wwPDB X-ray Structure Validation Summary Report (i)

Oct 31, 2016 – 11:42 AM EDT

PDB ID	:	5DHT
Title	:	Crystal structure of NAD kinase 1 from Listeria monocytogenes in complex with a novel inhibitor
Authors	:	Gelin, M.; Paoletti, J.; Assairi, L.; Huteau, V.; Pochet, S.; Labesse, G.
Deposited on	:	2015-08-31
Resolution	:	2.59 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 (i) symbol.

The following versions of software and data (see references (1)) were used in the production of this report:

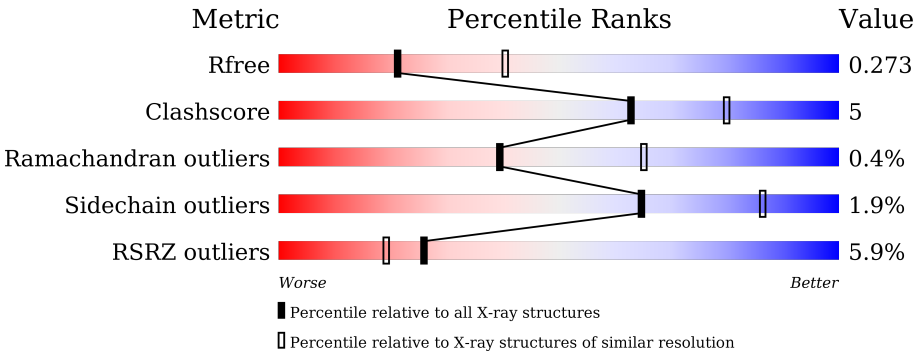
MolProbity	:	4.02b-467
Mogul	:	1.7.1 (RC1), CSD as537be (2016)
Xtriage (Phenix)	:	1.9-1692
EDS	:	rb-20028320
Percentile statistics	:	20151230.v01 (using entries in the PDB archive December 30th 2015)
Refmac	:	5.8.0135
CCP4	:	6.5.0
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	rb-20028320

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 2.59 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	2328 (2.60-2.60)
Clashscore	102246	2679 (2.60-2.60)
Ramachandran outliers	100387	2635 (2.60-2.60)
Sidechain outliers	100360	2635 (2.60-2.60)
RSRZ outliers	91569	2334 (2.60-2.60)

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	272	2%, 88%, 8% • •
1	B	272	6%, 78%, 16% • 5%
1	C	272	8%, 83%, 11% • •
1	D	272	6%, 77%, 14% • 8%

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 crite-

ria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
2	CIT	A	301	-	-	-	X
3	GOL	A	302	-	-	-	X

2 Entry composition (i)

There are 5 unique types of molecules in this entry. The entry contains 8476 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 NAD kinase 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	263	2066	1322	347	388	9	0	1	0
			Total	C	N	O	S			
1	B	259	2069	1328	347	385	9	0	0	0
			Total	C	N	O	S			
1	C	260	2020	1295	339	377	9	0	0	0
			Total	C	N	O	S			
1	D	250	1955	1250	332	365	8	0	0	0

There are 32 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	265	LEU	-	expression tag	UNP Q8Y8D7
A	266	GLU	-	expression tag	UNP Q8Y8D7
A	267	HIS	-	expression tag	UNP Q8Y8D7
A	268	HIS	-	expression tag	UNP Q8Y8D7
A	269	HIS	-	expression tag	UNP Q8Y8D7
A	270	HIS	-	expression tag	UNP Q8Y8D7
A	271	HIS	-	expression tag	UNP Q8Y8D7
A	272	HIS	-	expression tag	UNP Q8Y8D7
B	265	LEU	-	expression tag	UNP Q8Y8D7
B	266	GLU	-	expression tag	UNP Q8Y8D7
B	267	HIS	-	expression tag	UNP Q8Y8D7
B	268	HIS	-	expression tag	UNP Q8Y8D7
B	269	HIS	-	expression tag	UNP Q8Y8D7
B	270	HIS	-	expression tag	UNP Q8Y8D7
B	271	HIS	-	expression tag	UNP Q8Y8D7
B	272	HIS	-	expression tag	UNP Q8Y8D7
C	265	LEU	-	expression tag	UNP Q8Y8D7
C	266	GLU	-	expression tag	UNP Q8Y8D7
C	267	HIS	-	expression tag	UNP Q8Y8D7
C	268	HIS	-	expression tag	UNP Q8Y8D7
C	269	HIS	-	expression tag	UNP Q8Y8D7

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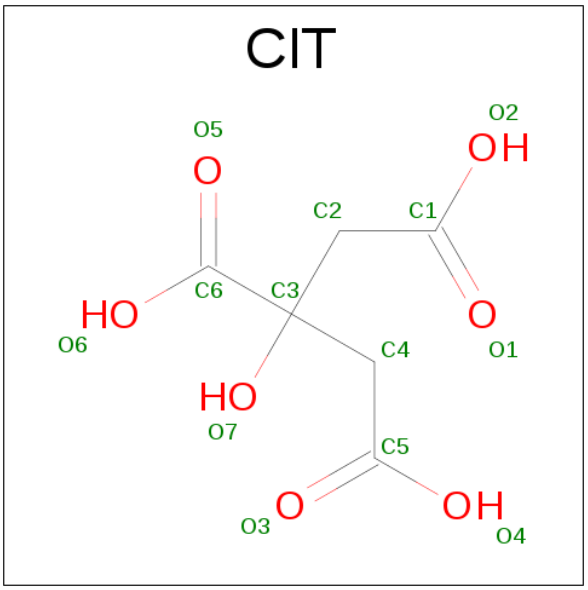
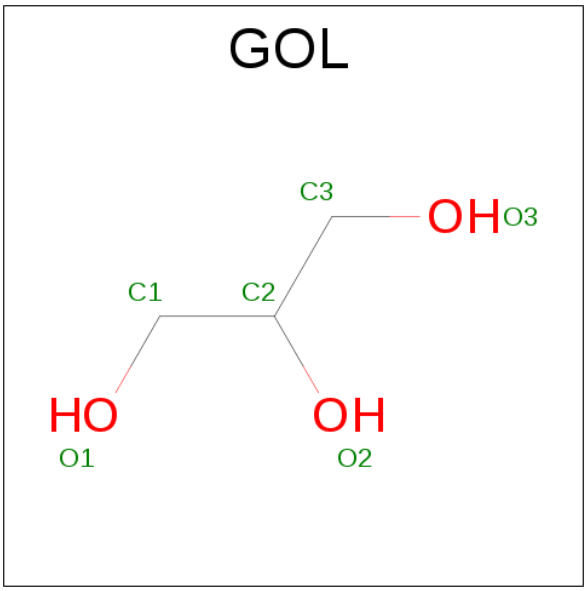
Chain	Residue	Modelled	Actual	Comment	Reference
C	270	HIS	-	expression tag	UNP Q8Y8D7
C	271	HIS	-	expression tag	UNP Q8Y8D7
C	272	HIS	-	expression tag	UNP Q8Y8D7
D	265	LEU	-	expression tag	UNP Q8Y8D7
D	266	GLU	-	expression tag	UNP Q8Y8D7
D	267	HIS	-	expression tag	UNP Q8Y8D7
D	268	HIS	-	expression tag	UNP Q8Y8D7
D	269	HIS	-	expression tag	UNP Q8Y8D7
D	270	HIS	-	expression tag	UNP Q8Y8D7
D	271	HIS	-	expression tag	UNP Q8Y8D7
D	272	HIS	-	expression tag	UNP Q8Y8D7

- Molecule 2 is CITRIC ACID (three-letter code: CIT) (formula: $C_6H_8O_7$).



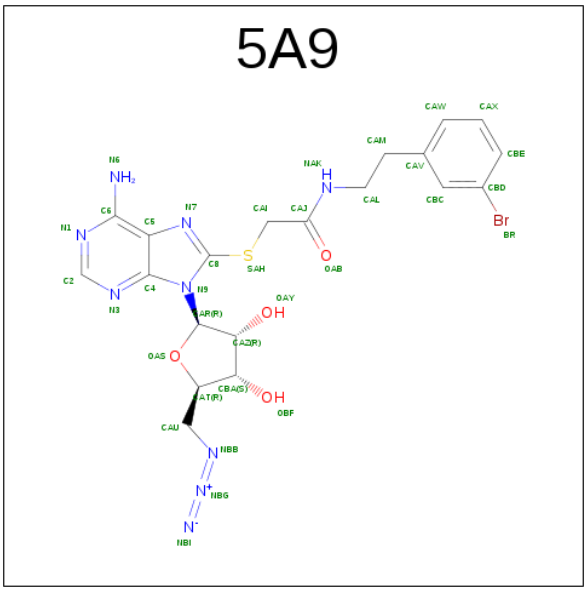
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	O		
2	A	1	13	6	7	0	0
			Total	C	O		
2	B	1	13	6	7	0	0

- Molecule 3 is GLYCEROL (three-letter code: GOL) (formula: $C_3H_8O_3$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	O		
3	A	1	6	3	3	0	0
			Total	C	O		
3	D	1	6	3	3	0	0

- Molecule 4 is 5'-azido-8-[(2-{[2-(3-bromophenyl)ethyl]amino}-2-oxoethyl)sulfanyl]-5'-deoxyadenosine (three-letter code: 5A9) (formula: $C_{20}H_{22}BrN_9O_4S$).



Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
			Total	Br	C	N	O	S		
4	A	1	35	1	20	9	4	1	0	0

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Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
			Total	Br	C	N	O	S		
4	B	1	35	1	20	9	4	1	0	0
4	C	1	35	1	20	9	4	1	0	0
4	D	1	35	1	20	9	4	1	0	0

- Molecule 5 is water.

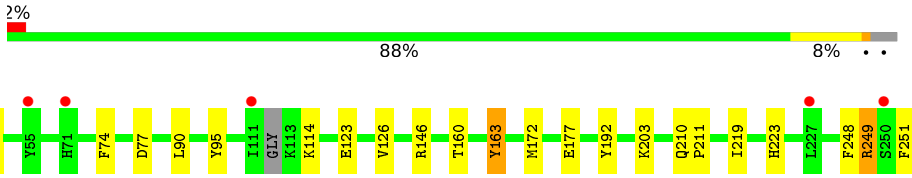
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
5	A	61	61	61	0	0
5	B	44	44	44	0	0
5	C	44	44	44	0	0
5	D	39	39	39	0	0

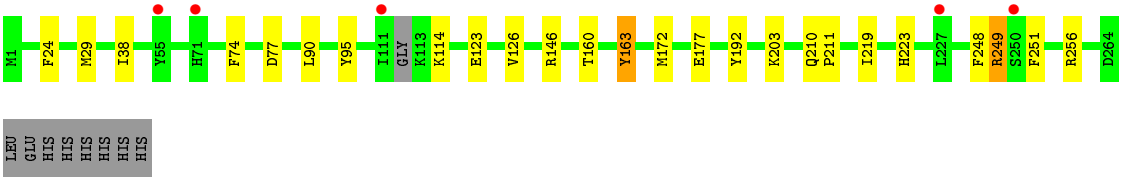
3 Residue-property plots (i)

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: NAD kinase 1

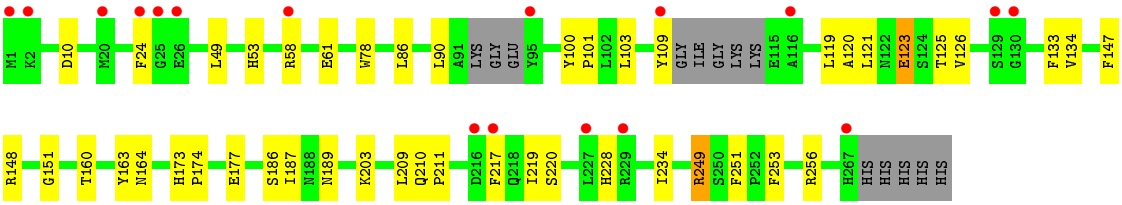
Chain A:





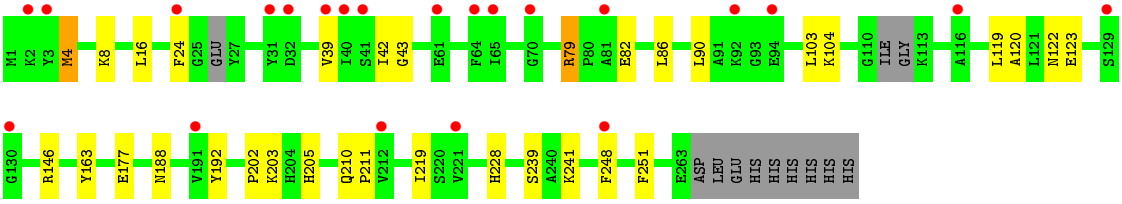
- Molecule 1: NAD kinase 1

Chain B:



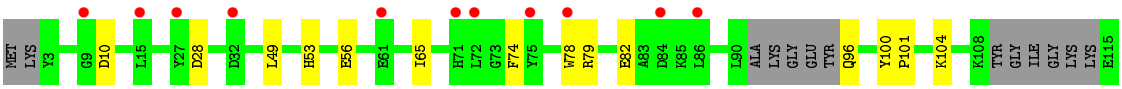
- Molecule 1: NAD kinase 1

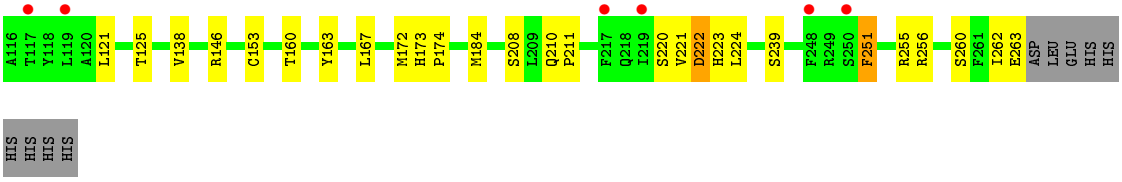
Chain C:



- Molecule 1: NAD kinase 1

Chain D:




A116
T117
Y118
L119
A120
L121
T125
V138
R146
C153
T160
Y163
L167
M172
H173
P174
M184
S208
L209
Q210
P211
F217
Q218
I219
S220
V221
D222
H223
L224
S239
F248
R249
S250
F251
R255
R256
S260
F261
I262
E263
ASP
LEU
GLU
HIS
HIS
HIS
HIS
HIS
HIS
HIS
HIS

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	66.78Å 119.07Å 67.35Å 90.00° 100.03° 90.00°	Depositor
Resolution (Å)	66.32 – 2.59 66.32 – 2.59	Depositor EDS
% Data completeness (in resolution range)	99.6 (66.32-2.59) 99.6 (66.32-2.59)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.04	Depositor
$< I/\sigma(I) >$ [1]	1.81 (at 2.58Å)	Xtriage
Refinement program	PHENIX (phenix.refine: 1.9_1692)	Depositor
R, R_{free}	0.229 , 0.271 0.229 , 0.273	Depositor DCC
R_{free} test set	1000 reflections (3.11%)	DCC
Wilson B-factor (Å^2)	51.3	Xtriage
Anisotropy	0.381	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.28 , 47.6	EDS
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.34$	Xtriage
Estimated twinning fraction	0.014 for l,-k,h	Xtriage
F_o,F_c correlation	0.92	EDS
Total number of atoms	8476	wwPDB-VP
Average B, all atoms (Å^2)	70.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.81% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 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: 5A9, GOL, CIT

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	0.24	0/2121	0.40	0/2871
1	B	0.23	0/2119	0.42	0/2864
1	C	0.22	0/2069	0.41	0/2801
1	D	0.23	0/2001	0.40	0/2708
All	All	0.23	0/8310	0.41	0/11244

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 (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	2066	0	1986	14	0
1	B	2069	0	2017	26	0
1	C	2020	0	1922	18	0
1	D	1955	0	1869	24	0
2	A	13	0	5	0	0
2	B	13	0	5	0	0
3	A	6	0	8	0	0
3	D	6	0	8	0	0
4	A	35	0	0	3	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	B	35	0	0	3	0
4	C	35	0	0	0	0
4	D	35	0	0	1	0
5	A	61	0	0	1	0
5	B	44	0	0	0	0
5	C	44	0	0	0	0
5	D	39	0	0	1	0
All	All	8476	0	7820	85	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 5.

The worst 5 of 85 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:24:PHE:HE1	1:B:90:LEU:HD11	1.56	0.70
1:B:249:ARG:H	1:B:249:ARG:HD3	1.57	0.68
1:A:38:ILE:HD13	1:A:90:LEU:HD22	1.77	0.67
1:C:24:PHE:HE1	1:C:90:LEU:HD11	1.60	0.66
1:A:256:ARG:NH2	5:A:403:HOH:O	2.29	0.64

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	260/272 (96%)	245 (94%)	14 (5%)	1 (0%)	39	65
1	B	253/272 (93%)	240 (95%)	13 (5%)	0	100	100
1	C	254/272 (93%)	239 (94%)	14 (6%)	1 (0%)	39	65
1	D	244/272 (90%)	229 (94%)	13 (5%)	2 (1%)	24	46

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
All	All	1011/1088 (93%)	953 (94%)	54 (5%)	4 (0%)	39 65

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	188	ASN
1	D	28	ASP
1	D	222	ASP
1	A	114	LYS

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	220/237 (93%)	216 (98%)	4 (2%)	66 87
1	B	224/237 (94%)	220 (98%)	4 (2%)	66 87
1	C	211/237 (89%)	207 (98%)	4 (2%)	65 86
1	D	206/237 (87%)	202 (98%)	4 (2%)	65 86
All	All	861/948 (91%)	845 (98%)	16 (2%)	65 86

5 of 16 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	251	PHE
1	C	4	MET
1	D	146	ARG
1	B	249	ARG
1	D	163	TYR

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	218	GLN

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Mol	Chain	Res	Type
1	A	258	HIS

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)

8 ligands are 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	CIT	A	301	-	3,12,12	1.24	0	3,17,17	2.23	2 (66%)
3	GOL	A	302	-	5,5,5	0.37	0	5,5,5	0.24	0
4	5A9	A	303	-	33,38,38	1.75	6 (18%)	32,53,53	2.72	3 (9%)
2	CIT	B	301	-	3,12,12	1.30	0	3,17,17	2.21	2 (66%)
4	5A9	B	302	-	33,38,38	2.31	9 (27%)	32,53,53	2.79	4 (12%)
4	5A9	C	301	-	33,38,38	2.10	7 (21%)	32,53,53	2.77	2 (6%)
3	GOL	D	301	-	5,5,5	0.34	0	5,5,5	0.25	0
4	5A9	D	302	-	33,38,38	2.74	12 (36%)	32,53,53	2.81	8 (25%)

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	CIT	A	301	-	-	0/6/16/16	0/0/0/0
3	GOL	A	302	-	-	0/4/4/4	0/0/0/0
4	5A9	A	303	-	-	0/13/35/35	0/4/4/4
2	CIT	B	301	-	-	0/6/16/16	0/0/0/0
4	5A9	B	302	-	-	0/13/35/35	0/4/4/4
4	5A9	C	301	-	-	0/13/35/35	0/4/4/4
3	GOL	D	301	-	-	0/4/4/4	0/0/0/0
4	5A9	D	302	-	-	0/13/35/35	0/4/4/4

The worst 5 of 34 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	D	302	5A9	BR-CBD	-8.00	1.73	1.90
4	D	302	5A9	C8-SAH	-7.52	1.55	1.75
4	B	302	5A9	NBG-NBB	-6.43	1.06	1.23
4	B	302	5A9	BR-CBD	-5.95	1.77	1.90
4	C	301	5A9	NBG-NBB	-5.78	1.07	1.23

The worst 5 of 21 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
4	A	303	5A9	N3-C2-N1	-13.65	118.14	128.87
4	C	301	5A9	N3-C2-N1	-13.56	118.22	128.87
4	B	302	5A9	N3-C2-N1	-13.37	118.37	128.87
4	D	302	5A9	N3-C2-N1	-12.32	119.19	128.87
4	C	301	5A9	CAT-OAS-CAR	-6.00	103.28	109.64

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

3 monomers are involved in 7 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	303	5A9	3	0
4	B	302	5A9	3	0
4	D	302	5A9	1	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 (i)

6.1 Protein, DNA and RNA chains (i)

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	263/272 (96%)	0.26	5 (1%)	70	64	31, 55, 92, 145	34 (12%)
1	B	259/272 (95%)	0.62	17 (6%)	22	16	33, 73, 106, 156	35 (13%)
1	C	260/272 (95%)	0.57	22 (8%)	13	9	34, 68, 116, 155	31 (11%)
1	D	250/272 (91%)	0.64	17 (6%)	20	15	37, 74, 133, 161	29 (11%)
All	All	1032/1088 (94%)	0.52	61 (5%)	26	19	31, 66, 118, 161	129 (12%)

The worst 5 of 61 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	109	TYR	5.7
1	C	212	VAL	4.8
1	B	229	ARG	4.3
1	D	119	LEU	4.3
1	A	111	ILE	4.1

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, 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
3	GOL	A	302	6/6	0.90	0.25	2.74	71,72,72,73	0
2	CIT	A	301	13/13	0.60	0.31	2.56	91,96,101,101	0
4	5A9	D	302	35/35	0.81	0.24	1.24	64,70,111,111	4
2	CIT	B	301	13/13	0.80	0.20	0.83	74,78,82,84	0
4	5A9	A	303	35/35	0.91	0.18	-0.06	37,46,68,70	5
4	5A9	B	302	35/35	0.93	0.14	-0.46	44,57,62,69	5
4	5A9	C	301	35/35	0.92	0.14	-0.56	38,44,62,66	5
3	GOL	D	301	6/6	0.77	0.15	-1.13	73,74,75,75	0

6.5 Other polymers (i)

There are no such residues in this entry.