

# WPEC SG44: *Investigation of covariance data in general purpose nuclear data libraries*

Vladimir Sobes

*US National Nuclear Data Week 2017  
November 6–9, 2017*



# Working Party on International Nuclear Data Evaluation Cooperation (WPEC)

#	Subgroup Name	Coordinators
39	Methods and approaches to provide feedback from nuclear and covariance data adjustment for improvement of nuclear data files	G. Palmiotti M. Salvatores
40	Collaborative International Evaluated Library Organization (CIELO) Pilot Project	M. Chadwick
41	Improving nuclear data accuracy of Am-241 and Np-237 capture cross-sections	H. Harada
42	Thermal scattering kernel $S(\alpha,\beta)$ : measurement, evaluation and application	G. Noguere
43	Code infrastructure to support a modern General Nuclear Database (GND) structure	F. Malvagi
44	Investigation of covariance data in general purpose nuclear data libraries	V. Sobes C. de Saint Jean
45	Validation of Nuclear Data Libraries (VaNDaL) Project	M. White D. Bernard
46	Efficient and effective use of integral experiments for nuclear data validation	M. Salvatores G. Palmiotti

# Subgroup participants (1/2)

- **Subgroup coordinators**

- Vladimir Sobes, ORNL, USA, (ENDF)
- Cyrille de Saint Jean, CEA, France, (JEFF)

- **ENDF**

- **Oak Ridge National Laboratory (ORNL):** Guber, Rearden, Sobes, Wiarda, Williams
- **Los Alamos National Laboratory (LANL):** Chadwick, Haeck, Neudecker, Talou, White
- **Lawrence Livermore National Laboratory(LLNL) :** Beck, Jugenson, Mattoon
- **Brookhaven National Laboratory (BNL):** Brown, Herman
- **National Nuclear Laboratory (NNL):** Barry, Holmes
- **Rensselaer Polytechnic Institute (RPI):** Danon
- **Spectra Tech Inc.:** Dunn
- **INL:** Palmiotti
- **CNL:** Roubtsov
- **ANL (retired):** Smith

# Subgroup participants (2/2)

- **JEFF**

- **CEA:** Archier, Bauge, Noguere, de Saint Jean, Tamagno
- **IRSN:** Ichou, Ivanov, Leal
- **PSI:** Hursin, Rochman
- **NEA:** Ivanova, Michel-Sendis
- **CNRS:** Kessedjian
- **KAERI:** Kim
- **JSI:** Kodeli
- **TU Wien:** Leeb
- **NNL:** Mills
- **CIEMAT:** Romojaro
- **Consultant:** Salvatores
- **JRC:** Schillebeeckx
- **UPM:** Cabellos

- **JENDL:** Iwamoto, Yokoyama, Chiba

- **BROND:** Ignatyuk, Rozhikhin, Koscheev

- **CENDL:** X. Ruirui, Z. Ge

- **TENDL:** Sjöstrand

- **IAEA-NDS:** Capote, Trkov



# Major contributions

1. Establish quality criteria in the nuclear data evaluation community through a best practices document, including:
  - a. Establishing guidance on the quality/fidelity of documentation of new covariance evaluations
  - b. Commenting on the place of integral experiments in general purpose nuclear data libraries. Collaboration with SG46.
2. Consider new types of data for covariance:
  - a. Secondary distributions, angular distributions,  $S(a,b)$ , prompt fission neutron spectra, collaboration with SG42
  - b. Correlations, energy, reaction, data type, isotopes
3. Take opportunity to redefine the covariance format working with GNDS. Collaboration with SG43 and EG-GNDS.

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# Deliverables

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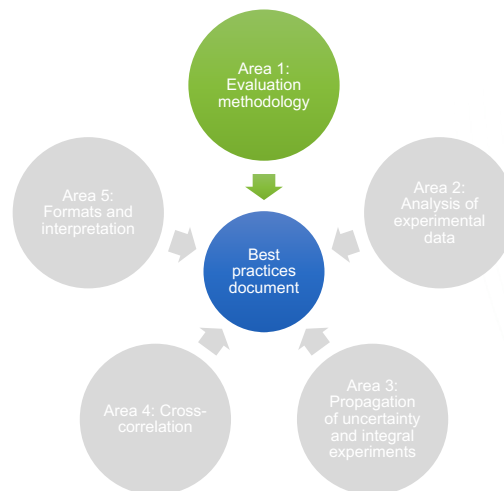
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# 5 subject areas for SG44



# Area 1: Evaluation techniques

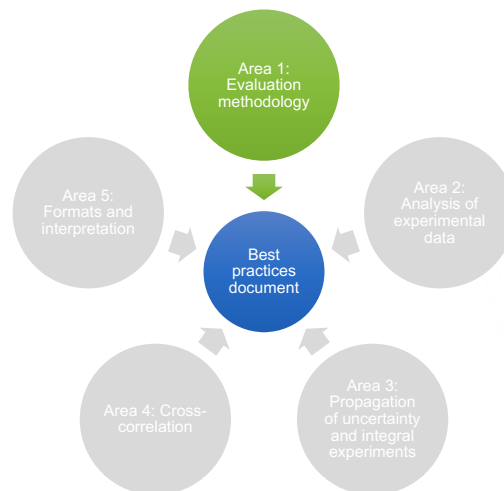
1. Model defects: phenomenological models can be poor but with very low evaluated uncertainties
2. Model biases: inference of biases from advanced models
3. Treatment and representation of uncertainties in the unresolved resonance region where self-shielding is important for reactors





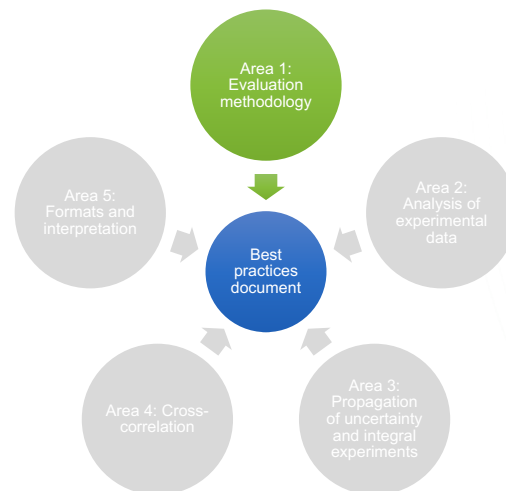
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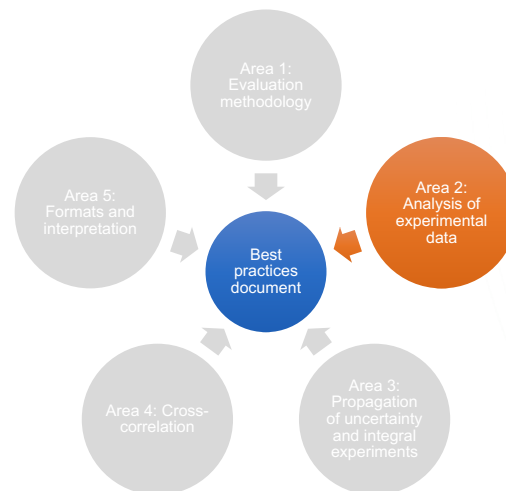
# Area 2: Analysis of experimental data

## 1. Sources of experimental uncertainty

1. Catalog
2. Publication requirements (not only numbers)
3. Recommendations for EXFOR database
4. Algorithms/methods

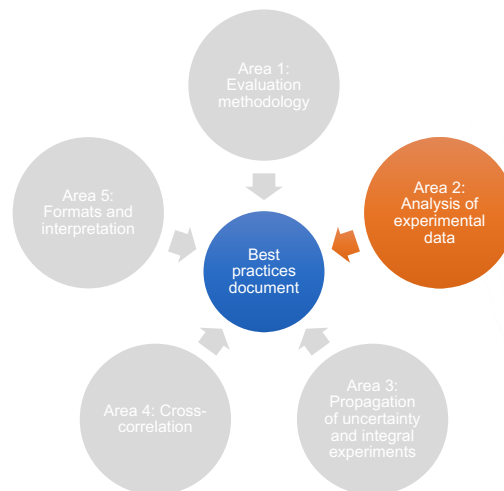
## 2. Commenting on autonomous/automatic methods

## 3. Commenting on handling of discrepant data sets



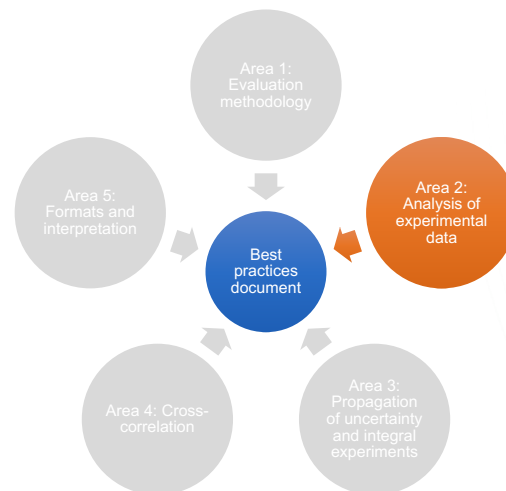
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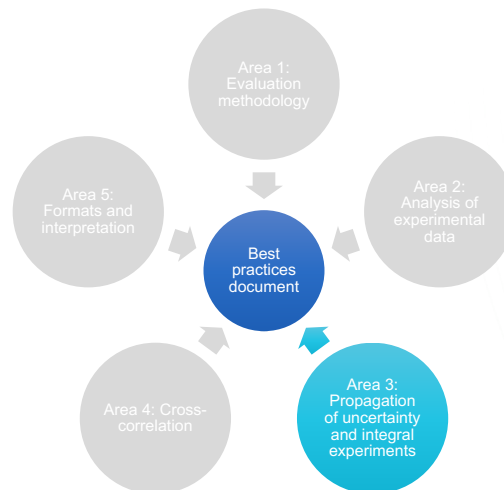
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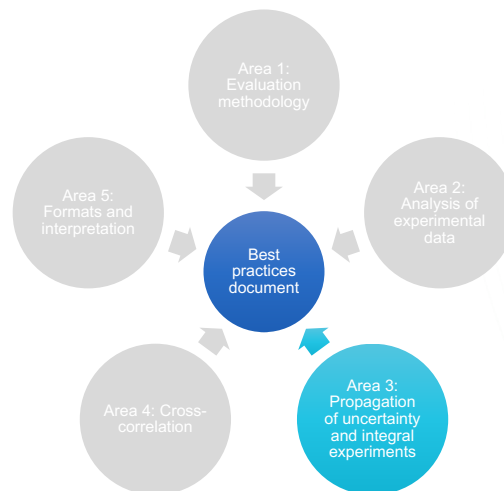
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2. Other probability distributions for nuclear data uncertainty: joint effort with Area 2 and Area 4
  1. Document
  2. Format
3. Testing of covariance data: joint effort with Area 5



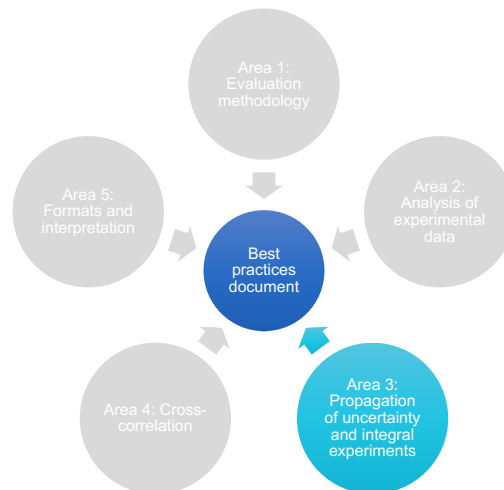
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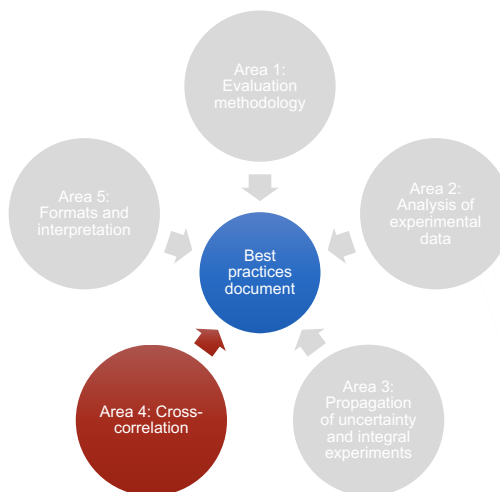
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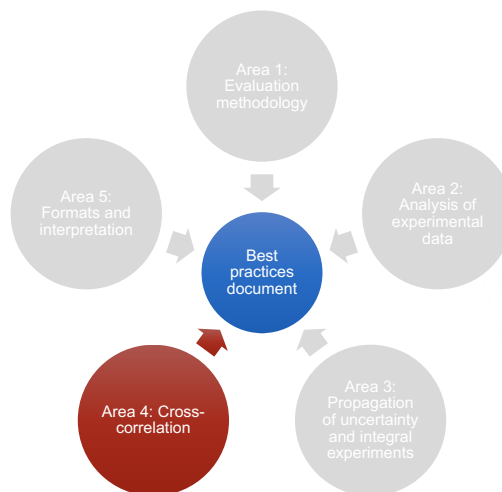
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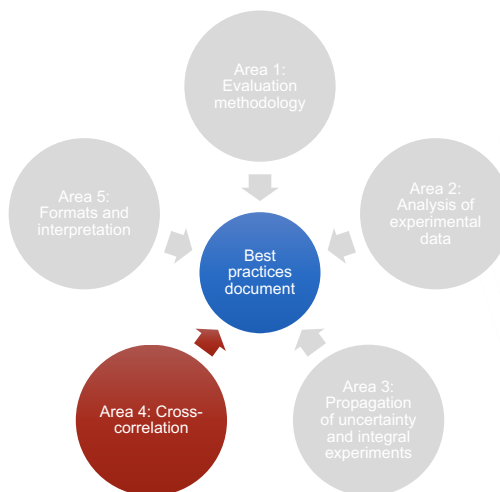
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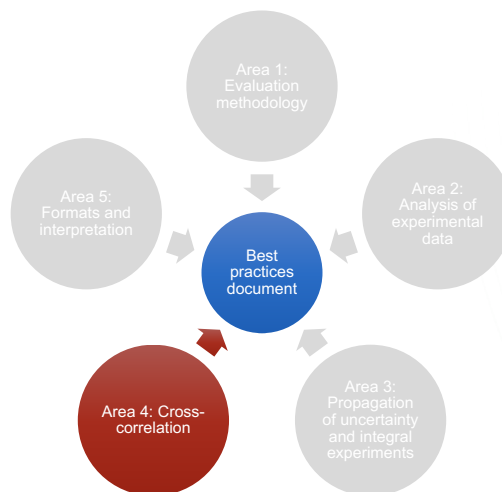
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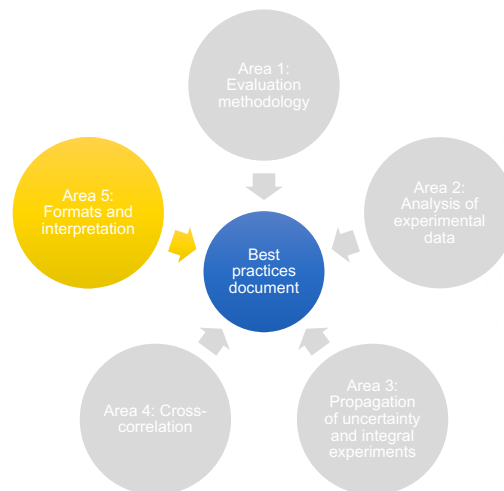
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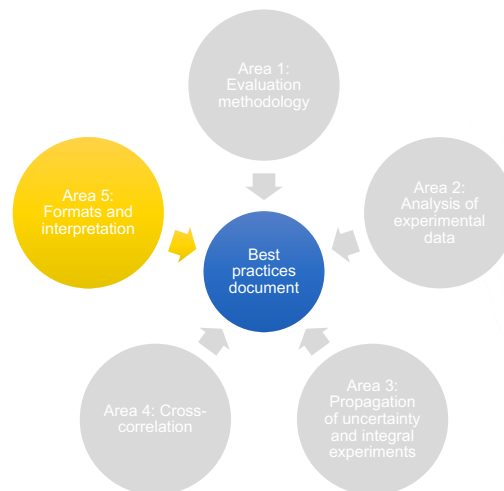
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1. Documentation of covariance evaluation technique
  1. Clear interpretation by evaluator
  2. Model parameters and code
  3. Reporting known unknowns vs estimating unknown unknowns
  4. Clear interpretation by user
2. Verification: positive definite, robust, stable to numerical errors. How to deal with negative eigenvalues?
3. Multigroup cross section covariance group and weighting assumptions



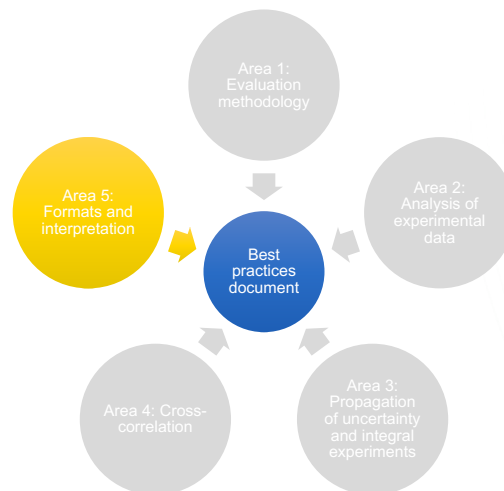
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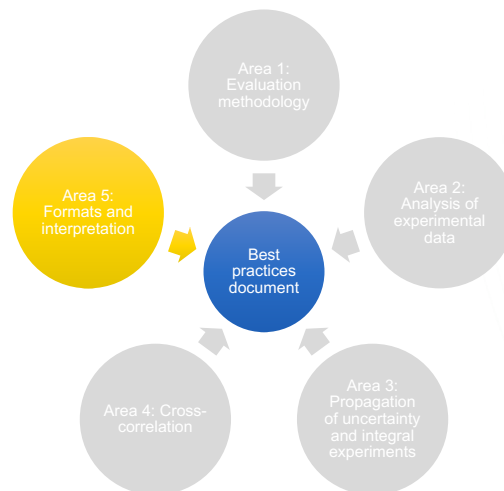
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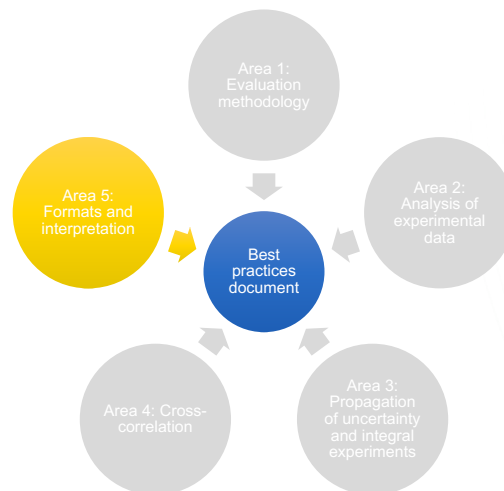
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1. Cross-correlations
2. Prompt fission neutron spectra (PFNS) correlations to cross section
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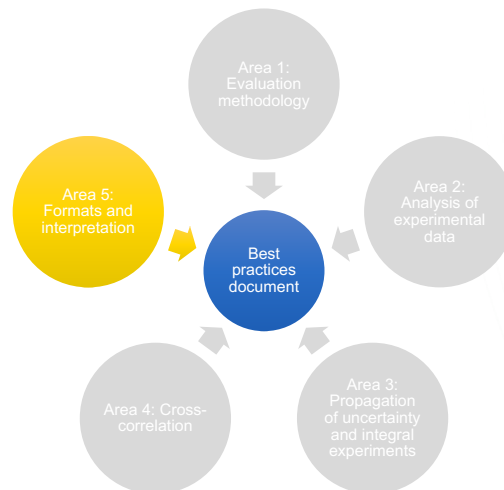
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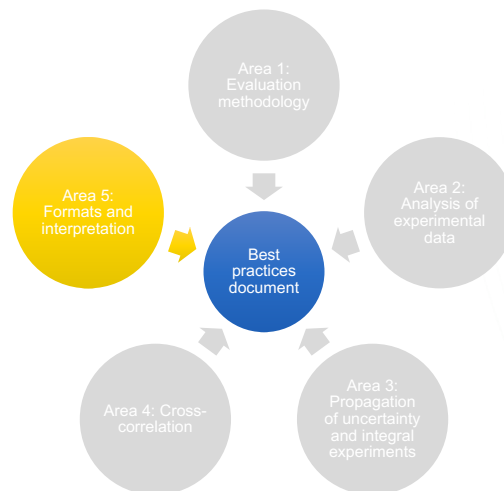
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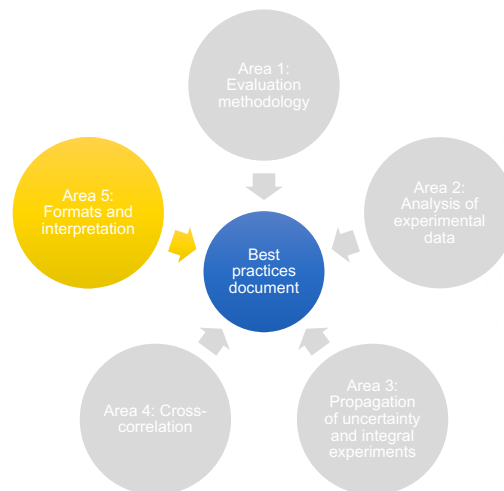
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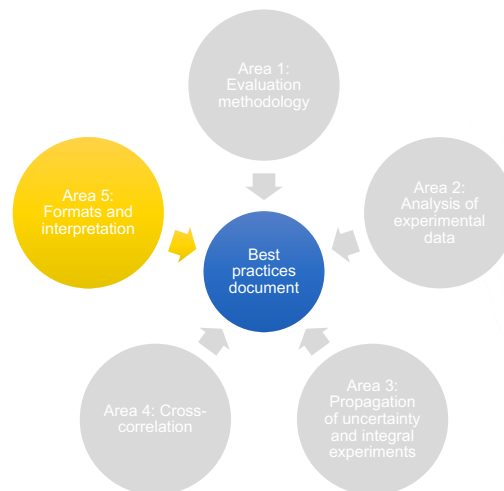
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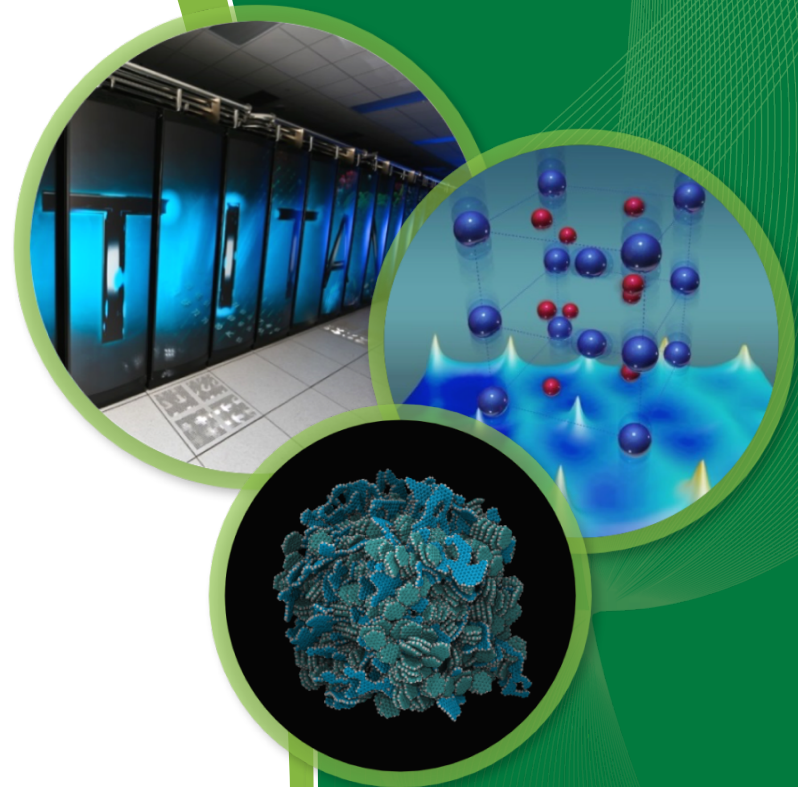


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Backup Slides

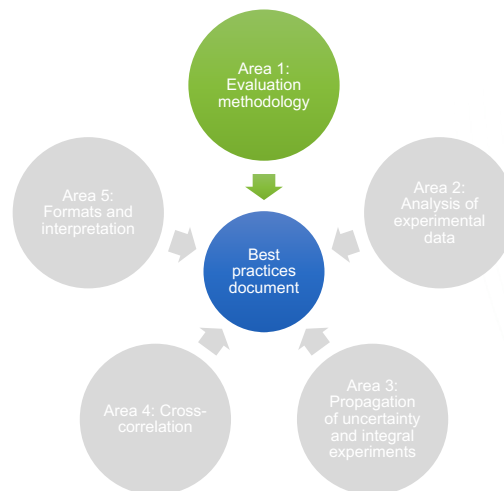
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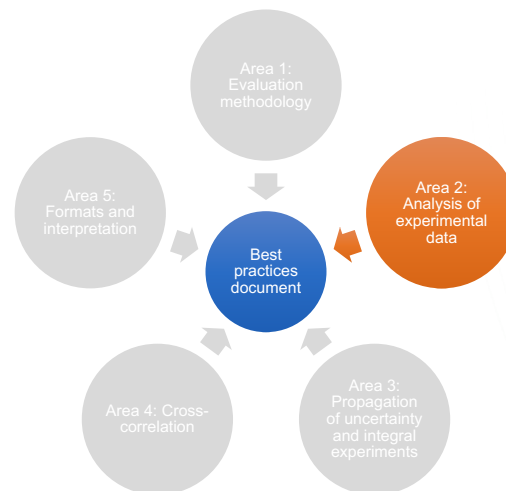
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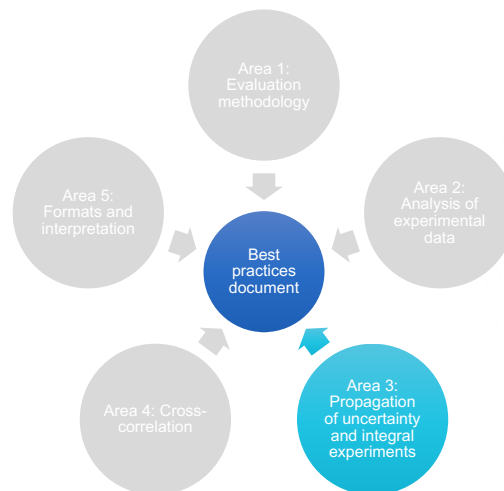
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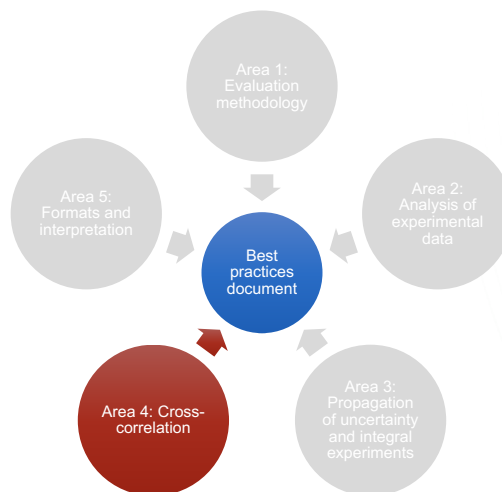
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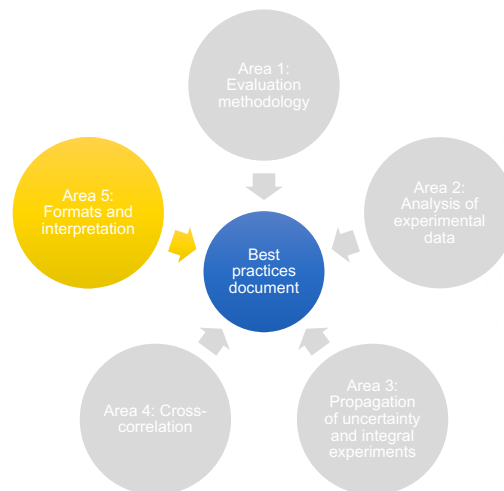
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