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European Organization for Nuclear Research

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MKI UFO MD

LHC Study Working Group

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for the UFO MD Team*

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Why?

- UFOs could be a **major limitation** for the performance of the LHC after LS1.

81 UFO beam dumps by arc UFOs in 2011 for 7TeV. (T. Baer, Evian 2011)

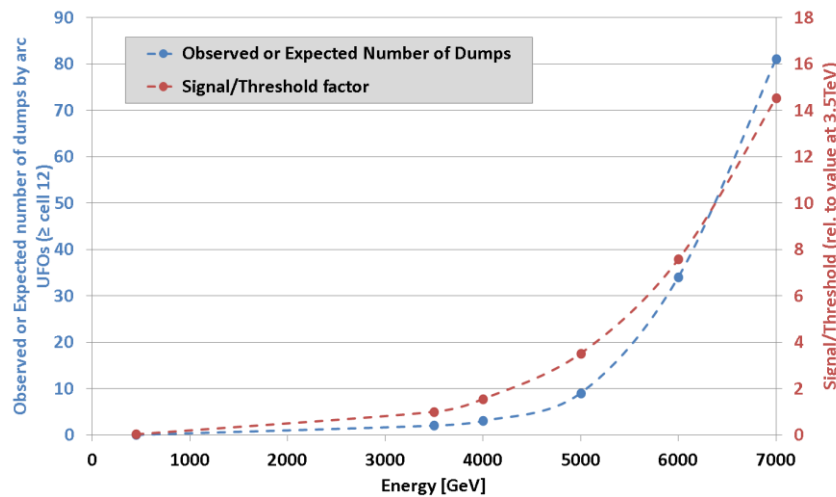
- No satisfactory **mitigation** for MKI UFOs, yet. (cf. also M. Barnes at LIBD #66)
- MKI UFO MDs are the **only option to study UFOs** directly.
- Many results obtained in previous MDs.

Pulsing of MKIs directly stimulates UFO production.

Fast UFOs (initially charged?).

No UFOs at MKQs (metalized ceramic tube as possible mitigation).

Distribution of UFOs after MKI pulse measured (particle dynamics).

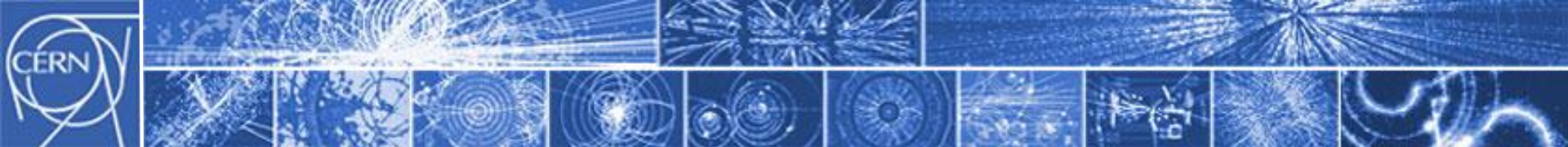




What?

- Investigate the ***production mechanism*** and ***dynamics*** of UFOs at the MKIs by pulsing the MKIs on a gap in the partly filled machine.
 - Pulsing of individual MKIs.
MKI asymmetry observed. (T. Baer, CMAC #4)
 - Study influence of e-cloud.
Correlation with e-cloud/vacuum activity expected. (Chamonix)
- Study macro particle dynamics.
BLM study buffer with 80 μ s resolution (can resolve structure of UFOs).
- 25ns, higher beam intensity (extrapolation).
Indication of strong UFO activity observed during 25ns MDs. (T. Baer, Evian 2011)
- Possibly variation of kick strength and/or pulse length.

} Remaining
from last MD.



**Thank you for
your attention!**

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Further information:

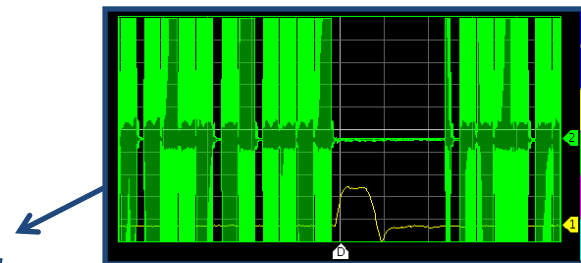
- T. Baer et al., "UFOs in the LHC", IPAC'11, TUPC137, September 2011.
- T. Baer et al., "MD on MKIs and MKQs", to be published soon.
- T. Baer et al., "MKI UFOs at Injection", CERN-ATS-Note-2011-065 MD, August 2011.

Plan: Study four main aspects:

- Study UFOs at **MKQ**. ✓
- Study **delay** of UFO occurrence w.r.t. MKI kick (UFO dynamics). ✓
- Study influence of e-cloud solenoids.
- ~~Study UFO **asymmetry** between kickers (pulsing individual kickers).~~

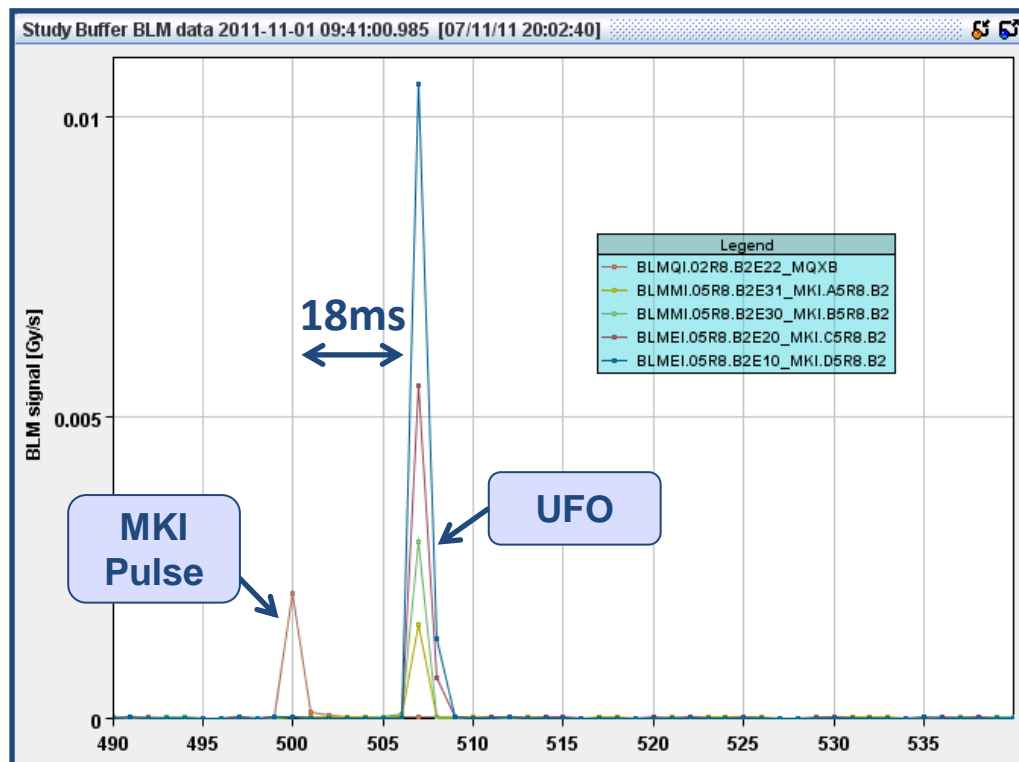
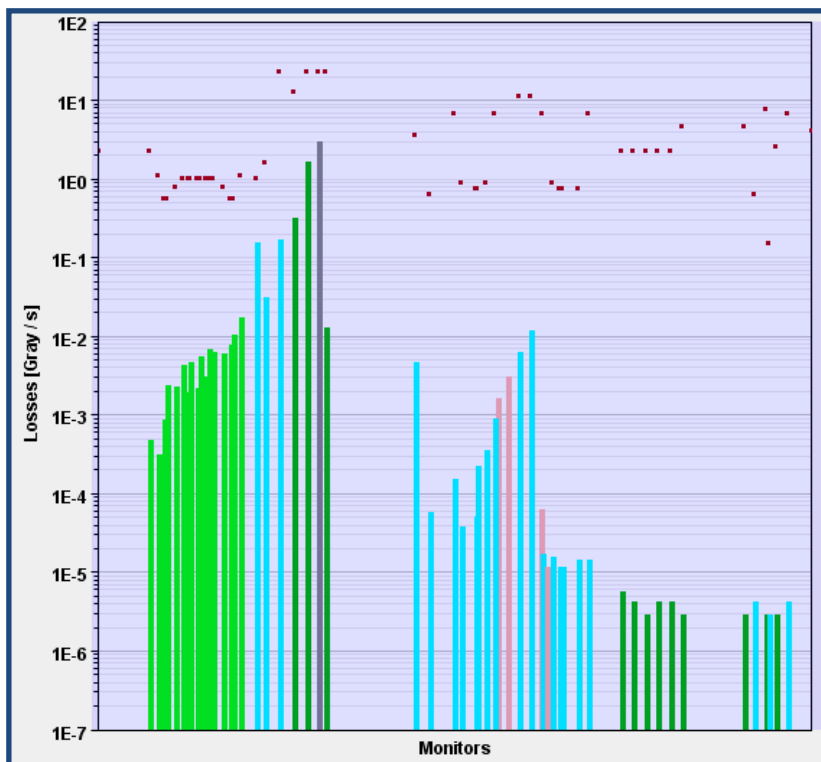
What was done:

- 01:45 – start **verification procedure** with pilots, both beams. **3.5h**
- 05:20 – injecting 1236b, problem with PS cavity. **2.75h**
- 08:05 – 1236b circulating, **start data taking**. **2h**
- 08:43 – start **pulsing MKI.05R8**.
- 08:55 – start **pulsing MKI.05L2**.
- 09:13 – start **pulsing all MKQs** inbetween MKI pulses.
- 09:44 – switch off **e-cloud solenoids** around MKI.05R8.
- 09:56 – **beams dumped** (injection cleaning problem), MD recovery. **0.5h**



MKQ pulse in abort gap

UFO at 09:40:52



Assuming free fall: $t = \sqrt{\frac{2 \cdot 19mm}{9.81 \frac{m}{s^2}}} = 62ms.$

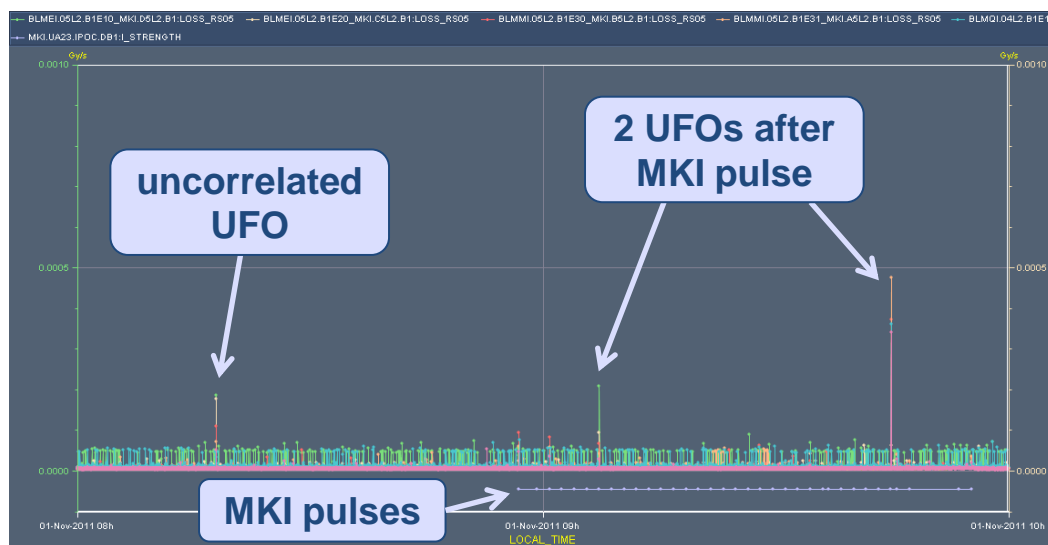
UFO dynamics cannot be explained by gravitational force alone.

Many similar events recorded.

UFOs at MKIs

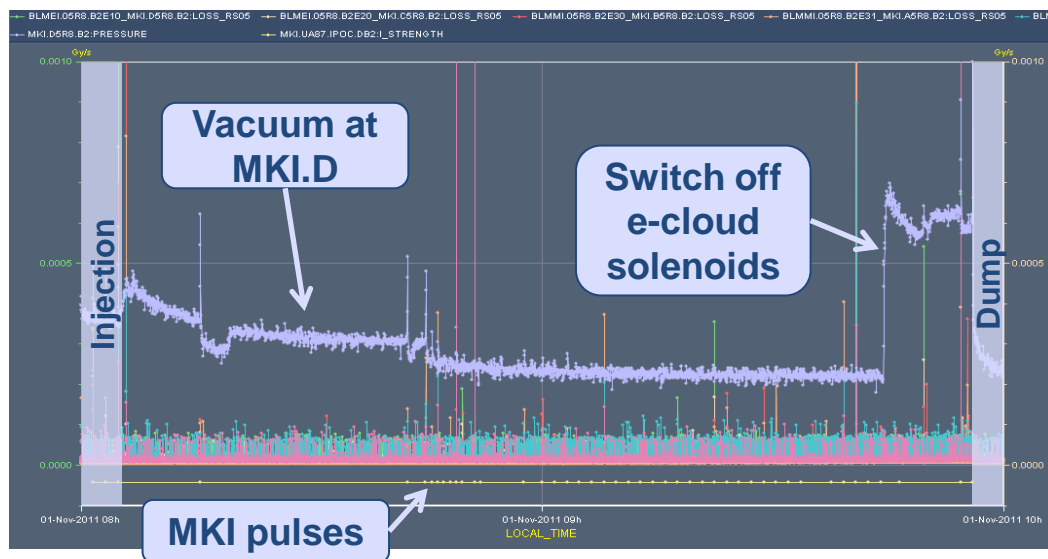
Losses and MKI pulses at MKI.5L2.

- 3 UFOs in 2 hours.



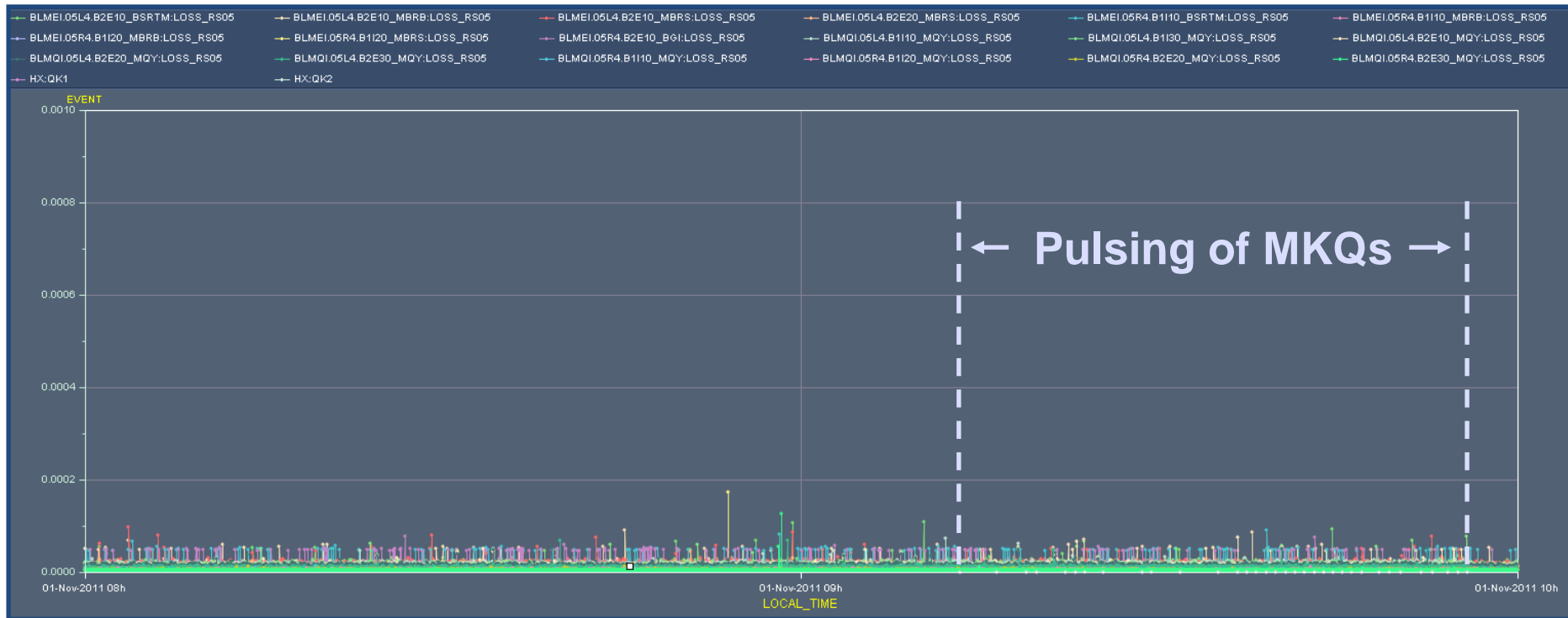
Losses and MKI pulses at MKI.5R8.

- Many UFOs, especially after MKI pulse.
- Sometimes vacuum spike after MKI pulse.





No UFOs at MKQ



No UFOs around MKQs observed.

Pulsing the MKQs 34 times, mostly both planes and beams together.