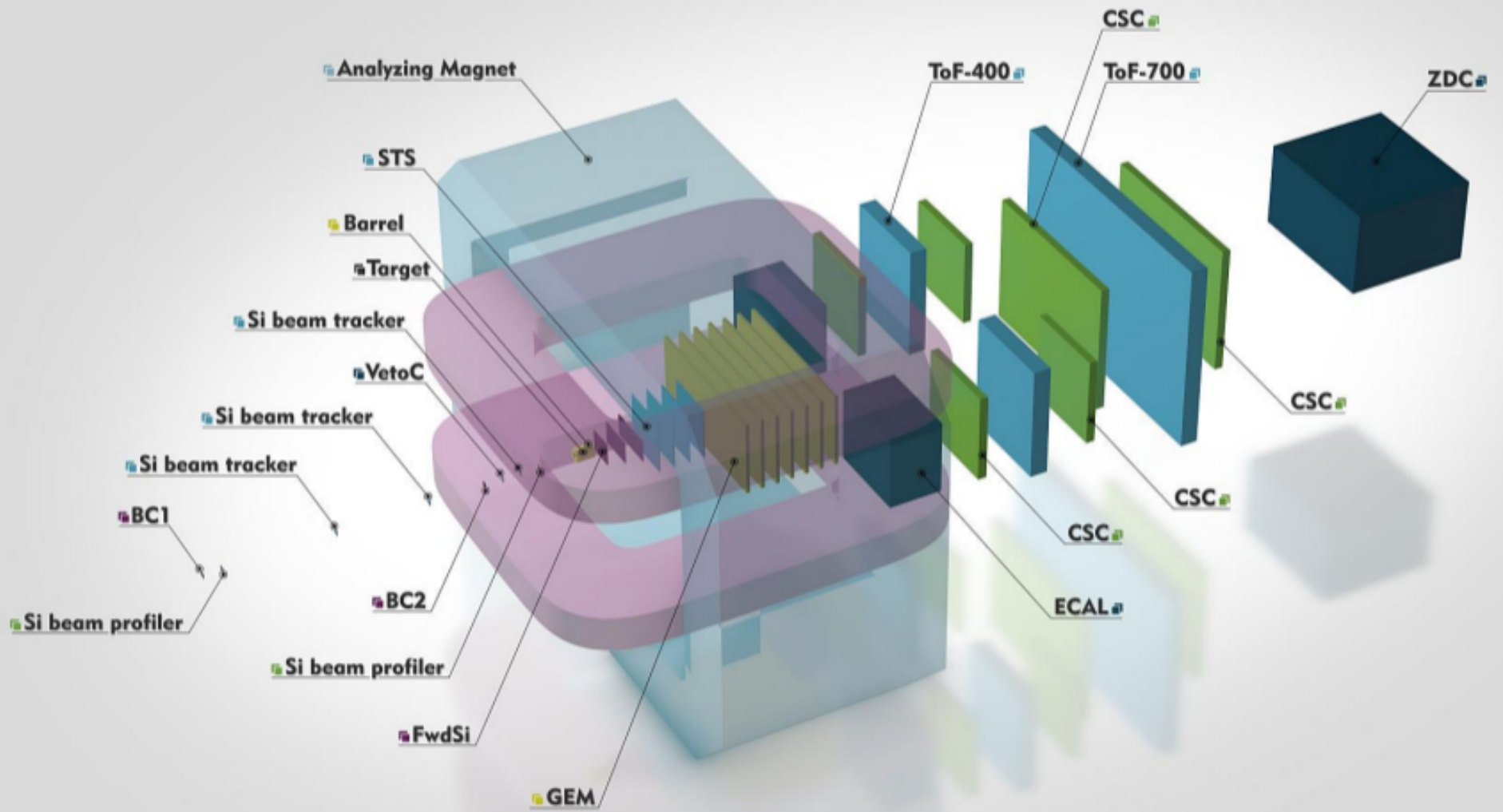


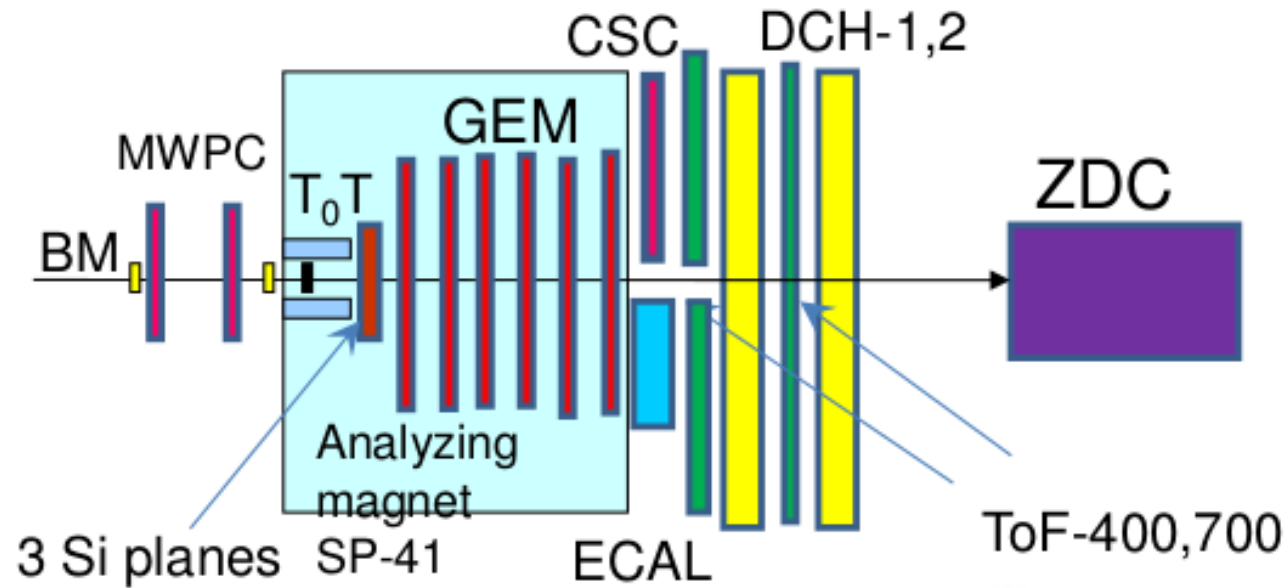


Идентификация частиц методом времени пролета в эксперименте BM@N

Бабкин В.А., Буряков М.Г., Головатюк В.М., Дулов П.О.,
Дмитриев А.В., Лобастов С.П., Румянцев М.М.

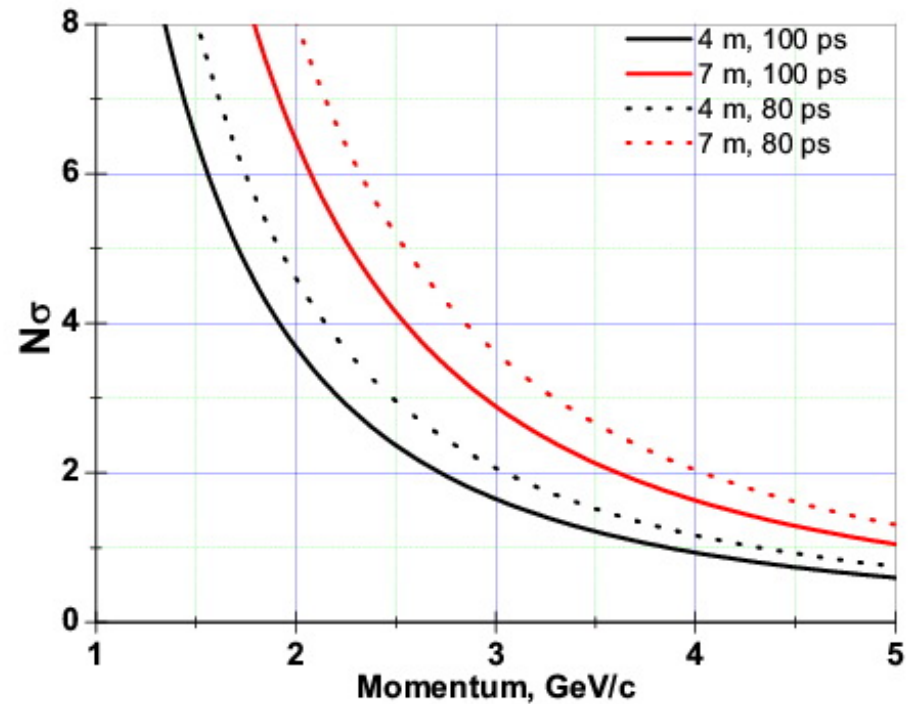
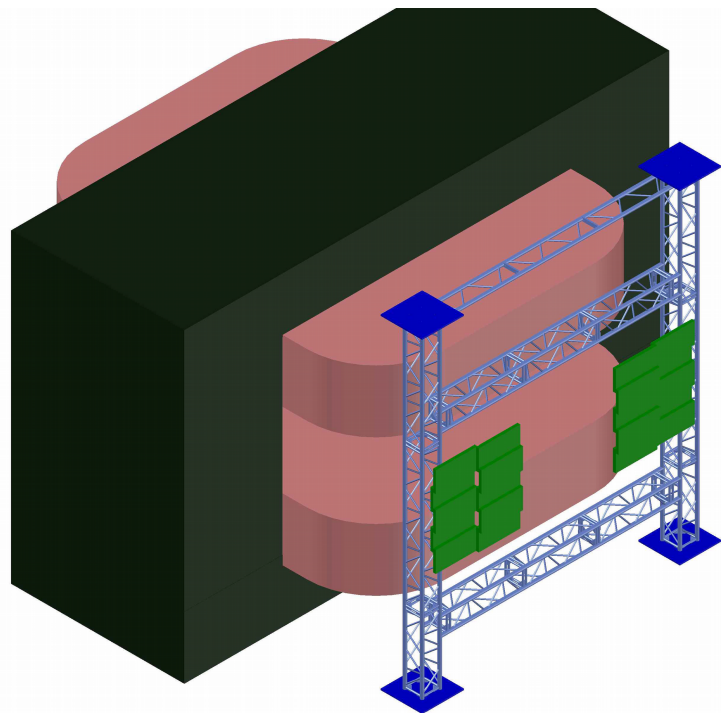
Установка BM@N

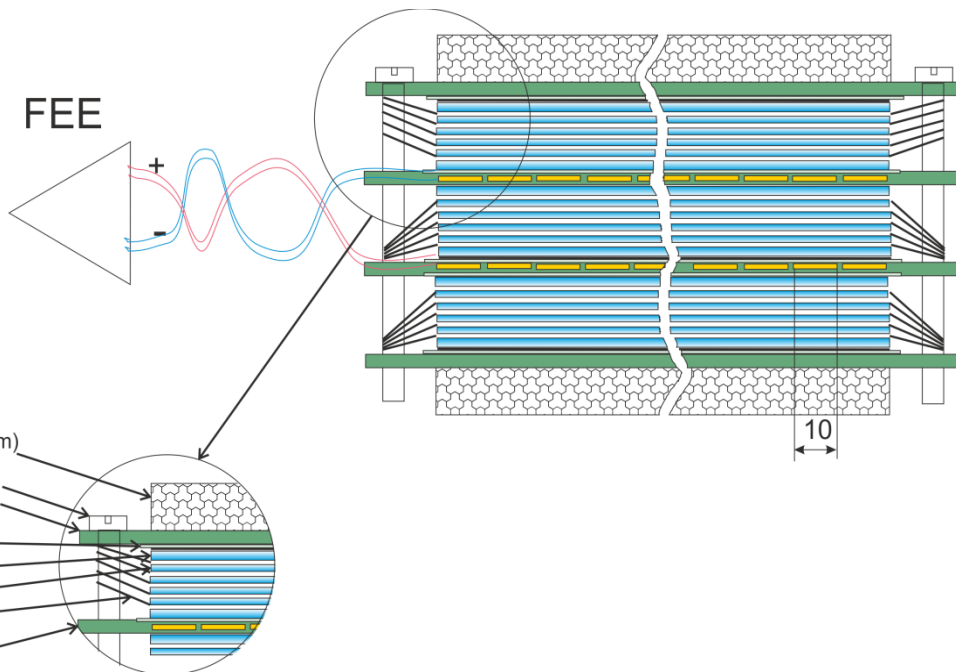




$$p = \gamma m v$$

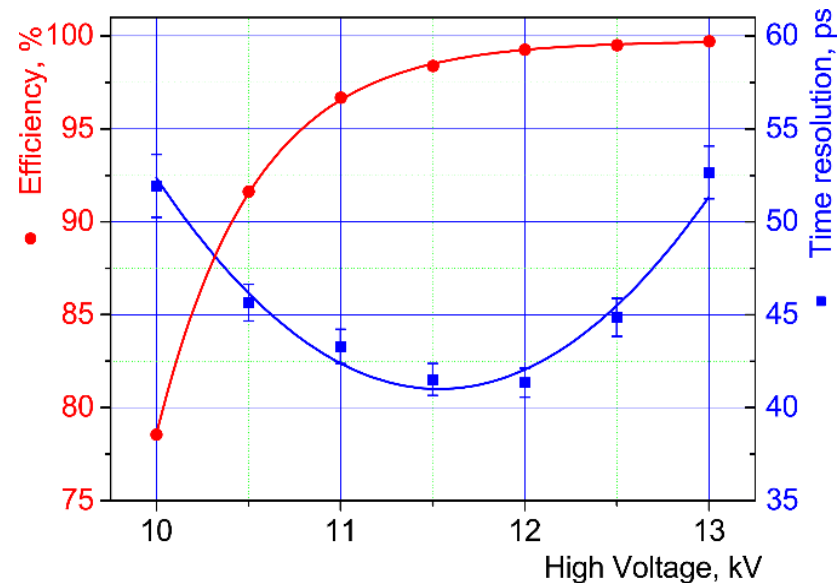
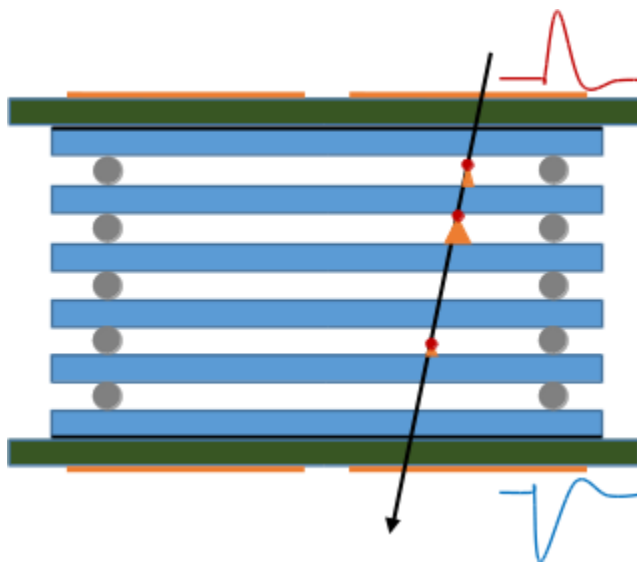
$$m = \frac{p}{c \gamma \beta}$$



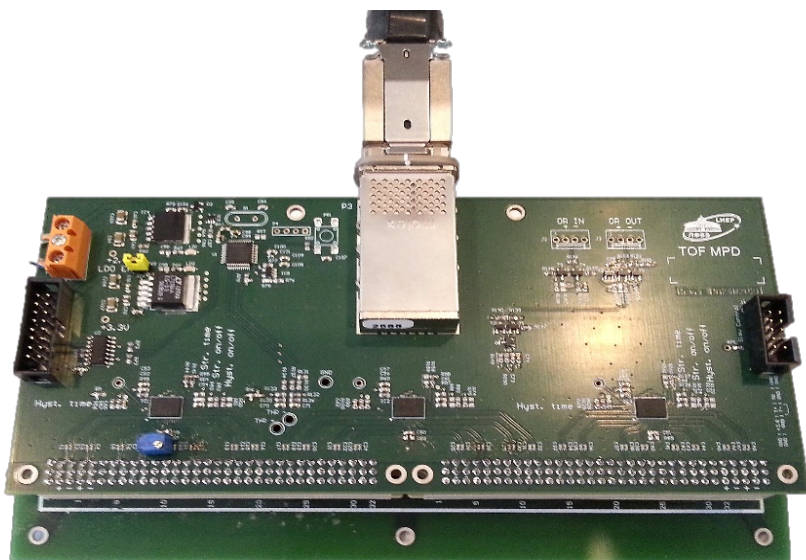


- ✓ Active area 30x60 cm²;
- ✓ Number of readout strip — 48;
- ✓ Number of FEE - 96;
- ✓ Efficiency — > 98%;
- ✓ Time resolution — < 50 ps;
- ✓ Gas mixture — C₂H₂F₄/SF₆/i-C₂H₄;
- ✓ Position resolution — < 5 mm;

Honeycomb (5 mm)
 PET Screw
 Outer PCB (1.5 mm)
 Mylar (100mkm)
 Outer HV glass (400 mkm)
 Inner glass (270 mkm)
 Spaser (fishing line 200 mkm)
 PCB with "strips" (1.5 mm)

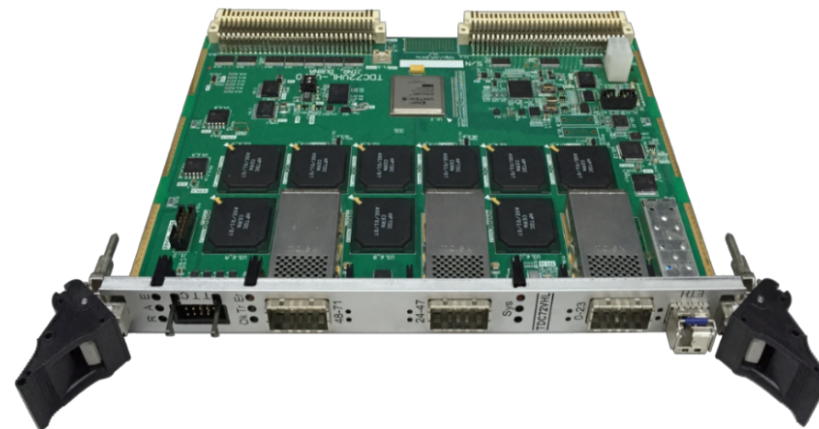


NINO based 24-channels
preamplifier-discriminator board PA24N2V2I

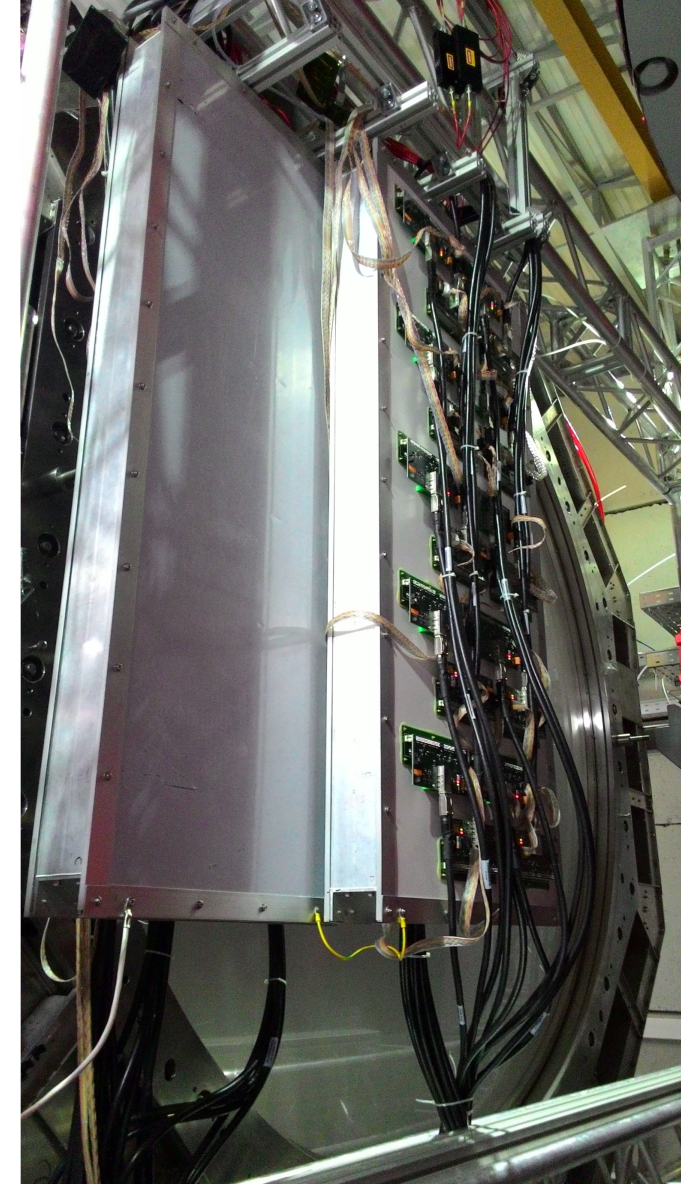
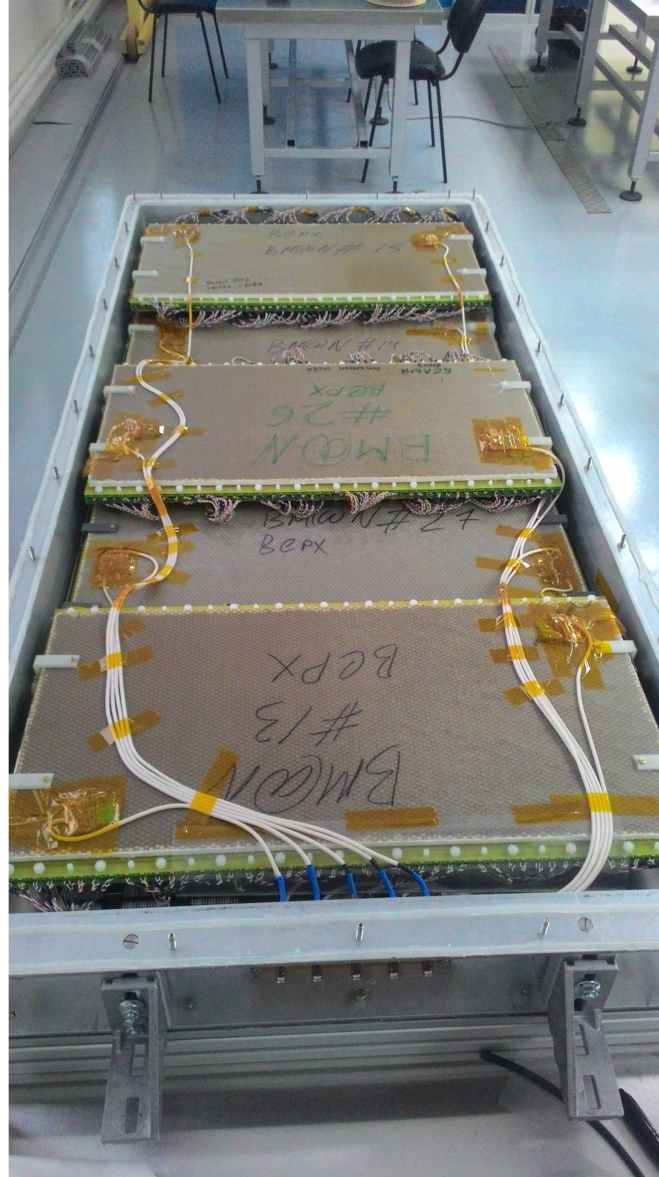
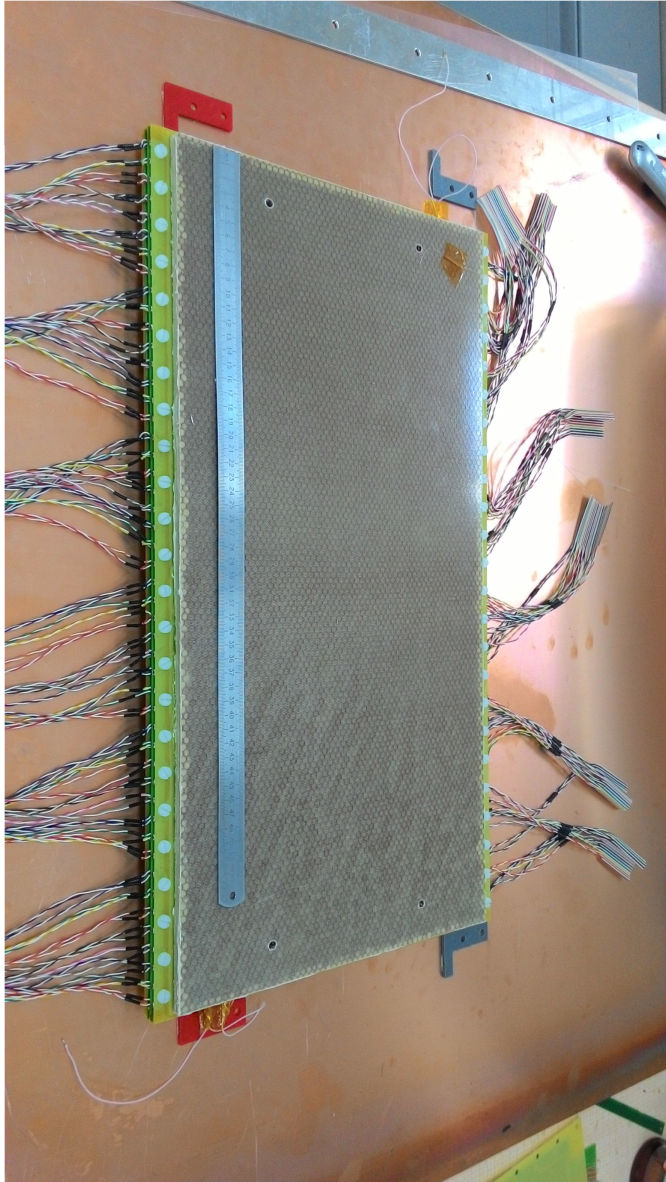


- ✓ Stabilization of the voltage (+2.5V);
- ✓ Differential input ($Z_{diff} = 55 \text{ Ohm}$);
- ✓ Inputs capacitors for two-end strip readout;
- ✓ CXP (InfiniBand) 100 Ω output connector;
- ✓ Series “or” output for 24 channels;
- ✓ Time jitter (RMS) for one channel $\approx 7 \text{ ps}$;
- ✓ “On board” slow control:
 - voltage control & monitoring;
 - preamplifier thresholds control;
 - board temperature monitoring $\pm 0.5 \text{ }^\circ\text{C}$;
 - gas volume temperature monitor.

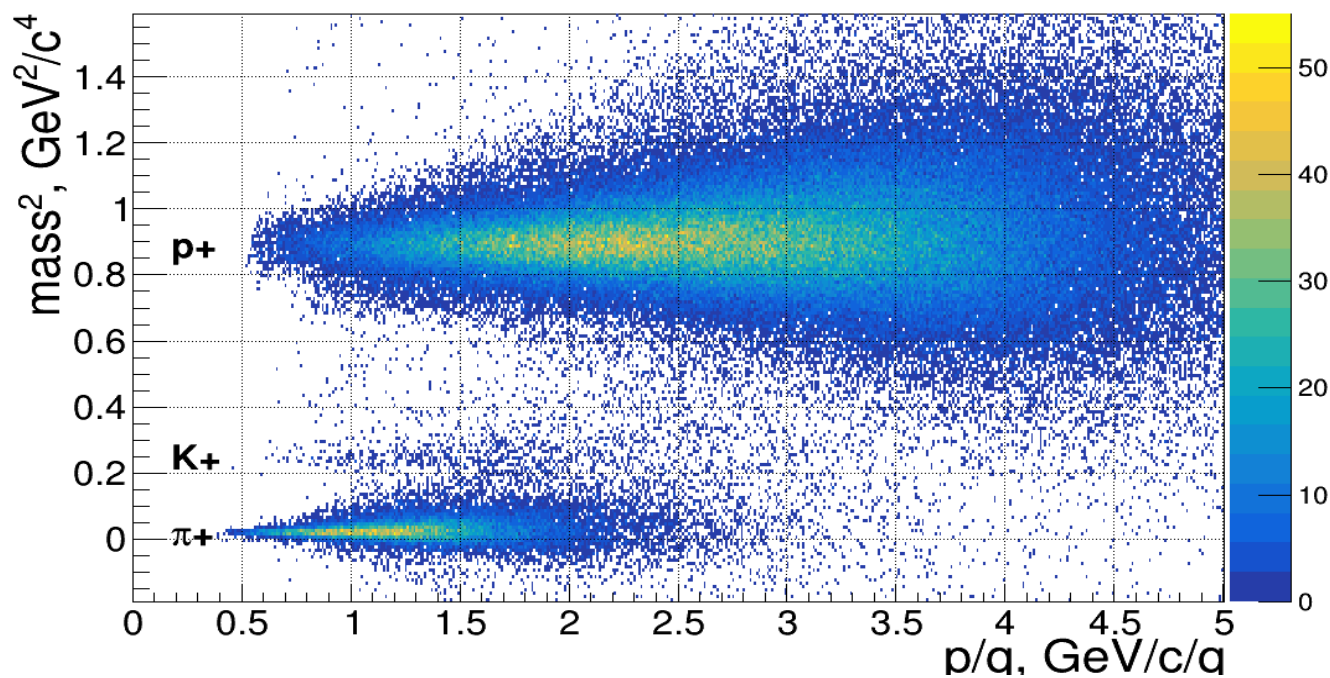
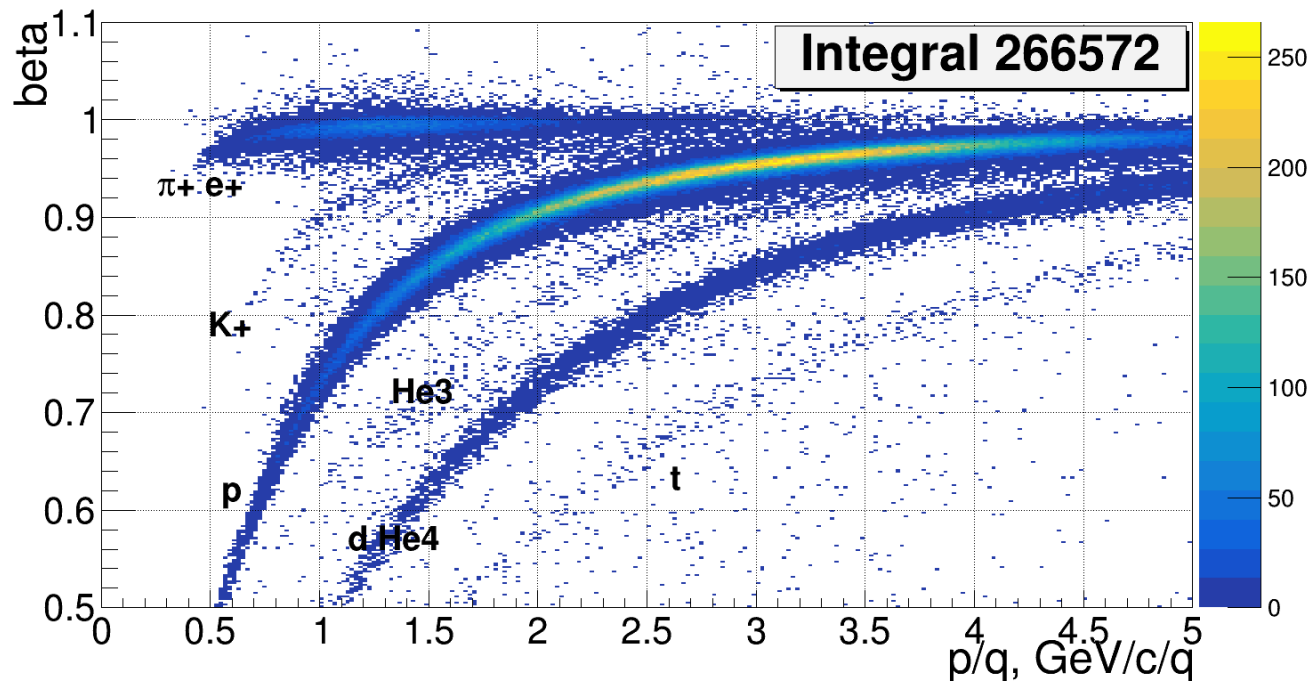
72-channels VME time-to-digital
converter TDC72VHL



- ✓ VME64x interface with VXS;
- ✓ TDC type: timestamping HPTDC chip;
- ✓ Input: differential 100 Ω (LVDS);
- ✓ Resolution: 23.4 ps bin size ($\sigma_t \approx 18 \text{ ps}$ - measured);
- ✓ Power consumption: +5V/0.13A; +3.3V/5.6A;
- Standalone mode:
 - ✓ Ethernet data transfer;
 - ✓ Time synchronization by the White Rabbit.



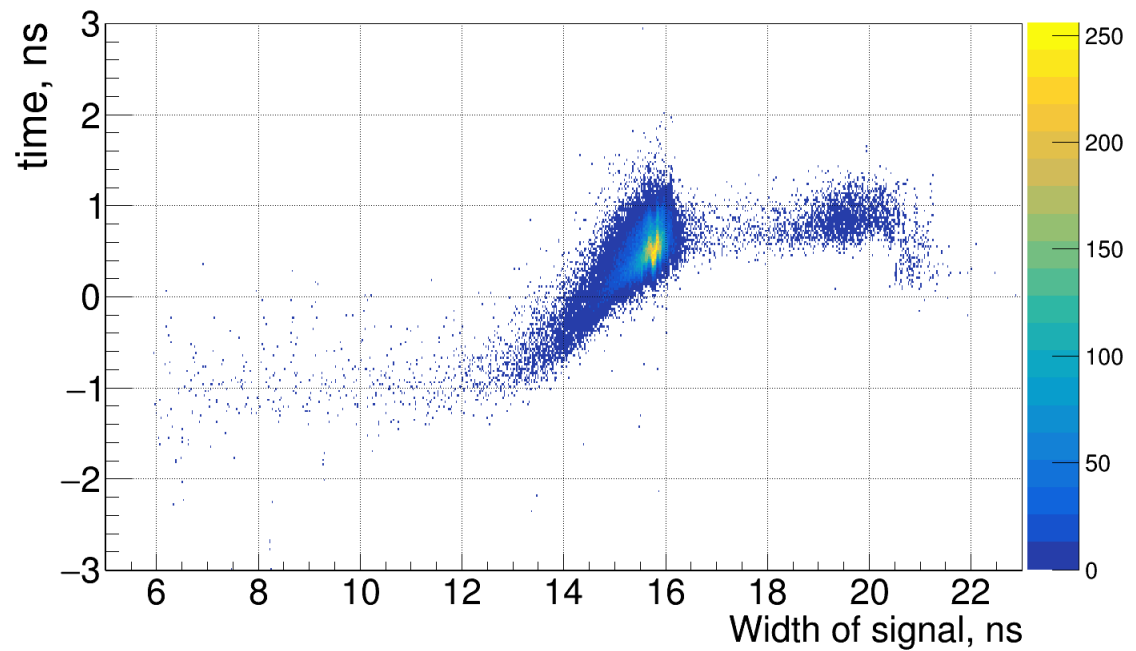
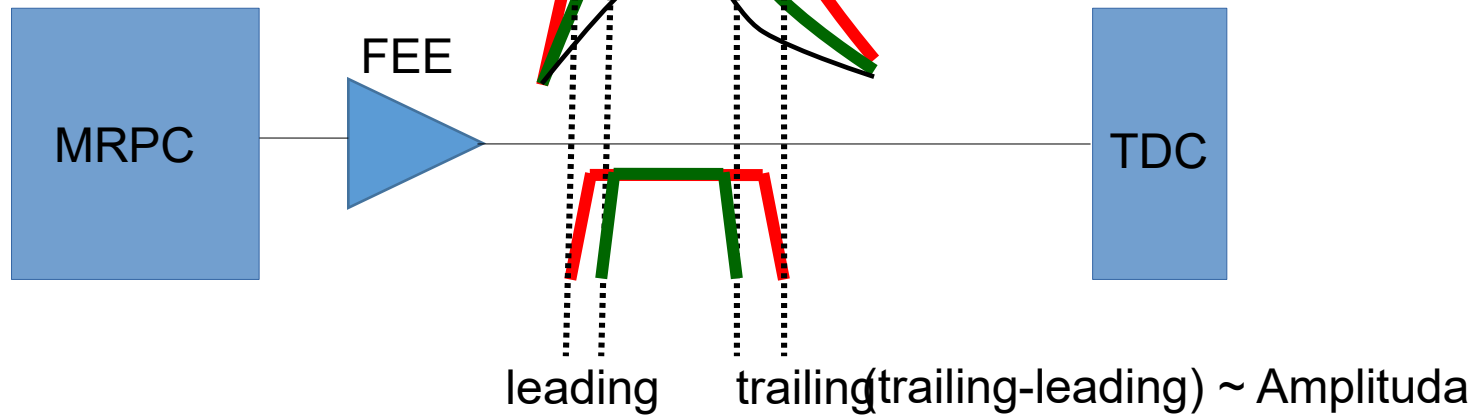
Результат идентификации



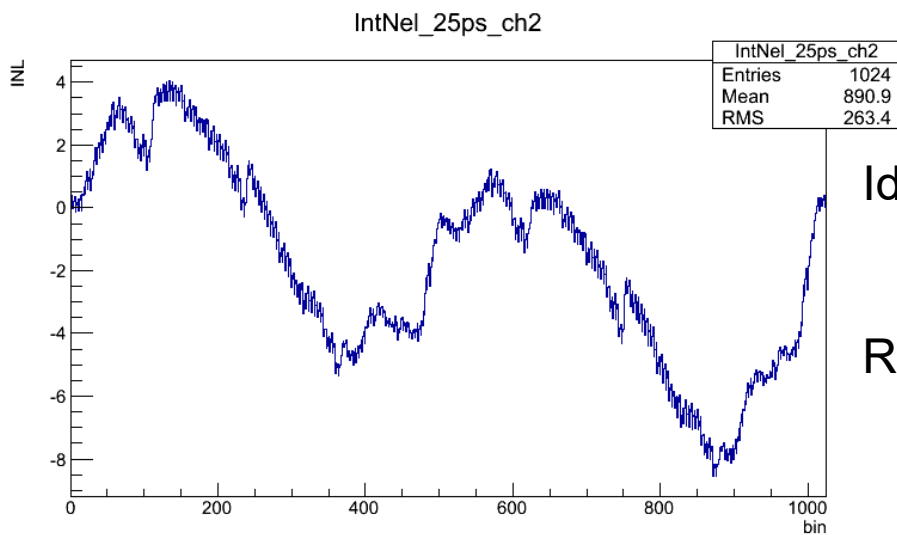
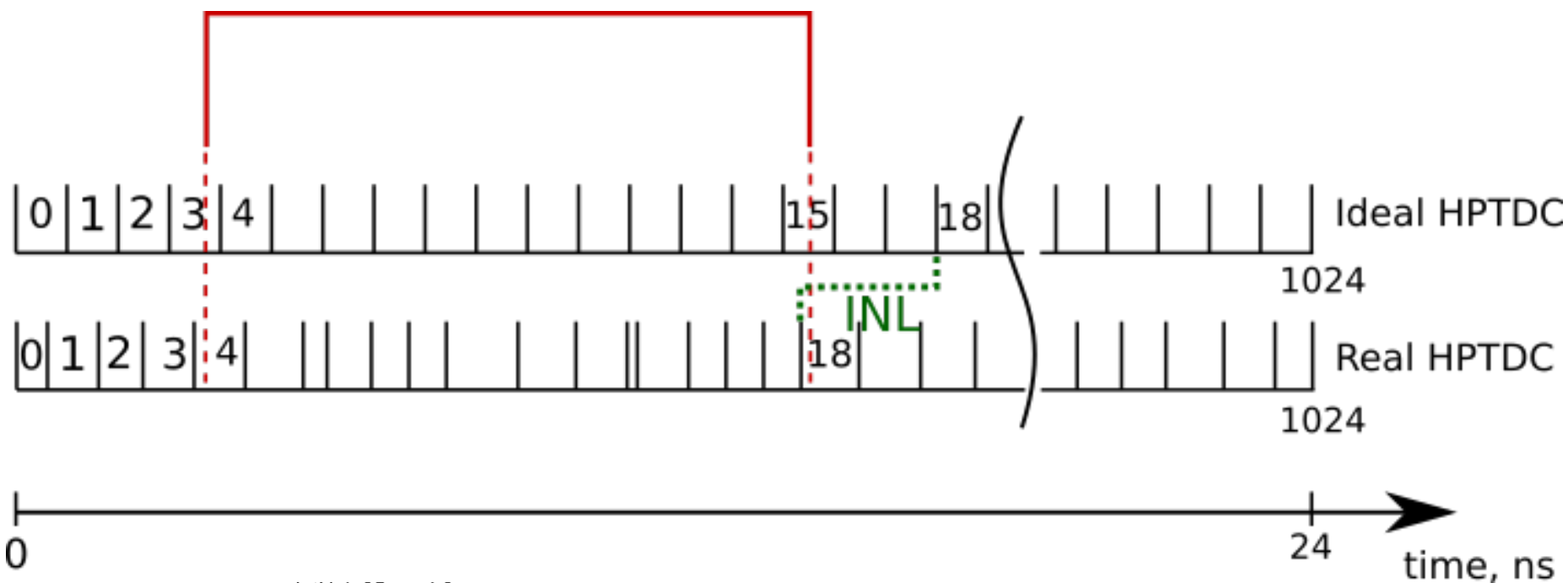


Спасибо за внимание

Время-Амплитудная коррекция



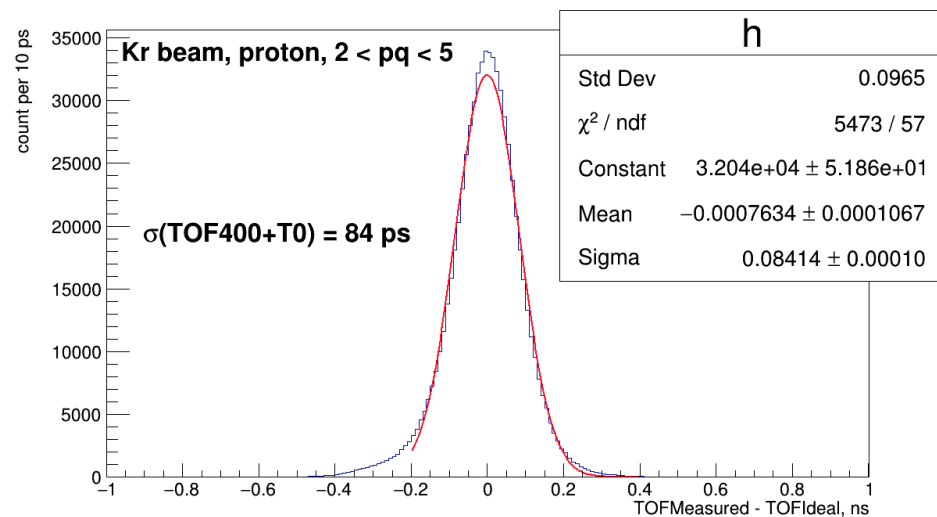
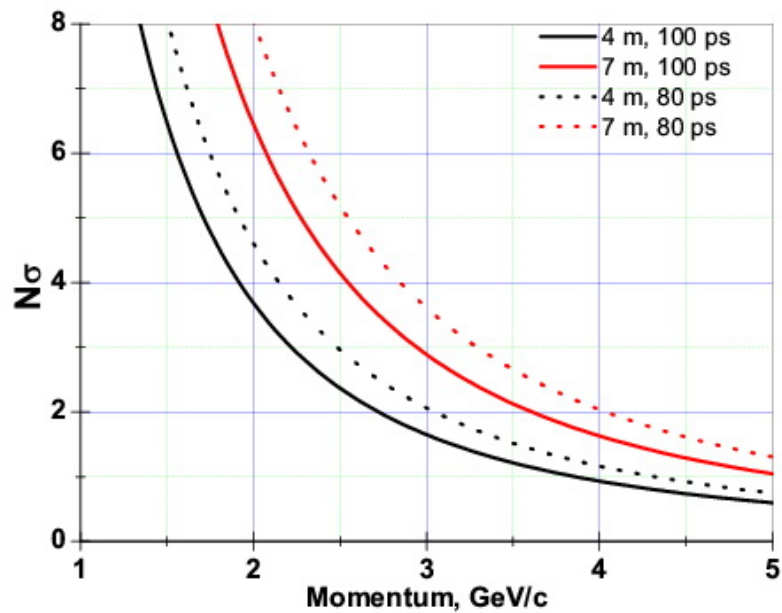
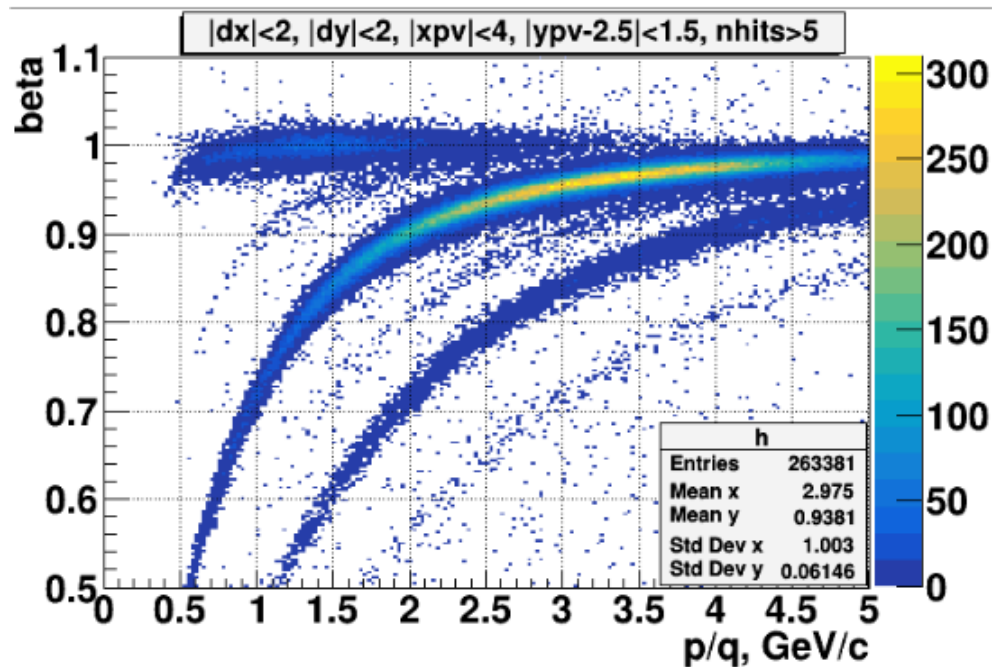
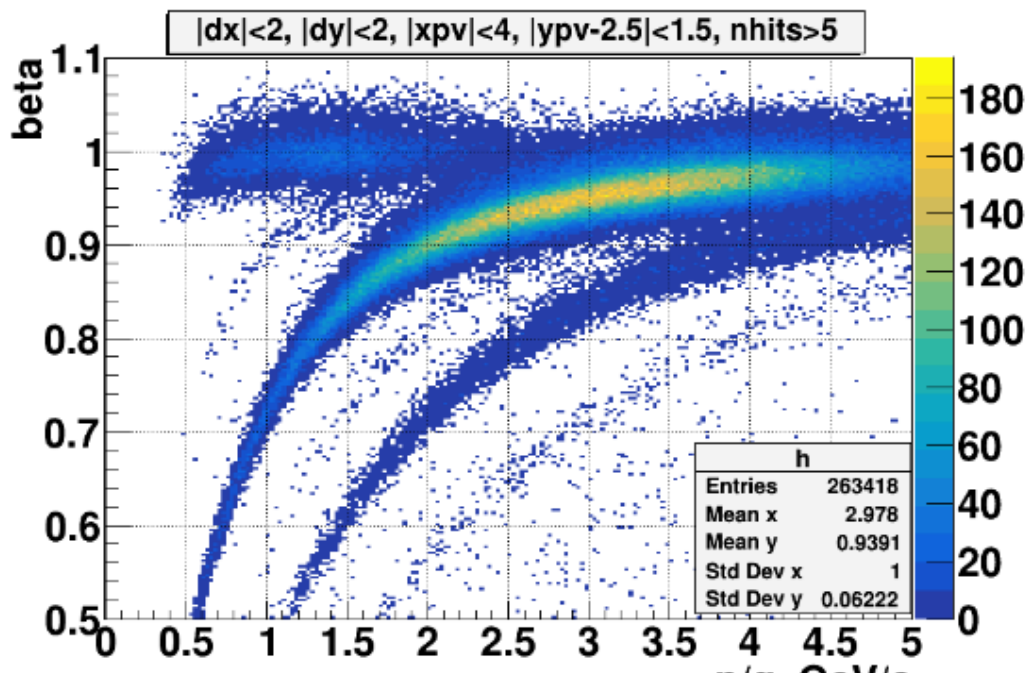
Коррекция нелинейности TDC

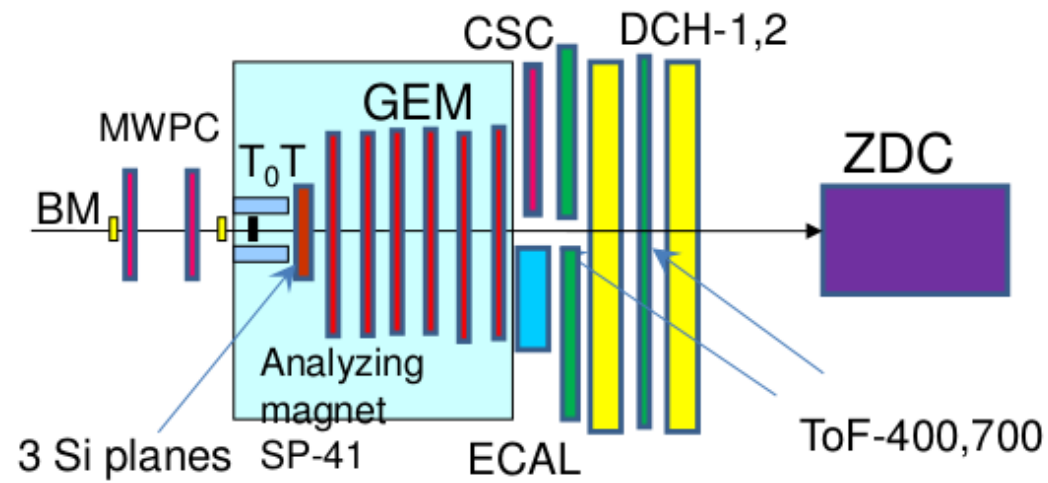


Ideal case: $Time = NumberOfBin * \frac{24\text{ ns}}{1024}$

Real case: $Time = (NumberOfBin + INL) * \frac{24\text{ ns}}{1024}$

Влияние коррекция на результат идентификации





$$\beta = \frac{l}{ct}$$

