



# Full wwPDB X-ray Structure Validation Report

Feb 28, 2014 – 01:00 AM GMT

PDB ID : 3KF3  
Title : Structure of fructofuranosidase from Schwanniomyces occidentalis complexed with fructose  
Authors : Sanz-Aparicio, J.; Polo, A.  
Deposited on : 2009-10-27  
Resolution : 1.90 Å(reported)

This is a full wwPDB validation report for a publicly released PDB entry.  
We welcome your comments at [validation@mail.wwpdb.org](mailto:validation@mail.wwpdb.org)  
A user guide is available at <http://wwpdb.org/ValidationPDFNotes.html>

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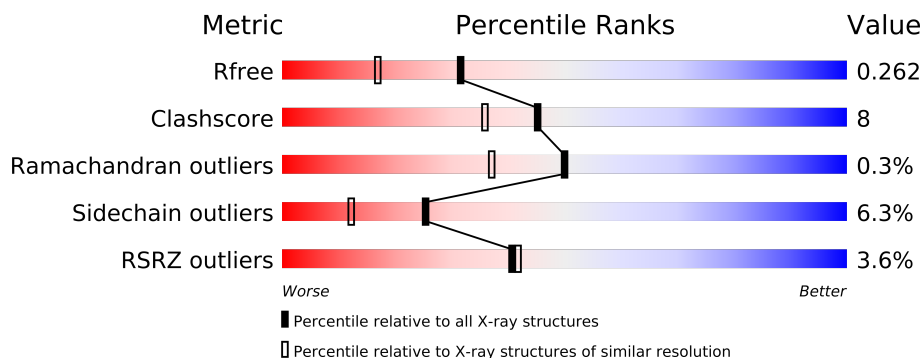
The following versions of software and data (see [references](#)) were used in the production of this report:

MolProbity : 4.02b-467  
Mogul : 1.15 2013  
Xtriage (Phenix) : dev-1323  
EDS : stable22639  
Percentile statistics : 21963  
Refmac : 5.8.0049  
CCP4 : 6.3.0 (Settle)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et. al. (1996)  
Validation Pipeline (wwPDB-VP) : stable22683

# 1 Overall quality at a glance

The reported resolution of this entry is 1.90 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))
$R_{free}$	66092	3684 (1.90-1.90)
Clashscore	79885	4465 (1.90-1.90)
Ramachandran outliers	78287	4413 (1.90-1.90)
Sidechain outliers	78261	4414 (1.90-1.90)
RSRZ outliers	66119	3686 (1.90-1.90)

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  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density.

Mol	Chain	Length	Quality of chain
1	A	509	
1	B	509	

The following table lists non-polymeric compounds that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Geometry	Electron density
2	FRU	A	600	-	X
2	FRU	B	600	-	X
3	NAG	A	1001	-	X
3	NAG	A	5001	-	X
3	NAG	B	5001	-	X

## 2 Entry composition i

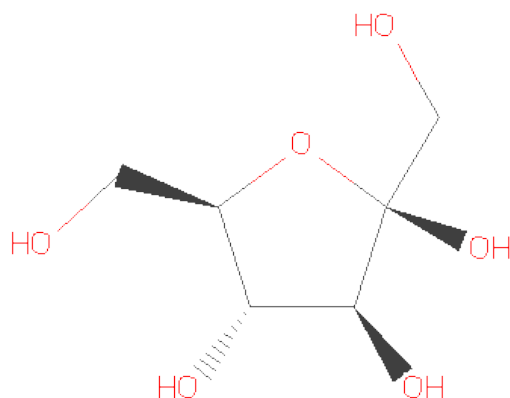
There are 4 unique types of molecules in this entry. The entry contains 9197 atoms, of which 0 are hydrogen and 0 are deuterium.

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 Invertase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	509	Total	C	N	O	S	0	0	0
			4134	2657	677	794	6			
1	B	509	Total	C	N	O	S	0	0	0
			4134	2657	677	794	6			

- Molecule 2 is SUGAR (FRUCTOSE) (three-letter code: FRU) (formula:  $C_6H_{12}O_6$ ).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total	C	O	0	0
			12	6	6		
2	B	1	Total	C	O	0	0
			12	6	6		

- Molecule 3 is SUGAR (N-ACETYL-D-GLUCOSAMINE) (three-letter code: NAG) (formula:  $C_8H_{15}NO_6$ ).



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

- Molecule 4 is water.

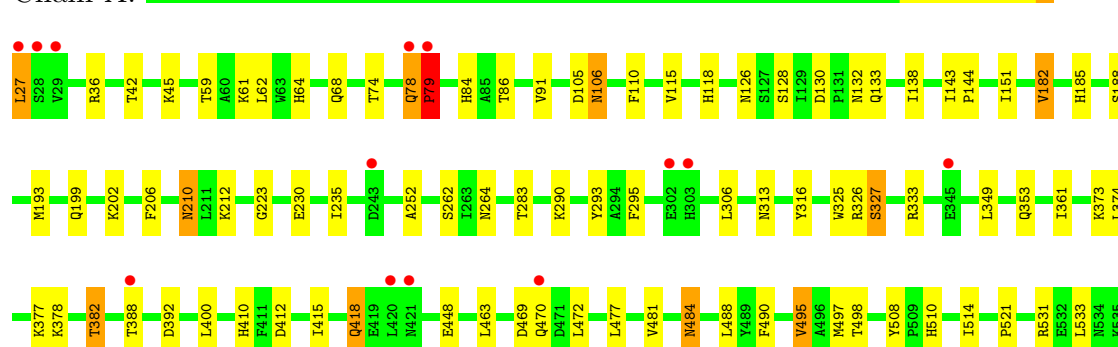
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	424	Total	O	0	0
			424	424		
4	B	383	Total	O	0	0
			383	383		

### 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 errors 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.

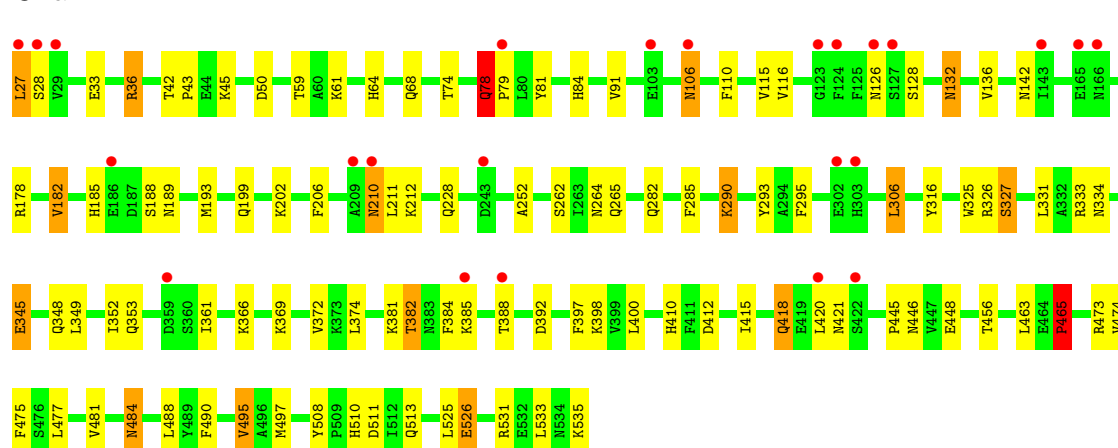
#### • Molecule 1: Invertase

Chain A:



#### • Molecule 1: Invertase

Chain B:



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	60.87Å 92.27Å 116.28Å 90.00° 104.81° 90.00°	Depositor
Resolution (Å)	49.62 – 1.90 49.62 – 1.90	Depositor EDS
% Data completeness (in resolution range)	99.6 (49.62-1.90) 99.6 (49.62-1.90)	Depositor EDS
$R_{merge}$	0.13	Depositor
$R_{sym}$	0.13	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.90 (at 1.90Å)	Xtriage
Refinement program	REFMAC 5.5.0088	Depositor
R, $R_{free}$	0.220 , 0.261 0.222 , 0.262	Depositor DCC
$R_{free}$ test set	4866 reflections (5.25%)	DCC
Wilson B-factor (Å <sup>2</sup> )	15.2	Xtriage
Anisotropy	0.170	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.38 , 27.6	EDS
Estimated twinning fraction	0.019 for h,-k,-h-l	Xtriage
L-test for twinning	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtriage
Outliers	4 of 97487 reflections (0.004%)	Xtriage
$F_o, F_c$ correlation	0.91	EDS
Total number of atoms	9197	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	18.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.38% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

## 5 Model quality

### 5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: NAG, FRU

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	0.45	1/4255 (0.0%)	0.65	5/5795 (0.1%)
1	B	0.42	0/4255	0.62	3/5795 (0.1%)
All	All	0.44	1/8510 (0.0%)	0.63	8/11590 (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	A	0	1
1	B	0	2
All	All	0	3

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	78	GLN	C-N	8.50	1.50	1.34

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	78	GLN	CB-CA-C	9.11	128.62	110.40
1	B	78	GLN	C-N-CD	-7.43	104.26	120.60
1	A	78	GLN	C-N-CD	-6.69	105.88	120.60
1	A	79	PRO	CA-CB-CG	-6.23	92.16	104.00
1	A	78	GLN	C-N-CA	5.72	146.04	122.00
1	A	27	LEU	CA-CB-CG	5.60	128.17	115.30
1	B	27	LEU	CA-CB-CG	5.59	128.15	115.30
1	B	465	PRO	CA-N-CD	-5.06	104.42	111.50

There are no chirality outliers.

All (3) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	78	GLN	Peptide
1	B	78	GLN	Mainchain,Peptide

## 5.2 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 hydrogens added by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, and the number in parentheses is this value normalized per 1000 atoms of the molecule in the chain. The Symm-Clashes column gives symmetry related clashes, in the same way as for the Clashes column.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	4134	0	3918	64	0
1	B	4134	0	3919	74	0
2	A	12	0	12	1	0
2	B	12	0	12	0	0
3	A	56	0	52	0	0
3	B	42	0	39	1	0
4	A	424	0	0	11	0
4	B	383	0	0	12	0
All	All	9197	0	7952	137	0

Clashscore is defined as the number of clashes calculated for the entry per 1000 atoms (including hydrogens) of the entry. The overall clashscore for this entry is 8.

All (137) close contacts within the same asymmetric unit are listed below.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:B:488:LEU:HD12	1:B:497:MET:HE2	1.29	1.08
1:B:497:MET:SD	4:B:601:HOH:O	2.12	1.08
1:A:497:MET:SD	4:A:694:HOH:O	2.12	1.07
1:B:488:LEU:HD12	1:B:497:MET:CE	1.85	1.06
1:A:488:LEU:HD12	1:A:497:MET:HE2	1.40	1.04
1:A:488:LEU:HD12	1:A:497:MET:CE	1.86	1.03
1:A:79:PRO:HG3	1:A:105:ASP:HA	1.48	0.93
1:A:418:GLN:HE21	1:A:418:GLN:H	1.13	0.91
1:B:59:THR:HG23	1:B:132:ASN:HD21	1.39	0.87
1:A:415:ILE:HD13	1:A:481:VAL:HG21	1.55	0.86
1:B:78:GLN:HE22	1:B:142:ASN:HD22	1.19	0.86

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Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:B:59:THR:HG23	1:B:132:ASN:ND2	1.92	0.84
1:B:418:GLN:H	1:B:418:GLN:HE21	1.28	0.82
1:A:313:ASN:ND2	4:A:939:HOH:O	2.06	0.81
1:B:42:THR:HG23	1:B:325:TRP:CD1	2.16	0.80
1:A:42:THR:HG23	1:A:325:TRP:CD1	2.19	0.77
1:B:415:ILE:HD13	1:B:481:VAL:HG21	1.65	0.77
1:A:193:MET:CE	1:A:206:PHE:CD2	2.69	0.76
1:B:42:THR:CG2	1:B:325:TRP:CD1	2.70	0.75
1:B:64:HIS:HD2	1:B:84:HIS:NE2	1.84	0.75
1:A:382:THR:CG2	4:A:613:HOH:O	2.36	0.73
1:A:42:THR:CG2	1:A:325:TRP:CD1	2.72	0.72
1:A:382:THR:HG22	4:A:613:HOH:O	1.89	0.71
1:A:68:GLN:HE22	1:A:110:PHE:HA	1.56	0.69
1:B:78:GLN:NE2	1:B:142:ASN:HD22	1.89	0.69
1:B:382:THR:HG22	4:B:541:HOH:O	1.92	0.68
1:A:418:GLN:N	1:A:418:GLN:HE21	1.90	0.67
1:B:290:LYS:HE2	1:B:456:THR:OG1	1.95	0.67
1:A:392:ASP:OD1	1:A:531:ARG:HD3	1.95	0.66
1:B:290:LYS:HD2	4:B:730:HOH:O	1.96	0.65
1:A:79:PRO:CG	1:A:105:ASP:HA	2.25	0.65
1:A:79:PRO:HD3	1:A:105:ASP:O	1.97	0.65
1:B:418:GLN:HE21	1:B:418:GLN:N	1.94	0.62
1:B:210:ASN:HB3	1:B:212:LYS:H	1.65	0.61
1:A:185:HIS:HD2	1:A:188:SER:OG	1.84	0.61
1:B:68:GLN:HE22	1:B:110:PHE:HA	1.65	0.61
1:B:264:ASN:HD21	1:B:295:PHE:H	1.49	0.61
1:B:193:MET:CE	1:B:206:PHE:CD2	2.84	0.60
1:B:398:LYS:HG2	1:B:474:VAL:HG22	1.85	0.59
1:A:210:ASN:HB3	1:A:212:LYS:H	1.67	0.59
1:B:282:GLN:HE22	1:B:348:GLN:HE21	1.49	0.59
1:A:418:GLN:HE22	1:A:508:TYR:H	1.52	0.58
1:A:64:HIS:HD2	1:A:84:HIS:NE2	2.02	0.58
1:A:235:ILE:HD12	4:A:885:HOH:O	2.03	0.58
1:B:418:GLN:HE22	1:B:508:TYR:H	1.50	0.58
1:A:193:MET:HE2	1:A:206:PHE:CD2	2.38	0.58
1:B:535:LYS:C	4:B:638:HOH:O	2.44	0.56
1:A:484:ASN:C	1:A:484:ASN:HD22	2.08	0.56
1:A:264:ASN:HD21	1:A:295:PHE:H	1.53	0.56
1:B:508:TYR:O	1:B:510:HIS:HD2	1.88	0.55
1:B:252:ALA:HB1	1:B:293:TYR:CE1	2.41	0.55
1:A:290:LYS:HG2	1:A:316:TYR:OH	2.07	0.55
1:A:490:PHE:HD1	1:A:495:VAL:HG22	1.71	0.55

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Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:A:333:ARG:HH11	1:A:353:GLN:NE2	2.05	0.54
1:A:488:LEU:HD12	1:A:497:MET:HE1	1.84	0.54
1:A:59:THR:HG23	1:A:132:ASN:HD22	1.70	0.54
1:A:252:ALA:HB1	1:A:293:TYR:CE1	2.43	0.54
1:B:126:ASN:ND2	4:B:816:HOH:O	2.41	0.53
1:B:178:ARG:HH22	1:B:228:GLN:NE2	2.06	0.53
1:B:465:PRO:HG3	1:B:473:ARG:HB3	1.89	0.53
1:B:262:SER:HB2	1:B:293:TYR:CD1	2.45	0.52
1:B:333:ARG:HH11	1:B:353:GLN:NE2	2.07	0.52
1:A:42:THR:HG21	1:A:325:TRP:CD1	2.44	0.52
1:A:410:HIS:HD2	1:A:412:ASP:OD1	1.92	0.52
1:B:306:LEU:HD21	3:B:4001:NAG:H82	1.91	0.52
1:A:74:THR:HG21	4:A:696:HOH:O	2.09	0.52
1:B:535:LYS:O	4:B:638:HOH:O	2.19	0.51
1:B:42:THR:HG21	1:B:325:TRP:CD1	2.46	0.51
1:A:62:LEU:HG	1:A:86:THR:HB	1.91	0.51
1:A:290:LYS:HG3	1:A:313:ASN:HD22	1.76	0.51
1:A:59:THR:HG21	1:A:130:ASP:OD2	2.11	0.50
1:A:326:ARG:O	1:A:327:SER:HB2	2.11	0.50
1:B:185:HIS:HD2	1:B:188:SER:OG	1.94	0.50
1:B:91:VAL:HG11	1:B:361:ILE:HD11	1.92	0.50
1:A:374:LEU:HD11	1:A:514:ILE:HG22	1.94	0.49
1:B:326:ARG:O	1:B:327:SER:HB2	2.13	0.49
1:A:118:HIS:HE1	4:A:23:HOH:O	1.95	0.49
1:A:378:LYS:HE3	4:A:726:HOH:O	2.12	0.48
1:B:488:LEU:CD1	1:B:497:MET:CE	2.76	0.48
1:B:410:HIS:HD2	1:B:412:ASP:OD1	1.96	0.48
1:B:484:ASN:C	1:B:484:ASN:HD22	2.16	0.48
1:A:262:SER:HB2	1:A:293:TYR:CD1	2.49	0.47
1:B:445:PRO:O	1:B:446:ASN:HB2	2.14	0.47
1:A:333:ARG:NH2	1:A:498:THR:OG1	2.43	0.47
1:B:116:VAL:HG11	1:B:132:ASN:HA	1.97	0.46
1:B:79:PRO:HB2	1:B:81:TYR:CE1	2.51	0.46
1:B:228:GLN:NE2	4:B:818:HOH:O	2.45	0.45
1:B:490:PHE:HD1	1:B:495:VAL:HG22	1.81	0.45
1:A:199:GLN:HE21	1:B:345:GLU:HB2	1.81	0.45
1:A:508:TYR:O	1:A:510:HIS:HD2	1.99	0.45
1:B:193:MET:HE3	1:B:206:PHE:CD2	2.52	0.45
1:B:74:THR:OG1	1:B:326:ARG:HG3	2.16	0.45
1:A:469:ASP:O	1:A:470:GLN:HB2	2.16	0.45
1:A:199:GLN:NE2	4:A:585:HOH:O	2.49	0.45
1:B:397:PHE:CZ	1:B:475:PHE:HB2	2.51	0.45

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Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:A:74:THR:HG23	4:A:868:HOH:O	2.17	0.45
1:B:418:GLN:H	1:B:418:GLN:NE2	2.05	0.44
1:B:36:ARG:NH1	1:B:42:THR:HG22	2.32	0.44
1:A:115:VAL:HG11	1:A:182:VAL:HG22	1.99	0.44
1:B:64:HIS:CD2	1:B:84:HIS:NE2	2.75	0.44
1:A:484:ASN:C	1:A:484:ASN:ND2	2.70	0.44
1:B:331:LEU:HD22	4:B:837:HOH:O	2.17	0.44
1:B:372:VAL:CG2	1:B:525:LEU:HB2	2.48	0.44
1:A:415:ILE:CD1	1:A:481:VAL:HG21	2.39	0.43
1:A:126:ASN:HB3	1:A:128:SER:H	1.83	0.43
1:A:230:GLU:OE2	2:A:600:FRU:H12	2.19	0.43
1:A:143:ILE:HG23	1:A:144:PRO:HD2	2.01	0.43
1:A:373:LYS:HB3	1:A:521:PRO:HB3	2.00	0.43
1:B:36:ARG:HH11	1:B:42:THR:CG2	2.32	0.42
1:B:290:LYS:HG2	1:B:316:TYR:OH	2.19	0.42
1:B:136:VAL:HG11	1:B:211:LEU:HD13	2.01	0.42
1:B:79:PRO:HB2	1:B:81:TYR:CZ	2.54	0.42
1:B:74:THR:HG21	4:B:610:HOH:O	2.19	0.42
1:A:264:ASN:ND2	1:A:295:PHE:H	2.16	0.42
1:B:306:LEU:HD12	1:B:334:ASN:HA	2.02	0.42
1:A:118:HIS:CE1	4:A:23:HOH:O	2.72	0.42
1:B:392:ASP:OD1	1:B:531:ARG:HD3	2.20	0.42
1:B:384:PHE:HB2	4:B:698:HOH:O	2.20	0.42
1:A:410:HIS:CD2	1:A:412:ASP:OD1	2.73	0.41
1:A:91:VAL:HG11	1:A:361:ILE:HD11	2.01	0.41
1:B:381:LYS:HG2	1:B:513:GLN:HG2	2.03	0.41
1:B:42:THR:HG22	1:B:43:PRO:O	2.21	0.41
1:B:265:GLN:HA	1:B:285:PHE:HA	2.03	0.41
1:B:398:LYS:NZ	1:B:526:GLU:OE1	2.47	0.41
1:B:199:GLN:HG2	1:B:228:GLN:HG2	2.01	0.41
1:A:223:GLY:HA2	1:A:283:THR:OG1	2.21	0.41
1:A:106:ASN:HA	1:A:106:ASN:HD22	1.66	0.41
1:A:290:LYS:HG3	1:A:313:ASN:ND2	2.35	0.41
1:A:463:LEU:HD21	1:A:495:VAL:HG13	2.03	0.41
1:B:420:LEU:HB3	1:B:421:ASN:H	1.57	0.41
1:B:126:ASN:HB3	1:B:128:SER:H	1.86	0.40
1:A:138:ILE:HG13	1:A:151:ILE:HG22	2.03	0.40
1:B:410:HIS:HE1	4:B:587:HOH:O	2.04	0.40
1:B:106:ASN:HA	1:B:106:ASN:HD22	1.60	0.40
1:B:115:VAL:HG11	1:B:182:VAL:HG22	2.03	0.40
1:B:465:PRO:HD3	1:B:475:PHE:CZ	2.57	0.40
1:B:484:ASN:N	4:B:724:HOH:O	2.54	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	507/509 (100%)	484 (96%)	21 (4%)	2 (0%)	43	29
1	B	507/509 (100%)	482 (95%)	24 (5%)	1 (0%)	56	44
All	All	1014/1018 (100%)	966 (95%)	45 (4%)	3 (0%)	50	37

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	79	PRO
1	A	327	SER
1	B	327	SER

### 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	461/461 (100%)	438 (95%)	23 (5%)	34	20
1	B	461/461 (100%)	426 (92%)	35 (8%)	19	8
All	All	922/922 (100%)	864 (94%)	58 (6%)	25	12

All (58) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	27	LEU
1	A	36	ARG
1	A	45	LYS

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Mol	Chain	Res	Type
1	A	61	LYS
1	A	79	PRO
1	A	106	ASN
1	A	133	GLN
1	A	182	VAL
1	A	202	LYS
1	A	210	ASN
1	A	306	LEU
1	A	349	LEU
1	A	377	LYS
1	A	382	THR
1	A	388	THR
1	A	400	LEU
1	A	418	GLN
1	A	448	GLU
1	A	472	LEU
1	A	477	LEU
1	A	484	ASN
1	A	495	VAL
1	A	533	LEU
1	B	27	LEU
1	B	28	SER
1	B	33	GLU
1	B	36	ARG
1	B	45	LYS
1	B	50	ASP
1	B	61	LYS
1	B	106	ASN
1	B	132	ASN
1	B	182	VAL
1	B	189	ASN
1	B	202	LYS
1	B	210	ASN
1	B	290	LYS
1	B	306	LEU
1	B	345	GLU
1	B	349	LEU
1	B	352	ILE
1	B	366	LYS
1	B	369	LYS
1	B	374	LEU
1	B	382	THR

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Mol	Chain	Res	Type
1	B	385	LYS
1	B	388	THR
1	B	400	LEU
1	B	418	GLN
1	B	448	GLU
1	B	463	LEU
1	B	465	PRO
1	B	477	LEU
1	B	484	ASN
1	B	495	VAL
1	B	511	ASP
1	B	526	GLU
1	B	533	LEU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (49) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	52	ASN
1	A	64	HIS
1	A	68	GLN
1	A	78	GLN
1	A	106	ASN
1	A	118	HIS
1	A	132	ASN
1	A	133	GLN
1	A	185	HIS
1	A	199	GLN
1	A	210	ASN
1	A	213	ASN
1	A	227	ASN
1	A	228	GLN
1	A	264	ASN
1	A	296	GLN
1	A	348	GLN
1	A	353	GLN
1	A	401	ASN
1	A	410	HIS
1	A	418	GLN
1	A	435	GLN
1	A	484	ASN
1	A	510	HIS
1	A	513	GLN

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Mol	Chain	Res	Type
1	B	52	ASN
1	B	64	HIS
1	B	68	GLN
1	B	78	GLN
1	B	106	ASN
1	B	118	HIS
1	B	132	ASN
1	B	133	GLN
1	B	185	HIS
1	B	199	GLN
1	B	210	ASN
1	B	213	ASN
1	B	227	ASN
1	B	228	GLN
1	B	264	ASN
1	B	296	GLN
1	B	348	GLN
1	B	353	GLN
1	B	410	HIS
1	B	418	GLN
1	B	435	GLN
1	B	484	ASN
1	B	510	HIS
1	B	513	GLN

### 5.3.3 RNA ⓘ

There are no RNA chains 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 carbohydrates in this entry.

### 5.6 Ligand geometry ⓘ

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	$\# Z  > 2$
3	NAG	A	1001	1	12,14,15	0.71	1 (8%)	15,19,21	1.05	0
3	NAG	A	3001	1	12,14,15	0.73	0	15,19,21	0.70	0
3	NAG	A	4001	1	12,14,15	0.67	0	15,19,21	0.66	0
3	NAG	A	5001	1	12,14,15	0.66	0	15,19,21	1.16	2 (13%)
2	FRU	A	600	-	12,12,12	1.09	1 (8%)	18,18,18	3.16	3 (16%)
3	NAG	B	3001	1	12,14,15	0.67	0	15,19,21	1.14	1 (6%)
3	NAG	B	4001	1	12,14,15	0.65	0	15,19,21	1.02	1 (6%)
3	NAG	B	5001	1	12,14,15	0.50	0	15,19,21	1.29	1 (6%)
2	FRU	B	600	-	12,12,12	1.08	1 (8%)	18,18,18	3.16	3 (16%)

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
3	NAG	A	1001	1	-	0/6/23/26	0/1/1/1
3	NAG	A	3001	1	-	0/6/23/26	0/1/1/1
3	NAG	A	4001	1	-	0/6/23/26	0/1/1/1
3	NAG	A	5001	1	-	0/6/23/26	0/1/1/1
2	FRU	A	600	-	-	0/5/24/24	0/1/1/1
3	NAG	B	3001	1	-	0/6/23/26	0/1/1/1
3	NAG	B	4001	1	-	0/6/23/26	0/1/1/1
3	NAG	B	5001	1	-	0/6/23/26	0/1/1/1
2	FRU	B	600	-	-	0/5/24/24	0/1/1/1

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	600	FRU	O2-C2	2.71	1.45	1.41
2	B	600	FRU	O2-C2	2.67	1.45	1.41
3	A	1001	NAG	O5-C5	-2.10	1.41	1.45



All (11) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	600	FRU	O5-C2-C1	11.66	126.53	108.17
2	B	600	FRU	O5-C2-C1	11.64	126.51	108.17
3	B	5001	NAG	C3-C2-N2	-3.98	105.70	111.76
2	A	600	FRU	O2-C2-C3	-3.89	100.44	109.14
2	B	600	FRU	O2-C2-C3	-3.87	100.48	109.14
2	A	600	FRU	O2-C2-O5	-3.40	102.41	109.47
2	B	600	FRU	O2-C2-O5	-3.39	102.43	109.47
3	A	5001	NAG	O5-C5-C6	2.69	109.81	106.98
3	B	3001	NAG	C3-C2-N2	-2.53	107.91	111.76
3	A	5001	NAG	C3-C2-N2	-2.41	108.09	111.76
3	B	4001	NAG	O5-C5-C4	-2.04	108.07	110.65

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

## 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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	509/509 (100%)	0.15	13 (2%) 53 55	7, 16, 26, 34	0
1	B	509/509 (100%)	0.33	24 (4%) 30 30	7, 17, 28, 36	0
All	All	1018/1018 (100%)	0.24	37 (3%) 41 42	7, 16, 27, 36	0

All (37) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	27	LEU	7.2
1	B	27	LEU	6.8
1	A	28	SER	4.6
1	B	302	GLU	3.5
1	B	422	SER	3.4
1	B	127	SER	3.2
1	A	420	LEU	3.1
1	B	420	LEU	3.1
1	B	385	LYS	3.0
1	A	79	PRO	3.0
1	A	302	GLU	2.9
1	A	78	GLN	2.9
1	B	79	PRO	2.7
1	B	143	ILE	2.7
1	B	124	PHE	2.6
1	B	165	GLU	2.6
1	A	29	VAL	2.6
1	B	243	ASP	2.6
1	B	28	SER	2.6
1	B	303	HIS	2.6
1	A	470	GLN	2.6
1	B	209	ALA	2.4
1	B	210	ASN	2.4
1	A	303	HIS	2.4

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Mol	Chain	Res	Type	RSRZ
1	A	388	THR	2.3
1	B	106	ASN	2.3
1	B	126	ASN	2.3
1	A	345	GLU	2.3
1	B	103	GLU	2.3
1	B	29	VAL	2.2
1	B	186	GLU	2.2
1	A	421	ASN	2.2
1	A	243	ASP	2.1
1	B	359	ASP	2.1
1	B	388	THR	2.0
1	B	166	ASN	2.0
1	B	123	GLY	2.0

## 6.2 Non-standard residues in protein, DNA, RNA chains ⓘ

There are no non-standard protein/DNA/RNA residues in this entry.

## 6.3 Carbohydrates ⓘ

There are no carbohydrates in this entry.

## 6.4 Ligands ⓘ

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. 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, 95<sup>th</sup> 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	RSR	LLDF	B-factors(Å <sup>2</sup> )	Q<0.9
2	FRU	A	600	12/12	0.28	12.66	12,20,25,27	0
2	FRU	B	600	12/12	0.28	10.40	12,20,25,27	0
3	NAG	B	5001	14/15	0.31	7.61	30,35,37,37	0
3	NAG	A	5001	14/15	0.24	3.97	30,34,35,36	0
3	NAG	A	1001	14/15	0.31	2.48	31,35,37,37	0
3	NAG	B	3001	14/15	0.15	1.06	29,32,34,35	0
3	NAG	A	4001	14/15	0.17	0.82	23,26,28,28	0
3	NAG	B	4001	14/15	0.16	0.64	22,25,26,26	0

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Mol	Type	Chain	Res	Atoms	RSR	LLDF	B-factors( $\text{\AA}^2$ )	Q<0.9
3	NAG	A	3001	14/15	0.13	0.16	25,28,30,30	0

## 6.5 Other polymers ⓘ

There are no such residues in this entry.