Full wwPDB X-ray Structure Validation Report (i)

Apr 28, 2025 – 08:07 PM EDT

PDB ID : 2QPE / pdb_00002qpe

Title : An unexpected outcome of surface-engineering an integral membrane protein: Improved crystallization of cytochrome ba3 oxidase from Thermus thermophilus

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Deposited on : 2007-07-23

Resolution : 2.90 Å(reported)

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

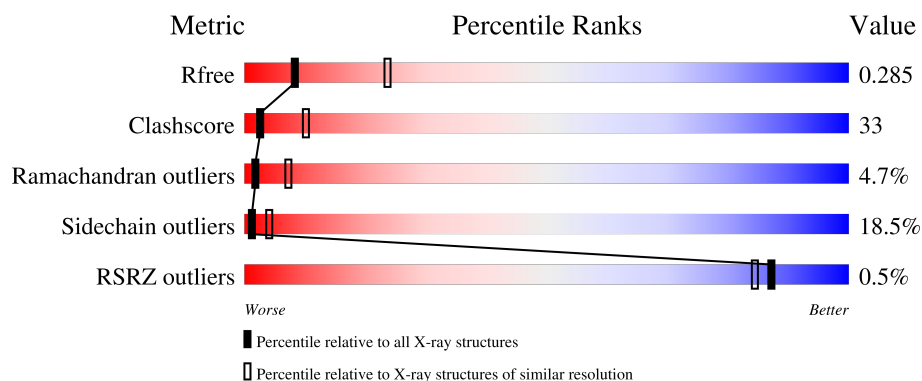|		
MolProbity	:	4-5-2 with Phenix2.0rc1
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.0rc1
EDS	:	3.0
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.006 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.43.1

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		0.285
Clashscore		33
Ramachandran outliers		4.7%
Sidechain outliers		18.5%
RSRZ outliers		0.5%

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}	164625	2335 (2.90-2.90)
Clashscore	180529	2564 (2.90-2.90)
Ramachandran outliers	177936	2514 (2.90-2.90)
Sidechain outliers	177891	2516 (2.90-2.90)
RSRZ outliers	164620	2337 (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	568	37% / 46% / 14%
2	B	168	49% / 39% / 9%
3	C	34	35% / 38% / 24%

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 criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
6	HAS	A	801	X	-	-	-

2 Entry composition ⓘ

There are 7 unique types of molecules in this entry. The entry contains 6077 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 Cytochrome c oxidase subunit 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	557	Total 4409	C 2985	N 709	O 699	S 16	0	0	0

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-5	MET	-	expression tag	UNP Q5SJ79
A	-4	HIS	-	expression tag	UNP Q5SJ79
A	-3	HIS	-	expression tag	UNP Q5SJ79
A	-2	HIS	-	expression tag	UNP Q5SJ79
A	-1	HIS	-	expression tag	UNP Q5SJ79
A	0	HIS	-	expression tag	UNP Q5SJ79
A	1	HIS	-	expression tag	UNP Q5SJ79
A	258	ARG	LYS	engineered mutation	UNP Q5SJ79

- Molecule 2 is a protein called Cytochrome c oxidase subunit 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	166	Total 1298	C 844	N 217	O 233	S 4	0	0	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	4	GLN	GLU	engineered mutation	UNP Q5SJ80

- Molecule 3 is a protein called Cytochrome c oxidase polypeptide 2A.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
3	C	33	Total 259	C 179	N 39	O 41	0	0	0

- Molecule 4 is COPPER (I) ION (CCD ID: CU1) (formula: Cu).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	1	Total Cu 1 1		0	0

- Molecule 5 is PROTOPORPHYRIN IX CONTAINING FE (CCD ID: HEM) (formula: $C_{34}H_{32}FeN_4O_4$).
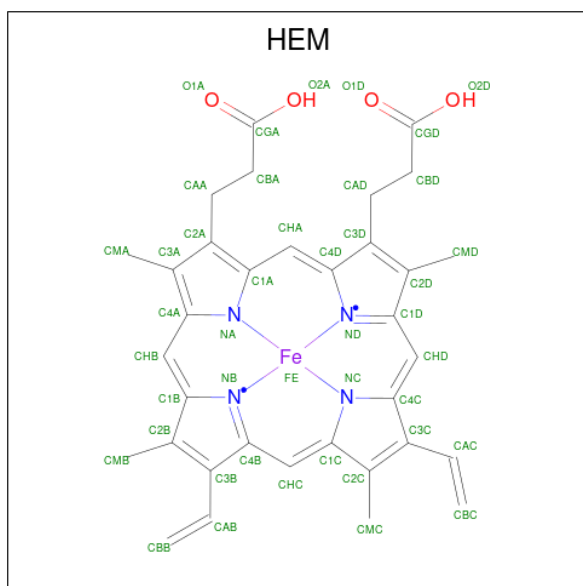
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
5	A	1	Total 43	C 34	Fe 1	N 4	O 4	0	0

- Molecule 6 is HEME-AS (CCD ID: HAS) (formula: $C_{54}H_{64}FeN_4O_6$).
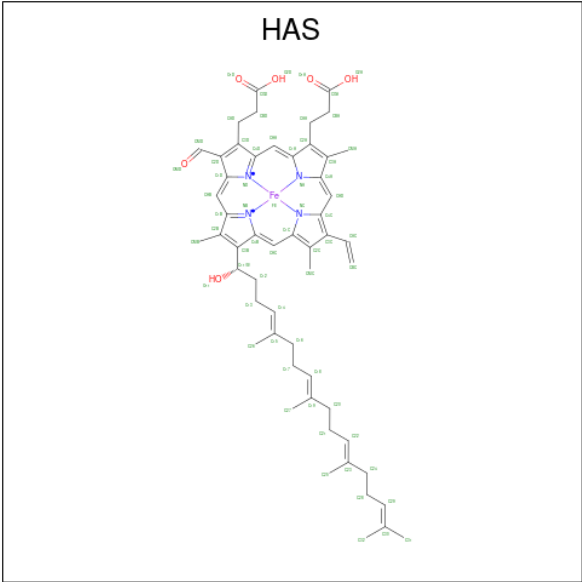
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
6	A	1	Total	C	Fe	N	O	0	0
			65	54	1	4	6		

• Molecule 7 is DINUCLEAR COPPER ION (CCD ID: CUA) (formula: Cu_2).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	B	1	Total	Cu	0	0
			2	2		

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: Cytochrome c oxidase subunit 1

• Molecule 2: Cytochrome c oxidase subunit 2

Y82 V83 L84 A85 F86 A87 F88 P92 I95 E96 V97 P98 Q99 G100 A101 E102 I103 V104 F105 K106 I107 T108 S109 P110 D111 V112 I113 H114 G115 E119 N122 V127 V132 S133 T134 V135 R136 F139 K140 R141 P142 Y145 R146 I147 I148 C149 N150 G154 L155 G156

H157 Q158 N159 M160 F161 V166 K167 E168

• Molecule 3: Cytochrome c oxidase polypeptide 2A

Chain C:

35%   38%   24%   •

MET E2 K6 L9 A10 V11 I12 L13 V14 L15 T16 L20 V21 L24 G25 V26 Y27 A28 V29 F30 F31 A32 R33 G34

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 41 21 2	Depositor
Cell constants a, b, c, α, β, γ	114.64Å 114.64Å 148.57Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	19.99 – 2.90 19.99 – 2.90	Depositor EDS
% Data completeness (in resolution range)	95.1 (19.99-2.90) 94.7 (19.99-2.90)	Depositor EDS
R_{merge}	0.04	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.33 (at 2.88Å)	Xtriage
Refinement program	REFMAC 5.2.0019	Depositor
R, R_{free}	0.234 , 0.302 0.196 , 0.285	Depositor DCC
R_{free} test set	1083 reflections (5.06%)	wwPDB-VP
Wilson B-factor (Å^2)	93.1	Xtriage
Anisotropy	0.073	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.27 , 66.3	EDS
L-test for twinning[2]	$< |L| > = 0.48, < L^2 > = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	6077	wwPDB-VP
Average B, all atoms (Å^2)	92.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.84% 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 ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: CU1, HAS, HEM, CUA

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	1.21	9/4566 (0.2%)	1.42	35/6266 (0.6%)
2	B	1.19	3/1335 (0.2%)	1.42	13/1822 (0.7%)
3	C	1.27	0/265	1.44	4/359 (1.1%)
All	All	1.20	12/6166 (0.2%)	1.42	52/8447 (0.6%)

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	A	0	1
2	B	0	1
All	All	0	2

All (12) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	72	VAL	CA-CB	7.26	1.64	1.54
1	A	119	VAL	CA-CB	6.94	1.64	1.54
1	A	547	VAL	CA-CB	6.38	1.63	1.54
2	B	45	ILE	CA-C	-6.11	1.48	1.53
1	A	378	THR	CA-C	-5.89	1.45	1.52
1	A	90	VAL	CA-CB	5.83	1.62	1.54
1	A	434	ILE	CA-CB	5.48	1.60	1.54
1	A	223	VAL	CA-CB	5.47	1.60	1.54
1	A	357	ILE	CA-C	5.32	1.58	1.52
1	A	162	ILE	CA-CB	5.30	1.59	1.54
2	B	35	TYR	N-CA	-5.29	1.40	1.46
1	A	302	THR	N-CA	5.12	1.52	1.46

WORLDWIDE PDB
PROTEIN DATA BANK

All (52) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	218	GLY	N-CA-C	9.95	126.12	110.90
1	A	357	ILE	CA-C-N	-9.93	108.35	119.28
1	A	357	ILE	C-N-CA	-9.93	108.35	119.28
2	B	155	LEU	N-CA-C	8.35	122.73	112.54
3	C	12	ILE	N-CA-C	-7.56	105.19	113.43
1	A	103	MET	N-CA-C	7.44	121.46	112.38
1	A	79	VAL	N-CA-C	7.40	118.00	110.82
1	A	330	ARG	CA-C-N	-6.82	115.52	122.27
1	A	330	ARG	C-N-CA	-6.82	115.52	122.27
1	A	262	ASP	N-CA-C	-6.81	103.36	112.55
1	A	460	TYR	CA-C-N	6.78	128.31	119.84
1	A	460	TYR	C-N-CA	6.78	128.31	119.84
1	A	241	LEU	CA-C-N	-6.54	111.80	119.05
1	A	241	LEU	C-N-CA	-6.54	111.80	119.05
2	B	97	VAL	CA-C-N	6.51	126.27	119.76
2	B	97	VAL	C-N-CA	6.51	126.27	119.76
1	A	251	LEU	CA-C-N	-6.37	112.44	119.19
1	A	251	LEU	C-N-CA	-6.37	112.44	119.19
2	B	113	ILE	CB-CA-C	-6.32	101.91	111.33
2	B	166	VAL	N-CA-CB	6.23	117.32	110.53
1	A	393	VAL	N-CA-CB	6.21	117.14	110.62
1	A	66	TYR	N-CA-C	6.13	118.75	111.33
2	B	52	ARG	N-CA-C	6.05	119.14	110.24
1	A	360	GLY	N-CA-C	-6.03	105.20	112.49
1	A	223	VAL	N-CA-CB	5.98	117.40	110.65
1	A	442	ALA	N-CA-C	-5.95	104.88	111.36
1	A	300	VAL	N-CA-CB	5.73	116.87	110.62
1	A	290	ILE	CB-CA-C	5.70	118.66	110.33
1	A	503	GLU	N-CA-C	-5.69	105.00	111.14
1	A	25	LEU	CB-CG-CD1	-5.66	93.71	110.70
1	A	187	VAL	N-CA-C	-5.66	105.59	110.74
2	B	166	VAL	N-CA-C	-5.61	101.49	108.89
1	A	13	GLU	N-CA-C	-5.54	105.50	114.09
2	B	24	ALA	N-CA-C	-5.53	104.95	110.97
2	B	115	GLY	N-CA-C	-5.53	102.67	111.18
1	A	302	THR	N-CA-C	5.48	117.96	111.33
3	C	11	VAL	CA-C-N	-5.44	115.30	122.16
3	C	11	VAL	C-N-CA	-5.44	115.30	122.16
3	C	12	ILE	CB-CA-C	5.41	117.60	110.84
1	A	336	ILE	N-CA-C	5.30	115.52	110.53
1	A	434	ILE	N-CA-CB	5.26	116.34	110.51
1	A	527	ILE	N-CA-C	5.25	115.87	110.36

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	B	47	ALA	N-CA-C	-5.25	102.28	110.10
1	A	277	THR	CA-C-N	5.23	126.37	119.84
1	A	277	THR	C-N-CA	5.23	126.37	119.84
1	A	468	VAL	N-CA-C	-5.21	105.63	110.53
1	A	38	PHE	N-CA-C	5.19	116.94	111.28
1	A	413	ILE	N-CA-C	5.14	114.70	106.88
2	B	109	SER	CA-C-N	5.13	124.82	119.64
2	B	109	SER	C-N-CA	5.13	124.82	119.64
2	B	95	ILE	N-CA-C	-5.12	99.79	107.37
1	A	351	LEU	N-CA-C	-5.08	105.44	111.69

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	8	ILE	Peptide
2	B	87	ALA	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	4409	0	4515	350	0
2	B	1298	0	1282	62	0
3	C	259	0	279	15	0
4	A	1	0	0	0	0
5	A	43	0	30	7	0
6	A	65	0	61	14	0
7	B	2	0	0	0	0
All	All	6077	0	6167	408	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 33.

All (408) 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:A:233:HIS:NE2	1:A:237:TYR:CE2	1.71	1.53
1:A:233:HIS:NE2	1:A:237:TYR:HE2	0.79	1.27
1:A:385:PHE:CB	6:A:801:HAS:HMA2	1.73	1.18
1:A:385:PHE:CG	6:A:801:HAS:HMA2	1.81	1.16
1:A:410:GLY:CA	1:A:502:ALA:HB2	1.74	1.16
1:A:182:VAL:HG21	1:A:508:PHE:HE2	1.08	1.12
1:A:518:ARG:HH21	1:A:518:ARG:HG3	1.08	1.11
1:A:7:GLU:HB3	1:A:10:ARG:HA	1.30	1.08
1:A:182:VAL:HG21	1:A:508:PHE:CE2	1.91	1.04
1:A:410:GLY:HA2	1:A:502:ALA:CB	1.90	1.01
2:B:142:PRO:HA	2:B:166:VAL:CG2	1.90	1.00
2:B:142:PRO:HA	2:B:166:VAL:HG22	1.48	0.95
1:A:497:ARG:C	1:A:499:PRO:HD3	1.91	0.95
1:A:506:LEU:H	1:A:506:LEU:HD23	1.32	0.94
1:A:385:PHE:HB2	6:A:801:HAS:CMA	1.98	0.93
1:A:410:GLY:HA2	1:A:502:ALA:HB2	0.94	0.93
1:A:430:LEU:O	1:A:434:ILE:HG13	1.70	0.91
1:A:562:TRP:HA	2:B:155:LEU:HD12	1.52	0.91
1:A:518:ARG:HG3	1:A:518:ARG:NH2	1.79	0.91
1:A:76:ASN:HB3	5:A:800:HEM:HBC2	1.53	0.89
1:A:233:HIS:CD2	1:A:237:TYR:CE2	2.61	0.89
1:A:233:HIS:CD2	1:A:237:TYR:HE2	1.91	0.88
1:A:385:PHE:HB2	6:A:801:HAS:HMA2	1.52	0.88
1:A:412:PRO:HB3	1:A:501:LEU:HD21	1.56	0.87
1:A:233:HIS:CE1	1:A:237:TYR:HE2	1.91	0.87
1:A:385:PHE:CB	6:A:801:HAS:CMA	2.53	0.87
1:A:12:TYR:CD1	1:A:19:LYS:HB2	2.10	0.86
1:A:449:ARG:HD2	1:A:450:ARG:HG3	1.58	0.85
1:A:20:ALA:HB3	1:A:106:MET:HE2	1.60	0.83
1:A:45:ASN:ND2	1:A:65:TYR:CE1	2.47	0.83
1:A:385:PHE:CG	6:A:801:HAS:CMA	2.61	0.83
1:A:7:GLU:CB	1:A:10:ARG:HA	2.11	0.81
1:A:329:GLY:HA2	1:A:330:ARG:HE	1.43	0.81
1:A:374:VAL:HG12	1:A:375:VAL:HG13	1.63	0.80
1:A:454:ALA:O	1:A:457:PRO:HG3	1.80	0.80
1:A:277:THR:H	1:A:278:PRO:HD2	1.46	0.80
1:A:233:HIS:CE1	1:A:282:HIS:HE1	2.01	0.79
1:A:277:THR:N	1:A:278:PRO:HD2	1.98	0.78
1:A:321:GLU:HA	1:A:335:TRP:CE3	2.19	0.78
1:A:385:PHE:CD2	6:A:801:HAS:HMA2	2.19	0.78
1:A:388:GLN:HB3	6:A:801:HAS:HMC2	1.66	0.78
1:A:162:ILE:O	1:A:165:ASP:HB3	1.84	0.77

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:307:VAL:HA	1:A:310:LEU:HD12	1.65	0.77
1:A:124:LEU:HD21	1:A:145:PHE:HD1	1.46	0.76
1:A:152:PHE:C	1:A:152:PHE:CD2	2.62	0.76
1:A:152:PHE:C	1:A:152:PHE:HD2	1.95	0.75
1:A:455:GLN:C	1:A:457:PRO:HD3	2.11	0.75
1:A:459:ALA:C	1:A:461:PRO:HD2	2.12	0.75
1:A:410:GLY:CA	1:A:502:ALA:CB	2.60	0.74
1:A:547:VAL:HG12	1:A:548:GLN:N	2.02	0.74
2:B:92:PRO:HD2	2:B:95:ILE:HD11	1.68	0.74
1:A:108:LEU:O	1:A:112:MET:HG3	1.87	0.74
1:A:124:LEU:HD21	1:A:145:PHE:CD1	2.21	0.74
1:A:518:ARG:HH21	1:A:518:ARG:CG	1.95	0.73
1:A:549:LEU:O	1:A:553:LEU:HD23	1.88	0.73
2:B:103:ILE:HD13	2:B:139:PHE:HD1	1.54	0.73
1:A:497:ARG:O	1:A:499:PRO:HD3	1.89	0.73
1:A:63:GLN:CG	1:A:127:ASN:HD22	2.02	0.73
1:A:10:ARG:O	1:A:12:TYR:N	2.22	0.72
1:A:233:HIS:HB3	1:A:234:PRO:CD	2.20	0.72
1:A:52:TYR:O	1:A:56:LYS:HB2	1.90	0.72
1:A:370:THR:HA	1:A:373:TYR:CE1	2.25	0.72
1:A:160:ILE:HD13	1:A:194:PHE:HB2	1.72	0.71
1:A:407:ASN:HD21	1:A:506:LEU:CD2	2.03	0.71
1:A:81:THR:HG1	1:A:239:TRP:CD1	2.09	0.71
1:A:107:TRP:O	1:A:111:TRP:HD1	1.73	0.71
1:A:365:VAL:HG12	1:A:366:ASN:N	2.05	0.71
1:A:390:ALA:O	1:A:394:THR:HB	1.91	0.71
1:A:264:MET:HA	1:A:264:MET:HE2	1.73	0.71
1:A:282:HIS:CD2	1:A:283:HIS:CD2	2.78	0.70
1:A:331:GLY:H	1:A:334:GLY:HA3	1.57	0.70
1:A:407:ASN:HD21	1:A:506:LEU:HD23	1.56	0.70
1:A:277:THR:N	1:A:278:PRO:CD	2.55	0.70
1:A:272:PHE:CZ	1:A:308:PRO:HB2	2.27	0.69
1:A:277:THR:H	1:A:278:PRO:CD	2.05	0.69
1:A:7:GLU:HB3	1:A:10:ARG:CA	2.15	0.69
1:A:220:ASP:OD2	2:B:52:ARG:NH1	2.26	0.69
1:A:20:ALA:CB	1:A:106:MET:HE2	2.22	0.69
1:A:76:ASN:HB3	5:A:800:HEM:CBC	2.21	0.69
1:A:27:LEU:HD23	1:A:83:LEU:CD2	2.23	0.68
1:A:233:HIS:CE1	1:A:282:HIS:CE1	2.80	0.68
1:A:329:GLY:HA2	1:A:330:ARG:NE	2.09	0.68
2:B:97:VAL:O	2:B:166:VAL:HA	1.93	0.68

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:27:LEU:HD23	1:A:83:LEU:HD22	1.74	0.68
1:A:294:TRP:CZ2	1:A:544:PRO:HG2	2.28	0.68
1:A:321:GLU:OE1	1:A:325:ARG:NH2	2.26	0.67
2:B:55:PRO:O	2:B:58:VAL:HG12	1.94	0.67
1:A:499:PRO:HB3	1:A:502:ALA:HB3	1.75	0.66
1:A:14:ALA:O	1:A:100:ARG:NH1	2.29	0.66
1:A:294:TRP:HZ2	1:A:544:PRO:HG2	1.60	0.65
1:A:234:PRO:HG3	1:A:277:THR:HA	1.79	0.65
1:A:97:LEU:HD21	1:A:180:PRO:HG2	1.78	0.65
1:A:152:PHE:CD2	1:A:152:PHE:O	2.50	0.65
2:B:86:PHE:O	2:B:88:PHE:N	2.28	0.65
1:A:233:HIS:CD2	1:A:233:HIS:C	2.74	0.65
1:A:63:GLN:HG3	1:A:127:ASN:HD22	1.60	0.65
1:A:45:ASN:ND2	1:A:65:TYR:HE1	1.96	0.64
1:A:156:THR:O	1:A:160:ILE:HG13	1.98	0.64
1:A:330:ARG:HD2	1:A:330:ARG:N	2.12	0.64
1:A:332:LEU:HD23	1:A:333:PHE:CE2	2.33	0.64
1:A:59:LEU:HB2	1:A:61:PHE:HE1	1.62	0.64
1:A:414:SER:OG	1:A:417:GLN:HG3	1.97	0.63
1:A:506:LEU:H	1:A:506:LEU:CD2	2.02	0.63
1:A:435:MET:HG2	1:A:439:LEU:HD22	1.79	0.63
1:A:330:ARG:N	1:A:330:ARG:CD	2.61	0.63
1:A:107:TRP:O	1:A:111:TRP:CD1	2.52	0.62
1:A:213:PHE:HB3	1:A:215:LEU:HD22	1.80	0.62
1:A:120:ALA:O	1:A:123:PRO:HD2	2.00	0.62
1:A:342:ASP:HB2	1:A:418:ARG:HH22	1.64	0.62
1:A:28:GLY:O	1:A:31:ALA:HB3	1.99	0.62
1:A:233:HIS:ND1	1:A:282:HIS:HE1	1.94	0.61
1:A:78:ILE:HG22	1:A:79:VAL:N	2.14	0.61
1:A:233:HIS:CD2	1:A:237:TYR:CD2	2.89	0.61
1:A:366:ASN:HB3	6:A:801:HAS:CMD	2.31	0.61
1:A:366:ASN:HB3	6:A:801:HAS:HMD	1.81	0.61
1:A:477:LEU:HA	1:A:480:ALA:HB3	1.83	0.61
1:A:385:PHE:O	1:A:389:VAL:HG12	2.01	0.61
2:B:142:PRO:HA	2:B:166:VAL:HG21	1.81	0.60
1:A:477:LEU:HD13	5:A:800:HEM:HMB1	1.83	0.60
2:B:83:VAL:HG12	2:B:84:LEU:N	2.17	0.60
1:A:335:TRP:O	1:A:339:LEU:HD22	2.02	0.60
1:A:370:THR:HA	1:A:373:TYR:CD1	2.36	0.60
1:A:56:LYS:O	1:A:60:PRO:HA	2.01	0.60
1:A:386:HIS:CD2	1:A:435:MET:HE1	2.37	0.60

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:539:VAL:O	1:A:543:GLY:HA3	2.03	0.59
1:A:102:ASN:OD1	1:A:102:ASN:O	2.21	0.59
1:A:307:VAL:HA	1:A:310:LEU:CD1	2.32	0.59
1:A:385:PHE:HB2	6:A:801:HAS:HMA1	1.84	0.59
1:A:551:GLY:C	1:A:552:HIS:ND1	2.61	0.59
1:A:50:ASP:O	1:A:53:PRO:HD2	2.03	0.58
1:A:388:GLN:N	1:A:388:GLN:HE21	2.00	0.58
1:A:52:TYR:N	1:A:53:PRO:HD2	2.19	0.58
1:A:342:ASP:O	1:A:418:ARG:NH2	2.36	0.58
2:B:92:PRO:HD2	2:B:95:ILE:CD1	2.32	0.58
1:A:233:HIS:HB3	1:A:234:PRO:HD2	1.84	0.58
1:A:547:VAL:CG1	1:A:548:GLN:N	2.67	0.58
1:A:137:PRO:HG2	1:A:224:ALA:CB	2.34	0.58
1:A:137:PRO:CG	1:A:224:ALA:HB1	2.33	0.58
1:A:59:LEU:HB2	1:A:61:PHE:CE1	2.37	0.58
1:A:420:LEU:HD12	1:A:424:VAL:HG23	1.84	0.58
1:A:186:ALA:O	1:A:190:TRP:HD1	1.86	0.57
3:C:26:VAL:O	3:C:27:TYR:C	2.47	0.57
1:A:186:ALA:O	1:A:190:TRP:CD1	2.57	0.57
1:A:400:SER:O	1:A:404:LEU:HB2	2.04	0.57
1:A:523:ALA:O	1:A:526:ARG:HG3	2.03	0.57
1:A:310:LEU:O	1:A:313:ALA:HB3	2.04	0.57
1:A:137:PRO:HG2	1:A:224:ALA:HB1	1.85	0.57
1:A:562:TRP:CA	2:B:155:LEU:HD12	2.30	0.57
1:A:98:ASN:ND2	1:A:98:ASN:O	2.38	0.57
1:A:446:ASN:OD1	2:B:119:GLU:HG3	2.04	0.57
1:A:146:TYR:CD2	1:A:208:LEU:HD13	2.41	0.56
1:A:211:TRP:HZ2	1:A:558:GLY:HA3	1.70	0.56
2:B:32:LEU:O	2:B:35:TYR:HB3	2.06	0.56
1:A:282:HIS:HA	1:A:285:PHE:CZ	2.41	0.56
1:A:261:SER:HB3	1:A:264:MET:HB2	1.87	0.56
1:A:63:GLN:CG	1:A:127:ASN:ND2	2.67	0.56
1:A:377:ASN:HB3	2:B:150:ASN:O	2.06	0.56
2:B:157:HIS:C	2:B:159:ASN:H	2.13	0.56
1:A:119:VAL:HG12	1:A:148:GLY:CA	2.35	0.56
1:A:459:ALA:O	2:B:146:ARG:NH1	2.34	0.56
1:A:220:ASP:HB3	1:A:223:VAL:HG22	1.87	0.55
1:A:91:TYR:CE1	1:A:95:ARG:HD2	2.42	0.55
1:A:191:LEU:HB3	1:A:531:PHE:CD2	2.41	0.55
1:A:410:GLY:HA3	1:A:499:PRO:HG3	1.88	0.55
2:B:86:PHE:CD1	2:B:86:PHE:C	2.86	0.54

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:314:PHE:CZ	2:B:14:TYR:HB3	2.43	0.54
1:A:330:ARG:H	1:A:334:GLY:HA3	1.73	0.54
1:A:391:SER:O	1:A:395:LEU:HD12	2.07	0.54
2:B:70:ALA:HB1	2:B:82:TYR:O	2.07	0.54
1:A:382:PRO:HA	1:A:385:PHE:CE2	2.41	0.54
1:A:274:LEU:N	1:A:274:LEU:CD1	2.70	0.54
1:A:388:GLN:NE2	1:A:388:GLN:CA	2.70	0.54
1:A:389:VAL:HG22	5:A:800:HEM:HAC	1.88	0.54
1:A:456:VAL:HG23	1:A:456:VAL:O	2.08	0.54
1:A:547:VAL:HG12	1:A:548:GLN:H	1.72	0.54
1:A:460:TYR:N	1:A:461:PRO:CD	2.70	0.54
2:B:96:GLU:HB3	2:B:167:LYS:NZ	2.22	0.54
2:B:157:HIS:O	2:B:159:ASN:N	2.40	0.54
1:A:27:LEU:O	1:A:28:GLY:C	2.51	0.53
1:A:152:PHE:HD2	1:A:152:PHE:O	1.90	0.53
1:A:344:PRO:HG3	1:A:422:LEU:HG	1.90	0.53
1:A:300:VAL:HG22	2:B:30:ILE:HD13	1.90	0.53
2:B:105:PHE:CZ	2:B:139:PHE:HE1	2.26	0.53
2:B:42:ALA:HB1	2:B:45:ILE:HD12	1.90	0.53
2:B:3:ASP:OD1	3:C:2:GLU:HB3	2.09	0.53
1:A:181:LEU:O	1:A:185:MET:HG3	2.09	0.53
1:A:48:ASN:ND2	1:A:467:MET:HE2	2.24	0.53
1:A:135:PHE:O	1:A:137:PRO:HD3	2.08	0.53
1:A:388:GLN:NE2	1:A:388:GLN:HA	2.24	0.53
1:A:420:LEU:O	1:A:421:GLY:C	2.52	0.53
1:A:106:MET:O	1:A:109:SER:HB3	2.08	0.52
3:C:29:VAL:O	3:C:30:PHE:C	2.51	0.52
1:A:423:ALA:O	1:A:427:LEU:HB2	2.10	0.52
1:A:391:SER:HB2	1:A:395:LEU:HD11	1.92	0.52
1:A:189:PHE:O	1:A:192:MET:N	2.41	0.52
1:A:274:LEU:N	1:A:274:LEU:HD12	2.22	0.52
2:B:105:PHE:HZ	2:B:139:PHE:HE1	1.58	0.52
1:A:426:TRP:O	1:A:430:LEU:HD22	2.11	0.51
3:C:10:ALA:O	3:C:14:VAL:HG23	2.10	0.51
1:A:36:SER:O	1:A:40:PRO:HD3	2.10	0.51
1:A:120:ALA:HB2	1:A:148:GLY:HA3	1.92	0.51
1:A:195:LEU:CD2	1:A:534:ALA:HB1	2.40	0.51
1:A:390:ALA:HB1	1:A:432:MET:HE3	1.92	0.51
1:A:513:SER:O	2:B:5:HIS:CE1	2.63	0.51
1:A:240:LEU:HA	1:A:393:VAL:HG22	1.92	0.51
1:A:398:MET:HG2	1:A:484:PHE:CE1	2.46	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:52:TYR:N	1:A:53:PRO:CD	2.74	0.51
1:A:332:LEU:CD2	1:A:333:PHE:CE2	2.94	0.51
1:A:433:MET:O	1:A:436:ALA:HB3	2.11	0.51
1:A:7:GLU:O	1:A:10:ARG:HG3	2.11	0.51
1:A:56:LYS:CE	1:A:62:VAL:O	2.59	0.51
1:A:146:TYR:HD2	1:A:208:LEU:HD13	1.76	0.50
1:A:39:GLY:C	5:A:800:HEM:HMB3	2.36	0.50
1:A:46:TYR:CE1	5:A:800:HEM:HBA2	2.46	0.50
1:A:465:VAL:O	1:A:468:VAL:HG23	2.10	0.50
1:A:95:ARG:HA	1:A:95:ARG:CZ	2.41	0.50
1:A:384:HIS:O	1:A:388:GLN:HG2	2.12	0.50
1:A:450:ARG:O	2:B:157:HIS:HD2	1.94	0.50
2:B:113:ILE:HA	2:B:127:VAL:O	2.11	0.50
1:A:101:PRO:HA	1:A:166:LEU:HD11	1.94	0.50
1:A:365:VAL:HG12	1:A:366:ASN:H	1.74	0.50
2:B:157:HIS:C	2:B:159:ASN:N	2.70	0.50
1:A:37:LEU:O	1:A:40:PRO:HD2	2.12	0.50
1:A:379:ALA:O	1:A:382:PRO:HD2	2.12	0.50
1:A:20:ALA:HB3	1:A:106:MET:CE	2.38	0.50
1:A:124:LEU:CD2	1:A:129:ALA:HB3	2.41	0.50
1:A:233:HIS:CE1	1:A:237:TYR:CE2	2.78	0.50
1:A:93:PRO:HB3	1:A:183:THR:HA	1.94	0.49
1:A:233:HIS:CB	1:A:234:PRO:CD	2.87	0.49
1:A:459:ALA:C	1:A:461:PRO:CD	2.84	0.49
2:B:145:TYR:CE1	2:B:166:VAL:HG13	2.47	0.49
1:A:385:PHE:HB3	6:A:801:HAS:HMA2	1.82	0.49
1:A:410:GLY:O	1:A:501:LEU:CD1	2.61	0.49
1:A:410:GLY:O	1:A:501:LEU:HD11	2.12	0.49
2:B:99:GLN:O	2:B:99:GLN:HG3	2.10	0.49
1:A:63:GLN:HB2	1:A:127:ASN:ND2	2.28	0.49
1:A:182:VAL:CG2	1:A:508:PHE:HE2	2.00	0.49
1:A:192:MET:HG3	1:A:272:PHE:O	2.12	0.49
1:A:391:SER:C	1:A:395:LEU:HD12	2.38	0.49
2:B:64:TRP:CD1	2:B:83:VAL:O	2.65	0.49
1:A:240:LEU:O	1:A:240:LEU:HG	2.12	0.49
1:A:101:PRO:HB3	1:A:166:LEU:HD11	1.94	0.49
2:B:47:ALA:HB2	2:B:134:THR:HB	1.95	0.49
1:A:459:ALA:O	1:A:461:PRO:HD2	2.12	0.48
1:A:10:ARG:O	1:A:11:VAL:C	2.56	0.48
1:A:262:ASP:O	1:A:263:PRO:C	2.56	0.48
1:A:119:VAL:HG12	1:A:148:GLY:HA2	1.95	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:365:VAL:O	1:A:366:ASN:C	2.57	0.48
2:B:27:PHE:HA	2:B:30:ILE:HG13	1.95	0.48
1:A:79:VAL:HG13	1:A:152:PHE:HE1	1.79	0.48
1:A:252:PRO:O	1:A:255:ALA:HB3	2.14	0.48
1:A:388:GLN:HE21	1:A:388:GLN:CA	2.26	0.48
1:A:63:GLN:CB	1:A:127:ASN:ND2	2.77	0.48
1:A:262:ASP:N	1:A:263:PRO:HD2	2.28	0.48
1:A:132:LEU:C	1:A:134:THR:H	2.22	0.47
1:A:330:ARG:HD2	1:A:330:ARG:H	1.79	0.47
1:A:488:LEU:CD1	1:A:492:LEU:HD12	2.44	0.47
1:A:373:TYR:OH	2:B:45:ILE:HG12	2.13	0.47
1:A:101:PRO:O	1:A:103:MET:N	2.47	0.47
1:A:41:PHE:CE1	1:A:55:LEU:HD12	2.50	0.47
2:B:83:VAL:HG12	2:B:84:LEU:H	1.79	0.47
1:A:33:ILE:O	1:A:33:ILE:HG22	2.14	0.47
1:A:518:ARG:HA	1:A:518:ARG:HD2	1.69	0.47
2:B:142:PRO:CA	2:B:166:VAL:HG22	2.32	0.47
1:A:41:PHE:CD1	1:A:55:LEU:HD12	2.49	0.47
1:A:450:ARG:O	2:B:157:HIS:CD2	2.67	0.47
1:A:504:ALA:HA	1:A:505:PRO:HD3	1.84	0.47
2:B:63:PRO:HG2	2:B:82:TYR:CD2	2.50	0.47
1:A:193:TRP:CE3	1:A:193:TRP:HA	2.50	0.46
1:A:314:PHE:CD1	2:B:15:GLU:HG2	2.50	0.46
1:A:407:ASN:ND2	1:A:506:LEU:HD22	2.30	0.46
1:A:511:VAL:HG12	1:A:512:ILE:C	2.39	0.46
1:A:78:ILE:O	1:A:82:GLN:HB2	2.15	0.46
1:A:89:MET:HB2	1:A:190:TRP:CZ2	2.50	0.46
1:A:273:LEU:C	1:A:274:LEU:HD12	2.40	0.46
2:B:26:LEU:O	2:B:30:ILE:HG13	2.14	0.46
1:A:79:VAL:HG13	1:A:152:PHE:CE1	2.50	0.46
1:A:101:PRO:O	1:A:103:MET:HG2	2.15	0.46
1:A:192:MET:CG	1:A:273:LEU:HA	2.44	0.46
1:A:340:PRO:C	1:A:342:ASP:H	2.23	0.46
1:A:32:LEU:HA	1:A:76:ASN:ND2	2.30	0.46
1:A:360:GLY:O	1:A:364:ILE:HG13	2.16	0.46
1:A:374:VAL:HG21	3:C:30:PHE:HA	1.98	0.46
2:B:119:GLU:OE2	2:B:146:ARG:NH2	2.46	0.46
1:A:460:TYR:N	1:A:461:PRO:HD2	2.28	0.46
1:A:42:GLN:HG2	1:A:52:TYR:OH	2.16	0.46
1:A:518:ARG:NH2	1:A:518:ARG:CG	2.59	0.46
1:A:12:TYR:CE1	1:A:19:LYS:HB2	2.50	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:56:LYS:NZ	1:A:62:VAL:O	2.49	0.46
1:A:79:VAL:HA	1:A:152:PHE:CZ	2.51	0.46
1:A:96:GLU:O	1:A:96:GLU:HG2	2.16	0.46
1:A:143:TRP:CE3	1:A:213:PHE:HE2	2.33	0.45
1:A:403:TRP:CZ3	1:A:404:LEU:HD22	2.51	0.45
1:A:385:PHE:CD1	1:A:385:PHE:C	2.94	0.45
1:A:372:ASP:OD1	1:A:376:HIS:HB2	2.17	0.45
3:C:12:ILE:HA	3:C:15:LEU:HB3	1.98	0.45
2:B:148:ILE:HG23	2:B:161:PHE:CE2	2.52	0.45
2:B:101:ALA:O	2:B:103:ILE:HD12	2.16	0.45
1:A:181:LEU:CD1	1:A:266:ARG:HG3	2.46	0.45
1:A:407:ASN:ND2	1:A:506:LEU:CD2	2.77	0.45
1:A:427:LEU:HA	1:A:427:LEU:HD23	1.54	0.45
2:B:154:GLY:O	2:B:157:HIS:HB2	2.16	0.45
1:A:199:GLY:HA3	1:A:230:TRP:HB3	1.99	0.45
1:A:207:PHE:CD1	1:A:219:VAL:HG13	2.52	0.45
1:A:363:GLY:O	1:A:366:ASN:HB2	2.17	0.45
3:C:31:PHE:O	3:C:34:GLY:N	2.44	0.45
1:A:92:LEU:O	1:A:93:PRO:C	2.57	0.45
1:A:404:LEU:O	1:A:408:LEU:HG	2.17	0.44
1:A:439:LEU:HD13	1:A:470:ASN:OD1	2.15	0.44
1:A:548:GLN:O	1:A:551:GLY:N	2.50	0.44
1:A:24:PHE:HZ	1:A:109:SER:OG	2.00	0.44
1:A:355:GLY:HA2	1:A:358:PRO:HD2	1.99	0.44
1:A:81:THR:OG1	1:A:239:TRP:CD1	2.70	0.44
1:A:119:VAL:CG1	1:A:148:GLY:HA2	2.48	0.44
1:A:381:VAL:HG12	1:A:385:PHE:CD2	2.52	0.44
3:C:20:LEU:O	3:C:21:VAL:C	2.60	0.44
1:A:499:PRO:HB3	1:A:502:ALA:CB	2.47	0.44
2:B:74:THR:HG23	2:B:78:GLN:HB3	1.99	0.44
1:A:390:ALA:HB1	1:A:432:MET:CE	2.47	0.44
1:A:488:LEU:HD11	1:A:492:LEU:HD12	1.99	0.44
1:A:41:PHE:HD2	1:A:51:ALA:HB3	1.82	0.44
1:A:146:TYR:CD2	1:A:208:LEU:HB3	2.53	0.44
1:A:69:LEU:HD23	1:A:132:LEU:HD22	2.00	0.43
3:C:6:LYS:HA	3:C:9:LEU:HD12	2.00	0.43
1:A:506:LEU:O	1:A:508:PHE:N	2.49	0.43
1:A:105:LEU:HD23	1:A:105:LEU:HA	1.57	0.43
1:A:112:MET:HB3	1:A:112:MET:HE2	1.76	0.43
1:A:374:VAL:HG23	2:B:122:ASN:ND2	2.34	0.43
1:A:184:TYR:CD1	1:A:527:ILE:HD11	2.53	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:96:GLU:CD	1:A:180:PRO:HB2	2.43	0.43
1:A:142:HIS:ND1	1:A:144:ALA:HB3	2.33	0.43
1:A:310:LEU:HB3	2:B:18:TRP:CZ2	2.54	0.43
1:A:69:LEU:HD23	1:A:132:LEU:CD2	2.49	0.43
1:A:195:LEU:HD12	1:A:195:LEU:HA	1.83	0.43
1:A:274:LEU:HD12	1:A:274:LEU:HA	1.80	0.43
1:A:486:TYR:O	1:A:490:SER:HB3	2.19	0.43
1:A:307:VAL:CA	1:A:310:LEU:HD12	2.42	0.42
1:A:324:GLY:HA3	1:A:335:TRP:HB2	2.01	0.42
1:A:401:LEU:O	1:A:405:LEU:HB2	2.19	0.42
1:A:420:LEU:HD12	1:A:420:LEU:O	2.19	0.42
1:A:522:LEU:HD12	1:A:522:LEU:HA	1.51	0.42
2:B:51:GLU:OE2	2:B:132:VAL:HB	2.18	0.42
2:B:107:ILE:HG21	2:B:127:VAL:HG21	2.00	0.42
1:A:449:ARG:HH12	6:A:801:HAS:CGA	2.31	0.42
1:A:239:TRP:O	1:A:242:PRO:HD2	2.20	0.42
1:A:378:THR:OG1	1:A:380:TRP:HB3	2.19	0.42
1:A:498:LYS:N	1:A:499:PRO:HD3	2.27	0.42
3:C:16:THR:O	3:C:20:LEU:HG	2.19	0.42
1:A:204:ALA:HA	1:A:208:LEU:HB2	2.01	0.42
1:A:347:VAL:HG12	1:A:351:LEU:HD12	2.00	0.42
1:A:30:LEU:HD23	1:A:30:LEU:HA	2.00	0.42
1:A:188:VAL:O	1:A:189:PHE:O	2.37	0.42
1:A:325:ARG:NH1	1:A:331:GLY:O	2.53	0.42
2:B:105:PHE:HZ	2:B:139:PHE:CE1	2.36	0.42
3:C:27:TYR:O	3:C:28:ALA:C	2.61	0.42
1:A:84:PHE:CE1	1:A:397:ALA:HA	2.54	0.42
1:A:134:THR:O	1:A:135:PHE:C	2.62	0.42
1:A:282:HIS:HA	1:A:285:PHE:CE2	2.54	0.42
1:A:130:THR:O	1:A:130:THR:HG22	2.19	0.42
1:A:342:ASP:HB2	1:A:418:ARG:NH2	2.34	0.42
2:B:24:ALA:O	2:B:28:VAL:HG23	2.20	0.42
1:A:27:LEU:HD23	1:A:83:LEU:HD21	2.01	0.42
1:A:61:PHE:H	1:A:61:PHE:HD1	1.68	0.42
1:A:229:TRP:HZ3	1:A:232:GLY:O	2.02	0.42
1:A:251:LEU:HA	1:A:254:GLN:CG	2.50	0.42
1:A:351:LEU:HD21	1:A:426:TRP:CH2	2.54	0.42
1:A:561:LEU:HD23	1:A:561:LEU:HA	1.72	0.42
1:A:56:LYS:HD3	1:A:62:VAL:O	2.20	0.41
1:A:82:GLN:HG2	1:A:238:PHE:CZ	2.55	0.41
1:A:178:VAL:HG22	1:A:522:LEU:CD1	2.50	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:387:LEU:HD23	1:A:387:LEU:HA	1.86	0.41
1:A:25:LEU:O	1:A:29:PHE:HD1	2.04	0.41
1:A:72:HIS:HE1	5:A:800:HEM:C4B	2.38	0.41
1:A:105:LEU:O	1:A:108:LEU:HB3	2.21	0.41
1:A:306:ALA:O	1:A:310:LEU:HD12	2.20	0.41
2:B:10:ALA:O	2:B:14:TYR:HD1	2.04	0.41
1:A:15:TYR:CZ	1:A:95:ARG:NH1	2.89	0.41
1:A:381:VAL:HB	1:A:382:PRO:HD3	2.03	0.41
1:A:82:GLN:NE2	1:A:156:THR:HG23	2.34	0.41
2:B:140:LYS:HB3	2:B:140:LYS:HE3	1.69	0.41
3:C:31:PHE:O	3:C:32:ALA:C	2.64	0.41
1:A:122:LEU:O	1:A:123:PRO:C	2.63	0.41
1:A:239:TRP:HE3	6:A:801:HAS:HBC2	1.85	0.41
1:A:259:LEU:HG	1:A:261:SER:H	1.85	0.41
1:A:374:VAL:HG11	3:C:26:VAL:HG13	2.02	0.41
1:A:411:LYS:HA	1:A:412:PRO:HD3	1.83	0.41
3:C:24:LEU:HD12	3:C:24:LEU:HA	1.97	0.41
1:A:38:PHE:HE2	1:A:62:VAL:HG21	1.86	0.41
1:A:132:LEU:O	1:A:134:THR:N	2.54	0.41
1:A:223:VAL:O	1:A:226:THR:N	2.53	0.41
1:A:466:PRO:O	1:A:469:PHE:N	2.54	0.41
2:B:40:HIS:CD2	2:B:41:THR:HG23	2.56	0.41
1:A:405:LEU:O	1:A:406:PRO:C	2.63	0.41
1:A:488:LEU:HD11	1:A:492:LEU:CD1	2.51	0.41
2:B:44:VAL:HG11	2:B:122:ASN:C	2.46	0.41
2:B:155:LEU:HD23	2:B:155:LEU:O	2.21	0.41
1:A:192:MET:HG2	1:A:273:LEU:HA	2.03	0.40
1:A:233:HIS:CD2	1:A:234:PRO:N	2.89	0.40
1:A:303:LEU:HD13	2:B:30:ILE:HG12	2.03	0.40
1:A:387:LEU:C	1:A:388:GLN:HE21	2.29	0.40
1:A:417:GLN:HE22	1:A:491:VAL:HA	1.86	0.40
1:A:9:SER:OG	1:A:11:VAL:HG23	2.22	0.40
1:A:184:TYR:CD2	1:A:184:TYR:C	2.99	0.40
1:A:254:GLN:H	1:A:254:GLN:HG2	1.73	0.40
2:B:96:GLU:HB3	2:B:167:LYS:HZ3	1.85	0.40
3:C:15:LEU:C	3:C:15:LEU:HD12	2.46	0.40
1:A:420:LEU:HD12	1:A:420:LEU:C	2.47	0.40
1:A:472:LEU:HD23	1:A:472:LEU:HA	1.91	0.40

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	555/568 (98%)	427 (77%)	100 (18%)	28 (5%)	1	6
2	B	164/168 (98%)	139 (85%)	21 (13%)	4 (2%)	5	19
3	C	31/34 (91%)	19 (61%)	9 (29%)	3 (10%)	0	1
All	All	750/770 (97%)	585 (78%)	130 (17%)	35 (5%)	2	7

All (35) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	11	VAL
1	A	58	LEU
1	A	102	ASN
1	A	189	PHE
1	A	366	ASN
2	B	87	ALA
2	B	88	PHE
3	C	32	ALA
1	A	190	TRP
1	A	365	VAL
1	A	379	ALA
1	A	496	GLU
1	A	526	ARG
2	B	158	GLN
3	C	15	LEU
3	C	16	THR
1	A	109	SER
1	A	341	TRP
1	A	504	ALA
1	A	517	ASP
1	A	461	PRO
1	A	57	ARG
1	A	89	MET
1	A	224	ALA

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Mol	Chain	Res	Type
1	A	392	LEU
1	A	422	LEU
1	A	452	TYR
1	A	548	GLN
2	B	4	GLN
1	A	234	PRO
1	A	233	HIS
1	A	355	GLY
1	A	499	PRO
1	A	547	VAL
1	A	28	GLY

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	453/462 (98%)	368 (81%)	85 (19%)	1	4
2	B	136/138 (99%)	112 (82%)	24 (18%)	1	5
3	C	26/27 (96%)	21 (81%)	5 (19%)	1	3
All	All	615/627 (98%)	501 (82%)	114 (18%)	1	4

All (114) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	7	GLU
1	A	8	ILE
1	A	23	TYR
1	A	26	VAL
1	A	48	ASN
1	A	54	LEU
1	A	56	LYS
1	A	59	LEU
1	A	70	THR
1	A	74	VAL
1	A	78	ILE

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Mol	Chain	Res	Type
1	A	82	GLN
1	A	99	MET
1	A	103	MET
1	A	124	LEU
1	A	125	LEU
1	A	133	TYR
1	A	134	THR
1	A	147	LEU
1	A	150	SER
1	A	152	PHE
1	A	164	LEU
1	A	168	ARG
1	A	169	ARG
1	A	177	LYS
1	A	179	THR
1	A	183	THR
1	A	195	LEU
1	A	213	PHE
1	A	215	LEU
1	A	216	VAL
1	A	236	VAL
1	A	238	PHE
1	A	253	LYS
1	A	254	GLN
1	A	261	SER
1	A	305	VAL
1	A	309	SER
1	A	315	THR
1	A	319	SER
1	A	326	LEU
1	A	327	ARG
1	A	330	ARG
1	A	339	LEU
1	A	350	VAL
1	A	354	LEU
1	A	364	ILE
1	A	374	VAL
1	A	388	GLN
1	A	389	VAL
1	A	391	SER
1	A	395	LEU
1	A	404	LEU

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Mol	Chain	Res	Type
1	A	405	LEU
1	A	418	ARG
1	A	419	ARG
1	A	420	LEU
1	A	430	LEU
1	A	434	ILE
1	A	437	VAL
1	A	439	LEU
1	A	449	ARG
1	A	455	GLN
1	A	465	VAL
1	A	468	VAL
1	A	472	LEU
1	A	477	LEU
1	A	478	LEU
1	A	490	SER
1	A	492	LEU
1	A	496	GLU
1	A	500	GLU
1	A	501	LEU
1	A	506	LEU
1	A	512	ILE
1	A	518	ARG
1	A	520	LEU
1	A	522	LEU
1	A	533	VAL
1	A	536	ILE
1	A	537	LEU
1	A	547	VAL
1	A	548	GLN
1	A	556	VAL
1	A	560	ARG
2	B	6	LYS
2	B	9	LYS
2	B	11	ILE
2	B	12	LEU
2	B	16	LYS
2	B	19	LEU
2	B	23	LEU
2	B	26	LEU
2	B	30	ILE
2	B	39	THR

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Mol	Chain	Res	Type
2	B	46	PRO
2	B	72	VAL
2	B	77	ASN
2	B	95	ILE
2	B	99	GLN
2	B	111	ASP
2	B	136	ARG
2	B	140	LYS
2	B	141	ARG
2	B	146	ARG
2	B	149	CYS
2	B	155	LEU
2	B	166	VAL
2	B	168	GLU
3	C	2	GLU
3	C	6	LYS
3	C	13	LEU
3	C	21	VAL
3	C	24	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (12) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	48	ASN
1	A	76	ASN
1	A	127	ASN
1	A	254	GLN
1	A	388	GLN
1	A	455	GLN
2	B	4	GLN
2	B	5	HIS
2	B	78	GLN
2	B	91	GLN
2	B	122	ASN
2	B	151	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 oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 4 ligands modelled in this entry, 1 is monoatomic - leaving 3 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	#$|Z| > 2$
5	HEM	A	800	1	42,50,50	2.13	9 (21%)	46,82,82	2.28	13 (28%)
7	CUA	B	802	2	0,1,1	-	-	-		
6	HAS	A	801	1	69,72,72	2.62	19 (27%)	75,109,109	3.24	39 (52%)

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
5	HEM	A	800	1	-	6/12/54/54	-
6	HAS	A	801	1	1/1/8/18	8/40/82/82	-

All (28) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	A	801	HAS	CHD-C4A	11.34	1.50	1.35
5	A	800	HEM	C3D-C2D	8.39	1.54	1.36
6	A	801	HAS	CHC-C4B	6.71	1.51	1.34
6	A	801	HAS	C2A-C3A	6.55	1.50	1.36
6	A	801	HAS	CHB-C1D	6.50	1.51	1.38

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	A	800	HEM	C3C-C2C	-5.93	1.32	1.40
6	A	801	HAS	CHA-C1A	4.86	1.47	1.38
6	A	801	HAS	CHA-C4D	4.83	1.50	1.39
6	A	801	HAS	CHB-C1B	4.71	1.49	1.39
6	A	801	HAS	C1A-NA	-4.05	1.32	1.39
6	A	801	HAS	C4A-C3A	3.81	1.52	1.45
6	A	801	HAS	C4A-NA	-3.38	1.33	1.39
6	A	801	HAS	C2D-C3D	3.19	1.44	1.37
5	A	800	HEM	CMB-C2B	3.08	1.57	1.50
6	A	801	HAS	C1C-CHC	2.94	1.49	1.41
5	A	800	HEM	CAB-C3B	2.92	1.55	1.47
6	A	801	HAS	C3C-C2C	2.83	1.44	1.40
5	A	800	HEM	CMA-C3A	2.65	1.56	1.51
6	A	801	HAS	FE-NB	2.56	2.13	1.98
5	A	800	HEM	C3C-C4C	2.55	1.45	1.41
6	A	801	HAS	C1A-C2A	2.46	1.49	1.45
6	A	801	HAS	C4B-C3B	-2.42	1.40	1.44
6	A	801	HAS	C4C-CHD	2.41	1.47	1.41
6	A	801	HAS	C2D-C1D	2.28	1.49	1.44
6	A	801	HAS	C1D-ND	-2.25	1.36	1.40
5	A	800	HEM	CMD-C2D	2.21	1.55	1.50
5	A	800	HEM	C4A-CHB	-2.12	1.35	1.41
5	A	800	HEM	C1A-NA	2.05	1.40	1.36

All (52) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	A	801	HAS	CHA-C1A-NA	7.67	132.80	124.45
6	A	801	HAS	CHA-C1A-C2A	-7.64	112.81	124.86
6	A	801	HAS	CMC-C2C-C1C	-7.42	117.58	128.46
5	A	800	HEM	CBA-CAA-C2A	6.79	123.95	112.54
6	A	801	HAS	CHD-C4A-NA	6.41	131.42	124.44
6	A	801	HAS	C4A-C3A-C2A	-6.02	98.04	106.97
6	A	801	HAS	CHB-C1D-ND	5.85	131.60	124.37
6	A	801	HAS	C2D-C3D-C4D	-5.80	102.23	106.43
6	A	801	HAS	CBA-CAA-C2A	-5.50	97.32	112.53
6	A	801	HAS	CMC-C2C-C3C	-5.47	113.75	124.68
6	A	801	HAS	OMD-CMD-C2D	-5.30	113.65	125.62
5	A	800	HEM	CAA-CBA-CGA	-5.18	99.88	113.83
5	A	800	HEM	C4D-ND-C1D	4.95	111.06	105.21
6	A	801	HAS	CMA-C3A-C2A	-4.92	112.84	126.15
6	A	801	HAS	C1A-CHA-C4D	-4.75	115.92	126.02

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
6	A	801	HAS	C27-C19-C20	4.57	123.17	115.23
6	A	801	HAS	CAA-C2A-C3A	-4.29	119.84	127.87
6	A	801	HAS	O1A-CGA-CBA	-4.26	109.59	123.09
5	A	800	HEM	CMA-C3A-C4A	-4.23	122.26	128.46
5	A	800	HEM	C2C-C3C-C4C	4.18	109.81	106.90
6	A	801	HAS	CHC-C4B-NB	4.08	129.43	124.37
5	A	800	HEM	CAD-CBD-CGD	-4.05	102.91	113.67
5	A	800	HEM	CMA-C3A-C2A	4.03	132.54	124.94
6	A	801	HAS	C1B-CHB-C1D	-4.02	117.00	125.69
6	A	801	HAS	C2A-C1A-NA	3.95	114.13	110.32
6	A	801	HAS	C3D-C4D-ND	3.92	114.14	110.35
6	A	801	HAS	CMB-C2B-C3B	-3.89	122.76	130.28
5	A	800	HEM	C4B-CHC-C1C	3.87	127.67	122.56
6	A	801	HAS	C3A-C4A-NA	3.85	116.77	109.64
6	A	801	HAS	C25-C23-C24	3.68	121.61	115.23
6	A	801	HAS	CAD-C3D-C4D	3.43	130.67	124.70
6	A	801	HAS	CHA-C4D-C3D	-3.38	119.85	124.77
6	A	801	HAS	CHC-C4B-C3B	-3.21	117.70	125.80
6	A	801	HAS	CMB-C2B-C1B	3.01	129.73	125.03
6	A	801	HAS	C1D-ND-C4D	2.90	108.64	105.21
6	A	801	HAS	CHB-C1B-NB	2.75	127.38	124.42
6	A	801	HAS	C31-C30-C29	-2.70	114.56	122.66
6	A	801	HAS	C3B-C4B-NB	2.64	112.87	109.84
5	A	800	HEM	C4A-C3A-C2A	-2.59	105.19	107.00
6	A	801	HAS	CAA-C2A-C1A	-2.57	119.63	124.85
6	A	801	HAS	O2A-CGA-CBA	2.50	121.90	114.00
6	A	801	HAS	C20-C19-C18	-2.47	115.62	121.17
6	A	801	HAS	C3C-C4C-NC	-2.36	106.16	109.21
5	A	800	HEM	C1D-C2D-C3D	-2.32	104.54	106.98
5	A	800	HEM	CMD-C2D-C1D	2.28	128.60	125.03
5	A	800	HEM	CAA-C2A-C3A	2.26	133.74	127.25
6	A	801	HAS	CHB-C1B-C2B	-2.23	121.51	125.03
6	A	801	HAS	C24-C23-C22	-2.20	116.22	121.17
6	A	801	HAS	C1A-C2A-C3A	-2.09	104.35	107.11
5	A	800	HEM	C3B-C2B-C1B	-2.05	104.88	106.41
6	A	801	HAS	C32-C30-C31	2.02	119.24	114.59
6	A	801	HAS	O2D-CGD-CBD	2.01	120.36	114.00

All (1) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
6	A	801	HAS	NA

All (14) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	A	800	HEM	C1A-C2A-CAA-CBA
5	A	800	HEM	C3A-C2A-CAA-CBA
6	A	801	HAS	C1D-C2D-CMD-OMD
6	A	801	HAS	C3D-C2D-CMD-OMD
6	A	801	HAS	C1A-C2A-CAA-CBA
6	A	801	HAS	CAA-CBA-CGA-O1A
5	A	800	HEM	CAA-CBA-CGA-O1A
5	A	800	HEM	CAD-CBD-CGD-O1D
6	A	801	HAS	CAA-CBA-CGA-O2A
5	A	800	HEM	CAD-CBD-CGD-O2D
6	A	801	HAS	C11-C12-C13-C14
5	A	800	HEM	CAA-CBA-CGA-O2A
6	A	801	HAS	CAD-CBD-CGD-O1D
6	A	801	HAS	CAD-CBD-CGD-O2D

There are no ring outliers.

2 monomers are involved in 21 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	A	800	HEM	7	0
6	A	801	HAS	14	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less then 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.

Ligand HEM A 800

Bond lengths

Bond angles

Torsions

Rings

Ligand HAS A 801

Bond lengths

Bond angles

Torsions

Rings
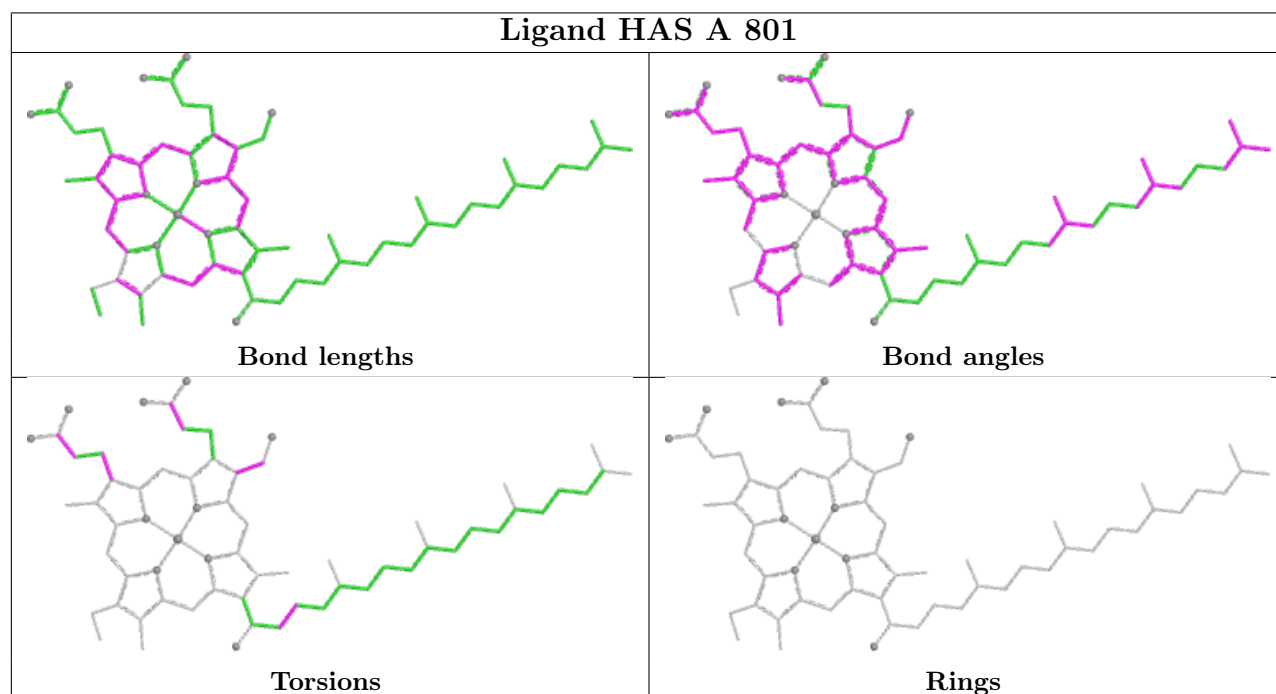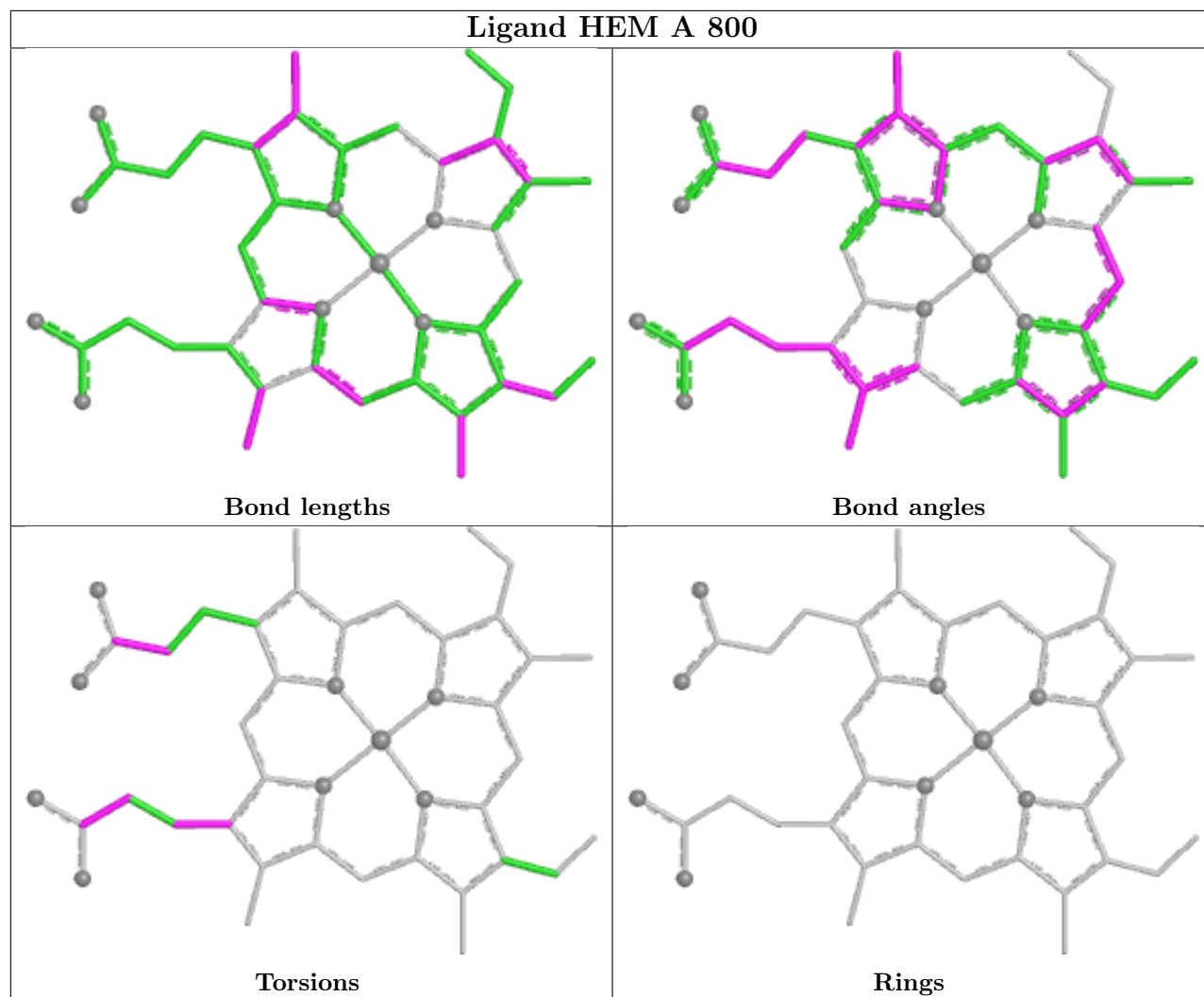
5.7　Other polymers ⓘ

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	557/568 (98%)	-0.59	4 (0%)	84	80	64, 88, 129, 216	0
2	B	166/168 (98%)	-0.79	0	100	100	71, 88, 124, 174	0
3	C	33/34 (97%)	-0.80	0	100	100	69, 79, 133, 154	0
All	All	756/770 (98%)	-0.65	4 (0%)	87	84	64, 88, 131, 216	0

All (4) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	173	ALA	3.8
1	A	8	ILE	2.9
1	A	503	GLU	2.4
1	A	9	SER	2.2

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 ⓘ
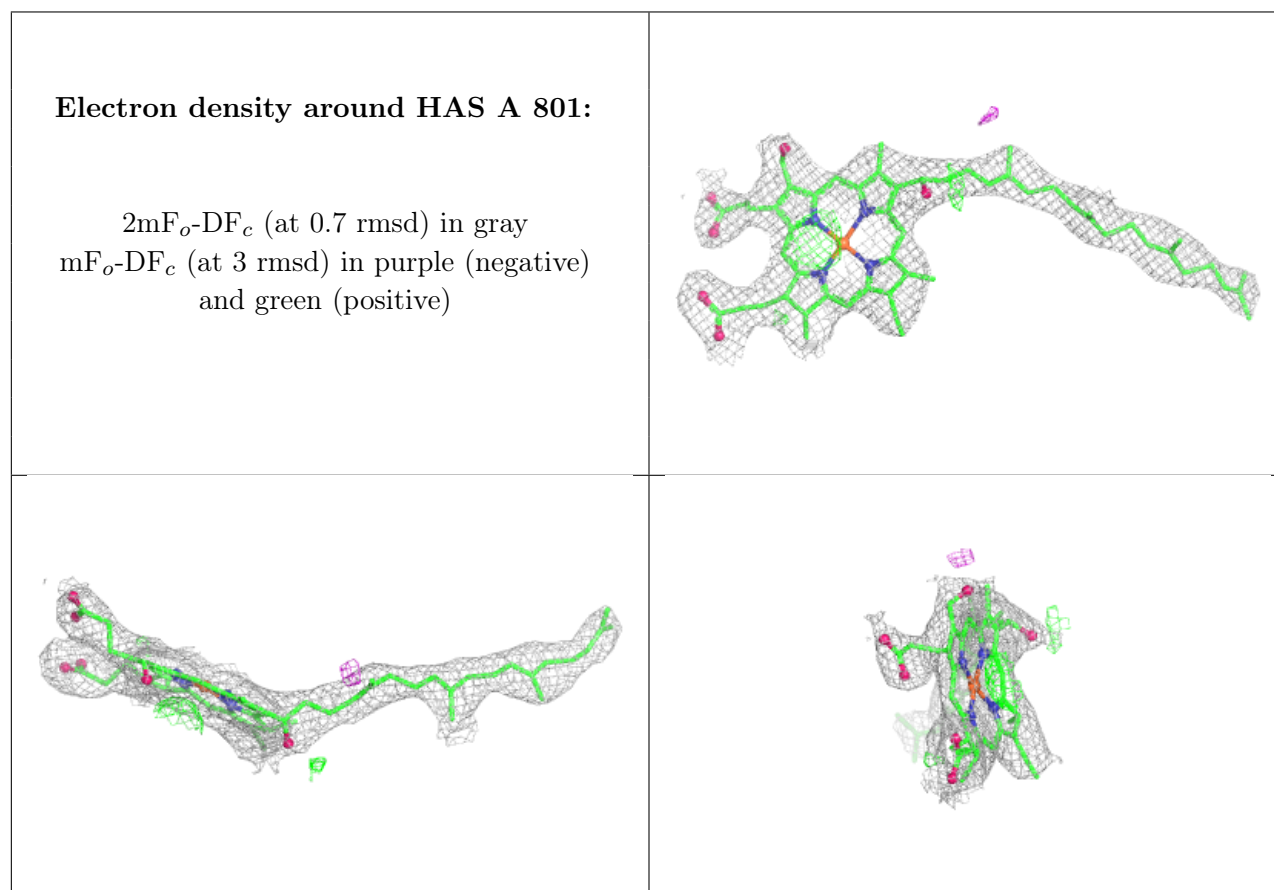
There are no monosaccharides in this entry.

6.4 Ligands ⓘ

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, 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.
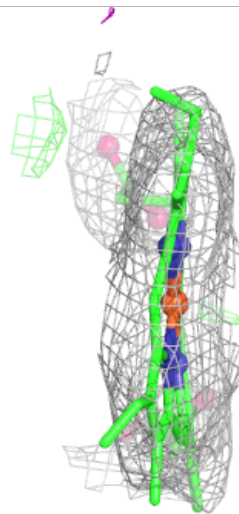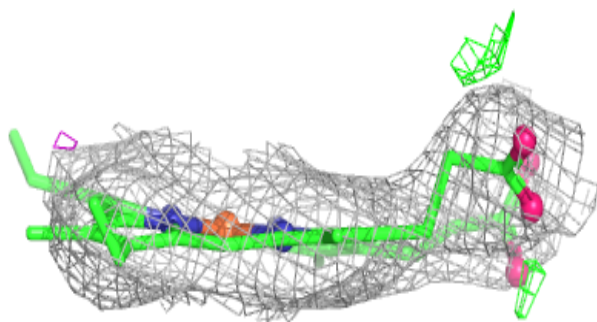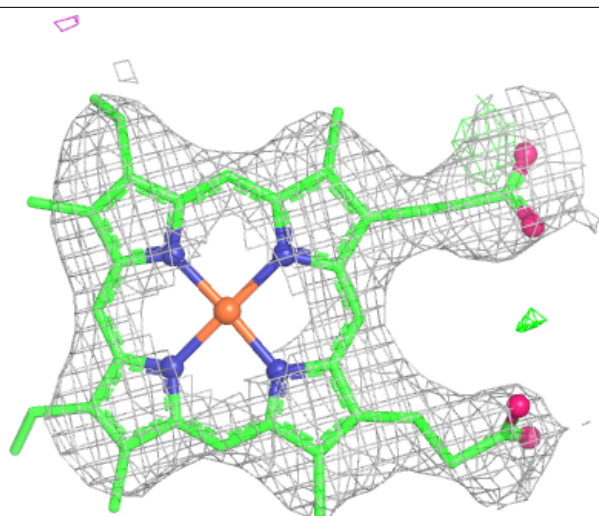
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
6	HAS	A	801	65/65	0.96	0.09	53,74,87,93	0
5	HEM	A	800	43/43	0.97	0.07	50,68,90,98	0
4	CU1	A	803	1/1	0.98	0.04	84,84,84,84	0
7	CUA	B	802	2/2	0.99	0.02	88,88,88,90	0

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.

Electron density around HAS A 801:

2mF$_o$-DF$_c$ (at 0.7 rmsd) in gray
mF$_o$-DF$_c$ (at 3 rmsd) in purple (negative)
and green (positive)

Electron density around HEM A 800:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

6.5 Other polymers ⓘ

There are no such residues in this entry.