



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 11:40 AM UTC

PDB ID : 1ZZT / pdb_00001zzt
Title : Bovine eNOS N368D/V106M double mutant with L-N(omega)-Nitroarginine-(4R)-Amino-L-Proline Amide Bound
Authors : Li, H.; Flinspach, M.L.; Igarashi, J.; Jamal, J.; Yang, W.; Gomez-Vidal, J.A.; Litzinger, E.A.; Silverman, R.B.; Poulos, T.L.
Deposited on : 2005-06-14
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

A user guide is available at

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

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

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

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

MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

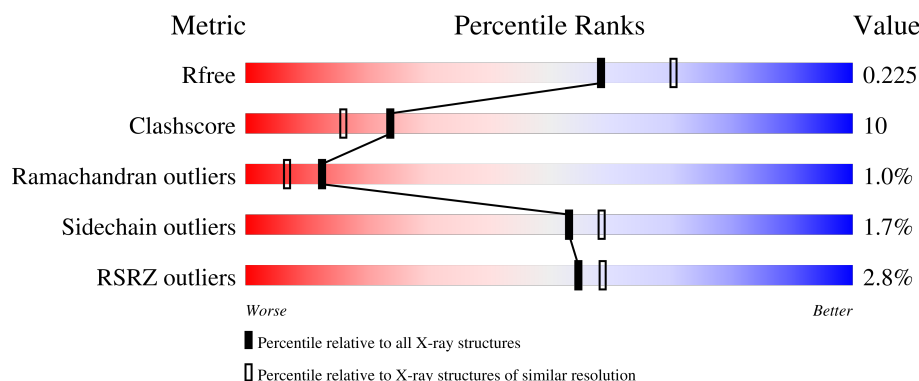
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

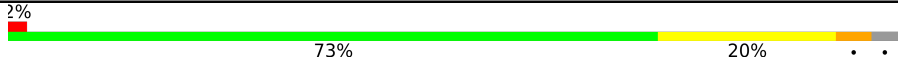
The reported resolution of this entry is 2.14 Å.

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}	180053	3689 (2.16-2.12)
Clashscore	190562	3812 (2.16-2.12)
Ramachandran outliers	187476	3773 (2.16-2.12)
Sidechain outliers	187428	3772 (2.16-2.12)
RSRZ outliers	180081	3691 (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 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 $\leq 5\%$. 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	416	
1	B	416	

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
2	ACT	B	861	-	-	X	-

2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 6994 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.

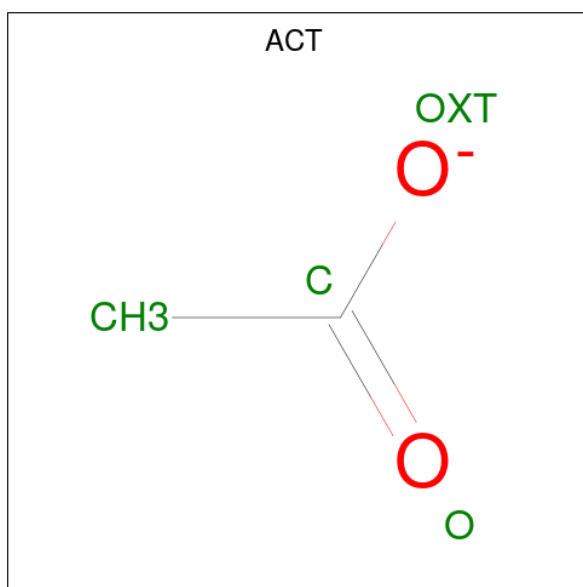
- Molecule 1 is a protein called Nitric-oxide synthase, endothelial.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	405	Total	As	C	N	O	S	0	0	0
			3220	1	2048	564	590	17			
1	B	405	Total	As	C	N	O	S	0	0	0
			3227	1	2052	567	590	17			

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	100	ARG	CYS	see remark 999	UNP P29473
A	106	MET	VAL	engineered mutation	UNP P29473
A	368	ASP	ASN	engineered mutation	UNP P29473
A	384	CAS	CYS	modified residue	UNP P29473
B	100	ARG	CYS	see remark 999	UNP P29473
B	106	MET	VAL	engineered mutation	UNP P29473
B	368	ASP	ASN	engineered mutation	UNP P29473
B	384	CAS	CYS	modified residue	UNP P29473

- Molecule 2 is ACETATE ION (CCD ID: ACT) (formula: C₂H₃O₂).

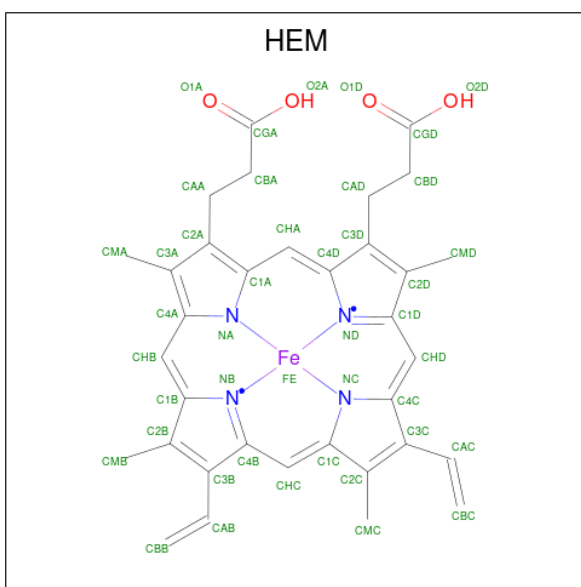


Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total	C	O	0	0
			4	2	2		
2	B	1	Total	C	O	0	0
			4	2	2		

- Molecule 3 is ZINC ION (CCD ID: ZN) (formula: Zn).

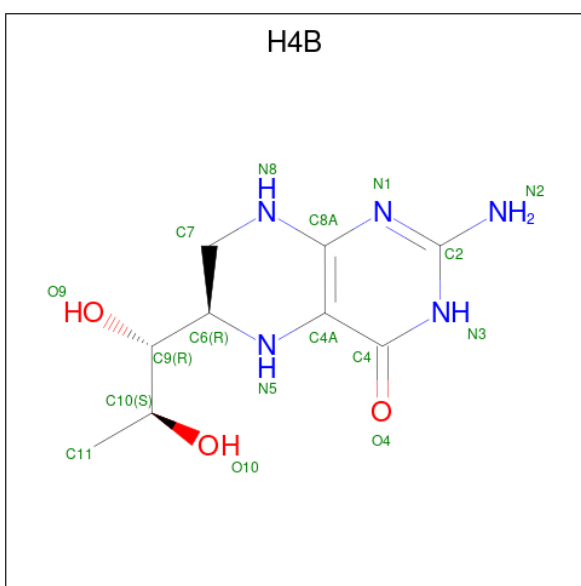
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	1	Total	Zn	0	0
			1	1		

- Molecule 4 is PROTOPORPHYRIN IX CONTAINING FE (CCD ID: HEM) (formula: C₃₄H₃₂FeN₄O₄).



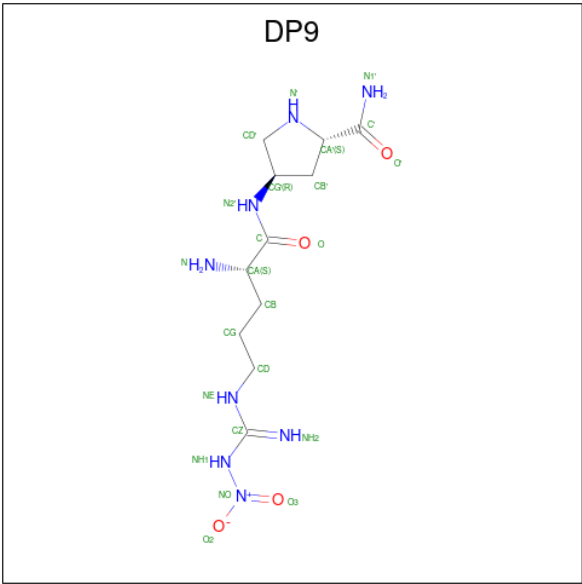
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
4	A	1	Total 43	C 34	Fe 1	N 4	O 4	0	0
4	B	1	Total 43	C 34	Fe 1	N 4	O 4	0	0

- Molecule 5 is 5,6,7,8-TETRAHYDROBIOPTERIN (CCD ID: H4B) (formula: $\text{C}_9\text{H}_{15}\text{N}_5\text{O}_3$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
5	A	1	Total 17	C 9	N 5	O 3	0	0
5	B	1	Total 17	C 9	N 5	O 3	0	0

- Molecule 6 is L-N(OMEGA)-NITROARGININE-(4R)-AMINO-L-PROLINE AMIDE (CCD ID: DP9) (formula: C₁₁H₂₂N₈O₄).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
6	A	1	Total	C	N	O	0	0
			23	11	8	4		
6	B	1	Total	C	N	O	0	0
			23	11	8	4		

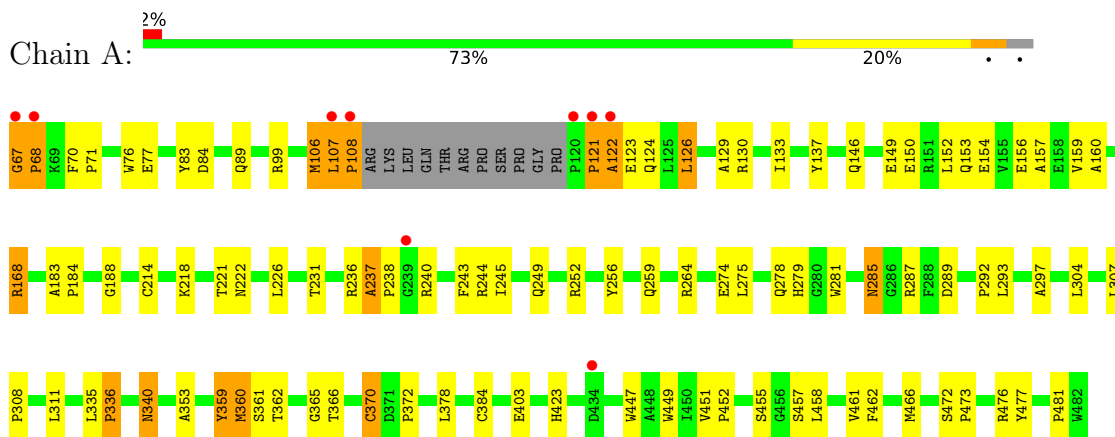
- Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	189	Total	O	0	0
			189	189		
7	B	183	Total	O	0	0
			183	183		

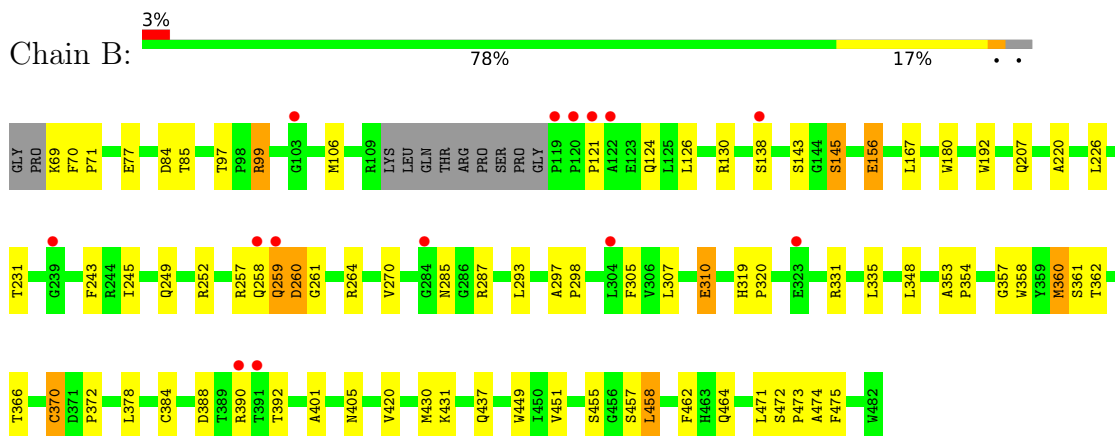
3 Residue-property plots [i](#)

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: Nitric-oxide synthase, endothelial



- Molecule 1: Nitric-oxide synthase, endothelial



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	56.45Å 105.74Å 155.60Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	47.43 – 2.14 47.43 – 2.14	Depositor EDS
% Data completeness (in resolution range)	99.2 (47.43-2.14) 99.2 (47.43-2.14)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.06	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.55 (at 2.07Å)	Xtriage
Refinement program	CNS 1.1	Depositor
R, R_{free}	0.189 , 0.233 0.183 , 0.225	Depositor DCC
R_{free} test set	2703 reflections (4.94%)	wwPDB-VP
Wilson B-factor (Å ²)	37.3	Xtriage
Anisotropy	0.279	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.37 , 35.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	6994	wwPDB-VP
Average B, all atoms (Å ²)	42.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.52% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

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

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: CAS, DP9, ACT, H4B, HEM, ZN

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	0.59	0/3301	1.05	19/4495 (0.4%)
1	B	0.58	0/3308	1.03	17/4504 (0.4%)
All	All	0.58	0/6609	1.04	36/8999 (0.4%)

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

There are no bond length outliers.

All (36) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed($^{\circ}$)	Ideal($^{\circ}$)
1	A	67	GLY	CA-C-N	10.18	132.56	119.84
1	A	67	GLY	C-N-CA	10.18	132.56	119.84
1	B	360	MET	N-CA-C	-9.00	94.57	109.24
1	B	243	PHE	N-CA-C	-8.53	96.72	110.20
1	A	360	MET	N-CA-C	-8.38	95.58	109.24
1	A	243	PHE	N-CA-C	-8.37	96.97	110.20
1	B	245	ILE	N-CA-C	-7.63	96.73	107.80
1	B	261	GLY	N-CA-C	-7.52	104.89	114.37
1	A	245	ILE	N-CA-C	-7.19	97.37	107.80
1	B	451	VAL	CA-C-N	6.57	124.45	119.66
1	B	451	VAL	C-N-CA	6.57	124.45	119.66
1	A	168	ARG	N-CA-C	-6.56	101.69	110.55
1	A	361	SER	N-CA-C	6.46	120.03	111.75
1	B	335	LEU	N-CA-C	6.44	120.29	108.69

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	138	SER	N-CA-C	-6.27	104.44	111.28
1	A	226	LEU	N-CA-C	6.05	118.77	110.24
1	B	297	ALA	N-CA-C	-5.88	102.48	110.36
1	B	437	GLN	N-CA-C	-5.69	104.98	111.07
1	B	361	SER	N-CA-C	5.61	118.11	111.33
1	B	97	THR	N-CA-C	-5.59	101.71	108.14
1	A	297	ALA	N-CA-C	-5.44	103.07	110.36
1	A	359	TYR	N-CA-C	5.37	118.43	110.48
1	A	335	LEU	N-CA-C	5.35	118.31	108.69
1	A	237	ALA	CA-C-N	5.34	126.51	119.84
1	A	237	ALA	C-N-CA	5.34	126.51	119.84
1	B	475	PHE	N-CA-C	-5.27	101.11	109.76
1	A	452	PRO	CA-C-N	5.21	124.82	119.56
1	A	452	PRO	C-N-CA	5.21	124.82	119.56
1	B	298	PRO	N-CA-C	5.20	119.73	111.26
1	B	370	CYS	N-CA-C	5.14	119.71	113.38
1	B	357	GLY	N-CA-C	-5.11	101.06	113.18
1	A	365	GLY	N-CA-C	5.11	118.86	112.73
1	B	458	LEU	N-CA-C	-5.09	107.02	113.18
1	A	477	TYR	N-CA-C	-5.07	103.71	110.55
1	A	370	CYS	N-CA-C	5.07	120.45	113.97
1	A	336	PRO	N-CA-C	-5.03	102.10	112.47

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	137	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	3220	0	3119	77	0
1	B	3227	0	3129	58	0
2	A	4	0	3	1	0
2	B	4	0	3	8	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	A	1	0	0	0	0
4	A	43	0	30	0	0
4	B	43	0	30	1	0
5	A	17	0	15	2	0
5	B	17	0	15	3	0
6	A	23	0	21	0	0
6	B	23	0	21	0	0
7	A	189	0	0	7	0
7	B	183	0	0	4	0
All	All	6994	0	6386	131	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 10.

All (131) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:106:MET:HE2	5:B:761:H4B:H9	1.47	0.97
1:A:126:LEU:HD11	1:A:156:GLU:HG2	1.48	0.92
1:B:126:LEU:O	1:B:130:ARG:HG3	1.74	0.88
1:B:358:TRP:HE1	2:B:861:ACT:H2	1.39	0.86
1:B:358:TRP:HE1	2:B:861:ACT:CH3	1.87	0.86
1:A:249:GLN:HB2	1:A:252:ARG:HG3	1.64	0.80
1:B:388:ASP:OD1	1:B:390:ARG:HB2	1.83	0.78
1:A:126:LEU:O	1:A:130:ARG:HG3	1.86	0.75
1:A:126:LEU:HD12	1:A:130:ARG:HE	1.50	0.75
1:A:68:PRO:HD2	1:A:83:TYR:CE2	2.26	0.71
1:A:370:CYS:SG	1:A:378:LEU:HD13	2.31	0.70
1:B:370:CYS:SG	1:B:378:LEU:HD13	2.33	0.68
4:B:700:HEM:HMC2	4:B:700:HEM:HBC2	1.75	0.68
1:A:293:LEU:HG	1:A:307:LEU:HD21	1.75	0.67
1:A:77:GLU:HG3	1:B:372:PRO:HG2	1.78	0.66
1:A:126:LEU:HD23	1:A:159:VAL:HG11	1.77	0.66
1:B:257:ARG:HE	1:B:270:VAL:HG11	1.60	0.65
1:B:358:TRP:NE1	2:B:861:ACT:H2	2.09	0.65
1:B:249:GLN:HB2	1:B:252:ARG:HG2	1.78	0.64
1:A:126:LEU:HD12	1:A:130:ARG:NE	2.13	0.63
1:A:293:LEU:HG	1:A:307:LEU:CD2	2.30	0.62
1:A:146:GLN:HG2	1:A:150:GLU:OE2	2.02	0.60
1:B:249:GLN:HB2	1:B:252:ARG:CG	2.32	0.60
1:A:279:HIS:HE1	7:A:1069:HOH:O	1.84	0.59

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:274:GLU:O	1:A:278:GLN:HG3	2.01	0.59
1:B:293:LEU:HD11	1:B:307:LEU:HD21	1.85	0.59
1:B:167:LEU:HG	1:B:348:LEU:HD12	1.85	0.59
1:A:152:LEU:O	1:A:156:GLU:HG3	2.02	0.58
1:B:420:VAL:HG11	2:B:861:ACT:H3	1.84	0.58
1:A:107:LEU:HB3	1:A:108:PRO:CD	2.33	0.58
1:B:431:LYS:HE3	7:B:936:HOH:O	2.03	0.57
1:A:106:MET:HE1	7:A:1055:HOH:O	2.04	0.57
1:A:372:PRO:HG2	1:B:77:GLU:HG3	1.86	0.56
1:B:378:LEU:HB2	7:B:863:HOH:O	2.05	0.56
1:B:449:TRP:HA	5:B:761:H4B:N1	2.20	0.56
1:A:107:LEU:HB3	1:A:108:PRO:HD2	1.87	0.56
1:A:188:GLY:HA2	2:A:860:ACT:H1	1.89	0.55
1:A:68:PRO:CD	1:A:83:TYR:CZ	2.89	0.55
1:A:107:LEU:O	1:A:108:PRO:C	2.47	0.55
1:A:149:GLU:O	1:A:153:GLN:HG3	2.07	0.55
1:B:71:PRO:HG2	1:B:84:ASP:HB3	1.89	0.55
1:B:310:GLU:HG2	1:B:310:GLU:O	2.07	0.55
1:A:287:ARG:HD2	7:A:962:HOH:O	2.07	0.54
1:A:99:ARG:HH11	1:A:99:ARG:HG3	1.73	0.54
1:B:130:ARG:HH11	1:B:130:ARG:HB3	1.71	0.54
1:A:275:LEU:O	1:A:279:HIS:HD2	1.92	0.53
1:A:360:MET:HE3	1:A:362:THR:OG1	2.09	0.53
1:A:472:SER:HA	1:A:473:PRO:C	2.34	0.53
1:A:423:HIS:HB2	1:B:392:THR:HB	1.92	0.52
1:A:237:ALA:HB3	1:A:240:ARG:HB3	1.90	0.52
1:A:146:GLN:O	1:A:150:GLU:HG3	2.11	0.51
1:A:68:PRO:HG2	1:A:83:TYR:CG	2.44	0.51
1:A:264:ARG:HH11	1:A:264:ARG:HG3	1.73	0.51
1:B:360:MET:HE3	1:B:362:THR:OG1	2.11	0.51
1:B:390:ARG:HD2	7:B:972:HOH:O	2.10	0.51
1:A:279:HIS:CE1	7:A:1069:HOH:O	2.63	0.51
1:A:70:PHE:HB3	1:A:84:ASP:O	2.11	0.51
1:A:76:TRP:CD1	1:B:106:MET:HE3	2.46	0.51
1:A:244:ARG:NH2	1:A:481:PRO:HD3	2.26	0.50
1:A:264:ARG:NE	1:A:285:ASN:O	2.40	0.50
1:B:287:ARG:HD3	7:B:974:HOH:O	2.11	0.50
1:B:126:LEU:HD11	1:B:156:GLU:HG2	1.93	0.50
1:A:461:VAL:HB	1:A:466:MET:HE1	1.94	0.50
1:B:99:ARG:HB2	1:B:99:ARG:HH11	1.76	0.49
1:B:264:ARG:NE	1:B:285:ASN:O	2.44	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:154:GLU:OE1	1:A:168:ARG:NH2	2.46	0.49
1:B:455:SER:HB3	1:B:458:LEU:HD12	1.94	0.49
1:B:472:SER:HA	1:B:473:PRO:C	2.38	0.49
1:B:420:VAL:CB	2:B:861:ACT:H3	2.43	0.48
1:A:68:PRO:HD3	1:A:83:TYR:CZ	2.48	0.48
1:A:281:TRP:HB2	1:A:304:LEU:HD21	1.94	0.48
1:A:99:ARG:HG3	1:A:99:ARG:NH1	2.29	0.48
1:B:264:ARG:HH11	1:B:264:ARG:HG3	1.78	0.48
1:A:293:LEU:CG	1:A:307:LEU:HD21	2.43	0.47
1:B:69:LYS:HD2	1:B:70:PHE:CE1	2.49	0.47
1:A:121:PRO:C	1:A:123:GLU:N	2.72	0.47
1:A:236:ARG:NH1	7:A:1073:HOH:O	2.44	0.47
1:A:336:PRO:HB3	1:A:359:TYR:CZ	2.49	0.47
1:B:130:ARG:HB3	1:B:130:ARG:NH1	2.30	0.47
1:A:378:LEU:HB2	7:A:909:HOH:O	2.14	0.47
1:B:143:SER:C	1:B:145:SER:H	2.23	0.47
1:B:180:TRP:CE3	1:B:192:TRP:HA	2.50	0.47
1:B:319:HIS:CG	1:B:320:PRO:HD2	2.51	0.46
1:A:366:THR:O	1:A:370:CYS:HB2	2.15	0.46
1:A:285:ASN:C	1:A:285:ASN:HD22	2.24	0.46
1:B:362:THR:HA	1:B:405:ASN:HD21	1.80	0.46
1:B:362:THR:HA	1:B:405:ASN:ND2	2.29	0.46
1:A:292:PRO:HA	7:A:970:HOH:O	2.15	0.46
1:B:207:GLN:NE2	1:B:305:PHE:HE2	2.13	0.46
1:A:68:PRO:CD	1:A:83:TYR:CE2	2.98	0.45
1:A:121:PRO:O	1:A:124:GLN:N	2.50	0.45
1:B:258:GLN:O	1:B:259:GLN:C	2.59	0.45
1:A:221:THR:O	1:A:222:ASN:C	2.60	0.45
1:A:457:SER:HA	1:A:462:PHE:CG	2.51	0.45
1:A:157:ALA:O	1:A:160:ALA:HB3	2.17	0.45
1:A:449:TRP:HA	5:A:760:H4B:N1	2.32	0.45
1:B:388:ASP:OD1	1:B:388:ASP:C	2.60	0.45
1:A:285:ASN:C	1:A:285:ASN:ND2	2.75	0.45
1:A:121:PRO:O	1:A:123:GLU:N	2.51	0.44
1:A:403:GLU:HA	1:A:403:GLU:OE1	2.16	0.44
1:B:457:SER:HA	1:B:462:PHE:CG	2.52	0.44
1:B:70:PHE:HD2	1:B:85:THR:HA	1.83	0.44
1:B:121:PRO:HG2	1:B:124:GLN:HE21	1.83	0.44
1:A:308:PRO:HD2	1:A:311:LEU:HD12	2.00	0.43
1:A:455:SER:HB3	1:A:458:LEU:HD12	2.00	0.43
1:A:214:CYS:O	1:A:218:LYS:HG3	2.18	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:476:ARG:HG2	1:A:476:ARG:HH11	1.82	0.43
1:A:126:LEU:CD2	1:A:159:VAL:HG11	2.48	0.43
1:A:256:TYR:OH	1:A:289:ASP:OD2	2.33	0.43
1:A:447:TRP:CZ2	1:A:451:VAL:HG21	2.53	0.43
1:B:420:VAL:CG1	2:B:861:ACT:H3	2.46	0.43
1:B:358:TRP:HE1	2:B:861:ACT:H1	1.77	0.43
1:A:129:ALA:O	1:A:133:ILE:HG12	2.19	0.43
1:B:231:THR:O	1:B:353:ALA:HA	2.18	0.43
1:A:476:ARG:HG2	1:A:476:ARG:NH1	2.33	0.42
1:A:231:THR:O	1:A:353:ALA:HA	2.19	0.42
1:A:458:LEU:HD11	1:B:401:ALA:CB	2.50	0.42
1:A:67:GLY:HA3	1:A:68:PRO:HD3	1.54	0.42
1:B:126:LEU:HG	1:B:130:ARG:HD2	2.01	0.42
1:A:106:MET:HE1	5:A:760:H4B:HN5	1.85	0.42
1:B:471:LEU:O	1:B:474:ALA:HB2	2.19	0.42
1:A:122:ALA:O	1:A:126:LEU:HB2	2.19	0.41
1:A:71:PRO:HD2	1:A:84:ASP:O	2.20	0.41
1:A:183:ALA:HA	1:A:184:PRO:HD3	1.93	0.41
1:B:420:VAL:HG21	2:B:861:ACT:H3	2.02	0.41
1:A:340:ASN:H	1:A:340:ASN:HD22	1.68	0.41
1:B:366:THR:O	1:B:370:CYS:HB2	2.21	0.41
1:B:106:MET:CE	5:B:761:H4B:H9	2.32	0.40
1:B:430:MET:HE1	1:B:464:GLN:OE1	2.21	0.40
1:B:220:ALA:O	1:B:226:LEU:HA	2.22	0.40
1:B:231:THR:O	1:B:354:PRO:HD2	2.21	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	400/416 (96%)	380 (95%)	15 (4%)	5 (1%)	9 4

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	B	400/416 (96%)	384 (96%)	13 (3%)	3 (1%)	16	9
All	All	800/832 (96%)	764 (96%)	28 (4%)	8 (1%)	12	7

All (8) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	68	PRO
1	B	259	GLN
1	B	145	SER
1	B	260	ASP
1	A	121	PRO
1	A	122	ALA
1	A	238	PRO
1	A	107	LEU

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	343/353 (97%)	336 (98%)	7 (2%)	48	53
1	B	344/353 (98%)	339 (98%)	5 (2%)	57	63
All	All	687/706 (97%)	675 (98%)	12 (2%)	53	58

All (12) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	89	GLN
1	A	106	MET
1	A	108	PRO
1	A	126	LEU
1	A	259	GLN
1	A	285	ASN
1	A	340	ASN
1	B	99	ARG

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Mol	Chain	Res	Type
1	B	156	GLU
1	B	260	ASP
1	B	310	GLU
1	B	331	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (23) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	128	GLN
1	A	146	GLN
1	A	153	GLN
1	A	191	GLN
1	A	207	GLN
1	A	279	HIS
1	A	285	ASN
1	A	340	ASN
1	A	376	ASN
1	A	413	GLN
1	A	468	ASN
1	A	478	GLN
1	B	124	GLN
1	B	146	GLN
1	B	191	GLN
1	B	207	GLN
1	B	215	ASN
1	B	222	ASN
1	B	279	HIS
1	B	405	ASN
1	B	410	HIS
1	B	413	GLN
1	B	478	GLN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

2 non-standard protein/DNA/RNA residues are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul

statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
1	CAS	A	384	1	5,8,9	2.83	2 (40%)	1,9,11	1.10	0
1	CAS	B	384	1	5,8,9	2.95	2 (40%)	1,9,11	0.78	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
1	CAS	A	384	1	-	0/0/7/9	-
1	CAS	B	384	1	-	0/0/7/9	-

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	384	CAS	AS-CE1	-4.61	1.83	1.96
1	B	384	CAS	AS-CE2	-4.57	1.84	1.96
1	A	384	CAS	AS-CE2	-4.45	1.84	1.96
1	A	384	CAS	AS-CE1	-4.40	1.84	1.96

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

5.5 Carbohydrates

There are no oligosaccharides in this entry.

5.6 Ligand geometry

Of 9 ligands modelled in this entry, 1 is monoatomic - leaving 8 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
2	ACT	B	861	-	3,3,3	0.91	0	3,3,3	0.68	0
5	H4B	B	761	-	17,18,18	1.47	2 (11%)	14,26,26	2.07	4 (28%)
6	DP9	A	799	-	17,23,23	0.97	1 (5%)	20,30,30	1.66	6 (30%)
4	HEM	A	700	1	50,50,50	1.14	4 (8%)	67,82,82	1.38	6 (8%)
6	DP9	B	800	-	17,23,23	0.94	2 (11%)	20,30,30	1.78	5 (25%)
2	ACT	A	860	-	3,3,3	1.06	0	3,3,3	0.60	0
4	HEM	B	700	1	50,50,50	1.06	3 (6%)	67,82,82	1.25	6 (8%)
5	H4B	A	760	-	17,18,18	1.57	3 (17%)	14,26,26	2.04	4 (28%)

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
6	DP9	A	799	-	-	2/20/32/32	0/1/1/1
5	H4B	B	761	-	-	0/8/17/17	0/2/2/2
4	HEM	A	700	1	-	0/14/54/54	-
6	DP9	B	800	-	-	2/20/32/32	0/1/1/1
4	HEM	B	700	1	-	2/14/54/54	-
5	H4B	A	760	-	-	0/8/17/17	0/2/2/2

All (15) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	B	761	H4B	C4A-N5	3.99	1.47	1.37
5	A	760	H4B	C4A-N5	3.81	1.46	1.37
5	A	760	H4B	C6-N5	3.68	1.54	1.47
5	B	761	H4B	C6-N5	2.96	1.52	1.47

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	700	HEM	CAB-C3B	-2.53	1.40	1.47
4	A	700	HEM	CMD-C2D	2.51	1.55	1.50
6	B	800	DP9	CG'-N2'	2.47	1.51	1.46
5	A	760	H4B	C7-C6	2.41	1.54	1.52
4	B	700	HEM	C2A-C3A	-2.41	1.32	1.38
4	A	700	HEM	CAC-C3C	-2.29	1.41	1.47
6	A	799	DP9	CG'-N2'	2.27	1.51	1.46
6	B	800	DP9	O3-NO	2.15	1.29	1.24
4	A	700	HEM	FE-NC	2.12	2.02	1.95
4	B	700	HEM	FE-NC	2.05	2.01	1.95
4	B	700	HEM	CMA-C3A	2.02	1.54	1.50

All (31) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	A	760	H4B	C2-N1-C8A	5.31	122.74	113.36
5	B	761	H4B	C2-N1-C8A	5.20	122.53	113.36
6	A	799	DP9	CD-NE-CZ	3.79	130.41	123.46
6	B	800	DP9	CD-NE-CZ	3.71	130.26	123.46
4	A	700	HEM	C3B-C4B-NB	3.68	112.11	109.47
5	B	761	H4B	O10-C10-C9	-3.48	104.01	109.77
4	B	700	HEM	C4C-C3C-C2C	-3.44	103.83	106.81
4	A	700	HEM	CBA-CAA-C2A	-3.42	103.07	112.53
6	B	800	DP9	O'-C'-N1'	-3.41	117.03	123.04
5	A	760	H4B	O10-C10-C9	-3.21	104.46	109.77
6	B	800	DP9	C'-CA'-N'	-3.17	104.63	111.16
4	B	700	HEM	CBA-CAA-C2A	-3.15	103.83	112.53
5	A	760	H4B	N3-C2-N1	-3.12	117.61	123.32
5	B	761	H4B	N3-C2-N1	-3.10	117.65	123.32
4	A	700	HEM	CMD-C2D-C1D	2.80	129.41	125.03
4	A	700	HEM	C4B-C3B-C2B	-2.80	104.71	107.28
6	A	799	DP9	O'-C'-N1'	-2.76	118.17	123.04
6	A	799	DP9	C'-CA'-N'	-2.71	105.58	111.16
6	B	800	DP9	CA'-C'-N1'	2.69	121.34	116.76
4	B	700	HEM	C3B-C2B-C1B	2.69	108.43	106.41
4	A	700	HEM	C3B-C2B-C1B	2.55	108.33	106.41
4	B	700	HEM	C3B-C4B-NB	2.35	111.15	109.47
6	A	799	DP9	CG'-N2'-C	2.25	126.91	123.29
5	A	760	H4B	O9-C9-C6	2.23	114.63	109.28
5	B	761	H4B	O9-C9-C6	2.23	114.62	109.28
6	A	799	DP9	CA'-C'-N1'	2.20	120.50	116.76
4	B	700	HEM	C4B-C3B-C2B	-2.10	105.35	107.28

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	B	800	DP9	CG'-N2'-C	2.09	126.65	123.29
6	A	799	DP9	NE-CZ-NH2	-2.03	116.52	120.26
4	A	700	HEM	C4A-C3A-C2A	-2.02	104.50	106.82
4	B	700	HEM	CMB-C2B-C3B	-2.01	123.55	128.43

There are no chirality outliers.

All (6) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
6	A	799	DP9	C-CA-CB-CG
4	B	700	HEM	C4B-C3B-CAB-CBB
6	B	800	DP9	C-CA-CB-CG
6	A	799	DP9	N-CA-CB-CG
6	B	800	DP9	N-CA-CB-CG
4	B	700	HEM	CAA-CBA-CGA-O2A

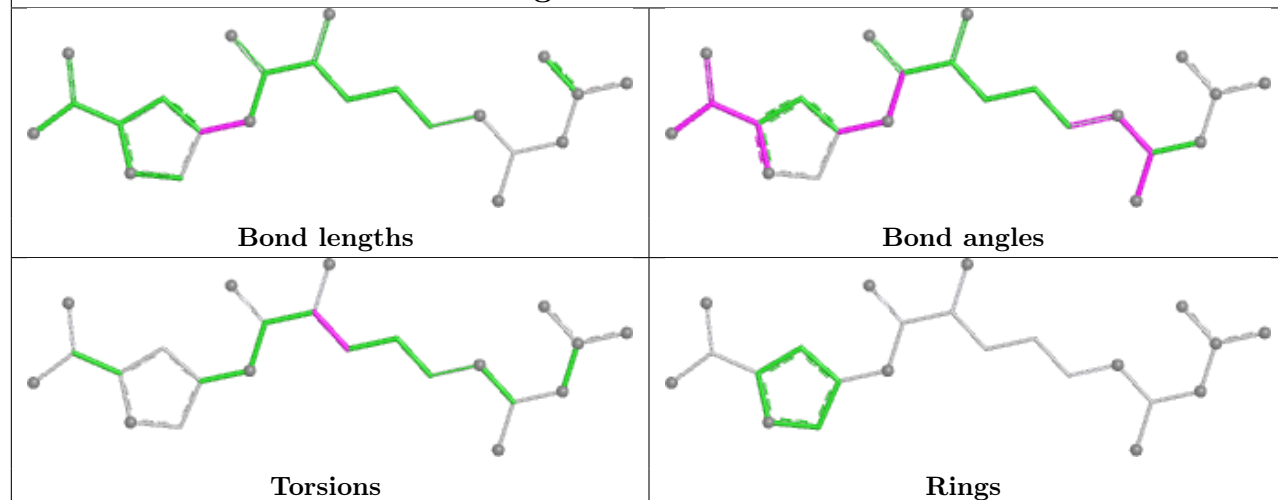
There are no ring outliers.

5 monomers are involved in 15 short contacts:

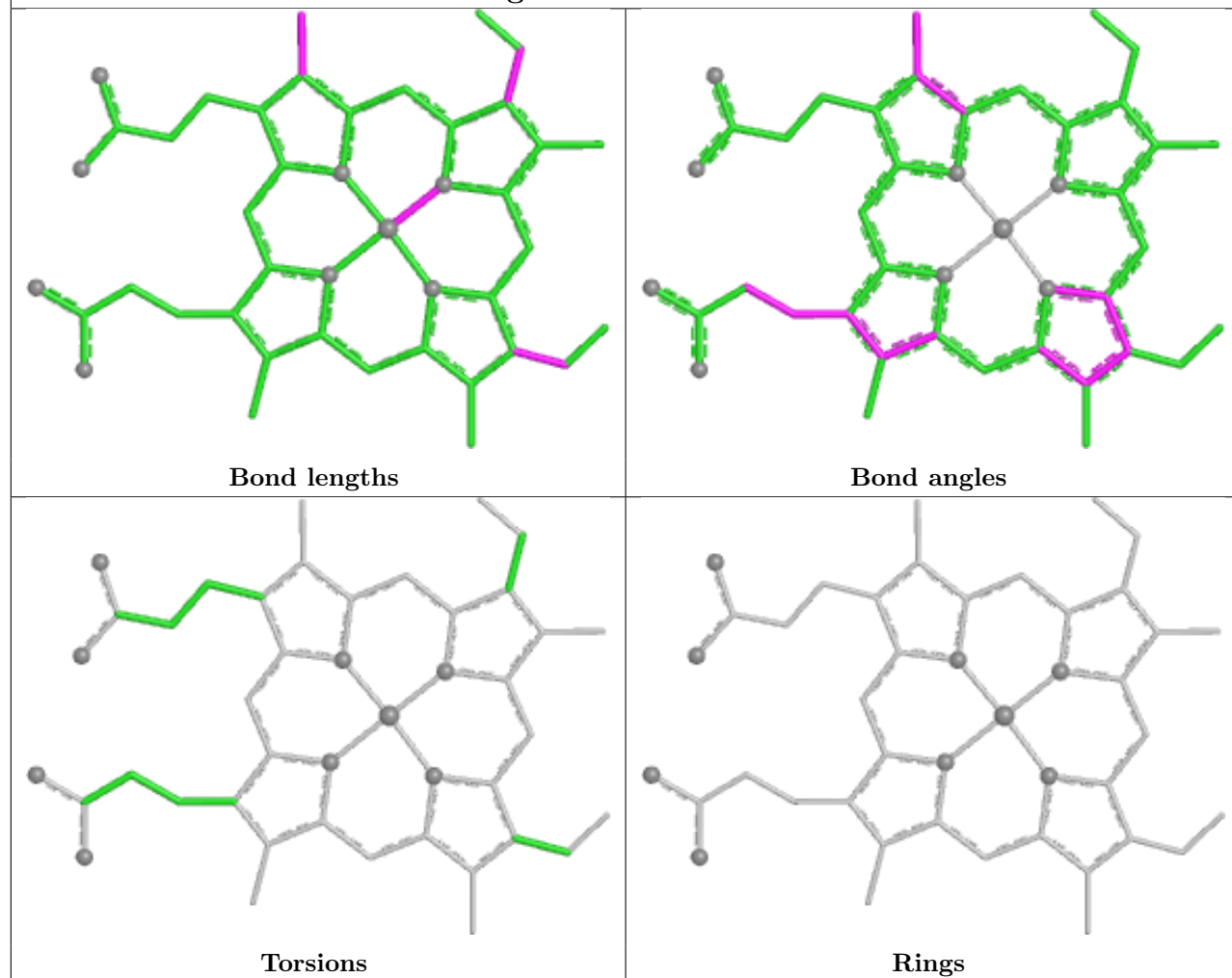
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	861	ACT	8	0
5	B	761	H4B	3	0
2	A	860	ACT	1	0
4	B	700	HEM	1	0
5	A	760	H4B	2	0

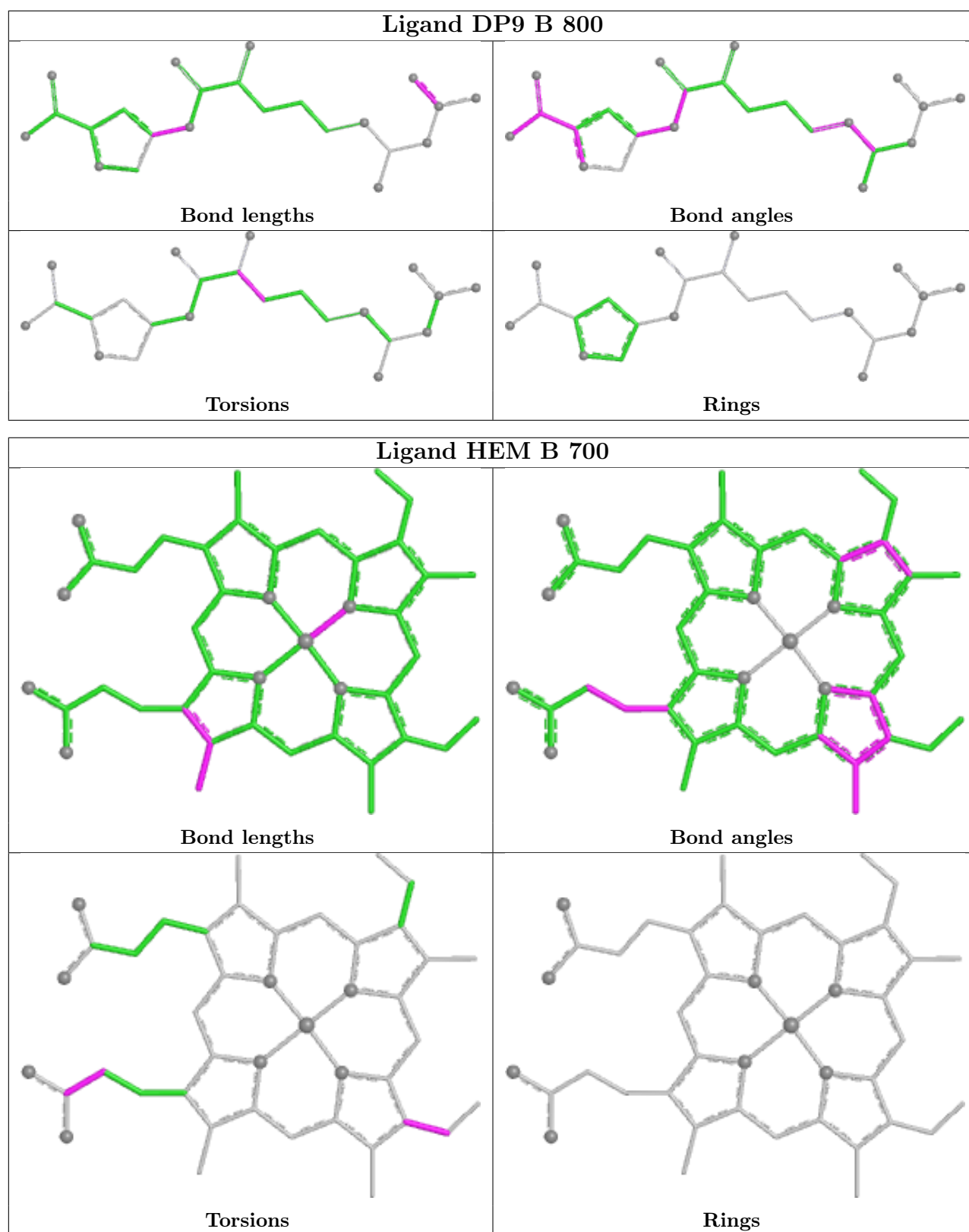
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 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 DP9 A 799



Ligand HEM A 700





5.7 Other polymers [i](#)

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	404/416 (97%)	0.12	9 (2%) 62 66	27, 37, 63, 85	0
1	B	404/416 (97%)	0.25	14 (3%) 47 51	29, 40, 65, 92	0
All	All	808/832 (97%)	0.18	23 (2%) 55 59	27, 39, 64, 92	0

All (23) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	108	PRO	6.2
1	B	120	PRO	5.8
1	A	120	PRO	5.4
1	A	121	PRO	3.7
1	A	107	LEU	3.6
1	B	119	PRO	3.6
1	A	67	GLY	3.6
1	B	121	PRO	3.1
1	A	122	ALA	2.9
1	B	239	GLY	2.8
1	B	258	GLN	2.7
1	B	259	GLN	2.7
1	B	284	GLY	2.5
1	B	323	GLU	2.3
1	B	138	SER	2.3
1	A	68	PRO	2.3
1	B	391	THR	2.3
1	A	434	ASP	2.2
1	B	390	ARG	2.2
1	A	239	GLY	2.1
1	B	122	ALA	2.1
1	B	304	LEU	2.1
1	B	103	GLY	2.1

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

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 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
1	CAS	B	384	9/10	0.95	0.11	49,51,66,67	0
1	CAS	A	384	9/10	0.98	0.07	36,37,52,56	0

6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

6.4 Ligands [i](#)

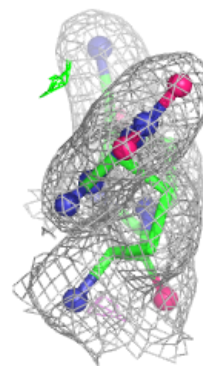
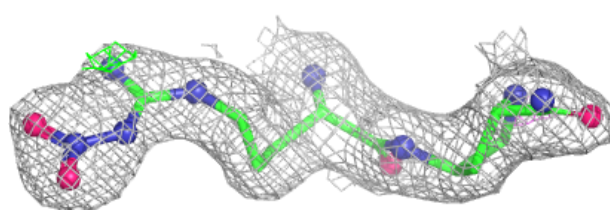
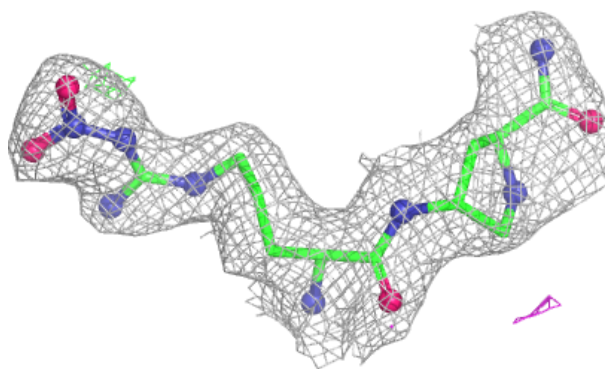
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
2	ACT	A	860	4/4	0.86	0.20	41,42,42,43	0
2	ACT	B	861	4/4	0.91	0.19	46,48,51,53	0
6	DP9	A	799	23/23	0.92	0.09	33,38,49,52	0
6	DP9	B	800	23/23	0.92	0.09	31,38,51,53	0
5	H4B	A	760	17/17	0.97	0.05	30,35,38,39	0
5	H4B	B	761	17/17	0.97	0.06	30,32,36,36	0
4	HEM	A	700	43/43	0.98	0.06	23,28,34,42	0
3	ZN	A	900	1/1	0.99	0.07	40,40,40,40	0
4	HEM	B	700	43/43	0.99	0.05	25,29,37,39	0

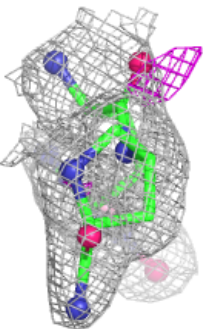
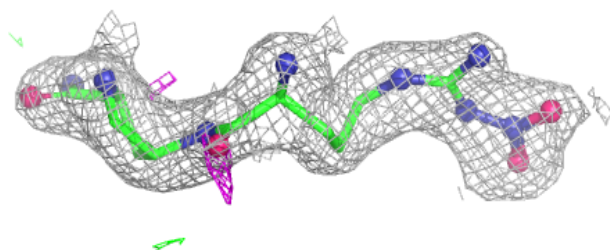
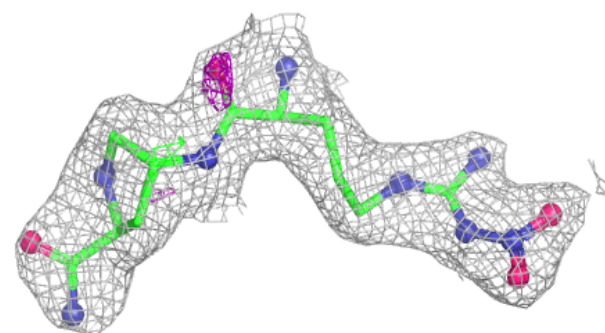
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around DP9 A 799:

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

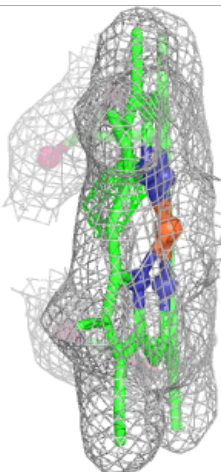
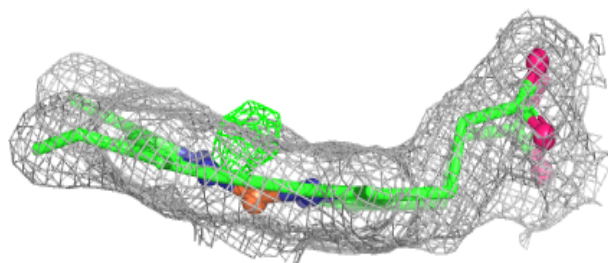
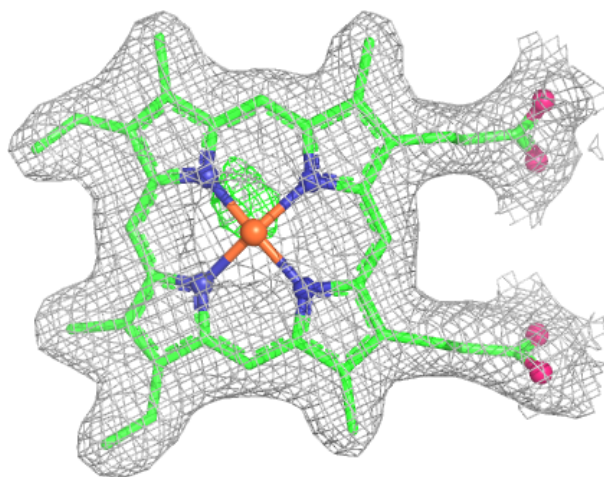
**Electron density around DP9 B 800:**

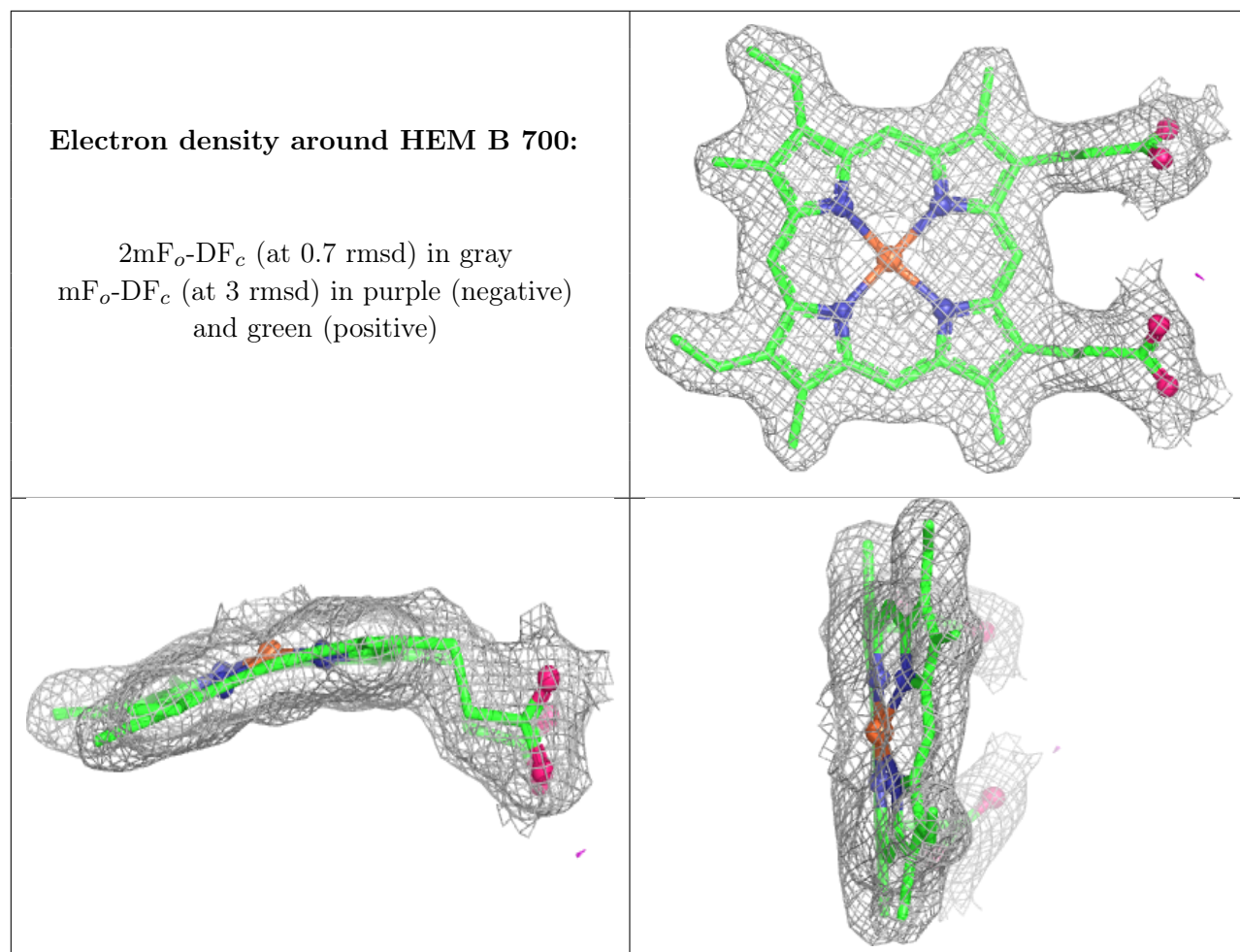
$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



Electron density around HEM A 700:

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





6.5 Other polymers [i](#)

There are no such residues in this entry.