



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2026 – 10:02 AM UTC

PDB ID : 3LF7 / pdb_00003lf7
Title : Crystal structure of fructosyltransferase (wild-type) from *A. japonicus*
Authors : Chuankhayan, P.; Chen, C.J.; Chiang, C.M.
Deposited on : 2010-01-16
Resolution : 2.00 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
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

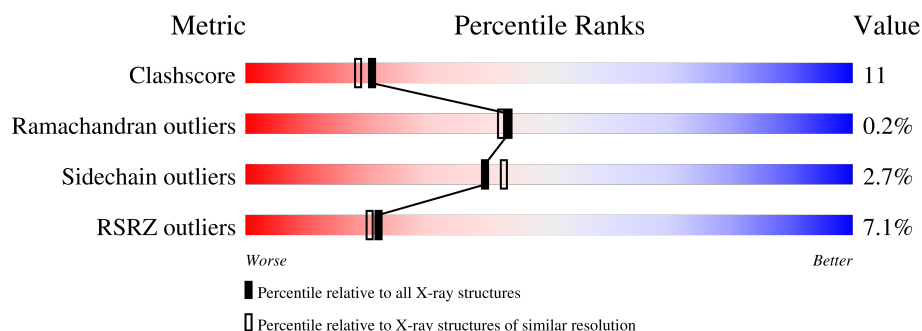
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.00 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))
Clashscore	190562	11152 (2.00-2.00)
Ramachandran outliers	187476	11031 (2.00-2.00)
Sidechain outliers	187428	11029 (2.00-2.00)
RSRZ outliers	180081	10067 (2.00-2.00)

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	634	

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 5185 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 Fructosyltransferase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	633	Total	C	N	O	S	0	0	0
			4880	3089	823	965	3			

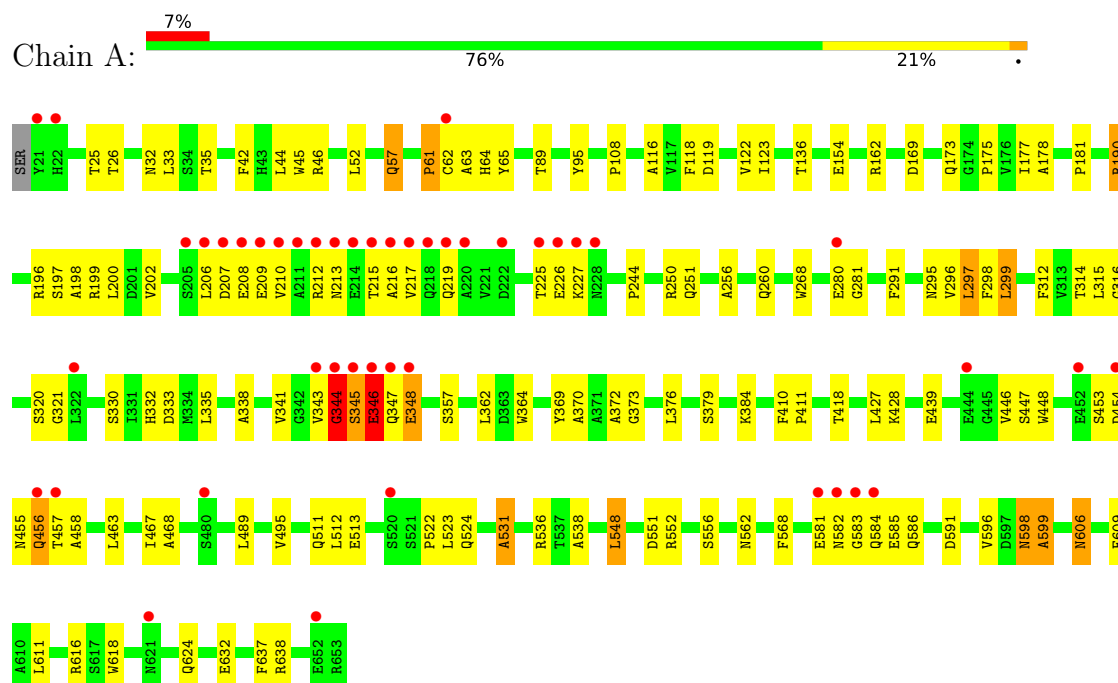
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	305	Total	O	0	0
			305	305		

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: Fructosyltransferase



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, α , β , γ	98.92Å 110.92Å 66.80Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	30.00 – 2.00 30.00 – 2.05	Depositor EDS
% Data completeness (in resolution range)	88.8 (30.00-2.00) 95.3 (30.00-2.05)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	0.08	Depositor
$\langle I/\sigma(I) \rangle$ ¹	6.09 (at 2.05Å)	Xtriage
Refinement program	CNS	Depositor
R, R_{free}	0.208 , 0.240 0.219 , (Not available)	Depositor DCC
R_{free} test set	No test flags present.	wwPDB-VP
Wilson B-factor (Å ²)	20.9	Xtriage
Anisotropy	0.336	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 47.8	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	0.93	EDS
Total number of atoms	5185	wwPDB-VP
Average B, all atoms (Å ²)	25.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.94% 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

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	0.48	3/5011 (0.1%)	0.97	30/6854 (0.4%)

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	3

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	346	GLU	C-N	9.94	1.44	1.33
1	A	596	VAL	C-N	-8.83	1.22	1.33
1	A	598	ASN	C-N	6.36	1.42	1.34

All (30) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	348	GLU	N-CA-C	-8.08	103.51	112.72
1	A	123	ILE	N-CA-C	-7.79	99.83	107.55
1	A	61	PRO	N-CA-C	-7.77	99.75	111.57
1	A	26	THR	N-CA-C	-6.88	104.56	114.12
1	A	599	ALA	O-C-N	-6.45	114.34	122.27
1	A	346	GLU	CA-C-N	-6.44	111.12	122.20
1	A	346	GLU	C-N-CA	-6.44	111.12	122.20
1	A	376	LEU	CA-C-N	6.41	126.43	119.90
1	A	376	LEU	C-N-CA	6.41	126.43	119.90
1	A	122	VAL	N-CA-C	6.32	117.58	108.48
1	A	345	SER	CA-C-N	-6.08	112.41	122.32
1	A	345	SER	C-N-CA	-6.08	112.41	122.32
1	A	63	ALA	N-CA-C	5.99	119.69	111.54

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	495	VAL	N-CA-C	5.90	114.46	107.73
1	A	362	LEU	N-CA-C	-5.85	104.49	111.69
1	A	548	LEU	N-CA-C	-5.77	99.84	109.24
1	A	370	ALA	N-CA-C	5.59	118.90	111.30
1	A	357	SER	N-CA-C	-5.54	107.16	114.31
1	A	321	GLY	N-CA-C	-5.42	104.32	112.89
1	A	42	PHE	N-CA-C	5.41	117.60	111.11
1	A	190	ARG	N-CA-C	5.39	116.18	108.74
1	A	531	ALA	N-CA-C	5.34	118.44	109.95
1	A	335	LEU	N-CA-C	5.34	118.36	110.46
1	A	344	GLY	O-C-N	5.27	129.55	122.70
1	A	46	ARG	N-CA-C	5.18	117.11	109.50
1	A	556	SER	N-CA-C	5.16	116.82	108.41
1	A	177	ILE	N-CA-C	-5.10	98.72	109.34
1	A	299	LEU	N-CA-C	5.10	118.38	110.17
1	A	583	GLY	N-CA-C	-5.04	108.93	115.59
1	A	618	TRP	N-CA-C	5.02	119.36	112.68

There are no chirality outliers.

All (3) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	346	GLU	Mainchain
1	A	598	ASN	Mainchain
1	A	599	ALA	Mainchain

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	4880	0	4604	105	0
2	A	305	0	0	0	0
All	All	5185	0	4604	105	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 11.

All (105) close contacts within the same asymmetric unit are listed below, sorted by their clash

magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:215:THR:HG22	1:A:219:GLN:HE22	1.34	0.91
1:A:295:ASN:HD21	1:A:373:GLY:H	1.21	0.89
1:A:61:PRO:O	1:A:62:CYS:SG	2.30	0.88
1:A:173:GLN:HE22	1:A:260:GLN:HE22	1.22	0.88
1:A:33:LEU:H	1:A:562:ASN:HD21	1.27	0.82
1:A:454:ASP:HB2	1:A:456:GLN:NE2	1.95	0.80
1:A:446:VAL:HG21	1:A:448:TRP:CZ2	2.19	0.78
1:A:446:VAL:HG22	1:A:447:SER:H	1.50	0.75
1:A:454:ASP:HB2	1:A:456:GLN:HE21	1.52	0.73
1:A:606:ASN:HD22	1:A:606:ASN:N	1.85	0.73
1:A:346:GLU:O	1:A:346:GLU:CD	2.32	0.72
1:A:216:ALA:HA	1:A:219:GLN:OE1	1.90	0.72
1:A:295:ASN:ND2	1:A:373:GLY:H	1.87	0.71
1:A:456:GLN:NE2	1:A:457:THR:H	1.89	0.71
1:A:213:ASN:ND2	1:A:216:ALA:H	1.90	0.69
1:A:591:ASP:H	1:A:606:ASN:HD21	1.44	0.65
1:A:213:ASN:HD21	1:A:216:ALA:H	1.42	0.65
1:A:206:LEU:HB3	1:A:210:VAL:HG13	1.77	0.65
1:A:446:VAL:HG21	1:A:448:TRP:CH2	2.32	0.65
1:A:33:LEU:H	1:A:562:ASN:ND2	1.96	0.62
1:A:61:PRO:C	1:A:62:CYS:SG	2.83	0.61
1:A:523:LEU:C	1:A:523:LEU:HD23	2.25	0.61
1:A:523:LEU:HD23	1:A:524:GLN:N	2.16	0.61
1:A:175:PRO:HG2	1:A:178:ALA:HB2	1.82	0.61
1:A:456:GLN:CD	1:A:457:THR:H	2.09	0.60
1:A:582:ASN:C	1:A:584:GLN:H	2.08	0.59
1:A:345:SER:OG	1:A:347:GLN:NE2	2.36	0.59
1:A:453:SER:HB2	1:A:458:ALA:HB2	1.85	0.59
1:A:209:GLU:HA	1:A:212:ARG:HG2	1.85	0.58
1:A:299:LEU:HG	1:A:428:LYS:HA	1.84	0.58
1:A:606:ASN:HD22	1:A:606:ASN:H	1.53	0.57
1:A:454:ASP:CB	1:A:456:GLN:HE21	2.16	0.56
1:A:591:ASP:H	1:A:606:ASN:ND2	2.03	0.56
1:A:62:CYS:SG	1:A:119:ASP:CG	2.89	0.56
1:A:446:VAL:HG13	1:A:448:TRP:H	1.71	0.55
1:A:57:GLN:HB2	1:A:418:THR:HB	1.88	0.55
1:A:343:VAL:O	1:A:344:GLY:O	2.25	0.55
1:A:454:ASP:CB	1:A:456:GLN:NE2	2.68	0.55
1:A:581:GLU:OE2	1:A:586:GLN:NE2	2.40	0.54
1:A:118:PHE:HB2	1:A:136:THR:HB	1.90	0.53
1:A:208:GLU:O	1:A:212:ARG:HG2	2.07	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:199:ARG:NH1	1:A:217:VAL:HG11	2.24	0.53
1:A:162:ARG:HD2	1:A:169:ASP:OD2	2.09	0.53
1:A:244:PRO:HB2	1:A:291:PHE:CD1	2.43	0.52
1:A:207:ASP:HB2	1:A:210:VAL:HG12	1.91	0.52
1:A:296:VAL:C	1:A:297:LEU:HD12	2.34	0.52
1:A:523:LEU:HA	1:A:632:GLU:HB2	1.91	0.52
1:A:297:LEU:HD12	1:A:297:LEU:N	2.24	0.52
1:A:522:PRO:HB2	1:A:632:GLU:HG3	1.92	0.52
1:A:345:SER:O	1:A:347:GLN:N	2.43	0.51
1:A:57:GLN:CB	1:A:418:THR:HB	2.41	0.51
1:A:439:GLU:H	1:A:439:GLU:CD	2.19	0.50
1:A:489:LEU:HD12	1:A:637:PHE:HE2	1.76	0.50
1:A:582:ASN:C	1:A:584:GLN:N	2.69	0.50
1:A:200:LEU:CD2	1:A:341:VAL:HG11	2.41	0.49
1:A:32:ASN:ND2	1:A:35:THR:HG23	2.27	0.49
1:A:295:ASN:HB2	1:A:314:THR:OG1	2.13	0.49
1:A:62:CYS:SG	1:A:119:ASP:OD1	2.71	0.49
1:A:209:GLU:HA	1:A:212:ARG:CG	2.43	0.49
1:A:638:ARG:HG2	1:A:638:ARG:HH11	1.78	0.48
1:A:197:SER:HB2	1:A:298:PHE:CZ	2.49	0.48
1:A:320:SER:HA	1:A:330:SER:OG	2.14	0.48
1:A:312:PHE:CE1	1:A:338:ALA:HB2	2.48	0.47
1:A:315:LEU:N	1:A:315:LEU:HD23	2.29	0.47
1:A:346:GLU:O	1:A:346:GLU:OE1	2.32	0.47
1:A:446:VAL:HG22	1:A:447:SER:N	2.25	0.46
1:A:297:LEU:N	1:A:297:LEU:CD1	2.78	0.46
1:A:446:VAL:CG2	1:A:448:TRP:CH2	2.98	0.46
1:A:379:SER:O	1:A:384:LYS:HE2	2.15	0.46
1:A:45:TRP:CE2	1:A:616:ARG:HB3	2.52	0.45
1:A:548:LEU:HD12	1:A:609:PHE:CE2	2.52	0.45
1:A:154:GLU:OE2	1:A:190:ARG:HD3	2.17	0.45
1:A:511:GLN:C	1:A:512:LEU:HD12	2.42	0.45
1:A:453:SER:HB2	1:A:458:ALA:CB	2.46	0.45
1:A:456:GLN:CD	1:A:457:THR:N	2.74	0.44
1:A:538:ALA:HB3	1:A:551:ASP:HB3	1.98	0.44
1:A:251:GLN:OE1	1:A:256:ALA:HA	2.18	0.44
1:A:410:PHE:CG	1:A:411:PRO:HD2	2.52	0.44
1:A:531:ALA:O	1:A:624:GLN:HB2	2.17	0.44
1:A:196:ARG:HD3	1:A:226:GLU:HG3	2.00	0.44
1:A:346:GLU:C	1:A:347:GLN:HG3	2.42	0.43
1:A:295:ASN:HD21	1:A:373:GLY:N	2.00	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:206:LEU:HB3	1:A:210:VAL:CG1	2.46	0.43
1:A:467:ILE:O	1:A:468:ALA:C	2.61	0.43
1:A:207:ASP:CB	1:A:210:VAL:HG12	2.50	0.42
1:A:280:GLU:O	1:A:281:GLY:C	2.62	0.42
1:A:64:HIS:O	1:A:65:TYR:HB3	2.19	0.42
1:A:213:ASN:O	1:A:217:VAL:HG23	2.19	0.42
1:A:453:SER:CB	1:A:458:ALA:HB2	2.49	0.42
1:A:297:LEU:HB3	1:A:299:LEU:HD13	2.00	0.42
1:A:552:ARG:HD3	1:A:568:PHE:O	2.20	0.41
1:A:250:ARG:O	1:A:251:GLN:C	2.64	0.41
1:A:513:GLU:OE1	1:A:638:ARG:HD2	2.19	0.41
1:A:89:THR:HB	1:A:95:TYR:CD1	2.56	0.41
1:A:207:ASP:H	1:A:210:VAL:CG1	2.34	0.41
1:A:332:HIS:HB3	1:A:369:TYR:CD2	2.55	0.41
1:A:25:THR:HG21	1:A:44:LEU:HD13	2.02	0.41
1:A:198:ALA:O	1:A:202:VAL:HG23	2.21	0.41
1:A:108:PRO:HB3	1:A:116:ALA:HA	2.03	0.41
1:A:316:GLY:HA2	1:A:333:ASP:O	2.21	0.41
1:A:454:ASP:O	1:A:455:ASN:HB2	2.21	0.40
1:A:227:LYS:HE3	1:A:227:LYS:HB2	1.94	0.40
1:A:364:TRP:HB2	1:A:611:LEU:HD13	2.03	0.40
1:A:638:ARG:HG2	1:A:638:ARG:NH1	2.36	0.40
1:A:61:PRO:HG2	1:A:372:ALA:HB3	2.03	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	631/634 (100%)	596 (94%)	34 (5%)	1 (0%)	43	42

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	344	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	516/517 (100%)	502 (97%)	14 (3%)	39 42

All (14) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	52	LEU
1	A	57	GLN
1	A	181	PRO
1	A	225	THR
1	A	268	TRP
1	A	297	LEU
1	A	346	GLU
1	A	348	GLU
1	A	427	LEU
1	A	456	GLN
1	A	463	LEU
1	A	536	ARG
1	A	585	GLU
1	A	606	ASN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (14) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	39	ASN
1	A	57	GLN
1	A	156	GLN
1	A	213	ASN
1	A	219	GLN
1	A	260	GLN
1	A	295	ASN

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Mol	Chain	Res	Type
1	A	347	GLN
1	A	456	GLN
1	A	511	GLN
1	A	554	GLN
1	A	562	ASN
1	A	606	ASN
1	A	639	ASN

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 ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

There are no ligands in this entry.

5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

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, 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	633/634 (99%)	0.29	45 (7%) 22 20	12, 21, 48, 84	0

All (45) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	211	ALA	6.1
1	A	62	CYS	5.3
1	A	210	VAL	5.2
1	A	345	SER	4.7
1	A	213	ASN	4.7
1	A	21	TYR	4.6
1	A	228	ASN	4.2
1	A	346	GLU	4.2
1	A	214	GLU	4.0
1	A	344	GLY	3.4
1	A	456	GLN	3.3
1	A	217	VAL	3.3
1	A	581	GLU	3.3
1	A	215	THR	3.2
1	A	212	ARG	3.2
1	A	227	LYS	3.1
1	A	219	GLN	3.1
1	A	216	ALA	3.1
1	A	582	ASN	3.0
1	A	621	ASN	2.9
1	A	348	GLU	2.9
1	A	206	LEU	2.8
1	A	225	THR	2.7
1	A	343	VAL	2.7
1	A	208	GLU	2.7
1	A	218	GLN	2.6
1	A	22	HIS	2.6

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Mol	Chain	Res	Type	RSRZ
1	A	220	ALA	2.6
1	A	584	GLN	2.6
1	A	205	SER	2.5
1	A	583	GLY	2.4
1	A	454	ASP	2.4
1	A	347	GLN	2.4
1	A	444	GLU	2.4
1	A	520	SER	2.4
1	A	226	GLU	2.3
1	A	207	ASP	2.3
1	A	452	GLU	2.3
1	A	480	SER	2.3
1	A	222	ASP	2.3
1	A	280	GLU	2.2
1	A	209	GLU	2.1
1	A	652	GLU	2.1
1	A	322	LEU	2.0
1	A	457	THR	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](#)

There are no oligosaccharides in this entry.

6.4 Ligands [i](#)

There are no ligands in this entry.

6.5 Other polymers [i](#)

There are no such residues in this entry.