



# Full wwPDB X-ray Structure Validation Report ⓘ

Nov 19, 2023 – 08:58 PM JST

PDB ID : 7BUI  
Title : Complex of reduced oxygenase and oxidized ferredoxin in carbazole 1,9a-dioxygenase  
Authors : Matsuzawa, J.; Wang, Y.X.; Suzuki-Minakuchi, C.; Nojiri, H.  
Deposited on : 2020-04-06  
Resolution : 2.15 Å (reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at [validation@mail.wwpdb.org](mailto:validation@mail.wwpdb.org)

A user guide is available at

<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>.

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

MolProbity : 4.02b-467  
Mogul : 1.8.5 (274361), CSD as541be (2020)  
Xtriage (Phenix) : 1.13  
EDS : 2.36  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Refmac : 5.8.0158  
CCP4 : 7.0.044 (Gargrove)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.36

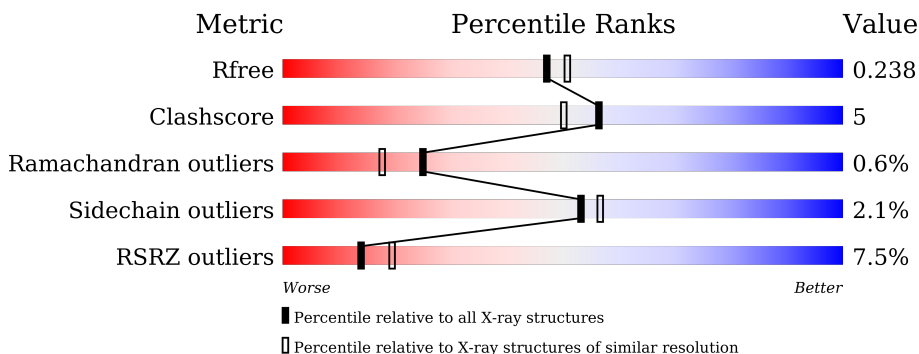
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.15 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))
$R_{free}$	130704	1479 (2.16-2.16)
Clashscore	141614	1585 (2.16-2.16)
Ramachandran outliers	138981	1560 (2.16-2.16)
Sidechain outliers	138945	1559 (2.16-2.16)
RSRZ outliers	127900	1456 (2.16-2.16)

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  $\geq 3$ , 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	392	
1	B	392	
1	C	392	
2	D	115	
2	E	115	

## 2 Entry composition i

There are 7 unique types of molecules in this entry. The entry contains 11513 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 Terminal oxygenase component of carbazole.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	389	3146	2010	540	583	13	0	1	0
1	B	389	3162	2024	541	583	14	0	3	0
1	C	388	3128	1999	534	582	13	0	0	0

There are 24 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	385	LEU	-	expression tag	UNP Q84II6
A	386	GLU	-	expression tag	UNP Q84II6
A	387	HIS	-	expression tag	UNP Q84II6
A	388	HIS	-	expression tag	UNP Q84II6
A	389	HIS	-	expression tag	UNP Q84II6
A	390	HIS	-	expression tag	UNP Q84II6
A	391	HIS	-	expression tag	UNP Q84II6
A	392	HIS	-	expression tag	UNP Q84II6
B	385	LEU	-	expression tag	UNP Q84II6
B	386	GLU	-	expression tag	UNP Q84II6
B	387	HIS	-	expression tag	UNP Q84II6
B	388	HIS	-	expression tag	UNP Q84II6
B	389	HIS	-	expression tag	UNP Q84II6
B	390	HIS	-	expression tag	UNP Q84II6
B	391	HIS	-	expression tag	UNP Q84II6
B	392	HIS	-	expression tag	UNP Q84II6
C	385	LEU	-	expression tag	UNP Q84II6
C	386	GLU	-	expression tag	UNP Q84II6
C	387	HIS	-	expression tag	UNP Q84II6
C	388	HIS	-	expression tag	UNP Q84II6
C	389	HIS	-	expression tag	UNP Q84II6
C	390	HIS	-	expression tag	UNP Q84II6
C	391	HIS	-	expression tag	UNP Q84II6

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Chain	Residue	Modelled	Actual	Comment	Reference
C	392	HIS	-	expression tag	UNP Q84II6

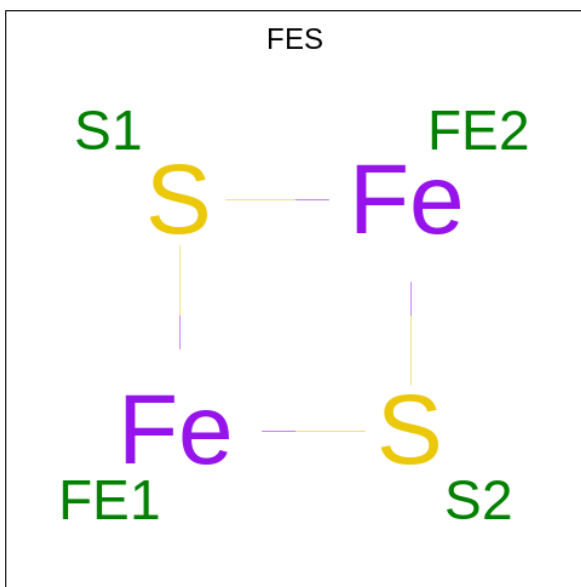
- Molecule 2 is a protein called Ferredoxin CarAc.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	D	98	Total	C	N	O	S	0	0	0
			715	447	120	141	7			
2	E	108	Total	C	N	O	S	0	1	0
			808	507	135	159	7			

There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
D	108	LEU	-	expression tag	UNP Q8GI16
D	109	GLU	-	expression tag	UNP Q8GI16
D	110	HIS	-	expression tag	UNP Q8GI16
D	111	HIS	-	expression tag	UNP Q8GI16
D	112	HIS	-	expression tag	UNP Q8GI16
D	113	HIS	-	expression tag	UNP Q8GI16
D	114	HIS	-	expression tag	UNP Q8GI16
D	115	HIS	-	expression tag	UNP Q8GI16
E	108	LEU	-	expression tag	UNP Q8GI16
E	109	GLU	-	expression tag	UNP Q8GI16
E	110	HIS	-	expression tag	UNP Q8GI16
E	111	HIS	-	expression tag	UNP Q8GI16
E	112	HIS	-	expression tag	UNP Q8GI16
E	113	HIS	-	expression tag	UNP Q8GI16
E	114	HIS	-	expression tag	UNP Q8GI16
E	115	HIS	-	expression tag	UNP Q8GI16

- Molecule 3 is FE2/S2 (INORGANIC) CLUSTER (three-letter code: FES) (formula: Fe<sub>2</sub>S<sub>2</sub>).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	Fe	S	0	0
			4	2	2		
3	B	1	Total	Fe	S	0	0
			4	2	2		
3	C	1	Total	Fe	S	0	0
			4	2	2		
3	D	1	Total	Fe	S	0	0
			4	2	2		
3	E	1	Total	Fe	S	0	0
			4	2	2		

- Molecule 4 is FE (II) ION (three-letter code: FE2) (formula: Fe) (labeled as "Ligand of Interest" by depositor).

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

- Molecule 5 is 1,2-ETHANEDIOL (three-letter code: EDO) (formula: C<sub>2</sub>H<sub>6</sub>O<sub>2</sub>).



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

- Molecule 6 is DI(HYDROXYETHYL)ETHER (three-letter code: PEG) (formula: C<sub>4</sub>H<sub>10</sub>O<sub>3</sub>).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	B	1	Total C O 7 4 3	0	0
6	E	1	Total C O 7 4 3	0	0

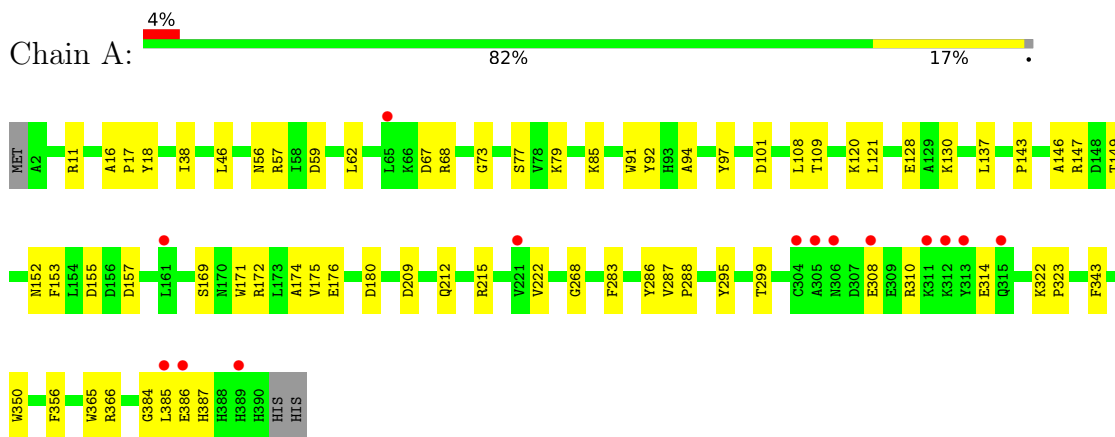
- Molecule 7 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	A	104	Total O 104 104	0	0
7	B	214	Total O 214 214	0	0
7	C	129	Total O 129 129	0	0
7	D	9	Total O 9 9	0	0
7	E	21	Total O 21 21	0	0

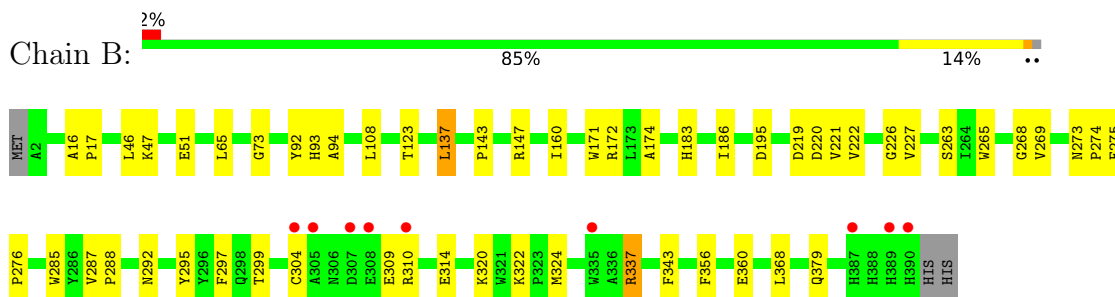
### 3 Residue-property plots [i](#)

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.

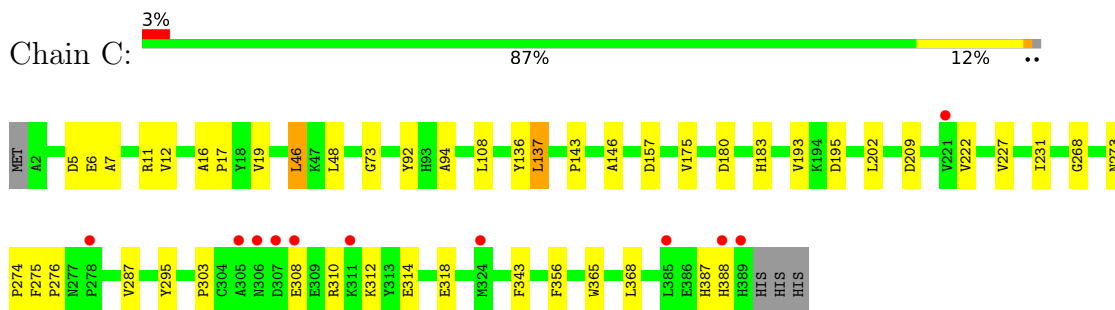
- Molecule 1: Terminal oxygenase component of carbazole



- Molecule 1: Terminal oxygenase component of carbazole

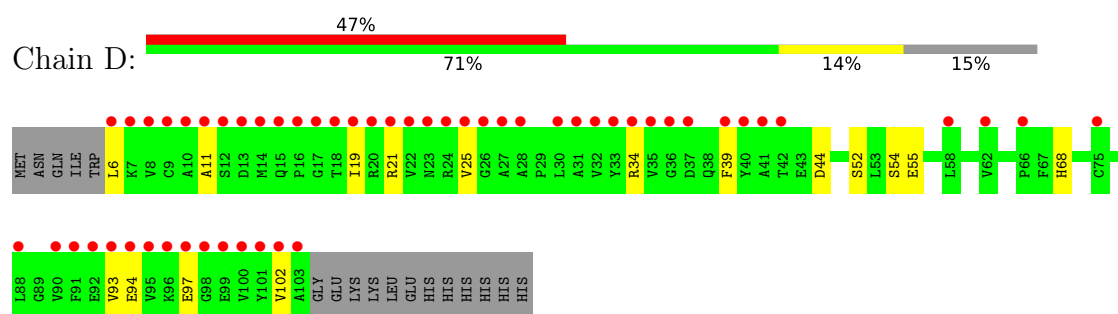


- Molecule 1: Terminal oxygenase component of carbazole

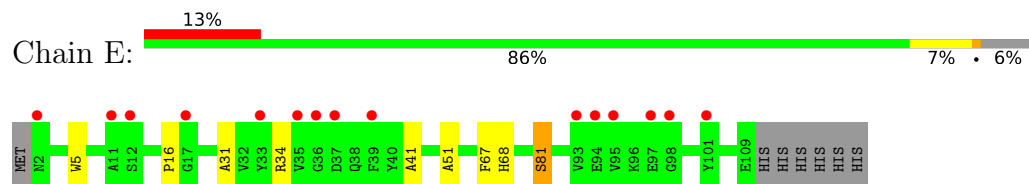


- Molecule 2: Ferredoxin CarAc





- Molecule 2: Ferredoxin CarAc



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	97.29Å 81.56Å 116.13Å 90.00° 100.12° 90.00°	Depositor
Resolution (Å)	62.17 – 2.15 62.10 – 2.15	Depositor EDS
% Data completeness (in resolution range)	99.9 (62.17-2.15) 99.9 (62.10-2.15)	Depositor EDS
$R_{merge}$	0.08	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.38 (at 2.14Å)	Xtrriage
Refinement program	REFMAC 5.8.0238	Depositor
R, $R_{free}$	0.187 , 0.238 0.193 , 0.238	Depositor DCC
$R_{free}$ test set	4814 reflections (4.94%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	43.5	Xtrriage
Anisotropy	0.013	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.37 , 46.9	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	11513	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	55.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.44% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

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

## 5 Model quality [i](#)

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

Bond lengths and bond angles in the following residue types are not validated in this section: FES, PEG, EDO, FE2

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	0.69	0/3235	0.81	0/4391
1	B	0.69	0/3259	0.87	1/4424 (0.0%)
1	C	0.67	0/3213	0.82	0/4362
2	D	0.74	0/729	0.81	0/993
2	E	0.70	0/827	0.82	0/1124
All	All	0.69	0/11263	0.83	1/15294 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	337	ARG	CB-CA-C	-5.42	99.55	110.40

There are no chirality outliers.

There are no planarity outliers.

### 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	3146	0	3050	36	0
1	B	3162	0	3069	36	0
1	C	3128	0	3030	26	0
2	D	715	0	689	8	0
2	E	808	0	782	7	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	A	4	0	0	0	0
3	B	4	0	0	1	0
3	C	4	0	0	0	0
3	D	4	0	0	0	0
3	E	4	0	0	1	0
4	A	1	0	0	0	0
4	B	1	0	0	0	0
4	C	1	0	0	0	0
5	A	12	0	18	0	0
5	B	16	0	24	2	0
5	C	12	0	18	0	0
6	B	7	0	10	2	0
6	E	7	0	10	2	0
7	A	104	0	0	1	0
7	B	214	0	0	3	0
7	C	129	0	0	1	0
7	D	9	0	0	0	0
7	E	21	0	0	0	0
All	All	11513	0	10700	108	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 5.

All (108) 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)
2:D:11:ALA:O	2:D:34:ARG:NH1	2.09	0.85
1:A:310:ARG:O	1:A:314:GLU:HG3	1.84	0.77
2:D:39:PHE:O	2:D:93:VAL:HG21	1.89	0.71
1:A:215[A]:ARG:NH1	7:A:501:HOH:O	2.18	0.70
6:B:403:PEG:H12	6:B:403:PEG:H42	1.80	0.63
1:B:322:LYS:NZ	7:B:503:HOH:O	2.32	0.62
1:C:310:ARG:NH2	7:C:502:HOH:O	2.30	0.62
1:B:379:GLN:OE1	5:B:404:EDO:O1	2.17	0.62
1:C:94:ALA:HB1	1:C:108:LEU:HB2	1.82	0.61
1:B:360:GLU:OE2	7:B:501:HOH:O	2.16	0.60
2:D:19:ILE:HG21	2:D:54:SER:HA	1.84	0.59
1:A:171:TRP:CG	1:A:288:PRO:HG3	2.38	0.58
1:C:48:LEU:HD23	1:C:137:LEU:HD23	1.85	0.58
1:B:310:ARG:O	1:B:314:GLU:HG3	2.04	0.56
1:B:287:VAL:HB	1:B:295:TYR:HB2	1.88	0.56

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:304:CYS:HB3	1:B:309:GLU:HB2	1.87	0.56
2:D:93:VAL:HG12	2:D:102:VAL:HG12	1.87	0.55
1:B:94:ALA:HB1	1:B:108:LEU:HB2	1.89	0.55
2:E:16:PRO:HA	2:E:34:ARG:HD3	1.89	0.55
1:C:275:PHE:CG	1:C:276:PRO:HA	2.44	0.53
1:B:16:ALA:HB3	1:B:17:PRO:HD3	1.91	0.53
1:B:174:ALA:HA	1:B:337:ARG:HG2	1.91	0.52
1:A:322:LYS:HB3	1:A:323:PRO:HD3	1.91	0.52
1:B:160:ILE:HG23	1:B:299:THR:HB	1.92	0.52
2:D:44:ASP:OD2	2:D:52:SER:OG	2.21	0.51
1:B:221:VAL:HG13	1:B:222:VAL:HG13	1.91	0.51
1:A:209:ASP:OD1	1:A:212:GLN:HG3	2.09	0.50
1:C:227:VAL:HG23	1:C:368:LEU:HD22	1.92	0.50
1:C:388:HIS:HA	2:E:81:SER:HB3	1.93	0.50
1:A:350:TRP:O	2:D:68:HIS:HD2	1.95	0.50
1:C:7:ALA:O	1:C:11:ARG:HG3	2.12	0.50
1:A:97:TYR:CD2	1:A:121:LEU:HB2	2.47	0.49
1:C:146:ALA:CB	1:C:222:VAL:HG21	2.42	0.49
1:B:320:LYS:O	1:B:324[B]:MET:HB2	2.13	0.48
1:A:57:ARG:NH1	1:A:128:GLU:OE1	2.33	0.48
1:A:18:TYR:CE2	1:A:366:ARG:HG2	2.50	0.47
1:A:56:ASN:O	1:A:62:LEU:HA	2.14	0.47
1:C:94:ALA:CB	1:C:108:LEU:HB2	2.45	0.47
1:C:175:VAL:HG11	1:C:365:TRP:CE2	2.50	0.47
2:E:5:TRP:CE2	6:E:202:PEG:H11	2.50	0.47
1:B:220:ASP:OD1	1:B:222:VAL:HG22	2.15	0.47
1:B:65:LEU:HD23	1:B:123:THR:HG22	1.96	0.47
1:A:174:ALA:HB1	1:A:286:TYR:CD1	2.50	0.46
2:D:21:ARG:NH2	2:D:55:GLU:OE2	2.48	0.46
1:A:73:GLY:HA3	1:C:343:PHE:CG	2.51	0.46
1:A:68:ARG:HH22	1:A:384:GLY:HA3	1.80	0.46
1:C:16:ALA:HB3	1:C:17:PRO:HD3	1.97	0.46
1:B:292:ASN:HB3	5:B:405:EDO:H11	1.97	0.46
1:B:368:LEU:C	1:B:368:LEU:HD13	2.36	0.46
1:A:176:GLU:O	1:A:180:ASP:HB2	2.16	0.46
1:C:287:VAL:HB	1:C:295:TYR:HB2	1.98	0.46
1:B:94:ALA:CB	1:B:108:LEU:HB2	2.46	0.45
1:A:130:LYS:NZ	1:A:155:ASP:O	2.34	0.45
1:B:183:HIS:O	1:B:186:ILE:HG12	2.17	0.45
1:A:171:TRP:CE2	1:A:172:ARG:HG3	2.51	0.45
1:B:343:PHE:CG	1:C:73:GLY:HA3	2.52	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:5:ASP:OD1	1:C:6:GLU:N	2.50	0.45
1:C:12:VAL:HG21	1:C:19:VAL:HG21	1.99	0.45
1:B:195:ASP:HB3	1:B:324[B]:MET:CE	2.47	0.44
1:C:273:ASN:HA	1:C:274:PRO:HA	1.80	0.44
1:A:67:ASP:OD2	1:A:77:SER:OG	2.28	0.44
1:B:143:PRO:HG3	1:B:147:ARG:CZ	2.47	0.44
1:B:195:ASP:HB3	1:B:324[B]:MET:HE1	2.00	0.44
1:A:108:LEU:HD12	1:A:108:LEU:N	2.31	0.44
2:E:31:ALA:O	2:E:41:ALA:HA	2.18	0.44
1:B:93:HIS:HB2	3:B:401:FES:S1	2.58	0.44
1:B:174:ALA:HB2	1:B:337:ARG:HD3	1.99	0.44
1:A:343:PHE:CG	1:B:73:GLY:HA3	2.53	0.44
1:A:130:LYS:HE3	1:A:153:PHE:O	2.18	0.44
1:A:385:LEU:N	1:A:385:LEU:HD12	2.33	0.44
1:A:175:VAL:HG11	1:A:365:TRP:CE2	2.54	0.43
1:A:222:VAL:HG12	1:A:222:VAL:O	2.19	0.43
1:A:283:PHE:HB2	1:A:299:THR:OG1	2.18	0.43
2:E:5:TRP:CD2	6:E:202:PEG:H11	2.54	0.43
2:E:68:HIS:HB2	3:E:201:FES:S1	2.58	0.43
1:A:101:ASP:O	1:A:120:LYS:HE2	2.18	0.43
1:A:287:VAL:HB	1:A:295:TYR:HB2	2.01	0.43
1:C:137:LEU:HD22	1:C:137:LEU:HA	1.94	0.43
1:A:16:ALA:HB3	1:A:17:PRO:HD3	2.01	0.42
1:B:47:LYS:NZ	7:B:513:HOH:O	2.43	0.42
1:C:46:LEU:CD1	1:C:46:LEU:N	2.82	0.42
1:C:180:ASP:HB3	1:C:183:HIS:HB3	2.01	0.42
1:B:47:LYS:HA	1:B:51:GLU:O	2.20	0.42
1:B:171:TRP:CE2	1:B:172:ARG:HG3	2.55	0.42
1:B:275:PHE:CG	1:B:276:PRO:HA	2.55	0.42
1:A:94:ALA:HB1	1:A:108:LEU:HB2	2.02	0.42
1:B:137:LEU:HD22	1:B:137:LEU:HA	1.95	0.42
1:C:136:TYR:CE1	1:C:143:PRO:HD2	2.55	0.42
1:C:308:GLU:O	1:C:312:LYS:HG2	2.20	0.42
1:A:11:ARG:HB3	2:D:68:HIS:O	2.20	0.41
1:A:68:ARG:NH2	1:A:384:GLY:HA3	2.35	0.41
1:A:143:PRO:HG3	1:A:147:ARG:CZ	2.50	0.41
1:B:226:GLY:HA3	1:B:265:TRP:CE3	2.54	0.41
1:C:146:ALA:HB3	1:C:222:VAL:HG21	2.03	0.41
1:A:59:ASP:OD1	1:A:85:LYS:NZ	2.48	0.41
1:A:79:LYS:HB3	1:A:91:TRP:HB3	2.02	0.41
1:C:314:GLU:O	1:C:318:GLU:HG2	2.21	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:E:51:ALA:HB2	2:E:67:PHE:CG	2.56	0.41
1:B:273:ASN:HA	1:B:274:PRO:HA	1.78	0.41
1:B:285:TRP:HB2	1:B:297:PHE:HB3	2.02	0.41
1:A:16:ALA:N	1:A:17:PRO:CD	2.83	0.40
6:B:403:PEG:C1	6:B:403:PEG:C4	2.99	0.40
1:C:157:ASP:OD2	1:C:303:PRO:HB3	2.22	0.40
1:A:109:THR:HG22	1:C:202:LEU:O	2.20	0.40
1:B:287:VAL:HA	1:B:288:PRO:HD3	1.95	0.40
1:A:146:ALA:HA	1:A:149:THR:OG1	2.22	0.40
1:B:227:VAL:O	1:B:263:SER:HA	2.21	0.40
1:B:265:TRP:HB2	1:B:269:VAL:HG13	2.02	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	388/392 (99%)	366 (94%)	20 (5%)	2 (0%)	29 22
1	B	390/392 (100%)	367 (94%)	21 (5%)	2 (0%)	29 22
1	C	386/392 (98%)	366 (95%)	17 (4%)	3 (1%)	19 12
2	D	96/115 (84%)	84 (88%)	11 (12%)	1 (1%)	15 9
2	E	107/115 (93%)	100 (94%)	7 (6%)	0	100 100
All	All	1367/1406 (97%)	1283 (94%)	76 (6%)	8 (1%)	25 18

All (8) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	268	GLY
1	B	219	ASP
1	B	268	GLY

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Mol	Chain	Res	Type
1	C	268	GLY
1	C	387	HIS
2	D	25	VAL
1	A	152	ASN
1	C	193	VAL

### 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	337/339 (99%)	327 (97%)	10 (3%)	41	40
1	B	339/339 (100%)	335 (99%)	4 (1%)	71	76
1	C	335/339 (99%)	328 (98%)	7 (2%)	53	57
2	D	77/93 (83%)	74 (96%)	3 (4%)	32	30
2	E	87/93 (94%)	86 (99%)	1 (1%)	73	78
All	All	1175/1203 (98%)	1150 (98%)	25 (2%)	53	57

All (25) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	38	ILE
1	A	46	LEU
1	A	92	TYR
1	A	137	LEU
1	A	157	ASP
1	A	169	SER
1	A	308	GLU
1	A	356	PHE
1	A	386	GLU
1	A	387	HIS
1	B	46	LEU
1	B	92	TYR
1	B	137	LEU
1	B	356	PHE

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Mol	Chain	Res	Type
1	C	46	LEU
1	C	92	TYR
1	C	137	LEU
1	C	195	ASP
1	C	209	ASP
1	C	231	ILE
1	C	356	PHE
2	D	6	LEU
2	D	94	GLU
2	D	97	GLU
2	E	81	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

### 5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

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

## 5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

Of 20 ligands modelled in this entry, 3 are monoatomic - leaving 17 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	EDO	B	405	-	3,3,3	0.39	0	2,2,2	0.73	0
6	PEG	B	403	-	6,6,6	0.46	0	5,5,5	0.08	0
3	FES	E	201	2	0,4,4	-	-	-	-	-
5	EDO	B	406	-	3,3,3	0.07	0	2,2,2	0.26	0
6	PEG	E	202	-	6,6,6	0.17	0	5,5,5	0.13	0
3	FES	B	401	1	0,4,4	-	-	-	-	-
5	EDO	C	404	-	3,3,3	0.41	0	2,2,2	0.51	0
5	EDO	C	403	-	3,3,3	0.16	0	2,2,2	0.25	0
3	FES	C	401	1	0,4,4	-	-	-	-	-
5	EDO	A	405	-	3,3,3	0.09	0	2,2,2	0.18	0
5	EDO	B	404	-	3,3,3	0.22	0	2,2,2	0.06	0
5	EDO	C	405	-	3,3,3	0.20	0	2,2,2	0.40	0
5	EDO	A	403	-	3,3,3	0.17	0	2,2,2	0.21	0
3	FES	A	401	1	0,4,4	-	-	-	-	-
5	EDO	B	407	-	3,3,3	0.11	0	2,2,2	0.08	0
5	EDO	A	404	-	3,3,3	0.19	0	2,2,2	0.20	0
3	FES	D	201	2	0,4,4	-	-	-	-	-

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	EDO	B	405	-	-	0/1/1/1	-
6	PEG	B	403	-	-	1/4/4/4	-
3	FES	E	201	2	-	-	0/1/1/1
5	EDO	B	406	-	-	1/1/1/1	-
6	PEG	E	202	-	-	2/4/4/4	-
3	FES	B	401	1	-	-	0/1/1/1
5	EDO	C	404	-	-	1/1/1/1	-
5	EDO	C	403	-	-	1/1/1/1	-
3	FES	C	401	1	-	-	0/1/1/1
5	EDO	A	405	-	-	1/1/1/1	-
5	EDO	B	404	-	-	1/1/1/1	-
5	EDO	C	405	-	-	0/1/1/1	-
5	EDO	A	403	-	-	1/1/1/1	-
3	FES	A	401	1	-	-	0/1/1/1
5	EDO	B	407	-	-	0/1/1/1	-
5	EDO	A	404	-	-	1/1/1/1	-
3	FES	D	201	2	-	-	0/1/1/1

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (10) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	C	404	EDO	O1-C1-C2-O2
6	B	403	PEG	C4-C3-O2-C2
5	A	404	EDO	O1-C1-C2-O2
6	E	202	PEG	O1-C1-C2-O2
5	A	405	EDO	O1-C1-C2-O2
5	B	406	EDO	O1-C1-C2-O2
5	A	403	EDO	O1-C1-C2-O2
5	B	404	EDO	O1-C1-C2-O2
6	E	202	PEG	C4-C3-O2-C2
5	C	403	EDO	O1-C1-C2-O2

There are no ring outliers.

6 monomers are involved in 8 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	B	405	EDO	1	0
6	B	403	PEG	2	0
3	E	201	FES	1	0
6	E	202	PEG	2	0
3	B	401	FES	1	0
5	B	404	EDO	1	0

## 5.7 Other polymers [i](#)

There are no such residues in this entry.

## 5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

## 6 Fit of model and data

### 6.1 Protein, DNA and RNA chains

In the following table, the column labelled ‘#RSRZ > 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95<sup>th</sup> percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q < 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å <sup>2</sup> )	Q<0.9
1	A	389/392 (99%)	0.36	14 (3%) 42 51	34, 53, 82, 144	0
1	B	389/392 (99%)	0.32	9 (2%) 60 68	27, 42, 72, 105	0
1	C	388/392 (98%)	0.40	11 (2%) 53 62	29, 52, 83, 118	0
2	D	98/115 (85%)	2.80	54 (55%) 0 0	46, 84, 139, 149	0
2	E	108/115 (93%)	0.79	15 (13%) 2 3	33, 58, 94, 117	0
All	All	1372/1406 (97%)	0.57	103 (7%) 14 19	27, 51, 94, 149	0

All (103) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	D	102	VAL	9.8
2	D	93	VAL	9.6
2	D	25	VAL	9.5
2	D	8	VAL	8.9
2	D	101	TYR	8.5
2	D	95	VAL	7.5
2	D	28	ALA	6.4
2	D	27	ALA	6.4
2	D	32	VAL	6.2
2	D	39	PHE	6.2
2	D	98	GLY	6.2
2	D	99	GLU	6.1
2	D	26	GLY	6.0
2	E	2	ASN	6.0
2	D	100	VAL	5.8
2	D	94	GLU	5.7
2	D	35	VAL	5.7
2	D	91	PHE	5.4
2	D	9	CYS	5.4
1	A	305	ALA	5.2

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Mol	Chain	Res	Type	RSRZ
2	D	97	GLU	5.1
2	D	6	LEU	5.1
2	D	11	ALA	5.0
1	B	307	ASP	4.6
2	D	30	LEU	4.5
2	D	41	ALA	4.5
2	D	13	ASP	4.3
2	D	14	MET	4.2
2	D	23	ASN	4.2
2	D	33	TYR	4.2
2	E	95	VAL	4.1
2	D	90	VAL	4.0
2	D	22	VAL	4.0
1	A	386	GLU	3.9
2	D	31	ALA	3.8
2	D	24	ARG	3.8
2	D	92	GLU	3.7
1	C	389	HIS	3.6
2	D	34	ARG	3.6
2	D	96	LYS	3.5
2	D	15	GLN	3.5
2	D	7	LYS	3.5
1	B	308	GLU	3.4
2	E	37	ASP	3.4
2	E	97	GLU	3.3
1	A	385	LEU	3.3
1	A	313	TYR	3.3
2	D	16	PRO	3.3
1	B	335[A]	TRP	3.2
2	D	12	SER	3.2
2	D	40	TYR	3.2
2	D	36	GLY	3.2
1	C	388	HIS	3.1
2	D	20	ARG	3.1
2	D	10	ALA	3.0
2	E	93	VAL	3.0
1	A	306	ASN	3.0
2	D	103	ALA	3.0
2	D	17	GLY	3.0
1	A	308	GLU	2.9
1	B	389	HIS	2.9
2	D	19	ILE	2.9

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Mol	Chain	Res	Type	RSRZ
1	C	385	LEU	2.8
1	B	390	HIS	2.8
1	C	221	VAL	2.8
2	E	33	TYR	2.7
2	D	58	LEU	2.7
2	E	101	TYR	2.7
1	B	310	ARG	2.6
1	C	305	ALA	2.6
1	C	308	GLU	2.6
2	D	18	THR	2.6
1	A	312	LYS	2.6
1	B	304	CYS	2.6
2	E	39	PHE	2.6
2	E	17	GLY	2.6
2	E	98	GLY	2.6
2	D	42	THR	2.5
1	A	389	HIS	2.5
2	E	11	ALA	2.5
1	A	311	LYS	2.5
1	C	307	ASP	2.4
1	C	324	MET	2.4
2	D	37	ASP	2.4
2	D	66	PRO	2.3
1	C	306	ASN	2.3
2	E	12	SER	2.3
2	D	88	LEU	2.2
1	C	311	LYS	2.2
1	A	315	GLN	2.2
1	B	387	HIS	2.2
2	D	21	ARG	2.2
2	E	35	VAL	2.2
1	B	305	ALA	2.2
1	A	65	LEU	2.1
1	A	161	LEU	2.1
1	C	278	PRO	2.1
1	A	221	VAL	2.1
2	D	62	VAL	2.1
2	D	75	CYS	2.1
2	E	94	GLU	2.1
2	E	36	GLY	2.0
1	A	304	CYS	2.0

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

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

## 6.3 Carbohydrates [i](#)

There are no monosaccharides in this entry.

## 6.4 Ligands [i](#)

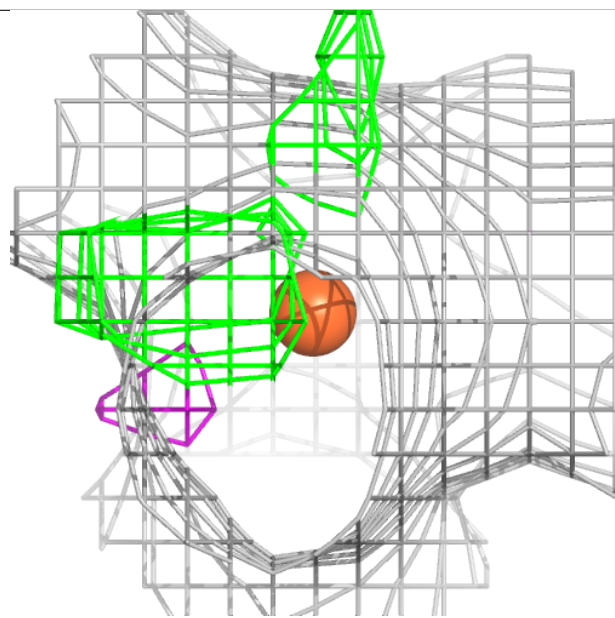
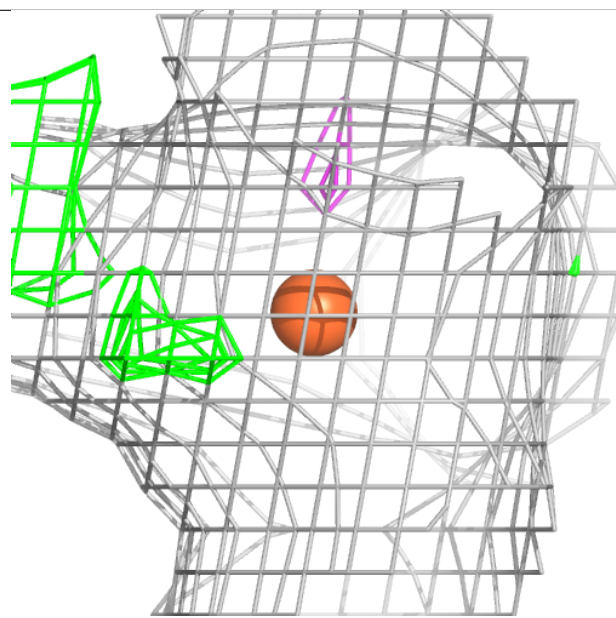
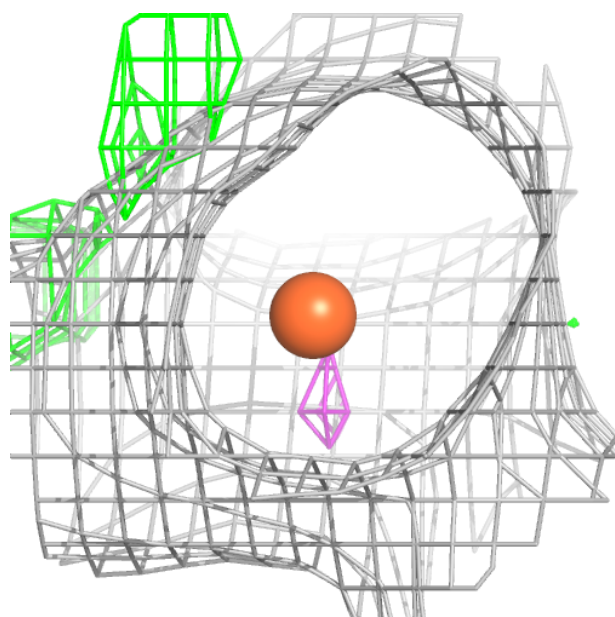
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
5	EDO	C	405	4/4	0.72	0.20	71,71,72,74	0
5	EDO	B	405	4/4	0.76	0.28	61,62,63,63	0
5	EDO	C	404	4/4	0.78	0.26	60,61,66,71	0
5	EDO	A	403	4/4	0.80	0.16	68,69,70,75	0
5	EDO	B	407	4/4	0.83	0.16	59,66,72,77	0
5	EDO	A	404	4/4	0.85	0.16	69,76,79,79	0
6	PEG	B	403	7/7	0.86	0.21	50,65,77,78	0
5	EDO	A	405	4/4	0.90	0.18	72,76,76,79	0
5	EDO	C	403	4/4	0.91	0.14	64,67,70,71	0
6	PEG	E	202	7/7	0.91	0.15	67,72,84,87	0
5	EDO	B	406	4/4	0.92	0.15	65,69,70,77	0
5	EDO	B	404	4/4	0.93	0.19	55,56,57,63	0
4	FE2	C	402	1/1	0.98	0.11	52,52,52,52	0
4	FE2	A	402	1/1	0.99	0.14	52,52,52,52	0
4	FE2	B	402	1/1	0.99	0.15	43,43,43,43	0
3	FES	A	401	4/4	0.99	0.14	45,49,50,55	0
3	FES	D	201	4/4	0.99	0.09	45,46,47,48	0
3	FES	E	201	4/4	0.99	0.17	35,37,37,42	0
3	FES	C	401	4/4	1.00	0.16	29,30,32,33	0
3	FES	B	401	4/4	1.00	0.16	32,33,35,36	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 FE2 C 402:**

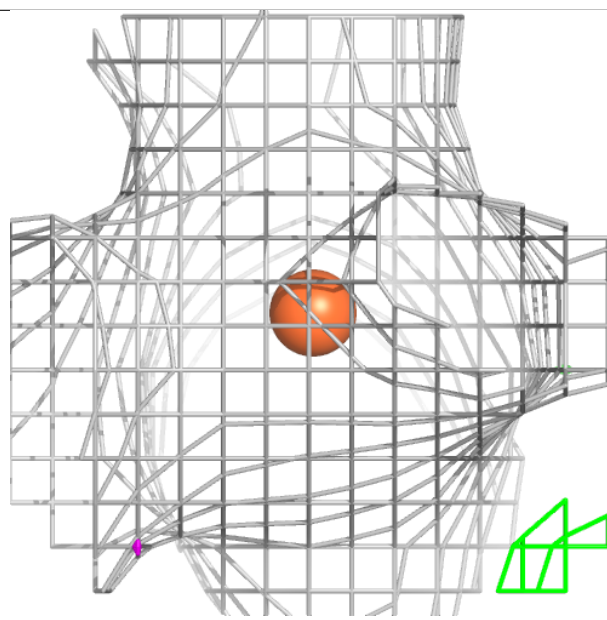
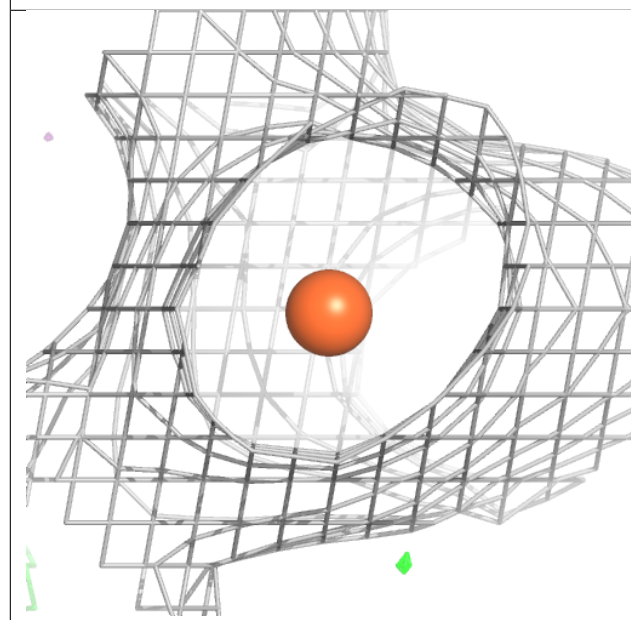
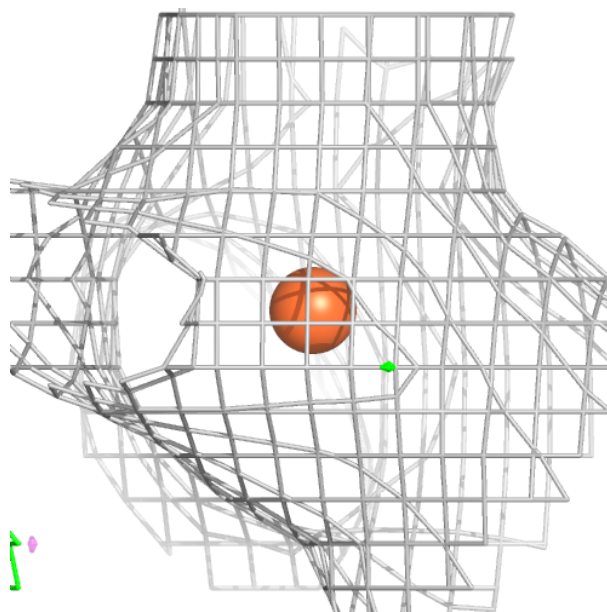
$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)

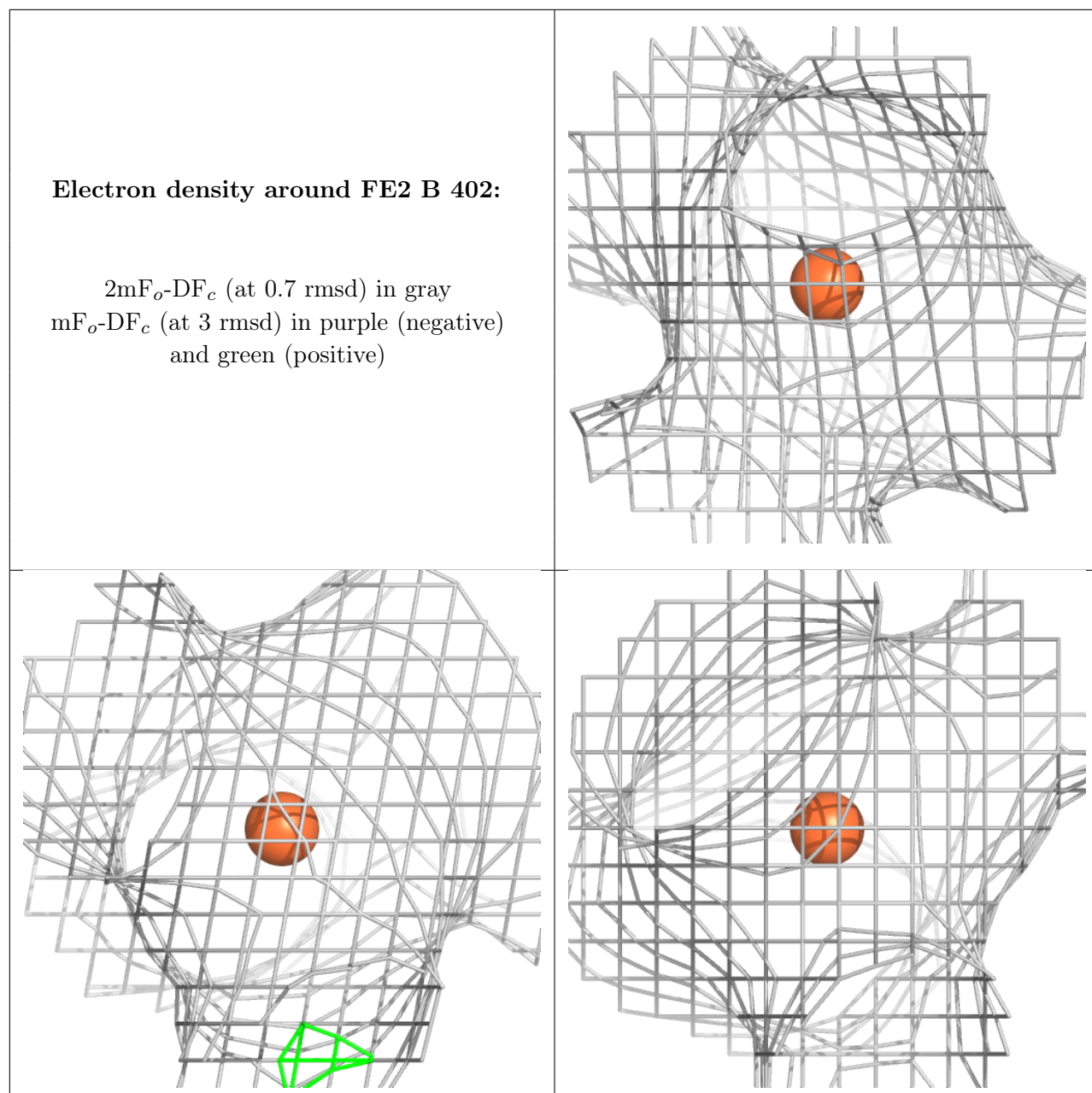




**Electron density around FE2 A 402:**

$2mF_o-DF_c$  (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.