Working group 2 summary

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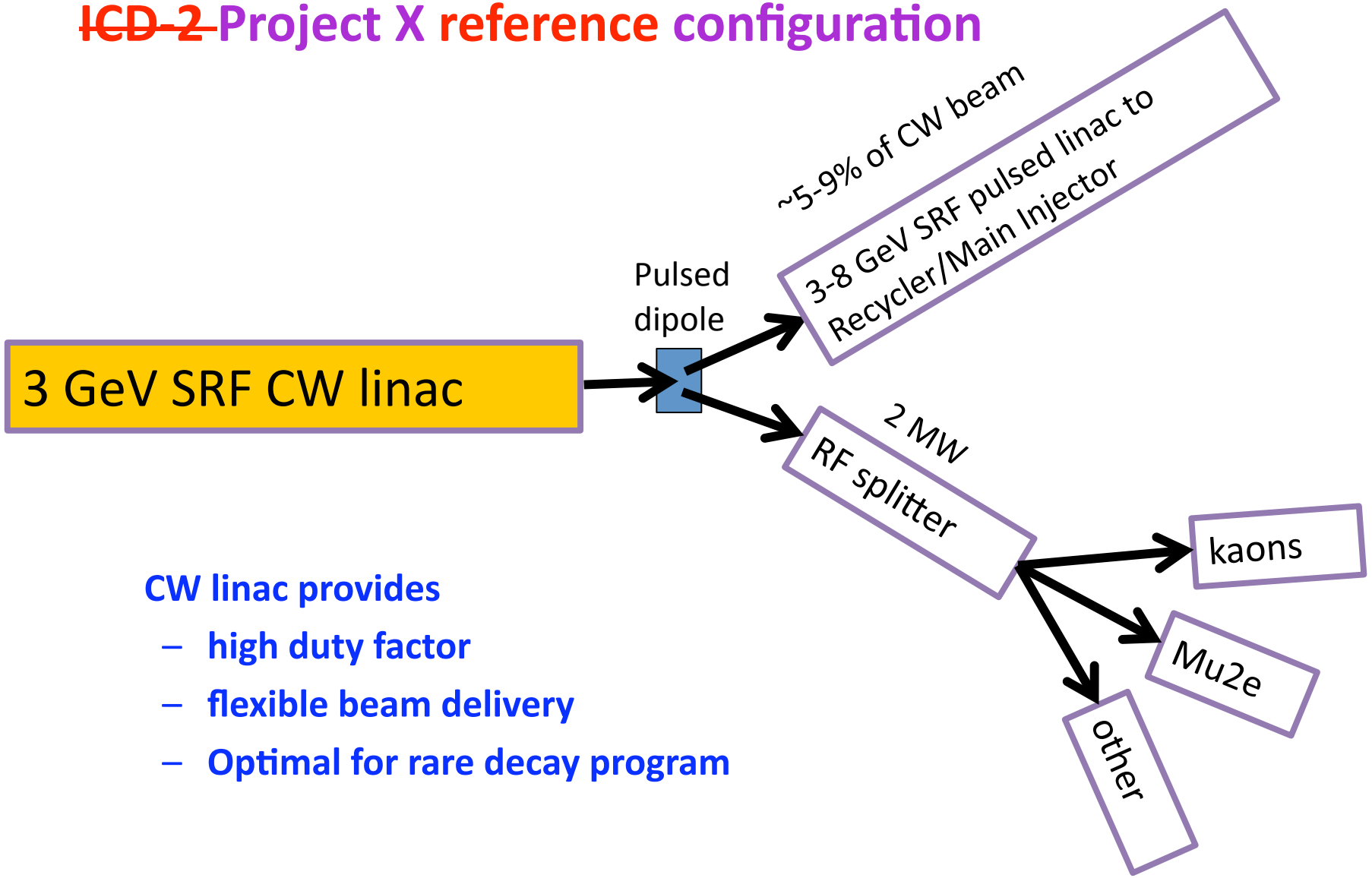
~~ICD-2~~ Project X reference configuration



CW linac provides

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

Cavities

- Much progress on 325 and 650 MHz cavities since last meeting
- Electromagnetic, mechanical analysis (pressure Lorentz, microphonics) of spokes and ellipticals
- SSR tests continue to be encouraging
- Beta 0.9 650 MHz single-cells on order from industry
- Beta 0.6 650 MHz single cells to be developed by JLab
- Opinion converging on CW option
  - No 1.3 GHz modules in CW linac
  - Optimized beta values for 650's give smoother energy profile
  - Improved IBS, losses, RF focussing etc.
- Many details still TBD
- Possibly room for optimization ~Beta=0.5 (multi-spokes?)

Cryomodules

- ILC type is appropriate for 3-8 GeV pulsed
  - Higher duty factor may be needed
- 325 MHz prototype design well advanced
  - "cylindrical" preferred over "bathtub"
- 650 could go either way
  - Modified ILC type (FNAL investigating)
  - SNS-type (highly modular scheme possible) (Jlab)
  - Something new?

Segmentation

- 3-8 GeV probably long strings are OK
- 0-3 GeV favors finer segmentation
  - Higher cryogenic loads
  - More cavity families and styles of modules
  - Higher technical risks (new designs)
- Flexibility of operation and maintenance are highly desirable
  - Quick turn around for repairs
  - Phased cool-down & commissioning
- Penalties in cryogenic load and space need to be evaluated
- CW linac lattice suggests “natural” segmentation
  - Maximum of 8 cavities between doublets at high end
  - Not so natural at low beta but desirable to split SSR0 to minimize risk

HOM damping

- Jury out on requirements
- Gut feeling that likely not needed for BBU
- Other effects may be important
  - Potentially high fields in cavities if resonantly excited
  - Emmittance degradation or bunch distortion
  - Generation of halo or losses
  - HOM power getting into unwanted places
- If needed, HOM dampers must be reliable
- Complicates cavity and CM design

Cavity and CM processing

- New capacity is coming online at FNAL/ANL
- Jlab TEDF will significantly expand capability
  - "Volunteer" for 650 MHz cavity and CM
  - Contribute to 1300 and 325 cavity processing if project phasing permits
- Industry capabilities increasing
- Role of foreign participants may be significant
- Process details still TBD (more R&D needed)
- Plenty of work to go around!

Project X Open Issues and Questions

- What pressure stability will be achieved in the 2 K helium bath? 0.1 Torr?
- What is the optimal cryogenic system segmentation plan? CW=fine, 3-8= coarse
- Do the 650 MHz cavities need HOM couplers? TBD, probably not for BBU but ??
- What beam current shall we plan for in the cw and pulsed linacs?
  - 1 mA cw and 1 mA, 2 ms, 20 Hz? Must be “upgradable” to at least 4 mA
- What cryomodule configuration is optimal for 325 and 650 MHz sections?
  - bathtub (ANL, TRIUMF, FRIB), ILC/XFEL, or space-frame (SNS) Under investigation
- What range of Q values can be expected for the 650 MHz cavities? 1-2 E10? Process development needed, optimized for medium field Q, no FE
- Fundamental power coupler design choices
  - Fixed vs. variable coupling Maybe fixed with external adjustment is OK?
  - One vs. two windows One good one!? If in doubt 2 is safer
- Are the specifications for cavity dF/dP and Lorentz-force detuning coefficients appropriate? Work in progress but seemed reasonable for 2K, CW
- Where will the cavities undergo chemistry and test preparation? FNAL/ANL/Jlab/ Industry/India/???
- Shall we eliminate the 1.3 GHz section of the CW linac? Yes?

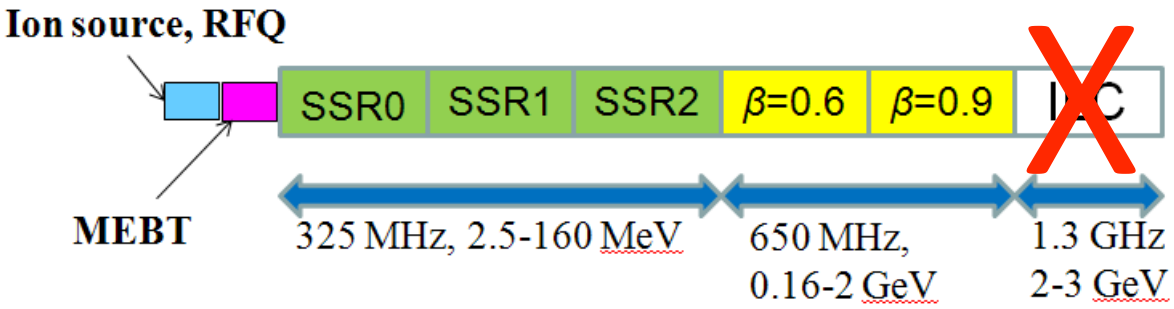
Project X

Conclusions

- Much progress on all beta value cavities and cryomodule families
- Designs converging on CW and Pulsed sections
- Active participation by collaborating institutions
- Many systems or components entering prototype hardware stage
- Still a lot to do

Backup

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 Replace with 650's	1300	2000-3000	72 / 8 / 9	9-cell cavity, quad