Project X

RF Power Sources for Project X Injector Experiment (PXIE)

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RF Sources for PXIE

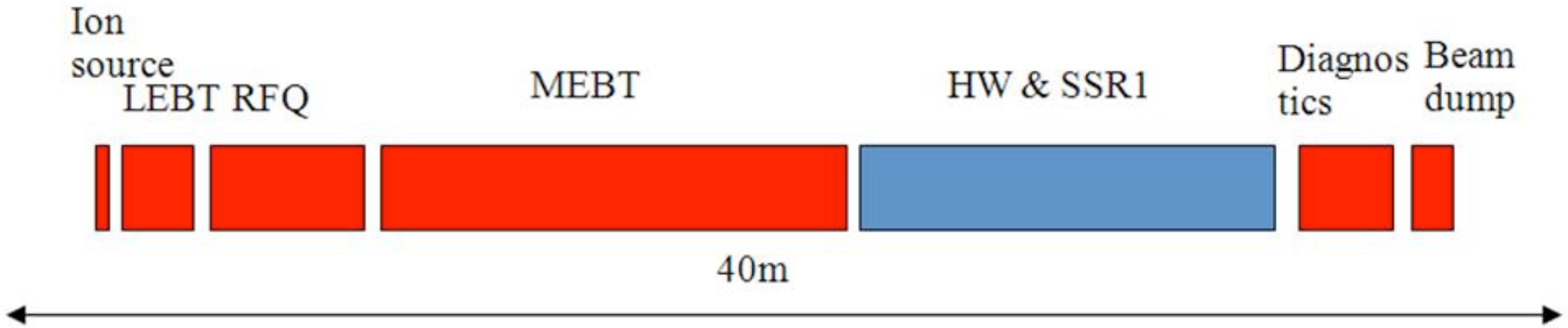
Frequencies and Powers

- Two Frequencies, 162.5, 325 MHz
- RFQ 162.5 MHz, 100-150 KW CW
- Half Wave Resonators 162.5 MHz, 4 KW CW
- Single Spoke Resonators 325 MHz, 4 KW CW

RF Sources for PXIE

Number of Cavities

- 1 RFQ 162.5 MHz
- 3 normal conducting bunchers 162.5 MHz
- 9 SC half wave resonators 162.5 MHz
- 8 SC single spoke resonators 325 MHz



RF Sources for PXIE

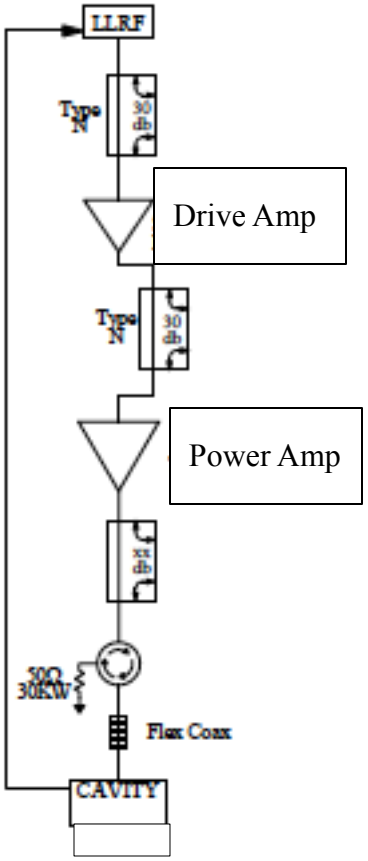
Typical Amplifier Performance Specs

- 50% efficiency at saturated power
- 40% efficiency at -1 dB power
- Water cooled
- Bandwidth 2-5 MHz
- Sufficient gain for Saturated output with 0 dBm drive
- 50 ohms input/output impedance
- Output protected against opens and shorts

AC Power Consumption Estimate

- 40% AC to RF efficiency at -1 dB power
- Total RF power RFQ plus 20 cavities=230 KW
- AC to RF power at 40%=575 KW
- Ancillary power for LLRF, interlocks, etc.=45 KW
- Total AC power= 620 KW

RF Sources for PXIE

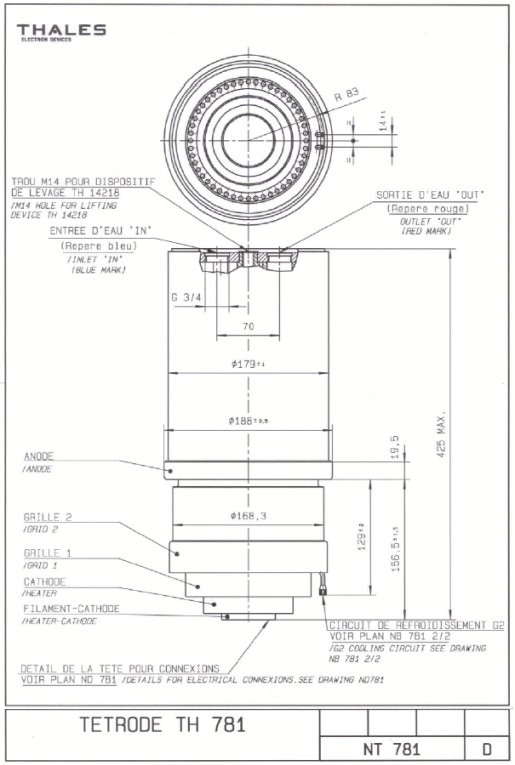


Nominal Block Diagram
One RF Source per Cavity

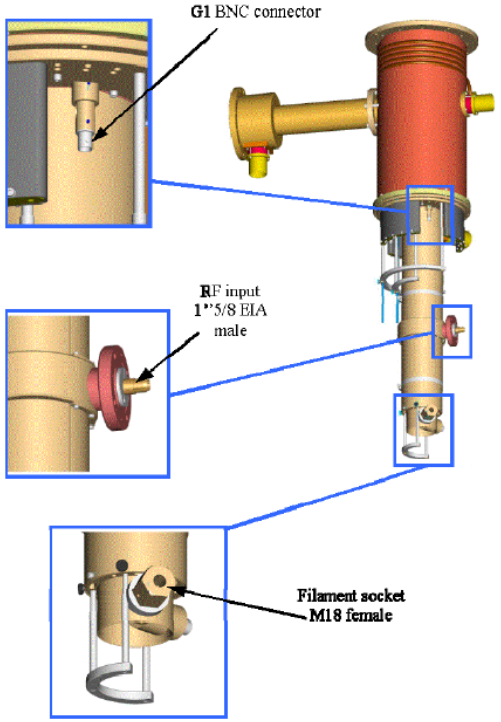
Could use two amps for RFQ in Push Pull if Necessary

RF Sources for PXIE

RF Power for 162.5 MHz RFQ



THALES



Thales 781 Tetrode and Cavity
200 Kwatts CW

RF Sources for PXIE

200 KW CW RF Power for 162.5 MHz RFQ

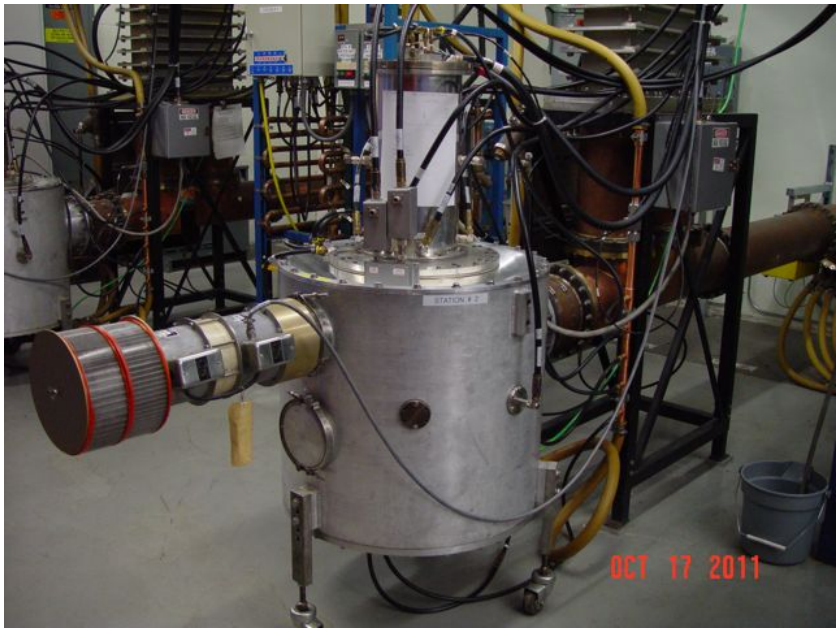
THOMSON

Utilizes Thales 781 Tetrode and Cavity

200 Kwatts CW

RF Sources for PXIE

RF Power for 162.5 MHz RFQ:Tev RF a Possibility



8 Operational Systems+Spares
Two Required for NOVA, Balance Available
Tevatron Tetrode Eimac Y567B and New Cavity Design
To Deliver 100-150 Kwatts CW in One Amp or Two in Push Pull

RF Sources for PXIE

Eimac Y567B Tetrode 150KW Anode Dissipation

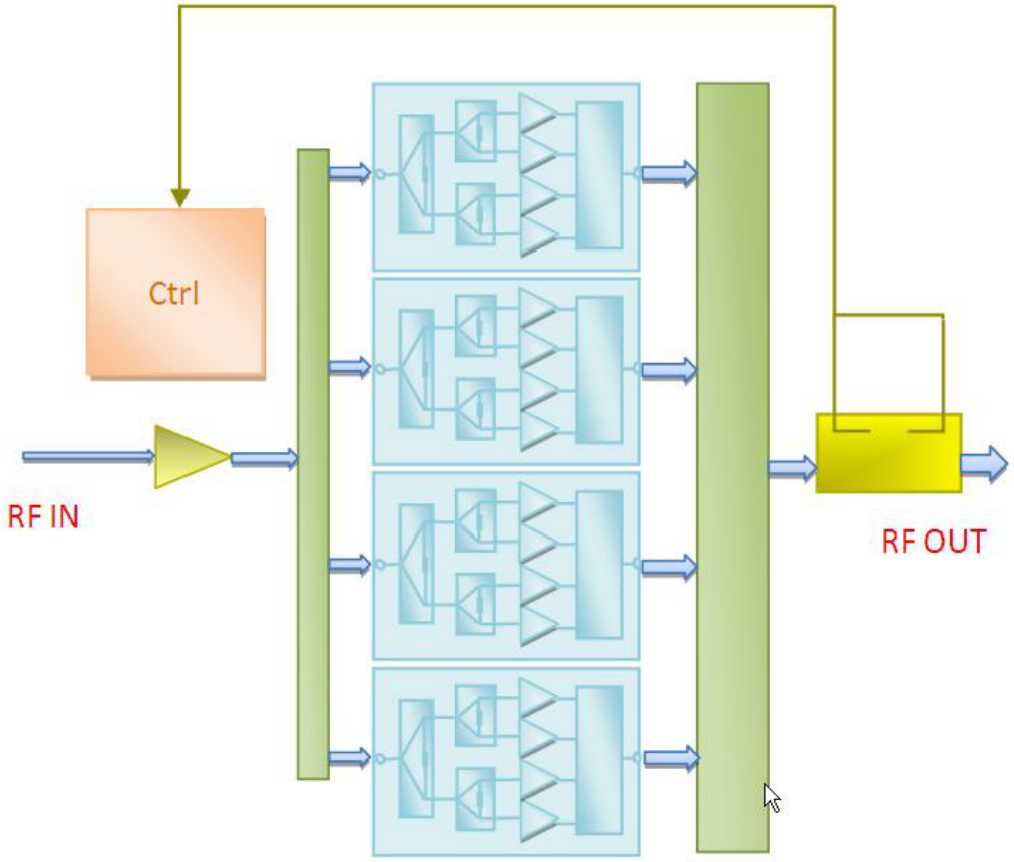
ELECTRICAL

Filament: Thoriated-tungsten Mesh		
Voltage	15.5 ± 0.75	V
Current @ 15.5 volts	215	A
Direct Interelectrode Capacitances (grounded cathode)		
Cin	370	pF
Cout	60	pF
Cgp	1.0	pF
Direct Interelectrode Capacitances (grounded grid)		
Cin	175	pF
Cout	60	pF
Cpk	0.35	pF
Frequency of Maximum Rating, CW	108 250 MHz ∫ MAX USE	MHz

Need to understand limits of power output at 162.5 MHz

RF Sources for PXIE

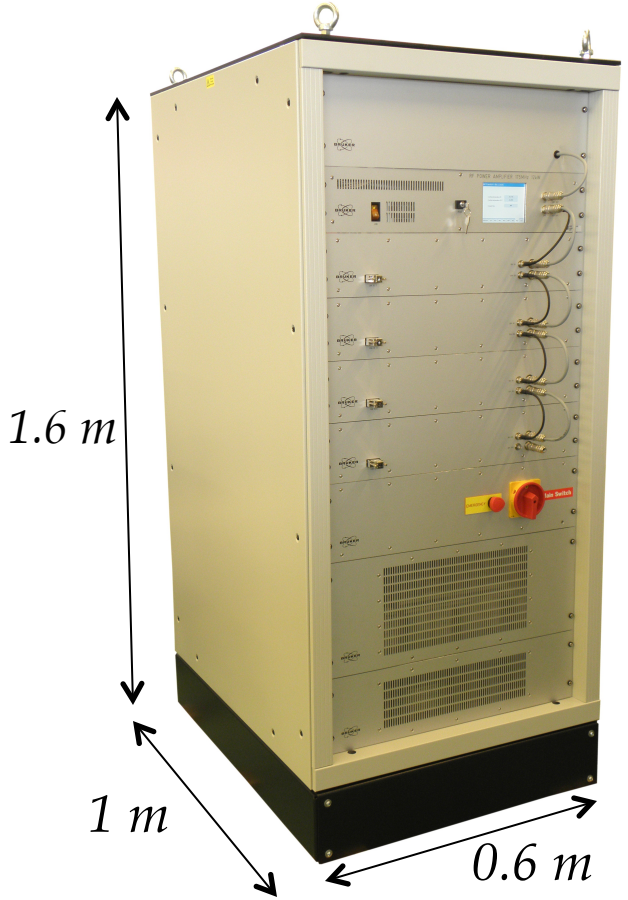
Commercial Solid State Development



BRUKER

RF Sources for PXIE

10 KW CW in a Rack
Combines 4-2.5 KW Module, New Version combines 2-5KW Modules



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RF Sources for PXIE

Commercial Solid State
Other Vendors

EMPOWER
RF SYSTEMS, INC.

RF Sources for PXIE

Proposed Next Steps

- Investigate reuse of Tevatron hardware includes a modified output cavity and solid-state driver amplifier, two amplifiers required to achieve 150 KW CW
- Decide on commercial or custom solid-state amps
- Develop a cost estimate for complete RF system