



Full wwPDB X-ray Structure Validation Report ⓘ

Jan 31, 2016 – 06:54 PM GMT

PDB ID : 1D4X
Title : Crystal Structure of Caenorhabditis Elegans Mg-ATP Actin Complexed with Human Gelsolin Segment 1 at 1.75 Å resolution.
Authors : Vorobiev, S.; Ono, S.; Almo, S.C.
Deposited on : 1999-10-06
Resolution : 1.75 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 ⓘ 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) : **NOT EXECUTED**
EDS : **NOT EXECUTED**
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : trunk26865

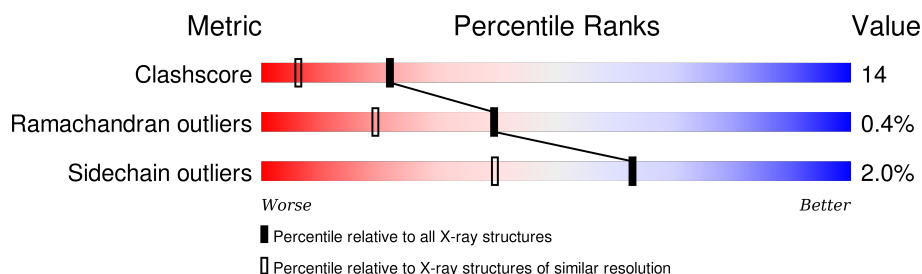
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.75 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))
Clashscore	102246	1730 (1.76-1.76)
Ramachandran outliers	100387	1711 (1.76-1.76)
Sidechain outliers	100360	1711 (1.76-1.76)

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.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	375	
2	G	126	

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
7	SO2	A	684	-	X	-	-

2 Entry composition

There are 8 unique types of molecules in this entry. The entry contains 4365 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 C. ELEGANS ACTIN 1/3.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	368	Total	C	N	O	S	0	0	0
			2838	1799	480	540	19			

- Molecule 2 is a protein called GELSOLIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	G	124	Total	C	N	O	S	0	0	0
			984	637	163	183	1			

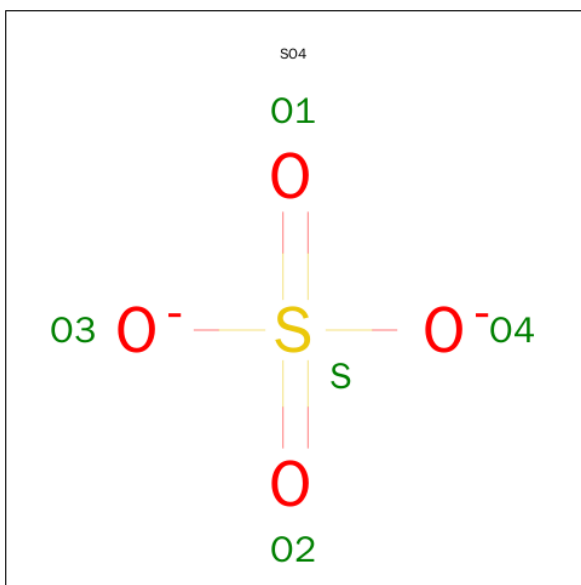
- Molecule 3 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

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

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

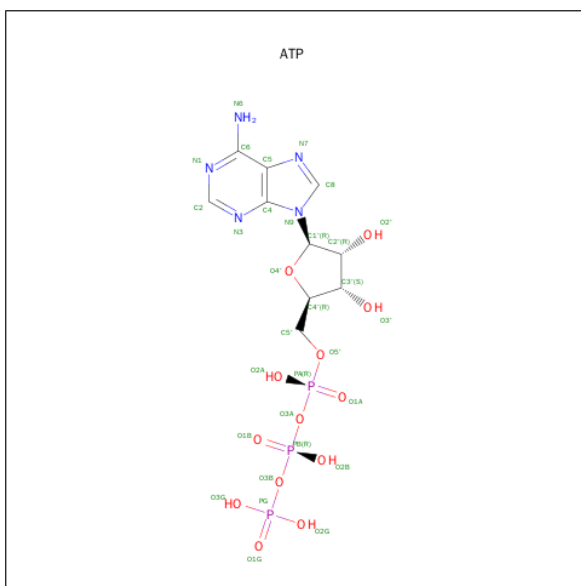
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	G	1	Total	Ca	0	0
			1	1		

- Molecule 5 is SULFATE ION (three-letter code: SO4) (formula: O₄S).



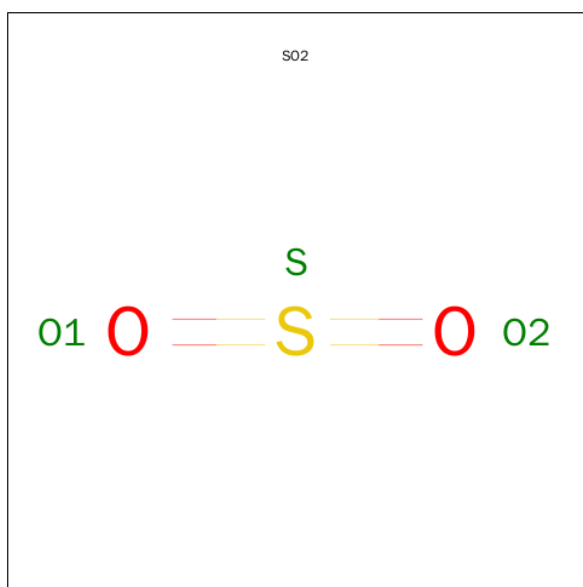
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	A	1	Total	O	S	0	0
			5	4	1		

- Molecule 6 is ADENOSINE-5'-TRIPHOSPHATE (three-letter code: ATP) (formula: $C_{10}H_{16}N_5O_{13}P_3$).



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

- Molecule 7 is SULFUR DIOXIDE (three-letter code: SO2) (formula: O_2S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
7	A	1	Total	O	S	0	0
			3	2	1		

- Molecule 8 is water.

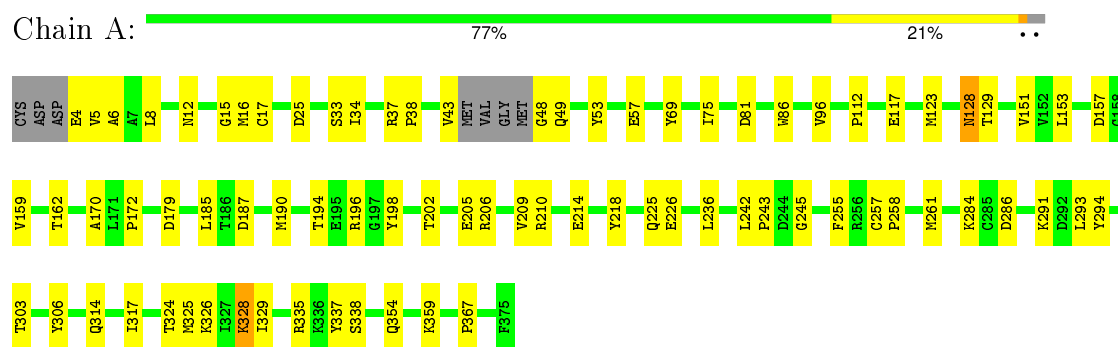
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
8	A	351	Total	O	0	0
			351	351		
8	G	151	Total	O	0	0
			151	151		

3 Residue-property plots [i](#)

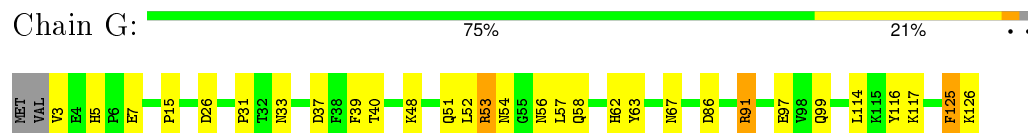
These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according 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.

Note EDS was not executed.

• Molecule 1: C. ELEGANS ACTIN 1/3



• Molecule 2: GELSOLIN



4 Data and refinement statistics

Xtriage (Phenix) and EDS were not executed - this section will therefore be incomplete.

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	177.82Å 68.99Å 56.59Å 90.00° 104.15° 90.00°	Depositor
Resolution (Å)	23.20 – 1.75	Depositor
% Data completeness (in resolution range)	4.0 (23.20-1.75)	Depositor
R_{merge}	0.04	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	X-PLOR 3.851	Depositor
R, R_{free}	0.199 , 0.233	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	4365	wwPDB-VP
Average B, all atoms (Å ²)	24.0	wwPDB-VP

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: MG, SO2, CA, ATP, SO4

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	0.58	2/2900 (0.1%)	0.77	6/3932 (0.2%)
2	G	0.52	0/1010	0.75	3/1365 (0.2%)
All	All	0.56	2/3910 (0.1%)	0.76	9/5297 (0.2%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	43	VAL	N-CA	6.52	1.59	1.46
1	A	48	GLY	CA-C	-6.25	1.41	1.51

All (9) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	48	GLY	CA-C-N	-9.53	96.22	117.20
1	A	48	GLY	O-C-N	7.82	135.21	122.70
1	A	43	VAL	N-CA-C	6.91	129.66	111.00
2	G	125	PHE	CB-CG-CD1	-6.63	116.16	120.80
2	G	125	PHE	CB-CA-C	-5.69	99.03	110.40
1	A	48	GLY	C-N-CA	5.55	135.58	121.70
1	A	48	GLY	N-CA-C	-5.31	99.83	113.10
1	A	43	VAL	CA-C-O	5.27	131.16	120.10
2	G	125	PHE	CA-C-N	-5.06	106.07	117.20

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	2838	0	2778	78	0
2	G	984	0	941	29	0
3	A	1	0	0	0	0
4	G	1	0	0	0	0
5	A	5	0	0	0	0
6	A	31	0	12	0	0
7	A	3	0	0	0	0
8	A	351	0	0	30	0
8	G	151	0	0	7	1
All	All	4365	0	3731	106	1

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 14.

All (106) 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:17:CYS:HB3	8:A:1064:HOH:O	1.44	1.17
1:A:291:LYS:HA	1:A:325:MET:HE1	1.28	1.15
1:A:33:SER:HB2	8:A:991:HOH:O	1.50	1.11
1:A:359:LYS:HG2	8:A:1196:HOH:O	1.48	1.10
1:A:159:VAL:HG23	1:A:179:ASP:HA	1.34	1.04
1:A:291:LYS:HA	1:A:325:MET:CE	1.88	1.02
1:A:37:ARG:HD3	8:A:1035:HOH:O	1.61	1.01
1:A:328:LYS:HB3	8:A:1146:HOH:O	1.62	0.96
2:G:86:ASP:HB3	8:G:1085:HOH:O	1.69	0.93
1:A:328:LYS:HE2	8:A:1146:HOH:O	1.71	0.88
1:A:17:CYS:SG	8:A:1129:HOH:O	2.34	0.84
1:A:6:ALA:HB1	8:A:990:HOH:O	1.79	0.82
1:A:123:MET:HE2	1:A:129:THR:HG21	1.63	0.81
1:A:25:ASP:OD1	2:G:126:LYS:HE2	1.86	0.76
1:A:12:ASN:HD21	1:A:86:TRP:HE1	1.30	0.76
2:G:52:LEU:HD21	2:G:58:GLN:HB2	1.68	0.76
2:G:3:VAL:HG12	2:G:5:HIS:H	1.52	0.75
1:A:326:LYS:NZ	1:A:328:LYS:HD3	2.03	0.74

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:G:37:ASP:HB3	2:G:117:LYS:HE2	1.70	0.74
1:A:123:MET:CE	1:A:129:THR:HG21	2.18	0.72
2:G:54:ASN:CB	8:G:905:HOH:O	2.37	0.72
2:G:54:ASN:CB	8:G:1164:HOH:O	2.37	0.72
2:G:56:ASN:OD1	8:G:905:HOH:O	2.08	0.71
1:A:359:LYS:HD3	8:A:1118:HOH:O	1.90	0.70
2:G:5:HIS:HD2	2:G:7:GLU:HB2	1.57	0.69
1:A:324:THR:HG23	8:A:803:HOH:O	1.91	0.69
1:A:337:TYR:CD2	8:A:1148:HOH:O	2.45	0.68
1:A:190:MET:HE2	8:A:981:HOH:O	1.92	0.67
2:G:5:HIS:CD2	2:G:7:GLU:HB2	2.32	0.65
1:A:210:ARG:NH1	8:A:841:HOH:O	2.30	0.65
1:A:53:TYR:CD2	1:A:57:GLU:HG2	2.33	0.64
1:A:326:LYS:HZ1	1:A:328:LYS:HD3	1.63	0.64
1:A:324:THR:HA	8:A:1149:HOH:O	1.97	0.63
2:G:67:ASN:H	2:G:99:GLN:NE2	1.96	0.62
1:A:159:VAL:HG12	8:A:895:HOH:O	2.01	0.61
1:A:328:LYS:NZ	8:A:1104:HOH:O	2.33	0.61
1:A:194:THR:HA	1:A:198:TYR:O	2.01	0.60
1:A:317:ILE:HD12	1:A:329:ILE:HD11	1.83	0.59
1:A:15:GLY:HA3	1:A:157:ASP:OD2	2.03	0.59
1:A:187:ASP:OD1	1:A:206:ARG:NH1	2.34	0.58
1:A:226:GLU:OE2	1:A:226:GLU:HA	2.03	0.57
2:G:114:LEU:HD11	2:G:116:TYR:CE2	2.40	0.57
1:A:324:THR:CG2	8:A:803:HOH:O	2.51	0.56
2:G:125:PHE:O	2:G:126:LYS:OXT	2.24	0.56
1:A:242:LEU:HB3	1:A:243:PRO:HD2	1.89	0.55
1:A:37:ARG:HG3	8:A:949:HOH:O	2.06	0.55
2:G:5:HIS:HE1	2:G:26:ASP:OD1	1.89	0.55
2:G:125:PHE:C	2:G:126:LYS:OXT	2.44	0.55
2:G:62:HIS:HD2	2:G:97:GLU:OE2	1.90	0.54
1:A:261:MET:HE1	1:A:306:TYR:CE1	2.43	0.54
1:A:291:LYS:HA	1:A:325:MET:HE3	1.80	0.54
2:G:52:LEU:HB2	2:G:56:ASN:O	2.07	0.53
1:A:284:LYS:HE2	8:A:885:HOH:O	2.07	0.53
1:A:12:ASN:ND2	1:A:86:TRP:HE1	2.04	0.53
2:G:86:ASP:CB	8:G:1085:HOH:O	2.43	0.52
1:A:261:MET:CE	1:A:306:TYR:CE1	2.93	0.52
1:A:17:CYS:N	8:A:991:HOH:O	2.42	0.52
2:G:40:THR:HB	2:G:99:GLN:HE22	1.74	0.52
1:A:225:GLN:C	1:A:225:GLN:OE1	2.48	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:324:THR:HG22	8:A:1149:HOH:O	2.10	0.51
2:G:31:PRO:HB2	2:G:33:ASN:OD1	2.11	0.51
1:A:185:LEU:HD11	1:A:261:MET:HE2	1.93	0.51
2:G:53:ARG:HG3	2:G:54:ASN:N	2.26	0.50
1:A:159:VAL:CG2	1:A:179:ASP:HA	2.25	0.50
1:A:123:MET:CE	1:A:129:THR:CG2	2.87	0.50
1:A:190:MET:HG3	1:A:209:VAL:HG11	1.93	0.50
1:A:37:ARG:NH2	1:A:81:ASP:OD2	2.43	0.49
1:A:34:ILE:HG12	1:A:69:TYR:CE2	2.48	0.49
1:A:210:ARG:HD3	8:A:727:HOH:O	2.13	0.48
1:A:153:LEU:HD13	1:A:162:THR:HG22	1.94	0.48
1:A:16:MET:C	8:A:991:HOH:O	2.52	0.48
1:A:151:VAL:HG13	1:A:293:LEU:HD22	1.96	0.48
1:A:291:LYS:CA	1:A:325:MET:HE1	2.21	0.47
1:A:328:LYS:CB	8:A:1146:HOH:O	2.40	0.47
2:G:57:LEU:O	2:G:91:ARG:NH2	2.47	0.47
1:A:128:ASN:ND2	8:A:1118:HOH:O	2.47	0.47
1:A:326:LYS:CE	1:A:328:LYS:HD3	2.45	0.47
1:A:354:GLN:HB2	8:A:1107:HOH:O	2.14	0.47
1:A:294:TYR:HD2	1:A:325:MET:CE	2.28	0.47
1:A:257:CYS:HB3	1:A:258:PRO:HD3	1.97	0.46
1:A:12:ASN:ND2	8:A:1115:HOH:O	2.47	0.46
2:G:48:LYS:HE2	8:G:1016:HOH:O	2.14	0.46
1:A:294:TYR:HD2	1:A:325:MET:HE1	1.81	0.46
1:A:324:THR:CA	8:A:1149:HOH:O	2.61	0.45
1:A:8:LEU:HD11	1:A:96:VAL:HG21	1.99	0.45
1:A:294:TYR:CD2	1:A:325:MET:CE	2.99	0.44
1:A:218:TYR:O	1:A:255:PHE:HA	2.18	0.44
1:A:170:ALA:O	1:A:172:PRO:HD3	2.18	0.44
1:A:37:ARG:HB3	1:A:38:PRO:HD2	1.99	0.44
1:A:294:TYR:CD2	1:A:325:MET:HE2	2.54	0.43
2:G:39:PHE:HA	2:G:117:LYS:O	2.19	0.43
2:G:114:LEU:HD12	2:G:114:LEU:C	2.39	0.42
1:A:324:THR:CB	8:A:1149:HOH:O	2.67	0.42
1:A:202:THR:OG1	1:A:205:GLU:HG3	2.19	0.42
1:A:303:THR:O	1:A:303:THR:HG22	2.20	0.42
1:A:335:ARG:HA	1:A:338:SER:OG	2.20	0.42
1:A:286:ASP:OD1	1:A:286:ASP:C	2.59	0.41
1:A:75:ILE:HD12	1:A:112:PRO:CD	2.50	0.41
1:A:210:ARG:O	1:A:214:GLU:HG3	2.21	0.41
2:G:91:ARG:HH11	2:G:91:ARG:HG3	1.85	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:117:GLU:HB3	1:A:367:PRO:HB2	2.03	0.41
1:A:4:GLU:CB	1:A:5:VAL:HG23	2.51	0.41
2:G:125:PHE:HB3	2:G:126:LYS:H	1.49	0.41
2:G:15:PRO:HG3	2:G:51:GLN:HB2	2.02	0.40
1:A:328:LYS:CE	8:A:1146:HOH:O	2.49	0.40
2:G:48:LYS:NZ	8:G:1168:HOH:O	2.53	0.40

All (1) 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)
8:G:1085:HOH:O	8:G:1209:HOH:O[4_546]	2.13	0.07

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	364/375 (97%)	353 (97%)	9 (2%)	2 (0%)	34	14
2	G	122/126 (97%)	121 (99%)	1 (1%)	0	100	100
All	All	486/501 (97%)	474 (98%)	10 (2%)	2 (0%)	39	19

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	49	GLN
1	A	245	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	301/317 (95%)	296 (98%)	5 (2%)	68	49
2	G	100/104 (96%)	97 (97%)	3 (3%)	48	22
All	All	401/421 (95%)	393 (98%)	8 (2%)	63	39

All (8) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	128	ASN
1	A	196	ARG
1	A	236	LEU
1	A	314	GLN
1	A	328	LYS
2	G	53	ARG
2	G	63	TYR
2	G	91	ARG

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	12	ASN
1	A	128	ASN
1	A	280	ASN
1	A	314	GLN
2	G	5	HIS
2	G	62	HIS
2	G	99	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

Of 5 ligands modelled in this entry, 2 are monoatomic - leaving 3 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
6	ATP	A	676	3	24,33,33	1.29	4 (16%)	31,52,52	1.49	6 (19%)
5	SO4	A	682	-	4,4,4	1.78	2 (50%)	6,6,6	0.45	0
7	SO2	A	684	-	2,2,2	4.16	2 (100%)	1,1,1	1.20	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
6	ATP	A	676	3	-	0/18/38/38	0/3/3/3
5	SO4	A	682	-	-	0/0/0/0	0/0/0/0
7	SO2	A	684	-	-	0/0/0/0	0/0/0/0

All (8) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	A	676	ATP	PG-O2G	-2.08	1.47	1.54
6	A	676	ATP	PA-O2A	-2.05	1.46	1.54
5	A	682	SO4	O4-S	2.01	1.54	1.47
5	A	682	SO4	O3-S	2.40	1.56	1.47
6	A	676	ATP	C4-N3	2.98	1.40	1.35
6	A	676	ATP	C2-N1	3.55	1.40	1.33
7	A	684	SO2	O1-S	3.88	1.66	1.40
7	A	684	SO2	O2-S	4.42	1.69	1.40

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	A	676	ATP	N3-C2-N1	-3.36	126.32	128.89
6	A	676	ATP	C1'-N9-C4	-2.65	122.95	126.94
6	A	676	ATP	O3G-PG-O1G	-2.58	102.27	110.58
6	A	676	ATP	O2B-PB-O3B	2.31	115.58	105.09
6	A	676	ATP	O4'-C1'-N9	2.45	113.22	108.10
6	A	676	ATP	O2G-PG-O1G	2.91	119.94	110.58

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

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 ⓘ

EDS was not executed - this section will therefore be empty.

6.2 Non-standard residues in protein, DNA, RNA chains ⓘ

EDS was not executed - this section will therefore be empty.

6.3 Carbohydrates ⓘ

EDS was not executed - this section will therefore be empty.

6.4 Ligands ⓘ

EDS was not executed - this section will therefore be empty.

6.5 Other polymers ⓘ

EDS was not executed - this section will therefore be empty.