



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 5, 2026 – 06:55 AM UTC

PDB ID : 4LAJ / pdb_00004laJ
Title : Crystal structure of HIV-1 YU2 envelope gp120 glycoprotein in complex with CD4-mimetic miniprotein, M48U1, and llama single-domain, broadly neutralizing, co-receptor binding site antibody, JM4
Authors : Acharya, P.; Luongo, T.S.; Kwong, P.D.
Deposited on : 2013-06-20
Resolution : 2.14 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

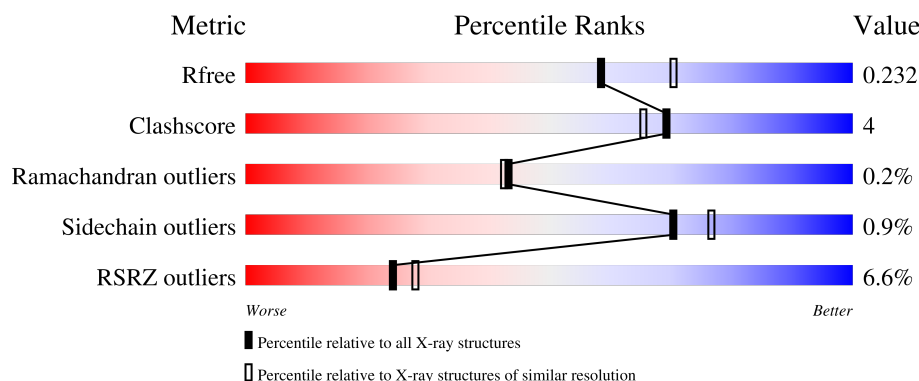
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.14 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	3689 (2.16-2.12)
Clashscore	190562	3812 (2.16-2.12)
Ramachandran outliers	187476	3773 (2.16-2.12)
Sidechain outliers	187428	3772 (2.16-2.12)
RSRZ outliers	180081	3691 (2.16-2.12)

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	376	5% 86% 5% 9%
1	B	376	4% 82% 8% 9%
1	F	376	4% 85% • 11%
1	J	376	6% 85% 5% 10%
2	C	28	11% 82% 14% •

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Mol	Chain	Length	Quality of chain
2	D	28	11% 75% 21%
2	G	28	14% 71% 21% 7%
2	K	28	11% 82% 14%
3	H	129	5% 85% 10%
3	I	129	6% 88% 8%
3	L	129	8% 82% 10% 5%
3	M	129	14% 84% 9% 5%

2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 16384 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 HIV-1 YU2 gp120 envelope glycoprotein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	J	337	Total	C	N	O	S	0	6	0
			2660	1669	465	506	20			
1	F	334	Total	C	N	O	S	0	5	0
			2633	1654	461	498	20			
1	A	343	Total	C	N	O	S	0	4	0
			2702	1693	474	515	20			
1	B	341	Total	C	N	O	S	0	3	0
			2680	1681	470	509	20			

- Molecule 2 is a protein called CD4-mimetic miniprotein M48U1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	K	28	Total	C	N	O	S	0	1	1
			214	136	39	33	6			
2	D	28	Total	C	N	O	S	0	0	1
			209	133	38	32	6			
2	G	28	Total	C	N	O	S	0	0	1
			209	133	38	32	6			
2	C	28	Total	C	N	O	S	0	0	1
			209	133	38	32	6			

- Molecule 3 is a protein called Llama single domain antibody, JM4.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	H	124	Total	C	N	O	S	0	0	0
			944	589	156	193	6			
3	M	123	Total	C	N	O	S	0	0	0
			939	586	155	192	6			
3	L	123	Total	C	N	O	S	0	0	0
			939	586	155	192	6			
3	I	125	Total	C	N	O	S	0	0	0
			949	592	157	194	6			

- Molecule 4 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula: $C_8H_{15}NO_6$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	J	1	Total	C	N	O	0	0
			14	8	1	5		
4	J	1	Total	C	N	O	0	0
			14	8	1	5		
4	J	1	Total	C	N	O	0	0
			14	8	1	5		
4	J	1	Total	C	N	O	0	0
			14	8	1	5		
4	J	1	Total	C	N	O	0	0
			14	8	1	5		
4	J	1	Total	C	N	O	0	0
			14	8	1	5		
4	J	1	Total	C	N	O	0	0
			14	8	1	5		
4	J	1	Total	C	N	O	0	0
			14	8	1	5		
4	F	1	Total	C	N	O	0	0
			14	8	1	5		
4	F	1	Total	C	N	O	0	0
			14	8	1	5		
4	F	1	Total	C	N	O	0	0
			14	8	1	5		

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

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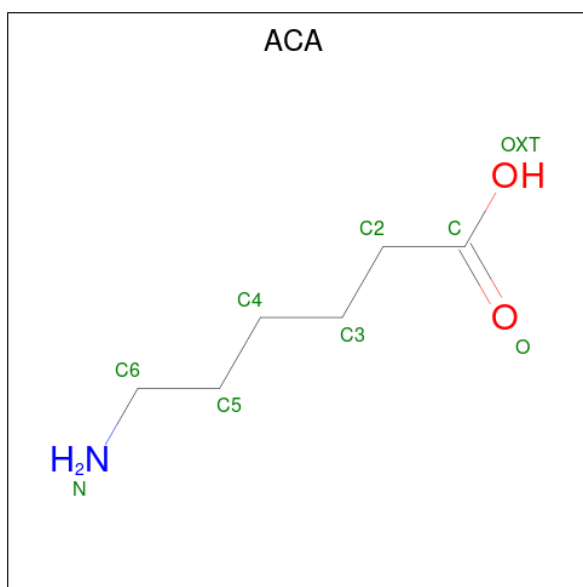
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	B	1	Total	C	N	O	0	0
			14	8	1	5		
4	B	1	Total	C	N	O	0	0
			14	8	1	5		

- Molecule 5 is 1,2-ETHANEDIOL (CCD ID: EDO) (formula: $C_2H_6O_2$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	J	1	Total	C	O	0	0
			4	2	2		
5	A	1	Total	C	O	0	0
			4	2	2		
5	A	1	Total	C	O	0	0
			4	2	2		
5	A	1	Total	C	O	0	0
			4	2	2		
5	B	1	Total	C	O	0	0
			4	2	2		
5	B	1	Total	C	O	0	0
			4	2	2		
5	B	1	Total	C	O	0	0
			4	2	2		

- Molecule 6 is 6-AMINOHEXANOIC ACID (CCD ID: ACA) (formula: $C_6H_{13}NO_2$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
6	B	1	Total	C	N	O	0	0
			9	6	1	2		

- Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	J	73	Total	O	0	0
			73	73		
7	F	111	Total	O	0	0
			111	111		
7	A	114	Total	O	0	0
			114	114		
7	B	139	Total	O	0	0
			139	139		
7	K	4	Total	O	0	0
			4	4		
7	D	10	Total	O	0	0
			10	10		
7	G	3	Total	O	0	0
			3	3		
7	C	10	Total	O	0	0
			10	10		
7	H	37	Total	O	0	0
			37	37		
7	M	9	Total	O	0	0
			9	9		
7	L	25	Total	O	0	0
			25	25		

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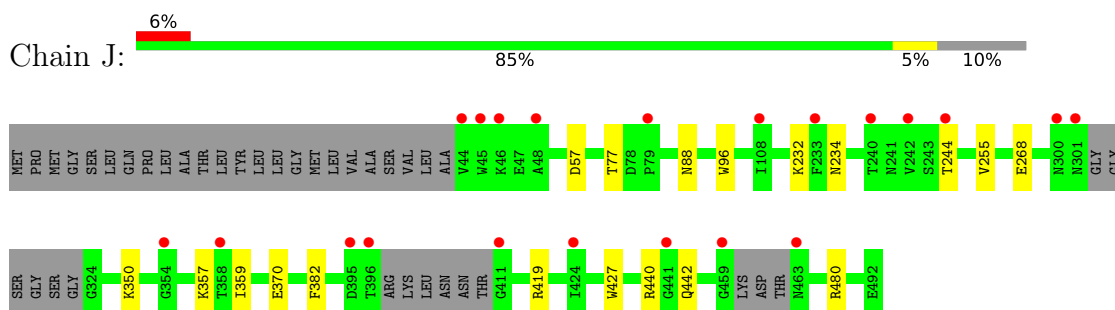
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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	I	35	Total	O	0	0
			35	35		

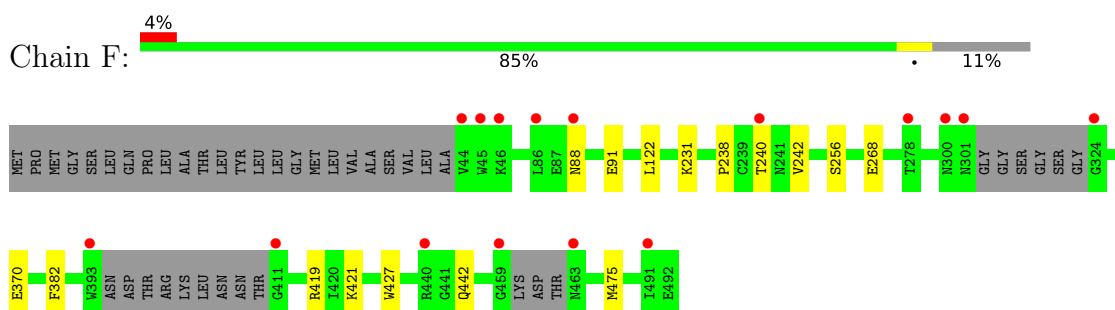
3 Residue-property plots [i](#)

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.

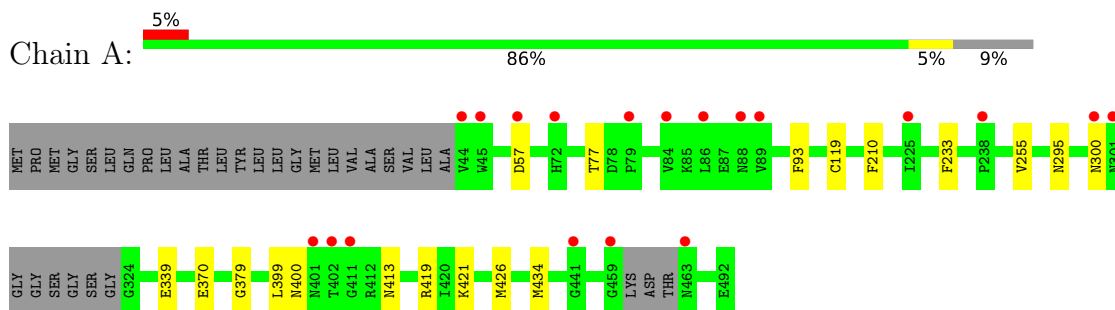
- Molecule 1: HIV-1 YU2 gp120 envelope glycoprotein



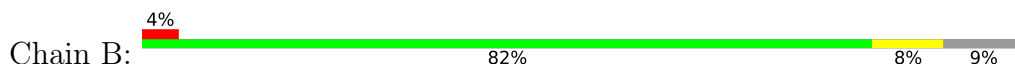
- Molecule 1: HIV-1 YU2 gp120 envelope glycoprotein

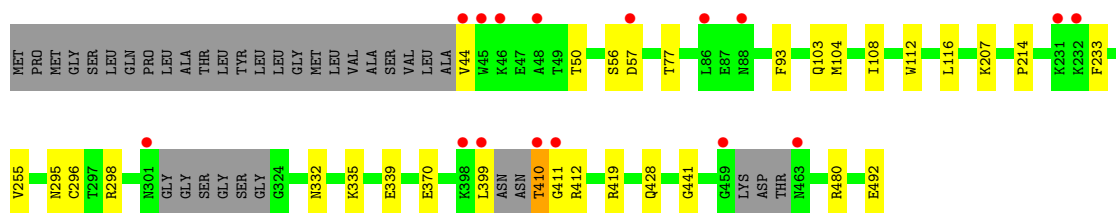


- Molecule 1: HIV-1 YU2 gp120 envelope glycoprotein

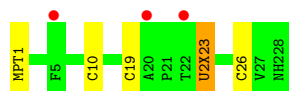
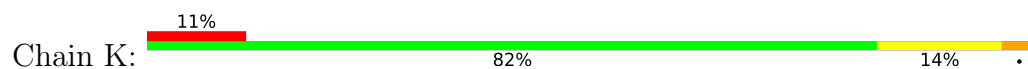


- Molecule 1: HIV-1 YU2 gp120 envelope glycoprotein

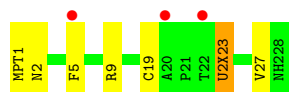
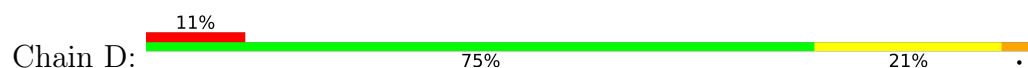




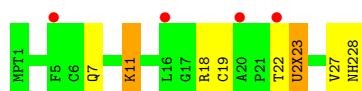
• Molecule 2: CD4-mimetic miniprotein M48U1



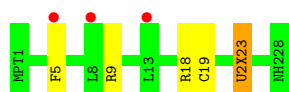
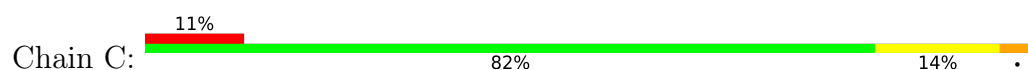
• Molecule 2: CD4-mimetic miniprotein M48U1



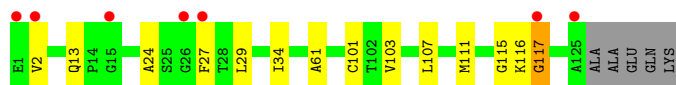
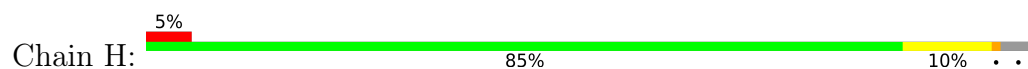
• Molecule 2: CD4-mimetic miniprotein M48U1

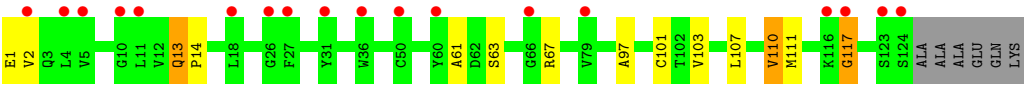


• Molecule 2: CD4-mimetic miniprotein M48U1

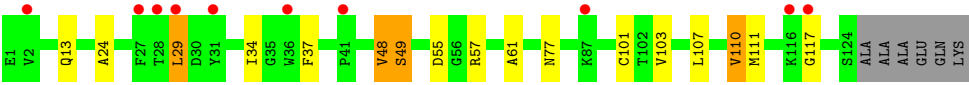
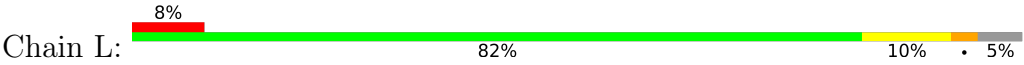


• Molecule 3: Llama single domain antibody, JM4

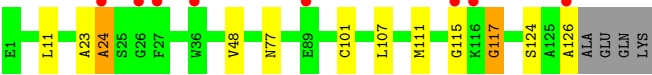
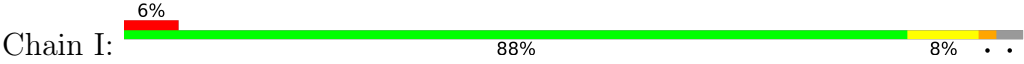




• Molecule 3: Llama single domain antibody, JM4



• Molecule 3: Llama single domain antibody, JM4



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	96.77Å 86.22Å 144.85Å 90.00° 102.88° 90.00°	Depositor
Resolution (Å)	38.80 – 2.14 38.80 – 2.14	Depositor EDS
% Data completeness (in resolution range)	76.7 (38.80-2.14) 72.1 (38.80-2.14)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.11	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.84 (at 2.14Å)	Xtriage
Refinement program	PHENIX (phenix.refine: 1.8.2_1309)	Depositor
R, R_{free}	0.185 , 0.227 0.193 , 0.232	Depositor DCC
R_{free} test set	4979 reflections (3.84%)	wwPDB-VP
Wilson B-factor (Å ²)	29.5	Xtriage
Anisotropy	0.350	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 49.2	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	0.94	EDS
Total number of atoms	16384	wwPDB-VP
Average B, all atoms (Å ²)	60.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 8.68% 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: U2X, NAG, ACA, NH2, DPR, MPT, EDO

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	0.34	0/2783	0.67	0/3775
1	B	0.34	0/2754	0.69	0/3734
1	F	0.33	0/2706	0.66	1/3670 (0.0%)
1	J	0.34	0/2746	0.69	2/3724 (0.1%)
2	C	0.83	1/176 (0.6%)	1.13	3/231 (1.3%)
2	D	0.86	1/176 (0.6%)	0.95	2/231 (0.9%)
2	G	0.83	1/176 (0.6%)	0.71	0/231
2	K	0.51	1/184 (0.5%)	0.97	1/242 (0.4%)
3	H	0.35	0/962	0.77	1/1304 (0.1%)
3	I	0.33	0/967	0.74	1/1311 (0.1%)
3	L	0.37	0/957	0.75	1/1297 (0.1%)
3	M	0.33	0/957	0.77	1/1297 (0.1%)
All	All	0.37	4/15544 (0.0%)	0.71	13/21047 (0.1%)

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
2	D	0	1
2	K	0	2
3	H	0	1
3	I	0	1
3	L	0	1
3	M	0	1
All	All	0	7

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	19	CYS	C-N	10.65	1.48	1.33
2	G	19	CYS	C-N	10.22	1.47	1.33
2	C	19	CYS	C-N	10.16	1.47	1.33
2	K	19	CYS	C-N	5.60	1.41	1.33

The worst 5 of 13 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	19	CYS	CA-C-N	8.08	136.24	121.70
2	C	19	CYS	C-N-CA	8.08	136.24	121.70
3	M	117	GLY	N-CA-C	7.92	120.63	111.36
2	C	19	CYS	O-C-N	-6.95	114.92	122.85
1	J	440	ARG	N-CA-C	-6.51	102.14	110.53

There are no chirality outliers.

5 of 7 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
2	D	1	MPT	Mainchain
3	H	117	GLY	Peptide
2	K	1	MPT	Peptide
3	L	117	GLY	Peptide
3	M	117	GLY	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	2702	0	2627	16	0
1	B	2680	0	2605	24	0
1	F	2633	0	2557	15	0
1	J	2660	0	2584	13	0
2	C	209	0	212	5	0
2	D	209	0	212	3	0
2	G	209	0	212	11	0
2	K	214	0	220	7	0
3	H	944	0	901	7	0
3	I	949	0	906	10	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	L	939	0	896	9	0
3	M	939	0	896	8	0
4	A	126	0	117	2	0
4	B	112	0	104	2	0
4	F	126	0	117	3	0
4	J	126	0	117	4	0
5	A	12	0	18	4	0
5	B	12	0	18	3	0
5	J	4	0	6	1	0
6	B	9	0	6	1	0
7	A	114	0	0	0	0
7	B	139	0	0	3	0
7	C	10	0	0	1	0
7	D	10	0	0	0	0
7	F	111	0	0	1	0
7	G	3	0	0	0	0
7	H	37	0	0	0	0
7	I	35	0	0	3	0
7	J	73	0	0	0	0
7	K	4	0	0	0	0
7	L	25	0	0	0	0
7	M	9	0	0	0	0
All	All	16384	0	15331	110	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 4.

The worst 5 of 110 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:K:10:CYS:CB	2:K:26:CYS:SG	2.24	1.25
2:K:10:CYS:SG	2:K:26:CYS:SG	1.05	0.96
2:K:10:CYS:SG	2:K:26:CYS:CB	2.63	0.86
1:B:296:CYS:SG	7:B:717:HOH:O	2.33	0.85
1:J:370:GLU:HG2	2:K:23:U2X:H71	1.59	0.85

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	342/376 (91%)	326 (95%)	15 (4%)	1 (0%)	36	33
1	B	336/376 (89%)	323 (96%)	13 (4%)	0	100	100
1	F	330/376 (88%)	317 (96%)	12 (4%)	1 (0%)	36	33
1	J	336/376 (89%)	322 (96%)	14 (4%)	0	100	100
2	C	24/28 (86%)	24 (100%)	0	0	100	100
2	D	24/28 (86%)	24 (100%)	0	0	100	100
2	G	24/28 (86%)	24 (100%)	0	0	100	100
2	K	25/28 (89%)	23 (92%)	2 (8%)	0	100	100
3	H	122/129 (95%)	118 (97%)	4 (3%)	0	100	100
3	I	123/129 (95%)	118 (96%)	4 (3%)	1 (1%)	16	9
3	L	121/129 (94%)	116 (96%)	4 (3%)	1 (1%)	16	9
3	M	121/129 (94%)	117 (97%)	4 (3%)	0	100	100
All	All	1928/2132 (90%)	1852 (96%)	72 (4%)	4 (0%)	43	42

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	F	88	ASN
1	A	413	ASN
3	I	24	ALA
3	L	29	LEU

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	307/328 (94%)	306 (100%)	1 (0%)	86	90
1	B	303/328 (92%)	302 (100%)	1 (0%)	86	90
1	F	297/328 (90%)	296 (100%)	1 (0%)	86	90
1	J	302/328 (92%)	301 (100%)	1 (0%)	86	90
2	C	20/20 (100%)	20 (100%)	0	100	100
2	D	20/20 (100%)	18 (90%)	2 (10%)	7	3
2	G	20/20 (100%)	19 (95%)	1 (5%)	22	17
2	K	21/20 (105%)	21 (100%)	0	100	100
3	H	103/106 (97%)	102 (99%)	1 (1%)	68	74
3	I	103/106 (97%)	101 (98%)	2 (2%)	50	55
3	L	103/106 (97%)	100 (97%)	3 (3%)	37	38
3	M	103/106 (97%)	101 (98%)	2 (2%)	50	55
All	All	1702/1816 (94%)	1687 (99%)	15 (1%)	70	77

5 of 15 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
3	H	13	GLN
3	I	48	VAL
3	M	13	GLN
3	I	124	SER
3	L	48	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 11 such sidechains are listed below:

Mol	Chain	Res	Type
3	H	82	GLN
3	L	82	GLN
3	I	84	ASN
3	I	82	GLN
1	B	229	ASN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

8 non-standard protein/DNA/RNA residues 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	U2X	G	23	2	19,20,21	2.61	4 (21%)	20,25,27	1.42	4 (20%)
2	U2X	D	23	2	19,20,21	2.54	4 (21%)	20,25,27	1.44	4 (20%)
2	U2X	C	23	2	19,20,21	2.57	5 (26%)	20,25,27	1.41	3 (15%)
2	U2X	K	23	2	19,20,21	2.64	4 (21%)	20,25,27	1.37	3 (15%)

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	U2X	G	23	2	-	3/10/19/21	0/2/2/2
2	U2X	D	23	2	-	3/10/19/21	0/2/2/2
2	U2X	C	23	2	-	3/10/19/21	0/2/2/2
2	U2X	K	23	2	-	5/10/19/21	0/2/2/2

The worst 5 of 17 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	K	23	U2X	CE2-CD2	8.54	1.52	1.38
2	G	23	U2X	CE2-CD2	8.39	1.52	1.38
2	C	23	U2X	CE2-CD2	8.27	1.52	1.38
2	D	23	U2X	CE2-CD2	8.13	1.52	1.38
2	K	23	U2X	CE1-CD1	5.14	1.47	1.38

The worst 5 of 14 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	23	U2X	C2-C3-C7	2.99	119.39	111.42

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	G	23	U2X	C2-C3-C7	2.98	119.37	111.42
2	K	23	U2X	C2-C3-C7	2.86	119.04	111.42
2	G	23	U2X	OH-C7-C3	2.82	117.35	108.73
2	C	23	U2X	C2-C3-C7	2.79	118.87	111.42

There are no chirality outliers.

5 of 14 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	G	23	U2X	C2-C3-C7-OH
2	G	23	U2X	C4-C3-C7-OH
2	K	23	U2X	C2-C3-C7-OH
2	K	23	U2X	C4-C3-C7-OH
2	D	23	U2X	C2-C3-C7-OH

There are no ring outliers.

4 monomers are involved in 13 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	G	23	U2X	5	0
2	D	23	U2X	2	0
2	C	23	U2X	3	0
2	K	23	U2X	3	0

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

43 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
4	NAG	F	501	1	14,14,15	0.26	0	17,19,21	0.57	0
4	NAG	F	502	1	14,14,15	0.31	0	17,19,21	0.63	0
4	NAG	A	505	1	14,14,15	0.18	0	17,19,21	0.48	0
4	NAG	A	502	-	14,14,15	0.31	0	17,19,21	0.56	0
4	NAG	A	506	1	14,14,15	0.40	0	17,19,21	0.50	0
5	EDO	B	511	-	3,3,3	0.42	0	2,2,2	0.38	0
4	NAG	A	507	1	14,14,15	0.30	0	17,19,21	0.43	0
5	EDO	A	510	-	3,3,3	0.39	0	2,2,2	0.32	0
4	NAG	A	503	1	14,14,15	0.23	0	17,19,21	0.55	0
5	EDO	A	512	-	3,3,3	0.36	0	2,2,2	0.26	0
4	NAG	J	506	1	14,14,15	0.25	0	17,19,21	0.43	0
4	NAG	J	501	1	14,14,15	0.36	0	17,19,21	0.47	0
4	NAG	F	506	1	14,14,15	0.48	0	17,19,21	0.75	1 (5%)
4	NAG	A	508	1	14,14,15	0.47	0	17,19,21	0.94	1 (5%)
4	NAG	J	508	1	14,14,15	0.29	0	17,19,21	0.41	0
4	NAG	J	507	1	14,14,15	0.32	0	17,19,21	0.42	0
4	NAG	F	508	1	14,14,15	0.16	0	17,19,21	0.46	0
4	NAG	F	507	1	14,14,15	0.20	0	17,19,21	0.52	0
4	NAG	B	508	1	14,14,15	0.42	0	17,19,21	0.74	0
5	EDO	J	510	-	3,3,3	0.42	0	2,2,2	0.38	0
5	EDO	B	510	-	3,3,3	0.42	0	2,2,2	0.37	0
4	NAG	B	505	1	14,14,15	0.32	0	17,19,21	0.46	0
5	EDO	A	511	-	3,3,3	0.29	0	2,2,2	0.57	0
4	NAG	J	503	1	14,14,15	0.25	0	17,19,21	1.08	1 (5%)
4	NAG	B	501	1	14,14,15	0.19	0	17,19,21	0.67	0
4	NAG	F	503	1	14,14,15	0.35	0	17,19,21	0.51	0
4	NAG	J	505	-	14,14,15	0.25	0	17,19,21	0.35	0
4	NAG	A	504	1	14,14,15	0.25	0	17,19,21	0.65	0
6	ACA	B	512	-	8,8,8	0.71	0	8,8,8	0.95	0
4	NAG	A	509	1	14,14,15	0.27	0	17,19,21	0.38	0
4	NAG	J	504	1	14,14,15	0.19	0	17,19,21	0.55	0
4	NAG	F	504	1	14,14,15	0.29	0	17,19,21	0.67	0
4	NAG	F	509	-	14,14,15	0.93	1 (7%)	17,19,21	0.67	0
4	NAG	B	506	1	14,14,15	0.55	0	17,19,21	0.41	0
4	NAG	B	502	-	14,14,15	0.34	0	17,19,21	0.65	0
4	NAG	B	507	1	14,14,15	0.46	0	17,19,21	0.43	0
4	NAG	B	503	1	14,14,15	0.38	0	17,19,21	0.54	0
4	NAG	J	502	1	14,14,15	0.13	0	17,19,21	0.63	0
4	NAG	F	505	1	14,14,15	0.33	0	17,19,21	0.47	0
4	NAG	J	509	1	14,14,15	0.23	0	17,19,21	0.49	0
4	NAG	B	504	1	14,14,15	0.20	0	17,19,21	0.61	0
5	EDO	B	509	-	3,3,3	0.42	0	2,2,2	0.38	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
4	NAG	A	501	1	14,14,15	0.14	0	17,19,21	0.58	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	F	501	1	-	2/6/23/26	0/1/1/1
4	NAG	F	502	1	-	2/6/23/26	0/1/1/1
4	NAG	A	505	1	-	0/6/23/26	0/1/1/1
4	NAG	A	502	-	-	3/6/23/26	0/1/1/1
4	NAG	A	506	1	-	1/6/23/26	0/1/1/1
5	EDO	B	511	-	-	0/1/1/1	-
4	NAG	A	507	1	-	0/6/23/26	0/1/1/1
5	EDO	A	510	-	-	1/1/1/1	-
4	NAG	A	503	1	-	3/6/23/26	0/1/1/1
5	EDO	A	512	-	-	1/1/1/1	-
4	NAG	J	506	1	-	2/6/23/26	0/1/1/1
4	NAG	J	501	1	-	2/6/23/26	0/1/1/1
4	NAG	F	506	1	-	0/6/23/26	0/1/1/1
4	NAG	A	508	1	-	4/6/23/26	0/1/1/1
4	NAG	J	508	1	-	2/6/23/26	0/1/1/1
4	NAG	J	507	1	-	1/6/23/26	0/1/1/1
4	NAG	F	508	1	-	2/6/23/26	0/1/1/1
4	NAG	F	507	1	-	0/6/23/26	0/1/1/1
4	NAG	B	508	1	-	2/6/23/26	0/1/1/1
5	EDO	J	510	-	-	0/1/1/1	-
5	EDO	B	510	-	-	0/1/1/1	-
4	NAG	B	505	1	-	1/6/23/26	0/1/1/1
5	EDO	A	511	-	-	1/1/1/1	-
4	NAG	J	503	1	-	5/6/23/26	0/1/1/1
4	NAG	B	501	1	-	2/6/23/26	0/1/1/1
4	NAG	F	503	1	-	1/6/23/26	0/1/1/1
4	NAG	J	505	-	-	2/6/23/26	0/1/1/1
4	NAG	A	504	1	-	0/6/23/26	0/1/1/1
6	ACA	B	512	-	-	0/6/6/6	-
4	NAG	A	509	1	-	2/6/23/26	0/1/1/1
4	NAG	J	504	1	-	0/6/23/26	0/1/1/1

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
4	NAG	F	504	1	-	0/6/23/26	0/1/1/1
4	NAG	F	509	-	-	0/6/23/26	0/1/1/1
4	NAG	B	506	1	-	0/6/23/26	0/1/1/1
4	NAG	B	502	-	-	2/6/23/26	0/1/1/1
4	NAG	B	507	1	-	0/6/23/26	0/1/1/1
4	NAG	B	503	1	-	2/6/23/26	0/1/1/1
4	NAG	J	502	1	-	2/6/23/26	0/1/1/1
4	NAG	F	505	1	-	0/6/23/26	0/1/1/1
4	NAG	J	509	1	-	2/6/23/26	0/1/1/1
4	NAG	B	504	1	-	0/6/23/26	0/1/1/1
5	EDO	B	509	-	-	0/1/1/1	-
4	NAG	A	501	1	-	2/6/23/26	0/1/1/1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	F	509	NAG	O5-C1	-2.87	1.38	1.43

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	J	503	NAG	C2-N2-C7	3.01	126.94	122.90
4	A	508	NAG	C1-O5-C5	2.91	116.08	112.19
4	F	506	NAG	C1-O5-C5	2.82	115.96	112.19

There are no chirality outliers.

5 of 52 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	508	NAG	C4-C5-C6-O6
4	A	508	NAG	O5-C5-C6-O6
4	A	509	NAG	O5-C5-C6-O6
4	B	508	NAG	O5-C5-C6-O6
4	J	501	NAG	C4-C5-C6-O6

There are no ring outliers.

12 monomers are involved in 20 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	502	NAG	2	0

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Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	A	510	EDO	1	0
5	A	512	EDO	3	0
5	J	510	EDO	1	0
5	B	510	EDO	2	0
4	J	503	NAG	2	0
4	J	505	NAG	1	0
6	B	512	ACA	1	0
4	F	509	NAG	3	0
4	B	502	NAG	2	0
4	J	502	NAG	1	0
5	B	509	EDO	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	343/376 (91%)	0.38	19 (5%)	30 35	22, 50, 97, 160	4 (1%)
1	B	341/376 (90%)	0.25	16 (4%)	36 41	29, 45, 87, 140	3 (0%)
1	F	334/376 (88%)	0.39	16 (4%)	35 41	26, 53, 97, 135	4 (1%)
1	J	337/376 (89%)	0.62	21 (6%)	26 30	27, 60, 102, 133	6 (1%)
2	C	24/28 (85%)	0.80	3 (12%)	8 9	21, 49, 70, 72	0
2	D	24/28 (85%)	0.67	3 (12%)	8 9	21, 51, 70, 76	0
2	G	24/28 (85%)	1.08	4 (16%)	4 5	21, 66, 81, 88	0
2	K	24/28 (85%)	1.04	3 (12%)	8 9	21, 60, 79, 86	1 (4%)
3	H	124/129 (96%)	0.49	7 (5%)	30 34	35, 53, 83, 131	0
3	I	125/129 (96%)	0.42	8 (6%)	25 29	34, 54, 83, 117	0
3	L	123/129 (95%)	0.71	10 (8%)	18 20	38, 63, 87, 113	0
3	M	123/129 (95%)	1.17	18 (14%)	6 7	47, 92, 134, 156	0
All	All	1946/2132 (91%)	0.51	128 (6%)	24 28	21, 55, 103, 160	18 (0%)

The worst 5 of 128 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
3	H	27	PHE	6.0
3	I	27	PHE	5.3
3	H	125	ALA	5.3
1	B	45	TRP	4.9
1	B	410	THR	4.7

6.2 Non-standard residues in protein, DNA, RNA chains [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
2	DPR	C	21	7/8	0.84	0.13	19,19,24,25	0
2	DPR	G	21	7/8	0.87	0.14	19,19,24,25	0
2	DPR	D	21	7/8	0.88	0.11	19,19,24,25	0
2	DPR	K	21	7/8	0.89	0.16	19,19,24,25	0
2	U2X	K	23	19/20	0.90	0.11	35,46,57,59	0
2	U2X	D	23	19/20	0.93	0.09	32,39,47,47	0
2	U2X	C	23	19/20	0.93	0.09	25,38,46,50	0
2	U2X	G	23	19/20	0.95	0.08	35,41,50,58	0

6.3 Carbohydrates [i](#)

There are no oligosaccharides 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. 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
4	NAG	F	503	14/15	0.46	0.20	115,130,142,143	0
4	NAG	A	508	14/15	0.67	0.20	72,81,90,92	0
4	NAG	J	502	14/15	0.69	0.17	91,95,98,103	0
4	NAG	J	503	14/15	0.69	0.11	97,104,107,107	0
4	NAG	J	501	14/15	0.72	0.14	90,98,103,104	0
4	NAG	F	506	14/15	0.74	0.15	84,89,93,94	0
4	NAG	J	505	14/15	0.74	0.18	98,109,122,128	0
4	NAG	B	502	14/15	0.75	0.18	47,79,94,94	0
4	NAG	J	506	14/15	0.76	0.12	90,94,104,106	0
4	NAG	A	502	14/15	0.76	0.20	57,75,97,100	0
4	NAG	A	501	14/15	0.78	0.11	66,75,80,86	0
4	NAG	B	508	14/15	0.79	0.14	50,72,78,83	0
4	NAG	A	503	14/15	0.80	0.12	82,85,94,94	0
4	NAG	J	509	14/15	0.82	0.11	84,93,103,104	0
4	NAG	F	501	14/15	0.83	0.12	62,70,79,87	0
4	NAG	B	501	14/15	0.83	0.11	61,69,76,80	0
5	EDO	B	510	4/4	0.83	0.25	80,81,81,84	0
4	NAG	J	507	14/15	0.84	0.11	81,85,96,98	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
5	EDO	J	510	4/4	0.84	0.25	78,79,79,83	0
4	NAG	B	503	14/15	0.84	0.11	73,84,89,91	0
4	NAG	B	506	14/15	0.85	0.13	49,60,68,69	0
4	NAG	A	509	14/15	0.86	0.10	50,62,82,84	0
4	NAG	A	506	14/15	0.86	0.11	52,62,72,76	0
5	EDO	B	511	4/4	0.86	0.14	53,59,63,70	0
6	ACA	B	512	9/9	0.86	0.18	52,59,69,70	0
4	NAG	F	508	14/15	0.87	0.10	57,74,84,87	0
4	NAG	F	509	14/15	0.87	0.14	56,67,90,95	0
5	EDO	A	511	4/4	0.87	0.14	49,50,50,52	0
5	EDO	A	512	4/4	0.89	0.13	55,55,57,59	0
5	EDO	B	509	4/4	0.89	0.16	58,59,61,61	0
4	NAG	F	505	14/15	0.89	0.09	67,71,80,83	0
4	NAG	A	505	14/15	0.89	0.09	62,67,76,79	0
4	NAG	F	502	14/15	0.89	0.10	52,62,71,74	0
4	NAG	F	507	14/15	0.90	0.09	52,58,65,68	0
4	NAG	B	505	14/15	0.92	0.08	47,52,70,70	0
5	EDO	A	510	4/4	0.92	0.14	62,63,64,66	0
4	NAG	J	504	14/15	0.93	0.10	52,55,64,64	0
4	NAG	A	507	14/15	0.93	0.08	36,45,52,52	0
4	NAG	J	508	14/15	0.94	0.08	45,50,59,61	0
4	NAG	F	504	14/15	0.95	0.10	34,43,55,58	0
4	NAG	A	504	14/15	0.95	0.07	30,40,46,47	0
4	NAG	B	507	14/15	0.95	0.07	34,44,48,50	0
4	NAG	B	504	14/15	0.95	0.09	29,40,44,45	0

6.5 Other polymers [i](#)

There are no such residues in this entry.