



Full wwPDB X-ray Structure Validation Report ⓘ

Jul 26, 2023 – 04:29 AM EDT

PDB ID : 1BKS
Title : TRYPTOPHAN SYNTHASE (E.C.4.2.1.20) FROM SALMONELLA TY-PHIMURIUM
Authors : Hyde, C.C.
Deposited on : 1998-07-10
Resolution : 2.20 Å(reported)

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

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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

MolProbity : 4.02b-467
Mogul : 1.8.5 (274361), CSD as541be (2020)
Xtrriage (Phenix) : **NOT EXECUTED**
EDS : **NOT EXECUTED**
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.34

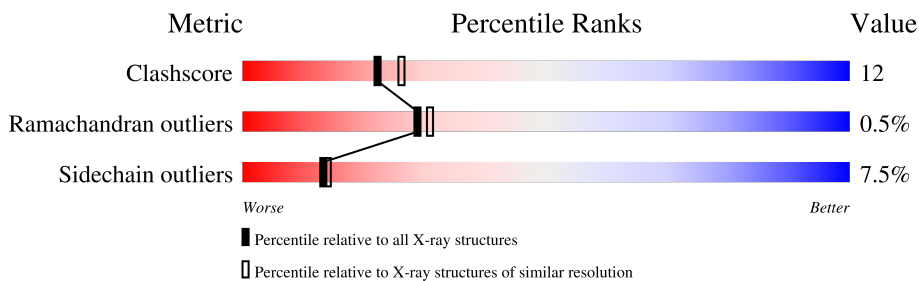
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.20 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
Clashscore	141614	5594 (2.20-2.20)
Ramachandran outliers	138981	5503 (2.20-2.20)
Sidechain outliers	138945	5504 (2.20-2.20)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions $\leq 5\%$.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	268	
2	B	397	

2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 5231 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 TRYPTOPHAN SYNTHASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	255	1935	1237	332	358	8	0	1	0

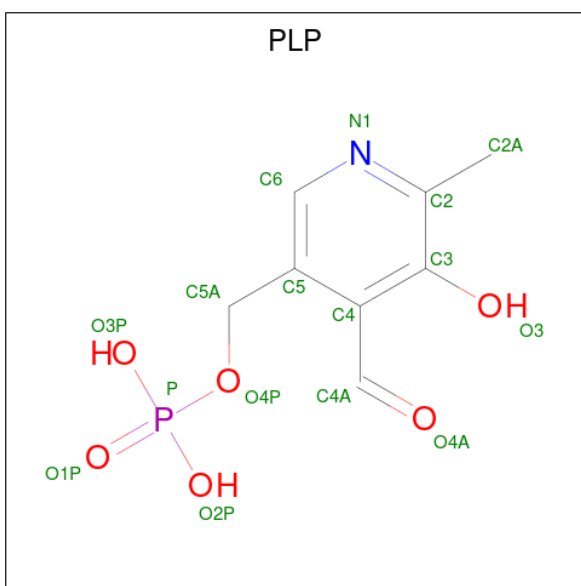
- Molecule 2 is a protein called TRYPTOPHAN SYNTHASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	392	2988	1878	526	565	19	0	3	0

- Molecule 3 is SODIUM ION (three-letter code: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Na		
3	B	1	1	1	0	0

- Molecule 4 is PYRIDOXAL-5'-PHOSPHATE (three-letter code: PLP) (formula: C₈H₁₀NO₆P).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	P		
4	B	1	15	8	1	5	1	0	0

- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	105	Total	O	0	0
			105	105		
5	B	187	Total	O	0	0
			187	187		

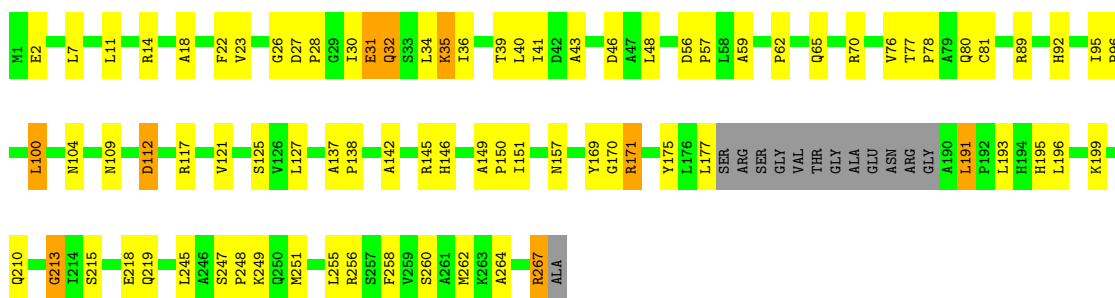
3 Residue-property plots [i](#)

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. 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.

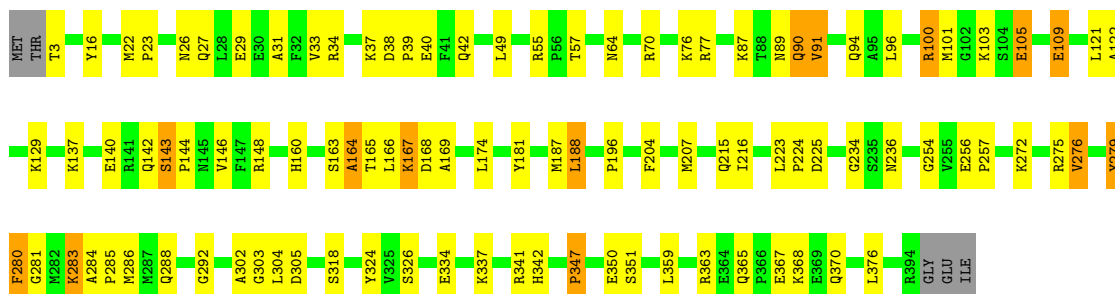
• Molecule 1: TRYPTOPHAN SYNTHASE

Chain A: 



• Molecule 2: TRYPTOPHAN SYNTHASE

Chain B: 



4 Data and refinement statistics

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

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	184.58Å 62.06Å 67.61Å 90.00° 94.69° 90.00°	Depositor
Resolution (Å)	(Not available) – 2.20	Depositor
% Data completeness (in resolution range)	(Not available) ((Not available)-2.20)	Depositor
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	PROLSQ	Depositor
R, R_{free}	(Not available) , (Not available)	Depositor
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	5231	wwPDB-VP
Average B, all atoms (Å ²)	33.0	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: PLP, NA

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	0.74	0/1978	1.12	2/2688 (0.1%)
2	B	0.82	0/3059	1.18	8/4130 (0.2%)
All	All	0.79	0/5037	1.16	10/6818 (0.1%)

There are no bond length outliers.

All (10) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	100	ARG	NE-CZ-NH1	7.80	124.20	120.30
2	B	100	ARG	NE-CZ-NH2	-6.24	117.18	120.30
2	B	275	ARG	NE-CZ-NH2	-6.15	117.22	120.30
1	A	171	ARG	NE-CZ-NH1	6.05	123.32	120.30
2	B	275	ARG	NE-CZ-NH1	5.82	123.21	120.30
2	B	234	GLY	N-CA-C	5.50	126.86	113.10
1	A	169	TYR	CB-CG-CD1	5.47	124.28	121.00
2	B	188	LEU	CA-CB-CG	5.46	127.85	115.30
2	B	292	GLY	N-CA-C	5.32	126.40	113.10
2	B	148	ARG	NE-CZ-NH1	5.11	122.85	120.30

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	1935	0	1951	44	0
2	B	2988	0	2970	75	0
3	B	1	0	0	0	0
4	B	15	0	6	1	0
5	A	105	0	0	2	0
5	B	187	0	0	2	0
All	All	5231	0	4927	115	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 12.

All (115) 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:B:90:GLN:HE22	2:B:94:GLN:HE21	1.14	0.91
2:B:34:ARG:HG3	2:B:100:ARG:HH11	1.46	0.80
1:A:39:THR:HG23	1:A:256:ARG:HE	1.48	0.78
1:A:7:LEU:HD22	1:A:96:PRO:HG2	1.72	0.72
2:B:55:ARG:HH11	2:B:89:ASN:HD21	1.38	0.71
2:B:143:SER:N	2:B:144:PRO:HD2	2.05	0.71
2:B:34:ARG:HG3	2:B:100:ARG:NH1	2.10	0.66
2:B:76:LYS:NZ	2:B:215:GLN:HE22	1.93	0.66
2:B:90:GLN:HE22	2:B:94:GLN:NE2	1.90	0.65
2:B:90:GLN:NE2	2:B:94:GLN:HE21	1.93	0.64
2:B:174:LEU:HD11	2:B:280:PHE:HE1	1.64	0.62
1:A:70:ARG:HD3	1:A:245:LEU:HD21	1.81	0.62
1:A:56:ASP:OD2	2:B:167[B]:LYS:HG3	1.99	0.61
1:A:26:GLY:HA3	1:A:76:VAL:HG21	1.82	0.60
2:B:38:ASP:CG	2:B:100:ARG:HH22	2.05	0.59
2:B:142:GLN:O	2:B:146:VAL:HG23	2.03	0.57
2:B:91:VAL:HG13	2:B:122:ALA:HB2	1.85	0.57
1:A:264:ALA:HA	1:A:267:ARG:NH1	2.20	0.57
1:A:112:ASP:OD2	1:A:145:ARG:NH2	2.39	0.55
2:B:57:THR:HB	2:B:77:ARG:O	2.06	0.55
2:B:22:MET:N	2:B:23:PRO:CD	2.70	0.54
2:B:16:TYR:O	2:B:281:GLY:HA2	2.08	0.54
1:A:137:ALA:HB3	1:A:138:PRO:CD	2.38	0.54
2:B:359:LEU:O	2:B:363:ARG:HG3	2.07	0.54
1:A:89:ARG:NH1	1:A:92:HIS:O	2.41	0.53
2:B:103:LYS:NZ	2:B:181:TYR:O	2.41	0.53
2:B:105:GLU:HG3	2:B:129:LYS:HB2	1.90	0.53
1:A:104:ASN:HD21	2:B:288:GLN:NE2	2.07	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:76:LYS:HZ3	2:B:215:GLN:HE22	1.56	0.53
2:B:174:LEU:HD11	2:B:280:PHE:CE1	2.43	0.53
2:B:76:LYS:HZ3	2:B:215:GLN:NE2	2.06	0.52
1:A:117:ARG:O	1:A:121:VAL:HG22	2.09	0.52
1:A:175:TYR:HE1	1:A:177:LEU:HD13	1.75	0.52
1:A:258:PHE:O	1:A:262:MET:HG2	2.10	0.52
2:B:38:ASP:O	2:B:42:GLN:HG2	2.09	0.52
2:B:87:LYS:NZ	4:B:401:PLP:O3	2.39	0.51
1:A:62:PRO:HA	1:A:65:GLN:HB2	1.93	0.50
2:B:31:ALA:O	2:B:34:ARG:HG2	2.11	0.50
2:B:279:TYR:HD2	2:B:286:MET:HE2	1.77	0.50
1:A:35:LYS:HD3	5:A:607:HOH:O	2.11	0.50
2:B:37:LYS:O	2:B:39:PRO:HD3	2.11	0.50
2:B:49:LEU:HD22	2:B:89:ASN:HD22	1.77	0.50
2:B:223:LEU:HB3	2:B:224:PRO:HD2	1.94	0.50
2:B:137:LYS:HB2	2:B:164:ALA:O	2.11	0.49
2:B:303:GLY:HA3	2:B:350:GLU:OE2	2.12	0.49
1:A:77:THR:OG1	1:A:80:GLN:HG3	2.12	0.49
1:A:104:ASN:HD21	2:B:288:GLN:HE22	1.60	0.49
1:A:41:ILE:HD11	1:A:48:LEU:HD11	1.95	0.49
2:B:347:PRO:CB	2:B:376:LEU:HD11	2.43	0.49
2:B:91:VAL:O	2:B:187:MET:HE2	2.13	0.49
2:B:109:GLU:HB2	2:B:169:ALA:HB1	1.94	0.49
1:A:109:ASN:HB3	5:A:664:HOH:O	2.13	0.48
2:B:29:GLU:HB2	2:B:196:PRO:HG3	1.94	0.48
1:A:142:ALA:O	1:A:146:HIS:HD2	1.97	0.48
2:B:34:ARG:HE	2:B:100:ARG:HD3	1.79	0.48
2:B:91:VAL:HG22	2:B:187:MET:SD	2.54	0.48
2:B:257:PRO:HG3	2:B:304:LEU:HB3	1.95	0.48
1:A:78:PRO:O	1:A:81:CYS:HB2	2.14	0.47
2:B:143:SER:N	2:B:144:PRO:CD	2.74	0.47
1:A:31:GLU:HG2	1:A:32:GLN:HE21	1.79	0.47
1:A:62:PRO:N	1:A:65:GLN:HE21	2.13	0.47
2:B:57:THR:OG1	2:B:76:LYS:HE3	2.14	0.47
2:B:284:ALA:HB1	2:B:285:PRO:HD2	1.96	0.47
1:A:95:ILE:HA	1:A:96:PRO:HD3	1.78	0.46
2:B:165:THR:HG22	2:B:166:LEU:H	1.81	0.46
2:B:284:ALA:O	2:B:286:MET:HE3	2.15	0.46
2:B:365:GLN:NE2	2:B:368:LYS:HD2	2.31	0.46
2:B:225:ASP:OD2	2:B:370:GLN:HA	2.15	0.46
2:B:302:ALA:O	2:B:305[A]:ASP:HB2	2.15	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:36:ILE:HD11	1:A:251:MET:SD	2.56	0.46
1:A:125:SER:HB2	1:A:151:ILE:HG12	1.97	0.46
1:A:11:LEU:CD1	1:A:18:ALA:HB2	2.46	0.45
1:A:213:GLY:O	1:A:219:GLN:NE2	2.50	0.45
2:B:256:GLU:O	2:B:326:SER:HA	2.16	0.45
2:B:351:SER:HB3	2:B:376:LEU:HD12	1.99	0.45
2:B:351:SER:CB	2:B:376:LEU:HD12	2.47	0.45
1:A:40:LEU:HD21	1:A:255:LEU:HD22	1.99	0.45
2:B:163:SER:O	2:B:164:ALA:C	2.55	0.44
2:B:90:GLN:HA	2:B:204:PHE:HB3	2.00	0.44
1:A:137:ALA:HB3	1:A:138:PRO:HD3	2.00	0.44
1:A:11:LEU:HD23	1:A:14:ARG:HH21	1.84	0.43
2:B:334[A]:GLU:HG2	5:B:586:HOH:O	2.18	0.43
1:A:22:PHE:CE2	1:A:100[B]:LEU:HD13	2.54	0.43
2:B:283:LYS:O	2:B:283:LYS:HG3	2.18	0.43
1:A:195:HIS:NE2	1:A:199:LYS:HE3	2.33	0.43
2:B:27:GLN:HG2	2:B:101:MET:CE	2.49	0.43
2:B:64:ASN:HB2	2:B:342:HIS:HB3	2.00	0.43
1:A:31:GLU:H	1:A:31:GLU:CD	2.22	0.43
1:A:247:SER:HA	1:A:248:PRO:HD3	1.74	0.42
2:B:160:HIS:HA	2:B:164:ALA:HB2	1.99	0.42
2:B:76:LYS:NZ	2:B:215:GLN:NE2	2.63	0.42
2:B:276:VAL:HA	2:B:285:PRO:HA	2.02	0.42
2:B:254:GLY:O	2:B:324:TYR:HA	2.19	0.42
2:B:90:GLN:HE21	2:B:90:GLN:HB2	1.53	0.42
1:A:30:ILE:O	1:A:34:LEU:HG	2.19	0.41
2:B:22:MET:O	2:B:26:ASN:ND2	2.53	0.41
2:B:216:ILE:HG21	2:B:224:PRO:HD3	2.02	0.41
2:B:34:ARG:NE	2:B:100:ARG:HD3	2.35	0.41
2:B:70:ARG:NH2	2:B:367:GLU:HB3	2.35	0.41
1:A:175:TYR:CE1	1:A:177:LEU:HD13	2.54	0.41
2:B:165:THR:HG22	2:B:166:LEU:N	2.35	0.41
1:A:43:ALA:HB2	1:A:256:ARG:HD3	2.02	0.41
1:A:18:ALA:HA	1:A:46:ASP:OD2	2.21	0.41
1:A:57:PRO:C	1:A:59:ALA:H	2.23	0.41
2:B:55:ARG:HD2	2:B:89:ASN:ND2	2.36	0.41
1:A:27:ASP:HA	1:A:28:PRO:HA	1.93	0.40
2:B:3:THR:N	5:B:482:HOH:O	2.54	0.40
1:A:149:ALA:HA	1:A:150:PRO:HD3	1.90	0.40
1:A:157:ASN:ND2	2:B:23:PRO:HG2	2.36	0.40
2:B:347:PRO:HB3	2:B:376:LEU:HD11	2.04	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:170:GLY:O	1:A:171:ARG:HD3	2.21	0.40
2:B:33:VAL:O	2:B:37:LYS:HG3	2.21	0.40
2:B:76:LYS:HZ2	2:B:215:GLN:HE22	1.63	0.40
2:B:337:LYS:O	2:B:341:ARG:HD3	2.22	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	252/268 (94%)	239 (95%)	11 (4%)	2 (1%)	19	19
2	B	393/397 (99%)	376 (96%)	16 (4%)	1 (0%)	41	46
All	All	645/665 (97%)	615 (95%)	27 (4%)	3 (0%)	29	31

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	B	164	ALA
1	A	191	LEU
1	A	213	GLY

5.3.2 Protein sidechains [i](#)

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

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

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	201/208 (97%)	183 (91%)	18 (9%)	9	9
2	B	310/311 (100%)	288 (93%)	22 (7%)	14	16
All	All	511/519 (98%)	471 (92%)	40 (8%)	13	13

All (40) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	2	GLU
1	A	23	VAL
1	A	31	GLU
1	A	32	GLN
1	A	35	LYS
1	A	100[A]	LEU
1	A	100[B]	LEU
1	A	112	ASP
1	A	127	LEU
1	A	191	LEU
1	A	193	LEU
1	A	196	LEU
1	A	210	GLN
1	A	215	SER
1	A	218	GLU
1	A	249	LYS
1	A	260	SER
1	A	267	ARG
2	B	40	GLU
2	B	90	GLN
2	B	91	VAL
2	B	96	LEU
2	B	105	GLU
2	B	109	GLU
2	B	121	LEU
2	B	140	GLU
2	B	143	SER
2	B	167[A]	LYS
2	B	167[B]	LYS
2	B	168	ASP
2	B	188	LEU
2	B	207	MET
2	B	236	ASN
2	B	272	LYS
2	B	276	VAL

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Mol	Chain	Res	Type
2	B	279	TYR
2	B	280	PHE
2	B	283	LYS
2	B	318	SER
2	B	347	PRO

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (12) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	32	GLN
1	A	65	GLN
1	A	68	ASN
2	B	27	GLN
2	B	42	GLN
2	B	89	ASN
2	B	90	GLN
2	B	160	HIS
2	B	215	GLN
2	B	288	GLN
2	B	317	ASN
2	B	365	GLN

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 2 ligands modelled in this entry, 1 is monoatomic - leaving 1 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	PLP	B	401	2	15,15,16	1.45	3 (20%)	20,22,23	2.10	9 (45%)

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	PLP	B	401	2	-	0/6/6/8	0/1/1/1

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	B	401	PLP	C5-C4	-3.29	1.36	1.40
4	B	401	PLP	P-O4P	-2.97	1.50	1.60
4	B	401	PLP	O3-C3	-2.24	1.31	1.37

All (9) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	B	401	PLP	O3P-P-O4P	3.72	116.64	106.73
4	B	401	PLP	O4P-C5A-C5	3.34	115.72	109.35
4	B	401	PLP	C4A-C4-C3	-3.24	115.01	120.50
4	B	401	PLP	C2A-C2-C3	3.20	124.84	120.89
4	B	401	PLP	C3-C4-C5	3.03	122.02	118.74
4	B	401	PLP	C6-N1-C2	3.01	124.75	119.17
4	B	401	PLP	C5-C6-N1	-2.72	119.29	123.82
4	B	401	PLP	C3-C2-N1	-2.37	117.70	120.77
4	B	401	PLP	O3-C3-C2	2.28	122.46	117.49

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	B	401	PLP	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

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.