

# Luminosity determination for a synchrotron accelerator and for a collider with scintillators detectors systems



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## 1. ΔE-E detector for luminosity measurement

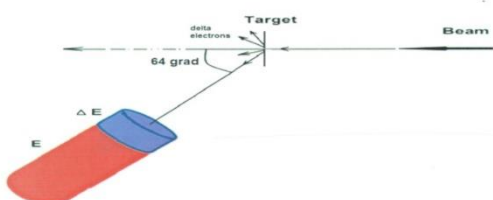


Fig.2

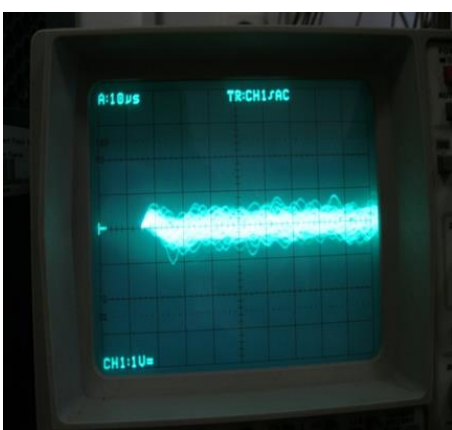


Fig.3

Fig.1. Detector ΔE-E semiconductor detector combined with CsI(Tl) crystal scintillator for luminosity determination at the synchrotron NUCLOTRON in JINR-Dubna.  
Fig.2. Position of ΔE-E detector inside the Internal Target Station of the NUCLOTRON-JINR-Dubna  
Fig.3. Response of the oscilloscope (HAMEG Instruments) for silicon photodiodes 300μm thickness S7478 Hamamatsu(ΔE-E detector).

Experimentally luminosity obtained with this detector  
for delta electrons:  $L_{exp} = (1.18 \pm 0.12) \times 10^{26} \text{ cm}^{-2}\text{s}^{-1}$  ;  
Theoretically luminosity for delta electrons:  $L_{calc} = (0.9 \pm 0.03) \times 10^{30} \text{ cm}^{-2}\text{s}^{-1}$ .

## 2. Detector for luminosity measurement at NICA

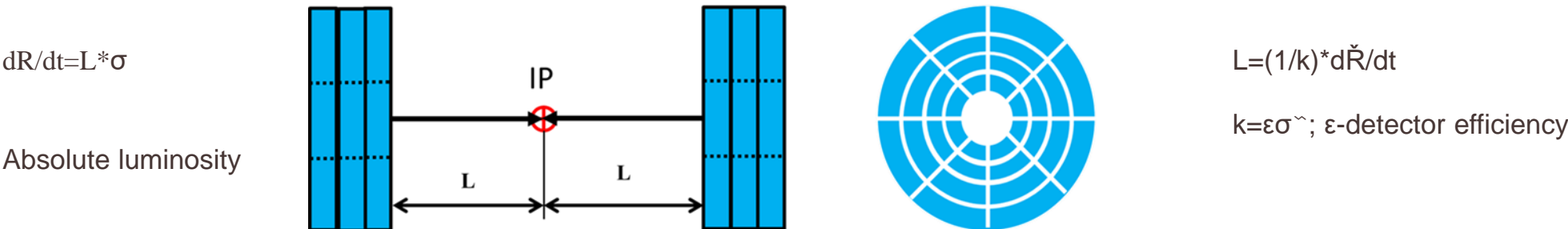


Fig.4 .Diagram of the scintillation detector for luminosity measurements. The central aperture is for ion guide

Detector system from plastic scintillators proposed for luminosity measurements; small- sized(crosswise size  $\varnothing \leq 25\text{cm}$  ) and mobile placed near the interaction point, left and right along the collision axis;  $L=300\text{cm}$ . Expected luminosity for Au-Au reactions  $L_{AuAu} = 1 \times 10^{27} \text{ cm}^{-2}\text{s}^{-1}$  at NICA energies with proton spectators, for heavy ions  $4\text{GeV} \leq \sqrt{s_{NN}} \leq 11\text{GeV}$ .

## 3. Hodoscope for luminosity measurement at NICA

Hodoscope designed in IFIN-HH; detector of small-area( $30 \times 30 \text{ cm}^2$ ) with plastic scintillators rods and PIN photodiodes

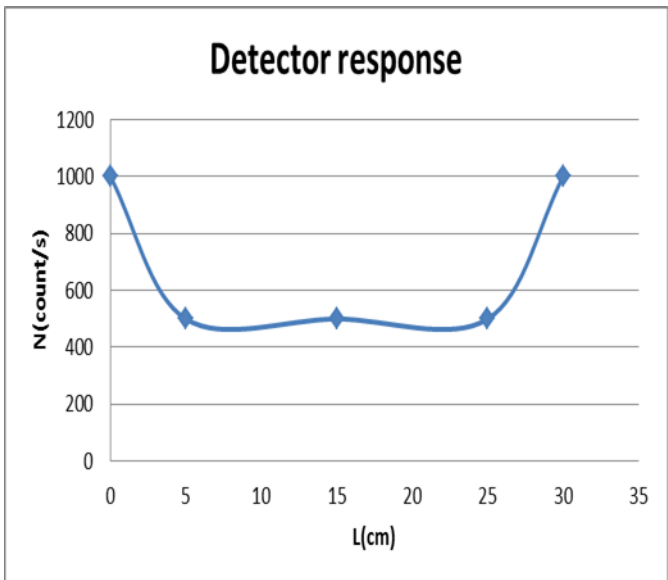
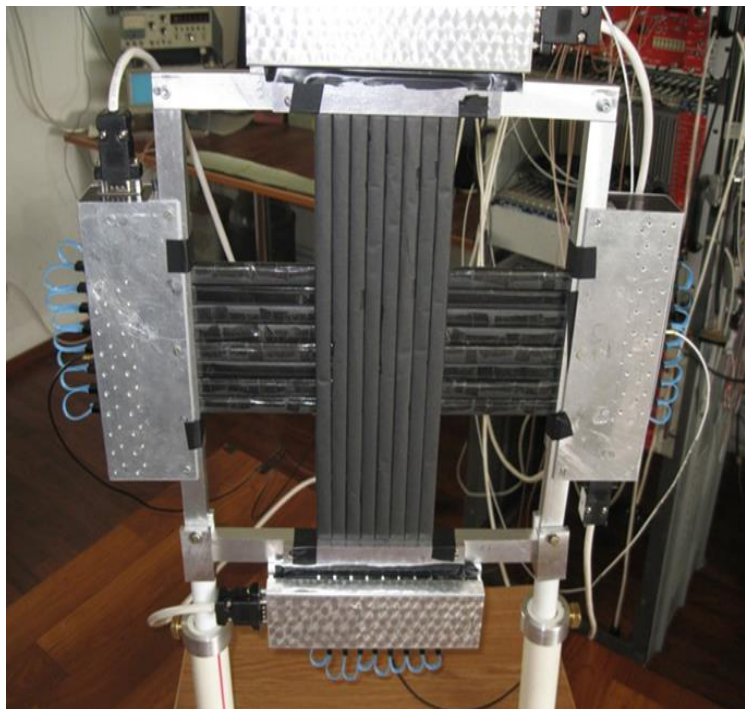


Fig.5 Hodoscope  
Fig 6. Response curve for hodoscope when is tested with radioactive source of (Sr-Y)90  
Time of flight measurements are possible to determine the maximum of interaction.

4. **Conclusions:** The luminosity measured with scintillators detectors for NICA collider is smaller than the luminosity measured with a ΔE-E detector for synchrotron accelerator Nuclotron; the absolute luminosity for the collider NICA can be measured with proposed detectors;

**References:** Z.Igamkulov, M.Crukeru et al., PEPAN Letters 2019(16)No.6, pp744-753;