



# Full wwPDB X-ray Structure Validation Report ⓘ

Feb 15, 2017 – 01:28 am GMT

PDB ID : 4KTO  
Title : Crystal Structure Of a Putative Isovaleryl-CoA dehydrogenase (PSI-NYSGRC-012251) from Sinorhizobium meliloti 1021  
Authors : Kumar, P.R.; Ahmed, M.; Attonito, J.; Bhosle, R.; Bonanno, J.; Chamala, S.; Chowdhury, S.; Glenn, A.S.; Hammonds, J.; Hillerich, B.; Himmel, D.; Love, J.D.; Seidel, R.; Stead, M.; Toro, R.; Wasserman, S.R.; Almo, S.C.; New York Structural Genomics Research Consortium (NYSGRC)  
Deposited on : 2013-05-20  
Resolution : 2.14 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	:	trunk28620
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)	:	recalc28949

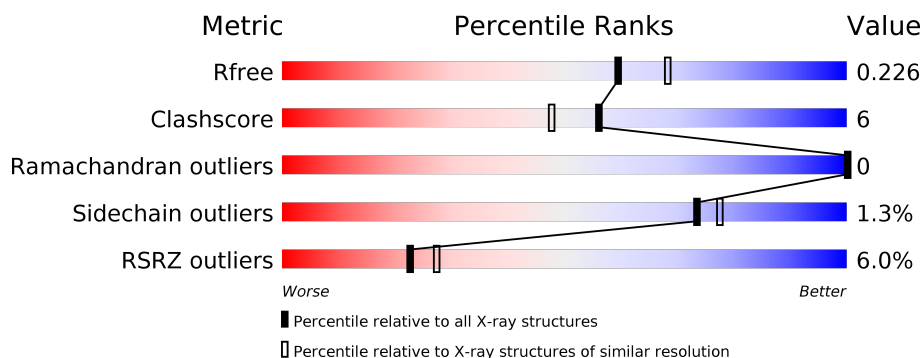
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 2.14 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	1915 (2.16-2.12)
Clashscore	112137	2047 (2.16-2.12)
Ramachandran outliers	110173	2020 (2.16-2.12)
Sidechain outliers	110143	2019 (2.16-2.12)
RSRZ outliers	101464	1921 (2.16-2.12)

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	410	<div> <div>5%</div> <div> <div></div> <div>81%</div> <div>11%</div> <div>8%</div> </div> </div>
1	B	410	<div> <div>4%</div> <div> <div></div> <div>83%</div> <div>9%</div> <div>9%</div> </div> </div>
1	C	410	<div> <div>6%</div> <div> <div></div> <div>80%</div> <div>10%</div> <div>9%</div> </div> </div>
1	D	410	<div> <div>6%</div> <div> <div></div> <div>81%</div> <div>10%</div> <div>9%</div> </div> </div>

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	FAD	A	401	-	-	-	X
3	TRS	A	402	-	-	-	X
3	TRS	B	402	-	-	-	X
3	TRS	D	402	-	-	-	X

## 2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 12031 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 isovaleryl-CoA dehydrogenase.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	377	Total	C	N	O	S	Se	0	0	0
			2826	1774	496	535	6	15			
1	B	375	Total	C	N	O	S	Se	0	0	0
			2810	1760	494	534	6	16			
1	C	374	Total	C	N	O	S	Se	0	0	0
			2794	1750	488	535	6	15			
1	D	374	Total	C	N	O	S	Se	0	0	0
			2799	1758	490	530	6	15			

There are 96 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-22	MSE	-	EXPRESSION TAG	UNP Q92VK1
A	-21	HIS	-	EXPRESSION TAG	UNP Q92VK1
A	-20	HIS	-	EXPRESSION TAG	UNP Q92VK1
A	-19	HIS	-	EXPRESSION TAG	UNP Q92VK1
A	-18	HIS	-	EXPRESSION TAG	UNP Q92VK1
A	-17	HIS	-	EXPRESSION TAG	UNP Q92VK1
A	-16	HIS	-	EXPRESSION TAG	UNP Q92VK1
A	-15	SER	-	EXPRESSION TAG	UNP Q92VK1
A	-14	SER	-	EXPRESSION TAG	UNP Q92VK1
A	-13	GLY	-	EXPRESSION TAG	UNP Q92VK1
A	-12	VAL	-	EXPRESSION TAG	UNP Q92VK1
A	-11	ASP	-	EXPRESSION TAG	UNP Q92VK1
A	-10	LEU	-	EXPRESSION TAG	UNP Q92VK1
A	-9	GLY	-	EXPRESSION TAG	UNP Q92VK1
A	-8	THR	-	EXPRESSION TAG	UNP Q92VK1
A	-7	GLU	-	EXPRESSION TAG	UNP Q92VK1
A	-6	ASN	-	EXPRESSION TAG	UNP Q92VK1
A	-5	LEU	-	EXPRESSION TAG	UNP Q92VK1
A	-4	TYR	-	EXPRESSION TAG	UNP Q92VK1
A	-3	PHE	-	EXPRESSION TAG	UNP Q92VK1
A	-2	GLN	-	EXPRESSION TAG	UNP Q92VK1

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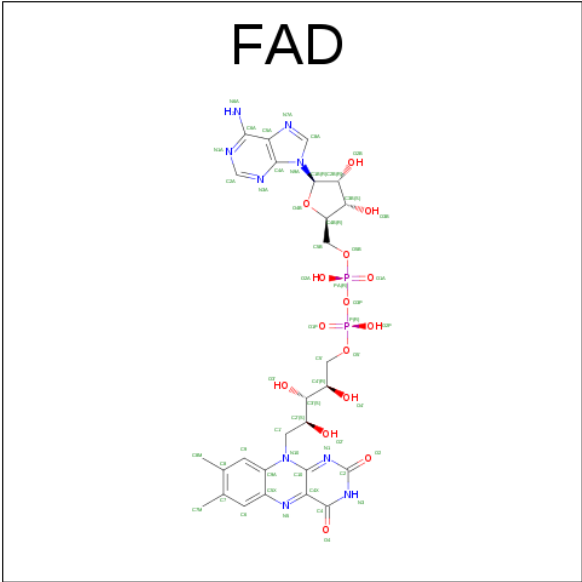
Chain	Residue	Modelled	Actual	Comment	Reference
A	-1	SER	-	EXPRESSION TAG	UNP Q92VK1
A	0	MSE	-	EXPRESSION TAG	UNP Q92VK1
A	1	MSE	-	EXPRESSION TAG	UNP Q92VK1
B	-22	MSE	-	EXPRESSION TAG	UNP Q92VK1
B	-21	HIS	-	EXPRESSION TAG	UNP Q92VK1
B	-20	HIS	-	EXPRESSION TAG	UNP Q92VK1
B	-19	HIS	-	EXPRESSION TAG	UNP Q92VK1
B	-18	HIS	-	EXPRESSION TAG	UNP Q92VK1
B	-17	HIS	-	EXPRESSION TAG	UNP Q92VK1
B	-16	HIS	-	EXPRESSION TAG	UNP Q92VK1
B	-15	SER	-	EXPRESSION TAG	UNP Q92VK1
B	-14	SER	-	EXPRESSION TAG	UNP Q92VK1
B	-13	GLY	-	EXPRESSION TAG	UNP Q92VK1
B	-12	VAL	-	EXPRESSION TAG	UNP Q92VK1
B	-11	ASP	-	EXPRESSION TAG	UNP Q92VK1
B	-10	LEU	-	EXPRESSION TAG	UNP Q92VK1
B	-9	GLY	-	EXPRESSION TAG	UNP Q92VK1
B	-8	THR	-	EXPRESSION TAG	UNP Q92VK1
B	-7	GLU	-	EXPRESSION TAG	UNP Q92VK1
B	-6	ASN	-	EXPRESSION TAG	UNP Q92VK1
B	-5	LEU	-	EXPRESSION TAG	UNP Q92VK1
B	-4	TYR	-	EXPRESSION TAG	UNP Q92VK1
B	-3	PHE	-	EXPRESSION TAG	UNP Q92VK1
B	-2	GLN	-	EXPRESSION TAG	UNP Q92VK1
B	-1	SER	-	EXPRESSION TAG	UNP Q92VK1
B	0	MSE	-	EXPRESSION TAG	UNP Q92VK1
B	1	MSE	-	EXPRESSION TAG	UNP Q92VK1
C	-22	MSE	-	EXPRESSION TAG	UNP Q92VK1
C	-21	HIS	-	EXPRESSION TAG	UNP Q92VK1
C	-20	HIS	-	EXPRESSION TAG	UNP Q92VK1
C	-19	HIS	-	EXPRESSION TAG	UNP Q92VK1
C	-18	HIS	-	EXPRESSION TAG	UNP Q92VK1
C	-17	HIS	-	EXPRESSION TAG	UNP Q92VK1
C	-16	HIS	-	EXPRESSION TAG	UNP Q92VK1
C	-15	SER	-	EXPRESSION TAG	UNP Q92VK1
C	-14	SER	-	EXPRESSION TAG	UNP Q92VK1
C	-13	GLY	-	EXPRESSION TAG	UNP Q92VK1
C	-12	VAL	-	EXPRESSION TAG	UNP Q92VK1
C	-11	ASP	-	EXPRESSION TAG	UNP Q92VK1
C	-10	LEU	-	EXPRESSION TAG	UNP Q92VK1
C	-9	GLY	-	EXPRESSION TAG	UNP Q92VK1
C	-8	THR	-	EXPRESSION TAG	UNP Q92VK1

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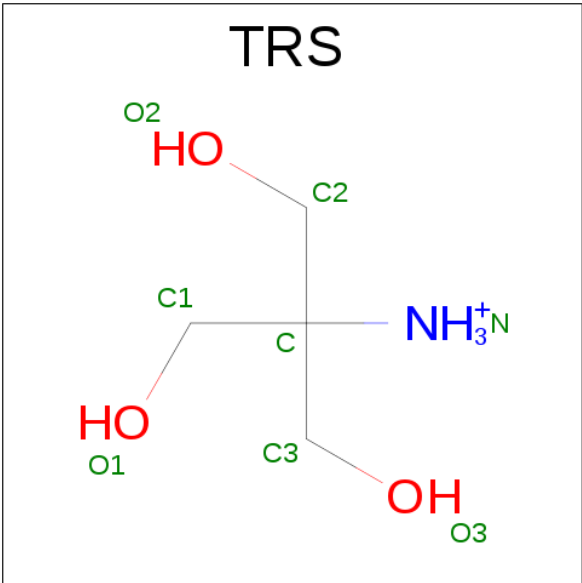
Chain	Residue	Modelled	Actual	Comment	Reference
C	-7	GLU	-	EXPRESSION TAG	UNP Q92VK1
C	-6	ASN	-	EXPRESSION TAG	UNP Q92VK1
C	-5	LEU	-	EXPRESSION TAG	UNP Q92VK1
C	-4	TYR	-	EXPRESSION TAG	UNP Q92VK1
C	-3	PHE	-	EXPRESSION TAG	UNP Q92VK1
C	-2	GLN	-	EXPRESSION TAG	UNP Q92VK1
C	-1	SER	-	EXPRESSION TAG	UNP Q92VK1
C	0	MSE	-	EXPRESSION TAG	UNP Q92VK1
C	1	MSE	-	EXPRESSION TAG	UNP Q92VK1
D	-22	MSE	-	EXPRESSION TAG	UNP Q92VK1
D	-21	HIS	-	EXPRESSION TAG	UNP Q92VK1
D	-20	HIS	-	EXPRESSION TAG	UNP Q92VK1
D	-19	HIS	-	EXPRESSION TAG	UNP Q92VK1
D	-18	HIS	-	EXPRESSION TAG	UNP Q92VK1
D	-17	HIS	-	EXPRESSION TAG	UNP Q92VK1
D	-16	HIS	-	EXPRESSION TAG	UNP Q92VK1
D	-15	SER	-	EXPRESSION TAG	UNP Q92VK1
D	-14	SER	-	EXPRESSION TAG	UNP Q92VK1
D	-13	GLY	-	EXPRESSION TAG	UNP Q92VK1
D	-12	VAL	-	EXPRESSION TAG	UNP Q92VK1
D	-11	ASP	-	EXPRESSION TAG	UNP Q92VK1
D	-10	LEU	-	EXPRESSION TAG	UNP Q92VK1
D	-9	GLY	-	EXPRESSION TAG	UNP Q92VK1
D	-8	THR	-	EXPRESSION TAG	UNP Q92VK1
D	-7	GLU	-	EXPRESSION TAG	UNP Q92VK1
D	-6	ASN	-	EXPRESSION TAG	UNP Q92VK1
D	-5	LEU	-	EXPRESSION TAG	UNP Q92VK1
D	-4	TYR	-	EXPRESSION TAG	UNP Q92VK1
D	-3	PHE	-	EXPRESSION TAG	UNP Q92VK1
D	-2	GLN	-	EXPRESSION TAG	UNP Q92VK1
D	-1	SER	-	EXPRESSION TAG	UNP Q92VK1
D	0	MSE	-	EXPRESSION TAG	UNP Q92VK1
D	1	MSE	-	EXPRESSION TAG	UNP Q92VK1

- Molecule 2 is FLAVIN-ADENINE DINUCLEOTIDE (three-letter code: FAD) (formula: C<sub>27</sub>H<sub>33</sub>N<sub>9</sub>O<sub>15</sub>P<sub>2</sub>).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	N	O	P	0	0
			53	27	9	15	2		
2	B	1	Total	C	N	O	P	0	0
			53	27	9	15	2		
2	C	1	Total	C	N	O	P	0	0
			53	27	9	15	2		
2	D	1	Total	C	N	O	P	0	0
			53	27	9	15	2		

- Molecule 3 is 2-AMINO-2-HYDROXYMETHYL-PROPANE-1,3-DIOL (three-letter code: TRS) (formula: C<sub>4</sub>H<sub>12</sub>NO<sub>3</sub>).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	N	O	0	0
			8	4	1	3		
3	B	1	Total	C	N	O	0	0
			8	4	1	3		
3	D	1	Total	C	N	O	0	0
			8	4	1	3		

- Molecule 4 is water.

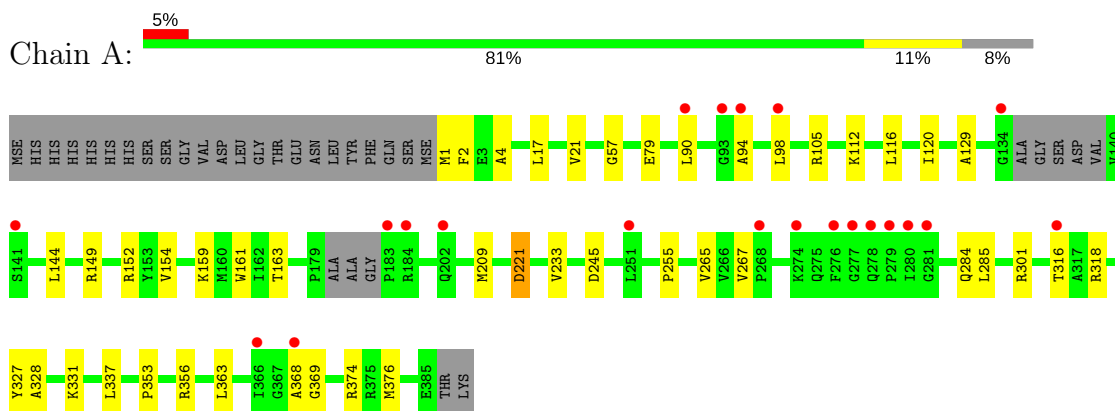
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	171	Total	O	0	0
			171	171		
4	B	153	Total	O	0	0
			153	153		
4	C	133	Total	O	0	0
			133	133		
4	D	109	Total	O	0	0
			109	109		



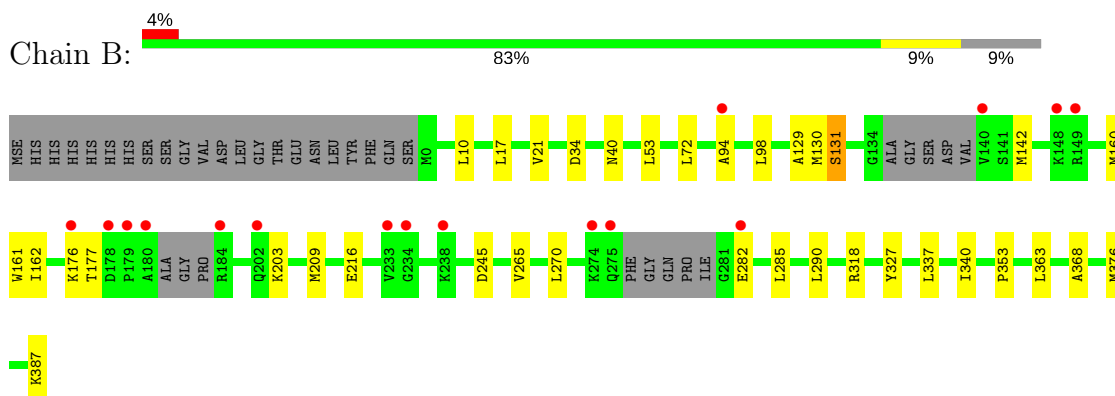
### 3 Residue-property plots [i](#)

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.

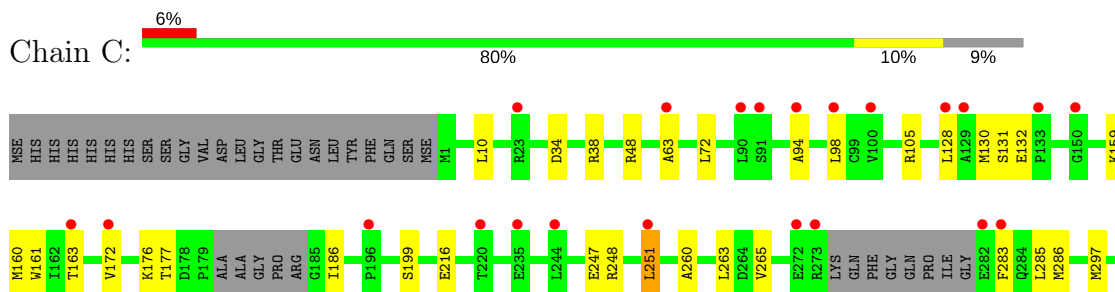
#### • Molecule 1: isovaleryl-CoA dehydrogenase

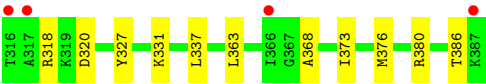


#### • Molecule 1: isovaleryl-CoA dehydrogenase

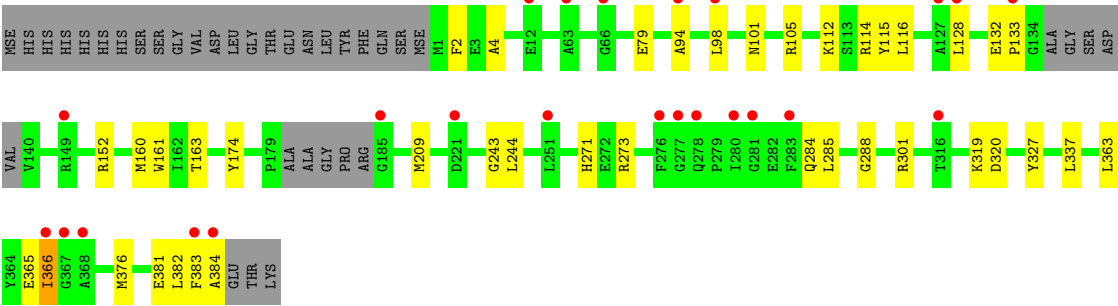
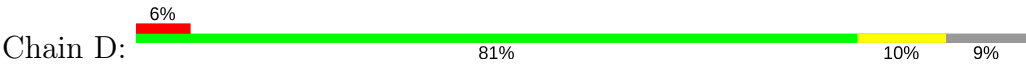


#### • Molecule 1: isovaleryl-CoA dehydrogenase





● Molecule 1: isovaleryl-CoA dehydrogenase



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	89.91Å 115.16Å 143.62Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	31.78 – 2.14 31.78 – 2.14	Depositor EDS
% Data completeness (in resolution range)	95.2 (31.78-2.14) 95.2 (31.78-2.14)	Depositor EDS
$R_{merge}$	0.13	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.77 (at 2.14Å)	Xtriage
Refinement program	PHENIX (phenix.refine: 1.8.2_1309)	Depositor
R, $R_{free}$	0.175 , 0.226 0.174 , 0.226	Depositor DCC
$R_{free}$ test set	3973 reflections (5.02%)	DCC
Wilson B-factor (Å <sup>2</sup> )	30.9	Xtriage
Anisotropy	0.332	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.40 , 53.4	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	12031	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	36.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.28% 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 [i](#)

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

Bond lengths and bond angles in the following residue types are not validated in this section: TRS, FAD

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	0.44	0/2857	0.59	0/3826
1	B	0.44	0/2836	0.56	0/3791
1	C	0.43	0/2822	0.57	0/3779
1	D	0.43	0/2829	0.58	0/3789
All	All	0.43	0/11344	0.57	0/15185

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	D	0	1

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	D	243	GLY	Peptide

### 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	2826	0	2823	39	0
1	B	2810	0	2810	30	1
1	C	2794	0	2786	36	0
1	D	2799	0	2796	38	0
2	A	53	0	31	11	0
2	B	53	0	31	6	0
2	C	53	0	31	5	0
2	D	53	0	31	8	0
3	A	8	0	12	4	0
3	B	8	0	12	0	0
3	D	8	0	12	2	0
4	A	171	0	0	5	2
4	B	153	0	0	3	0
4	C	133	0	0	7	0
4	D	109	0	0	2	1
All	All	12031	0	11375	132	2

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 6.

All (132) 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:C:263:LEU:HD12	1:C:297:MSE:HE2	1.36	1.08
1:C:260:ALA:HA	1:C:297:MSE:HE1	1.51	0.93
1:A:363:LEU:HD21	2:A:401:FAD:HM71	1.53	0.89
1:C:376:MSE:SE	1:D:284:GLN:HG3	2.25	0.86
1:B:376:MSE:HE3	1:D:285:LEU:HD11	1.56	0.86
1:B:285:LEU:HD11	1:D:376:MSE:HE3	1.61	0.81
1:A:376:MSE:HE3	1:C:285:LEU:HD11	1.63	0.81
1:D:94:ALA:HA	1:D:98:LEU:HG	1.65	0.78
1:A:356:ARG:HH12	3:A:402:TRS:H31	1.53	0.73
1:B:337:LEU:HD11	1:D:337:LEU:HD11	1.70	0.72
1:D:383:PHE:HA	1:D:384:ALA:HB3	1.70	0.72
1:A:285:LEU:HD11	1:C:376:MSE:HE3	1.72	0.71
1:D:363:LEU:HD21	2:D:401:FAD:HM83	1.72	0.71
1:D:320:ASP:OD1	4:D:551:HOH:O	2.08	0.71
1:A:284:GLN:HB2	1:D:284:GLN:HB3	1.73	0.70
1:A:94:ALA:HA	1:A:98:LEU:HG	1.73	0.70
1:C:368:ALA:O	4:C:574:HOH:O	2.10	0.68
1:B:368:ALA:O	4:B:624:HOH:O	2.11	0.67
1:B:160:MSE:HG3	1:B:161:TRP:CD1	2.33	0.64

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:285:LEU:HG	1:D:284:GLN:HG2	1.78	0.64
1:A:161:TRP:CZ3	2:A:401:FAD:HM82	2.32	0.63
1:C:128:LEU:HD12	1:C:172:VAL:HB	1.81	0.63
1:A:149:ARG:NH2	1:A:221:ASP:OD2	2.31	0.62
1:B:363:LEU:HD21	2:B:401:FAD:HM83	1.81	0.62
2:A:401:FAD:H9	2:A:401:FAD:H2'	1.81	0.62
1:D:114:ARG:HD3	1:D:115:TYR:CZ	2.35	0.61
1:A:163:THR:OG1	2:A:401:FAD:H6	2.00	0.61
1:A:209:MSE:HG3	1:A:363:LEU:HG	1.82	0.61
1:C:327:TYR:OH	1:D:327:TYR:OH	2.20	0.59
1:D:163:THR:OG1	2:D:401:FAD:H6	2.03	0.59
1:B:337:LEU:HD13	3:D:402:TRS:H12	1.86	0.58
1:D:79:GLU:OE2	1:D:301:ARG:NH1	2.36	0.58
1:B:131:SER:OG	2:B:401:FAD:N1	2.37	0.58
1:B:34:ASP:OD2	4:B:642:HOH:O	2.17	0.57
1:A:368:ALA:O	4:A:669:HOH:O	2.17	0.57
1:D:363:LEU:CD2	2:D:401:FAD:HM83	2.35	0.57
1:C:248:ARG:NE	4:C:574:HOH:O	2.26	0.57
1:A:90:LEU:HD21	2:A:401:FAD:HM73	1.87	0.57
1:D:160:MSE:SE	1:D:161:TRP:HD1	2.39	0.56
1:A:356:ARG:NH1	3:A:402:TRS:H31	2.21	0.56
1:C:10:LEU:HD22	1:C:72:LEU:HD21	1.87	0.56
1:B:142:MSE:O	1:B:176:LYS:NZ	2.33	0.56
1:C:176:LYS:HD3	1:C:186:ILE:HG12	1.89	0.55
1:A:144:LEU:HD22	1:A:159:LYS:HE2	1.89	0.55
1:C:376:MSE:HB3	1:C:380:ARG:HH21	1.72	0.54
1:C:105:ARG:NH1	4:C:522:HOH:O	2.28	0.54
1:D:133:PRO:HA	1:D:160:MSE:SE	2.58	0.54
1:D:161:TRP:CZ3	2:D:401:FAD:HM82	2.43	0.54
1:A:327:TYR:HH	1:B:327:TYR:HH	1.56	0.54
2:A:401:FAD:C9	2:A:401:FAD:H2'	2.38	0.53
1:D:112:LYS:HB3	1:D:116:LEU:HD12	1.91	0.53
1:A:79:GLU:OE2	1:A:301:ARG:NH1	2.41	0.53
1:D:209:MSE:HG3	1:D:363:LEU:HG	1.90	0.53
1:B:363:LEU:CD2	2:B:401:FAD:HM83	2.39	0.53
1:C:63:ALA:N	4:C:595:HOH:O	2.37	0.52
1:A:337:LEU:HD11	1:C:337:LEU:HD11	1.91	0.52
1:B:282:GLU:HB2	2:D:401:FAD:N3A	2.24	0.52
1:D:152:ARG:NH1	4:D:567:HOH:O	2.43	0.52
1:A:265:VAL:HG11	1:A:353:PRO:HG2	1.93	0.51
1:C:94:ALA:O	1:C:98:LEU:HB2	2.11	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:40:ASN:O	1:B:203:LYS:HE2	2.11	0.51
2:C:401:FAD:O2'	2:C:401:FAD:O4'	2.21	0.51
1:A:152:ARG:NH2	4:A:603:HOH:O	2.42	0.50
1:C:34:ASP:OD2	1:C:38:ARG:NH1	2.43	0.50
1:C:320:ASP:OD1	4:C:530:HOH:O	2.17	0.50
1:C:160:MSE:HG3	1:C:161:TRP:CD1	2.47	0.50
2:D:401:FAD:H8A	2:D:401:FAD:O1A	2.12	0.50
1:A:1:MSE:N	4:A:655:HOH:O	2.45	0.49
2:A:401:FAD:H1B	1:C:286:MSE:HE3	1.95	0.49
1:A:363:LEU:HD21	2:A:401:FAD:HM83	1.95	0.49
1:D:363:LEU:HD21	2:D:401:FAD:HM71	1.95	0.48
1:B:10:LEU:HD22	1:B:72:LEU:HD21	1.96	0.48
1:C:247:GLU:HG3	1:C:251:LEU:HD22	1.96	0.48
1:C:160:MSE:SE	1:C:216:GLU:HB3	2.64	0.47
1:A:2:PHE:CZ	1:A:4:ALA:HB3	2.50	0.47
1:A:369:GLY:O	1:A:374:ARG:NH2	2.47	0.47
1:B:340:ILE:HG22	1:D:366:ILE:HD12	1.96	0.47
1:A:285:LEU:HG	1:D:284:GLN:CG	2.43	0.46
1:A:356:ARG:HH22	3:A:402:TRS:H22	1.79	0.46
1:B:129:ALA:HA	1:B:162:ILE:HD12	1.98	0.46
1:A:284:GLN:CB	1:D:284:GLN:HB3	2.44	0.46
1:D:2:PHE:CZ	1:D:4:ALA:HB3	2.51	0.45
1:C:376:MSE:HB3	1:C:380:ARG:NH2	2.32	0.45
1:B:160:MSE:SE	1:B:216:GLU:HB3	2.66	0.45
1:D:160:MSE:SE	1:D:161:TRP:CD1	3.19	0.45
1:C:132:GLU:HG2	1:C:159:LYS:HD3	1.97	0.45
1:C:48:ARG:HD2	4:C:513:HOH:O	2.17	0.45
1:D:132:GLU:O	1:D:160:MSE:HE2	2.17	0.45
1:A:245:ASP:OD1	1:A:318:ARG:NH1	2.49	0.45
1:A:149:ARG:CZ	1:A:154:VAL:HG21	2.47	0.44
1:C:386:THR:OG1	1:D:271:HIS:HE1	2.00	0.44
1:A:363:LEU:HD21	2:A:401:FAD:C7M	2.38	0.44
2:B:401:FAD:O2A	1:D:273:ARG:NE	2.50	0.44
1:B:53:LEU:HA	1:B:53:LEU:HD23	1.82	0.44
1:A:57:GLY:HA3	1:A:120:ILE:HG12	2.00	0.44
1:D:163:THR:HG1	2:D:401:FAD:H6	1.82	0.43
1:A:129:ALA:HB1	1:A:159:LYS:HG3	2.00	0.43
1:C:363:LEU:CD2	2:C:401:FAD:HM83	2.48	0.43
1:B:17:LEU:O	1:B:21:VAL:HG23	2.19	0.43
1:C:131:SER:OG	2:C:401:FAD:H1'1	2.18	0.43
1:B:270:LEU:HD12	1:B:290:LEU:HD22	2.00	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:161:TRP:HB3	2:B:401:FAD:C9A	2.48	0.43
1:B:94:ALA:O	1:B:98:LEU:HB2	2.19	0.43
1:D:365:GLU:OE1	3:D:402:TRS:H21	2.19	0.43
1:A:105:ARG:NH1	4:A:524:HOH:O	2.44	0.43
1:A:327:TYR:O	1:A:331:LYS:HG2	2.19	0.43
1:A:363:LEU:CD2	2:A:401:FAD:HM83	2.49	0.43
1:A:17:LEU:O	1:A:21:VAL:HG23	2.19	0.42
3:A:402:TRS:H12	4:A:518:HOH:O	2.18	0.42
1:C:297:MSE:HE3	4:C:633:HOH:O	2.20	0.42
1:A:2:PHE:CD1	1:A:267:VAL:HG21	2.54	0.42
1:C:376:MSE:HE1	1:D:288:GLY:N	2.34	0.42
1:B:161:TRP:O	2:B:401:FAD:C4X	2.67	0.42
1:B:265:VAL:HG11	1:B:353:PRO:HG2	2.00	0.42
1:A:255:PRO:HB2	1:A:328:ALA:HB1	2.01	0.42
1:B:209:MSE:HG3	1:B:363:LEU:HG	2.02	0.42
2:A:401:FAD:C2A	1:C:283:PHE:HB3	2.50	0.42
1:C:130:MSE:HB3	2:C:401:FAD:O2	2.20	0.42
1:C:263:LEU:HD23	1:C:263:LEU:HA	1.89	0.41
1:D:114:ARG:HD3	1:D:115:TYR:CE2	2.55	0.41
1:D:319:LYS:HD2	1:D:382:LEU:HG	2.01	0.41
1:C:331:LYS:HA	1:C:331:LYS:HD3	1.69	0.41
1:C:247:GLU:O	1:C:251:LEU:HB2	2.19	0.41
1:C:163:THR:OG1	2:C:401:FAD:H6	2.21	0.41
1:D:128:LEU:HD11	1:D:174:TYR:HE2	1.84	0.41
1:A:112:LYS:HB3	1:A:116:LEU:HD12	2.03	0.41
1:D:383:PHE:HA	1:D:384:ALA:CB	2.44	0.41
1:B:216:GLU:HG2	4:B:567:HOH:O	2.20	0.41
1:B:282:GLU:H	1:B:282:GLU:CD	2.24	0.40
1:B:245:ASP:OD1	1:B:318:ARG:NH1	2.54	0.40
1:B:270:LEU:HA	1:B:270:LEU:HD23	1.88	0.40
1:D:101:ASN:O	1:D:105:ARG:HG3	2.21	0.40

All (2) 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)
4:A:633:HOH:O	4:D:582:HOH:O[2_665]	2.07	0.13
1:B:387:LYS:NZ	4:A:645:HOH:O[3_746]	2.11	0.09



## 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	371/410 (90%)	361 (97%)	10 (3%)	0	100	100
1	B	367/410 (90%)	358 (98%)	9 (2%)	0	100	100
1	C	368/410 (90%)	361 (98%)	7 (2%)	0	100	100
1	D	368/410 (90%)	361 (98%)	7 (2%)	0	100	100
All	All	1474/1640 (90%)	1441 (98%)	33 (2%)	0	100	100

There are no Ramachandran outliers to report.

### 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	284/293 (97%)	281 (99%)	3 (1%)	78	81
1	B	282/293 (96%)	279 (99%)	3 (1%)	78	81
1	C	281/293 (96%)	275 (98%)	6 (2%)	59	61
1	D	281/293 (96%)	278 (99%)	3 (1%)	78	81
All	All	1128/1172 (96%)	1113 (99%)	15 (1%)	73	77

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

Mol	Chain	Res	Type
1	A	221	ASP
1	A	233	VAL

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Mol	Chain	Res	Type
1	A	316	THR
1	B	130	MSE
1	B	131	SER
1	B	177	THR
1	C	177	THR
1	C	199	SER
1	C	251	LEU
1	C	265	VAL
1	C	318	ARG
1	C	373	ILE
1	D	244	LEU
1	D	366	ILE
1	D	381	GLU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	C	287	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 ⓘ

7 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	FAD	A	401	-	51,58,58	1.42	7 (13%)	54,89,89	2.04	12 (22%)
3	TRS	A	402	-	7,7,7	0.37	0	9,9,9	0.82	0
2	FAD	B	401	-	51,58,58	1.42	7 (13%)	54,89,89	2.04	9 (16%)
3	TRS	B	402	-	7,7,7	0.32	0	9,9,9	0.88	0
2	FAD	C	401	-	51,58,58	1.41	6 (11%)	54,89,89	2.05	8 (14%)
2	FAD	D	401	-	51,58,58	1.43	7 (13%)	54,89,89	1.96	9 (16%)
3	TRS	D	402	-	7,7,7	0.38	0	9,9,9	0.29	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
2	FAD	A	401	-	-	0/28/50/50	0/6/6/6
3	TRS	A	402	-	-	0/9/9/9	0/0/0/0
2	FAD	B	401	-	-	0/28/50/50	0/6/6/6
3	TRS	B	402	-	-	0/9/9/9	0/0/0/0
2	FAD	C	401	-	-	0/28/50/50	0/6/6/6
2	FAD	D	401	-	-	0/28/50/50	0/6/6/6
3	TRS	D	402	-	-	0/9/9/9	0/0/0/0

All (27) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	401	FAD	C6-C5X	-2.44	1.38	1.41
2	B	401	FAD	C6-C5X	-2.16	1.38	1.41
2	D	401	FAD	C6-C5X	-2.11	1.38	1.41
2	B	401	FAD	C9A-N10	2.37	1.41	1.38
2	D	401	FAD	C9A-N10	2.42	1.41	1.38
2	C	401	FAD	C9A-N10	2.45	1.42	1.38
2	A	401	FAD	C9A-N10	2.60	1.42	1.38
2	C	401	FAD	C5A-C4A	3.07	1.47	1.40
2	B	401	FAD	C5A-C4A	3.10	1.47	1.40
2	A	401	FAD	C5A-C4A	3.11	1.47	1.40
2	A	401	FAD	C4-C4X	3.35	1.47	1.41
2	D	401	FAD	C5A-C4A	3.38	1.48	1.40
2	D	401	FAD	C8-C7	3.38	1.49	1.41

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	401	FAD	C9A-C5X	3.44	1.49	1.42
2	D	401	FAD	C9A-C5X	3.45	1.49	1.42
2	B	401	FAD	C4-C4X	3.50	1.48	1.41
2	B	401	FAD	C9A-C5X	3.51	1.49	1.42
2	C	401	FAD	C9A-C5X	3.51	1.49	1.42
2	B	401	FAD	C8-C7	3.55	1.49	1.41
2	A	401	FAD	C8-C7	3.57	1.50	1.41
2	D	401	FAD	C4-C4X	3.59	1.48	1.41
2	C	401	FAD	C4-C4X	3.64	1.48	1.41
2	C	401	FAD	C8-C7	3.64	1.50	1.41
2	C	401	FAD	C4X-C10	4.33	1.48	1.41
2	B	401	FAD	C4X-C10	4.66	1.49	1.41
2	D	401	FAD	C4X-C10	4.67	1.49	1.41
2	A	401	FAD	C4X-C10	4.71	1.49	1.41

All (38) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	401	FAD	N3A-C2A-N1A	-6.60	123.11	128.86
2	A	401	FAD	N3A-C2A-N1A	-6.51	123.19	128.86
2	C	401	FAD	N3A-C2A-N1A	-6.51	123.19	128.86
2	D	401	FAD	N3A-C2A-N1A	-5.40	124.16	128.86
2	B	401	FAD	C4X-C4-N3	-4.34	117.31	123.48
2	D	401	FAD	C4X-C4-N3	-4.15	117.57	123.48
2	A	401	FAD	C4X-C4-N3	-3.97	117.83	123.48
2	C	401	FAD	C4-C4X-C10	-3.91	116.80	119.96
2	C	401	FAD	C4X-C4-N3	-3.79	118.09	123.48
2	D	401	FAD	C4A-C5A-N7A	-3.05	106.47	109.41
2	D	401	FAD	C4-C4X-C10	-3.02	117.52	119.96
2	B	401	FAD	C4-C4X-C10	-2.91	117.61	119.96
2	A	401	FAD	C4A-C5A-N7A	-2.85	106.66	109.41
2	B	401	FAD	C4A-C5A-N7A	-2.52	106.98	109.41
2	C	401	FAD	C4A-C5A-N7A	-2.19	107.29	109.41
2	A	401	FAD	C8M-C8-C9	-2.18	114.86	120.34
2	A	401	FAD	C4-C4X-C10	-2.13	118.24	119.96
2	A	401	FAD	C7M-C7-C8	2.09	125.10	120.72
2	D	401	FAD	C1'-N10-C10	2.12	120.68	118.50
2	B	401	FAD	C1'-N10-C10	2.26	120.82	118.50
2	A	401	FAD	C4X-N5-C5X	2.45	119.35	116.76
2	A	401	FAD	C1'-N10-C10	2.55	121.12	118.50
2	A	401	FAD	C8M-C8-C7	2.59	126.15	120.72
2	B	401	FAD	C5X-C9A-N10	2.77	119.72	117.66

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	401	FAD	C4X-N5-C5X	2.84	119.76	116.76
2	B	401	FAD	C4X-N5-C5X	2.86	119.78	116.76
2	D	401	FAD	C5X-C9A-N10	2.87	119.79	117.66
2	C	401	FAD	C4-C4X-N5	2.91	121.87	118.68
2	C	401	FAD	C4X-N5-C5X	3.47	120.43	116.76
2	A	401	FAD	C5X-C9A-N10	3.50	120.26	117.66
2	B	401	FAD	C1'-N10-C9A	3.72	121.75	118.35
2	D	401	FAD	C1'-N10-C9A	4.12	122.12	118.35
2	A	401	FAD	C1'-N10-C9A	4.78	122.72	118.35
2	C	401	FAD	C1'-N10-C9A	4.85	122.79	118.35
2	A	401	FAD	C4-N3-C2	7.42	121.65	115.16
2	D	401	FAD	C4-N3-C2	8.20	122.33	115.16
2	C	401	FAD	C4-N3-C2	8.31	122.43	115.16
2	B	401	FAD	C4-N3-C2	8.77	122.83	115.16

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

6 monomers are involved in 36 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	401	FAD	11	0
3	A	402	TRS	4	0
2	B	401	FAD	6	0
2	C	401	FAD	5	0
2	D	401	FAD	8	0
3	D	402	TRS	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

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	362/410 (88%)	0.05	21 (5%) 24 29	15, 28, 55, 71	0
1	B	359/410 (87%)	0.08	16 (4%) 34 40	16, 31, 65, 87	0
1	C	359/410 (87%)	0.20	26 (7%) 16 20	16, 33, 62, 84	0
1	D	359/410 (87%)	0.24	24 (6%) 19 22	17, 35, 67, 90	0
All	All	1439/1640 (87%)	0.14	87 (6%) 23 27	15, 31, 63, 90	0

All (87) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	280	ILE	6.4
1	C	316	THR	6.2
1	D	276	PHE	5.0
1	A	280	ILE	4.7
1	A	281	GLY	4.1
1	B	275	GLN	3.9
1	A	276	PHE	3.7
1	C	98	LEU	3.6
1	A	279	PRO	3.6
1	A	90	LEU	3.6
1	D	277	GLY	3.6
1	D	283	PHE	3.4
1	C	251	LEU	3.4
1	D	368	ALA	3.4
1	D	12	GLU	3.4
1	B	184	ARG	3.3
1	B	140	VAL	3.3
1	D	383	PHE	3.2
1	C	94	ALA	3.1
1	D	384	ALA	3.1
1	A	316	THR	3.1

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Mol	Chain	Res	Type	RSRZ
1	C	163	THR	3.1
1	A	94	ALA	3.0
1	C	128	LEU	3.0
1	C	129	ALA	3.0
1	B	179	PRO	2.9
1	A	98	LEU	2.9
1	A	134	GLY	2.9
1	D	185	GLY	2.9
1	C	387	LYS	2.9
1	C	150	GLY	2.9
1	B	149	ARG	2.8
1	A	277	GLY	2.8
1	A	184	ARG	2.8
1	C	90	LEU	2.8
1	B	233	VAL	2.8
1	D	367	GLY	2.8
1	A	202	GLN	2.8
1	A	251	LEU	2.7
1	B	178	ASP	2.7
1	A	93	GLY	2.6
1	A	183	PRO	2.6
1	D	63	ALA	2.6
1	D	316	THR	2.6
1	C	283	PHE	2.6
1	D	281	GLY	2.6
1	C	244	LEU	2.6
1	B	282	GLU	2.6
1	D	278	GLN	2.6
1	A	274	LYS	2.5
1	B	274	LYS	2.5
1	A	141	SER	2.5
1	A	268	PRO	2.5
1	C	220	THR	2.5
1	B	238	LYS	2.4
1	D	66	GLY	2.4
1	B	94	ALA	2.3
1	D	98	LEU	2.3
1	B	180	ALA	2.3
1	D	251	LEU	2.3
1	B	234	GLY	2.3
1	B	202	GLN	2.3
1	B	176	LYS	2.2

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Mol	Chain	Res	Type	RSRZ
1	C	63	ALA	2.2
1	D	366	ILE	2.2
1	D	149	ARG	2.2
1	A	366	ILE	2.2
1	A	368	ALA	2.2
1	C	366	ILE	2.2
1	D	133	PRO	2.2
1	C	196	PRO	2.2
1	D	128	LEU	2.1
1	C	235	GLU	2.1
1	D	94	ALA	2.1
1	C	282	GLU	2.1
1	C	100	VAL	2.1
1	B	148	LYS	2.1
1	A	278	GLN	2.1
1	C	133	PRO	2.1
1	C	272	GLU	2.1
1	C	317	ALA	2.1
1	C	91	SER	2.0
1	C	172	VAL	2.0
1	C	273	ARG	2.0
1	D	221	ASP	2.0
1	C	23	ARG	2.0
1	D	127	ALA	2.0

## 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, 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( $\text{\AA}^2$ )	Q<0.9
3	TRS	D	402	8/8	0.88	0.32	10.76	36,44,46,50	0
3	TRS	B	402	8/8	0.82	0.20	5.13	37,57,65,71	0
2	FAD	A	401	53/53	0.69	0.37	2.90	50,78,154,166	0
3	TRS	A	402	8/8	0.83	0.22	2.14	46,55,61,62	0
2	FAD	D	401	53/53	0.61	0.33	1.85	40,71,127,145	0
2	FAD	B	401	53/53	0.84	0.18	0.31	37,61,75,148	0
2	FAD	C	401	53/53	0.86	0.19	0.20	36,52,56,66	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.