RPC R&D Gruppo ATLAS Roma Tor Vergata

- **Upgrade di FaseI BIS78 e FaseII BI per il Muon Spectrometer ATLAS (RM2, Bo, Cosenza)**

  → con nuova Elettronica di FrontEnd,

  con elettrodi sottili su gap 1 mm, si garantisce alta efficienza, alta risoluzione temporale 0.5 ns fino a **Rate di 10 kHz/cm^2**

  → 3 gap (con lettura di entrambe le coordinate eta e phi) in 5 cm di spessore complessivi
- **R&D RPC**

  1) **Nuova Elettronica Front-End → FE in SiGe → fattore 5 sulla Rate Capability a parità di invecchiamento e sul range di linearità**

  2) Nuovi materiali, elettrodi sottili (coll. INFN Atlas Bologna)

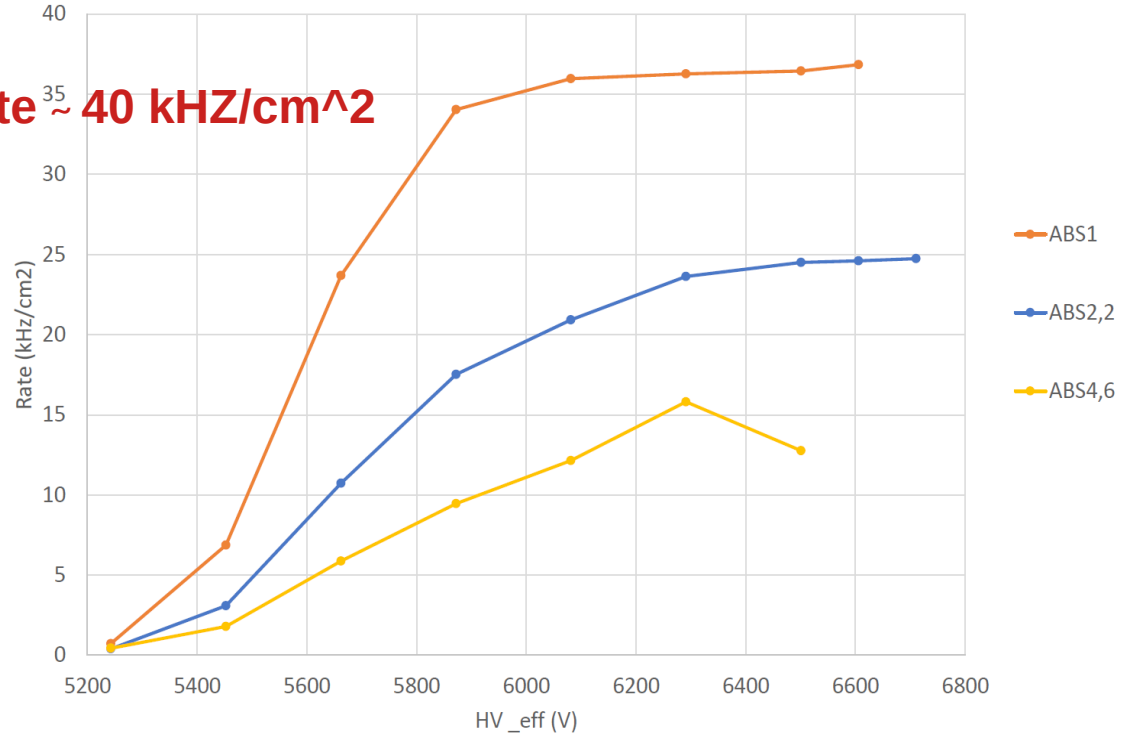
  3) Nuovi sistemi di lettura Segnale Ionico

- **New Detector RCC Resistive Cylindric Chamber**

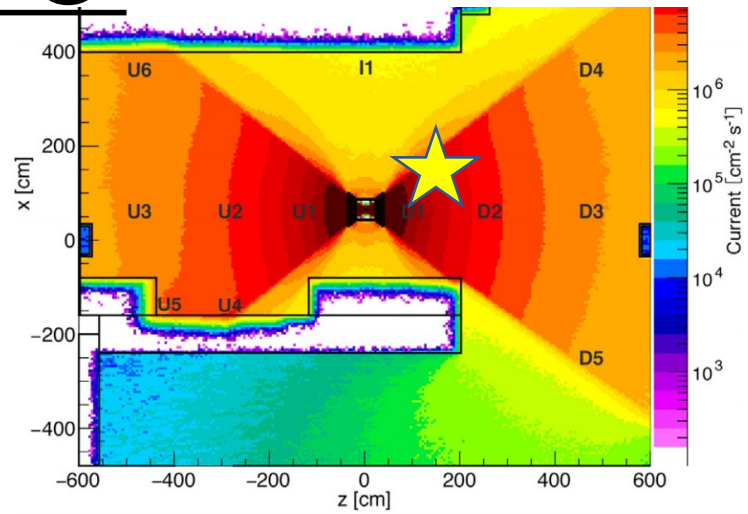
Rate capability performance of RPC with SI-GaAs electrodes

- **Hz/cm² in uniform high energy photons field**
- Equivalent discrimination threshold about 5 fC
- No photon converter on the electrode surface

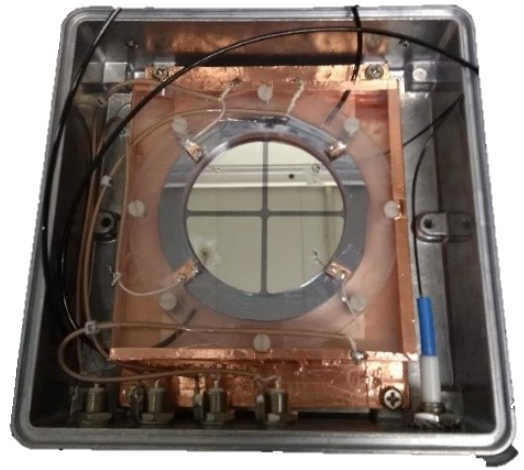
->RPC photon efficiency ~ -> maximum photons counting rate ~/cm²



14.1 TBq ^{137}Cs source (662 keV photons 33% - 54%) [3]



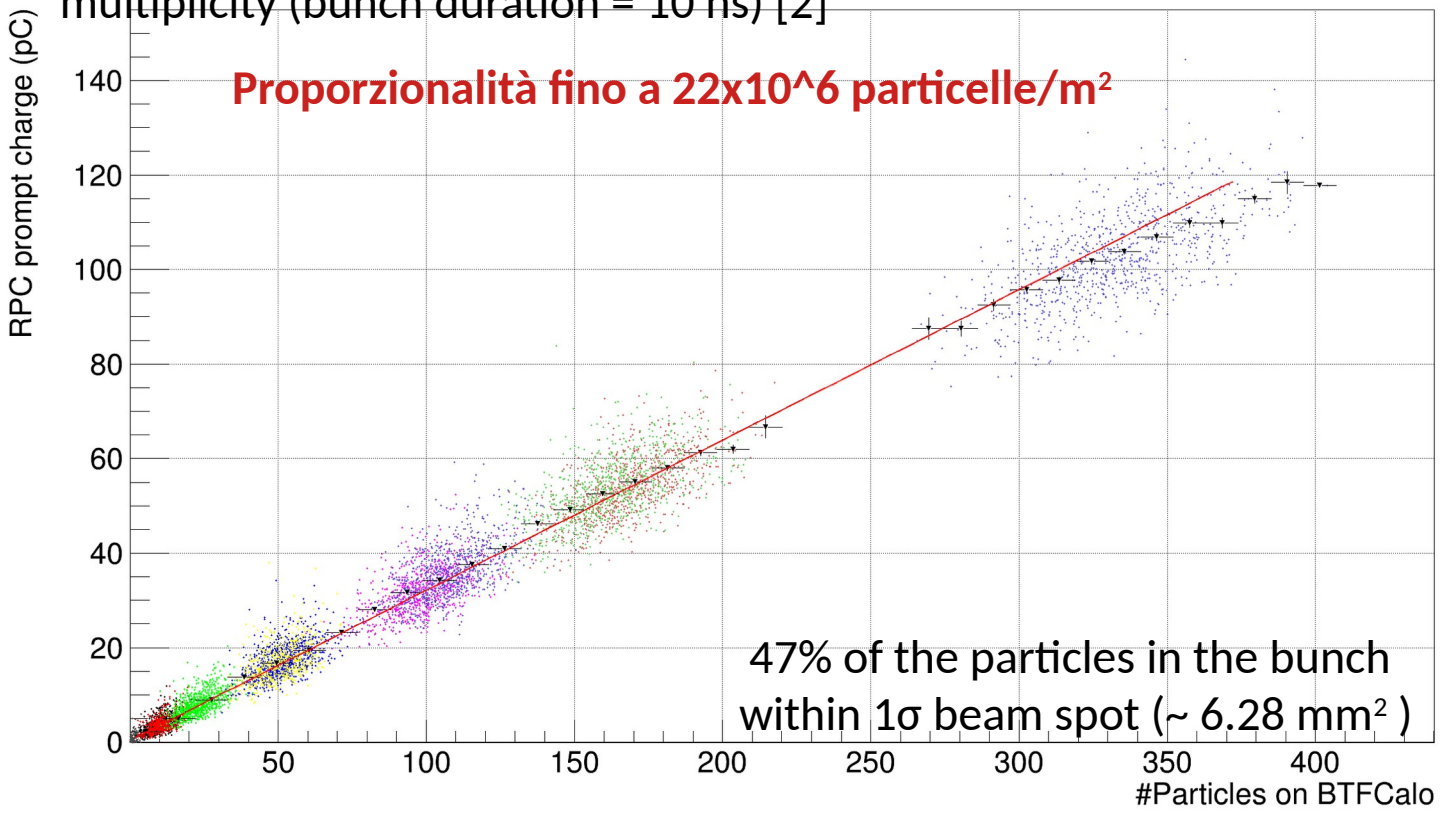
- Gas gap thickness 1 mm
- Semi Insulating GaAs electrodes
  - Thickness 0.6 mm
  - Resistivity 1.4×10^8 Ωcm
- Active area 6.25 cm²
- Four readout pads



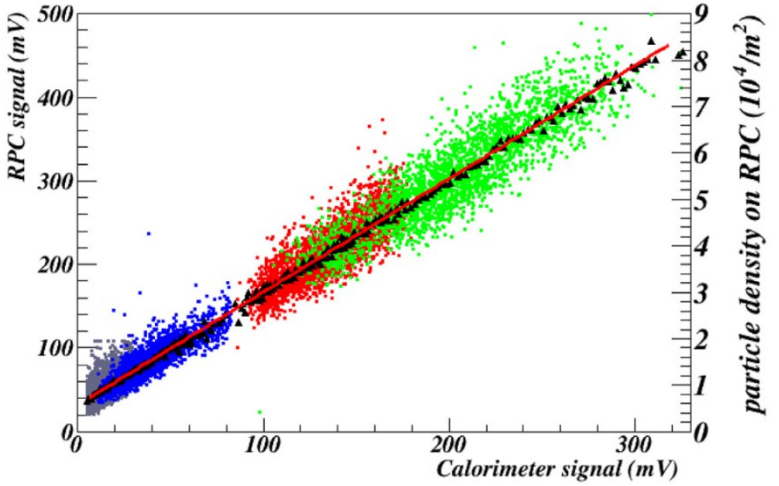
D. Pfeiffer et al, The radiation field in the Gamma Irradiation Facility GIF++ at CERN
A. Rocchi, R. Cardarelli, B. Liberti et al. *JINST* 15 (2020) 12, C12004. 10.1088/1748-0221/15/12/C12004

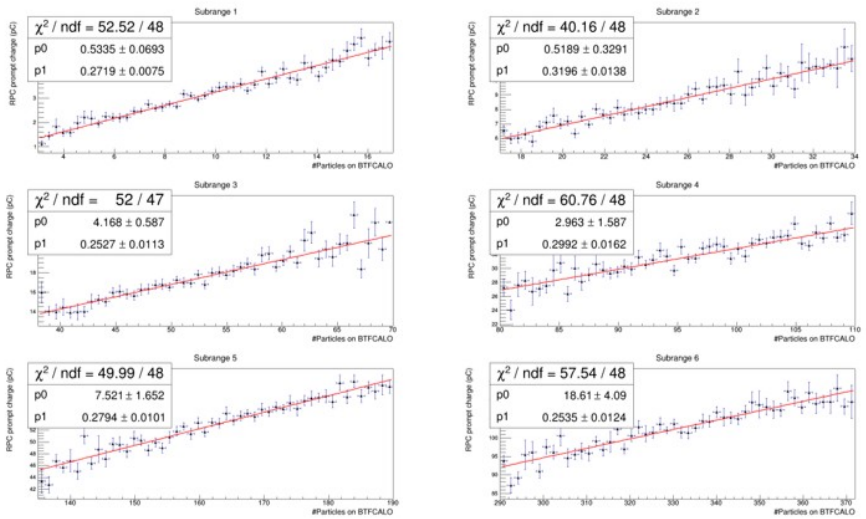
Analog calorimetry with RPC operated in saturated avalanche regime

RPC (1 mm gas gap thickness) electronic signal charge vs beam bunch multiplicity (bunch duration = 10 ns) [2]



Streamer regime response [1]

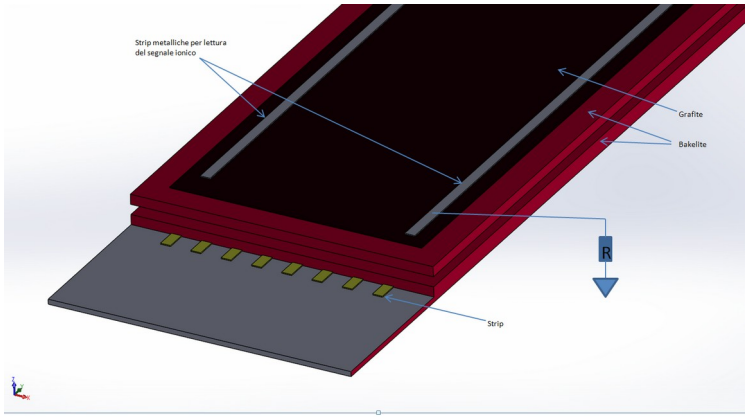


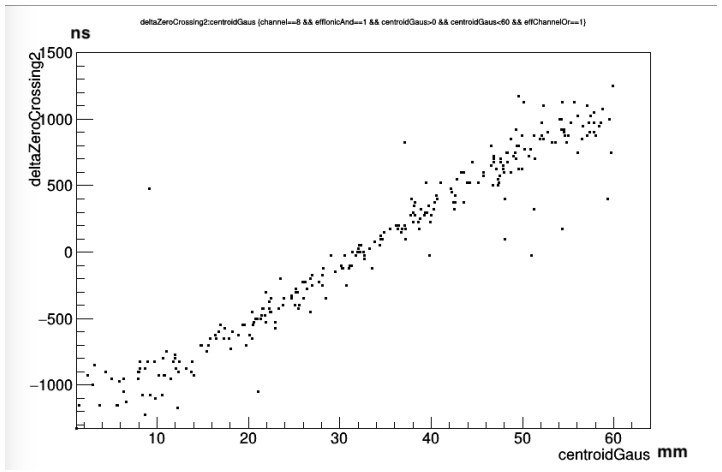


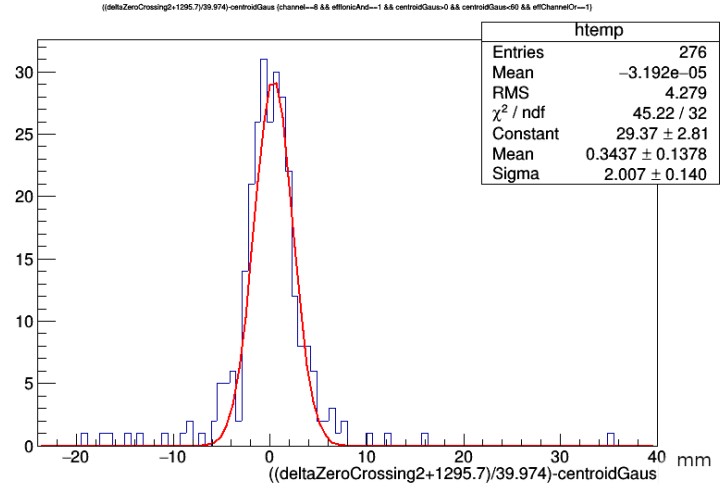
R. Bartoli et al. *Intrinsic linearity of bakelite Resistive Plate Chambers operated in streamer mode*. NIM Section A, 2019.

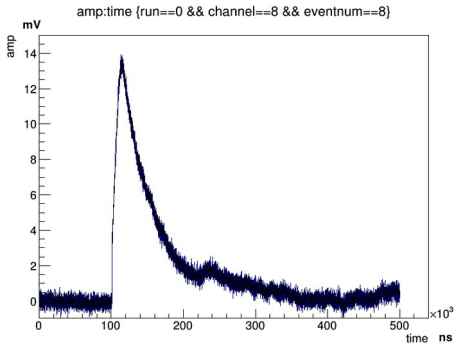
A. Rocchi, R. Cardarelli, B. Liberti et al. *JINST* 15 (2020) 12, C12004. 10.1088/1748-0221/15/12/C12004

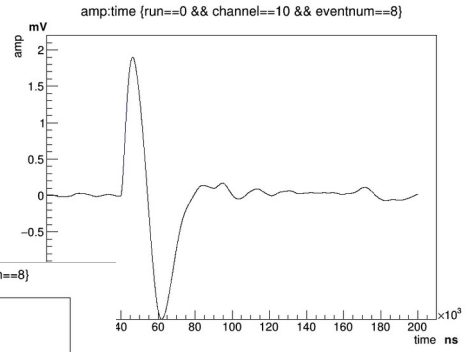
RPC - Spatial Resolution with Induced ionic signal

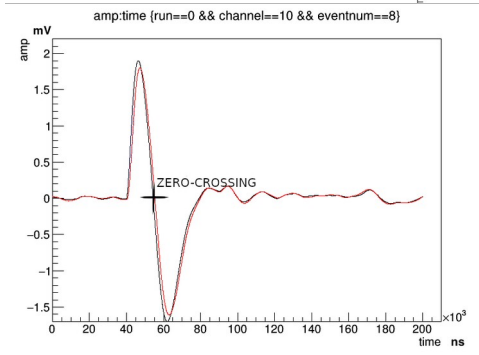












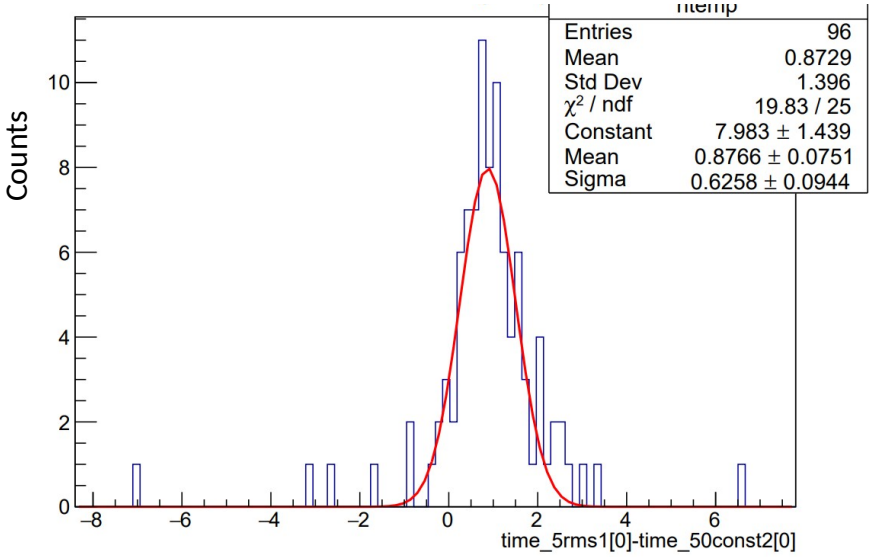
- Spatial resolution Real Time < 1mm (con 10 ch / m^2 RealTime)
- Digital FE (TDC interno) bassisimo consumo
- Maximum Rate 100 Hz/cm^2
- Detector con risoluzioni temporali tipiche RPCs e risoluzione spaziale

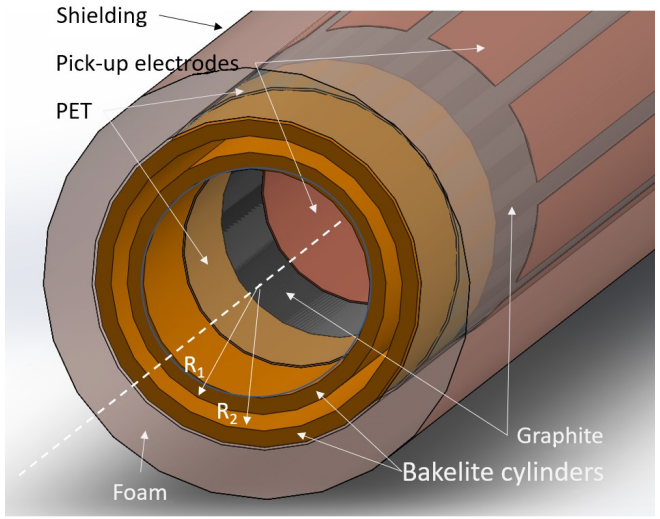
R. Cardarelli et Al. ***Track resolution in the RPC chamber*** NIM A572, vol. 1 170-172 (2007).

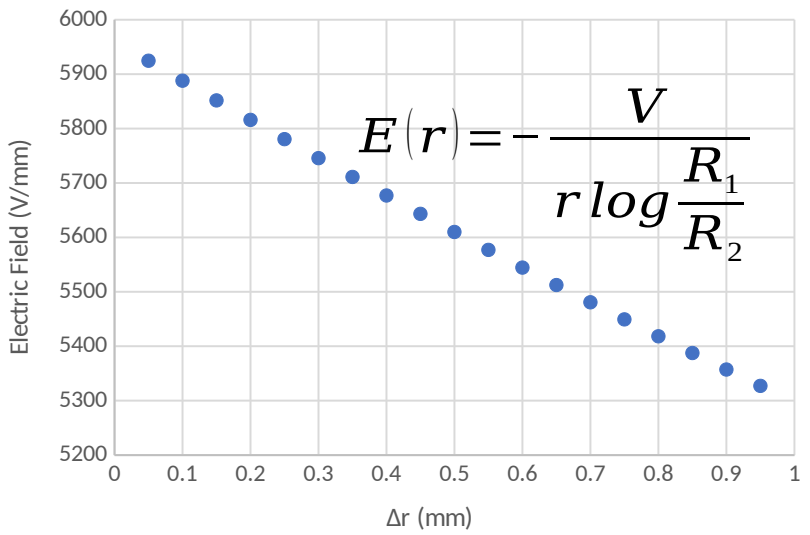
Tesi di Dottorato Dott. E. Alunno Camelia **Development of new read-out technique for Resistive Plate Chamber**

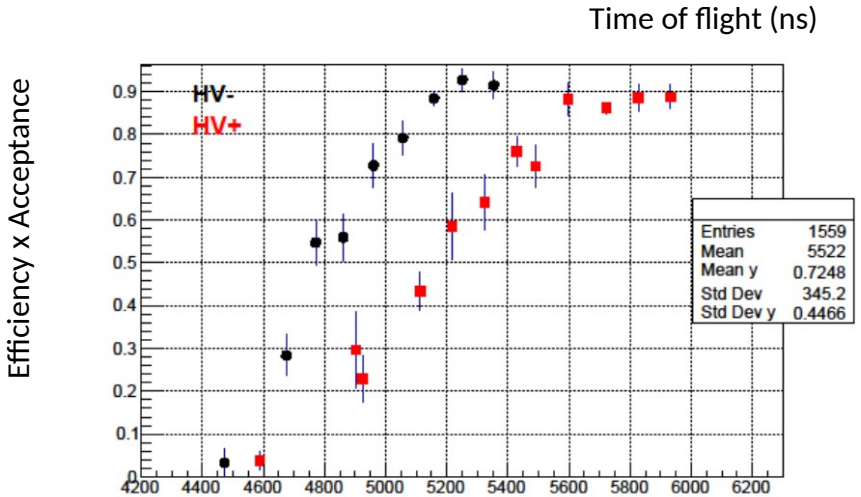
Resistive Cylindrical Chambers

- A cylindrical geometry consisting of two concentric pipes spaced by a gas gap allows to determine a very different evolution of the gas discharge development depending on the ratio of the facing surfaces radii
- The cylindrical geometry is resistant to the gas over-pressures. It can be argued that a gap working at a higher pressure is equivalent to a thicker gap, solving the lack of efficiency observed in the uniform field single thin gaps.
- In over pressure mode, new eco gases would be suitable for saturated working mode









R. Cardarelli "***Future RPC developments***", RPC2020 Roma 10-14 /02/2020 proceeding su JINST