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wwPDB X-ray Structure Validation Summary Report (i)

Jun 11, 2024 – 11:18 PM EDT

PDB ID	:	2A7S
Title	:	Crystal Structure of the Acyl-CoA Carboxylase, AccD5, from Mycobacterium tuberculosis
Authors	:	Lin, T.; Melgar, M.; Purdon, J.; Tseng, T.; Tsai, S.C.
Deposited on	:	2005-07-06
Resolution	:	2.90 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
https://www.wwpdb.org/validation/2017/XrayValidationReportHelp
with specific help available everywhere you see the (i) symbol.

The types of validation reports are described at
http://www.wwpdb.org/validation/2017/FAQs#types.

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

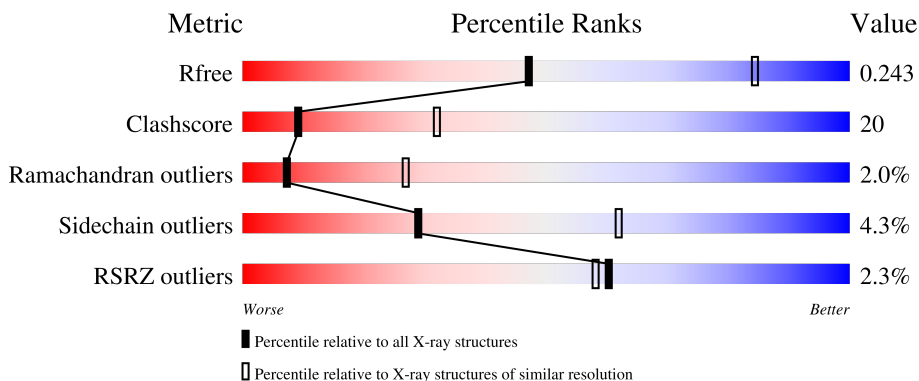|		
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.20.1
EDS	:	2.36.2
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36.2

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 2.90 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	Percentile Ranks	Value
Rfree		0.243
Clashscore		20
Ramachandran outliers		2.0%
Sidechain outliers		4.3%
RSRZ outliers		2.3%

Worse   *Better*

■ Percentile relative to all X-ray structures

▯ Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	1957 (2.90-2.90)
Clashscore	141614	2172 (2.90-2.90)
Ramachandran outliers	138981	2115 (2.90-2.90)
Sidechain outliers	138945	2117 (2.90-2.90)
RSRZ outliers	127900	1906 (2.90-2.90)

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 >=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 <=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	548	2% / 62% / 31% · · ·
1	B	548	2% / 64% / 30% · ·
1	C	548	3% / 65% / 29% · ·
1	D	548	2% / 64% / 30% · ·
1	E	548	2% / 57% / 36% · ·

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Mol	Chain	Length	Quality of chain
1	F	548	2% 67% 26%

2 Entry composition ⓘ

There are 2 unique types of molecules in this entry. The entry contains 25316 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 Probable propionyl-CoA carboxylase beta chain 5.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	529	Total 4030	C 2539	N 698	O 777	S 16	0	0	0
1	B	529	Total 4030	C 2539	N 698	O 777	S 16	0	0	0
1	C	529	Total 4030	C 2539	N 698	O 777	S 16	0	0	0
1	D	529	Total 4030	C 2539	N 698	O 777	S 16	0	0	0
1	E	529	Total 4030	C 2539	N 698	O 777	S 16	0	0	0
1	F	529	Total 4030	C 2539	N 698	O 777	S 16	0	0	0

- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	203	Total 203	O 203	0	0
2	B	220	Total 220	O 220	0	0
2	C	176	Total 176	O 176	0	0
2	D	175	Total 175	O 175	0	0
2	E	187	Total 187	O 187	0	0
2	F	175	Total 175	O 175	0	0

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 se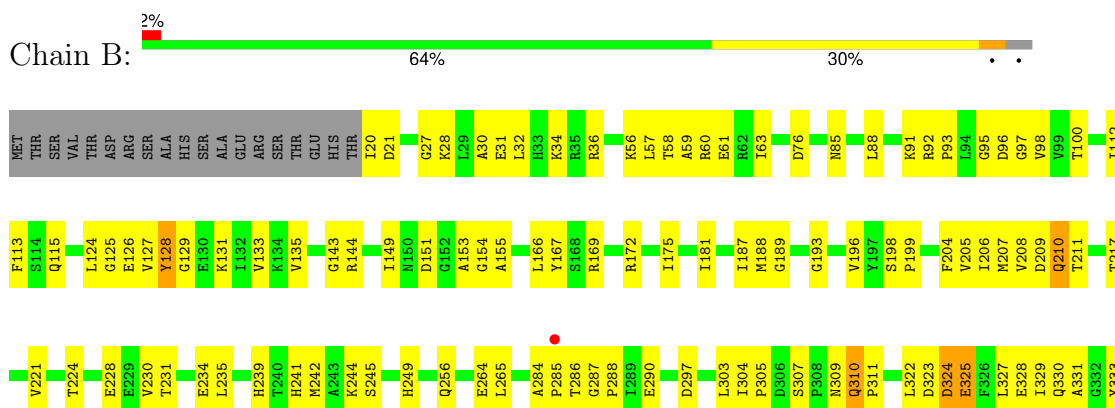quence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron 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: Probable propionyl-CoA carboxylase beta chain 5

Chain A:

• Molecule 1: Probable propionyl-CoA carboxylase beta chain 5

Chain B:

• Molecule 1: Probable propionyl-CoA carboxylase beta chain 5

Chain C:

• Molecule 1: Probable propionyl-CoA carboxylase beta chain 5
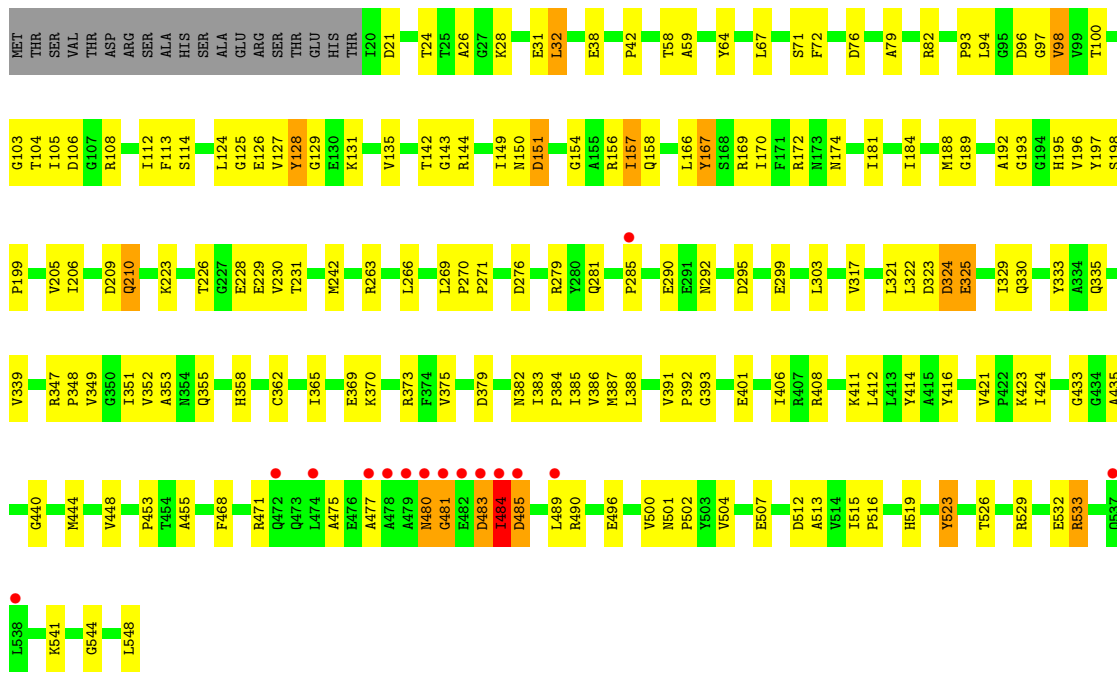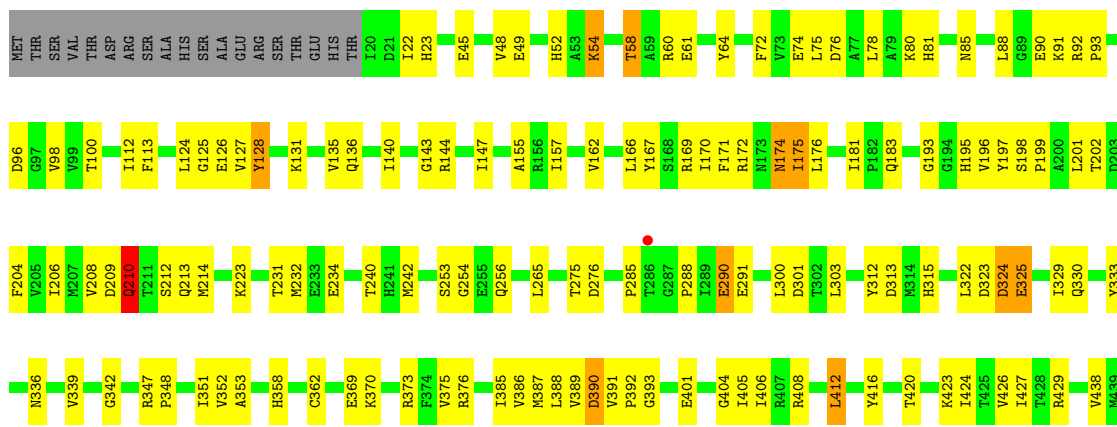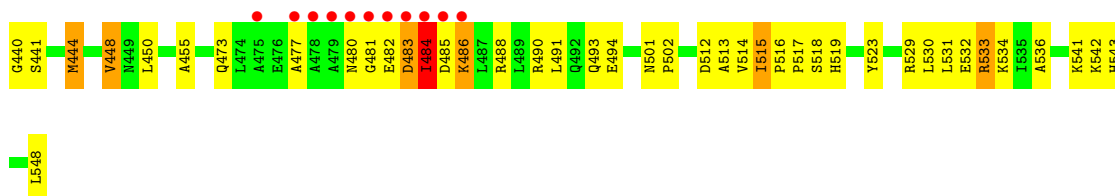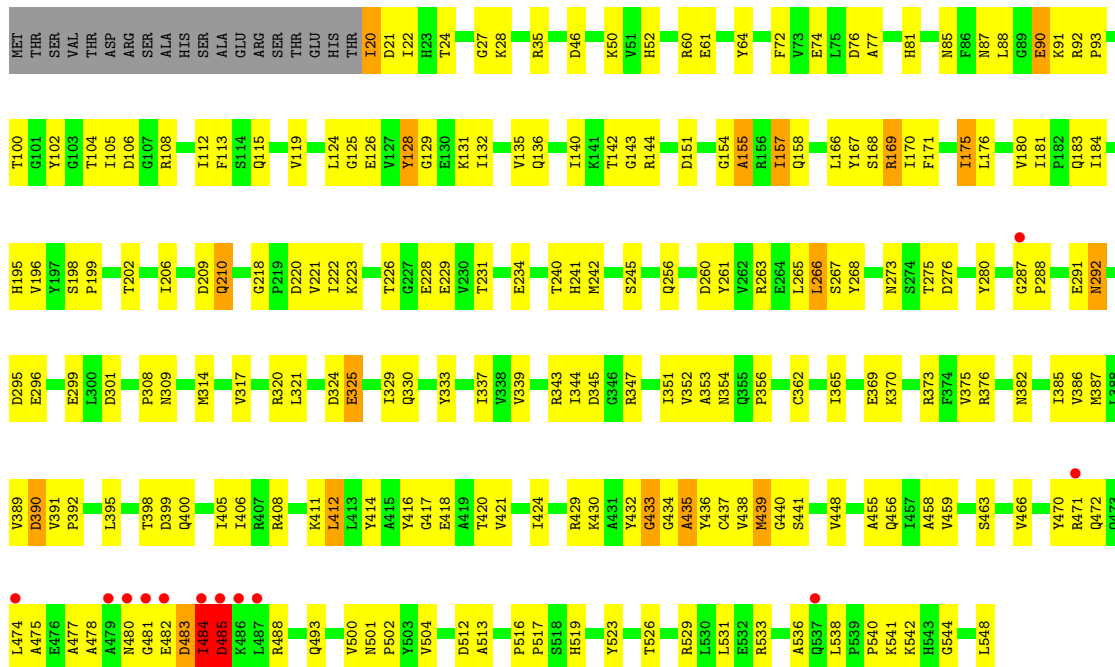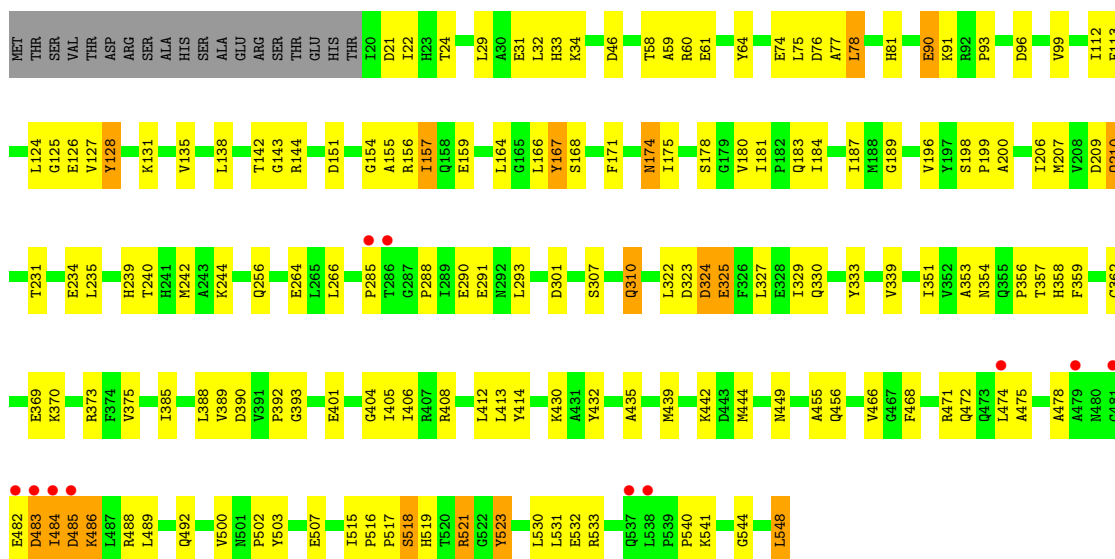
Chain D:

G440 S441 M444 V448 N449 L450 A455 Q473 L474 A475 E476 A477 A478 A479 N480 G481 E482 D483 I484 D485 K486 L487 R488 L489 R490 L491 Q492 Q493 E494 N501 P502 D512 A513 V514 I515 P516 P517 S518 H519 Y523 R529 L530 L531 E532 R533 K534 I535 A536 K541 K542 H543

L548

• Molecule 1: Probable propionyl-CoA carboxylase beta chain 5

Chain E:

2%

57%   36%   • •

MET THR SER VAL THR ASP ARG SER ALA HIS SER ALA GLU ARG SER THR GLU HIS THR I20 D21 I22 H23 T24 G27 K28 R35 D46 K50 V51 H52 R60 E61 Y64 F72 V73 E74 L75 D76 A77 H81 N85 F86 N87 L88 G89 E90 K91 R92 P93

T100 G101 Y102 G103 T104 I105 D106 G107 R108 I112 F113 S114 Q115 V119 L124 G125 E126 V127 Y128 G129 E130 K131 I132 V135 Q136 I140 K141 I142 G143 R144 D151 G154 A155 R156 I157 Q158 L166 Y167 S168 R169 I170 F171 I175 L176 V180 I181 P182 Q183 I184

H195 V196 Y197 S198 P199 T202 I206 D209 Q210 G218 P219 D220 V221 I222 K223 T226 G227 E228 E229 V230 T231 E234 T240 H241 M242 S245 Q256 D260 Y261 V262 R263 E264 L265 L266 S267 Y268 N273 S274 T275 D276 Y280 G287 P288 E291 N292

D295 E296 E299 L300 D301 P308 N309 M314 V317 R320 L321 D324 E325 I329 Q330 Y333 I337 V338 V339 R343 I344 D345 R347 I351 V352 A353 N354 Q355 P356 C362 I365 E369 K370 R373 F374 V375 R376 N382 I385 V386 M387 L388

V389 D390 V391 P392 L395 T398 D399 Q400 I405 I406 R407 R408 K411 L412 L413 Y414 A415 Y416 G417 E418 A419 T420 V421 I424 R429 K430 A431 Y432 G433 E434 A435 V436 C437 V438 M439 G440 S441 V448 A455 Q456 I457 A458 V459 S463 V466 Y470 R471 Q472 Q473

L474 A475 E476 A477 A478 A479 N480 G481 E482 D483 I484 D485 K486 L487 R488 Q493 V500 N501 P502 Y503 V504 D512 A513 P516 P517 S518 H519 Y523 T526 R529 L530 L531 E532 R533 A536 Q537 L538 P539 P540 K541 K542 H543 G544 L548

• Molecule 1: Probable propionyl-CoA carboxylase beta chain 5

Chain F:

2%

67%   26%   • •

MET THR SER VAL THR ASP ARG SER ALA HIS SER ALA GLU ARG SER THR GLU HIS THR I20 D21 I22 H23 T24 L29 A30 E31 L32 H33 K34 D46 T58 A59 R60 E61 Y64 E74 L75 D76 A77 L78 H81 E90 K91 P93 D96 V99 I112 F113

L124 G125 E126 V127 Y128 K131 V135 L138 T142 G143 R144 D151 G154 A155 R156 I157 Q158 E159 L164 G165 L166 Y167 S168 F171 N174 I175 S178 G179 V180 I181 P182 Q183 I184 I187 M188 G189 V196 Y197 S198 P199 A200 I206 M207 V208 D209 Q210

T231 E234 L235 H239 T240 H241 M242 A243 K244 Q256 E264 L265 L266 P285 T286 G287 P288 E290 E291 N292 L293 D301 S307 Q310 L322 D323 D324 E325 F326 L327 E328 I329 Q330 Y333 V339 I351 V352 A353 N354 Q355 P356 T357 H358 F359 C362

E369 K370 R373 F374 V375 I385 L388 V389 D390 V391 P392 G393 E401 G404 I405 I406 R407 R408 L412 L413 Y414 K430 A431 Y432 A435 M439 K442 D443 M444 N449 A455 Q456 V466 G467 F468 R471 Q472 Q473 L474 A475 A478 A479 N480 G481

E482 D483 I484 D485 K486 L487 R488 L489 Q492 V500 N501 P502 Y503 E507 I515 P516 P517 S518 H519 T520 R521 G522 Y523 L530 L531 E532 R533 Q537 L538 P539 P540 K541 G544 L548

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 41 21 2	Depositor
Cell constants a, b, c, α, β, γ	175.25Å 175.25Å 343.00Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	47.88 – 2.90 47.88 – 2.90	Depositor EDS
% Data completeness (in resolution range)	91.5 (47.88-2.90) 91.6 (47.88-2.90)	Depositor EDS
R_{merge}	0.16	Depositor
R_{sym}	0.11	Depositor
$< I/\sigma(I) >$ [1]	2.56 (at 2.91Å)	Xtriage
Refinement program	CNS 1.1	Depositor
R, R_{free}	0.193 , 0.245 0.192 , 0.243	Depositor DCC
R_{free} test set	10829 reflections (9.41%)	wwPDB-VP
Wilson B-factor (Å^2)	39.3	Xtriage
Anisotropy	0.038	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.29 , 44.2	EDS
L-test for twinning[2]	$< |L| > = 0.49, < L^2 > = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.93	EDS
Total number of atoms	25316	wwPDB-VP
Average B, all atoms (Å^2)	39.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.15% of the height of the origin peak. No significant pseudotranslation is detected.*

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[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 ⓘ

5.1 Standard geometry ⓘ

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	0.38	0/4107	0.63	0/5576
1	B	0.39	0/4107	0.62	0/5576
1	C	0.41	0/4107	0.66	0/5576
1	D	0.40	0/4107	0.63	0/5576
1	E	0.39	0/4107	0.63	0/5576
1	F	0.38	0/4107	0.63	0/5576
All	All	0.39	0/24642	0.63	0/33456

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	C	0	1
1	D	0	1
All	All	0	2

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	C	128	TYR	Sidechain
1	D	128	TYR	Sidechain

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	4030	0	3997	174	0
1	B	4030	0	3997	158	0
1	C	4030	0	3997	158	0
1	D	4030	0	3997	157	0
1	E	4030	0	3997	197	0
1	F	4030	0	3997	153	0
2	A	203	0	0	19	0
2	B	220	0	0	23	0
2	C	176	0	0	14	0
2	D	175	0	0	9	0
2	E	187	0	0	31	0
2	F	175	0	0	26	0
All	All	25316	0	23982	964	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 20.

The worst 5 of 964 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:484:ILE:O	1:C:485:ASP:HB2	1.46	1.11
1:A:209:ASP:O	1:A:210:GLN:HB2	1.31	1.09
1:C:483:ASP:O	1:C:484:ILE:O	1.69	1.09
1:F:485:ASP:CB	1:F:488:ARG:HB2	1.83	1.08
1:D:209:ASP:O	1:D:210:GLN:HB2	1.38	1.08

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	527/548 (96%)	476 (90%)	44 (8%)	7 (1%)	12	37
1	B	527/548 (96%)	482 (92%)	34 (6%)	11 (2%)	7	26
1	C	527/548 (96%)	477 (90%)	37 (7%)	13 (2%)	5	21
1	D	527/548 (96%)	474 (90%)	43 (8%)	10 (2%)	8	28
1	E	527/548 (96%)	470 (89%)	45 (8%)	12 (2%)	6	23
1	F	527/548 (96%)	484 (92%)	33 (6%)	10 (2%)	8	28
All	All	3162/3288 (96%)	2863 (90%)	236 (8%)	63 (2%)	7	27

5 of 63 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	210	GLN
1	A	480	ASN
1	A	483	ASP
1	B	325	GLU
1	B	480	ASN

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	423/440 (96%)	398 (94%)	25 (6%)	19	49
1	B	423/440 (96%)	408 (96%)	15 (4%)	36	70
1	C	423/440 (96%)	410 (97%)	13 (3%)	40	74
1	D	423/440 (96%)	402 (95%)	21 (5%)	24	57
1	E	423/440 (96%)	405 (96%)	18 (4%)	29	62
1	F	423/440 (96%)	405 (96%)	18 (4%)	29	62
All	All	2538/2640 (96%)	2428 (96%)	110 (4%)	29	62

5 of 110 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	D	169	ARG

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Mol	Chain	Res	Type
1	D	523	TYR
1	F	548	LEU
1	F	266	LEU
1	D	175	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 61 such sidechains are listed below:

Mol	Chain	Res	Type
1	D	158	GLN
1	F	183	GLN
1	D	403	ASN
1	F	174	ASN
1	F	473	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 monosaccharides in this entry.

5.6 Ligand geometry ⓘ

There are no ligands in this entry.

5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

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, 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	529/548 (96%)	-0.38	12 (2%)	60	58	19, 34, 86, 125	0
1	B	529/548 (96%)	-0.46	10 (1%)	66	65	19, 35, 82, 132	0
1	C	529/548 (96%)	-0.44	15 (2%)	53	49	18, 32, 86, 138	0
1	D	529/548 (96%)	-0.53	12 (2%)	60	58	18, 33, 84, 134	0
1	E	529/548 (96%)	-0.53	12 (2%)	60	58	18, 32, 75, 128	0
1	F	529/548 (96%)	-0.44	11 (2%)	63	61	18, 35, 82, 125	0
All	All	3174/3288 (96%)	-0.46	72 (2%)	60	58	18, 33, 84, 138	0

The worst 5 of 72 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	E	481	GLY	4.8
1	C	481	GLY	4.7
1	F	485	ASP	4.7
1	D	484	ILE	4.5
1	E	484	ILE	4.3

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

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

6.3 Carbohydrates ⓘ

There are no monosaccharides in this entry.

6.4 Ligands ⓘ

There are no ligands in this entry.

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6.5 Other polymers ⓘ

There are no such residues in this entry.