Full wwPDB X-ray Structure Validation Report (i)

Feb 19, 2016 – 07:46 PM GMT

PDB ID	:	4U5Q
Title	:	High resolution crystal structure of reductase (R) domain of nonribosomal peptide synthetase from Mycobacterium tuberculosis
Authors	:	Patel, K.D.; Haque, A.S.; Priyadarshan, K.; Sankaranarayanan, R.
Deposited on	:	2014-07-25
Resolution	:	1.81 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
http://wwpdb.org/validation/2016/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:

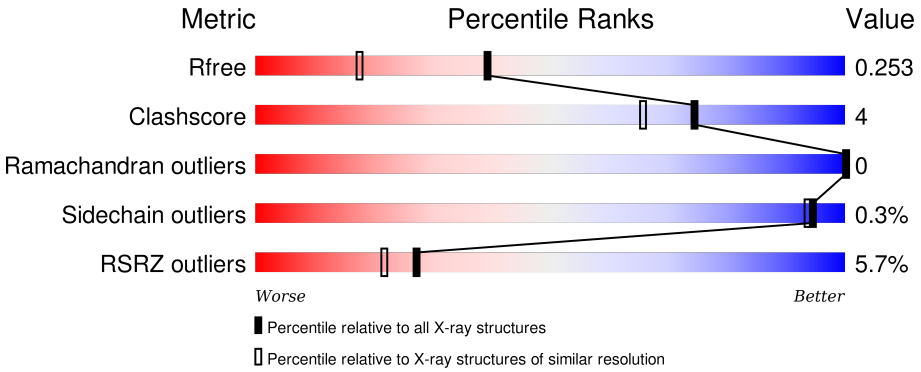
MolProbity	:	4.02b-467
Mogul	:	1.7.1 (RC1), CSD as537be (2016)
Xtriage (Phenix)	:	1.9-1692
EDS	:	rb-20026982
Percentile statistics	:	20151230.v01 (using entries in the PDB archive December 30th 2015)
Refmac	:	5.8.0135
CCP4	:	6.5.0
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	rb-20026982

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 1.81 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}	91344	5422 (1.84-1.80)
Clashscore	102246	6347 (1.84-1.80)
Ramachandran outliers	100387	6276 (1.84-1.80)
Sidechain outliers	100360	6276 (1.84-1.80)
RSRZ outliers	91569	5439 (1.84-1.80)

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. 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	478	5% 83% 6% 10%
1	B	478	5% 81% 8% 11%

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
2	XPE	B	2601	-	-	-	X

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 7239 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 Peptide synthetase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	429	Total	C	N	O	S	0	0	0
			3305	2092	576	625	12			
1	B	426	Total	C	N	O	S	0	0	0
			3293	2084	575	623	11			

There are 42 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	2035	MET	-	expression tag	UNP Q10896
A	2036	GLY	-	expression tag	UNP Q10896
A	2037	SER	-	expression tag	UNP Q10896
A	2038	SER	-	expression tag	UNP Q10896
A	2039	HIS	-	expression tag	UNP Q10896
A	2040	HIS	-	expression tag	UNP Q10896
A	2041	HIS	-	expression tag	UNP Q10896
A	2042	HIS	-	expression tag	UNP Q10896
A	2043	HIS	-	expression tag	UNP Q10896
A	2044	HIS	-	expression tag	UNP Q10896
A	2045	SER	-	expression tag	UNP Q10896
A	2046	SER	-	expression tag	UNP Q10896
A	2047	GLY	-	expression tag	UNP Q10896
A	2048	LEU	-	expression tag	UNP Q10896
A	2049	VAL	-	expression tag	UNP Q10896
A	2050	PRO	-	expression tag	UNP Q10896
A	2051	ARG	-	expression tag	UNP Q10896
A	2052	GLY	-	expression tag	UNP Q10896
A	2053	SER	-	expression tag	UNP Q10896
A	2054	HIS	-	expression tag	UNP Q10896
A	2055	MET	-	expression tag	UNP Q10896
B	2035	MET	-	expression tag	UNP Q10896
B	2036	GLY	-	expression tag	UNP Q10896
B	2037	SER	-	expression tag	UNP Q10896
B	2038	SER	-	expression tag	UNP Q10896

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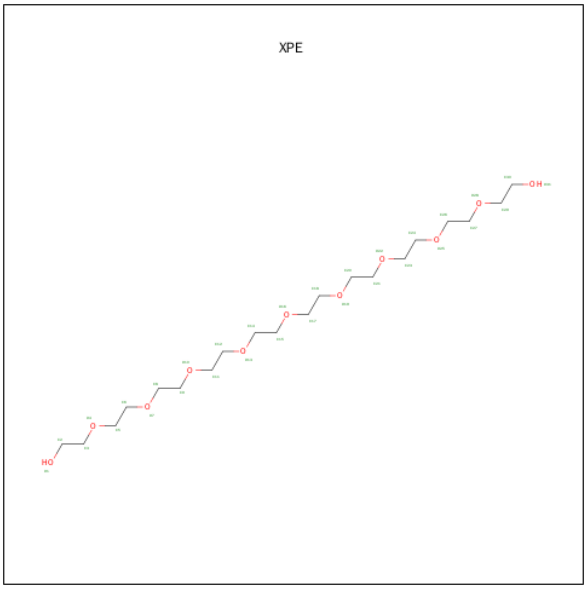
Chain	Residue	Modelled	Actual	Comment	Reference
B	2039	HIS	-	expression tag	UNP Q10896
B	2040	HIS	-	expression tag	UNP Q10896
B	2041	HIS	-	expression tag	UNP Q10896
B	2042	HIS	-	expression tag	UNP Q10896
B	2043	HIS	-	expression tag	UNP Q10896
B	2044	HIS	-	expression tag	UNP Q10896
B	2045	SER	-	expression tag	UNP Q10896
B	2046	SER	-	expression tag	UNP Q10896
B	2047	GLY	-	expression tag	UNP Q10896
B	2048	LEU	-	expression tag	UNP Q10896
B	2049	VAL	-	expression tag	UNP Q10896
B	2050	PRO	-	expression tag	UNP Q10896
B	2051	ARG	-	expression tag	UNP Q10896
B	2052	GLY	-	expression tag	UNP Q10896
B	2053	SER	-	expression tag	UNP Q10896
B	2054	HIS	-	expression tag	UNP Q10896
B	2055	MET	-	expression tag	UNP Q10896

- Molecule 2 is 3,6,9,12,15,18,21,24,27-NONAOXANONACOSANE-1,29-DIOL (three-letter code: XPE) (formula: $C_{20}H_{42}O_{11}$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	B	1	Total	C	O	0	0
			31	20	11		

- Molecule 3 is water.

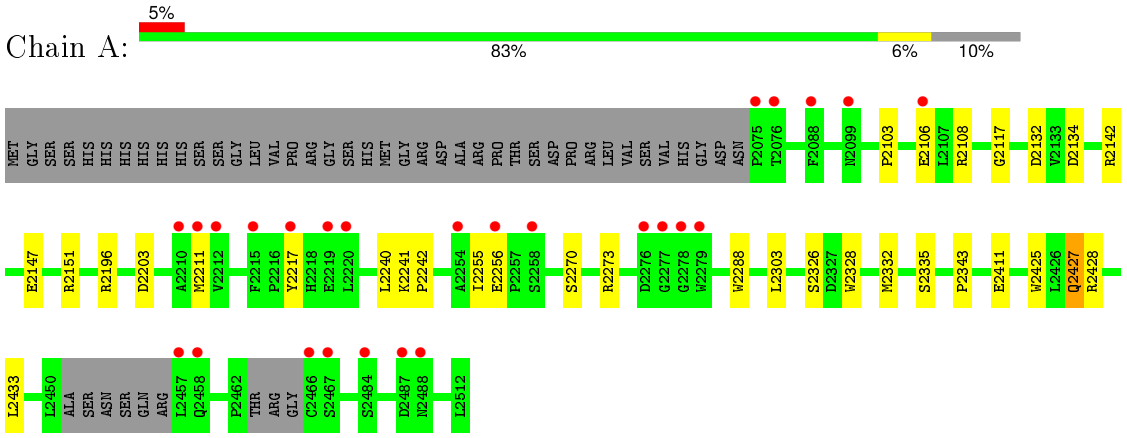
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	304	Total O 304 304	0	0
3	B	306	Total O 306 306	0	0

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 errors 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.

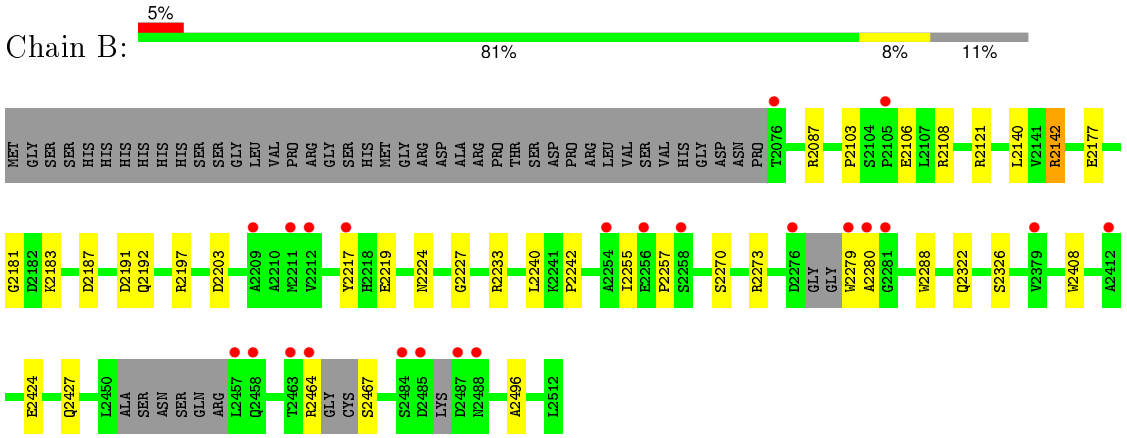
- Molecule 1: Peptide synthetase

Chain A:



- Molecule 1: Peptide synthetase

Chain B:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	78.53Å 88.59Å 126.08Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	42.98 – 1.81 42.99 – 1.81	Depositor EDS
% Data completeness (in resolution range)	99.3 (42.98-1.81) 99.3 (42.99-1.81)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.09	Depositor
$< I/\sigma(I) >$ [1]	1.18 (at 1.81Å)	Xtriage
Refinement program	PHENIX (1.10_2155)	Depositor
R, R_{free}	0.202 , 0.245 0.213 , 0.253	Depositor DCC
R_{free} test set	4030 reflections (5.30%)	DCC
Wilson B-factor (Å^2)	23.9	Xtriage
Anisotropy	0.564	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.35 , 45.1	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.34$	Xtriage
Outliers	2 of 80119 reflections (0.002%)	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	7239	wwPDB-VP
Average B, all atoms (Å^2)	28.0	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 47.13 % 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 1.0375e-04.The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.375 respectively for untwinned datasets, and 0.333, 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: XPE

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	0.38	0/3374	0.56	0/4593
1	B	0.36	0/3359	0.56	0/4571
All	All	0.37	0/6733	0.56	0/9164

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	3305	0	3281	23	0
1	B	3293	0	3268	30	0
2	B	31	0	42	5	0
3	A	304	0	0	2	0
3	B	306	0	0	4	0
All	All	7239	0	6591	53	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 (53) 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:2151:ARG:NH2	3:A:2601:HOH:O	2.15	0.80
1:B:2187:ASP:OD1	1:B:2233:ARG:NH1	2.13	0.80
1:B:2191:ASP:OD2	3:B:2701:HOH:O	2.07	0.70
1:B:2255:ILE:HD11	1:B:2270:SER:HB2	1.72	0.69
1:B:2087:ARG:HE	2:B:2601:XPE:H142	1.57	0.68
1:B:2257:PRO:HB3	1:B:2467:SER:HB3	1.77	0.66
1:B:2187:ASP:OD2	1:B:2192:GLN:NE2	2.29	0.65
1:B:2142:ARG:NH1	3:B:2703:HOH:O	2.30	0.64
1:A:2427:GLN:HE21	1:A:2428:ARG:HG3	1.65	0.61
1:A:2411:GLU:HG2	2:B:2601:XPE:H51	1.84	0.60
1:B:2219:GLU:OE2	1:B:2224:ASN:ND2	2.33	0.60
1:B:2106:GLU:HG3	1:B:2108:ARG:NH1	2.17	0.59
1:A:2147:GLU:HG3	1:A:2151:ARG:HE	1.68	0.58
1:B:2087:ARG:HE	2:B:2601:XPE:H171	1.68	0.58
1:A:2427:GLN:HE21	1:A:2428:ARG:N	2.01	0.58
1:B:2121:ARG:HD2	1:B:2322:GLN:OE1	2.03	0.58
1:A:2256:GLU:OE2	1:A:2256:GLU:N	2.25	0.58
1:B:2106:GLU:OE1	3:B:2702:HOH:O	2.18	0.56
1:B:2464:ARG:HG2	1:B:2467:SER:N	2.21	0.55
1:B:2219:GLU:HG3	1:B:2224:ASN:HB2	1.87	0.55
1:B:2464:ARG:NH2	3:B:2706:HOH:O	2.39	0.54
1:A:2255:ILE:HD11	1:A:2270:SER:HB2	1.89	0.54
1:A:2427:GLN:NE2	1:A:2428:ARG:HG3	2.23	0.54
1:B:2217:TYR:HB3	1:B:2326:SER:HB2	1.91	0.52
1:B:2087:ARG:NE	2:B:2601:XPE:H142	2.26	0.50
1:B:2106:GLU:N	1:B:2106:GLU:OE2	2.34	0.50
1:A:2106:GLU:OE1	1:A:2108:ARG:NH2	2.46	0.49
1:A:2203:ASP:O	1:A:2242:PRO:HD2	2.16	0.46
1:A:2147:GLU:HG2	1:A:2151:ARG:HH21	1.80	0.46
1:B:2203:ASP:O	1:B:2242:PRO:HD2	2.16	0.46
1:B:2183:LYS:HG2	1:B:2227:GLY:HA3	1.98	0.46
1:B:2257:PRO:CB	1:B:2467:SER:HB3	2.46	0.46
1:A:2335:SER:HB3	1:A:2433:LEU:HD21	1.99	0.45
1:A:2117:GLY:HA2	1:A:2211:MET:HB2	1.98	0.45
1:B:2273:ARG:HD2	1:B:2288:TRP:CG	2.52	0.44
1:B:2103:PRO:HB3	1:B:2240:LEU:O	2.18	0.44
1:A:2217:TYR:HB3	1:A:2326:SER:HB2	1.99	0.44
1:B:2424:GLU:OE2	1:B:2427:GLN:NE2	2.51	0.43
1:A:2196:ARG:NH1	3:A:2620:HOH:O	2.50	0.43
1:B:2408:TRP:CE3	1:B:2496:ALA:HA	2.53	0.43
1:A:2142:ARG:CZ	1:A:2142:ARG:HB3	2.48	0.43
1:B:2087:ARG:NE	2:B:2601:XPE:H171	2.31	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:2177:GLU:OE1	1:B:2197:ARG:NH2	2.44	0.42
1:A:2273:ARG:HD2	1:A:2288:TRP:CG	2.54	0.42
1:A:2328:TRP:CZ2	1:A:2332:MET:HG3	2.54	0.42
1:A:2132:ASP:HB3	1:A:2134:ASP:OD1	2.20	0.42
1:A:2106:GLU:OE1	1:A:2108:ARG:CZ	2.57	0.41
1:A:2241:LYS:O	1:A:2303:LEU:HD11	2.20	0.41
1:B:2106:GLU:HG3	1:B:2108:ARG:HH11	1.86	0.41
1:B:2279:TRP:CD2	1:B:2280:ALA:N	2.89	0.41
1:A:2103:PRO:HB3	1:A:2240:LEU:O	2.21	0.40
1:B:2140:LEU:HD11	1:B:2181:GLY:HA3	2.03	0.40
1:A:2343:PRO:HD3	1:A:2425:TRP:CE2	2.56	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	423/478 (88%)	415 (98%)	8 (2%)	0	100	100
1	B	416/478 (87%)	406 (98%)	10 (2%)	0	100	100
All	All	839/956 (88%)	821 (98%)	18 (2%)	0	100	100

There are no Ramachandran outliers to report.

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	349/390 (90%)	348 (100%)	1 (0%)	94 93
1	B	348/390 (89%)	347 (100%)	1 (0%)	94 93
All	All	697/780 (89%)	695 (100%)	2 (0%)	94 93

All (2) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	2427	GLN
1	B	2142	ARG

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	2427	GLN
1	B	2427	GLN

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

1 ligand is 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	XPE	B	2601	-	30,30,30	0.72	0	29,29,29	0.43	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	XPE	B	2601	-	-	0/28/28/28	0/0/0/0

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

1 monomer is involved in 5 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	2601	XPE	5	0

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^{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	429/478 (89%)	0.35	26 (6%)	25	20	16, 25, 45, 61	0
1	B	426/478 (89%)	0.34	23 (5%)	29	24	16, 26, 47, 67	0
All	All	855/956 (89%)	0.35	49 (5%)	27	22	16, 25, 47, 67	0

All (49) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	2279	TRP	7.8
1	B	2276	ASP	6.5
1	B	2484	SER	6.4
1	A	2278	GLY	6.2
1	A	2279	TRP	5.8
1	B	2258	SER	5.8
1	B	2488	ASN	5.6
1	B	2280	ALA	5.4
1	A	2258	SER	5.2
1	B	2457	LEU	5.2
1	B	2487	ASP	5.1
1	A	2211	MET	5.0
1	A	2466	CYS	5.0
1	A	2276	ASP	4.8
1	A	2075	PRO	4.7
1	A	2277	GLY	4.4
1	B	2212	VAL	4.1
1	B	2463	THR	4.0
1	B	2211	MET	3.6
1	A	2467	SER	3.4
1	A	2457	LEU	3.4
1	A	2256	GLU	3.3
1	A	2220	LEU	3.3
1	B	2076	THR	3.2

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Mol	Chain	Res	Type	RSRZ
1	A	2217	TYR	3.2
1	A	2219	GLU	3.2
1	A	2484	SER	3.0
1	B	2412	ALA	2.8
1	A	2458	GLN	2.8
1	B	2254	ALA	2.7
1	B	2105	PRO	2.6
1	A	2076	THR	2.5
1	B	2485	ASP	2.5
1	B	2209	ALA	2.4
1	A	2488	ASN	2.4
1	A	2088	PHE	2.4
1	A	2254	ALA	2.4
1	B	2256	GLU	2.4
1	A	2210	ALA	2.4
1	B	2217	TYR	2.3
1	B	2281	GLY	2.3
1	A	2215	PHE	2.3
1	A	2106	GLU	2.3
1	B	2458	GLN	2.3
1	B	2379	VAL	2.2
1	A	2212	VAL	2.1
1	B	2464	ARG	2.1
1	A	2487	ASP	2.0
1	A	2099	ASN	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 carbohydrates 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. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. The B-factors column lists the minimum, median, 95^{th} 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	LLDF	B-factors(Å^2)	Q<0.9
2	XPE	B	2601	31/31	0.80	0.23	3.46	32,39,44,49	0

6.5 Other polymers (i)

There are no such residues in this entry.