Full wwPDB X-ray Structure Validation Report (i)

Apr 1, 2025 – 10:35 pm BST

PDB ID	:	9HML / pdb_00009hml
Title	:	KIR2DL1 bound to RIFIN PfKE01_040007400
Authors	:	Chamberlain, S.G.; Higgins, M.K.
Deposited on	:	2024-12-09
Resolution	:	2.17 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 (i) 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 (i)) were used in the production of this report:

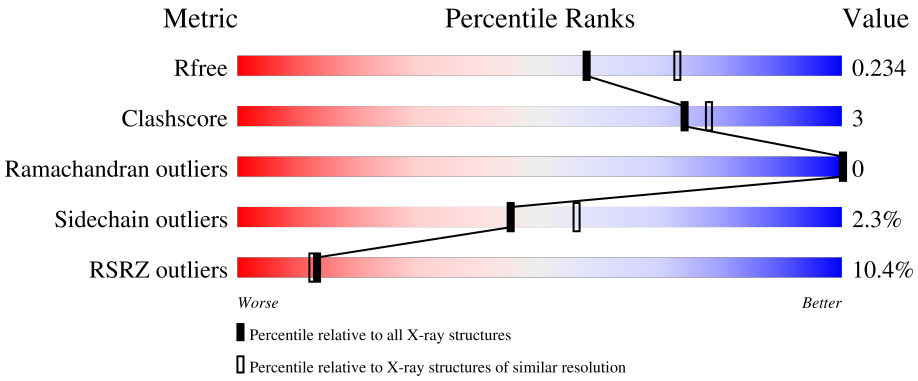
MolProbity	:	4.02b-467
Mogul	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	3.0
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.003 (Gargrove)
Density-Fitness	:	1.0.11
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.42

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 2.17 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	8336 (2.20-2.16)
Clashscore	180529	9404 (2.20-2.16)
Ramachandran outliers	177936	9297 (2.20-2.16)
Sidechain outliers	177891	9297 (2.20-2.16)
RSRZ outliers	164620	8337 (2.20-2.16)

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	140	11% 77% • 19%
2	B	204	13% 80% 8% • 11%
3	C	126	2% 87% 7% • 6%
4	D	2	50% 50%

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 3380 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 RIFIN PfKE01_040007400.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	114	Total	C	N	O	S	0	0	0
			851	535	145	167	4			

- Molecule 2 is a protein called KIR2DL protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	181	Total	C	N	O	S	0	0	0
			1416	892	245	271	8			

There are 11 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	25	THR	-	expression tag	UNP A0A191URJ7
B	26	GLY	-	expression tag	UNP A0A191URJ7
B	220	GLY	-	expression tag	UNP A0A191URJ7
B	221	THR	-	expression tag	UNP A0A191URJ7
B	222	LYS	-	expression tag	UNP A0A191URJ7
B	223	HIS	-	expression tag	UNP A0A191URJ7
B	224	HIS	-	expression tag	UNP A0A191URJ7
B	225	HIS	-	expression tag	UNP A0A191URJ7
B	226	HIS	-	expression tag	UNP A0A191URJ7
B	227	HIS	-	expression tag	UNP A0A191URJ7
B	228	HIS	-	expression tag	UNP A0A191URJ7

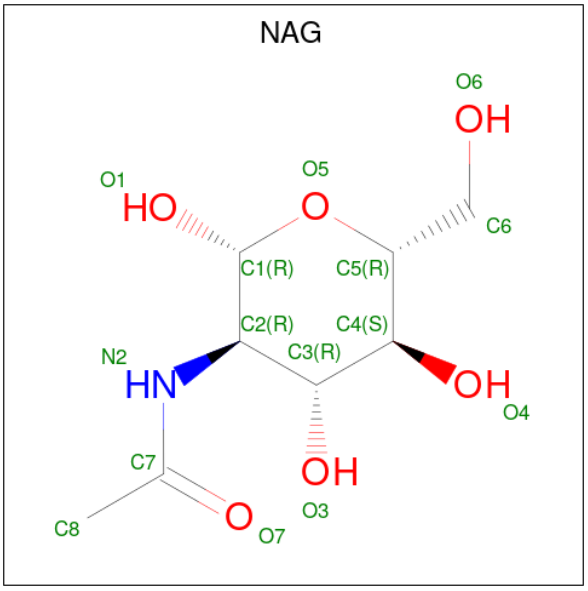
- Molecule 3 is a protein called nanobody Nb1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	C	119	Total	C	N	O	S	0	0	0
			917	573	159	181	4			

- Molecule 4 is an oligosaccharide called alpha-L-fucopyranose-(1-6)-2-acetamido-2-deoxy-beta-D-glucopyranose.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf	Trace
4	D	2	Total C N O 24 14 1 9	0	0	0

- Molecule 5 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula: $C_8H_{15}NO_6$).



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

- Molecule 6 is water.

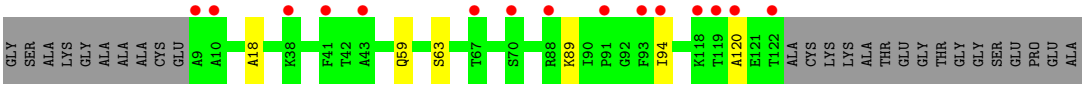
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	A	36	Total O 36 36	0	0
6	B	70	Total O 70 70	0	0
6	C	52	Total O 52 52	0	0

3 Residue-property plots (i)

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.

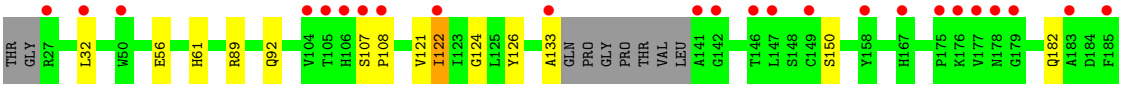
• Molecule 1: RIFIN PfKE01_040007400

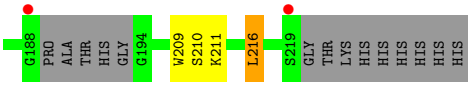
Chain A:



• Molecule 2: KIR2DL protein

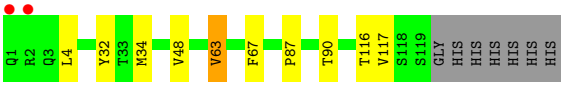
Chain B:





• Molecule 3: nanobody Nb1

Chain C:



• Molecule 4: alpha-L-fucopyranose-(1-6)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain D:

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 31 2 1	Depositor
Cell constants a, b, c, α, β, γ	97.17Å 97.17Å 109.20Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	28.05 – 2.17 28.05 – 2.17	Depositor EDS
% Data completeness (in resolution range)	100.0 (28.05-2.17) 99.9 (28.05-2.17)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	0.98 (at 2.18Å)	Xtriage
Refinement program	BUSTER 2.10.4	Depositor
R, R_{free}	0.221 , 0.232 0.214 , 0.234	Depositor DCC
R_{free} test set	1609 reflections (4.98%)	wwPDB-VP
Wilson B-factor (Å^2)	57.6	Xtriage
Anisotropy	0.078	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.34 , 52.3	EDS
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.33$	Xtriage
Estimated twinning fraction	0.026 for -h,-k,l	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	3380	wwPDB-VP
Average B, all atoms (Å^2)	72.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.91% 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, FUC

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	0.37	0/864	0.53	0/1172
2	B	0.39	0/1454	0.59	0/1969
3	C	0.43	0/939	0.65	0/1271
All	All	0.40	0/3257	0.59	0/4412

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	851	0	857	3	0
2	B	1416	0	1345	9	0
3	C	917	0	867	8	0
4	D	24	0	22	0	0
5	B	14	0	13	0	0
6	A	36	0	0	0	0
6	B	70	0	0	1	0
6	C	52	0	0	0	0
All	All	3380	0	3104	19	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 3.

All (19) 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)
2:B:121:VAL:HG11	2:B:209:TRP:CD2	2.31	0.65
2:B:92:GLN:HA	2:B:122:ILE:HD11	1.82	0.60
3:C:90:THR:HG23	3:C:116:THR:HA	1.85	0.58
2:B:150:SER:HB3	2:B:182:GLN:HG3	1.87	0.56
2:B:107:SER:HB2	2:B:108:PRO:HD3	1.89	0.55
2:B:89:ARG:NH1	6:B:502:HOH:O	2.43	0.51
2:B:124:GLY:HA2	2:B:211:LYS:HA	1.95	0.48
3:C:63:VAL:HG13	3:C:67:PHE:HB2	1.94	0.48
2:B:133:ALA:HB2	2:B:216:LEU:HD21	1.96	0.47
3:C:32:TYR:HB2	3:C:34:MET:CE	2.46	0.46
1:A:89:LYS:HB2	1:A:94:ILE:HG22	1.99	0.45
3:C:32:TYR:HB2	3:C:34:MET:HE2	2.00	0.44
1:A:18:ALA:HB2	1:A:120:ALA:HB2	1.98	0.44
3:C:32:TYR:CB	3:C:34:MET:HE1	2.48	0.44
3:C:32:TYR:CB	3:C:34:MET:CE	2.97	0.43
1:A:63:SER:HB3	2:B:61:HIS:CD2	2.55	0.42
3:C:87:PRO:HA	3:C:117:VAL:HB	2.01	0.42
3:C:32:TYR:HB3	3:C:34:MET:HE1	2.03	0.40
2:B:126:TYR:H	2:B:210:SER:HA	1.87	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	112/140 (80%)	110 (98%)	2 (2%)	0	100	100
2	B	175/204 (86%)	172 (98%)	3 (2%)	0	100	100
3	C	117/126 (93%)	115 (98%)	2 (2%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
All	All	404/470 (86%)	397 (98%)	7 (2%)	0	100 100

There are no Ramachandran outliers to report.

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	92/106 (87%)	91 (99%)	1 (1%)	70 80
2	B	158/176 (90%)	154 (98%)	4 (2%)	42 53
3	C	96/102 (94%)	93 (97%)	3 (3%)	35 43
All	All	346/384 (90%)	338 (98%)	8 (2%)	45 56

All (8) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	59	GLN
2	B	32	LEU
2	B	56	GLU
2	B	122	ILE
2	B	216	LEU
3	C	4	LEU
3	C	48	VAL
3	C	63	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
2	B	61	HIS
3	C	39	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

2 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	$\#\|Z\| > 2$
4	NAG	D	1	4,2	14,14,15	0.32	0	17,19,21	0.79	1 (5%)
4	FUC	D	2	4	10,10,11	0.52	0	14,14,16	0.61	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
4	NAG	D	1	4,2	-	2/6/23/26	0/1/1/1
4	FUC	D	2	4	-	-	0/1/1/1

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
4	D	1	NAG	C1-O5-C5	2.15	115.11	112.19

There are no chirality outliers.

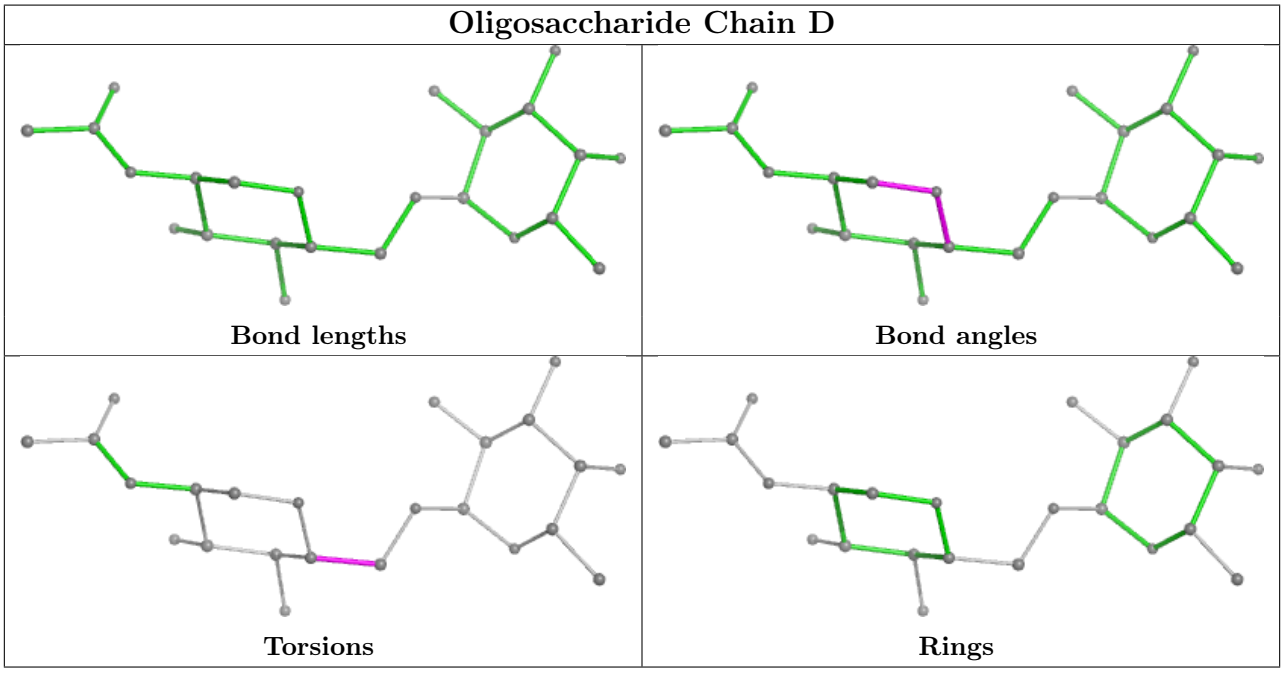
All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	D	1	NAG	O5-C5-C6-O6
4	D	1	NAG	C4-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.



5.6 Ligand geometry (i)

1 ligand is 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	$\#\|Z\| > 2$
5	NAG	B	400	2	14,14,15	0.28	0	17,19,21	0.44	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
5	NAG	B	400	2	-	0/6/23/26	0/1/1/1

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

5.7 Other polymers (i)

There are no such residues in this entry.

5.8 Polymer linkage issues (i)

There are no chain breaks in this entry.

6 Fit of model and data

6.1 Protein, DNA and RNA chains

In the following table, the column labelled '#RSRZ> 2' contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95^{th} 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	114/140 (81%)	0.85	15 (13%)	8	8	51, 76, 122, 136	0
2	B	181/204 (88%)	0.76	26 (14%)	7	7	47, 71, 120, 135	0
3	C	119/126 (94%)	0.20	2 (1%)	69	67	46, 59, 84, 104	0
All	All	414/470 (88%)	0.62	43 (10%)	13	12	46, 68, 117, 136	0

All (43) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	B	177	VAL	6.2
1	A	9	ALA	5.3
2	B	188	GLY	5.0
2	B	141	ALA	4.8
1	A	41	PHE	3.8
2	B	27	ARG	3.8
2	B	179	GLY	3.7
3	C	2	ARG	3.7
2	B	133	ALA	3.7
2	B	167	HIS	3.5
1	A	120	ALA	3.4
2	B	147	LEU	3.3
1	A	10	ALA	3.3
2	B	149	CYS	3.2
2	B	219	SER	3.2
3	C	1	GLN	3.1
2	B	108	PRO	3.0
2	B	158	TYR	2.9
1	A	43	ALA	2.9
2	B	146	THR	2.7
2	B	106	HIS	2.7
2	B	32	LEU	2.7
1	A	94	ILE	2.7

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Mol	Chain	Res	Type	RSRZ
2	B	178	ASN	2.7
2	B	105	THR	2.6
1	A	122	THR	2.5
1	A	91	PRO	2.5
1	A	118	LYS	2.5
2	B	50	TRP	2.4
2	B	176	LYS	2.4
1	A	70	SER	2.4
1	A	88	ARG	2.3
2	B	104	VAL	2.3
2	B	142	GLY	2.3
1	A	93	PHE	2.3
1	A	38	LYS	2.3
2	B	107	SER	2.3
1	A	119	THR	2.2
2	B	175	PRO	2.2
1	A	67	THR	2.2
2	B	183	ALA	2.1
2	B	185	PHE	2.1
2	B	122	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)

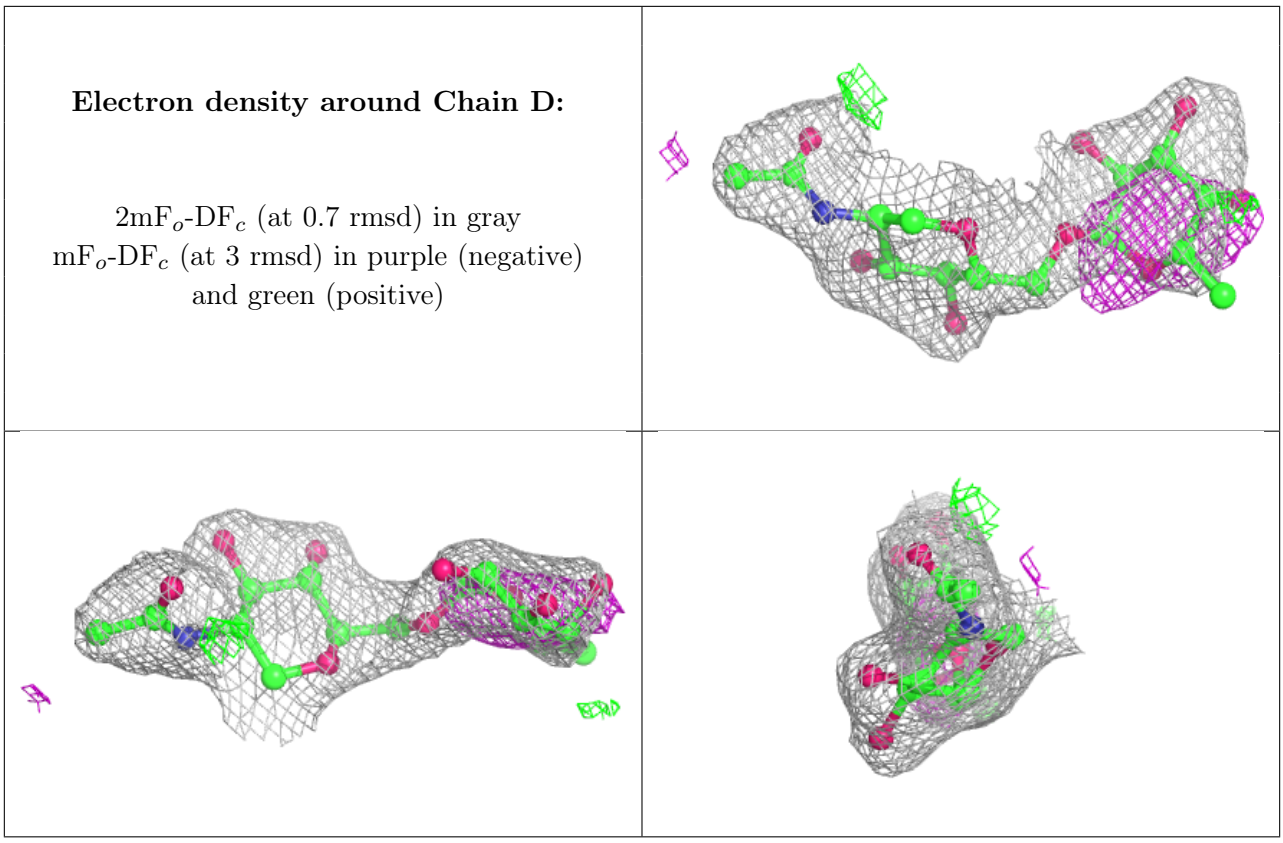
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' 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
4	FUC	D	2	10/11	0.87	0.19	76,78,79,79	0
4	NAG	D	1	14/15	0.92	0.10	62,65,70,73	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

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95^{th} 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
5	NAG	B	400	14/15	0.89	0.10	70,71,72,72	0

6.5 Other polymers

There are no such residues in this entry.