Full wwPDB X-ray Structure Validation Report (i)

Sep 6, 2023 – 06:06 PM EDT

PDB ID	:	4FSC
Title	:	Crystal Structure of Bacillus thuringiensis PlcR in its apo form
Authors	:	Grenha, R.; Slamti, L.; Bouillaut, L.; Lereclus, D.; Nessler, S.
Deposited on	:	2012-06-27
Resolution	:	3.65 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 (i) 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 (1)) were used in the production of this report:

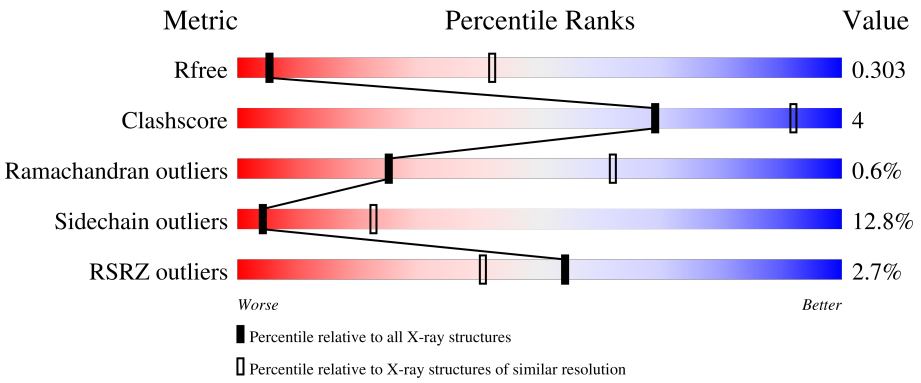
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.35
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.35

1 Overall quality at a glance (i)

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

The reported resolution of this entry is 3.65 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	1557 (3.82-3.50)
Clashscore	141614	1037 (3.80-3.52)
Ramachandran outliers	138981	1004 (3.80-3.52)
Sidechain outliers	138945	1002 (3.80-3.52)
RSRZ outliers	127900	1441 (3.82-3.50)

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	293	2% 73% 15% • 10%
1	B	293	2% 71% 17% • 10%
1	C	293	2% 71% 18% • 9%
1	D	293	3% 70% 19% • 10%

2 Entry composition (i)

There is only 1 type of molecule in this entry. The entry contains 8866 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 Transcriptional activator PlcR protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	264	2211	1434	361	408	8	0	0	0
1	B	264	2212	1433	361	410	8	0	0	0
1	C	266	2231	1445	366	412	8	0	0	0
1	D	264	2212	1433	361	410	8	0	0	0

There are 32 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	286	LEU	-	expression tag	UNP Q45782
A	287	GLU	-	expression tag	UNP Q45782
A	288	HIS	-	expression tag	UNP Q45782
A	289	HIS	-	expression tag	UNP Q45782
A	290	HIS	-	expression tag	UNP Q45782
A	291	HIS	-	expression tag	UNP Q45782
A	292	HIS	-	expression tag	UNP Q45782
A	293	HIS	-	expression tag	UNP Q45782
B	286	LEU	-	expression tag	UNP Q45782
B	287	GLU	-	expression tag	UNP Q45782
B	288	HIS	-	expression tag	UNP Q45782
B	289	HIS	-	expression tag	UNP Q45782
B	290	HIS	-	expression tag	UNP Q45782
B	291	HIS	-	expression tag	UNP Q45782
B	292	HIS	-	expression tag	UNP Q45782
B	293	HIS	-	expression tag	UNP Q45782
C	286	LEU	-	expression tag	UNP Q45782
C	287	GLU	-	expression tag	UNP Q45782
C	288	HIS	-	expression tag	UNP Q45782
C	289	HIS	-	expression tag	UNP Q45782
C	290	HIS	-	expression tag	UNP Q45782

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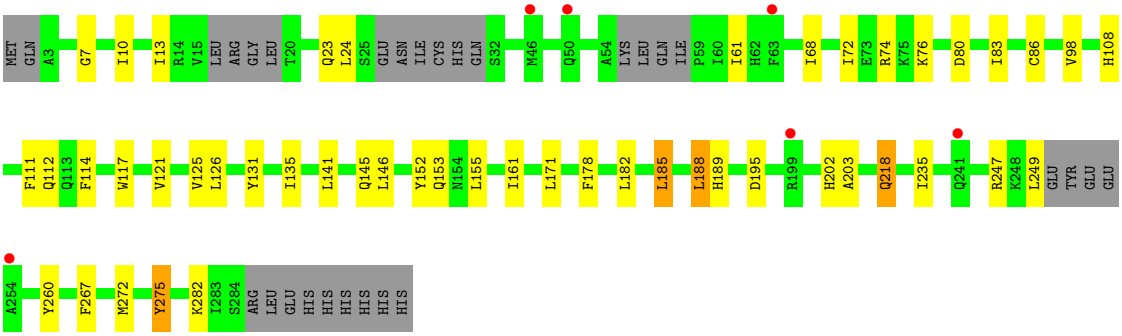
Chain	Residue	Modelled	Actual	Comment	Reference
C	291	HIS	-	expression tag	UNP Q45782
C	292	HIS	-	expression tag	UNP Q45782
C	293	HIS	-	expression tag	UNP Q45782
D	286	LEU	-	expression tag	UNP Q45782
D	287	GLU	-	expression tag	UNP Q45782
D	288	HIS	-	expression tag	UNP Q45782
D	289	HIS	-	expression tag	UNP Q45782
D	290	HIS	-	expression tag	UNP Q45782
D	291	HIS	-	expression tag	UNP Q45782
D	292	HIS	-	expression tag	UNP Q45782
D	293	HIS	-	expression tag	UNP Q45782

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.

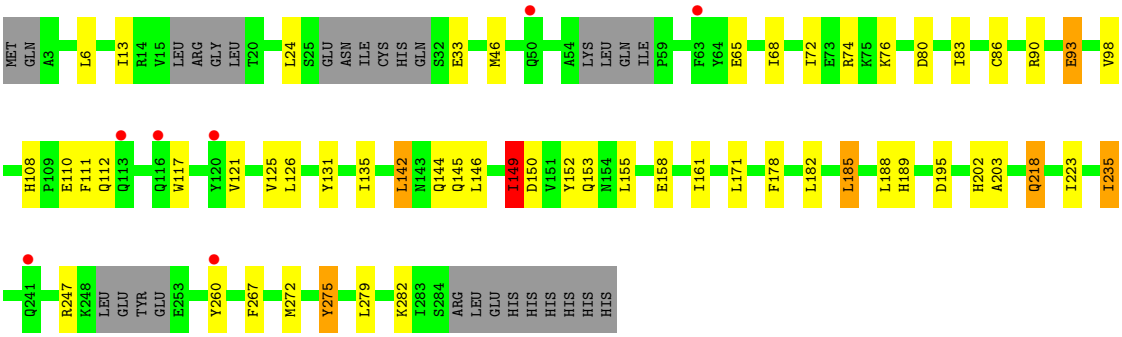
• Molecule 1: Transcriptional activator PlcR protein

Chain A:



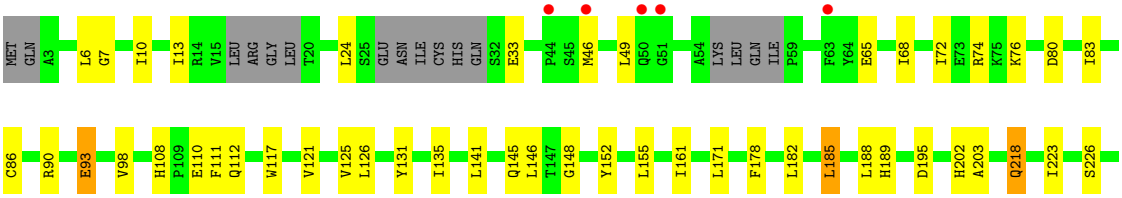
• Molecule 1: Transcriptional activator PlcR protein

Chain B:



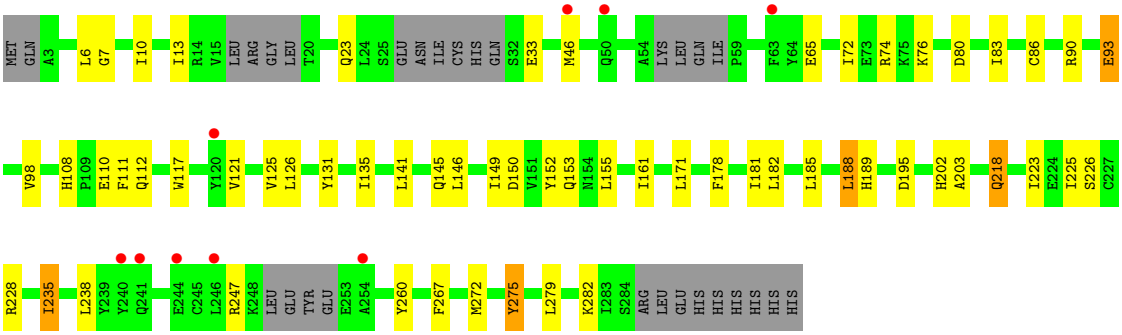
• Molecule 1: Transcriptional activator PlcR protein

Chain C:



• Molecule 1: Transcriptional activator PlcR protein

Chain D:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 31	Depositor
Cell constants a, b, c, α, β, γ	99.59Å 99.59Å 137.85Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	53.84 – 3.65 49.79 – 3.65	Depositor EDS
% Data completeness (in resolution range)	99.7 (53.84-3.65) 99.6 (49.79-3.65)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	0.07	Depositor
$< I/\sigma(I) >$ [1]	2.41 (at 3.67Å)	Xtriage
Refinement program	BUSTER-TNT, BUSTER 2.10.0	Depositor
R, R_{free}	0.238 , 0.276 0.263 , 0.303	Depositor DCC
R_{free} test set	858 reflections (5.06%)	wwPDB-VP
Wilson B-factor (Å^2)	149.6	Xtriage
Anisotropy	0.070	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.32 , 56.1	EDS
L-test for twinning[2]	$< \|L\| > = 0.46$, $< L^2 > = 0.28$	Xtriage
Estimated twinning fraction	0.428 for -h,-k,l 0.429 for h,-h-k,-l 0.428 for -k,-h,-l	Xtriage
F_o,F_c correlation	0.93	EDS
Total number of atoms	8866	wwPDB-VP
Average B, all atoms (Å^2)	73.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.52% 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	0.41	0/2250	0.65	0/3018
1	B	0.42	0/2251	0.67	0/3019
1	C	0.42	0/2270	0.66	0/3044
1	D	0.41	0/2251	0.65	0/3019
All	All	0.42	0/9022	0.66	0/12100

There are no bond length outliers.

There are no bond angle outliers.

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	2211	0	2226	15	0
1	B	2212	0	2221	18	0
1	C	2231	0	2245	16	0
1	D	2212	0	2221	19	0
All	All	8866	0	8913	65	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 4.

All (65) 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:135:ILE:HD12	1:A:161:ILE:HG23	1.83	0.61
1:D:135:ILE:HD12	1:D:161:ILE:HG23	1.83	0.61
1:A:203:ALA:HB2	1:A:218:GLN:HB3	1.82	0.60
1:B:135:ILE:HD12	1:B:161:ILE:HG23	1.83	0.60
1:B:203:ALA:HB2	1:B:218:GLN:HB3	1.82	0.60
1:C:135:ILE:HD12	1:C:161:ILE:HG23	1.85	0.58
1:B:149:ILE:HG23	1:B:150:ASP:H	1.71	0.56
1:A:114:PHE:HB2	1:A:153:GLN:HE22	1.70	0.55
1:D:203:ALA:HB2	1:D:218:GLN:HB3	1.89	0.55
1:C:203:ALA:HB2	1:C:218:GLN:HB3	1.88	0.55
1:D:90:ARG:HG2	1:D:93:GLU:HB2	1.91	0.53
1:D:108:HIS:HD2	1:D:111:PHE:HB2	1.74	0.53
1:B:90:ARG:HG2	1:B:93:GLU:HB2	1.91	0.53
1:C:108:HIS:HD2	1:C:111:PHE:HB2	1.74	0.52
1:B:108:HIS:HD2	1:B:111:PHE:HB2	1.74	0.52
1:C:90:ARG:HG2	1:C:93:GLU:HB2	1.92	0.52
1:A:108:HIS:HD2	1:A:111:PHE:HB2	1.74	0.52
1:A:114:PHE:HB2	1:A:153:GLN:NE2	2.24	0.51
1:B:150:ASP:HB3	1:B:153:GLN:HB2	1.92	0.51
1:D:247:ARG:HH12	1:D:282:LYS:HD2	1.76	0.51
1:A:80:ASP:HA	1:A:83:ILE:HD12	1.93	0.50
1:A:247:ARG:HH12	1:A:282:LYS:HD2	1.76	0.50
1:B:80:ASP:HA	1:B:83:ILE:HD12	1.93	0.50
1:B:247:ARG:HH12	1:B:282:LYS:HD2	1.76	0.50
1:C:247:ARG:HH12	1:C:282:LYS:HD2	1.76	0.50
1:D:80:ASP:HA	1:D:83:ILE:HD12	1.93	0.50
1:C:80:ASP:HA	1:C:83:ILE:HD12	1.94	0.50
1:A:267:PHE:CE1	1:A:275:TYR:HB3	2.48	0.49
1:D:267:PHE:CE1	1:D:275:TYR:HB3	2.48	0.48
1:B:267:PHE:CE1	1:B:275:TYR:HB3	2.48	0.48
1:C:267:PHE:CE1	1:C:275:TYR:HB3	2.48	0.48
1:A:178:PHE:HB3	1:A:202:HIS:CD2	2.50	0.46
1:B:178:PHE:HB3	1:B:202:HIS:CD2	2.50	0.46
1:C:178:PHE:HB3	1:C:202:HIS:CD2	2.50	0.46
1:D:178:PHE:HB3	1:D:202:HIS:CD2	2.50	0.46
1:D:7:GLY:HA2	1:D:10:ILE:HB	1.99	0.45
1:A:68:ILE:HD12	1:D:65:GLU:HG3	1.98	0.45
1:C:223:ILE:HD13	1:C:235:ILE:HD13	1.99	0.45
1:A:131:TYR:O	1:A:135:ILE:HG12	2.17	0.45
1:C:272:MET:HG3	1:C:275:TYR:HB2	1.99	0.45
1:C:131:TYR:O	1:C:135:ILE:HG12	2.17	0.45
1:D:182:LEU:HA	1:D:185:LEU:HD12	1.98	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:131:TYR:O	1:B:135:ILE:HG12	2.17	0.44
1:D:131:TYR:O	1:D:135:ILE:HG12	2.17	0.44
1:A:272:MET:HG3	1:A:275:TYR:HB2	1.99	0.44
1:B:272:MET:HG3	1:B:275:TYR:HB2	2.00	0.44
1:D:149:ILE:HG23	1:D:150:ASP:H	1.84	0.43
1:D:272:MET:HG3	1:D:275:TYR:HB2	1.99	0.43
1:A:182:LEU:HA	1:A:185:LEU:HD22	2.00	0.43
1:D:223:ILE:HD11	1:D:238:LEU:HB3	2.01	0.43
1:B:65:GLU:HG3	1:C:68:ILE:HD12	2.00	0.42
1:B:68:ILE:HD12	1:C:65:GLU:HG3	2.01	0.42
1:C:182:LEU:HA	1:C:185:LEU:HD22	2.00	0.42
1:D:121:VAL:O	1:D:125:VAL:HG23	2.19	0.42
1:D:225:ILE:HA	1:D:228:ARG:HG2	2.02	0.42
1:B:142:LEU:HD11	1:B:158:GLU:HG3	2.02	0.42
1:A:7:GLY:HA2	1:A:10:ILE:HB	2.02	0.42
1:A:121:VAL:O	1:A:125:VAL:HG23	2.19	0.41
1:C:7:GLY:HA2	1:C:10:ILE:HB	2.01	0.41
1:B:182:LEU:HA	1:B:185:LEU:HD22	2.01	0.41
1:D:181:ILE:O	1:D:185:LEU:HG	2.20	0.41
1:C:121:VAL:O	1:C:125:VAL:HG23	2.19	0.41
1:B:121:VAL:O	1:B:125:VAL:HG23	2.19	0.41
1:B:223:ILE:HD13	1:B:235:ILE:HD13	2.02	0.41
1:D:223:ILE:HD13	1:D:235:ILE:HD13	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	254/293 (87%)	234 (92%)	19 (8%)	1 (0%)	34 69
1	B	254/293 (87%)	233 (92%)	19 (8%)	2 (1%)	19 56

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	C	256/293 (87%)	230 (90%)	24 (9%)	2 (1%)	19	56
1	D	254/293 (87%)	233 (92%)	20 (8%)	1 (0%)	34	69
All	All	1018/1172 (87%)	930 (91%)	82 (8%)	6 (1%)	25	62

All (6) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	188	LEU
1	D	188	LEU
1	B	149	ILE
1	B	188	LEU
1	A	188	LEU
1	C	148	GLY

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	237/265 (89%)	210 (89%)	27 (11%)	5	27
1	B	237/265 (89%)	206 (87%)	31 (13%)	4	22
1	C	239/265 (90%)	206 (86%)	33 (14%)	3	20
1	D	237/265 (89%)	206 (87%)	31 (13%)	4	22
All	All	950/1060 (90%)	828 (87%)	122 (13%)	4	22

All (122) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	13	ILE
1	A	23	GLN
1	A	24	LEU
1	A	61	ILE
1	A	72	ILE
1	A	74	ARG

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Mol	Chain	Res	Type
1	A	76	LYS
1	A	86	CYS
1	A	98	VAL
1	A	112	GLN
1	A	117	TRP
1	A	126	LEU
1	A	141	LEU
1	A	145	GLN
1	A	146	LEU
1	A	152	TYR
1	A	155	LEU
1	A	171	LEU
1	A	185	LEU
1	A	188	LEU
1	A	189	HIS
1	A	195	ASP
1	A	218	GLN
1	A	235	ILE
1	A	249	LEU
1	A	260	TYR
1	A	275	TYR
1	B	6	LEU
1	B	13	ILE
1	B	24	LEU
1	B	33	GLU
1	B	46	MET
1	B	72	ILE
1	B	74	ARG
1	B	76	LYS
1	B	86	CYS
1	B	93	GLU
1	B	98	VAL
1	B	110	GLU
1	B	112	GLN
1	B	117	TRP
1	B	126	LEU
1	B	142	LEU
1	B	144	GLN
1	B	145	GLN
1	B	146	LEU
1	B	149	ILE
1	B	152	TYR

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Mol	Chain	Res	Type
1	B	155	LEU
1	B	171	LEU
1	B	185	LEU
1	B	189	HIS
1	B	195	ASP
1	B	218	GLN
1	B	235	ILE
1	B	260	TYR
1	B	275	TYR
1	B	279	LEU
1	C	6	LEU
1	C	13	ILE
1	C	24	LEU
1	C	33	GLU
1	C	46	MET
1	C	49	LEU
1	C	72	ILE
1	C	74	ARG
1	C	76	LYS
1	C	86	CYS
1	C	93	GLU
1	C	98	VAL
1	C	110	GLU
1	C	112	GLN
1	C	117	TRP
1	C	126	LEU
1	C	141	LEU
1	C	145	GLN
1	C	146	LEU
1	C	152	TYR
1	C	155	LEU
1	C	171	LEU
1	C	185	LEU
1	C	189	HIS
1	C	195	ASP
1	C	218	GLN
1	C	226	SER
1	C	235	ILE
1	C	260	TYR
1	C	275	TYR
1	C	279	LEU
1	C	285	ARG

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Mol	Chain	Res	Type
1	C	286	LEU
1	D	6	LEU
1	D	13	ILE
1	D	23	GLN
1	D	33	GLU
1	D	46	MET
1	D	72	ILE
1	D	74	ARG
1	D	76	LYS
1	D	86	CYS
1	D	93	GLU
1	D	98	VAL
1	D	110	GLU
1	D	112	GLN
1	D	117	TRP
1	D	126	LEU
1	D	141	LEU
1	D	145	GLN
1	D	146	LEU
1	D	152	TYR
1	D	153	GLN
1	D	155	LEU
1	D	171	LEU
1	D	188	LEU
1	D	189	HIS
1	D	195	ASP
1	D	218	GLN
1	D	226	SER
1	D	235	ILE
1	D	260	TYR
1	D	275	TYR
1	D	279	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (17) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	108	HIS
1	A	145	GLN
1	A	153	GLN
1	A	168	ASN
1	B	77	GLN
1	B	108	HIS

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Mol	Chain	Res	Type
1	B	112	GLN
1	B	143	ASN
1	B	144	GLN
1	B	168	ASN
1	C	77	GLN
1	C	108	HIS
1	C	112	GLN
1	C	168	ASN
1	D	108	HIS
1	D	112	GLN
1	D	168	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)

There are no chain breaks in this entry.

6 Fit of model and data (i)

6.1 Protein, DNA and RNA chains (i)

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	264/293 (90%)	0.15	6 (2%)	60	46	29, 66, 125, 173	0
1	B	264/293 (90%)	0.05	7 (2%)	54	40	24, 65, 128, 173	0
1	C	266/293 (90%)	0.05	7 (2%)	56	42	28, 64, 131, 177	0
1	D	264/293 (90%)	0.07	9 (3%)	45	33	31, 66, 124, 178	0
All	All	1058/1172 (90%)	0.08	29 (2%)	54	40	24, 65, 129, 178	0

All (29) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	50	GLN	5.9
1	D	241	GLN	4.3
1	A	46	MET	4.1
1	C	50	GLN	3.9
1	D	50	GLN	3.8
1	D	63	PHE	3.7
1	B	241	GLN	3.6
1	B	50	GLN	3.6
1	A	63	PHE	3.2
1	C	241	GLN	3.2
1	B	63	PHE	3.1
1	C	44	PRO	3.1
1	A	199	ARG	2.8
1	D	240	TYR	2.8
1	D	246	LEU	2.7
1	D	46	MET	2.7
1	B	260	TYR	2.7
1	A	241	GLN	2.7
1	C	46	MET	2.7
1	A	254	ALA	2.7
1	C	51	GLY	2.6

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Mol	Chain	Res	Type	RSRZ
1	D	254	ALA	2.5
1	C	63	PHE	2.4
1	B	120	TYR	2.4
1	C	246	LEU	2.2
1	D	244	GLU	2.2
1	B	116	GLN	2.1
1	B	113	GLN	2.1
1	D	120	TYR	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 monosaccharides 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.