



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 03:57 PM UTC

PDB ID : 8DYG / pdb_00008dyd
Title : Crystal structure of human SDHA-SDHAF2-SDHAF4 assembly intermediate
Authors : Sharma, P.; Maklashina, E.; Cecchini, G.; Iverson, T.M.
Deposited on : 2022-08-04
Resolution : 1.52 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

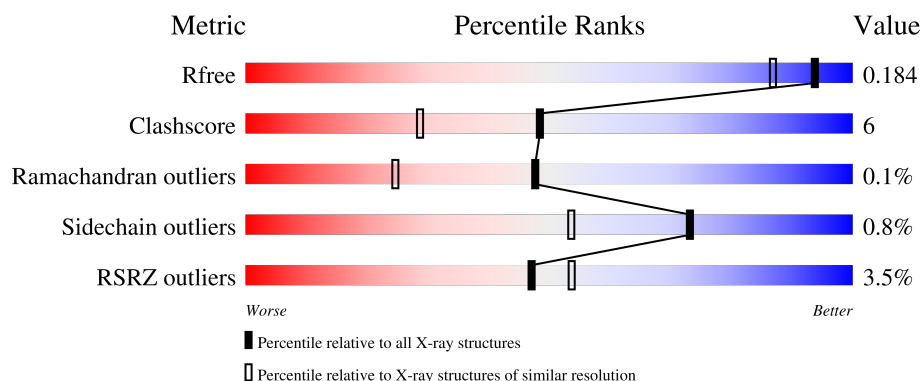
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.52 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	5890 (1.54-1.50)
Clashscore	190562	6116 (1.54-1.50)
Ramachandran outliers	187476	6002 (1.54-1.50)
Sidechain outliers	187428	5999 (1.54-1.50)
RSRZ outliers	180081	5891 (1.54-1.50)

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	632	<div> <div>2%</div> <div>89%</div> <div>7%</div> <div>.</div> </div>
2	B	137	<div> <div>9%</div> <div>84%</div> <div>5%</div> <div>10%</div> </div>
3	C	98	<div> <div>4%</div> <div>31%</div> <div>.</div> <div>65%</div> </div>

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
5	PG4	A	702	-	-	X	-
5	PG4	A	703	-	-	X	-
8	EDO	A	721	-	-	X	-
8	EDO	A	727	-	-	X	-

2 Entry composition [i](#)

There are 10 unique types of molecules in this entry. The entry contains 12592 atoms, of which 5778 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 Succinate dehydrogenase [ubiquinone] flavoprotein subunit, mitochondrial.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	610	Total	C	H	N	O	S	0	32	1
			9413	3002	4608	856	914	33			

There are 11 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	33	MET	-	expression tag	UNP P31040
A	34	ARG	-	expression tag	UNP P31040
A	35	GLY	-	expression tag	UNP P31040
A	36	SER	-	expression tag	UNP P31040
A	37	HIS	-	expression tag	UNP P31040
A	38	HIS	-	expression tag	UNP P31040
A	39	HIS	-	expression tag	UNP P31040
A	40	HIS	-	expression tag	UNP P31040
A	41	HIS	-	expression tag	UNP P31040
A	42	HIS	-	expression tag	UNP P31040
A	43	GLY	-	expression tag	UNP P31040

- Molecule 2 is a protein called Succinate dehydrogenase assembly factor 2, mitochondrial.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
2	B	123	Total	C	H	N	O	S	0	0	0
			1932	642	924	175	186	5			

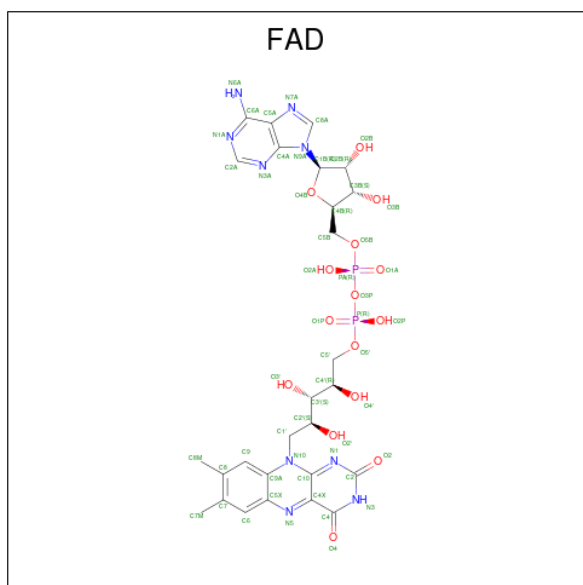
- Molecule 3 is a protein called Succinate dehydrogenase assembly factor 4, mitochondrial.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
3	C	34	Total	C	H	N	O	S	0	0	0
			516	167	246	51	51	1			

There are 23 discrepancies between the modelled and reference sequences:

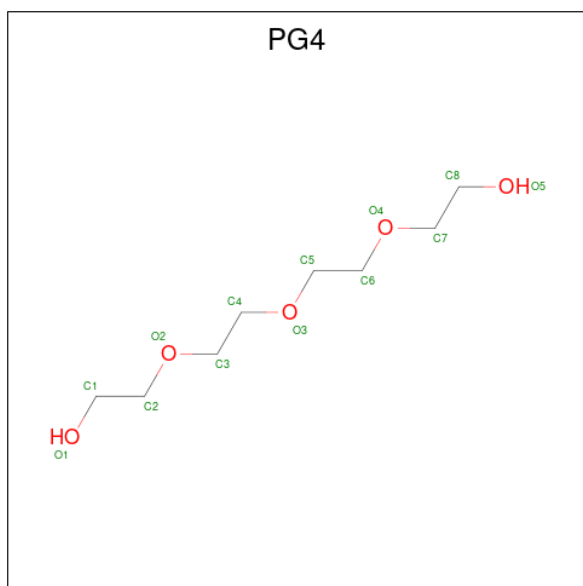
Chain	Residue	Modelled	Actual	Comment	Reference
C	11	MET	-	initiating methionine	UNP Q5VUM1
C	12	ARG	-	expression tag	UNP Q5VUM1
C	13	SER	-	expression tag	UNP Q5VUM1
C	14	HIS	-	expression tag	UNP Q5VUM1
C	15	HIS	-	expression tag	UNP Q5VUM1
C	16	HIS	-	expression tag	UNP Q5VUM1
C	17	HIS	-	expression tag	UNP Q5VUM1
C	18	HIS	-	expression tag	UNP Q5VUM1
C	19	HIS	-	expression tag	UNP Q5VUM1
C	20	GLU	-	expression tag	UNP Q5VUM1
C	21	ASN	-	expression tag	UNP Q5VUM1
C	22	LEU	-	expression tag	UNP Q5VUM1
C	23	TYR	-	expression tag	UNP Q5VUM1
C	24	PHE	-	expression tag	UNP Q5VUM1
C	25	GLN	-	expression tag	UNP Q5VUM1
C	26	GLY	-	expression tag	UNP Q5VUM1
C	27	ILE	-	expression tag	UNP Q5VUM1
C	28	ASP	-	expression tag	UNP Q5VUM1
C	29	PRO	-	expression tag	UNP Q5VUM1
C	30	PHE	-	expression tag	UNP Q5VUM1
C	31	THR	-	expression tag	UNP Q5VUM1
C	32	GLY	-	expression tag	UNP Q5VUM1
C	33	SER	-	expression tag	UNP Q5VUM1

- Molecule 4 is FLAVIN-ADENINE DINUCLEOTIDE (CCD ID: FAD) (formula: $C_{27}H_{33}N_9O_{15}P_2$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
4	A	1	Total	C	N	O	P	0	0
			53	27	9	15	2		

- Molecule 5 is TETRAETHYLENE GLYCOL (CCD ID: PG4) (formula: $C_8H_{18}O_5$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	A	1	Total	C	O	0	0
			10	6	4		
5	A	1	Total	C	O	0	0
			13	8	5		

- Molecule 6 is POTASSIUM ION (CCD ID: K) (formula: K).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	A	1	Total K	0	0
			1 1		

- Molecule 7 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	A	1	Total Cl	0	0
			1 1		

- Molecule 8 is 1,2-ETHANEDIOL (CCD ID: EDO) (formula: $C_2H_6O_2$).



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

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

- Molecule 9 is DI(HYDROXYETHYL)ETHER (CCD ID: PEG) (formula: C₄H₁₀O₃).

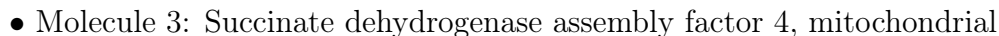
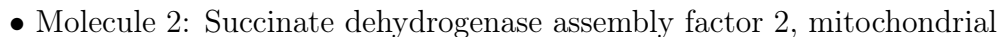


Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
9	A	1	Total	C	O	0	0
			7	4	3		
9	B	1	Total	C	O	0	0
			7	4	3		

- Molecule 10 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
10	A	416	Total	O	0	0
			416	416		
10	B	81	Total	O	0	0
			81	81		
10	C	22	Total	O	0	0
			22	22		

- Molecule 1: Succinate dehydrogenase [ubiquinone] flavoprotein subunit, mitochondrial



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	66.05Å 103.21Å 126.24Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	35.49 – 1.52 35.49 – 1.52	Depositor EDS
% Data completeness (in resolution range)	87.0 (35.49-1.52) 75.0 (35.49-1.52)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	0.47 (at 1.52Å)	Xtriage
Refinement program	PHENIX 1.19.2_4158	Depositor
R, R_{free}	0.157 , 0.184 0.157 , 0.184	Depositor DCC
R_{free} test set	5938 reflections (4.51%)	wwPDB-VP
Wilson B-factor (Å ²)	13.9	Xtriage
Anisotropy	0.527	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.42 , 45.8	EDS
L-test for twinning ²	$\langle L \rangle = 0.46$, $\langle L^2 \rangle = 0.29$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.97	EDS
Total number of atoms	12592	wwPDB-VP
Average B, all atoms (Å ²)	25.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.32% 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 [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: EDO, FAD, PG4, CL, PEG, K

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	$\# Z > 5$	RMSZ	$\# Z > 5$
1	A	0.38	0/5043	0.59	2/6823 (0.0%)
2	B	0.38	0/1032	0.57	0/1398
3	C	0.33	0/278	0.51	0/373
All	All	0.38	0/6353	0.58	2/8594 (0.0%)

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	444	ALA	CA-C-N	5.03	130.75	121.70
1	A	444	ALA	C-N-CA	5.03	130.75	121.70

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	4805	4608	4565	50	0
2	B	1008	924	965	9	0
3	C	270	246	255	3	0
4	A	53	0	30	4	0
5	A	23	0	31	15	0
6	A	1	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
7	A	1	0	0	0	0
8	A	100	0	150	22	0
8	B	16	0	24	0	0
8	C	4	0	6	1	0
9	A	7	0	10	1	0
9	B	7	0	10	2	0
10	A	416	0	0	12	0
10	B	81	0	0	1	0
10	C	22	0	0	0	0
All	All	6814	5778	6046	69	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 6.

All (69) 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:99:HIS:NE2	4:A:701:FAD:C8M	1.72	1.51
8:A:725:EDO:H22	10:A:869:HOH:O	1.67	0.92
1:A:340[B]:ARG:CZ	8:A:721:EDO:H12	2.07	0.85
1:A:99:HIS:CE1	4:A:701:FAD:C8M	2.62	0.82
1:A:340[B]:ARG:H	8:A:721:EDO:H11	1.52	0.75
1:A:99:HIS:CD2	8:A:723:EDO:H21	2.22	0.74
2:B:137:MET:HE2	2:B:141:ARG:HG3	1.67	0.74
2:B:103:ASN:HB2	9:B:205:PEG:H11	1.70	0.73
1:A:345:ARG:NH2	1:A:593:ALA:HB3	2.06	0.71
1:A:526:PHE:CE1	5:A:702:PG4:H61	2.26	0.71
5:A:703:PG4:H81	10:A:850:HOH:O	1.91	0.70
1:A:54:GLN:OE1	1:A:54:GLN:HA	1.93	0.68
1:A:340[A]:ARG:H	8:A:721:EDO:H11	1.58	0.66
5:A:703:PG4:H62	10:A:1137:HOH:O	1.96	0.63
1:A:99:HIS:NE2	4:A:701:FAD:C8	2.61	0.63
1:A:339:SER:HA	8:A:721:EDO:H22	1.79	0.63
5:A:703:PG4:H82	10:A:827:HOH:O	1.99	0.62
1:A:397:LYS:HG3	1:A:398:GLU:HG3	1.80	0.62
1:A:526:PHE:HE1	5:A:702:PG4:H61	1.65	0.59
1:A:99:HIS:HD2	8:A:723:EDO:H21	1.67	0.58
2:B:44:GLN:N	10:B:302:HOH:O	2.37	0.58
1:A:440:GLU:OE1	8:A:723:EDO:H22	2.04	0.57
1:A:492:SER:HA	5:A:703:PG4:H52	1.87	0.56
2:B:123:THR:O	2:B:124:GLU:HB2	2.05	0.56

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:314:GLU:OE1	1:A:379:ARG:HD2	2.06	0.55
1:A:222:LEU:HB3	5:A:703:PG4:H71	1.87	0.55
5:A:703:PG4:H51	10:A:970:HOH:O	2.07	0.55
8:A:725:EDO:H12	10:A:881:HOH:O	2.08	0.54
1:A:152:GLU:HB3	8:A:727:EDO:H12	1.90	0.53
1:A:330:TYR:CD1	8:A:724:EDO:H11	2.43	0.53
1:A:526:PHE:CZ	5:A:702:PG4:H61	2.44	0.52
1:A:156:TYR:HE2	8:A:727:EDO:H11	1.75	0.51
1:A:511[B]:LEU:HD12	1:A:542:LEU:HD22	1.93	0.51
2:B:103:ASN:CB	9:B:205:PEG:H11	2.38	0.51
3:C:79:ASN:ND2	8:C:201:EDO:H12	2.26	0.51
1:A:595:GLU:HG3	5:A:702:PG4:H52	1.94	0.50
1:A:547:LYS:NZ	10:A:812:HOH:O	2.45	0.49
1:A:195:ARG:NH2	2:B:44:GLN:HA	2.28	0.49
1:A:595:GLU:CG	5:A:702:PG4:H52	2.43	0.49
1:A:157:GLY:O	2:B:46:ASP:HB3	2.13	0.49
3:C:94:THR:HA	3:C:98:ASP:O	2.13	0.48
2:B:46:ASP:N	2:B:46:ASP:OD1	2.46	0.48
1:A:444:ALA:N	1:A:445:SER:HA	2.28	0.47
1:A:152:GLU:OE1	8:A:727:EDO:O1	2.28	0.47
1:A:340[A]:ARG:HB2	8:A:721:EDO:H11	1.95	0.47
5:A:702:PG4:H51	5:A:702:PG4:H32	1.50	0.47
1:A:340[B]:ARG:NH1	8:A:721:EDO:H12	2.30	0.47
1:A:345:ARG:HG3	1:A:525:VAL:HG12	1.97	0.46
1:A:250:LYS:NZ	1:A:479:ASP:OD2	2.49	0.45
1:A:637:VAL:O	8:A:715:EDO:H21	2.17	0.45
1:A:340[B]:ARG:H	8:A:721:EDO:C1	2.26	0.45
1:A:105:GLY:HA2	3:C:99:TRP:CE2	2.53	0.44
1:A:153:LEU:HG	8:A:727:EDO:H21	2.00	0.44
5:A:703:PG4:C6	10:A:1137:HOH:O	2.61	0.43
1:A:345:ARG:CZ	1:A:593:ALA:HB3	2.48	0.43
5:A:702:PG4:H41	8:A:724:EDO:O2	2.19	0.43
1:A:142:MET:HA	1:A:462:VAL:HG11	2.01	0.42
1:A:195:ARG:NH2	2:B:46:ASP:OD1	2.41	0.42
1:A:132:TRP:CE2	1:A:659:PRO:HA	2.55	0.42
5:A:703:PG4:H12	10:A:905:HOH:O	2.19	0.41
1:A:616:LYS:NZ	10:A:823:HOH:O	2.52	0.41
1:A:230:GLU:HB3	9:A:731:PEG:H42	2.02	0.41
1:A:237:LEU:HD21	8:A:709:EDO:H11	2.03	0.41
1:A:340[A]:ARG:CB	8:A:721:EDO:H11	2.50	0.41
1:A:473:GLU:OE1	10:A:801:HOH:O	2.21	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:99:HIS:CD2	4:A:701:FAD:C8M	2.82	0.40
8:A:712:EDO:H22	10:A:975:HOH:O	2.20	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	640/632 (101%)	629 (98%)	11 (2%)	0	100	100
2	B	121/137 (88%)	118 (98%)	2 (2%)	1 (1%)	16	4
3	C	32/98 (33%)	31 (97%)	1 (3%)	0	100	100
All	All	793/867 (92%)	778 (98%)	14 (2%)	1 (0%)	48	25

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	B	124	GLU

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	523/512 (102%)	519 (99%)	4 (1%)	73	53
2	B	104/127 (82%)	103 (99%)	1 (1%)	68	44

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
3	C	28/87 (32%)	28 (100%)	0	100	100
All	All	655/726 (90%)	650 (99%)	5 (1%)	73	53

All (5) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	115	GLU
1	A	268	SER
1	A	403	LEU
1	A	456	SER
2	B	79	MET

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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 37 ligands modelled in this entry, 2 are monoatomic - leaving 35 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
8	EDO	B	204	-	3,3,3	0.41	0	2,2,2	0.49	0
8	EDO	A	726	-	3,3,3	0.44	0	2,2,2	0.42	0
8	EDO	A	717	-	3,3,3	0.45	0	2,2,2	0.59	0
4	FAD	A	701	-	58,58,58	0.62	1 (1%)	85,89,89	0.61	1 (1%)
8	EDO	C	201	-	3,3,3	0.43	0	2,2,2	0.32	0
8	EDO	A	708	-	3,3,3	0.38	0	2,2,2	0.39	0
8	EDO	A	727	-	3,3,3	0.33	0	2,2,2	0.45	0
8	EDO	A	721	-	3,3,3	0.32	0	2,2,2	0.29	0
8	EDO	B	201	-	3,3,3	0.50	0	2,2,2	0.48	0
8	EDO	A	713	-	3,3,3	0.34	0	2,2,2	0.95	0
8	EDO	A	710	-	3,3,3	0.62	0	2,2,2	0.35	0
8	EDO	A	716	-	3,3,3	0.42	0	2,2,2	0.52	0
8	EDO	A	722	-	3,3,3	0.39	0	2,2,2	0.46	0
8	EDO	A	711	-	3,3,3	0.32	0	2,2,2	0.73	0
8	EDO	A	714	-	3,3,3	0.48	0	2,2,2	0.40	0
8	EDO	B	203	-	3,3,3	0.71	0	2,2,2	0.48	0
9	PEG	B	205	-	6,6,6	0.48	0	5,5,5	0.33	0
5	PG4	A	703	-	12,12,12	0.53	0	11,11,11	0.54	0
8	EDO	A	724	-	3,3,3	0.36	0	2,2,2	0.63	0
8	EDO	A	706	-	3,3,3	0.56	0	2,2,2	0.27	0
8	EDO	A	709	-	3,3,3	0.39	0	2,2,2	0.84	0
8	EDO	A	720	-	3,3,3	0.40	0	2,2,2	0.42	0
5	PG4	A	702	-	9,9,12	0.56	0	8,8,11	0.40	0
8	EDO	A	707	-	3,3,3	0.51	0	2,2,2	0.34	0
8	EDO	A	718	-	3,3,3	0.40	0	2,2,2	0.64	0
8	EDO	A	719	-	3,3,3	0.38	0	2,2,2	0.16	0
8	EDO	A	729	-	3,3,3	0.14	0	2,2,2	0.06	0
9	PEG	A	731	-	6,6,6	0.50	0	5,5,5	0.30	0
8	EDO	A	712	-	3,3,3	0.38	0	2,2,2	0.59	0
8	EDO	A	728	-	3,3,3	0.44	0	2,2,2	0.46	0
8	EDO	A	730	-	3,3,3	0.51	0	2,2,2	0.26	0
8	EDO	B	202	-	3,3,3	0.44	0	2,2,2	0.40	0
8	EDO	A	715	-	3,3,3	0.42	0	2,2,2	0.37	0
8	EDO	A	723	-	3,3,3	0.35	0	2,2,2	0.81	0
8	EDO	A	725	-	3,3,3	0.31	0	2,2,2	0.55	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
8	EDO	B	204	-	-	1/1/1/1	-
8	EDO	A	726	-	-	0/1/1/1	-
8	EDO	A	717	-	-	1/1/1/1	-
4	FAD	A	701	-	-	5/34/50/50	0/6/6/6
8	EDO	C	201	-	-	0/1/1/1	-
8	EDO	A	708	-	-	0/1/1/1	-
8	EDO	A	727	-	-	0/1/1/1	-
8	EDO	A	721	-	-	0/1/1/1	-
8	EDO	B	201	-	-	1/1/1/1	-
8	EDO	A	713	-	-	0/1/1/1	-
8	EDO	A	710	-	-	0/1/1/1	-
8	EDO	A	716	-	-	1/1/1/1	-
8	EDO	A	722	-	-	1/1/1/1	-
8	EDO	A	711	-	-	0/1/1/1	-
8	EDO	A	714	-	-	0/1/1/1	-
8	EDO	B	203	-	-	1/1/1/1	-
9	PEG	B	205	-	-	0/4/4/4	-
5	PG4	A	703	-	-	5/10/10/10	-
8	EDO	A	724	-	-	0/1/1/1	-
8	EDO	A	706	-	-	0/1/1/1	-
8	EDO	A	709	-	-	1/1/1/1	-
8	EDO	A	720	-	-	0/1/1/1	-
5	PG4	A	702	-	-	3/7/7/10	-
8	EDO	A	707	-	-	0/1/1/1	-
8	EDO	A	718	-	-	0/1/1/1	-
8	EDO	A	719	-	-	1/1/1/1	-
8	EDO	A	729	-	-	1/1/1/1	-
9	PEG	A	731	-	-	3/4/4/4	-
8	EDO	A	712	-	-	1/1/1/1	-
8	EDO	A	728	-	-	1/1/1/1	-
8	EDO	A	730	-	-	0/1/1/1	-
8	EDO	B	202	-	-	0/1/1/1	-
8	EDO	A	715	-	-	1/1/1/1	-
8	EDO	A	723	-	-	1/1/1/1	-
8	EDO	A	725	-	-	1/1/1/1	-

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	701	FAD	C10-N1	2.12	1.37	1.33

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	701	FAD	C4'-C3'-C2'	-2.63	109.20	113.57

There are no chirality outliers.

All (30) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	701	FAD	N10-C1'-C2'-O2'
4	A	701	FAD	N10-C1'-C2'-C3'
4	A	701	FAD	PA-O3P-P-O5'
5	A	703	PG4	O3-C5-C6-O4
5	A	702	PG4	C3-C4-O3-C5
9	A	731	PEG	O1-C1-C2-O2
8	A	728	EDO	O1-C1-C2-O2
8	A	729	EDO	O1-C1-C2-O2
5	A	702	PG4	O3-C5-C6-O4
5	A	702	PG4	C5-C6-O4-C7
8	A	725	EDO	O1-C1-C2-O2
4	A	701	FAD	P-O3P-PA-O1A
5	A	703	PG4	C8-C7-O4-C6
9	A	731	PEG	C1-C2-O2-C3
5	A	703	PG4	C5-C6-O4-C7
5	A	703	PG4	C1-C2-O2-C3
4	A	701	FAD	P-O3P-PA-O2A
8	B	204	EDO	O1-C1-C2-O2
8	B	203	EDO	O1-C1-C2-O2
5	A	703	PG4	C3-C4-O3-C5
9	A	731	PEG	C4-C3-O2-C2
8	A	709	EDO	O1-C1-C2-O2
8	A	712	EDO	O1-C1-C2-O2
8	A	723	EDO	O1-C1-C2-O2
8	A	715	EDO	O1-C1-C2-O2
8	A	719	EDO	O1-C1-C2-O2
8	A	722	EDO	O1-C1-C2-O2
8	A	716	EDO	O1-C1-C2-O2
8	A	717	EDO	O1-C1-C2-O2
8	B	201	EDO	O1-C1-C2-O2

There are no ring outliers.

14 monomers are involved in 44 short contacts:

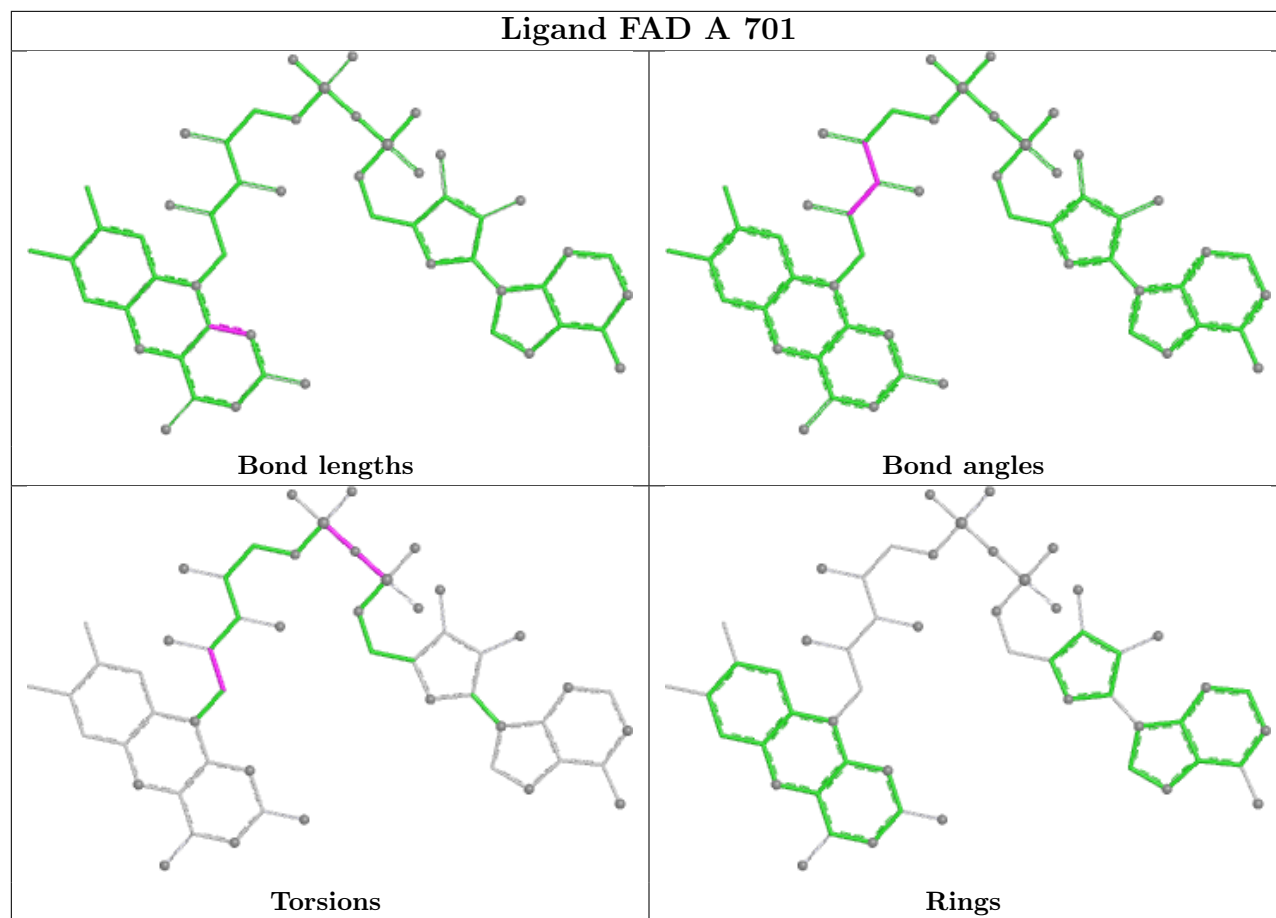
Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	701	FAD	4	0

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Mol	Chain	Res	Type	Clashes	Symm-Clashes
8	C	201	EDO	1	0
8	A	727	EDO	4	0
8	A	721	EDO	8	0
9	B	205	PEG	2	0
5	A	703	PG4	8	0
8	A	724	EDO	2	0
8	A	709	EDO	1	0
5	A	702	PG4	7	0
9	A	731	PEG	1	0
8	A	712	EDO	1	0
8	A	715	EDO	1	0
8	A	723	EDO	3	0
8	A	725	EDO	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.



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, 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	610/632 (96%)	-0.08	11 (1%) 67 73	7, 21, 40, 64	16 (2%)
2	B	123/137 (89%)	0.36	12 (9%) 13 15	16, 26, 57, 74	0
3	C	34/98 (34%)	0.40	4 (11%) 9 11	20, 26, 51, 75	0
All	All	767/867 (88%)	0.01	27 (3%) 47 54	7, 22, 46, 75	16 (2%)

All (27) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	B	131	ILE	4.1
1	A	662	ARG	4.1
3	C	75	PRO	3.8
2	B	129	PRO	3.4
1	A	425	VAL	3.3
3	C	76	ASP	3.3
1	A	57	VAL	3.3
2	B	128	ALA	3.2
1	A	54	GLN	3.2
2	B	166	ARG	3.1
2	B	44	GLN	3.0
2	B	47	MET	2.9
2	B	165	PRO	2.8
1	A	610	ILE	2.7
1	A	661	ILE	2.6
1	A	614	GLN	2.5
1	A	53	ALA	2.5
2	B	125	ALA	2.5
2	B	133	GLU	2.4
2	B	127	PRO	2.4
3	C	81	VAL	2.3
3	C	82	THR	2.1
1	A	210	ARG	2.1

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Mol	Chain	Res	Type	RSRZ
1	A	552	PHE	2.1
2	B	52	LEU	2.1
1	A	481	VAL	2.0
2	B	48	ILE	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 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.

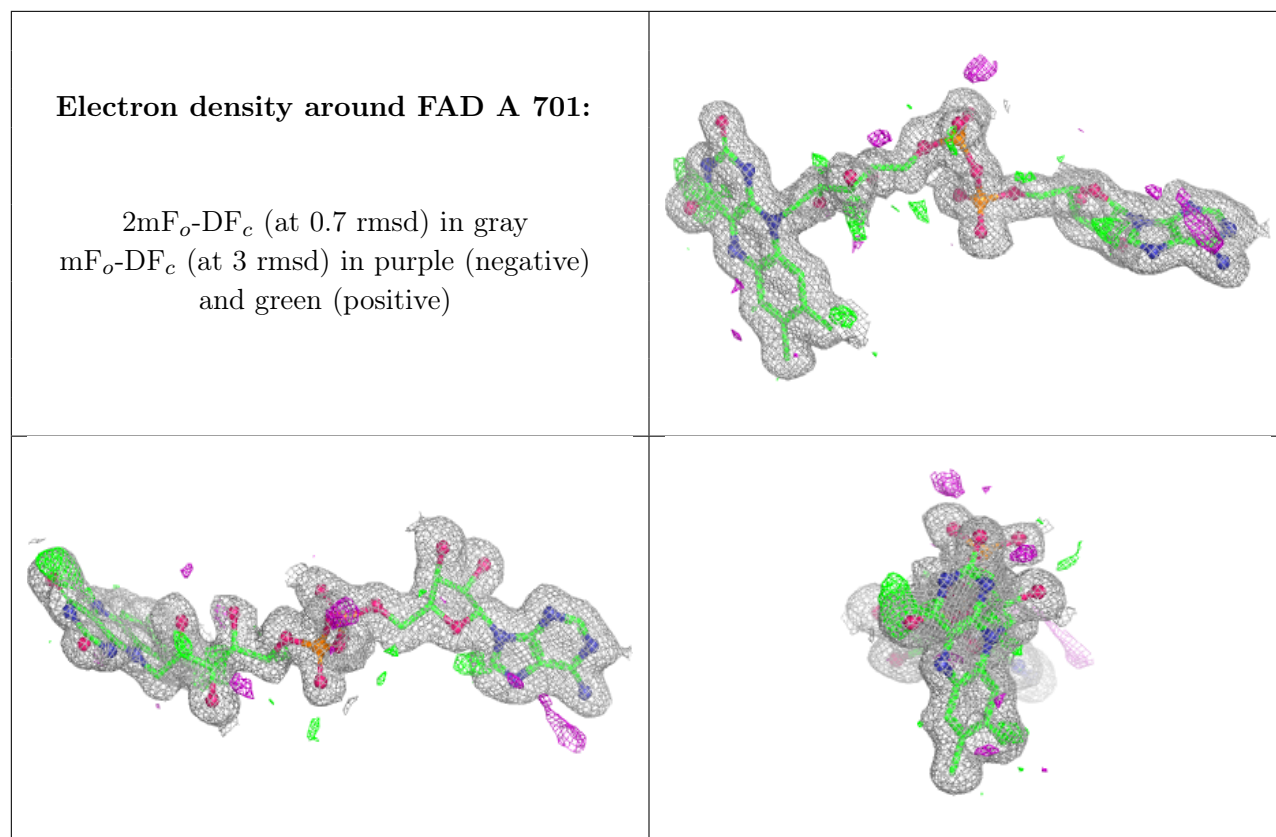
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
8	EDO	B	204	4/4	0.77	0.16	42,45,47,56	0
8	EDO	A	726	4/4	0.80	0.21	49,50,52,62	0
9	PEG	A	731	7/7	0.80	0.19	39,48,52,58	0
8	EDO	A	724	4/4	0.82	0.17	32,38,43,44	0
8	EDO	A	729	4/4	0.82	0.21	26,32,35,50	0
8	EDO	A	728	4/4	0.84	0.13	41,43,49,54	0
8	EDO	C	201	4/4	0.85	0.14	39,47,54,56	0
8	EDO	A	713	4/4	0.86	0.17	22,27,32,39	0
8	EDO	B	203	4/4	0.87	0.12	22,28,28,29	0
9	PEG	B	205	7/7	0.87	0.13	43,48,53,61	0
8	EDO	A	721	4/4	0.88	0.15	33,36,46,47	0
8	EDO	A	706	4/4	0.88	0.16	33,36,38,47	0
8	EDO	A	730	4/4	0.89	0.14	28,30,39,40	0
5	PG4	A	702	10/13	0.89	0.12	24,33,35,46	0
8	EDO	A	712	4/4	0.89	0.12	24,38,39,48	0
5	PG4	A	703	13/13	0.89	0.13	21,35,44,47	0
8	EDO	A	716	4/4	0.89	0.14	39,43,50,52	0
8	EDO	A	719	4/4	0.89	0.14	25,29,33,49	0
8	EDO	A	720	4/4	0.90	0.11	33,35,36,37	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
8	EDO	A	714	4/4	0.90	0.10	24,34,34,40	0
8	EDO	B	202	4/4	0.90	0.12	29,38,40,45	0
8	EDO	A	722	4/4	0.90	0.10	28,29,37,41	0
8	EDO	A	711	4/4	0.92	0.09	28,29,29,32	0
8	EDO	A	725	4/4	0.92	0.11	32,36,37,41	0
8	EDO	A	717	4/4	0.92	0.12	33,33,43,55	0
8	EDO	B	201	4/4	0.93	0.09	26,27,29,31	0
8	EDO	A	718	4/4	0.94	0.09	26,28,36,41	0
8	EDO	A	715	4/4	0.94	0.09	31,33,33,49	0
8	EDO	A	710	4/4	0.95	0.09	22,22,25,26	0
8	EDO	A	727	4/4	0.95	0.09	25,29,36,38	0
8	EDO	A	723	4/4	0.96	0.13	21,23,23,32	0
8	EDO	A	708	4/4	0.96	0.11	19,24,33,33	0
7	CL	A	705	1/1	0.96	0.07	36,36,36,36	0
8	EDO	A	707	4/4	0.97	0.05	19,19,21,22	0
8	EDO	A	709	4/4	0.97	0.11	21,28,28,33	0
4	FAD	A	701	53/53	0.98	0.05	11,13,15,17	0
6	K	A	704	1/1	0.99	0.16	20,20,20,20	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.



6.5 Other polymers [i](#)

There are no such residues in this entry.