



# Full wwPDB X-ray Structure Validation Report ⓘ

Nov 5, 2023 – 01:10 AM EDT

PDB ID : 5TCF  
Title : Crystal structure of tryptophan synthase from *M. tuberculosis* - ligand-free form  
Authors : Michalska, K.; Maltseva, N.; Jedrzejczak, R.; Joachimiak, A.; Center for Structural Genomics of Infectious Diseases (CSGID)  
Deposited on : 2016-09-15  
Resolution : 2.46 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

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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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 : 1.8.5 (274361), CSD as541be (2020)  
Xtriage (Phenix) : 1.13  
EDS : 2.36  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Refmac : 5.8.0158  
CCP4 : 7.0.044 (Gargrove)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.36

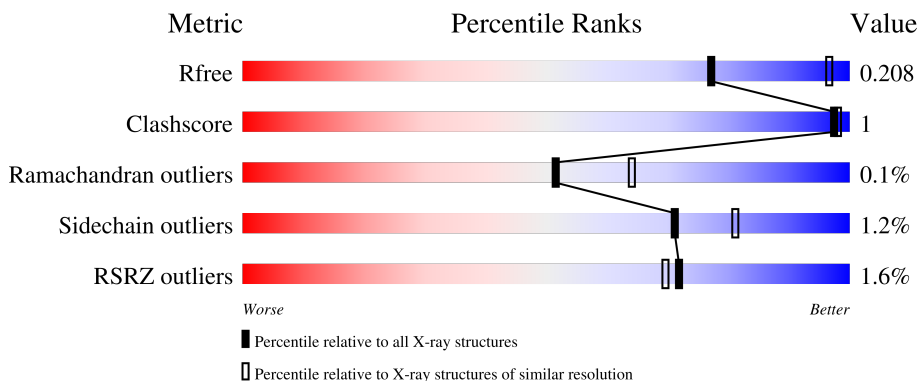
# 1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.46 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.



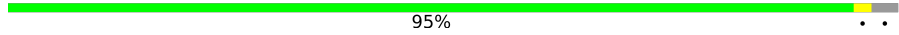
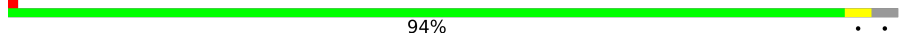

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
$R_{free}$	130704	1544 (2.48-2.44)
Clashscore	141614	1613 (2.48-2.44)
Ramachandran outliers	138981	1598 (2.48-2.44)
Sidechain outliers	138945	1598 (2.48-2.44)
RSRZ outliers	127900	1523 (2.48-2.44)

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 of the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria respectively. 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	276	 89% 10%
1	C	276	 87% 10%
1	E	276	 86% 11%
1	G	276	 87% 11%
2	B	410	 94%

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Mol	Chain	Length	Quality of chain
2	D	410	 95% . .
2	F	410	%  94% . .
2	H	410	%  93% 6% .

## 2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 19844 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 Tryptophan synthase alpha chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	249	Total 1803	C 1131	N 323	O 344	S 5	0	0	0
1	G	247	Total 1790	C 1124	N 321	O 340	S 5	0	0	0
1	E	245	Total 1776	C 1115	N 319	O 337	S 5	0	0	0
1	C	248	Total 1798	C 1127	N 322	O 344	S 5	0	0	0

There are 24 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	271	HIS	-	expression tag	UNP P9WFY1
A	272	HIS	-	expression tag	UNP P9WFY1
A	273	HIS	-	expression tag	UNP P9WFY1
A	274	HIS	-	expression tag	UNP P9WFY1
A	275	HIS	-	expression tag	UNP P9WFY1
A	276	HIS	-	expression tag	UNP P9WFY1
G	271	HIS	-	expression tag	UNP P9WFY1
G	272	HIS	-	expression tag	UNP P9WFY1
G	273	HIS	-	expression tag	UNP P9WFY1
G	274	HIS	-	expression tag	UNP P9WFY1
G	275	HIS	-	expression tag	UNP P9WFY1
G	276	HIS	-	expression tag	UNP P9WFY1
E	271	HIS	-	expression tag	UNP P9WFY1
E	272	HIS	-	expression tag	UNP P9WFY1
E	273	HIS	-	expression tag	UNP P9WFY1
E	274	HIS	-	expression tag	UNP P9WFY1
E	275	HIS	-	expression tag	UNP P9WFY1
E	276	HIS	-	expression tag	UNP P9WFY1
C	271	HIS	-	expression tag	UNP P9WFY1
C	272	HIS	-	expression tag	UNP P9WFY1
C	273	HIS	-	expression tag	UNP P9WFY1

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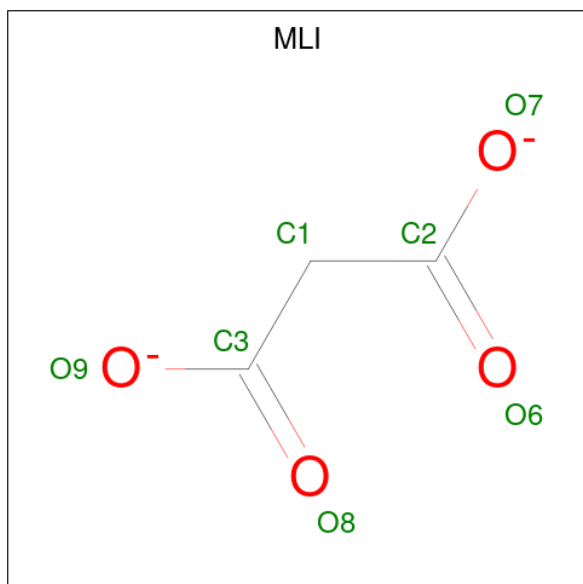
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Chain	Residue	Modelled	Actual	Comment	Reference
C	274	HIS	-	expression tag	UNP P9WFY1
C	275	HIS	-	expression tag	UNP P9WFY1
C	276	HIS	-	expression tag	UNP P9WFY1

- Molecule 2 is a protein called Tryptophan synthase beta chain.

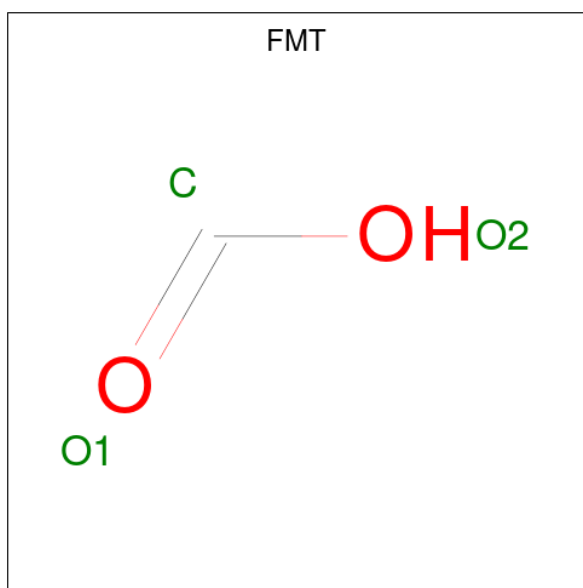
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace	
			Total	C	N	O	P				S
2	B	405	Total	C	N	O	P	S	0	3	0
			3061	1911	555	581	1	13			
2	H	405	Total	C	N	O	P	S	0	6	0
			3078	1924	557	583	1	13			
2	F	399	Total	C	N	O	P	S	0	1	0
			2995	1869	540	572	1	13			
2	D	398	Total	C	N	O	P	S	0	0	0
			2980	1861	538	567	1	13			

- Molecule 3 is MALONATE ION (three-letter code: MLI) (formula: C<sub>3</sub>H<sub>2</sub>O<sub>4</sub>).



Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	C O		
3	A	1	Total	C O	0	0
			7	3 4		
3	G	1	Total	C O	0	0
			7	3 4		
3	E	1	Total	C O	0	0
			7	3 4		
3	C	1	Total	C O	0	0
			7	3 4		

- Molecule 4 is FORMIC ACID (three-letter code: FMT) (formula: CH<sub>2</sub>O<sub>2</sub>).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	1	Total C O 3 1 2	0	0
4	B	1	Total C O 3 1 2	0	0
4	B	1	Total C O 3 1 2	0	0
4	B	1	Total C O 3 1 2	0	0
4	B	1	Total C O 3 1 2	0	0
4	G	1	Total C O 3 1 2	0	0
4	G	1	Total C O 3 1 2	0	0
4	H	1	Total C O 3 1 2	0	0
4	H	1	Total C O 3 1 2	0	0
4	E	1	Total C O 3 1 2	0	0
4	F	1	Total C O 3 1 2	0	0
4	F	1	Total C O 3 1 2	0	0
4	F	1	Total C O 3 1 2	0	0

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Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	C	1	Total C O 3 1 2	0	0
4	D	1	Total C O 3 1 2	0	0
4	D	1	Total C O 3 1 2	0	0
4	D	1	Total C O 3 1 2	0	0
4	D	1	Total C O 3 1 2	0	0
4	D	1	Total C O 3 1 2	0	0
4	D	1	Total C O 3 1 2	0	0
4	D	1	Total C O 3 1 2	0	0

- Molecule 5 is POTASSIUM ION (three-letter code: K) (formula: K).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	B	2	Total K 2 2	0	0
5	H	1	Total K 1 1	0	0

- Molecule 6 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	A	28	Total O 28 28	0	0
6	B	99	Total O 101 101	0	2
6	G	33	Total O 33 33	0	0
6	H	105	Total O 105 105	0	0
6	E	9	Total O 9 9	0	0
6	F	84	Total O 86 86	0	2
6	C	17	Total O 17 17	0	0

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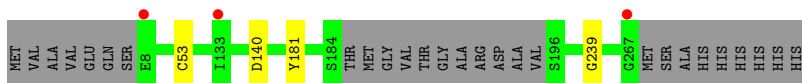
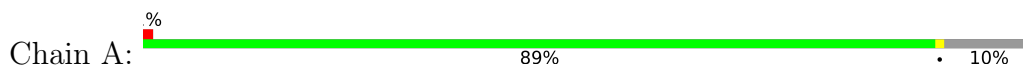
<b>Mol</b>	<b>Chain</b>	<b>Residues</b>	<b>Atoms</b>		<b>ZeroOcc</b>	<b>AltConf</b>
6	D	90	Total	O	0	0
			90	90		



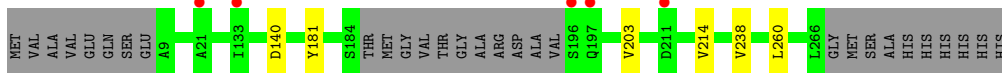
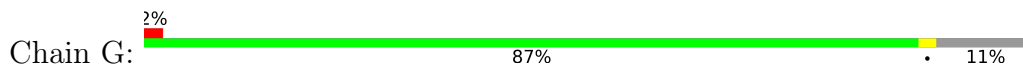
### 3 Residue-property plots

These plots are drawn for all protein, RNA, DNA and oligosaccharide 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.

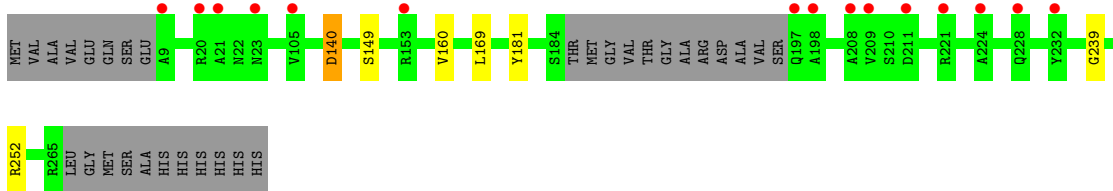
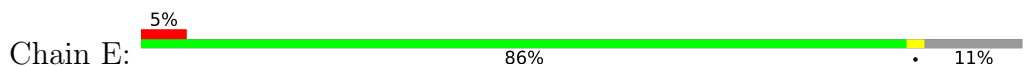
- Molecule 1: Tryptophan synthase alpha chain



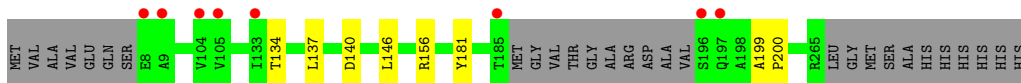
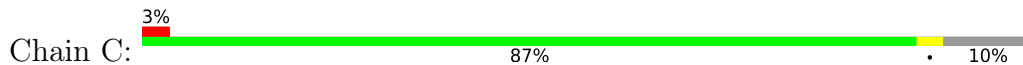
- Molecule 1: Tryptophan synthase alpha chain



- Molecule 1: Tryptophan synthase alpha chain



- Molecule 1: Tryptophan synthase alpha chain



- Molecule 2: Tryptophan synthase beta chain

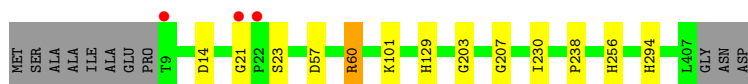
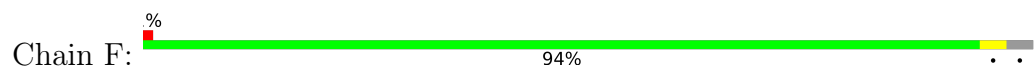




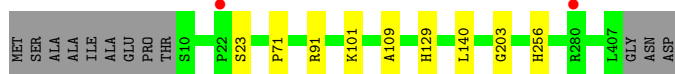
- Molecule 2: Tryptophan synthase beta chain



- Molecule 2: Tryptophan synthase beta chain



- Molecule 2: Tryptophan synthase beta chain



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	135.14Å 157.99Å 166.65Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	30.00 – 2.46 30.03 – 2.46	Depositor EDS
% Data completeness (in resolution range)	99.1 (30.00-2.46) 99.2 (30.03-2.46)	Depositor EDS
$R_{merge}$	0.11	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	11.25 (at 2.45Å)	Xtrriage
Refinement program	REFMAC 5.8.0155	Depositor
R, $R_{free}$	0.176 , 0.207 0.180 , 0.208	Depositor DCC
$R_{free}$ test set	2493 reflections (1.94%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	36.4	Xtrriage
Anisotropy	0.392	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.33 , 39.8	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	19844	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	42.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.02% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical values of  $\langle |L| \rangle$ ,  $\langle L^2 \rangle$  for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

## 5 Model quality

### 5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: K, MLI, LLP, FMT

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	0.54	0/1832	0.68	0/2500
1	C	0.54	0/1827	0.71	0/2494
1	E	0.52	0/1805	0.65	0/2464
1	G	0.55	0/1819	0.71	0/2483
2	B	0.56	0/3098	0.74	1/4197 (0.0%)
2	D	0.59	0/3015	0.73	0/4085
2	F	0.55	0/3030	0.72	2/4106 (0.0%)
2	H	0.58	0/3114	0.75	1/4217 (0.0%)
All	All	0.56	0/19540	0.72	4/26546 (0.0%)

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	F	14	ASP	CB-CG-OD2	5.19	122.97	118.30
2	F	60	ARG	NE-CZ-NH2	5.16	122.88	120.30
2	H	280	ARG	NE-CZ-NH2	5.10	122.85	120.30
2	B	303	ASP	CB-CG-OD1	5.02	122.82	118.30

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	1803	0	1822	0	0
1	C	1798	0	1815	2	0
1	E	1776	0	1797	2	0
1	G	1790	0	1813	2	0
2	B	3061	0	2970	8	0
2	D	2980	0	2894	3	0
2	F	2995	0	2904	4	0
2	H	3078	0	2994	12	0
3	A	7	0	2	0	0
3	C	7	0	2	0	0
3	E	7	0	2	0	0
3	G	7	0	2	0	0
4	A	3	0	1	0	0
4	B	12	0	4	0	0
4	C	3	0	1	0	0
4	D	21	0	7	0	0
4	E	3	0	1	0	0
4	F	9	0	3	0	0
4	G	6	0	2	0	0
4	H	6	0	2	0	0
5	B	2	0	0	0	0
5	H	1	0	0	0	0
6	A	28	0	0	0	0
6	B	101	0	0	0	0
6	C	17	0	0	0	0
6	D	90	0	0	0	0
6	E	9	0	0	0	0
6	F	86	0	0	0	0
6	G	33	0	0	0	0
6	H	105	0	0	0	0
All	All	19844	0	19038	31	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 1.

All (31) 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:E:160:VAL:HG11	1:E:169:LEU:HD12	1.85	0.57
2:B:225:GLU:HG2	2:H:5:ILE:HD11	1.88	0.55
2:B:129:HIS:CE1	2:B:203:GLY:HA2	2.44	0.53
2:D:129:HIS:CE1	2:D:203:GLY:HA2	2.43	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:H:109:ALA:HB1	2:H:140:LEU:HD12	1.93	0.49
2:H:207:GLY:HA2	2:H:294:HIS:O	2.13	0.49
2:H:315:SER:HB3	2:H:363:ILE:HG22	1.96	0.47
2:F:230:ILE:HG21	2:F:238:PRO:HD3	1.96	0.47
2:F:57:ASP:OD1	2:F:60:ARG:NH1	2.48	0.47
2:B:177:SER:OG	2:B:179:THR:HG22	2.16	0.45
2:B:123:GLU:OE1	2:B:200:TYR:OH	2.30	0.45
2:H:202[B]:PHE:CE2	2:H:211:PHE:CE2	3.05	0.44
2:H:5:ILE:HG22	2:H:6:ALA:N	2.33	0.44
2:H:129:HIS:CE1	2:H:203:GLY:HA2	2.53	0.44
2:H:177:SER:OG	2:H:179:THR:OG1	2.33	0.44
1:G:203:VAL:HG22	1:G:214:VAL:HG11	2.00	0.43
1:G:238:VAL:HG21	1:G:260:LEU:HD13	2.00	0.42
2:B:207:GLY:HA2	2:B:294:HIS:O	2.19	0.42
2:B:242:VAL:HG12	2:B:267:VAL:HB	2.00	0.42
2:B:402:LYS:HG3	2:B:407:LEU:HD12	2.01	0.42
2:H:209:HIS:ND1	2:H:210:PRO:HA	2.33	0.42
2:H:109:ALA:CB	2:H:140:LEU:HD12	2.50	0.41
1:C:134:THR:HB	1:C:137:LEU:HB3	2.02	0.41
2:H:343:ASP:O	2:H:347:MET:HG2	2.20	0.41
1:C:199:ALA:HB3	1:C:200:PRO:CD	2.50	0.41
2:D:71:PRO:HD2	2:D:91:ARG:HB2	2.02	0.41
2:B:5:ILE:HD11	2:H:225:GLU:HG2	2.01	0.41
2:F:129:HIS:CE1	2:F:203:GLY:HA2	2.55	0.41
2:F:207:GLY:HA2	2:F:294:HIS:O	2.21	0.41
1:E:140:ASP:OD1	1:E:140:ASP:N	2.51	0.40
2:D:109:ALA:HB1	2:D:140:LEU:HD12	2.03	0.40

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	245/276 (89%)	242 (99%)	2 (1%)	1 (0%)	34	41
1	C	244/276 (88%)	241 (99%)	3 (1%)	0	100	100
1	E	241/276 (87%)	235 (98%)	5 (2%)	1 (0%)	34	41
1	G	243/276 (88%)	238 (98%)	5 (2%)	0	100	100
2	B	405/410 (99%)	400 (99%)	5 (1%)	0	100	100
2	D	395/410 (96%)	386 (98%)	9 (2%)	0	100	100
2	F	397/410 (97%)	386 (97%)	10 (2%)	1 (0%)	41	49
2	H	407/410 (99%)	400 (98%)	7 (2%)	0	100	100
All	All	2577/2744 (94%)	2528 (98%)	46 (2%)	3 (0%)	51	64

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	239	GLY
2	F	21	GLY
1	E	239	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	179/200 (90%)	176 (98%)	3 (2%)	60	73
1	C	179/200 (90%)	175 (98%)	4 (2%)	52	64
1	E	176/200 (88%)	172 (98%)	4 (2%)	50	63
1	G	178/200 (89%)	176 (99%)	2 (1%)	73	82
2	B	301/301 (100%)	299 (99%)	2 (1%)	84	90
2	D	293/301 (97%)	291 (99%)	2 (1%)	84	90
2	F	295/301 (98%)	293 (99%)	2 (1%)	84	90
2	H	302/301 (100%)	298 (99%)	4 (1%)	69	79
All	All	1903/2004 (95%)	1880 (99%)	23 (1%)	71	81

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

Mol	Chain	Res	Type
1	A	53	CYS
1	A	140	ASP
1	A	181	TYR
2	B	250	ASN
2	B	256	HIS
1	G	140	ASP
1	G	181	TYR
2	H	256	HIS
2	H	296	SER
2	H	300	LEU
2	H	355	ARG
1	E	140	ASP
1	E	149	SER
1	E	181	TYR
1	E	252	ARG
2	F	23	SER
2	F	256	HIS
1	C	140	ASP
1	C	146	LEU
1	C	156	ARG
1	C	181	TYR
2	D	23	SER
2	D	256	HIS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
2	H	46	GLN
1	E	22	ASN

### 5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

4 non-standard protein/DNA/RNA residues 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	LLP	B	101	2	23,24,25	2.59	5 (21%)	25,32,34	1.69	6 (24%)
2	LLP	H	101	2	23,24,25	2.77	7 (30%)	25,32,34	1.90	7 (28%)
2	LLP	F	101	2	23,24,25	2.58	6 (26%)	25,32,34	1.58	2 (8%)
2	LLP	D	101	2	23,24,25	2.62	7 (30%)	25,32,34	1.77	5 (20%)

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	LLP	B	101	2	-	4/16/17/19	0/1/1/1
2	LLP	H	101	2	-	5/16/17/19	0/1/1/1
2	LLP	F	101	2	-	4/16/17/19	0/1/1/1
2	LLP	D	101	2	-	4/16/17/19	0/1/1/1

All (25) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	H	101	LLP	C4-C4'	8.48	1.62	1.46
2	F	101	LLP	C4-C4'	8.24	1.62	1.46
2	D	101	LLP	C4-C4'	8.24	1.62	1.46
2	B	101	LLP	C4-C4'	8.18	1.62	1.46
2	F	101	LLP	C4'-NZ	5.66	1.46	1.27
2	B	101	LLP	C4'-NZ	5.53	1.45	1.27
2	H	101	LLP	C4'-NZ	5.45	1.45	1.27
2	D	101	LLP	C4'-NZ	5.35	1.45	1.27
2	H	101	LLP	C4-C5	-4.81	1.35	1.42
2	D	101	LLP	C4-C5	-4.40	1.36	1.42
2	F	101	LLP	C4-C5	-4.03	1.36	1.42
2	B	101	LLP	C4-C5	-4.00	1.36	1.42
2	H	101	LLP	C2'-C2	3.53	1.56	1.50
2	H	101	LLP	C6-N1	3.34	1.41	1.34
2	B	101	LLP	C6-N1	2.99	1.40	1.34
2	F	101	LLP	C6-N1	2.89	1.40	1.34

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	101	LLP	C2'-C2	2.83	1.55	1.50
2	D	101	LLP	C6-N1	2.63	1.40	1.34
2	F	101	LLP	C2'-C2	2.38	1.54	1.50
2	F	101	LLP	P-OP4	-2.25	1.53	1.60
2	B	101	LLP	C2'-C2	2.25	1.54	1.50
2	D	101	LLP	C4-C3	-2.13	1.37	1.40
2	H	101	LLP	C4-C3	-2.11	1.37	1.40
2	H	101	LLP	C5'-C5	2.09	1.56	1.50
2	D	101	LLP	C5'-C5	2.05	1.56	1.50

All (20) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	F	101	LLP	C4-C4'-NZ	-5.43	99.37	124.31
2	D	101	LLP	C4-C4'-NZ	-5.17	100.57	124.31
2	H	101	LLP	C4-C4'-NZ	-5.11	100.83	124.31
2	B	101	LLP	C4-C4'-NZ	-4.69	102.78	124.31
2	D	101	LLP	OP4-C5'-C5	3.44	115.90	109.35
2	H	101	LLP	C2'-C2-C3	-3.30	116.82	120.89
2	H	101	LLP	C2'-C2-N1	3.24	123.99	117.67
2	H	101	LLP	OP2-P-OP4	2.98	114.66	106.73
2	D	101	LLP	C3-C4-C4'	-2.94	114.94	120.41
2	H	101	LLP	C4-C3-C2	2.84	121.94	120.19
2	B	101	LLP	OP4-C5'-C5	2.68	114.45	109.35
2	B	101	LLP	C3-C4-C4'	-2.57	115.62	120.41
2	F	101	LLP	C3-C4-C4'	-2.52	115.72	120.41
2	H	101	LLP	C3-C4-C4'	-2.38	115.98	120.41
2	B	101	LLP	C2'-C2-C3	-2.37	117.97	120.89
2	B	101	LLP	OP4-P-OP1	2.34	113.04	106.47
2	D	101	LLP	C3-C4-C5	2.32	120.04	118.26
2	H	101	LLP	CD-CG-CB	-2.10	106.19	113.62
2	B	101	LLP	C5-C4-C4'	2.07	124.96	121.56
2	D	101	LLP	C5-C4-C4'	2.02	124.88	121.56

There are no chirality outliers.

All (17) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	H	101	LLP	C5'-OP4-P-OP1
2	H	101	LLP	C5'-OP4-P-OP3
2	F	101	LLP	C4-C4'-NZ-CE
2	B	101	LLP	CG-CD-CE-NZ

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Mol	Chain	Res	Type	Atoms
2	H	101	LLP	C3-C4-C4'-NZ
2	H	101	LLP	C5-C4-C4'-NZ
2	B	101	LLP	C3-C4-C4'-NZ
2	D	101	LLP	C3-C4-C4'-NZ
2	B	101	LLP	CD-CE-NZ-C4'
2	F	101	LLP	CD-CE-NZ-C4'
2	F	101	LLP	C3-C4-C4'-NZ
2	B	101	LLP	C5-C4-C4'-NZ
2	D	101	LLP	C5-C4-C4'-NZ
2	D	101	LLP	CD-CE-NZ-C4'
2	H	101	LLP	C5'-OP4-P-OP2
2	D	101	LLP	CG-CD-CE-NZ
2	F	101	LLP	C5-C4-C4'-NZ

There are no ring outliers.

No monomer is involved in short contacts.

## 5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

Of 28 ligands modelled in this entry, 3 are monoatomic - leaving 25 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	FMT	B	503	-	2,2,2	0.88	0	1,1,1	0.55	0
4	FMT	D	504	-	2,2,2	0.78	0	1,1,1	0.60	0
3	MLI	G	301	-	6,6,6	1.16	0	7,7,7	0.96	0
4	FMT	G	302	-	2,2,2	0.82	0	1,1,1	0.60	0
4	FMT	G	303	-	2,2,2	0.71	0	1,1,1	0.69	0
4	FMT	F	502	-	2,2,2	0.72	0	1,1,1	0.61	0
4	FMT	D	502	-	2,2,2	0.74	0	1,1,1	0.68	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
4	FMT	E	302	-	2,2,2	0.71	0	1,1,1	0.67	0
4	FMT	D	507	-	2,2,2	0.80	0	1,1,1	0.60	0
4	FMT	B	502	-	2,2,2	0.77	0	1,1,1	0.67	0
3	MLI	A	301	-	6,6,6	1.12	0	7,7,7	1.07	0
4	FMT	B	501	-	2,2,2	0.81	0	1,1,1	0.66	0
4	FMT	D	501	-	2,2,2	0.73	0	1,1,1	0.67	0
4	FMT	D	506	-	2,2,2	0.81	0	1,1,1	0.48	0
3	MLI	E	301	-	6,6,6	1.15	0	7,7,7	1.19	0
4	FMT	D	503	-	2,2,2	0.67	0	1,1,1	0.70	0
4	FMT	C	302	-	2,2,2	0.82	0	1,1,1	0.63	0
4	FMT	F	501	-	2,2,2	0.70	0	1,1,1	0.72	0
4	FMT	B	504	-	2,2,2	0.84	0	1,1,1	0.60	0
4	FMT	H	502	-	2,2,2	0.71	0	1,1,1	0.74	0
4	FMT	H	501	-	2,2,2	0.78	0	1,1,1	0.63	0
4	FMT	A	302	-	2,2,2	0.81	0	1,1,1	0.56	0
4	FMT	F	503	-	2,2,2	0.73	0	1,1,1	0.69	0
3	MLI	C	301	-	6,6,6	1.09	0	7,7,7	0.99	0
4	FMT	D	505	-	2,2,2	0.69	0	1,1,1	0.67	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
3	MLI	C	301	-	-	2/4/4/4	-
3	MLI	G	301	-	-	2/4/4/4	-
3	MLI	A	301	-	-	1/4/4/4	-
3	MLI	E	301	-	-	1/4/4/4	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (6) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	G	301	MLI	C3-C1-C2-O6
3	G	301	MLI	C3-C1-C2-O7
3	C	301	MLI	C2-C1-C3-O8
3	C	301	MLI	C2-C1-C3-O9

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Mol	Chain	Res	Type	Atoms
3	E	301	MLI	C3-C1-C2-O6
3	A	301	MLI	C2-C1-C3-O9

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

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	249/276 (90%)	-0.37	3 (1%) 79 77	34, 47, 64, 88	0
1	C	248/276 (89%)	-0.21	8 (3%) 47 44	32, 49, 73, 89	0
1	E	245/276 (88%)	0.25	15 (6%) 21 18	45, 74, 105, 121	0
1	G	247/276 (89%)	-0.42	5 (2%) 65 62	30, 45, 62, 88	0
2	B	404/410 (98%)	-0.56	2 (0%) 91 92	24, 34, 54, 87	0
2	D	397/410 (96%)	-0.53	2 (0%) 91 92	24, 33, 49, 68	0
2	F	398/410 (97%)	-0.55	3 (0%) 86 86	24, 35, 52, 76	0
2	H	404/410 (98%)	-0.49	4 (0%) 82 83	21, 33, 58, 93	0
All	All	2592/2744 (94%)	-0.40	42 (1%) 72 69	21, 39, 76, 121	0

All (42) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	8	GLU	5.7
1	E	21	ALA	5.2
1	E	9	ALA	4.8
2	D	22	PRO	4.4
1	E	197	GLN	4.2
1	C	197	GLN	3.9
1	C	9	ALA	3.7
2	F	22	PRO	3.6
1	G	196	SER	3.5
1	E	23	ASN	3.5
2	F	9	THR	3.2
1	E	20	ARG	3.2
1	E	211	ASP	3.2
2	H	23	SER	3.1
2	H	22	PRO	3.0
1	E	228	GLN	3.0

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Mol	Chain	Res	Type	RSRZ
1	G	21	ALA	2.9
1	C	196	SER	2.9
1	E	153	ARG	2.9
1	E	221	ARG	2.7
1	A	267	GLY	2.6
2	H	8	PRO	2.6
1	E	224	ALA	2.5
1	E	198	ALA	2.5
1	C	185	THR	2.5
1	C	133	ILE	2.4
1	E	209	VAL	2.4
1	A	133	ILE	2.3
2	F	21	GLY	2.3
1	C	105	VAL	2.3
1	A	8	GLU	2.3
2	H	6	ALA	2.3
2	D	280	ARG	2.2
1	G	133	ILE	2.2
1	G	211	ASP	2.1
1	E	208	ALA	2.1
1	C	104	VAL	2.1
2	B	5	ILE	2.1
2	B	8	PRO	2.1
1	E	232	TYR	2.1
1	E	105	VAL	2.0
1	G	197	GLN	2.0

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

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. 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	B-factors(Å <sup>2</sup> )	Q<0.9
2	LLP	H	101	24/25	0.98	0.16	23,25,27,28	0
2	LLP	B	101	24/25	0.99	0.15	25,26,28,29	0
2	LLP	F	101	24/25	0.99	0.16	24,27,29,30	0
2	LLP	D	101	24/25	0.99	0.15	24,28,30,30	0

### 6.3 Carbohydrates [i](#)

There are no monosaccharides 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. 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	B-factors(Å <sup>2</sup> )	Q<0.9
4	FMT	B	503	3/3	0.65	0.18	56,56,56,62	0
4	FMT	D	506	3/3	0.75	0.28	56,56,58,58	0
5	K	B	506	1/1	0.76	0.20	73,73,73,73	0
3	MLI	E	301	7/7	0.83	0.22	73,79,83,87	0
4	FMT	H	501	3/3	0.83	0.21	58,58,61,61	0
4	FMT	B	504	3/3	0.85	0.21	50,50,52,54	0
4	FMT	C	302	3/3	0.85	0.21	56,56,57,59	0
4	FMT	E	302	3/3	0.88	0.39	76,76,78,79	0
4	FMT	G	302	3/3	0.88	0.31	53,53,59,59	0
5	K	H	503	1/1	0.89	0.26	74,74,74,74	0
4	FMT	D	504	3/3	0.90	0.25	56,56,60,61	0
3	MLI	C	301	7/7	0.90	0.15	65,70,75,76	0
4	FMT	F	503	3/3	0.91	0.13	63,63,63,66	0
4	FMT	D	502	3/3	0.91	0.27	60,60,61,63	0
3	MLI	A	301	7/7	0.92	0.12	53,55,59,62	0
4	FMT	B	502	3/3	0.93	0.12	59,59,62,62	0
4	FMT	A	302	3/3	0.93	0.19	50,50,53,54	0
4	FMT	G	303	3/3	0.93	0.24	54,54,56,57	0
4	FMT	D	505	3/3	0.94	0.36	60,60,62,63	0
4	FMT	D	501	3/3	0.94	0.23	49,49,51,52	0
4	FMT	B	501	3/3	0.94	0.16	43,43,46,47	0
4	FMT	F	502	3/3	0.94	0.31	60,60,61,63	0
4	FMT	D	507	3/3	0.95	0.13	48,48,52,54	0
5	K	B	505	1/1	0.95	0.07	62,62,62,62	0
3	MLI	G	301	7/7	0.95	0.10	52,55,56,56	0
4	FMT	F	501	3/3	0.95	0.12	65,65,66,66	0
4	FMT	H	502	3/3	0.96	0.10	51,51,52,52	0
4	FMT	D	503	3/3	0.98	0.12	56,56,58,58	0

### 6.5 Other polymers [i](#)

There are no such residues in this entry.