



wwPDB X-ray Structure Validation Summary Report ⓘ

Feb 1, 2016 – 01:22 PM GMT

PDB ID : 3TPQ
Title : Crystal structure of wild-type MAL RPEL domain in complex with five G-actins
Authors : Hirano, H.; Matsuura, Y.
Deposited on : 2011-09-08
Resolution : 3.45 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
<http://wwpdb.org/validation/2016/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
Mogul : 1.7 (RC4), CSD as536be (2015)
Xtriage (Phenix) : 1.9-1692
EDS : rb-20026688
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) : trunk26865

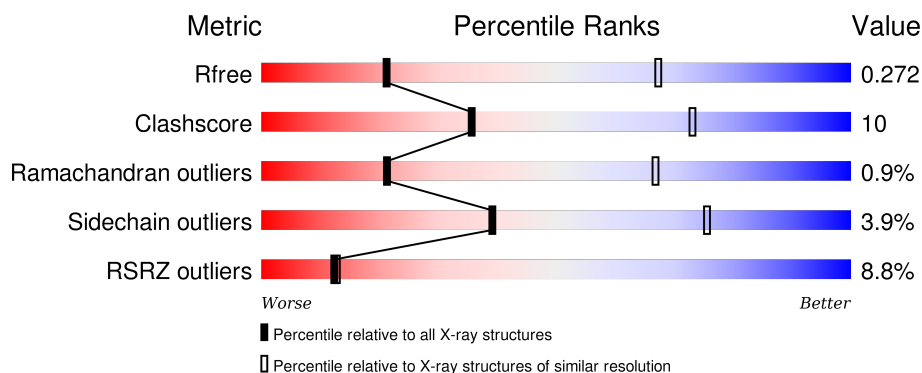
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.45 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	1000 (3.56-3.36)
Clashscore	102246	1090 (3.56-3.36)
Ramachandran outliers	100387	1057 (3.56-3.36)
Sidechain outliers	100360	1058 (3.56-3.36)
RSRZ outliers	91569	1005 (3.56-3.36)

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 $\leq 5\%$. 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	375	<div> <div>74%</div> <div>16%</div> <div>8%</div> </div>
1	B	375	<div> <div>4%</div> <div>75%</div> <div>18%</div> <div>5%</div> </div>
1	C	375	<div> <div>6%</div> <div>82%</div> <div>11%</div> <div>5%</div> </div>
1	D	375	<div> <div>5%</div> <div>81%</div> <div>13%</div> <div>5%</div> </div>
1	E	375	<div> <div>27%</div> <div>74%</div> <div>9%</div> <div>15%</div> </div>

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Mol	Chain	Length	Quality of chain
2	M	117	 A horizontal bar chart showing the quality of chain M. The bar is divided into three segments: green (29%), yellow (51%), and orange (20%).

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 14613 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 Actin, alpha skeletal muscle.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	346	Total	C	N	O	S	0	0	0
			2700	1714	448	519	19			
1	B	358	Total	C	N	O	S	0	0	0
			2790	1771	464	536	19			
1	C	358	Total	C	N	O	S	0	0	0
			2784	1768	461	536	19			
1	D	358	Total	C	N	O	S	0	0	0
			2794	1773	464	538	19			
1	E	318	Total	C	N	O	S	0	0	0
			2485	1581	412	474	18			

- Molecule 2 is a protein called MAL.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	M	117	Total	C	N	O	S	0	0	0
			900	556	174	167	3			

- Molecule 3 is ADENOSINE-5'-TRIPHOSPHATE (three-letter code: ATP) (formula: $C_{10}H_{16}N_5O_{13}P_3$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	A	1	Total 31	C 10	N 5	O 13	P 3	0	0
3	B	1	Total 31	C 10	N 5	O 13	P 3	0	0
3	C	1	Total 31	C 10	N 5	O 13	P 3	0	0
3	D	1	Total 31	C 10	N 5	O 13	P 3	0	0
3	E	1	Total 31	C 10	N 5	O 13	P 3	0	0

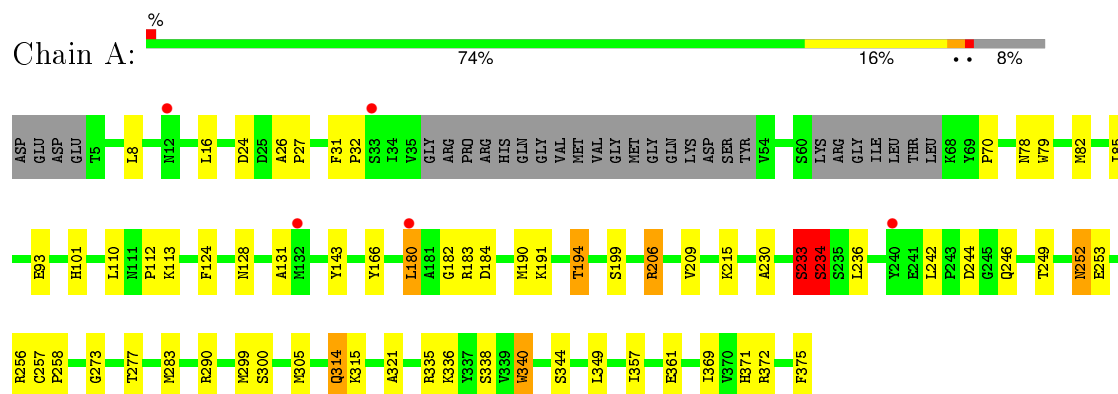
- Molecule 4 is CALCIUM ION (three-letter code: CA) (formula: Ca).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	B	1	Total Ca 1 1	0	0
4	A	1	Total Ca 1 1	0	0
4	D	1	Total Ca 1 1	0	0
4	C	1	Total Ca 1 1	0	0
4	E	1	Total Ca 1 1	0	0

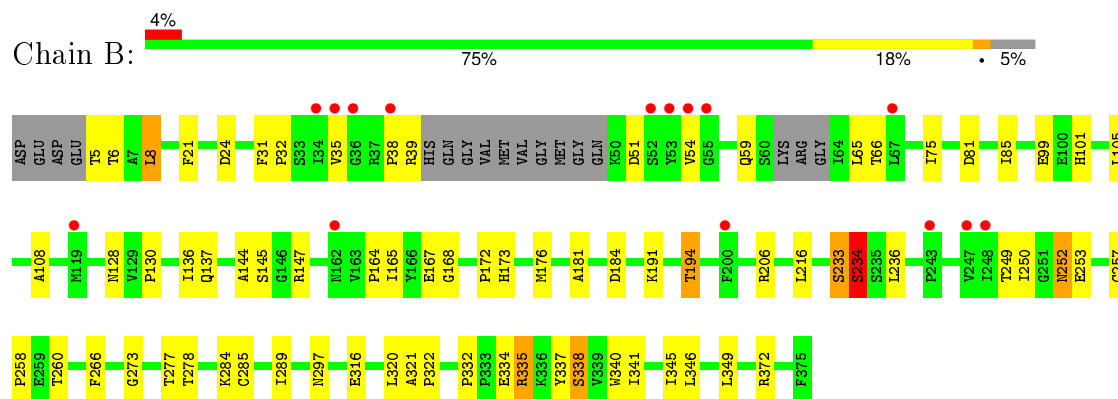
3 Residue-property plots [i](#)

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.

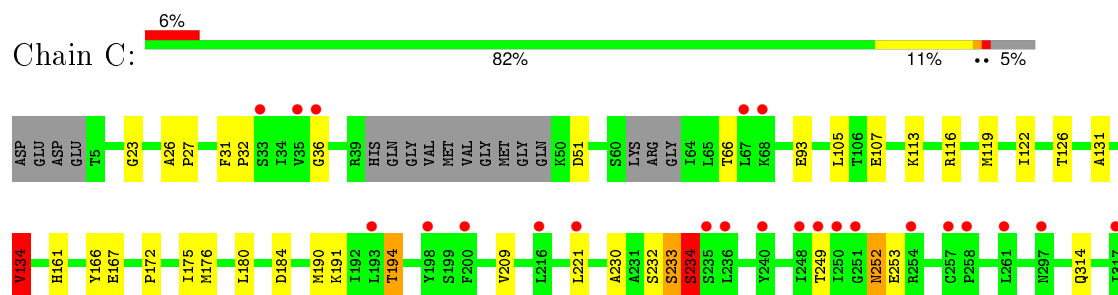
- Molecule 1: Actin, alpha skeletal muscle



- Molecule 1: Actin, alpha skeletal muscle

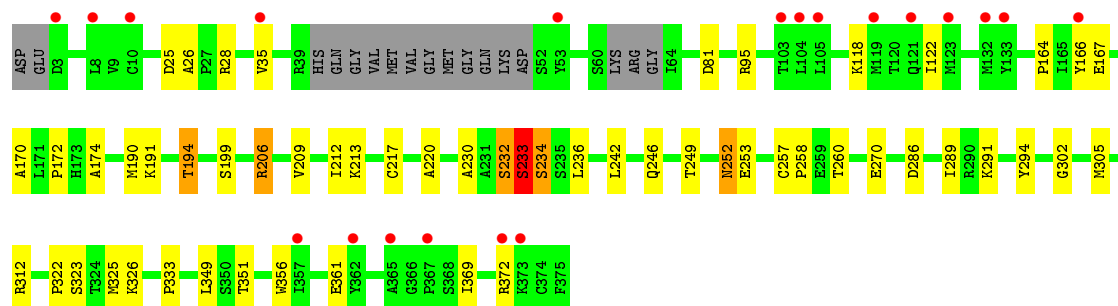
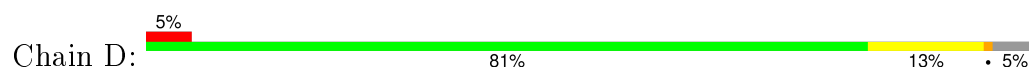


- Molecule 1: Actin, alpha skeletal muscle

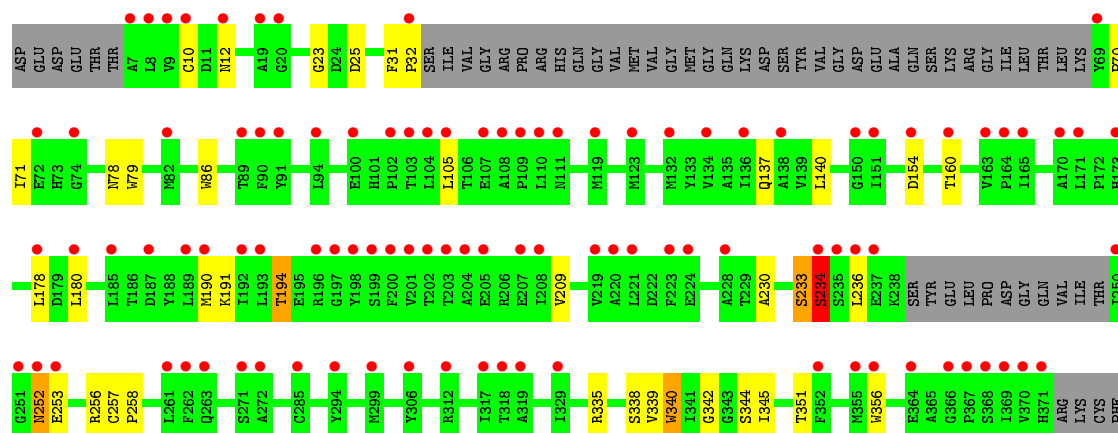
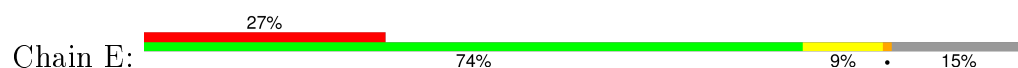




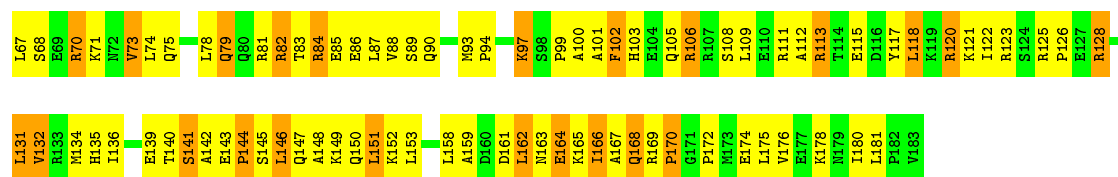
- Molecule 1: Actin, alpha skeletal muscle



- Molecule 1: Actin, alpha skeletal muscle



- Molecule 2: MAL



4 Data and refinement statistics

Property	Value	Source
Space group	P 65 2 2	Depositor
Cell constants a, b, c, α , β , γ	180.74Å 180.74Å 382.28Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	68.70 – 3.45 68.70 – 3.45	Depositor EDS
% Data completeness (in resolution range)	84.3 (68.70-3.45) 84.3 (68.70-3.45)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.85 (at 3.49Å)	Xtriage
Refinement program	REFMAC 5.6.0117	Depositor
R, R_{free}	0.224 , 0.273 0.224 , 0.272	Depositor DCC
R_{free} test set	2080 reflections (5.28%)	DCC
Wilson B-factor (Å ²)	111.6	Xtriage
Anisotropy	0.021	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 105.4	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning ²	$\langle L \rangle = 0.44$, $\langle L^2 \rangle = 0.27$	Xtriage
Outliers	1 of 41449 reflections (0.002%)	Xtriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	14613	wwPDB-VP
Average B, all atoms (Å ²)	153.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.30% 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, 0.375 respectively for untwinned datasets, and 0.333, 0.2 for perfectly twinned datasets.

5 Model quality [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: CA, ATP

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	0.70	2/2758 (0.1%)	0.80	1/3740 (0.0%)
1	B	0.78	0/2850	0.91	5/3865 (0.1%)
1	C	0.71	0/2844	0.84	5/3858 (0.1%)
1	D	0.71	1/2854 (0.0%)	0.84	1/3870 (0.0%)
1	E	0.60	4/2539 (0.2%)	0.71	0/3443
2	M	0.82	1/911 (0.1%)	1.03	3/1231 (0.2%)
All	All	0.71	8/14756 (0.1%)	0.84	15/20007 (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	2
1	B	0	1
1	C	0	1
1	D	0	2
1	E	0	1
All	All	0	7

The worst 5 of 8 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	M	161	ASP	CB-CG	7.93	1.68	1.51
1	A	340	TRP	CD2-CE2	6.34	1.49	1.41
1	E	340	TRP	CD2-CE2	5.36	1.47	1.41
1	A	79	TRP	CD2-CE2	5.35	1.47	1.41
1	E	86	TRP	CD2-CE2	5.30	1.47	1.41

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

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	119	MET	CG-SD-CE	6.66	110.85	100.20
1	D	206	ARG	NE-CZ-NH1	6.57	123.58	120.30
1	C	374	CYS	N-CA-C	6.52	128.62	111.00
2	M	162	LEU	CA-CB-CG	6.41	130.05	115.30
2	M	70	ARG	NE-CZ-NH1	5.97	123.28	120.30

There are no chirality outliers.

5 of 7 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	233	SER	Peptide
1	A	234	SER	Peptide
1	B	234	SER	Peptide
1	C	234	SER	Peptide
1	D	233	SER	Peptide

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	2700	0	2648	54	0
1	B	2790	0	2735	47	0
1	C	2784	0	2724	46	0
1	D	2794	0	2739	40	0
1	E	2485	0	2445	33	0
2	M	900	0	885	108	0
3	A	31	0	12	2	0
3	B	31	0	12	0	0
3	C	31	0	12	0	0
3	D	31	0	12	0	0
3	E	31	0	12	0	0
4	A	1	0	0	0	0
4	B	1	0	0	0	0
4	C	1	0	0	0	0
4	D	1	0	0	0	0
4	E	1	0	0	0	0
All	All	14613	0	14236	280	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 10.

The worst 5 of 280 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:C:372:ARG:O	1:C:373:LYS:HG2	1.23	1.27
2:M:106:ARG:HG2	2:M:106:ARG:HH11	1.18	1.02
1:D:166:TYR:CD1	2:M:175:LEU:HD21	1.96	1.00
2:M:131:LEU:HD12	2:M:136:ILE:HG21	1.44	0.97
1:C:113:LYS:HB3	1:C:371:HIS:HE1	1.29	0.94

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	340/375 (91%)	325 (96%)	13 (4%)	2 (1%)	30	74
1	B	352/375 (94%)	339 (96%)	11 (3%)	2 (1%)	30	74
1	C	352/375 (94%)	334 (95%)	14 (4%)	4 (1%)	17	62
1	D	352/375 (94%)	337 (96%)	13 (4%)	2 (1%)	30	74
1	E	312/375 (83%)	301 (96%)	9 (3%)	2 (1%)	30	74
2	M	115/117 (98%)	92 (80%)	19 (16%)	4 (4%)	4	36
All	All	1823/1992 (92%)	1728 (95%)	79 (4%)	16 (1%)	21	67

5 of 16 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	234	SER
1	B	233	SER
1	B	234	SER

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Mol	Chain	Res	Type
1	C	374	CYS
1	E	234	SER

5.3.2 Protein sidechains ⓘ

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	291/318 (92%)	283 (97%)	8 (3%)	52	83
1	B	300/318 (94%)	289 (96%)	11 (4%)	41	76
1	C	299/318 (94%)	291 (97%)	8 (3%)	52	83
1	D	301/318 (95%)	292 (97%)	9 (3%)	48	81
1	E	267/318 (84%)	264 (99%)	3 (1%)	80	92
2	M	90/106 (85%)	68 (76%)	22 (24%)	1	4
All	All	1548/1696 (91%)	1487 (96%)	61 (4%)	39	75

5 of 61 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	D	25	ASP
1	D	323	SER
2	M	151	LEU
1	D	194	THR
1	D	232	SER

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 19 such sidechains are listed below:

Mol	Chain	Res	Type
1	C	280	ASN
1	D	246	GLN
1	E	252	ASN
1	C	252	ASN
1	E	280	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 ⓘ

Of 10 ligands modelled in this entry, 5 are monoatomic - leaving 5 for Mogul analysis.

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$
3	ATP	A	1377	4	24,33,33	1.05	1 (4%)	31,52,52	2.28	7 (22%)
3	ATP	B	1377	4	24,33,33	1.07	1 (4%)	31,52,52	1.82	9 (29%)
3	ATP	C	1377	4	24,33,33	1.16	1 (4%)	31,52,52	1.86	8 (25%)
3	ATP	D	1377	4	24,33,33	1.16	3 (12%)	31,52,52	1.96	6 (19%)
3	ATP	E	1377	4	24,33,33	0.97	1 (4%)	31,52,52	1.81	6 (19%)

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
3	ATP	A	1377	4	-	0/18/38/38	0/3/3/3
3	ATP	B	1377	4	-	0/18/38/38	0/3/3/3
3	ATP	C	1377	4	-	0/18/38/38	0/3/3/3
3	ATP	D	1377	4	-	0/18/38/38	0/3/3/3

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	ATP	E	1377	4	-	0/18/38/38	0/3/3/3

The worst 5 of 7 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	D	1377	ATP	C4-N3	-2.50	1.31	1.35
3	D	1377	ATP	C5-N7	-2.02	1.32	1.39
3	D	1377	ATP	C2-N3	3.00	1.37	1.32
3	B	1377	ATP	C5-C4	3.20	1.47	1.40
3	A	1377	ATP	C5-C4	3.23	1.47	1.40

The worst 5 of 36 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	1377	ATP	N3-C2-N1	-8.26	122.57	128.89
3	D	1377	ATP	C4-C5-N7	-6.61	103.40	109.48
3	C	1377	ATP	N3-C2-N1	-5.93	124.35	128.89
3	A	1377	ATP	PA-O3A-PB	-4.66	119.65	132.73
3	D	1377	ATP	PA-O3A-PB	-4.45	120.24	132.73

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

1 monomer is involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	1377	ATP	2	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, 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	346/375 (92%)	0.17	5 (1%) 78 71	77, 140, 187, 211	0
1	B	358/375 (95%)	0.44	15 (4%) 40 34	74, 128, 196, 331	0
1	C	358/375 (95%)	0.45	24 (6%) 21 19	69, 142, 219, 272	0
1	D	358/375 (95%)	0.42	20 (5%) 28 25	67, 136, 200, 297	0
1	E	318/375 (84%)	1.48	100 (31%) 1 1	153, 227, 269, 303	0
2	M	117/117 (100%)	-0.03	0 100 100	81, 128, 196, 205	0
All	All	1855/1992 (93%)	0.54	164 (8%) 12 13	67, 144, 243, 331	0

The worst 5 of 164 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	250	ILE	8.5
1	E	236	LEU	7.1
1	E	200	PHE	7.0
1	E	170	ALA	5.9
1	B	36	GLY	5.8

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

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, 95th 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
4	CA	A	1378	1/1	0.95	0.31	0.91	108,108,108,108	0
4	CA	C	1378	1/1	0.98	0.28	0.47	104,104,104,104	0
4	CA	D	1378	1/1	0.95	0.23	0.19	104,104,104,104	0
4	CA	B	1378	1/1	0.98	0.30	-0.17	81,81,81,81	0
3	ATP	D	1377	31/31	0.98	0.21	-0.23	54,79,123,137	0
3	ATP	A	1377	31/31	0.95	0.21	-0.24	81,103,143,154	0
3	ATP	B	1377	31/31	0.97	0.20	-0.70	74,101,120,128	0
3	ATP	C	1377	31/31	0.95	0.17	-0.93	98,128,150,163	0
4	CA	E	1378	1/1	0.95	0.15	-1.01	245,245,245,245	0
3	ATP	E	1377	31/31	0.90	0.12	-1.21	148,187,237,261	0

6.5 Other polymers

There are no such residues in this entry.