



# Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2026 – 05:31 AM UTC

PDB ID : 1H8V / pdb\_00001h8v  
Title : The X-ray Crystal Structure of the Trichoderma reesei Family 12 Endoglucanase 3, Cel12A, at 1.9 Å Resolution  
Authors : Sandgren, M.; Shaw, A.; Ropp, T.H.; Wu, S.; Bott, R.; Cameron, A.D.; Stahlberg, J.; Mitchinson, C.; Jones, T.A.  
Deposited on : 2001-02-16  
Resolution : 1.90 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](mailto: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>.

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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

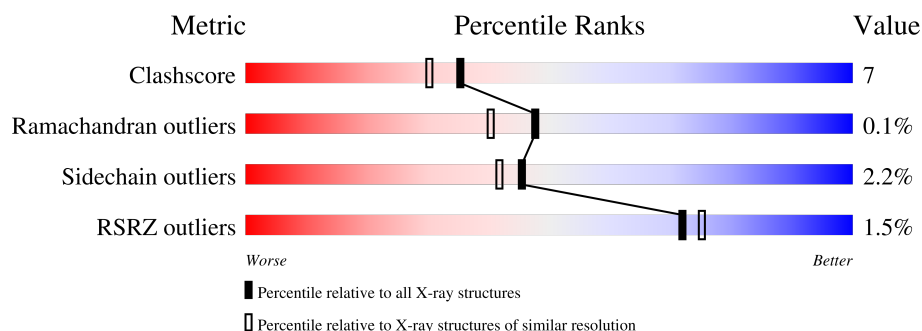
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 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))
Clashscore	190562	8410 (1.90-1.90)
Ramachandran outliers	187476	8333 (1.90-1.90)
Sidechain outliers	187428	8333 (1.90-1.90)
RSRZ outliers	180081	7790 (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 of the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 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	218	
1	B	218	
1	C	218	
1	D	218	
1	E	218	
1	F	218	

## 2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 11228 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 ENDO-BETA-1,4-GLUCANASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	218	Total	C	N	O	S	0	0	0
			1661	1045	278	333	5			
1	B	218	Total	C	N	O	S	0	0	0
			1661	1045	278	333	5			
1	C	218	Total	C	N	O	S	0	0	0
			1661	1045	278	333	5			
1	D	218	Total	C	N	O	S	0	0	0
			1661	1045	278	333	5			
1	E	218	Total	C	N	O	S	0	0	0
			1661	1045	278	333	5			
1	F	218	Total	C	N	O	S	0	0	0
			1661	1045	278	333	5			

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



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


- Molecule 3 is water.

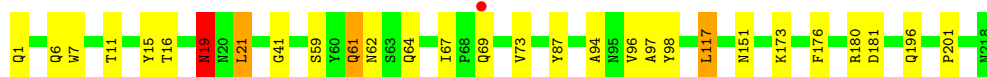
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	214	Total	O	0	0
			214	214		
3	B	154	Total	O	0	0
			154	154		
3	C	190	Total	O	0	0
			190	190		
3	D	216	Total	O	0	0
			216	216		
3	E	209	Total	O	0	0
			209	209		
3	F	195	Total	O	0	0
			195	195		

### 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.

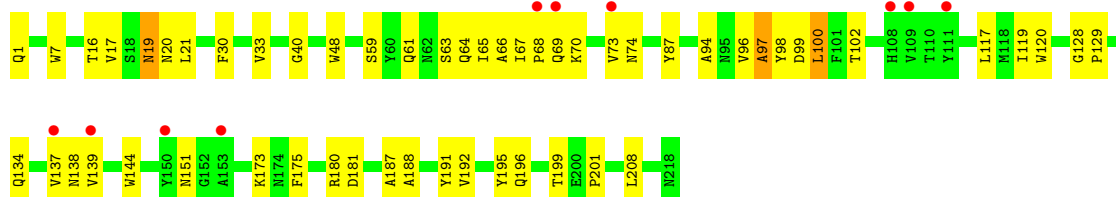
#### • Molecule 1: ENDO-BETA-1,4-GLUCANASE

Chain A: 




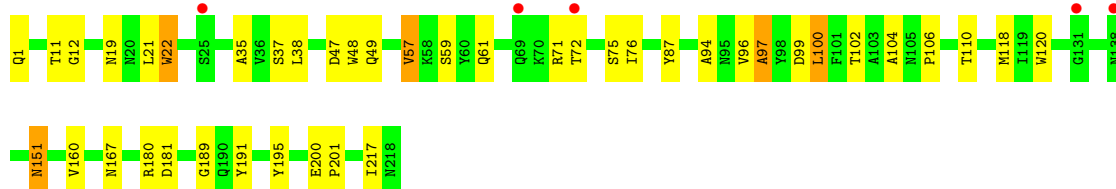
#### • Molecule 1: ENDO-BETA-1,4-GLUCANASE

Chain B: 




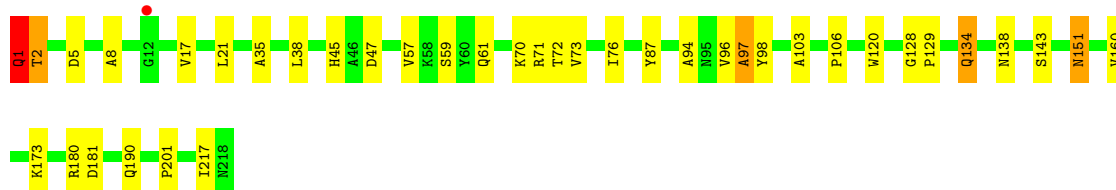
#### • Molecule 1: ENDO-BETA-1,4-GLUCANASE

Chain C: 

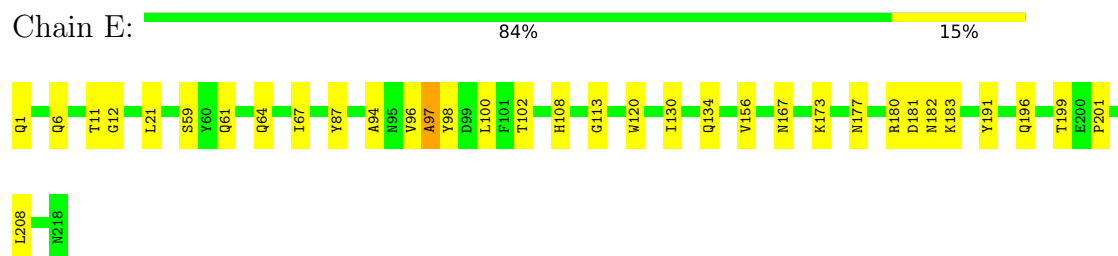


#### • Molecule 1: ENDO-BETA-1,4-GLUCANASE

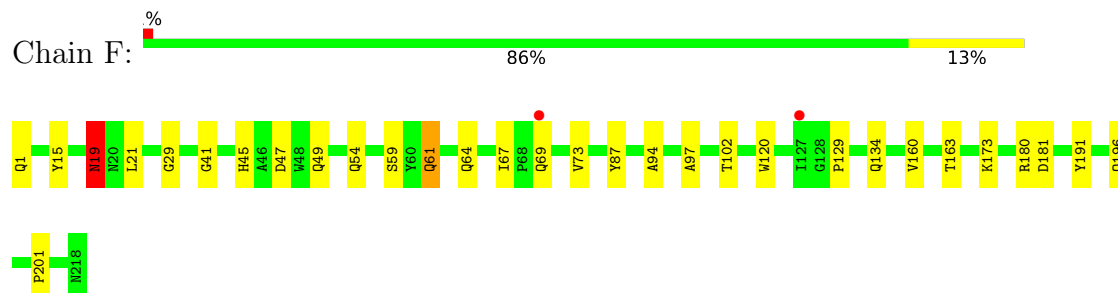
Chain D: 



## ● Molecule 1: ENDO-BETA-1,4-GLUCANASE



## ● Molecule 1: ENDO-BETA-1,4-GLUCANASE



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	69.72Å 71.58Å 121.40Å 90.00° 91.52° 90.00°	Depositor
Resolution (Å)	28.10 – 1.90 28.10 – 1.90	Depositor EDS
% Data completeness (in resolution range)	92.0 (28.10-1.90) 92.1 (28.10-1.90)	Depositor EDS
$R_{merge}$	0.07	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.85 (at 1.91Å)	Xtriage
Refinement program	CNS 1.0	Depositor
R, $R_{free}$	0.189 , 0.233 0.203 , (Not available)	Depositor DCC
$R_{free}$ test set	No test flags present.	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	13.0	Xtriage
Anisotropy	0.179	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.31 , 38.9	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	0.001 for -k,-h,-l 0.007 for k,h,-l 0.033 for h,-k,-l	Xtriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	11228	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	14.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 25.88 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 2.9205e-03. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

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

<sup>2</sup>Theoretical 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: NAG, PCA

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	0/1702	0.88	8/2326 (0.3%)
1	B	0.33	0/1702	0.86	6/2326 (0.3%)
1	C	0.34	0/1702	0.85	6/2326 (0.3%)
1	D	0.39	1/1702 (0.1%)	0.89	6/2326 (0.3%)
1	E	0.34	0/1702	0.85	6/2326 (0.3%)
1	F	0.34	0/1702	0.85	4/2326 (0.2%)
All	All	0.34	1/10212 (0.0%)	0.86	36/13956 (0.3%)

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	D	0	1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	D	2	THR	C-N	-5.37	1.26	1.33

All (36) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	1	PCA	O-C-N	-10.67	105.93	123.00
1	A	67	ILE	CA-C-N	6.82	126.33	119.24
1	A	67	ILE	C-N-CA	6.82	126.33	119.24
1	A	19	ASN	N-CA-C	-6.75	103.84	111.14
1	F	67	ILE	CA-C-N	6.36	125.85	119.24
1	F	67	ILE	C-N-CA	6.36	125.85	119.24

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	151	ASN	N-CA-C	-6.29	98.10	108.49
1	E	98	TYR	N-CA-C	-6.27	102.08	110.55
1	B	97	ALA	N-CA-C	6.18	118.25	108.79
1	D	57	VAL	N-CA-C	-6.18	101.57	109.30
1	E	97	ALA	N-CA-C	6.13	118.18	108.79
1	C	97	ALA	N-CA-C	5.96	117.92	108.79
1	A	96	VAL	N-CA-C	-5.91	98.98	107.78
1	E	96	VAL	N-CA-C	-5.86	99.10	107.77
1	B	151	ASN	N-CA-C	-5.84	100.30	108.54
1	D	97	ALA	N-CA-C	5.81	117.94	108.76
1	A	98	TYR	N-CA-C	-5.79	101.91	110.48
1	E	61	GLN	N-CA-C	-5.76	101.52	110.10
1	A	97	ALA	N-CA-C	5.55	117.54	108.76
1	C	22	TRP	N-CA-C	5.52	117.30	111.28
1	D	96	VAL	N-CA-C	-5.48	99.61	107.78
1	A	61	GLN	N-CA-C	-5.45	101.98	110.10
1	D	98	TYR	N-CA-C	-5.45	103.20	110.55
1	C	96	VAL	N-CA-C	-5.41	99.71	107.78
1	B	96	VAL	N-CA-C	-5.41	99.72	107.78
1	E	67	ILE	CA-C-N	5.39	125.47	119.32
1	E	67	ILE	C-N-CA	5.39	125.47	119.32
1	F	19	ASN	N-CA-C	-5.34	104.89	111.40
1	C	61	GLN	N-CA-C	-5.31	102.00	109.96
1	D	61	GLN	N-CA-C	-5.25	102.28	110.10
1	B	67	ILE	CA-C-N	5.16	124.78	119.05
1	B	67	ILE	C-N-CA	5.16	124.78	119.05
1	B	48	TRP	N-CA-C	5.10	116.04	108.60
1	C	110	THR	N-CA-C	5.08	119.46	113.16
1	F	61	GLN	N-CA-C	-5.01	102.63	110.10
1	C	48	TRP	N-CA-C	5.01	115.75	108.14

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	D	1	PCA	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	1661	0	1513	22	0
1	B	1661	0	1513	37	0
1	C	1661	0	1513	26	0
1	D	1661	0	1513	23	0
1	E	1661	0	1513	17	0
1	F	1661	0	1513	17	0
2	A	14	0	13	0	0
2	B	14	0	13	0	0
2	C	14	0	13	0	0
2	D	14	0	13	0	0
2	E	14	0	13	0	0
2	F	14	0	13	0	0
3	A	214	0	0	1	0
3	B	154	0	0	4	0
3	C	190	0	0	3	0
3	D	216	0	0	1	0
3	E	209	0	0	1	0
3	F	195	0	0	3	0
All	All	11228	0	9156	142	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 7.

All (142) 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:100:LEU:HD13	1:B:195:TYR:HA	1.59	0.83
1:C:100:LEU:HD13	1:C:195:TYR:HA	1.66	0.78
1:C:72:THR:HG21	3:C:2166:HOH:O	1.86	0.75
1:D:71:ARG:HB2	1:D:76:ILE:HD11	1.69	0.75
1:D:73:VAL:O	1:D:173:LYS:HE3	1.91	0.69
1:C:72:THR:HG23	1:C:75:SER:H	1.56	0.69
1:B:64:GLN:HB3	1:B:196:GLN:HG2	1.79	0.65
1:C:37:SER:C	1:C:38:LEU:HD12	2.23	0.64
1:B:70:LYS:HE2	3:B:2084:HOH:O	1.98	0.63
1:F:73:VAL:O	1:F:173:LYS:HE3	1.99	0.63
1:B:100:LEU:CD1	1:B:195:TYR:HA	2.30	0.62
1:A:180:ARG:HD2	1:A:181:ASP:OD2	2.01	0.60
1:A:69:GLN:NE2	1:A:69:GLN:H	2.00	0.59

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:71:ARG:CZ	1:D:76:ILE:HD13	2.33	0.58
1:F:180:ARG:HD2	1:F:181:ASP:OD2	2.04	0.58
1:C:22:TRP:CZ2	1:C:57:VAL:HG22	2.39	0.57
1:E:173:LYS:HE2	1:E:177:ASN:OD1	2.04	0.57
1:C:106:PRO:HG3	1:C:191:TYR:CZ	2.39	0.57
1:E:180:ARG:HD2	1:E:181:ASP:OD2	2.05	0.57
1:A:73:VAL:O	1:A:173:LYS:HE3	2.05	0.56
1:F:163:THR:HG21	3:F:2146:HOH:O	2.05	0.56
1:C:71:ARG:HB2	1:C:76:ILE:HD11	1.88	0.55
1:C:99:ASP:C	1:C:100:LEU:HD22	2.30	0.55
1:B:7:TRP:HZ3	1:B:20:ASN:HD22	1.55	0.54
1:C:106:PRO:HG3	1:C:191:TYR:CE1	2.42	0.54
1:D:72:THR:O	1:D:76:ILE:HG12	2.07	0.54
1:B:74:ASN:HB2	1:B:187:ALA:O	2.08	0.54
1:B:65:ILE:HG12	1:B:195:TYR:HB3	1.90	0.53
1:A:64:GLN:HB3	1:A:196:GLN:HG2	1.91	0.53
1:D:180:ARG:HD2	1:D:181:ASP:OD2	2.09	0.53
1:C:35:ALA:HB1	1:C:38:LEU:HD11	1.91	0.53
1:E:11:THR:HG22	3:E:2020:HOH:O	2.09	0.52
1:F:21:LEU:HA	1:F:59:SER:HB3	1.91	0.52
1:D:76:ILE:HD12	1:D:217:ILE:CG2	2.39	0.52
1:B:180:ARG:HD2	1:B:181:ASP:OD2	2.10	0.52
1:B:94:ALA:HB2	1:B:201:PRO:HA	1.91	0.51
1:B:199:THR:HB	1:B:208:LEU:HD22	1.91	0.51
1:B:99:ASP:C	1:B:100:LEU:HD22	2.35	0.51
1:C:38:LEU:HD12	1:C:38:LEU:N	2.26	0.50
1:C:102:THR:HA	1:C:191:TYR:O	2.12	0.50
1:A:69:GLN:N	1:A:69:GLN:CD	2.70	0.50
1:B:139:VAL:HG21	1:B:175:PHE:CE2	2.47	0.50
1:B:21:LEU:HA	1:B:59:SER:HB3	1.95	0.49
1:F:64:GLN:HB3	1:F:196:GLN:HG2	1.92	0.49
1:A:19:ASN:ND2	1:A:61:GLN:HE21	2.09	0.49
1:E:182:ASN:C	1:E:183:LYS:HD2	2.37	0.49
1:A:11:THR:HG22	1:A:16:THR:HG23	1.95	0.48
1:D:21:LEU:HA	1:D:59:SER:CB	2.43	0.48
1:D:94:ALA:HB2	1:D:201:PRO:HA	1.95	0.48
1:D:97:ALA:HB2	1:D:120:TRP:HA	1.96	0.48
1:B:74:ASN:HB2	1:B:188:ALA:HA	1.95	0.48
1:C:47:ASP:HB3	3:C:2049:HOH:O	2.13	0.48
1:D:138:ASN:HD22	1:D:143:SER:HA	1.78	0.48
1:D:5:ASP:HB2	1:D:8:ALA:HB2	1.96	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:F:69:GLN:O	1:F:69:GLN:HG2	2.12	0.48
1:B:117:LEU:C	1:B:117:LEU:HD13	2.38	0.48
1:D:151:ASN:ND2	3:D:2163:HOH:O	2.46	0.48
1:D:17:VAL:HG23	1:D:38:LEU:HD21	1.96	0.48
1:D:21:LEU:HA	1:D:59:SER:HB3	1.94	0.48
1:E:182:ASN:O	1:E:183:LYS:HD2	2.13	0.48
1:A:19:ASN:HD22	1:A:19:ASN:HA	1.56	0.47
1:A:21:LEU:HA	1:A:59:SER:HB3	1.95	0.47
1:C:180:ARG:HD2	1:C:181:ASP:OD2	2.13	0.47
1:A:94:ALA:HB2	1:A:201:PRO:HA	1.97	0.47
1:B:21:LEU:HA	1:B:59:SER:CB	2.43	0.47
1:B:138:ASN:HB3	3:B:2101:HOH:O	2.12	0.47
1:B:40:GLY:N	3:B:2035:HOH:O	2.45	0.47
1:C:72:THR:HG22	1:C:75:SER:HB3	1.96	0.47
1:C:97:ALA:HB2	1:C:120:TRP:HA	1.97	0.47
1:A:62:ASN:ND2	1:A:196:GLN:HE21	2.13	0.46
1:B:139:VAL:HG22	1:B:144:TRP:CD1	2.50	0.46
1:D:1:PCA:HG2	1:D:35:ALA:O	2.15	0.46
1:C:118:MET:HE1	1:C:200:GLU:OE1	2.15	0.46
1:B:66:ALA:C	1:B:68:PRO:HD3	2.41	0.46
1:C:76:ILE:HD12	1:C:217:ILE:CG2	2.45	0.46
1:B:94:ALA:CB	1:B:201:PRO:HA	2.46	0.46
1:D:45:HIS:HD2	1:D:47:ASP:OD1	1.98	0.46
1:A:19:ASN:HD21	1:A:61:GLN:HE21	1.64	0.46
1:D:70:LYS:HG2	1:D:106:PRO:O	2.16	0.46
1:F:173:LYS:HE2	3:F:2086:HOH:O	2.16	0.45
1:F:97:ALA:HB2	1:F:120:TRP:HA	1.97	0.45
1:A:64:GLN:CB	1:A:196:GLN:HG2	2.46	0.45
1:E:21:LEU:HA	1:E:59:SER:CB	2.47	0.45
1:A:21:LEU:HA	1:A:59:SER:CB	2.47	0.45
1:F:21:LEU:HA	1:F:59:SER:CB	2.46	0.45
1:B:73:VAL:HG12	1:B:192:VAL:CG2	2.47	0.44
1:B:173:LYS:HE2	3:B:2126:HOH:O	2.17	0.44
1:B:73:VAL:HG23	1:B:187:ALA:HB1	1.99	0.44
1:E:6:GLN:HG3	1:E:21:LEU:HB2	1.99	0.44
1:C:11:THR:HG22	1:C:12:GLY:N	2.33	0.44
1:E:130:ILE:HD12	1:E:156:VAL:HG11	1.99	0.44
1:D:94:ALA:CB	1:D:201:PRO:HA	2.48	0.44
1:D:103:ALA:HA	1:D:190:GLN:HE22	1.81	0.44
1:A:69:GLN:H	1:A:69:GLN:CD	2.25	0.44
1:F:15:TYR:CZ	1:F:41:GLY:HA2	2.53	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:F:94:ALA:HB2	1:F:201:PRO:HA	1.98	0.43
1:B:19:ASN:HD22	1:B:19:ASN:HA	1.56	0.43
1:A:173:LYS:HE2	3:A:2091:HOH:O	2.18	0.43
1:A:15:TYR:CZ	1:A:41:GLY:HA2	2.54	0.43
1:A:117:LEU:HD12	1:A:176:PHE:CZ	2.54	0.43
1:C:72:THR:O	1:C:76:ILE:HG12	2.19	0.43
1:A:6:GLN:HG2	1:A:7:TRP:CD1	2.54	0.42
1:E:108:HIS:CE1	1:E:113:GLY:HA2	2.54	0.42
1:E:102:THR:HA	1:E:191:TYR:O	2.19	0.42
1:F:45:HIS:HD2	1:F:47:ASP:OD1	2.02	0.42
1:F:102:THR:HA	1:F:191:TYR:O	2.20	0.42
1:A:94:ALA:CB	1:A:201:PRO:HA	2.49	0.42
1:B:102:THR:HA	1:B:191:TYR:O	2.20	0.42
1:B:128:GLY:HA2	1:B:129:PRO:HD3	1.88	0.42
1:F:54:GLN:NE2	3:F:2065:HOH:O	2.52	0.42
1:C:21:LEU:HA	1:C:59:SER:HB3	2.01	0.42
1:E:97:ALA:HB2	1:E:120:TRP:HA	2.01	0.42
1:B:137:VAL:HG12	1:B:138:ASN:N	2.34	0.42
1:C:104:ALA:HA	1:C:189:GLY:O	2.19	0.42
1:F:19:ASN:ND2	1:F:61:GLN:HE21	2.18	0.42
1:D:128:GLY:HA2	1:D:129:PRO:HD3	1.90	0.42
1:E:11:THR:HG22	1:E:12:GLY:N	2.35	0.42
1:A:69:GLN:HG2	1:A:69:GLN:O	2.19	0.41
1:C:120:TRP:HB2	1:C:160:VAL:HA	2.02	0.41
1:C:49:GLN:HG2	3:C:2052:HOH:O	2.21	0.41
1:D:134:GLN:CA	1:D:134:GLN:HE21	2.31	0.41
1:E:100:LEU:HD12	1:E:100:LEU:N	2.35	0.41
1:B:69:GLN:O	1:B:69:GLN:CG	2.67	0.41
1:B:17:VAL:CG1	1:B:33:VAL:HG21	2.51	0.41
1:B:16:THR:O	1:B:63:SER:HA	2.21	0.41
1:C:151:ASN:HD22	1:C:151:ASN:HA	1.62	0.41
1:E:180:ARG:CD	1:E:181:ASP:OD2	2.69	0.41
1:A:173:LYS:HD2	1:A:173:LYS:HA	1.88	0.41
1:B:73:VAL:HG22	1:B:187:ALA:O	2.20	0.41
1:B:98:TYR:HB2	1:B:119:ILE:HB	2.02	0.41
1:E:64:GLN:HB3	1:E:196:GLN:HG2	2.02	0.41
1:F:29:GLY:HA3	1:F:49:GLN:O	2.21	0.41
1:D:76:ILE:HD12	1:D:217:ILE:HG22	2.02	0.41
1:E:94:ALA:HB2	1:E:201:PRO:HA	2.02	0.41
1:E:199:THR:HB	1:E:208:LEU:HD22	2.03	0.41
1:B:64:GLN:CB	1:B:196:GLN:HG2	2.48	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:120:TRP:HB2	1:D:160:VAL:HA	2.03	0.40
1:B:19:ASN:HD22	1:B:61:GLN:HG2	1.86	0.40
1:B:30:PHE:CD1	1:B:30:PHE:C	3.00	0.40
1:C:94:ALA:HB2	1:C:201:PRO:HA	2.02	0.40
1:F:129:PRO:HG2	1:F:160:VAL:HG21	2.02	0.40
1:B:97:ALA:HB2	1:B:120:TRP:HA	2.04	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	216/218 (99%)	210 (97%)	6 (3%)	0	100	100
1	B	216/218 (99%)	205 (95%)	11 (5%)	0	100	100
1	C	216/218 (99%)	208 (96%)	8 (4%)	0	100	100
1	D	216/218 (99%)	209 (97%)	6 (3%)	1 (0%)	24	16
1	E	216/218 (99%)	210 (97%)	6 (3%)	0	100	100
1	F	216/218 (99%)	211 (98%)	5 (2%)	0	100	100
All	All	1296/1308 (99%)	1253 (97%)	42 (3%)	1 (0%)	48	40

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	D	2	THR

### 5.3.2 Protein sidechains [i](#)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar

resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	172/172 (100%)	168 (98%)	4 (2%)	44	40
1	B	172/172 (100%)	168 (98%)	4 (2%)	44	40
1	C	172/172 (100%)	166 (96%)	6 (4%)	32	24
1	D	172/172 (100%)	169 (98%)	3 (2%)	53	52
1	E	172/172 (100%)	169 (98%)	3 (2%)	53	52
1	F	172/172 (100%)	169 (98%)	3 (2%)	53	52
All	All	1032/1032 (100%)	1009 (98%)	23 (2%)	45	42

All (23) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	19	ASN
1	A	21	LEU
1	A	87	TYR
1	A	117	LEU
1	B	19	ASN
1	B	87	TYR
1	B	100	LEU
1	B	134	GLN
1	C	19	ASN
1	C	57	VAL
1	C	87	TYR
1	C	100	LEU
1	C	151	ASN
1	C	167	ASN
1	D	87	TYR
1	D	134	GLN
1	D	151	ASN
1	E	87	TYR
1	E	134	GLN
1	E	167	ASN
1	F	19	ASN
1	F	87	TYR
1	F	134	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (69) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	13	ASN
1	A	19	ASN
1	A	20	ASN
1	A	45	HIS
1	A	55	ASN
1	A	56	ASN
1	A	69	GLN
1	A	138	ASN
1	A	142	GLN
1	A	151	ASN
1	A	155	GLN
1	A	162	GLN
1	A	196	GLN
1	B	13	ASN
1	B	19	ASN
1	B	20	ASN
1	B	45	HIS
1	B	49	GLN
1	B	55	ASN
1	B	138	ASN
1	B	142	GLN
1	B	151	ASN
1	B	162	GLN
1	B	182	ASN
1	B	190	GLN
1	B	196	GLN
1	C	19	ASN
1	C	45	HIS
1	C	49	GLN
1	C	142	GLN
1	C	151	ASN
1	C	162	GLN
1	C	167	ASN
1	C	218	ASN
1	D	6	GLN
1	D	13	ASN
1	D	20	ASN
1	D	45	HIS
1	D	55	ASN
1	D	64	GLN
1	D	69	GLN
1	D	134	GLN
1	D	138	ASN

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Mol	Chain	Res	Type
1	D	142	GLN
1	D	151	ASN
1	D	162	GLN
1	D	190	GLN
1	E	13	ASN
1	E	20	ASN
1	E	45	HIS
1	E	49	GLN
1	E	56	ASN
1	E	62	ASN
1	E	64	GLN
1	E	134	GLN
1	E	151	ASN
1	E	155	GLN
1	E	162	GLN
1	E	167	ASN
1	E	196	GLN
1	E	218	ASN
1	F	19	ASN
1	F	45	HIS
1	F	54	GLN
1	F	134	GLN
1	F	142	GLN
1	F	151	ASN
1	F	155	GLN
1	F	218	ASN

### 5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

6 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
1	PCA	A	1	1	7,8,9	0.76	0	9,10,12	1.49	2 (22%)
1	PCA	F	1	1	7,8,9	0.80	0	9,10,12	1.33	1 (11%)
1	PCA	D	1	1	7,8,9	2.73	3 (42%)	9,10,12	2.81	4 (44%)
1	PCA	C	1	1	7,8,9	0.73	0	9,10,12	1.59	1 (11%)
1	PCA	E	1	1	7,8,9	0.78	0	9,10,12	1.50	1 (11%)
1	PCA	B	1	1	7,8,9	0.75	0	9,10,12	1.32	2 (22%)

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
1	PCA	A	1	1	-	0/0/11/13	0/1/1/1
1	PCA	F	1	1	-	0/0/11/13	0/1/1/1
1	PCA	D	1	1	-	0/0/11/13	0/1/1/1
1	PCA	C	1	1	-	0/0/11/13	0/1/1/1
1	PCA	E	1	1	-	0/0/11/13	0/1/1/1
1	PCA	B	1	1	-	0/0/11/13	0/1/1/1

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	D	1	PCA	CA-N	-5.43	1.40	1.46
1	D	1	PCA	CD-N	-3.38	1.25	1.34
1	D	1	PCA	CG-CD	2.01	1.55	1.50

All (11) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	1	PCA	O-C-CA	-6.68	107.58	124.77
1	C	1	PCA	CB-CA-C	-3.66	107.64	112.66
1	D	1	PCA	OE-CD-N	-3.34	117.73	124.96
1	E	1	PCA	CB-CA-C	-3.29	108.14	112.66
1	A	1	PCA	CB-CA-C	-3.19	108.28	112.66
1	F	1	PCA	CB-CA-C	-2.71	108.94	112.66
1	D	1	PCA	CB-CG-CD	-2.43	100.65	104.41
1	B	1	PCA	CB-CA-C	-2.39	109.38	112.66
1	D	1	PCA	OE-CD-CG	2.28	130.78	126.72
1	B	1	PCA	O-C-CA	-2.06	119.48	124.77
1	A	1	PCA	CB-CA-N	2.01	108.76	103.24

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
1	D	1	PCA	1	0

## 5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

6 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$
2	NAG	A	301	1	14,14,15	0.58	0	17,19,21	0.72	0
2	NAG	C	301	1	14,14,15	0.56	0	17,19,21	0.75	1 (5%)
2	NAG	F	301	1	14,14,15	0.62	0	17,19,21	0.74	0
2	NAG	D	301	1	14,14,15	0.64	0	17,19,21	0.74	0
2	NAG	E	301	1	14,14,15	0.68	0	17,19,21	0.67	0
2	NAG	B	301	1	14,14,15	0.54	0	17,19,21	0.66	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
2	NAG	A	301	1	-	0/6/23/26	0/1/1/1
2	NAG	C	301	1	-	0/6/23/26	0/1/1/1
2	NAG	F	301	1	-	0/6/23/26	0/1/1/1

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	NAG	D	301	1	-	3/6/23/26	0/1/1/1
2	NAG	E	301	1	-	0/6/23/26	0/1/1/1
2	NAG	B	301	1	-	0/6/23/26	0/1/1/1

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	301	NAG	C2-N2-C7	-2.08	120.12	122.90

There are no chirality outliers.

All (3) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	D	301	NAG	C8-C7-N2-C2
2	D	301	NAG	O7-C7-N2-C2
2	D	301	NAG	C1-C2-N2-C7

There are no ring outliers.

No monomer is involved in short contacts.

## 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

### 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	217/218 (99%)	-0.23	1 (0%) 87 89	5, 12, 18, 29	0
1	B	217/218 (99%)	0.46	10 (4%) 37 40	7, 20, 32, 42	0
1	C	217/218 (99%)	0.21	5 (2%) 61 65	6, 15, 27, 31	0
1	D	217/218 (99%)	-0.22	1 (0%) 87 89	5, 10, 19, 26	0
1	E	217/218 (99%)	-0.28	0 100 100	4, 10, 18, 24	0
1	F	217/218 (99%)	-0.15	2 (0%) 81 83	7, 12, 20, 29	0
All	All	1302/1308 (99%)	-0.04	19 (1%) 72 75	4, 13, 26, 42	0

All (19) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	111	TYR	4.9
1	B	69	GLN	3.4
1	B	153	ALA	3.2
1	F	69	GLN	3.1
1	C	72	THR	3.0
1	C	138	ASN	2.8
1	B	139	VAL	2.5
1	D	12	GLY	2.4
1	B	68	PRO	2.4
1	C	25	SER	2.4
1	B	150	TYR	2.3
1	B	109	VAL	2.3
1	B	73	VAL	2.2
1	C	69	GLN	2.2
1	F	127	ILE	2.2
1	B	137	VAL	2.1
1	B	108	HIS	2.1
1	C	131	GLY	2.1
1	A	69	GLN	2.0

## 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, 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	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
1	PCA	D	1	8/9	0.85	0.11	17,22,24,26	0
1	PCA	E	1	8/9	0.90	0.10	22,24,25,26	0
1	PCA	B	1	8/9	0.91	0.08	18,19,20,22	0
1	PCA	A	1	8/9	0.93	0.07	12,14,15,15	0
1	PCA	C	1	8/9	0.93	0.07	12,16,17,18	0
1	PCA	F	1	8/9	0.95	0.06	14,14,15,16	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, 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	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
2	NAG	B	301	14/15	0.93	0.08	12,13,17,18	0
2	NAG	F	301	14/15	0.94	0.06	7,10,13,14	0
2	NAG	C	301	14/15	0.95	0.06	6,7,10,10	0
2	NAG	E	301	14/15	0.96	0.06	5,6,8,8	0
2	NAG	D	301	14/15	0.96	0.06	6,8,10,12	0
2	NAG	A	301	14/15	0.97	0.05	4,8,10,11	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.