



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 4, 2026 – 08:11 PM UTC

PDB ID : 1M51 / pdb_00001m51
Title : PEPCK complex with a GTP-competitive inhibitor
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Deposited on : 2002-07-06
Resolution : 2.25 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)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

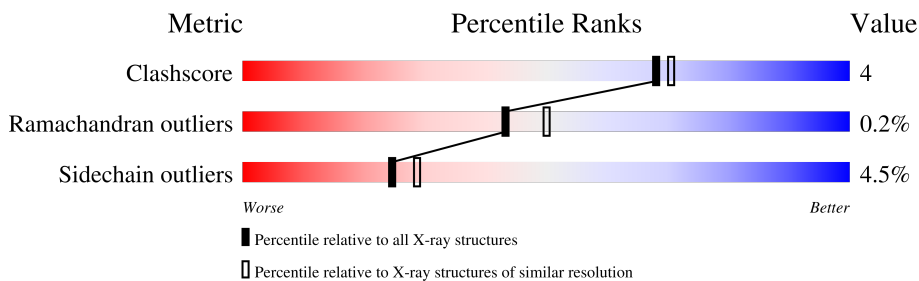
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.25 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))
Clashscore	190562	2005 (2.26-2.26)
Ramachandran outliers	187476	1965 (2.26-2.26)
Sidechain outliers	187428	1966 (2.26-2.26)

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 $\leq 5\%$.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	625	

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 4945 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 phosphoenolpyruvate carboxykinase, cytosolic.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	603	Total	C	N	O	S	0	0	0
			4720	3010	808	867	35			

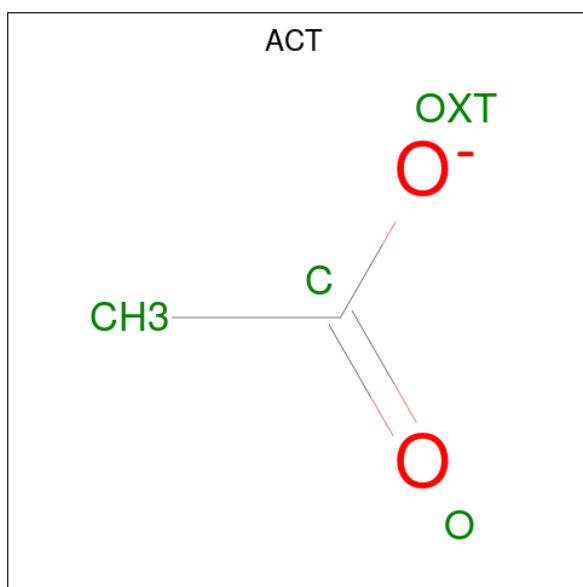
There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-2	GLY	-	cloning artifact	UNP P35558
A	-1	GLU	-	cloning artifact	UNP P35558
A	0	LEU	-	cloning artifact	UNP P35558
A	267	VAL	ILE	variant	UNP P35558
A	586	ASP	GLU	variant	UNP P35558
A	597	VAL	GLU	variant	UNP P35558

- Molecule 2 is MANGANESE (II) ION (CCD ID: MN) (formula: Mn).

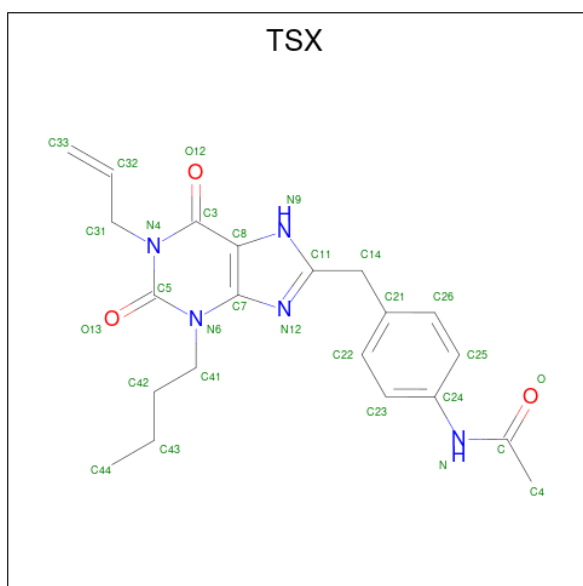
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	1	Total	Mn	0	0
			1	1		

- Molecule 3 is ACETATE ION (CCD ID: ACT) (formula: C₂H₃O₂).



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

- Molecule 4 is N-[4-(1-ALLYL-3-BUTYL-2,6-DIOXO-2,3,6,7-TETRAHYDRO-1H-PURIN-8-YLMETHYL)-PHENYL]-ACETAMIDE (CCD ID: TSX) (formula: C₂₁H₂₅N₅O₃).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	A	1	Total	C	N	O	0	0
			29	21	5	3		

- Molecule 5 is 1,2-ETHANEDIOL (CCD ID: EDO) (formula: C₂H₆O₂).



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

- Molecule 6 is water.

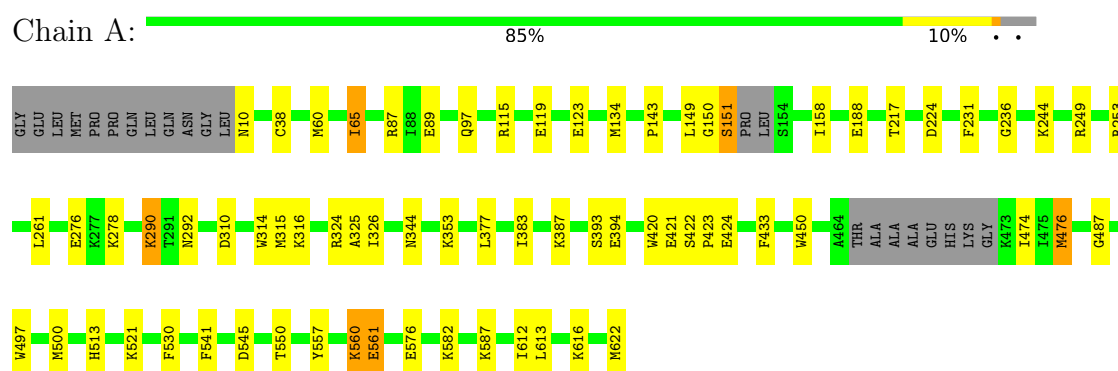
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	183	Total	O	0	0
			183	183		

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. 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. 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.

Note EDS was not executed.

- Molecule 1: phosphoenolpyruvate carboxykinase, cytosolic



4 Data and refinement statistics

Xtriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α , β , γ	45.41 Å 61.07 Å 62.01 Å 88.91° 70.21° 72.62°	Depositor
Resolution (Å)	50.00 – 2.25	Depositor
% Data completeness (in resolution range)	94.0 (50.00-2.25)	Depositor
R_{merge}	(Not available)	Depositor
R_{sym}	0.04	Depositor
Refinement program	REFMAC 5.1.24	Depositor
R, R_{free}	0.178 , 0.237	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	4945	wwPDB-VP
Average B, all atoms (Å ²)	17.0	wwPDB-VP

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: MN, EDO, TSX, ACT

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	0.64	0/4840	0.87	1/6552 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed($^{\circ}$)	Ideal($^{\circ}$)
1	A	236	GLY	N-CA-C	5.02	118.95	112.83

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	4720	0	4663	34	0
2	A	1	0	0	0	0
3	A	4	0	3	1	0
4	A	29	0	25	1	0
5	A	8	0	12	1	0
6	A	183	0	0	0	0
All	All	4945	0	4703	34	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 4.

All (34) 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:497:TRP:HA	1:A:500:MET:HE3	1.61	0.83
1:A:497:TRP:HA	1:A:500:MET:CE	2.12	0.80
1:A:244:LYS:HE2	3:A:1004:ACT:H2	1.75	0.69
1:A:290:LYS:HE2	1:A:310:ASP:O	1.98	0.63
1:A:261:LEU:HD11	1:A:500:MET:SD	2.44	0.58
1:A:450:TRP:HA	5:A:1002:EDO:H22	1.88	0.56
1:A:315:MET:HA	1:A:324:ARG:O	2.06	0.55
1:A:530:PHE:HA	4:A:1001:TSX:H32	1.88	0.55
1:A:38:CYS:HB3	1:A:134:MET:HG3	1.90	0.54
1:A:497:TRP:CA	1:A:500:MET:HE3	2.38	0.51
1:A:550:THR:HB	1:A:557:TYR:HB3	1.94	0.50
1:A:278:LYS:HG3	1:A:541:PHE:CE1	2.46	0.49
1:A:292:ASN:HA	1:A:344:ASN:ND2	2.28	0.49
1:A:420:TRP:CE2	1:A:421:GLU:HG3	2.49	0.48
1:A:433:PHE:O	1:A:513:HIS:HA	2.15	0.47
1:A:217:THR:HA	1:A:231:PHE:O	2.14	0.47
1:A:474:ILE:HG22	1:A:476:MET:HG2	1.96	0.47
1:A:582:LYS:HG3	1:A:622:MET:HG2	1.98	0.46
1:A:150:GLY:O	1:A:151:SER:C	2.59	0.45
1:A:249:ARG:O	1:A:487:GLY:HA3	2.16	0.45
1:A:422:SER:HA	1:A:423:PRO:HD3	1.86	0.45
1:A:60:MET:HG2	1:A:65:ILE:HD12	1.98	0.45
1:A:314:TRP:O	1:A:325:ALA:HA	2.17	0.44
1:A:497:TRP:O	1:A:500:MET:HE3	2.17	0.44
1:A:582:LYS:HG3	1:A:622:MET:CG	2.48	0.44
1:A:143:PRO:HA	1:A:158:ILE:HD13	2.01	0.43
1:A:560:LYS:HG3	1:A:561:GLU:N	2.32	0.43
1:A:377:LEU:HD11	1:A:383:ILE:HD11	2.00	0.43
1:A:97:GLN:HG2	1:A:119:GLU:OE2	2.18	0.43
1:A:613:LEU:O	1:A:616:LYS:HG3	2.20	0.42
1:A:261:LEU:HD21	1:A:500:MET:HE2	2.01	0.42
1:A:87:ARG:HH11	1:A:87:ARG:HG3	1.84	0.41
1:A:612:ILE:O	1:A:616:LYS:HG2	2.21	0.41
1:A:276:GLU:OE2	1:A:545:ASP:OD2	2.40	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	597/625 (96%)	576 (96%)	20 (3%)	1 (0%)	43	50

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	149	LEU

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	507/523 (97%)	484 (96%)	23 (4%)	24	29

All (23) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	10	ASN
1	A	65	ILE
1	A	89	GLU
1	A	115	ARG
1	A	123	GLU
1	A	151	SER
1	A	188	GLU
1	A	224	ASP
1	A	253	ARG
1	A	290	LYS

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Mol	Chain	Res	Type
1	A	316	LYS
1	A	326	ILE
1	A	353	LYS
1	A	387	LYS
1	A	393	SER
1	A	394	GLU
1	A	424	GLU
1	A	476	MET
1	A	521	LYS
1	A	560	LYS
1	A	561	GLU
1	A	576	GLU
1	A	587	LYS

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 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
4	TSX	A	1001	-	31,31,31	1.61	2 (6%)	41,43,43	2.82	20 (48%)
5	EDO	A	1003	-	3,3,3	0.29	0	2,2,2	0.52	0
5	EDO	A	1002	-	3,3,3	0.25	0	2,2,2	0.29	0
3	ACT	A	1004	-	3,3,3	0.84	0	3,3,3	1.39	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
4	TSX	A	1001	-	-	1/15/15/15	0/3/3/3
5	EDO	A	1003	-	-	0/1/1/1	-
5	EDO	A	1002	-	-	1/1/1/1	-

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	1001	TSX	C11-N9	5.44	1.45	1.36
4	A	1001	TSX	C8-C3	5.12	1.51	1.42

All (20) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	1001	TSX	N6-C5-N4	6.65	123.86	115.75
4	A	1001	TSX	C8-N9-C11	-5.83	100.56	107.94
4	A	1001	TSX	C31-N4-C3	5.44	123.85	117.54
4	A	1001	TSX	C3-C8-C7	-4.65	119.46	123.13
4	A	1001	TSX	C14-C21-C26	-4.52	114.24	120.89
4	A	1001	TSX	C21-C14-C11	-4.44	104.44	113.62
4	A	1001	TSX	O12-C3-C8	-4.20	118.08	126.64
4	A	1001	TSX	C41-N6-C5	3.73	123.15	117.64
4	A	1001	TSX	O12-C3-N4	3.59	125.83	119.99
4	A	1001	TSX	C3-N4-C5	-3.55	121.25	125.62
4	A	1001	TSX	C26-C21-C22	3.39	123.28	118.23
4	A	1001	TSX	O13-C5-N6	-3.29	117.55	121.98
4	A	1001	TSX	C23-C22-C21	-3.22	116.77	121.00
4	A	1001	TSX	N9-C11-N12	3.10	114.61	111.28
4	A	1001	TSX	C32-C31-N4	3.03	120.98	112.52
4	A	1001	TSX	C5-N6-C7	-2.64	117.78	119.59
4	A	1001	TSX	O13-C5-N4	-2.52	118.58	121.98
4	A	1001	TSX	C7-C8-N9	2.29	110.26	106.06

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	1001	TSX	C24-N-C	-2.13	124.00	127.98
4	A	1001	TSX	C25-C24-C23	2.12	121.85	119.04

There are no chirality outliers.

All (2) torsion outliers are listed below:

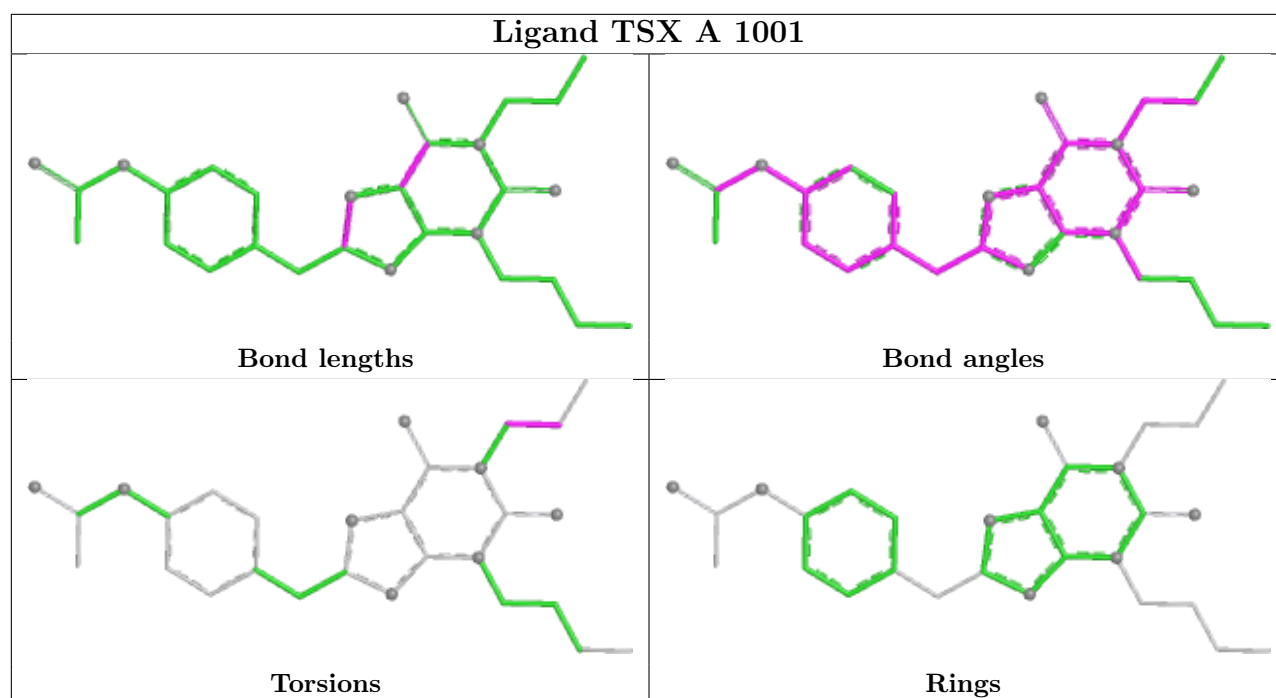
Mol	Chain	Res	Type	Atoms
4	A	1001	TSX	N4-C31-C32-C33
5	A	1002	EDO	O1-C1-C2-O2

There are no ring outliers.

3 monomers are involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	1001	TSX	1	0
5	A	1002	EDO	1	0
3	A	1004	ACT	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

6.1 Protein, DNA and RNA chains

EDS was not executed - this section is therefore empty.

6.2 Non-standard residues in protein, DNA, RNA chains

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates

EDS was not executed - this section is therefore empty.

6.4 Ligands

EDS was not executed - this section is therefore empty.

6.5 Other polymers

EDS was not executed - this section is therefore empty.