# wwPDB X-ray Structure Validation Summary Report (i)

Mar 23, 2024 – 10:43 PM EDT

|  |  |  |
|---|---|---|
| PDB ID | : | 2ZIT |
| Title | : | Structure of the eEF2-ExoA-NAD+ complex |
| Authors | : | Jorgensen, R.; Merrill, A.R. |
| Deposited on | : | 2008-02-24 |
| Resolution | : | 3.00 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*
A user guide is available at
https://www.wwpdb.org/validation/2017/XrayValidationReportHelp
with specific help available everywhere you see the (i) 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 (i)) were used in the production of this report:

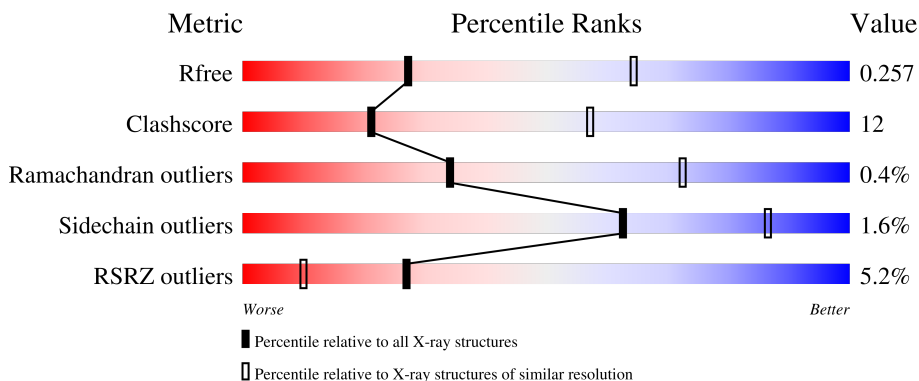|  |  |  |
|---|---|---|
| MolProbity | : | 4.02b-467 |
| Mogul | : | 1.8.5 (274361), CSD as541be (2020) |
| Xtriage (Phenix) | : | 1.13 |
| EDS | : | 2.36.1 |
| buster-report | : | 1.1.7 (2018) |
| Percentile statistics | : | 20191225.v01 (using entries in the PDB archive December 25th 2019) |
| Refmac | : | 5.8.0158 |
| CCP4 | : | 7.0.044 (Gargrove) |
| Ideal geometry (proteins) | : | Engh & Huber (2001) |
| Ideal geometry (DNA, RNA) | : | Parkinson et al. (1996) |
| Validation Pipeline (wwPDB-VP) | : | 2.36.1 |

# 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 3.00 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 | Percentile Ranks | Value |
|--------|------------------|-------|
| Rfree | | 0.257 |
| Clashscore | | 12 |
| Ramachandran outliers | | 0.4% |
| Sidechain outliers | | 1.6% |
| RSRZ outliers | | 5.2% |

*Worse* ... *Better*

▌Percentile relative to all X-ray structures

▐ Percentile relative to X-ray structures of similar resolution

| Metric | Whole archive (#Entries) | Similar resolution (#Entries, resolution range(Å)) |
|--------|--------------------------|---------------------------------------------------|
| $R_{free}$ | 130704 | 2092 (3.00-3.00) |
| Clashscore | 141614 | 2416 (3.00-3.00) |
| Ramachandran outliers | 138981 | 2333 (3.00-3.00) |
| Sidechain outliers | 138945 | 2336 (3.00-3.00) |
| RSRZ outliers | 127900 | 1990 (3.00-3.00) |

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% The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

| Mol | Chain | Length | Quality of chain |
|-----|-------|--------|------------------|
| 1 | A | 842 | 2% — 72% — 25% — · · |
| 1 | C | 842 | 5% — 72% — 25% — · · |
| 1 | E | 842 | 13% — 61% — 36% — · · |
| 2 | B | 207 | 79% — 20% — · |
| 2 | D | 207 | 76% — 23% |

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| Mol | Chain | Length | Quality of chain |
|-----|-------|--------|------------------|
| 2 | F | 207 | 79%                                          20%          • |

# 2　Entry composition ⓘ

There are 3 unique types of molecules in this entry. The entry contains 24121 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 Elongation factor 2.

| Mol | Chain | Residues | Atoms | | | | | ZeroOcc | AltConf | Trace |
|-----|-------|----------|-------|------|------|------|------|---------|---------|-------|
| 1 | A | 823 | Total | C | N | O | S | 0 | 0 | 0 |
| | | | 6405 | 4075 | 1093 | 1207 | 30 | | | |
| 1 | C | 823 | Total | C | N | O | S | 0 | 0 | 0 |
| | | | 6415 | 4082 | 1095 | 1208 | 30 | | | |
| 1 | E | 823 | Total | C | N | O | S | 0 | 0 | 0 |
| | | | 6405 | 4075 | 1093 | 1207 | 30 | | | |

- Molecule 2 is a protein called Exotoxin A.

| Mol | Chain | Residues | Atoms | | | | ZeroOcc | AltConf | Trace |
|-----|-------|----------|-------|------|-----|-----|---------|---------|-------|
| 2 | B | 207 | Total | C | N | O | 0 | 0 | 0 |
| | | | 1588 | 1001 | 283 | 304 | | | |
| 2 | D | 207 | Total | C | N | O | 0 | 0 | 0 |
| | | | 1588 | 1001 | 283 | 304 | | | |
| 2 | F | 207 | Total | C | N | O | 0 | 0 | 0 |
| | | | 1588 | 1001 | 283 | 304 | | | |

There are 9 discrepancies between the modelled and reference sequences:

| Chain | Residue | Modelled | Actual | Comment | Reference |
|-------|---------|----------|--------|---------|-----------|
| B | 399 | ALA | - | expression tag | UNP P11439 |
| B | 407 | VAL | ILE | SEE REMARK 999 | UNP P11439 |
| B | 515 | SER | GLY | SEE REMARK 999 | UNP P11439 |
| D | 399 | ALA | - | expression tag | UNP P11439 |
| D | 407 | VAL | ILE | SEE REMARK 999 | UNP P11439 |
| D | 515 | SER | GLY | SEE REMARK 999 | UNP P11439 |
| F | 399 | ALA | - | expression tag | UNP P11439 |
| F | 407 | VAL | ILE | SEE REMARK 999 | UNP P11439 |
| F | 515 | SER | GLY | SEE REMARK 999 | UNP P11439 |

- Molecule 3 is NICOTINAMIDE-ADENINE-DINUCLEOTIDE (three-letter code: NAD) (formula: $C_{21}H_{27}N_7O_{14}P_2$).

NAD

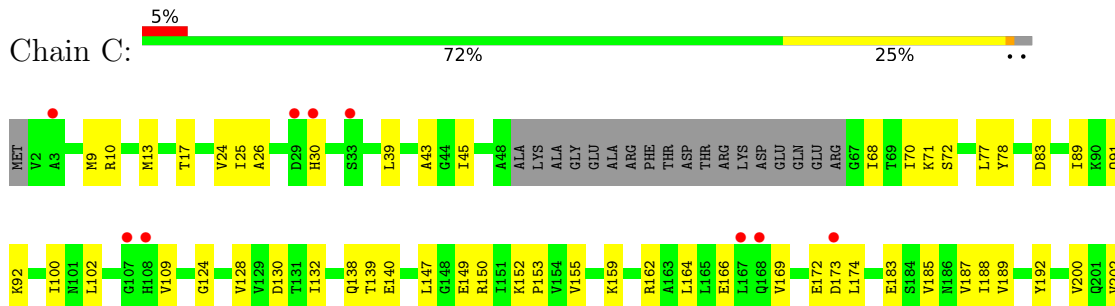| Mol | Chain | Residues | Atoms | | | | | ZeroOcc | AltConf |
|-----|-------|----------|-------|---|---|---|---|---------|---------|
| 3 | B | 1 | Total | C | N | O | P | 0 | 0 |
| | | | 44 | 21 | 7 | 14 | 2 | | |
| 3 | D | 1 | Total | C | N | O | P | 0 | 0 |
| | | | 44 | 21 | 7 | 14 | 2 | | |
| 3 | F | 1 | Total | C | N | O | P | 0 | 0 |
| | | | 44 | 21 | 7 | 14 | 2 | | |

# 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 and electron density. 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. A red dot above a residue indicates a poor fit to the electron density (RSRZ > 2). 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.
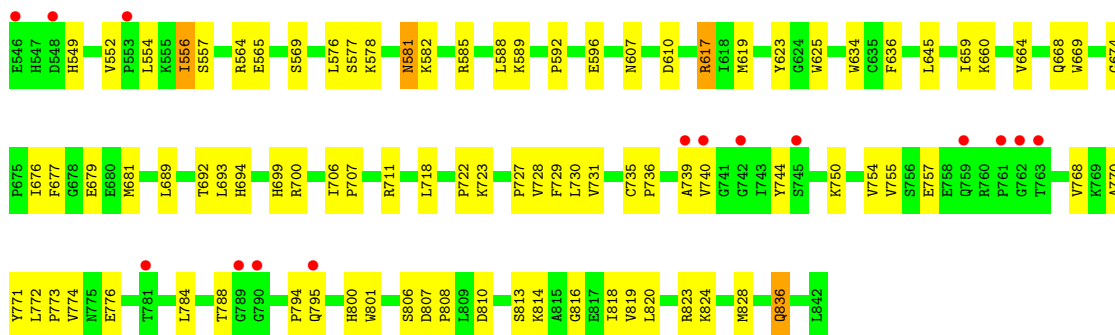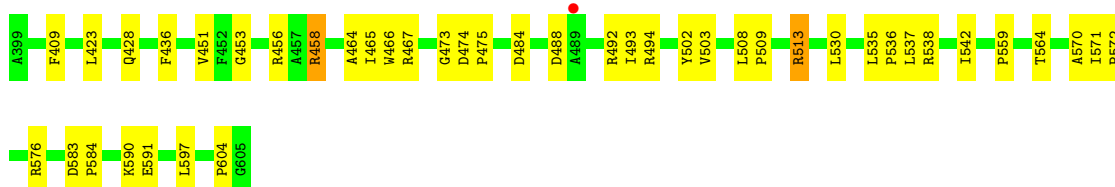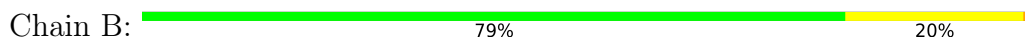
• Molecule 1: Elongation factor 2
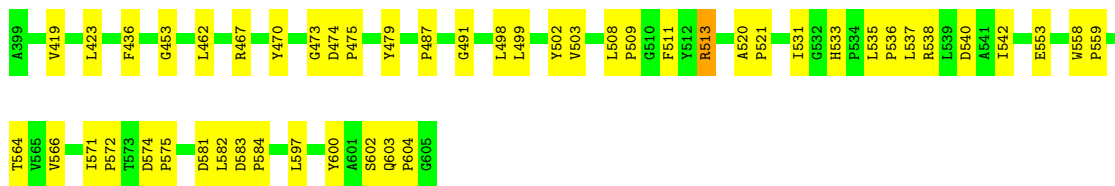
Chain A:



• Molecule 1: Elongation factor 2

Chain C:

H216 G217 W218 A219 F220 Q224 D236 K237 M240 N251 P252 T258 N259 K260 D261 T262 E265 N274 I277 L278 D279 P280 R283 L284 I288 M289 N290 F291 D294 E295 I296 P297 V298 L299 L300 E301 V306 G309 D310 E311 K312 D313 L314 E315 G316 K317

A318 L319 L320 K321 F327 L328 P329 A330 L334 L335 E336 M337 I338 V339 L340 H341 L342 A348 Y351 Q355 D362 P374 M379 V386 P387 T388 S389 D390 A396 F397 A402 G403 T404 V405 K406 I413 V419 P420 G421 M437 M438 G439 I445 D446 D447

C448 P449 M452 L456 I459 D460 L464 A475 S472 A475 M478 K479 F483 S484 V485 S486 P487 V491 E494 V495 K496 N497 A498 N499 D500 L501 P502 K503 L504 V505 E506 G507 L508 K509 R510 K513 S514 D515 V518 M522 S523 I529 V530 A531 L538

L542 Q543 D544 L545 E546 H547 D548 H549 A550 P553 L554 K555 I556 P559 R564 K578 K582 R585 L588 N607 P608 R609 D610 A614 I618 V627 R631 W634 C635 F636 N644 L645 D648 K651 L656 I659 K660 W669 P675

T692 L693 H694 H699 R700 I706 P707 Y714 P722 K723 I724 Q725 E726 P727 V728 F729 L730 V731 C735 P736 V740 V755 Q759 R760 T763 A770 Y771 L772 P773 V774 L784 P794 Q795 M796 V797 F798 D799 D807 P808 L820 R823 K824 V832

L842

• Molecule 1: Elongation factor 2

13%

Chain E:                    61%                                        36%

MET V2 A3 F4 M9 R10 S11 L12 M13 D14 K15 V16 T17 R20 N21 A26 H27 V28 D29 H30 G31 K32 L35 L39 V40 Q41 R42 A43 G44 I45 I46 S47 A48 ALA LYS ALA GLY GLU ALA ARG PHE THR ASP THR ARG LYS ASP GLU GLN GLU ARG G67 I68 T69 I70

K71 A74 I75 S76 L77 Y78 S79 E80 M81 S82 D83 E84 D85 V86 K87 E88 I89 K90 Q91 K92 T93 S97 I100 N101 L102 I103 D104 G107 H108 V109 D110 F111 E114 V115 T116 A117 A118 L119 R120 V121 T122 D123 V128 V129 D130 T131 I132 E133 G134 V135 C136 V137 Q138

T141 R144 L147 G148 E149 R150 I151 V155 V156 I157 N158 K159 V160 D161 R162 A163 L164 L165 E166 L167 Q168 V169 L174 T177 F178 A179 R180 T181 V185 V189 Y192 A193 D194 E195 V196 L197 V200 Q201 V202 Y203 P204 A205 R206 G207 T208 V209 A210 F211 G212 W218

A219 F220 T221 I222 F225 A226 A230 K231 K232 K237 A238 K239 M240 R243 L244 W245 G246 D247 S248 F249 F250 K253 T254 K255 K256 W257 T258 K267 P268 R271 A272 F273 N274 M275 D279 P280 I281 F282 R283 L284 F285 I288 M289 N290 F291 K292 K293 D294 E295 I296 P297

L300 L307 K308 G309 D310 E311 K312 D313 L314 E315 G316 K317 A318 L319 L320 K321 V322 V323 M324 R325 K326 F327 L328 P329 A330 A331 D332 A333 L334 L335 E336 M337 I338 L342 P343 S344 P345 A348 Q349 A350 Y351 R352 A353 E354 Q355 L356 Y357 E358 G359 P360 A361 D362 D363 A364 N365 C366

I367 A368 I369 K370 A376 D377 L378 M379 L380 Y381 V382 S383 K384 M385 V386 P387 T388 S389 D390 K391 G392 R393 F394 Y395 A396 F397 G398 F401 A402 G403 T404 V405 K410 V411 R412 I413 V419 P420 G421 K422 K429 A430 M437 V442 D447 C448 P449 I453 I454 G455 L456

V457 G458 I459 D460 Q461 F462 L463 L464 K465 L469 T470 T471 S472 A475 H476 N477 M478 K479 V480 M481 V485 S486 P487 V488 E494 V495 A498 N499 D500 L501 P502 K503 L504 R510 D515 P516 C517 V518 L519 T520 V530 A531 L536 H537 L538 E539 S540 C541 L542 L545

E546 H547 D548 H549 V552 P553 L554 K555 I556 S557 R564 E565 S569 L576 S577 K578 N581 K582 R585 L588 K589 P592 E596 N607 D610 R617 I618 M619 Y623 G624 W625 W634 C635 F636 L645 I659 K660 V664 Q668 W669 G674

P675 I676 F677 G678 E679 E680 M681 L689 T692 L693 H694 H699 R700 I706 P707 R711 L718 P722 K723 P727 V728 F729 L730 V731 C735 P736 A739 V740 G741 G742 I743 Y744 S745 K750 V754 V755 S756 E757 E758 Q759 R760 P761 G762 T763 V768 K769 A770

Y771 L772 P773 V774 N775 E776 T781 L784 T788 G789 G790 P794 Q795 H800 W801 S806 D807 P808 L809 D810 S813 K814 A815 G816 E817 I818 V819 L820 R823 K824 M828 Q836 L842

• Molecule 2: Exotoxin A

Chain B:　79%　20%　•

A399 F409 L423 Q428 F436 V451 F452 G453 R456 A457 R458 A464 I465 W466 R467 G473 D474 P475 D484 D488 A489 R492 I493 R494 Y502 V503 L508 P509 R513 L530 L535 P536 L537 R538 I542 P559 T564 A570 I571 P572

R576 D583 P584 K590 E591 L597 P604 G605

• Molecule 2: Exotoxin A

Chain D:　76%　23%

A399 V419 L423 F436 G453 L462 R467 Y470 G473 D474 P475 Y479 P487 G491 L498 L499 Y502 V503 L508 P509 G510 F511 Y512 R513 A520 P521 I531 G532 H533 P534 L535 P536 L537 R538 I539 D540 A541 I542 E553 W558 P559

T564 V565 V566 I571 P572 T573 D574 P575 D581 L582 D583 P584 L597 Y600 A601 S602 Q603 P604 G605

• Molecule 2: Exotoxin A

Chain F:　79%　20%　•

A399 D403 D406 L423 V435 F436 T442 F443 L444 E445 G453 A457 L462 W466 R467 Y470 I471 D488 A489 R492 I493 R494 L499 R500 V501 Y502 V503 L508 P509 G510 F511 Y512 R513 T517 L518 A519 L535 P536 L537 R538 I542 E547

E553 W558 T564 V565 V566 A570 E591 I594 P598 D599 Y600 G605

# 4 Data and refinement statistics ⓘ

| Property | Value | Source |
|---|---|---|
| Space group | C 1 2 1 | Depositor |
| Cell constants<br>a, b, c, $\alpha$, $\beta$, $\gamma$ | 326.92Å   69.24Å   190.48Å<br>90.00°   103.30°   90.00° | Depositor |
| Resolution (Å) | 19.90 – 3.00<br>19.90 – 2.97 | Depositor<br>EDS |
| % Data completeness<br>(in resolution range) | 98.5 (19.90-3.00)<br>97.0 (19.90-2.97) | Depositor<br>EDS |
| $R_{merge}$ | 0.16 | Depositor |
| $R_{sym}$ | (Not available) | Depositor |
| $< I/\sigma(I) >$ [1] | 1.87 (at 2.98Å) | Xtriage |
| Refinement program | PHENIX | Depositor |
| R, $R_{free}$ | 0.220 , 0.266<br>0.212 , 0.257 | Depositor<br>DCC |
| $R_{free}$ test set | 1691 reflections (2.01%) | wwPDB-VP |
| Wilson B-factor (Å$^2$) | 54.4 | Xtriage |
| Anisotropy | 0.586 | Xtriage |
| Bulk solvent $k_{sol}$(e/Å$^3$), $B_{sol}$(Å$^2$) | 0.26 , 59.1 | EDS |
| L-test for twinning[2] | $< |L| > = 0.47$, $< L^2 > = 0.30$ | Xtriage |
| Estimated twinning fraction | No twinning to report. | Xtriage |
| $F_o$,$F_c$ correlation | 0.94 | EDS |
| Total number of atoms | 24121 | wwPDB-VP |
| Average B, all atoms (Å$^2$) | 95.0 | wwPDB-VP |

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 61.09 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 1.3798e-05. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

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[1]Intensities estimated from amplitudes.
[2]Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

# 5 Model quality ⓘ

## 5.1 Standard geometry ⓘ

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

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 | 0.20 | 0/6517 | 0.38 | 0/8823 |
| 1 | C | 0.20 | 0/6517 | 0.38 | 0/8823 |
| 1 | E | 0.20 | 0/6517 | 0.37 | 0/8823 |
| 2 | B | 0.22 | 0/1627 | 0.39 | 0/2216 |
| 2 | D | 0.21 | 0/1627 | 0.40 | 0/2216 |
| 2 | F | 0.22 | 0/1627 | 0.40 | 0/2216 |
| All | All | 0.21 | 0/24432 | 0.38 | 0/33117 |

There are no bond length outliers.

There are no bond angle outliers.

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 | A | 6405 | 0 | 6472 | 137 | 0 |
| 1 | C | 6415 | 0 | 6488 | 155 | 0 |
| 1 | E | 6405 | 0 | 6472 | 216 | 0 |
| 2 | B | 1588 | 0 | 1542 | 32 | 0 |
| 2 | D | 1588 | 0 | 1542 | 25 | 0 |
| 2 | F | 1588 | 0 | 1542 | 27 | 0 |
| 3 | B | 44 | 0 | 26 | 0 | 0 |

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| Mol | Chain | Non-H | H(model) | H(added) | Clashes | Symm-Clashes |
|-----|-------|-------|----------|----------|---------|--------------|
| 3 | D | 44 | 0 | 26 | 4 | 0 |
| 3 | F | 44 | 0 | 26 | 2 | 0 |
| All | All | 24121 | 0 | 24136 | 584 | 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.

The worst 5 of 584 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:C:699:DDE:HAB2 | 1:C:699:DDE:HAT2 | 1.41 | 0.98 |
| 1:C:699:DDE:HAA1 | 3:D:701:NAD:H4D | 1.46 | 0.98 |
| 1:A:470:THR:HG22 | 1:A:472:SER:H | 1.31 | 0.94 |
| 1:A:710:ARG:HG3 | 1:A:710:ARG:HH11 | 1.33 | 0.92 |
| 1:E:147:LEU:HD13 | 1:E:192:TYR:HB2 | 1.51 | 0.92 |

There are no symmetry-related clashes.

## 5.3 Torsion angles ⓘ

### 5.3.1 Protein backbone ⓘ

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 | 818/842 (97%) | 776 (95%) | 38 (5%) | 4 (0%) | 29 | 68 |
| 1 | C | 818/842 (97%) | 767 (94%) | 48 (6%) | 3 (0%) | 34 | 72 |
| 1 | E | 818/842 (97%) | 754 (92%) | 61 (8%) | 3 (0%) | 34 | 72 |
| 2 | B | 205/207 (99%) | 199 (97%) | 6 (3%) | 0 | 100 | 100 |
| 2 | D | 205/207 (99%) | 196 (96%) | 8 (4%) | 1 (0%) | 29 | 68 |
| 2 | F | 205/207 (99%) | 198 (97%) | 6 (3%) | 1 (0%) | 29 | 68 |
| All | All | 3069/3147 (98%) | 2890 (94%) | 167 (5%) | 12 (0%) | 34 | 72 |

5 of 12 Ramachandran outliers are listed below:

| Mol | Chain | Res | Type |
|-----|-------|-----|------|
| 1 | A | 309 | GLY |
| 1 | E | 479 | LYS |
| 1 | A | 479 | LYS |
| 1 | A | 641 | ASN |
| 1 | C | 446 | ASP |

### 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 | A | 699/714 (98%) | 690 (99%) | 9 (1%) | 69 | 89 |
| 1 | C | 699/714 (98%) | 690 (99%) | 9 (1%) | 69 | 89 |
| 1 | E | 699/714 (98%) | 688 (98%) | 11 (2%) | 62 | 86 |
| 2 | B | 161/161 (100%) | 159 (99%) | 2 (1%) | 71 | 90 |
| 2 | D | 161/161 (100%) | 157 (98%) | 4 (2%) | 47 | 79 |
| 2 | F | 161/161 (100%) | 156 (97%) | 5 (3%) | 40 | 75 |
| All | All | 2580/2625 (98%) | 2540 (98%) | 40 (2%) | 62 | 86 |

5 of 40 residues with a non-rotameric sidechain are listed below:

| Mol | Chain | Res | Type |
|-----|-------|-----|------|
| 1 | E | 332 | ASP |
| 2 | F | 403 | ASP |
| 1 | E | 494 | GLU |
| 1 | E | 730 | LEU |
| 2 | F | 494 | ARG |

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 17 such sidechains are listed below:

| Mol | Chain | Res | Type |
|-----|-------|-----|------|
| 1 | E | 654 | GLN |
| 2 | F | 428 | GLN |

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| Mol | Chain | Res | Type |
|-----|-------|-----|------|
| 2 | D | 428 | GLN |
| 1 | E | 30 | HIS |
| 1 | E | 355 | GLN |

### 5.3.3   RNA   ⓘ

There are no RNA molecules in this entry.

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

3 non-standard protein/DNA/RNA residues 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 | $\#|Z| > 2$ |
| 1 | DDE | C | 699 | 1 | 14,20,21 | 0.90 | 0 | 14,28,30 | 1.23 | 2 (14%) |
| 1 | DDE | A | 699 | 1 | 5,10,21 | 0.58 | 0 | 3,12,30 | 1.36 | 1 (33%) |
| 1 | DDE | E | 699 | 1 | 5,10,21 | 0.60 | 0 | 3,12,30 | 1.33 | 1 (33%) |

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 |
|-----|------|-------|-----|------|---------|----------|-------|
| 1 | DDE | C | 699 | 1 | - | 3/20/21/23 | 0/1/1/1 |
| 1 | DDE | A | 699 | 1 | - | 1/5/6/23 | 0/1/1/1 |
| 1 | DDE | E | 699 | 1 | - | 1/5/6/23 | 0/1/1/1 |

There are no bond length outliers.

All (4) bond angle outliers are listed below:

| Mol | Chain | Res | Type | Atoms | Z | Observed(°) | Ideal(°) |
|-----|-------|-----|------|-------|---|-------------|----------|
| 1 | C | 699 | DDE | CAU-CBW-CBI | -2.39 | 106.45 | 111.20 |
| 1 | C | 699 | DDE | CAB-NCB-CBW | 2.23 | 116.07 | 110.51 |
| 1 | A | 699 | DDE | CD2-NE2-CE1 | 2.09 | 109.03 | 105.78 |
| 1 | E | 699 | DDE | CD2-NE2-CE1 | 2.02 | 108.93 | 105.78 |

There are no chirality outliers.

All (5) torsion outliers are listed below:

| Mol | Chain | Res | Type | Atoms |
|-----|-------|-----|------|-------|
| 1 | A | 699 | DDE | O-C-CA-CB |
| 1 | C | 699 | DDE | O-C-CA-CB |
| 1 | E | 699 | DDE | O-C-CA-CB |
| 1 | C | 699 | DDE | NAD-CBI-CBW-NCB |
| 1 | C | 699 | DDE | OAG-CBI-CBW-NCB |

There are no ring outliers.

2 monomers are involved in 9 short contacts:

| Mol | Chain | Res | Type | Clashes | Symm-Clashes |
|-----|-------|-----|------|---------|--------------|
| 1 | C | 699 | DDE | 8 | 0 |
| 1 | A | 699 | DDE | 1 | 0 |

## 5.5 Carbohydrates ⓘ

There are no monosaccharides in this entry.

## 5.6 Ligand geometry ⓘ

3 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 | #$|Z| > 2$ |
| 3 | NAD | B | 700 | - | 42,48,48 | 0.67 | 0 | 50,73,73 | 1.28 | 4 (8%) |

| Mol | Type | Chain | Res | Link | Bond lengths | | | Bond angles | | |
|-----|------|-------|-----|------|--------|------|-----------|--------|------|-----------|
| | | | | | Counts | RMSZ | $\#|Z| > 2$ | Counts | RMSZ | $\#|Z| > 2$ |
| 3 | NAD | F | 702 | - | 42,48,48 | 0.67 | 0 | 50,73,73 | 1.28 | 3 (6%) |
| 3 | NAD | D | 701 | - | 42,48,48 | 0.67 | 0 | 50,73,73 | 1.25 | 3 (6%) |

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 | NAD | B | 700 | - | - | 4/26/62/62 | 0/5/5/5 |
| 3 | NAD | F | 702 | - | - | 5/26/62/62 | 0/5/5/5 |
| 3 | NAD | D | 701 | - | - | 4/26/62/62 | 0/5/5/5 |

There are no bond length outliers.

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

| Mol | Chain | Res | Type | Atoms | Z | Observed($^o$) | Ideal($^o$) |
|-----|-------|-----|------|-------|---|----------|--------|
| 3 | B | 700 | NAD | N3A-C2A-N1A | -4.61 | 121.47 | 128.68 |
| 3 | D | 701 | NAD | N3A-C2A-N1A | -4.54 | 121.59 | 128.68 |
| 3 | F | 702 | NAD | N3A-C2A-N1A | -4.46 | 121.71 | 128.68 |
| 3 | F | 702 | NAD | C3D-C2D-C1D | 3.66 | 106.49 | 100.98 |
| 3 | D | 701 | NAD | C3D-C2D-C1D | 3.46 | 106.18 | 100.98 |

There are no chirality outliers.

5 of 13 torsion outliers are listed below:

| Mol | Chain | Res | Type | Atoms |
|-----|-------|-----|------|-------|
| 3 | B | 700 | NAD | C3D-C4D-C5D-O5D |
| 3 | F | 702 | NAD | C3D-C4D-C5D-O5D |
| 3 | B | 700 | NAD | O4D-C4D-C5D-O5D |
| 3 | D | 701 | NAD | O4D-C4D-C5D-O5D |
| 3 | D | 701 | NAD | C3D-C4D-C5D-O5D |

There are no ring outliers.
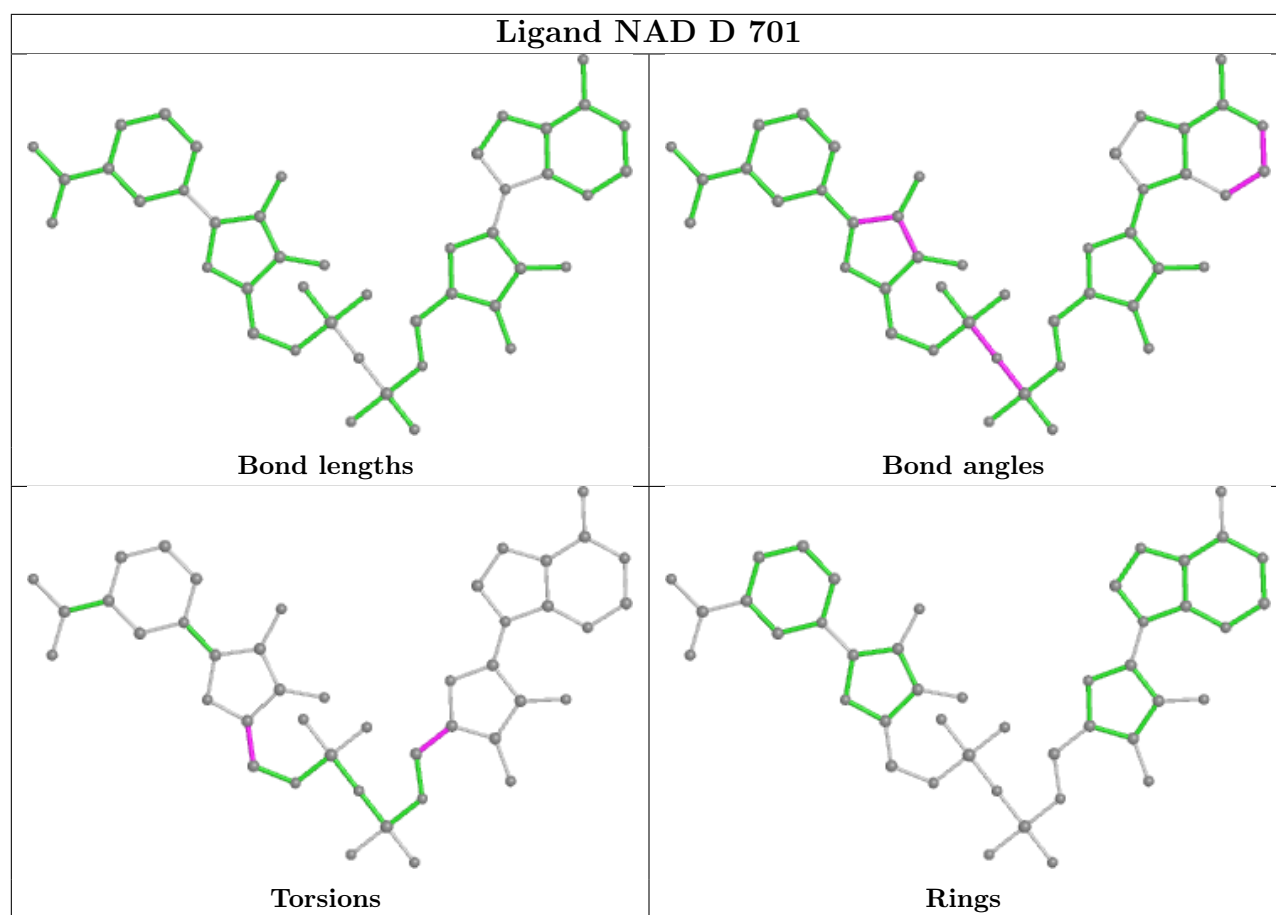
2 monomers are involved in 6 short contacts:

| Mol | Chain | Res | Type | Clashes | Symm-Clashes |
|-----|-------|-----|------|---------|--------------|
| 3 | F | 702 | NAD | 2 | 0 |
| 3 | D | 701 | NAD | 4 | 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 then 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.



**Ligand NAD B 700**

Bond lengths

Bond angles

Torsions

Rings

## Ligand NAD F 702



**Bond lengths**



**Bond angles**



**Torsions**



**Rings**

**Ligand NAD D 701**



Bond lengths

Bond angles

Torsions

Rings
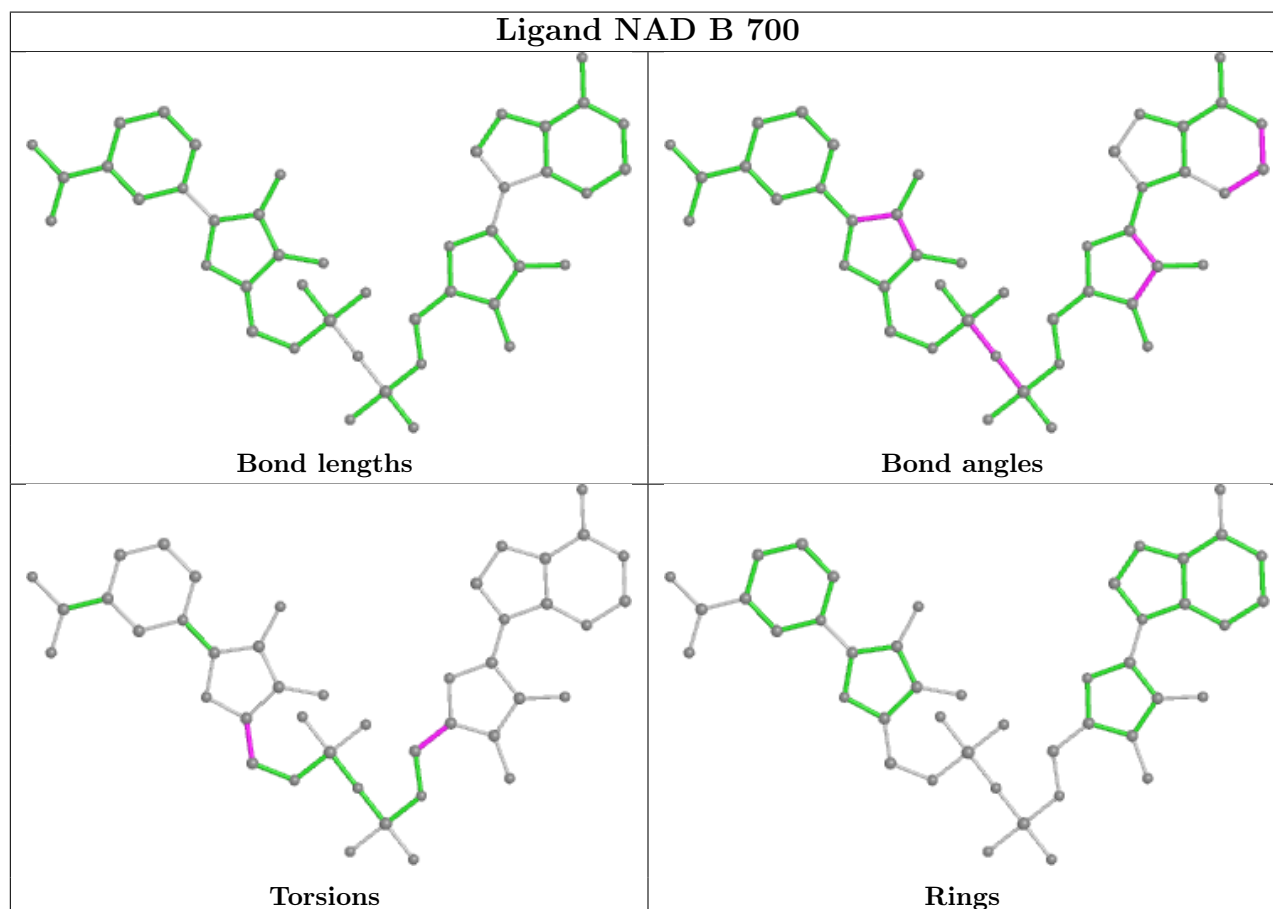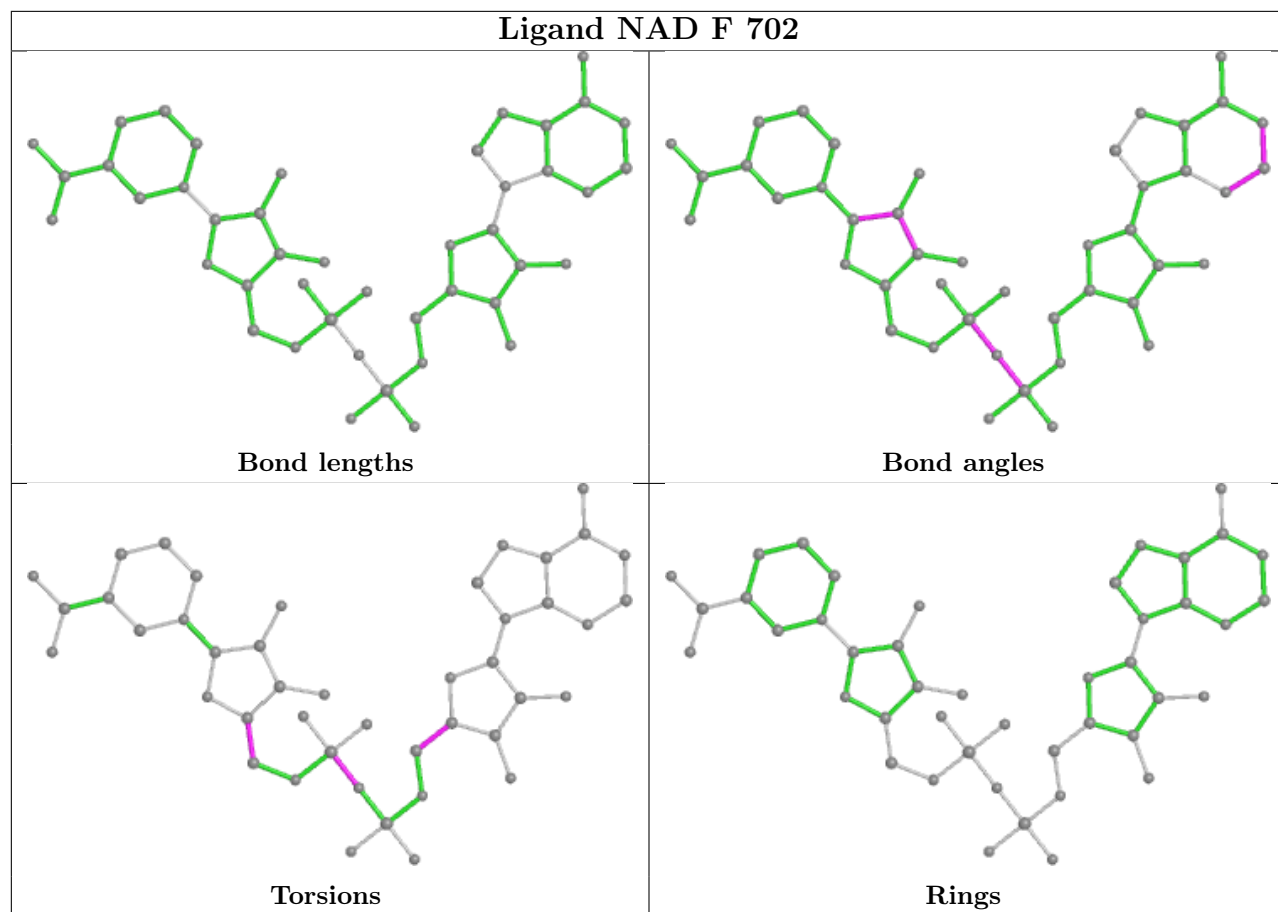
## 5.7 Other polymers ⓘ

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 ⓘ

In the following table, the column labelled '#RSRZ> 2' contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, $95^{th}$ percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled 'Q< 0.9' lists the number of (and percentage) of residues with an average occupancy less than 0.9.

| Mol | Chain | Analysed | <RSRZ> | #RSRZ>2 | | | OWAB(Å²) | Q<0.9 |
|-----|-------|----------|--------|---------|----|----|----------|-------|
| 1 | A | 822/842 (97%) | -0.34 | 16 (1%) | 66 | 37 | 18, 85, 143, 217 | 0 |
| 1 | C | 822/842 (97%) | -0.11 | 39 (4%) | 31 | 11 | 20, 92, 182, 240 | 0 |
| 1 | E | 822/842 (97%) | 0.44 | 106 (12%) | 3 | 1 | 20, 154, 219, 298 | 0 |
| 2 | B | 207/207 (100%) | -0.73 | 1 (0%) | 91 | 75 | 15, 37, 76, 118 | 0 |
| 2 | D | 207/207 (100%) | -0.78 | 0 | 100 | 100 | 17, 34, 75, 113 | 0 |
| 2 | F | 207/207 (100%) | -0.73 | 0 | 100 | 100 | 19, 41, 81, 123 | 0 |
| All | All | 3087/3147 (98%) | -0.15 | 162 (5%) | 27 | 10 | 15, 85, 196, 298 | 0 |

The worst 5 of 162 RSRZ outliers are listed below:

| Mol | Chain | Res | Type | RSRZ |
|-----|-------|-----|------|------|
| 1 | C | 29 | ASP | 7.6 |
| 1 | E | 739 | ALA | 6.4 |
| 1 | C | 313 | ASP | 6.0 |
| 1 | A | 29 | ASP | 5.2 |
| 1 | E | 759 | GLN | 5.2 |

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

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, $95^{th}$ percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

| Mol | Type | Chain | Res | Atoms | RSCC | RSR | B-factors(Å²) | Q<0.9 |
|-----|------|-------|-----|-------|------|-----|---------------|-------|
| 1 | DDE | C | 699 | 20/21 | 0.89 | 0.29 | 31,88,128,128 | 0 |
| 1 | DDE | A | 699 | 10/21 | 0.92 | 0.14 | 59,75,77,80 | 0 |
| 1 | DDE | E | 699 | 10/21 | 0.96 | 0.13 | 36,51,77,82 | 0 |

## 6.3　Carbohydrates ⓘ
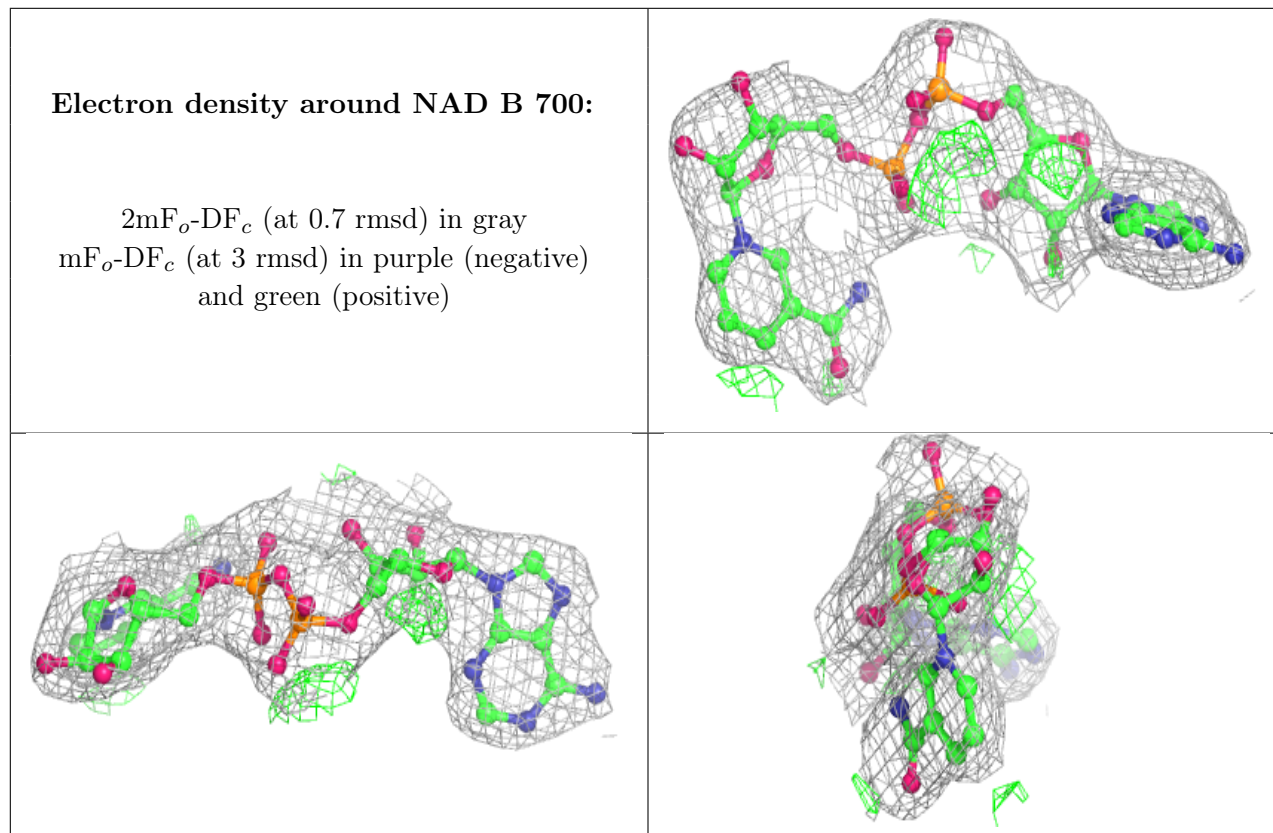
There are no monosaccharides in this entry.

## 6.4　Ligands ⓘ

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, $95^{th}$ percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

| Mol | Type | Chain | Res | Atoms | RSCC | RSR | B-factors($\text{Å}^2$) | Q<0.9 |
|-----|------|-------|-----|-------|------|-----|-------------------------|-------|
| 3 | NAD | B | 700 | 44/44 | 0.97 | 0.12 | 24,42,55,66 | 0 |
| 3 | NAD | D | 701 | 44/44 | 0.97 | 0.13 | 20,43,55,69 | 0 |
| 3 | NAD | F | 702 | 44/44 | 0.97 | 0.13 | 23,49,59,71 | 0 |

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.
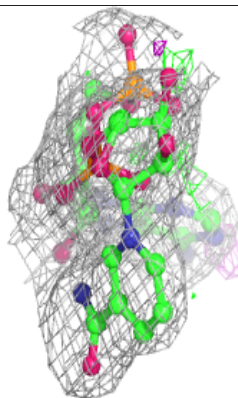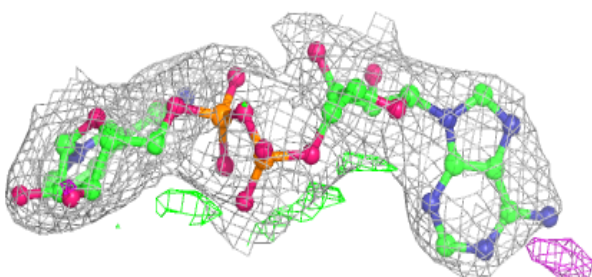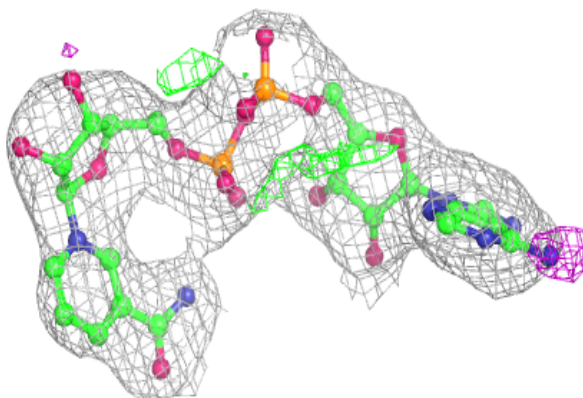
**Electron density around NAD B 700:**

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative) and green (positive)

**Electron density around NAD D 701:**

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)
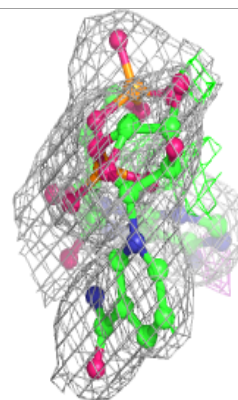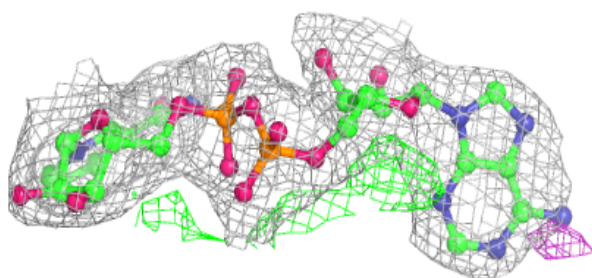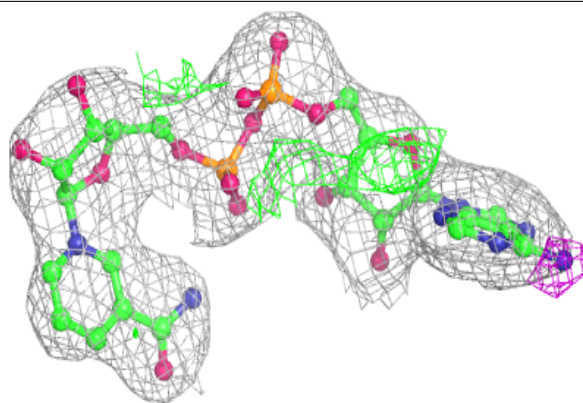


**Electron density around NAD F 702:**

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)

## 6.5 Other polymers ⓘ

There are no such residues in this entry.