

Professor Peter Skands  
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## Research interests

Theoretical High Energy Physics  
Particle Physics Phenomenology  
Collider Physics  
Quantum Chromodynamics  
Computer Physics, Monte Carlo Event Generators  
Collaborations: PYTHIA, VINCIA, LHC@home/Test4Theory

## Qualifications

Theoretical Physics, PhD, Phenomenological Studies of Supersymmetry and the Strong Force, Lunds Universitet (Lund University)  
1 Sept 2001 → 14 Oct 2004  
Award Date: 14 Oct 2004  
Physics, Candidatus Scientiarum (5-year Masters degree), L-Violating Supersymmetry: Implementation in PYTHIA and Study of LHC Discovery Potential  
2000 → 2001  
Award Date: 6 Aug 2001

## Employment

### Professor

School of Physics and Astronomy  
MONASH UNIVERSITY  
1 Oct 2018 → present

### Staff Scientist (LD)

CERN - Conseil Européen pour la Recherche Nucléaire (European Organization for Nuclear Research)  
Geneva, Switzerland  
1 Oct 2009 → 30 Sept 2014

### Associate Scientist (tenure-track)

Fermi National Accelerator Laboratory  
Batavia, United States of America  
15 Mar 2007 → 30 Sept 2009

### Research Associate (post doc)

Fermi National Accelerator Laboratory  
Batavia, United States of America  
1 Nov 2004 → 14 Mar 2007

## Awards

### Beautiful strings

Skands, P., Egede, U. & Kreps, M.

Australian Research Council (ARC): A\$573,917.00, Monash University – Internal School Contribution: A\$233,197.00  
1/06/23 → 31/05/26

## Research output

### Impact of QCD uncertainties on antiproton spectra from dark-matter annihilation

Jueid, A., Kip, J., Ruiz De Austri, R. & Skands, P., 28 Apr 2023, In: *Journal of Cosmology and Astroparticle Physics*. 2023, 4, 14 p., 068.

### Computational scientists should consider climate impacts and grant agencies should reward them

Skands, P., Mar 2023, In: *Nature Reviews Physics*. 5, 3, p. 137-138 2 p.

### A standard convention for particle-level Monte Carlo event-variation weights

Bothmann, E. (ed.), Buckley, A. (ed.), Gütschow, C. (ed.), Prestel, S. (ed.), Schönherr, M. (ed.), Skands, P. (ed.), Andersen, J. R., Bhattacharya, S., Butterworth, J., Chahal, G. S., Corpe, L., Gellersen, L., Gignac, M., Höche, S., Kar, D., Krauss, F., Kretzschmar, J., Lönnblad, L., McFayden, J., Papaefstathiou, A., & 6 othersPlätzer, S., Schumann, S., Seymour, M. H., Siegert, F., Siódmok, A. & The MCnet Community, 8 Feb 2023, In: *SciPost Physics Core*. 6, 1, 11 p., 007.

### Towards NNLO+PS matching with sector showers

Campbell, J. M., Höche, S., Li, H. T., Preuss, C. T. & Skands, P., 10 Jan 2023, In: *Physics Letters B*. 836, 10 p., 137614.

### The role of multi-parton interactions in doubly-heavy hadron production

Egede, U., Hadavizadeh, T., Singla, M., Skands, P. & Vesterinen, M., 1 Sept 2022, In: *European Physical Journal C*. 82, 9, 20 p., 773.

### Review of Particle Physics

Particle Data Group, Aug 2022, In: *Progress of Theoretical and Experimental Physics*. 2022, 8, 2270 p., 083C01.

### Estimating QCD uncertainties on antiproton spectra from dark-matter annihilation

Jueid, A., Kip, J., de Austri, R. R. & Skands, P., 14 Jul 2022, *Proceedings of Science: 2021 Computational Tools for High Energy Physics and Cosmology, CompTools 2021*. Arbey, A., Belanger, G., Boussejra, A., Desai, N., Gonzalo, T., Harlander, R. & Mahmoudi, N. (eds.). Italy: Sissa Medialab, SRL, Vol. 409. 16 p. 005. (Proceedings of Science).

### Interleaved resonance decays and electroweak radiation in the Vincia parton shower

Brooks, H., Skands, P. & Verheyen, R., 22 Mar 2022, In: *SciPost Physics*. 12, 3, 39 p., 101.

### A study of QCD radiation in VBF Higgs production with VINCIA and PYTHIA

Höche, S., Mrenna, S., Payne, S., Preuss, C. T. & Skands, P., 10 Jan 2022, In: *SciPost Physics*. 12, 1, 31 p., 010.

### Particle spectra from dark matter annihilation: Physics modeling and QCD uncertainties

Amoroso, S., Caron, S., Jueid, A., de Austri, R. R. & Skands, P., 10 May 2021, *Proceedings, Tools for High Energy Physics and Cosmology (TOOLS 2020): Lyon, France, November 2-6, 2020*. Italy: Sissa Medialab, SRL, Vol. 392. 14 p. 028. (Proceedings of Science).

### Multipole photon radiation in the Vincia parton shower

Skands, P. & Verheyen, R., 10 Dec 2020, In: *Physics Letters B*. 811, 6 p., 135878.

### String fragmentation with a time-dependent tension

Hunt-Smith, N. & Skands, P., Nov 2020, In: *European Physical Journal C*. 80, 11, 13 p., 1073.

### Review of particle physics

Particle Data Group, Aug 2020, In: *Progress of Theoretical and Experimental Physics*. 2020, 8, 2093 p., 083C01.

### **Sector showers for hadron collisions**

Brooks, H., Preuss, C. T. & Skands, P., 1 Jul 2020, In: Journal of High Energy Physics. 2020, 7, 58 p., 32.

### **Fragmentation of two repelling lund strings**

Duncan, C. B. & Skands, P., May 2020, In: SciPost Physics. 8, 5, 28 p., 080.

### **Coherent Showers in Decays of Coloured Resonances**

Brooks, H. M. & Skands, P., 11 Oct 2019, In: Physical Review D. 100, 7, 24 p., 076006.

### **FCC-hh: The Hadron Collider: Future Circular Collider Conceptual Design Report Volume 3**

the FCC Collaboration, 1 Jul 2019, In: European Physical Journal Special Topics. 228, 4, p. 755-1107 353 p.

### **HE-LHC: The High-Energy Large Hadron Collider: Future Circular Collider Conceptual Design Report Volume 4**

the FCC Collaboration, 1 Jul 2019, In: European Physical Journal Special Topics. 228, 5, p. 1109-1382 274 p.

### **FCC Physics Opportunities: Future Circular Collider Conceptual Design Report Volume 1**

the FCC Collaboration, 1 Jun 2019, In: European Physical Journal C. 79, 6, 161 p., 474.

### **FCC-ee: The Lepton Collider: Future Circular Collider Conceptual Design Report Volume 2**

the FCC Collaboration, 1 Jun 2019, In: European Physical Journal Special Topics. 228, 2, p. 261-623 363 p.

### **Estimating QCD uncertainties in Monte Carlo event generators for gamma-ray dark matter searches**

Amoroso, S., Caron, S., Jueid, A., De Austri, R. R. & Skands, P., 7 May 2019, In: Journal of Cosmology and Astroparticle Physics. 2019, 5, 45 p., 007.

### **Monte Carlo event generators for high energy particle physics event simulation**

Buckley, A. (ed.), Krauss, F. (ed.), Platzer, S. (ed.), Seymour, M. H. (ed.), Alioli, S., Andersen, J., Bellm, J., Butterworth, J., Dasgupta, M., Duhr, C., Frixione, S., Gieseke, S., Hamilton, K., Hesketh, G., Hoche, S., Jung, H., Kilian, W., Lonnblad, L., Maltoni, F., Mangano, M. L., & 23 others Mrenna, S., Nagy, Z., Nason, P., Nurse, E., Ohl, T., Oleari, C., Papaefstathiou, A., Plehn, T., Prestel, S., Re, E., Reuter, J., Richardson, P. J., Salam, G., Schonherr, M., Schumann, S., Siebert, F., Siodmok, A., Sjostrand, T., Skands, P., Soper, D., Soyez, G. & Webber, B. R., 5 Feb 2019, *Proceedings*. 7 p.

### **Average event properties from LHC to FCC-hh**

Brooks, H. & Skands, P., 1 Nov 2018, In: European Physical Journal C. 78, 11, 16 p., 963.

### **Review of Particle Physics**

Tanabashi, M., Hagiwara, K., Hikasa, K., Nakamura, K., Sumino, Y., Takahashi, F., Tanaka, J., Agashe, K., Aielli, G., Amsler, C., Antonelli, M., Asner, D. M., Baer, H., Banerjee, S., Barnett, R. M., Basaglia, T., Bauer, C. W., Beatty, J. J., Belousov, V. I., Beringer, J., & 211 others Bethke, S., Bettini, A., Bichsel, H., Biebel, O., Black, K. M., Blucher, E., Buchmuller, O., Burkert, V., Bychkov, M. A., Cahn, R. N., Carena, M., Ceccucci, A., Cerri, A., Chakraborty, D., Chen, M. C., Chivukula, R. S., Cowan, G., Dahl, O., D'Ambrosio, G., Damour, T., De Florian, D., De Gouvêa, A., Degrand, T., De Jong, P., Dissertori, G., Dobrescu, B. A., D'Onofrio, M., Doser, M., Drees, M., Dreiner, H. K., Dwyer, D. A., Eerola, P., Eidelman, S., Ellis, J., Erler, J., Ezhela, V. V., Fetscher, W., Fields, B. D., Firestone, R., Foster, B., Freitas, A., Gallagher, H., Garren, L., Gerber, H. J., Gerbier, G., Gershon, T., Gershtein, Y., Gherghetta, T., Godizov, A. A., Goodman, M., Grab, C., Gribsan, A. V., Grojean, C., Groom, D. E., Grünwald, M., Gurtu, A., Gutsche, T., Haber, H. E., Hanhart, C., Hashimoto, S., Hayato, Y., Hayes, K. G., Hebecker, A., Heinemeyer, S., Heltsley, B., Hernández-Rey, J. J., Hisano, J., Höcker, A., Holder, J., Holzkamp, A., Hyodo, T., Irwin, K. D., Johnson, K. F., Kado, M., Karliner, M., Katz, U. F., Klein, S. R., Klempt, E., Kowalewski, R. V., Krauss, F., Kreps, M., Krusche, B., Kuyanov, Y. V., Kwon, Y., Lahav, O., Laiho, J., Lesgourgues, J., Liddle, A., Ligeti, Z., Lin, C. J., Lippmann, C., Liss, T. M., Littenberg, L., Lugovsky, K. S., Lugovsky, S. B., Lusiani, A., Makida, Y., Maltoni, F., Mannel, T., Manohar, A. V., Marciano, W. J., Martin, A. D., Masoni, A., Matthews, J., Meißner, U. G., Milstead, D., Mitchell, R. E., Mönig, K., Molaro, P., Moortgat, F., Moskovic, M., Murayama, H., Narain, M., Nason, P., Navas, S., Neubert, M., Nevski, P., Nir, Y., Olive, K. A., Pagan Griso, S., Parsons, J., Patrignani, C., Peacock, J. A., Pennington, M., Petcov, S. T., Petrov, V. A., Pianori, E., Piepke, A., Pomarol, A., Quadt, A., Rademacker, J., Raffelt, G., Ratcliff, B. N., Richardson, P., Ringwald, A., Roesler, S., Rolli, S., Romaniouk, A., Rosenberg, L. J., Rosner, J. L., Rybka, G., Rytun, R. A., Sachrajda, C. T., Sakai, Y., Salam, G. P., Sarkar, S., Sauli, F., Schneider, O., Scholberg, K., Schwartz, A. J., Scott, D., Sharma, V., Sharpe, S. R., Shutt, T., Silari, M., Sjöstrand, T., Skands, P., Skwarnicki, T., Smith, J. G., Smoot, G. F., Spanier, S., Spieler, H., Spiering, C., Stahl, A., Stone, S. L., Sumiyoshi, T., Syphers, M. J., Terashi, K.

, Terning, J., Thoma, U., Thorne, R. S., Tiator, L., Titov, M., Tkachenko, N. P., Törnqvist, N. A., Tovey, D. R., Valencia, G., Van De Water, R., Varelas, N., Venanzoni, G., Verde, L., Vinciter, M. G., Vogel, P., Vogt, A., Wakely, S. P., Walkowiak, W., Walter, C. W., Wands, D., Ward, D. R., Wascko, M. O., Weiglein, G., Weinberg, D. H., Weinberg, E. J., White, M., Wiencke, L. R., Willocq, S., Wohl, C. G., Womersley, J., Woody, C. L., Workman, R. L., Yao, W. M., Zeller, G. P., Zenin, O. V., Zhu, R. Y., Zhu, S. L., Zimmermann, F., Zyla, P. A., Anderson, J., Fuller, L., Lugovsky, V. S. & Schaffner, P., 17 Aug 2018, In: Physical Review D. 98, 3, 1898 p., 030001.

### **Les Houches 2017: Physics at TeV Colliders Standard Model Working Group Report**

Les Houches 2017 SM Working Group, 21 Mar 2018. 314 p.

#### **On renormalization scale variations in parton showers**

Höche, S., Mrenna, S., Prestel, S., Schonherr, M. & Skands, P., 21 Mar 2018, *Les Houches 2017: Physics at TeV Colliders Standard Model Working Group Report*. Bendavid, J., Caola, F., Harlander, R., Tackmann, K., Heinrich, G., Huston, J., Kallweit, S., Thaler, J., Theofilatos, K., Ciulli, V., Re, E. & Prestel, S. (eds.). p. 215-223 9 p.

#### **LHC@Home: A BOINC-based volunteer computing infrastructure for physics studies at CERN**

Barranco, J., Cai, Y., Cameron, D., Crouch, M., Maria, R. D., Field, L., Giovannozzi, M., Hermes, P., Høimyr, N., Kaltchev, D., Karastathis, N., Luzzi, C., Maclean, E., McIntosh, E., Mereghetti, A., Molson, J., Nosochkov, Y., Pieloni, T., Reid, I. D., Rivkin, L., & 6 others Segal, B., Sjobak, K., Skands, P., Tambasco, C., Veken, F. V. D. & Zacharov, I., 29 Dec 2017, In: Open Engineering. 7, 1, p. 379-393 15 p.

#### **Helicity antenna showers for hadron colliders**

Fischer, N., Lifson, A. & Skands, P., 1 Oct 2017, In: European Physical Journal C. 77, 10, 17 p., 719.

#### **A framework for second-order parton showers**

Li, H. T. & Skands, P., 10 Aug 2017, In: Physics Letters B. 771, p. 59-66 8 p.

#### **QCD**

Skands, P. Z., 1 Jul 2017, *Proceedings of the 2014 Asia-Europe-Pacific School of High-Energy Physics: 2nd Asia-Europe-Pacific School of High-Energy Physics, AEPSHEP 2014; Puri; India; 4 November 2014 through 17 November 2014*. Mulders, M. & Godbole, R. (eds.). Geneva Switzerland: CERN, Vol. 2/2017. p. 63-123 61 p. (CERN Yellow Reports: School Proceedings; vol. 2/2017).

#### **Systematics of quark/gluon tagging**

Gras, P., Höche, S., Kar, D., Larkoski, A., Lönnblad, L., Plätzer, S., Siódmok, A., Skands, P., Soyez, G. & Thaler, J., 1 Jul 2017, In: Journal of High Energy Physics. 2017, 7, 50 p., 91.

#### **Coherent showers for the LHC**

Fischer, N. & Skands, P., 29 Jun 2017, *Proceedings of Science: 12th International Symposium on Radiative Corrections (Radcor 2015) and LoopFest XIV (Radiative Corrections for the LHC and Future Colliders)*. Sissa Medialab, SRL, 8 p. 016. (Proceedings of Science; vol. 235).

#### **LHC@Home: A BOINC-based volunteer computing infrastructure for physics studies at CERN**

Barranco, J., Cai, Y., Cameron, D., Crouch, M., De Maria, R., Field, L., Giovannozzi, M., Hermes, P., Høimyr, N., Kaltchev, D., Karastathis, N., Luzzi, C., Maclean, E., McIntosh, E., Mereghetti, A., Molson, J., Nosochkov, Y., Pieloni, T., Reid, I. D., Rivkin, L., & 6 others Segal, B., Sjobak, K., Skands, P., Tambasco, C., Van Der Veken, F. & Zacharov, I., 1 Jan 2017, *Proceedings of the Third International Conference BOINC-based High Performance Computing: Fundamental Research and Development (BOINC:FAST 2017)*. Ivahsko, E. & Rumyantsev, A. (eds.). CEUR-WS, Vol. 1973. p. 15-26 12 p. (CEUR Workshop Proceedings).

#### **VINCIA for hadron colliders**

Fischer, N., Prestel, S., Ritzmann, M. & Skands, P., 1 Nov 2016, In: European Physical Journal C. 76, 11, 47 p., 589.

#### **Automated parton-shower variations in PYTHIA 8**

Mrenna, S. & Skands, P., 3 Oct 2016, In: Physical Review D. 94, 7, 14 p., 074005.

### **Review of particle physics**

Particle Data Group, 1 Oct 2016, In: Chinese Physics C. 40, 10, 100001.

### **Measurement of parton shower observables with OPAL**

Fischer, N., Gieseke, S., Kluth, S., Plätzer, S., Skands, P. & OPAL Collaboration, 4 Jul 2016, *XLV International Symposium on Multiparticle Dynamics (ISMD 2015)*. Barillari, T., Bethke, S., Kluth, S. & Menke, S. (eds.). France: EDP Sciences, 6 p. 05001. (EPJ Web of Conferences; vol. 120).

### **Les Houches 2015: Physics at TeV Colliders Standard Model Working Group Report**

Les Houches 2015 SM Working Group, 16 May 2016. 226 p.

### **Probing collective effects in hadronisation with the extremes of the underlying event**

Martin, T., Skands, P. & Farrington, S., 1 May 2016, In: European Physical Journal C. 76, 5, 12 p., 299.

### **QCD and $\gamma\gamma$ studies at the FCC-ee**

Skands, P. & d'Enterria, D., 2016, p. 1-5. 5 p.

### **The VINCIA antenna shower for hadron colliders**

Skands, P., Fischer, N., Prestel, S. & Ritzmann, M., 2016, *38th International Conference on High Energy Physics, ICHEP 2016: Chicago; United States; 3 August 2016 through 10 August 2016; Code 128556*. Proceedings of Science, Vol. Part F128556. 6 p. 596

### **The extremes of the underlying event**

Martin, T., Skands, P. & Farrington, S., 2016, *38th International Conference on High Energy Physics, ICHEP 2016: Chicago; United States; 3 August 2016 through 10 August 2016; Code 128556*. Vol. Part F128556. 4 p. 606

### **Introduction**

d'Enterria, D. & Skands, P. Z., 16 Dec 2015, *High-Precision  $\alpha_s$  Measurements from LHC to FCC-ee*. d'Enterria, D. & Skands, P. (eds.). Geneva Switzerland: CERN, p. 3-4 2 p.

### **An introduction to PYTHIA 8.2**

Sjostrand, T., Ask, S., Christiansen, J. R., Corke, R., Desai, N., Ilten, P., Mrenna, S., Prestel, S., Rasmussen, C. O. & Skands, P. Z., 2015, In: Computer Physics Communications. 191, p. 159-177 19 p.

### **LHC Forward Physics**

The LHC Forward Physics Working Group, 2015, Geneva Switzerland: CERN. 358 p.

### **Measurement of observables sensitive to coherence effects in hadronic Z decays with the OPAL detector at LEP**

Fischer, N., Gieseke, S., Kluth, S., Platzer, S. & Skands, P. Z., 2015, In: European Physical Journal C. 75, 12, p. 1-17 17 p., 571.

### **Measurement of observables sensitive to coherence effects in hadronic Z decays with the OPAL detector at LEP**

Fischer, N., Gieseke, S., Kluth, S., Plätzer, S., Skands, P. & Verbytskyi, A., 2015, *The European Physical Society Conference on High Energy Physics*. Schieck, J. (ed.). Italy: Proceedings of Science, 7 p. 469

### **Modelling hadronic interactions in HEP MC generators**

Skands, P. Z., 2015, *EPJ Web of Conferences (ISVHECRI 2014): 18th International Symposium on Very High Energy Cosmic Ray Interactions*. Berge, D., de Roeck, A., Mangano, M. & Pattison, B. (eds.). Les Ulis France: EDP Sciences, Vol. 99. p. 1-5 5 p. 09001

### **String formation beyond leading colour**

Christiansen, J. R. & Skands, P. Z., 2015, In: Journal of High Energy Physics. 2015, 8, p. 1-51 51 p.

Future hadron colliders: From physics perspectives to technology R&D

Barletta, W., Battaglia, M., Klute, M., Mangano, M. L., Prestemon, S., Rossi, L. & Skands, P. Z., 11 Nov 2014, In: Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors and Associated Equipment. 764, 1, p. 352-368 17 p.

Determination of the top quark mass circa 2013: methods, subtleties, perspectives

Juste, A., Mantry, S., Mitov, A. D., Penin, A. A., Skands, P. Z., Varnes, E. W., Vos, M. & Wimpenny, S. J., Oct 2014, In: European Physical Journal C. 74, 10, 14 p., 3119.

Tuning PYTHIA 8.1: the Monash 2013 tune

Skands, P. Z., Carrazza, S. & Rojo, J., Aug 2014, In: European Physical Journal C. 74, 8, 39 p., 3024.

Revisiting radiation patterns in  $e^+e^-$  collisions

Fischer, N., Gieseke, S., Platzer, S. & Skands, P. Z., Apr 2014, In: European Physical Journal C. 74, 4, 18 p., 2831.

MCPLOTS: A particle physics resource based on volunteer computing

Karneyeu, A. E., Mijovic, L., Prestel, S. & Skands, P. Z., Feb 2014, In: European Physical Journal C. 74, 2, 22 p., 2714.

### Review of particle physics

Olive, K. A., Agashe, K., Amsler, C., Antonelli, M., Arguin, J-F., Asner, D. M., Baer, H. A., Band, H. R., Barnett, M., Basaglia, T., Bauer, C. W., Beatty, J. J., Belousov, V. I., Beringer, J., Bernadi, G., Bethke, S., Bichsel, H., Biebel, O., Blucher, E. C., Blusk, S., & 31 othersBrooijmans, G. H., Buchmueller, O., Burkert, V. D., Bychkov, M. A., Cahn, R. N., Carena, M., Ceccucci, A., Cerri, A., Chakraborty, D., Chen, M-C., Chivukula, R. S., Copic, K., Cowan, G., Dahl, O. I., D'Ambrosio, G., Damour, T., de Florian, D., de Gouvea, A. L., DeGrand, T., de Jong, P., Dissertori, G., Dobrescu, B. A., Doser, M., Drees, M., Dreiner, H., Edwards, D. A., Eidelman, S., Erler, J., Ezhela, V. V., Valencia, G. & Skands, P. Z., 2014, In: Chinese Physics C. 38, 9, p. 1 - 1676 1676 p.

### The mass of a top

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Update of the Binoth les Houches Accord for a standard interface between Monte Carlo tools and one-loop programs

Alioli, S., Badger, S. D., Bellm, J., Biedermann, B., Boudjema, F., Cullen, G., Denner, A., Dittmaier, S., Frederix, R., van Deurzen, H., Frixione, S., Garzelli, M. V., Gieseke, S., Glover, E. W. N., Greiner, N., Heinrich, G., Hirschi, V., Hoche, S., Huston, J. W., Ita, H., & 27 othersKauer, N., Krauss, F., Luisoni, G., Maitre, D., Maltoni, F., Nason, P., Oleari, C., Pittau, R., Platzer, S., Pozzorini, S., Reina, L., Reuschle, C., Robens, T., Schlenk, J., Schonherr, M., Siegert, F., Von Soden-Fraunhofen, J. F., Tackmann, F. J., Tramontano, F., Uwer, P., Salam, G., Skands, P. Z., Weinzierl, S., Winter, J. C., Yundin, V. I., Zanderighi, G. & Zaro, M., 2014, In: Computer Physics Communications. 185, 2, p. 560-571 12 p.

Antenna showers with one-loop matrix elements

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Helicity-dependent showers and matching with VINCIA

Larkoski, A. J., Lopez-Villarejo, J. J. & Skands, P., 26 Mar 2013, In: Physical Review D. 87, 5, 054033.

Antenna showers with hadronic initial states

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Monte Carlo event generators & the top quark forward-backward asymmetry

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