Cavities and Cryomodules

Introduction to WG2
and
Design Status Overview

Mark Champion

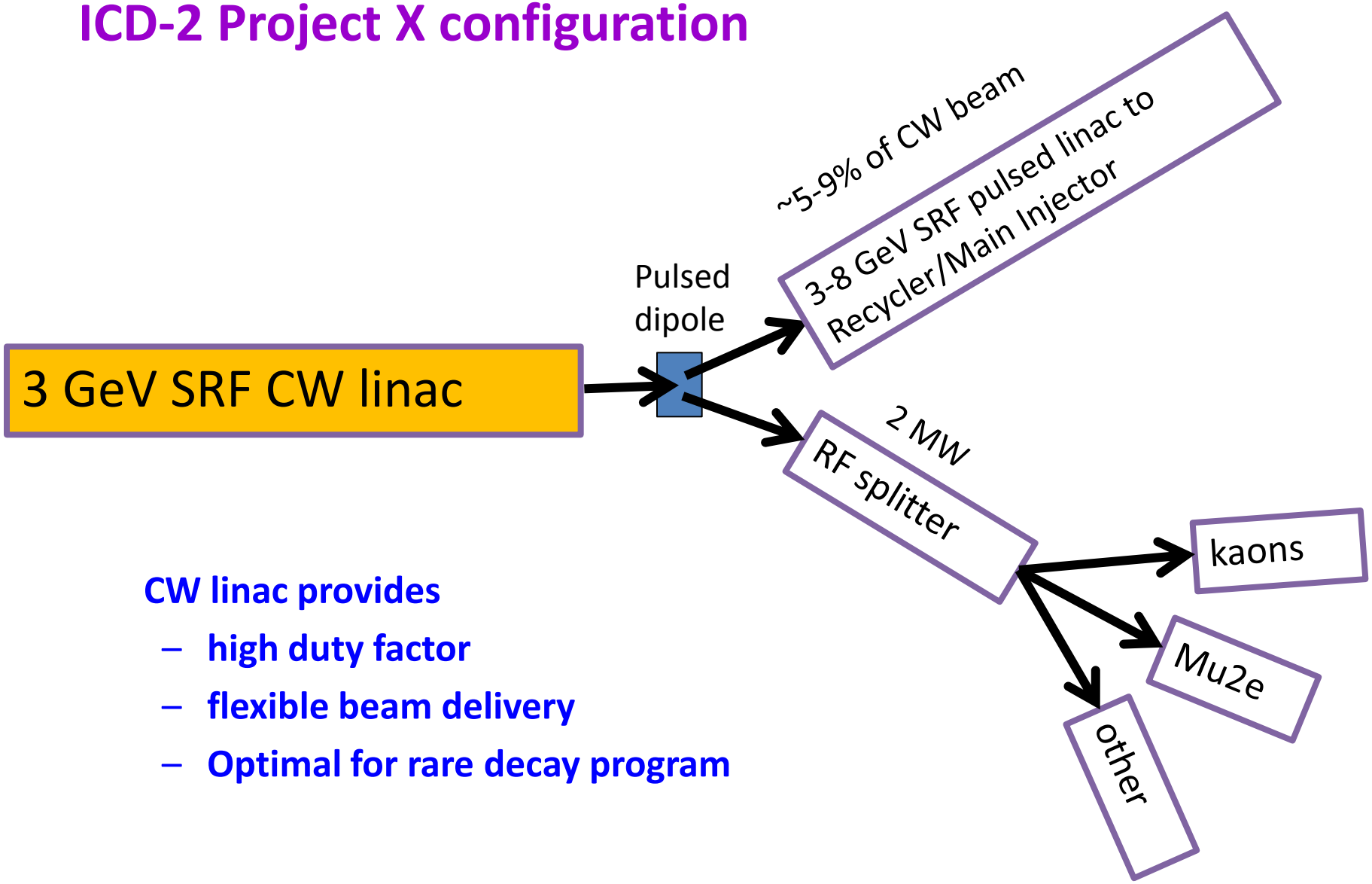
Project X Collaboration Meeting
September 8-9, 2010

Project X

Agenda

Working Group Session 1 - Hermitage			
11:00	0:20	Cavitie & Cryomodules design status overview	Mark Champion
11:20	0:20	Cavities & Cryomodules RD&D Plan	Bob Kephart
11:40	0:20	325 MHz Cavities - Report on first dressed cavity test	Bob Wagner
12:00	0:20	Cavity processing plans	Allan Rowe & Mike Kelly
12:20	0:10	Discussion	all
12:30		BREAK	
Working Group Session 2 - Hermitage and 1W			
13:30	0:20	Microphonics (with Linac Integration at 1W)	Matthias Liepe
13:50	0:20	LLRF / Microphonics (with Linac Integration at 1W)	Brian Chase
14:10	0:10	*** Move to Hermitage *****	
14:20	0:20	325 and 650 MHz cavity electromagnetic designs	Slava Yakovlev
14:40	0:20	325 and 650 MHz cavity mechanical designs	Mike Foley
15:00	0:20	650 MHz cavity design concepts	Bob Rimmer
15:20	0:10	Discussion	all
15:30		BREAK	
Working Group Session 3 (with Cryogenics and Linac Integration at 1W)			
16:00	0:20	Cryogenic segmentation	Jay Theilacker
16:20	0:20	Cryomodule design concepts	Tom Peterson
16:40	0:20	650 MHz cryomodule design concepts	Bob Rimmer
17:00	0:20	RF Coupler design concepts (optional)	Sergey Kazakov
17:20	0:10	Discussion	all
17:30		END	

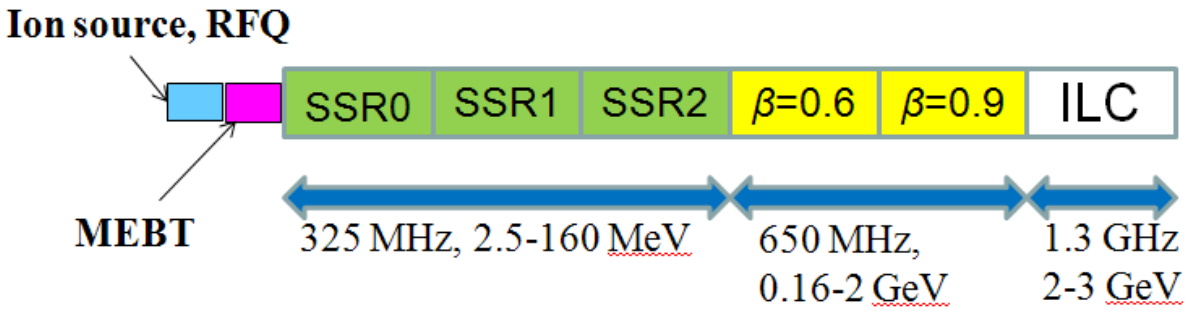
ICD-2 Project X configuration



CW linac provides

- **high duty factor**
- **flexible beam delivery**
- **Optimal for rare decay program**

Concept of 3 GeV, 3 MW CW linac:



- ion source,
- RFQ,
- medium energy beam transport (MEBT), including the chopper and bunching cavities,
- three sections based on 325 MHz Single-Spoke Resonators,
- two sections of 650 MHz elliptical cavities, and
- section of 1.3 GHz ILC (TESLA) type cavities.

Break points and number of components (03.08.2010)

Section	Freq	Energy MeV	Number of cav/mag/CM	Type of
Re-bunching RT Cavity (β_G=0.11)	325	2.5	4	Pill-box cavity, triplet
SSR0 (β_G=0.11)	325	2.5-10	26/26/ 1	Single-spoke cavity, solenoid
SSR1 (β_G=0.22)	325	10-32	18 / 18/ 2	Single-spoke cavity, solenoid
SSR2 (β_G=0.4)	325	32-160	44 / 24 / 4	Single spoke cavity, solenoid
LB 650 (β_G=0.61)	650	160-520	42 / 21 / 7	5-cell cavity, doublet
HB 650 (β_G=0.9)	650	520-2000	96 / 12 / 12	5-cell cavity, doublet
ILC 1.3	1300	2000-3000	72 / 8 / 9	9-cell cavity, quad

Design Status

- EM designs for all cavities
  - HOM couplers an open issue
- Engineering design for SSR-1 cavities
  - 2 prototypes have been tested in vertical dewar
  - 1 of 2 has been dressed and tested in horizontal test cryostat
  - 2 additional cavities in fabrication at IUAC (Delhi)
  - 10 additional cavities in fabrication at Niowave/Roark
    - First pair due end of calendar year
- Six beta 0.9 single-cell 650 MHz cavities out for bid
- Beta 0.6 single-cell cavities to be fabricated at JLab
- 88 ILC cavities total (44 received / 44 on order)
  - ILC R&D program, but funded through SRF and ARRA
- Cryomodule design work in early stages

Open Issues and Questions

- What pressure stability will be achieved in the 2 K helium bath?
- What is the optimal cryogenic system segmentation plan?
- Do the 650 MHz cavities need HOM couplers?
- What beam current shall we plan for in the cw and pulsed linacs?
  - 1 mA cw and 1 mA, 2 ms, 20 Hz?
- What cryomodule configuration is optimal for 325 and 650 MHz sections?
  - bathtub (ANL, TRIUMF, FRIB), ILC/XFEL, or space-frame (SNS)
- What range of Q values can be expected for the 650 MHz cavities?
- Fundamental power coupler design choices
  - Fixed vs. variable coupling
  - One vs. two windows
- Are the specifications for cavity dF/dP and Lorentz-force detuning coefficients appropriate?
- Where will the cavities undergo chemistry and test preparation?
- Shall we eliminate the 1.3 GHz section of the CW linac?