Full wwPDB X-ray Structure Validation Report ⓘ

May 16, 2020 – 02:16 pm BST

PDB ID	:	4BXT
Title	:	Crystal structure of the human metapneumovirus phosphoprotein tetramerization domain
Authors	:	Leyrat, C.; Renner, M.; Harlos, K.; Grimes, J.M.
Deposited on	:	2013-07-15
Resolution	:	3.13 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 following versions of software and data (see references ⓘ) were used in the production of this report:

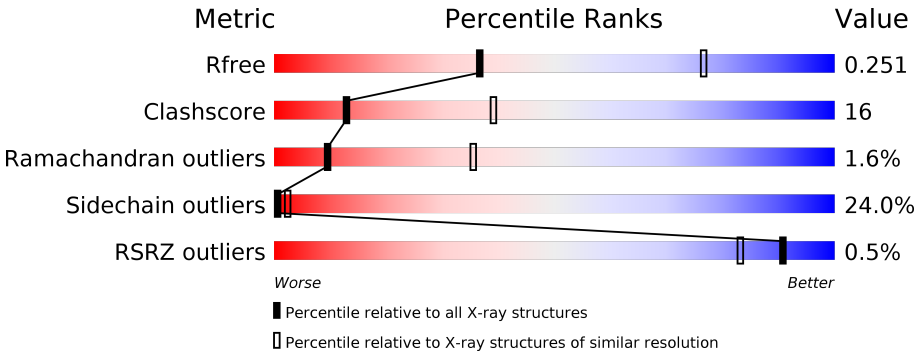
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.11
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.11

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 3.13 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	1626 (3.18-3.10)
Clashscore	141614	1735 (3.18-3.10)
Ramachandran outliers	138981	1677 (3.18-3.10)
Sidechain outliers	138945	1677 (3.18-3.10)
RSRZ outliers	127900	1588 (3.18-3.10)

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 >=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	80	20% 10% 70%
1	B	80	15% 13% • 69%
1	C	80	13% 13% 6% 69%
1	D	80	% 18% 14% • 68%
1	E	80	19% 8% 5% 69%
1	F	80	16% 14% • 69%

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Mol	Chain	Length	Quality of chain
1	G	80	
1	H	80	

2 Entry composition (i)

There is only 1 type of molecule in this entry. The entry contains 1560 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 PHOSPHOPROTEIN P.

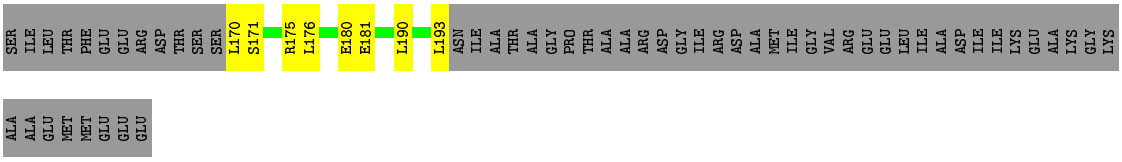
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	24	Total	C	N	O	S	0	0	0
			189	121	31	36	1			
1	B	25	Total	C	N	O	S	0	0	0
			197	125	33	38	1			
1	C	25	Total	C	N	O	S	0	0	0
			195	124	32	38	1			
1	D	26	Total	C	N	O	S	0	0	0
			203	128	34	40	1			
1	E	25	Total	C	N	O	S	0	0	0
			197	125	33	38	1			
1	F	25	Total	C	N	O	S	0	0	0
			197	125	33	38	1			
1	G	26	Total	C	N	O	S	0	0	0
			201	127	33	40	1			
1	H	23	Total	C	N	O	S	0	0	0
			181	115	30	35	1			

3 Residue-property plots (i)

These plots are drawn for all protein, RNA and DNA 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.

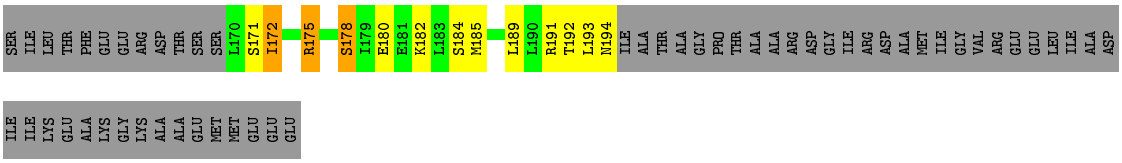
- Molecule 1: PHOSPHOPROTEIN P

Chain A:



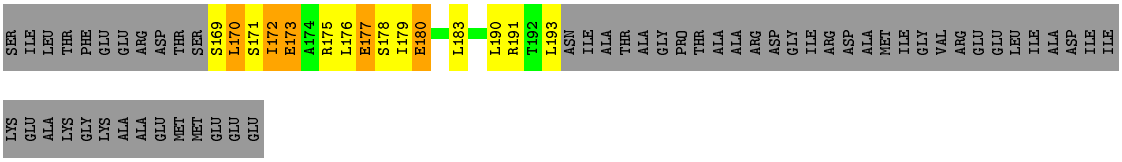
- Molecule 1: PHOSPHOPROTEIN P

Chain B:



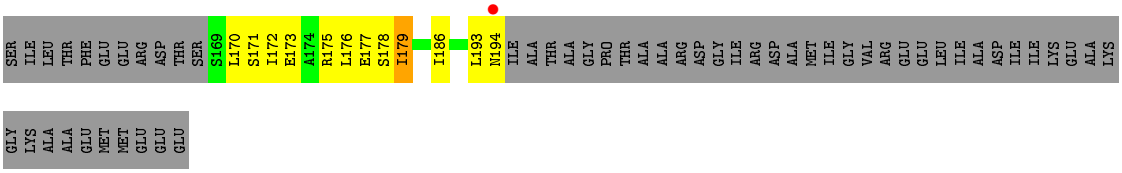
- Molecule 1: PHOSPHOPROTEIN P

Chain C:



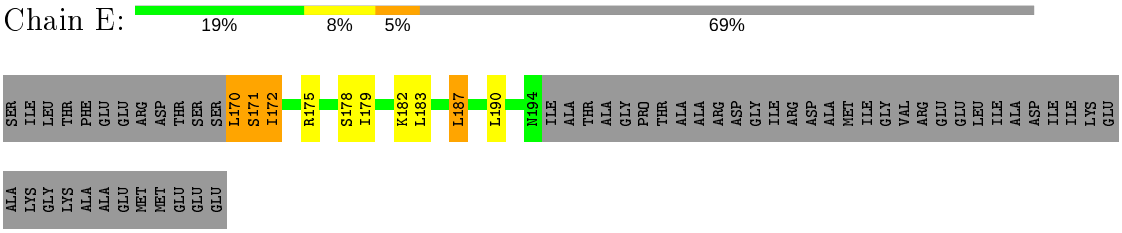
- Molecule 1: PHOSPHOPROTEIN P

Chain D:



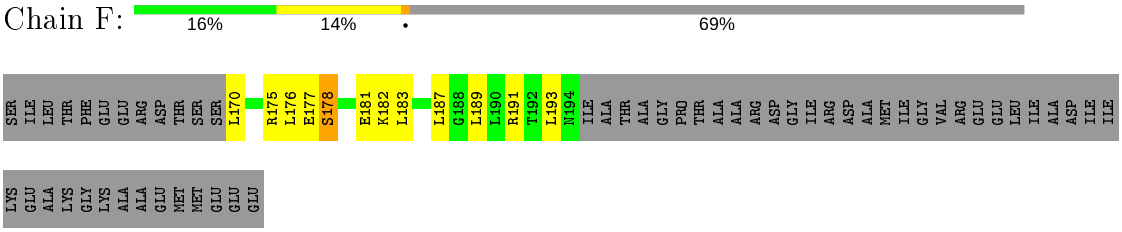
- Molecule 1: PHOSPHOPROTEIN P

Chain E:



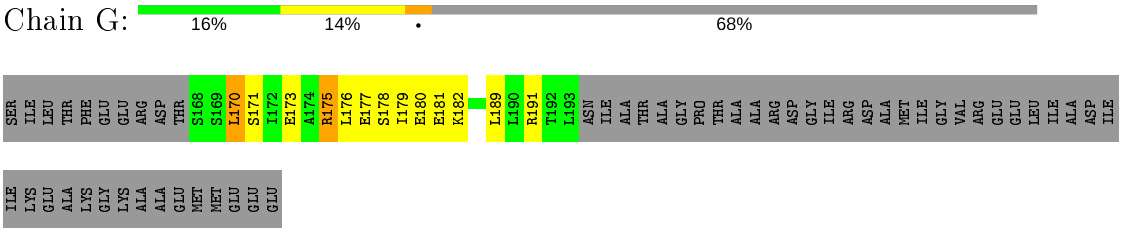
• Molecule 1: PHOSPHOPROTEIN P

Chain F:



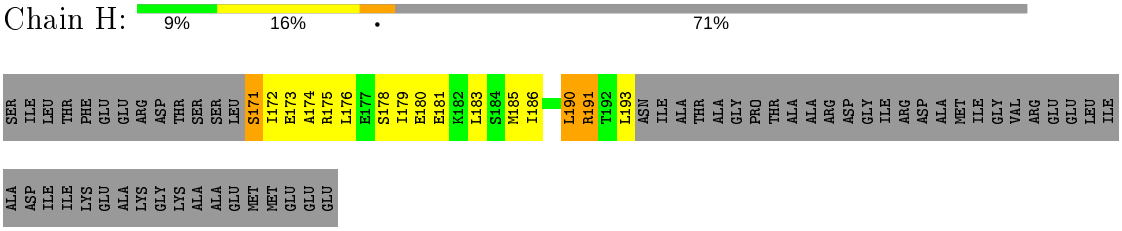
• Molecule 1: PHOSPHOPROTEIN P

Chain G:



• Molecule 1: PHOSPHOPROTEIN P

Chain H:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	66.91Å 48.52Å 64.45Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	46.42 – 3.13 46.42 – 3.13	Depositor EDS
% Data completeness (in resolution range)	89.6 (46.42-3.13) 89.6 (46.42-3.13)	Depositor EDS
R_{merge}	0.35	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.71 (at 3.12Å)	Xtriage
Refinement program	BUSTER 2.11.2	Depositor
R, R_{free}	0.235 , 0.252 0.239 , 0.251	Depositor DCC
R_{free} test set	153 reflections (4.28%)	wwPDB-VP
Wilson B-factor (Å^2)	57.8	Xtriage
Anisotropy	0.768	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.32 , 44.4	EDS
L-test for twinning[2]	$< \|L\| > = 0.46$, $< L^2 > = 0.29$	Xtriage
Estimated twinning fraction	0.062 for l,-k,h	Xtriage
F_o,F_c correlation	0.91	EDS
Total number of atoms	1560	wwPDB-VP
Average B, all atoms (Å^2)	53.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 9.17% 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

5.1 Standard geometry

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	0.42	0/188	0.63	0/250
1	B	0.50	0/196	0.72	0/261
1	C	0.51	0/194	0.71	0/258
1	D	0.47	0/202	0.77	0/269
1	E	0.45	0/196	0.64	0/261
1	F	0.44	0/196	0.68	0/261
1	G	0.77	0/200	0.80	0/266
1	H	0.47	0/180	0.74	0/239
All	All	0.52	0/1552	0.71	0/2065

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

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	189	0	211	3	0
1	B	197	0	217	9	0
1	C	195	0	216	9	2
1	D	203	0	222	5	0
1	E	197	0	217	10	0
1	F	197	0	217	7	0
1	G	201	0	221	13	0
1	H	181	0	200	16	2

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
All	All	1560	0	1721	54	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 16.

All (54) 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:F:178:SER:OG	1:G:180:GLU:OE2	1.88	0.89
1:H:176:LEU:O	1:H:180:GLU:HG3	1.72	0.88
1:B:191:ARG:NH1	1:F:181:GLU:OE2	2.12	0.83
1:C:176:LEU:O	1:C:180:GLU:HG2	1.84	0.77
1:B:185:MET:O	1:B:189:LEU:HD12	1.86	0.76
1:G:170:LEU:H	1:G:170:LEU:HD12	1.55	0.70
1:H:191:ARG:N	1:H:191:ARG:HD2	2.10	0.66
1:G:179:ILE:HG23	1:H:183:LEU:HD11	1.77	0.66
1:C:179:ILE:O	1:C:183:LEU:HD23	1.96	0.65
1:B:185:MET:O	1:B:189:LEU:CD1	2.45	0.64
1:A:175:ARG:NH1	1:B:180:GLU:OE1	2.32	0.63
1:D:175:ARG:O	1:D:179:ILE:HG23	2.00	0.62
1:E:172:ILE:HG22	1:F:176:LEU:HD11	1.83	0.61
1:H:175:ARG:HG2	1:H:175:ARG:HH11	1.65	0.59
1:D:171:SER:HB2	1:D:173:GLU:OE1	2.02	0.59
1:G:176:LEU:HD21	1:H:176:LEU:HD21	1.84	0.59
1:G:170:LEU:HD13	1:G:175:ARG:HG3	1.84	0.57
1:B:172:ILE:HA	1:B:175:ARG:HG3	1.87	0.56
1:G:179:ILE:HG23	1:H:183:LEU:CD1	2.36	0.55
1:C:176:LEU:O	1:C:180:GLU:CG	2.55	0.55
1:A:176:LEU:O	1:A:180:GLU:HG3	2.07	0.54
1:B:191:ARG:O	1:B:194:ASN:HB2	2.09	0.53
1:C:169:SER:O	1:C:170:LEU:HB2	2.09	0.53
1:E:170:LEU:O	1:E:171:SER:HB3	2.10	0.52
1:E:187:LEU:HD21	1:H:185:MET:HG2	1.91	0.52
1:C:172:ILE:HD11	1:D:172:ILE:HG13	1.92	0.52
1:C:179:ILE:O	1:C:183:LEU:CD2	2.58	0.51
1:G:171:SER:O	1:G:175:ARG:HB2	2.12	0.50
1:E:190:LEU:HD11	1:H:186:ILE:HG23	1.94	0.49
1:G:181:GLU:HG3	1:G:182:LYS:HE2	1.93	0.49
1:H:175:ARG:NH1	1:H:175:ARG:HG2	2.28	0.48
1:E:190:LEU:CD1	1:H:186:ILE:HG23	2.43	0.48
1:C:172:ILE:HG12	1:D:176:LEU:HD12	1.96	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:190:LEU:HA	1:C:193:LEU:HD13	1.97	0.47
1:G:170:LEU:N	1:G:170:LEU:HD12	2.28	0.47
1:F:187:LEU:HD22	1:F:191:ARG:HE	1.79	0.45
1:H:190:LEU:O	1:H:193:LEU:HB2	2.16	0.45
1:E:183:LEU:HD11	1:H:179:ILE:HG23	1.98	0.45
1:F:170:LEU:HA	1:F:175:ARG:NH2	2.32	0.44
1:G:178:SER:O	1:G:182:LYS:HG2	2.18	0.44
1:B:178:SER:O	1:B:182:LYS:HG3	2.18	0.44
1:B:175:ARG:H	1:B:175:ARG:HG2	1.63	0.43
1:A:190:LEU:HD11	1:D:186:ILE:HG23	2.01	0.43
1:B:189:LEU:O	1:B:192:THR:OG1	2.29	0.43
1:G:178:SER:O	1:G:179:ILE:C	2.52	0.42
1:C:177:GLU:HA	1:C:180:GLU:HG3	2.02	0.42
1:H:193:LEU:HD23	1:H:193:LEU:HA	1.93	0.42
1:E:187:LEU:HD21	1:H:185:MET:CG	2.49	0.41
1:G:178:SER:HA	1:G:181:GLU:HG2	2.02	0.41
1:G:175:ARG:HH21	1:H:176:LEU:HB2	1.85	0.41
1:E:170:LEU:HA	1:E:170:LEU:HD22	1.95	0.41
1:E:172:ILE:HG22	1:F:176:LEU:CD1	2.50	0.40
1:E:179:ILE:HG23	1:F:183:LEU:HD11	2.02	0.40
1:H:171:SER:HB2	1:H:174:ALA:HB3	2.03	0.40

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)
1:C:191:ARG:NH2	1:H:181:GLU:OE1[4_455]	1.84	0.36
1:C:173:GLU:OE2	1:H:173:GLU:OE1[3_554]	2.19	0.01

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	22/80 (28%)	21 (96%)	1 (4%)	0	100 100
1	B	23/80 (29%)	23 (100%)	0	0	100 100
1	C	23/80 (29%)	22 (96%)	0	1 (4%)	2 14
1	D	24/80 (30%)	23 (96%)	1 (4%)	0	100 100
1	E	23/80 (29%)	22 (96%)	0	1 (4%)	2 14
1	F	23/80 (29%)	23 (100%)	0	0	100 100
1	G	24/80 (30%)	23 (96%)	1 (4%)	0	100 100
1	H	21/80 (26%)	20 (95%)	0	1 (5%)	2 13
All	All	183/640 (29%)	177 (97%)	3 (2%)	3 (2%)	9 35

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	170	LEU
1	H	172	ILE
1	E	171	SER

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	22/65 (34%)	18 (82%)	4 (18%)	1 7
1	B	23/65 (35%)	17 (74%)	6 (26%)	0 1
1	C	23/65 (35%)	16 (70%)	7 (30%)	0 1
1	D	24/65 (37%)	18 (75%)	6 (25%)	0 2
1	E	23/65 (35%)	17 (74%)	6 (26%)	0 1
1	F	23/65 (35%)	18 (78%)	5 (22%)	1 4
1	G	24/65 (37%)	18 (75%)	6 (25%)	0 2
1	H	21/65 (32%)	17 (81%)	4 (19%)	1 6
All	All	183/520 (35%)	139 (76%)	44 (24%)	0 2

All (44) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	170	LEU
1	A	171	SER
1	A	181	GLU
1	A	193	LEU
1	B	171	SER
1	B	172	ILE
1	B	175	ARG
1	B	178	SER
1	B	184	SER
1	B	193	LEU
1	C	171	SER
1	C	172	ILE
1	C	173	GLU
1	C	175	ARG
1	C	177	GLU
1	C	178	SER
1	C	180	GLU
1	D	170	LEU
1	D	177	GLU
1	D	178	SER
1	D	179	ILE
1	D	193	LEU
1	D	194	ASN
1	E	170	LEU
1	E	172	ILE
1	E	175	ARG
1	E	178	SER
1	E	182	LYS
1	E	187	LEU
1	F	177	GLU
1	F	178	SER
1	F	182	LYS
1	F	189	LEU
1	F	193	LEU
1	G	170	LEU
1	G	173	GLU
1	G	175	ARG
1	G	177	GLU
1	G	189	LEU
1	G	191	ARG
1	H	171	SER
1	H	178	SER

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Mol	Chain	Res	Type
1	H	190	LEU
1	H	191	ARG

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	E	194	ASN

5.3.3 RNA

There are no RNA molecules 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

There are no ligands in this entry.

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^{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	24/80 (30%)	-0.47	0 100 100	39, 43, 57, 70	0
1	B	25/80 (31%)	-0.28	0 100 100	45, 49, 59, 88	0
1	C	25/80 (31%)	-0.28	0 100 100	47, 55, 66, 72	0
1	D	26/80 (32%)	-0.29	1 (3%) 40 21	45, 51, 59, 67	0
1	E	25/80 (31%)	-0.10	0 100 100	46, 51, 59, 90	0
1	F	25/80 (31%)	-0.38	0 100 100	42, 47, 61, 78	0
1	G	26/80 (32%)	-0.25	0 100 100	40, 52, 66, 67	0
1	H	23/80 (28%)	-0.05	0 100 100	46, 55, 64, 92	0
All	All	199/640 (31%)	-0.26	1 (0%) 91 83	39, 51, 67, 92	0

All (1) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	194	ASN	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

There are no ligands in this entry.

6.5 Other polymers (i)

There are no such residues in this entry.