



Full wwPDB X-ray Structure Validation Report ⓘ

Feb 13, 2017 – 09:09 pm GMT

PDB ID : 1FPL
Title : FRUCTOSE-1,6-BISPHOSPHATASE (D-FRUCTOSE-1,6-BISPHOSPHAT
E 1-PHOSPHOHYDROLASE) COMPLEXED WITH AMP, 2,5-ANHYDRO
-D-GLUCITOL-1,6-BISPHOSPHATE AND THALLIUM IONS (10 MM)
Authors : Villeret, V.; Lipscomb, W.N.
Deposited on : 1995-06-02
Resolution : 2.30 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	:	1.7.2 (RC1), CSD as538be (2017)
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Percentile statistics	:	20161228.v01 (using entries in the PDB archive December 28th 2016)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	recalc28949

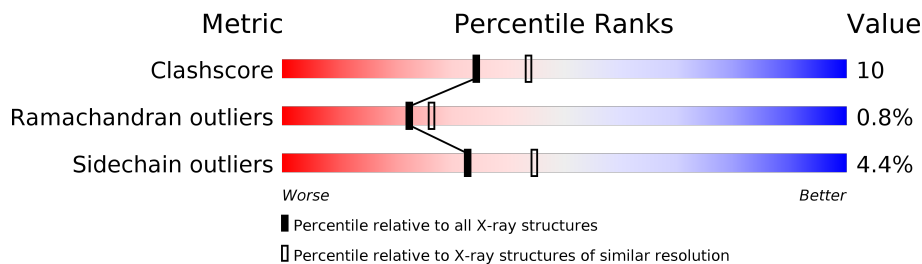
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.30 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	112137	4751 (2.30-2.30)
Ramachandran outliers	110173	4705 (2.30-2.30)
Sidechain outliers	110143	4704 (2.30-2.30)

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	335	
1	B	335	

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 5069 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 FRUCTOSE-1,6-BISPHOSPHATASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	317	Total	C	N	O	S	0	0	0
			2426	1546	409	456	15			
1	B	317	Total	C	N	O	S	0	0	0
			2426	1546	409	456	15			

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	20	GLN	GLU	CONFLICT	UNP P00636
A	96	THR	SER	CONFLICT	UNP P00636
A	199	ASN	ASP	CONFLICT	UNP P00636
B	20	GLN	GLU	CONFLICT	UNP P00636
B	96	THR	SER	CONFLICT	UNP P00636
B	199	ASN	ASP	CONFLICT	UNP P00636

- Molecule 2 is THALLIUM (I) ION (three-letter code: TL) (formula: Tl).

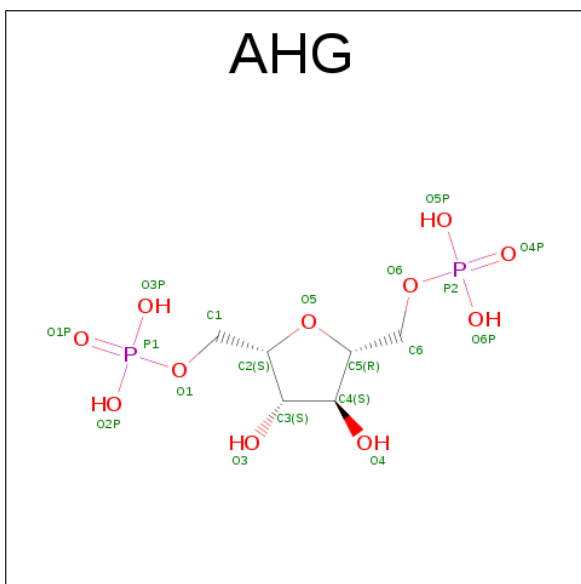
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	B	3	Total	Tl	0	0
			3	3		
2	A	3	Total	Tl	0	0
			3	3		

- Molecule 3 is ADENOSINE MONOPHOSPHATE (three-letter code: AMP) (formula: C₁₀H₁₄N₅O₇P).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	A	1	Total	C	N	O	P	0	0
			23	10	5	7	1		
3	B	1	Total	C	N	O	P	0	0
			23	10	5	7	1		

- Molecule 4 is 2,5-ANHYDROGLUCITOL-1,6-BIPHOSPHATE (three-letter code: AHG) (formula: $C_6H_{14}O_{11}P_2$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	A	1	Total	C	O	P	0	0
			19	6	11	2		

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Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	B	1	Total	C	O	P	0	0
			19	6	11	2		

- Molecule 5 is water.

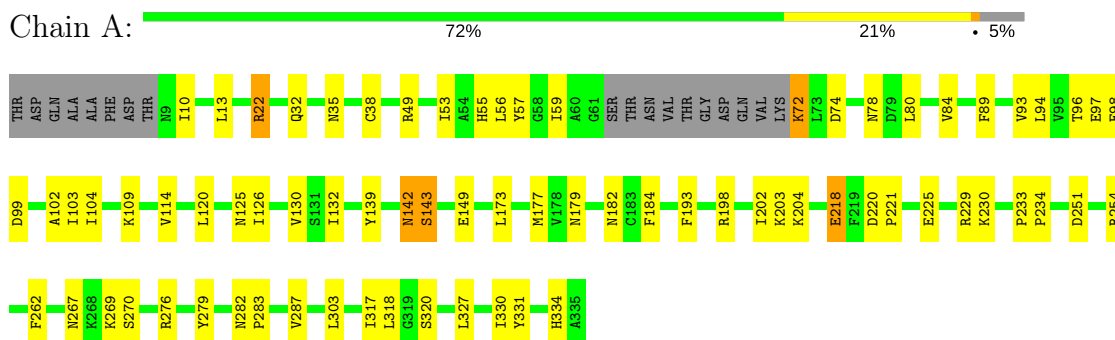
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	68	Total	O	0	0
			68	68		
5	B	59	Total	O	0	0
			59	59		

3 Residue-property plots [i](#)

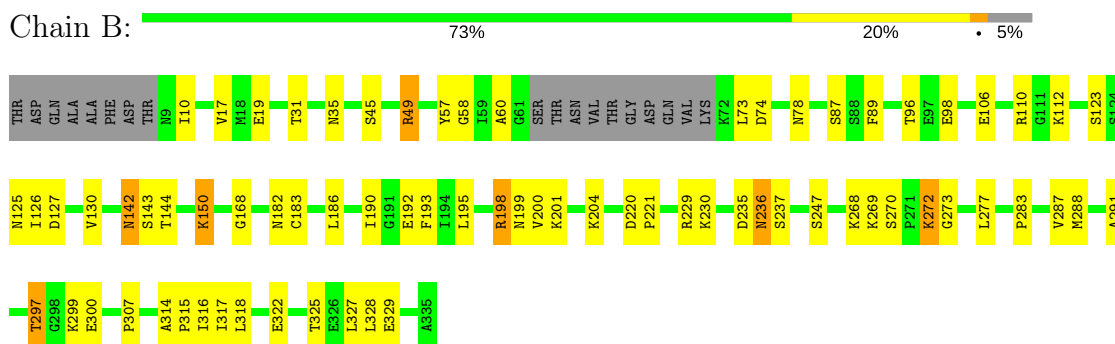
These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are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

Note EDS was not executed.

• Molecule 1: FRUCTOSE-1,6-BISPHOSPHATASE



• Molecule 1: FRUCTOSE-1,6-BISPHOSPHATASE



4 Data and refinement statistics

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

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, α , β , γ	61.10Å 166.90Å 80.20Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	8.00 – 2.30	Depositor
% Data completeness (in resolution range)	88.0 (8.00-2.30)	Depositor
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	X-PLOR 3.1	Depositor
R, R_{free}	0.194 , (Not available)	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	5069	wwPDB-VP
Average B, all atoms (Å ²)	29.0	wwPDB-VP

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: AMP, TL, AHG

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	0.47	0/2467	0.65	0/3335
1	B	0.48	0/2467	0.69	0/3335
All	All	0.48	0/4934	0.67	0/6670

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	2426	0	2486	49	0
1	B	2426	0	2486	45	0
2	A	3	0	0	0	0
2	B	3	0	0	0	0
3	A	23	0	10	1	0
3	B	23	0	10	2	0
4	A	19	0	10	0	0
4	B	19	0	10	0	0
5	A	68	0	0	4	0
5	B	59	0	0	2	0
All	All	5069	0	5012	95	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.

All (95) 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:B:78:ASN:OD1	1:B:96:THR:HG21	1.81	0.81
1:A:78:ASN:OD1	1:A:96:THR:HG21	1.84	0.77
1:B:182:ASN:HD22	1:B:198:ARG:HA	1.56	0.69
1:A:125:ASN:HB3	1:A:130:VAL:HB	1.73	0.69
1:B:125:ASN:HB3	1:B:130:VAL:HB	1.75	0.69
1:A:225:GLU:O	1:A:229:ARG:HG3	1.94	0.66
1:A:96:THR:HG22	1:A:98:GLU:H	1.62	0.64
1:A:182:ASN:HD22	1:A:198:ARG:HA	1.63	0.63
1:B:96:THR:HG22	1:B:98:GLU:H	1.63	0.63
1:A:10:ILE:HB	1:B:57:TYR:O	1.99	0.62
1:A:55:HIS:HA	1:A:59:ILE:HG22	1.81	0.62
1:A:102:ALA:HB3	1:A:149:GLU:HG2	1.84	0.58
1:B:268:LYS:HG2	1:B:269:LYS:N	2.19	0.57
1:B:17:VAL:HG12	1:B:31:THR:HG23	1.87	0.56
1:A:218:GLU:HB2	1:A:267:ASN:HB2	1.87	0.55
1:A:89:PHE:CD2	1:A:109:LYS:HA	2.42	0.55
1:B:19:GLU:HG3	5:B:368:HOH:O	2.06	0.55
1:A:22:ARG:HH11	1:A:22:ARG:HG2	1.72	0.54
1:A:120:LEU:HD11	1:A:132:ILE:HD12	1.90	0.53
1:B:316:ILE:HD11	1:B:318:LEU:HD23	1.90	0.53
1:A:142:ASN:O	1:A:143:SER:HB3	2.09	0.53
1:B:195:LEU:HD21	1:B:198:ARG:HG3	1.90	0.53
1:B:45:SER:O	1:B:49:ARG:HD2	2.09	0.53
1:A:72:LYS:HB3	1:A:72:LYS:NZ	2.23	0.53
1:B:106:GLU:O	1:B:110:ARG:HG3	2.08	0.52
1:B:230:LYS:HE2	1:B:230:LYS:HA	1.92	0.52
1:B:220:ASP:HB2	1:B:221:PRO:HD2	1.91	0.52
1:B:49:ARG:NH2	1:B:168:GLY:O	2.43	0.51
1:A:53:ILE:HD11	1:A:57:TYR:HE1	1.75	0.51
1:B:317:ILE:HD13	1:B:327:LEU:CD2	2.40	0.51
1:A:317:ILE:HG21	1:A:327:LEU:HD23	1.92	0.51
1:A:55:HIS:HE1	5:A:389:HOH:O	1.94	0.50
1:B:317:ILE:HD13	1:B:327:LEU:HD21	1.92	0.50
1:A:251:ASP:OD1	1:A:254:ARG:NH2	2.43	0.50
1:B:204:LYS:HE2	1:B:322:GLU:OE2	2.11	0.50
1:B:317:ILE:HG21	1:B:327:LEU:HD23	1.92	0.50
1:B:297:THR:HG22	1:B:299:LYS:H	1.76	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:262:PHE:HB3	1:A:318:LEU:CD1	2.42	0.49
1:A:56:LEU:O	1:A:56:LEU:HD23	2.13	0.48
1:A:94:LEU:HB2	1:A:103:ILE:HB	1.96	0.48
1:B:142:ASN:HD22	1:B:143:SER:N	2.11	0.48
1:B:283:PRO:O	1:B:287:VAL:HG23	2.14	0.48
1:A:184:PHE:HB3	1:A:193:PHE:HB3	1.95	0.48
1:A:229:ARG:HH11	1:A:330:ILE:HD11	1.79	0.48
1:B:325:THR:O	1:B:329:GLU:HG3	2.14	0.48
1:A:276:ARG:HG2	1:A:279:TYR:CZ	2.49	0.47
1:A:32:GLN:HA	1:A:32:GLN:NE2	2.28	0.47
1:B:270:SER:HB3	1:B:273:GLY:O	2.14	0.47
1:B:142:ASN:HD22	1:B:143:SER:H	1.61	0.47
1:A:204:LYS:O	1:A:320:SER:HB3	2.15	0.47
1:A:233:PRO:HA	1:A:234:PRO:HD2	1.78	0.47
1:A:282:ASN:HD22	1:A:303:LEU:HD23	1.80	0.47
1:B:123:SER:HA	1:B:126:ILE:HG13	1.96	0.47
1:A:32:GLN:NE2	5:A:397:HOH:O	2.48	0.46
1:B:150:LYS:HB2	1:B:150:LYS:NZ	2.31	0.46
1:A:93:VAL:HG22	1:A:104:ILE:CD1	2.47	0.45
1:A:182:ASN:HD22	1:A:198:ARG:CA	2.29	0.45
1:A:225:GLU:OE1	1:A:334:HIS:CE1	2.69	0.45
1:A:126:ILE:HA	5:A:356:HOH:O	2.16	0.45
1:B:269:LYS:HB2	5:B:383:HOH:O	2.16	0.45
1:A:283:PRO:O	1:A:287:VAL:HG23	2.16	0.44
1:B:328:LEU:HA	1:B:328:LEU:HD23	1.78	0.44
1:B:190:ILE:HG13	1:B:192:GLU:HB2	1.99	0.44
1:A:114:VAL:HB	1:A:139:TYR:HB2	2.00	0.44
1:B:182:ASN:ND2	1:B:198:ARG:HA	2.27	0.44
1:B:87:SER:O	1:B:89:PHE:HD1	2.01	0.44
1:A:262:PHE:HB3	1:A:318:LEU:HD12	2.00	0.44
1:A:89:PHE:HA	1:A:109:LYS:O	2.17	0.43
1:B:314:ALA:HA	1:B:315:PRO:HD3	1.85	0.43
1:A:220:ASP:HB2	1:A:221:PRO:HD2	1.99	0.43
1:B:182:ASN:ND2	1:B:199:ASN:H	2.16	0.43
1:A:202:ILE:HG12	1:A:203:LYS:N	2.34	0.43
1:A:142:ASN:O	1:A:143:SER:CB	2.67	0.43
1:A:102:ALA:CB	1:A:149:GLU:HG2	2.47	0.43
1:A:80:LEU:O	1:A:84:VAL:HG23	2.19	0.42
1:B:235:ASP:O	1:B:237:SER:N	2.52	0.42
1:B:186:LEU:HB2	1:B:193:PHE:CE1	2.53	0.42
1:A:13:LEU:HD23	1:A:38:CYS:HB2	2.01	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:272:LYS:HB2	1:B:272:LYS:HE3	1.82	0.42
1:A:99:ASP:HB2	5:A:362:HOH:O	2.20	0.42
1:B:277:LEU:HD23	1:B:307:PRO:HB3	2.01	0.42
1:A:22:ARG:NH1	1:A:22:ARG:HG2	2.35	0.42
3:A:339:AMP:H8	3:A:339:AMP:O5'	2.03	0.42
1:A:96:THR:HG22	1:A:97:GLU:N	2.35	0.42
1:B:35:ASN:HA	1:B:35:ASN:HD22	1.71	0.42
1:B:112:LYS:NZ	3:B:339:AMP:O1P	2.50	0.41
1:B:201:LYS:HA	1:B:291:ALA:O	2.20	0.41
1:B:183:CYS:SG	1:B:200:VAL:HG21	2.60	0.41
1:B:270:SER:HB3	1:B:273:GLY:C	2.41	0.41
1:B:288:MET:HG3	1:B:318:LEU:HB2	2.02	0.41
3:B:339:AMP:H8	3:B:339:AMP:O5'	2.04	0.40
1:B:58:GLY:C	1:B:60:ALA:H	2.22	0.40
1:A:177:MET:HB2	1:A:179:ASN:OD1	2.21	0.40
1:A:182:ASN:ND2	1:A:198:ARG:HA	2.32	0.40
1:A:35:ASN:HA	1:A:35:ASN:HD22	1.64	0.40

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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	313/335 (93%)	302 (96%)	9 (3%)	2 (1%)	28	34
1	B	313/335 (93%)	295 (94%)	15 (5%)	3 (1%)	18	20
All	All	626/670 (93%)	597 (95%)	24 (4%)	5 (1%)	22	26

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	143	SER

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Mol	Chain	Res	Type
1	A	270	SER
1	B	236	ASN
1	B	144	THR
1	B	73	LEU

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	263/278 (95%)	253 (96%)	10 (4%)	38	52
1	B	263/278 (95%)	250 (95%)	13 (5%)	29	39
All	All	526/556 (95%)	503 (96%)	23 (4%)	33	45

All (23) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	22	ARG
1	A	49	ARG
1	A	72	LYS
1	A	74	ASP
1	A	142	ASN
1	A	173	LEU
1	A	218	GLU
1	A	230	LYS
1	A	269	LYS
1	A	331	TYR
1	B	10	ILE
1	B	49	ARG
1	B	74	ASP
1	B	127	ASP
1	B	142	ASN
1	B	150	LYS
1	B	198	ARG
1	B	229	ARG
1	B	236	ASN

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Mol	Chain	Res	Type
1	B	247	SER
1	B	272	LYS
1	B	297	THR
1	B	300	GLU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (13) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	32	GLN
1	A	35	ASN
1	A	125	ASN
1	A	154	GLN
1	A	182	ASN
1	A	282	ASN
1	B	35	ASN
1	B	142	ASN
1	B	154	GLN
1	B	182	ASN
1	B	236	ASN
1	B	282	ASN
1	B	332	GLN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates [i](#)

There are no carbohydrates in this entry.

5.6 Ligand geometry [i](#)

Of 10 ligands modelled in this entry, 6 are monoatomic - leaving 4 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	AMP	A	339	-	22,25,25	1.90	4 (18%)	24,38,38	2.45	4 (16%)
4	AHG	A	340	2	19,19,19	1.15	1 (5%)	29,29,29	1.29	3 (10%)
3	AMP	B	339	-	22,25,25	1.91	5 (22%)	24,38,38	2.53	5 (20%)
4	AHG	B	340	2	19,19,19	1.00	1 (5%)	29,29,29	1.51	4 (13%)

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	AMP	A	339	-	-	0/6/26/26	0/3/3/3
4	AHG	A	340	2	-	0/12/28/28	0/1/1/1
3	AMP	B	339	-	-	0/6/26/26	0/3/3/3
4	AHG	B	340	2	-	0/12/28/28	0/1/1/1

All (11) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	339	AMP	O3'-C3'	-5.43	1.30	1.43
3	A	339	AMP	O3'-C3'	-5.31	1.30	1.43
3	A	339	AMP	O2'-C2'	-4.55	1.32	1.43
3	B	339	AMP	O2'-C2'	-4.53	1.32	1.43
4	B	340	AHG	O5-C5	-2.45	1.39	1.45
4	A	340	AHG	O5-C5	-2.33	1.39	1.45
3	B	339	AMP	P-O5'	-2.32	1.52	1.60
3	B	339	AMP	C2'-C1'	2.06	1.56	1.53
3	A	339	AMP	C2'-C1'	2.32	1.57	1.53
3	A	339	AMP	O4'-C1'	2.74	1.45	1.41
3	B	339	AMP	O4'-C1'	2.93	1.45	1.41

All (16) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	339	AMP	N3-C2-N1	-9.98	120.17	128.86
3	B	339	AMP	N3-C2-N1	-9.96	120.19	128.86
3	A	339	AMP	C4'-O4'-C1'	-4.06	105.45	109.77
3	B	339	AMP	C4'-O4'-C1'	-3.94	105.57	109.77
4	B	340	AHG	O3-C3-C2	-3.77	100.09	111.09
4	A	340	AHG	O4-C4-C5	-3.28	101.50	111.09
4	A	340	AHG	O3-C3-C2	-2.92	102.54	111.09
3	B	339	AMP	C4-C5-N7	-2.68	106.82	109.41
4	B	340	AHG	O5-C5-C4	-2.46	100.27	105.17
3	A	339	AMP	O5'-P-O1P	2.00	112.10	106.47
4	A	340	AHG	O6-P2-O4P	2.15	112.52	106.47
4	B	340	AHG	C3-C4-C5	2.47	107.43	102.62
4	B	340	AHG	O4-C4-C3	2.52	119.91	111.83
3	A	339	AMP	C2-N1-C6	2.71	123.52	118.77
3	B	339	AMP	O5'-P-O1P	2.72	114.09	106.47
3	B	339	AMP	C2-N1-C6	2.95	123.93	118.77

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

2 monomers are involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	339	AMP	1	0
3	B	339	AMP	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

EDS was not executed - this section is therefore empty.

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

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates

EDS was not executed - this section is therefore empty.

6.4 Ligands

EDS was not executed - this section is therefore empty.

6.5 Other polymers

EDS was not executed - this section is therefore empty.