



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2026 – 04:31 AM UTC

PDB ID : 1YHZ / pdb_00001yhz
Title : Crystal structure of Arabidopsis thaliana Acetohydroxyacid synthase In Complex With A Sulfonylurea Herbicide, Chlorsulfuron
Authors : McCourt, J.A.; Pang, S.S.; King-Scott, J.; Guddat, L.W.; Duggleby, R.G.
Deposited on : 2005-01-10
Resolution : 2.70 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

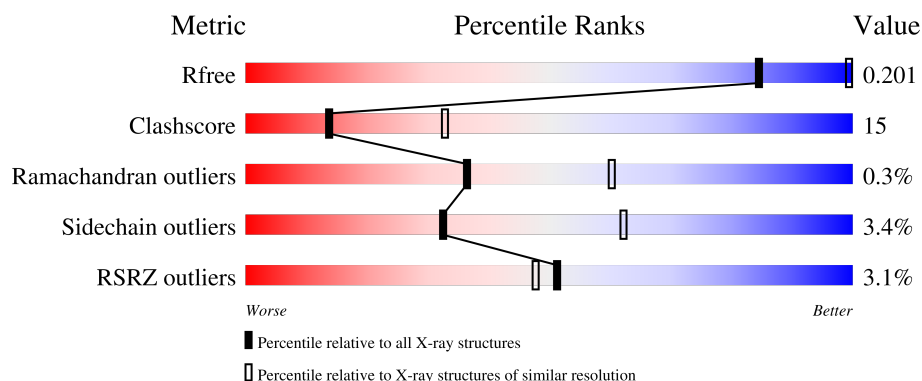
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.70 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	3538 (2.70-2.70)
Clashscore	190562	3843 (2.70-2.70)
Ramachandran outliers	187476	3778 (2.70-2.70)
Sidechain outliers	187428	3778 (2.70-2.70)
RSRZ outliers	180081	3538 (2.70-2.70)

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	590	

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
3	1CS	A	695	-	X	-	-

2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 4864 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 Acetolactate synthase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	582	Total	C	N	O	S	0	0	0
			4419	2803	759	833	24			

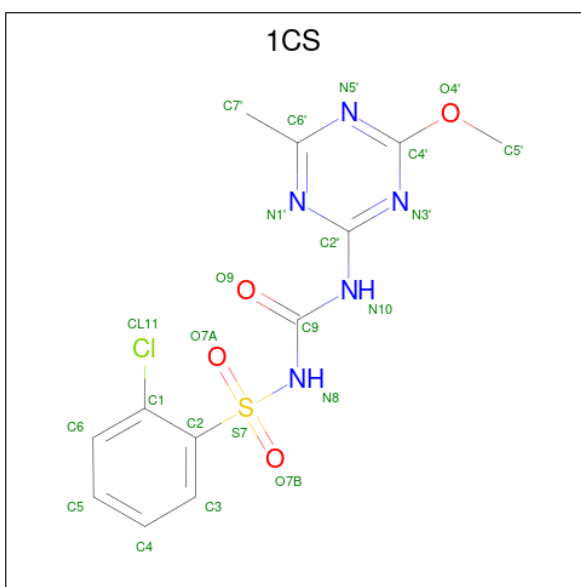
There are 9 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	340	CSD	CYS	modified residue	UNP P17597
A	668	LEU	-	expression tag	UNP P17597
A	669	GLU	-	expression tag	UNP P17597
A	670	HIS	-	expression tag	UNP P17597
A	671	HIS	-	expression tag	UNP P17597
A	672	HIS	-	expression tag	UNP P17597
A	673	HIS	-	expression tag	UNP P17597
A	674	HIS	-	expression tag	UNP P17597
A	675	HIS	-	expression tag	UNP P17597

- Molecule 2 is MAGNESIUM ION (CCD ID: MG) (formula: Mg).

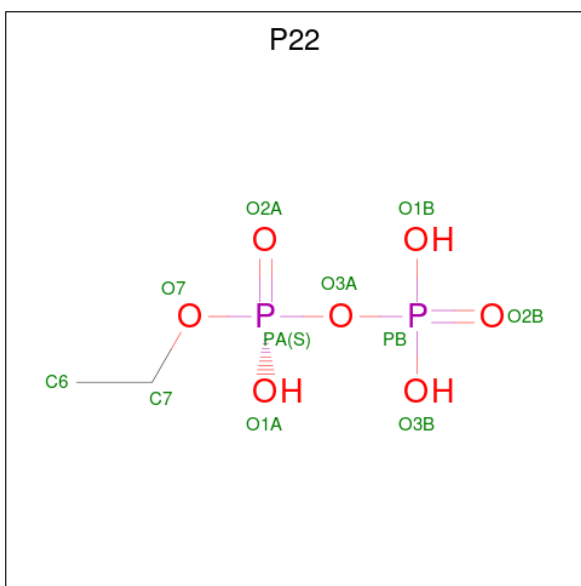
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	1	Total	Mg	0	0
			1	1		

- Molecule 3 is 1-(2-CHLOROPHENYLSULFONYL)-3-(4-METHOXY-6-METHYL-L,3,5-T RIAZIN-2-YL)UREA (CCD ID: 1CS) (formula: C₁₂H₁₂ClN₅O₄S).



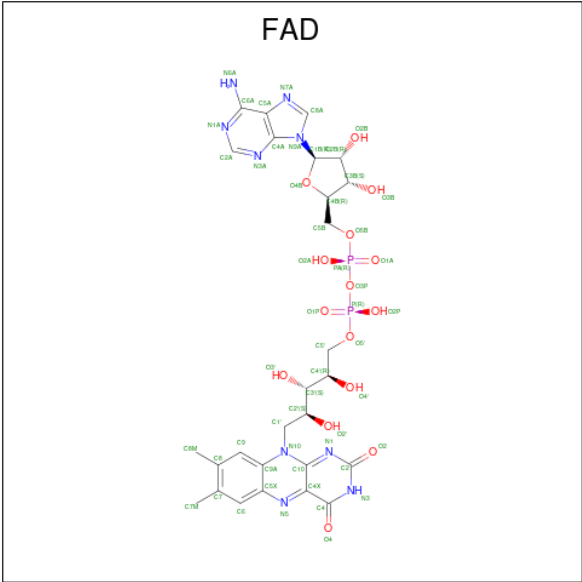
Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
3	A	1	Total	C	Cl	N	O	S	0	0
			23	12	1	5	4	1		

- Molecule 4 is ETHYL DIHYDROGEN DIPHOSPHATE (CCD ID: P22) (formula: $C_2H_8O_7P_2$).



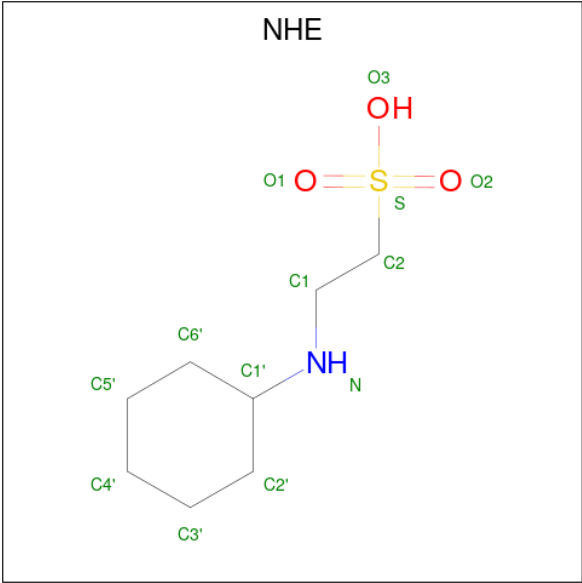
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	A	1	Total	C	O	P	0	0
			11	2	7	2		

- Molecule 5 is FLAVIN-ADENINE DINUCLEOTIDE (CCD ID: FAD) (formula: $C_{27}H_{33}N_9O_{15}P_2$).



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

- Molecule 6 is 2-[N-CYCLOHEXYLAMINO]ETHANE SULFONIC ACID (CCD ID: NHE) (formula: C₈H₁₇NO₃S).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
6	A	1	Total	C	N	O	S	0	0
			13	8	1	3	1		

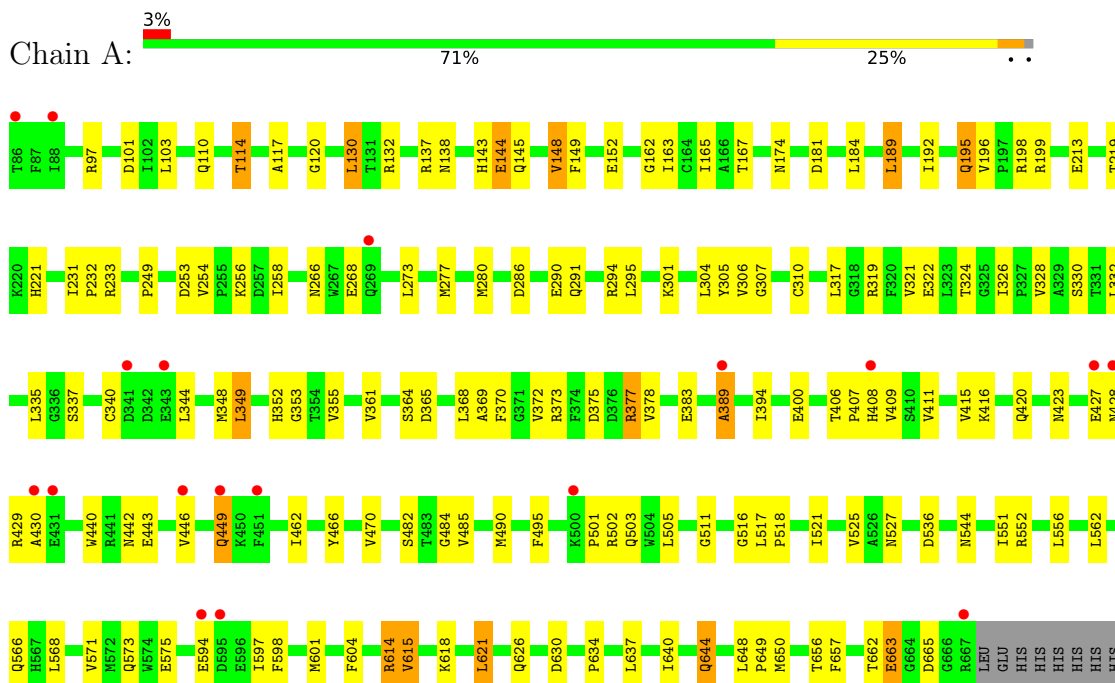
- Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	344	Total 344	O 344	0	0

3 Residue-property plots

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density ($RSRZ > 2$). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

• Molecule 1: Acetolactate synthase



4 Data and refinement statistics

Property	Value	Source
Space group	P 64 2 2	Depositor
Cell constants a, b, c, α , β , γ	178.51Å 178.51Å 185.68Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	50.00 – 2.70 50.00 – 2.70	Depositor EDS
% Data completeness (in resolution range)	95.4 (50.00-2.70) 95.4 (50.00-2.70)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	5.16 (at 2.69Å)	Xtriage
Refinement program	CNS	Depositor
R, R_{free}	0.177 , 0.201 0.179 , 0.201	Depositor DCC
R_{free} test set	4867 reflections (10.07%)	wwPDB-VP
Wilson B-factor (Å ²)	43.9	Xtriage
Anisotropy	0.090	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 43.3	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	0.95	EDS
Total number of atoms	4864	wwPDB-VP
Average B, all atoms (Å ²)	41.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 1.92% 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: P22, FAD, CSD, MG, 1CS, NHE

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	0.39	0/4507	0.94	16/6127 (0.3%)

There are no bond length outliers.

All (16) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	449	GLN	OE1-CD-NE2	-9.71	112.89	122.60
1	A	254	VAL	N-CA-C	7.48	115.55	108.15
1	A	503	GLN	N-CA-C	-7.19	105.03	114.31
1	A	495	PHE	N-CA-C	7.00	121.14	112.59
1	A	516	GLY	N-CA-C	6.65	120.69	112.64
1	A	449	GLN	CG-CD-NE2	6.65	126.37	116.40
1	A	484	GLY	N-CA-C	-6.63	103.00	112.55
1	A	328	VAL	N-CA-C	6.56	117.31	107.80
1	A	527	ASN	CA-C-N	6.41	126.62	119.32
1	A	527	ASN	C-N-CA	6.41	126.62	119.32
1	A	621	LEU	N-CA-C	5.97	117.46	111.07
1	A	389	ALA	CA-C-O	5.63	127.26	121.23
1	A	408	HIS	N-CA-C	-5.61	104.65	112.45
1	A	568	LEU	N-CA-C	-5.43	99.11	108.56
1	A	604	PHE	N-CA-C	-5.35	105.53	111.36
1	A	148	VAL	CB-CA-C	-5.31	105.18	111.97

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	4419	0	4367	129	0
2	A	1	0	0	0	0
3	A	23	0	12	0	0
4	A	11	0	5	0	0
5	A	53	0	31	3	0
6	A	13	0	17	1	0
7	A	344	0	0	15	0
All	All	4864	0	4432	130	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 15.

All (130) 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:195:GLN:HE21	1:A:196:VAL:N	1.60	0.97
1:A:195:GLN:NE2	1:A:196:VAL:H	1.62	0.96
1:A:566:GLN:HE22	1:A:598:PHE:H	1.07	0.96
1:A:195:GLN:HE21	1:A:196:VAL:H	0.94	0.93
1:A:117:ALA:H	1:A:138:ASN:HD21	1.18	0.92
1:A:143:HIS:HD2	1:A:145:GLN:H	1.16	0.92
1:A:332:LEU:HA	1:A:348:MET:HE2	1.55	0.89
1:A:364:SER:O	1:A:389:ALA:HB2	1.72	0.89
1:A:501:PRO:HA	7:A:4208:HOH:O	1.81	0.80
1:A:145:GLN:HE21	1:A:544:ASN:HD21	1.30	0.79
1:A:614:ARG:HD2	1:A:640:ILE:HD11	1.69	0.75
1:A:233:ARG:HD3	7:A:4261:HOH:O	1.90	0.71
1:A:375:ASP:OD2	1:A:377:ARG:HB2	1.92	0.69
1:A:352:HIS:HB2	1:A:490:MET:CE	2.23	0.68
1:A:365:ASP:C	1:A:389:ALA:HB1	2.18	0.68
1:A:273:LEU:O	1:A:277:MET:HG2	1.97	0.65
1:A:306:VAL:HG13	1:A:310:CYS:SG	2.36	0.65
1:A:352:HIS:CD2	1:A:490:MET:HE2	2.33	0.64
1:A:373:ARG:HG2	5:A:701:FAD:O1P	1.99	0.63
1:A:332:LEU:HD13	1:A:348:MET:HE1	1.81	0.63

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:443:GLU:O	1:A:446:VAL:HG22	1.99	0.62
1:A:656:THR:HG22	1:A:657:PHE:N	2.16	0.60
1:A:114:THR:HG21	1:A:525:VAL:HG11	1.84	0.60
1:A:337:SER:HA	1:A:501:PRO:HG3	1.84	0.58
1:A:406:THR:HG22	7:A:4097:HOH:O	2.02	0.58
1:A:352:HIS:HB2	1:A:490:MET:HE2	1.85	0.57
1:A:394:ILE:HG12	1:A:411:VAL:HB	1.87	0.57
1:A:485:VAL:HG21	1:A:511:GLY:C	2.30	0.56
1:A:332:LEU:CD1	1:A:348:MET:HE1	2.35	0.56
1:A:573:GLN:HE21	1:A:650:MET:HE3	1.68	0.56
1:A:502:ARG:HG2	1:A:502:ARG:HH11	1.70	0.55
1:A:552:ARG:HD3	1:A:552:ARG:O	2.07	0.55
1:A:597:ILE:HD13	1:A:640:ILE:CD1	2.36	0.55
1:A:277:MET:HA	1:A:280:MET:HE2	1.89	0.54
1:A:428:ASN:C	1:A:430:ALA:H	2.15	0.54
5:A:701:FAD:H51A	7:A:4055:HOH:O	2.08	0.54
1:A:552:ARG:HD3	1:A:552:ARG:C	2.33	0.53
1:A:184:LEU:HD22	7:A:4062:HOH:O	2.09	0.53
1:A:406:THR:HG23	7:A:4301:HOH:O	2.08	0.53
1:A:370:PHE:HB3	1:A:415:VAL:HG21	1.90	0.53
1:A:117:ALA:H	1:A:138:ASN:ND2	1.96	0.53
1:A:144:GLU:HG3	1:A:174:ASN:HB2	1.89	0.53
1:A:502:ARG:N	7:A:4208:HOH:O	2.43	0.52
1:A:562:LEU:HD21	1:A:601:MET:HG3	1.90	0.52
1:A:502:ARG:HG2	1:A:502:ARG:NH1	2.25	0.51
1:A:566:GLN:NE2	1:A:598:PHE:H	1.92	0.51
1:A:321:VAL:HG12	1:A:344:LEU:HD13	1.91	0.51
1:A:266:ASN:ND2	1:A:268:GLU:H	2.09	0.51
1:A:286:ASP:O	1:A:290:GLU:HG3	2.10	0.51
1:A:364:SER:C	1:A:389:ALA:HB2	2.36	0.51
1:A:416:LYS:O	1:A:420:GLN:HG3	2.11	0.51
1:A:256:LYS:HE3	7:A:4184:HOH:O	2.10	0.51
1:A:571:VAL:O	1:A:575:GLU:HG3	2.11	0.51
1:A:195:GLN:HE21	1:A:195:GLN:CA	2.24	0.50
1:A:305:TYR:CE2	1:A:372:VAL:HG21	2.47	0.50
1:A:304:LEU:HD23	1:A:368:LEU:HB2	1.93	0.50
1:A:120:GLY:HA3	1:A:167:THR:HB	1.93	0.50
1:A:573:GLN:NE2	1:A:650:MET:HE3	2.26	0.50
1:A:117:ALA:HB2	1:A:165:ILE:HB	1.94	0.50
1:A:163:ILE:HD12	1:A:163:ILE:N	2.27	0.50
1:A:423:ASN:O	1:A:427:GLU:HG3	2.11	0.50

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:195:GLN:NE2	1:A:196:VAL:HG22	2.26	0.50
1:A:307:GLY:HA3	1:A:372:VAL:HG12	1.94	0.49
1:A:442:ASN:O	1:A:446:VAL:HG13	2.12	0.49
1:A:556:LEU:O	1:A:634:PRO:HG3	2.12	0.49
1:A:162:GLY:C	1:A:163:ILE:HD12	2.38	0.49
1:A:103:LEU:HD21	1:A:192:ILE:HD13	1.93	0.49
1:A:144:GLU:HG3	1:A:174:ASN:CB	2.43	0.49
1:A:349:LEU:HD23	1:A:361:VAL:HG21	1.94	0.48
1:A:517:LEU:HB3	1:A:518:PRO:HD3	1.95	0.48
1:A:466:TYR:O	1:A:470:VAL:HG23	2.14	0.48
1:A:400:GLU:HG3	5:A:701:FAD:O3B	2.13	0.48
1:A:231:ILE:HB	1:A:232:PRO:HD3	1.96	0.48
1:A:317:LEU:O	1:A:321:VAL:HG23	2.13	0.48
1:A:143:HIS:CD2	1:A:145:GLN:H	2.09	0.48
1:A:482:SER:HA	1:A:505:LEU:O	2.14	0.48
1:A:319:ARG:HA	1:A:322:GLU:HG2	1.97	0.47
1:A:462:ILE:HG23	1:A:621:LEU:HD22	1.96	0.47
1:A:365:ASP:C	1:A:389:ALA:CB	2.88	0.47
1:A:615:VAL:HG22	1:A:637:LEU:HD11	1.97	0.47
1:A:101:ASP:OD1	1:A:132:ARG:NH1	2.46	0.46
1:A:352:HIS:HD2	1:A:490:MET:HE2	1.78	0.46
1:A:353:GLY:O	1:A:649:PRO:HG2	2.16	0.46
1:A:349:LEU:HD13	1:A:378:VAL:HG13	1.97	0.46
1:A:321:VAL:CG1	1:A:344:LEU:HD13	2.47	0.46
1:A:383:GLU:CD	1:A:383:GLU:H	2.24	0.45
1:A:656:THR:CG2	1:A:657:PHE:N	2.79	0.45
1:A:626:GLN:HG3	1:A:630:ASP:OD2	2.16	0.45
1:A:566:GLN:NE2	1:A:597:ILE:HA	2.31	0.45
1:A:198:ARG:HD3	1:A:258:ILE:HD11	1.98	0.44
1:A:517:LEU:HD11	1:A:551:ILE:CD1	2.47	0.44
1:A:221:HIS:ND1	6:A:696:NHE:H2'2	2.33	0.44
1:A:195:GLN:HE21	1:A:195:GLN:C	2.23	0.44
1:A:644:GLN:H	1:A:644:GLN:CD	2.26	0.44
1:A:213:GLU:HG3	7:A:4018:HOH:O	2.17	0.44
1:A:626:GLN:HE21	1:A:630:ASP:CG	2.26	0.44
1:A:195:GLN:HG2	1:A:253:ASP:CG	2.42	0.43
1:A:355:VAL:HA	7:A:4084:HOH:O	2.19	0.43
1:A:330:SER:O	1:A:348:MET:HA	2.18	0.43
1:A:132:ARG:NH2	7:A:4149:HOH:O	2.48	0.43
1:A:130:LEU:HD12	1:A:130:LEU:HA	1.89	0.42
1:A:120:GLY:HA3	1:A:167:THR:CB	2.49	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:648:LEU:HA	1:A:649:PRO:C	2.44	0.42
1:A:466:TYR:CD2	1:A:618:LYS:HE3	2.55	0.42
1:A:501:PRO:O	1:A:502:ARG:HB2	2.19	0.42
1:A:117:ALA:CB	1:A:165:ILE:HB	2.49	0.42
1:A:291:GLN:O	1:A:294:ARG:HB3	2.19	0.42
1:A:195:GLN:HG2	1:A:253:ASP:OD1	2.20	0.42
1:A:406:THR:HA	1:A:407:PRO:HD3	1.86	0.42
1:A:152:GLU:OE2	1:A:181:ASP:OD2	2.37	0.42
1:A:195:GLN:NE2	1:A:195:GLN:CA	2.82	0.42
1:A:295:LEU:HD11	1:A:409:VAL:HG21	2.01	0.42
1:A:266:ASN:HD21	1:A:268:GLU:HB2	1.85	0.41
1:A:369:ALA:HB1	1:A:372:VAL:CG2	2.51	0.41
1:A:335:LEU:HD11	1:A:348:MET:CE	2.51	0.41
1:A:184:LEU:HD13	7:A:4062:HOH:O	2.20	0.41
1:A:521:ILE:HD11	1:A:551:ILE:HG13	2.01	0.41
1:A:117:ALA:N	1:A:138:ASN:HD21	1.99	0.41
1:A:301:LYS:HG2	1:A:440:TRP:CE3	2.56	0.41
1:A:377:ARG:HA	1:A:377:ARG:HD2	1.83	0.41
1:A:324:THR:HB	1:A:326:ILE:HG13	2.03	0.41
1:A:233:ARG:HB2	7:A:4040:HOH:O	2.20	0.41
1:A:349:LEU:HD12	1:A:349:LEU:H	1.86	0.40
1:A:662:THR:O	1:A:663:GLU:HG3	2.21	0.40
1:A:644:GLN:O	1:A:665:ASP:HB2	2.22	0.40
1:A:189:LEU:O	1:A:249:PRO:HA	2.21	0.40
1:A:149:PHE:HB3	1:A:518:PRO:HB2	2.04	0.40
1:A:199:ARG:HG2	7:A:4189:HOH:O	2.22	0.40
1:A:110:GLN:HG2	7:A:4066:HOH:O	2.20	0.40
1:A:219:THR:HA	1:A:249:PRO:HG2	2.04	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	579/590 (98%)	559 (96%)	18 (3%)	2 (0%)	36 60

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	429	ARG
1	A	594	GLU

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	468/486 (96%)	452 (97%)	16 (3%)	32 62

All (16) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	97	ARG
1	A	114	THR
1	A	130	LEU
1	A	137	ARG
1	A	144	GLU
1	A	148	VAL
1	A	189	LEU
1	A	195	GLN
1	A	349	LEU
1	A	377	ARG
1	A	449	GLN
1	A	536	ASP
1	A	614	ARG
1	A	615	VAL
1	A	644	GLN
1	A	663	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (16) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	110	GLN
1	A	138	ASN
1	A	143	HIS
1	A	145	GLN
1	A	174	ASN
1	A	195	GLN
1	A	266	ASN
1	A	269	GLN
1	A	288	HIS
1	A	291	GLN
1	A	312	ASN
1	A	363	HIS
1	A	442	ASN
1	A	497	ASN
1	A	566	GLN
1	A	626	GLN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

1 non-standard protein/DNA/RNA residue is 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	CSD	A	340	1	4,7,8	3.15	1 (25%)	1,8,10	7.21	1 (100%)

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	CSD	A	340	1	-	0/2/6/8	-

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	340	CSD	OD1-SG	-6.19	1.42	1.47

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	340	CSD	OD1-SG-CB	7.21	118.89	105.60

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 [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 5 ligands modelled in this entry, 1 is monoatomic - leaving 4 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	$\# Z > 2$
3	1CS	A	695	-	24,24,24	3.77	16 (66%)	34,34,34	4.17	16 (47%)
5	FAD	A	701	-	58,58,58	2.74	25 (43%)	85,89,89	1.55	13 (15%)
6	NHE	A	696	-	13,13,13	3.34	6 (46%)	16,17,17	2.36	8 (50%)
4	P22	A	702	2	9,10,10	1.68	3 (33%)	13,15,15	1.60	2 (15%)

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
3	1CS	A	695	-	-	5/17/17/17	0/2/2/2
5	FAD	A	701	-	-	3/34/50/50	0/6/6/6
6	NHE	A	696	-	-	1/7/15/15	0/1/1/1
4	P22	A	702	2	-	2/10/10/10	-

All (50) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	695	1CS	C1-C2	7.52	1.50	1.40
5	A	701	FAD	C4A-N3A	7.25	1.48	1.34
6	A	696	NHE	O1-S	6.74	1.64	1.45
5	A	701	FAD	C2A-N1A	6.71	1.45	1.33
3	A	695	1CS	C4-C3	6.30	1.49	1.38
6	A	696	NHE	O2-S	6.20	1.62	1.45
3	A	695	1CS	C3-C2	6.11	1.46	1.39
3	A	695	1CS	C6'-N5'	6.01	1.44	1.34
5	A	701	FAD	C8A-N9A	5.80	1.47	1.37
5	A	701	FAD	C5A-C4A	5.69	1.49	1.39
5	A	701	FAD	C5A-C6A	5.58	1.56	1.41
3	A	695	1CS	C6'-N1'	5.51	1.43	1.34
3	A	695	1CS	C5-C4	5.35	1.50	1.38
6	A	696	NHE	O3-S	4.95	1.65	1.47
3	A	695	1CS	C4'-N5'	4.95	1.42	1.33
5	A	701	FAD	O4'-C4'	4.63	1.53	1.43
3	A	695	1CS	O4'-C4'	4.57	1.44	1.33
5	A	701	FAD	C1'-C2'	-4.15	1.46	1.52
5	A	701	FAD	C9A-C5X	4.14	1.47	1.41
5	A	701	FAD	O3'-C3'	4.09	1.53	1.43
5	A	701	FAD	C6A-N1A	3.71	1.46	1.35
3	A	695	1CS	C6-C1	3.71	1.46	1.38
3	A	695	1CS	C2'-N1'	3.62	1.44	1.34
5	A	701	FAD	C2A-N3A	3.55	1.40	1.33
5	A	701	FAD	C4X-N5	3.51	1.38	1.30
6	A	696	NHE	C6'-C1'	3.38	1.59	1.52
5	A	701	FAD	C5'-C4'	-3.25	1.47	1.51
5	A	701	FAD	C1B-N9A	2.99	1.54	1.46
5	A	701	FAD	C10-N1	2.97	1.39	1.33
5	A	701	FAD	C3B-C4B	2.85	1.60	1.53

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	A	701	FAD	P-O2P	-2.83	1.42	1.55
5	A	701	FAD	C6-C5X	2.81	1.44	1.40
5	A	701	FAD	C8-C7	2.80	1.47	1.40
3	A	695	1CS	C2'-N3'	2.65	1.42	1.34
5	A	701	FAD	C6-C7	2.62	1.43	1.39
5	A	701	FAD	PA-O2A	-2.50	1.43	1.55
3	A	695	1CS	C5-C6	2.50	1.43	1.38
5	A	701	FAD	C9-C9A	2.44	1.43	1.39
6	A	696	NHE	C5'-C6'	-2.42	1.47	1.53
4	A	702	P22	PA-O1A	-2.40	1.44	1.55
3	A	695	1CS	C7'-C6'	-2.36	1.43	1.49
3	A	695	1CS	O7B-S7	2.34	1.46	1.43
3	A	695	1CS	C2'-N10	-2.31	1.35	1.38
4	A	702	P22	PA-O2A	-2.24	1.43	1.50
5	A	701	FAD	C4-N3	2.18	1.42	1.38
4	A	702	P22	PB-O1B	-2.18	1.46	1.54
6	A	696	NHE	C4'-C3'	2.13	1.59	1.51
3	A	695	1CS	C4'-N3'	2.12	1.37	1.33
5	A	701	FAD	PA-O5B	-2.12	1.51	1.59
5	A	701	FAD	O2B-C2B	-2.02	1.38	1.43

All (39) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	695	1CS	C4'-N3'-C2'	12.26	122.87	112.86
3	A	695	1CS	C1-C2-S7	11.35	131.02	123.19
3	A	695	1CS	O7A-S7-C2	6.88	119.05	107.68
3	A	695	1CS	O7B-S7-N8	-6.76	87.42	106.77
3	A	695	1CS	O7B-S7-C2	-6.56	96.86	107.68
3	A	695	1CS	O7A-S7-N8	5.64	122.93	106.77
3	A	695	1CS	C2'-N10-C9	-5.18	125.01	130.34
3	A	695	1CS	C3-C2-S7	-5.06	110.25	117.51
6	A	696	NHE	O1-S-C2	4.99	114.27	106.73
6	A	696	NHE	C1-N-C1'	-4.63	105.27	114.18
3	A	695	1CS	N3'-C2'-N1'	-4.55	118.80	126.26
4	A	702	P22	O7-C7-C6	4.47	137.41	110.80
5	A	701	FAD	C4A-N9A-C1B	4.35	136.81	126.63
3	A	695	1CS	N8-C9-N10	-3.95	108.60	114.87
3	A	695	1CS	N3'-C4'-N5'	-3.76	120.83	127.65
5	A	701	FAD	C4A-N9A-C8A	-3.57	101.99	105.74
5	A	701	FAD	C6A-C5A-C4A	-3.53	112.36	117.18
6	A	696	NHE	C2-C1-N	3.31	120.84	111.40

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	A	701	FAD	N3A-C2A-N1A	-3.16	123.79	128.58
5	A	701	FAD	O2B-C2B-C1B	3.08	120.71	110.10
5	A	701	FAD	C6A-C5A-N7A	2.99	137.86	132.09
3	A	695	1CS	O9-C9-N10	2.97	128.91	123.64
5	A	701	FAD	O2B-C2B-C3B	2.88	121.06	111.82
5	A	701	FAD	O2-C2-N1	-2.85	117.07	121.80
6	A	696	NHE	C3'-C2'-C1'	-2.67	106.30	111.09
5	A	701	FAD	C1B-N9A-C8A	-2.66	121.19	127.09
5	A	701	FAD	C5B-C4B-C3B	2.63	124.69	115.21
6	A	696	NHE	O3-S-O1	-2.55	105.01	111.40
3	A	695	1CS	C7'-C6'-N1'	2.46	120.81	117.13
3	A	695	1CS	N1'-C6'-N5'	-2.23	121.84	125.77
5	A	701	FAD	C1'-C2'-C3'	2.18	115.58	109.66
3	A	695	1CS	C2'-N1'-C6'	2.16	117.84	114.61
6	A	696	NHE	O2-S-O1	-2.16	106.79	113.82
3	A	695	1CS	C5'-O4'-C4'	2.10	120.88	117.56
6	A	696	NHE	O2-S-C2	2.08	109.88	106.73
5	A	701	FAD	O4-C4-C4X	-2.08	121.05	126.53
6	A	696	NHE	C6'-C1'-C2'	-2.05	107.26	110.80
5	A	701	FAD	C4-N3-C2	-2.03	122.04	125.64
4	A	702	P22	O3B-PB-O1B	2.00	115.31	107.80

There are no chirality outliers.

All (11) torsion outliers are listed below:

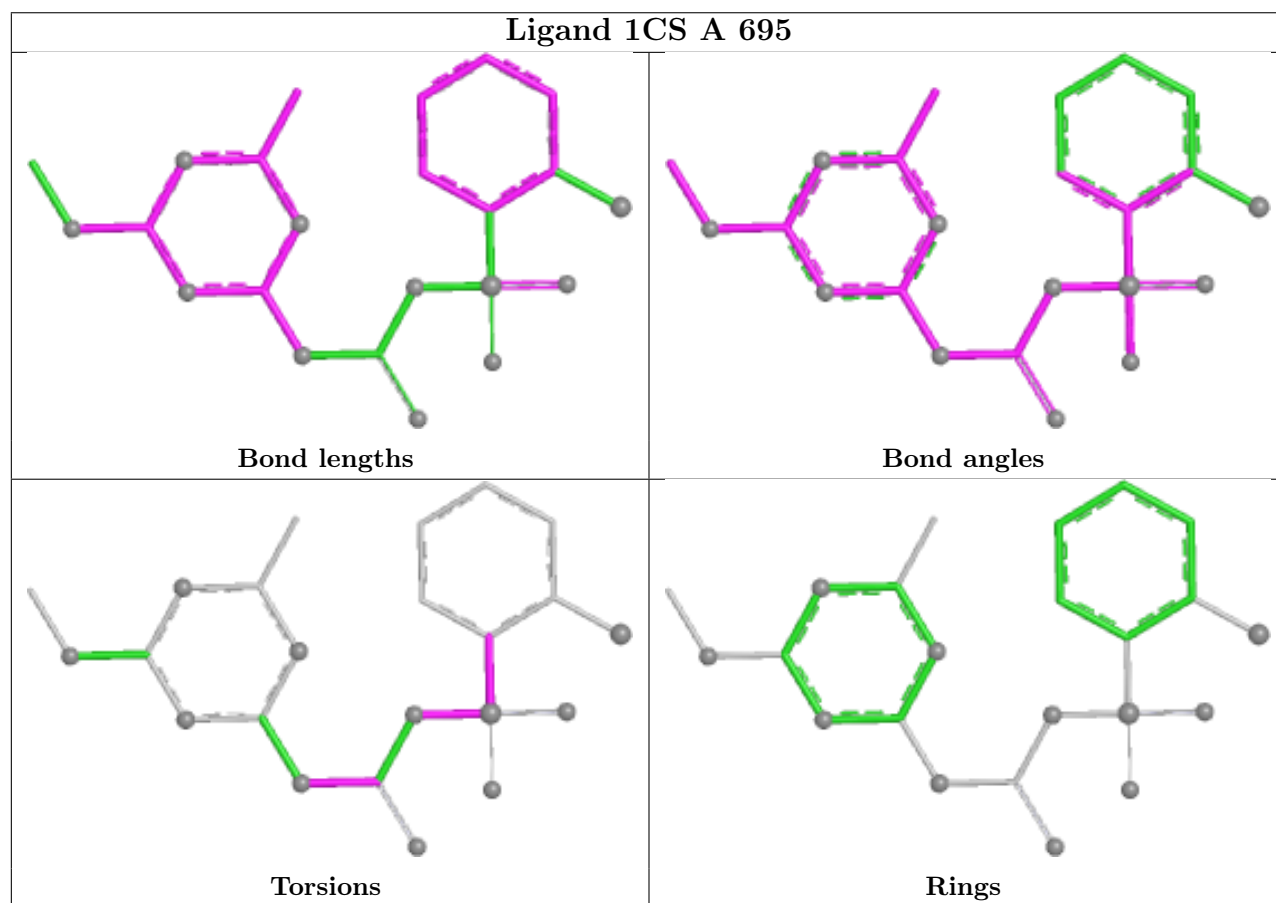
Mol	Chain	Res	Type	Atoms
4	A	702	P22	C7-O7-PA-O2A
3	A	695	1CS	C9-N8-S7-O7A
3	A	695	1CS	C1-C2-S7-N8
4	A	702	P22	PB-O3A-PA-O7
3	A	695	1CS	C3-C2-S7-N8
6	A	696	NHE	C2'-C1'-N-C1
3	A	695	1CS	O9-C9-N10-C2'
5	A	701	FAD	C2B-C1B-N9A-C8A
3	A	695	1CS	N8-C9-N10-C2'
5	A	701	FAD	PA-O3P-P-O2P
5	A	701	FAD	O4B-C4B-C5B-O5B

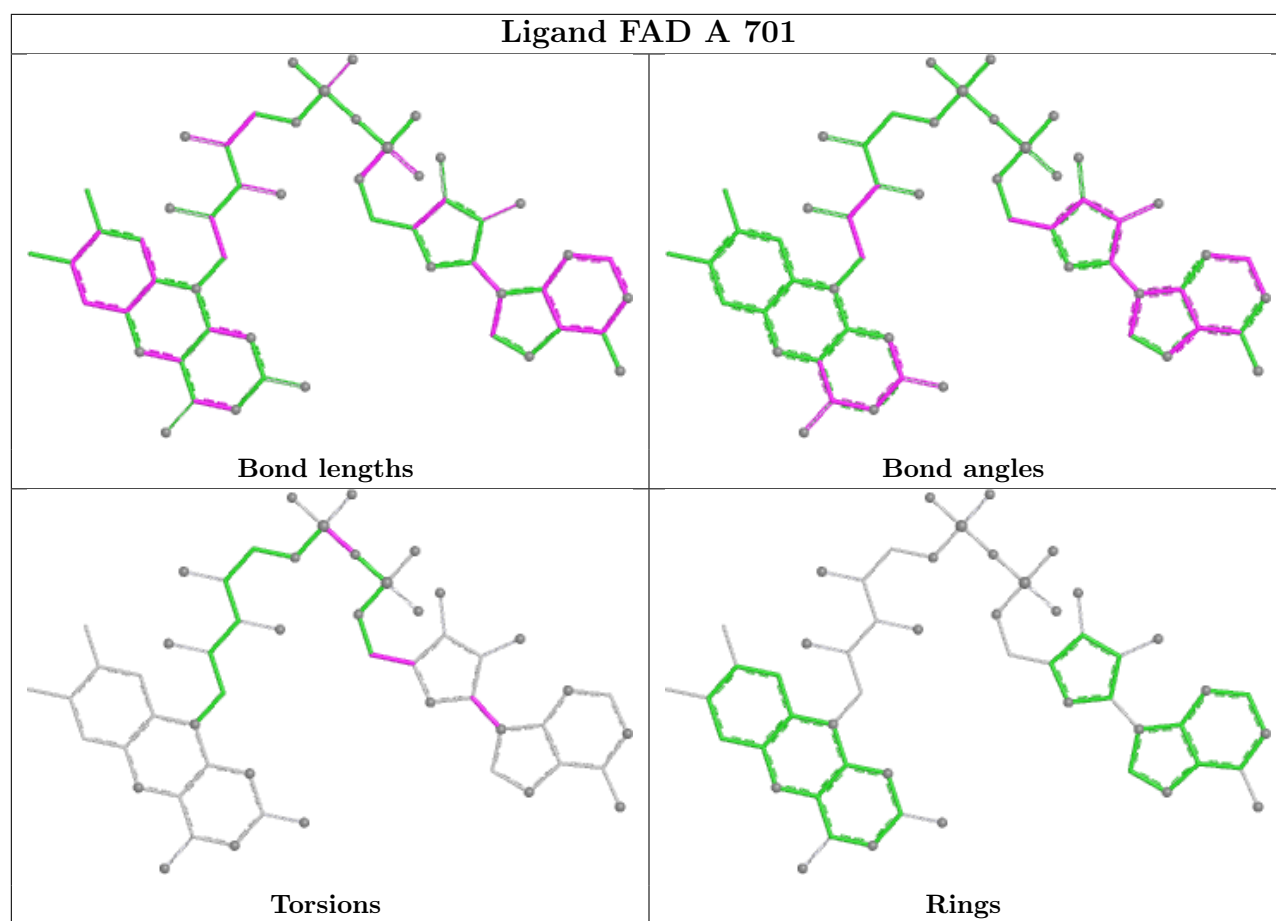
There are no ring outliers.

2 monomers are involved in 4 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	A	701	FAD	3	0
6	A	696	NHE	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	581/590 (98%)	-0.18	18 (3%) 51 48	22, 38, 63, 82	0

All (18) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	449	GLN	5.8
1	A	341	ASP	4.0
1	A	408	HIS	4.0
1	A	594	GLU	3.5
1	A	86	THR	3.2
1	A	431	GLU	3.2
1	A	667	ARG	3.1
1	A	451	PHE	2.7
1	A	595	ASP	2.4
1	A	343	GLU	2.4
1	A	500	LYS	2.2
1	A	428	ASN	2.2
1	A	427	GLU	2.2
1	A	88	ILE	2.2
1	A	269	GLN	2.2
1	A	389	ALA	2.2
1	A	430	ALA	2.1
1	A	446	VAL	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($\text{\AA}^2$)	Q<0.9
1	CSD	A	340	8/9	0.85	0.22	63,66,69,69	0

6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

6.4 Ligands [i](#)

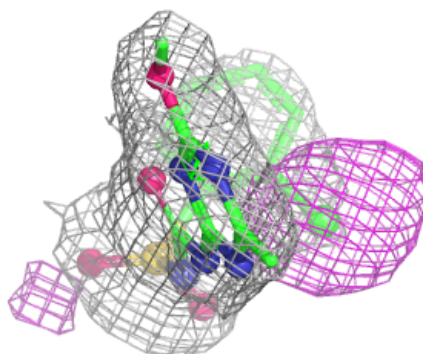
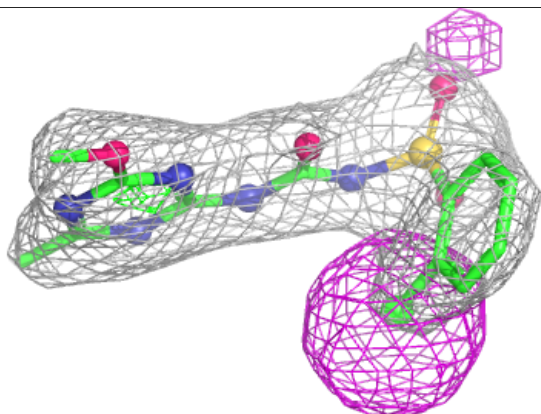
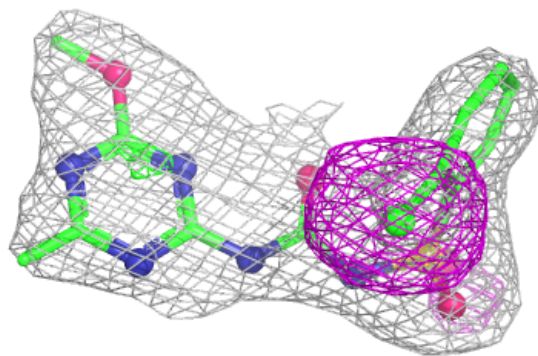
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
4	P22	A	702	11/11	0.86	0.16	55,59,63,63	0
3	1CS	A	695	23/23	0.88	0.12	35,39,42,44	0
6	NHE	A	696	13/13	0.95	0.12	34,36,39,42	0
5	FAD	A	701	53/53	0.97	0.08	21,30,35,37	0
2	MG	A	699	1/1	0.98	0.04	52,52,52,52	0

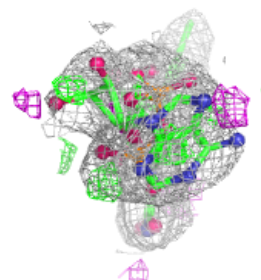
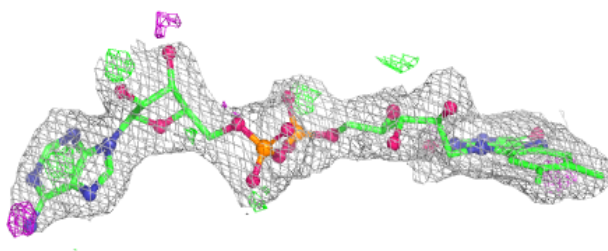
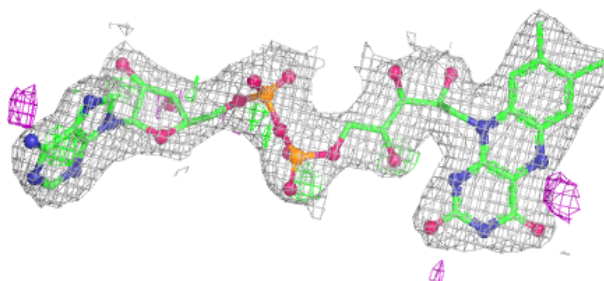
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around 1CS A 695:

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

**Electron density around FAD A 701:**

$2mF_o-DF_c$ (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.