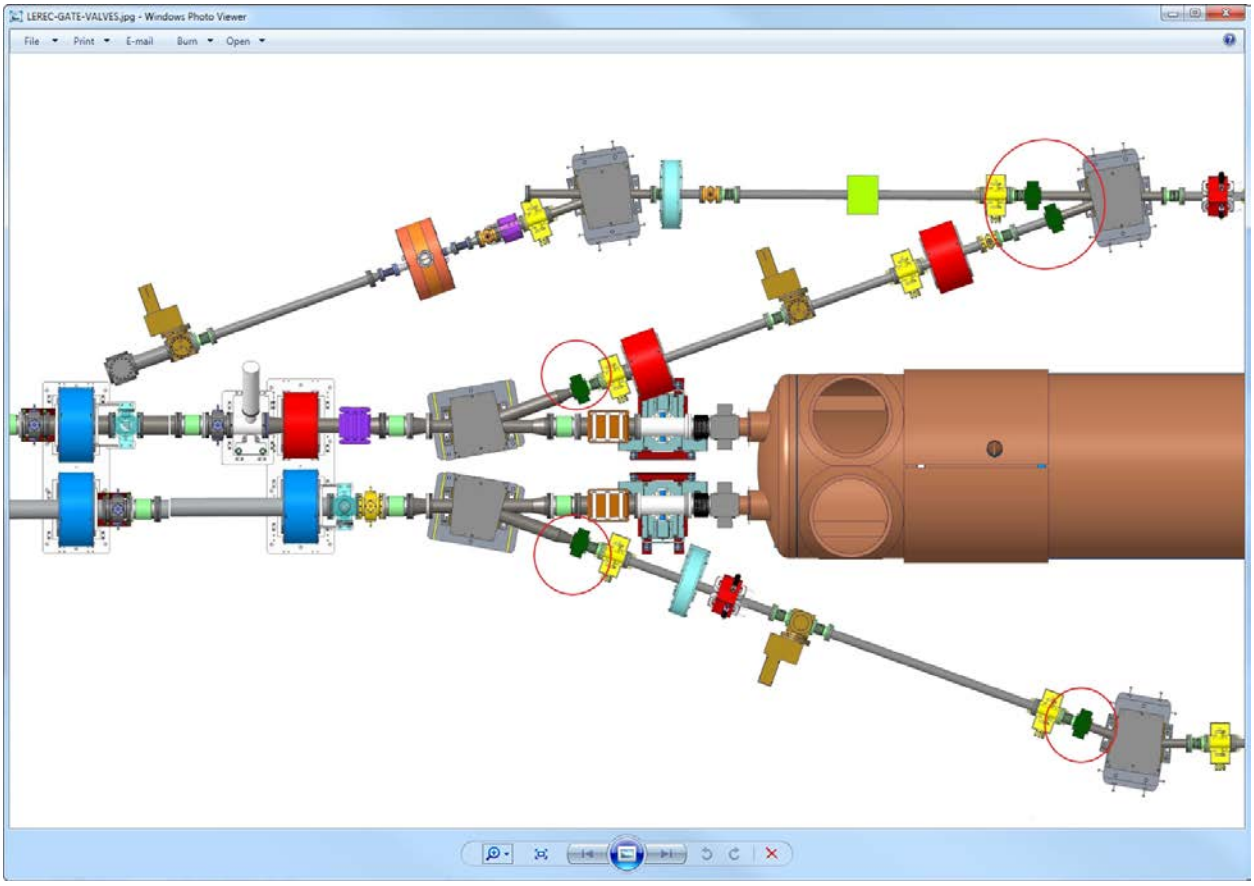
LEReC RF Diagnostic Line Notes

KSS 2016-06-13

2016-06-10 Meeting (Note 3)

1) First meeting in some time, since the LEReC DOE Mini-Review.
    a. The diagnostic line now has no spectrometer (cost consideration pre-review).
2) For the time being, the detailed layout of the Diagnostic Line is deferred until we:
    a. Settle on the final arrangement of beamline elements.
    b. Have a designer available to do the layout.
3) We achieved a general agreement on the layout of the components downstream of the 20 deg dipole.
    a. The layout which was used for discussion follows at the end of the 2016-06-10 notes below.
    b. The Deflection Cavity will move as far upstream toward the dipole as practical.
        i. This is to maximize available horizontal aperture for beams with high energy spread.
            1. 704 deflecting cavity is the limiting aperture?
                a. I'm gonna look at that again.
    c. The components immediately upstream of the Deflection Cavity as of 06/10 will move downstream.
    d. Decision on Y-Pipe with straight stub on 20 deg dipole?
4) Went in circles discussing the required beam dump size and present location.
    a. This has an impact on the specifics of locating the beamline and its components.
    b. The required size of the dump needs to be analyzed based on power considerations.
        i. J. Hock will work on this.
    c. The location of the dump is such that components in the cooling section are directly downstream (w.r.t. to the diagnostic line beam direction) and on plane.
        i. Thus it's in the line of fire of any radiation coming off the dump.
        ii. J. Hock will get D. Beavis to analyze whether this represents a risk to those components. D. Beavis will also analyze residual activation of the dump based on dump material.
        iii. Alexei needs to provide the nominal diagnostic line beam parameters to D. Beavis and J. Hock.
        iv. There were various proposals on tilting the beamline.
            1. Not going there yet.
5) B. Xiao and M. Blaskiewicz will look into the field profiles in the deflection cavity.
    a. Concern is what kind of alignment tolerances we need so that the phase space profiles will not be distorted (rotated for example) and limit ability to resolve slice spreads.
    b. D. Kayran and J. Kewisch will do particle tracking to determine tolerances.

6) B. Xiao will analyze tuning range of deflection cavity to see if tuning with cooling water temperature control will suffice.
7) End of notes.



2016-01-29 Meeting (Note 2)

1) Initial discussion centered once again on the question of whether or not this line is needed and will it do what we need. So here's my take on the outcome, which I think is no different from where we have been since the near the beginning of these meetings beginning:
    a. Purpose of the line:
        i. The diagnostic line provides the only means for making absolute energy and energy spread measurements under steady state full beam intensity conditions.
        ii. The electrostatic spectrometer provides the only absolute energy calibration we are able to make.
        iii. The RF deflector line provides us with the only slice energy spread measurement (longitudinal phase space) we can make.
    b. Location of the line:
        i. Downstream of the first 20 degree bend.
        ii. Used with the first 20 degree bend powered off.
        iii. There are space constraints which must be accommodated.
    c. Concept of its use:
        i. Provides the stated measurements in (1.a) at a known reference location.
        ii. Assumes that we can accurately model and predict the subsequent transport from the entrance of the 20 degree bend, through the dogleg and the first cooling section, such that it ensures we achieve the desired longitudinal phase space distribution at the 180 degree bend necessary to provide optimal cooling.
    d. Requirements:
        i. Must provide sufficient resolution and stability to measure absolute energy to 5E-4.
        ii. Must provide sufficient resolution to measure the slice energy spread to 1E-4.
    e. Other Related Measurements Elsewhere along the Cooling Section:
        i. BPMs will provide real time relative measurements of relative beam energy drift, employing dispersion from the 180 degree bend.
        ii. There is no other location which can provide the measurements of (1.a) under steady state full beam intensity conditions.

2) Current Status:
    a. The highest priority in the near term is to generate a full cost estimate of the diagnostic beamline for the upcoming April review.
        i. This estimate is the basis for the required PCR.
    b. The major items to be costed are:
        i. Requiring conceptual design to allow for costing:
            1. The fast kicker used to limit total beam power dumped onto the diagnostic screens.
                a. Behlke switch or other modulator.
            2. The internal beam dump which absorbs the beam until we reach steady state.

3. The vertical deflecting cavity, RFPA, cabling and LLRF.
4. The electrostatic spectrometer.
    a. Including power supply, cabling, girder/stand, calibration work at TVdG, transport back and forth.

ii. Costed based on generally well known existing designs:

1. 20 degree bend for deflector line.
    a. What was the decision on laminating the upstream 20 degree bend and/or all bends?
    b. Power supply(s).
2. Fixed YAG for deflector line, camera, cabling, etc..
3. Plunging YAG upstream of electrostatic spectrometer.
    a. Slits?
4. Fixed double YAG at end of spectrometer line.
    a. Motion control.
    b. Faraday cup.
5. Required solenoids and quads.
6. Beampipe.
7. Mu-metal shielding or distributed corrector dipoles.
8. MPS related devices:
    a. Loss monitors.
    b. Temperature measurement.
    c. Vacuum gauges and controllers.
9. Vacuum valves.
10. Stands for everything.

c. There will be no detailed design for some time due to lack of available resources.

3) Homework:
    a. Dima will provide the simulated YAG longitudinal phase space data for proof of principle data analysis by Michiko and Kevin Mernick.

4) Other:
    a. I'll likely have another meeting next week focusing on making sure we've identified everything required for the cost estimate in (2) above. We also review who's responsible for generating what parts of the cost estimate.
    b. Reminder that the LEReC Website with lots of info, presentations, meeting notes, etc. is here:
        i. http://www.c-ad.bnl.gov/esfd/LE_RHICeCooling_Project/LEReC.htm
    c. Reminder that there is now a LEReC RF Wiki (under development) here:
        i. http://www.cadops.bnl.gov/RF/Wiki/index.php/LEReC_RF_Systems

2016-01-05 Meeting (Note 1)

1) Discussed the need to provide schedule for long lead items for the line by end of the month.
    a. Refer to e-mails between K. Mirabella and Alexei, 2015-12-03:

RE: LEReC Beam Instrumentation line

Fedotov, Alexei

Sent: Thu 12/3/2015 11:24 AM
To: Mirabella, Kerry A; Gassner, David M; Tuozzolo, Joseph E
Cc: Williams, Khianne; Mahler, George J; Smith, Kevin S; Zaltsman, Alexander; Minty, Michiko

We should try.
But is it feasible before some design of items 1-3 exists?

Even if detailed cost estimate is not required for this recommendation

- Generate a schedule, list of long-lead procurements, performance specifications, and commissioning plan for the diagnostics beamline and submit to NP by February 4, 2016.

we will need cost estimate for all these line
elements pretty soon since we will need to submit PCR and ask to use contingency
money for this line. I am sure as soon as RF deflecting cavity design
is done in a few month Alex would like to order this cavity.

We need to start with the schedule of these elements, especially long-lead items.
For example, if we need RF deflecting cavity at BNL by summer of 2016, we will need
to place a bid for the cavity in summer of 2016, which means that mechanical design has to complete
in Spring of 2016. So we need PCR for this beamline to be already approved
in Spring of 2016, which means detailed cost estimate by Spring of 2016.

Alexei

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    b. Identified only two beamline components which we consider long lead:
        i. 704 MHz Transverse Deflector Cavity
            1. KSS will develop schedule.
        ii. Electrostatic Spectrometer
            1. KSS will set up meeting with PT et al to develop schedule.
    c. Electrostatic Kicker and Beam Dump not considered long lead.
        i. Does not imply they won't need significant design time / effort.
2) Dima reviewed the overall optics design and evolving component layout.
    a. J. Hock will have an updated preliminary layout with basic component spacings in a couple of days.
3) Homework:
    a. HW1: Dima will use the updated layout to start firming up beamline component layout based on desired optics.

i. Kicker and Dump
    1. KM can provide nominal deflection angle info for the fast kicker.
    2. Just assume the “internal dump” for now is the standard beampipe wall.
    3. Beam transverse size provided by existing sim data.
    4. This gives nominal spacing kicker to dump and dump length.
ii. Place other correctors, BPMs, etc. as necessary.
iii. By next meeting we should have a reasonable layout for discussion, with all major components placed.
iv. Obviously this will get iterated.

b. HW2: Dima will use Jorg’s tolerance table to simulate longitudinal phase space profiles to see how this translates into the observable distribution on the YAG.
    i. Tolerance table via Alexei:

Parameter	Tolerance
SRF phase	+/- 0.4 deg
SRF voltage	+/- 1.7 kV (1.2e-3 rel)
Warm 2.1 GHz phase	+/- 1.8 deg
Warm 2.1 GHz voltage	+/- 1.6 kV (2e-2 rel)
Warm 704 MHz phase	+/- 0.4 deg
Warm 704 MHz voltage	+/- 1.2 kV (2e-2 rel)
Gun Voltage	+/- 1 kV (2e-3)
Solenoid 1 Scale	2e-2 (relative)
Solenoid 2 Scale	2e-2 (relative)

c. HW3: Binping will the HOM/wake analysis for the deflector cavity.
    i. MMB and Binping discussed the details. I missed writing that down.

4) I’ll work at getting the meeting documentation up on line.
5) No meeting next week as Alex and I will be on travel Tue-Fri.