



Full wwPDB X-ray Structure Validation Report ⓘ

Aug 26, 2023 – 06:57 PM EDT

PDB ID : 3GPM
Title : Structure of the trimeric form of the E113G PCNA mutant protein
Authors : Freudenthal, B.D.; Gakhar, L.; Ramaswamy, S.; Washington, M.T.
Deposited on : 2009-03-23
Resolution : 3.80 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 : 4.02b-467
Xtriage (Phenix) : 1.13
EDS : 2.35
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac : 5.8.0158
CCP4 : 7.0.044 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.35

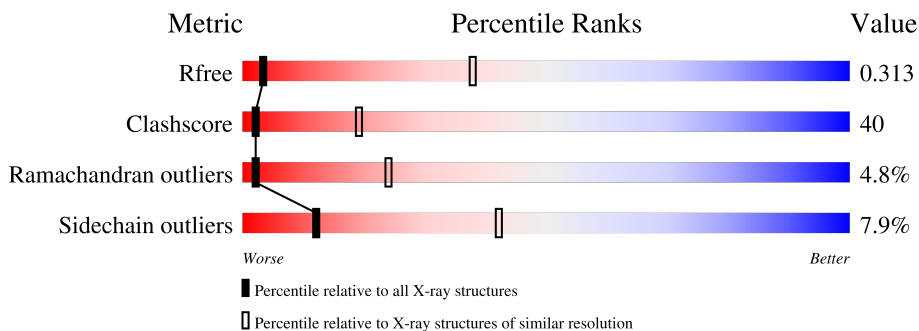
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.80 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}	130704	1212 (4.00-3.60)
Clashscore	141614	1288 (4.00-3.60)
Ramachandran outliers	138981	1243 (4.00-3.60)
Sidechain outliers	138945	1237 (4.00-3.60)

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 $\leq 5\%$

Mol	Chain	Length	Quality of chain
1	A	258	

2 Entry composition [i](#)

There is only 1 type of molecule in this entry. The entry contains 1990 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 Proliferating cell nuclear antigen.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	254	1990	1274	314	392	10	0	0	0

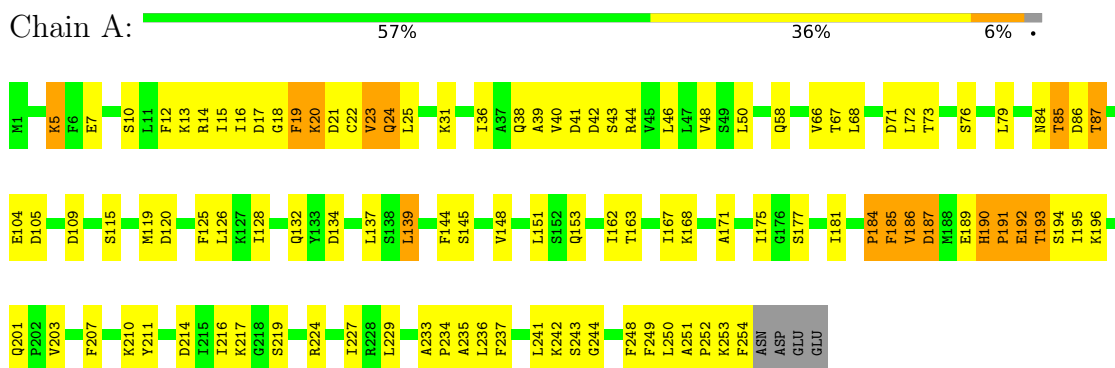
There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	113	GLY	GLU	engineered mutation	UNP P15873

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. 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. 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: Proliferating cell nuclear antigen



4 Data and refinement statistics i

Property	Value	Source
Space group	P 21 3	Depositor
Cell constants a, b, c, α , β , γ	122.09Å 122.09Å 122.09Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	29.62 – 3.80 29.61 – 3.80	Depositor EDS
% Data completeness (in resolution range)	99.2 (29.62-3.80) 99.5 (29.61-3.80)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.07	Depositor
$\langle I/\sigma(I) \rangle$ ¹	5.52 (at 3.75Å)	Xtrriage
Refinement program	REFMAC 5.2.0019	Depositor
R, R_{free}	0.273 , 0.312 0.336 , 0.313	Depositor DCC
R_{free} test set	282 reflections (4.59%)	wwPDB-VP
Wilson B-factor (Å ²)	112.9	Xtrriage
Anisotropy	0.000	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.29 , 47.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.55$, $\langle L^2 \rangle = 0.39$	Xtrriage
Estimated twinning fraction	0.012 for l,-k,h	Xtrriage
F_o, F_c correlation	0.85	EDS
Total number of atoms	1990	wwPDB-VP
Average B, all atoms (Å ²)	87.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.40% 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	0.50	0/2020	0.68	1/2724 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	187	ASP	CB-CG-OD2	5.16	122.94	118.30

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts [i](#)

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	1990	0	2016	159	0
All	All	1990	0	2016	159	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 40.

All (159) 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:16:ILE:HA	1:A:19:PHE:CE2	1.56	1.39
1:A:168:LYS:HE3	1:A:181:ILE:CD1	1.59	1.32

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:22:CYS:SG	1:A:48:VAL:HG21	1.76	1.24
1:A:16:ILE:CA	1:A:19:PHE:HE2	1.58	1.16
1:A:168:LYS:HG3	1:A:181:ILE:HG12	1.20	1.14
1:A:24:GLN:O	1:A:25:LEU:HD12	1.45	1.13
1:A:190:HIS:HB3	1:A:191:PRO:CD	1.78	1.11
1:A:23:VAL:HG23	1:A:42:ASP:OD1	1.51	1.11
1:A:185:PHE:HD1	1:A:186:VAL:N	1.47	1.11
1:A:185:PHE:HD1	1:A:185:PHE:C	1.56	1.05
1:A:236:LEU:HD13	1:A:249:PHE:CE1	1.92	1.05
1:A:190:HIS:CB	1:A:191:PRO:HD2	1.87	1.05
1:A:23:VAL:O	1:A:23:VAL:HG13	1.57	1.01
1:A:84:ASN:O	1:A:85:THR:HG23	1.58	1.01
1:A:185:PHE:CD1	1:A:186:VAL:N	2.29	1.01
1:A:190:HIS:CB	1:A:191:PRO:CD	2.34	1.00
1:A:168:LYS:CE	1:A:181:ILE:HD11	1.93	0.98
1:A:168:LYS:HE3	1:A:181:ILE:HD11	0.98	0.97
1:A:185:PHE:C	1:A:185:PHE:CD1	2.29	0.96
1:A:16:ILE:O	1:A:19:PHE:HD2	1.49	0.95
1:A:16:ILE:HA	1:A:19:PHE:HE2	0.82	0.94
1:A:190:HIS:HB3	1:A:191:PRO:HD2	1.43	0.93
1:A:22:CYS:SG	1:A:48:VAL:CG2	2.57	0.92
1:A:229:LEU:HD23	1:A:235:ALA:CB	1.98	0.92
1:A:19:PHE:HB3	1:A:22:CYS:HB2	1.52	0.92
1:A:16:ILE:CA	1:A:19:PHE:CE2	2.42	0.89
1:A:23:VAL:CG2	1:A:42:ASP:OD1	2.21	0.89
1:A:84:ASN:C	1:A:85:THR:HG23	1.94	0.88
1:A:190:HIS:HB3	1:A:191:PRO:HD3	1.56	0.87
1:A:19:PHE:O	1:A:20:LYS:HB2	1.73	0.86
1:A:17:ASP:O	1:A:217:LYS:HE2	1.76	0.85
1:A:10:SER:HB3	1:A:85:THR:HG22	1.59	0.84
1:A:168:LYS:HG3	1:A:181:ILE:CG1	2.05	0.84
1:A:16:ILE:O	1:A:19:PHE:CD2	2.32	0.83
1:A:190:HIS:HB2	1:A:191:PRO:HD2	1.62	0.82
1:A:229:LEU:CD2	1:A:235:ALA:HB2	2.10	0.82
1:A:25:LEU:HD11	1:A:71:ASP:OD2	1.80	0.82
1:A:38:GLN:HE22	1:A:126:LEU:H	1.27	0.81
1:A:191:PRO:HD2	1:A:193:THR:CG2	2.11	0.81
1:A:168:LYS:HE3	1:A:181:ILE:HD13	1.63	0.80
1:A:229:LEU:CD2	1:A:235:ALA:CB	2.59	0.80
1:A:38:GLN:HE22	1:A:126:LEU:N	1.79	0.79
1:A:84:ASN:O	1:A:85:THR:CG2	2.30	0.79

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:86:ASP:O	1:A:87:THR:HB	1.83	0.78
1:A:21:ASP:HB2	1:A:214:ASP:HB3	1.67	0.77
1:A:168:LYS:CE	1:A:181:ILE:CD1	2.53	0.77
1:A:10:SER:CB	1:A:85:THR:HG22	2.16	0.76
1:A:184:PRO:HA	1:A:195:ILE:HG22	1.68	0.75
1:A:87:THR:HG22	1:A:87:THR:O	1.87	0.75
1:A:191:PRO:HD2	1:A:193:THR:HG21	1.66	0.75
1:A:229:LEU:HD23	1:A:235:ALA:HB1	1.67	0.74
1:A:19:PHE:CD2	1:A:19:PHE:N	2.56	0.74
1:A:38:GLN:OE1	1:A:125:PHE:CD2	2.41	0.74
1:A:187:ASP:HB3	1:A:189:GLU:HB2	1.68	0.74
1:A:19:PHE:O	1:A:20:LYS:CB	2.34	0.73
1:A:23:VAL:O	1:A:23:VAL:CG1	2.30	0.72
1:A:236:LEU:HD13	1:A:249:PHE:CZ	2.25	0.72
1:A:229:LEU:HD23	1:A:235:ALA:HB2	1.65	0.71
1:A:38:GLN:NE2	1:A:126:LEU:H	1.92	0.67
1:A:184:PRO:HA	1:A:195:ILE:CG2	2.27	0.64
1:A:10:SER:HB3	1:A:85:THR:CG2	2.26	0.64
1:A:21:ASP:HB2	1:A:214:ASP:CB	2.28	0.64
1:A:21:ASP:OD2	1:A:46:LEU:HD22	1.99	0.63
1:A:21:ASP:CB	1:A:214:ASP:HB3	2.29	0.62
1:A:151:LEU:HB3	1:A:171:ALA:HB2	1.80	0.62
1:A:192:GLU:O	1:A:193:THR:C	2.37	0.62
1:A:229:LEU:CD2	1:A:235:ALA:HB1	2.27	0.62
1:A:23:VAL:O	1:A:25:LEU:N	2.34	0.60
1:A:84:ASN:O	1:A:85:THR:CB	2.49	0.60
1:A:191:PRO:HG2	1:A:193:THR:HG22	1.84	0.60
1:A:86:ASP:O	1:A:87:THR:CB	2.49	0.59
1:A:84:ASN:C	1:A:85:THR:CG2	2.66	0.59
1:A:216:ILE:O	1:A:219:SER:HB2	2.02	0.59
1:A:41:ASP:OD2	1:A:211:TYR:HE1	1.86	0.59
1:A:187:ASP:HB3	1:A:189:GLU:CB	2.33	0.59
1:A:192:GLU:O	1:A:194:SER:N	2.36	0.58
1:A:184:PRO:O	1:A:185:PHE:CG	2.56	0.58
1:A:191:PRO:HD2	1:A:193:THR:HG22	1.84	0.57
1:A:14:ARG:O	1:A:17:ASP:HB2	2.05	0.57
1:A:38:GLN:OE1	1:A:125:PHE:CG	2.57	0.57
1:A:191:PRO:CD	1:A:193:THR:HG22	2.34	0.56
1:A:19:PHE:O	1:A:217:LYS:HE3	2.06	0.56
1:A:5:LYS:O	1:A:5:LYS:HG3	2.05	0.56
1:A:153:GLN:HE21	1:A:153:GLN:HA	1.71	0.56

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:236:LEU:HD13	1:A:249:PHE:CD1	2.40	0.56
1:A:21:ASP:CG	1:A:46:LEU:HD22	2.26	0.55
1:A:234:PRO:HA	1:A:252:PRO:HD3	1.89	0.55
1:A:10:SER:OG	1:A:85:THR:HG22	2.07	0.55
1:A:31:LYS:HE2	1:A:36:ILE:HD11	1.89	0.55
1:A:233:ALA:HB1	1:A:234:PRO:HD2	1.89	0.55
1:A:21:ASP:HB2	1:A:214:ASP:CG	2.27	0.54
1:A:24:GLN:C	1:A:25:LEU:HD12	2.21	0.54
1:A:137:LEU:HA	1:A:196:LYS:O	2.08	0.54
1:A:153:GLN:HA	1:A:153:GLN:NE2	2.23	0.54
1:A:12:PHE:CZ	1:A:16:ILE:HD11	2.44	0.53
1:A:241:LEU:N	1:A:244:GLY:O	2.40	0.53
1:A:192:GLU:OE1	1:A:224:ARG:HD3	2.08	0.53
1:A:25:LEU:HD11	1:A:71:ASP:CG	2.30	0.52
1:A:15:ILE:O	1:A:19:PHE:CE2	2.63	0.52
1:A:85:THR:O	1:A:86:ASP:OD2	2.27	0.52
1:A:104:GLU:HG2	1:A:105:ASP:N	2.25	0.52
1:A:19:PHE:HB3	1:A:22:CYS:CB	2.32	0.52
1:A:105:ASP:O	1:A:109:ASP:HA	2.10	0.51
1:A:187:ASP:CB	1:A:189:GLU:HB2	2.40	0.51
1:A:38:GLN:OE1	1:A:125:PHE:HA	2.10	0.51
1:A:189:GLU:HG3	1:A:190:HIS:N	2.26	0.51
1:A:7:GLU:HB2	1:A:58:GLN:HB2	1.92	0.51
1:A:186:VAL:HG13	1:A:186:VAL:O	2.10	0.50
1:A:168:LYS:CE	1:A:181:ILE:HD13	2.34	0.50
1:A:19:PHE:HD2	1:A:19:PHE:H	1.55	0.50
1:A:23:VAL:C	1:A:25:LEU:N	2.64	0.50
1:A:109:ASP:O	1:A:109:ASP:OD1	2.29	0.50
1:A:12:PHE:O	1:A:16:ILE:HG12	2.12	0.49
1:A:119:MET:O	1:A:120:ASP:HB2	2.12	0.49
1:A:236:LEU:CD1	1:A:249:PHE:CZ	2.95	0.49
1:A:139:LEU:HD11	1:A:144:PHE:HB2	1.95	0.49
1:A:187:ASP:CB	1:A:189:GLU:CB	2.91	0.49
1:A:16:ILE:HG13	1:A:79:LEU:HD11	1.95	0.48
1:A:16:ILE:C	1:A:19:PHE:CD2	2.85	0.48
1:A:84:ASN:O	1:A:85:THR:OG1	2.30	0.48
1:A:162:ILE:HG13	1:A:167:ILE:HG23	1.95	0.48
1:A:189:GLU:O	1:A:190:HIS:O	2.32	0.48
1:A:23:VAL:C	1:A:25:LEU:H	2.17	0.48
1:A:191:PRO:CG	1:A:193:THR:HG22	2.43	0.47
1:A:18:GLY:C	1:A:217:LYS:HZ3	2.17	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:15:ILE:HG23	1:A:50:LEU:HD13	1.96	0.47
1:A:36:ILE:HG22	1:A:50:LEU:O	2.15	0.47
1:A:193:THR:O	1:A:193:THR:HG23	2.15	0.47
1:A:253:LYS:O	1:A:254:PHE:HB2	2.14	0.47
1:A:16:ILE:C	1:A:19:PHE:CE2	2.88	0.47
1:A:19:PHE:HB2	1:A:72:LEU:HD13	1.96	0.47
1:A:40:VAL:HG11	1:A:44:ARG:HG2	1.97	0.46
1:A:13:LYS:NZ	1:A:79:LEU:O	2.49	0.46
1:A:187:ASP:HB2	1:A:189:GLU:HB3	1.97	0.46
1:A:253:LYS:O	1:A:254:PHE:CB	2.64	0.46
1:A:148:VAL:HG21	1:A:216:ILE:HG21	1.96	0.45
1:A:41:ASP:OD1	1:A:42:ASP:N	2.50	0.45
1:A:187:ASP:O	1:A:189:GLU:HB2	2.17	0.45
1:A:85:THR:O	1:A:85:THR:OG1	2.34	0.44
1:A:22:CYS:HB3	1:A:39:ALA:HB1	2.00	0.44
1:A:134:ASP:HB3	1:A:201:GLN:HB2	1.98	0.44
1:A:184:PRO:O	1:A:195:ILE:HB	2.18	0.44
1:A:191:PRO:CD	1:A:193:THR:CG2	2.88	0.44
1:A:85:THR:O	1:A:86:ASP:CG	2.57	0.44
1:A:84:ASN:O	1:A:84:ASN:OD1	2.36	0.43
1:A:217:LYS:C	1:A:219:SER:H	2.21	0.43
1:A:190:HIS:HB2	1:A:193:THR:CG2	2.49	0.43
1:A:87:THR:O	1:A:87:THR:CG2	2.59	0.43
1:A:41:ASP:OD2	1:A:211:TYR:CE1	2.69	0.43
1:A:248:PHE:CD1	1:A:248:PHE:N	2.86	0.43
1:A:22:CYS:HB3	1:A:39:ALA:CB	2.49	0.42
1:A:190:HIS:HB2	1:A:191:PRO:CD	2.29	0.42
1:A:241:LEU:O	1:A:243:SER:N	2.53	0.41
1:A:41:ASP:HB3	1:A:43:SER:O	2.20	0.41
1:A:227:ILE:HG12	1:A:237:PHE:CD2	2.56	0.41
1:A:251:ALA:HA	1:A:252:PRO:HD3	1.77	0.41
1:A:23:VAL:HG12	1:A:25:LEU:O	2.21	0.40
1:A:207:PHE:CD1	1:A:207:PHE:N	2.90	0.40
1:A:46:LEU:HD12	1:A:250:LEU:HB2	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	252/258 (98%)	215 (85%)	25 (10%)	12 (5%)	2 24

All (12) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	85	THR
1	A	87	THR
1	A	184	PRO
1	A	190	HIS
1	A	191	PRO
1	A	20	LYS
1	A	24	GLN
1	A	186	VAL
1	A	193	THR
1	A	242	LYS
1	A	210	LYS
1	A	192	GLU

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	228/232 (98%)	210 (92%)	18 (8%)	12 42

All (18) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	5	LYS
1	A	19	PHE
1	A	23	VAL
1	A	66	VAL
1	A	67	THR
1	A	68	LEU
1	A	73	THR
1	A	76	SER
1	A	115	SER
1	A	128	ILE
1	A	132	GLN
1	A	139	LEU
1	A	145	SER
1	A	163	THR
1	A	175	ILE
1	A	177	SER
1	A	185	PHE
1	A	203	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	29	GLN
1	A	38	GLN
1	A	132	GLN
1	A	153	GLN
1	A	247	GLN

5.3.3 RNA [i](#)

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 monosaccharides in this entry.

5.6 Ligand geometry [i](#)

There are no ligands in this entry.

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](#)

Unable to reproduce the depositors R factor - this section is therefore empty.

6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

Unable to reproduce the depositors R factor - this section is therefore empty.

6.3 Carbohydrates [i](#)

Unable to reproduce the depositors R factor - this section is therefore empty.

6.4 Ligands [i](#)

Unable to reproduce the depositors R factor - this section is therefore empty.

6.5 Other polymers [i](#)

Unable to reproduce the depositors R factor - this section is therefore empty.