

LPC Clermont-Fd IN2P3-CNRS Universités Blaise Pascal		Electron detector TJNAF		Service Mécanique Specification
Author : DAUDON	Date : 27/06/2006	Modified : 09/04/2008 By : DAUDON	Validated on : 09/04/2007	Ref : TJN-DetE-S1.B ID :

TECHNICAL SPECIFICATIONS

Electron detector for Compton polarimeter TJNAF, Hall A

Responsibilities :

- LPC spokesperson : B. Michel
- JLAB spokesperson : S. Nanda
- JLAB mechanical integration : A. Gavalya / J. Miller
- LPC electronics leader : M. Brossard
- LPC mechanics leader : F. Daudon
- DAQ : A. Cansonne
- Motor control : S. Witherspoon

1- Introduction :

a. Experiment :

The project purpose is to modify the actual electron detector to give it a bigger range of measurement and increase the precision.

b. Context :

The new system will substitute the previous one in the beam input of Hall A at TJNAF. Tubes, cavity and laser will be updated by TJNAF team.

Ref : **TJN-DetE-MOU** 10/03/06

Beam characteristics :

Energy = 6 à 8 GeV expansible to 12 GeV

Beam diameter = 50µm

Straight beam Position known at ± 50µm

2- Interfaces and equipment delivery limits:

LPC will deliver the whole electron detector system, with its electronics and mechanical support.

- The mechanical support is limited to the vacuum box (cf : TJN-DetE-D01). Feet or integration support are in charge of TJNAF lab. Interface with the beam line are link flanges.
- Linear translator is delivered by LPC with motor and its electronic control.
- Software control (EPICS) is in charge of TJNAF.
- LPC will deliver technical documentation on all delivery equipment.

3- System description :

• Detectors data :

- 4 detection plans of silicon micro-strip, perpendicular to the chicane beam.
- Detectors Dimensions: See : **TJN-DetE-D10**
 - Silicium thickness 500µm ; Pitch : 240 µm (strip 200µm ; gap 40µm)
 - Useful height: 48 mm ; useful width : 10 mm
 - Channels number: 192 /plan → Total channels Number = 768

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- Detection plan pitch = 11mm.
- Vertical shift between plan = 0,06 mm (1st layer lower than last)
- Ceramic support thickness = 1 mm
- Relative position of detectors measured at $\pm 20\mu\text{m}$
- Max voltage 100Volt

- Position / beam See : **TJN-DetE-D02** and **D03**

- Movement :

- Detectors can move vertically (perpendicularly to straight beam)
- Angular adjustment can be adapted up to 12 GeV beam ($3^{\circ}226 \rightarrow 2^{\circ}34$)
- A garage position will be arranged out of any beam (beam pipe clearance) \rightarrow travel 120 mm.
- Work position begins at 2 mm above chicane beam.

- Working constraints :

- Vacuum level : 10^{-7} Torr
- Link cable between detectors and front-end must be shorter than 50cm and resist to the movement.
- No particular cooling for detectors electronics: natural convection.
- Working temperature (20°C) \rightarrow forbidden to heat vacuum chamber above 80°C .
- Avoid intersection of detectors with beam.
- Ambient radiations \rightarrow Tungsten plate (70 mm thick) in front of detectors in garage position.
Beam wandering \rightarrow (10mm overflow out of silicium)

- Position constraints :

See : **TJN-DetE-S2**

Beam alignment will be made by global positioning of the vacuum chamber (with marks) and by positioning detectors relatively to the upper flange of the chamber.

These alignments will be made by geometers at $\pm 0,2\text{mm}$

- Operating features :

Detector position absolute precision: $\pm 100\mu\text{m}$ ($\pm 300\mu\text{m}$ with geometers errors)

Positioning repetitivity : $\pm 25\mu\text{m}$

Vertical speed movement: Total travel in few minutes: ~ 50 to 100 mm/mn.

4- External constraints :

- ✓ Radiations: acceptable in garage position behind 70mm of tungsten.
- ✓ Synchrotron absorber for the beam line \rightarrow TJNAF charge.
- ✓ Magnetic field (magnet 4) \rightarrow Chamber material: Inox 316L .
- ✓ Photon detector envelope: 6 GeV design is used, 12 GeV design will be adapted.
- ✓ US voltage 110V, 60 Hz.