



# Full wwPDB X-ray Structure Validation Report ⓘ

Jul 19, 2017 – 01:58 PM EDT

PDB ID : 4HB3  
Title : Crystal structure of CRM1(T539S)-Ran-RanBP1 with weakly bound unmod-  
eled Leptomycin B  
Authors : Sun, Q.; Chook, Y.M.  
Deposited on : unknown  
Resolution : 2.80 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](mailto: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.

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The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467  
Mogul : 1.7.2 (RC1), CSD as538be (2017)  
Xtriage (Phenix) : 1.9-1692  
EDS : rb-20029824  
Percentile statistics : 20161228.v01 (using entries in the PDB archive December 28th 2016)  
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-20029824

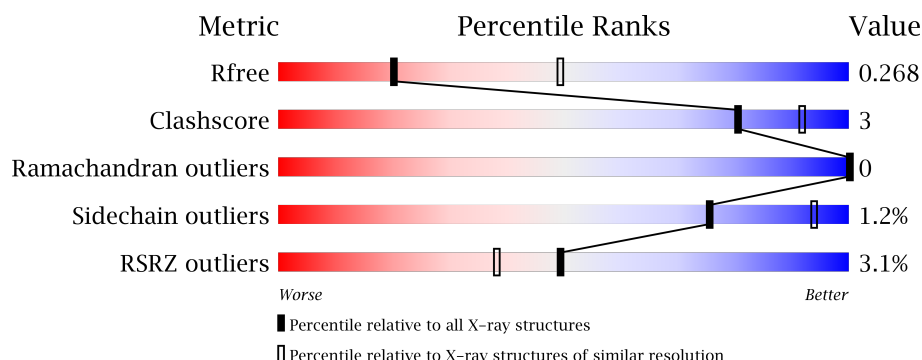
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.80 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))
$R_{free}$	100719	2583 (2.80-2.80)
Clashscore	112137	3033 (2.80-2.80)
Ramachandran outliers	110173	2983 (2.80-2.80)
Sidechain outliers	110143	2985 (2.80-2.80)
RSRZ outliers	101464	2610 (2.80-2.80)

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  $\geq 3$ , 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	216	<div> <div>4%</div> <div> <div></div> <div>85%</div> <div>8%</div> <div>6%</div> </div> </div>
2	B	140	<div> <div>6%</div> <div> <div></div> <div>79%</div> <div>7%</div> <div>14%</div> </div> </div>
3	C	1023	<div> <div>2%</div> <div> <div></div> <div>89%</div> <div>9%</div> <div>.</div> </div> </div>

## 2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 11058 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 GTP-binding nuclear protein Ran.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	202	Total	C	N	O	S	0	4	0
			1655	1067	284	298	6			

- Molecule 2 is a protein called Ran-specific GTPase-activating protein 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	121	Total	C	N	O	S	0	1	0
			1001	633	175	189	4			

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	98	LYS	ALA	CONFLICT	UNP P41920

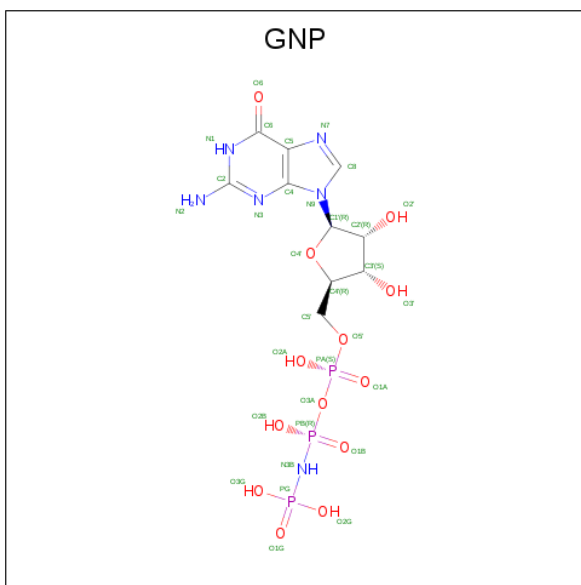
- Molecule 3 is a protein called Exportin-1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	C	1013	Total	C	N	O	S	0	21	0
			8300	5343	1356	1559	42			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	-1	GLY	-	EXPRESSION TAG	UNP P30822
C	0	ALA	-	EXPRESSION TAG	UNP P30822
C	539	SER	THR	ENGINEERED MUTATION	UNP P30822
C	1022	CYS	TYR	ENGINEERED MUTATION	UNP P30822

- Molecule 4 is PHOSPHOAMINOPHOSPHONIC ACID-GUANYLATE ESTER (three-letter code: GNP) (formula: C<sub>10</sub>H<sub>17</sub>N<sub>6</sub>O<sub>13</sub>P<sub>3</sub>).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
4	A	1	Total	C	N	O	P	0	0
			32	10	6	13	3		

- Molecule 5 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	1	Total	Mg	0	0
			1	1		

- Molecule 6 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	C	1	Total	Cl	0	0
			1	1		

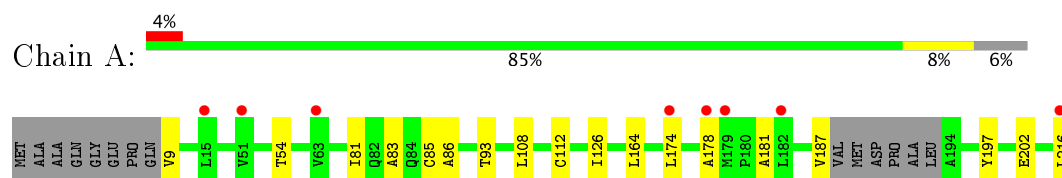
- Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	16	Total	O	0	0
			16	16		
7	B	2	Total	O	0	0
			2	2		
7	C	50	Total	O	0	0
			50	50		

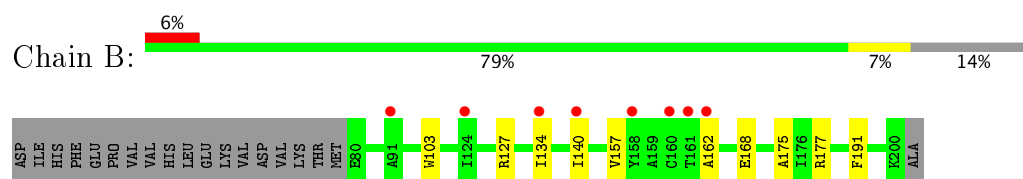
### 3 Residue-property plots [i](#)

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.

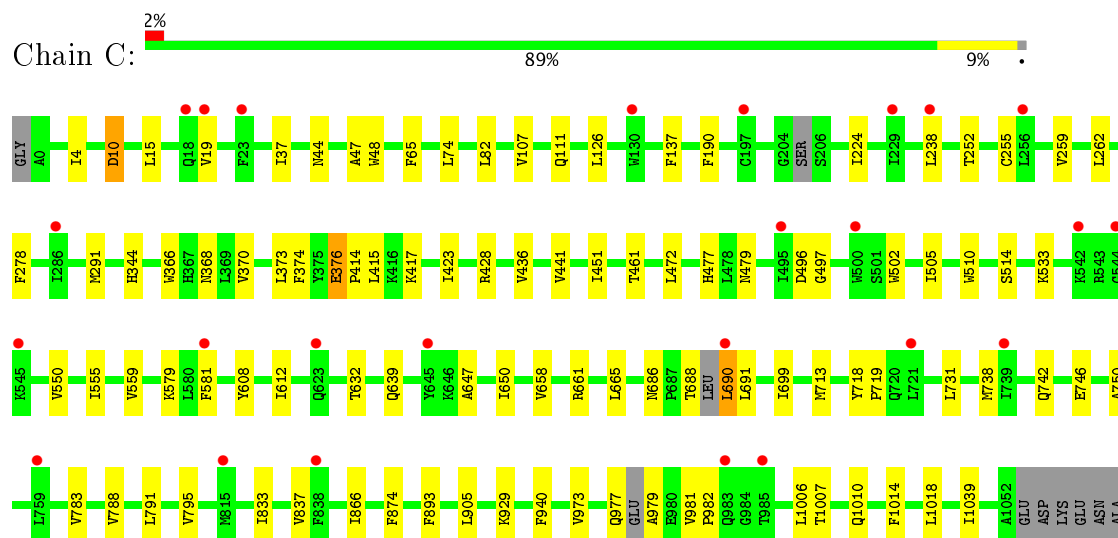
- Molecule 1: GTP-binding nuclear protein Ran



- Molecule 2: Ran-specific GTPase-activating protein 1



- Molecule 3: Exportin-1



GLOBAL-STATISTICS INFOmissingINFO

## 4 Model quality [i](#)

### 4.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: GNP, MG, CL

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	0/1701	0.50	0/2303
2	B	0.42	0/1018	0.50	0/1359
3	C	0.42	0/8504	0.47	0/11520
All	All	0.42	0/11223	0.48	0/15182

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

### 4.2 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	1655	0	1652	14	0
2	B	1001	0	994	8	0
3	C	8300	0	8417	53	0
4	A	32	0	13	0	0
5	A	1	0	0	0	0
6	C	1	0	0	0	0
7	A	16	0	0	1	0
7	B	2	0	0	0	0
7	C	50	0	0	0	0
All	All	11058	0	11076	69	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 3.

All (69) 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)
3:C:981:VAL:HG13	3:C:982:PRO:HD2	1.77	0.67
1:A:54:THR:HG21	1:A:174:LEU:HD21	1.80	0.63
3:C:688:THR:HA	3:C:691:LEU:HD23	1.80	0.63
3:C:44:ASN:HB3	3:C:47:ALA:HB2	1.83	0.60
3:C:414:PRO:O	3:C:415:LEU:HB2	2.02	0.60
3:C:107:VAL:HG13	3:C:111:GLN:HG3	1.84	0.59
3:C:74:LEU:HD11	3:C:82:LEU:HD21	1.86	0.58
3:C:126:LEU:HD11	3:C:137:PHE:CE2	2.42	0.55
3:C:376:GLU:HA	3:C:376:GLU:OE1	2.05	0.54
3:C:1014:PHE:CZ	3:C:1018:LEU:HD22	2.43	0.54
1:A:187:VAL:CG2	2:B:162:ALA:HB2	2.38	0.53
3:C:791:LEU:O	3:C:795:VAL:HG22	2.09	0.53
3:C:783:VAL:O	3:C:788:VAL:HG23	2.09	0.53
1:A:181:ALA:HB2	2:B:134:ILE:HD11	1.91	0.52
1:A:83:ALA:HB3	1:A:112:CYS:SG	2.50	0.52
3:C:1007:THR:H	3:C:1010:GLN:HE21	1.58	0.51
3:C:893:PHE:CE1	3:C:905:LEU:HD23	2.44	0.51
3:C:833:ILE:O	3:C:837:VAL:HG22	2.10	0.51
3:C:686:ASN:HD22	3:C:688:THR:HG23	1.76	0.51
3:C:451:ILE:HG13	3:C:550:VAL:HG23	1.92	0.51
1:A:187:VAL:HG21	2:B:162:ALA:HB2	1.94	0.50
2:B:168[B]:GLU:OE1	2:B:168[B]:GLU:HA	2.11	0.50
3:C:893:PHE:CD1	3:C:905:LEU:HD23	2.46	0.50
3:C:929:LYS:HE2	3:C:973:VAL:HG21	1.94	0.50
3:C:366:TRP:O	3:C:370:VAL:HG22	2.13	0.49
3:C:10:ASP:N	3:C:10:ASP:OD2	2.45	0.48
3:C:555:ILE:O	3:C:559:VAL:HG22	2.12	0.48
1:A:93:THR:HG21	1:A:126:ILE:HD12	1.96	0.48
3:C:690:LEU:HD12	3:C:738:MET:SD	2.53	0.48
2:B:103:TRP:CH2	2:B:175:ALA:HB2	2.49	0.47
3:C:1006:LEU:HD11	3:C:1039:ILE:HG22	1.95	0.47
3:C:374:PHE:HE1	3:C:477[A]:HIS:CG	2.33	0.47
1:A:86:ALA:CB	1:A:108:LEU:HD21	2.44	0.47
3:C:436:VAL:HG21	3:C:461:THR:HB	1.95	0.47
3:C:190:PHE:CZ	3:C:224:ILE:HG21	2.49	0.47
3:C:699:ILE:HG21	3:C:731:LEU:HD21	1.97	0.46
1:A:85:CYS:HB2	1:A:164:LEU:HD22	1.97	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:C:238:LEU:CD2	3:C:252:THR:HG23	2.46	0.46
3:C:686:ASN:HD22	3:C:688:THR:CG2	2.29	0.46
3:C:977:GLN:O	3:C:979:ALA:HB3	2.17	0.45
3:C:48:TRP:CG	3:C:74:LEU:HD22	2.51	0.45
3:C:746:GLU:HB2	3:C:750:ALA:HB2	1.97	0.45
3:C:4:ILE:HD11	3:C:37:ILE:HG22	1.99	0.45
3:C:608:TYR:CE2	3:C:612:ILE:HD13	2.51	0.45
3:C:496:ASP:OD1	3:C:497:GLY:N	2.50	0.45
3:C:15:LEU:O	3:C:19:VAL:HG23	2.18	0.44
1:A:54:THR:CG2	1:A:174:LEU:HD21	2.46	0.44
1:A:93:THR:HG21	1:A:126:ILE:CD1	2.48	0.43
1:A:178:ALA:HB1	2:B:127:ARG:CZ	2.48	0.43
3:C:647:ALA:HA	3:C:650:ILE:HD12	2.00	0.43
3:C:658:VAL:HG22	3:C:661:ARG:HH22	1.82	0.43
1:A:9:VAL:N	7:A:413:HOH:O	2.52	0.42
1:A:81:ILE:HD11	3:C:65:PHE:CG	2.54	0.42
3:C:255:CYS:O	3:C:259:VAL:HG23	2.20	0.42
3:C:428:ARG:NH2	3:C:479:ASN:HB3	2.35	0.42
3:C:374:PHE:HE1	3:C:477[A]:HIS:CD2	2.38	0.42
2:B:140:ILE:HG23	2:B:191:PHE:CE1	2.55	0.42
3:C:502:TRP:O	3:C:505:ILE:HG22	2.20	0.42
3:C:441:VAL:HG21	3:C:510:TRP:HE1	1.85	0.41
3:C:866:ILE:HG22	3:C:874:PHE:CE1	2.55	0.41
3:C:665:LEU:HD13	3:C:713:MET:SD	2.60	0.41
3:C:238:LEU:HD23	3:C:252:THR:HG23	2.02	0.41
3:C:344:HIS:HB3	3:C:423:ILE:HD12	2.01	0.41
3:C:581:PHE:HB3	3:C:632:THR:HG23	2.03	0.41
3:C:690:LEU:HB3	3:C:738:MET:HE1	2.02	0.41
3:C:373:LEU:HD22	3:C:417:LYS:HA	2.03	0.40
1:A:216:LEU:OXT	2:B:177:ARG:NE	2.52	0.40
3:C:718:TYR:HB3	3:C:719:PRO:HD3	2.02	0.40
3:C:472:LEU:HD23	3:C:514:SER:OG	2.22	0.40

There are no symmetry-related clashes.

## 4.3 Torsion angles [i](#)

### 4.3.1 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	202/216 (94%)	193 (96%)	9 (4%)	0	100	100
2	B	120/140 (86%)	113 (94%)	7 (6%)	0	100	100
3	C	1026/1023 (100%)	990 (96%)	36 (4%)	0	100	100
All	All	1348/1379 (98%)	1296 (96%)	52 (4%)	0	100	100

There are no Ramachandran outliers to report.

#### 4.3.2 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	179/185 (97%)	177 (99%)	2 (1%)	78	94
2	B	104/122 (85%)	103 (99%)	1 (1%)	80	95
3	C	946/933 (101%)	934 (99%)	12 (1%)	73	93
All	All	1229/1240 (99%)	1214 (99%)	15 (1%)	75	94

All (15) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	197	TYR
1	A	202	GLU
2	B	157	VAL
3	C	10	ASP
3	C	262	LEU
3	C	278	PHE
3	C	291	MET
3	C	368	ASN
3	C	376	GLU
3	C	533	LYS
3	C	579	LYS

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Mol	Chain	Res	Type
3	C	639	GLN
3	C	690	LEU
3	C	742	GLN
3	C	940	PHE

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	62	ASN
1	A	205	GLN
3	C	173	GLN
3	C	463	GLN
3	C	639	GLN
3	C	686	ASN
3	C	1010	GLN

#### 4.3.3 RNA [i](#)

There are no RNA molecules in this entry.

#### 4.4 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

#### 4.5 Carbohydrates [i](#)

There are no carbohydrates in this entry.

#### 4.6 Ligand geometry [i](#)

Of 3 ligands modelled in this entry, 2 are monoatomic - leaving 1 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
4	GNP	A	301	5	27,34,34	2.63	6 (22%)	26,54,54	1.25	3 (11%)

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
4	GNP	A	301	5	-	0/16/38/38	0/3/3/3

All (6) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	301	GNP	C4-N9	-10.51	1.33	1.47
4	A	301	GNP	C8-N9	-3.90	1.34	1.46
4	A	301	GNP	C2-N1	-2.28	1.34	1.44
4	A	301	GNP	C5-C6	-2.18	1.49	1.53
4	A	301	GNP	PB-N3B	3.87	1.73	1.63
4	A	301	GNP	PG-N3B	4.06	1.74	1.63

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	301	GNP	PA-O3A-PB	-3.55	119.83	132.38
4	A	301	GNP	O1G-PG-N3B	-3.21	107.00	111.79
4	A	301	GNP	O6-C6-N1	-2.23	119.72	122.70

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

## 4.7 Other polymers [i](#)

There are no such residues in this entry.

## 4.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

## 5 Fit of model and data

### 5.1 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<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	202/216 (93%)	-0.09	8 (3%)	39 28	57, 74, 118, 162	0
2	B	121/140 (86%)	0.14	8 (6%)	19 11	73, 94, 123, 143	0
3	C	1013/1023 (99%)	-0.10	25 (2%)	58 47	58, 82, 117, 146	0
All	All	1336/1379 (96%)	-0.08	41 (3%)	49 38	57, 82, 118, 162	0

All (41) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
3	C	690	LEU	4.2
1	A	179	MET	4.0
3	C	983	GLN	3.8
1	A	182	LEU	3.8
2	B	140	ILE	3.6
3	C	815	MET	3.4
2	B	134	ILE	3.4
3	C	545	LYS	3.4
3	C	721	LEU	3.3
3	C	23	PHE	3.2
2	B	162	ALA	3.1
3	C	500	TRP	3.0
2	B	124	ILE	2.9
3	C	229	ILE	2.9
1	A	178	ALA	2.7
2	B	160	CYS	2.7
2	B	158	TYR	2.7
3	C	18	GLN	2.7
3	C	838	PHE	2.7
3	C	197[A]	CYS	2.6
3	C	623	GLN	2.6
2	B	161	THR	2.6
3	C	544	GLY	2.6

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Mol	Chain	Res	Type	RSRZ
1	A	216	LEU	2.6
3	C	256	LEU	2.6
3	C	985	THR	2.5
1	A	63	VAL	2.5
3	C	286[A]	ILE	2.5
3	C	759	LEU	2.4
3	C	130	TRP	2.4
3	C	495	ILE	2.3
1	A	174	LEU	2.3
3	C	645	TYR	2.2
1	A	15	LEU	2.2
3	C	739	ILE	2.2
3	C	542	LYS	2.2
3	C	238	LEU	2.1
1	A	51	VAL	2.1
3	C	581	PHE	2.0
2	B	91	ALA	2.0
3	C	19	VAL	2.0

## 5.2 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

## 5.3 Carbohydrates [i](#)

There are no carbohydrates in this entry.

## 5.4 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<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
4	GNP	A	301	32/32	0.97	0.16	0.00	61,63,65,66	0
5	MG	A	302	1/1	0.98	0.13	-0.58	58,58,58,58	0
6	CL	C	1101	1/1	0.95	0.13	-1.08	111,111,111,111	0

## 5.5 Other polymers

There are no such residues in this entry.