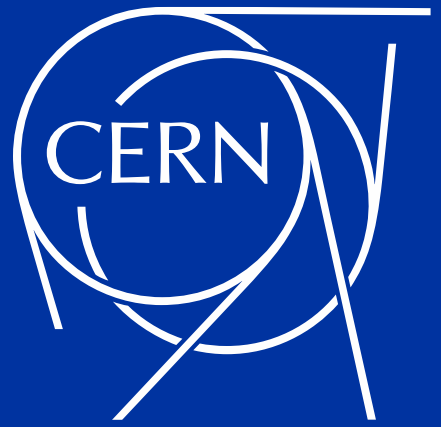
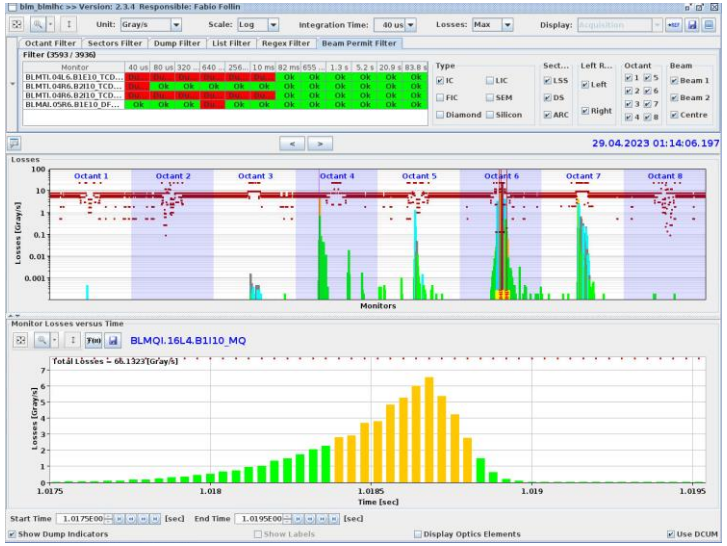


Workshop on Dust Charging and Beam-Dust Interaction in Particle Accelerators Introduction

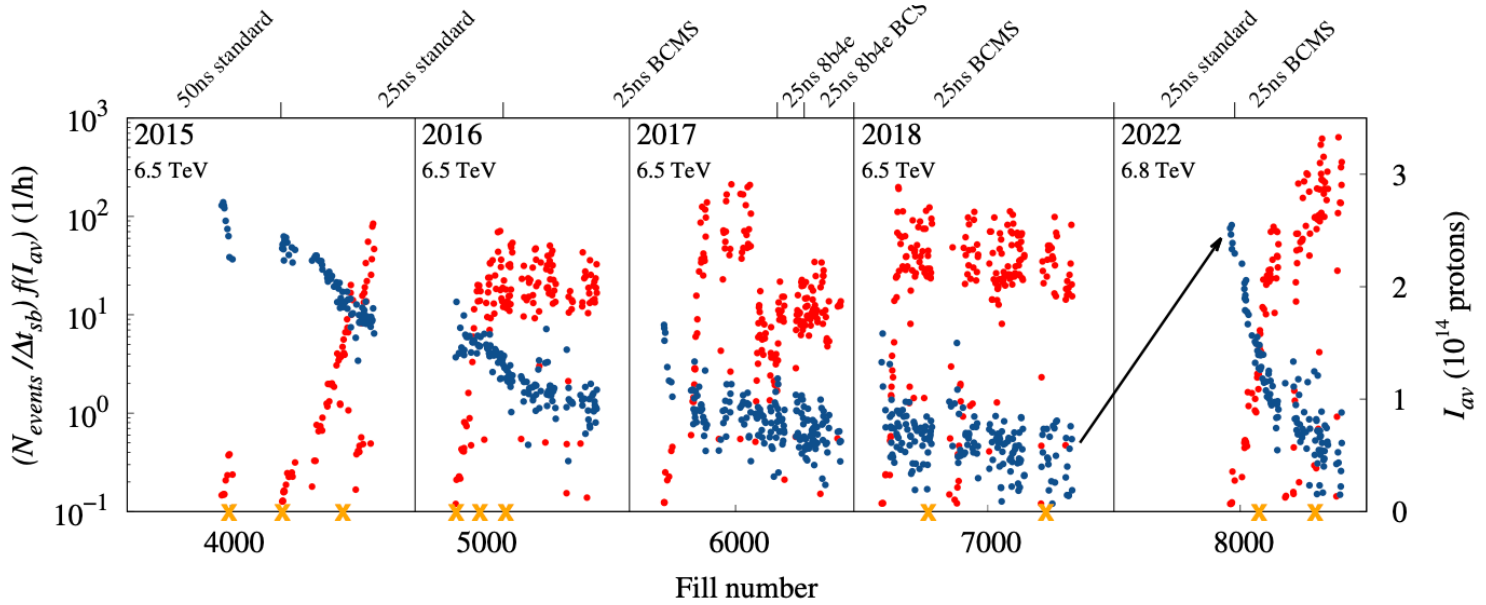
D. Wollmann

WELCOME

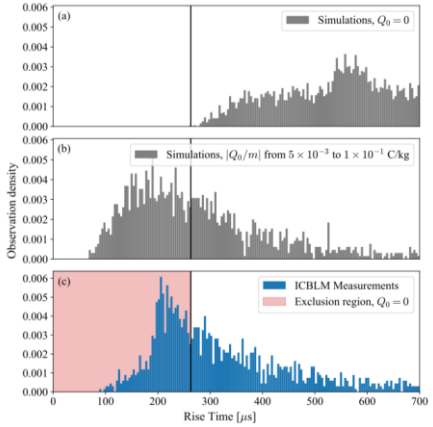
‘UFOs’ at the LHC



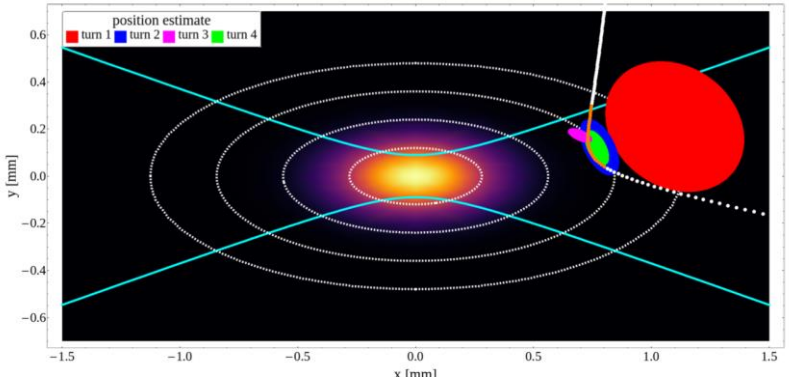
Loss structure due to beam-dust interaction on 29.04. causing the quench of a main dipole



UFO rates (blue) & beam intensity (red) over time (fill number)
Courtesy A. Lechner



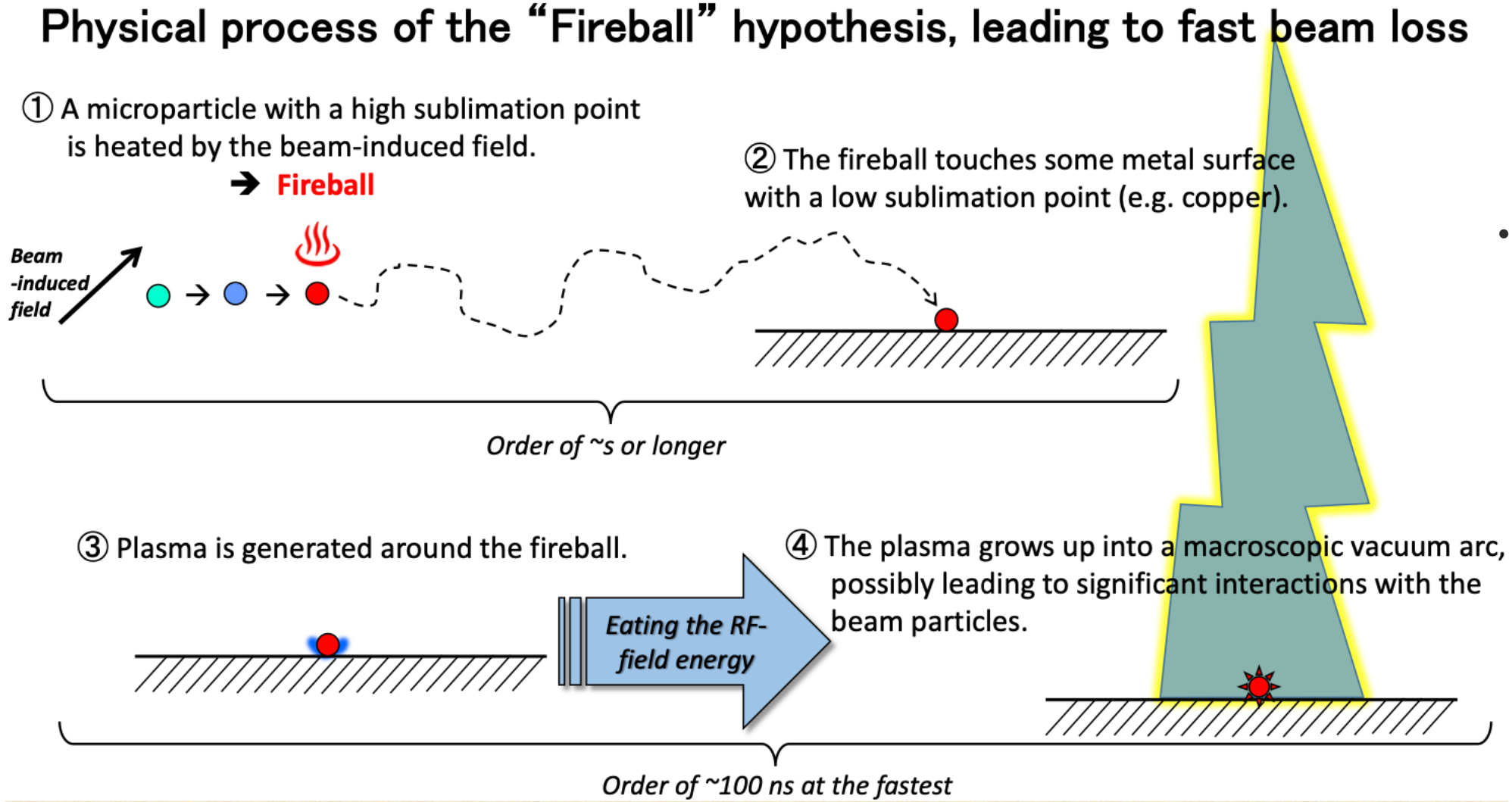
Loss signal rise-time – simulations vs measurements
Courtesy P. Belanger



Trajectory of a charged dust particle.
Courtesy B. Lindstroem

- Beam dust interactions (‘UFOs’) have been observed in the LHC from the beginning of beam operation.
- Last for a few ms and can stop the LHC for several hours.
- Strong conditioning has been observed over the years.
- Simulations and measurements indicate that macro-particles need to have a negative pre-charge.

'Fireball' at SuperKEKb



- Sudden beam losses, which can potentially lead to equipment damage (collimators).

Courtesy T. Abe

Beam dust interactions at CERN

- **Detailed studies** have been performed in **close collaboration** between many different groups at CERN: Operation (BE-OP), Beam Instrumentation (SY-BI), Sources Targets & Interactions (SY-STI), Accelerator Beam Transfer (SY-ABT), Vacuum Surfaces & Coatings (TE-VSC), Accelerator and Beam Physics (BE-ABP), Machine Protection and Electrical Integrity (TE-MPE).
- TE-MPE's involvement in these studies comes from two viewpoints: **machine protection & machine availability**.
- A lot has been understood & many **open questions** remain:
  - How are dust particles charged in accelerators?
  - How are they released from the surface?
  - How does the observed conditioning work?
  - Looking into the future: will beam dust interactions be limiting in future accelerators and what can we do about this?
- Organise a workshop bringing together the **accelerator, space-research and fusion community** on the topic of dust charging and beam dust interaction.

Goals of the workshop

- Improve understanding of **beam-dust interactions** in particle accelerators, in particular, of **dust-charging and release** mechanisms.
- Improve understanding of **evolution** of beam-dust **interaction rate** as a function of beam and other parameters.
- Present **modelling work** on beam-dust interactions and their consequences.
- Present research on **dust issues in space** applications.
- Improve understanding of the **behaviour of dust particles** in accelerator hardware systems (Vacuum, RF, treated surfaces…) and **their consequences**.
- Improve understanding of mechanisms of **dust migration** into sensitive devices, such as high field gradient superconducting cavities, and ways to prevent this migration.
- **Identify synergies** between particle-accelerator, space-research and nuclear fusion communities.
- **Define next research steps** and possible **collaborations**.

Workshop structure – 6 Sessions

- Session 1: **Introduction** (Tue AM, Convener: J. Uythoven, Sc. Secretary: M. Blaszkiewicz)
- Session 2: **Dust in particle accelerators I - Beam-dust interactions** (Tue PM and Wed AM, Convener: P. Bélanger, Sc. Secretary C. Hernalsteens)
- Session 3: **Dust in space research and nuclear fusion** (Tue PM, Convener: X. Wang, Sc. Secretary L. Felsberger)
- Session 4: **Dust in particle accelerators II – vacuum, surfaces and RF** (Wed AM & PM, Convener: G. Rosaz, Sc. Secretary J. Heron)
- Session 5: **Dust charging and dust release in particle accelerators** (Thu AM, Convener: M. Horanyi, Sc. secretary C. Obermair)
- Session 6: **Closure and discussion** (Thu AM, Convener: D. Wollmann, Sc. Secretary C. Obermair)

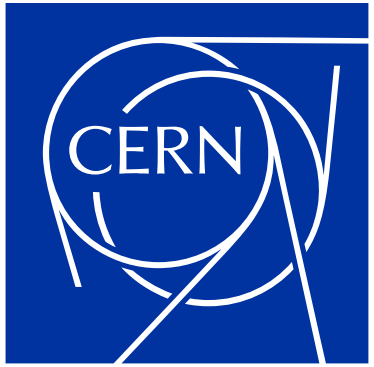
Miscellanea

- The **workshop** is organised in a **hybrid way**, thus, please **always use a microphone** for questions and discussions to keep our remotely connected colleagues involved.
- **Discussions** are the central goal of the workshop, thus, please **stick to the 20+10 min** format of the talks. In addition, a discussion session is foreseen at the end of each session.
- The **outcome** of the workshop will be summarized in ‘light proceedings’ in **form of session summaries**, focusing on the main discussion points and prepared by the session conveners with the help of the sc. secretaries.
- **Coffee breaks**: next door
- **Lunch**: Cafeteria (other end of this floor) or Restaurant 2 (7 mins walk)
- **Visit** to CERN’s large magnet facility (building 180) & the CERN Control Centre (CCC) – Wed. 16:10 – 18:00 → leaves from here and transport will bring us back to the CERN hostels just after 18:00.

Big thanks to …

- Claudia Dupraz for administrative support
- Christoph Wiesner & Rüdiger Schmidt for being key in the planning and preparation of this workshop from the first ideas to today
- Program committee: Philippe Belanger (TRIUMF), Mihaly Horanyi (LASP, University of Colorado, Boulder), Hitomi Ikeda (KEK), Anton Lechner (CERN), Lotta Mether (CERN), Thomas Planche (TRIUMF), Guillaume Rosaz (CERN), Rudiger Schmidt (TU Darmstadt, CERN), Xu Wang (LASP, University of Colorado, Boulder), Christoph Wiesner (CERN), Daniel Wollmann (CERN) for putting the program together, discussing with speakers, etc.
- Speakers, session conveners and sc. secretaries
- Félix Rodriguez Mateos for the support by the TE-MPE group
- José Miguel Jimenez for the support by CERN's Technology Department

Have a fruitful workshop



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