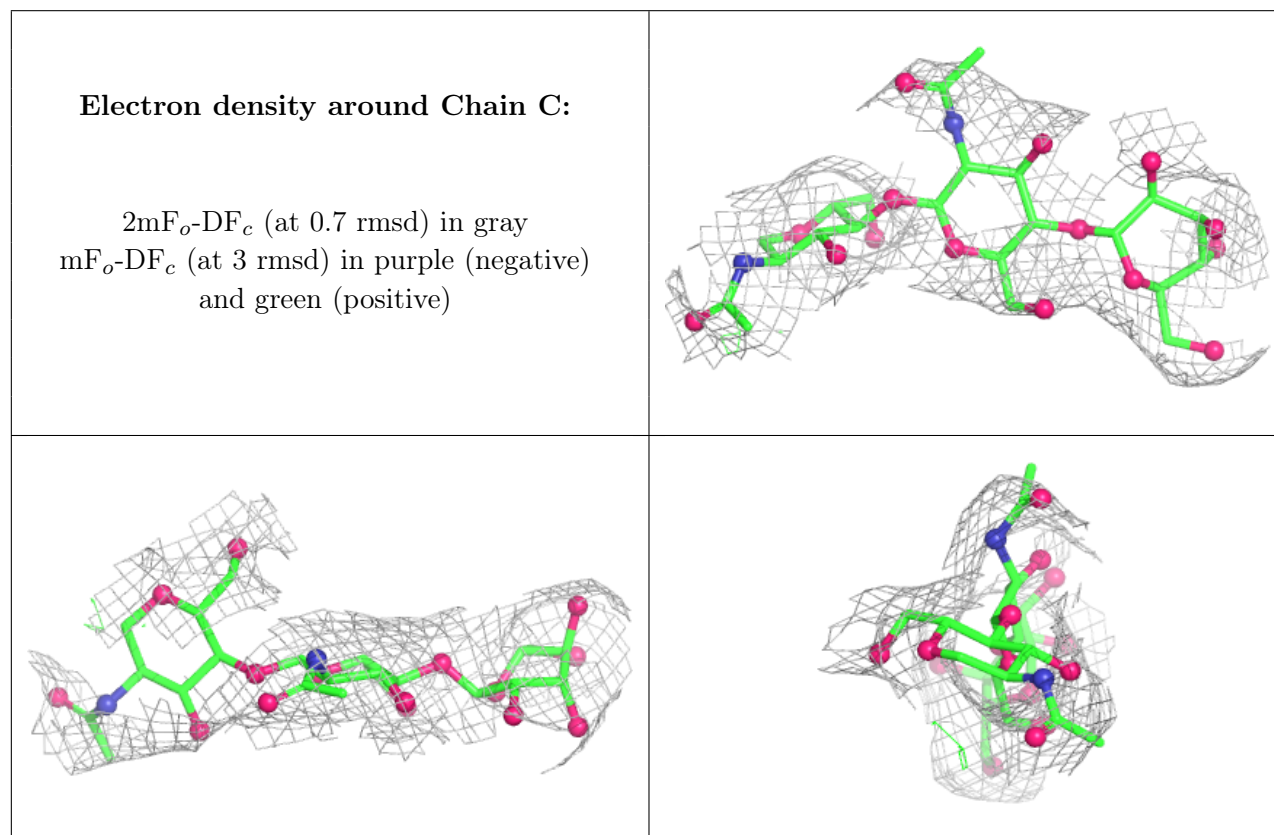
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
3	MAN	D	3	11/12	0.52	0.12	138,138,138,138	0
3	NAG	C	1	14/15	0.70	0.13	158,158,158,158	0
3	MAN	C	3	11/12	0.76	0.10	146,146,146,146	0
3	NAG	D	2	14/15	0.79	0.14	178,178,178,178	0
3	NAG	D	1	14/15	0.79	0.11	103,103,103,103	0

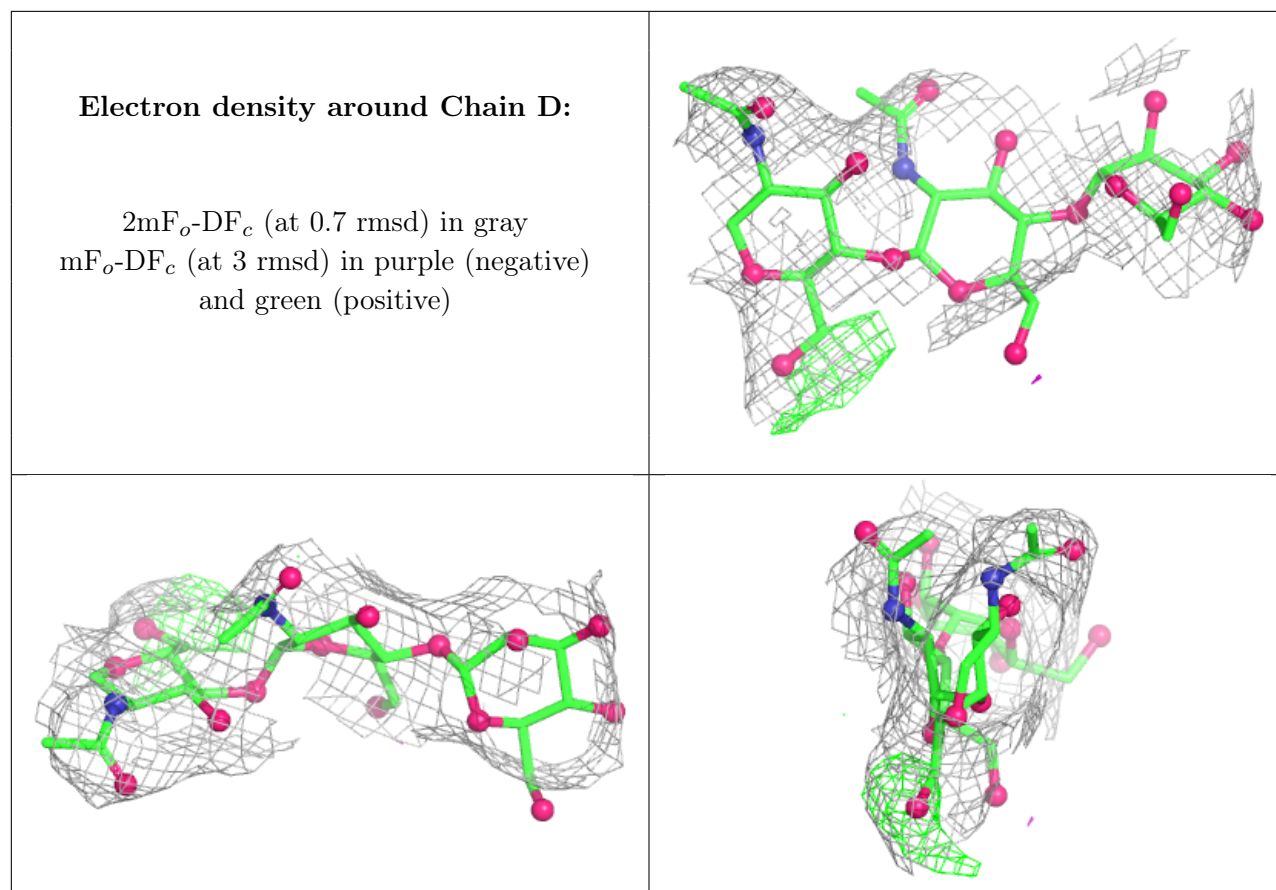
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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
3	NAG	C	2	14/15	0.82	0.14	123,123,123,123	0

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](#)

There are no ligands in this entry.

6.5 Other polymers [i](#)

There are no such residues in this entry.