Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 10:34 PM UTC

PDB ID	:	1LFW / pdb_00001lfw
Title	:	Crystal structure of pepV
Authors	:	Jozic, D.; Bourenkow, G.; Bartunik, H.; Scholze, H.; Dive, V.; Henrich, B.; Huber, R.; Bode, W.; Maskos, K.
Deposited on	:	2002-04-12
Resolution	:	1.80 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:

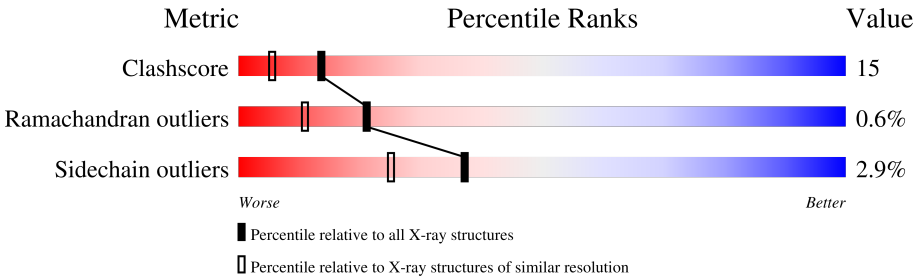
MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 1.80 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	8479 (1.80-1.80)
Ramachandran outliers	187476	8391 (1.80-1.80)
Sidechain outliers	187428	8390 (1.80-1.80)

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 <=5%

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	470	73% 21% 5%

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 4238 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.

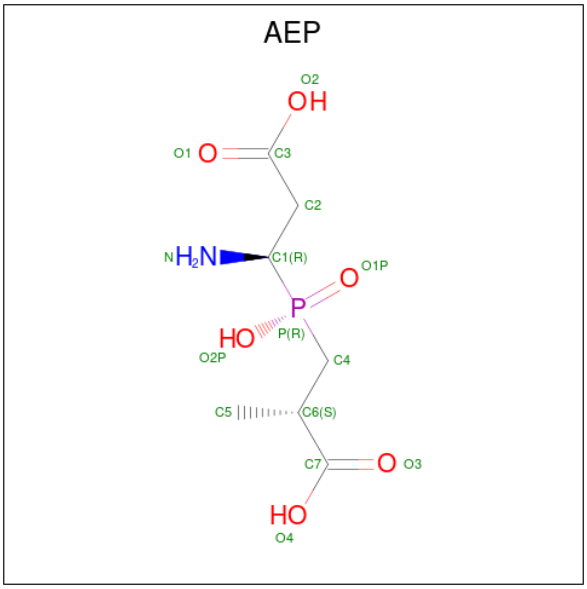
- Molecule 1 is a protein called pepV.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	468	3651	2332	586	720	13	0	0	0

- Molecule 2 is ZINC ION (CCD ID: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Zn		
2	A	2	2	2	0	0

- Molecule 3 is 3-[(1-AMINO-2-CARBOXY-ETHYL)-HYDROXY-PHOSPHINOYL]-2-METHYL-PROPIONIC ACID (CCD ID: AEP) (formula: $C_7H_{14}NO_6P$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	P		
3	A	1	15	7	1	6	1	0	0

- Molecule 4 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	570	Total O 570 570	0	0

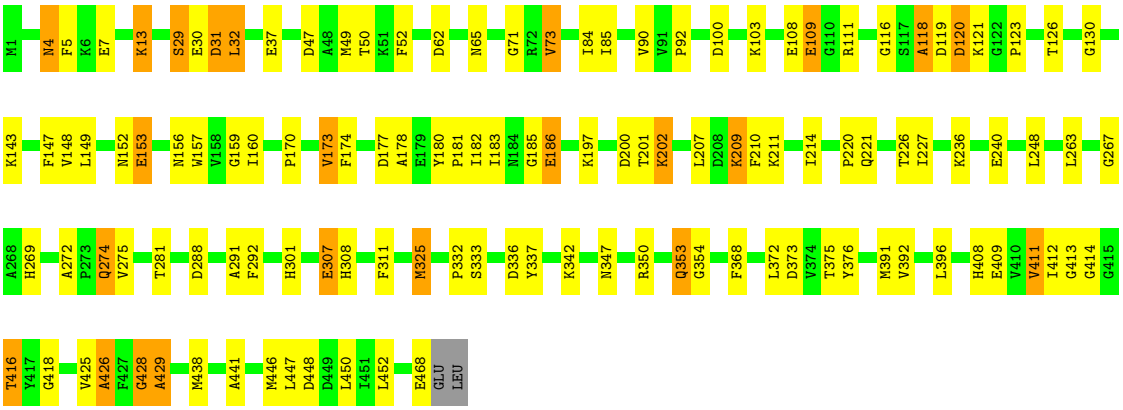
3 Residue-property plots (i)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. 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: pepV

Chain A:



4 Data and refinement statistics (i)

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

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	67.15Å 77.03Å 89.95Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	11.00 – 1.80	Depositor
% Data completeness (in resolution range)	(Not available) (11.00-1.80)	Depositor
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	unknown	Depositor
R, R_{free}	0.174 , (Not available)	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	4238	wwPDB-VP
Average B, all atoms (Å^2)	15.0	wwPDB-VP

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: ZN, AEP

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	0.86	2/3736 (0.1%)	1.16	31/5052 (0.6%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	120	ASP	C-N	29.95	1.72	1.33
1	A	118	ALA	C-N	23.64	1.71	1.33

All (31) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	120	ASP	O-C-N	-21.02	89.37	123.00
1	A	118	ALA	O-C-N	-20.62	93.08	122.36
1	A	292	PHE	N-CA-C	-9.50	98.27	110.53
1	A	353	GLN	N-CA-C	-7.22	100.97	110.43
1	A	73	VAL	N-CA-C	-7.05	97.58	107.80
1	A	441	ALA	N-CA-C	-6.94	100.72	110.50
1	A	332	PRO	N-CA-C	-6.81	99.81	110.50
1	A	350	ARG	N-CA-C	-6.40	98.08	108.52
1	A	85	ILE	N-CA-C	6.37	117.05	107.75
1	A	84	ILE	N-CA-C	-6.06	97.06	107.24
1	A	156	ASN	N-CA-C	6.03	120.66	112.88
1	A	368	PHE	N-CA-C	5.93	121.30	112.94
1	A	220	PRO	N-CA-C	5.92	120.19	110.55
1	A	148	VAL	N-CA-C	5.86	117.44	108.71
1	A	5	PHE	N-CA-C	5.73	117.98	111.11
1	A	62	ASP	N-CA-C	-5.70	100.00	109.46
1	A	428	GLY	O-C-N	5.70	129.91	122.96
1	A	426	ALA	N-CA-C	-5.69	100.42	109.59
1	A	325	MET	N-CA-C	5.49	119.97	113.16

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	307	GLU	N-CA-C	5.45	119.09	112.23
1	A	333	SER	N-CA-C	5.37	120.70	114.04
1	A	130	GLY	N-CA-C	-5.31	105.97	112.77
1	A	311	PHE	N-CA-C	5.30	117.81	111.71
1	A	373	ASP	N-CA-C	-5.28	101.27	109.72
1	A	354	GLY	N-CA-C	-5.28	107.72	114.37
1	A	153	GLU	N-CA-C	5.26	117.76	111.71
1	A	173	VAL	N-CA-C	5.25	115.28	108.35
1	A	143	LYS	N-CA-C	-5.22	101.25	109.50
1	A	29	SER	N-CA-C	-5.16	103.58	110.55
1	A	291	ALA	N-CA-C	5.08	121.62	110.80
1	A	411	VAL	N-CA-C	-5.05	101.04	108.11

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	3651	0	3511	104	0
2	A	2	0	0	0	0
3	A	15	0	11	2	0
4	A	570	0	0	25	0
All	All	4238	0	3522	105	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 (105) 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:120:ASP:C	1:A:121:LYS:N	1.72	1.48
1:A:118:ALA:C	1:A:119:ASP:N	1.71	1.47
1:A:416:THR:HG23	1:A:418:GLY:H	1.22	1.02
1:A:207:LEU:HA	4:A:1244:HOH:O	1.65	0.97

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:375:THR:HG22	1:A:376:TYR:H	1.34	0.94
1:A:4:ASN:HD22	1:A:4:ASN:H	1.05	0.92
1:A:207:LEU:HD12	4:A:1244:HOH:O	1.69	0.91
1:A:65:ASN:HA	4:A:1255:HOH:O	1.75	0.86
1:A:274:GLN:H	1:A:274:GLN:NE2	1.76	0.84
1:A:221:GLN:NE2	1:A:267:GLY:H	1.76	0.82
1:A:120:ASP:O	1:A:121:LYS:N	2.11	0.81
1:A:274:GLN:H	1:A:274:GLN:HE21	1.29	0.81
1:A:120:ASP:CA	1:A:121:LYS:N	2.44	0.80
1:A:118:ALA:O	1:A:119:ASP:N	2.16	0.78
1:A:375:THR:HG22	1:A:376:TYR:N	2.01	0.75
1:A:227:ILE:HG22	4:A:1244:HOH:O	1.87	0.74
1:A:221:GLN:HE21	1:A:267:GLY:H	1.37	0.72
1:A:226:THR:O	4:A:1244:HOH:O	2.06	0.71
1:A:468:GLU:HB3	4:A:1107:HOH:O	1.90	0.70
1:A:4:ASN:HD22	1:A:4:ASN:N	1.83	0.68
1:A:13:LYS:HE3	1:A:447:LEU:HD21	1.75	0.68
1:A:52:PHE:CD2	1:A:149:LEU:HD11	2.29	0.68
1:A:209:LYS:HG3	1:A:211:LYS:HE3	1.74	0.68
1:A:31:ASP:OD2	1:A:31:ASP:N	2.25	0.67
1:A:416:THR:HG23	1:A:418:GLY:N	2.02	0.67
1:A:412:ILE:HG12	1:A:413:GLY:N	2.10	0.67
1:A:126:THR:HG23	1:A:450:LEU:HD12	1.77	0.66
1:A:126:THR:CG2	1:A:450:LEU:HD12	2.25	0.66
1:A:236:LYS:O	1:A:240:GLU:HG2	1.97	0.65
1:A:108:GLU:HG2	1:A:109:GLU:OE1	1.96	0.64
1:A:452:LEU:HD12	4:A:1151:HOH:O	1.98	0.64
1:A:116:GLY:O	1:A:121:LYS:HB2	1.99	0.63
1:A:157:TRP:HB2	1:A:160:ILE:HG22	1.79	0.63
1:A:325:MET:SD	1:A:353:GLN:HG3	2.40	0.62
1:A:4:ASN:H	1:A:4:ASN:ND2	1.86	0.62
1:A:108:GLU:H	1:A:108:GLU:CD	2.08	0.61
1:A:412:ILE:HG13	4:A:1308:HOH:O	1.99	0.61
1:A:412:ILE:HG12	1:A:414:GLY:H	1.65	0.61
1:A:375:THR:CG2	1:A:376:TYR:H	2.13	0.60
3:A:683:AEP:H22	4:A:1164:HOH:O	2.01	0.60
1:A:170:PRO:HB2	1:A:173:VAL:HG23	1.83	0.60
1:A:448:ASP:HB3	4:A:1160:HOH:O	2.01	0.60
1:A:180:TYR:CE2	1:A:428:GLY:HA3	2.38	0.58
1:A:412:ILE:HG12	1:A:413:GLY:H	1.68	0.58
1:A:126:THR:HG23	1:A:450:LEU:CD1	2.33	0.58

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:182:ILE:HD13	1:A:392:VAL:HG13	1.87	0.57
1:A:30:GLU:HG2	1:A:32:LEU:HD13	1.88	0.56
1:A:100:ASP:HB3	1:A:103:LYS:HB2	1.88	0.56
1:A:416:THR:HG21	1:A:426:ALA:HB2	1.87	0.56
1:A:170:PRO:HB2	1:A:173:VAL:CG2	2.37	0.54
1:A:30:GLU:CG	1:A:32:LEU:HD13	2.38	0.54
1:A:274:GLN:HE21	1:A:274:GLN:N	2.04	0.54
1:A:152:ASN:N	4:A:1272:HOH:O	2.40	0.53
1:A:269:HIS:CD2	4:A:1164:HOH:O	2.62	0.53
1:A:272:ALA:O	1:A:275:VAL:HG22	2.09	0.52
1:A:197:LYS:HD3	4:A:1154:HOH:O	2.08	0.52
1:A:183:ILE:HB	1:A:426:ALA:HB3	1.92	0.51
1:A:448:ASP:HB3	4:A:1488:HOH:O	2.10	0.51
1:A:92:PRO:HB2	1:A:214:ILE:CG2	2.40	0.51
1:A:52:PHE:CG	1:A:149:LEU:HD11	2.47	0.50
1:A:111:ARG:HG2	1:A:446:MET:SD	2.52	0.49
1:A:408:HIS:ND1	1:A:409:GLU:N	2.60	0.49
1:A:182:ILE:HG22	1:A:396:LEU:HD21	1.95	0.49
1:A:157:TRP:HB2	1:A:160:ILE:CG2	2.42	0.49
1:A:50:THR:HG21	4:A:1548:HOH:O	2.12	0.49
1:A:126:THR:CG2	1:A:450:LEU:CD1	2.90	0.49
1:A:50:THR:HG23	4:A:1449:HOH:O	2.13	0.49
1:A:120:ASP:C	1:A:121:LYS:CA	2.78	0.49
1:A:281:THR:OG1	1:A:308:HIS:HD2	1.96	0.48
1:A:49:MET:SD	4:A:1255:HOH:O	2.61	0.48
1:A:227:ILE:HA	4:A:1244:HOH:O	2.14	0.47
1:A:31:ASP:CB	4:A:1489:HOH:O	2.62	0.47
1:A:123:PRO:HG3	1:A:429:ALA:HB1	1.97	0.47
1:A:372:LEU:C	1:A:372:LEU:HD12	2.40	0.47
1:A:438:MET:SD	4:A:1164:HOH:O	2.60	0.47
1:A:186:GLU:OE1	1:A:416:THR:HG22	2.16	0.46
1:A:200:ASP:O	1:A:202:LYS:HD3	2.16	0.46
1:A:210:PHE:HB3	1:A:337:TYR:HB3	1.97	0.46
1:A:185:GLY:HA3	1:A:411:VAL:HG22	1.98	0.46
1:A:263:LEU:HD23	1:A:263:LEU:C	2.41	0.45
1:A:153:GLU:OE1	3:A:683:AEP:H42	2.17	0.45
1:A:7:GLU:HG2	4:A:1148:HOH:O	2.17	0.44
1:A:180:TYR:CZ	1:A:428:GLY:HA3	2.53	0.44
1:A:428:GLY:O	1:A:429:ALA:CB	2.65	0.44
1:A:174:PHE:HA	1:A:425:VAL:O	2.18	0.44
1:A:391:MET:HE3	1:A:425:VAL:HG22	2.00	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:108:GLU:CD	1:A:108:GLU:N	2.76	0.43
1:A:200:ASP:O	1:A:201:THR:C	2.62	0.43
1:A:47:ASP:HA	1:A:50:THR:HG22	2.01	0.42
1:A:342:LYS:HB2	4:A:1524:HOH:O	2.20	0.42
1:A:159:GLY:HA3	4:A:1272:HOH:O	2.20	0.42
1:A:412:ILE:CG1	1:A:413:GLY:N	2.78	0.42
1:A:73:VAL:HB	1:A:147:PHE:HB3	2.02	0.42
1:A:31:ASP:HB3	4:A:1489:HOH:O	2.20	0.42
1:A:71:GLY:HA2	4:A:1255:HOH:O	2.20	0.42
1:A:211:LYS:HE2	1:A:336:ASP:OD1	2.20	0.42
1:A:118:ALA:CA	1:A:119:ASP:N	2.72	0.41
1:A:325:MET:HE2	1:A:411:VAL:CG1	2.49	0.41
1:A:248:LEU:HD13	1:A:263:LEU:HD21	2.02	0.41
1:A:288:ASP:OD2	1:A:301:HIS:HD2	2.04	0.41
1:A:412:ILE:CG1	1:A:413:GLY:H	2.33	0.41
1:A:307:GLU:OE1	1:A:347:ASN:ND2	2.48	0.41
1:A:120:ASP:HB2	1:A:177:ASP:OD2	2.20	0.41
1:A:29:SER:HA	1:A:90:VAL:O	2.21	0.40
1:A:118:ALA:C	1:A:119:ASP:CA	2.82	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	466/470 (99%)	451 (97%)	12 (3%)	3 (1%)	21 11

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	429	ALA
1	A	178	ALA

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Mol	Chain	Res	Type
1	A	181	PRO

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	383/385 (100%)	372 (97%)	11 (3%)	37 25

All (11) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	4	ASN
1	A	13	LYS
1	A	31	ASP
1	A	32	LEU
1	A	37	GLU
1	A	109	GLU
1	A	186	GLU
1	A	202	LYS
1	A	209	LYS
1	A	274	GLN
1	A	416	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (10) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	4	ASN
1	A	152	ASN
1	A	221	GLN
1	A	274	GLN
1	A	289	GLN
1	A	298	ASN
1	A	301	HIS
1	A	308	HIS
1	A	377	ASN

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Mol	Chain	Res	Type
1	A	402	GLN

5.3.3 RNA

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates

There are no oligosaccharides in this entry.

5.6 Ligand geometry

Of 3 ligands modelled in this entry, 2 are 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	$\#\|Z\| > 2$
3	AEP	A	683	2	11,14,14	6.09	6 (54%)	10,20,20	2.35	5 (50%)

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	AEP	A	683	2	-	4/13/19/19	-

All (6) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	683	AEP	P-C4	-16.71	1.63	1.79
3	A	683	AEP	O1-C3	7.74	1.47	1.22
3	A	683	AEP	C2-C1	5.79	1.63	1.54
3	A	683	AEP	O2-C3	4.43	1.45	1.30
3	A	683	AEP	C6-C7	2.41	1.58	1.51
3	A	683	AEP	C2-C3	2.34	1.57	1.51

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	A	683	AEP	O2-C3-C2	5.07	129.75	114.00
3	A	683	AEP	O1-C3-C2	-3.30	112.72	122.84
3	A	683	AEP	C5-C6-C7	-2.60	102.31	109.16
3	A	683	AEP	O2-C3-O1	-2.27	117.49	123.33
3	A	683	AEP	O2P-P-C1	2.01	111.38	106.87

There are no chirality outliers.

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	683	AEP	C6-C4-P-O1P
3	A	683	AEP	C6-C4-P-O2P
3	A	683	AEP	C1-C2-C3-O1
3	A	683	AEP	C1-C2-C3-O2

There are no ring outliers.

1 monomer is involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	683	AEP	2	0

5.7 Other polymers (i)

There are no such residues in this entry.

5.8 Polymer linkage issues (i)

The following chains have linkage breaks:

Mol	Chain	Number of breaks
1	A	2

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	A	120:ASP	C	121:LYS	N	1.72
1	A	118:ALA	C	119:ASP	N	1.71

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.