



# wwPDB X-ray Structure Validation Summary Report

May 13, 2020 – 01:09 am BST

PDB ID : 1NQT  
Title : Crystal structure of bovine Glutamate dehydrogenase-ADP complex  
Authors : Banerjee, S.; Schmidt, T.; Fang, J.; Stanley, C.A.; Smith, T.J.  
Deposited on : 2003-01-23  
Resolution : 3.50 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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.

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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 : 1.8.5 (274361), CSD as541be (2020)  
Xtrriage (Phenix) : **NOT EXECUTED**  
EDS : **NOT EXECUTED**  
buster-report : 1.1.7 (2018)  
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) : 2.11

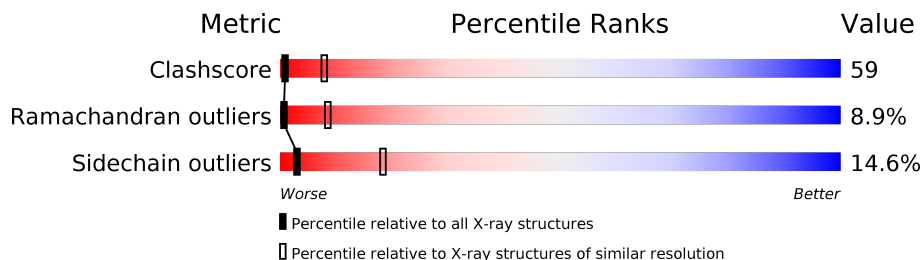
# 1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 3.50 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	1036 (3.58-3.42)
Ramachandran outliers	138981	1005 (3.58-3.42)
Sidechain outliers	138945	1006 (3.58-3.42)



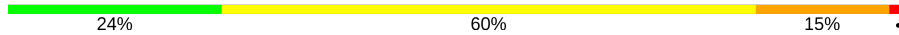
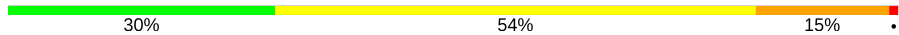
The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments on the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria 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	A	496	33% 54% 12% .
1	B	496	34% 50% 14% .
1	C	496	26% 54% 18% .
1	D	496	29% 55% 15% .
1	E	496	33% 49% 17% .
1	F	496	36% 51% 12%
1	G	496	32% 52% 15% .
1	H	496	30% 55% 14% .

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Mol	Chain	Length	Quality of chain
1	I	496	 31% 52% 16% .
1	J	496	 34% 49% 15% .
1	K	496	 24% 60% 15% .
1	L	496	 30% 54% 15% .

## 2 Entry composition [i](#)

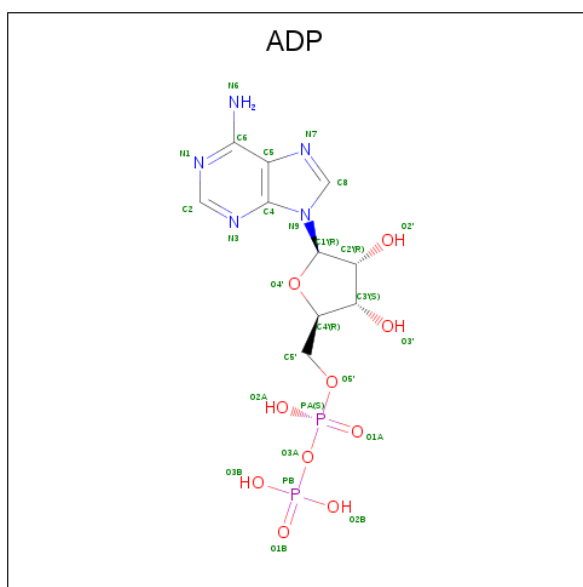
There are 2 unique types of molecules in this entry. The entry contains 46812 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 Glutamate dehydrogenase 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	496	3874	2450	679	726	19	0	0	0
1	B	496	3874	2450	679	726	19	0	0	0
1	C	496	3874	2450	679	726	19	0	0	0
1	D	496	3874	2450	679	726	19	0	0	0
1	E	496	3874	2450	679	726	19	0	0	0
1	F	496	3874	2450	679	726	19	0	0	0
1	G	496	3874	2450	679	726	19	0	0	0
1	H	496	3874	2450	679	726	19	0	0	0
1	I	496	3874	2450	679	726	19	0	0	0
1	J	496	3874	2450	679	726	19	0	0	0
1	K	496	3874	2450	679	726	19	0	0	0
1	L	496	3874	2450	679	726	19	0	0	0

- Molecule 2 is ADENOSINE-5'-DIPHOSPHATE (three-letter code: ADP) (formula:  $C_{10}H_{15}N_5O_{10}P_2$ ).



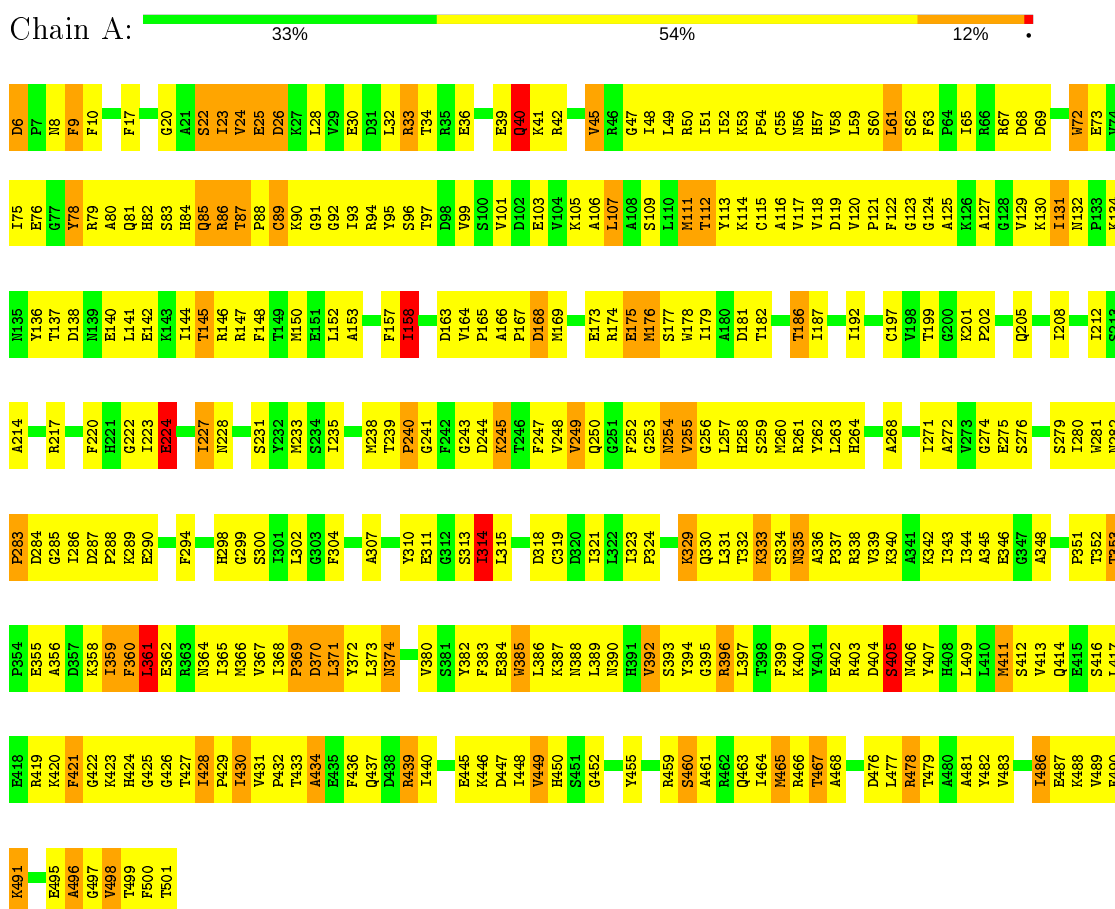
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	P		
2	A	1	Total	C	N	O	P	0	0
			27	10	5	10	2		
2	B	1	Total	C	N	O	P	0	0
			27	10	5	10	2		
2	C	1	Total	C	N	O	P	0	0
			27	10	5	10	2		
2	D	1	Total	C	N	O	P	0	0
			27	10	5	10	2		
2	E	1	Total	C	N	O	P	0	0
			27	10	5	10	2		
2	F	1	Total	C	N	O	P	0	0
			27	10	5	10	2		
2	G	1	Total	C	N	O	P	0	0
			27	10	5	10	2		
2	H	1	Total	C	N	O	P	0	0
			27	10	5	10	2		
2	I	1	Total	C	N	O	P	0	0
			27	10	5	10	2		
2	J	1	Total	C	N	O	P	0	0
			27	10	5	10	2		
2	K	1	Total	C	N	O	P	0	0
			27	10	5	10	2		
2	L	1	Total	C	N	O	P	0	0
			27	10	5	10	2		

### 3 Residue-property plots

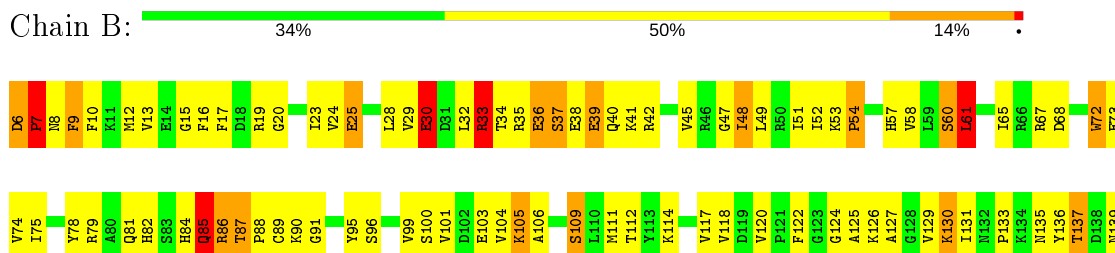
These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. Residues are color-coded according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

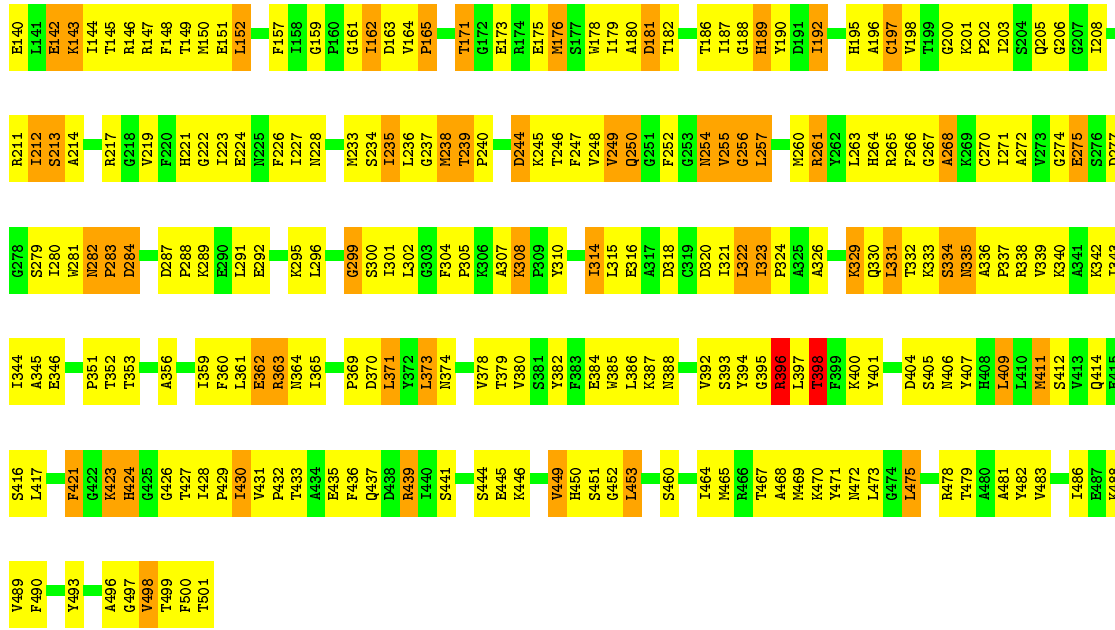
Note EDS was not executed.

- Molecule 1: Glutamate dehydrogenase 1

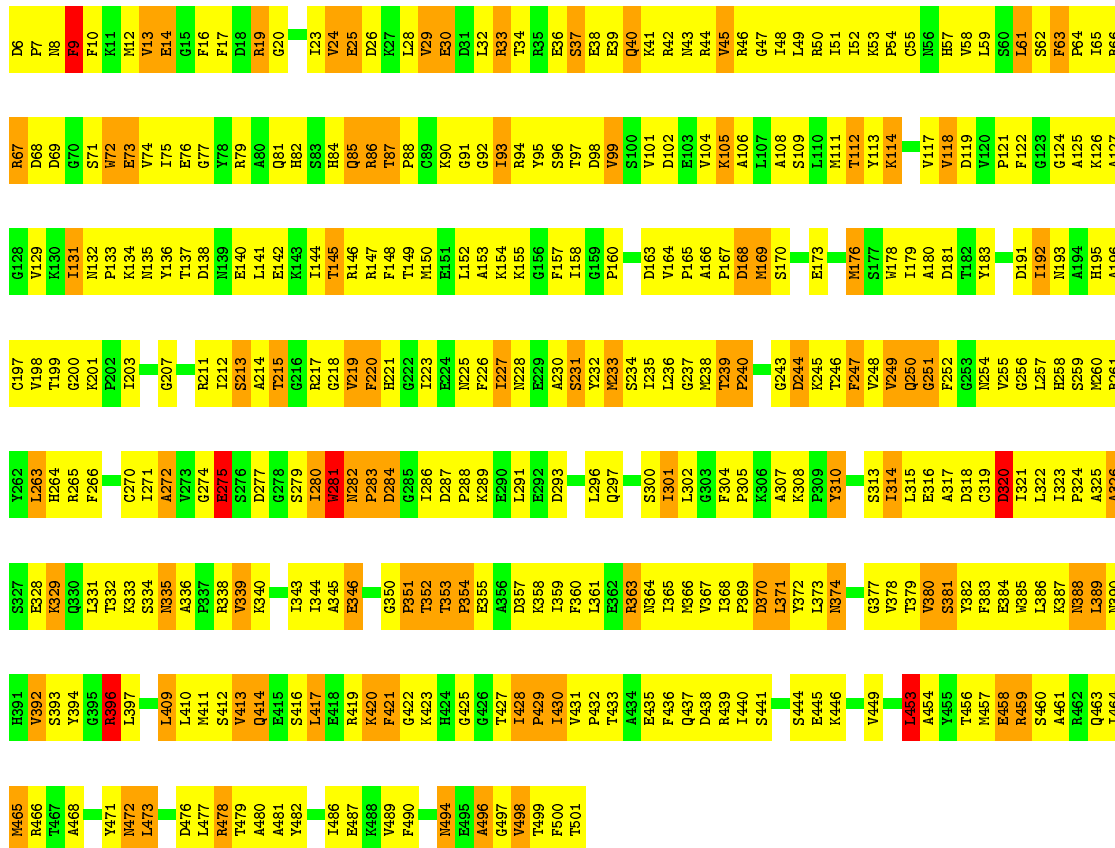
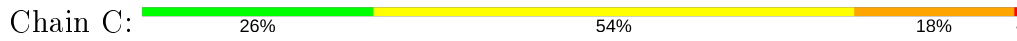


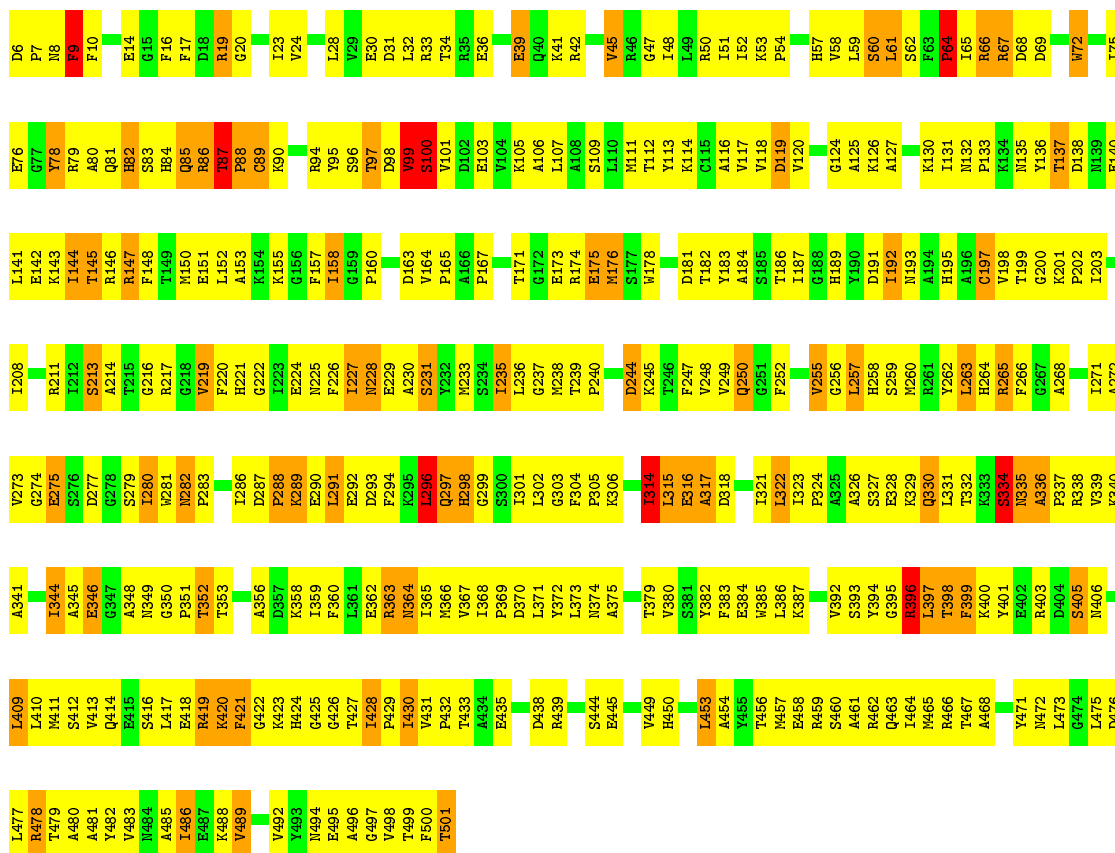
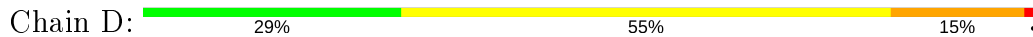
- Molecule 1: Glutamate dehydrogenase 1



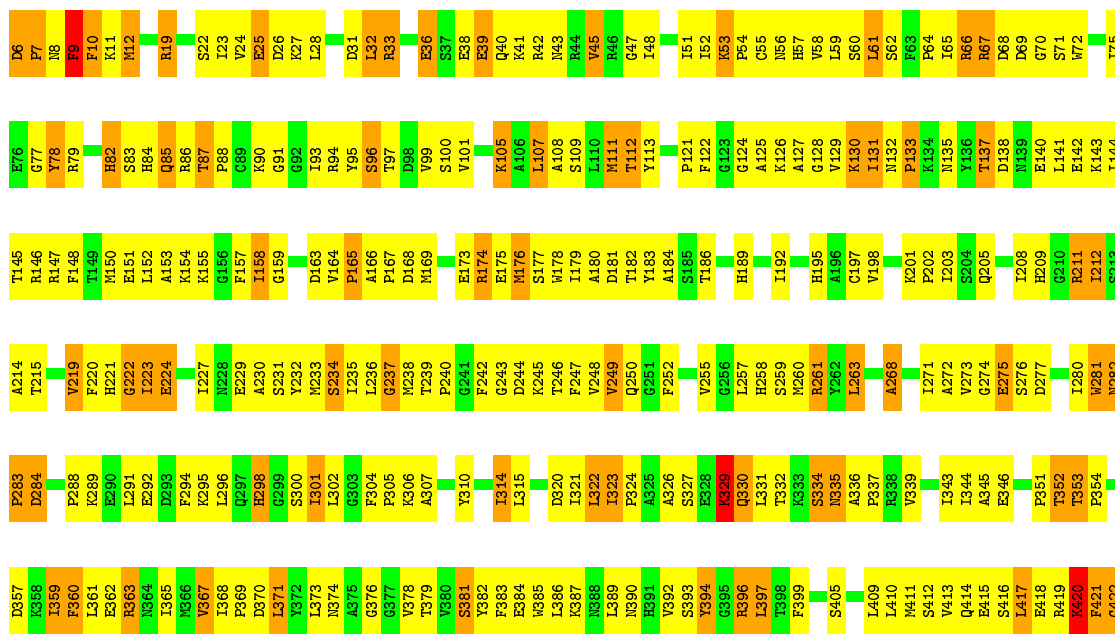
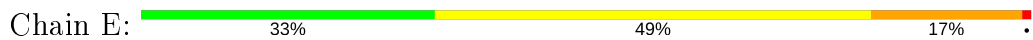


• Molecule 1: Glutamate dehydrogenase 1



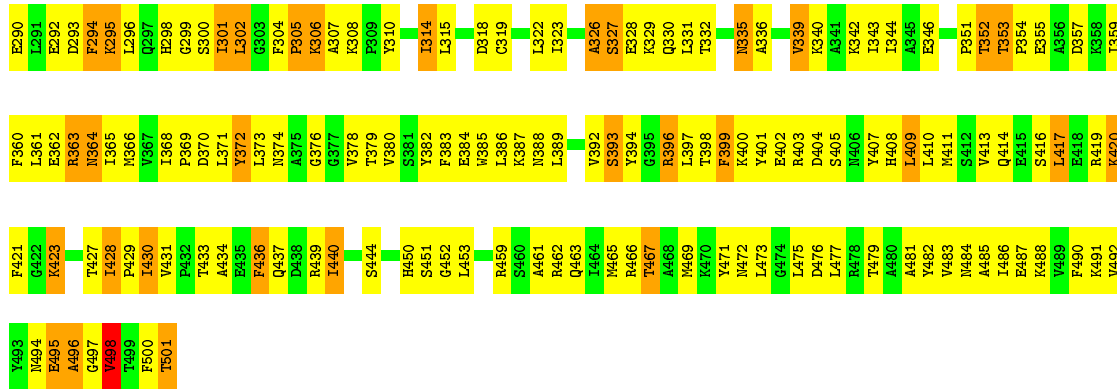


• Molecule 1: Glutamate dehydrogenase 1

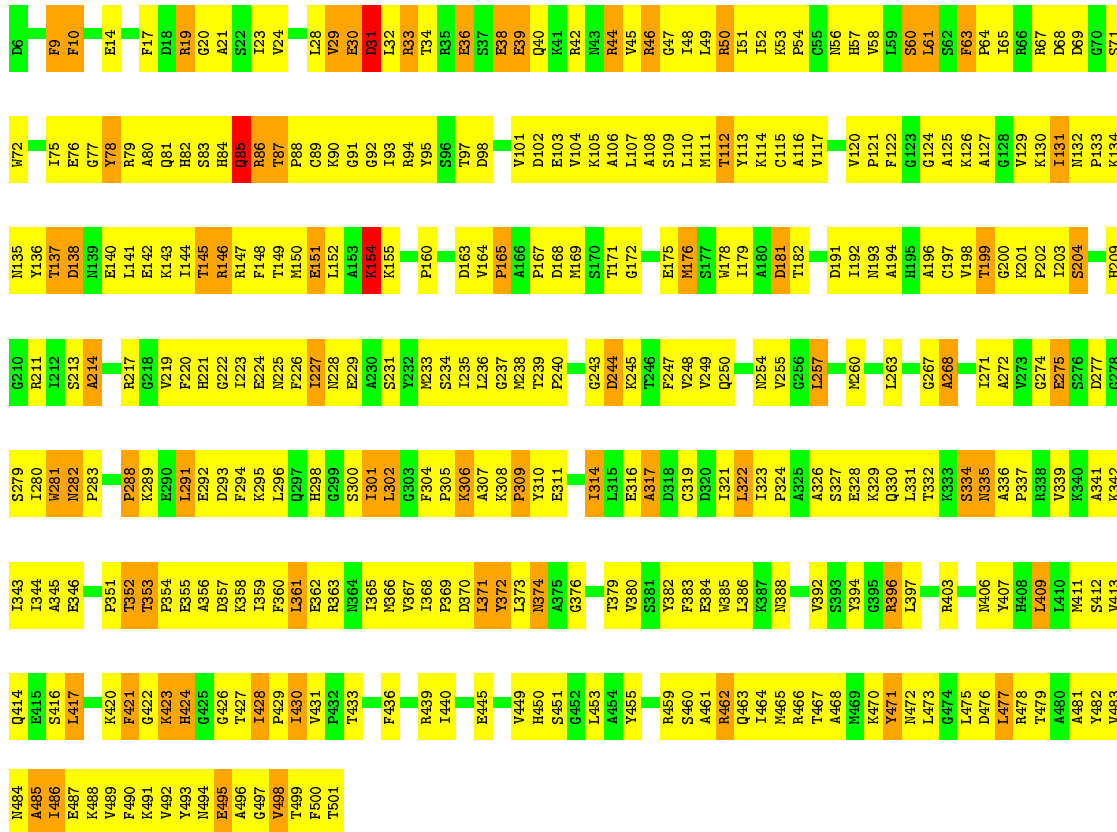




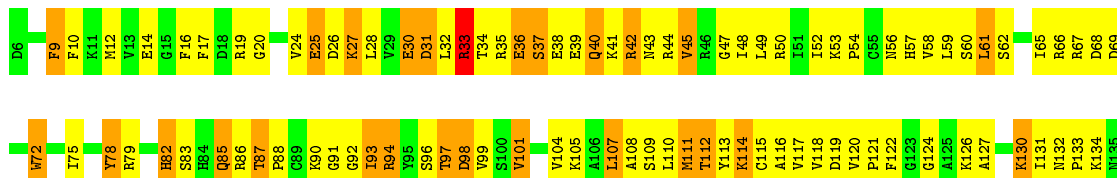
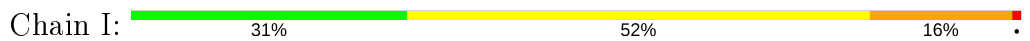


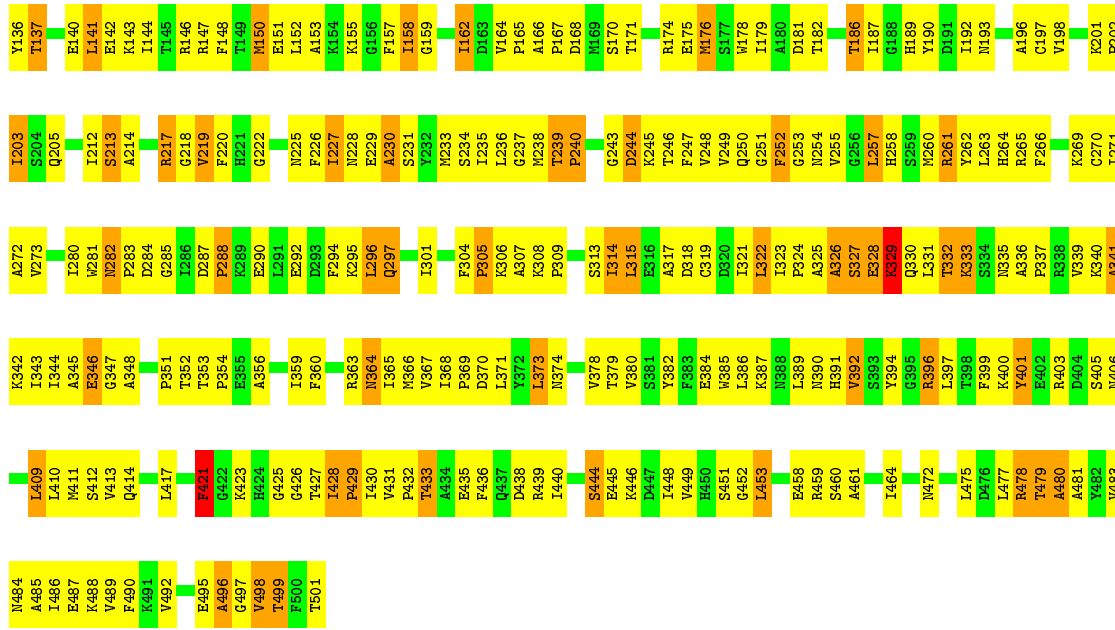


• Molecule 1: Glutamate dehydrogenase 1

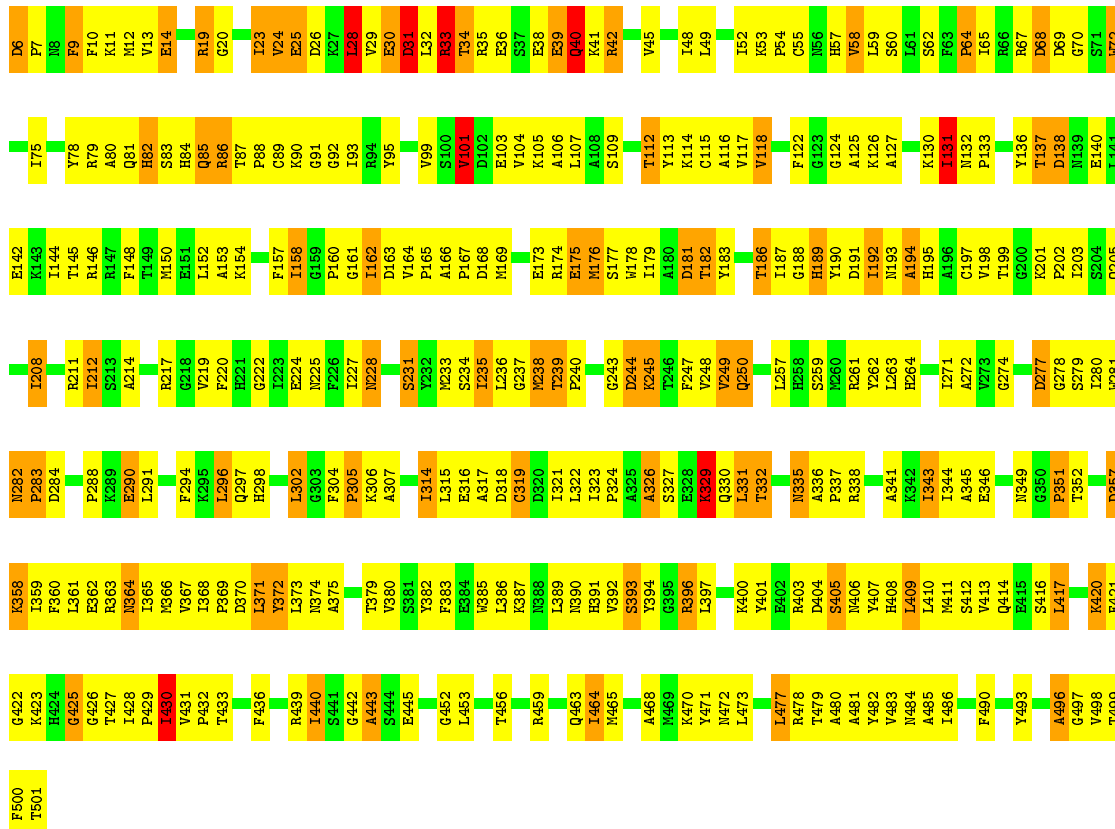
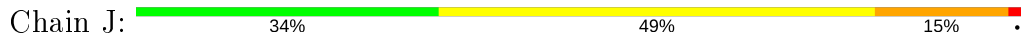


• Molecule 1: Glutamate dehydrogenase 1



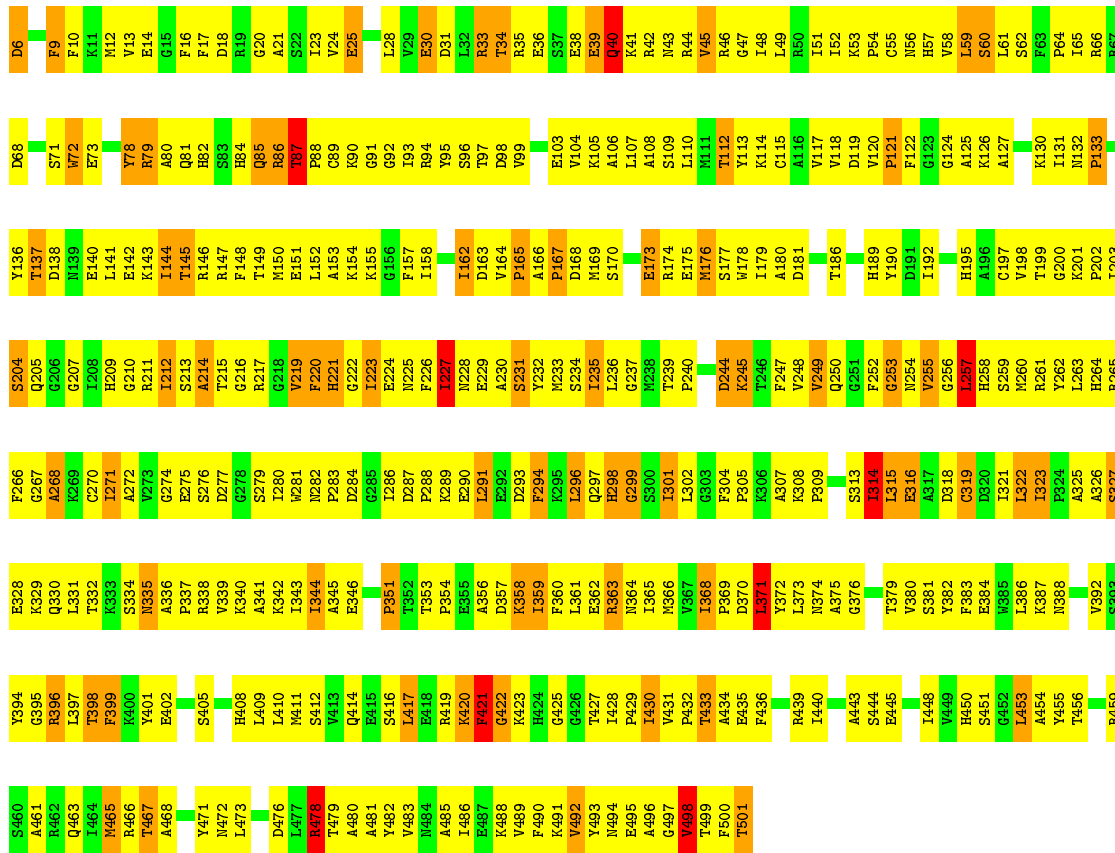


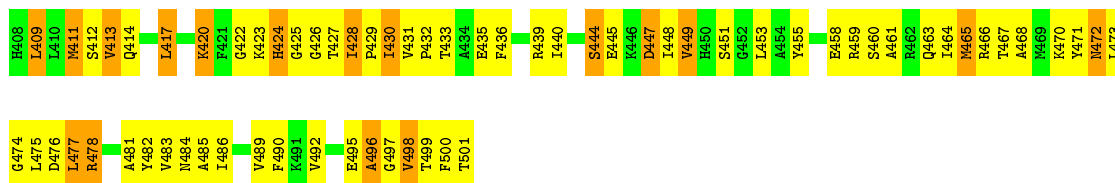
• Molecule 1: Glutamate dehydrogenase 1



• Molecule 1: Glutamate dehydrogenase 1

Chain K: 24% 60% 15%





## 4 Data and refinement statistics

Xtrriage (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, $\alpha$ , $\beta$ , $\gamma$	96.46Å 171.93Å 439.68Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	19.97 – 3.50	Depositor
% Data completeness (in resolution range)	94.0 (19.97-3.50)	Depositor
$R_{merge}$	0.07	Depositor
$R_{sym}$	(Not available)	Depositor
Refinement program	CNS	Depositor
R, $R_{free}$	0.207 , 0.276	Depositor
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	46812	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	59.0	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: ADP

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	0.70	1/3958 (0.0%)	0.89	2/5340 (0.0%)
1	B	0.76	1/3958 (0.0%)	0.91	2/5340 (0.0%)
1	C	0.72	1/3958 (0.0%)	0.91	2/5340 (0.0%)
1	D	0.69	2/3958 (0.1%)	0.89	4/5340 (0.1%)
1	E	0.71	0/3958	0.91	2/5340 (0.0%)
1	F	0.73	0/3958	0.89	0/5340
1	G	0.79	0/3958	0.95	2/5340 (0.0%)
1	H	0.78	1/3958 (0.0%)	0.89	1/5340 (0.0%)
1	I	0.71	1/3958 (0.0%)	0.88	1/5340 (0.0%)
1	J	0.74	1/3958 (0.0%)	0.91	1/5340 (0.0%)
1	K	0.70	0/3958	0.89	2/5340 (0.0%)
1	L	0.73	2/3958 (0.1%)	0.88	0/5340
All	All	0.73	10/47496 (0.0%)	0.90	19/64080 (0.0%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	E	0	2
1	F	0	1
1	G	0	1
1	H	0	1
All	All	0	5

The worst 5 of 10 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	I	197	CYS	CB-SG	-7.54	1.69	1.82
1	B	197	CYS	CB-SG	-6.96	1.70	1.82

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	D	89	CYS	CB-SG	-6.15	1.71	1.82
1	C	55	CYS	CB-SG	-6.08	1.72	1.82
1	L	89	CYS	CB-SG	-5.47	1.73	1.81

The worst 5 of 19 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	G	245	LYS	CD-CE-NZ	7.41	128.75	111.70
1	J	296	LEU	CA-CB-CG	6.82	130.98	115.30
1	B	61	LEU	CA-CB-CG	6.37	129.94	115.30
1	D	87	THR	N-CA-C	6.27	127.92	111.00
1	H	146	ARG	NE-CZ-NH2	-6.19	117.20	120.30

There are no chirality outliers.

All (5) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	E	310	TYR	Sidechain
1	E	490	PHE	Sidechain
1	F	455	TYR	Sidechain
1	G	113	TYR	Sidechain
1	H	310	TYR	Sidechain

## 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	3874	0	3841	456	0
1	B	3874	0	3841	464	0
1	C	3874	0	3841	527	0
1	D	3874	0	3841	499	0
1	E	3874	0	3841	437	0
1	F	3874	0	3841	420	0
1	G	3874	0	3841	453	0
1	H	3874	0	3841	481	0
1	I	3874	0	3841	509	0
1	J	3874	0	3841	446	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	K	3874	0	3841	569	0
1	L	3874	0	3841	508	0
2	A	27	0	12	6	0
2	B	27	0	12	5	0
2	C	27	0	12	6	0
2	D	27	0	12	5	0
2	E	27	0	12	6	0
2	F	27	0	12	3	0
2	G	27	0	12	4	0
2	H	27	0	12	2	0
2	I	27	0	12	5	0
2	J	27	0	12	3	0
2	K	27	0	12	2	0
2	L	27	0	12	4	0
All	All	46812	0	46236	5447	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 59.

The worst 5 of 5447 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:423:LYS:HD3	1:A:426:GLY:HA3	1.23	1.17
1:B:95:TYR:OH	1:B:145:THR:HG22	1.44	1.16
1:L:57:HIS:CD2	1:L:84:HIS:HE1	1.62	1.15
1:C:235:ILE:HG22	1:C:364:ASN:HD21	1.12	1.13
1:C:396:ARG:HH11	1:C:396:ARG:HG3	1.14	1.12

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	494/496 (100%)	341 (69%)	109 (22%)	44 (9%)	1	8
1	B	494/496 (100%)	359 (73%)	94 (19%)	41 (8%)	1	9
1	C	494/496 (100%)	351 (71%)	82 (17%)	61 (12%)	0	5
1	D	494/496 (100%)	344 (70%)	105 (21%)	45 (9%)	1	8
1	E	494/496 (100%)	352 (71%)	100 (20%)	42 (8%)	1	9
1	F	494/496 (100%)	378 (76%)	85 (17%)	31 (6%)	1	14
1	G	494/496 (100%)	362 (73%)	94 (19%)	38 (8%)	1	10
1	H	494/496 (100%)	341 (69%)	116 (24%)	37 (8%)	1	11
1	I	494/496 (100%)	355 (72%)	89 (18%)	50 (10%)	0	7
1	J	494/496 (100%)	353 (72%)	99 (20%)	42 (8%)	1	9
1	K	494/496 (100%)	328 (66%)	113 (23%)	53 (11%)	0	6
1	L	494/496 (100%)	347 (70%)	102 (21%)	45 (9%)	1	8
All	All	5928/5952 (100%)	4211 (71%)	1188 (20%)	529 (9%)	1	8

5 of 529 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	9	PHE
1	A	25	GLU
1	A	26	ASP
1	A	30	GLU
1	A	33	ARG

### 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	413/413 (100%)	368 (89%)	45 (11%)	6	29
1	B	413/413 (100%)	352 (85%)	61 (15%)	3	17
1	C	413/413 (100%)	348 (84%)	65 (16%)	2	15
1	D	413/413 (100%)	354 (86%)	59 (14%)	3	19

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	E	413/413 (100%)	343 (83%)	70 (17%)	2	12
1	F	413/413 (100%)	359 (87%)	54 (13%)	4	21
1	G	413/413 (100%)	354 (86%)	59 (14%)	3	19
1	H	413/413 (100%)	348 (84%)	65 (16%)	2	15
1	I	413/413 (100%)	362 (88%)	51 (12%)	4	23
1	J	413/413 (100%)	348 (84%)	65 (16%)	2	15
1	K	413/413 (100%)	346 (84%)	67 (16%)	2	14
1	L	413/413 (100%)	351 (85%)	62 (15%)	3	17
All	All	4956/4956 (100%)	4233 (85%)	723 (15%)	3	18

5 of 723 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	F	238	MET
1	G	428	ILE
1	L	58	VAL
1	F	322	LEU
1	G	100	SER

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 164 such sidechains are listed below:

Mol	Chain	Res	Type
1	F	84	HIS
1	G	139	ASN
1	L	205	GLN
1	F	139	ASN
1	F	388	ASN

### 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 carbohydrates in this entry.

## 5.6 Ligand geometry [i](#)

12 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
2	ADP	A	1	-	24,29,29	1.41	3 (12%)	29,45,45	1.52	4 (13%)
2	ADP	E	5	-	24,29,29	1.77	3 (12%)	29,45,45	1.50	4 (13%)
2	ADP	L	502	-	24,29,29	1.19	2 (8%)	29,45,45	1.49	4 (13%)
2	ADP	J	502	-	24,29,29	1.12	2 (8%)	29,45,45	1.53	4 (13%)
2	ADP	D	4	-	24,29,29	1.76	3 (12%)	29,45,45	1.45	3 (10%)
2	ADP	G	502	-	24,29,29	1.54	4 (16%)	29,45,45	1.55	4 (13%)
2	ADP	I	502	-	24,29,29	1.13	1 (4%)	29,45,45	1.49	3 (10%)
2	ADP	F	502	-	24,29,29	1.18	2 (8%)	29,45,45	1.48	4 (13%)
2	ADP	C	3	-	24,29,29	1.26	3 (12%)	29,45,45	1.49	4 (13%)
2	ADP	B	2	-	24,29,29	1.16	2 (8%)	29,45,45	1.49	3 (10%)
2	ADP	K	502	-	24,29,29	1.17	2 (8%)	29,45,45	1.48	3 (10%)
2	ADP	H	502	-	24,29,29	1.11	2 (8%)	29,45,45	1.50	3 (10%)

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
2	ADP	A	1	-	-	1/12/32/32	0/3/3/3
2	ADP	E	5	-	-	1/12/32/32	0/3/3/3
2	ADP	L	502	-	-	1/12/32/32	0/3/3/3
2	ADP	J	502	-	-	1/12/32/32	0/3/3/3
2	ADP	D	4	-	-	1/12/32/32	0/3/3/3

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	ADP	G	502	-	-	1/12/32/32	0/3/3/3
2	ADP	I	502	-	-	1/12/32/32	0/3/3/3
2	ADP	F	502	-	-	1/12/32/32	0/3/3/3
2	ADP	C	3	-	-	1/12/32/32	0/3/3/3
2	ADP	B	2	-	-	1/12/32/32	0/3/3/3
2	ADP	K	502	-	-	1/12/32/32	0/3/3/3
2	ADP	H	502	-	-	1/12/32/32	0/3/3/3

The worst 5 of 29 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	E	5	ADP	O4'-C1'	5.52	1.48	1.41
2	D	4	ADP	O4'-C1'	4.97	1.48	1.41
2	G	502	ADP	PB-O2B	4.62	1.72	1.54
2	A	1	ADP	PB-O2B	4.49	1.72	1.54
2	E	5	ADP	PB-O2B	4.13	1.70	1.54

The worst 5 of 43 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	2	ADP	N3-C2-N1	-5.10	120.71	128.68
2	H	502	ADP	N3-C2-N1	-5.02	120.84	128.68
2	E	5	ADP	N3-C2-N1	-4.98	120.89	128.68
2	L	502	ADP	N3-C2-N1	-4.95	120.95	128.68
2	I	502	ADP	N3-C2-N1	-4.94	120.96	128.68

There are no chirality outliers.

5 of 12 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	D	4	ADP	C4'-C5'-O5'-PA
2	E	5	ADP	C4'-C5'-O5'-PA
2	A	1	ADP	C4'-C5'-O5'-PA
2	L	502	ADP	C4'-C5'-O5'-PA
2	J	502	ADP	C4'-C5'-O5'-PA

There are no ring outliers.

12 monomers are involved in 51 short contacts:

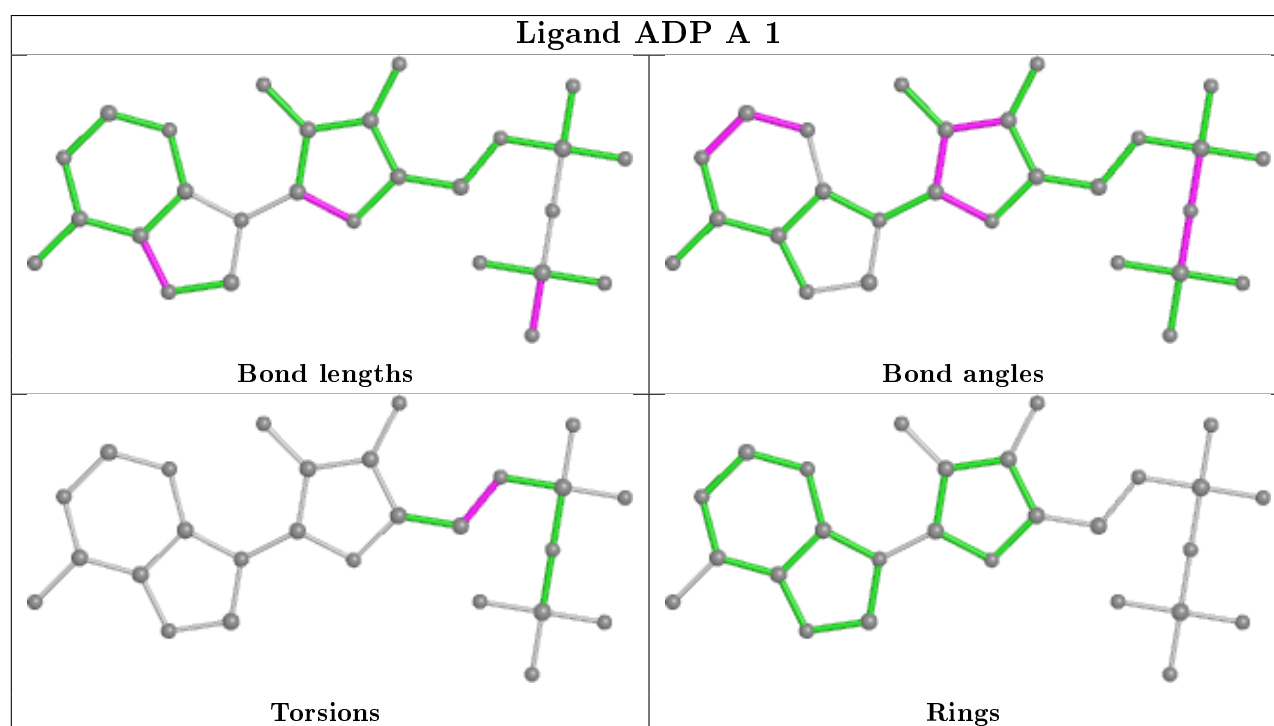
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	1	ADP	6	0

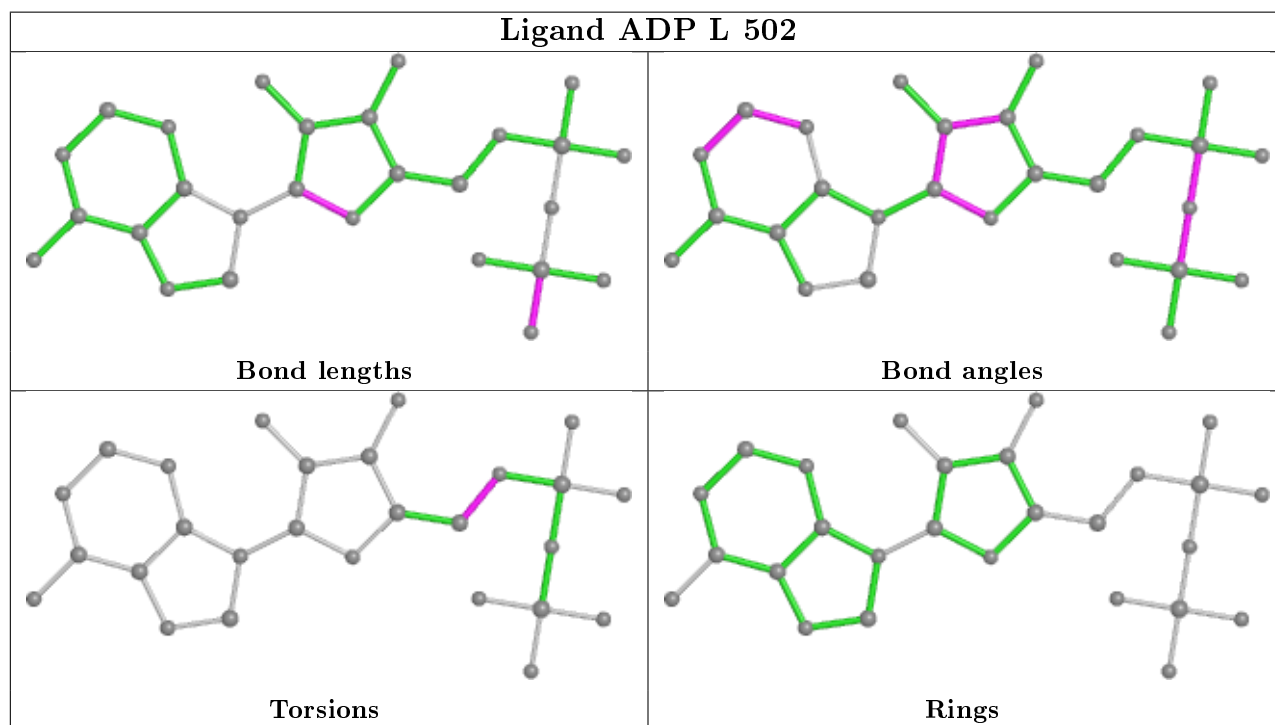
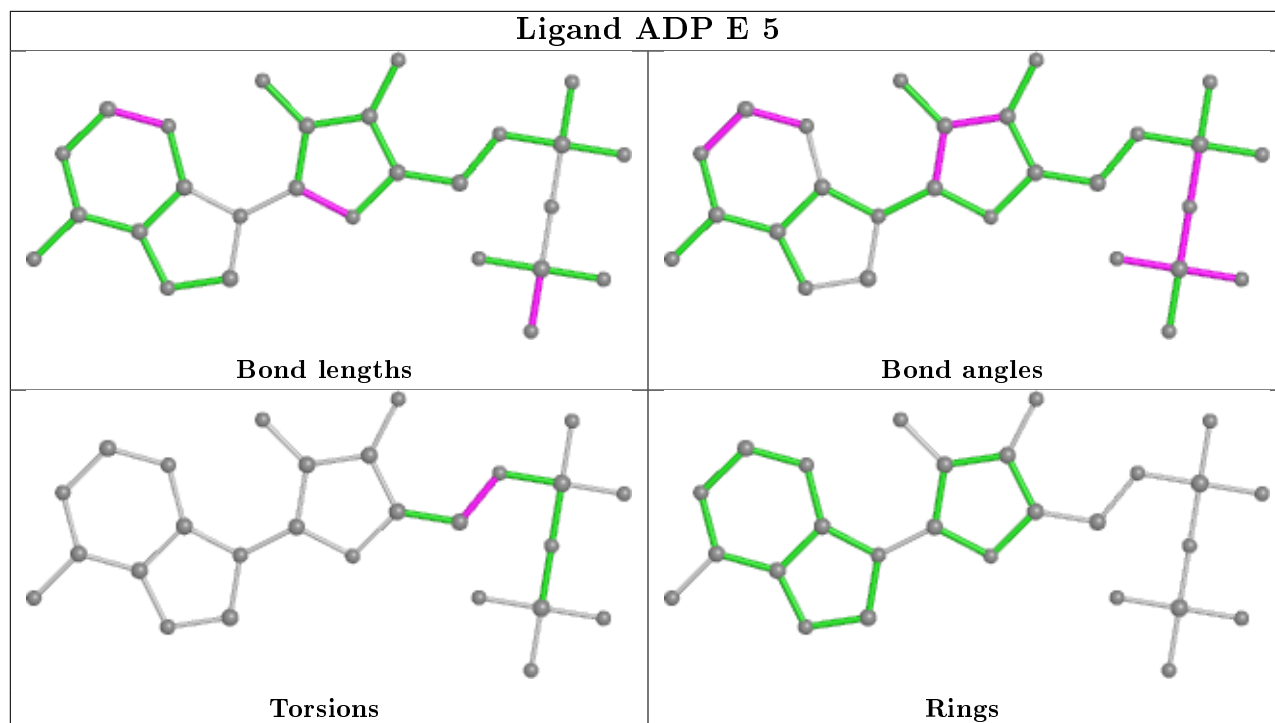
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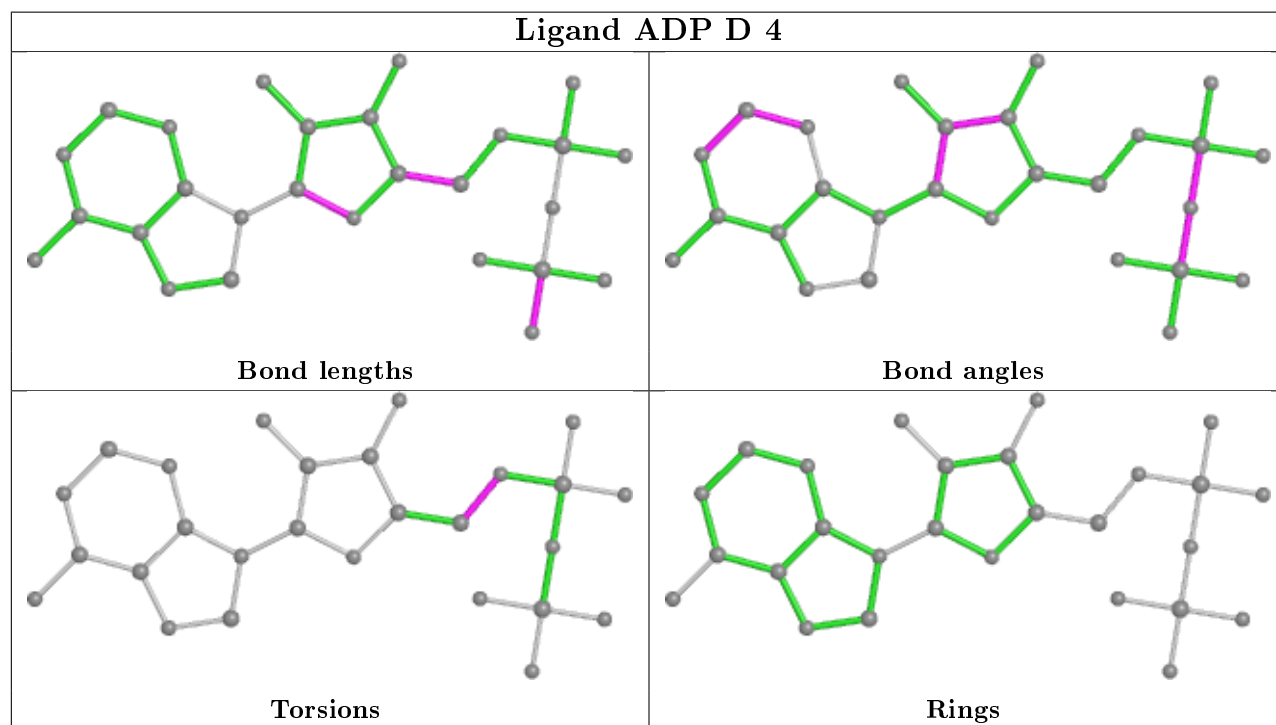
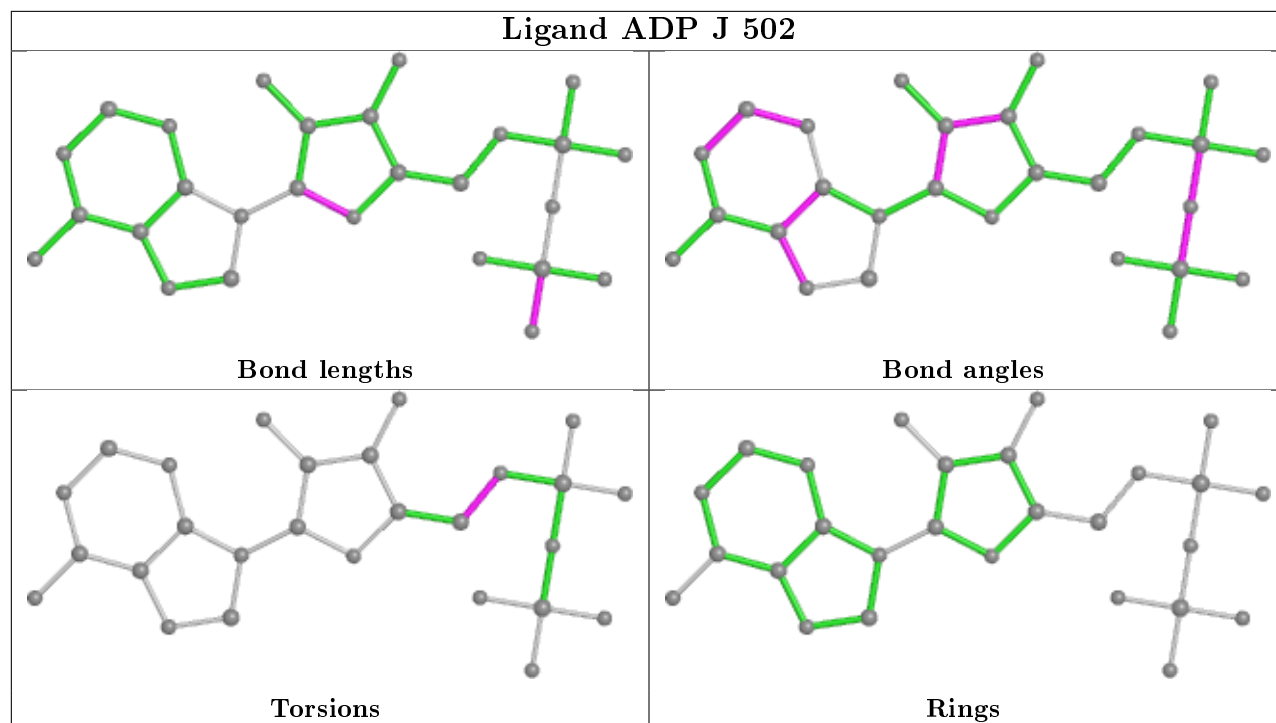
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Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	E	5	ADP	6	0
2	L	502	ADP	4	0
2	J	502	ADP	3	0
2	D	4	ADP	5	0
2	G	502	ADP	4	0
2	I	502	ADP	5	0
2	F	502	ADP	3	0
2	C	3	ADP	6	0
2	B	2	ADP	5	0
2	K	502	ADP	2	0
2	H	502	ADP	2	0

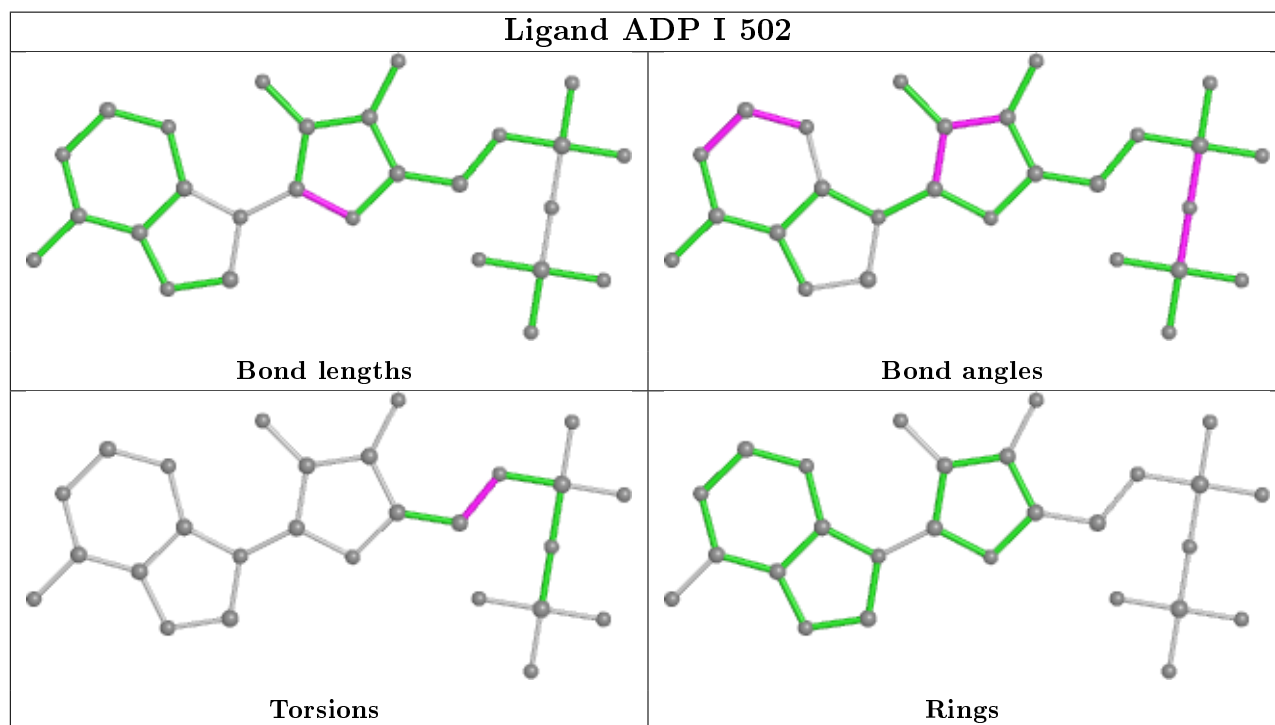
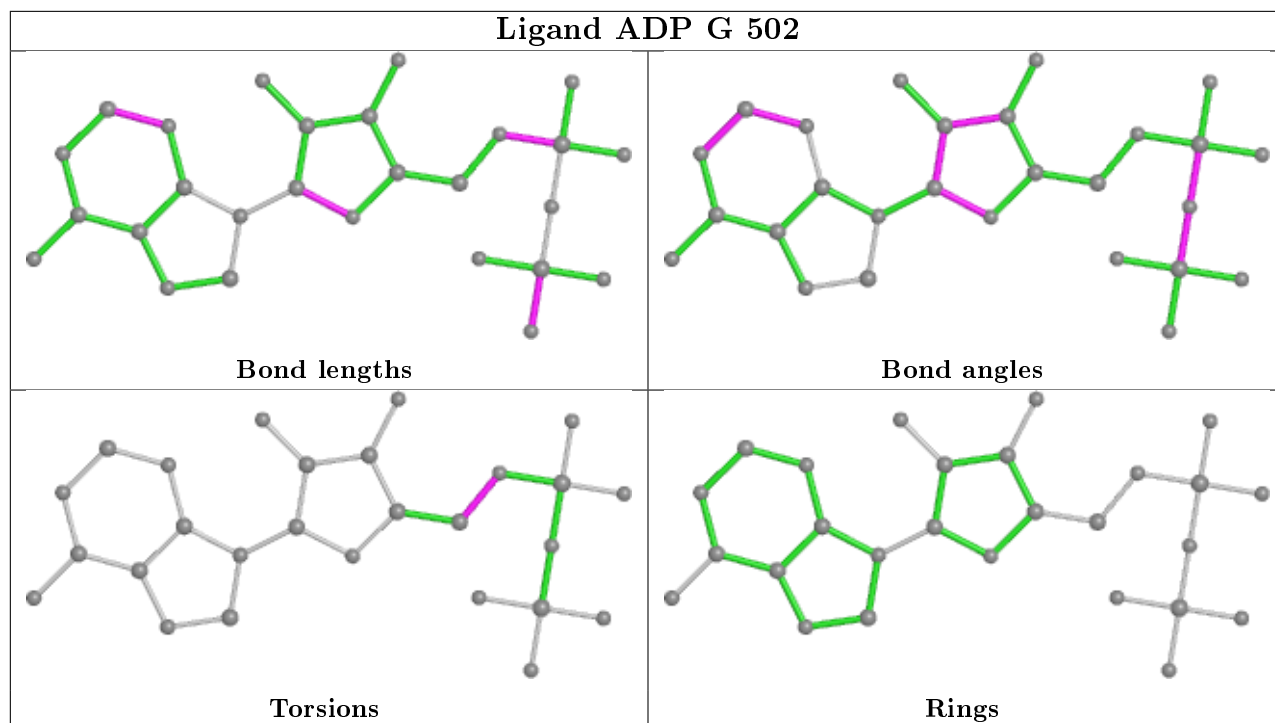
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. 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.

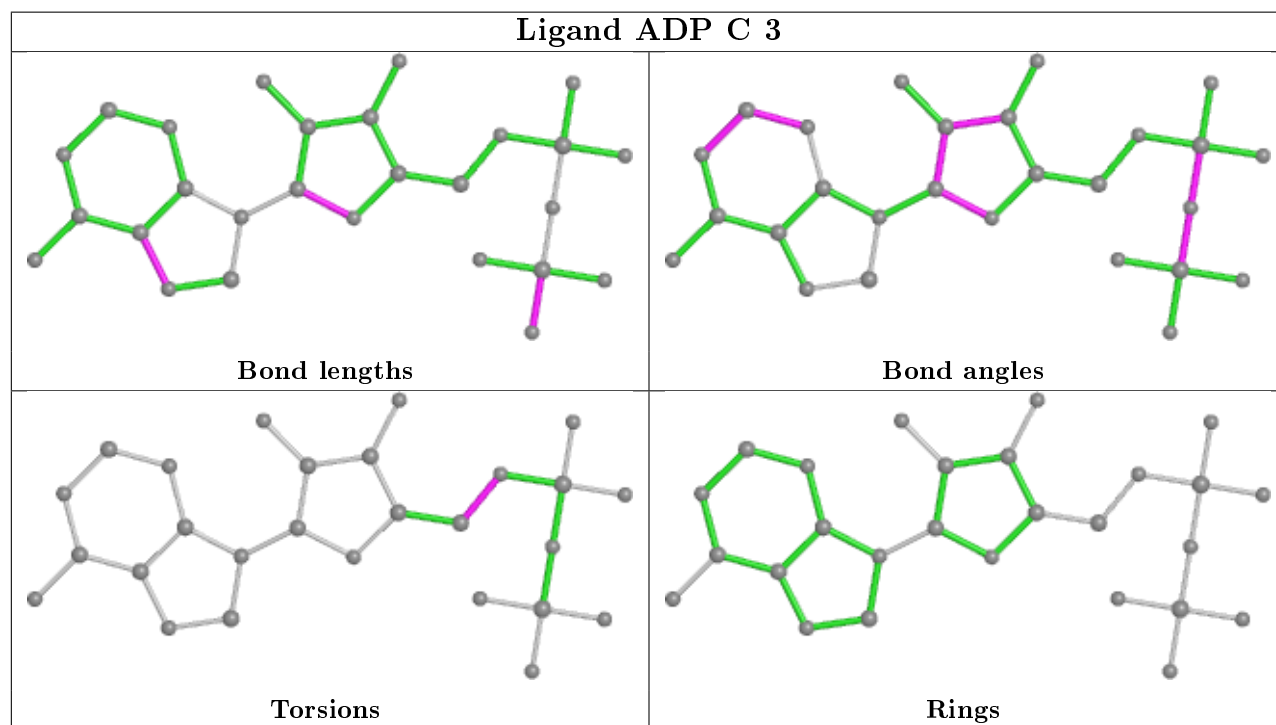
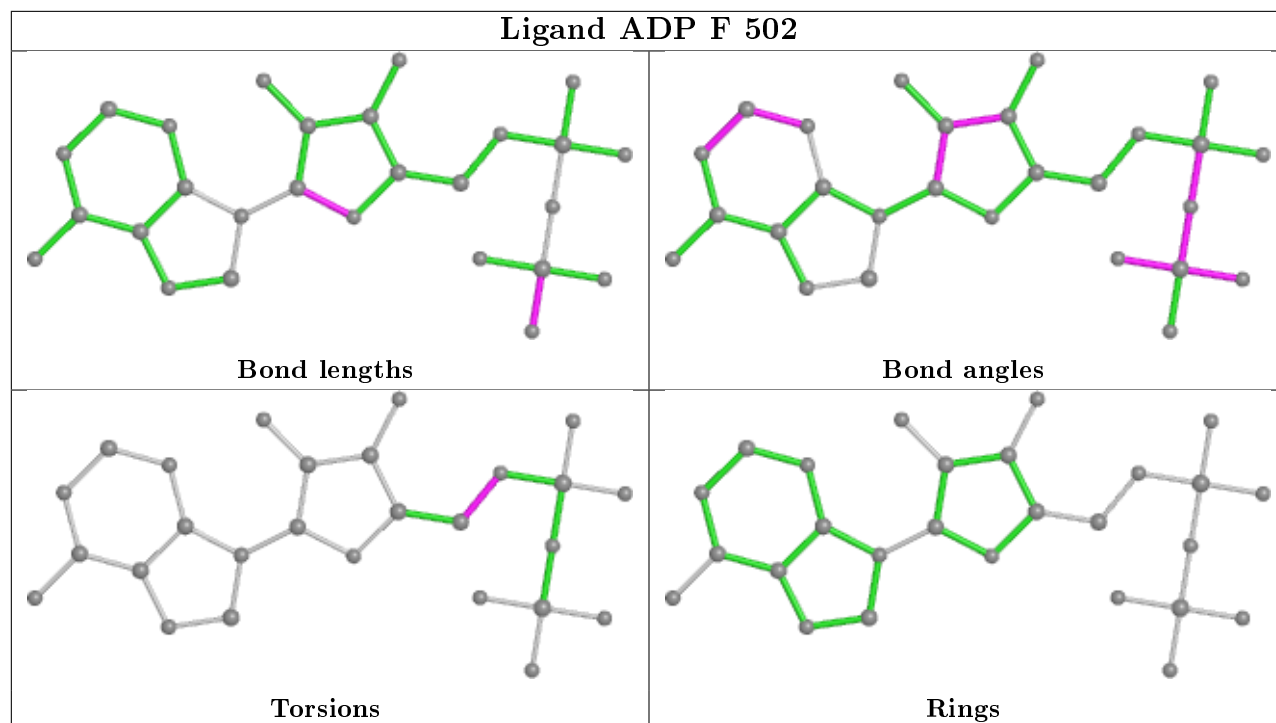


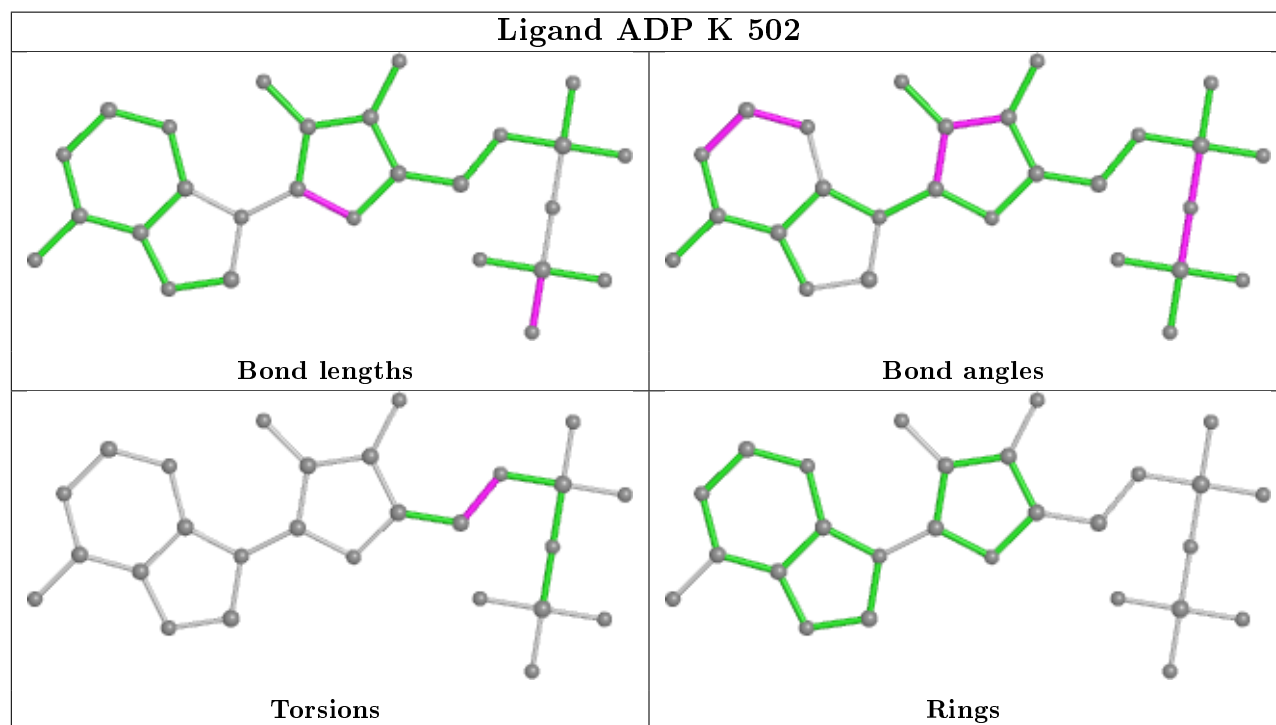
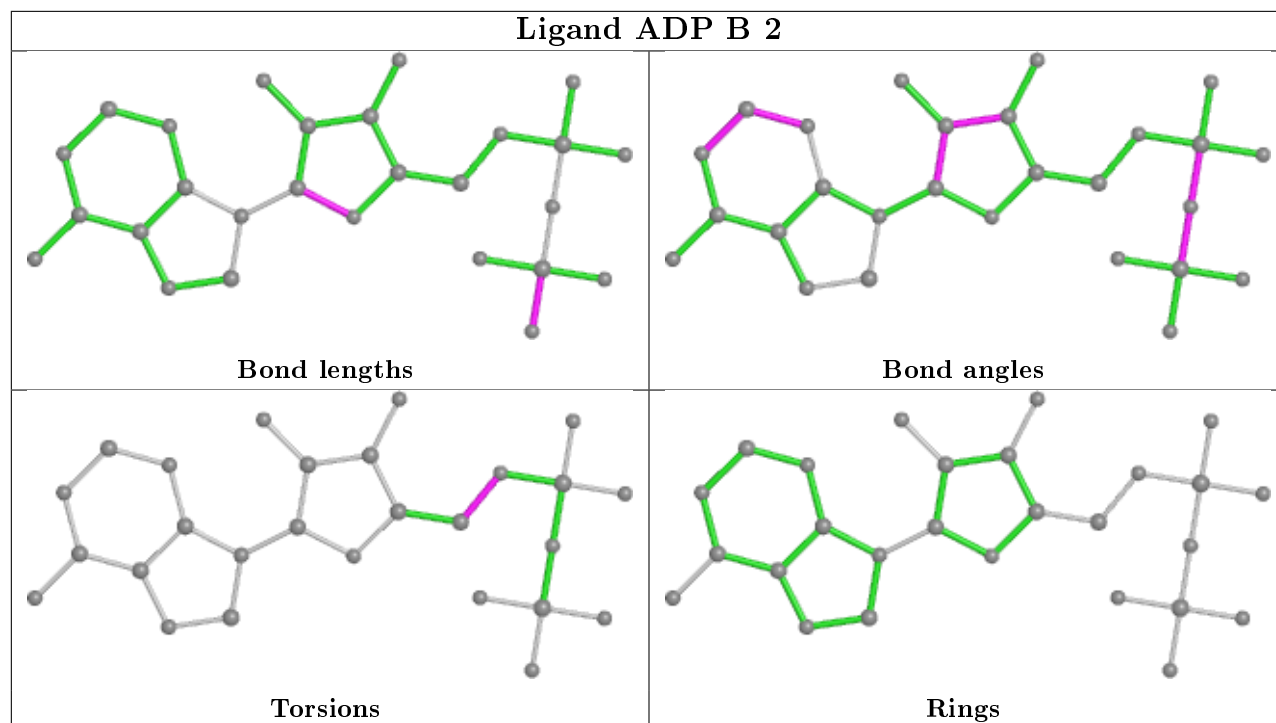


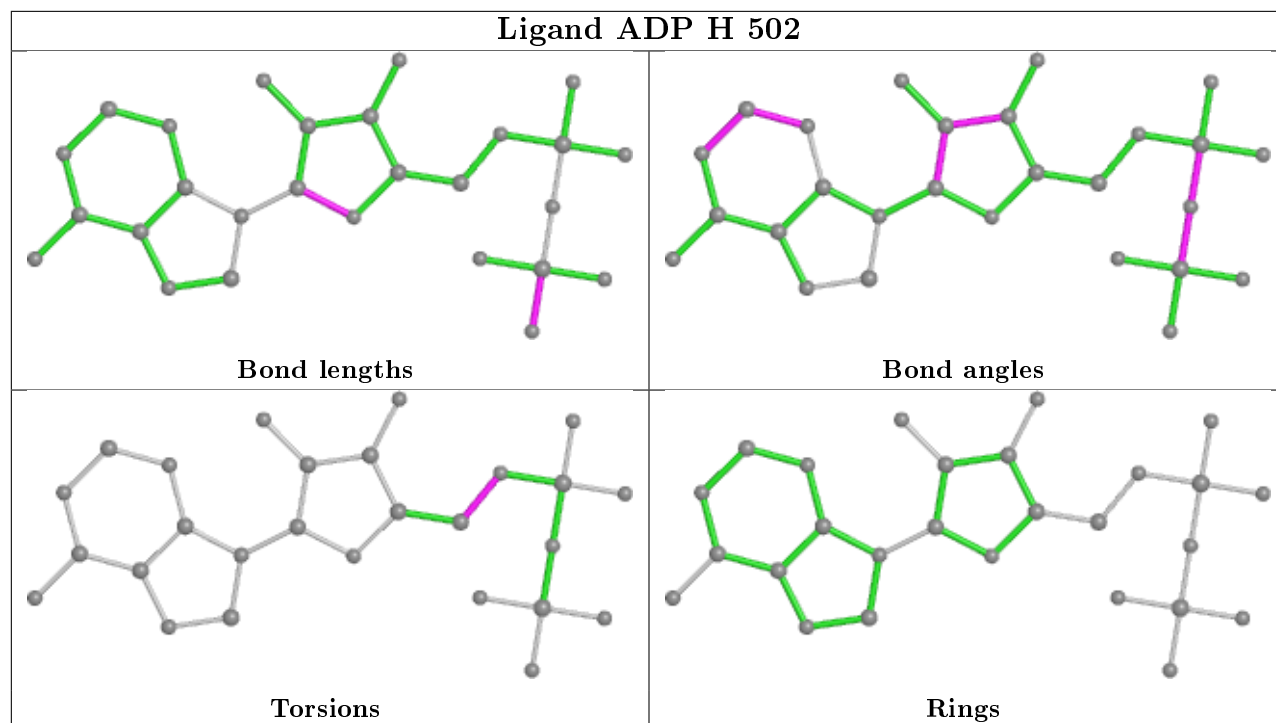












## 5.7 Other polymers [i](#)

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.