Objet: Minutes of the First Workshop HRS

Participants:

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H. Weick, GSI, Germany

Program:

B. Blank: Introduction to the workshop

C. Davids: The CARIBU HRS: design, manufacturing and installation

R. Baartman: High-resolution separators at TRIUMF

F. Varenne: SPIRAL2 and its production building

D. Lunney: Beam preparation with the DESIR RFQ SHIRAC

T. Kurtukian-Nieto: Design studies of the DESIR HRS

L. Serani: TURTLE calculation of the HRS

F. Meot: The HRS as seen by ZGOUBI

H. Weick: GICOSY calculations for the HRS

B. Blank:

Introduction to the workshop and brief description of SPIRAL2-DESIR project. It was proposed to perform a second workshop in 2010.

C. Davids:

The CARIBU HRS: design, manufacturing and installation.

- It is important to leave enough space between dipoles in order to be able to place vacuum pumps, etc.
- The energy dispersion destroys the resolution. Second order chromatic aberrations are negligible compared to that effect.
- Too small slits are difficult to manage.
- All fringe fields for the electrical elements were calculated using SIMION8.
- The fringe fields for dipoles are the measured ones by the manufacturer. Ask the manufacturer for 3D field maps.
- Because the size of the beam in y is small, the precision in the field map of dipoles is not so much important.
- Inside the multipole there are diagnostics.
- The alignment to 0.1mm is not a problem.
- It can be necessary to place slits before the magnets.
- Field clamps at dipoles made the installation more difficult.
- The HRS for CARIBU is currently at the installation stage.
- The magnet homogeneity is $3*10^{-5}$ of field integral.
- He advises to take care of all manufacturing process.
- For diagnostics they use 2D micro channel plates.
- The cooler is crucial to get the high resolution desired.
- The time schedule is to be ready in the spring.
- He said that they had no place for it, but that it would be good to have an electrical compensation section at the separator.
- Consider 2 years for the manufacturing of dipoles.

R. Baartman:

High-resolution separators at TRIUMF http://lin12.triumf.ca/text/Talks/2009DESIR_HRS

- High mass separation is an engineering issue and not a beam dynamics one.
- The field index of the dipole at the TRIUMF HRS is 0.5.
- The system has a pre-separation section of ~1000 resolution to reduce activation.
- The actual beam is $\Delta x=0.524$ mm and $\Delta\theta,\varphi=11.9$ mrad but the design goals were $\Delta x=0.13$ mm and $\Delta\theta,\varphi=60$ mrad.
- Problems found at HRS/TRIUMF:
    - Slits are not controllable to fractions of mm

- Hall probe only good to 0.3 Gauss
- Aberrations are bad: bad optics
- Insufficient intensity i.e. lack of an offline source

- What they learned:
  - Provide an offline source upstream of separator so we can commission it independently.
  - Use vertical constraints (not just horizontal slits) to aid reproducibility.
  - More diagnostics to help match out of separator. This is an often-overlooked issue. Magnification from mass slit to transport system is >> 1.
  - Should have given more thought to low resolution setup. As it is, it takes too much time to set up a simple low resolution tune.
  - Should arrange for ample commissioning time.

- Tuning to high order corrections is hard and the return is small.
- No more than 5000 in resolution in "real life".
- The design should be done in the way to get as small correction as possible.
- For ISAC3 design, the high order corrections will be within the dipole.

F. Varenne:

SPIRAL2 and its production building. Description of the main constraint on the production building and the transport beam lines.

- The HV can be as low as 15 keV, so we should take care of this situation.
- We have 3 months to still change the design.

D. Lunney:

Beam preparation with the DESIR RFQ SHIRAC status report based on the F. Duval thesis work.

- From the preliminary results obtained with SHIRaC-1, we can expect to have a good beam emmittance to handle the beams with the HRS and obtained the required high resolution.

T. Kurtukian-Nieto:

Design studies of the DESIR HRS. Overview of the design goals and description of the different layouts proposed which are adapted to the different configurations into the production building.

A new layout for the HRS has been proposed as a conclusion of the discussion with the experts: An HRS Alpha 270 degrees which consist of a HRS U180 separator (two 90 degree dipoles) followed by two 45 degree electrostatic deflectors.

Two variants will be studied:

- A Caribu-like separator: ribbon shaped beam (doublet) and flat edges at dipoles with a multipole in the middle.
- An ISAC-like separator: dipoles have curved edges to correct higher-order aberrations.

L. Serani:

TURTLE calculation of the HRS. The performance of the different layouts studied for the HRS was presented including transmission and cross-contamination of neighbouring isobars.

F. Meot:

The HRS as seen by ZGOUBI.

- Fringe fields in matching quadrupoles seem not to be so important.
- There is no agreement between experts on the use of real field maps in the calculations. However, we'll use in the future TOSCA maps and/or Enge coefficients as obtained from the CARIBU dipoles, and SIMION8 maps for the electrical elements.

H. Weick:

GICOSY calculations for the HRS

- FQ1 is more sensible to the fringe fields but this is not so crucial since we can refit the system again and get the correct values for the excitations.
- Is important to place field clamps at Q-poles

<u>Proposal for a new HRS design for SPIRAL2/DESIR</u>:

- Two 90 degree dipoles. Aperture gap 80 mm and 85cm radii. Maybe reduce the horizontal gape to 50cm, with two configurations: flat or curved pole edges.
- Two 45 degree cylindrical electrical bends as the ones used at ISAC. 1.5 inch, ±9 kV. R. Baartman will send the drawings.
- Use coaxial cables at q-poles.
- C. Davis will send the drawings of all electrical elements.
- Try the use of skew (30 degree) sextupoles in the design.
- Keep the system symmetric
- M. Duval proposes to reduce the dipole radii to 60cm

Outlook:

- All participants agree in organising a new meeting in 2010 to discuss the progress of the project. H. Weick and F. Meot want to keep close collaboration with the project.

- We expect to have the new preliminary ion-optical studies ready before spring.