RF UNITS CONCEPTS

ScandiNova Systems
User’s Meeting Webinar
2020-05-07

Presented by: Mikael Lindholm

WHY SOLID STATE? WHY RF UNITS?

- SMALLER
- BETTER
- EASY TO USE

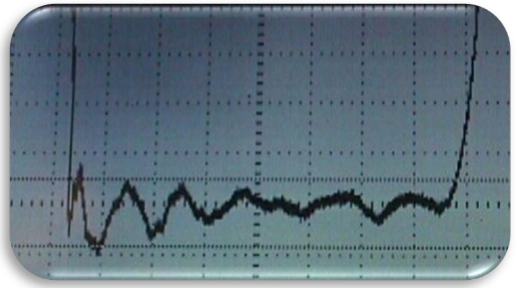
SMALLER

1992 KS
STOCKHOLM

118kV / 79A / 8us / 300Hz

10m³

0.9MW/m³



Scanditronix MM50

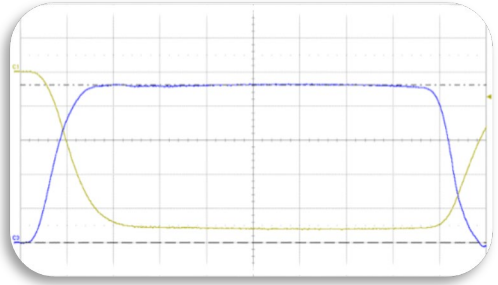
10-50MV

1997 NCC
TOKYO

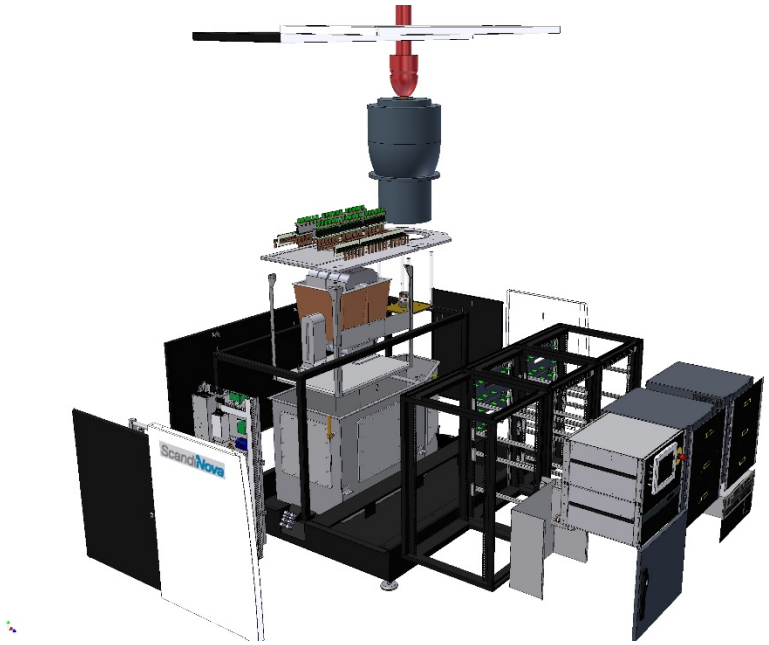
130kV / 90A / 8us / 300Hz

1m³

12MW/m³



DESIGN FOR
COMPACTNESS & SERVICEABILITY

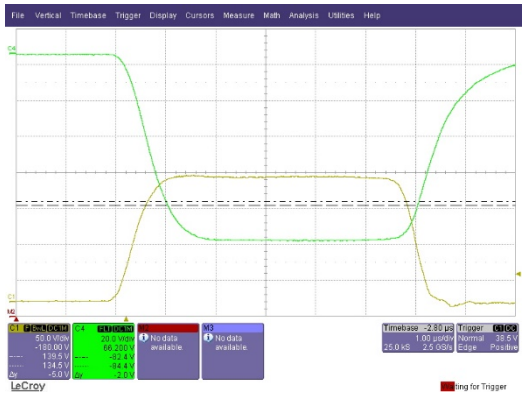


2010: K2-1 SYSTEM FOR 22MW S-BAND

Size: 1.8m x 1.5m x 1.2m

3.2m³

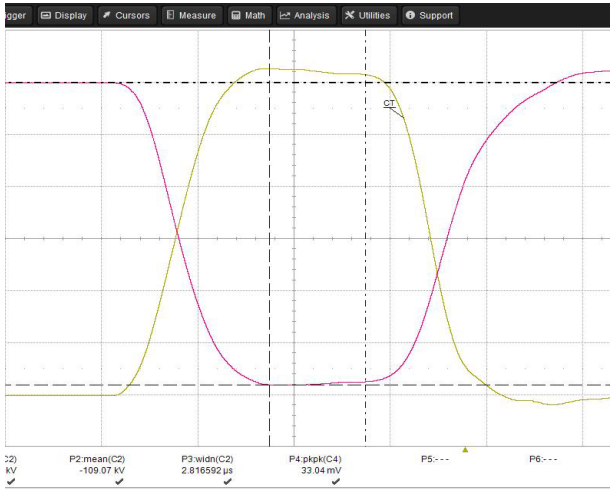
18 MW/m³



250kV
240 A
4 us
3 Hz

2019: K300 SYSTEM FOR 50MW C-BAND

Los Alamos
NATIONAL LABORATORY
EST. 1943



370 kV
344 A
1us
100 Hz

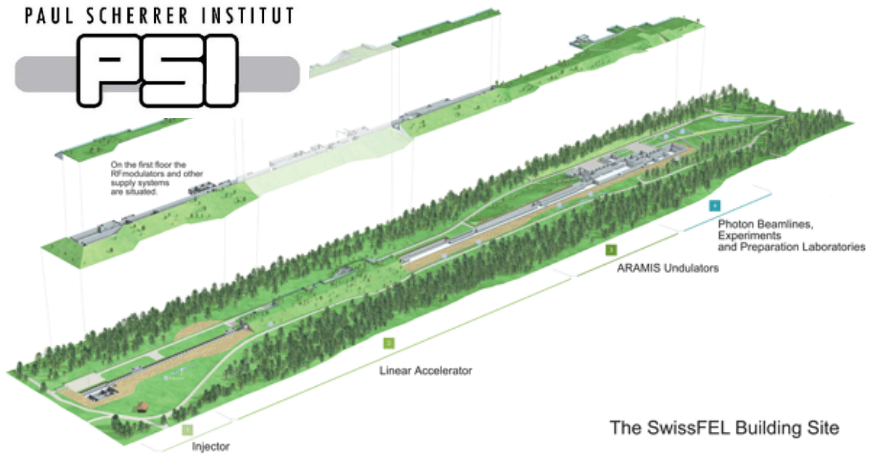
Size: 1.8m x 1.4m x 1.9m

4.8m³

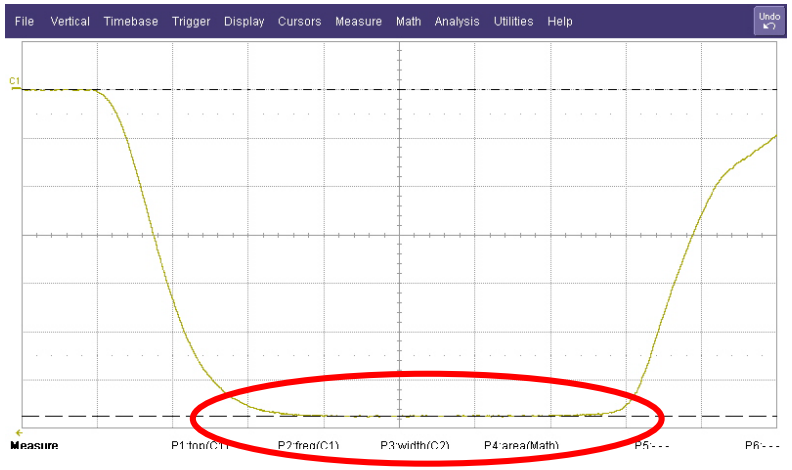
26 MW/m³

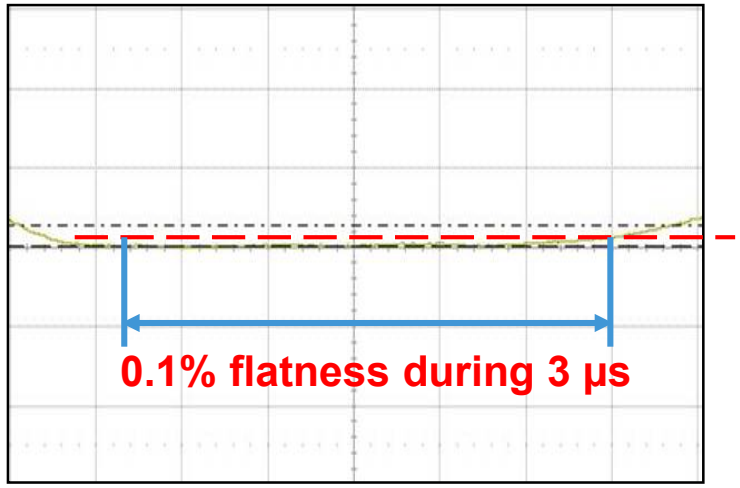
BETTER

IMPROVED PULSE FLATNESS



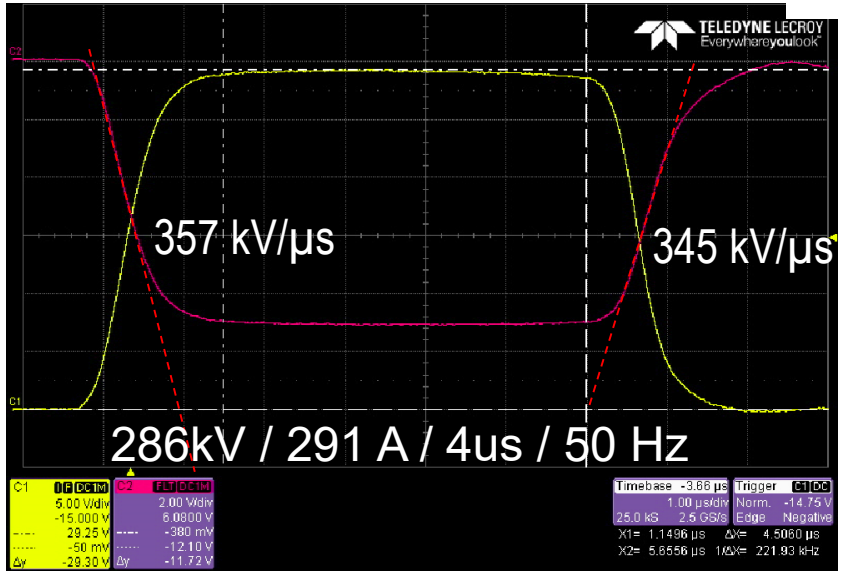
2009: K2-3 35MW S-BAND

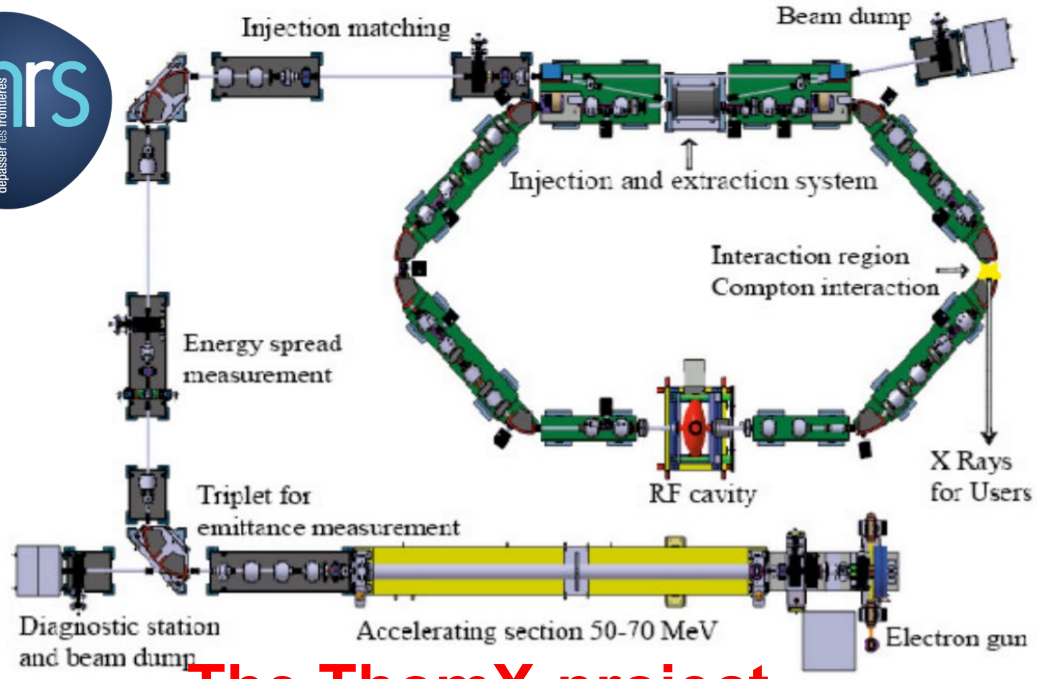




IMPROVED RISE/FALL TIME

2016: K300 SYSTEM
37MW S-BAND

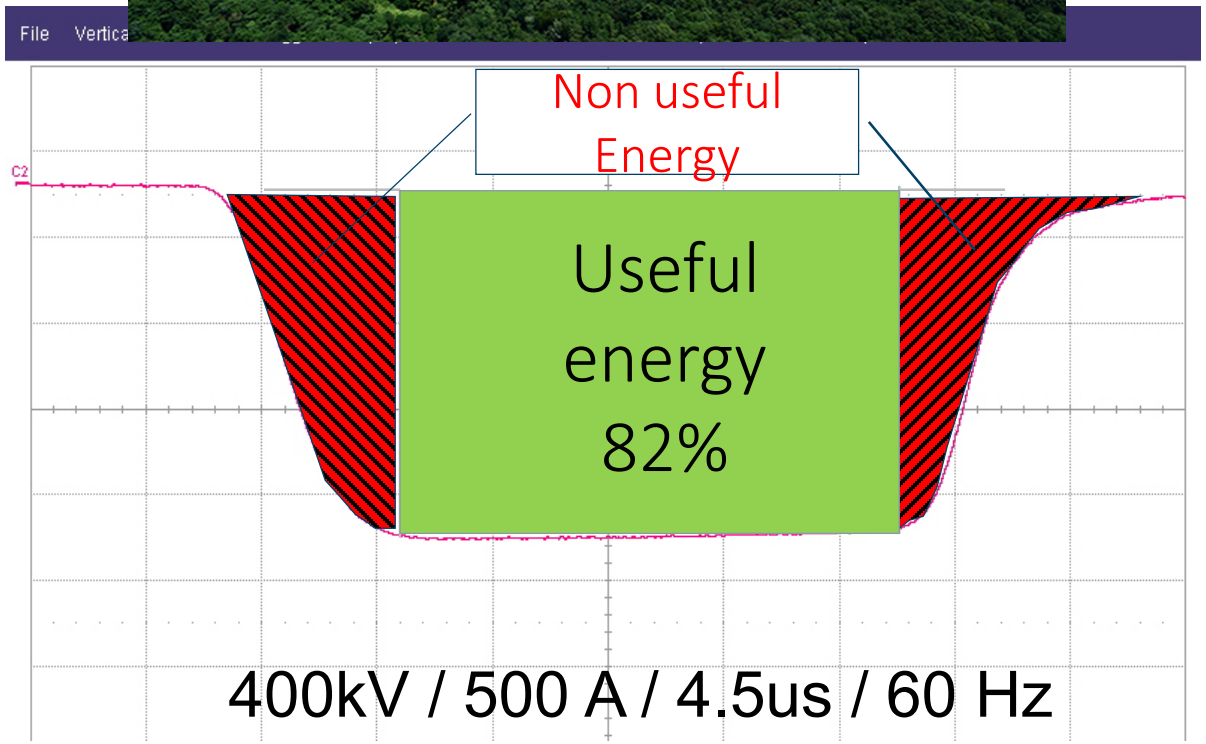




The ThomX-project

IMPROVED POWER EFFICIENCY

2012: K2-4 SYSTEM
80MW S-BAND

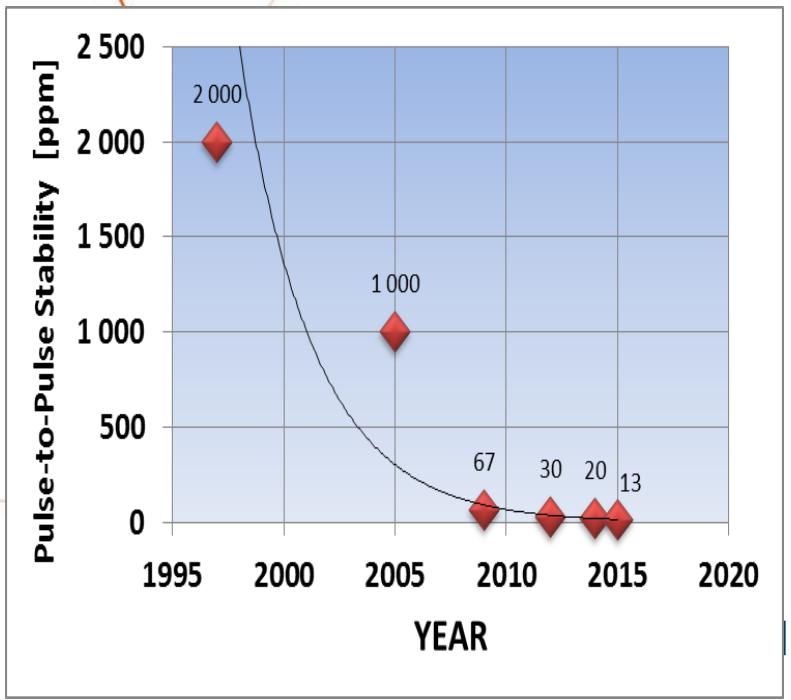


IMPROVED PULSE TO PULSE STABILITY

WORLD RECORD!
PULSE TO PULSE STABILITY

Pulse Current Stability
13 ppm rms

Pulse Voltage Stability
8.7 ppm rms



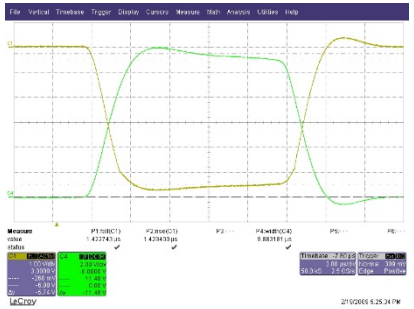
IMPROVED RELIABILITY

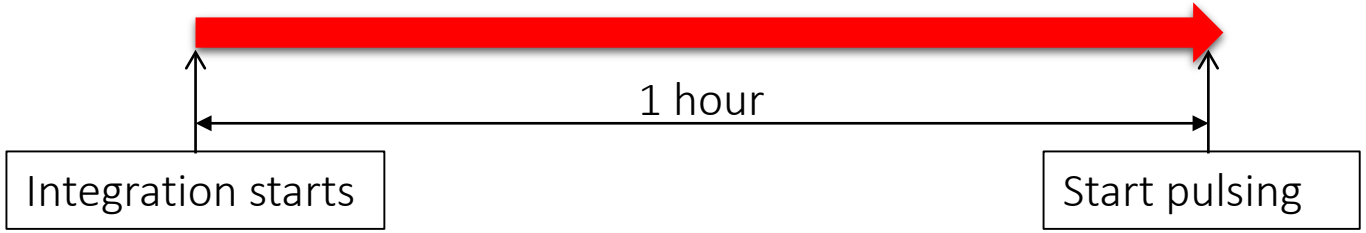
- Modulators & RF Units delivered: 1 185 units
- Power Modules delivered: 1 836 units
- Switch Modules delivered: 11 093 units
- Total operational hours: 1 534 607 hours
- Simulated MTBF (MIL-HDBK-217): 13 067 hours

EASY TO USE

REDUCED INSTALLATION TIME

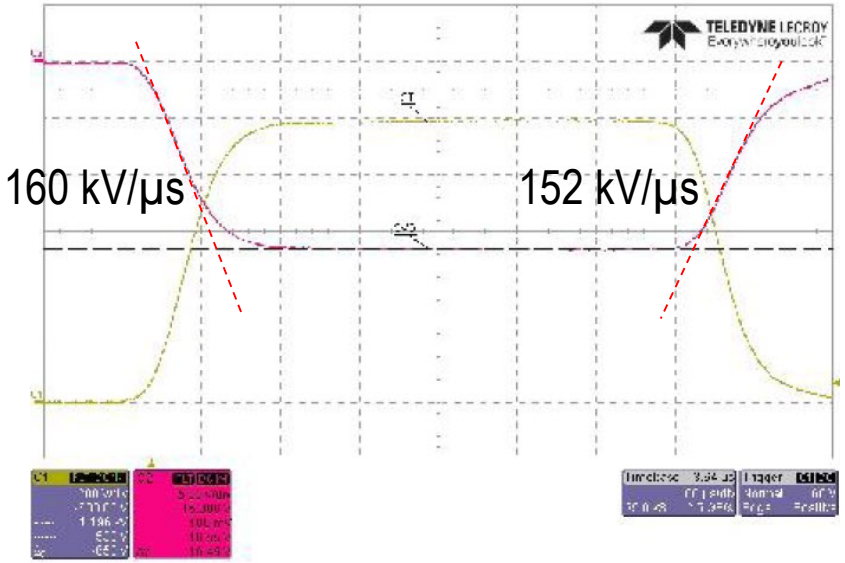
Sterigenics





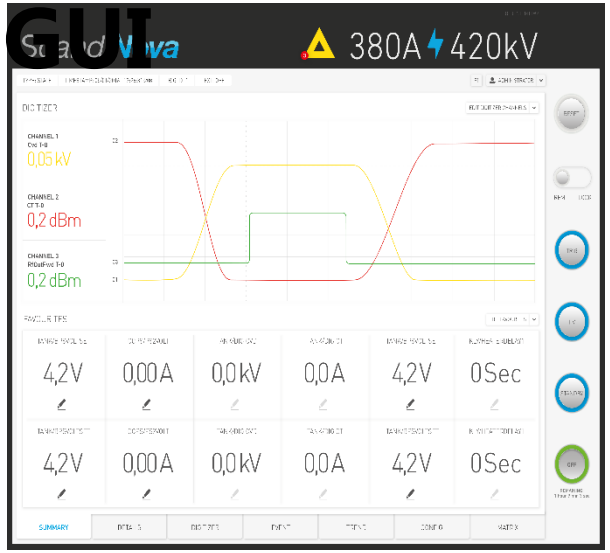
2014: K2-1 SYSTEM 6 MW X-BAND

CERN TOSHIBA



152kV / 99 A / 5us / 400 Hz

User friendly GUI



IMPROVED REMOTE SUPPORT

K SERIES - ScandiCAT™ CONTROL SYSTEM

1. PLC and FPGA
2. Timing&Interlock system
3. Auxiliary equipment
4. Interlocks & Safety circuits
5. Communication interface
6. Local GUI
7. **PC benefits**

EXAMPLE

THE 25 MW RF UNIT FOR DELHI LIGHT SOURCE AT IUAC

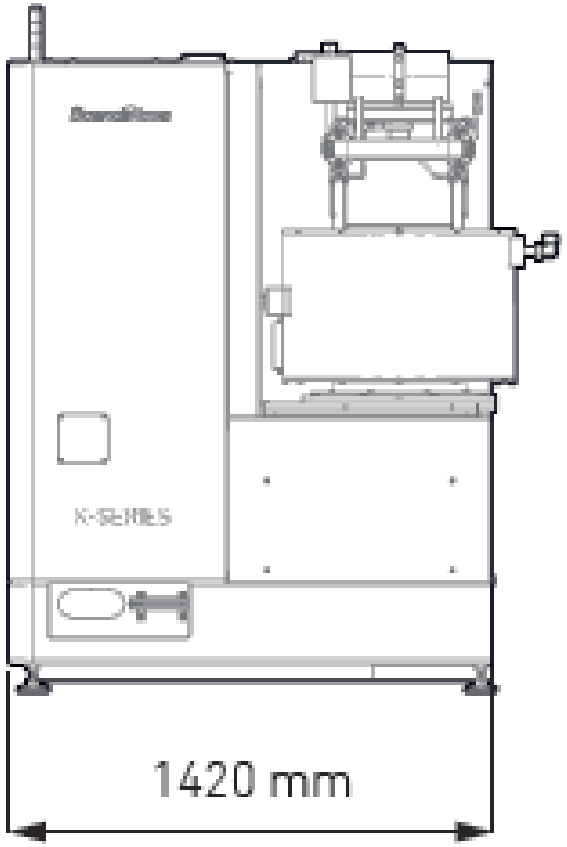
K300 RF UNIT 25MW ADAPTED TO IUAC –MAIN PARAMETERS

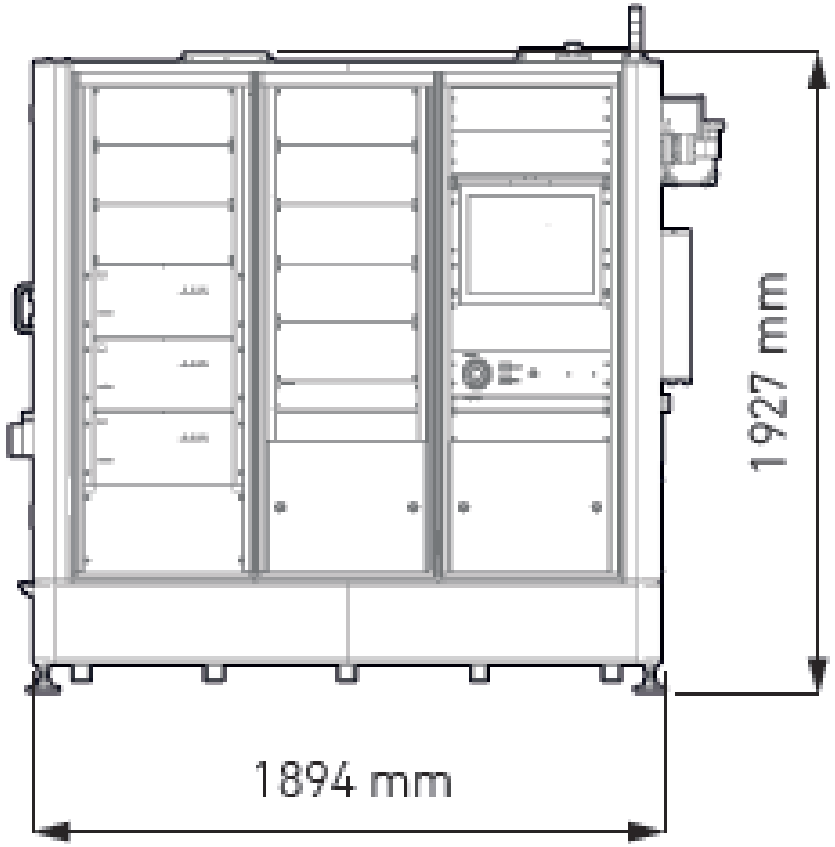
Main Parameters	Value	Unit
RF Peak Power	25	MW
RF Average Power	5	kW
Klystron Voltage	245	kV
Klystron Current	255	A
RF Pulse width	4	µs
Pulse Repetition	50	Hz

Integration of …

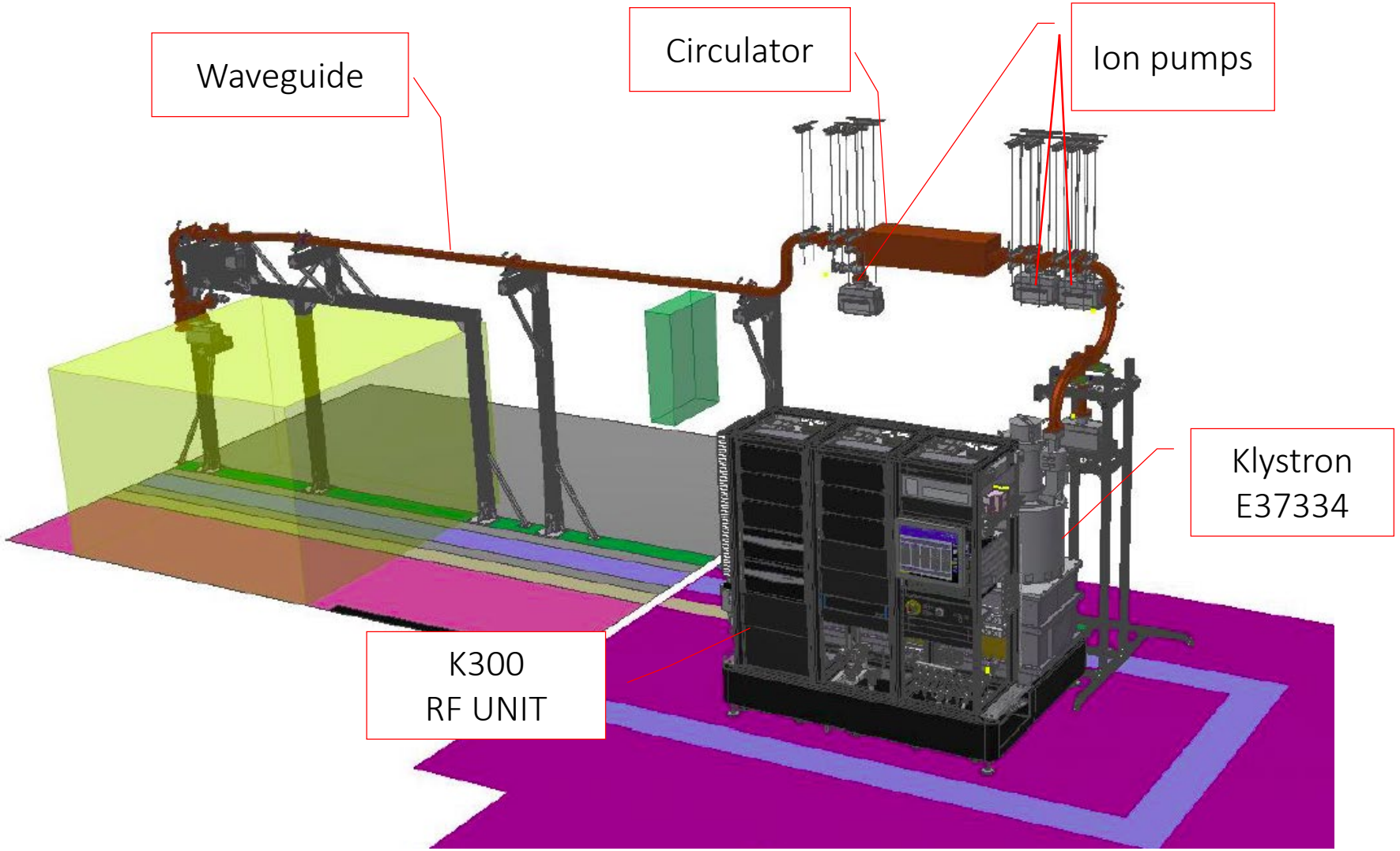
- Solenoid Power Supply
- Ion Pump Power Supply
- RF Drive amplifier
- Cooling of Klystron (Collector, Body, window), Solenoid
- Diagnostics and interlocks
- RF waveguide system (circulator, Loads, Directional couplers, vacuum pumps)

MAIN DIMENSIONS

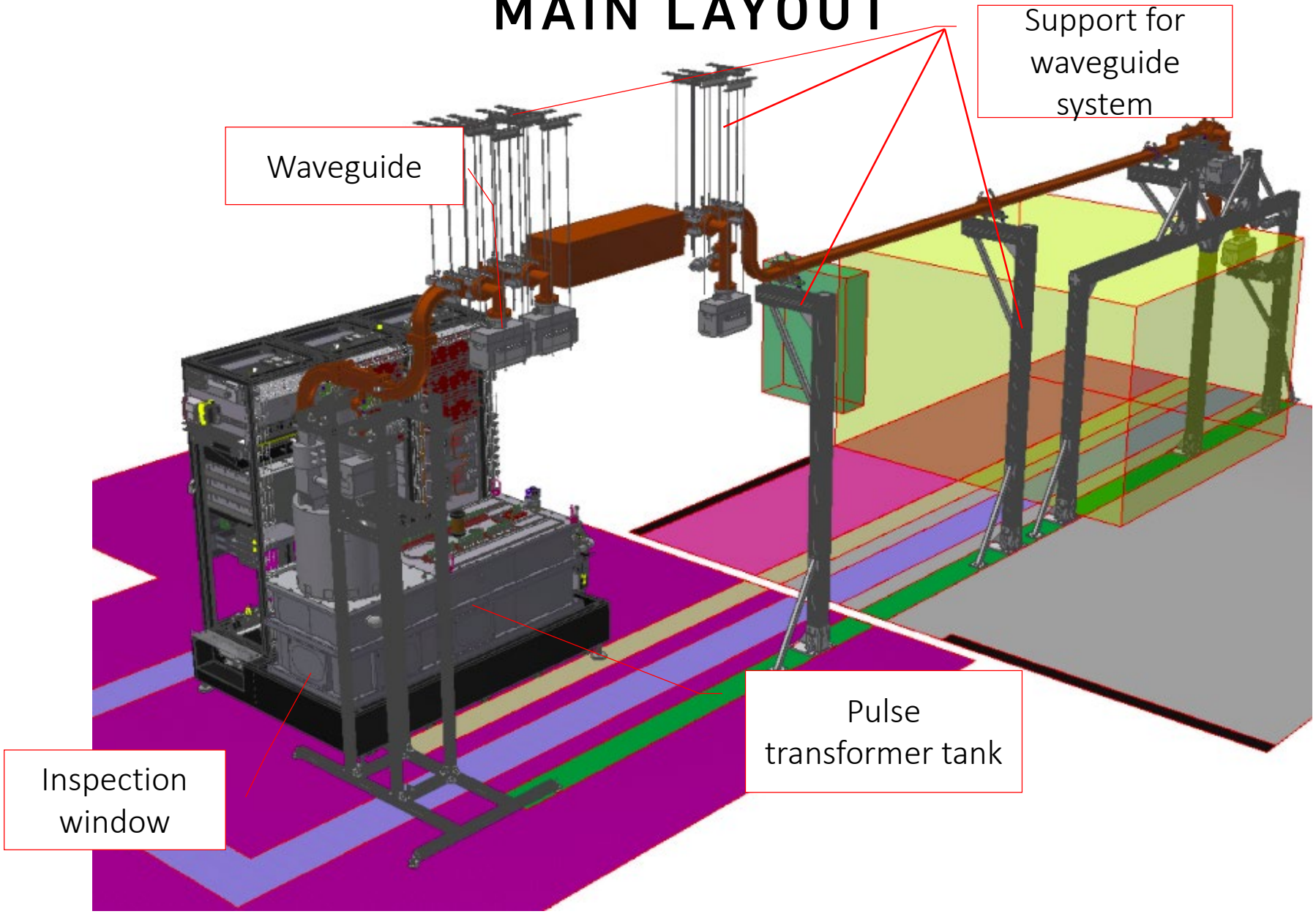




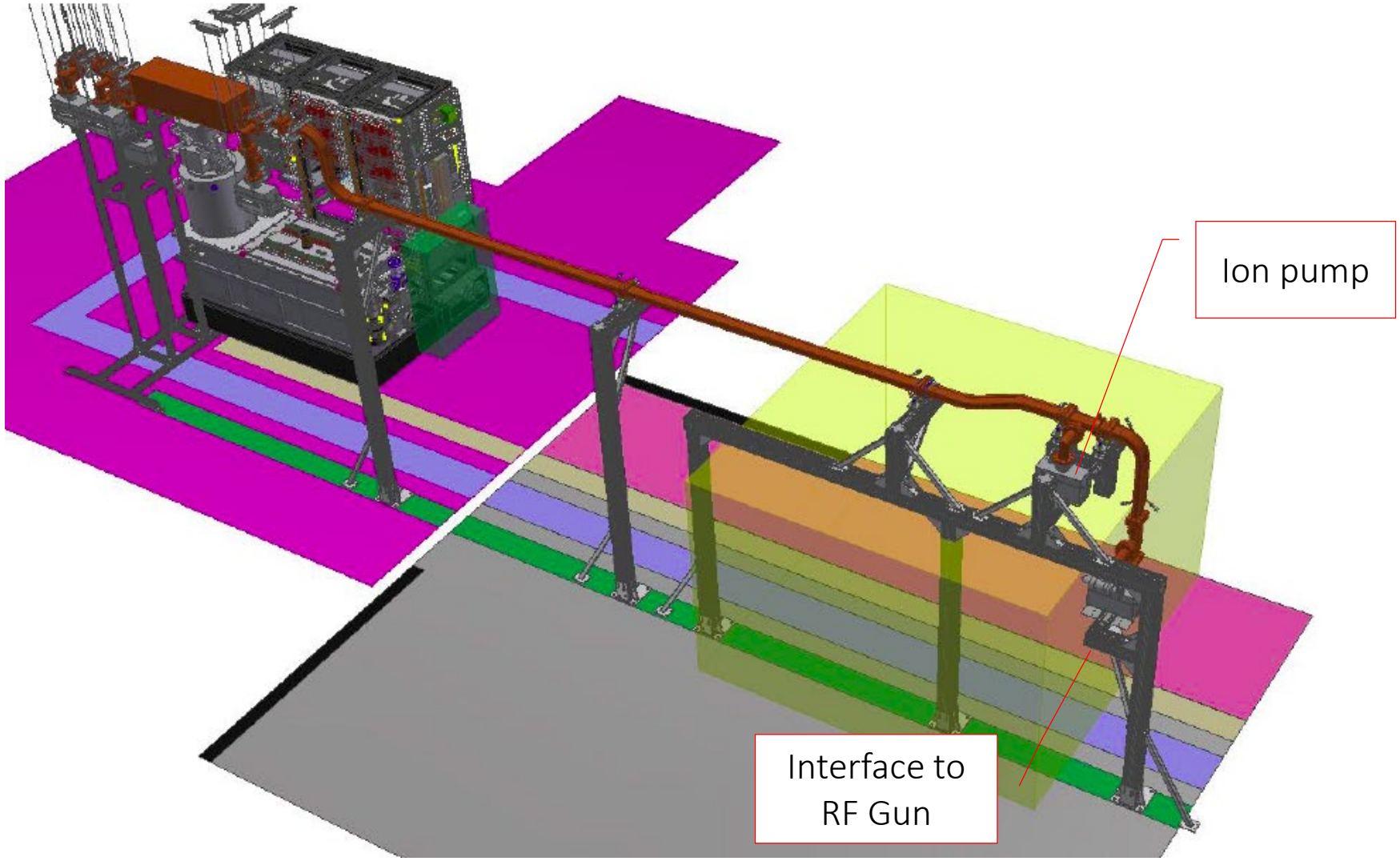
MAIN SYSTEM LAYOUT



K300 RF UNIT 25 MW FOR IUAC MAIN LAYOUT



K300 RF UNIT 25 MW FOR IUAC
MAIN LAYOUT



SUMMARY

RF UNIT RANGE

RECORDS OF USED MAGNETRONS & KLYSTRONS

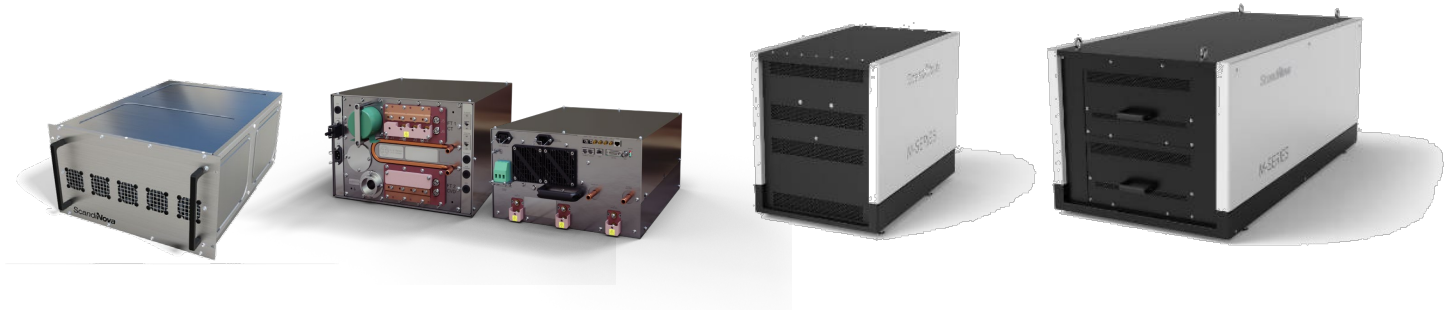
Number of tubes used so far…

Magnetrons (0.2 – 7.5MW): 33

Klystrons (3 – 80MW): 49

STANDARD RF UNIT PLATFORMS

M-SERIES 0.1 – 5MW RF



K-SERIES 3 - 100MW RF

ScandiNova

THANK YOU!