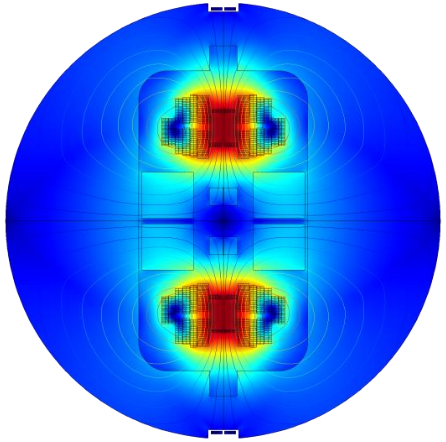
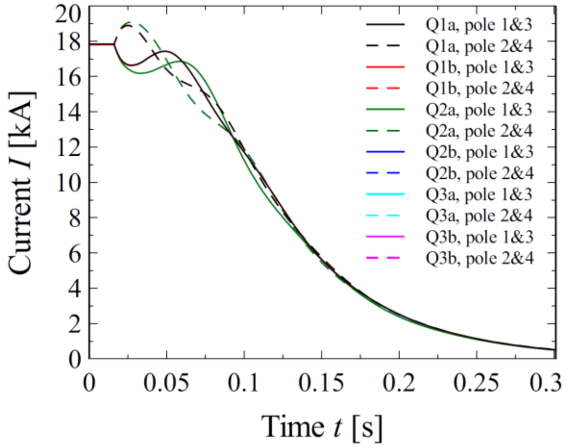
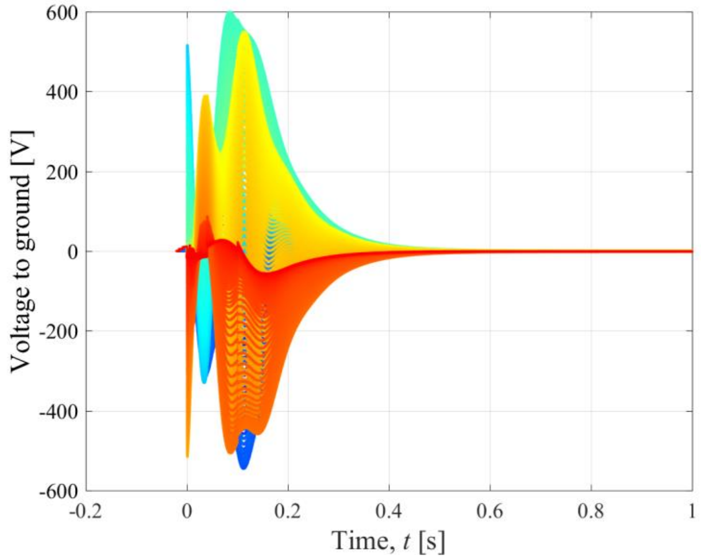


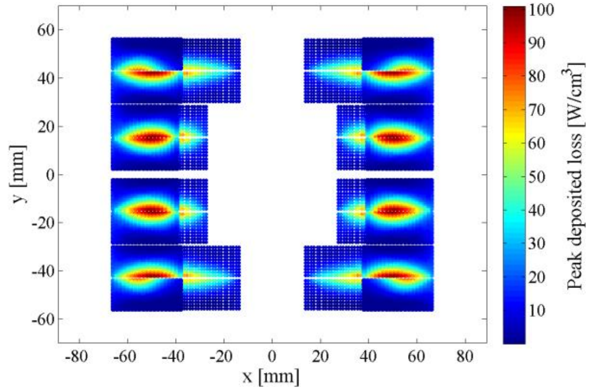
WELCOME





2nd STEAM workshop
11th – 15th October 2021

https://indico.cern.ch/event/1060073



Mariusz Wozniak
on behalf of the STEAM team
Dimitri Datskov, Marvin Janitschke, Emmanuele Ravaioli, Ola Tranum Arnegaard, Arjan Verweij, Mariusz Wozniak

These slides are based on Arjan Verweij slides from the 1st STEAM Workshop from 2019

Aim of the workshop

- Give participants information on STEAM architecture, physics, tools, use cases, notebooks, …(day 1)
- Forum for STEAM users to showcase their work (3x20 min on, day 2, 3, 4)
- Hands-on oportunity to use STEAM and time to ask questions about using the tools and developing new models (day 1, 2, 3, 4)
- Discuss future plans for STEAM (day 5)

But also:

- Build-up a network of people working on similar issues
- Get feedback from participants for improvements
- See if participants are interested to integrate in-house written software to STEAM (mutual interest)
- Increase the number of users
- Get users involved in the validation

Why STEAM project started?

- To have a set of well-documented and validated tools:
  - for simulating various transients in the LHC and future accelerators (switch openings, converter switch-off, short-to-ground, inter-turn short, CLIQ discharge, …)
  - for co-simulating circuit, magnet, PC regulation, quench protection, …
- To increase the accuracy of several types of simulations, which is important for the designs of Nb_3Sn magnets for HL-LHC and FCC which have small margins.
- To avoid that tools/models are abandoned/forgotten as soon as the programmer leaves CERN.

What is STEAM?

Framework to simulate ***transient effects*** in the ***SC circuits and magnets*** of the LHC, future upgrades (HL-LHC), accelerator designs studies (FCC), and other SC magnets/circuits.

- ***Application driven!!!***
- Variety of tools (both commercial and in-house), each with its own features and advantages.
- Maintainable and long-term $\Rightarrow$ well-written and documented.
- Attractive possibility to co-simulate two or more tools.
- Tested, cross-checked, and validated (up to a certain level).

Transients:

- Quench (training, beam-induced, triggered by QH/CLIQ, quench back)
- Fast Power Abort (converter switch-off and EE activation, voltage waves)
- Shorts (coil-to-ground, coil-to-heater, inter-turn, double short, arcing)
- ELQA tests (FTM, HiPotting, diode tests)
- Quench Detection response to the above

Agenda

Mon 11/10

- 11:00 – Hands-on session: STEAM Notebooks + materials properties database - recommended for users in Asia — **Notebooks** — 11:00 - 12:00
- 14:00 – Hands-on session: STEAM Notebooks + materials properties database - recommended for users in Europe — **Notebooks** — 14:00 - 15:00
- Welcome
- STEAM framework — *Mariusz Wozniak* — 16:10 - 16:40
- New STEAM developments — *Dr Emmanuele Ravaioli* — 16:40 - 17:10
- Break
- STEAM notebooks — *Marvin Janitschke* — 17:30 - 18:00
- Hands-on session: STEAM Notebooks + materials properties database - recommended for users in Americas — **Notebooks** — 18:30 - 19:30

Tue 12/10

- Hands-on session: SIGMA - recommended for users in Asia — **SIGMA** — 07:30 - 09
- Hands-on session: ProteCCT - recommended for users in Asia — **ProteCCT** — 09:30 - 10
- Hands-on session: SIGMA - recommended for users in Europe — **SIGMA** — 11:00 - 12
- Hands-on session: ProteCCT - recommended for users in Europe — **ProteCCT** — 14:00 - 15
- 16:00 – Quench protection of HEPDipo magnet using STEAM-LEDET — *Xabier Saras*
- Powering and protection of the MQXF test facility at FNAL using STEAM-CO… — *Vittorio Marinc*
- Analysis of fast discharge of the SIS100 dipole circuit using a SING-generated P… — *Dimitri De*
- Hands-on session: SIGMA - recommended for users in Americas — **SIGMA** — 17:30 - 19
- Hands-on session: ProteCCT - recommended for users in Americas — **ProteCCT** — 19:30 - 20

Wed 13/10

- Hands-on session: LEDET - recommended for users in Asia — **LEDET** — 07:30 - 09:
- Hands-on session: BBQ - recommended for users in Asia — **BBQ** — 09:30 - 10:
- Hands-on session: LEDET - recommended for users in Europe — **LEDET** — 11:00 - 12:
- Hands-on session: BBQ - recommended for users in Europe — **BBQ** — 14:00 - 15:
- 16:00 – 3D magnet quench simulations using STEAM-LEDET — *Ola Tranum Arnegaa*
- Analysis of thermal transients in a superconducting combined function magnet for… — *Vittorio*
- [to be confirmed] Simulation of CLIQ transients in a cos-theta dipole magnet using STEAM-L
- Hands-on session: LEDET - recommended for users in Americas — **LEDET** — 17:30 - 19:
- Hands-on session: BBQ - recommended for users in Americas — **BBQ** — 19:30 - 20:

Thu 14/10

- Hands-on session: SING and PSPICE - recommended for users in Asia — **SING & PSPICE** — 07:30 - 08:30
- Hands-on session: COSIM - recommended for users in Asia — **COSIM** — 09:00 - 10:30
- Hands-on session: SING and PSPICE - recommended for users in Europe — **SING & PSPICE** — 11:00 - 12:00
- Hands-on session: COSIM - recommended for users in Europe — **COSIM** — 13:30 - 15:00
- 16:00 – Implementing HTS in STEAM-LEDET from test coils to full-scale systems — *Daniel Davis*
- Thermal analysis of quench-heater heating stations using STEAM-BBQ — *Marvin Janitschke*
- Quench protection simulations of HEL Solenoid using STEAM-LEDET — *Mariusz Wozniak*
- Hands-on session: SING and PSPICE - recommended for users in Americas — **SING & PSPICE** — 17:30 - 18:30
- Hands-on session: COSIM - recommended for users in Americas — **COSIM** — 19:00 - 20:30

Fri 15/10

- 16:00 – STEAM future — *Dr Emmanuele Ravaioli et al.* — 16:00 - 16:30
- Discussion — 16:30 - 17:00

Repeated sessions

Sessions for all

https://indico.cern.ch/event/1060073/timetable/#all

Participants

	Last Name	First Name	Institution		Last Name	First Name	Institution
1	Davis	Daniel	ASC-NHMFL-FSU	25	Caiffi	Barbara	INFN Genova
2	AVRONSART	Julien	Brookhaven National Laboratory	26	Pampaloni	Alessandra	INFN Genova
3	Ben Yahia	Anis	Brookhaven National Laboratory	27	Hou	Zhilong	Institute of high energy physics
4	Joshi	Piyush	Brookhaven National Laboratory	28	menglin	WANG	Institute of High Energy Physics
5	Babouche	Romain	CEA - IRFM	29	Kang	Rui	Institute of High Energy Physics, CAS
6	NICOLLET	Sylvie	CEA, IRFM	30	Chen	Yuquan	Institute of Modern Physics,
7	Gorit	Quentin	CEA/ IRFM	31	tong	yujin	Institute of Modern Physics, Chinese Academy of Sciences
8	Delkov	Dimitri	CERN	32	Zheng	Shijun	Institute of Modern Physics, Chinese
9	Ferrentino	Vittorio	CERN	33	Suzuki	Kento	KEK
10	Mentink	Matthias	CERN	34	Barthlott	Dominic	KIT
11	Ravaioli	Emmanuele	CERN	35	Barthlott	Dominic Thomas	KIT
12	Tranum Arnegaard	Ola	CERN	36	Shen	Tengming	Lawrence Berkeley National Lab
13	Verweij	Arjan	CERN	37	Teyber	Reed	LBNL
14	Vitrano	Andrea	CERN	38	Li	Chunyi	member
15	Wozniak	Mariusz	CERN	39	Murgia	Federica	N/A
16	Janitschke	Marvin	CERN, TU Berlin	40	Liu	Dong	Tampere University
17	Schnaubelt	Erik	CERN, TU Darmstadt	41	Salmi	Tiina	Tampere University
18	Garcia Matos	Jesus Angel	CIEMAT	42	Sotnikov	Dmitry	Tampere University
19	Sarasola	Xabier	EPFL-SPC	43	Otin	Ruben	UK Atmomic Energy Authority
20	Marinozzi	Vittorio	FNAL	44	Zhang	Heng	UK Atomic Energy Authority
21	Raginel	Vivien	GSI Helmholtzzentrum für Schwerionenforschung GmbH	45	Bender	Lennard	University of Applied Sciences (DE)
22	Ze	feng	IHEP	46	Pepitone	Kevin	Uppsala University
23	Levi	Filippo	INFN	47	Barna	Daniel	Wigner Research Centre for Physics
24	Prioli	Marco	INFN - Milano				

Final remarks

- STEAM is a framework that has already proven to be very useful for explaining events in the LHC, and for studying HL-LHC and FCC magnet circuits.
- STEAM is not a final product but will evolve over time (new tools, additional physics, more validations).
- Integration of tools from users could give a lot of synergy for the user due to existing circuit and magnet model generators, co-simulation, material database, …
- Although initially set up for ***transients*** in ***accelerator magnets***, STEAM could handle steady-state, and be applied to other superconducting magnets.
- The software is offered free of charge; however, to obtain a copy you need to sign our user agreement (available at: https://edms.cern.ch/document/2024516).
- Do not forget all the time/effort put in, so, in papers and presentations (partially) based on STEAM results, please acknowledge our work and add proper references.

Abbreviations

CLIQ: Coupling Loss Induced Quench system
EE: Energy Extraction (system)
FCC: Future Circular Collider
FPA: Fast Power Abort
HL-LHC: High Luminosity upgrade of the LHC
MB: Main dipole magnet in the LHC
MIITs: Integral of I^2dt during the current discharge
QDS: Quench Detection System
QH: Quench Heater
QPS: Quench Protection system
PC: Power Converter
RB: Main dipole circuit in the LHC
RQD/F: Main defocusing/focusing quadrupole circuit in the LHC

See also: https://espace.cern.ch/steam/_layouts/15/start.aspx#/SitePages/Naming%20conventions.aspx