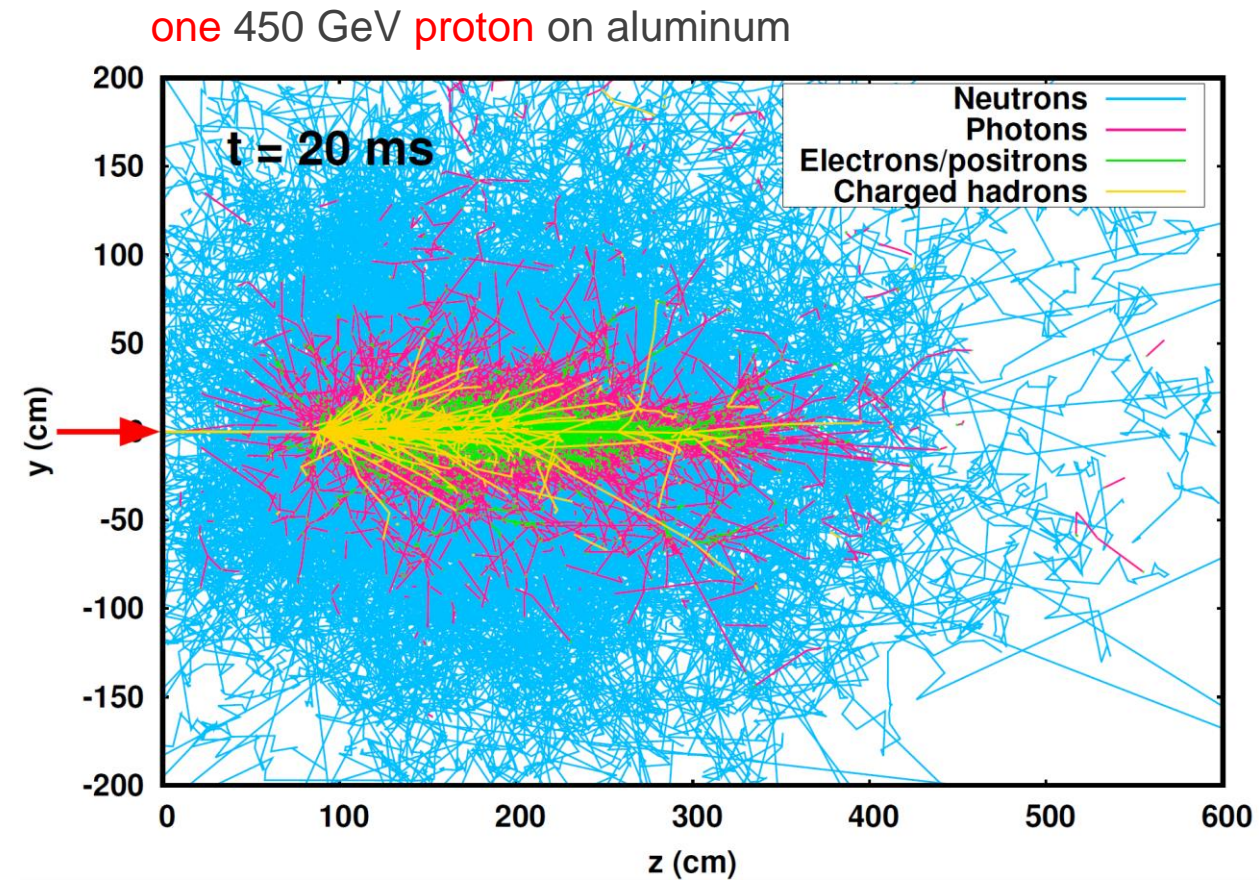




Introduction to FLUKA

FLUKA at a glance

- hadron-hadron and hadron-nucleus interactions
 - nucleus-nucleus interactions (including deuterons!)
 - photon interactions (>100 eV)
 - electron interactions (> 1 keV; including electronuclear)
 - muon interactions (including photonuclear)
 - neutrino interactions
 - low energy (<20 MeV) neutron interactions and transport
 - particle decay
 - ionization and multiple (single) scattering (including all ions down to 250 eV/u)
-
- coherent effects in crystals (channelling)
 - magnetic field, and electric field in vacuum
-
- combinatorial geometry and lattice capabilities
 - voxel geometry and DICOM importing



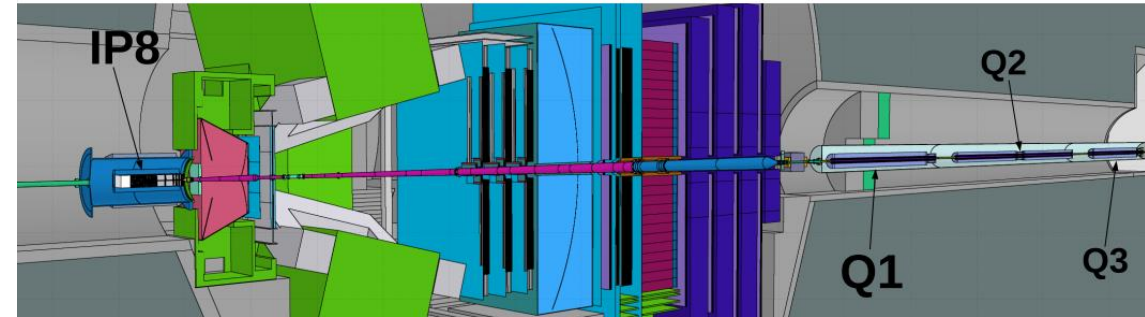
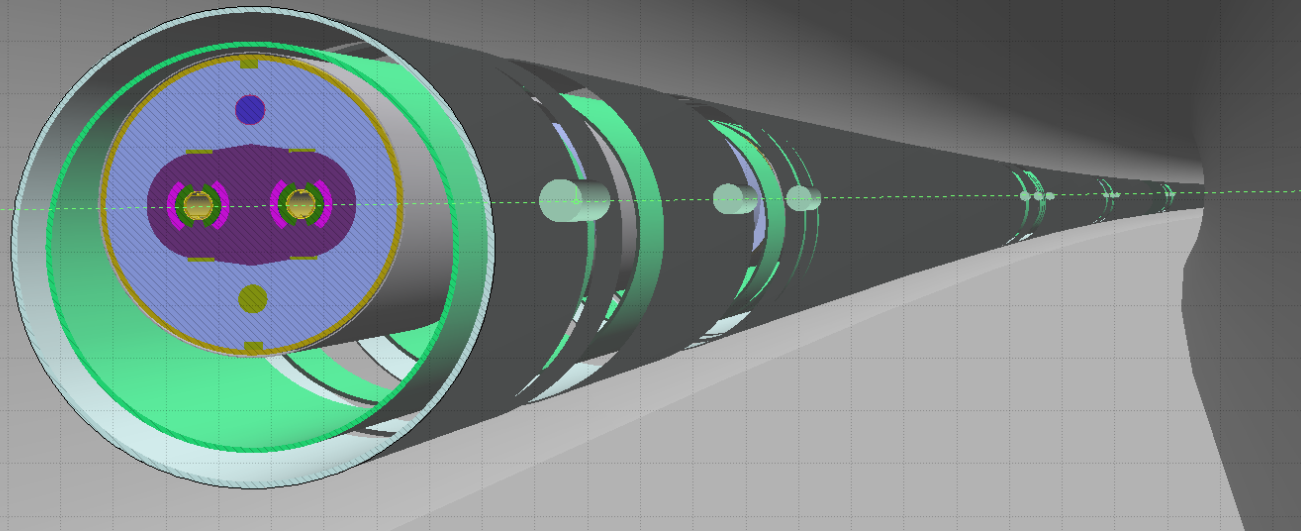
- analogue or biased treatment
- on-line buildup and evolution of induced radioactivity and dose
- built-in scoring of several quantities (including DPA and dose equivalent)

FLUKA at a glance [II]

In support of a
wide range of applications

- ✓ Accelerator design
- ✓ Particle physics
- ✓ Cosmic ray physics
- ✓ Neutrino physics
- ✓ Medical applications

- ✓ Radiation protection (shielding design, activation)
- ✓ Dosimetry
- ✓ Radiation damage
- ✓ Radiation to electronics effects
- ✓ ADS systems, waste transmutation
- ✓ Neutronics



A bit of history

- FLUKA was born **in the 60's** at **CERN** with **Johannes Ranft**
- It was further developed **in the 70s and 80s** in a collaboration between **Leipzig University, CERN** and **Helsinki University** for applications, e.g., at CERN's high energy accelerators, and **in the 90s** with **INFN**, among others for the design of SSC and LHC
- **From 2003 until August 2019** maintained and developed under a **CERN & INFN** agreement
- **From December 2019**, new **CERN** distribution aiming to ensure FLUKA's long-term sustainability and capability to meet the evolving requirements of its user community, **welcoming contributions by both established FLUKA contributors as well as new partners within a formal international collaboration.**
- Presently a joint development & management team based in the **CERN Accelerators and Technology Sector and Radiation Protection Group and at ELI Beamlines (Prague, CZ)**, with contributors from JRC-Geel and the CERN Research and Computing Sector, is in place.

FLUKA.CERN distribution

<https://fluka.cern>



Release of FLUKA 4-0.1
2020-08-24 - [Release](#)

FLUKA online training for beginners (Sept/Oct 2020)
2020-08-01 - [Event](#)

Release of FLUKA 4.0 and Flair 3.1
2020-06-30 - [Release](#)

FLUKA online training in autumn 2020
2020-06-29 - [Event](#)

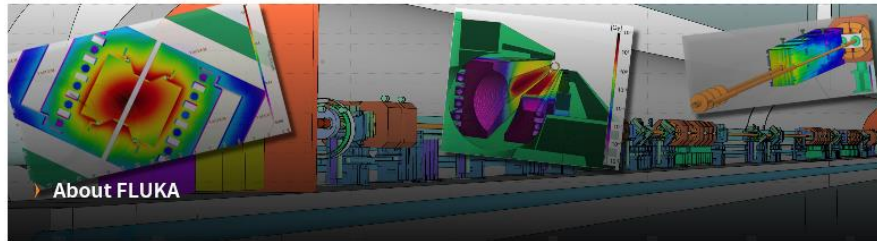
[more](#)

FLUKA 4-0.1, 2020-08-24

Flair 3.1-2nd, 2020-07-10

Registration problems? Enquiry about a commercial license? Enquiry about an institutional license for accessing the source code? Feedback to the website?

Use the [contact form](#).



- About FLUKA**
- Installing, Running and Runtime Errors**
Category for questions related to installing and running FLUKA and Flair
- Flair**
Category for questions related to the graphical user interface Flair
- Source Definition**
Category for questions concerning built-in source options, like particle beams, hadron-hadron collisions or radioactive sources
- Geometry and Materials**
Category for material and geometry-related questions including topics like transformations and lattices
- Scoring and Biasing**
Category for questions related to built-in scoring and biasing options
- Physics, Transport and Magnetic Fields**
Category for physics-related questions, as well as questions on transport and magnetic field settings
- Advanced Features and User Routines**
Category for questions on user routines and other advanced features
- Applications**
Category for application-related questions, including code snippets
- User Forum**
- Download**
- Documentation**
- Flair Graphical User Interface**
- Courses and events**

FLUKA 4-0 released in June 2020

FLUKA 4-0.1 released in August 2020

FLUKA 4-1 released in November 2020

FLUKA 4-1.1 released in February 2021

FLUKA 4-2 released in October 2021

FLUKA 4-2.1 released in December 2021

FLUKA 4-2.2 released in March 2022

FLUKA 4-3 released in September 2022

FLUKA 4-3.1 released in December 2022

FLUKA 4-3.2 released in March 2023

FLUKA 4-3.3 released in **May 2023**

Licensing Scheme

Registration options

FLUKA Single User License Agreement

Affiliates of institutes with a FLUKA Institutional License Agreement

CERN Staff members and Fellows

Affiliates of institutes which signed the FLUKA Memorandum of Understanding

Companies which purchased a FLUKA Commercial License Agreement

Includes access to the

source code

development version

- **Licences are free** except for commercial use
- They are granted for **non-military use** only
- Certain **past restrictions** were **removed**: benchmark publications are straight allowed and source code modifications are permitted through the institutional licence
- The FLUKA.CERN collaboration is **open to interested contributors**

Main features released in the last 3 years

- FLUKA 4-0
 - Electric field in vacuum; electronuclear reactions; direct (p,n) reactions
 - Coherent transport effects for charged particles in bent crystals
- FLUKA 4-1
 - Compound nucleus spin and parity accounted for in evaporation and Fermi break-up
 - New source routine
- FLUKA 4-2
 - Low-energy deuterons interaction model; proton reaction cross section refinement
 - Generation and transport of alpha particles from decay
 - ICRP116 and ICRU95 conversion coefficients
 - Simplified out-of-the-box usage of multiple magnetic fields
- FLUKA 4-3
 - Pointwise treatment for low energy neutrons interactions
 - Synchrotron radiation emission during tracking












Towards the FLUKA 5th generation

It will feature a new C++ technical infrastructure, based on the Geant4 engine

- Keeping the same FLUKA philosophy of today:
 - Fully integrated physics models
 - Same (or better) physics performance
 - Same (or better) user experience (input and output backward compatibility assured through the Flair interface)
- Increasing synergy with Geant4:
 - FLUKA physics models become accessible from Geant4, namely for hadron-nucleus inelastic interactions with the Geant4 beta release of June 2023
 - Flair interface facilitates code inter-comparisons by enabling users to run Geant4 from a FLUKA input

See and quote

New Capabilities of the FLUKA Multi-Purpose Code

 C. Ahdida¹,  D. Bozzato^{1,2},  D. Calzolari¹,  F. Cerutti^{1*},  N. Charitonidis¹,  A. Cimmino³,  A. Coronetti^{1,4},  G. L. D'Alessandro¹,  A. Donadon Servelle^{1,5},  L. S. Esposito¹,  R. Froeschl¹, R. García Alía¹, A. Gerbershagen¹, S. Gilardoni¹, D. Horváth³, G. Hugo¹, A. Infantino¹, V. Kouskoura¹, A. Lechner¹, B. Lefebvre³, G. Lerner¹, M. Magistris¹, A. Manousos^{1,6}, G. Moryc¹, F. Ogallar Ruiz^{1,7}, F. Pozzi¹, D. Prelicpean^{1,8}, S. Roesler¹, R. Rossi¹, M. Sabaté Gilarte¹, F. Salvat Pujol¹, P. Schoofs¹, V. Stránský³, C. Theis¹, A. Tsinganis⁹, R. Versaci³, V. Vlachoudis¹, A. Waets⁴ and M. Widorski¹

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⁶Department of Physics, Aristotle University of Thessaloniki, Thessaloniki, Greece

⁷Department of Atomic, Molecular and Nuclear Physics, University of Granada, Granada, Spain

⁸Department of Physics, Technical University of Munich (TUM), Munich, Germany

⁹European Commission, Joint Research Centre (JRC), Geel, Belgium

ORIGINAL RESEARCH article

Front. Phys., 27 January 2022 | <https://doi.org/10.3389/fphy.2021.788253>

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3 Flair, the FLUKA User Interface

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5 Code Testing and Benchmarking

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Author Contributions

Conflict of Interest

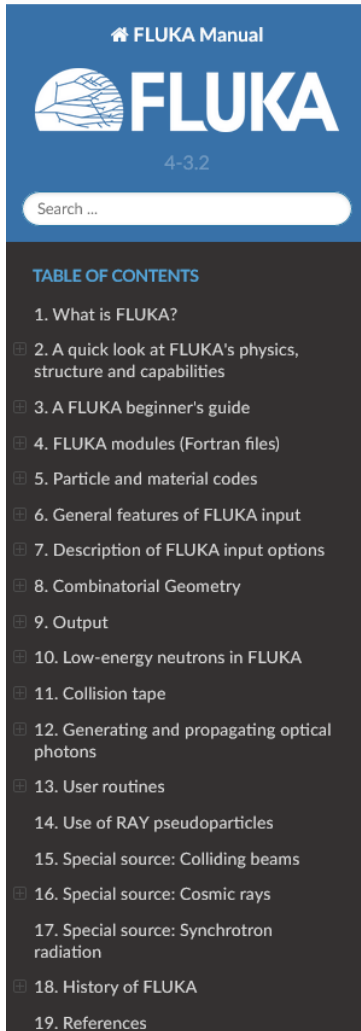
Publisher's Note

Acknowledgments

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User support



FLUKA Manual
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Search ...

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17. Special source: Synchrotron radiation
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19. References

FLUKA Manual

Can be opened through Flair

FLUKA Manual



Version: 4-3.2

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IMPORTANT WARNING FOR THE USERS

This manual is a reference tool for preparing input for the FLUKA particle transport code. It is not correct and should not be cited: the proper references to be cited in any recent work related to FLUKA are listed at the end of the manual and copyright and hence is bound to quote the above references.

For any comment or criticism on this manual and/or the code, please refer to <https://fluka.cern> and/or

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- 2. A quick look at FLUKA's physics, structure and capabilities
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 - 2.1.1. Hadron inelastic nuclear interactions
 - 2.1.2. Elastic Scattering
 - 2.1.3. Nucleus-Nucleus interactions
 - 2.1.4. Transport of charged hadrons and muons

<https://cern.ch/fluka-forum>

Expand Details

Discussion forum for users of the FLUKA Monte Carlo code and its graphical user interface Flair, distributed by CERN on fluka.cern and flair.cern.
Sign-up: Mandatory for **posting** only. If you are not a FLUKA.CERN user yet, please first register [here](#), and you will receive a forum account creation link.

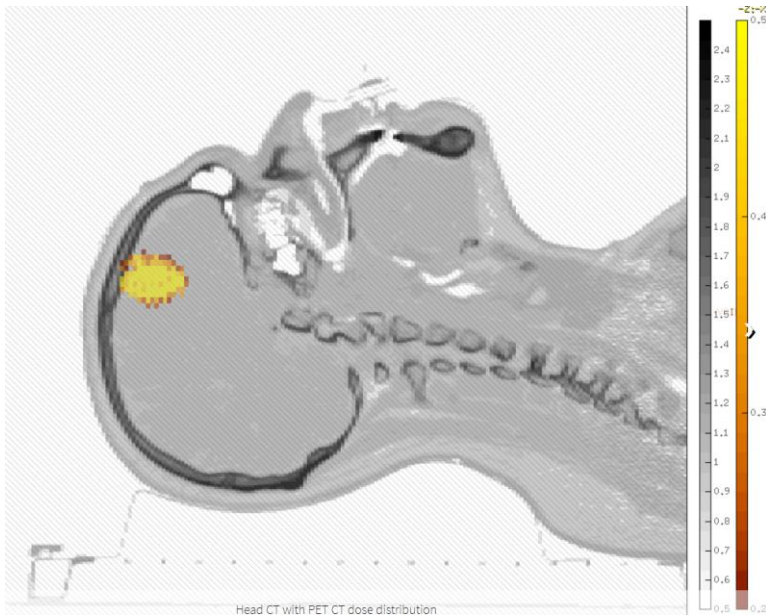
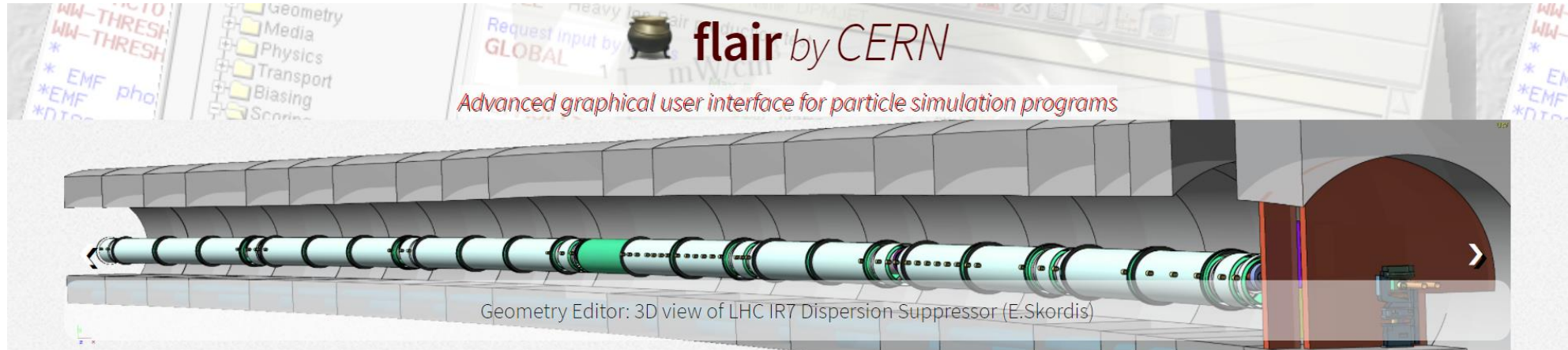
all categories ▾ all tags ▾ Categories Latest

Category	Topics	Latest
Announcements As of December 2019, this discussion list represents the official forum for users of the FLUKA Monte Carlo code and its graphical user interface Flair, distributed by the European Organization for Nuclear Research (CERN).	2 / month	F Release of FLUKA 4-3.2 Announcements 30 Mar 1
Installation Category for questions related to the installation of FLUKA and Flair.	4 / month	U IMPORTANT: Registration and package download FAQ Installation Nov '22 2
Running and Runtime Errors Category for questions related to running FLUKA and Flair.	6 / month	A Scoring the number of deposits with energy Scoring 2h 3
Flair Category for questions related to the graphical user interface Flair.	5 / month	C Print the parent particle information corresponding to the current particle Advanced Features and User Routines 8h 2
Source Definition Category for questions concerning built-in source options, like particle beams, hadron-hadron collisions or isotropic sources.	140	I DICOM and hounsfield unit ranges Geometry and Materials 11h 6
Geometry and Materials Category for material and geometry-related questions including topics like transformations and lattices.	3 / month	U An error occurred when using Gd material in LOW-PWXS card Physics, Transport and Magnetic Fields 17h 1
Scoring Category for questions related to built-in scoring options.	17 / month	U how to get energy deposition in FLUKA Scoring 1d 1
Biasing Category for questions related to biasing options.	27	U Activation discrepancy with PHITS Scoring 3d 4
Physics, Transport and Magnetic Fields Category for physics-related questions, as well as questions on transport and magnetic field settings.	7 / month	2 Unable to load flair Running and Runtime Errors 3d 2
Advanced Features and User Routines Category for questions on user routines and other advanced features.	4 / month	S Discrepancies of detect card result Scoring 3d 5
		R Using source routine with DMPJET Advanced Features and User Routines 3d 8

Note: an independent one time registration is required to be able to participate

Thanks for your answers!

Link your FLUKA papers in the dedicated category



Authors

authors: Vasilis Vlachoudis (lead author)
Christian Theis
Wioletta Kozłowska

Current Version

- Latest version: 3.2-4.5
- Released on: *Fri 26-May-2023*
- Powered by python3, tkinter, gnuplot, pydicom

Features

- modern and intuitive design
- Input editor for error free inputs
- Interactive geometry editor, photorealistic ray tracer and debugger
- run and monitor the simulation
- back-end for post-processing of results
- I/O of other simulation formats (MCNPX,GDML,...)
- Medical file importing, DICOM, RT-PLAN,DOSE,...
- extended material library

The advanced course

	8	9	10	11	12	13	14	15	16	17	18	19	
Monday	7.30 ANL access	Course registration	Welcome	Introduction to FLUKA/ Participants Introduction	Coffee	FLUKA environment	Fortran Primer	Lunch	Source Routines	Source routines	Coffee	User Workshop	Dinner
Tuesday		Advanced Geometry	Advanced Geometry	Coffee	Adv Geo	EM fields	Lunch	EM fields	Advanced Scoring	Coffee	Advanced Scoring		
Wednesday		User Routines I	User Routines I	Coffee	URI	Radiation protection calculations	Lunch	Radiation protection calculations	User Workshop	Coffee	User Workshop		
Thursday		User Routines II	User Routines II	Coffee	URII	Advanced Settings	Lunch	User Workshop	Biasing	Coffee	Biasing		
Friday		Neutronics	Neutronics	Coffee	Neut	User Workshop	Lunch	Optical Photons	Optical Photons	Course evaluation and closing	Coffee		

Lecture

Exercise

Pause

- Exploring the **user routines** world
- Learning/practicing **additional built-in** capabilities
- Achieving a more **conscious use** of the code
- Unprecedented final focus on **optical photon** simulation

...and the user workshop!

- Lior Epstein:** Contribution of β and γ radiation to the dose from diffusing alpha-emitters radiation therapy
- Tim Ramaker:** Using FLUKA to estimate dose rates of sources with arbitrary geometry
- Jingfang Zhao:** Depth dose and LET distribution of carbon ion beam in the microporous structure
- Vittorio Boccone:** Lead-free compact shielding for electron detectors
- Mary Chin:** FLUKA simulation experience and needs at BNL
- Yael Fried:** Radiation protection calculations for an Am-Be neutron source
- Sanjeev Faruk:** Shielding assessments for the Diamond II upgrade
- Dajun Zhu:** Radiation shielding design simulation for ANSTO accelerator test facility
- Isabela Castro de Moraes:** Radiation shielding for the Brazilian synchrotron light source
- Andrei Patapenka:** FLUKA simulations to support “NorthStar” Mo-99 producer facility commissioning



Many thanks to ANL

and in particular to **Sunil Chitra**