



BESIII Italian Collaboration

R. Baldini Ferroli, M. Bertani, A. Calcaterra, S. Pacetti, A. Zallo, M. Anelli
(LNF)

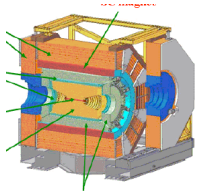
D. Alberto, M. Destefanis, M. Greco, M. Maggiora, S. Spataro (TO)

Riunione Commissione Scientifica Nazionale 1,



Parma, 21 settembre 2010

OUTLINE



BESIII and BEPCII status



Preliminary results on $J/\psi \rightarrow p\bar{p}, n\bar{n}$ measurement

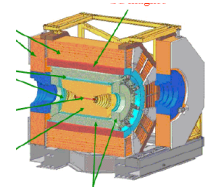


ZDD: prototype and cosmic ray test

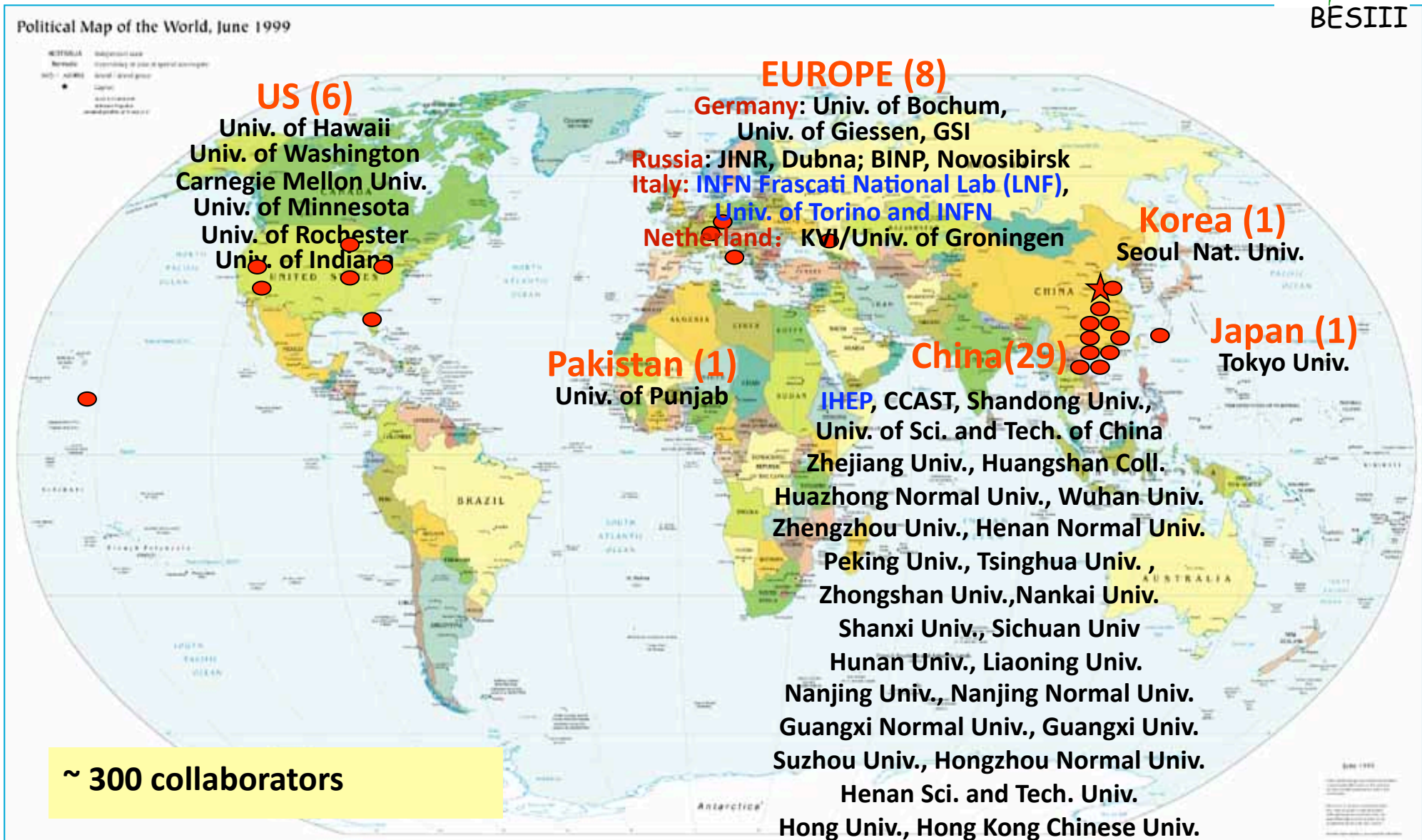


2011 Financial requests

BESIII collaboration: 46 Institutes



BESIII



BEPCH/BESIII Milestones

Beginning of 2004, construction starts

Mar. 2008: Collisions at 500 mA × 500 mA, Lum.: $1 \times 10^{32} \text{ cm}^{-2}\text{s}^{-1}$

Apr. 30, 2008: Move BESIII to IP

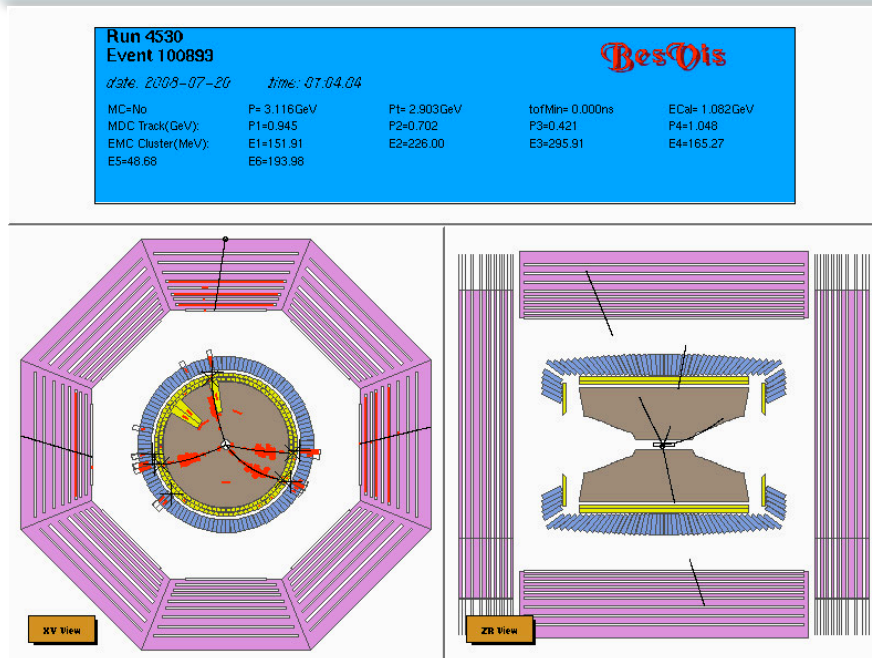
July 18, 2008: First e^+e^- collision event in BESIII

Apr. 14, 2009 $\sim 106 \text{ M } \psi(2S)$ events (42.3 pb^{-1} at 3.65 GeV)

July 28, 2009 $\sim 226 \text{ M } J/\psi$ events

June 27, 2010 $\sim 930 \text{ pb}^{-1}$ at $\psi(3770)$, with $\sim 70 \text{ pb}^{-1}$ scanning in $\psi(3770)$ energy region.

Record Luminosity
 $3.2 \times 10^{32} \text{ cm}^{-2}\text{s}^{-1}$,



First collision event

NEXT Run (fixed quad. misalignment)

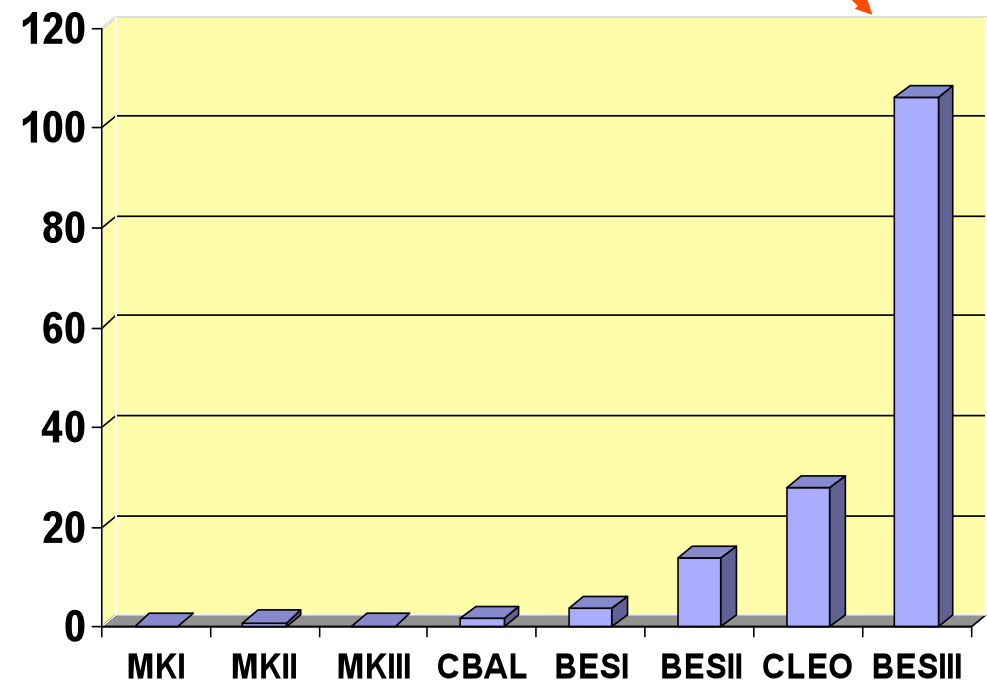
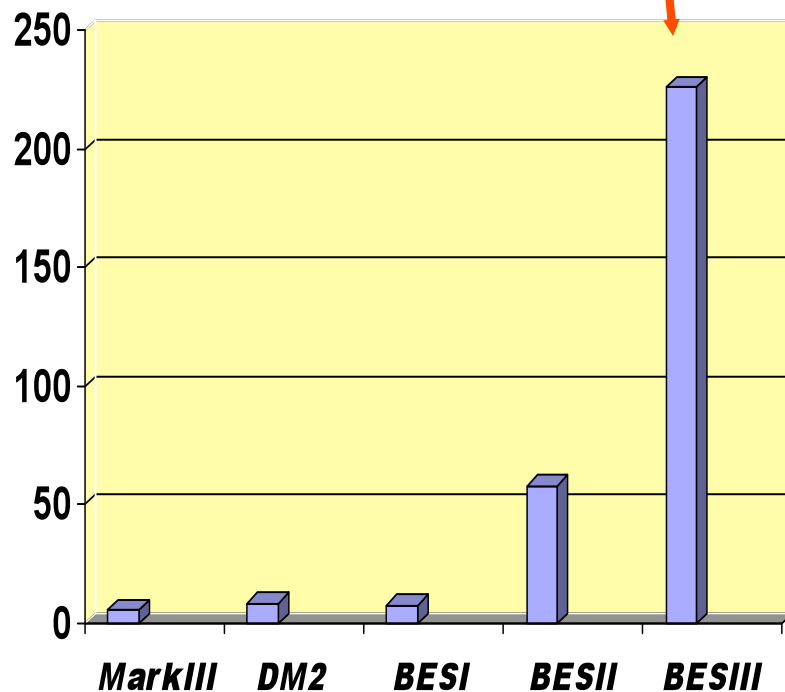
Sep 2, 2010: BEPCII startup for S.R.

Nov 1, 2010: colliding mode

Nov 15, 2010: J/ψ data taking

World Largest J/ψ and $\psi(2S)$ Samples ($\times 10^6$)

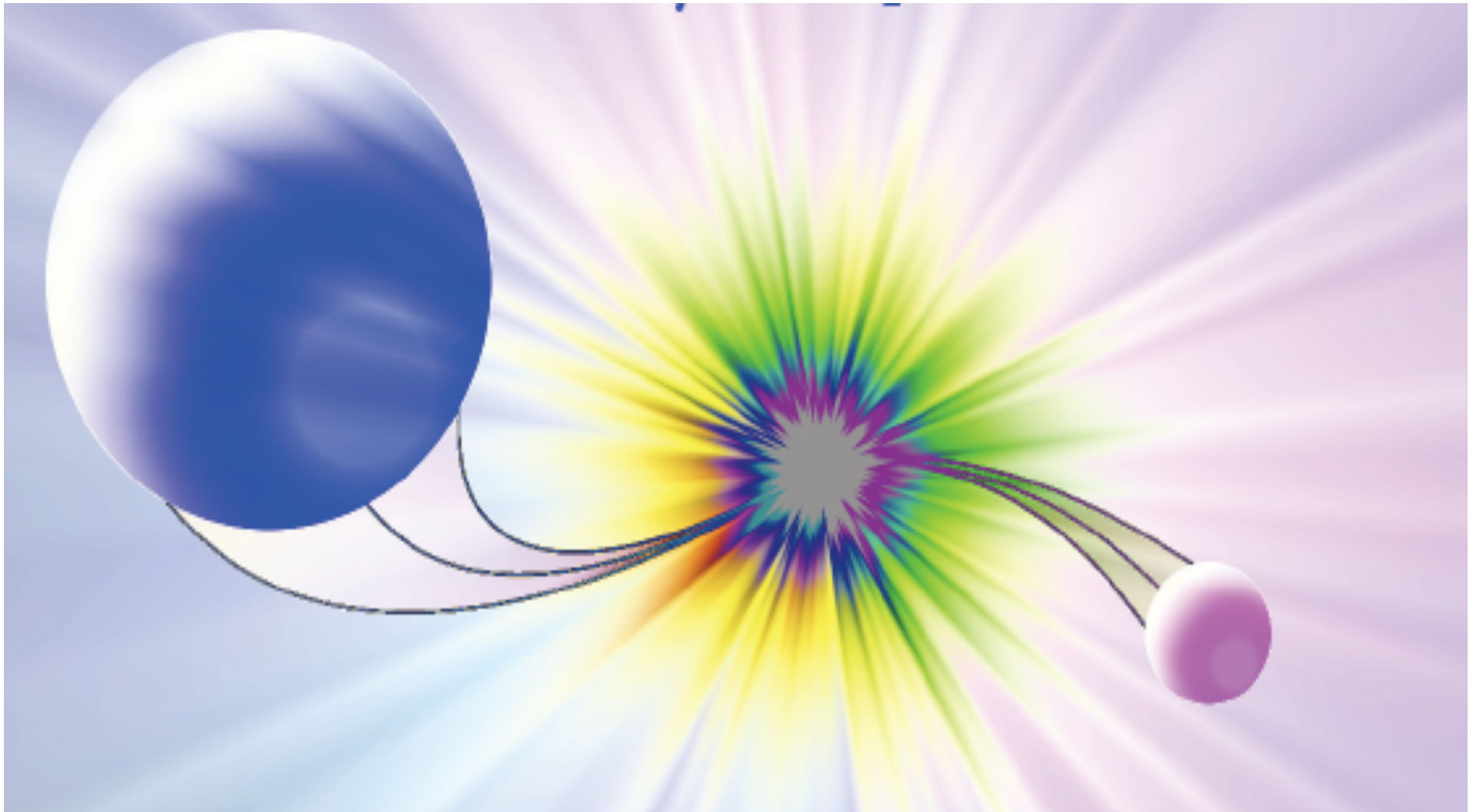
BESIII: 226M J/ψ (65pb^{-1}) 106M $\psi(2S)$ events (150pb^{-1})



BESII: J/ψ 58M $\psi(2S)$ 14M

Measurement of $J/\psi \rightarrow p\bar{p}, n\bar{n}$

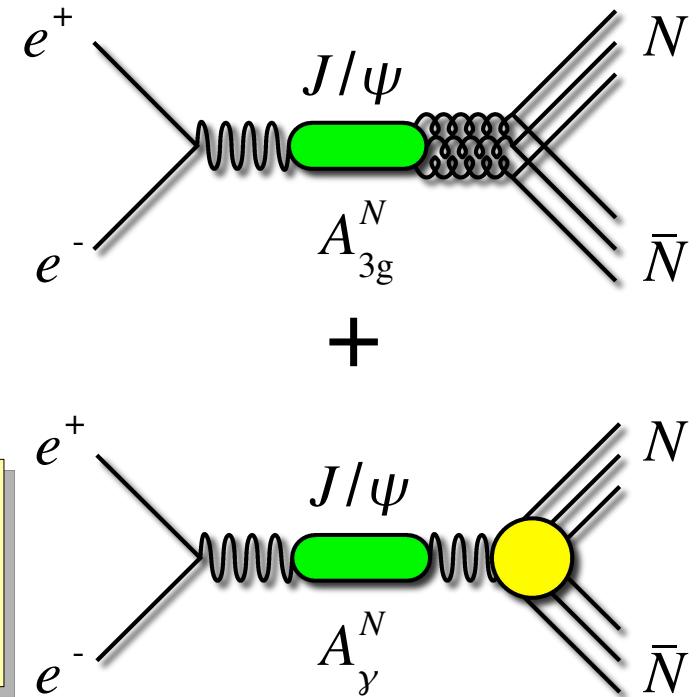
J.M. Bian and the Italian BESIII collaboration



Introduction

- $p \bar{p}$ amplitude A_{γ}^p from BABAR data
- $n \bar{n}$ amplitude A_{γ}^n from FENICE data
- $A_{\gamma}^p - A_{\gamma}^n$ relative phase from pQCD

$$B(J/\psi \rightarrow n \bar{n}) = \left| \frac{A_{3g} + A_{\gamma}^n}{A_{3g} + A_{\gamma}^p} \right|^2 B(J/\psi \rightarrow p \bar{p}) = (1.4 \pm 0.2) \times 10^{-3}$$



● **BESII at BEPC** [PLB591,42]: $BR(J/\psi \rightarrow p \bar{p}) = (2.26 \pm 0.01 \pm 0.14) \times 10^{-3}$

● **FENICE at ADONE** [PLB444,111]: $BR(J/\psi \rightarrow n \bar{n}) = (2.2 \pm 0.4) \times 10^{-3}$

$B(J/\psi \rightarrow p \bar{p}) \sim B(J/\psi \rightarrow n \bar{n}) \Rightarrow \text{large } A_{3g}^N - A_{\gamma}^N \text{ relative phase}$

Data samples for $p\bar{p}$ and $n\bar{n}$

Based on boss 6.5.1 at BESIII

Data samples $\sim 226\text{M } J/\psi$

Control sample of $n\bar{n}$: $J/\psi \rightarrow p\pi^- (\bar{n})$ and $\bar{p} \pi^+(n)$

Inclusive MC samples for bck studies: 200 M J/ψ

MC $e^+e^- \rightarrow \gamma\gamma$ ($|\cos\theta| < 0.8$)

$J/\psi \rightarrow p\bar{p}$ Event Selection

Selection only on MDC information, not EMC

Good charged tracks

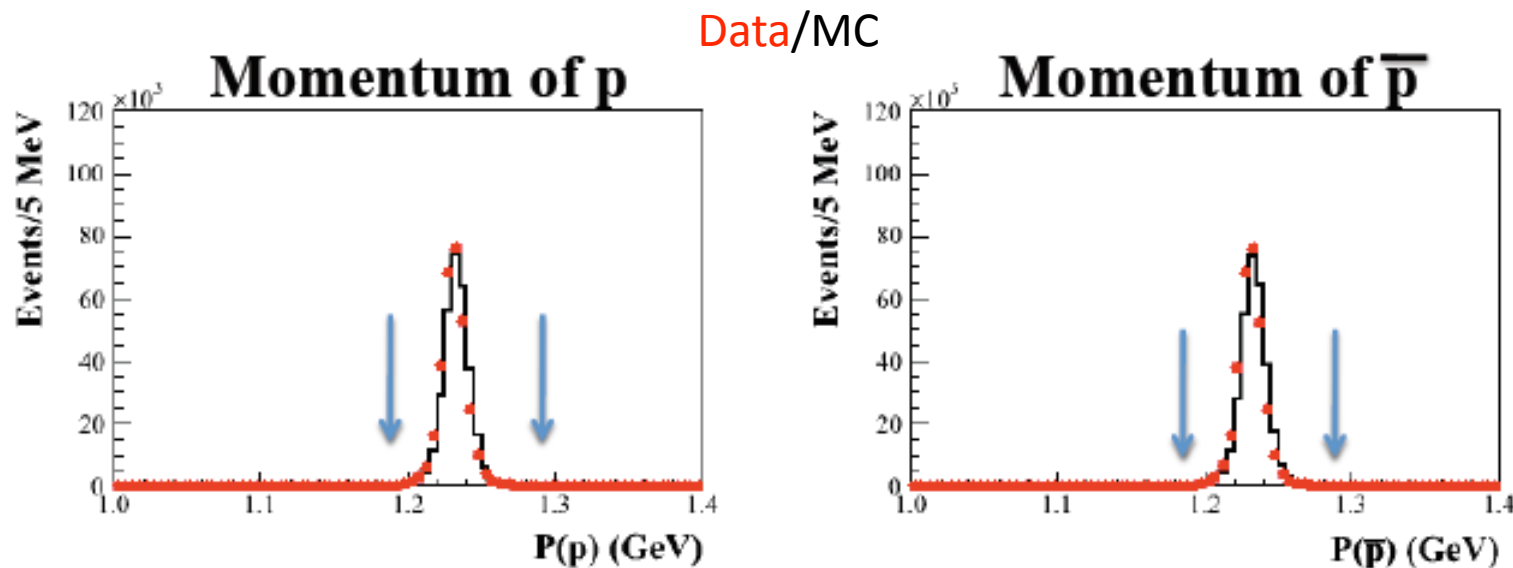
- IP region: $|R_{xy}| \leq 1\text{cm}$, $|R_z| \leq 10\text{cm}$
- Momentum: $p < 2.0\text{GeV}$
- Polar angle: $|\cos\theta| < 0.93$

Particle Identification

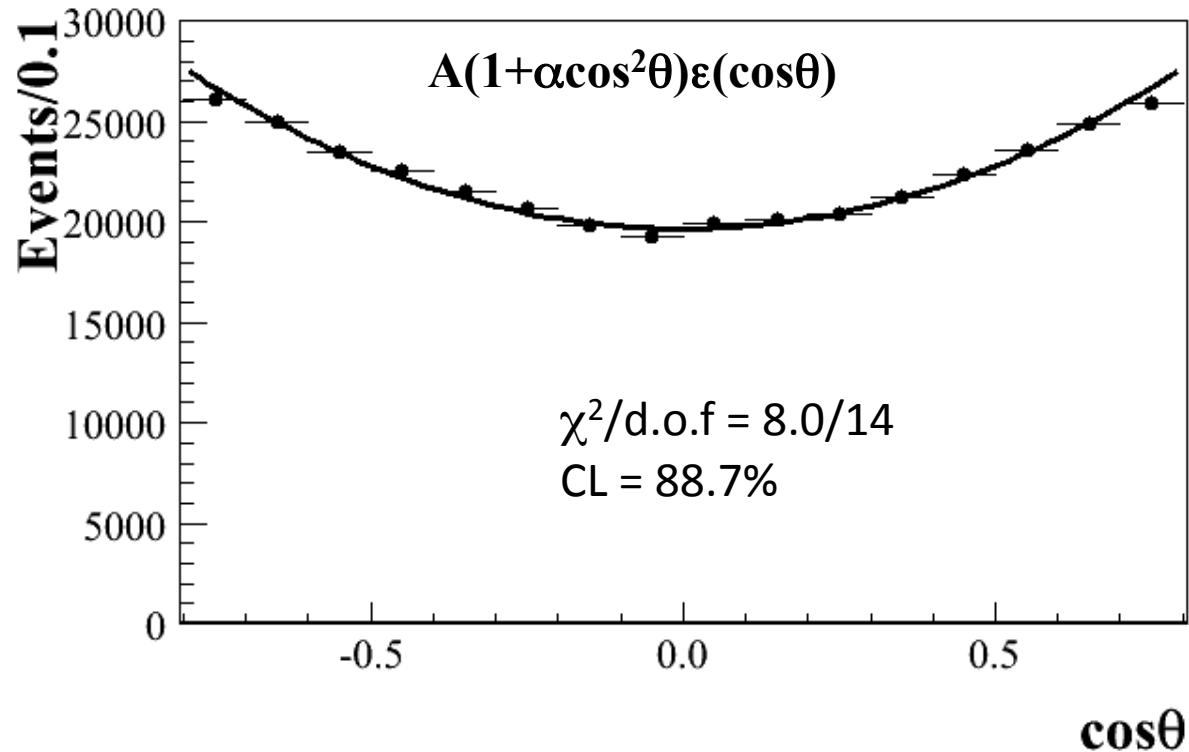
- TOF+dE/dX
- p $\text{Prob}(p) > \text{Prob}(\pi)$
- p $\text{Prob}(p) > \text{Prob}(K)$

Event level

- Two tracks opening angle $> 178^\circ$
- $|P(\bar{p}) - 1.232| < 0.05\text{GeV}$
- $|P(p) - 1.232| < 0.05\text{GeV}$
- $|\cos\theta| < 0.8$, polar angle of p



$p\bar{p}$: fit to the angular distribution



$$\text{Br}(J/\psi \rightarrow p\bar{p}) = (2.179 \pm 0.004 \pm 0.042) \times 10^{-3}$$

$$\alpha = 0.628 \pm 0.013 \pm 0.032$$

$$\text{PDG: Br}(J/\psi \rightarrow p\bar{p}) = (2.17 \pm 0.07) \times 10^{-3}$$

$$\text{BESII: } \alpha = 0.676 \pm 0.036 \pm 0.042$$

Event selection for $J/\psi \rightarrow n\bar{n}$

No good charged tracks

Good Shower in ECAL

• **No TOF** information at the moment

$\bar{n}$ identification

- Most energetic shower
- $E > 0.6 \text{ GeV}$, $E < 2.0 \text{ GeV}$
- $\text{SecondMoment} > 20$
- Total hits nearby 50° the most energetic shower > 40

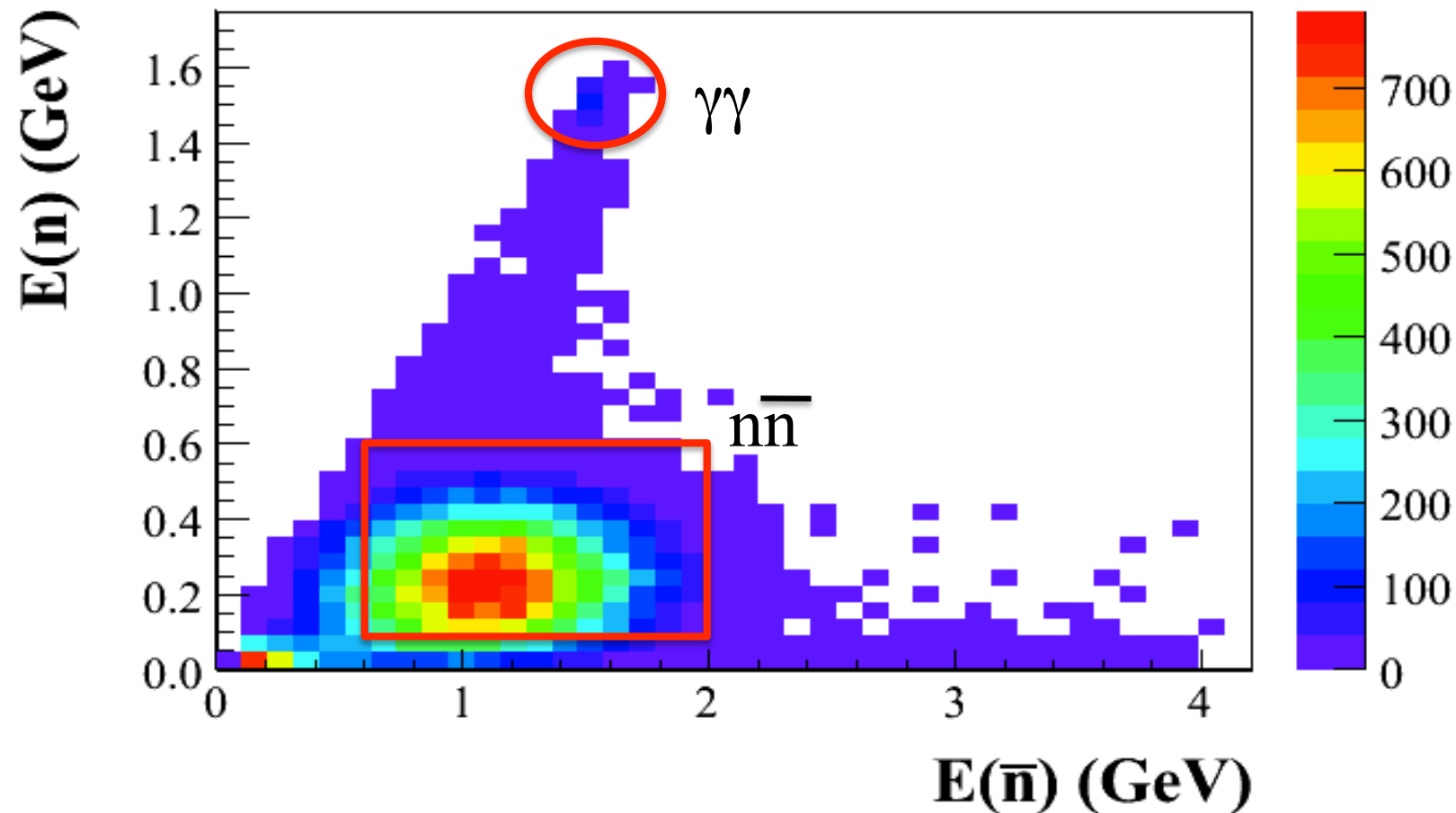
n identification

- $0.6 \text{ GeV} > E > 0.06 \text{ GeV}$

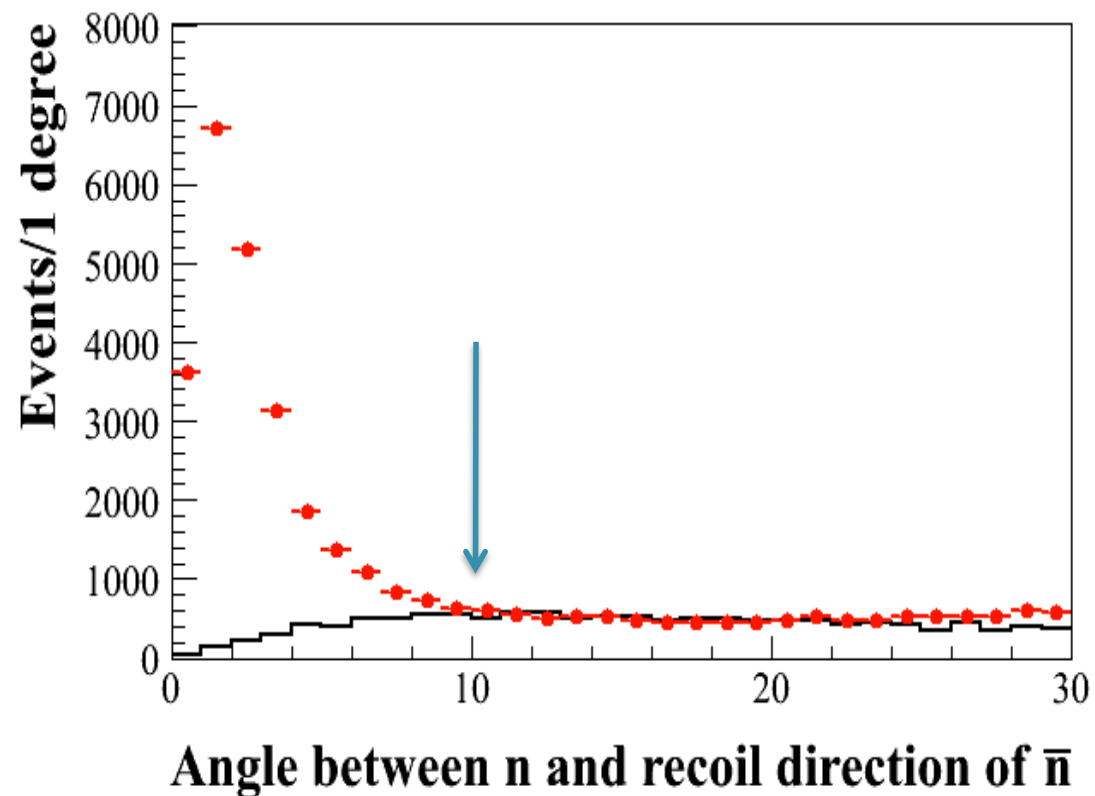
Event level

- The most energetic shower which pass $n\bar{n}$ ID criteria is taken as the $n\bar{n}$ candidate
- The shower which is most near the recoil direction of $n\bar{n}$ and passes n ID criteria is taken as n
- no **total deposit energy outside** a 50° cone around the $n\bar{n}$ candidate direction and n direction
- $|\cos\theta| < 0.8$ (the polar angle of the $n\bar{n}$ candidate)
- The signal will be an enhancement nearby zero in the distribution of the the angle between n and recoil direction of $n\bar{n}$.

Deposit energy of n vs $\bar{n}$ candidate in the data



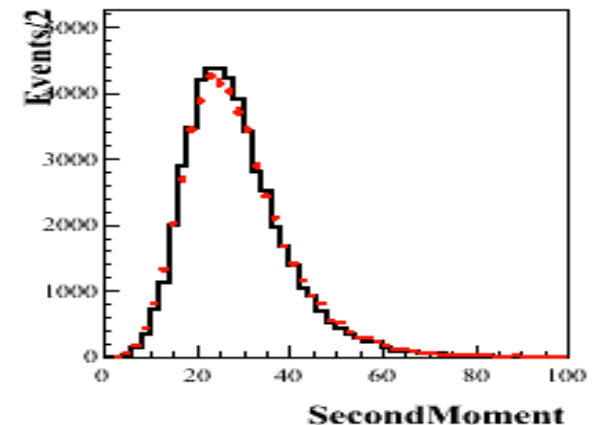
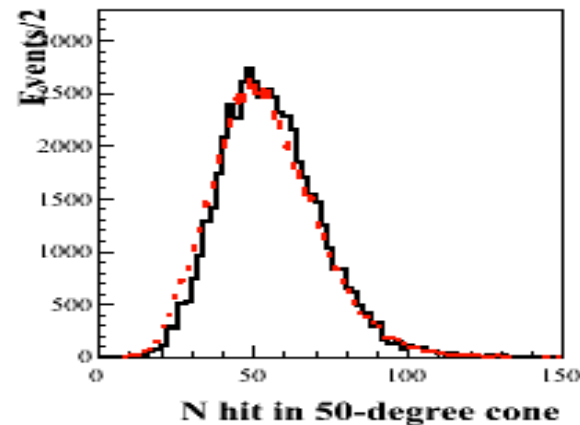
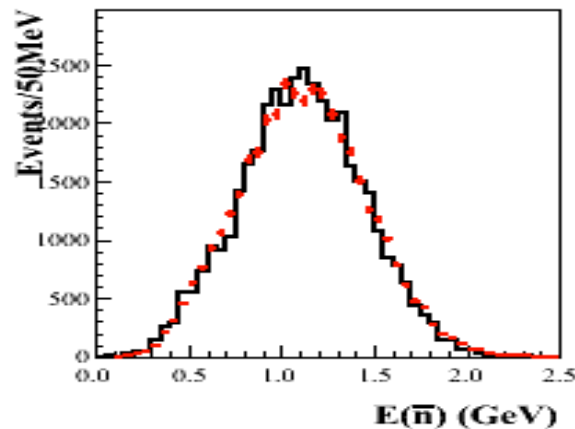
Use bkg shape of Monte Carlo $J/\psi \rightarrow \pi^0 n \bar{n}$
to estimate number of bkg events in signal region



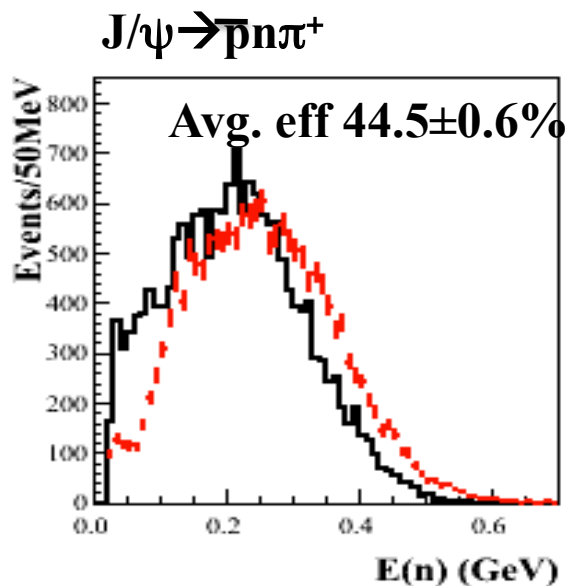
Bkg shape MC: $J/\psi \rightarrow \pi^0 n \bar{n}$
Sideband: $10 \sim 20^\circ$
Signal region: $< 10^\circ$

Comparisons of $\bar{n}$ samples in $J/\psi \rightarrow n\bar{n}$ (red cross) and $J/\psi \rightarrow p\bar{n}\pi^-$ (hist) (missing momentum selected close to $\bar{n}$)

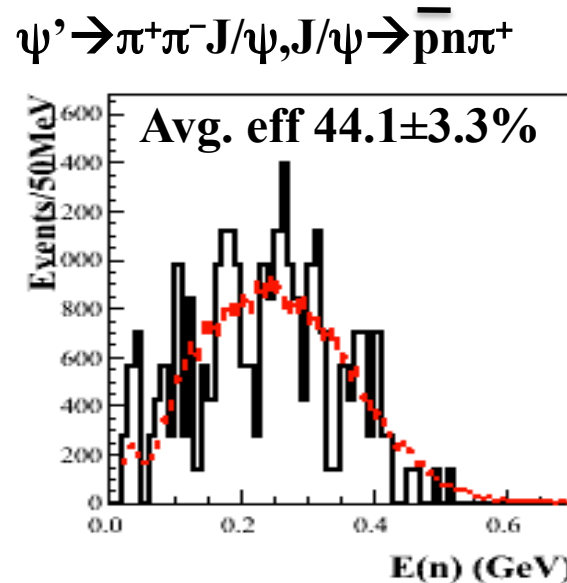
$J/\psi \rightarrow p\bar{n}\pi^-$ is used to calibrate
efficiency of $\bar{n}$ selection



Comparisons of n samples in $J/\psi \rightarrow n\pi$ (red cross) , $J/\psi \rightarrow \bar{p}n\pi^+$ and $\psi' \rightarrow \pi^+\pi^- J/\psi, J/\psi \rightarrow \bar{p}n\pi^+$



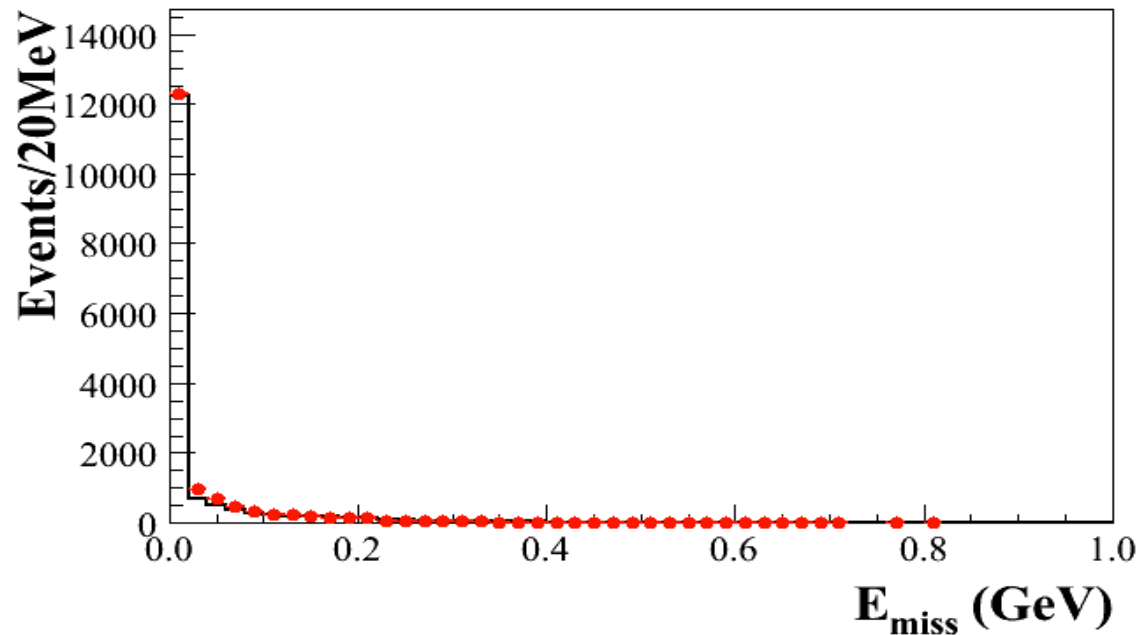
Momentum of n (1.1-1.2)GeV



Momentum of n (1.2-1.3)GeV

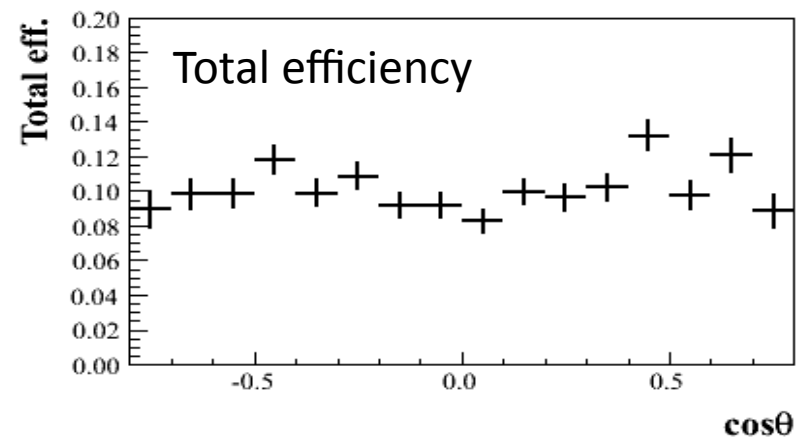
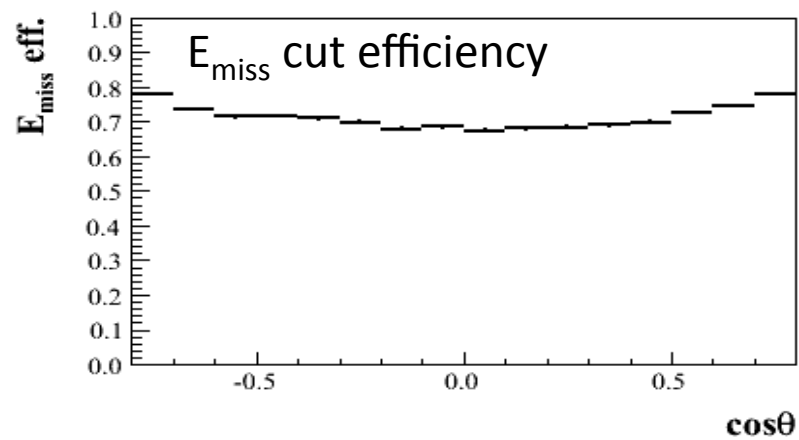
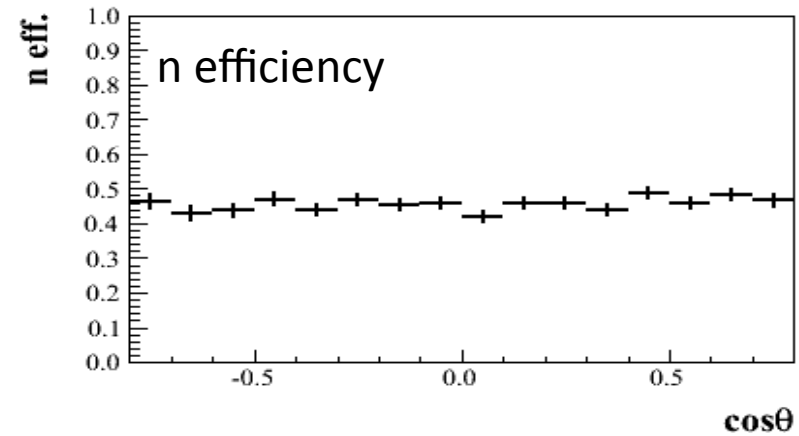
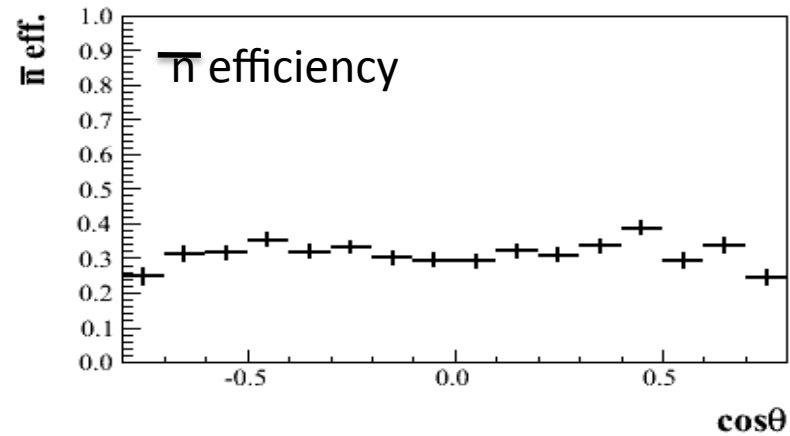
$J/\psi \rightarrow \bar{p}n\pi^+$ is used to calibrate efficiency of n selection,
 $\psi' \rightarrow \pi^+\pi^- J/\psi, J/\psi \rightarrow \bar{p}n\pi^+$ is used to estimate systematic error.

E_{miss} in $J/\psi \rightarrow n\bar{n}$ and $J/\psi \rightarrow p\bar{p}$

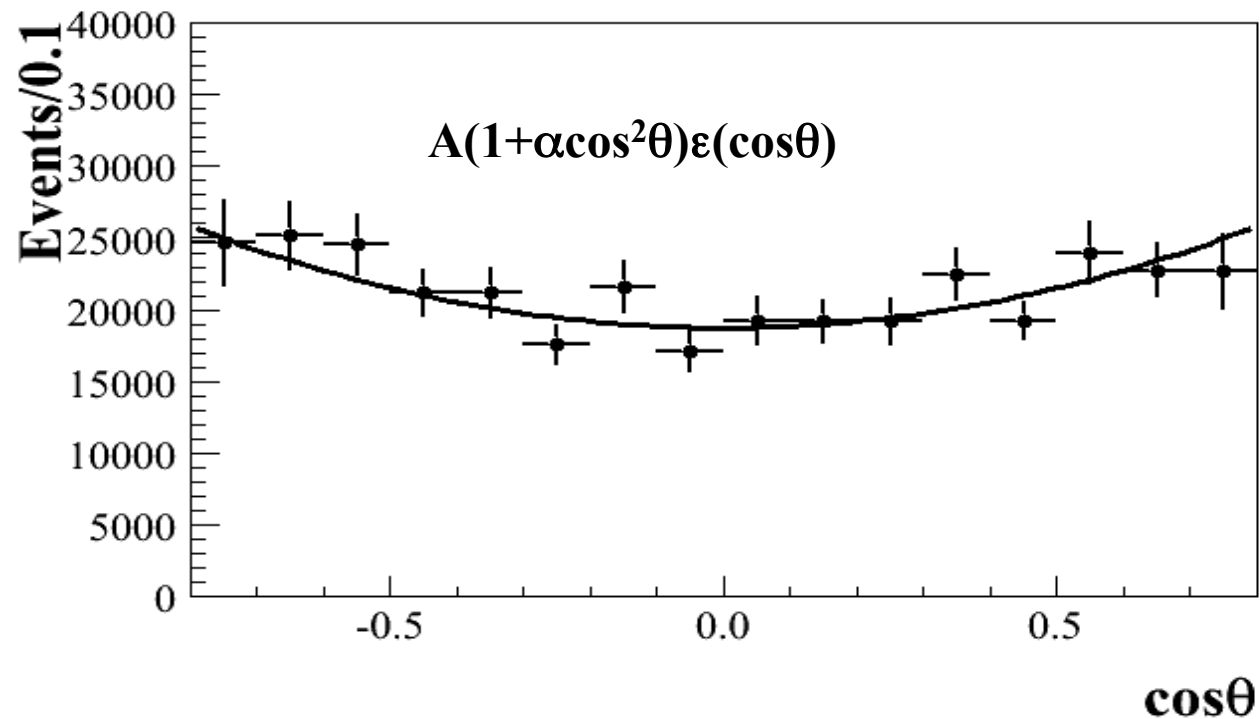


The $J/\psi \rightarrow p\bar{p}$ sample is selected by means of MDC information only.
It is used to calibrate the efficiency of E_{miss} cut.
Showers in EMC in $J/\psi \rightarrow p\bar{p}$ sample: same method as $J/\psi \rightarrow n\bar{n}$.

$n, \bar{n}$ Efficiency corrections



Corrected number of events vs. polar angle and the fitting



$$N_{EV} = 50000$$

$$Br(J/\psi \rightarrow n\bar{n}) = (2.01 \pm 0.05 \pm 0.09) \times 10^{-3}$$

$$\alpha = 0.59 \pm 0.16 \pm 0.10$$

Preliminary Results

$$\text{Br}(J/\psi \rightarrow p\bar{p}) = (2.179 \pm 0.004 \pm 0.042) \times 10^{-3}$$

$$\alpha = 0.628 \pm 0.013 \pm 0.032$$

$$\text{PDG: Br}(J/\psi \rightarrow p\bar{p}) = (2.17 \pm 0.07) \times 10^{-3}$$

$$\text{BESII: } \alpha = 0.676 \pm 0.036 \pm 0.042$$

$$\text{Br}(J/\psi \rightarrow n\bar{n}) = (2.01 \pm 0.05 \pm 0.09) \times 10^{-3}$$

$$\alpha = 0.59 \pm 0.16 \pm 0.10$$

$$\text{PDG: Br}(J/\psi \rightarrow n\bar{n}) = (2.2 \pm 0.4) \times 10^{-3}$$

Our $\text{Br}(J/\psi \rightarrow n\bar{n})$ is much larger than $\sim 1.4 \times 10^{-3}$ (PQCD expectation, i.e. 0 phase angle)
The consistency between $\text{Br}(J/\psi \rightarrow p\bar{p})$ and $\text{Br}(J/\psi \rightarrow n\bar{n})$
suggests a large phase ($\sim 90^\circ$) between strong and em amplitudes.

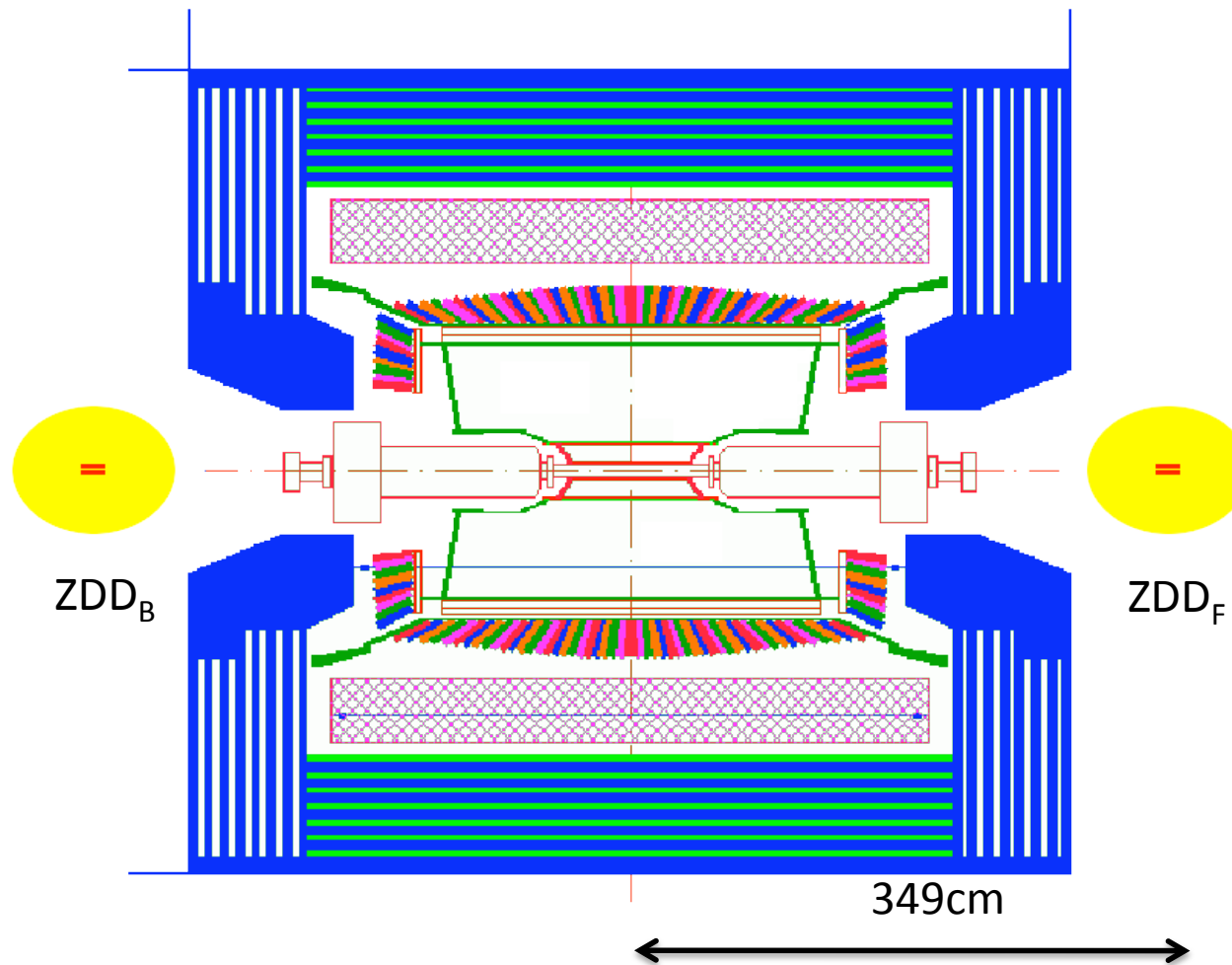
Italian proposal to measure the phase through a J/ψ and ψ' energy scan to search for interference pattern; proposal approved by BESIII collaboration.

Status of ZDD (Zero Degree Detector)



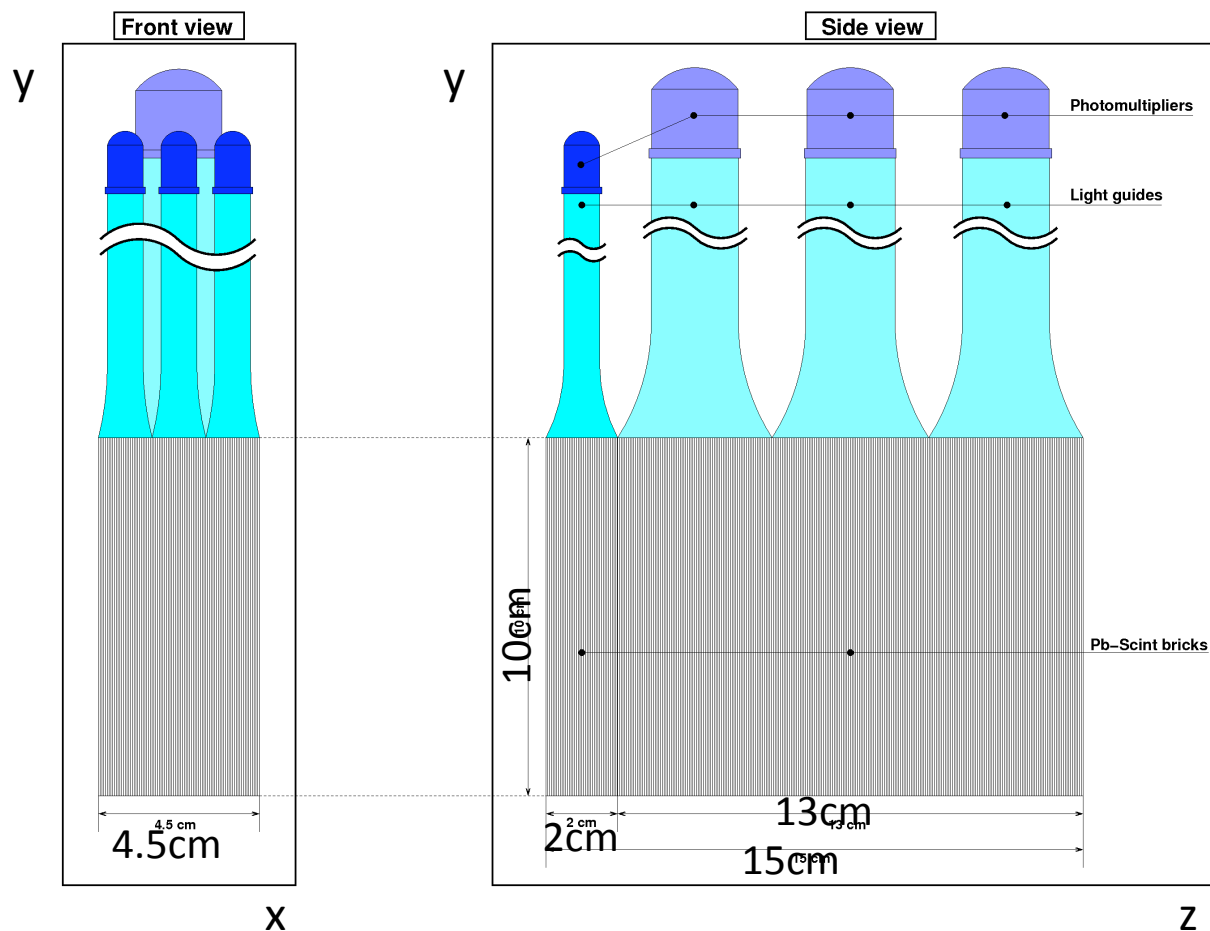
- design sketches
- survey pictures
- cosmic ray test
- preliminary results

ZDD (Zero Degree Detector) @ BESIII



Shenyang BESIII summer meeting: accettata proposta ZDD a` la KLOE: per il run 2011/2012 una sola stazione per mantenere nell'altro lato un lumi-monitor  $e^+e^- \gamma$  per la misura della luminosita` bunch-to-bunch

ZDD: a sketch



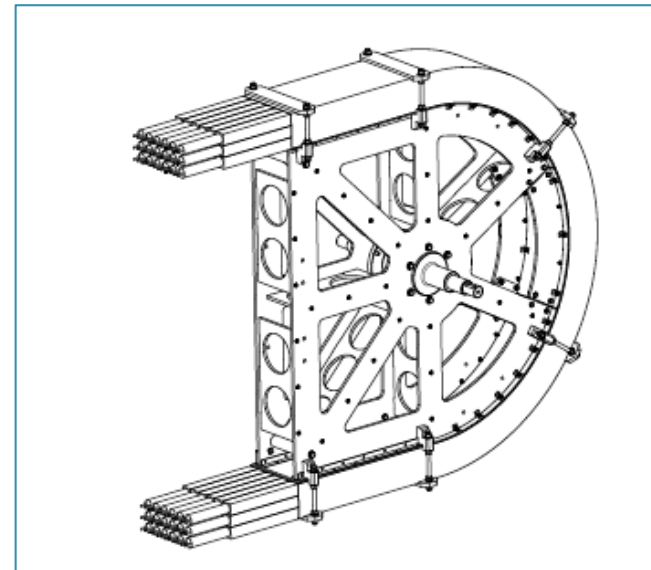
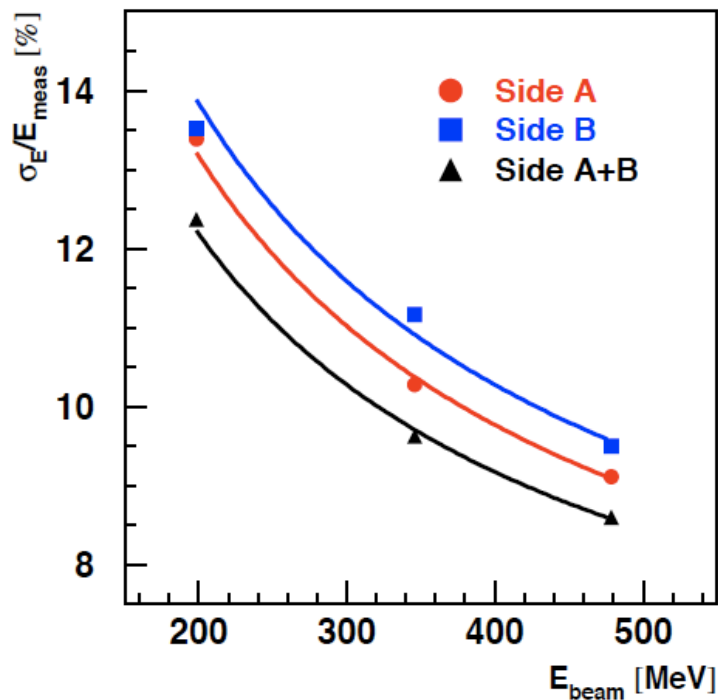
- Soluzione **Pb-Sci** a' la Kloe, da prototipo di P326/Na62 @ LNF
- lettura con **PM+guide di luce a fibre in chiaro**, per meglio segmentare parte iniziale sciame
- movimentazione verticale per allontanare i due moduli dal fascio durante l'iniezione dei fasci

Prototipo P326

F. Ambrosino, et al., in: 2007 IEEE Nuclear Science Symposium Conf. Record, Honolulu, 2007, pp. N05-6, arXiv:0711.3398

- Prototipo Pb/scifi a` la Kloe di P326/NA62,
- offerto per il taglio in sostituzione del modulo zero di Kloe, piu` recente (2006) e meglio conservato
- 1-mm diametro fibre,
- 42(Pb)/48(scifi)/10(colla)
- dimensioni: 350x12.6x25cm³
- peso:590Kg

grazie !



$$\frac{\sigma_E}{E} = \frac{5.1\%}{\sqrt{E(\text{GeV})}} \oplus 4.4\%$$

Fig. 6. Energy resolution for the fiber prototype at $E_{\text{beam}} = 203, 350$, and 483 MeV.

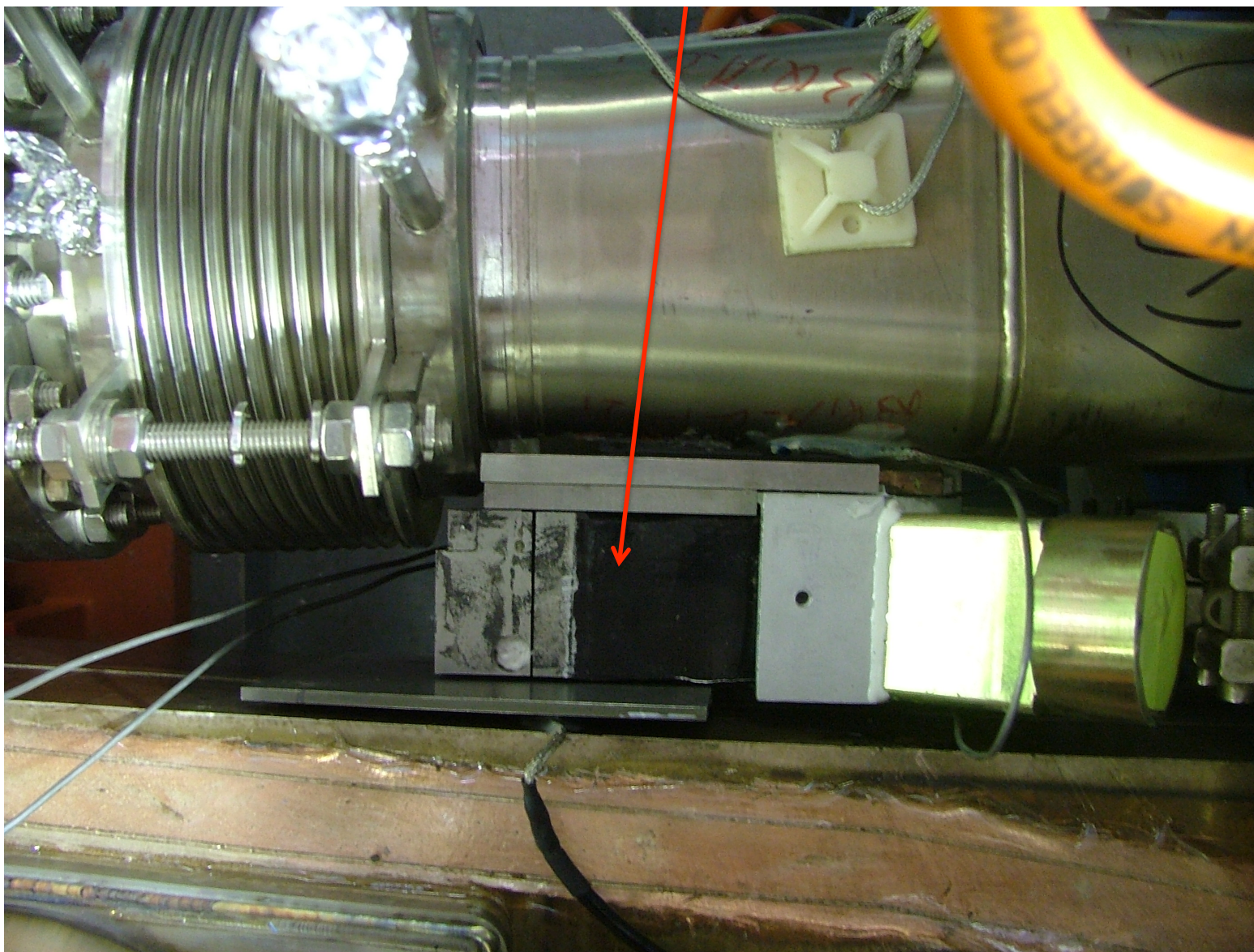
From P326 to ZDD

- **Fine luglio:** taglio prototipo P326 alla ditta ACM di Acilia: ricavati (tagliati e fresati) da una 'sezione diritta' 5 blocchetti (10x13 x 4.5) cm³; 4 blocchetti (10x13x2) cm³
- **Primi di agosto:** tutti i blocchi a LNF,
- **Primi settembre:** 1 blocco utilizzato per test, rifinito e avvolto in scotch alluminato per test raggi cosmici
- **17 settembre:** inizio test raggi cosmici prototipo

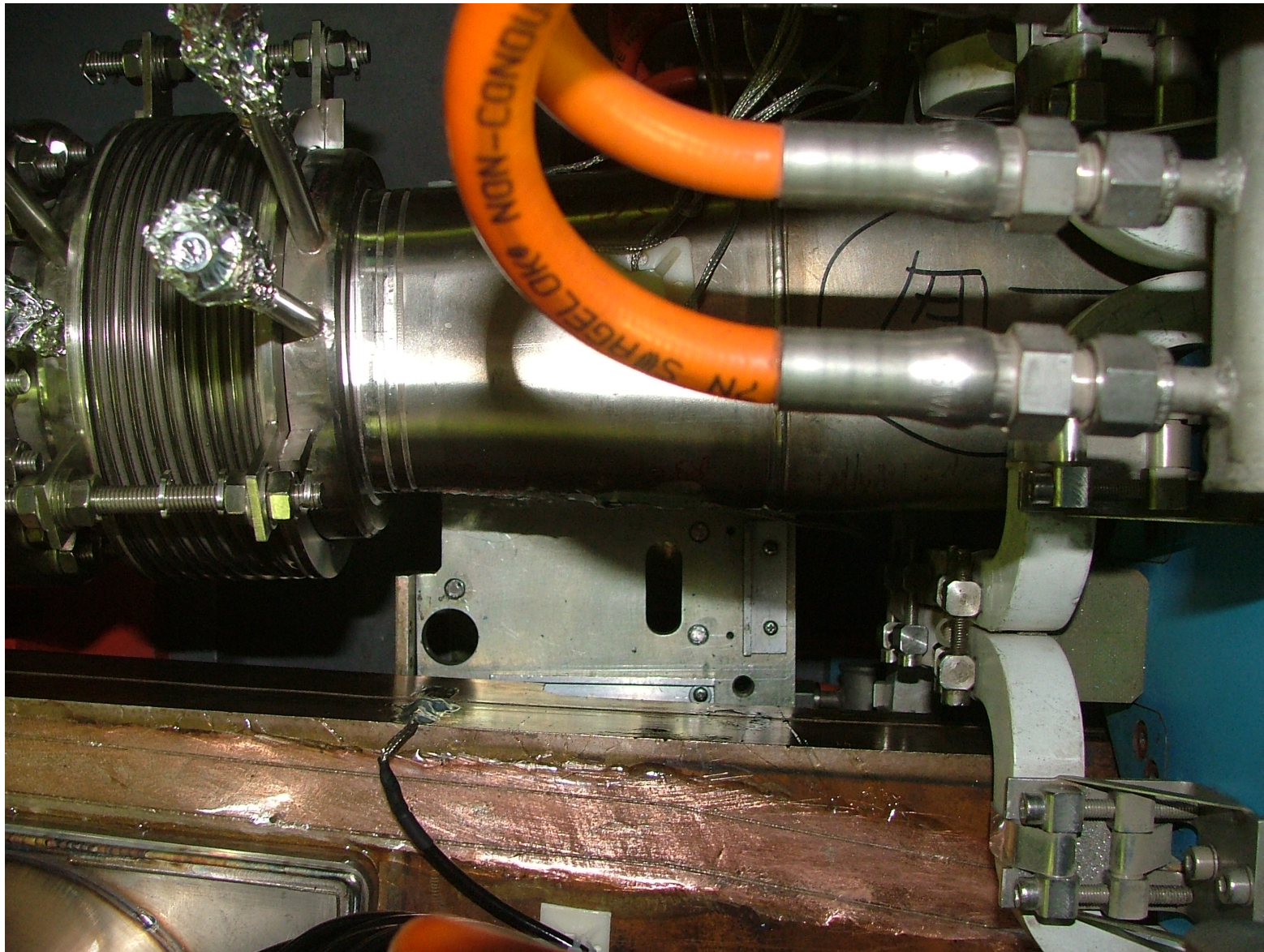
Il calorimetro funziona !

In agosto effettuato survey in zona a IHEP, prese misure spazi, ingombri beam pipe e cavi

BESIII Lumi detector



BESIII Lumi detector

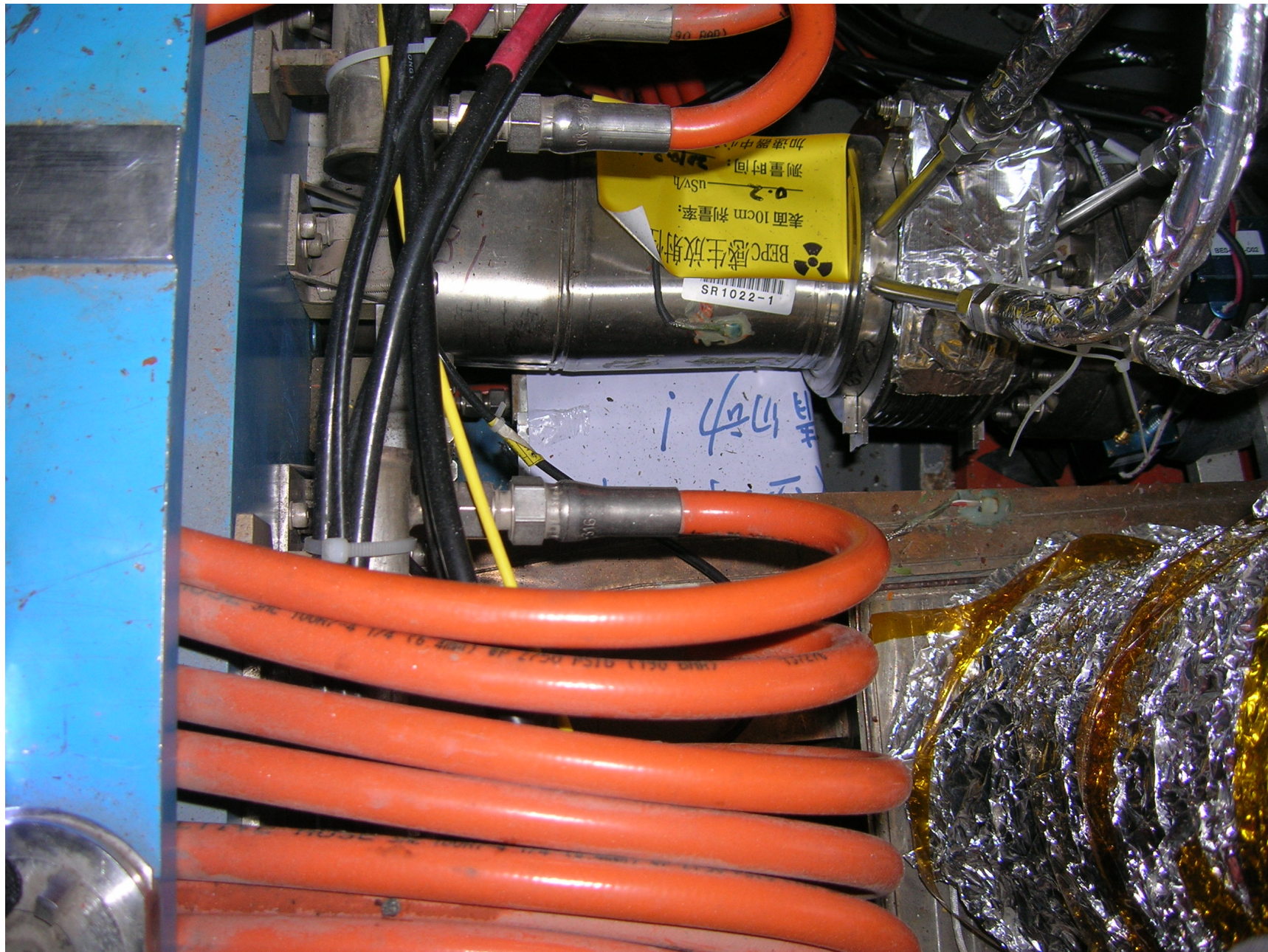


August survey of the region, no Lumi detector, side view

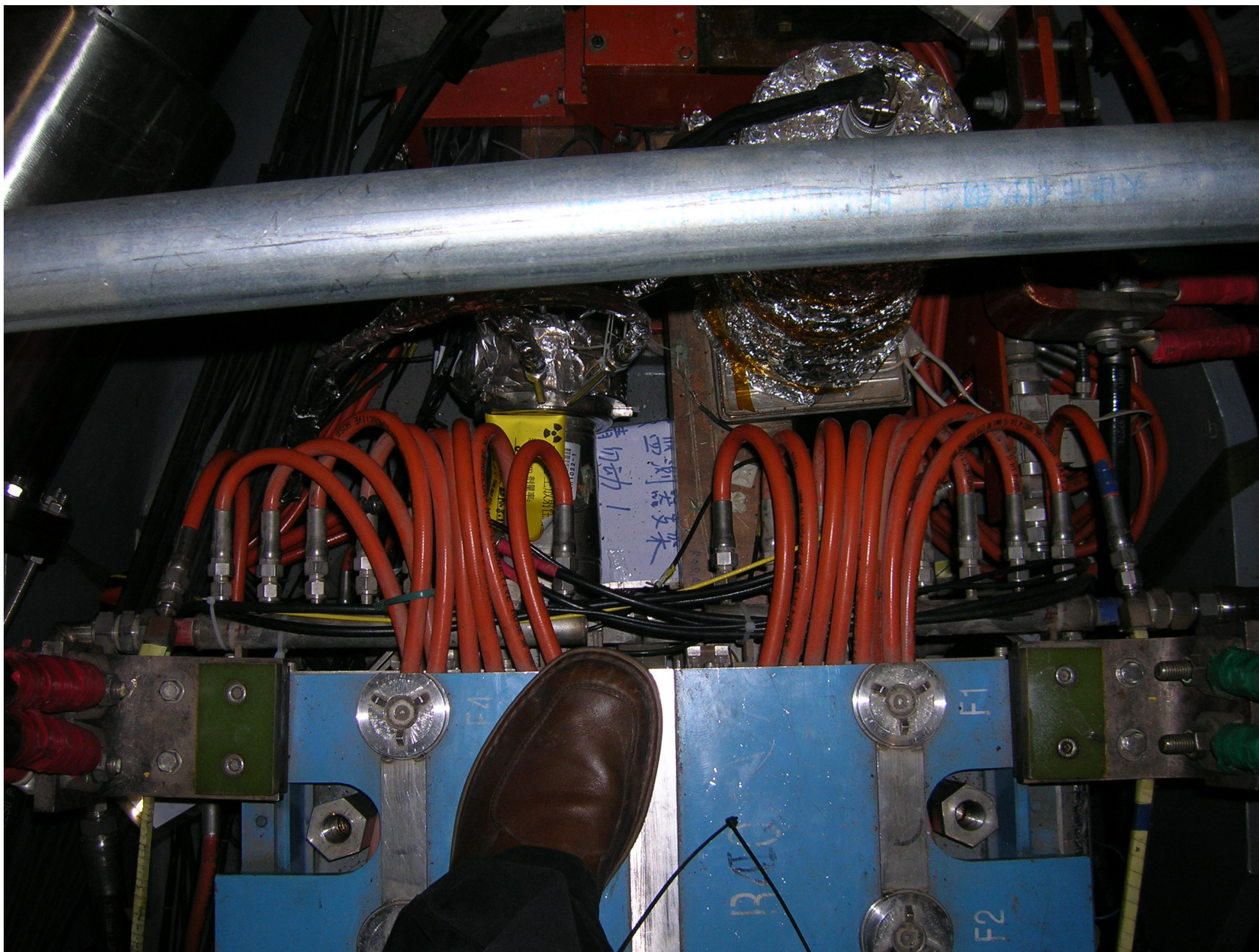


Present luminometer
pedestal (185 mm)

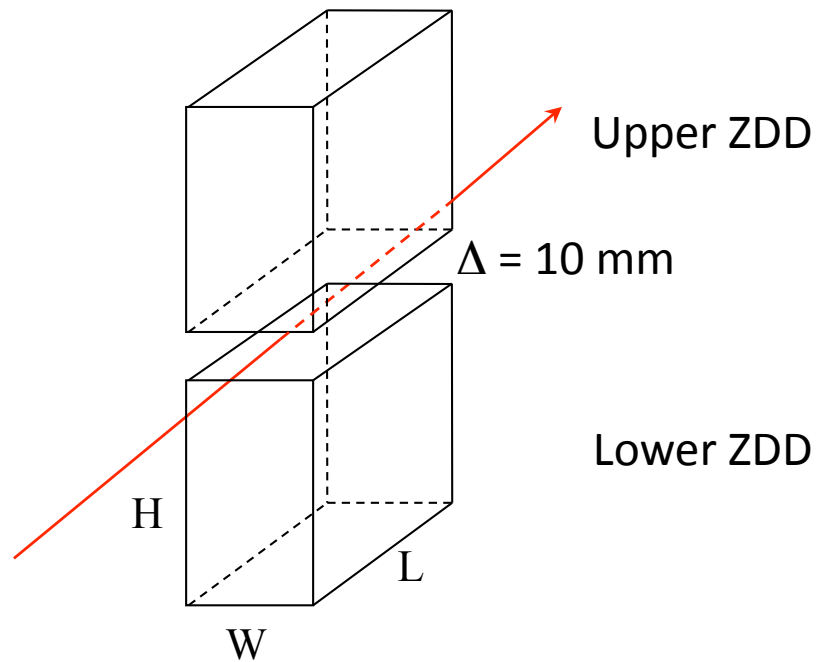
August survey of the region, no Lumi detector, top view



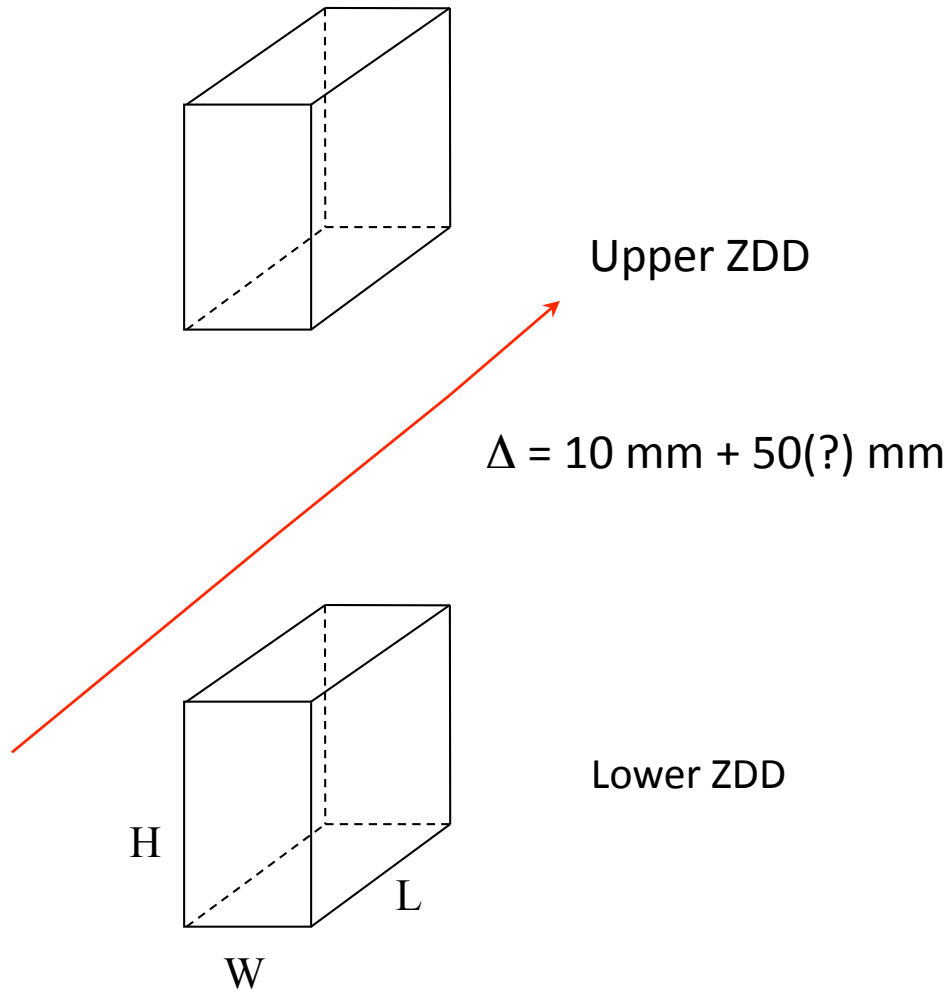
August survey of the region, no Lumi detector, top view



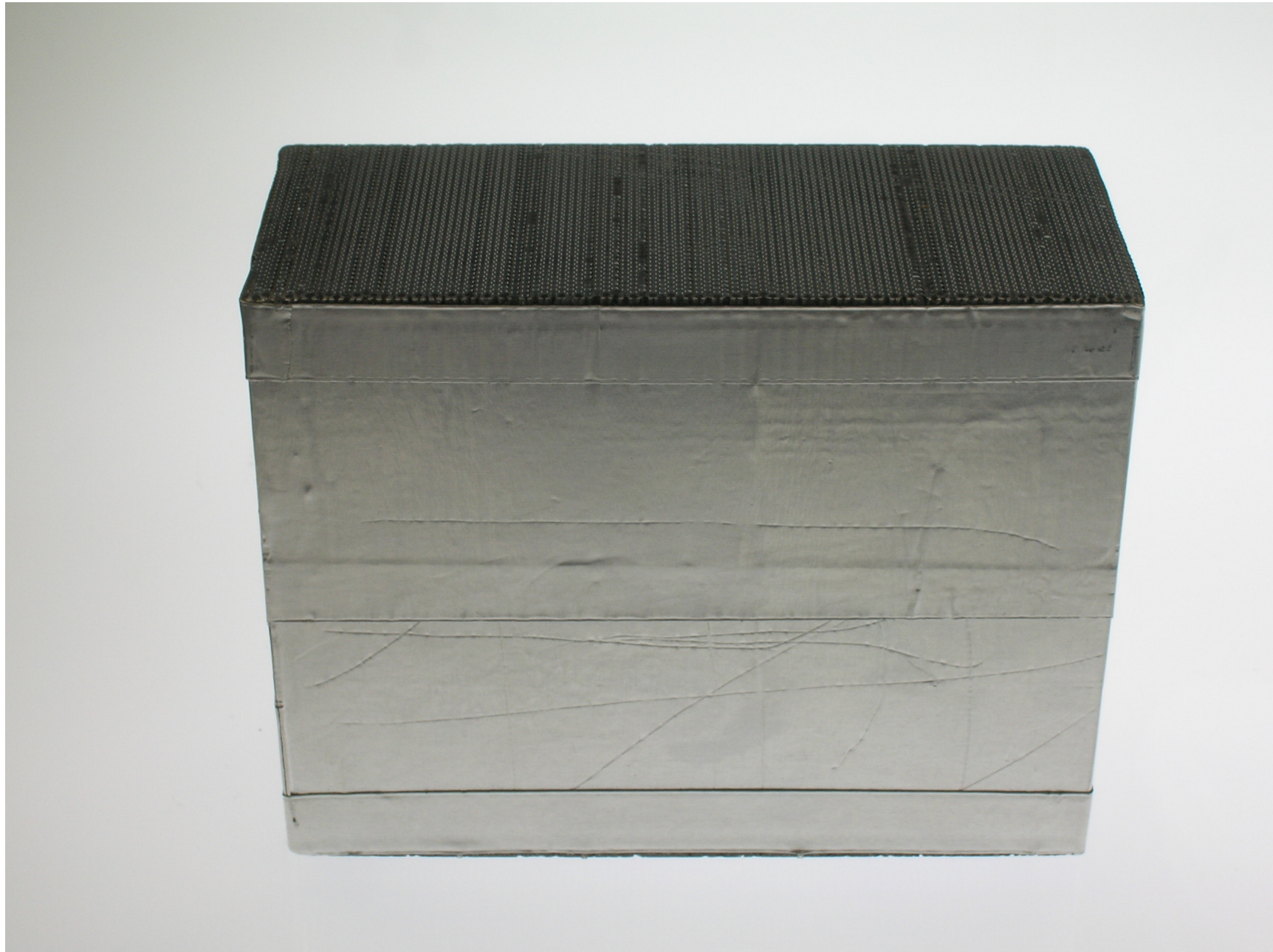
ZDD Closed position (data taking)



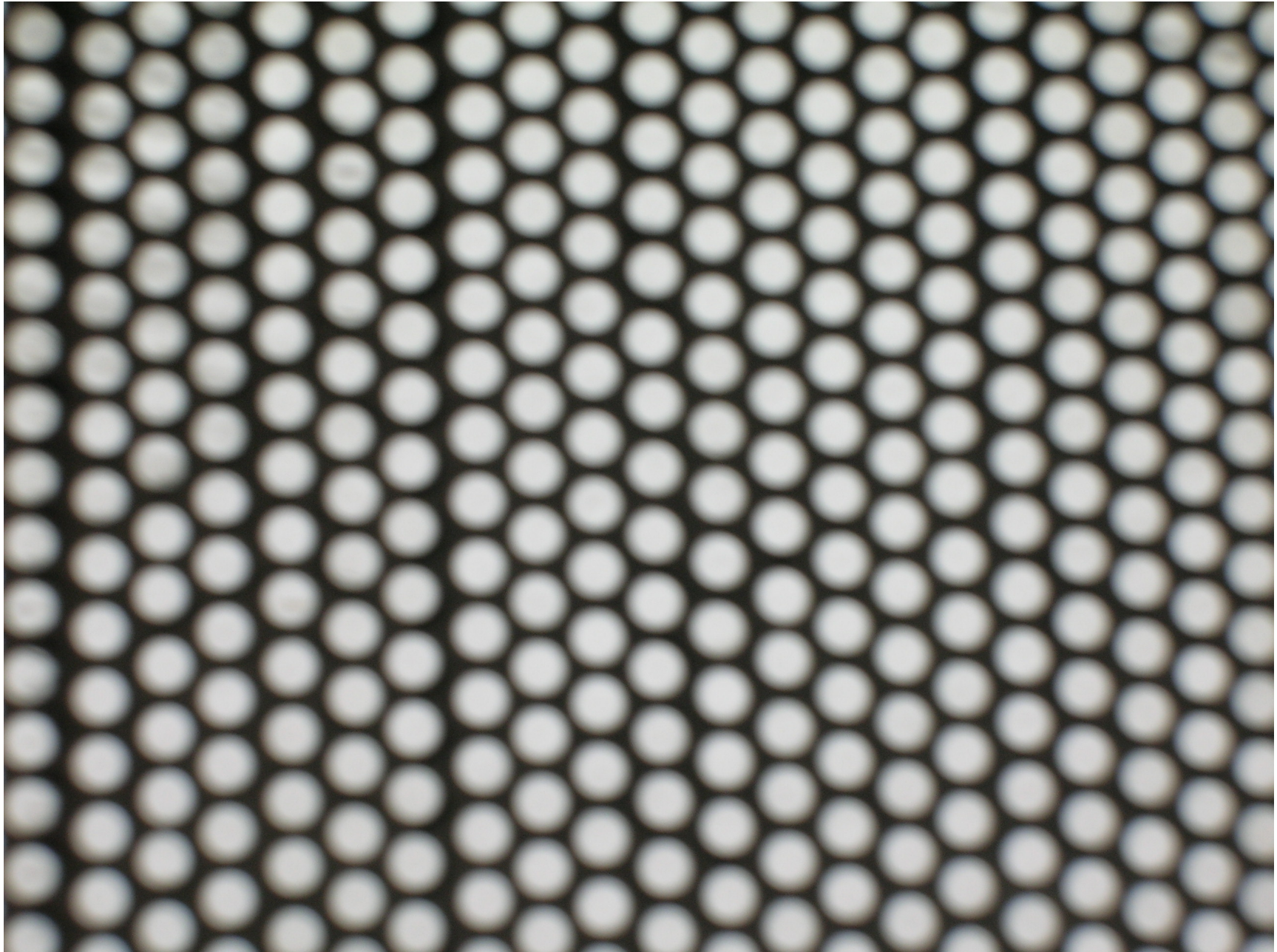
ZDD Open position (injection)



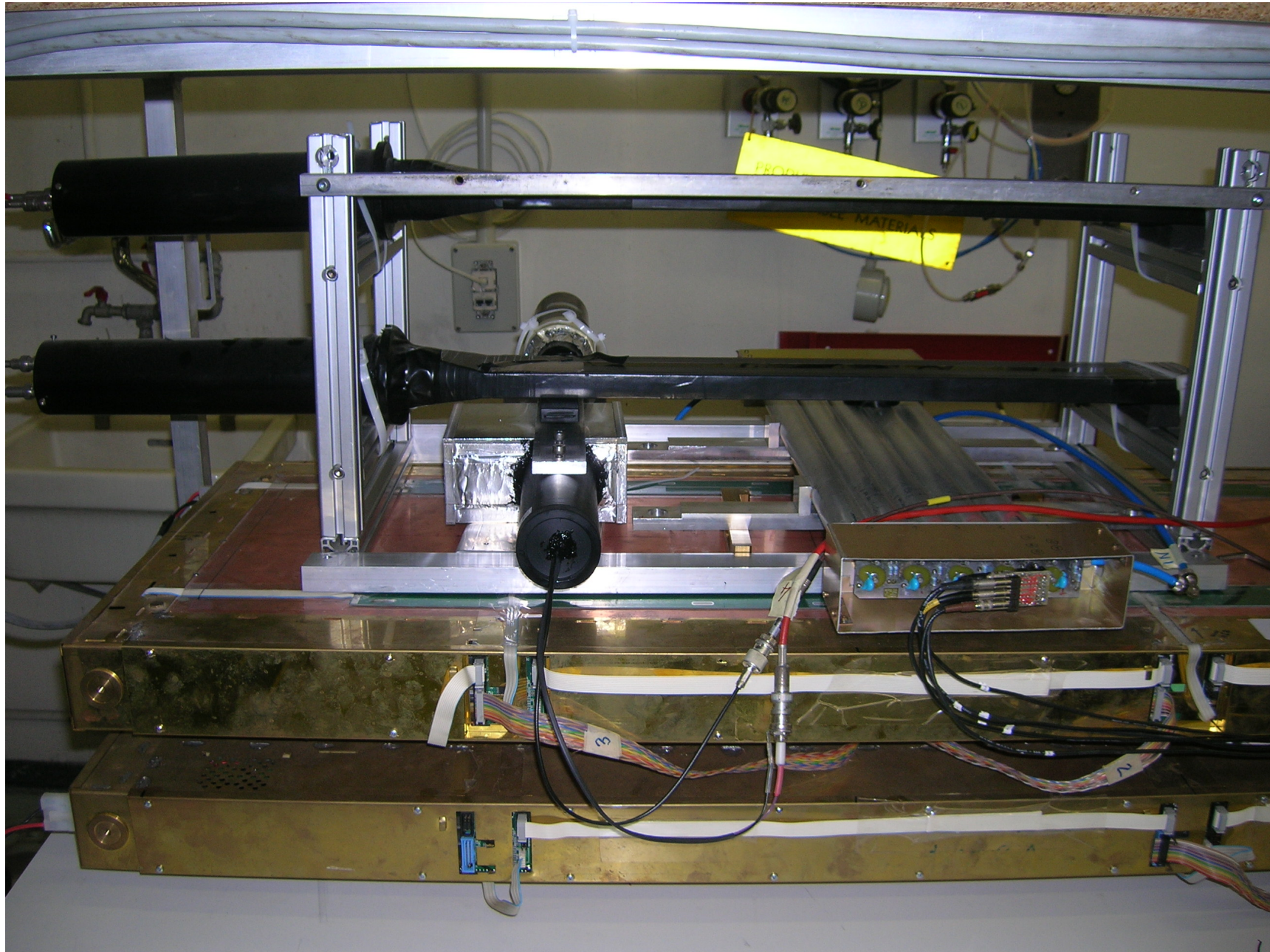
**Primo prototipo ricavato da P326,
9 settembre 2010**



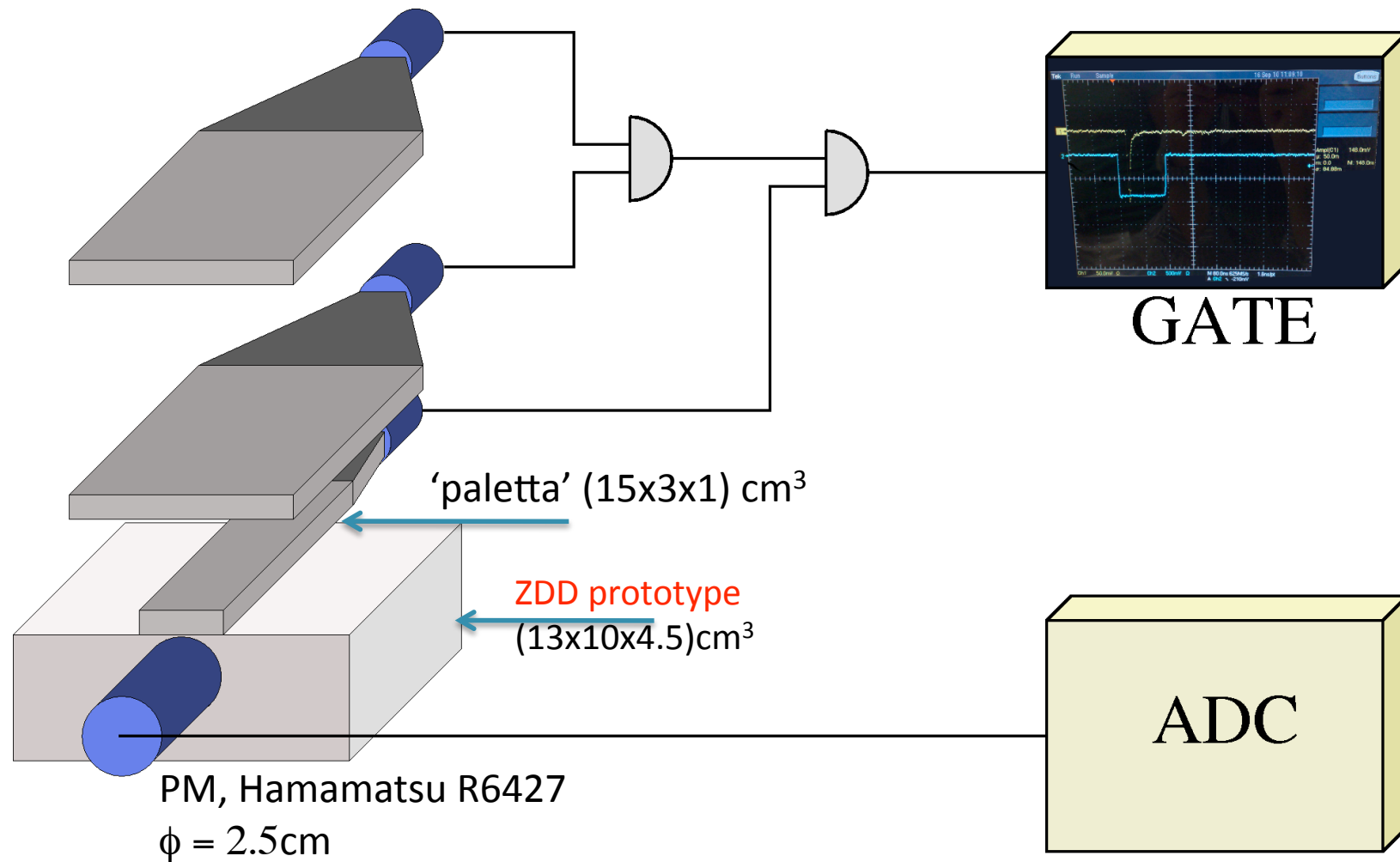
**Primo prototipo ZDD ricavato da P326,
9 settembre 2010**



Primo prototipo ZDD: in test raggi cosmici
17 settembre 2010

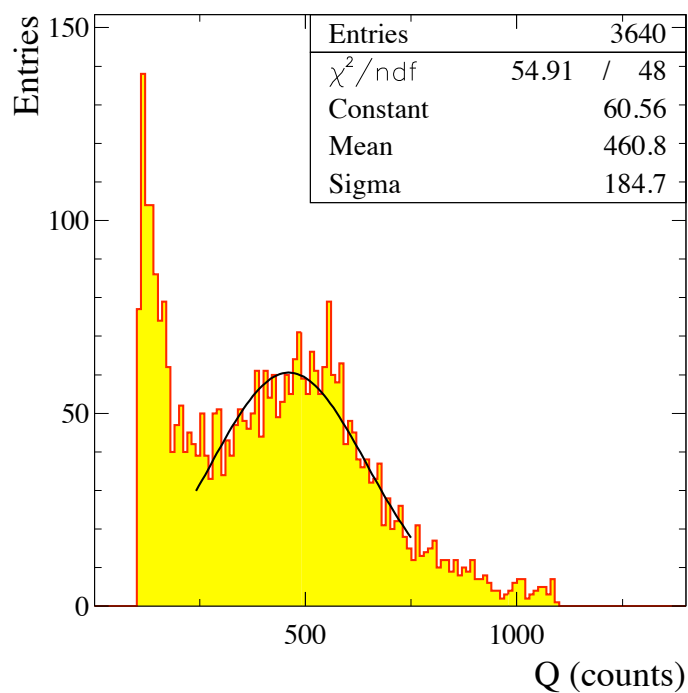


Cosmic ray setup @ LNF

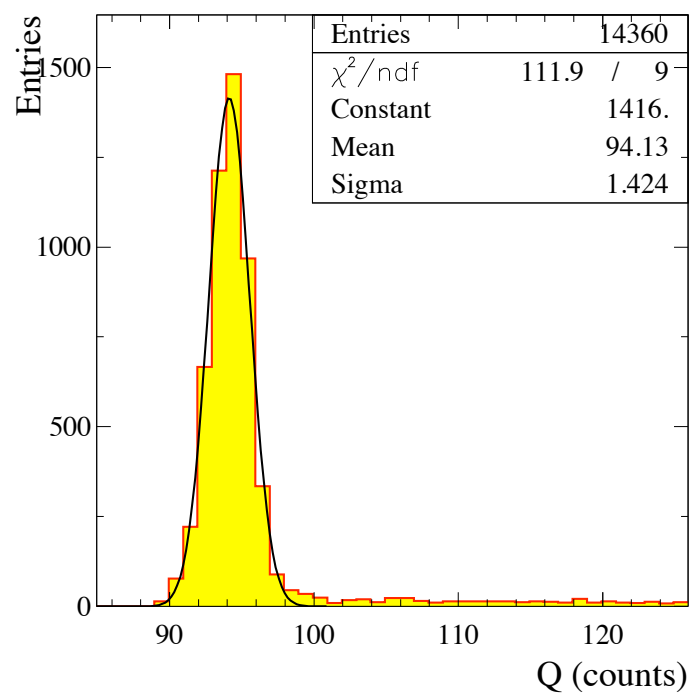


Cosmic ray test: preliminary results

ADC Counts

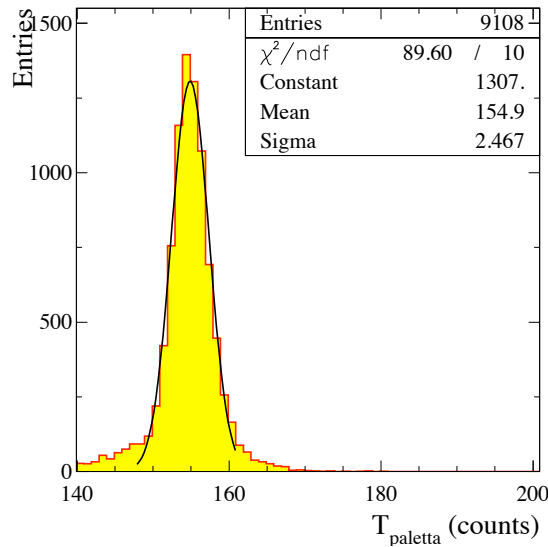


ADC pedestal

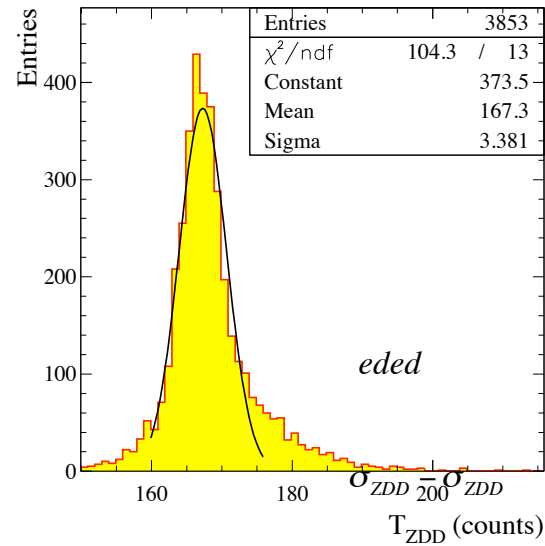


Cosmic ray test: preliminary results

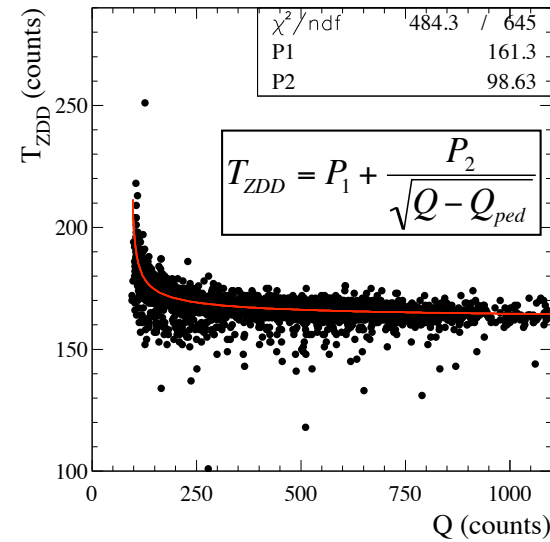
'Paletta': TDC Counts



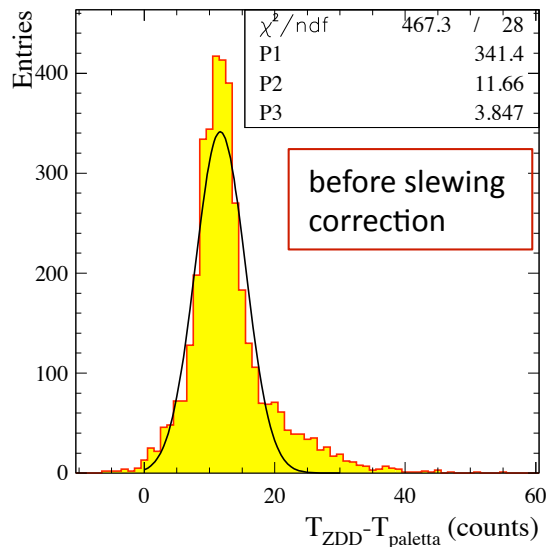
ZDD: TDC Counts



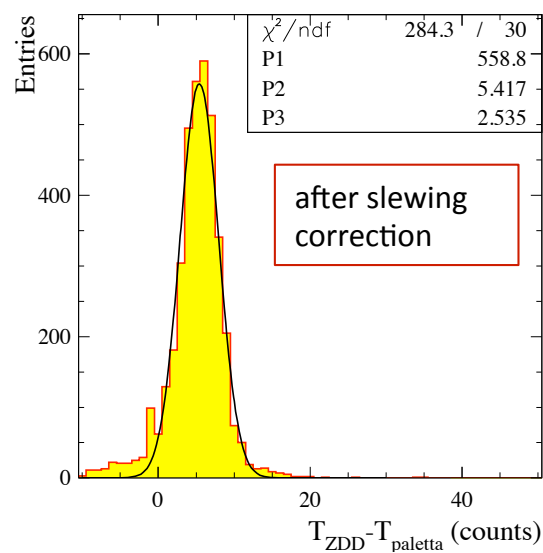
ZDD: TDC vs ADC Counts



ZDD: TDC Counts



TDC Counts 'Paletta'



$$\sigma_{ZDD} - \sigma_{paletta} = \frac{\tau_{ZDD}}{\sqrt{N_{p.e.}}}$$

$$\tau_{ZDD} = 2.2ns$$

@17MeV:

$$N_{p.e.} = \left(\frac{\tau_{ZDD}}{\sigma_{ZDD} - \sigma_{paletta}} \right)^2 = 20$$

$$N_{p.e.} = 20/17 \geq 1 p.e./MeV$$

Milestones ZDD 2010-2011

- Luglio 2010: taglio e fresatura P326 FATTO!
- Agosto 2010: survey in loco (BEPCII) FATTO!
- settembre 2010: test prototipo in laboratorio FATTO!
- entro dicembre 2010: test BTF
- gennaio-febbraio 2011: consegna PM ed elettronica
- maggio 2011: struttura e movimentazione meccanica
- marzo-giugno: test ZDD cosmici e BTF
- agosto 2011: installazione ZDD a BEPCII

RICHIESTE FINANZIARIE 2011



BESIII Italia nel 2011

Per il 2011 facciamo richiesta di apertura sigla nazionale BESIII

sezioni coinvolte: LNF (3.0 FTE) e Torino (2.3 FTE)

impegno LNF: ZDD, analisi fattori di forma barioni

impegno Torino : analisi fattori di forma barioni, analisi dei segnali da ZDD, farm di calcolo

Composizione del gruppo LNF:

<i>R. Baldini Ferroli</i>	100%
<i>M. Bertani (resp. naz. e LNF)</i>	80%
<i>A. Calcaterra (resp. costruzione ZDD)</i>	50%
<i>S. Pacetti</i>	20%
<i>A. Zallo</i>	50%

<i>TOT</i>	<i>3.0 FTE</i>

Composizione del gruppo TO:

<i>D. Alberto</i>	50%
<i>M. Destefanis</i>	30%
<i>M. Greco</i>	50%
<i>M. Maggiora (resp. TO)</i>	50%
<i>S. Spataro</i>	50%

<i>TOT</i>	<i>2.3 FTE</i>

Richieste ai LNF per 2011 per costruzione rivelatore:

Supporto tecnico servizio esperimenti alte energie (supervisor M. Anelli): 0.5 F.T.E.

Servizio progettazione: 2 mesi/uomo per disegno e progettazione supporti e movimentazione

Servizio Elettronica e automazione : 3 mesi/uomo per circuiti FEE, software movimentazione supporti (automazione)

Meccanica: 2 mesi/uomo per realizzazione supporti





Richieste finanziarie per il 2011 @LNF

	Richieste (K€)
Missioni estere	47.0
Missioni interne	7.5
Mat. Consumo (tot)	36.0
<i>scheda elettronica(splitter e disc) custom LNF</i>	5.0
<i>guide di luce, fibre da 1mm diametro</i>	15.0
<i>strutture meccaniche ZDD</i>	4.0
<i>movimentazione (4k€/motore, 2 motori)</i>	8.0
<i>prelievo magazzino centrale e metalli</i>	3.0
<i>trasporto ZDD LNF-Pechino (DHL)</i>	1.0
Apparati	
<i>PM (1Keuro/PM, 12PM)</i>	12.0
Inventario	36.0
<i>Crate VME +CPU</i>	5.2
<i>Elettronica ZDD (2FADC, 1TDC)</i>	16.7
<i>Alimentazione PM (PowerSupply system, H.V. ch.)</i>	14.0
Totale LNF	138.5



Richieste finanziarie per il 2011 @TO

	Richieste(K€)	S.J. (K€)
Missioni estere	43.5	4.0
Missioni interne	9.5	3.0
Mat. Consumo	5.0	
<i>nastri LTO per storage dati LNF+TO</i>	3.0	
<i>metabolismo</i>	2.0	
Inventario	26.5	
<i>server per mirror nazionale DB di BESIII</i>	4.5	
<i>WN per analisi dati e simulazioni</i>	12.0	
<i>storage NAS iSCSI RAID</i>	6.0	
<i>spazio disco</i>	4.0	
Totale TO	84.5	7.0

Dettagli richieste Missioni Estere, 2011



- partecipazione alle riunioni di collaborazione, IB meeting, discussione analisi dati e simulazioni, discussione pubblicazione e release risultati per conferenza
LNF: 2meeting/anno x (8d in Cina + viaggio + fee) x 3p = 12.5 K€
TO : 2meeting/anno x (8d in Cina + viaggio + fee) x 3p = 12.5 K€
- partecipazione a BESIII Physics Workshop: discussione analisi dati e simulazioni, discussione pubblicazione e release risultati per conferenze
LNF: 2meeting/anno x (8d in Cina + viaggio + fee) x 3p = 12.5 K€
TO: 2meeting/anno x (8d in Cina + viaggio + fee) x 3p = 12.5 K€
- turni di presa dati: Token turni richiesto da BESIII: 12turni/persona
LNF: 1periodo/persona/anno x (12d in Cina + viaggio) x 5p = 13.0 K€
TO: 1periodo/persona/anno x (12d in Cina + viaggio) x 5p = 13.0 K€
- lavoro fuori sede di un PostDoc/Ricercatore @ IHEP: sviluppo sw ricostruzione, analisi e simulazione
TO: 2periodi/anno x (15d + viaggio) x 1p = 5.5
- attività installazione ZDD @ IHEP:
 - LNF: attività installazione e messa in opera ZDD sul posto:
2sett/anno x (15d + viaggio) x 3p = 9.0 K€
 - TO: analisi segnali ZDD post-installazione ZDD sul posto, S.J. validazione ZDD
1sett/anno x (10d + viaggio) x 2p = 4.0 K

Dettagli richieste Missioni Interne 2011



- riunioni di coordinamento software/fisica TO $\leftrightarrow$ LNF:
analisi dati 2009-2010 e 2011 , analisi canali $e^+e^- \rightarrow p \bar{p}$, $e^+e^- \rightarrow n \bar{n}$,
sviluppo codice simulazioni
LNF: 4 riunioni/anno x (3d + viaggio) x 2pp = 5.5 K€
TO: 4 riunioni/anno x (3d + viaggio) x 2pp = 5.5 K€
- partecipazione alle riunioni CSN1
LNF: 2riunioni/anno x (2d + viaggio) x 2pp = 2.0 K€
TO: 2riunioni/anno x (2d + viaggio) x 2pp = 2.0 K€
- lavoro fuori sede di un PostDoc/Ricercatore di TO @ LNF:
sviluppo sw ricostruzione, analisi e simulazione
TO: 2periodi/anno x (5d + viaggio) x 1p = 2.0 K€
- test segnali da ZDD presso LNF
sj mancato anticipo a Settembre 2010
TO: 1sett x (5d + viaggio) x 3p = 3.0 K€



Dettagli richieste computing

- **Inventariabile (richieste computing TO + LNF @ TO)**
 - WN per analisi dati e simulazioni (2 x Xeon 6 core 2 x HDD SAS 146GB, 2 x 1GbEth, 3y NBD): 4 WN (2 TO, 2 LNF) = 12.0 K€
 - server per replica nazionale Event DB BESIII (2 x Xeon 4core, 16GB RAM, 2 x HDD SAS 146GB, 2 x 1GbEth, 3y NBD): 1 server (TO) = 4.5 K€
 - NAS iSCSI + RAID per storage dati reali e simulazioni (2x2xiSCSI ctrl 1Gb, 12slot SATA/SAS, RAID 0/1/5, 3y NBD): 1 NAS (TO) = 6.0 K€
 - spazio disco per NAS SAS per storage dati reali e simulazioni / 7 x 2TB SAS HDD, 10 TB utili in Raid 1/5 + spare, upgradabile a 20 TB utili Raid 1/5 + spare acquistando altri 5 HDD, 3y NBD): 7 HDD SAS 2TB (TO) = 4.0 K€
- **Consumo (TO+LNF @ TO)**
 - supporto memorizzazione dati: 3.0 K€ (anticipabile al 2010)
 - metabolismo: 2K€

tutte le richieste sono anticipabili al 2010

Dettagli richieste CON. / INV. LNF 2011



GUIDE DI LUCE in fibra plastica, L=2 m per portare segnale a PM

Offerta ditta Luceat (BS) : fibra plastica non rivestita da 1mm: Prezzo 0,39 Euro/m

Necessari 14 Km di fibra/modulo, 2 moduli = 28Km → **15K€**

PM Hamamtsu, stime in corso,
(3piccoli, 1"+3medi,2")/modulo, 12 PM
1k€/PM → **12K€**

ALIMENTAZIONE PM

SY252LC PowerSupply system → 6.0K€

A1733N-SY1527 H.V. channels (12ch), 2 schede →
8.0k€ TOT= 14 K€

ELETTRONICA ZDD (CAEN)

1 Crate VME =3.0

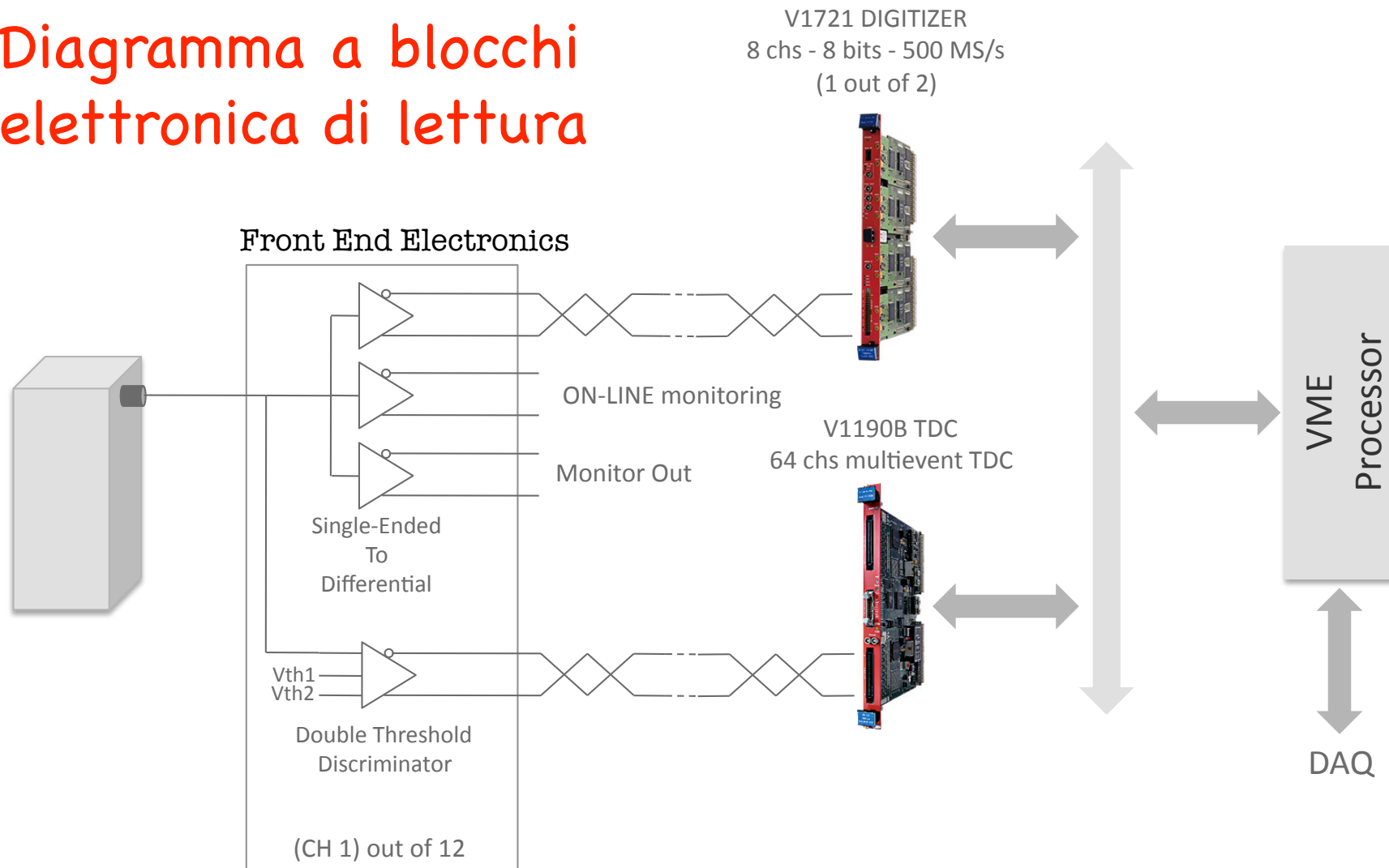
1 CPU = 2.2

2FADC V1721 - 8 Ch. 8 bit 500 MS/s, 5700 *2= 11.4 K€

1TDC V1190B 64 CANALI, 5.3 K€

TOT= K€ 22.0

Diagramma a blocchi elettronica di lettura



Conclusioni

Il gruppo italiano BESIII cresciuto

ZDD: buoni segnali da prototipo

proposte alla collaborazione BESIII ben accolte

$n\bar{n}$: prima analisi da dati J/ψ !

SPARES

Attività: fisica & calcolo 2011

- Studio dei fattori di forma nucleonici time-like @ BESIII
 - Attività simulazioni e analisi dati BESIII:
 - studio e validazione interazione n e $\bar{n}$ nello spettrometro BESIII tramite dati reali
 - analisi dati 2009 e 2010 per studio di fattibilità resonance scan
 - analisi dati 2009 e 2010 per canali $p\bar{p}$, $n\bar{n}$, $\Lambda\bar{\Lambda}$ e 3-body con π per valutazioni di efficienza
 - Situazione dati sperimentali BESIII:
 - marzo 2009 – aprile 2009:
 - ◆ 30 TB raw
 - ◆ 6.4 TB dst
 - ◆ 2.1 GeV $\supset$ 108 MeV Ψ'
 - giugno 2009 – luglio 2009:
 - ◆ 35 TB raw
 - ◆ 7.9 TB dst
 - ◆ 1.5 GeV $\supset$ 220 MeV J/Ψ
 - gennaio 2010 – giugno 2010:
 - ◆ 90 TB raw
 - ◆ 24 TB dst
 - ◆ 6.5 GeV $\supset$ $\sim 930 \text{ pb}^{-1}$ Ψ''

Richieste finanziarie LNF per il 2011 (preventivi luglio)

- Attivita' di partecipazione a meeting e turni di presa dati a BEPCI
- Messa in opera e installazione ZDD
- Analisi dati (calcolo richiesto tutto a Torino)

	Richieste (K€)	S.J. (K€)
Missioni estere	38.0	9.0
Missioni interne	7.5	
Mat. Consumo (tot)	22.0	
<i>circuiti amplific.</i>	5.0	
<i>guide luce, plexiglass</i>	2.0	
<i>metabolismo(strutture meccaniche,movimentazione)</i>	12.0	
<i>prelievo magazzino centrale e metalli</i>	3.0	
Apparati		
<i>PM (3Keuro/PM, 10PM)</i>	30.0	
Inventario		
<i>Elettronica ZDD (2FADC, 1TDC)</i>	20.0	
Totale LNF	117.5	9.0

BESIII

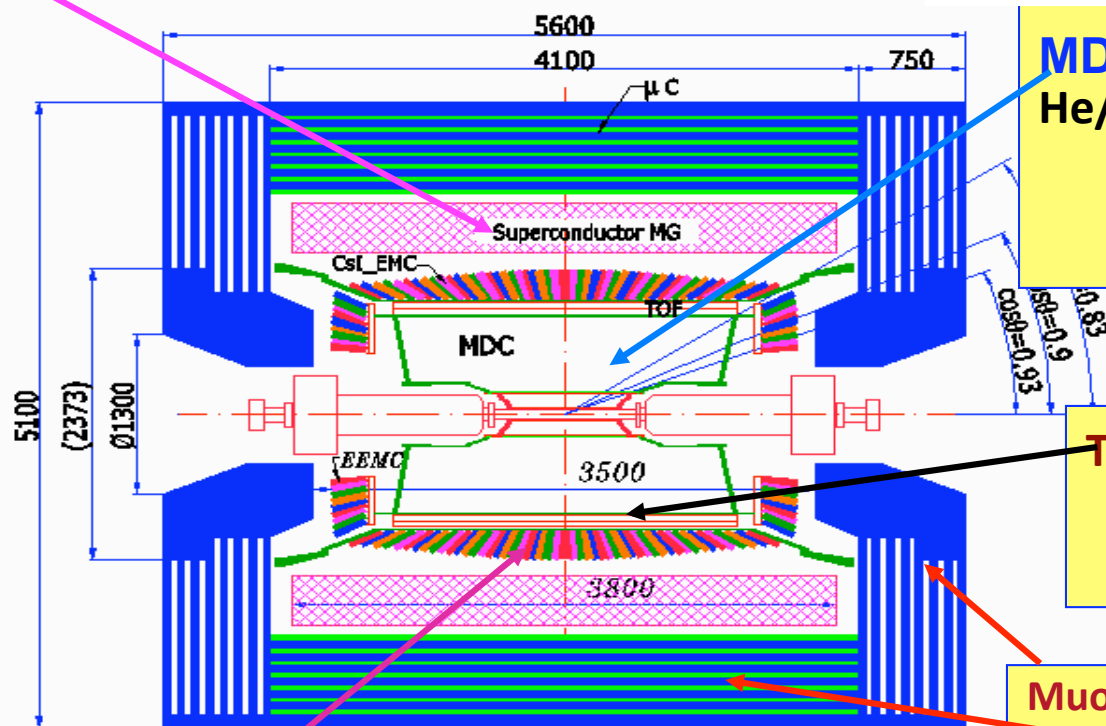
BESIII detector: all new !

CsI calorimeter

Precision tracking

Time-of-flight + dE/dx PID

Magnet: 1 T Super conducting



MDC: small cell & Gas:
 He/C₃H₈ (60/40), 43 layers
 $\sigma_{xy} = 130 \mu\text{m}$
 $\sigma_p/p = 0.5\% @ 1\text{GeV}$
 $dE/dx = 6\%$

TOF:

$\sigma_T = 100 \text{ ps}$ Barrel
 110 ps Endcap

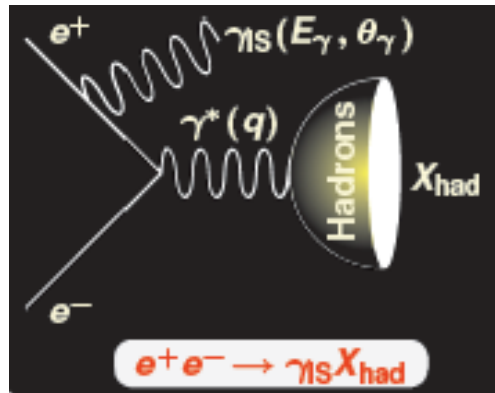
Muon ID: 9 layers RPC
 8 layers for endcap

EMC: CsI crystal, 28 cm
 $\Delta E/E = 2.5\% @ 1 \text{ GeV}$
 $\sigma_z = 0.6 \text{ cm}/\sqrt{E}$

Data Acquisition:
 Event rate = 4 kHz
 Total data volume ~ 50 MB/s

The detector is hermetic for neutral and charged particle with excellent resolution, PID, and large coverage.

ISR a BESIII



- $\frac{d^2\sigma}{dE_\gamma d\theta_\gamma} = W(E_\gamma, \theta_\gamma) \cdot \sigma_{e^+e^- \rightarrow X_{had}}(s)$
- $W(E_\gamma, \theta_\gamma) = \frac{\alpha}{\pi x} \left(\frac{2 - 2x + x^2}{\sin^2 \theta_\gamma} \right)$

- $s = q^2$, q X_{had} momentum
- E_γ, θ_γ .. CM γ energy, scatt. ang.
- E_{CM} CM e^+e^- energy
- $x = E_\gamma / 2E_{CM}$

Interessanti risultati mostrano un andamento inaspettato a soglia delle reazioni

$e^+e^- \rightarrow p\bar{p}, \Lambda\bar{\Lambda}$

a BABAR,

una sola misura di FENICE per

$e^+e^- \rightarrow n\bar{n}$

$J/\psi, \psi(2S), \psi(3770)$ decadono con alti branching ratio in stati finali con π^0 e γ costituiscono fondo se il γ_{ISR} e' rivelato a grande angolo (i.e. nel rivelatore BESIII)

Per questo e' nata la proposta di Frascati di installare due ZDD, a e a ovest dell'IP, per rivelare i fotoni ISR.

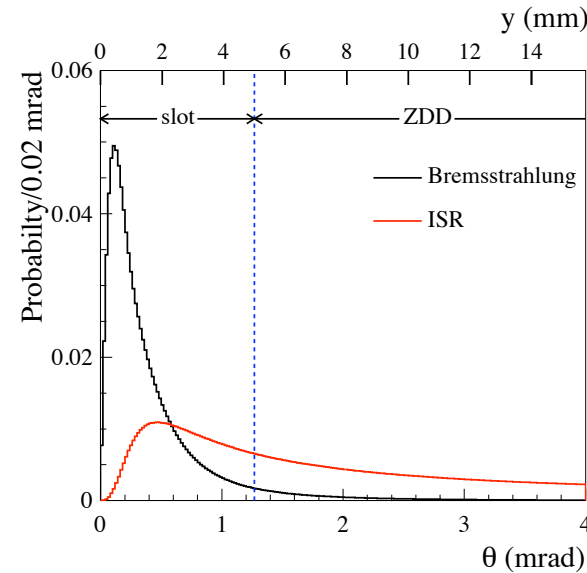
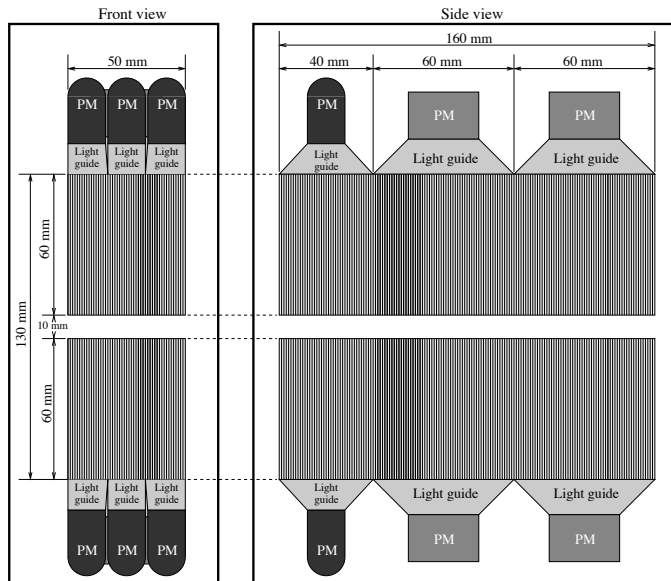
A BESIII attualmente due monitor di luminosita' si trovano in queste posizioni

Vantaggi:

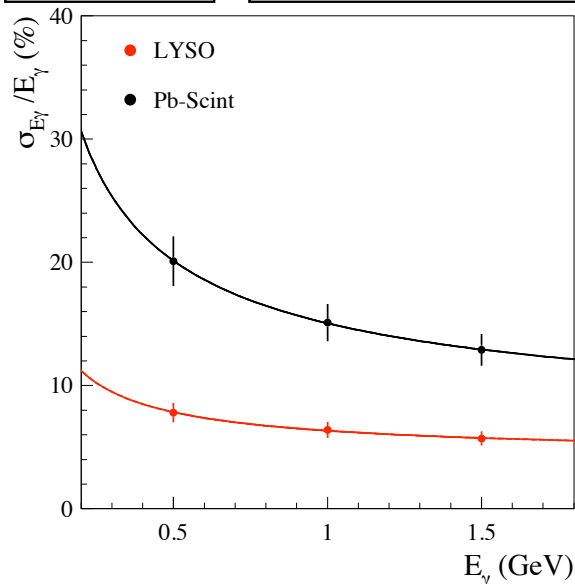
- tutte le energie disponibili allo stesso tempo $\rightarrow$ miglior controllo della sistematica
- rivelazione ISR $\rightarrow$ copertura angolare totale per X_{had}
- CM boost:
 - a soglia ε diversa da 0
 - ris. energia $\sim 1\text{MeV}$

Pb-Scifi design a` la Kloe:

- Kloe prototype module zero available for cutting (thanks to Kloe collab.)
- mechanical vertical movement to vary the opening



- $E_{\text{beam}} = 1.89 \text{ GeV}$
- $E_{\gamma}^{\text{min}} = 50 \text{ MeV}$
- $\sigma_{\text{Bre}}(4\pi) = 353 \text{ mb}$
- $\sigma_{\text{Bre}}(\text{ZDD}) = 10 \text{ mb}$
- $\mathcal{L} = 8 \times 10^{32} \text{ cm}^{-2} \text{ s}^{-1}$



$$\frac{\sigma_{E_{\gamma}}}{E_{\gamma}} = C_1 \oplus \frac{C_2}{\sqrt{E_{\gamma}/\text{GeV}}}$$

	LYSO	Pb-Scint
C_1	4.3%	6.9 %
C_2	4.6%	13.4 %
$\tau(\text{ns})$	40	2.5

- ISR in ZDD **13.7%** of total solid angle
- Bremsstrahlung in ZDD **2.8%** of total solid angle
- Bremsstrahlung rate in a single ZDD element (upper or lower):

800 kHz at $\mathcal{L} = 3 \times 10^{32} \text{ cm}^{-2} \text{ s}^{-1}$
2.1 MHz at $\mathcal{L} = 8 \times 10^{32} \text{ cm}^{-2} \text{ s}^{-1}$

2011 run test with Pb-Scifi with better timing resolution dealing with high rates.