Working meeting on LINAC-100 and LINAC-30.

Participants:
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S.M. Polozov (MEPhI) – main speaker. Design of LINAC-100 and LINAC-30 for new rare isotope facility project DERICA at JINR.

Several burning questions concerning conceptual design of LINAC-100 were actively discussed during the talk of S.M. Polozov:

1) The discussion of staging of DERICA project vs. the 7-year plan of FLNR is not finished yet. Stage 1 of DERICA considers construction of the {gas cell – ion trap – charge breeder} system and then LINAC-30. Alternative vision is possible where the emphasis is done on the accelerated construction of LINAC-100 + DFS to move there scientific program of U-400M + ACCULINNA-2. Motivation for this change is growing understanding that successful upgrade of U-400M in 2019-2020 even in the case of considerable increase of beam energies and intensities will not produce corresponding increase in scientific opportunities because of radiation safety limitations. At the moment there seem to be no satisfactory solution to the problem in the sense price/quality criterion.

2) There is problem of efficient conjugation between ECR ion source and LINAC-100. Such an efficient conjugation impose strong requirements to the RFQ entry section LINAC-100 in the sense of size and cost. Experience of existing ECR sources at FLNR is connected with specific use of these sources (axial injection for cyclotrons). Design options for ECR sources (which can decrease emittance of the beam injected into LINAC-100) should be considered before RFQ design is finalized.

3) The basic design of LINAC-100 assumes effective acceleration of U beam with typical A/Z ratio from ion source in the range 6–7. In reality the U beam energies around 100 AMeV are too low for efficient RIB production. However, efficient beam acceleration is important considering possibility of future energy upgrade to energies 150-200 AMeV. Thus, we need to keep in mind that in reality much lighter beams are expected to be most often used in the first years of DERICA functioning. They can be obtained with much lower A/Z ratio source in the range 3-5 from directly from ion source. However, accepted “acceleration strategy” is to use A/Z~6 in the first stage. To achieve higher acceleration efficiency one or even two stripping stages should be used to decrease A/Z ratio. Lighter primary beams will be fully stripped at once, while for heavier beams the charge state separation is required and corresponding installations for damping of the beams with “wrong” charge states. Location of stripping stage and corresponding machinery is to be optimized and fit in the “global layout” of LINAC-100.
4) Decision about “global layout” of LINAC-100 is also perplexed by the need to take into account the following requirements:

– Upgradeability of LINAC-100 to 150-200 AMeV. Opportunity to accommodate extra resonators in the LINAC-100 “tunnel” should be reserved already now.
– Location of two possible experimental areas should be decided. These are areas for (i) applied studies with high-energy primary beams (end of LINAC-100) and (ii) physical experiments with primary beams of Coulomb barrier energies (7–10 AMeV, beginning of LINAC-100)

5) LINAC-100 is the largest device of the whole DERICA project. Also it should be conjugated in some natural way with DFS fragment separator. DFS with its very high radiation load in the {production target – preseparator} area is expected to be the most massive part of DERICA in the sense of civil engineering. At the moment there is a need to fix “global layout” of DERICA project. However, it is strongly dependent on layout of LINAC-100+DFS combination. So, some urgent efforts for primary design of LINAC-100, DFS, DFS radiation protection, experimental areas around LINAC-100 are needed to resolve the DERICA “global layout” problem.