

**tentative conclusions**

# Beam parameters

- new parameter sets with acceptable electron cloud & pile-up events
- 25 ns spacing ultimate beam with low  $\beta^*$  - may need D0 and small-angle crab cavities
- 50 ns spacing long bunches – may need wire compensation
- ( 25-ns large emittance & 12.5 ns short bunches imply unacceptable heat load )

# IR upgrade

- quadrupole 1<sup>st</sup> is preferred: less demanding development; optimal layout under investigation
- NbTi & Nb<sub>3</sub>Sn & hybrid solutions
- incentive to develop high-gradient large-aperture quadrupoles
- investigations to minimize chromaticity and impact on field quality
- pursue D0 and Q0
- wire compensation & small angle crab cavities

# Injector upgrade

- normal-conducting PS2 should be successor of PS: reliability & availability, well advanced technology
- optimum extraction energy, layout, & other parameters to be determined
- PS2 to be complemented by measures in SPS
- experimental validation of energy scaling
- launch s.c. magnet R&D: 3.5-4.5 T, 2 T/s rate
- superferric LER in SPS to be more deeply investigated
- studies on space-charge compensation?

## Discussion on injectors:

- D. Tommassini: does not agree with preferring PS2+ over PS2 – no fair comparison
- R. Garoby: agree on basis of arguments
- P. Lebrun: two studies should be conducted in parallel
- R. Schmidt: PS2+ same field or higher field?
- P. Spiller: contrast of perfect control in LHC, but distributed losses in PS; philosophy that losses can be controlled; running GSI machines have no beam loss during acceleration; other cables could be option
- P. Lebrun: are we too conservative when GSI is building two fast cycling s.c. machines?
- R. Garoby: need conservative design, also for heavy ions
- D. Tommassini: even 1 kW/m e-cloud losses would be acceptable
- L. Lebrun: need to shed light on advantages

Discussion on injectors II:

T. Taylor: combined function?

W. Scandale: not compatible with imaginary gamma transition

P. Spiller: would choose flexible machine for future

S. Peggs: does not like imaginary gamma transition;  
fundamental issues with optical functions; lack of flexibility

W. Scandale: no major geographic constraints

S. Peggs: now know more about transition crossing than before

R. Assmann: time scale for decision?

W. Scandale: preference for n.c. solution, but keep alive  
alternative option of s.c. option with conservative s.c. magnets

D. Tommasini: why preference for n.c. solution?

J.P. Koutchouk: feeling that n.c. was preferred; allow for  
competition

P. Lebrun: reminder that conservative design would be weak  
focusing

Discussion on injectors III:

G. Arduini, J.P. Koutchouk: find solutions for e-cloud

W. Scandale: PS2 parameters under investigation

W. Scandale: changes in the SPS itself; e.g., renovation of the SPS beam pipes; may be trigger for full renovation of the SPS

S. Peggs: examples like Fritz Caspers' enamel beam pipes?

W. Scandale: e-cloud, rf improvements, impedance reduction

S. Peggs: no R&D needed?

W. Scandale: NEG coating

T. Taylor: need to bake it!

R. Garoby: kicker impedance; cavity HOMs

V. Mertens: kicker improvements in progress

W. Scandale: changing of pipes ~3 months, needs to be well planned

Discussion on injectors IV:

G. Arduini: cures found is scrubbing

W. Scandale: changing of pipes ~3 months, needs to be well planned

R. Garoby: in situ treatment?

F. Zimmermann: glow-discharge cleaning done at DESY in DORIS and/or PETRA

W. Scandale: good recommendation for ECL2

M. Furman: objection to NEG material in LHC: activation

G. Arduini: tests were done in SPS;  $\delta_{\max} \sim 1.3$  even with saturated NEG

J.P. Koutchouk: A. Blondel showed no PS2 physics; extraction energy needs to be optimized for SPS+ ; PS2 engraves present scheme; without thinking about future; 50 GeV may not be OK

R. Garoby: 4-20 GeV is far from optimum; 20 GeV would limit for obscure reasons



Discussion on injectors V:

J.P. Koutchouk: Stage for DLHC goal; 50 GeV is either too low or too high

R. Schmidt: do fast ramping s.c. current have p.c. errors?

W. Scandale: factor 15 is considered save; discussed at magnet workshops

D. Tommasini: compare magnets below 2 T; with warm iron & s.c. coils magnets will be smaller and cheaper

T. Linnecar: intensity pushes SPS development; strong interest in going to higher intensity and higher energy; at least allow for 1 TeV SPS option

J.P. Koutchouk: PS2 should be naturally around 100 GeV

W. Scandale: launch s.c. magnet R&D for SPS+

S. Peggs: can you quantify the goals?

W. Scandale: similar to FAIR, 3.5-4.5 T, at least 2T/s ramp rate

Discussion on injectors VI:

R. Garoby: need scenario for LER

W. Scandale: coalescing for reaching higher intensity

R. Garoby: details important

W. Scandale: can organize a workshop

S. Peggs: FNAL efforts?

V. Shiltsev: 1.5 FTEs at the moment; could add more

T. Taylor: Gijs de Rijk would be interested

V. Shiltsev; need CERN people on board

T. Linnecar: fill SPS 50 ns spacing, and the slip stack to get 25 ns; avoids e-cloud problem in the SPS

V. Shiltsev: FNAL is willing to look into this; in line with FNAL effort

Discussion on IR:

S. Peggs: what does field quality mean?

W. Scandale: all optics solutions need to be worked out,  
including chromatic corrections