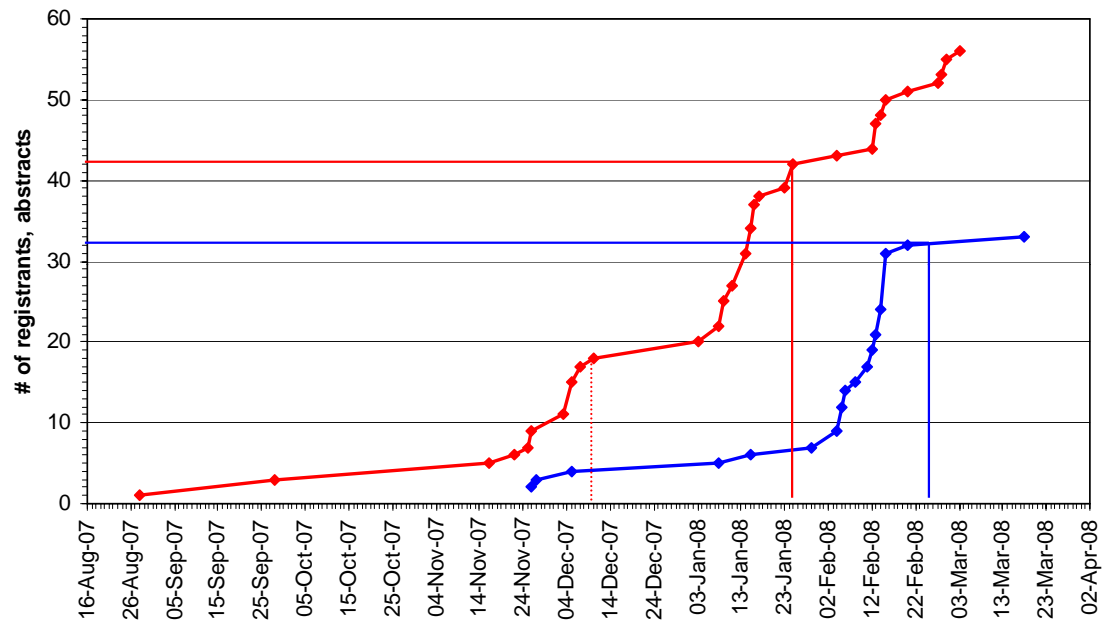


# SUMMARY

# Workshop summary

Workshop on High Power RF

CWRF08:  
finally we have:  
54 attendees @CERN  
~10 attendees @ANL  
33 talks



➔ Number of participants rose by almost 6dB since the 2006 workshop...

# Workshop summary

Workshop on High Power RF

- It seems the era of monster multi-megawatt CW klystrons for large next generation accelerators is over. There are only few customers left
- Demands for high power pulsed klystrons for e.g. medical applications and new linacs are rising
- Many new light sources are being built around the world. More than single high power station many ~100kW stations are required. But... “clean” RF power
- New devices like IOTs, diacrodes or solid state devices can do the job

# Workshop summary

- The solid state segment is rising. More and more labs are working on high power (~100kW) amplifiers
- We do not yet have enough experience with solid state amps. ~5000 hours running time of one amplifier is not sufficient to compare with the tube technology.
- Will be a very good subject for the 2010 meeting as more operation hours and experience will be available

# Tube vs. Transistor

- Tubes:
  - Few decades of experience
  - Presently almost a trouble-free technology
  - Development of new devices can be demand-driven by the scientific labs
  - Obsolescence is usually not an issue
  - For given power, amplifiers are quite compact – critical for the systems in fast feedback loops
  - Use of high voltage
  - Single device failure stops whole system
  - Well known, proven and reliable technology. Only the tubes are becoming more and more expensive.....

# Tube vs. Transistor

- Solid state amplifiers
  - Only very limited experience with high power systems
  - Development of new devices is industry driven, very unlikely to get custom made transistors for reasonable price
  - Life cycle of a typical industrial/telecom part is usually shorter than a development cycle time in the scientific sector.
  - No high voltage needed
  - The amplifier delivers desired signal even if several blocks failed
  - The amplifier itself is usually very bulky, problem with longer group delays
  - Problems with power combination and management
  - Lower efficiency than tube amplifiers
  - Perspective technology but still need many years of R&D

# Clean RF power

- Klystron amplifiers are very sensitive to a power supply ripples -> unwanted amplitude and phase modulation
- Can be improved by feedback loops
- However the problem should be cured at the source – DC supply quality
- 6 (12) pole thyristor controlled PS are being replaced by more sophisticated IGBT supplies -> better DC quality
- Tetrodes and new devices like IOTs and diacrodes are less sensitive
- And the solid state amplifiers are even better...

# Leave few engineers unattended for few seconds...

... and they immediately start to discuss





# Workshop summary

Workshop on High Power RF

- This year's workshop was pretty packed – many talks, two long visits
- It was a new challenge – the video conference
- We had several vendor representatives present
- And we had a nice dinner 😊

# Acknowledgements

Workshop on High Power RF

- Many thanks to everybody who was involved in the workshop organization
- Doug Horan, Ali Nassiri – experience transfer to a novice in the field 😊
- Annabel Cobas, Olivier Brunner, Eric Montesinos, Erk Jensen
- Scientific committee
- Members of the RF/Low-level section for lending us 15 helmets
- Martin Mery (merchandising), Adrian Macho (graphic design)

Thank you again for  
coming and see you in  
2010 (most likely in Spain)