



wwPDB X-ray Structure Validation Summary Report ⓘ

Feb 14, 2017 – 10:57 pm GMT

PDB ID : 5BV7
Title : Crystal structure of human LCAT (L4F, N5D) in complex with Fab of an agonistic antibody
Authors : Piper, D.E.; Romanow, W.G.; Thibault, S.T.; Walker, N.P.C.
Deposited on : 2015-06-04
Resolution : 2.45 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

<http://wwpdb.org/validation/2016/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 1.7.2 (RC1), CSD as538be (2017)
Xtriage (Phenix) : 1.9-1692
EDS : trunk28620
Percentile statistics : 20161228.v01 (using entries in the PDB archive December 28th 2016)
Refmac : 5.8.0135
CCP4 : 6.5.0
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : recalc28949

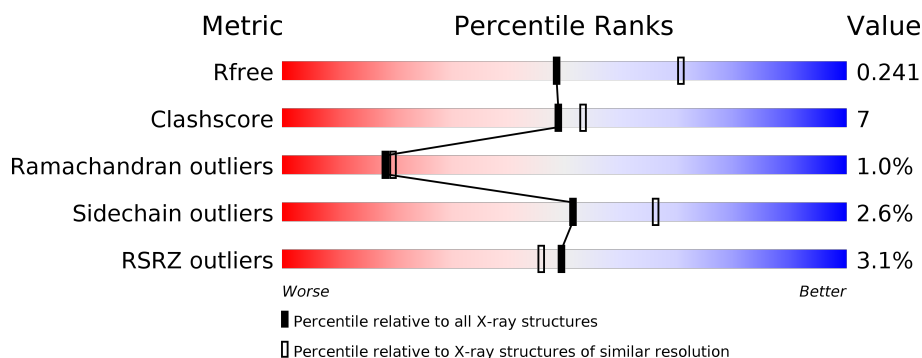
1 Overall quality at a glance ⓘ

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.45 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}	100719	1119 (2.48-2.44)
Clashscore	112137	1193 (2.48-2.44)
Ramachandran outliers	110173	1185 (2.48-2.44)
Sidechain outliers	110143	1185 (2.48-2.44)
RSRZ outliers	101464	1126 (2.48-2.44)

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 on the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria. 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	422	<div> <div>3%</div> <div> <div></div> <div>71%</div> <div>17%</div> <div>•</div> <div>11%</div> </div> </div>
2	L	214	<div> <div>91%</div> <div>7%</div> <div>•</div> </div>
3	H	233	<div> <div>2%</div> <div> <div></div> <div>84%</div> <div>11%</div> <div>5%</div> </div> </div>
4	B	213	<div> <div>5%</div> <div> <div></div> <div>84%</div> <div>15%</div> </div> </div>
5	C	238	<div> <div>5%</div> <div> <div></div> <div>68%</div> <div>21%</div> <div>•</div> <div>8%</div> </div> </div>

2 Entry composition

There are 8 unique types of molecules in this entry. The entry contains 10030 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 Phosphatidylcholine-sterol acyltransferase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	377	Total	C	N	O	S	0	0	0
			3036	1972	510	539	15			

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	4	PHE	LEU	engineered mutation	UNP P04180
A	5	ASP	ASN	engineered mutation	UNP P04180
A	417	GLU	-	expression tag	UNP P04180
A	418	ASN	-	expression tag	UNP P04180
A	419	LEU	-	expression tag	UNP P04180
A	420	TYR	-	expression tag	UNP P04180
A	421	PHE	-	expression tag	UNP P04180
A	422	GLN	-	expression tag	UNP P04180

- Molecule 2 is a protein called 27C3 light chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	L	210	Total	C	N	O	S	0	0	0
			1575	979	270	322	4			

- Molecule 3 is a protein called 27C3 heavy chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	H	222	Total	C	N	O	S	0	0	0
			1657	1044	276	330	7			

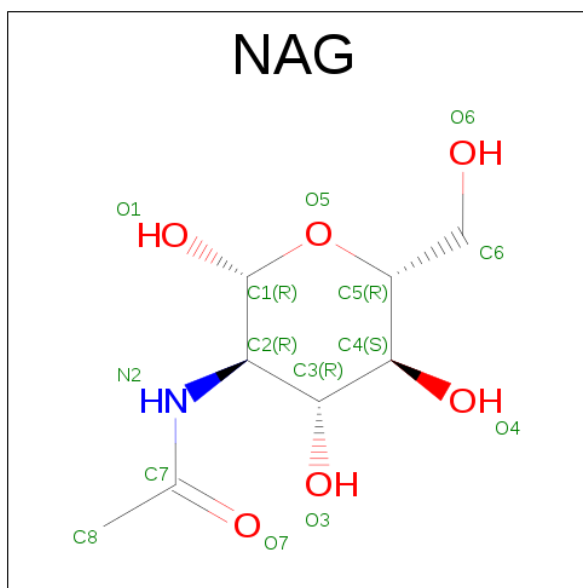
- Molecule 4 is a protein called Fab1 light chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
4	B	212	Total	C	N	O	S	0	0	0
			1592	998	261	327	6			

- Molecule 5 is a protein called Fab1 heavy chain.

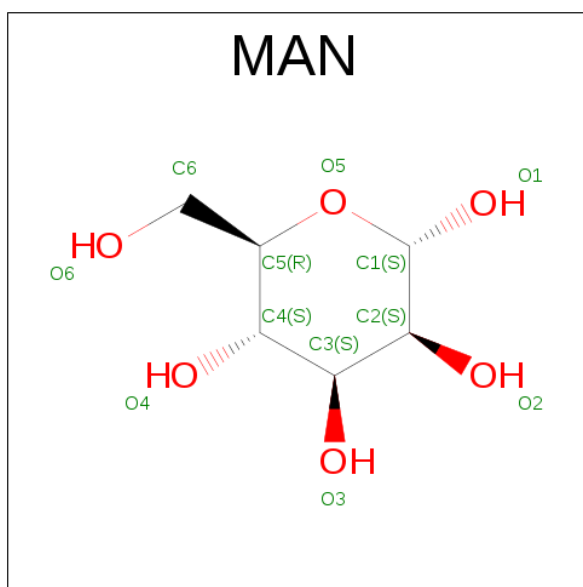
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
5	C	220	Total	C	N	O	S	0	0	0
			1671	1059	281	324	7			

- Molecule 6 is N-ACETYL-D-GLUCOSAMINE (three-letter code: NAG) (formula: $C_8H_{15}NO_6$).



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

- Molecule 7 is ALPHA-D-MANNOSE (three-letter code: MAN) (formula: $C_6H_{12}O_6$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
7	A	1	Total	C	O	0	0
			11	6	5		
7	A	1	Total	C	O	0	0
			11	6	5		
7	A	1	Total	C	O	0	0
			11	6	5		
7	A	1	Total	C	O	0	0
			11	6	5		
7	A	1	Total	C	O	0	0
			11	6	5		

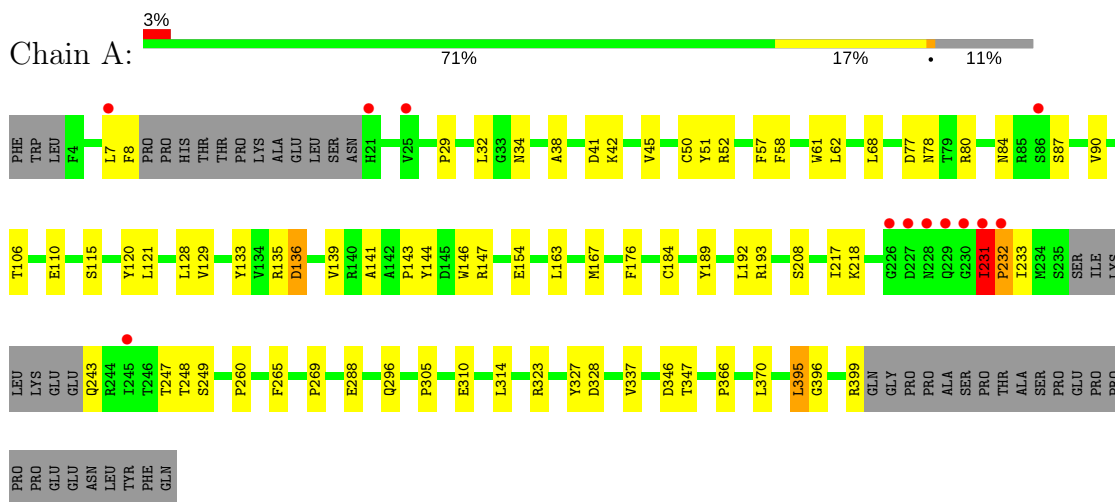
- Molecule 8 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
8	A	118	Total	O	0	0
			118	118		
8	L	107	Total	O	0	0
			107	107		
8	H	98	Total	O	0	0
			98	98		
8	B	52	Total	O	0	0
			52	52		
8	C	13	Total	O	0	0
			13	13		

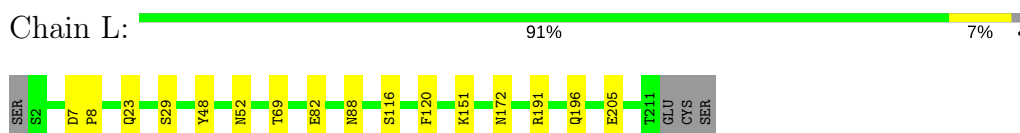
3 Residue-property plots

These plots are drawn for all protein, RNA and DNA 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.

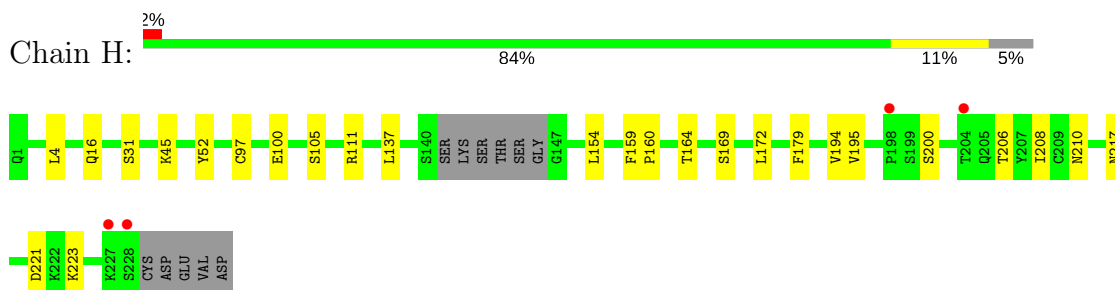
- Molecule 1: Phosphatidylcholine-sterol acyltransferase



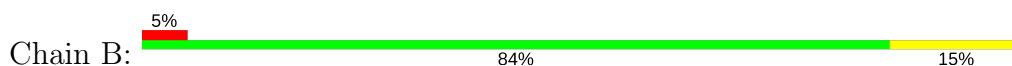
- Molecule 2: 27C3 light chain

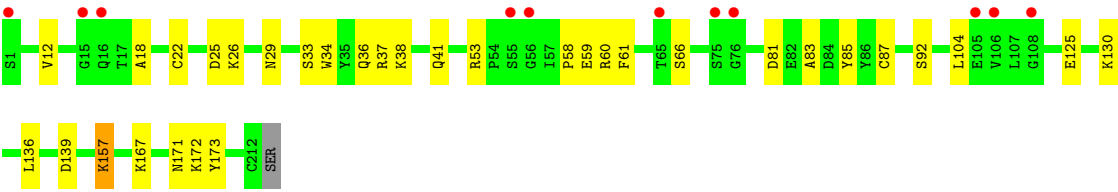


- Molecule 3: 27C3 heavy chain

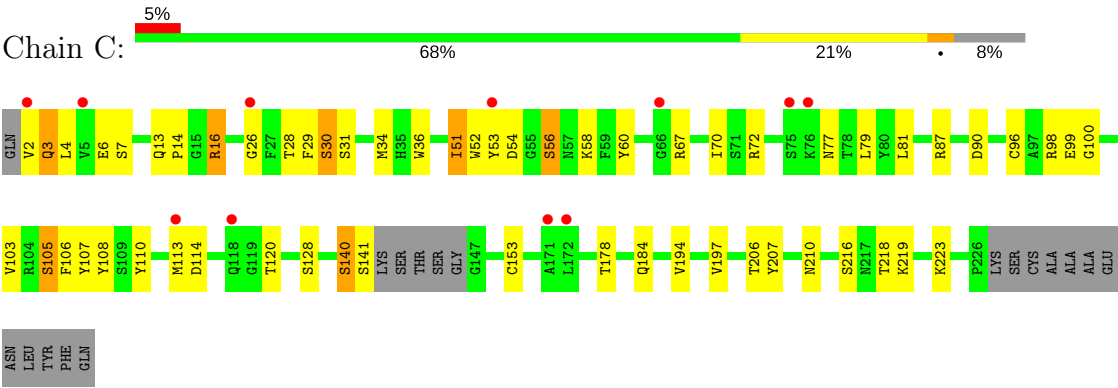


- Molecule 4: Fab1 light chain





● Molecule 5: Fab1 heavy chain



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	57.94Å 127.59Å 256.08Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	29.88 – 2.45 29.88 – 2.45	Depositor EDS
% Data completeness (in resolution range)	93.2 (29.88-2.45) 93.3 (29.88-2.45)	Depositor EDS
R_{merge}	0.11	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.74 (at 2.45Å)	Xtriage
Refinement program	PHENIX	Depositor
R, R_{free}	0.189 , 0.241 0.187 , 0.241	Depositor DCC
R_{free} test set	3226 reflections (4.88%)	DCC
Wilson B-factor (Å ²)	43.8	Xtriage
Anisotropy	0.433	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.30 , 41.3	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	0.94	EDS
Total number of atoms	10030	wwPDB-VP
Average B, all atoms (Å ²)	53.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.91% 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: 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	0.49	0/3132	0.63	1/4272 (0.0%)
2	L	0.52	0/1611	0.61	0/2199
3	H	0.53	0/1697	0.67	0/2316
4	B	0.47	0/1633	0.62	0/2231
5	C	0.45	0/1715	0.60	0/2335
All	All	0.49	0/9788	0.62	1/13353 (0.0%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	1
5	C	0	1
All	All	0	2

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	346	ASP	CB-CG-OD1	5.43	123.19	118.30

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	231	ILE	Peptide
5	C	30	SER	Peptide

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	3036	0	2938	52	1
2	L	1575	0	1519	9	1
3	H	1657	0	1628	13	0
4	B	1592	0	1538	21	0
5	C	1671	0	1608	41	0
6	A	56	0	50	2	0
7	A	55	0	46	1	0
8	A	118	0	0	2	0
8	B	52	0	0	0	0
8	C	13	0	0	1	0
8	H	98	0	0	0	0
8	L	107	0	0	0	0
All	All	10030	0	9327	129	1

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 7.

The worst 5 of 129 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)
4:B:60:ARG:NH2	4:B:81:ASP:OD2	2.08	0.85
5:C:51:ILE:HG21	5:C:72:ARG:HD2	1.61	0.81
1:A:218:LYS:HG3	1:A:347:THR:HG23	1.64	0.79
5:C:13:GLN:HG3	5:C:14:PRO:HD2	1.67	0.76
1:A:45:VAL:HB	1:A:52:ARG:HE	1.55	0.71

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:154:GLU:OE2	2:L:191:ARG:NH1[3_544]	2.11	0.09

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	371/422 (88%)	347 (94%)	18 (5%)	6 (2%)	11	10
2	L	208/214 (97%)	202 (97%)	6 (3%)	0	100	100
3	H	218/233 (94%)	205 (94%)	11 (5%)	2 (1%)	20	23
4	B	210/213 (99%)	193 (92%)	16 (8%)	1 (0%)	32	39
5	C	216/238 (91%)	199 (92%)	14 (6%)	3 (1%)	13	12
All	All	1223/1320 (93%)	1146 (94%)	65 (5%)	12 (1%)	18	19

5 of 12 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	231	ILE
1	A	232	PRO
5	C	56	SER
1	A	136	ASP
4	B	66	SER

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	326/367 (89%)	321 (98%)	5 (2%)	70	80
2	L	175/179 (98%)	172 (98%)	3 (2%)	66	78
3	H	192/202 (95%)	187 (97%)	5 (3%)	51	66
4	B	180/181 (99%)	176 (98%)	4 (2%)	57	71

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
5	C	184/198 (93%)	173 (94%)	11 (6%)	22	30
All	All	1057/1127 (94%)	1029 (97%)	28 (3%)	51	66

5 of 28 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
3	H	217	ASN
4	B	92	SER
5	C	178	THR
4	B	22	CYS
4	B	33	SER

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 18 such sidechains are listed below:

Mol	Chain	Res	Type
2	L	172	ASN
3	H	3	GLN
4	B	41	GLN
2	L	78	GLN
2	L	88	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](#)

There are no carbohydrates in this entry.

5.6 Ligand geometry [i](#)

9 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	501	1	14,14,15	1.83	2 (14%)	15,19,21	1.47	1 (6%)
6	NAG	A	502	1,6	14,14,15	0.34	0	15,19,21	0.51	0
6	NAG	A	503	7,6	14,14,15	0.89	1 (7%)	15,19,21	0.72	0
7	MAN	A	504	7,6	11,11,12	0.88	0	13,15,17	1.66	2 (15%)
7	MAN	A	505	7	11,11,12	0.97	1 (9%)	13,15,17	1.05	1 (7%)
7	MAN	A	506	7	11,11,12	0.73	0	13,15,17	0.93	0
7	MAN	A	507	7	11,11,12	1.11	1 (9%)	13,15,17	1.64	1 (7%)
7	MAN	A	508	7	11,11,12	1.34	1 (9%)	13,15,17	1.21	1 (7%)
6	NAG	A	509	1	14,14,15	0.39	0	15,19,21	0.48	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	501	1	-	0/6/23/26	0/1/1/1
6	NAG	A	502	1,6	-	0/6/23/26	0/1/1/1
6	NAG	A	503	7,6	-	0/6/23/26	0/1/1/1
7	MAN	A	504	7,6	-	0/2/19/22	1/1/1/1
7	MAN	A	505	7	-	0/2/19/22	0/1/1/1
7	MAN	A	506	7	-	0/2/19/22	0/1/1/1
7	MAN	A	507	7	-	0/2/19/22	0/1/1/1
7	MAN	A	508	7	-	0/2/19/22	0/1/1/1
6	NAG	A	509	1	-	0/6/23/26	0/1/1/1

The worst 5 of 6 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	A	503	NAG	O5-C1	-3.07	1.38	1.43
7	A	505	MAN	C4-C5	2.03	1.57	1.53
7	A	507	MAN	C4-C3	2.17	1.57	1.52
7	A	508	MAN	C2-C3	3.12	1.56	1.52
6	A	501	NAG	O5-C1	3.57	1.49	1.43

The worst 5 of 6 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
7	A	505	MAN	O2-C2-C3	-2.35	105.55	110.17
7	A	508	MAN	C1-O5-C5	2.97	116.25	112.17
7	A	504	MAN	C1-C2-C3	2.98	113.43	109.65
7	A	504	MAN	C1-O5-C5	3.75	117.33	112.17
7	A	507	MAN	C1-O5-C5	4.79	118.77	112.17

There are no chirality outliers.

There are no torsion outliers.

All (1) ring outliers are listed below:

Mol	Chain	Res	Type	Atoms
7	A	504	MAN	C1-C2-C3-C4-C5-O5

3 monomers are involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
6	A	501	NAG	2	0
7	A	505	MAN	1	0
7	A	507	MAN	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 [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	377/422 (89%)	-0.05	12 (3%) 48 44	25, 47, 76, 104	0
2	L	210/214 (98%)	-0.36	0 100 100	30, 42, 60, 73	0
3	H	222/233 (95%)	-0.18	4 (1%) 69 65	25, 42, 77, 90	0
4	B	212/213 (99%)	0.17	11 (5%) 28 26	32, 63, 96, 105	0
5	C	220/238 (92%)	0.34	11 (5%) 30 27	41, 68, 91, 98	0
All	All	1241/1320 (94%)	-0.02	38 (3%) 49 46	25, 50, 87, 105	0

The worst 5 of 38 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	230	GLY	6.6
1	A	229	GLN	4.0
1	A	231	ILE	3.8
1	A	228	ASN	3.5
1	A	21	HIS	3.4

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](#)

There are no carbohydrates in this entry.

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. LLDF column lists the quality of electron

density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. 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	LLDF	B-factors(Å ²)	Q<0.9
6	NAG	A	502	14/15	0.96	0.18	1.79	46,53,56,58	0
7	MAN	A	508	11/12	0.94	0.16	0.98	48,50,56,57	0
6	NAG	A	501	14/15	0.57	0.33	-	76,91,99,99	0
6	NAG	A	509	14/15	0.84	0.38	-	78,93,100,105	0
7	MAN	A	505	11/12	0.95	0.12	-	52,61,66,69	0
6	NAG	A	503	14/15	0.96	0.20	-	42,54,61,64	0
7	MAN	A	504	11/12	0.96	0.13	-	43,46,50,52	0
7	MAN	A	506	11/12	0.89	0.27	-	77,82,90,91	0
7	MAN	A	507	11/12	0.89	0.24	-	57,70,73,75	0

6.5 Other polymers

There are no such residues in this entry.