

High Energy High Intensity Hadron Beams

CARE-HHH Network:

Activities potentially related to a
MW Proton Driver

<http://care-hhh.web.cern.ch/care-hhh/>

CARE-HHH Network: 3 workpackages

WP1: Advancements in Accelerator Magnet Technologies (AMT)

- coordinated by L. Rossi (CERN) and L. Bottura (CERN)
- keywords: stability and quench limit of LHC insertion magnets, **pulsed magnets for LHC and GSI accelerator complex upgrade**, magnets for booster ring, high field magnet design, optimisation of the overall cost

WP2: Novel Methods for Accelerator Beam Instrumentation (ABI)

- coordinated by H. Schmickler (CERN) and K. Wittenburg (DESY)
- keywords: tools and diagnostic systems for luminosity, wire for beam-beam compensation, advanced transverse beam diagnostics, feedback loops for orbit, chromaticity and coupling, **advanced beam halo diagnostics**, remote diagnostics and maintenance of instrumentation

WP3: Accelerator Physics and synchrotron Design (APD)

- coordinated by F. Ruggiero (CERN) and F. Zimmermann (CERN)
- keywords: Interaction Region design for LHC luminosity upgrade, optics design for booster synchrotrons, impedance calculations, **structured list of intensity limits**, electron cloud effects, beam measurements and advanced theoretical studies (**including collimation, halo formation, and loss mechanisms**)

HHH activities in 2005 of possible relevance for a MW proton driver

- **W. Scandale and F. Zimmermann,
CERN seminar 03/02/2005**

Highlights of HHH-2004 Workshop: "Beam Dynamics in Future Hadron Colliders and Rapidly Cycling Synchrotrons".

Proceedings ready for publication as CARE and CERN Yellow Report:

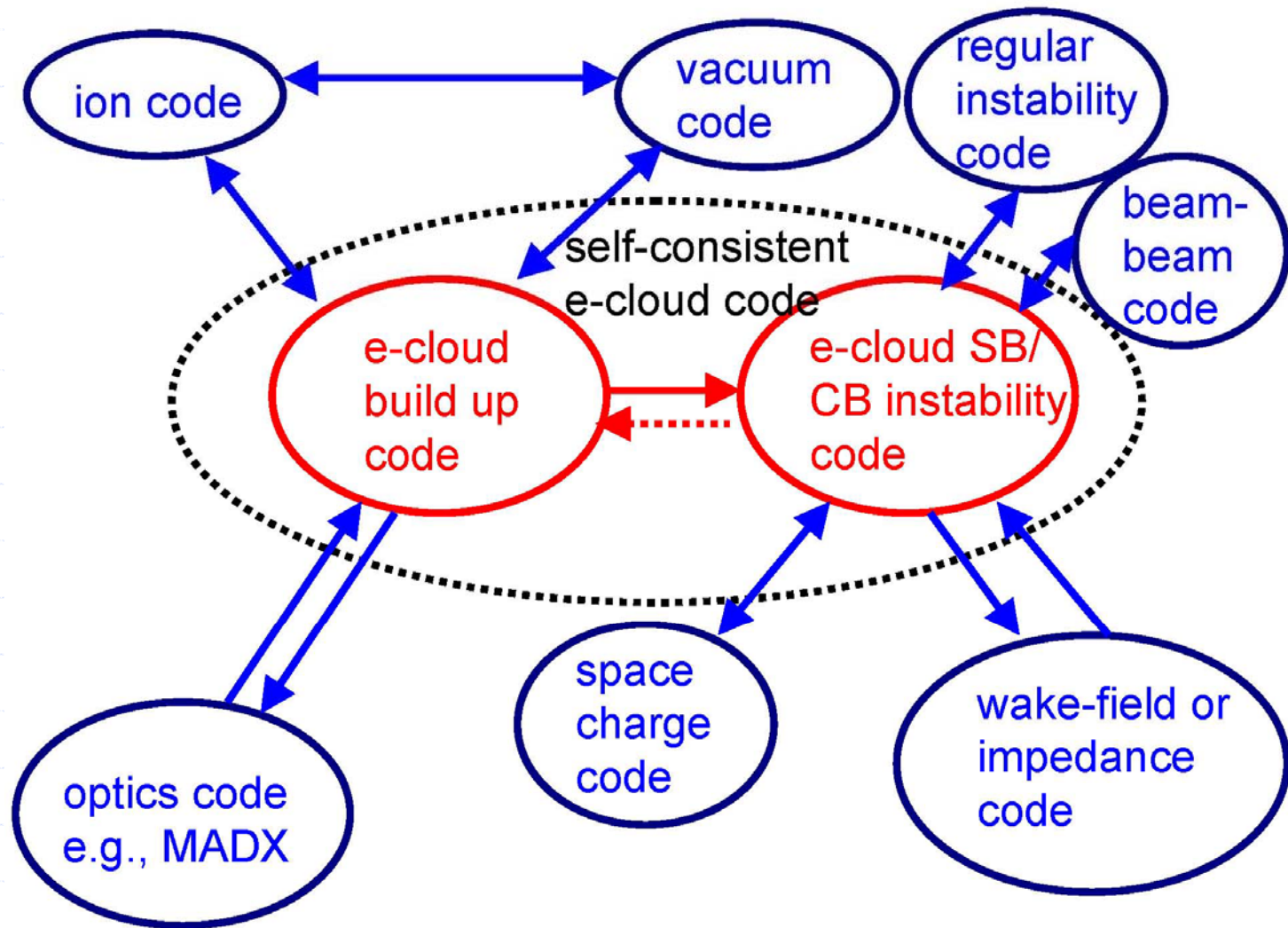
http://care-hhh.web.cern.ch/CARE-HHH/HHH-2004/Proceedings/proceedings_hhh2004.htm

CERN Courier article will be published in April 2005.

- **New Pulsed-Magnet Working Group:
first meeting at CERN, 17-18/02/2005
Participants: CERN-GSI-INFN-IHEP-CEA/Saclay**
web site at <http://pmwg.web.cern.ch/PMWG/>

Topics: Fast pulsed SC magnets for GSI and LHC injector upgrade.

Beam dynamics code repository



electron-cloud code table

code	contact	dim	e-model	features	Parallel (max CPU)
PEI	K.Ohmi, KEK		SR, SE	build-up; dipole inst.	
EPI	K.Ohmi, KEK		SR, SE	build-up; dipole inst.	
CLOUDLAND	L.Wang, BNL	3	SE,	build-up;	N
ECLLOUD	G.Rumolo, GSI, D.Schulte, F.Zimmermann, CERN	2-3	SR, SE, IZ	buildup; multibunch dipole inst.	N
POSINST	M.Furman, LBNL; M.Pivi, SLAC	2.5	SR, SE, IZ, BPL	buildup; multibunch dipole inst.	N
CSEC	M.Blaskiewicz, BNL	2-3	SE, IZ, BPL	build-up; single-bunch instability	N
HEADTAIL	D.Schulte, F.Zimmermann, G.Rumolo	2		build-up; single-bunch instability	
PEHT	K.Ohmi, KEK			head-tail	
PEHTS	K.Ohmi, KEK			head-tail; SC	
CLOUD_MAD	T.Raubenheimer, SLAC			MAD-tracking particles with ecloud "lenses"	
PARSEC	A.Adelmann, PSI	3	SE; IZ; SR; BPL	SC; lattice description	Y (4048)
ORBIT	J.Holmes, ORNL	2-3	SE; IZ	SC; lattice description	Y
WARP+POSINST	J.L.Vay, LBNL	3	SE; IZ; SR; BPL	SC; lattice description	Y
QUICKPIC	W.Mori, UCLA	2-3		PIC plasma code; initially- prescribed ecloud	Y (128)
BEST	H.Qin, PPPL	3		SC; Vlasov-Maxwell; no e- wall collisions	Y (512)
MEC	U.Iriso, BNL			empirical maps	

SR=synchrotron rad. photoelectrons; SE=secondary electron emission; IZ=ionization of resid. gas; BPL=beam-particle losses
SC=self-consistent;

[courtesy M. Furman,
modified by F. Zimmermann]

Some key people/activities relevant for a MW proton driver

- **HHH-APD** Beam Dynamics modelling and simulation of collective effects: **F. Ruggiero**, G. Rumolo and F. Zimmermann (CERN), B. Spataro (INFN/Frascati), W. Bruns (CERN and TUBE). CERN collimation team and RF experts (E. Shaposhnikova et al). Optics design: G. Arduini and R. Tomas (CERN). More help needed/expected from GSI (G. Franchetti?), DESY, CSIC-IFIC, and other CARE-HHH partners
- **HHH-AMT** Pulsed SC magnets: L. Bottura, D. Leroy, **W. Scandale**, and D. Tommasini (CERN), G. Moritz, J. Kaugerts, and M. Wilson (GSI), P. Fabbriatore and G. Volpini (INFN), J.M. Rifflet (CEA/Saclay), I. Bogdanov et al (IHEP)

All these people contribute only part-time!

Some CARE-HHH workshops in 2005

- **CARE-HHH-APD Workshop on “Scenarios for the LHC luminosity upgrade”, Arcidosso, 31/08-3/09/2005**
Topics: optical designs and luminosity performance for alternative IR layouts (dipole first vs quadrupole first (Nb-Ti or Ni3Sn) vs ironless magnet at very low beta*, beam-beam compensation schemes and machine-experiment interface), machine and magnet parameters for high energy injectors: lattice, magnet aperture, injection and extraction for new ring in the ISR tunnel, super-SPS with new transfer lines, or booster ring in the LHC tunnel \Rightarrow Super-PS proposed by Garoby
- **CARE-HHH-AMT Workshop on “SC Pulsed Magnets for Accelerators”, Frascati, 26–28 October 2005**
Topics: define set of agreed parameters for the development of SC magnets ranging from low field, continuously pulsed (typically 2 T peak, 4 T/s, 100 mm aperture, 10^8 cycles) to medium field, high-duty cycle magnets for storage and booster rings (typically 6 T peak, 1 T/s, 80 mm aperture, 10^6 cycles), translate requirements into specifications for performance of strand, cable, magnet and auxiliaries, define R&D required to achieve the above specifications and produce a tentative road-map for a procurement and prototyping activity.

Tentative conclusions

- A systematic review, optimization, and possible re-design of the **LHC injector complex** was not clearly identified as a topic within the CARE-HHH scope
- This is being partly corrected by re-scoping the HHH Network (see HHH-2004 and LUMI-05 workshops), but properly addressing all the weak/missing topics will require **additional resources**
- Further R&D on **pulsed magnets and optimized injector chain** may justify a new request to Brussels
- EU NEST proposal on “**Fast SC pulsed magnets**” for GSI and LHC injectors upgrade: CERN (Scandale)-GSI (Moritz)-INFN (Fabbriatore-Volpini)-CEA/Saclay (Rifflet) has **not been approved...**