wwPDB X-ray Structure Validation Summary Report (i)

Oct 17, 2021 – 08:27 AM EDT

PDB ID	:	1JQJ
Title	:	Mechanism of Processivity Clamp Opening by the Delta Subunit Wrench of the Clamp Loader Complex of E. coli DNA Polymerase III: Structure of the beta-delta complex
Authors	:	Jeruzalmi, D.; Yurieva, O.; Zhao, Y.; Young, M.; Stewart, J.; Hingorani, M.; O'Donnell, M.; Kuriyan, J.
Deposited on	:	2001-08-07
Resolution	:	2.90 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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 (i) symbol.

The following versions of software and data (see references (1)) were used in the production of this report:

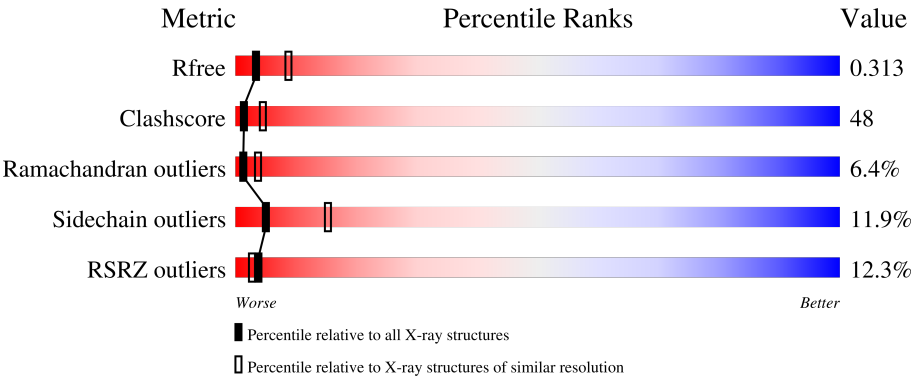
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.23.2
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.23.2

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 2.90 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}	130704	1957 (2.90-2.90)
Clashscore	141614	2172 (2.90-2.90)
Ramachandran outliers	138981	2115 (2.90-2.90)
Sidechain outliers	138945	2117 (2.90-2.90)
RSRZ outliers	127900	1906 (2.90-2.90)

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 >=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 <=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	366	9% 36% 54% 9%
1	B	366	19% 36% 53% 10%
2	C	343	7% 32% 50% 11%
2	D	343	13% 35% 50% 9% 5%

2 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 10860 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 DNA polymerase III, beta chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	366	Total	C	N	O	S	0	0	0
			2837	1780	498	540	19			
1	B	366	Total	C	N	O	S	0	0	0
			2837	1780	498	540	19			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	272	ALA	ILE	engineered mutation	UNP P0A988
A	273	ALA	LEU	engineered mutation	UNP P0A988
B	272	ALA	ILE	engineered mutation	UNP P0A988
B	273	ALA	LEU	engineered mutation	UNP P0A988

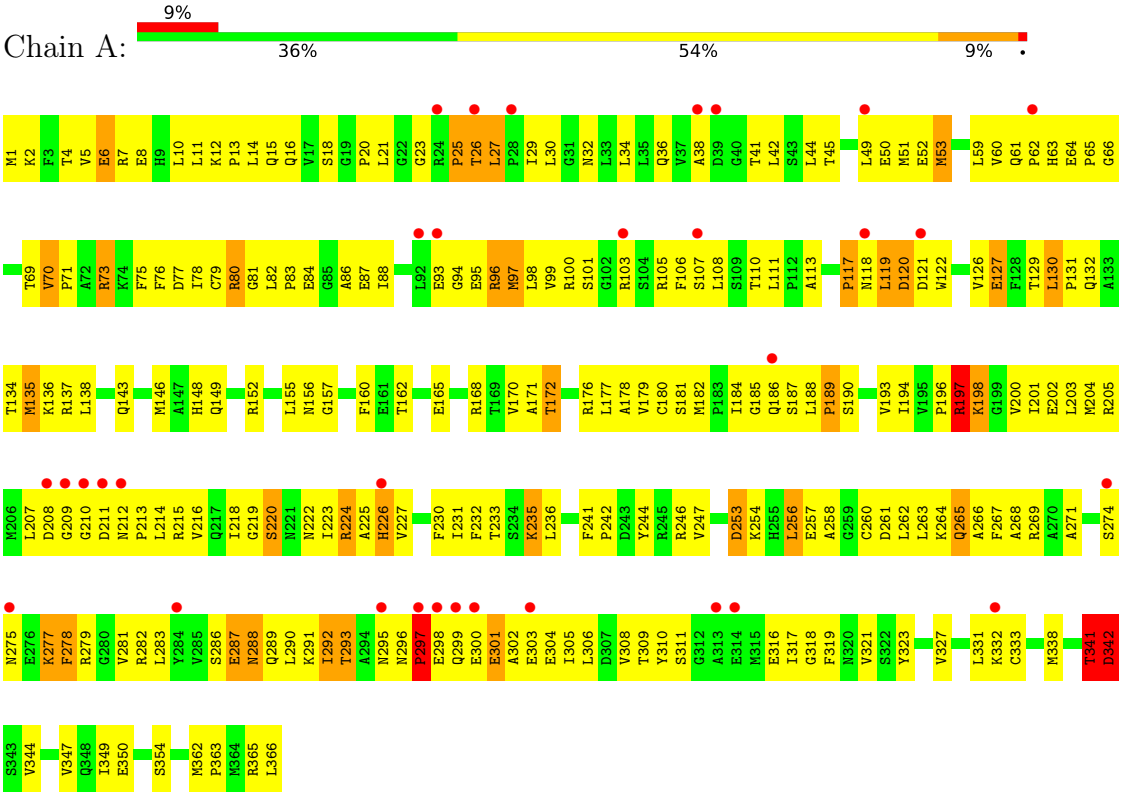
- Molecule 2 is a protein called DNA polymerase III, delta subunit.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	C	328	Total	C	N	O	S	0	0	0
			2606	1650	474	472	10			
2	D	325	Total	C	N	O	S	0	0	0
			2580	1632	469	469	10			

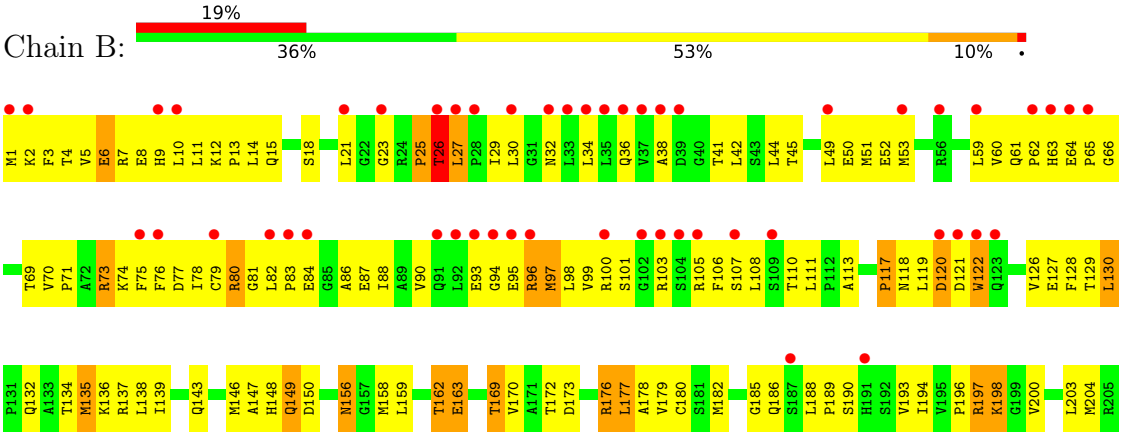
3 Residue-property plots (i)

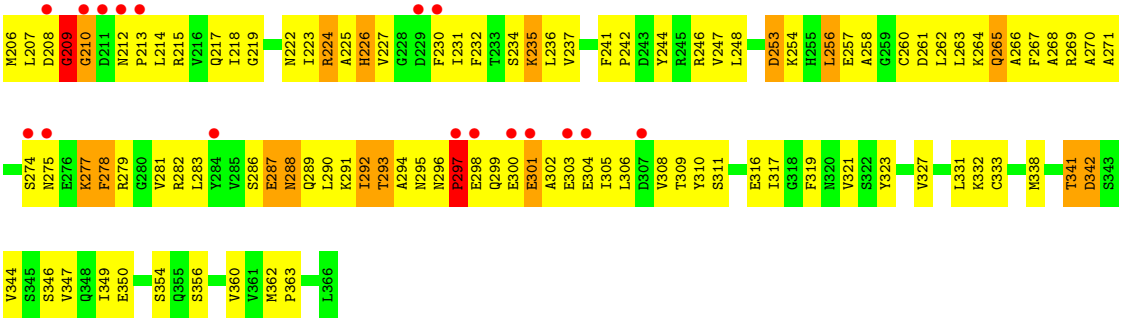
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. 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: DNA polymerase III, beta chain



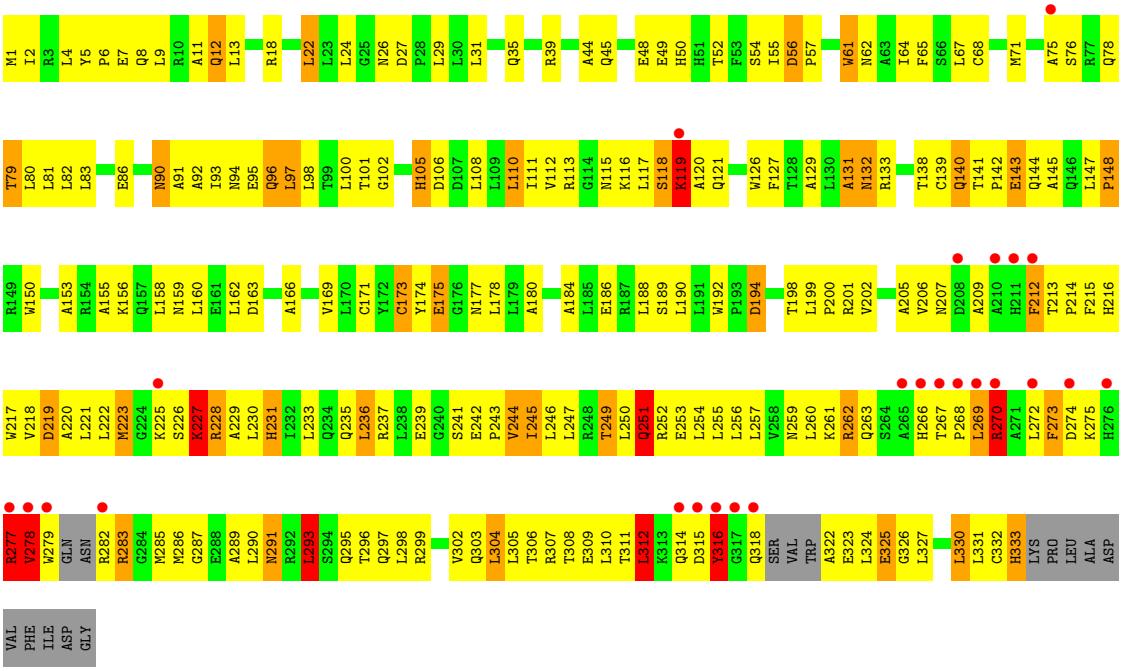
• Molecule 1: DNA polymerase III, beta chain





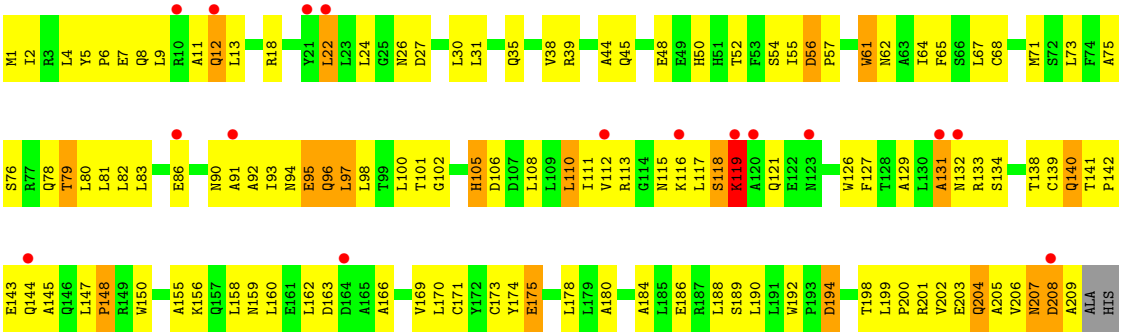
• Molecule 2: DNA polymerase III, delta subunit

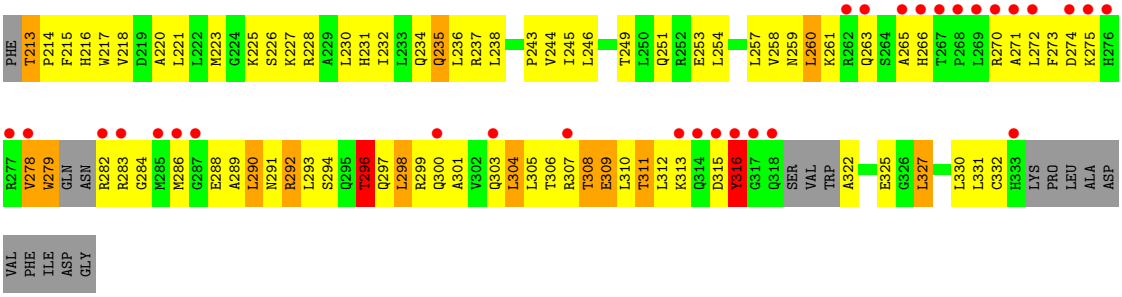
Chain C:



• Molecule 2: DNA polymerase III, delta subunit

Chain D:




PHE T213 P214 F215 H216 W217 V218 D219 A220 L221 L222 M223 G224 K225 S226 K227 R228 A229 L230 H231 I232 L233 Q234 Q235 L236 R237 L238 P243 V244 I245 L246 T249 L250 Q251 R252 E253 L254 L257 V258 N259 L260 K261 R262 Q263 S264 A265 H266 T267 P268 L269 R270 A271 L272 F273 D274 K275 H276
R277 V278 W279 GLN ASN R282 R283 G284 M285 M286 Q287 E288 A289 L290 N291 R292 L293 S294 Q295 T296 Q297 L298 R299 Q300 A301 V302 Q303 L304 L305 T306 R307 T308 E309 L310 T311 L312 K313 Q314 D315 Y316 G317 Q318 SER VAL TRP A322 E325 G326 L327 L330 L331 C332 H333 LYS PRO LEU ALA ASP
VAL PHE ILE ASP GLY

4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α, β, γ	198.84Å 99.29Å 113.02Å 90.00° 119.17° 90.00°	Depositor
Resolution (Å)	500.00 – 2.90 19.89 – 2.87	Depositor EDS
% Data completeness (in resolution range)	(Not available) (500.00-2.90) 96.3 (19.89-2.87)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.11	Depositor
$< I/\sigma(I) >$ [1]	2.86 (at 2.88Å)	Xtriage
Refinement program	CNS 1.0	Depositor
R, R_{free}	0.266 , 0.308 0.276 , 0.313	Depositor DCC
R_{free} test set	2188 reflections (5.01%)	wwPDB-VP
Wilson B-factor (Å^2)	58.3	Xtriage
Anisotropy	0.414	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.32 , 64.0	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.88	EDS
Total number of atoms	10860	wwPDB-VP
Average B, all atoms (Å^2)	77.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.71% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ 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	0.46	0/2886	0.73	2/3907 (0.1%)
1	B	0.44	0/2886	0.72	2/3907 (0.1%)
2	C	0.63	3/2649 (0.1%)	0.97	11/3594 (0.3%)
2	D	0.35	0/2620	0.70	0/3553
All	All	0.48	3/11041 (0.0%)	0.78	15/14961 (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	1
2	C	0	2
All	All	0	4

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	C	269	LEU	C-N	-17.52	0.93	1.34
2	C	278	VAL	N-CA	13.96	1.74	1.46
2	C	270	ARG	CB-CG	-10.10	1.25	1.52

The worst 5 of 15 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	C	269	LEU	O-C-N	-20.83	89.37	122.70
2	C	269	LEU	C-N-CA	20.39	172.67	121.70
2	C	269	LEU	CA-C-N	13.67	147.26	117.20
2	C	278	VAL	N-CA-C	13.42	147.22	111.00
1	B	341	THR	C-N-CA	9.74	146.06	121.70

There are no chirality outliers.

All (4) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	341	THR	Peptide
1	B	209	GLY	Mainchain
2	C	269	LEU	Peptide
2	C	277	ARG	Peptide

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	2837	0	2849	268	1
1	B	2837	0	2848	250	0
2	C	2606	0	2662	264	2
2	D	2580	0	2641	281	1
All	All	10860	0	11000	1048	2

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 48.

The worst 5 of 1048 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)
2:C:278:VAL:N	2:C:278:VAL:CA	1.74	1.51
2:D:304:LEU:HA	2:D:307:ARG:HD2	1.15	1.11
2:D:304:LEU:CA	2:D:307:ARG:HD2	1.85	1.04
1:A:1:MET:HB3	1:A:66:GLY:HA3	1.39	1.04
1:B:266:ALA:HB1	1:B:292:ILE:HG21	1.40	1.02

All (2) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:C:315:ASP:OD2	2:D:315:ASP:OD2[2_647]	1.79	0.41
1:A:279:ARG:NH1	2:C:132:ASN:OD1[2_656]	1.81	0.39

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	364/366 (100%)	281 (77%)	62 (17%)	21 (6%)	1 5
1	B	364/366 (100%)	284 (78%)	59 (16%)	21 (6%)	1 5
2	C	322/343 (94%)	234 (73%)	62 (19%)	26 (8%)	1 2
2	D	317/343 (92%)	229 (72%)	69 (22%)	19 (6%)	1 4
All	All	1367/1418 (96%)	1028 (75%)	252 (18%)	87 (6%)	1 4

5 of 87 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	6	GLU
1	A	26	THR
1	A	119	LEU
1	B	6	GLU
1	B	26	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	311/311 (100%)	276 (89%)	35 (11%)	6 18
1	B	311/311 (100%)	273 (88%)	38 (12%)	5 15
2	C	278/291 (96%)	242 (87%)	36 (13%)	4 13
2	D	276/291 (95%)	245 (89%)	31 (11%)	6 18
All	All	1176/1204 (98%)	1036 (88%)	140 (12%)	5 15

5 of 140 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	D	110	LEU
2	D	140	GLN
2	D	274	ASP
1	B	130	LEU
1	B	122	TRP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 42 such sidechains are listed below:

Mol	Chain	Res	Type
2	C	259	ASN
2	D	105	HIS
2	C	303	GLN
2	D	90	ASN
2	D	207	ASN

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)

The following chains have linkage breaks:

Mol	Chain	Number of breaks
2	C	1

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	C	269:LEU	C	270:ARG	N	0.93

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^{th} 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	366/366 (100%)	0.53	32 (8%) 10 7	26, 72, 106, 122	0
1	B	366/366 (100%)	0.85	68 (18%) 1 0	30, 81, 135, 149	0
2	C	328/343 (95%)	0.28	25 (7%) 13 10	21, 60, 132, 168	0
2	D	325/343 (94%)	0.66	46 (14%) 2 2	22, 82, 142, 160	0
All	All	1385/1418 (97%)	0.59	171 (12%) 4 3	21, 73, 132, 168	0

The worst 5 of 171 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	D	131	ALA	9.3
1	A	297	PRO	8.2
2	D	314	GLN	7.5
2	C	277	ARG	6.9
1	B	104	SER	6.5

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 monosaccharides in this entry.

6.4 Ligands

There are no ligands in this entry.

6.5 Other polymers (i)

There are no such residues in this entry.