



Full wwPDB X-ray Structure Validation Report ⓘ

Aug 4, 2026 – 09:21 AM EDT

PDB ID : 1YIQ / pdb_00001yiq
Title : Molecular cloning and structural analysis of quinohemoprotein alcohol dehydrogenase ADHIIG from *Pseudomonas putida* HK5. Compariison to the other quinohemoprotein alcohol dehydrogenase ADHIIB found in the same microorganism.
Authors : Toyama, H.; Chen, Z.W.; Fukumoto, M.; Adachi, O.; Matsushita, K.; Mathews, F.S.
Deposited on : 2005-01-12
Resolution : 2.20 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	: 9.0.015 (Gargrove)
Density-Fitness	: 1.0.12
Ideal geometry (proteins)	: Engh & Huber (2001)

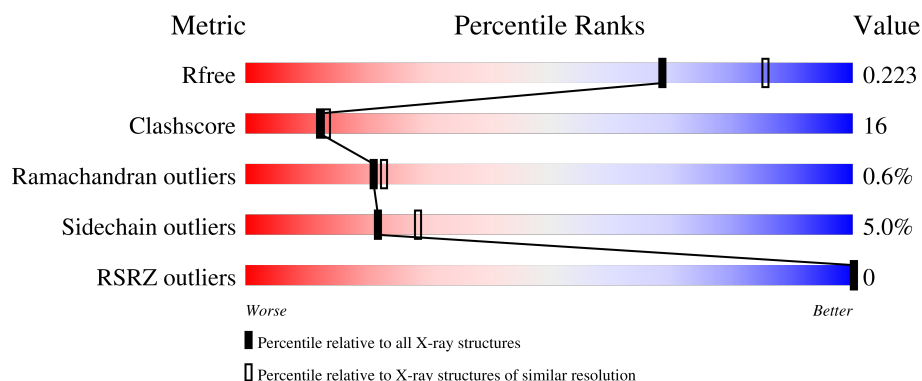
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.20 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	6164 (2.20-2.20)
Clashscore	190562	6851 (2.20-2.20)
Ramachandran outliers	187476	6768 (2.20-2.20)
Sidechain outliers	187428	6769 (2.20-2.20)
RSRZ outliers	180081	6166 (2.20-2.20)

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	689	

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:

Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
 Validation Pipeline (wwPDB-VP) : 2.50

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
4	HEC	A	901	X	-	-	-
5	PGR	A	803	-	X	-	-
5	PGR	A	804	-	X	-	-
5	PGR	A	805	-	X	-	-

2 Entry composition [i](#)

There are 6 unique types of molecules in this entry. The entry contains 5850 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.

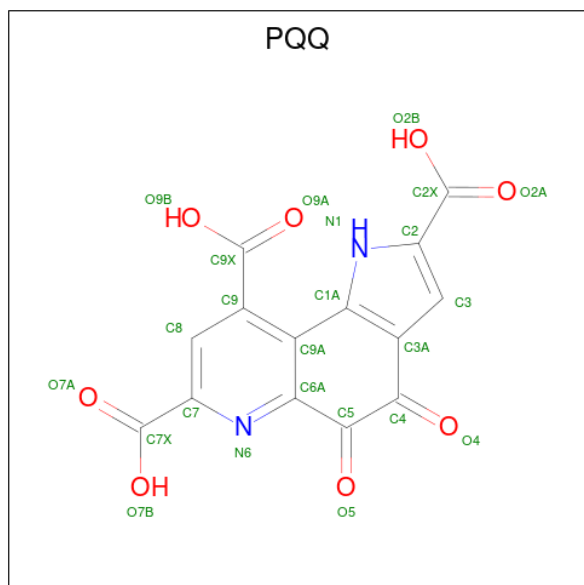
- Molecule 1 is a protein called Quinohemoprotein alcohol dehydrogenase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	684	Total	C	N	O	S	0	0	0
			5282	3367	903	991	21			

- Molecule 2 is CALCIUM ION (CCD ID: CA) (formula: Ca).

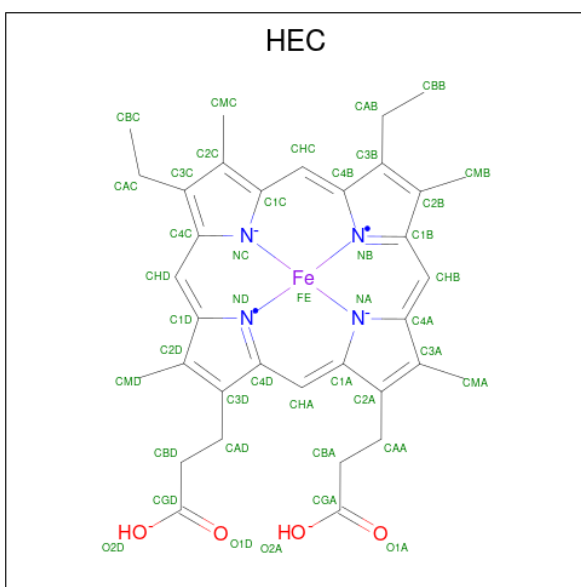
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	1	Total	Ca	0	0
			1	1		

- Molecule 3 is PYRROLOQUINOLINE QUINONE (CCD ID: PQQ) (formula: C₁₄H₆N₂O₈).



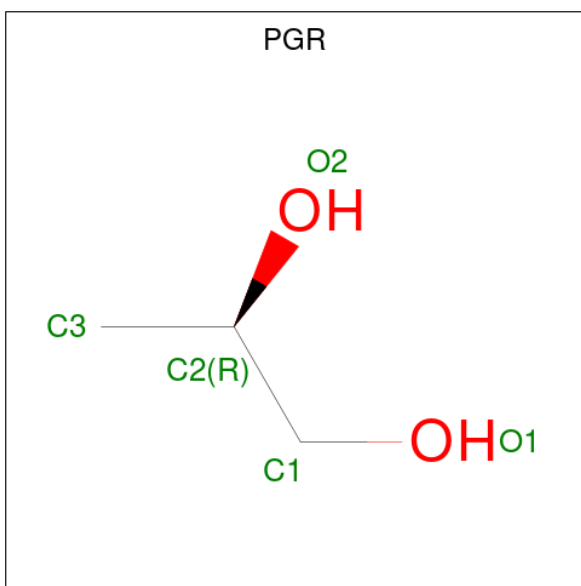
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	N	O	0	0
			24	14	2	8		

- Molecule 4 is HEME C (CCD ID: HEC) (formula: C₃₄H₃₆FeN₄O₄).



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

- Molecule 5 is R-1,2-PROPANEDIOL (CCD ID: PGR) (formula: $C_3H_8O_2$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	A	1	Total 5	C 3	O 2	0	0
5	A	1	Total 5	C 3	O 2	0	0
5	A	1	Total 5	C 3	O 2	0	0

- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	485	Total 485	O 485	0	0

4 Data and refinement statistics

Property	Value	Source
Space group	P 61	Depositor
Cell constants a, b, c, α , β , γ	75.48Å 75.48Å 237.89Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	40.00 – 2.20 40.00 – 2.20	Depositor EDS
% Data completeness (in resolution range)	93.4 (40.00-2.20) 93.6 (40.00-2.20)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.76 (at 2.20Å)	Xtriage
Refinement program	CNS	Depositor
R, R_{free}	0.173 , 0.226 0.170 , 0.223	Depositor DCC
R_{free} test set	3642 reflections (9.99%)	wwPDB-VP
Wilson B-factor (Å ²)	23.4	Xtriage
Anisotropy	0.149	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 39.8	EDS
L-test for twinning ²	$\langle L \rangle = 0.47$, $\langle L^2 \rangle = 0.29$	Xtriage
Estimated twinning fraction	0.085 for h,-h-k,-l	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	5850	wwPDB-VP
Average B, all atoms (Å ²)	27.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.92% 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: HEC, PQQ, PGR, CA

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	0.41	2/5434 (0.0%)	0.98	29/7399 (0.4%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	610	HIS	CE1-NE2	10.76	1.43	1.32
1	A	610	HIS	ND1-CE1	5.96	1.38	1.32

All (29) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	610	HIS	ND1-CG-CD2	13.56	119.66	106.10
1	A	610	HIS	CB-CG-CD2	-9.26	119.16	131.20
1	A	405	ILE	N-CA-C	8.96	117.66	107.89
1	A	679	THR	N-CA-C	-8.76	101.81	111.36
1	A	57	ASP	N-CA-C	7.29	119.31	111.36
1	A	377	LYS	N-CA-C	7.28	121.14	110.59
1	A	655	THR	N-CA-C	-7.25	100.91	110.40
1	A	607	SER	N-CA-C	6.61	118.49	111.28
1	A	64	ALA	N-CA-C	6.58	119.83	109.96
1	A	378	ARG	N-CA-C	-6.49	97.09	108.20
1	A	496	GLY	N-CA-C	6.37	125.80	115.67
1	A	610	HIS	CG-CD2-NE2	-6.12	101.08	107.20
1	A	584	LYS	CA-C-N	6.11	124.06	119.66
1	A	584	LYS	C-N-CA	6.11	124.06	119.66
1	A	678	ASP	N-CA-C	-6.07	97.88	110.80
1	A	23	MET	N-CA-C	6.00	120.61	113.16
1	A	39	GLN	N-CA-C	-5.97	104.77	111.28
1	A	239	SER	N-CA-C	5.93	118.87	110.50
1	A	479	GLY	N-CA-C	5.52	120.95	112.51

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	388	ALA	N-CA-C	-5.46	106.11	112.89
1	A	407	ALA	N-CA-C	5.45	118.58	110.52
1	A	255	ASN	N-CA-C	5.43	117.54	110.53
1	A	347	ILE	N-CA-C	-5.38	107.51	112.83
1	A	65	THR	N-CA-C	-5.29	101.00	109.04
1	A	405	ILE	CB-CA-C	-5.23	104.78	110.37
1	A	478	ASN	N-CA-C	-5.21	103.80	110.53
1	A	385	PHE	N-CA-C	5.19	119.10	112.87
1	A	502	ALA	N-CA-C	-5.10	102.31	109.96
1	A	391	TRP	N-CA-C	5.03	117.50	111.71

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts ⓘ

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	5282	0	5095	163	0
2	A	1	0	0	0	0
3	A	24	0	3	1	0
4	A	43	0	30	3	0
5	A	15	0	24	3	0
6	A	485	0	0	12	0
All	All	5850	0	5152	163	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 16.

All (163) 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:424:ASN:H	1:A:431:GLN:HE22	1.16	0.87
1:A:655:THR:H	1:A:658:GLN:HE21	1.23	0.87
1:A:17:LYS:HE3	1:A:17:LYS:HA	1.61	0.82
1:A:52:TRP:CZ2	1:A:564:THR:HG21	2.20	0.77

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:281:ASN:HD22	1:A:284:THR:H	1.31	0.75
1:A:638:LEU:HD11	4:A:901:HEC:HMB2	1.67	0.74
1:A:515:ALA:HB2	1:A:573:LEU:HD11	1.67	0.74
1:A:110:CYS:HB3	1:A:542:ALA:HB2	1.68	0.74
1:A:345:LYS:HG3	1:A:465:GLN:HB3	1.71	0.72
1:A:41:SER:H	1:A:44:ASN:HD21	1.38	0.72
1:A:608:GLN:HE21	1:A:608:GLN:H	1.37	0.72
1:A:392:GLN:NE2	1:A:392:GLN:H	1.89	0.71
1:A:40:ILE:H	1:A:531:GLN:NE2	1.90	0.70
1:A:588:LEU:HD23	1:A:589:SER:N	2.08	0.68
1:A:281:ASN:ND2	1:A:284:THR:H	1.91	0.68
1:A:447:LEU:CD1	1:A:451:LYS:HE3	2.23	0.68
1:A:447:LEU:HD11	1:A:451:LYS:HE3	1.75	0.67
1:A:73:MET:HE1	1:A:534:THR:HG21	1.76	0.66
1:A:351:SER:HB2	1:A:369:ASN:ND2	2.10	0.66
1:A:169:LYS:HE3	1:A:283:ASP:HA	1.77	0.65
1:A:423:ARG:HH11	1:A:423:ARG:HG2	1.60	0.65
1:A:424:ASN:H	1:A:431:GLN:NE2	1.93	0.64
1:A:215:MET:HE3	1:A:215:MET:HA	1.78	0.64
1:A:324:GLN:HG2	1:A:326:PRO:HD3	1.78	0.64
1:A:41:SER:H	1:A:44:ASN:ND2	1.95	0.64
1:A:230:GLN:HE22	1:A:264:ARG:HA	1.63	0.63
1:A:439:MET:HE1	6:A:1399:HOH:O	1.97	0.63
1:A:260:ASP:OD2	1:A:416:HIS:HD2	1.79	0.63
1:A:424:ASN:N	1:A:431:GLN:HE22	1.93	0.63
1:A:316:GLY:C	1:A:317:LYS:HD2	2.23	0.63
1:A:534:THR:HG22	1:A:564:THR:HB	1.81	0.63
1:A:586:PRO:HG3	6:A:1305:HOH:O	1.99	0.62
1:A:281:ASN:HD22	1:A:284:THR:N	1.99	0.61
1:A:384:ALA:HB3	1:A:410:MET:SD	2.40	0.61
1:A:40:ILE:H	1:A:531:GLN:HE22	1.49	0.60
1:A:625:LYS:HE3	5:A:805:PGR:H2	1.84	0.60
1:A:654:PHE:HA	1:A:658:GLN:NE2	2.17	0.60
1:A:389:HIS:HE1	1:A:392:GLN:O	1.85	0.60
1:A:579:ARG:NH2	1:A:618:GLY:HA3	2.16	0.60
1:A:456:LYS:HE3	1:A:458:ILE:HD11	1.85	0.59
1:A:616:SER:O	5:A:805:PGR:H12	2.03	0.58
1:A:534:THR:CG2	1:A:564:THR:HB	2.33	0.58
1:A:441:GLU:HG2	1:A:669:ARG:NH1	2.19	0.57
1:A:392:GLN:H	1:A:392:GLN:HE21	1.53	0.57
1:A:258:LEU:HG	1:A:433:GLY:HA3	1.87	0.57

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:51:ALA:HB2	1:A:566:LYS:HG2	1.86	0.56
1:A:212:GLY:O	1:A:216:GLU:HG3	2.05	0.56
1:A:482:LEU:CB	1:A:522:PRO:HG2	2.35	0.56
1:A:525:TYR:HE1	1:A:534:THR:CG2	2.19	0.56
1:A:177:ALA:HB3	3:A:801:PQQ:O7B	2.07	0.54
1:A:441:GLU:OE2	5:A:804:PGR:H12	2.07	0.54
1:A:655:THR:N	1:A:658:GLN:HE21	2.01	0.54
1:A:348:VAL:HG13	6:A:1400:HOH:O	2.09	0.53
1:A:586:PRO:O	1:A:671:HIS:HE1	1.91	0.53
1:A:215:MET:HA	1:A:215:MET:CE	2.38	0.53
1:A:356:MET:HE1	1:A:361:GLY:HA2	1.90	0.53
1:A:608:GLN:H	1:A:608:GLN:NE2	2.05	0.52
1:A:120:TRP:NE1	1:A:121:LYS:HD2	2.24	0.52
1:A:492:GLY:HA3	1:A:518:VAL:CG1	2.39	0.52
1:A:52:TRP:CH2	1:A:564:THR:HG21	2.43	0.52
1:A:230:GLN:CD	1:A:258:LEU:HD22	2.35	0.52
1:A:107:GLU:OE2	1:A:427:LYS:HE2	2.09	0.52
1:A:553:ARG:HD2	1:A:683:PHE:O	2.09	0.52
1:A:464:LYS:O	1:A:465:GLN:HB2	2.10	0.52
1:A:39:GLN:HB3	1:A:531:GLN:HE21	1.76	0.51
1:A:63:GLU:OE1	1:A:113:VAL:HG11	2.11	0.51
1:A:660:ASP:O	1:A:664:GLN:HG2	2.10	0.51
1:A:482:LEU:HB3	1:A:522:PRO:HG2	1.92	0.51
1:A:418:PRO:HG2	6:A:1202:HOH:O	2.10	0.51
1:A:63:GLU:HB3	1:A:391:TRP:CH2	2.45	0.50
1:A:447:LEU:HD23	1:A:683:PHE:CD1	2.47	0.50
1:A:356:MET:HE1	1:A:361:GLY:C	2.36	0.50
1:A:281:ASN:ND2	1:A:284:THR:HG23	2.28	0.49
1:A:109:CYS:SG	1:A:110:CYS:N	2.85	0.49
1:A:677:GLY:O	1:A:678:ASP:HB2	2.12	0.49
1:A:655:THR:H	1:A:658:GLN:NE2	2.02	0.49
1:A:351:SER:CB	1:A:369:ASN:ND2	2.74	0.49
1:A:633:MET:O	1:A:637:ILE:HG13	2.12	0.49
1:A:44:ASN:C	1:A:44:ASN:HD22	2.21	0.49
1:A:215:MET:HG2	6:A:1194:HOH:O	2.12	0.48
1:A:378:ARG:NH1	1:A:438:MET:HG3	2.28	0.48
1:A:628:PRO:O	1:A:632:GLN:HG3	2.13	0.48
1:A:422:LYS:C	1:A:422:LYS:HD2	2.38	0.48
1:A:226:ALA:HB2	6:A:1362:HOH:O	2.13	0.48
1:A:487:ASN:HD22	1:A:503:ALA:HB3	1.78	0.48
1:A:401:GLY:O	1:A:462:PRO:HD2	2.14	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:382:THR:HB	1:A:411:SER:HB3	1.95	0.48
1:A:422:LYS:HD2	1:A:423:ARG:N	2.29	0.47
1:A:629:GLU:HA	1:A:632:GLN:HE21	1.78	0.47
1:A:44:ASN:HD22	1:A:45:VAL:N	2.11	0.47
1:A:281:ASN:ND2	1:A:284:THR:N	2.60	0.47
1:A:543:PHE:HB3	6:A:1054:HOH:O	2.13	0.47
1:A:52:TRP:CE2	1:A:564:THR:HG21	2.50	0.47
1:A:104:ARG:NH2	1:A:130:ASP:HB2	2.29	0.47
1:A:106:GLY:HA2	4:A:901:HEC:CBC	2.45	0.47
1:A:482:LEU:HB2	1:A:522:PRO:HG2	1.96	0.46
1:A:215:MET:HE2	1:A:218:ALA:HB3	1.96	0.46
1:A:325:ALA:O	1:A:389:HIS:HD2	1.99	0.46
1:A:23:MET:HG2	1:A:69:VAL:HG22	1.96	0.46
1:A:284:THR:OG1	1:A:286:GLU:HG2	2.16	0.46
1:A:351:SER:CB	1:A:369:ASN:HD21	2.30	0.45
1:A:356:MET:HE1	1:A:361:GLY:CA	2.46	0.45
1:A:553:ARG:HH11	1:A:553:ARG:HG2	1.82	0.45
1:A:588:LEU:HD12	1:A:671:HIS:CG	2.52	0.45
1:A:435:ARG:HB3	1:A:438:MET:HE1	1.98	0.45
1:A:439:MET:HB3	1:A:449:MET:SD	2.57	0.45
1:A:493:SER:OG	1:A:497:ARG:HG2	2.16	0.45
1:A:668:LYS:HD3	1:A:668:LYS:C	2.41	0.45
1:A:389:HIS:CE1	1:A:392:GLN:O	2.68	0.45
1:A:522:PRO:HB3	1:A:535:PHE:CE1	2.51	0.45
1:A:379:ASN:O	1:A:413:TYR:HA	2.17	0.45
1:A:623:LEU:HB3	1:A:666:LEU:HD13	1.99	0.45
1:A:626:LEU:HD21	4:A:901:HEC:HBA2	1.99	0.45
1:A:447:LEU:C	1:A:447:LEU:HD13	2.42	0.45
1:A:44:ASN:ND2	1:A:44:ASN:C	2.75	0.45
1:A:377:LYS:HG3	1:A:379:ASN:HD21	1.82	0.44
1:A:522:PRO:HB3	1:A:535:PHE:CD1	2.52	0.44
1:A:565:TYR:CD1	1:A:565:TYR:N	2.85	0.44
1:A:372:TYR:HA	1:A:375:ASN:OD1	2.17	0.44
1:A:423:ARG:HH11	1:A:423:ARG:CG	2.27	0.44
1:A:487:ASN:ND2	1:A:503:ALA:HB3	2.33	0.44
1:A:317:LYS:HD2	1:A:317:LYS:N	2.33	0.44
1:A:543:PHE:CZ	1:A:551:SER:HA	2.53	0.44
1:A:328:ASN:HB2	1:A:352:TRP:CZ2	2.53	0.43
1:A:382:THR:HA	1:A:383:PRO:C	2.43	0.43
1:A:514:ALA:O	1:A:515:ALA:HB3	2.18	0.43
1:A:446:LEU:HG	1:A:549:ALA:CB	2.48	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:441:GLU:CG	1:A:669:ARG:NH1	2.81	0.43
1:A:258:LEU:CD1	6:A:1482:HOH:O	2.67	0.42
1:A:180:GLY:HA2	1:A:257:SER:OG	2.19	0.42
1:A:227:TYR:C	1:A:227:TYR:CD1	2.96	0.42
1:A:434:LEU:HD23	1:A:434:LEU:C	2.44	0.42
1:A:552:LEU:HD12	1:A:552:LEU:HA	1.90	0.42
1:A:87:ALA:HB1	1:A:525:TYR:CE2	2.54	0.42
1:A:380:LEU:HD12	1:A:412:ALA:C	2.44	0.42
1:A:489:VAL:HG13	1:A:489:VAL:O	2.20	0.42
1:A:254:GLY:HA3	6:A:1108:HOH:O	2.20	0.42
1:A:602:TYR:CD2	1:A:602:TYR:C	2.98	0.42
1:A:25:THR:O	1:A:65:THR:HG21	2.19	0.42
1:A:166:VAL:HG11	1:A:282:ALA:HB1	2.01	0.42
1:A:296:GLY:O	1:A:297:ASP:C	2.62	0.42
1:A:426:PHE:CE1	1:A:428:SER:HB2	2.55	0.42
1:A:174:ASN:O	1:A:235:THR:HB	2.20	0.41
1:A:289:TRP:HE3	1:A:290:HIS:N	2.18	0.41
1:A:633:MET:HE2	6:A:1178:HOH:O	2.20	0.41
1:A:35:SER:HA	1:A:36:PRO:HD3	1.92	0.41
1:A:500:ALA:HB3	1:A:510:TRP:HB3	2.03	0.41
1:A:588:LEU:HD23	1:A:589:SER:O	2.19	0.41
1:A:629:GLU:O	1:A:633:MET:HG2	2.20	0.41
1:A:643:VAL:HB	1:A:644:PRO:HD3	2.02	0.41
1:A:83:TYR:HE2	1:A:95:LYS:HE2	1.85	0.41
1:A:39:GLN:HE22	1:A:530:GLU:HA	1.86	0.41
1:A:322:LEU:C	1:A:322:LEU:HD23	2.45	0.41
1:A:539:TRP:CE3	1:A:539:TRP:HA	2.55	0.41
1:A:591:ASP:O	1:A:595:ILE:HG12	2.21	0.41
1:A:416:HIS:HE1	6:A:1460:HOH:O	2.03	0.40
1:A:465:GLN:HG2	6:A:1403:HOH:O	2.21	0.40
1:A:534:THR:HB	1:A:564:THR:HB	2.02	0.40
1:A:33:ARG:HD2	1:A:306:HIS:CE1	2.56	0.40
1:A:575:GLU:HB3	1:A:576:PRO:HD2	2.03	0.40
1:A:489:VAL:CG1	1:A:501:TYR:HB2	2.52	0.40
1:A:482:LEU:O	1:A:489:VAL:HA	2.22	0.40
1:A:549:ALA:O	1:A:552:LEU:HB2	2.21	0.40

There are no symmetry-related clashes.

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

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

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

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	682/689 (99%)	636 (93%)	42 (6%)	4 (1%)	21	23

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	678	ASP
1	A	676	GLU
1	A	559	TYR
1	A	387	GLY

5.3.2 Protein sidechains [i](#)

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

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

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	535/539 (99%)	508 (95%)	27 (5%)	22	28

All (27) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	17	LYS
1	A	44	ASN
1	A	121	LYS
1	A	129	LEU
1	A	147	VAL
1	A	213	LYS
1	A	215	MET

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Mol	Chain	Res	Type
1	A	258	LEU
1	A	348	VAL
1	A	377	LYS
1	A	392	GLN
1	A	422	LYS
1	A	434	LEU
1	A	435	ARG
1	A	438	MET
1	A	439	MET
1	A	446	LEU
1	A	523	VAL
1	A	534	THR
1	A	552	LEU
1	A	564	THR
1	A	579	ARG
1	A	582	THR
1	A	606	CYS
1	A	608	GLN
1	A	620	LEU
1	A	673	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (24) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	6	ASN
1	A	21	ASN
1	A	44	ASN
1	A	47	GLN
1	A	167	ASN
1	A	230	GLN
1	A	266	GLN
1	A	281	ASN
1	A	324	GLN
1	A	369	ASN
1	A	379	ASN
1	A	389	HIS
1	A	392	GLN
1	A	416	HIS
1	A	431	GLN
1	A	466	GLN
1	A	487	ASN
1	A	531	GLN

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Mol	Chain	Res	Type
1	A	557	GLN
1	A	608	GLN
1	A	632	GLN
1	A	658	GLN
1	A	661	GLN
1	A	671	HIS

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 6 ligands modelled in this entry, 1 is monoatomic - leaving 5 for Mogul analysis.

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

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
4	HEC	A	901	1	50,50,50	1.25	6 (12%)	68,82,82	0.90	1 (1%)
3	PQQ	A	801	2	26,26,26	2.28	9 (34%)	34,40,40	1.72	9 (26%)
5	PGR	A	803	-	4,4,4	1.18	1 (25%)	4,4,4	2.23	1 (25%)
5	PGR	A	805	-	4,4,4	1.28	1 (25%)	4,4,4	2.12	1 (25%)
5	PGR	A	804	-	4,4,4	1.23	1 (25%)	4,4,4	2.16	1 (25%)

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
4	HEC	A	901	1	1/1/3/7	6/14/54/54	-
3	PQQ	A	801	2	-	0/12/28/28	0/3/3/3
5	PGR	A	803	-	-	2/2/2/2	-
5	PGR	A	805	-	-	2/2/2/2	-
5	PGR	A	804	-	-	2/2/2/2	-

All (18) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	801	PQQ	C9A-C1A	6.79	1.54	1.46
3	A	801	PQQ	C9-C9A	4.81	1.48	1.41
3	A	801	PQQ	C8-C9	3.64	1.45	1.39
3	A	801	PQQ	C1A-N1	-2.84	1.32	1.37
3	A	801	PQQ	C9-C9X	2.60	1.55	1.49
3	A	801	PQQ	C5-C4	2.57	1.58	1.54
3	A	801	PQQ	C9A-C6A	2.50	1.45	1.41
4	A	901	HEC	CAD-C3D	2.49	1.57	1.51
4	A	901	HEC	CMC-C2C	2.45	1.55	1.50
4	A	901	HEC	FE-NB	2.34	2.02	1.94
4	A	901	HEC	FE-NA	2.33	2.02	1.95
4	A	901	HEC	CMD-C2D	2.27	1.55	1.50
5	A	805	PGR	C1-C2	2.23	1.58	1.46
3	A	801	PQQ	O2B-C2X	-2.21	1.24	1.30
4	A	901	HEC	O2A-CGA	-2.20	1.23	1.30
5	A	804	PGR	C1-C2	2.20	1.57	1.46
3	A	801	PQQ	C6A-C5	2.12	1.52	1.50
5	A	803	PGR	C1-C2	2.11	1.57	1.46

All (13) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	801	PQQ	C9A-C6A-C5	4.16	125.45	121.59
3	A	801	PQQ	C5-C6A-N6	-3.03	110.01	115.06
3	A	801	PQQ	C3A-C4-C5	-2.96	113.68	117.03
5	A	803	PGR	O2-C2-C1	-2.89	100.81	114.99
5	A	804	PGR	O2-C2-C1	-2.89	100.81	114.99
5	A	805	PGR	O2-C2-C1	-2.79	101.31	114.99
3	A	801	PQQ	O2A-C2X-C2	-2.70	115.53	121.01

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	801	PQQ	C8-C9-C9A	-2.70	116.87	120.33
3	A	801	PQQ	O4-C4-C3A	2.35	127.67	121.92
4	A	901	HEC	O1A-CGA-CBA	-2.22	116.06	123.09
3	A	801	PQQ	O9A-C9X-C9	-2.21	116.69	121.97
3	A	801	PQQ	C3-C2-C2X	-2.10	127.70	132.53
3	A	801	PQQ	C1A-C3A-C4	2.08	124.08	122.33

All (1) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
4	A	901	HEC	NA

All (12) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	901	HEC	C4D-C3D-CAD-CBD
5	A	803	PGR	O1-C1-C2-C3
5	A	803	PGR	O1-C1-C2-O2
5	A	805	PGR	O1-C1-C2-O2
4	A	901	HEC	C2D-C3D-CAD-CBD
5	A	804	PGR	O1-C1-C2-O2
5	A	804	PGR	O1-C1-C2-C3
5	A	805	PGR	O1-C1-C2-C3
4	A	901	HEC	C2B-C3B-CAB-CBB
4	A	901	HEC	C4B-C3B-CAB-CBB
4	A	901	HEC	CAD-CBD-CGD-O1D
4	A	901	HEC	CAD-CBD-CGD-O2D

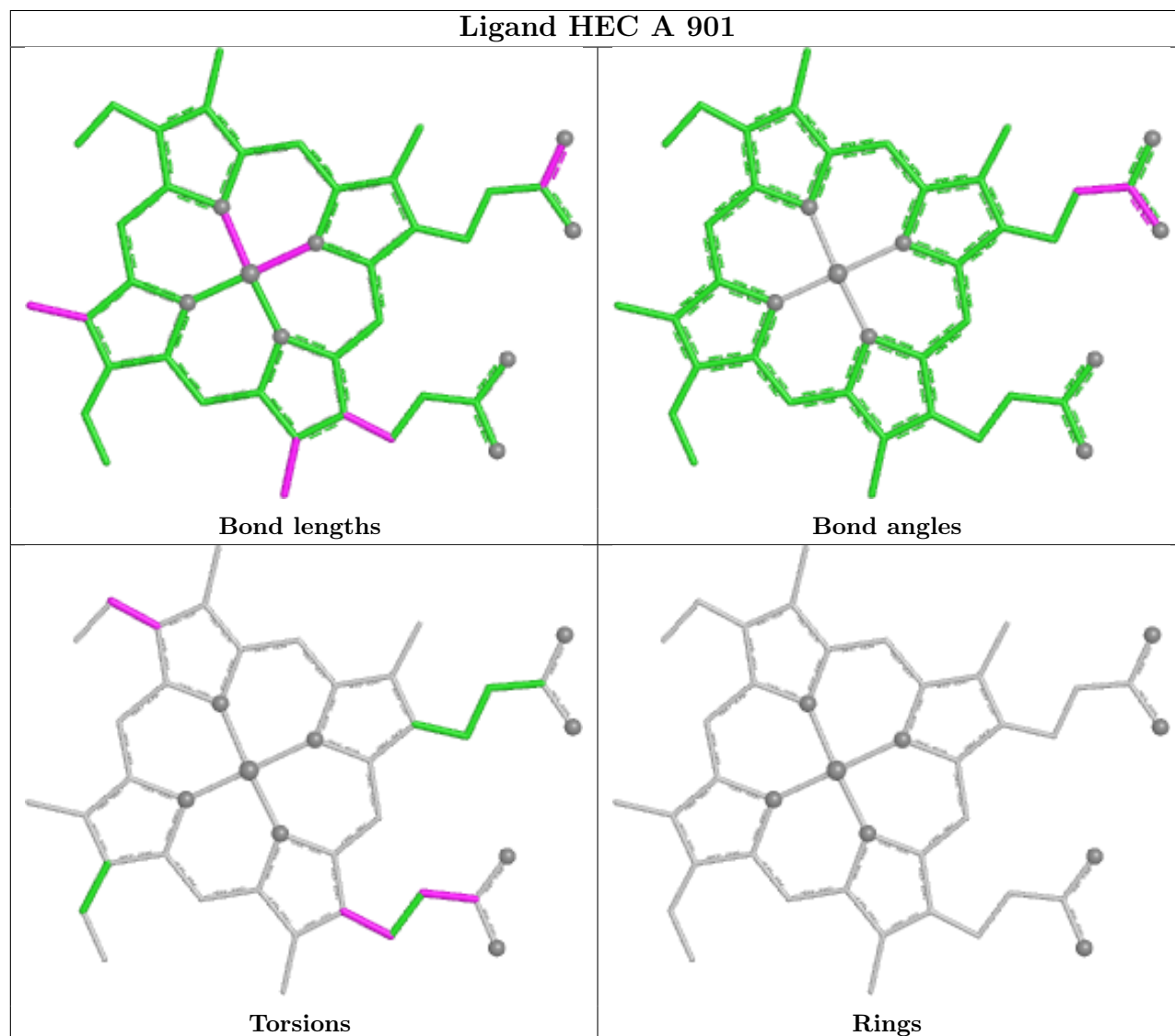
There are no ring outliers.

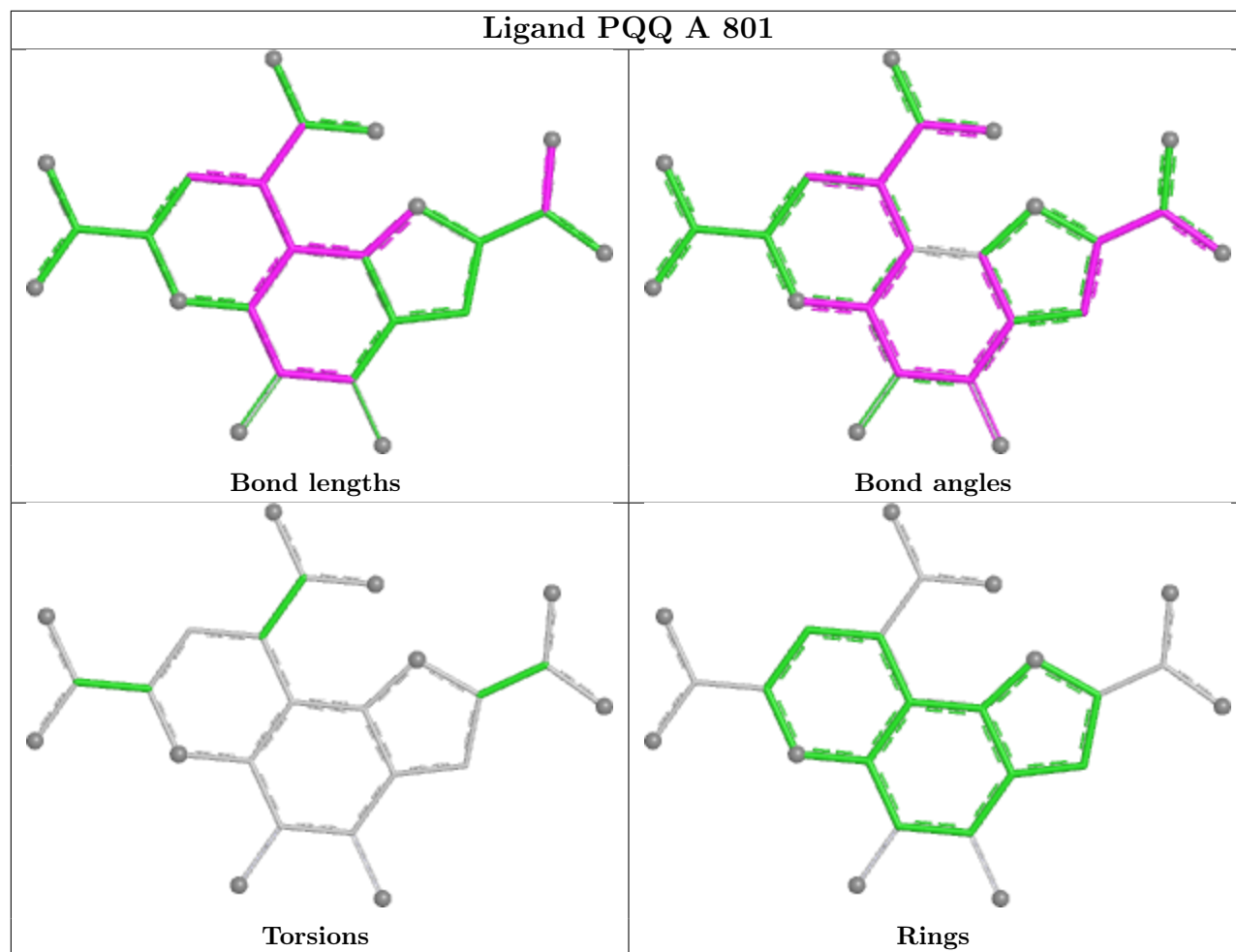
4 monomers are involved in 7 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	901	HEC	3	0
3	A	801	PQQ	1	0
5	A	805	PGR	2	0
5	A	804	PGR	1	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.





5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data [i](#)

6.1 Protein, DNA and RNA chains [i](#)

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	684/689 (99%)	-0.41	0 100 100	14, 24, 45, 61	0

There are no RSRZ outliers to report.

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

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

6.3 Carbohydrates [i](#)

There are no 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.

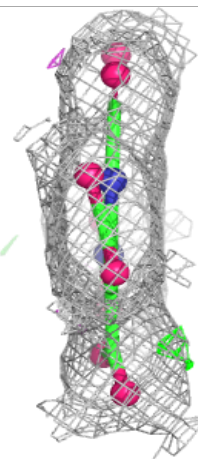
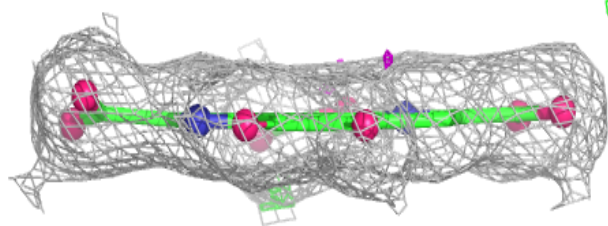
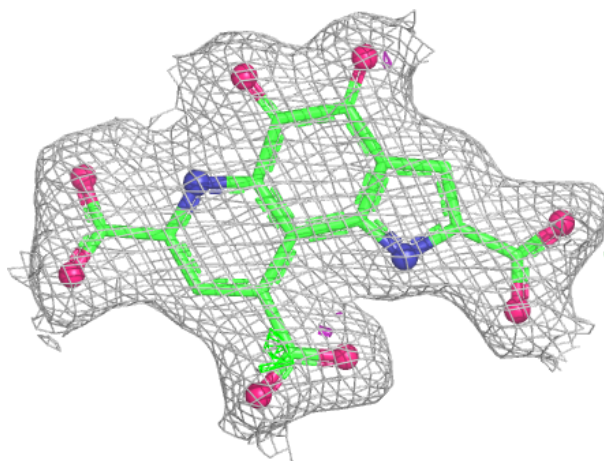
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
5	PGR	A	805	5/5	0.80	0.16	34,35,38,40	0
5	PGR	A	804	5/5	0.82	0.13	32,32,35,39	0
2	CA	A	802	1/1	0.91	0.20	68,68,68,68	1
5	PGR	A	803	5/5	0.94	0.08	24,25,26,27	0
3	PQQ	A	801	24/24	0.97	0.05	7,13,17,18	0
4	HEC	A	901	43/43	0.98	0.07	13,18,30,33	0

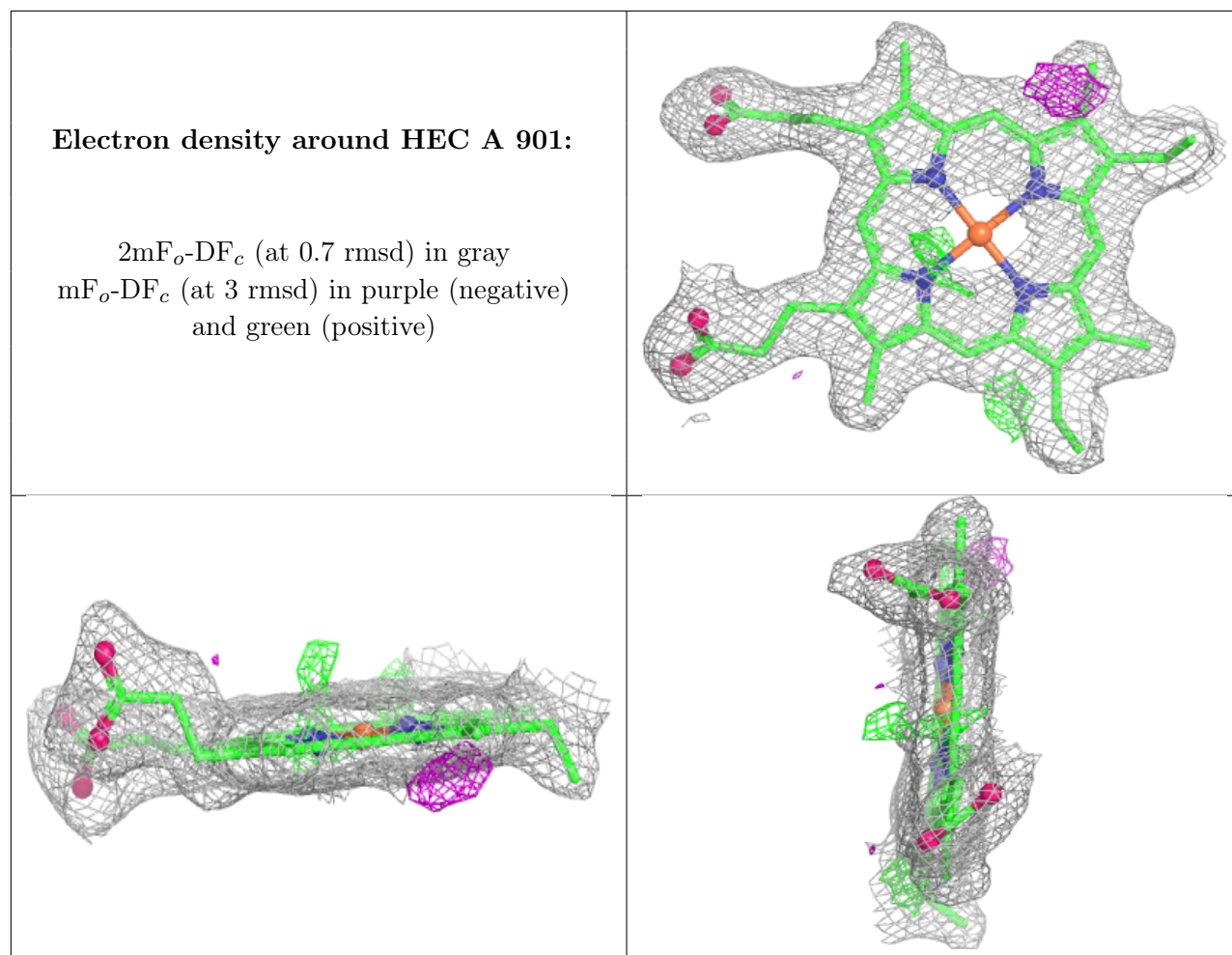
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different

orientation to approximate a three-dimensional view.

Electron density around PQQ 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)





6.5 Other polymers [i](#)

There are no such residues in this entry.