Sources Subgroup Special Meeting on JLab Participation Dec.3.2020

(This is not a faithful minutes. Just according to my memory)

Participants: Masao Kuriki, Hitishi Hayano, Gudi Moortgat-Pick, Joe Grames, Kaoru Yokoya, Steffen Doebert, Shin Michizono, Phill Burrows, Andy Lankford, Sabine Riemann, Peter Sievers, Kathy Machie, Dinh Nguyen, Vitally Yakimenko, (Some are missing, perhaps)

Indico: https://agenda.linearcollider.org/event/9010/

- Special meeting proposed by Joe for discussion of the possible participation of JLab on the issues of the positron source. (The electron source was not in the scope of the meeting).
- As an introduction Kaoru briefly described the issues of the positron sources both of the undulator scheme and of the e-driven sources.

(Uploaded to indico: PositronTargetIssue.pptx)

- Undulator source
 - ♦ Failure of TDR design
 - Rotating target \rightarrow vacuum leak from magnetic fluid
 - Flux concentrator \rightarrow time dependence of the field due to skin depth
 - Photon dump \rightarrow life of the window only several days due to dpa
 - ♦ New design
 - Longer undulator $147m \rightarrow 231m$ because of Ecm= $500 \rightarrow 250$ GeV
 - Thinner target $0.4X0 \rightarrow 0.2X0 (7mm)$
 - Flux concentrator \rightarrow QWT (Quarter Wave Transformer), peak field ~1T
 - Water cooling with ferro fluid vacuum seal → radiation cooling with magnetic bearing
 - \diamond Issue at present
 - Undulator itself: less problem
 - Rotating target: still in design, prototype desired
 - Magnetic focusing system: positron yield only ~0.8 (1.5 desired)
- e-Driven source
 - ♦ Latest design https: //doi.org/10.1016/j.nima.2019.163134
 - ♦ Electron driver: no problem
 - ♦ Rotating target (water-coolong, magnetic fluid seal):

- Magnetic fluid material: study dine. Good property fluid selected.
- Test of prototype wheel going well (less weight, full speead, no water)
- Next step: full weight, more accurate stress calculation
- \diamond Flux concentrator
 - Designed by BINP
 - Remaining issue: FC to target distance, cooling system
- ♦ Capture cavity (L-band standing wave)
 - Main remaining issue
 - Beam current: max ~2A, large beam loading
 - APS (Alternating Periodic Structure) cavity under design
 - Loading calculation under study
- Discussion
 - ♦ Undulator scheme
 - JLab has been involved with e-driven CW polarized positron source. We considered in which field JLab can contribute. One possible area may be DC QWT or long pulse (even DC) flux concentrator. (Joe)
 - Is there any study and computer code on the magnetic interaction between rotating target and magnetic field (eddy current)? (Peter)
 - Recent undulator scheme progress must be included → see Peter's file uploaded
 - Shorter pitch undulator? 231m undulator section may be reduced. → difficult to develop in 2 years for the immediate use.
 - Long undulator section may cause difficult orbit correction?
 - Interference between FC and magnetic bearing? → They are far each other.
 But even O(10gauss) may be an issue?
 - ♦ e-Driven scheme
 - Target: Is any vacuum spike seen? \rightarrow Found but much less serious.
 - Stress calculation: done by a company.
 - Flux concentrator cooling: development started in a company in Tohoku.
 - Flux concentrator: CERN can contribute (Steffen)
 - Capture cavity: heavy beam-loading. → Meeting at JLab on the Pre-Lab issue planned on Dec.15. Will discuss on this issue. Bob Rimmer may say something.
 - ♦ General
 - Polarization requirement from physics. If needed, e-driven drops out.
 - ANL interested in positron source. Past experience: Wan Ming, a guy from

Oxford who worked on the wheel, undulator experience.

- SLAC: helical undulator, beyond ILC, for FEL.
- Next meeting
 - > Time: Dec.7 23:00 JST, 15:00 EU, 9:00 EDT (No DST)
 - ➤ Topics:
 - ✤ Final discussion on the undulator source (presentation Gudi)
 - ✤ Expect to have the first drafts of the final document from e-driven, undulator, and electron source.