



# Full wwPDB X-ray Structure Validation Report ⓘ

Oct 5, 2024 – 08:59 AM EDT

PDB ID : 1PPK  
Title : CRYSTALLOGRAPHIC ANALYSIS OF TRANSITION STATE MIMICS  
BOUND TO PENICILLOPEPSIN: PHOSPHOROUS-CONTAINING PEP-  
TIDE ANALOGUES  
Authors : Strynadka, N.C.J.; James, M.N.G.  
Deposited on : 1994-01-20  
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](mailto: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>.

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

MolProbity	:	4.02b-467
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.39

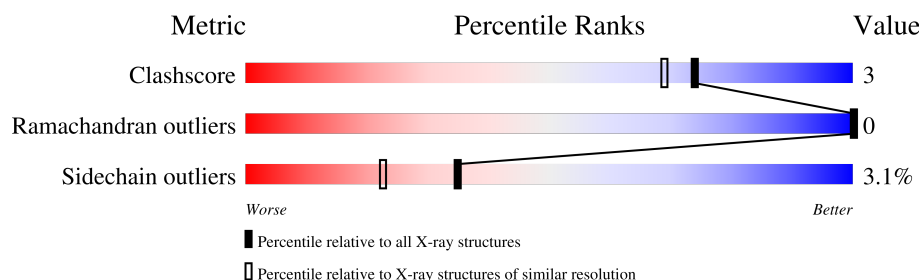
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.80 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	180529	8162 (1.80-1.80)
Ramachandran outliers	177936	8077 (1.80-1.80)
Sidechain outliers	177891	8076 (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  $\geq 3$ , 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	E	323	

## 2 Entry composition [i](#)

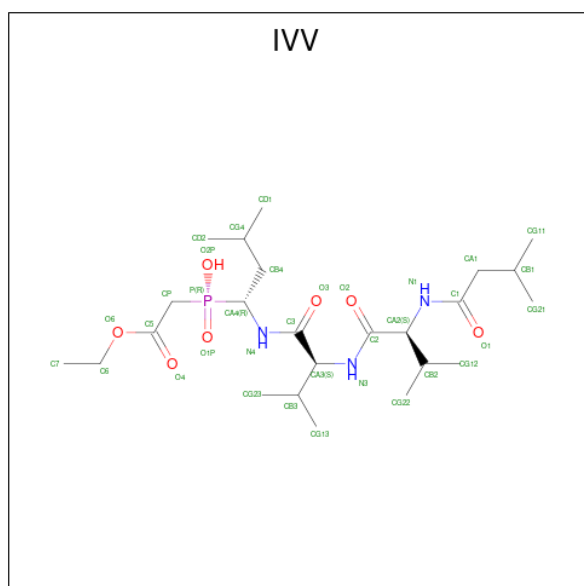
There are 7 unique types of molecules in this entry. The entry contains 2706 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 PENICILLOPEPSIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	E	323	2366	1479	377	508	2	0	0	0

- Molecule 2 is N-(3-methylbutanoyl)-L-valyl-N-[(1R)-1-[(R)-(2-ethoxy-2-oxoethyl)(hydroxy)phosphoryl]-3-methylbutyl]-L-valinamide (three-letter code: IVV) (formula:  $C_{24}H_{46}N_3O_7P$ ).



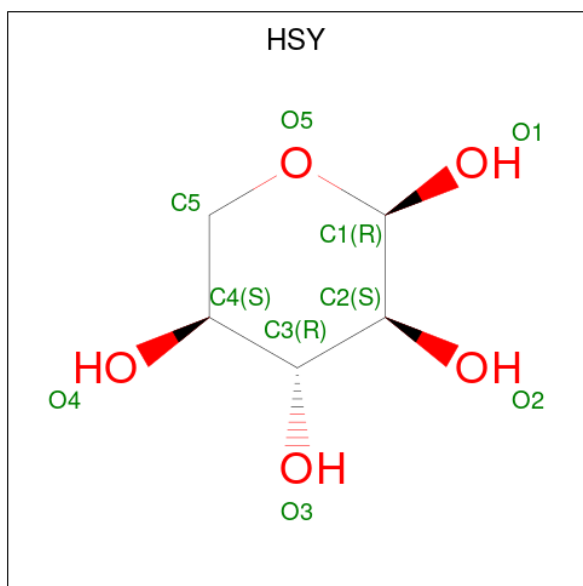
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	P		
2	E	1	35	24	3	7	1	0	0

- Molecule 3 is alpha-D-mannopyranose (three-letter code: MAN) (formula:  $C_6H_{12}O_6$ ).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	E	1	Total	C	O	0	0
			11	6	5		

- Molecule 4 is alpha-L-xylopyranose (three-letter code: HSY) (formula:  $C_5H_{10}O_5$ ).



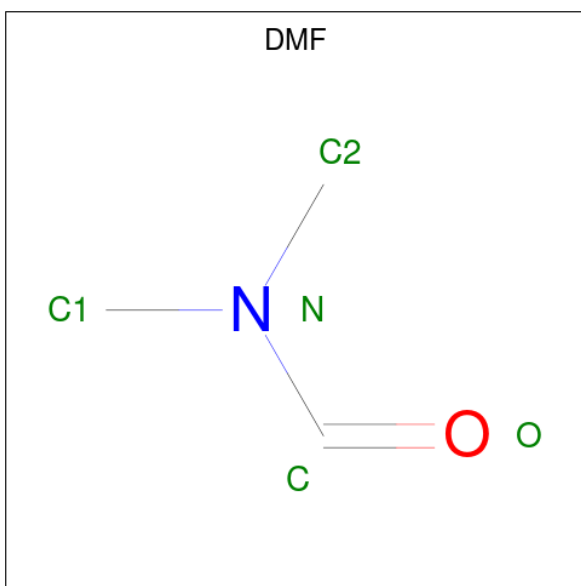
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	E	1	Total	C	O	0	0
			9	5	4		

- Molecule 5 is SULFATE ION (three-letter code: SO4) (formula:  $O_4S$ ).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	E	1	Total	O	S	0	0
			5	4	1		

- Molecule 6 is DIMETHYLFORMAMIDE (three-letter code: DMF) (formula: C<sub>3</sub>H<sub>7</sub>NO).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
6	E	1	Total	C	N	O	0	0
			5	3	1	1		

- Molecule 7 is water.

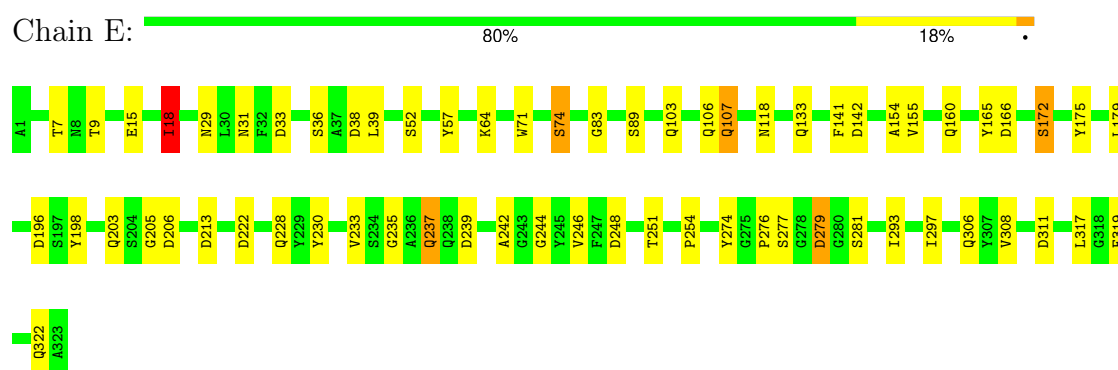
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	E	275	Total 275	O 275	0	0

### 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. 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: PENICILLOPEPSIN



## 4 Data and refinement statistics

Xtriage (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, $\alpha$ , $\beta$ , $\gamma$	97.48Å 46.55Å 66.42Å 90.00° 116.14° 90.00°	Depositor
Resolution (Å)	8.00 – 1.80	Depositor
% Data completeness (in resolution range)	(Not available) (8.00-1.80)	Depositor
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
Refinement program	PROLSQ	Depositor
R, $R_{free}$	0.132 , (Not available)	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	2706	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	15.0	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: DMF, IVV, MAN, SO4, HSY

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	E	1.32	3/2420 (0.1%)	1.89	45/3304 (1.4%)

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	E	36	SER	CB-OG	7.14	1.51	1.42
1	E	205	GLY	N-CA	6.41	1.55	1.46
1	E	15	GLU	CD-OE1	-5.25	1.19	1.25

All (45) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	E	206	ASP	CB-CG-OD1	14.92	131.73	118.30
1	E	142	ASP	CB-CG-OD1	14.50	131.35	118.30
1	E	222	ASP	CB-CG-OD2	-10.27	109.06	118.30
1	E	9	THR	CA-CB-CG2	-8.50	100.50	112.40
1	E	196	ASP	CB-CG-OD1	-8.25	110.87	118.30
1	E	33	ASP	CB-CG-OD2	7.95	125.46	118.30
1	E	237	GLN	CB-CG-CD	7.59	131.34	111.60
1	E	165	TYR	CB-CG-CD2	-7.36	116.59	121.00
1	E	222	ASP	CB-CG-OD1	7.19	124.77	118.30
1	E	206	ASP	OD1-CG-OD2	-6.79	110.39	123.30
1	E	196	ASP	OD1-CG-OD2	6.74	136.10	123.30
1	E	319	PHE	CB-CG-CD2	-6.47	116.27	120.80
1	E	230	TYR	CB-CG-CD1	-6.28	117.23	121.00
1	E	118	ASN	O-C-N	6.27	132.74	122.70
1	E	52	SER	O-C-N	6.26	133.85	123.20
1	E	317	LEU	O-C-N	6.20	133.74	123.20
1	E	141	PHE	CB-CG-CD1	-6.04	116.57	120.80
1	E	155	VAL	O-C-N	5.97	132.25	122.70

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	E	196	ASP	CB-CG-OD2	-5.97	112.93	118.30
1	E	213	ASP	N-CA-CB	-5.86	100.06	110.60
1	E	74	SER	CB-CA-C	5.82	121.16	110.10
1	E	172	SER	CA-CB-OG	-5.81	95.52	111.20
1	E	166	ASP	CB-CG-OD2	-5.70	113.17	118.30
1	E	206	ASP	CB-CA-C	5.66	121.72	110.40
1	E	160	GLN	CG-CD-NE2	5.62	130.19	116.70
1	E	154	ALA	O-C-N	5.57	131.61	122.70
1	E	297	ILE	O-C-N	5.52	131.53	122.70
1	E	213	ASP	CB-CG-OD1	5.49	123.24	118.30
1	E	89	SER	CA-CB-OG	-5.45	96.48	111.20
1	E	279	ASP	CB-CG-OD1	5.40	123.16	118.30
1	E	244	GLY	O-C-N	5.39	131.33	122.70
1	E	198	TYR	O-C-N	5.34	131.24	122.70
1	E	7	THR	CA-CB-OG1	-5.33	97.80	109.00
1	E	160	GLN	CG-CD-OE1	-5.33	110.93	121.60
1	E	276	PRO	O-C-N	5.33	131.23	122.70
1	E	293	ILE	CA-C-N	5.32	126.84	116.20
1	E	308	VAL	O-C-N	5.18	130.99	122.70
1	E	248	ASP	CB-CG-OD1	5.13	122.92	118.30
1	E	281	SER	N-CA-CB	-5.10	102.85	110.50
1	E	83	GLY	O-C-N	5.09	130.85	122.70
1	E	311	ASP	N-CA-CB	-5.04	101.53	110.60
1	E	246	VAL	O-C-N	5.03	130.75	122.70
1	E	274	TYR	CB-CG-CD1	-5.03	117.98	121.00
1	E	18	ILE	CB-CA-C	5.00	121.61	111.60
1	E	57	TYR	CB-CG-CD2	-5.00	118.00	121.00

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	E	2366	0	2181	13	0
2	E	35	0	45	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	E	11	0	10	0	0
4	E	9	0	7	0	0
5	E	5	0	0	1	0
6	E	5	0	7	1	0
7	E	275	0	0	3	0
All	All	2706	0	2250	14	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 3.

All (14) 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:E:235:GLY:HA2	7:E:616:HOH:O	1.93	0.68
1:E:179:LEU:N	5:E:326:SO4:O2	2.31	0.60
1:E:64:LYS:NZ	7:E:609:HOH:O	2.35	0.60
2:E:700:IVV:C5	6:E:327:DMF:H23	2.35	0.57
1:E:106:GLN:C	1:E:107:GLN:HG2	2.25	0.56
1:E:233:VAL:HG13	1:E:251:THR:HG21	1.89	0.54
1:E:133:GLN:NE2	7:E:589:HOH:O	2.46	0.47
1:E:239:ASP:OD1	1:E:279:ASP:OD2	2.33	0.46
1:E:306:GLN:C	1:E:322:GLN:HG3	2.37	0.45
1:E:71:TRP:CE2	1:E:103:GLN:HB3	2.52	0.45
1:E:203:GLN:OE1	1:E:228:GLN:HG3	2.17	0.45
1:E:18:ILE:HG13	1:E:29:ASN:HB3	2.01	0.42
1:E:172:SER:HA	1:E:175:TYR:CE1	2.55	0.42
1:E:242:ALA:HB1	1:E:277:SER:HB2	2.03	0.41

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	E	321/323 (99%)	318 (99%)	3 (1%)	0	100	100

There are no Ramachandran outliers to report.

### 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	E	259/259 (100%)	251 (97%)	8 (3%)	35	22

All (8) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	E	18	ILE
1	E	31	ASN
1	E	38	ASP
1	E	39	LEU
1	E	74	SER
1	E	107	GLN
1	E	237	GLN
1	E	254	PRO

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (8) such sidechains are listed below:

Mol	Chain	Res	Type
1	E	31	ASN
1	E	107	GLN
1	E	117	ASN
1	E	133	GLN
1	E	150	GLN
1	E	188	GLN
1	E	194	ASN
1	E	238	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 ⓘ

5 ligands are 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	$\# Z  > 2$
6	DMF	E	327	-	4,4,4	0.45	0	4,4,4	0.59	0
2	IVV	E	700	-	31,34,34	1.45	4 (12%)	37,47,47	1.57	9 (24%)
3	MAN	E	324	1	11,11,12	1.12	1 (9%)	15,15,17	1.37	1 (6%)
5	SO4	E	326	-	4,4,4	0.66	0	6,6,6	0.29	0
4	HSY	E	325	1	9,9,10	0.88	0	10,12,14	4.02	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	MAN	E	324	1	-	0/2/19/22	0/1/1/1
6	DMF	E	327	-	-	2/2/2/2	-
4	HSY	E	325	1	-	-	0/1/1/1
2	IVV	E	700	-	-	6/46/50/50	-

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	E	700	IVV	CB4-CA4	4.83	1.58	1.53
2	E	700	IVV	O6-C5	3.14	1.42	1.33
3	E	324	MAN	O2-C2	2.73	1.49	1.43
2	E	700	IVV	CA2-N1	2.63	1.51	1.45
2	E	700	IVV	O2-C2	2.44	1.28	1.23

All (15) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	E	325	HSY	C5-O5-C1	10.67	128.64	111.42
4	E	325	HSY	C5-C4-C3	3.68	115.00	109.64
4	E	325	HSY	O4-C4-C5	3.52	117.28	109.22
3	E	324	MAN	O2-C2-C1	-3.15	102.02	109.22
2	E	700	IVV	O1-C1-CA1	-3.13	116.95	121.54
2	E	700	IVV	O6-C5-O4	-2.92	116.33	123.63
4	E	325	HSY	O4-C4-C3	-2.75	104.46	110.15
2	E	700	IVV	CA2-N1-C1	-2.73	116.42	121.80
2	E	700	IVV	CG21-CB1-CA1	-2.59	101.08	111.16
4	E	325	HSY	O2-C2-C1	2.59	115.15	109.22
2	E	700	IVV	CB2-CA2-N1	-2.52	105.36	111.44
2	E	700	IVV	CA1-C1-N1	2.43	119.57	116.25
2	E	700	IVV	O3-C3-N4	2.38	127.22	122.96
2	E	700	IVV	O2-C2-N3	2.25	126.98	122.96
2	E	700	IVV	C3-CA3-N3	-2.17	104.41	110.32

There are no chirality outliers.

All (8) torsion outliers are listed below:

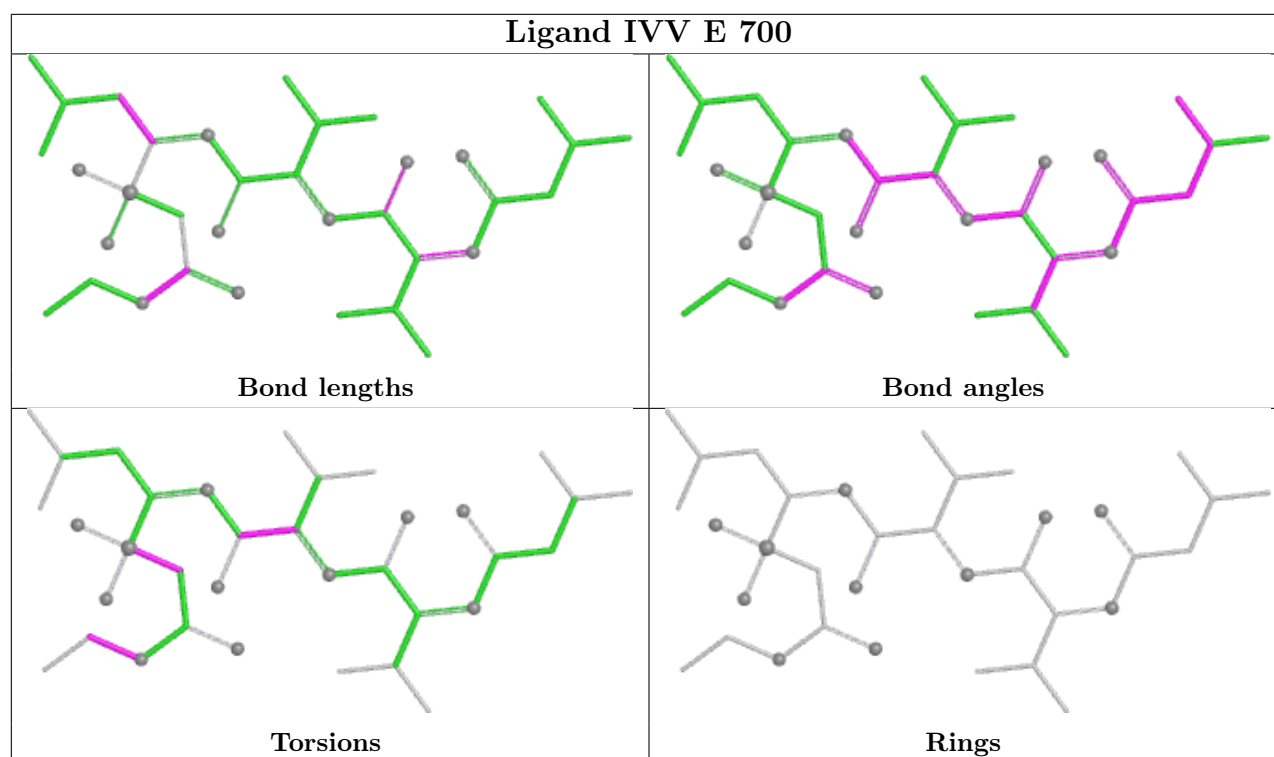
Mol	Chain	Res	Type	Atoms
6	E	327	DMF	O-C-N-C2
6	E	327	DMF	O-C-N-C1
2	E	700	IVV	O3-C3-CA3-N3
2	E	700	IVV	N4-C3-CA3-N3
2	E	700	IVV	C7-C6-O6-C5
2	E	700	IVV	N4-C3-CA3-CB3
2	E	700	IVV	O3-C3-CA3-CB3
2	E	700	IVV	C5-CP-P-O2P

There are no ring outliers.

3 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
6	E	327	DMF	1	0
2	E	700	IVV	1	0
5	E	326	SO4	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 ⓘ

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.