

Review of the GNDS Schema Build System

WPEC EG-GNDS meeting




















Caleb M. Mattoon (LLNL)
David A. Brown (BNL)
Godfree Gert* (LLNL)

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Specification Build System

FOLDERS

- ▼  gndsFormat
 - ▶  Conventions
 - ▶  DataContainers
 - ▶  Documentation
 - ▶  grokGNDS
 - ▶  PoPs
 - ▶  Styles
 - ▶  TopLevel
-  bibliography.bib
-  bibliography.tex
-  GNDDesignPhilosophy.md
-  GNDXMLStyleGuide.md
-  index_style.ist
-  intro.tex
-  /* Makefile
-  preamble.tex
-  README.md
-  specifications.tex
-  TODO.txt

1. JSON specification
 - Originally from XSD and GNDS Examples
2. Convert JSON to TEX
 - Specification text
 - Examples
3. Convert TEX to PDF
 - Static
 - Dynamic

Evolution of the JSON files




















- Formal definition of GNDS schema
 - Version 1.9 in XSD
 - Continuing evolution and updates based on JSON
- XSD generated manually
 - Primarily used in Fudge
 - More permissive
- Generation of JSON
 - Python utility from XSD and examples of GNDS files
 - Continuing manual updates

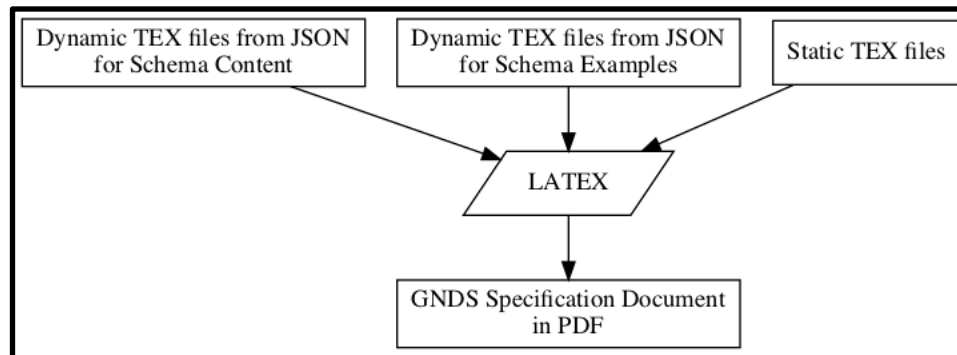
JSON file Topical Area Hierarchy

```
-DataContainers/summary_basic.json -- basic data types (double, i
-DataContainers/summary_gpdc.json -- general purpose data contain
-Documentation/summary_documentation.json -- documentation for do
-PoPs/summary_pops.json -- properties of particles
-TopLevel/summary_appData.json -- application data (currently hol
-TopLevel/summary_atomic.json -- data specific for photo-atomic a
-TopLevel/summary_common.json -- common data formats shared by ma
-TopLevel/summary_covariance.json -- covariance and uncertainty d
-TopLevel/summary_cpTransport.json -- data specific for charged-p
-TopLevel/summary_fissionTransport.json -- data specific for fiss
-TopLevel/summary_fpy.json -- fission product yield data
-TopLevel/summary_processed.json -- additions needed for support
-TopLevel/summary_resonance.json -- data specific for resonance d
-TopLevel/summary_transport.json -- general transport data suppor
-TopLevel/summary_tsl.json -- GNDS-1.9 implementation of thermal
-TopLevel/summary_tslNext.json -- planned implementation of therm
```

JSON to PDF

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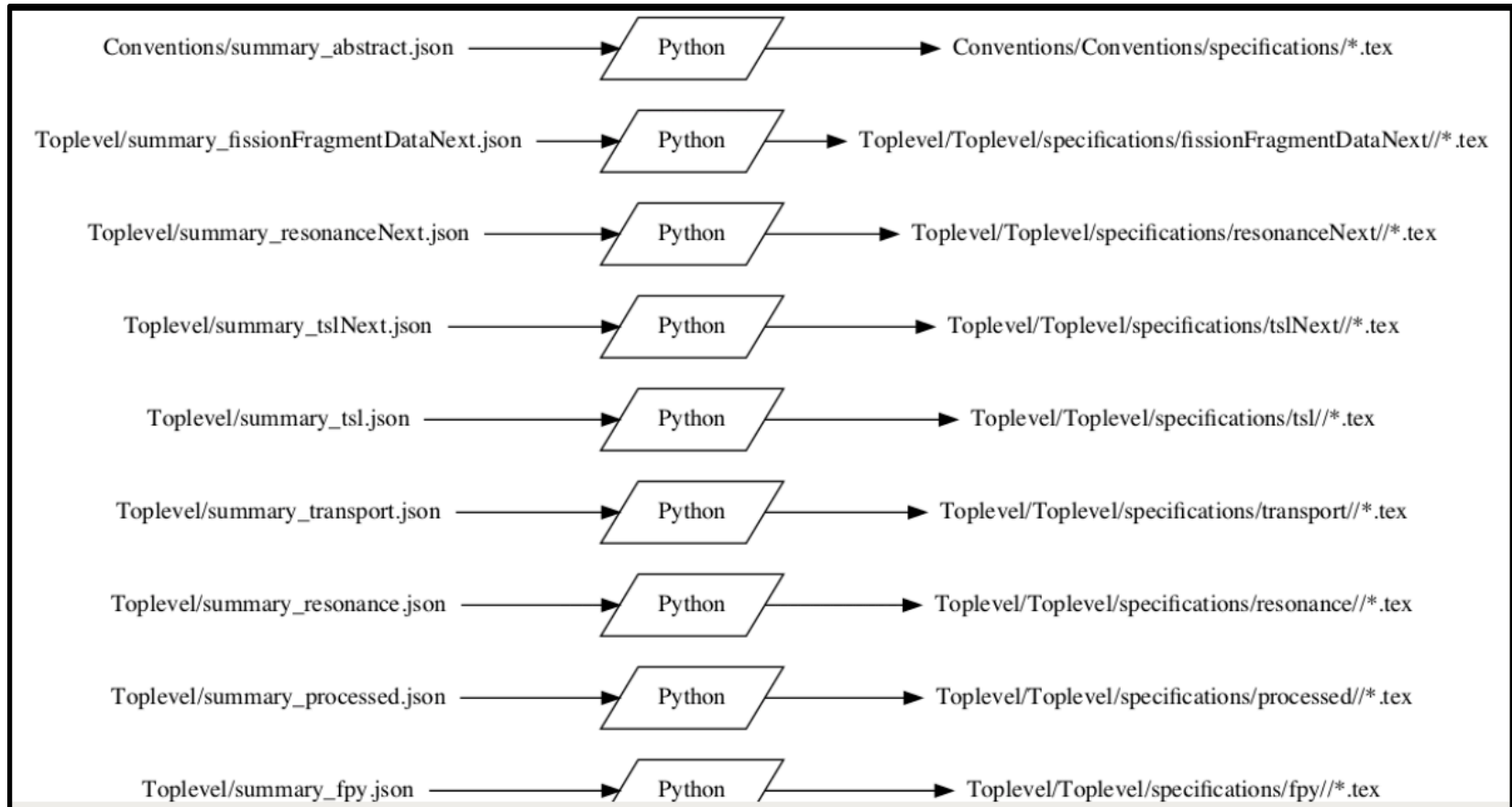
Specifications for GNDS-1.9

WPEC Subgroup-38 Final Report part II:
Specifications for a new database structure

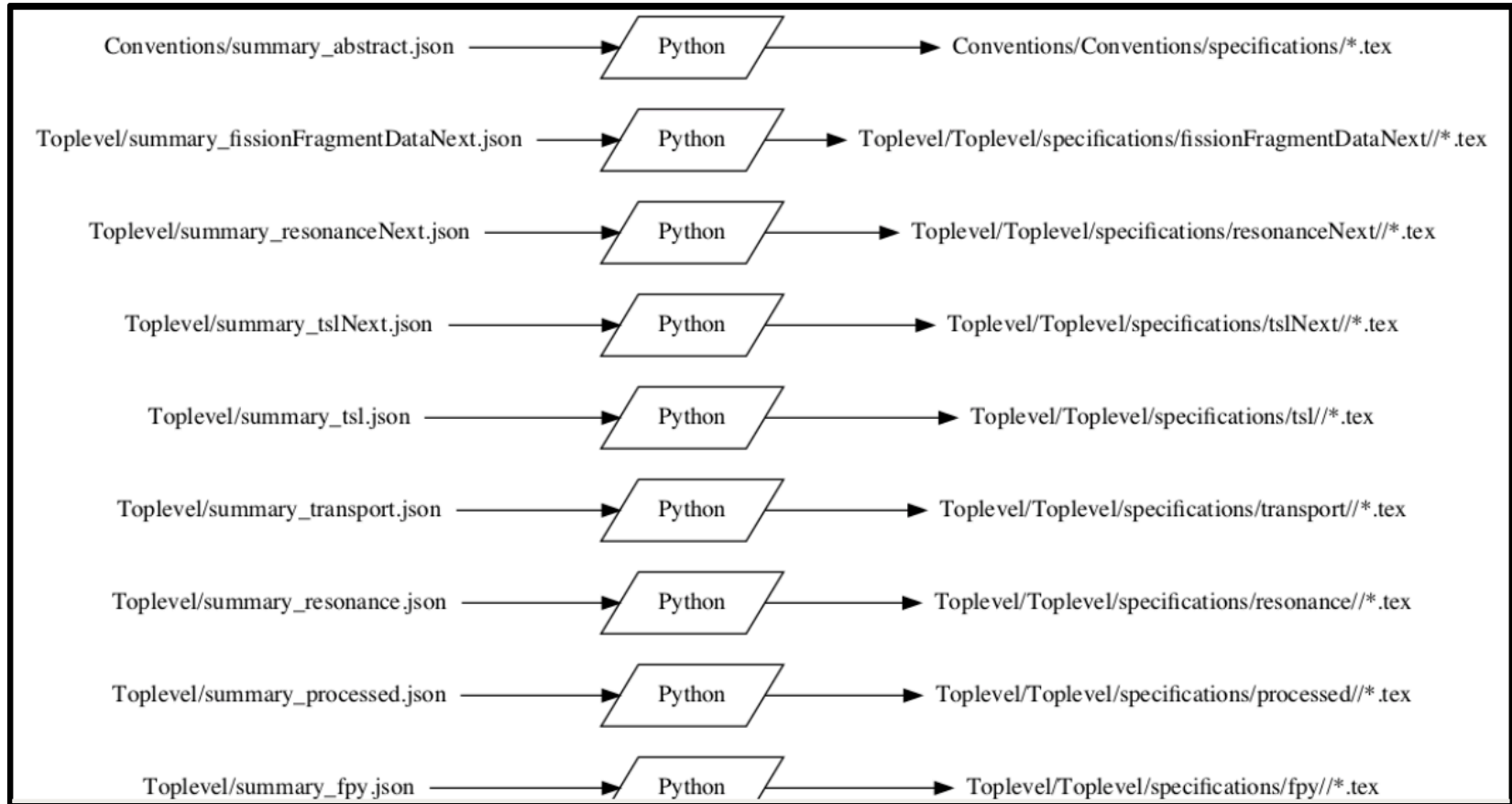
WPEC Subgroup 38

October 4, 2019

Dynamic TEX: Specification text



Dynamic TEX: Examples

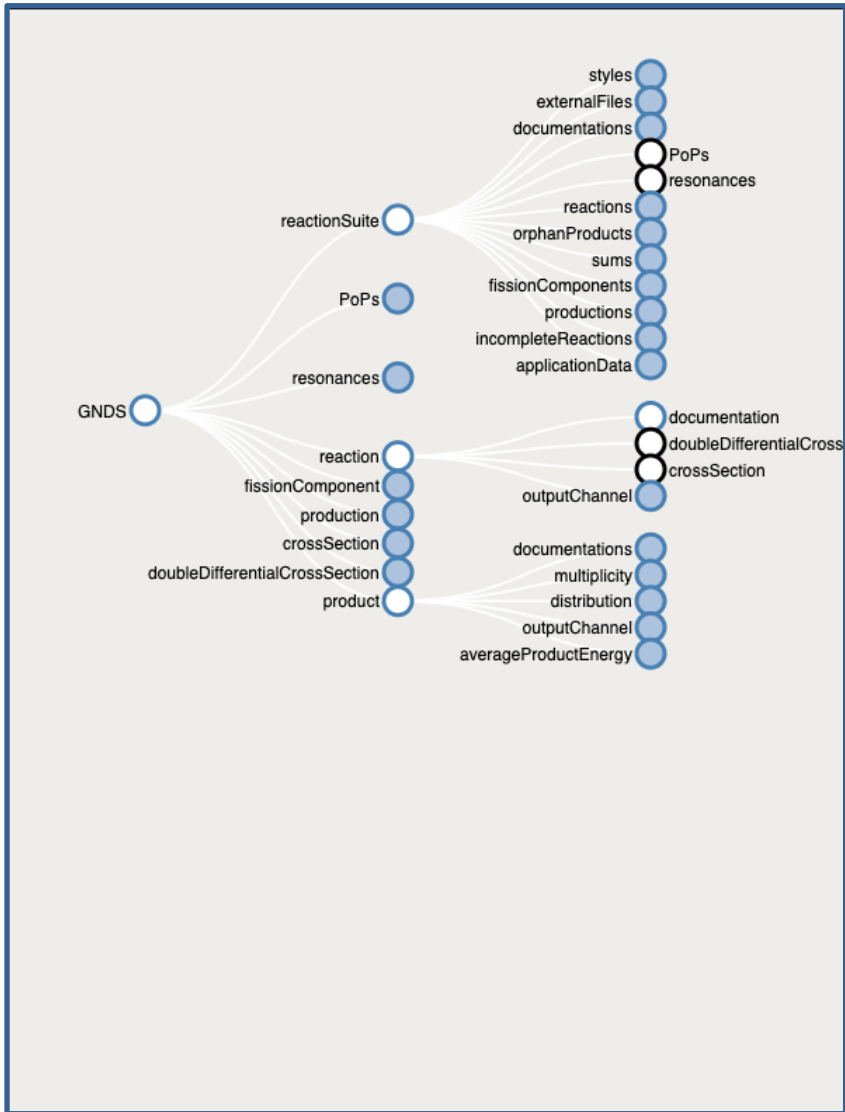


Proposed Improvements

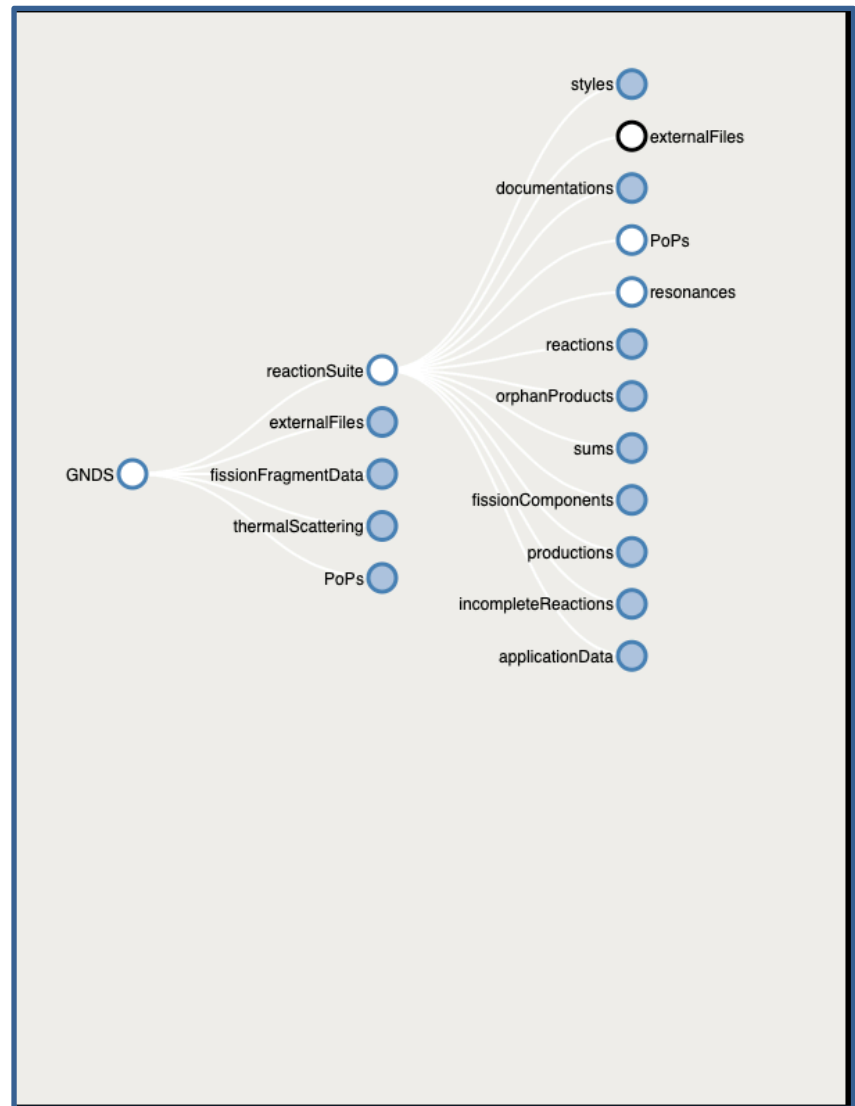
- Visualization Tool
 - Complement to Schema Report
 - Sourced from either XSD or JSON
 - Compare XSD to JSON
 - Remove inconsistencies
 - Translate between XSD and JSON
- General Updates
 - Reduce Complexity
 - Compliment dynamic examples with static ones

Interactive Visualization Tool

- Output format
 - Standalone HTML/JavaScript
- Generation
 - New Python utility
 1. XSD/JSON to internal Python hierarchical representation
 2. Python internal representation to HTML



From XSD



From JSON

General Updates

- Expand use of `__namespace__`
 - Resolve incorrect links:
 - `reactionSuite/reactions/reaction/outputChannel/products/product`
- Ordering of nodes
 - Should it be imposed?
- Static TEX files for examples in GNDS report
 - Complement existing dynamic examples from JSON
- Official JSON schema specification
 - Latest draft: September 2019
 - <https://json-schema.org>

reactionSuite/reactions/reaction/outputChannel/products/product

```
summary_transport.json x
1 {
2   "__namespace__": "transport",
3   "reactionSuite": {
139 },
140 "reactions": {
163 },
164 "reaction": {
165   "__class__": "nodes.Node",
166   "abstractNode": null,
167   "attributes": {
194 },
195   "bodyText": null,
196   "childNodes": {
197     "doubleDifferentialCrossSection": {
203 },
204     "crossSection": {
210 },
211     "outputChannel": {
217 }
218 },
219 },
252 },
253 "outputChannel": {
254   "__class__": "nodes.Node",
255   "abstractNode": null,
256   "attributes": {
273 },
274   "bodyText": null,
275   "childNodes": {
276     "Q": {
277       "__class__": "nodes.ChildNode",
278       "description": "The $Q$-value of the reaction. Fission reactions have a different format than other reactions.",
279       "name": "Q",
280       "occurrence": "1",
281       "required": false
282     },
283     "products": {
284       "__class__": "nodes.ChildNode",
285       "description": "A list of secondary products from the reaction",
286       "name": "products",
287       "occurrence": "1",
288       "required": false
289     }
290   }
},
```

reactionSuite/reactions/reaction/outputChannel/products/product/...?

```
summary_common.json x summary_pops.json x
1 {
2   "__namespace__": "common",
3   "Q": {
4     "product": {
5       "__class__": "nodes.Node",
6       "abstractNode": null,
7       "attributes": {
8         "multiplicity": {
9           "description": "One or more \\element{product} child e",
10          "name": "product",
11          "occurrence": "1+",
12          "required": false
13        },
14        "distribution": {
15          "description": "There are three `types` of product lists:\n",
16          "name": "products",
17          "required": false,
18          "rootNode": false
19        },
20        "outputChannel": {
21          "description": "A product is a particle that is the result of",
22          "name": "product",
23          "required": false,
24          "rootNode": false
25        }
26      },
27       "bodyText": null,
28       "childNodes": {
29         "product": {
30           "__class__": "nodes.ChildNode",
31           "description": "Single decay product.",
32           "name": "product",
33           "occurrence": "1+",
34           "required": true
35         }
36       }
37     },
38     "products": {
39       "__class__": "nodes.Node",
40       "abstractNode": null,
41       "attributes": {
42         "spectra": {
43           "description": "List of decay products.",
44           "name": "products",
45           "required": false,
46           "rootNode": false
47         },
48         "product": {
49           "__class__": "nodes.Node",
50           "abstractNode": null,
51           "attributes": {
52             "continuum": {
53               "description": "Single decay product.",
54               "name": "product",
55               "required": false,
56               "rootNode": false
57             },
58             "discrete": {
59               "description": "Single decay product.",
60               "name": "product",
61               "required": false,
62               "rootNode": false
63             }
64           },
65           "bodyText": null,
66           "childNodes": {
67             "product": {
68               "__class__": "nodes.ChildNode",
69               "description": "Single decay product.",
70               "name": "product",
71               "occurrence": "1+",
72               "required": true
73             }
74           }
75         }
76       }
77     }
78   }
79 }
100
101
102
103
104
105
106
107
108
109
110
111
112
113
114
```

Incorrect product in current GNDS report

- fullReport.pdf
 - Introduction
 - ▶ Conventions
 - ▶ I STANDARD DATA TYPES
 - ▶ II DATA STYLES
 - ▶ III PARTICLE PROPERTIES
 - ▼ IV REACTION DATA
 - ▶ Introduction
 - ▶ The main reaction hierarchy
 - ▶ Collecting together information from one reaction
 - ▶ Cross sections
 - ▼ Reaction outputs
 - ▼ The outputChannel element
 - outputChannel
 - Q
 - products
 - ▼ A product (of a reaction or decay)
 - product**
 - ▶ Multiplicities
 - ▶ Average product data
 - ▶ Product distributions
 - ▶ Resonance data
 - ▶ Thermal neutron scattering
 - ▶ Other fission transport data
 - ▶ Fission product yields
 - ▶ Charged particle transport data
 - ▶ Atomic reaction data
 - ▶ Covariance Data
 - ▶ Application-specific data
 - Index of formats
 - Bibliography

17.2 A product (of a reaction or decay)

Reaction products (and decay / breakup products) are stored in the GNDS **product** node. Each product has a **multiplicity** and **distribution**, and may also contain information about the average product energy / momentum (commonly contained in processed files).

17.2.1 product

A product is a particle that is the result of a reaction or decay. More than one particle of the same type can be released in a single reaction (e.g., (n, 2n)). A multiplicity (how many are produced) must be defined for each product. A distribution describing the outgoing energy and angle of the product is also required, although it may have a value of "unspecified".

Specifications for product

Node name: product

Attributes: The list of additional allowed attributes is:

- label** [**XMLName**, **required**] Product label. Must be unique within the list of **products**
- pid** [**XMLName**, **required**] Particle id, must correspond to the id of a particle in the particle database.
- decayRate** [**physicalQuantity**, optional] For delayed particle emission (say delayed fission neutrons), this is the decay rate in units of 1/time
- emissionMode** [**XMLName**, optional] For delayed particle emission (sa delayed fission neutrons), each product should have its one emissionMode designator

Child nodes: The list of additional allowed child nodes is:

- multiplicity**: [**required**, must appear one time] Component containing the multiplicity of the product.
- distribution**: [**required**, must appear one time] Component containing the energy/angle distribution of the product.
- outputChannel**: [optional, must appear one time] Used if the product breaks up into fragments (e.g., "Be8 -> He4 + He4")

Expanding “__namespace__”

```
summary_transport.json — sandbox/.../TopLevel x
1 {
2   "__namespace__": "transport",
3   "reactionSuite": {
139 },
140 "reactions": {
163 },
164 "reaction": {
223 },
224 "sums": {
252 },
253 "outputChannel": {
254   "__class__": "nodes.Node",
255   "abstractNode": null,
256   "attributes": {
273 },
274   "bodyText": null,
275   "childNodes": {
276     "Q": {
277       "__class__": "nodes.ChildNode",
278       "description": "The $Q$-value of the reaction. Fission reactions have
279       "name": "Q",
280       "occurrence": "1",
281       "required": false
282     },
283     "products": {
284       "__class__": "nodes.ChildNode",
285       "description": "A list of secondary products from the reaction",
286       "name": "products",
287       "occurrence": "1",
288       "required": false
289     }
290   },
291   "description": "The \\element{outputChannel} node contains all the data for t
292   "name": "outputChannel",
293   "required": false,
294   "rootNode": false
295 },
296 "crossSections": {
314 },
315 "crossSection": {
383 },
384 "resonancesWithBackground": {
427 },
428 "resonancesLink": {
429   "class": "nodes.Node",
summary_transport.json — projects/.../TopLevel x
1 {
2   "__namespace__": "transport",
3   "reactionSuite": {
144 },
145 "reactions": {
168 },
169 "reaction": {
236 },
237 "sums": {
265 },
266 "outputChannel": {
267   "__class__": "nodes.Node",
268   "abstractNode": null,
269   "attributes": {
286 },
287   "bodyText": null,
288   "childNodes": {
289     "Q": {
290       "__class__": "nodes.ChildNode",
291       "__namespace__": "common",
292       "description": "The $Q$-value of the reaction. Fission reactions have a
293       "name": "Q",
294       "occurrence": "1",
295       "required": false
296     },
297     "products": {
298       "__class__": "nodes.ChildNode",
299       "__namespace__": "common",
300       "description": "A list of secondary products from the reaction",
301       "name": "products",
302       "occurrence": "1",
303       "required": false
304     }
305   },
306   "description": "The \\element{outputChannel} node contains all the data for the
307   "name": "outputChannel",
308   "required": false,
309   "rootNode": false
310 },
311 "crossSections": {
329 },
330 "crossSection": {
398 },
399 "resonancesWithBackground": {
400   "class": "nodes.Node",
```

Before Expansion

After Expansion

Questions / Comments !!!





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