

Liquid Metal Flow Characterization Using Doppler Laser Radar (DOLAR)

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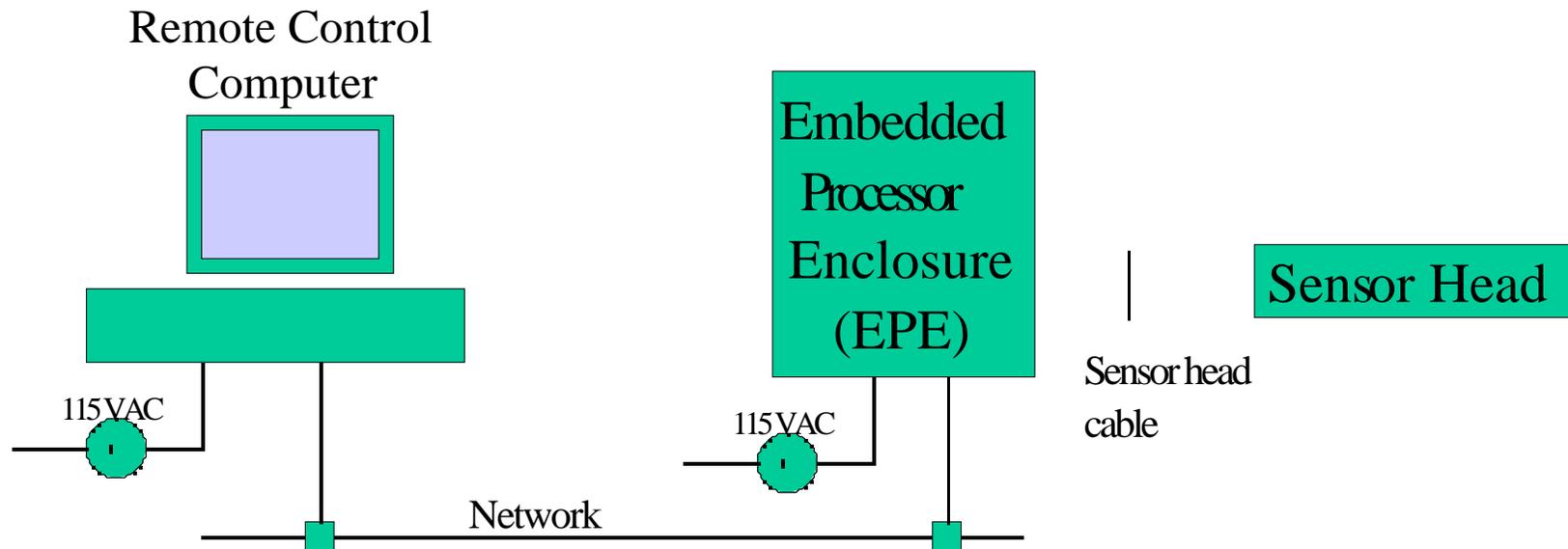
The Objectives of DOLAR Device

- Conduct precision range measurements of plasma facing surfaces remotely.
 - Through a window
 - In-vessel deployment
- Scan surfaces to provide range-based surface profiles.
- Measure velocity of freely flowing surfaces remotely in fusion experimental environment.
- Measure fluctuations in velocity.
- Scan velocity profiles of freely flowing surfaces.

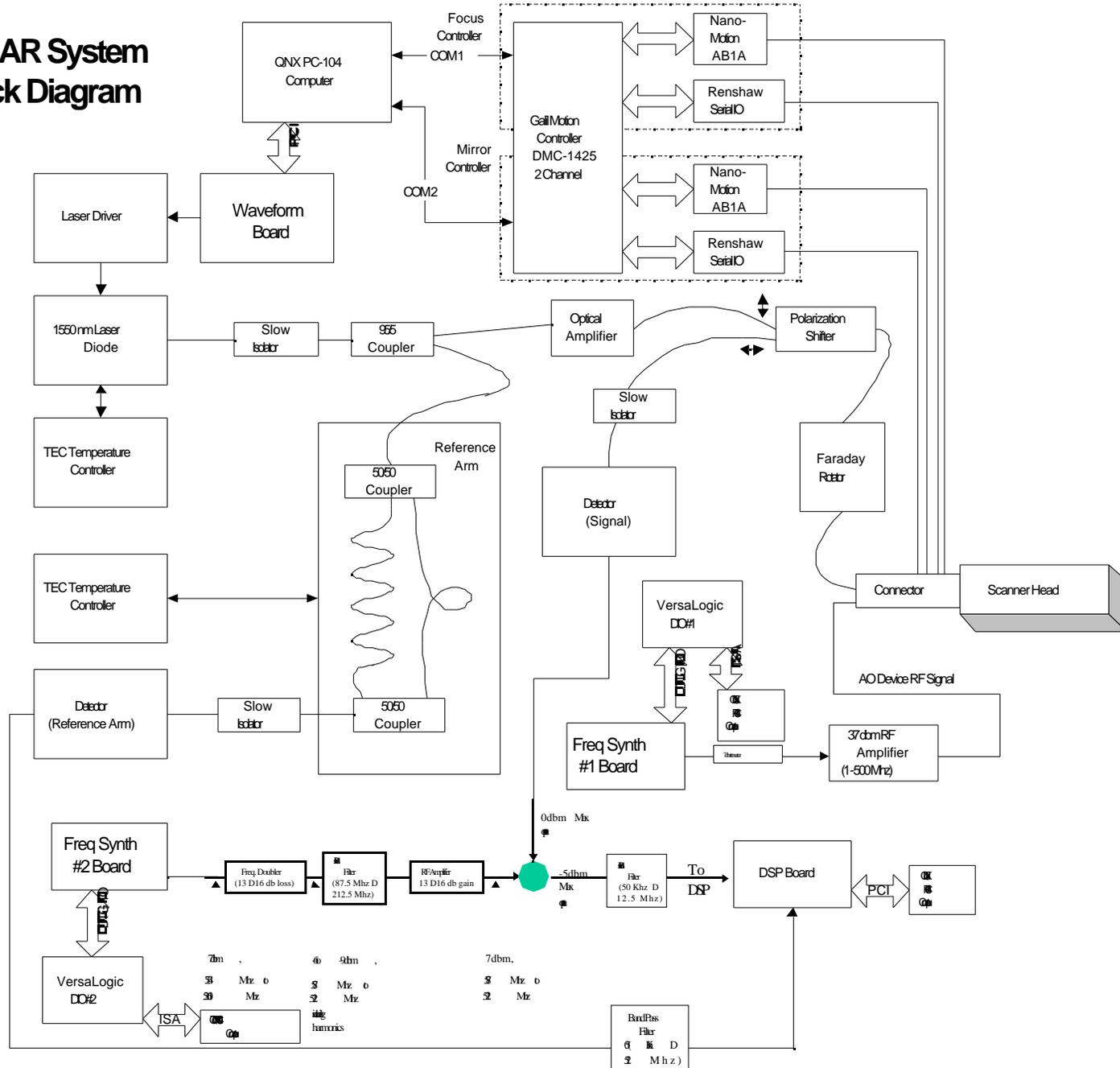
DOLAR Specifications

- Sub-millimeter accuracy in range measurements up to 15 m.
- Velocity measurements up to 10 m/s
- Resolve velocity fluctuations ($\sim 10^{-5}$)
- Maximum rate of range measurement
 - 4000/s without Doppler correction
 - 2000/s with Doppler correction
- Scanning capability in both directions
 - High speed limited (7°) scanning in one direction
 - Slow, but wider range scan (120°) in the other direction
- Compatible with fusion environment
 - High magnetic field ($\sim T$)
 - High temperature (in-vessel walls at $200^\circ C$)
 - Electromagnetic interference
 - Vacuum

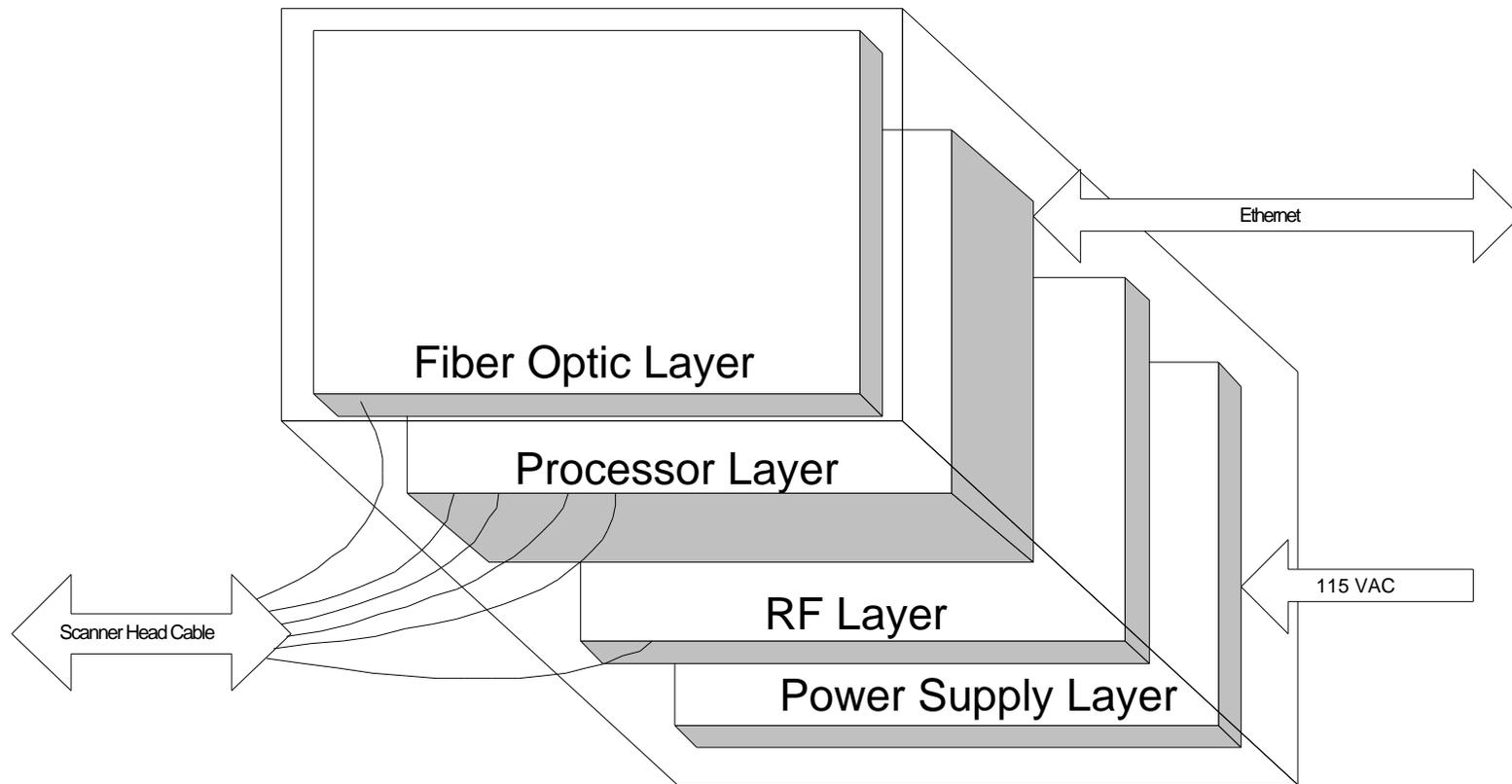
DOLAR System Configuration



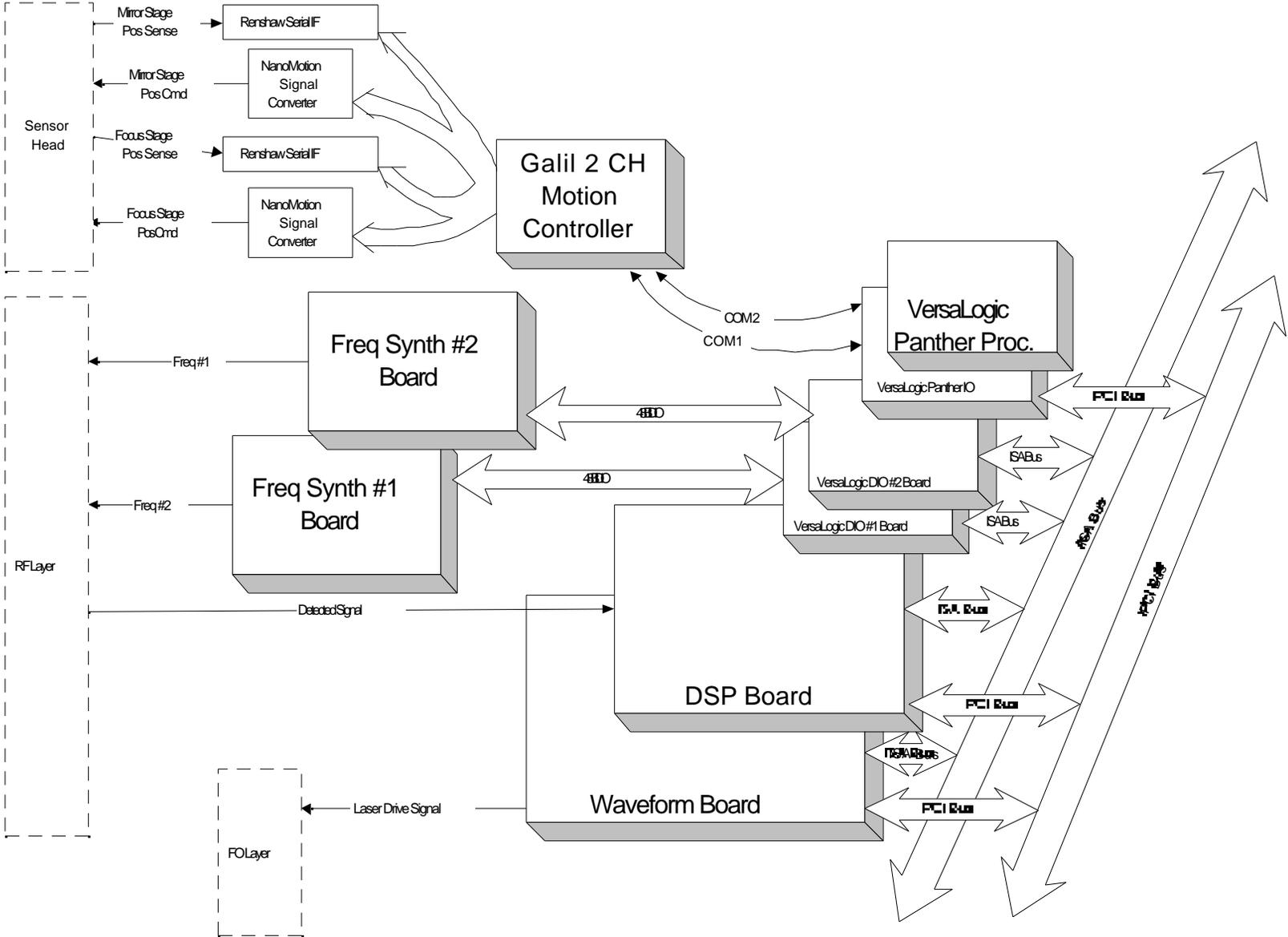
DOLAR System Block Diagram



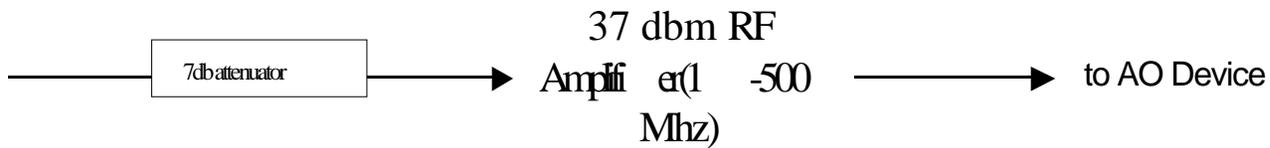
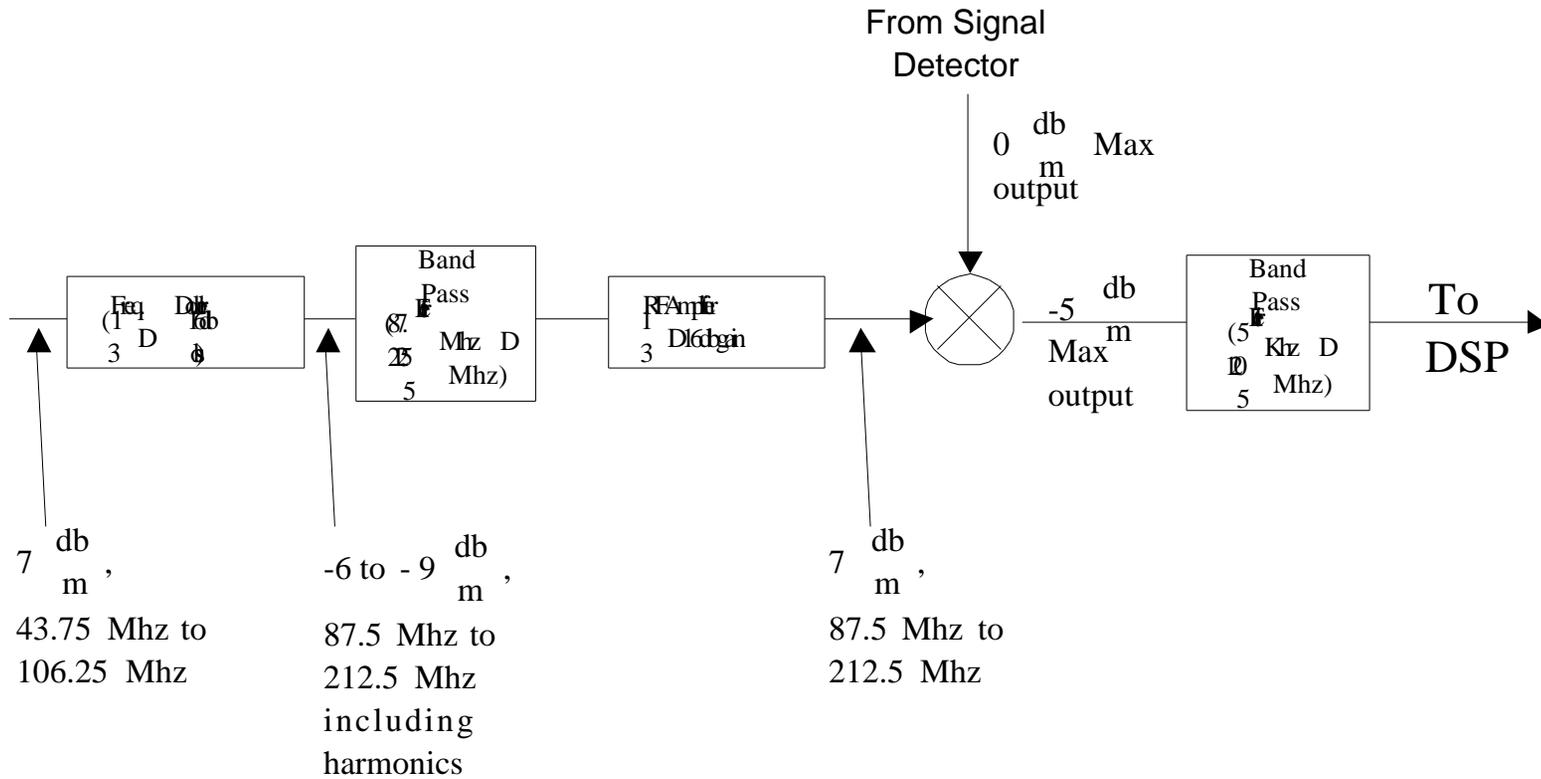
**DOLAR
Embedded Processor Enclosure
(EPE)
Arrangement**



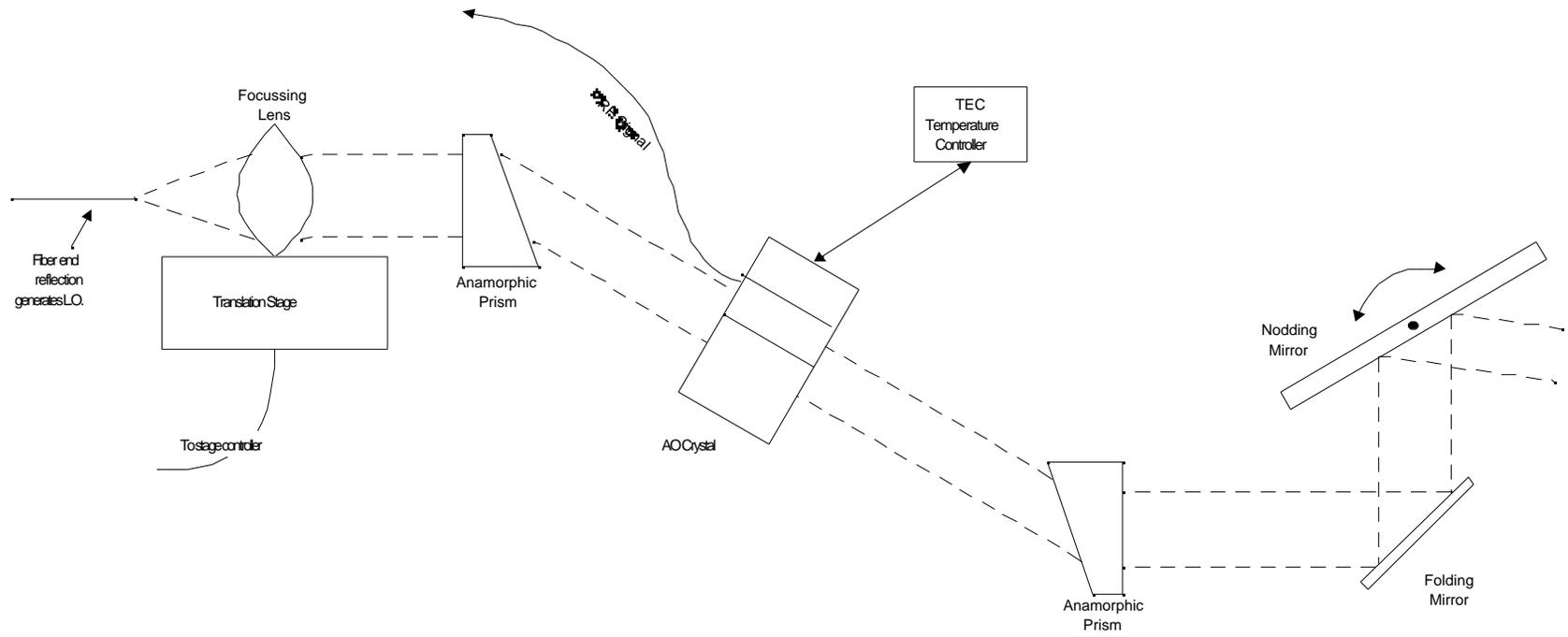
EPE Processor Layer Components



EPE RF Layer Components



DOLAR Scan Head Optical Design



Project Progress

- All needed personnel are in place.
- Detailed layout of the DOLAR system has been prepared.
- Laser Transmitter: The fiber optic circuit design was completed. The components are ordered and preparations have begun for mechanical assembly.
- Radar Receiver: RF circuit design was completed and parts are being ordered.
- Software Development: Evaluated the work needed to increase the measurement speed by factor of four.
- Scanner Head: Design of the compression prism system has started. Component selection has begun.