EuCARD-AccNet CERN-GSI Workshop on

Modeling Electron-Cloud Effects

CERN, Geneva, 7-8 March 2011, BE Auditorium Meyrin

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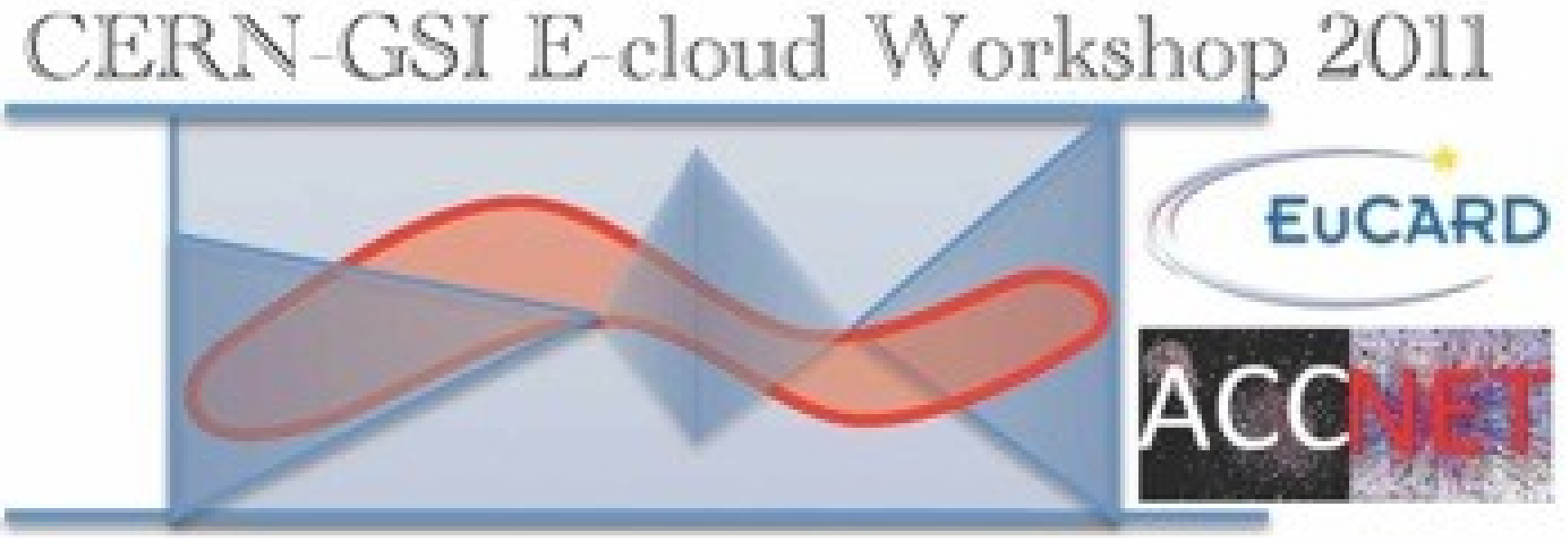

welcome!

"building on success"

CERN-GSI mini-workshops

- CARE-HHH-APD CERN-GSI bi-lateral working meeting on *Collective Effects–Coordination of Theory and Experiments*, GSI, Darmstadt, Germany, 30–31 March 2006
- CERN-GSI Meeting on *Collective Effects* integrated into CARE-HHH-APD Workshop on LHC Injectors Upgrade and LHC Beam Parameters Upgrade (BEAM'07), CERN, Geneva, Switzerland, 2-3 October 2007
- CERN/GSI *beam dynamics and collective effects* collaboration meeting, GSI, 18-19 February 2009

➢ EuCARD-AccNet mini-workshop on *Modeling Electron-Cloud Effects*, CERN, Geneva, 7-8 March 2011

e-cloud workshop series at CERN

- ECLOUD'02, *Mini-Workshop on Electron-Cloud Simulations for Proton and Positron Beams*, CERN, 15-18 April 2002
- Mini-Workshop on *SPS Scrubbing Run Results and Implications for the LHC*, CERN, 28 June 2002
- CARE-HHH, CARE-ELAN and EuroTeV mini-workshop on *electron-cloud clearing ("ECL2")*, CERN, 28.03-02.03. 2007
- CARE-HHH-APD mini-workshop on *electron-cloud mitigation* (ECM'08), CERN, 20-21 November 2008
- EuCARD-AccNet-EuroLumi Workshop on *Anti E-Cloud Coatings that require no activation* "AEC'09", CERN, 12-13 October 2009
- EuCARD-AccNet *mini-workshop on Modeling Electron-Cloud Effects*, CERN, Geneva, 7-8 March 2011

EuCARD is a **common venture of 37 European Accelerator Laboratories, Institutes, Universities and Industrial Partners** involved in accelerator sciences and technologies. The project, initiated by ESGARD, is an Integrating Activity **co-funded by the European Commission under Framework Programme 7 for a duration of four years, starting April 1st, 2009**.

Main goal: **upgrade the large European research accelerators** by R&D on innovative concepts and techniques.

EuCARD will strengthen durable **collaboration among the partners** and will contribute to the development of world-class infrastructures.

EuCARD

ACCNET

2007 - 2013

Accelerator Science Networks

Coordination & Management

coordinated by Walter Scandale, IN2P3 ; Peter Spiller, GSI
Frank Zimmermann, CERN

EUROLUMI

accelerators & colliders performance

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Frank Zimmermann, CERN
Ezio Todesco, CERN
GSI contact Oliver Boine-Frankenheim

RFTECH

sc & nc rf technologies

coordinated by
Jean-Marie de Conto, UJF
Mariusz Grecki, DESY
Wolfgang Weingarten, CERN
GSI contact Peter Huelsmann

EuroNNAc *European Network on Novel Accelerators*

coord.'d by Ralph Assmann, CERN; Jens Osterhoff, DESY; Henri Videau, IN2P3

e-cloud in LHC

e-cloud in LHC

concern since ~1997;

e-cloud crash programme set up by F. Ruggiero;

1st SPS e-cloud observations with LHC beam in '99;

numerous surface investigations, etc; simulation code developments (ECLOUD, HEADTAIL, Faktor2, IECP); 2005: halt of LHC e-cloud studies

when simulated heat load appeared acceptable for δ_{max}=1.7 at half the nominal beam intensity;

limited studies continued for LHC&SPS upgrade

fall 2010: first e-cloud observations in the LHC

e-cloud at GSI

joint GSI-CERN studies:

controlled e-cloud effect using e-cooler at GSI
(study for ECLOUD'02);
incoherent e-cloud effects (MICROMAP)

2004 e-cloud study for FAIR:

G. Rumolo, O. Boine-Frankenheim, E. Mustafin, I. Hofmann, "**Vacuum and electron cloud issues at the GSI present and future facilities,"** Proc. 31st ICFA Beam Dynamics Workshop ECLOUD04, Napa, California, 19-23 Apr 2004.

"If vacuum still seems to be a serious ***issue for the GSI International Accelerator Project, the electron cloud, on the other hand, is not expected to be of any concern for the future operation because of its high build up threshold. Maximum SEY's below 1.8 seem to be safe both for the SIS18 in upgraded operation and for the SIS100.*** *Such values can be easily achieved with proper surface treatment of the inner pipe walls in both rings."*

motivations for this workshop

proposed by Oliver Boine-Frankenheim, with main goal to discuss the recent findings from GSI electron cloud studies with CERN colleagues

restart of LHC electron-cloud simulation effort at CERN, triggered by LHC observations in the fall of 2010

organization

this workshop has been organized **by Giovanni Rumolo, Oliver Boine-Frankenheim**, and Frank Zimmermann, with a lot of input from the “community”, in particular from Gianluigi Arduini and Elias Metral

sponsors/supporters:

CERN → co-organization, programme, secretarial support, infrastructure

GSI → co-organization, programme

EuCARD-AccNet → supporting 3 participants, coffee breaks, and one working lunch

TUD. KEK. CELLS/ALBA. INFN-LNF. etc.

working lunch & dinner (today)

lunch offered by Eucard-ACCNET in CERN restaurant 2 "Les Caravelles"

no-host dinner in "Le Chaumaz"
http://www.restorang.ch/info.cfm?restono=898

thanks to Giovanni and Delphine !

28 registered participants

CERN: 15

GSI: 3

TUD: 3

KEK: 2

CELLS: 1

FNAL: 1

INFN-LNF: 1

TU Vienna: 1

NTU Athens: 1

workshop topics & structure

Session 1: Introduction, LHC beam observations, FAIR collective effects, KEK e-cloud studies

Session 2: LHC vacuum observations & forecast, surface properties

Session 3: Electron-cloud simulation tools & studies at CERN

Session 4: Electron-cloud simulation tools & studies at GSI

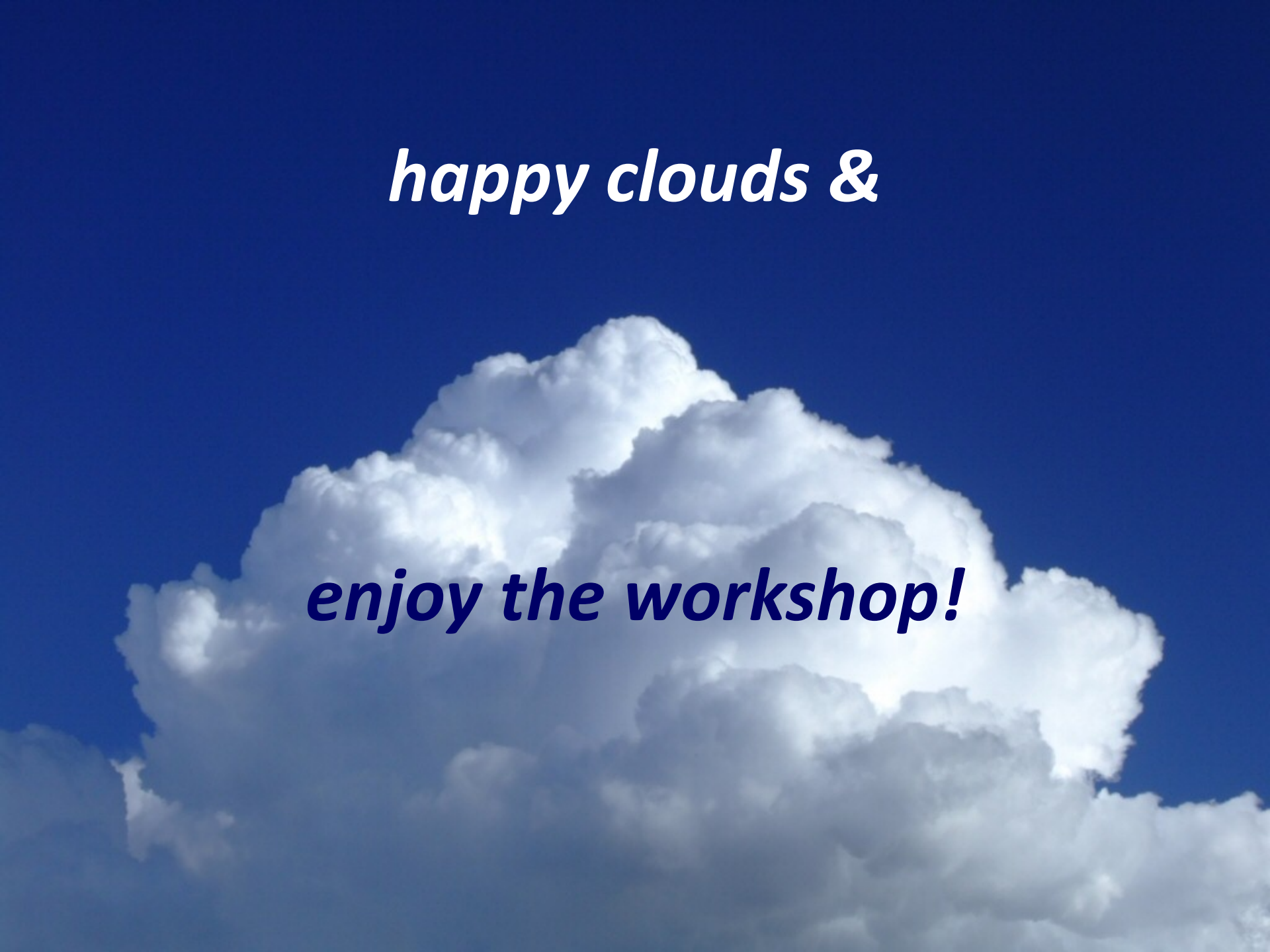
Session 5: Electron-cloud diagnostics and mitigation techniques

Session 6: Modeling instabilities & incoherent emittance growth due to electron cloud

~20 talks in 11 hours

a few of the open questions

- which δ_{max} , ε_{max}, *R* values can we obtain after “beam scrubbing”?
- what about the re-diffused electrons? do we need to include them and how?
- since e-cloud may have come back to the GSI could we reconsider a controlled e-cooler experiment?
- how can we simulate/model/predict the coupled-bunch higher-order head-tail instabilities driven by the electron cloud?
- how well can we model/predict the incoherent e-cloud effects which depend on e- pinch and distribution around the ring?
- how does e-cloud conspire with beam-beam, SC & impedance?
- what can a feedback system do?
- how many primary electrons are generated outside the beam?
- how do ε_{max} and *R* depend on δ_{max} (scrubbing) and how does *R* depend on the angle of incidence?


happy clouds &
enjoy the workshop!