Solid-State Linear Induction Modulator (LIM) for JLC project ISG8 San Francisco, USA

KEK = BINP(Protvino)

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June 2002
Linear Induction Modulator Technical Specification

- Number of PPM Klystrons: 4 klystrons, 8 klystrons in future
- Klystrons Voltage: 500 kV
- Total Current: 1060 A, 2120 A in future
- Pulse Width: 1.6 µs
- Pulse Top Flatness: 2%
- Efficiency: 75%
- Repetition Rate: 150 Hz
LIM main Problems:

- Protection
- Core material, weight
- Electrical field strength in oil
- Electrical field strength in cable insulation
- Switcher IGBT
- Capacitors
Induction type Modulator
with oil tank and klystrons
variant of 2001 year
LIM Electrical Field Strength (Oil)

Graphs showing the relationship between LIM length (cm) and electric field strength (E, kV/cm) along with radius (cm) and LIM length (cm) relationships.
Core material

Finemet
Metglas
Amet
Si = Steel

\[ W_{\text{core}} := \frac{U_{k1}^2 \cdot \pi \cdot \gamma \cdot \tau \cdot (a + 5.6 \cdot \frac{U_{k1}}{E_{\text{oil}}})}{U_{\text{ight}} \cdot \Delta B} \] (kg)
LIM oil tank mechanical test

Vacuum tank.

Aleksandr Abramov
Slit between two inductors

Cable $\varepsilon=2.7$, oil $\varepsilon=2.15$, polyamide $\varepsilon=4.3$
Radial electrical field strength in cable

Left $\varepsilon=4.3$ Right $\varepsilon=2.3$
\[ \varepsilon_{\text{cable}} = 2.7, \quad \varepsilon_{\text{oil}} = 2.15, \quad \varepsilon_{\text{polyamid}} = 4.3 \]
Four klystrons pack oil tank
Four klystrons pack oil tank
Linear induction modulator
Near time LIM Programme

- measuring core quality, choose type
- choose IGBT type, IGBT test
- primary mechanical design of core case and oil tank
- IGBT circuit together with protection circuits design
- two core cases test
- 50 kV setup test preparation