



Full wwPDB X-ray Structure Validation Report ⓘ

Apr 25, 2026 – 06:18 PM EDT

PDB ID : 4C22 / pdb_00004c22
Title : L-Fucose Isomerase In Complex With Fuculose
Authors : Higgins, M.A.; Suits, M.D.L.; Marsters, C.; Boraston, A.B.
Deposited on : 2013-08-16
Resolution : 2.70 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
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

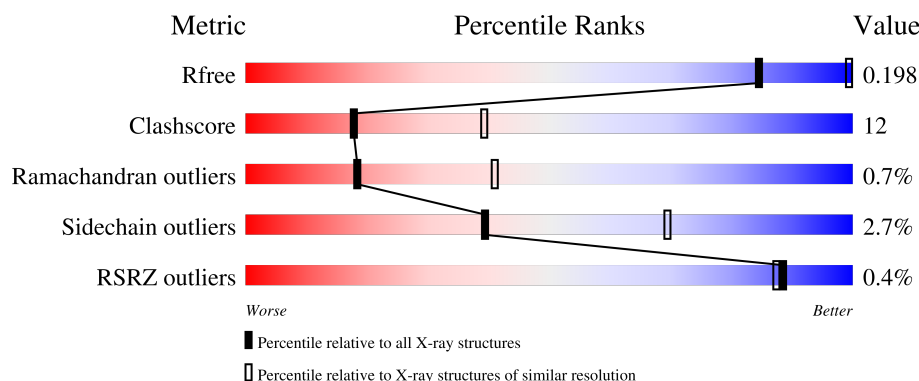
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.70 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	3538 (2.70-2.70)
Clashscore	190562	3843 (2.70-2.70)
Ramachandran outliers	187476	3778 (2.70-2.70)
Sidechain outliers	187428	3778 (2.70-2.70)
RSRZ outliers	180081	3538 (2.70-2.70)

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	604	 76% 20% . .
1	B	604	 76% 22% .

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
4	CVU	A	1589	-	X	-	-
5	EDO	A	1590	-	-	X	-
5	EDO	A	1592	-	-	X	-
5	EDO	B	1590	-	-	X	-
5	EDO	B	1593	-	-	X	-

2 Entry composition [i](#)

There are 6 unique types of molecules in this entry. The entry contains 9901 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 L-FUCOSE ISOMERASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	587	Total	C	N	O	S	0	1	0
			4612	2916	799	869	28			
1	B	604	Total	C	N	O	S	0	0	0
			4732	2989	826	888	29			

There are 34 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-15	HIS	-	expression tag	UNP Q97N97
A	-14	HIS	-	expression tag	UNP Q97N97
A	-13	HIS	-	expression tag	UNP Q97N97
A	-12	HIS	-	expression tag	UNP Q97N97
A	-11	SER	-	expression tag	UNP Q97N97
A	-10	SER	-	expression tag	UNP Q97N97
A	-9	GLY	-	expression tag	UNP Q97N97
A	-8	LEU	-	expression tag	UNP Q97N97
A	-7	VAL	-	expression tag	UNP Q97N97
A	-6	PRO	-	expression tag	UNP Q97N97
A	-5	ARG	-	expression tag	UNP Q97N97
A	-4	GLY	-	expression tag	UNP Q97N97
A	-3	SER	-	expression tag	UNP Q97N97
A	-2	HIS	-	expression tag	UNP Q97N97
A	-1	MET	-	expression tag	UNP Q97N97
A	0	ALA	-	expression tag	UNP Q97N97
A	1	SER	-	expression tag	UNP Q97N97
B	-15	HIS	-	expression tag	UNP Q97N97
B	-14	HIS	-	expression tag	UNP Q97N97
B	-13	HIS	-	expression tag	UNP Q97N97
B	-12	HIS	-	expression tag	UNP Q97N97
B	-11	SER	-	expression tag	UNP Q97N97
B	-10	SER	-	expression tag	UNP Q97N97
B	-9	GLY	-	expression tag	UNP Q97N97
B	-8	LEU	-	expression tag	UNP Q97N97

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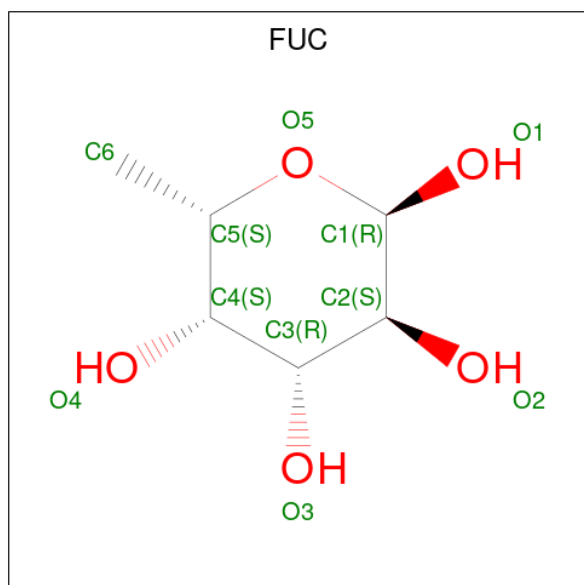
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Chain	Residue	Modelled	Actual	Comment	Reference
B	-7	VAL	-	expression tag	UNP Q97N97
B	-6	PRO	-	expression tag	UNP Q97N97
B	-5	ARG	-	expression tag	UNP Q97N97
B	-4	GLY	-	expression tag	UNP Q97N97
B	-3	SER	-	expression tag	UNP Q97N97
B	-2	HIS	-	expression tag	UNP Q97N97
B	-1	MET	-	expression tag	UNP Q97N97
B	0	ALA	-	expression tag	UNP Q97N97
B	1	SER	-	expression tag	UNP Q97N97

- Molecule 2 is MANGANESE (II) ION (CCD ID: MN) (formula: Mn).

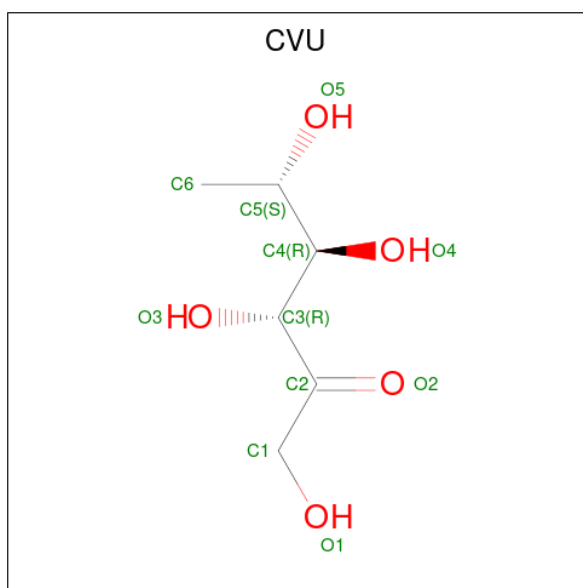
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	1	Total	Mn	0	0
			1	1		
2	B	1	Total	Mn	0	0
			1	1		

- Molecule 3 is alpha-L-fucopyranose (CCD ID: FUC) (formula: C₆H₁₂O₅).



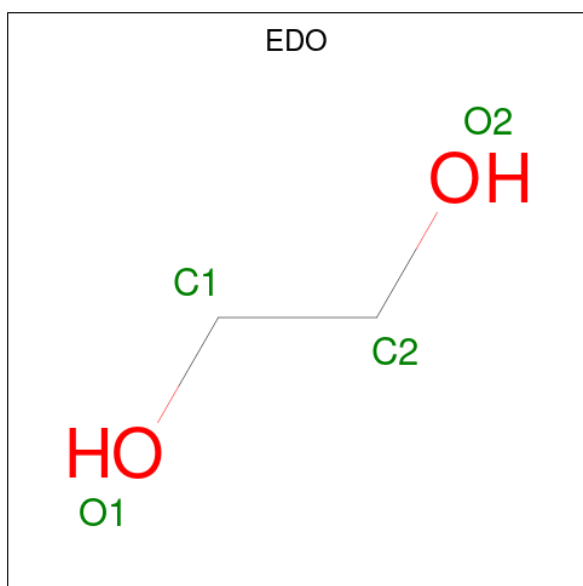
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	C	O	0	0
			11	6	5		
3	B	1	Total	C	O	0	0
			11	6	5		

- Molecule 4 is L-Fuculose open form (CCD ID: CVU) (formula: $C_6H_{12}O_5$).



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

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



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

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

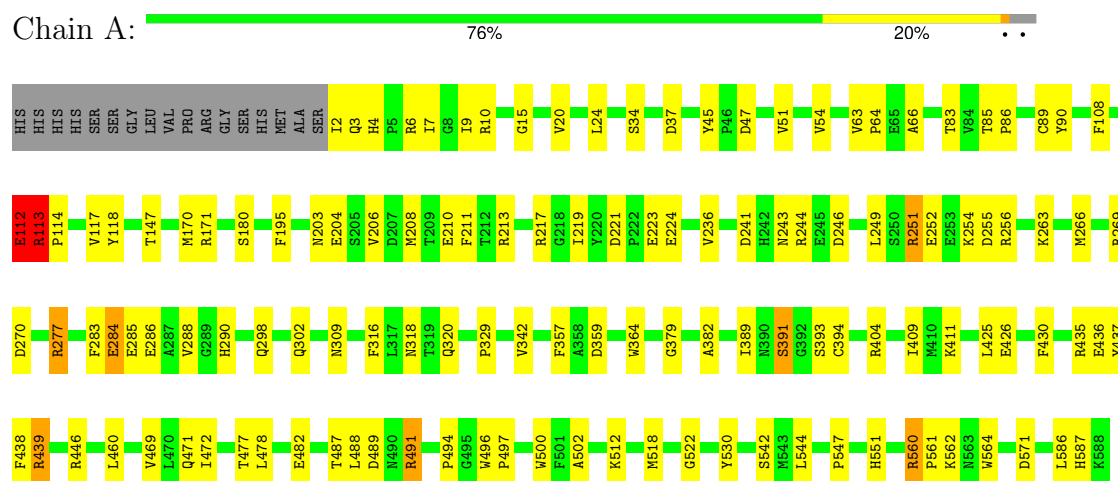
- Molecule 6 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	A	224	Total O 224 224	0	0
6	B	231	Total O 231 231	0	0

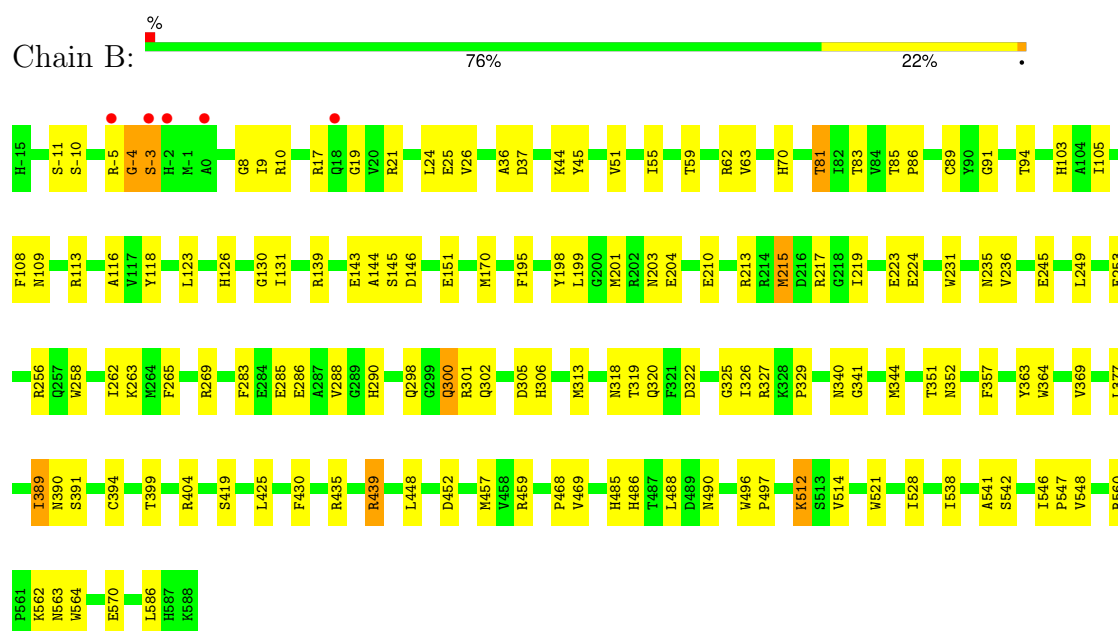
3 Residue-property plots

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: L-FUCOSE ISOMERASE



• Molecule 1: L-FUCOSE ISOMERASE



4 Data and refinement statistics

Property	Value	Source
Space group	H 3 2	Depositor
Cell constants a, b, c, α , β , γ	151.45Å 151.45Å 406.40Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	49.26 – 2.70 49.26 – 2.70	Depositor EDS
% Data completeness (in resolution range)	100.0 (49.26-2.70) 100.0 (49.26-2.70)	Depositor EDS
R_{merge}	0.11	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.65 (at 2.69Å)	Xtriage
Refinement program	REFMAC 5.7.0032	Depositor
R, R_{free}	0.144 , 0.198 0.144 , 0.198	Depositor DCC
R_{free} test set	2511 reflections (5.06%)	wwPDB-VP
Wilson B-factor (Å ²)	38.2	Xtriage
Anisotropy	0.083	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 37.9	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	9901	wwPDB-VP
Average B, all atoms (Å ²)	37.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.76% 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

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: FUC, EDO, CVU, MN

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	0.74	0/4732	1.01	9/6424 (0.1%)
1	B	0.78	0/4854	1.02	4/6587 (0.1%)
All	All	0.76	0/9586	1.01	13/13011 (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
1	B	0	1

There are no bond length outliers.

All (13) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	560	ARG	CA-C-N	-6.35	113.24	119.78
1	A	560	ARG	C-N-CA	-6.35	113.24	119.78
1	B	439	ARG	CB-CG-CD	6.23	125.63	111.30
1	A	112	GLU	N-CA-C	-6.20	99.06	108.67
1	B	546	ILE	CA-C-N	-5.95	113.84	119.85
1	B	546	ILE	C-N-CA	-5.95	113.84	119.85
1	A	20	VAL	N-CA-C	5.74	116.39	110.36
1	A	439	ARG	CB-CG-CD	5.68	124.37	111.30
1	A	90	TYR	CB-CA-C	5.57	120.04	110.86
1	A	316	PHE	N-CA-C	5.31	117.15	111.36
1	A	15	GLY	N-CA-C	5.20	120.64	113.99
1	B	325	GLY	N-CA-C	5.16	117.29	112.08
1	A	436	GLU	N-CA-C	-5.04	106.97	113.23

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	326	ILE	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	4612	0	4440	112	0
1	B	4732	0	4560	127	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
3	A	11	0	12	0	0
3	B	11	0	12	3	0
4	A	11	0	11	3	0
4	B	11	0	11	0	0
5	A	28	0	42	15	0
5	B	28	0	42	23	0
6	A	224	0	0	16	0
6	B	231	0	0	16	0
All	All	9901	0	9130	229	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 12.

All (229) 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:B:21:ARG:HH21	1:B:59:THR:HG23	1.07	1.19
1:A:277:ARG:HG3	1:A:277:ARG:HH11	1.19	1.07
1:B:21:ARG:NH2	1:B:59:THR:HG23	1.78	0.99
1:A:2:ILE:HB	6:A:2001:HOH:O	1.64	0.97
1:B:21:ARG:HH21	1:B:59:THR:CG2	1.80	0.94
1:B:231:TRP:HE1	3:B:603:FUC:H4	1.34	0.93
1:B:139:ARG:HD2	6:B:2058:HOH:O	1.68	0.92
1:A:471:GLN:HE22	1:A:522:GLY:H	0.92	0.92

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:180:SER:H	1:A:298:GLN:HE21	1.15	0.92
1:A:171:ARG:HD2	5:A:1592:EDO:H21	1.52	0.89
1:B:253:GLU:HG3	6:B:2113:HOH:O	1.72	0.89
1:B:542:SER:HB3	5:B:1590:EDO:H11	1.53	0.88
1:B:357:PHE:HB3	5:B:1593:EDO:H12	1.58	0.84
1:B:146:ASP:HB2	6:B:2060:HOH:O	1.78	0.83
1:A:409:ILE:HD11	1:A:411:LYS:HE3	1.61	0.82
1:B:223:GLU:HB3	6:B:2103:HOH:O	1.80	0.82
1:A:471:GLN:NE2	1:A:522:GLY:H	1.77	0.81
1:A:277:ARG:HG3	1:A:277:ARG:NH1	1.82	0.81
1:B:298:GLN:HE22	1:B:302:GLN:NE2	1.80	0.79
1:B:560:ARG:HE	5:B:1590:EDO:C1	1.94	0.78
1:B:116:ALA:HB3	5:B:1596:EDO:H22	1.65	0.78
1:B:151:GLU:HG3	6:B:2063:HOH:O	1.82	0.78
1:A:471:GLN:HE22	1:A:522:GLY:N	1.78	0.76
1:A:571:ASP:HB2	6:A:2216:HOH:O	1.87	0.74
1:A:318:ASN:ND2	5:A:1590:EDO:H12	2.04	0.72
1:A:586:LEU:HD13	5:A:1592:EDO:H11	1.71	0.71
1:A:171:ARG:HD2	5:A:1592:EDO:C2	2.21	0.71
1:A:439:ARG:HE	1:B:217:ARG:HH12	1.38	0.69
1:B:570:GLU:O	6:B:2221:HOH:O	2.09	0.69
1:A:439:ARG:CD	6:A:2171:HOH:O	2.41	0.69
1:A:439:ARG:HD2	6:A:2171:HOH:O	1.93	0.69
1:A:446:ARG:HD2	1:A:494:PRO:O	1.93	0.68
1:A:63:VAL:CG1	1:A:64:PRO:HD3	2.23	0.68
1:A:469:VAL:HG12	1:A:547:PRO:HG2	1.76	0.68
1:A:284:GLU:HB2	6:A:2117:HOH:O	1.94	0.67
1:A:217:ARG:HE	1:B:306:HIS:HD2	1.41	0.67
1:B:318:ASN:ND2	5:B:1593:EDO:H21	2.09	0.67
1:B:560:ARG:HE	5:B:1590:EDO:H12	1.59	0.66
1:B:301:ARG:NH1	1:B:305:ASP:OD2	2.28	0.66
1:A:586:LEU:HD13	5:A:1592:EDO:C1	2.26	0.65
1:A:357:PHE:HB3	5:A:1590:EDO:H21	1.79	0.65
1:A:217:ARG:HE	1:B:306:HIS:CD2	2.14	0.65
1:A:409:ILE:HG22	1:A:530:TYR:CZ	2.31	0.64
1:B:322:ASP:OD2	1:B:327:ARG:NH1	2.30	0.64
1:A:359:ASP:OD2	4:A:1589:CVU:HC1	1.97	0.64
5:B:1595:EDO:H12	6:B:2117:HOH:O	1.99	0.63
1:B:224:GLU:OE2	1:B:269:ARG:NH2	2.31	0.62
1:B:10:ARG:NH2	1:B:94:THR:O	2.30	0.62
1:A:204:GLU:OE1	1:A:290:HIS:HD2	1.83	0.61

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:318:ASN:HD22	5:A:1590:EDO:H12	1.63	0.61
1:A:285:GLU:O	1:A:288:VAL:HG22	2.00	0.61
1:A:223:GLU:CB	6:A:2100:HOH:O	2.48	0.60
1:A:320:GLN:HE21	1:A:329:PRO:HD3	1.67	0.60
1:A:89:CYS:HB2	1:A:118:TYR:CE1	2.37	0.59
1:A:404:ARG:HG3	1:A:404:ARG:HH11	1.67	0.59
1:B:199:LEU:C	5:B:1592:EDO:H21	2.27	0.59
1:A:244:ARG:NH1	1:A:246:ASP:OD2	2.36	0.59
1:A:409:ILE:HG22	1:A:530:TYR:CE1	2.38	0.58
1:B:448:LEU:HD13	1:B:485:HIS:CE1	2.38	0.58
1:B:25:GLU:OE1	1:B:59:THR:HG21	2.03	0.58
1:B:37:ASP:HB3	6:B:2018:HOH:O	2.03	0.58
1:B:319:THR:O	1:B:327:ARG:NH2	2.37	0.58
1:A:63:VAL:HG13	1:A:64:PRO:HD3	1.86	0.57
1:B:199:LEU:CB	1:B:201:MET:HE3	2.34	0.57
1:B:344:MET:HE1	1:B:357:PHE:HD2	1.69	0.57
1:B:116:ALA:CB	5:B:1596:EDO:H22	2.34	0.57
1:B:45:TYR:CE2	1:B:51:VAL:HA	2.40	0.57
1:B:298:GLN:HE22	1:B:302:GLN:HE22	1.48	0.56
1:B:318:ASN:HD22	5:B:1593:EDO:H21	1.68	0.56
1:A:496:TRP:HB3	1:A:497:PRO:CD	2.36	0.56
1:B:81:THR:HB	1:B:103:HIS:ND1	2.20	0.56
1:B:560:ARG:HD3	1:B:564:TRP:CD1	2.40	0.56
1:B:231:TRP:HE1	3:B:603:FUC:C4	2.12	0.56
1:B:560:ARG:NE	5:B:1590:EDO:H12	2.20	0.56
1:B:199:LEU:HD13	1:B:201:MET:CE	2.36	0.56
1:B:199:LEU:HB3	1:B:201:MET:HE3	1.88	0.55
1:A:45:TYR:CE2	1:A:51:VAL:HA	2.41	0.55
1:B:512:LYS:HE2	6:B:2190:HOH:O	2.06	0.55
1:B:213:ARG:NH2	1:B:286:GLU:OE2	2.40	0.55
1:B:341:GLY:HA2	1:B:344:MET:HE3	1.88	0.55
1:A:562:LYS:HZ2	5:A:1596:EDO:H11	1.72	0.54
1:A:394:CYS:HA	5:A:1590:EDO:H11	1.90	0.54
1:B:195:PHE:HB2	1:B:203:ASN:HD21	1.70	0.54
1:B:126:HIS:HE1	5:B:1591:EDO:H12	1.72	0.54
1:A:180:SER:H	1:A:298:GLN:NE2	1.97	0.54
1:A:389:ILE:HD11	1:A:496:TRP:HB2	1.88	0.54
1:B:327:ARG:HD3	6:B:2134:HOH:O	2.07	0.54
1:B:542:SER:N	5:B:1590:EDO:H22	2.23	0.54
1:B:199:LEU:CD1	1:B:201:MET:HE3	2.37	0.54
1:B:389:ILE:HD11	1:B:496:TRP:HB2	1.90	0.54

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:-4:GLY:O	1:B:-3:SER:CB	2.56	0.53
1:B:25:GLU:CD	1:B:59:THR:HG21	2.34	0.53
1:A:277:ARG:HH11	1:A:277:ARG:CG	2.07	0.53
1:A:24:LEU:HD11	1:A:113:ARG:HD2	1.91	0.53
1:B:210:GLU:OE1	1:B:213:ARG:NH1	2.42	0.53
1:B:548:VAL:HG23	5:B:1590:EDO:H21	1.90	0.53
1:B:123:LEU:HD13	1:B:562:LYS:HG2	1.91	0.53
1:B:231:TRP:NE1	3:B:603:FUC:H4	2.16	0.53
1:A:63:VAL:HG12	1:A:64:PRO:HD3	1.89	0.53
1:A:85:THR:HG21	1:A:118:TYR:CD2	2.44	0.53
1:B:44:LYS:HE2	6:B:2019:HOH:O	2.08	0.53
1:B:541:ALA:C	5:B:1590:EDO:H22	2.35	0.52
1:B:391:SER:HA	1:B:496:TRP:CE3	2.45	0.52
1:B:143:GLU:HA	6:B:2043:HOH:O	2.09	0.52
1:B:357:PHE:O	1:B:390:ASN:HB2	2.10	0.52
1:B:469:VAL:HG12	1:B:547:PRO:HG2	1.91	0.52
1:A:587:HIS:CE1	5:A:1592:EDO:H22	2.45	0.52
1:B:199:LEU:HB3	1:B:201:MET:CE	2.39	0.51
1:B:265:PHE:HA	1:B:313:MET:HG3	1.92	0.51
1:B:586:LEU:HD12	5:B:1592:EDO:H11	1.91	0.51
1:B:199:LEU:HD13	1:B:201:MET:HE3	1.91	0.51
1:A:562:LYS:NZ	5:A:1596:EDO:H11	2.25	0.51
1:A:404:ARG:HB2	1:A:409:ILE:HD13	1.91	0.51
1:A:439:ARG:HD3	6:A:2171:HOH:O	2.06	0.51
1:A:251:ARG:NH1	1:A:255:ASP:OD1	2.43	0.51
1:B:320:GLN:HE21	1:B:329:PRO:HD3	1.76	0.51
1:B:199:LEU:O	5:B:1592:EDO:H21	2.11	0.51
1:B:17:ARG:C	1:B:19:GLY:H	2.19	0.50
1:A:496:TRP:HB3	1:A:497:PRO:HD2	1.92	0.50
1:A:438:PHE:HB3	6:A:2126:HOH:O	2.11	0.50
1:B:89:CYS:HB2	1:B:118:TYR:CE1	2.45	0.50
1:B:285:GLU:O	5:B:1595:EDO:H11	2.11	0.50
1:B:364:TRP:CZ2	1:B:488:LEU:HD22	2.47	0.50
1:B:204:GLU:OE1	1:B:290:HIS:HD2	1.95	0.50
1:B:210:GLU:CD	1:B:213:ARG:NH1	2.70	0.50
1:B:24:LEU:HD21	1:B:113:ARG:HG3	1.94	0.49
1:A:213:ARG:HG3	1:B:306:HIS:HB2	1.94	0.49
1:A:236:VAL:HG13	1:A:430:PHE:CD1	2.47	0.49
1:B:210:GLU:OE2	1:B:213:ARG:NH1	2.44	0.49
1:B:126:HIS:HE1	5:B:1591:EDO:C1	2.25	0.49
1:B:170:MET:HB3	1:B:201:MET:HE2	1.94	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:263:LYS:HA	1:A:266:MET:HE3	1.94	0.49
1:B:258:TRP:O	1:B:262:ILE:HG13	2.12	0.49
1:A:4:HIS:O	1:A:6:ARG:HD2	2.12	0.49
1:A:263:LYS:HA	1:A:266:MET:CE	2.43	0.48
1:A:391:SER:HB3	4:A:1589:CVU:O2	2.12	0.48
1:A:290:HIS:HE1	6:A:2120:HOH:O	1.95	0.48
1:A:37:ASP:HB3	6:A:2010:HOH:O	2.11	0.48
1:A:112:GLU:CD	1:A:112:GLU:H	2.20	0.48
1:B:404:ARG:HG3	1:B:404:ARG:HH11	1.77	0.48
1:A:241:ASP:OD1	1:A:243:ASN:HB2	2.13	0.48
1:B:9:ILE:HD12	1:B:36:ALA:HB2	1.96	0.48
1:B:126:HIS:HD2	1:B:131:ILE:O	1.96	0.48
1:A:37:ASP:HB3	6:A:2011:HOH:O	2.14	0.47
1:A:302:GLN:HG2	1:B:210:GLU:HB2	1.94	0.47
1:A:7:ILE:HG22	1:A:9:ILE:HD13	1.96	0.47
1:B:344:MET:HE1	1:B:357:PHE:CD2	2.48	0.47
1:B:144:ALA:O	1:B:145:SER:CB	2.61	0.47
1:A:254:LYS:HE3	6:A:2109:HOH:O	2.14	0.47
1:B:253:GLU:HG2	1:B:256:ARG:NH2	2.29	0.47
1:A:512:LYS:HB2	6:A:2190:HOH:O	2.15	0.47
1:B:86:PRO:HA	1:B:108:PHE:HB3	1.96	0.47
1:B:394:CYS:HA	5:B:1593:EDO:H22	1.96	0.47
1:B:486:HIS:O	1:B:490:ASN:ND2	2.39	0.47
1:B:496:TRP:HB3	1:B:497:PRO:CD	2.44	0.47
1:A:437:TYR:CD2	4:A:1589:CVU:H61	2.51	0.46
1:A:10:ARG:O	1:A:83:THR:HA	2.15	0.46
1:A:472:ILE:O	1:A:551:HIS:HA	2.16	0.46
1:A:217:ARG:NE	1:B:306:HIS:HD2	2.12	0.46
1:B:109:ASN:HA	5:B:1596:EDO:H11	1.98	0.46
1:B:126:HIS:CD2	1:B:131:ILE:O	2.68	0.46
1:A:560:ARG:HD3	1:A:564:TRP:CD1	2.50	0.46
1:B:486:HIS:HD2	6:B:2184:HOH:O	1.99	0.46
1:B:8:GLY:O	1:B:81:THR:HA	2.16	0.46
1:B:70:HIS:HE1	6:B:2027:HOH:O	1.99	0.46
1:A:252:GLU:HB3	1:A:256:ARG:HH12	1.81	0.45
1:B:340:ASN:HB2	1:B:459:ARG:HH12	1.82	0.45
1:A:224:GLU:OE2	1:A:269:ARG:NH2	2.50	0.45
1:B:457:MET:HG2	1:B:521:TRP:CZ2	2.51	0.45
1:A:217:ARG:HH12	1:B:439:ARG:HE	1.63	0.45
1:B:219:ILE:HG21	1:B:286:GLU:HG2	1.99	0.45
1:B:369:VAL:HG21	1:B:377:LEU:HD11	1.98	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:538:ILE:HG23	5:B:1590:EDO:O1	2.16	0.45
1:B:198:TYR:CZ	1:B:468:PRO:HD2	2.52	0.45
1:A:285:GLU:OE2	1:B:301:ARG:NH2	2.50	0.44
1:A:393:SER:OG	5:A:1590:EDO:H22	2.17	0.44
1:B:-4:GLY:O	1:B:-3:SER:HB2	2.17	0.44
1:B:249:LEU:HD11	1:B:435:ARG:HD3	2.00	0.44
1:A:221:ASP:OD2	1:A:277:ARG:HG2	2.17	0.44
1:A:285:GLU:HB3	6:A:2118:HOH:O	2.18	0.44
1:A:10:ARG:HH11	5:A:1595:EDO:H21	1.82	0.44
1:A:269:ARG:NH1	1:A:270:ASP:OD1	2.51	0.44
1:A:478:LEU:HD11	1:A:502:ALA:HB2	1.99	0.44
1:B:351:THR:O	1:B:352:ASN:HB2	2.18	0.44
1:A:487:THR:O	1:A:491:ARG:HB2	2.17	0.43
1:B:219:ILE:HG12	1:B:283:PHE:CE1	2.53	0.43
1:A:170:MET:HE1	1:A:544:LEU:HD11	1.99	0.43
1:A:249:LEU:HD11	1:A:435:ARG:HD3	2.00	0.43
1:B:83:THR:HB	1:B:105:ILE:HG13	2.00	0.43
1:A:114:PRO:HB2	1:A:117:VAL:HB	2.00	0.43
1:A:195:PHE:HB2	1:A:203:ASN:HD21	1.83	0.43
1:B:17:ARG:O	1:B:19:GLY:N	2.50	0.43
1:B:130:GLY:HA2	6:B:2049:HOH:O	2.19	0.43
1:B:496:TRP:HB3	1:B:497:PRO:HD2	2.01	0.43
1:B:85:THR:HG21	1:B:118:TYR:CD2	2.54	0.42
1:A:213:ARG:NH2	1:A:286:GLU:OE2	2.38	0.42
1:B:399:THR:HB	6:B:2159:HOH:O	2.19	0.42
1:A:320:GLN:NE2	6:A:2135:HOH:O	2.53	0.42
1:A:586:LEU:HD13	5:A:1592:EDO:H12	2.02	0.42
1:A:63:VAL:HG13	1:A:64:PRO:CD	2.48	0.42
1:A:489:ASP:OD1	1:A:494:PRO:HA	2.19	0.42
1:A:210:GLU:HB2	1:B:302:GLN:HG3	2.00	0.42
1:B:363:TYR:CD1	1:B:514:VAL:HG12	2.55	0.42
1:B:357:PHE:CB	5:B:1593:EDO:H12	2.39	0.42
1:A:391:SER:HA	1:A:496:TRP:CE3	2.54	0.42
1:B:300:GLN:HA	1:B:301:ARG:HA	1.68	0.42
1:A:309:ASN:HB3	6:A:2126:HOH:O	2.20	0.41
1:A:404:ARG:HG3	1:A:404:ARG:NH1	2.35	0.41
1:A:477:THR:HA	1:A:500:TRP:O	2.20	0.41
1:B:62:ARG:O	1:B:63:VAL:C	2.63	0.41
1:B:144:ALA:O	1:B:145:SER:OG	2.29	0.41
1:A:342:VAL:HG12	1:A:460:LEU:CD1	2.50	0.41
1:A:542:SER:OG	1:A:561:PRO:HD3	2.20	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:210:GLU:HB2	1:B:302:GLN:CB	2.51	0.41
1:A:425:LEU:HD23	1:A:425:LEU:HA	1.92	0.41
1:A:63:VAL:O	1:A:66:ALA:HB3	2.21	0.41
1:B:236:VAL:HG13	1:B:430:PHE:CD1	2.56	0.41
1:A:10:ARG:NH1	5:A:1595:EDO:H21	2.36	0.41
1:A:379:GLY:O	1:A:382:ALA:HB2	2.21	0.41
1:A:208:MET:O	1:A:211:PHE:HB2	2.21	0.41
1:A:219:ILE:HG23	1:A:283:PHE:CG	2.56	0.41
1:A:285:GLU:CD	1:B:301:ARG:HH22	2.29	0.40
1:A:364:TRP:CH2	1:A:488:LEU:HD22	2.56	0.40
1:B:344:MET:CE	1:B:357:PHE:HD2	2.33	0.40
1:B:215:MET:CE	1:B:263:LYS:HB2	2.51	0.40
1:A:7:ILE:HG22	1:A:9:ILE:CD1	2.52	0.40
1:A:45:TYR:HB2	1:A:47:ASP:OD1	2.21	0.40
1:B:235:ASN:HB3	1:B:425:LEU:HD13	2.04	0.40
1:A:86:PRO:HA	1:A:108:PHE:HB3	2.02	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	586/604 (97%)	551 (94%)	33 (6%)	2 (0%)	36	60
1	B	602/604 (100%)	566 (94%)	30 (5%)	6 (1%)	12	32
All	All	1188/1208 (98%)	1117 (94%)	63 (5%)	8 (1%)	18	41

All (8) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	-3	SER
1	B	91	GLY

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Mol	Chain	Res	Type
1	B	389	ILE
1	A	113	ARG
1	A	391	SER
1	B	-10	SER
1	B	-5	ARG
1	B	-4	GLY

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	489/507 (96%)	475 (97%)	14 (3%)	37	67
1	B	502/507 (99%)	489 (97%)	13 (3%)	40	70
All	All	991/1014 (98%)	964 (97%)	27 (3%)	39	69

All (27) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	3	GLN
1	A	34	SER
1	A	54	VAL
1	A	112	GLU
1	A	113	ARG
1	A	147	THR
1	A	206	VAL
1	A	251	ARG
1	A	277	ARG
1	A	284	GLU
1	A	426	GLU
1	A	482	GLU
1	A	491	ARG
1	A	518	MET
1	B	-11	SER
1	B	26	VAL
1	B	55	ILE

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Mol	Chain	Res	Type
1	B	81	THR
1	B	215	MET
1	B	245	GLU
1	B	288	VAL
1	B	300	GLN
1	B	419	SER
1	B	452	ASP
1	B	512	LYS
1	B	528	ILE
1	B	563	ASN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (21) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	30	ASN
1	A	203	ASN
1	A	290	HIS
1	A	298	GLN
1	A	320	GLN
1	A	352	ASN
1	A	401	GLN
1	A	422	GLN
1	A	471	GLN
1	A	490	ASN
1	B	-14	HIS
1	B	-13	HIS
1	B	3	GLN
1	B	70	HIS
1	B	126	HIS
1	B	203	ASN
1	B	290	HIS
1	B	300	GLN
1	B	302	GLN
1	B	306	HIS
1	B	320	GLN

5.3.3 RNA ⓘ

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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 20 ligands modelled in this entry, 2 are monoatomic - leaving 18 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	$\# Z > 2$
5	EDO	B	1595	-	3,3,3	0.64	0	2,2,2	0.14	0
5	EDO	B	1591	-	3,3,3	0.96	0	2,2,2	0.65	0
4	CVU	A	1589	2	10,10,10	0.44	0	9,13,13	1.67	3 (33%)
5	EDO	A	1591	-	3,3,3	0.86	0	2,2,2	0.64	0
5	EDO	A	1590	-	3,3,3	0.91	0	2,2,2	0.59	0
5	EDO	A	1592	-	3,3,3	0.57	0	2,2,2	0.06	0
3	FUC	A	603	-	11,11,11	0.65	0	16,16,16	1.25	2 (12%)
5	EDO	A	1596	-	3,3,3	0.62	0	2,2,2	0.29	0
5	EDO	B	1593	-	3,3,3	0.94	0	2,2,2	0.72	0
5	EDO	A	1595	-	3,3,3	0.57	0	2,2,2	0.27	0
5	EDO	B	1594	-	3,3,3	0.44	0	2,2,2	0.12	0
5	EDO	A	1594	-	3,3,3	0.36	0	2,2,2	1.01	0
5	EDO	B	1596	-	3,3,3	0.56	0	2,2,2	0.18	0
5	EDO	B	1590	-	3,3,3	0.37	0	2,2,2	0.29	0
4	CVU	B	1589	2	10,10,10	0.82	0	9,13,13	1.32	1 (11%)
5	EDO	B	1592	-	3,3,3	0.48	0	2,2,2	0.07	0
5	EDO	A	1593	-	3,3,3	0.16	0	2,2,2	1.09	0
3	FUC	B	603	-	11,11,11	0.80	0	16,16,16	1.34	3 (18%)

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	EDO	B	1595	-	-	0/1/1/1	-
5	EDO	B	1591	-	-	0/1/1/1	-
4	CVU	A	1589	2	-	13/14/14/14	-
5	EDO	A	1591	-	-	1/1/1/1	-
5	EDO	A	1590	-	-	1/1/1/1	-
5	EDO	A	1592	-	-	1/1/1/1	-
3	FUC	A	603	-	-	-	0/1/1/1
5	EDO	A	1596	-	-	1/1/1/1	-
5	EDO	B	1593	-	-	1/1/1/1	-
5	EDO	A	1595	-	-	0/1/1/1	-
5	EDO	B	1594	-	-	1/1/1/1	-
5	EDO	A	1594	-	-	0/1/1/1	-
5	EDO	B	1596	-	-	1/1/1/1	-
5	EDO	B	1590	-	-	0/1/1/1	-
4	CVU	B	1589	2	-	6/14/14/14	-
5	EDO	B	1592	-	-	0/1/1/1	-
5	EDO	A	1593	-	-	0/1/1/1	-
3	FUC	B	603	-	-	-	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(°)
4	B	1589	CVU	C6-C5-C4	-3.40	107.95	112.11
3	B	603	FUC	O4-C4-C3	-3.22	102.79	110.38
4	A	1589	CVU	C6-C5-C4	-2.99	108.45	112.11
3	A	603	FUC	C1-C2-C3	-2.53	105.20	110.36
4	A	1589	CVU	O2-C2-C1	2.27	124.01	120.16
3	B	603	FUC	C6-C5-C4	2.14	117.00	113.08
4	A	1589	CVU	C5-C4-C3	-2.10	109.84	113.56
3	A	603	FUC	O5-C1-C2	-2.10	106.61	110.30
3	B	603	FUC	C1-O5-C5	-2.10	111.11	114.37

There are no chirality outliers.

All (26) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	1589	CVU	O1-C1-C2-O2
4	A	1589	CVU	C1-C2-C3-O3

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Mol	Chain	Res	Type	Atoms
4	A	1589	CVU	C1-C2-C3-C4
4	A	1589	CVU	O2-C2-C3-O3
4	A	1589	CVU	O2-C2-C3-C4
4	A	1589	CVU	C2-C3-C4-O4
4	A	1589	CVU	C2-C3-C4-C5
4	A	1589	CVU	O3-C3-C4-O4
4	A	1589	CVU	O3-C3-C4-C5
4	A	1589	CVU	C3-C4-C5-O5
4	A	1589	CVU	C3-C4-C5-C6
4	B	1589	CVU	C1-C2-C3-O3
4	B	1589	CVU	C1-C2-C3-C4
4	B	1589	CVU	O2-C2-C3-O3
4	B	1589	CVU	O2-C2-C3-C4
4	B	1589	CVU	C3-C4-C5-O5
4	A	1589	CVU	O4-C4-C5-O5
4	A	1589	CVU	O4-C4-C5-C6
5	A	1590	EDO	O1-C1-C2-O2
5	B	1593	EDO	O1-C1-C2-O2
5	A	1592	EDO	O1-C1-C2-O2
5	A	1596	EDO	O1-C1-C2-O2
5	B	1594	EDO	O1-C1-C2-O2
4	B	1589	CVU	C3-C4-C5-C6
5	A	1591	EDO	O1-C1-C2-O2
5	B	1596	EDO	O1-C1-C2-O2

There are no ring outliers.

12 monomers are involved in 44 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	B	1595	EDO	2	0
5	B	1591	EDO	2	0
4	A	1589	CVU	3	0
5	A	1590	EDO	5	0
5	A	1592	EDO	6	0
5	A	1596	EDO	2	0
5	B	1593	EDO	5	0
5	A	1595	EDO	2	0
5	B	1596	EDO	3	0
5	B	1590	EDO	8	0
5	B	1592	EDO	3	0
3	B	603	FUC	3	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	587/604 (97%)	-0.89	0	100 100	23, 36, 55, 69	1 (0%)
1	B	604/604 (100%)	-0.89	5 (0%)	82 81	23, 34, 58, 126	0
All	All	1191/1208 (98%)	-0.89	5 (0%)	88 87	23, 35, 57, 126	1 (0%)

All (5) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	-5	ARG	4.2
1	B	0	ALA	3.1
1	B	18	GLN	2.5
1	B	-2	HIS	2.3
1	B	-3	SER	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](#)

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($\text{\AA}^2$)	Q<0.9
5	EDO	B	1591	4/4	0.81	0.28	53,55,58,60	0
5	EDO	A	1590	4/4	0.82	0.29	55,58,58,59	0
5	EDO	A	1591	4/4	0.85	0.21	47,55,57,57	0
5	EDO	B	1593	4/4	0.87	0.24	49,51,53,56	0
5	EDO	B	1596	4/4	0.90	0.22	72,90,90,92	0
3	FUC	B	603	11/11	0.91	0.13	67,77,81,82	0
5	EDO	A	1596	4/4	0.92	0.13	38,40,46,49	0
5	EDO	A	1594	4/4	0.92	0.12	38,46,47,51	0
3	FUC	A	603	11/11	0.93	0.12	69,81,86,88	0
4	CVU	A	1589	11/11	0.95	0.10	46,62,65,70	0
5	EDO	A	1595	4/4	0.95	0.22	65,72,76,79	0
5	EDO	B	1595	4/4	0.95	0.13	45,46,47,47	0
4	CVU	B	1589	11/11	0.95	0.09	45,53,62,72	0
5	EDO	A	1592	4/4	0.97	0.16	49,51,54,56	0
5	EDO	B	1590	4/4	0.97	0.19	35,37,38,38	0
5	EDO	A	1593	4/4	0.97	0.09	36,38,39,49	0
5	EDO	B	1592	4/4	0.98	0.17	52,56,57,59	0
5	EDO	B	1594	4/4	0.98	0.05	34,34,35,37	0
2	MN	A	601	1/1	1.00	0.02	66,66,66,66	0
2	MN	B	601	1/1	1.00	0.02	54,54,54,54	0

6.5 Other polymers [i](#)

There are no such residues in this entry.