

Minutes of the SPL steering group

meeting no. 8

date: 18 April 2008

present: O. Brunner, S. Calatroni, E. Ciapala, R. Garoby, F. Gerigk, A. Lombardi, R. Losito, J. Tuckmantel, M. Vretenar, W. Weingarten

excused: V. Parma, C. Rossi

Agenda

1. General news and facts
2. Upcoming SPL review meeting
3. Recent SRF workshop at CERN
4. Impact of number of cells/cavity, frequency, and beam current on HOM sensitivity (J. Tuckmantel)
5. Next meeting

1. General news and facts

R. Garoby: there may be an opportunity for extended collaborations with the US, which may even be of interest for Linac4 on the subjects of: low-level RF, laser charge exchange injection, laser wire scanners, vector modulators. Also there are positive signs from Triumf for work on SC cavities, but nothing is clear so far.

Around 300 kCHF are available for the SPL this year. Most of it will go to the French contribution, some parts to the 3 MeV test stand, and the rest to the cryo-module development at CERN and for SLHC-CNI.

ESS-S now has support from Denmark. The 2 posts are expected to be filled in autumn. They are paid by ESS-S for 2 people to work at CERN and to learn about RF power modulators and general linac design aspects.

It was reminded that the talks for the review meeting should be ready by Monday evening.

F. Gerigk: The asymmetric power splitting system at the XFEL will work with mechanical phase shifters, not with fast ferrite based elements.

2. Upcoming SPL review meeting

The meeting has been announced and added to Indico:

<http://indico.cern.ch/conferenceDisplay.py?confId=32631>. It was decided that beam dynamics is covered within the talk on the different layout options by F. Gerigk. W. Weingarten will be the speaker for "SC cavities", and O. Brunner was asked to help E. Ciapala on the question on how the frequency choice affects the RF hardware.

A. Lombardi reported that the option of having 1408 MHz cavities from 160 MeV onwards looks feasible. This means that it may not be necessary to rely on spoke cavities for an intermediate energy range from 160 to 400 or 600 MeV.

In the morning of April, 30th Dave Mc Ginnis will give a talk on the "Status of the Project-X at Fermilab", 11:00 in the AT auditorium (30-7-018).

3. Recent SRF workshop at CERN

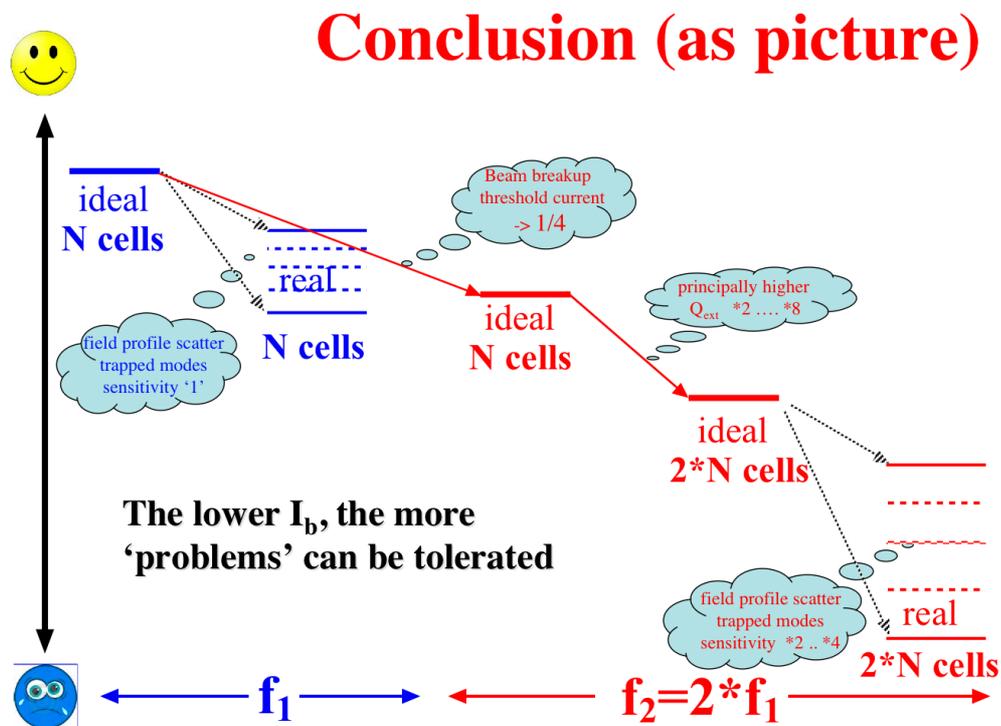
F. Gerigk reported on a discussion with Heinz Bohlen (CPI) on IOTs. Even though IOTs hold the promise to deliver up to 2 MW, they seem to be of interest primarily for CW applications. For pulsed power, klystrons will remain the most economical solution (not counting the cost for waveguide splitting systems). See H. Bohlen's talk and M. Caploto's (Thales) talk at SRF. H. Bohlen was confident the 1400 MHz multi-beam klystrons, which are now used at DESY (delivered from CPI, Thales, and Toshiba), can also work at the SPL duty cycle (up to 10%). It seems that the technology could also be used at lower frequencies (700 MHz) to obtain higher peak power at high duty cycles, given some time for development.

In a talk on a new RF fan-out system Y. Kang presented a vector control algorithm that allows to split klystron power to any number of cavities without having to provide a significant power overhead for the controls. The system relies on measurements at the input of each cavity and on the use of $2N+1$ fast phase shifters for N cavities. It was criticised that the beam loading will create multiple reflections in the waveguides, which will heavily disturb the measurements, which are necessary to adjust the voltage and phase in each cavity.

J. Tuckmantel reported on news that "copper black" (instead of Titanium Nitride) could be used to mitigate e-cloud effects. This could be of use in the SPL transfer lines.

4. Impact of number of cells/cavity, frequency, and beam current on HOM sensitivity (J. Tuckmantel)

J. Tuckmantel showed the summary slide of his talk for the review meeting:



The picture basically gives a relative measure on how much more sensitive the beam becomes to the Beam Break-Up instability (BBU) when the frequency is doubled (-> factor 4) and when the number of cells is doubled (-> factor 2). Additionally one has to take into account that in structures with more cells, there is a higher risk of trapped modes and that there is high likelihood that a number of HOMs will only couple very weakly to the HOM couplers. This effect can easily increase the sensitivity towards BBU by another factor of 4.

F. Gerigk has looked at some examples from the SNS studies:

- SNS HOM damping requirements via bunch tracking (PAC 2001) [↗](#)
- Transverse beam break-up study of the SNS SC Linac (PAC 2001) [↗](#)
- Higher order mode analysis of the SNS superconducting linac (PAC 2001) [↗](#)

which seem to indicate the BBU would be a problem if all HOM frequencies in the cavities were exactly the same. However, assuming a realistic frequency spread it was found that HOMs are no problem (even for high currents) if the loaded Q for each HOM is $< 10^8$. Nevertheless, HOM couplers were installed in the SNS cavities, but due to leaking problems at the feed-through locations, they are now being removed from the cavities.

5. Next meeting

to be announced

-- FrankGerigk - 25 Apr 2008

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