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RF SOURCE FOR THE ILC

Adam Balkcum and Thomas Habermann
CPI MPP Division, Palo Alto, CA U.S.A.

Prototype Klystron

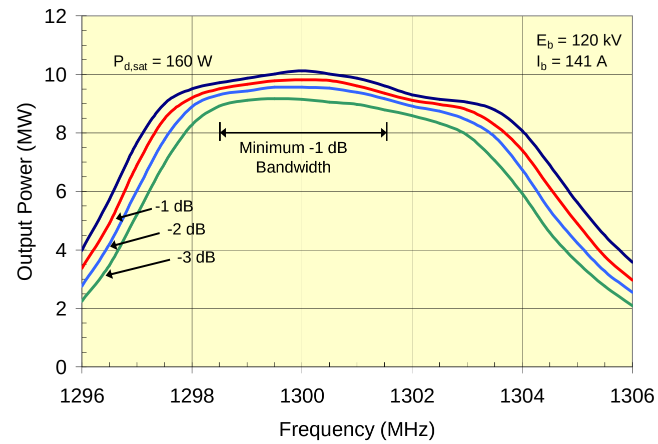
- VKL-8301 MBK developed for DESY X-FEL / TTF project
  - vertical prototype delivered to DESY in March 2005
  - uses six electron beams set on a large bolt circle for reduced cathode loading and longer life
  - considered one of the baseline sources for the ILC

Measured Performance

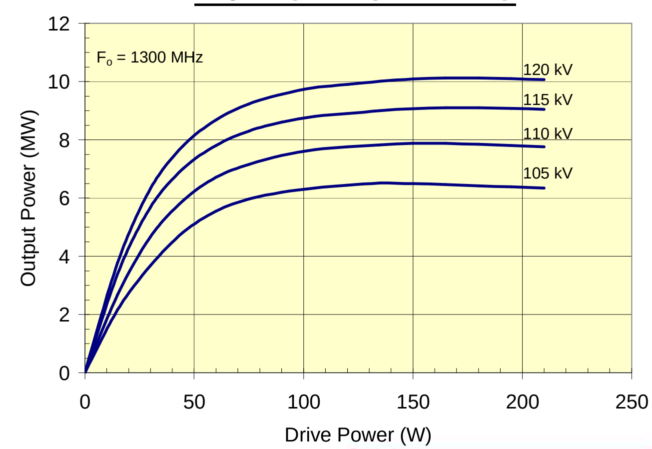
Test Results Compared to Klystron Specification

Parameter	Measurement	Specification
Frequency	1.3 GHz	1.3 GHz
Peak Power Output	10 / 9 MW*	10 MW
Ave. Power Output	150 kW	150 kW
Power Asymmetry	0.7 %	≤ 5 %
Efficiency	59 / 55 %*	65 % (goal)
Beam Voltage	120 kV	≤ 120 kV
Beam Current	141 A	≤ 150 A
Microperveance	3.4	≤ 3.6
RF Pulse Length	1.5 ms	1.5 ms
Saturated Gain	49 dB	≥ 47 dB
Cathode loading	2.2 A/cm^2	- - -
Body Current (DC)	0.6 A	- - -
Body Current (Sat)	3.6 A	- - -

Power vs Frequency



Power vs Drive



* Lower power and efficiency were measured at DESY

CPI Communications & Power Industries

Horizontal Prototype MBK

- Order received from DESY for second MBK for European X-FEL
  - horizontally oriented to fit in tunnel
  - includes integrated frame assembly for ease of movement and attachment to pulse transformer tank
  - includes integral lead shielding and cathode socket
  - above features are also appropriate for ILC source
- Design effort currently underway
  - prototype delivery scheduled for next summer
  - implementing some ideas for cost reduction identified in ILC cost study

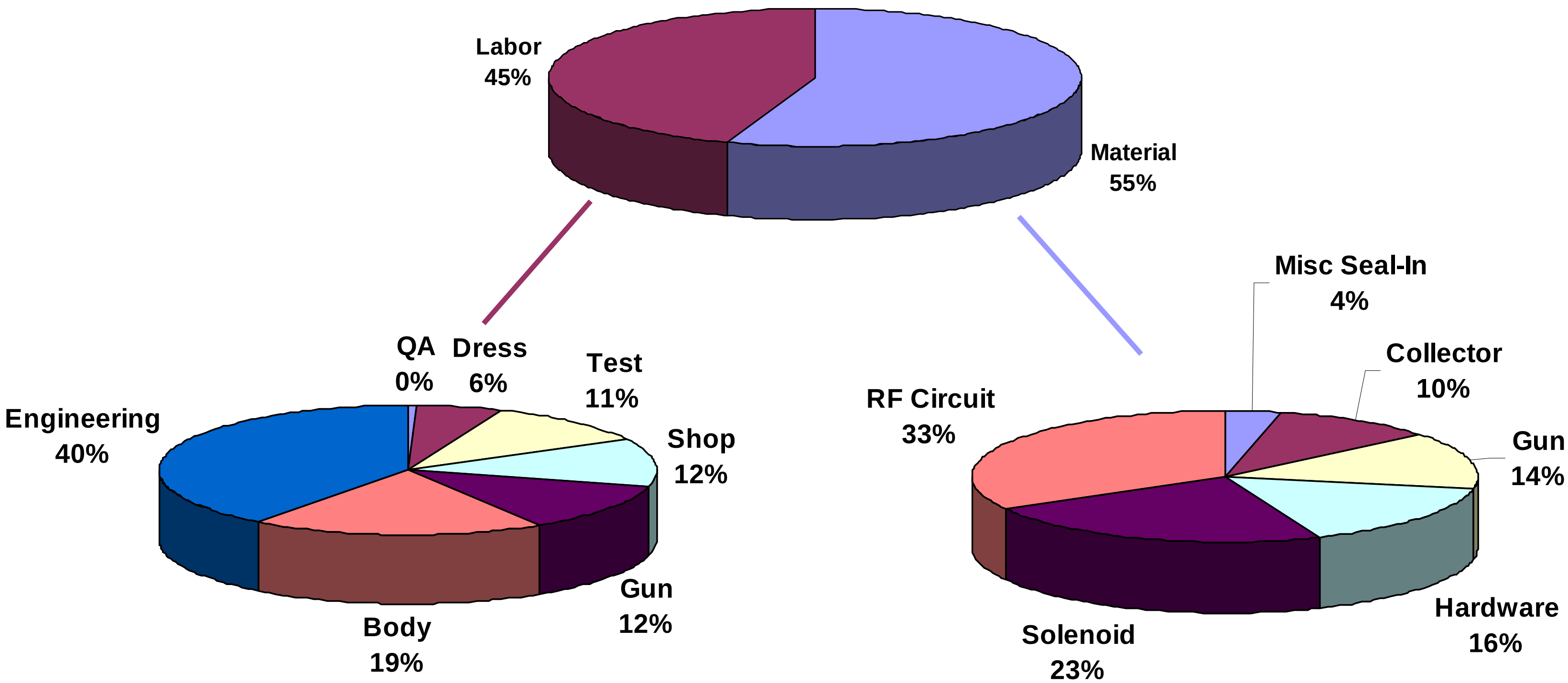
- CPI MPP participated in the ILC industrial cost study program for the Americas region
  - estimates provided for labor and material costs for quantities 1, 250 and 750
  - facilitization costs also estimated (space requirements, fixtures, equipment, energy, industrial gases, etc.)
- Ideas for cost reduction explored
- Cost estimate meets ± 20% requirement

Cost Study Methodology

- Material
  - majority of bill of material well established
  - multiple supplier quotes for individual piece parts in quantities
    - ~20 core suppliers
    - learning curve sanity check
    - ~80% of bill costed, ~20% estimated
- Labor
  - hours from previous build as baseline
  - estimates of savings from simplifications
  - learning curves applied for large quantities
- Facilities
  - examined current loading and cost rates to extrapolate requirements for peak production (1.7 and 5 per week)
- Experience with recent successful large klystron production program for the SNS project used for comparison

Direct Mat'l & Labor Cost Summary

Relative Costs for Qty 1



- Major cost areas identified
  - simplify RF circuit & solenoid
  - DFA / DFM for reduced engineering hours

Cost Study Conclusions

- Substantial (~20%) direct labor and material savings possible with design changes
  - DFA / DFM to simplify assembly and reduce parts count
  - alternative circuit configuration to reduce klystron and solenoid size
- Facilities investment to support peak production years
  - modest for qty 250 (a test stand & exhaust station)
  - much larger for qty 750 (several test stands, exhaust stations, furnaces, space)
- Facilities cost reduction through equipment loans
  - e.g., use of modulators & test equipment that can then ship with last klystrons for use on the accelerator
  - approach successfully used on other large scale production programs (*e.g.*, XM Radio)