Microwave system

- Varactor tuning
- IMPATT diode
- Tunable frequency
  70GHz +- 200MHz
- Used in the GDH Sum Rule experiment 2003
- LabView control panel
Microwave source

- Varactor tuning IMPATT (IMPAct Time Transition) diode
  - Frequency from 69.673 up to 70.266 GHz
  - Frequency stability of 0.008%
  - Power 200 mW
  - Power stability of 2%
  - Temperature stability of 0.7%
Calibration

Frequency: from 69.673 GHz up to 70.266 GHz

Power: About 200 mW.
Microwave results
MOTOR ATENUATOR

- Step Motor from Lin Engineering 0.9 degrees.
- MB15 micro step driver.
- UMI-7764 motion interface.
- Labview application.
Power Meter

- E4419B EPM Series Power Meter from Agilent Technologies
- Two sensors V8486A
LabView program
Ideas for COMPASS MW control system

• Power Supply of EIO. 6000V.
• Tuning motor EIO. 12V motor.
  Motor -> Driver -> LabView
• Power controlling motor.
  Motor -> Driver -> LabView
• Frequency counter.
  Read GPIB connection via LabView
• Power meter.
  Read AI Simatic/National Instruments Modules
• Attenuator.
  Motor -> Driver -> LabView
Questions

• How to control 6000 V Power Supply with LabView or Simatic?

• How to control EIO tuning motor, and PCA motor?

• Stability of to EIO source?

• Can we put the MW system close to the Cryostat in order to save MW power? Is it needed?

• How many mWatts are needed to polarized the target?

• Can we use Varactor Tuning IMPATT Diode as MW source?

• Measurement of the incoming and reflecting power.
3 Port Coupler

ABSORPTIVE MATERIAL
PICK-UP PROBE

DIRECTIONAL COUPLER
OUTPUT JACK

WAVEGUIDE
DIRECTION OF PROPAGATION

Absorptive material
oposit phase
pick-up probe

Waveguide
propagation way

Absorptive material
same phase
pick-up probe

Waveguide
propagation way
IMPATT diode

Converting DC power to RF power by introducing a 180 Degree phase delay between the voltage and the current

- External potential creates a peak and produces electron-holes pair. **Avalanche region**
- Electrons move to Anode with constant velocity. **Drift region**
- Induce mirror charges in anode.
**IMPATT diode**

- Current Increases as voltage decreases opposit phase.
- Diode embedded in resonant cavity produce microwave.
- Frequency depending on drift velocity and length of the drift:

\[
\nu = \frac{V_d}{2L}
\]

- Power:

\[
P_n = \frac{E_c^2 V_d^2}{4\pi X_c\nu^2}
\]

Rectance \(X_c\)

Critical field for avalanche breakdown \(E_c\)
Cryostat

- Horizontal Cryostat
- Temperatures of 50 mK
- Cooling power of 100 mW
- Superconducting holding coil integrated

Separator
- T = 3K
- He3-He4 mixture
- T = 50mK

Evaporator
- T = 1.8K

Separator and Evaporator precooling stages
- Target insert along the beam axis
- Fits in the geometry of the Crystal Ball detector
Pumping system

-Serie of 5 Roots pumps:
4000 m³/h, 2000 m³/h,
1000 m³/h, 500 m³/h
and 250 m³/h
- Very low leak rate