

Proposal for cumulative process studies in light ion – nuclear interactions

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LINC2008, IHEP - Protvino
20.06.08

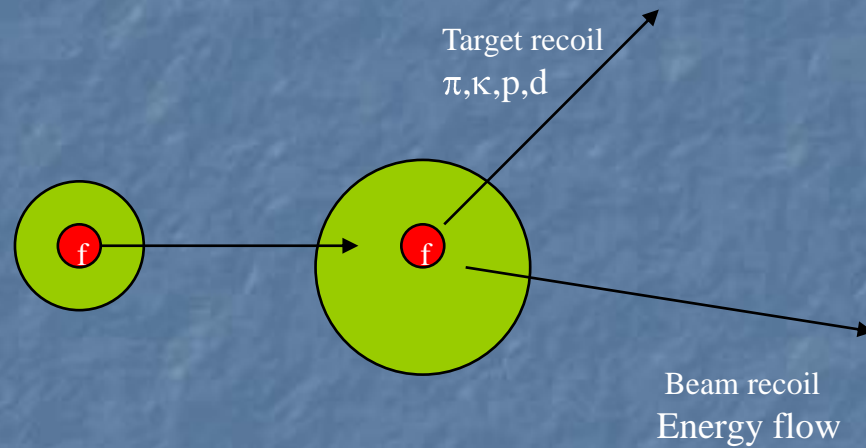
Proposal goal

Search for compressed baryon matter via
cumulative effects in correlations
at high P_t

Or by other language - search for
multi-quark or flucton states at high P_t

Proposal goal

on flucton language



| | | | | | |
|----|---|----|---|---|-----------------------------------|
| N | + | N | } | → | target recoil + beam recoil |
| 2N | + | N | | | |
| N | + | 2N | | | |
| 2N | + | 2N | | | |
| | | | | | (π,p) (rest) |

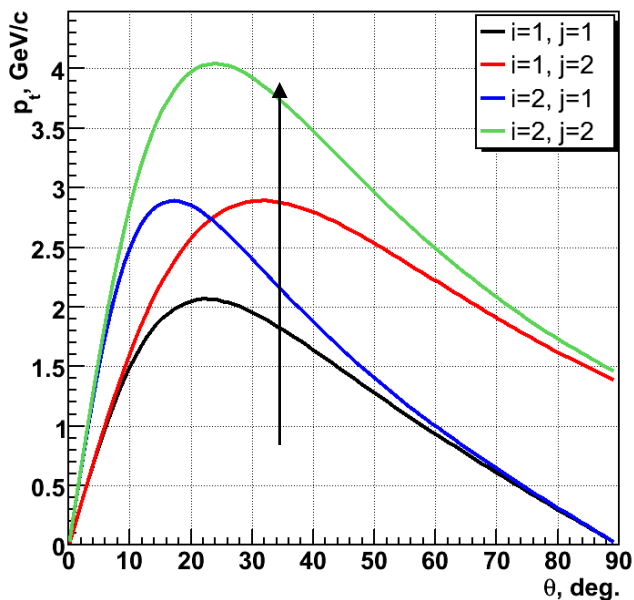
Required conditions

- Beam ions p, d, C
- Targets p, d, C, Cu, Pb
- beam energy 10, 20,30 GeV/A
- Lab angle for recoil arm - 35°
- Interaction rate – up to (10^9-10^{10}) MHz
- Slow stochastic extraction (high eff.)

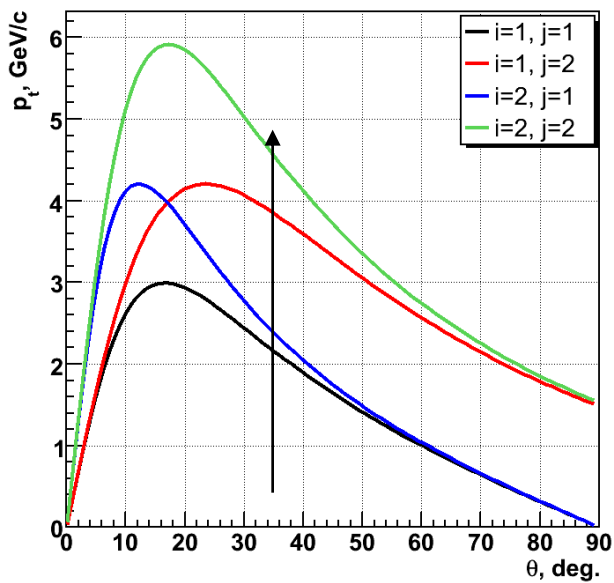
P_t v.s. θ_{rec}

A.Semak

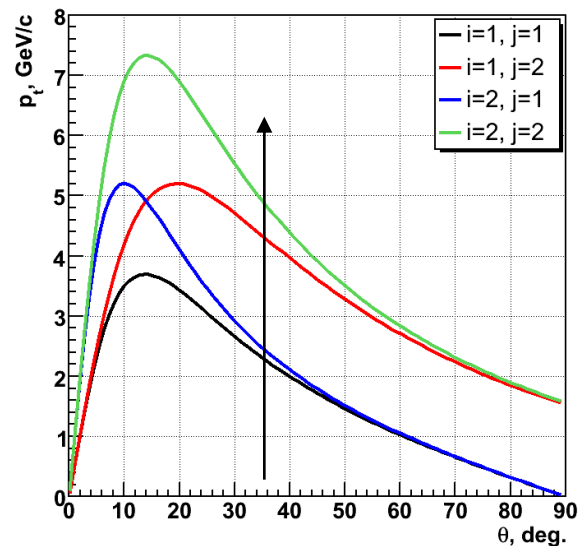
$i \times N + j \times N \rightarrow N + (i+j-1) \times N$, beam - 10 GeV/A



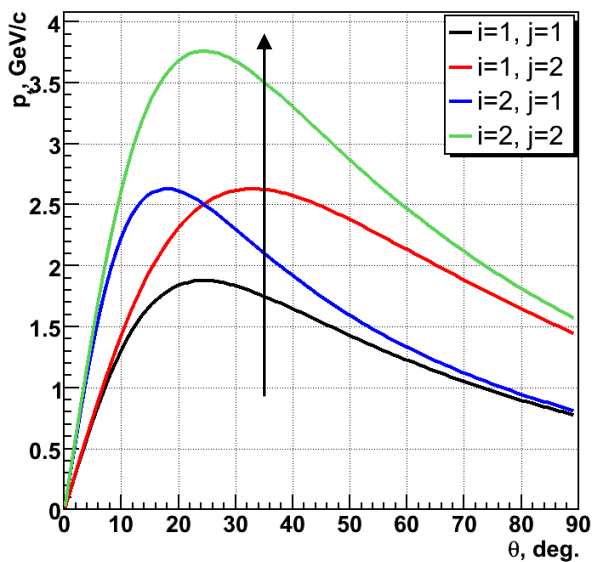
$i \times N + j \times N \rightarrow N + (i+j-1) \times N$, beam - 20 GeV/A



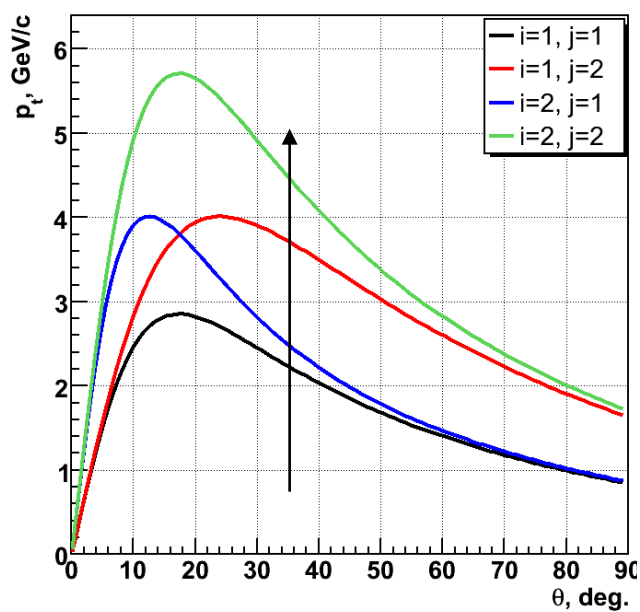
$i \times N + j \times N \rightarrow N + (i+j-1) \times N$, beam - 30 GeV/A



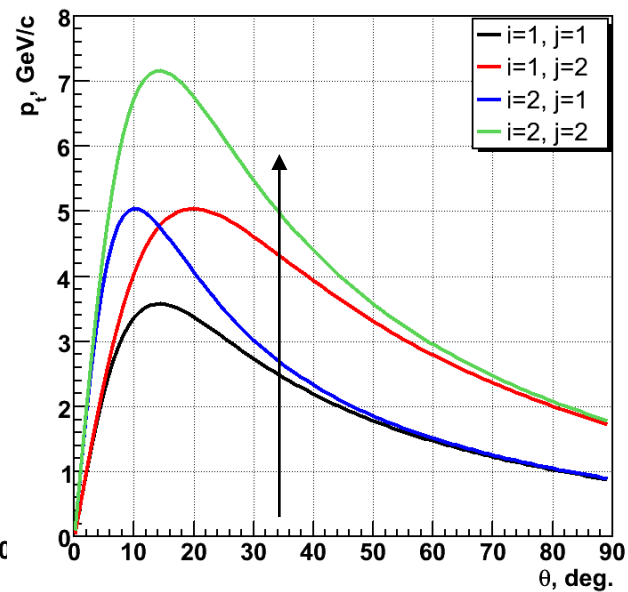
$i \times N + j \times N \rightarrow \pi + (i+j) \times N$, beam - 10 GeV/A



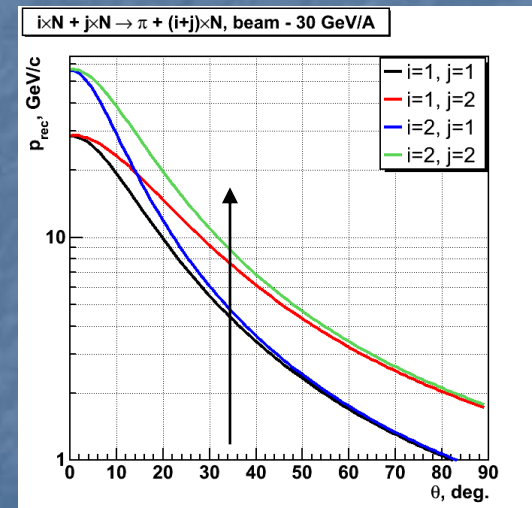
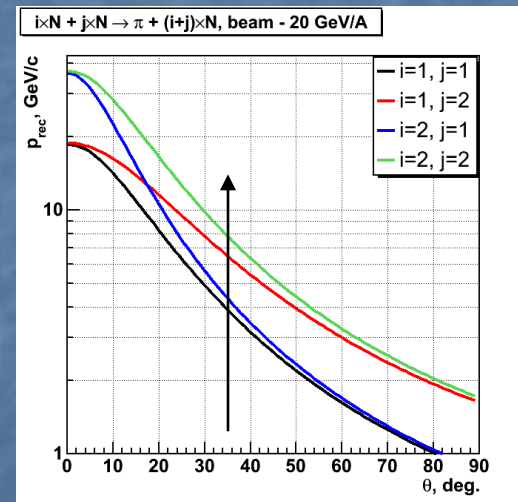
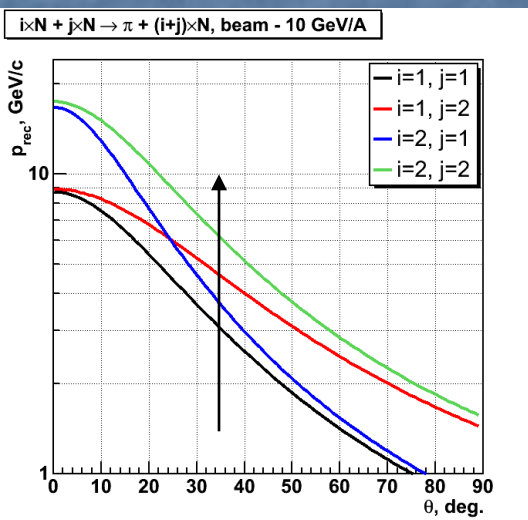
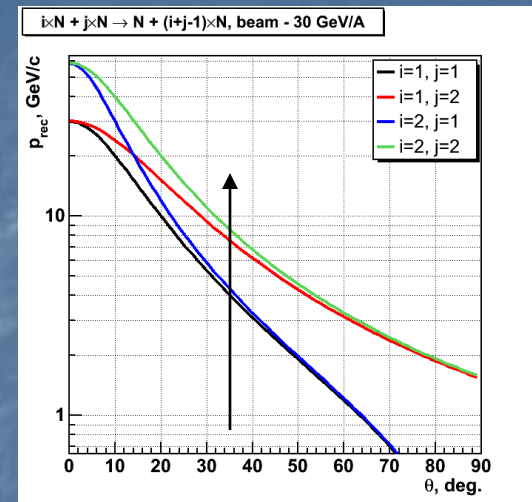
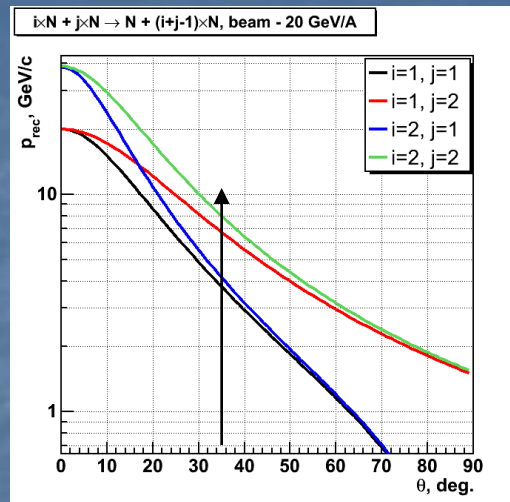
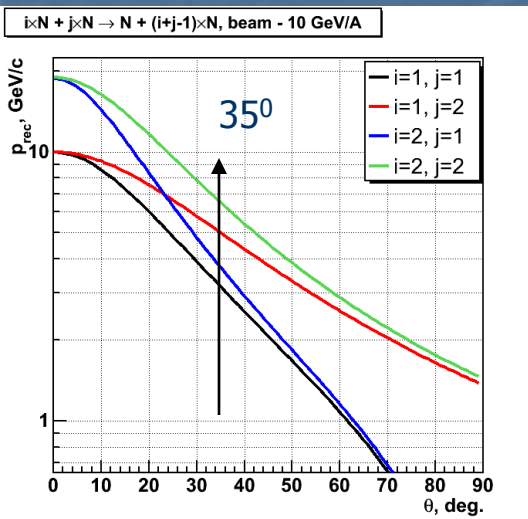
$i \times N + j \times N \rightarrow \pi + (i+j) \times N$, beam - 20 GeV/A



$i \times N + j \times N \rightarrow \pi + (i+j) \times N$, beam - 30 GeV/A



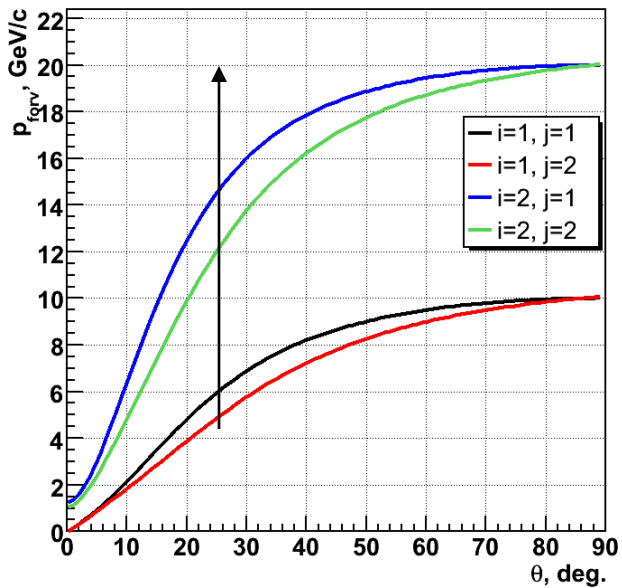
P_rec v.s. θ_{rec}



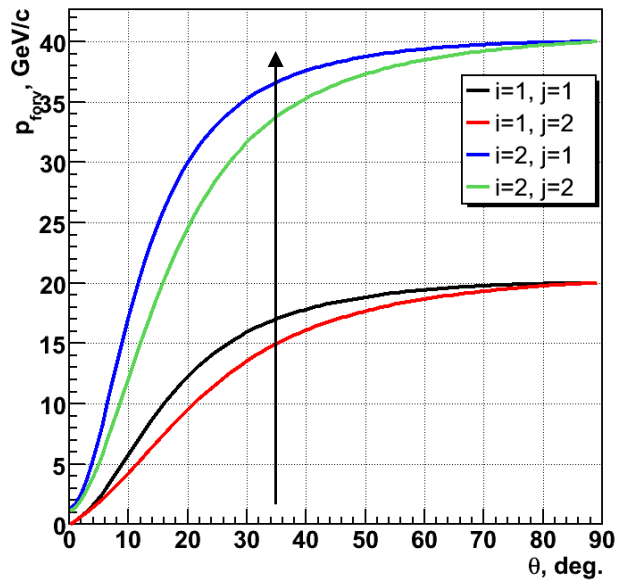
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P_forw v.s. θ_{rec}

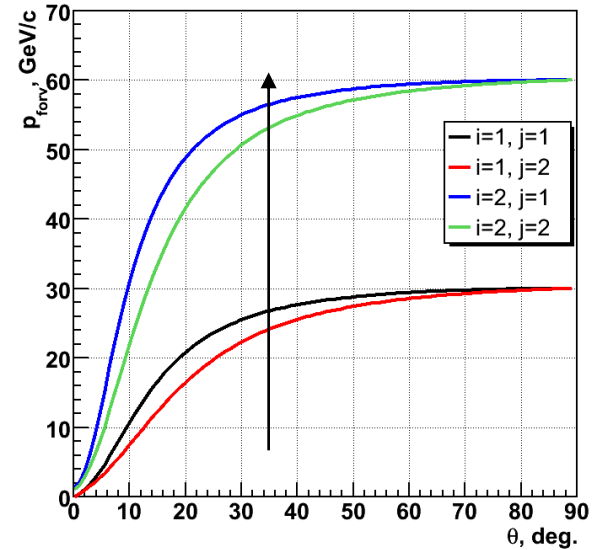
$i \times N + j \times N \rightarrow N + (i+j-1) \times N$, beam - 10 GeV/A



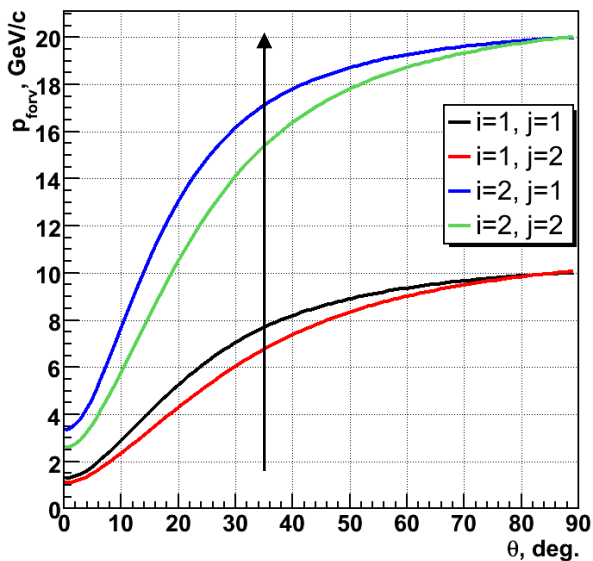
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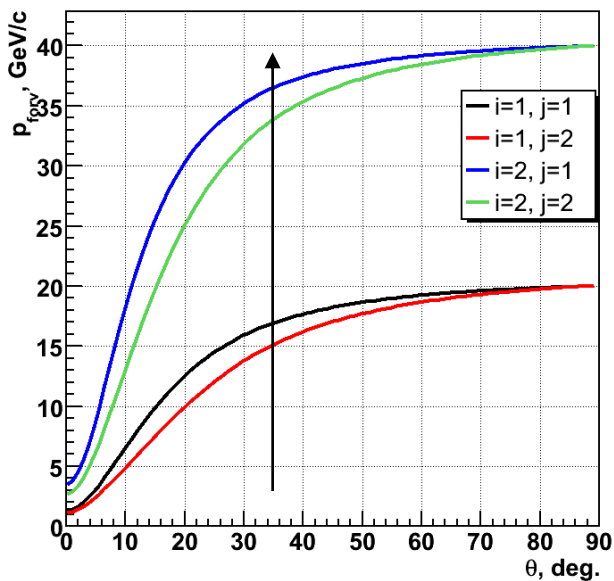
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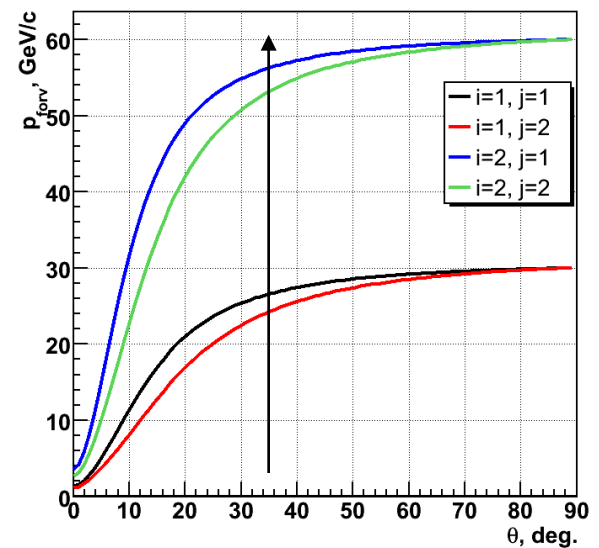
$i \times N + j \times N \rightarrow \pi + (i+j) \times N$, beam - 10 GeV/A



$i \times N + j \times N \rightarrow \pi + (i+j) \times N$, beam - 20 GeV/A

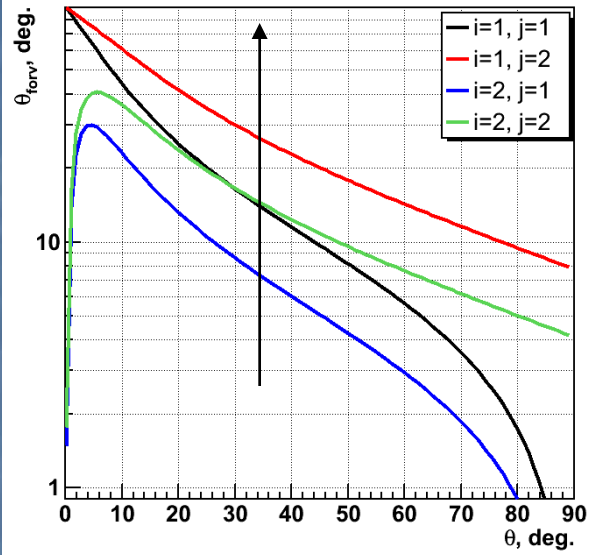


$i \times N + j \times N \rightarrow \pi + (i+j) \times N$, beam - 30 GeV/A

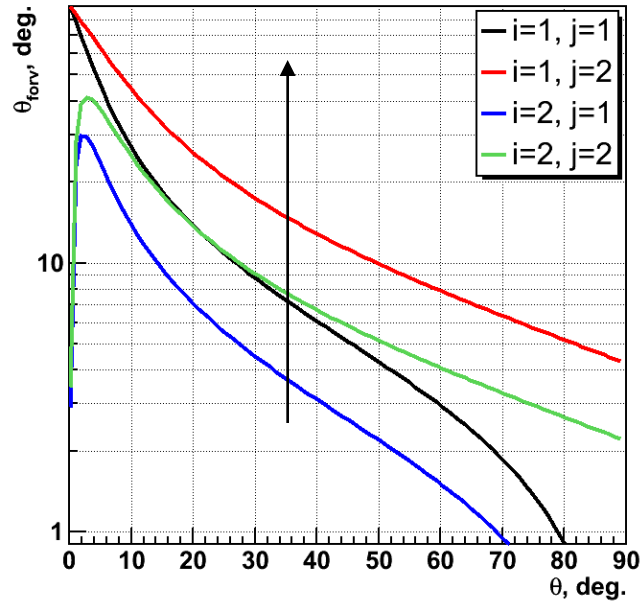


θ_{forw} v.s. θ_{rec}

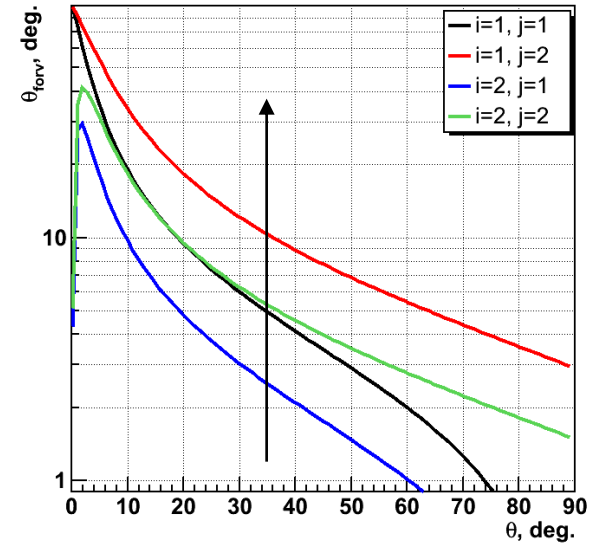
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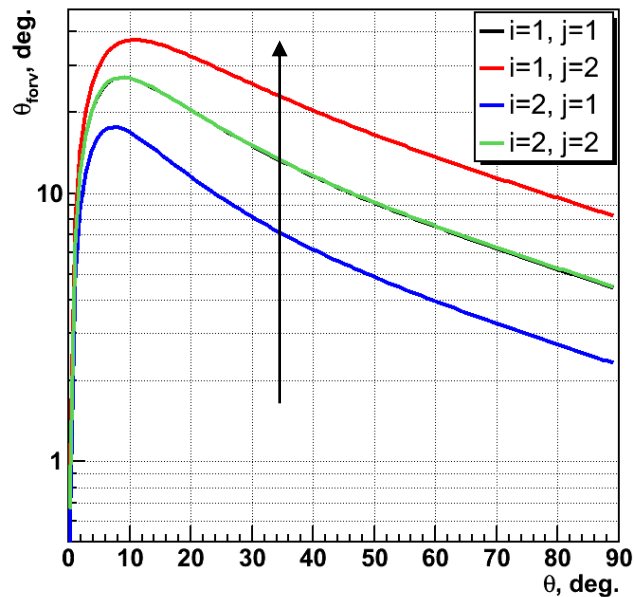
$i \times N + j \times N \rightarrow N + (i+j-1) \times N$, beam - 20 GeV/A



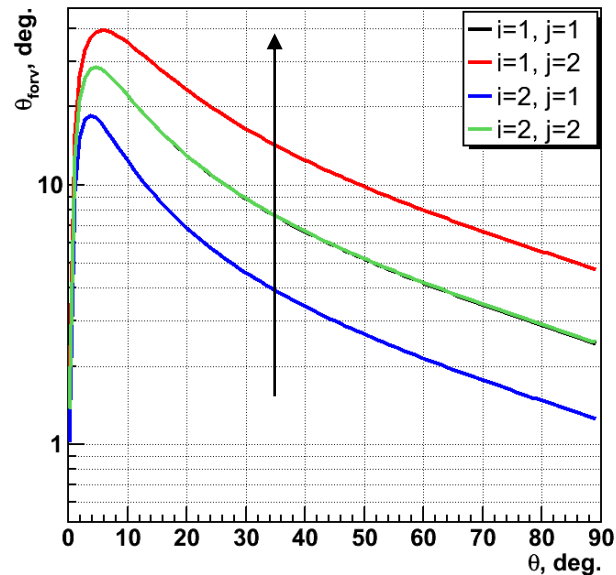
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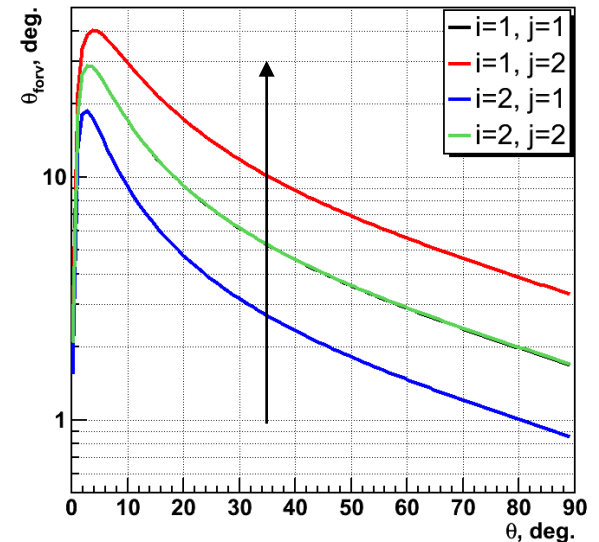
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$i \times N + j \times N \rightarrow \pi + (i+j) \times N$, beam - 20 GeV/A

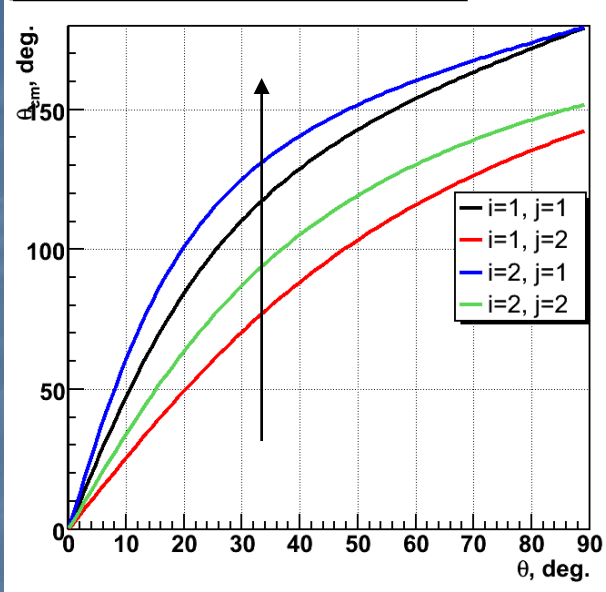


$i \times N + j \times N \rightarrow \pi + (i+j) \times N$, beam - 30 GeV/A

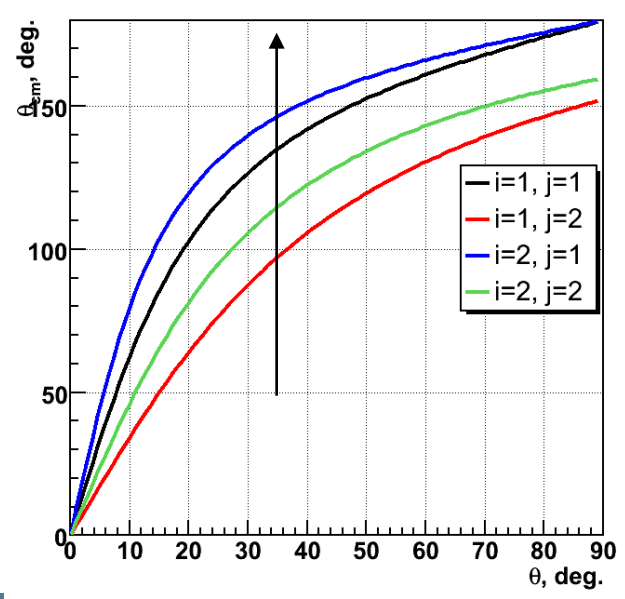


θ_{cm} v.s. θ_{rec}

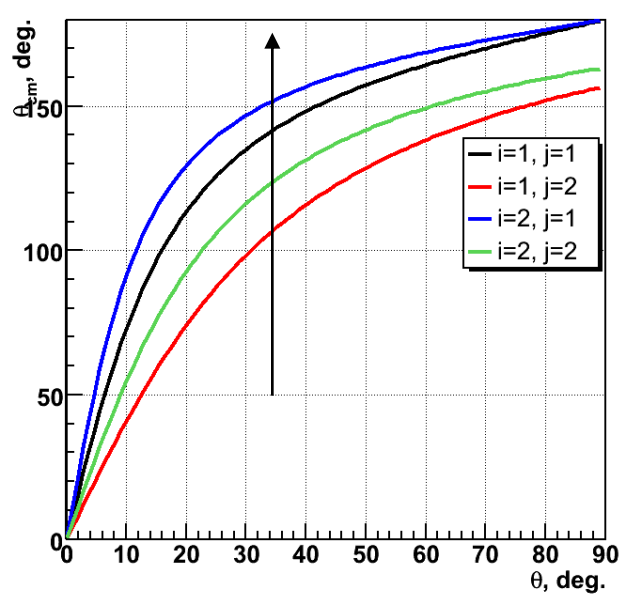
$i \times N + j \times N \rightarrow N + (i+j-1) \times N$, beam - 10 GeV/A



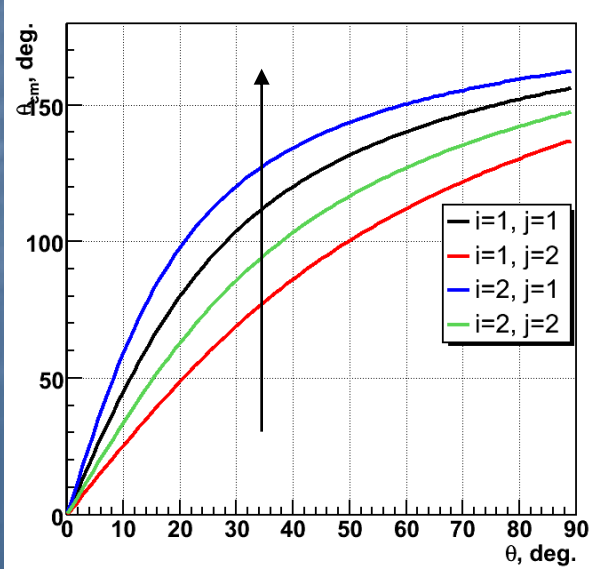
$i \times N + j \times N \rightarrow N + (i+j-1) \times N$, beam - 20 GeV/A



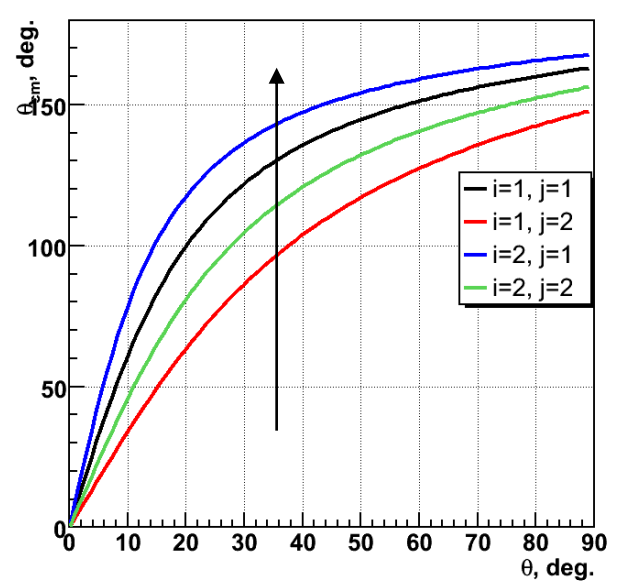
$i \times N + j \times N \rightarrow N + (i+j-1) \times N$, beam - 30 GeV/A



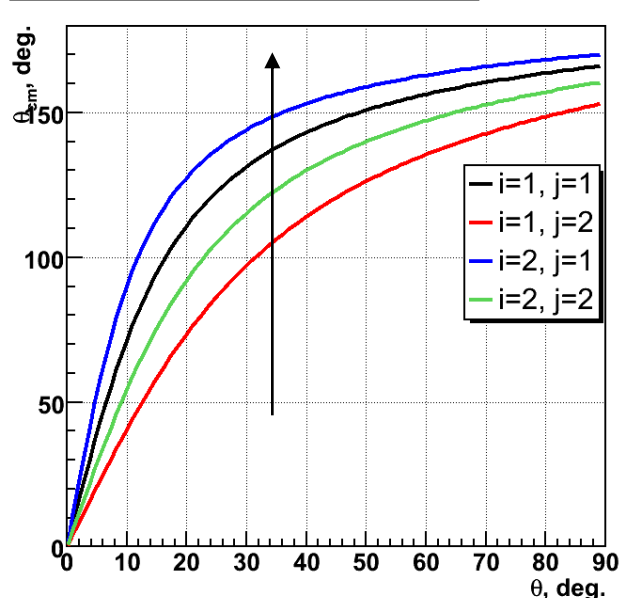
$i \times N + j \times N \rightarrow \pi + (i+j) \times N$, beam - 10 GeV/A



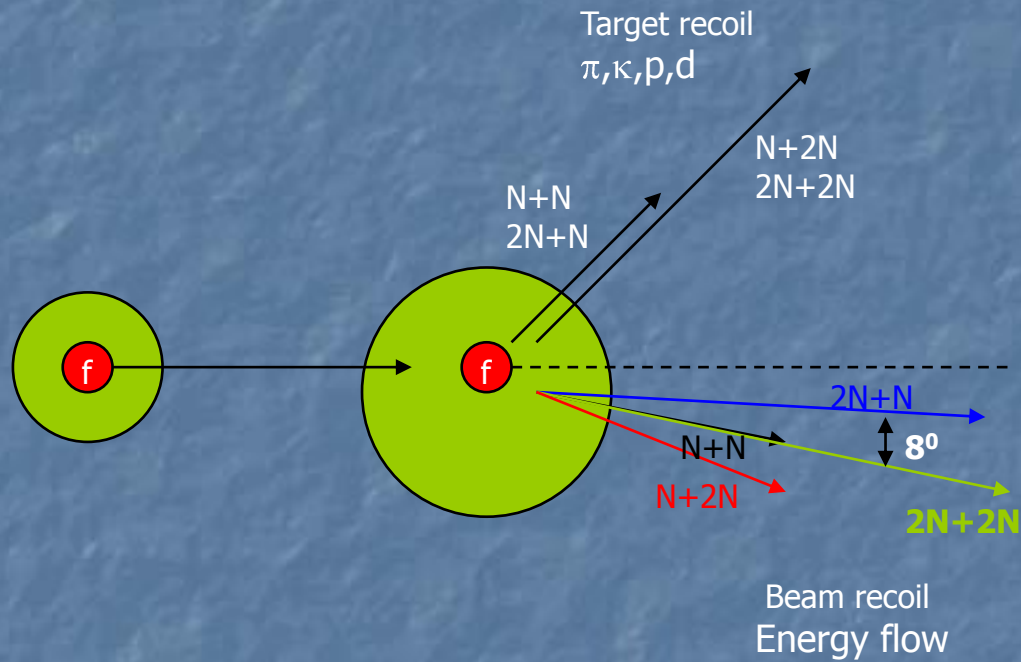
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$i \times N + j \times N \rightarrow \pi + (i+j) \times N$, beam - 30 GeV/A



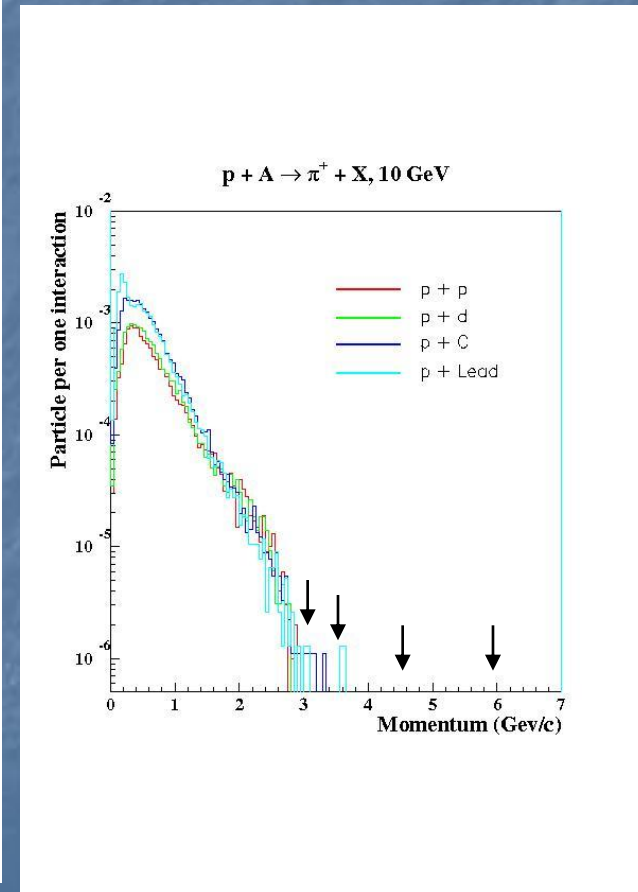
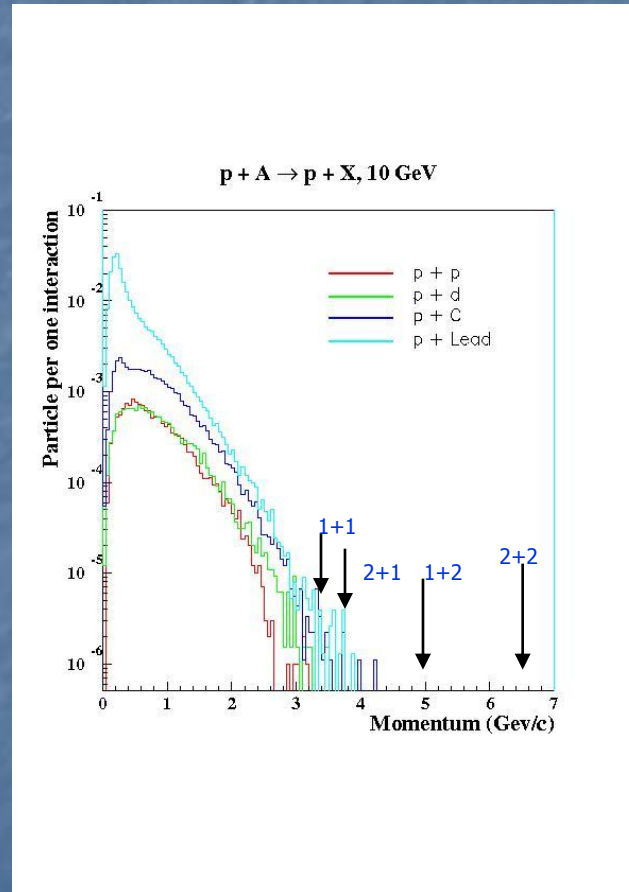
Possible configurations



Inclusive distributions

V.Koreshev

URQMD
35 deg
1 M evts

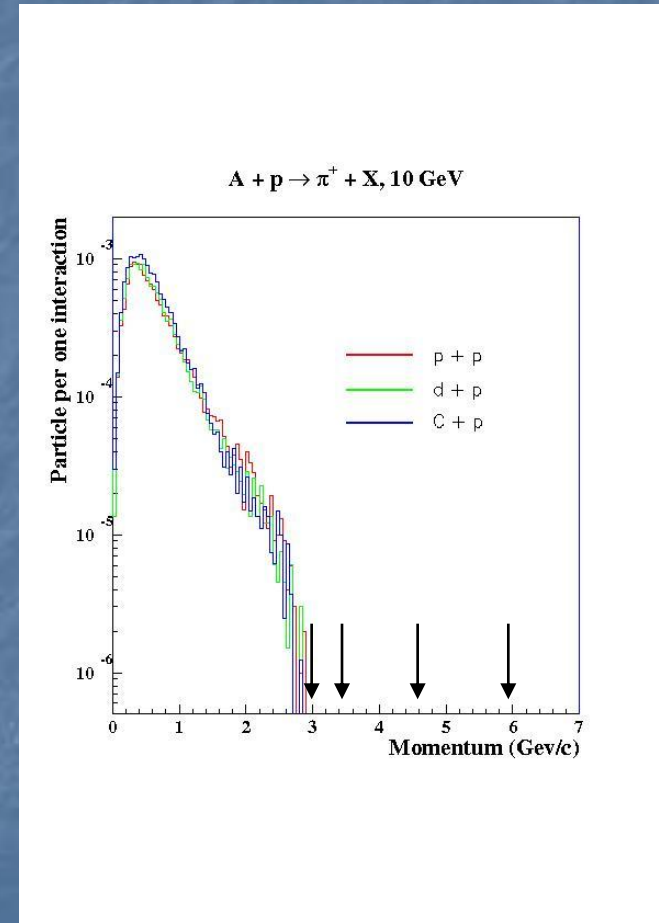
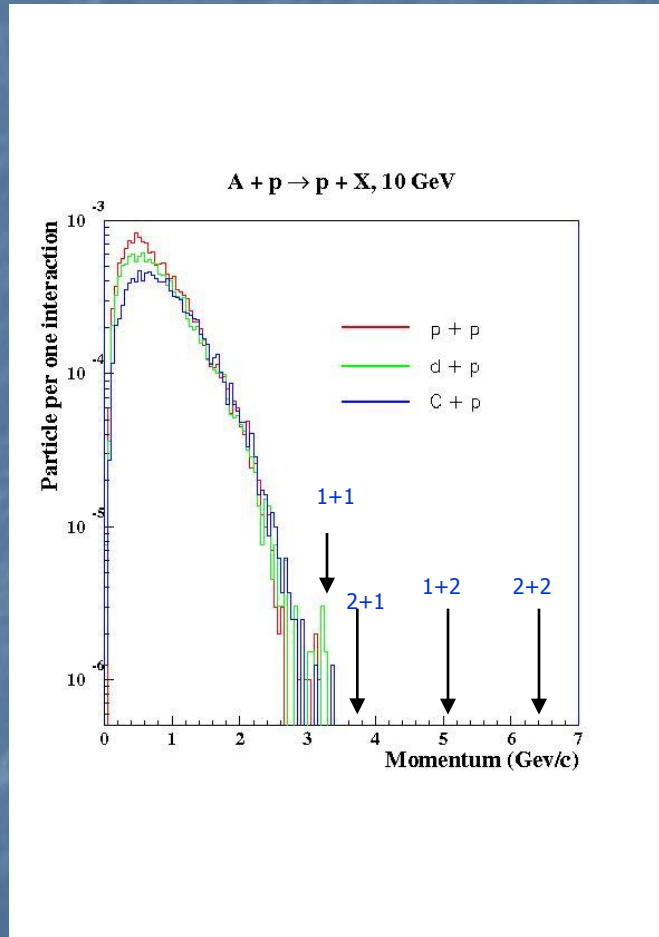


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Inclusive distributions

V.Koreshev

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35 deg
1M evts



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Correlations

V.Koreshev

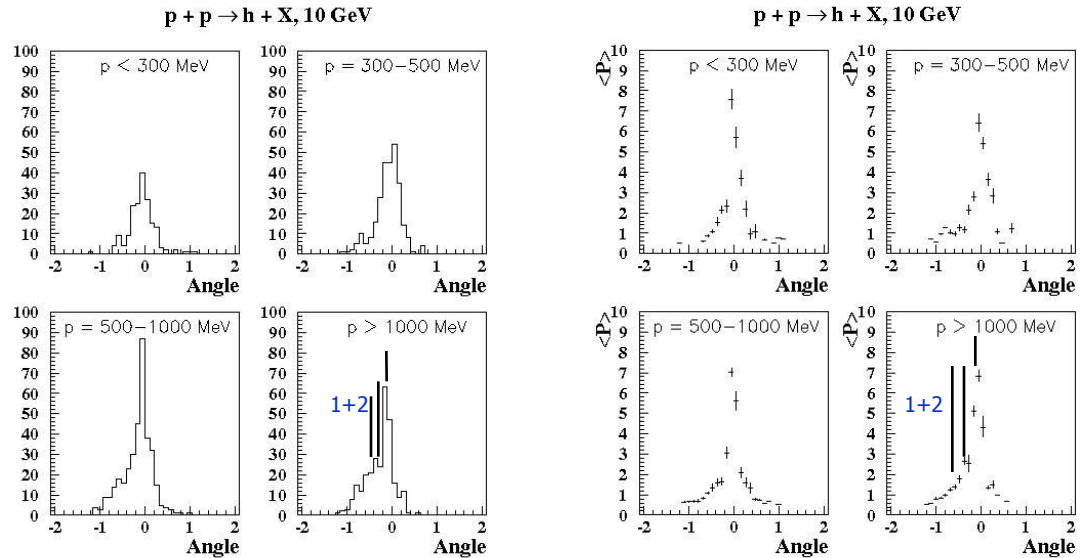
URQMD

Energy flow in
'jet'

$$\Delta\phi = \pm 100 \text{ mrad}$$

$$\Delta\theta = 100 \text{ mrad}$$

P+P, 10 GeV



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Correlations

V.Koreshev

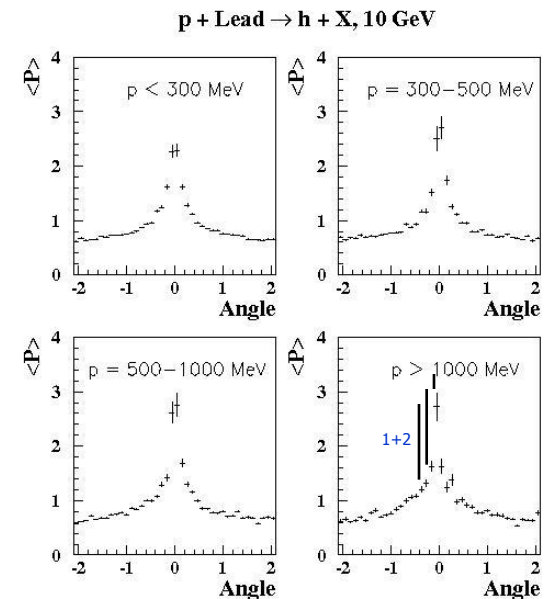
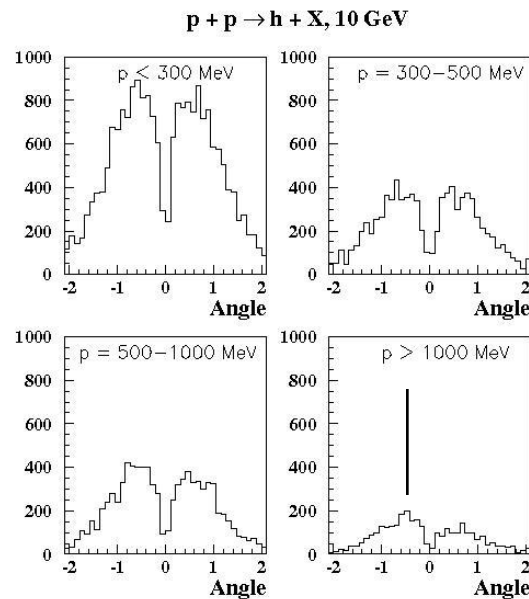
URQMD

Energy flow
in 'jet'

$\Delta\phi = \pm 100$ mrad

$\Delta\theta = 100$ mrad

P+Pb, 10 GeV



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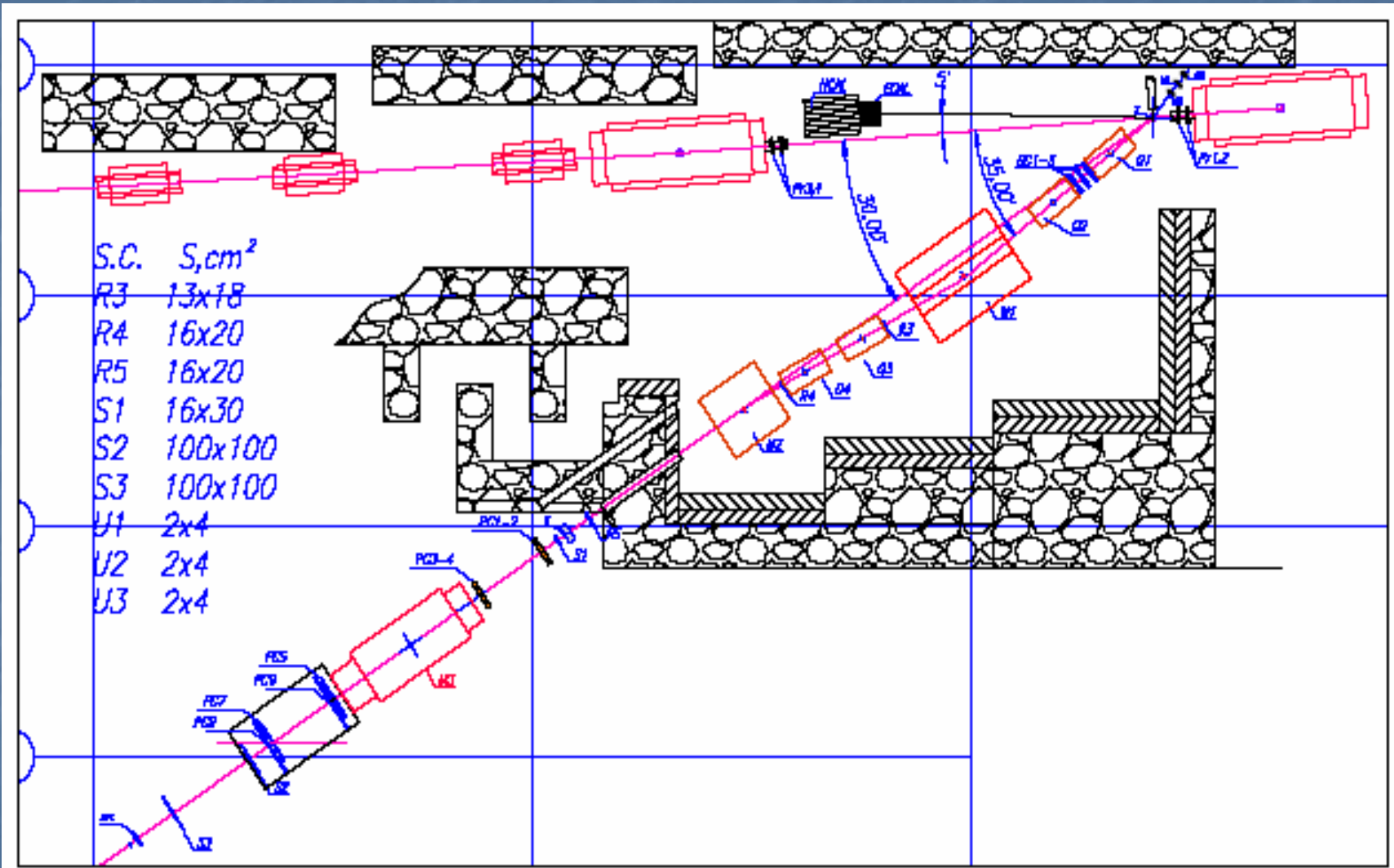
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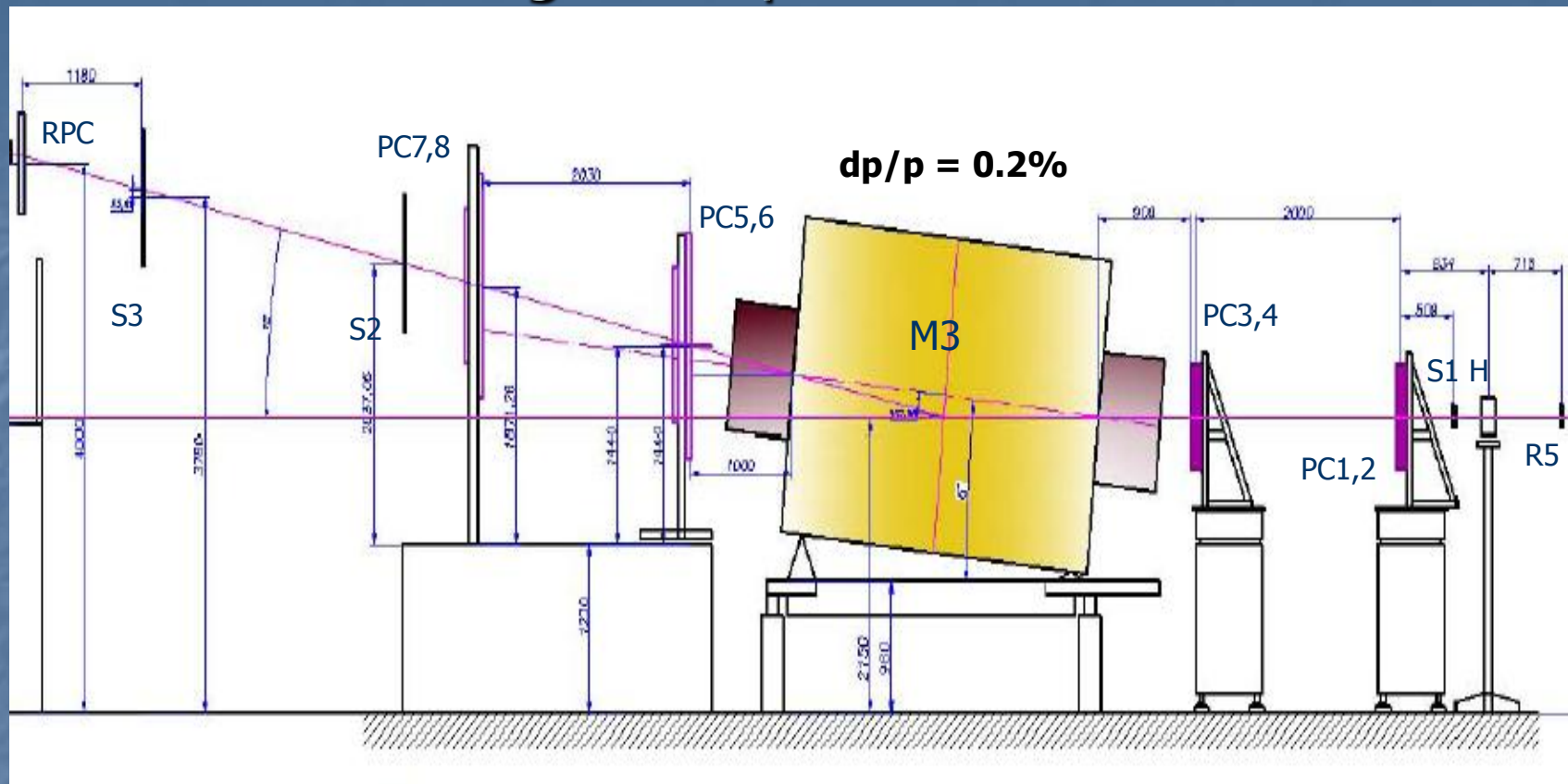
Expected rates for quasi elastic NN for 10^9 Hz interactions

| p0,GeV | th_cm,deg | th_lab,deg | dsig/dt, nb/gev-2 | Nev |
|--------|-----------|------------|----------------------|---------|
| 10 | 90 | 22.5 | 2.27 | 21 |
| | 119 | 35.1 | 357 | 3315 |
| 20 | 90 | 18 | 7.00E-02 | 0.7 |
| | 130 | 35 | 1.20E+01 | 122 |
| 30 | 90 | 13.8 | 9.34E-03 | 1.8E-02 |
| | 141 | 34.8 | 0.304 | 3.4 |
| 70 | 90 | 9.2 | 1.35E-04 | 1.3E-03 |
| | 154 | 35.2 | 2.30E-02 | 2.7E-01 |

Proposed set up



Magnetic spectrometer



TOF: HTOF/MRPC, $dT \sim 150$ ps
 π/κ sep < 6 GeV
 k/p sep < 10 GeV

Trigger R5*S1*S2*S3

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Hot zone

Recoil channel

Q1-4 – lenses

M1,M2 – magnets

$\Delta p/p = 3\%$

$\Delta \varphi = 100 \text{ mrad}$

$\Delta \theta = 15 \text{ mrad}$

Forward

HCAL from RAMPEX ?

100x100 mm² cell

100 channels

$dE/E \sim 50\%/\sqrt{E}$

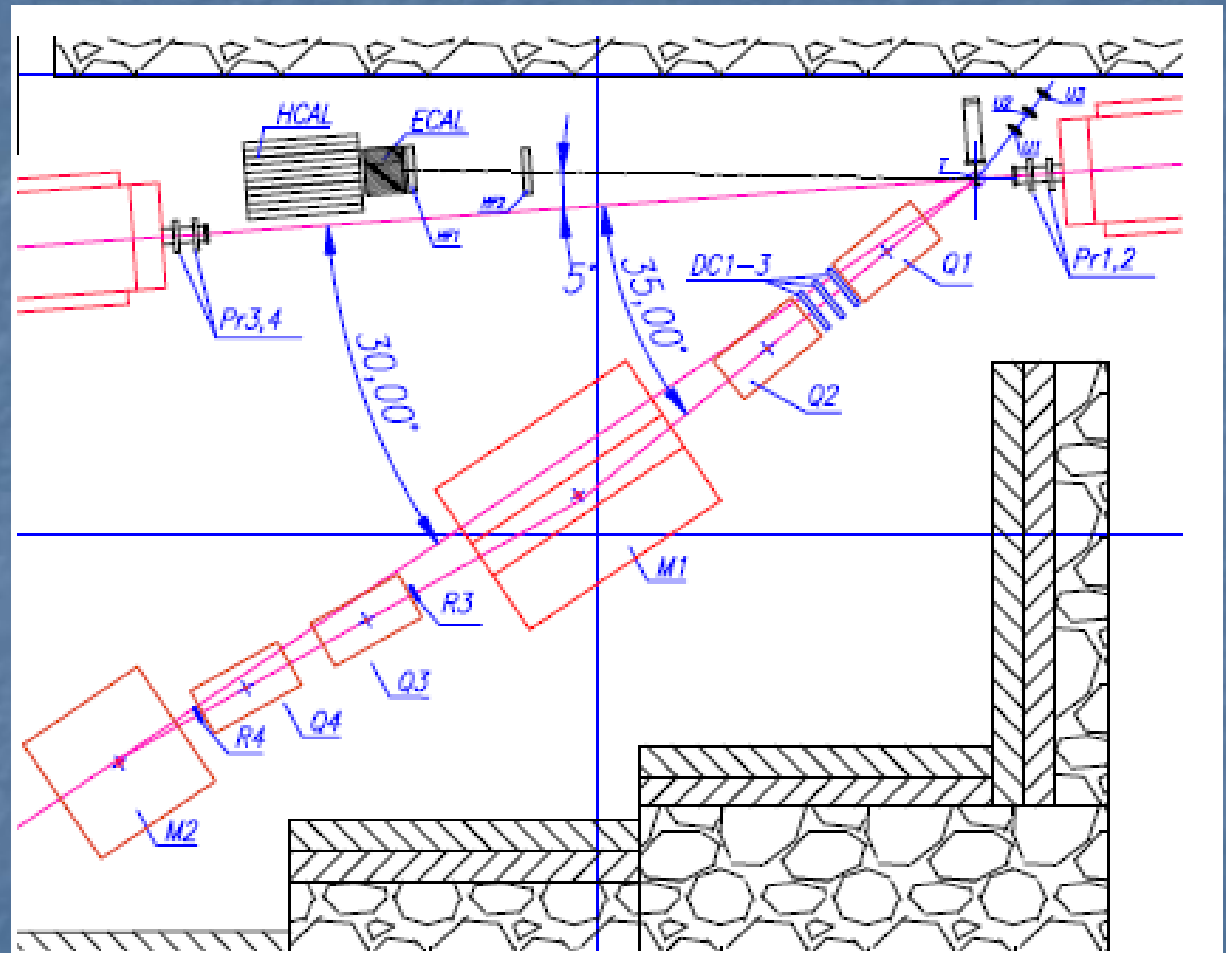
ECAL from VES ?

43x43 mm² lead glass cell

225 channels

$dE/E \sim 7\%/\sqrt{E}$

HF1,2 – hodoscopes for angles



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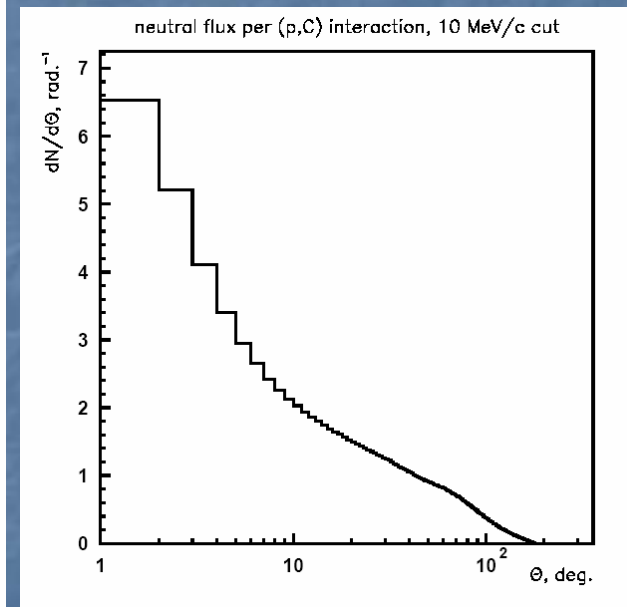
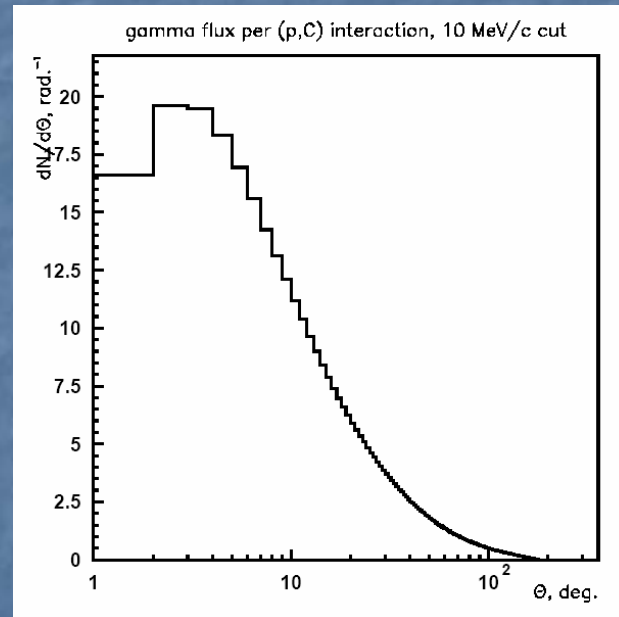
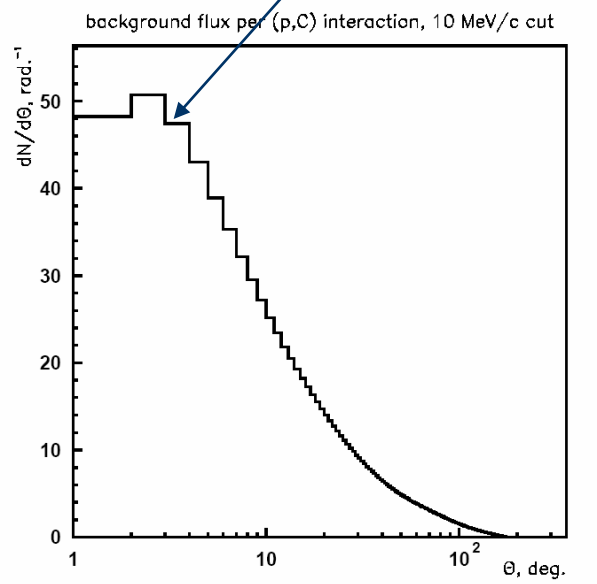
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Background rates in forward region for 50 GeV p+C

10^5 all part./cm² * 10^9 Hz
at 10 m from target

40% gamma

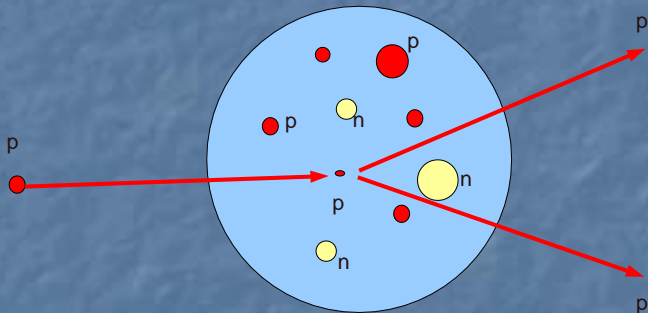
10% neutrals



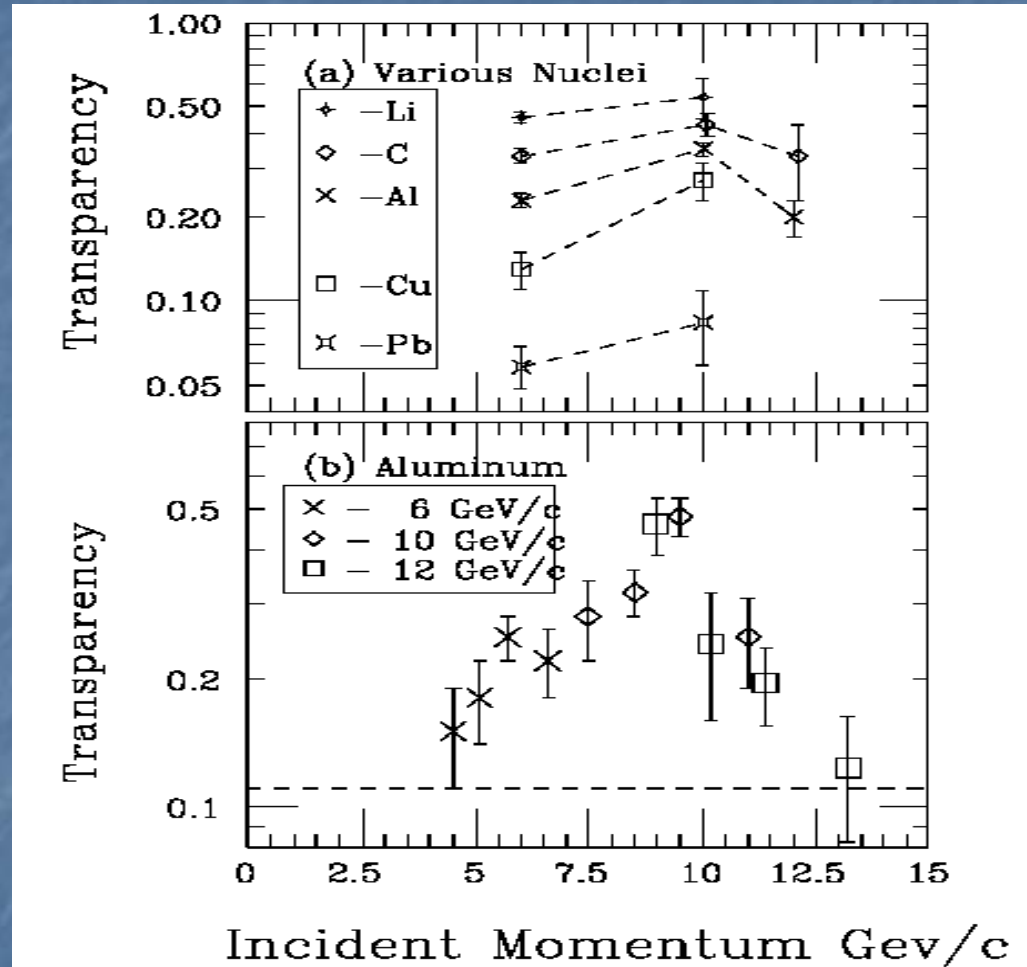
In addition
Color transparency for
Quasielastic pp

From S. Shimansky

$$T = \frac{\frac{d\sigma}{dt}(p + "p" \rightarrow p + p)}{Z \frac{d\sigma}{dt}(p + p \rightarrow p + p)}$$



A.S. Carrol et al., Phys. Rev. Lett. 61, 1698 (1988)
Nuclear Transparency to Large-Angle pp Elastic Scattering



Status of matter for the project

1. Slow extraction for low, 10-30 GeV momenta into ch.8 - **should be initiated**
2. Beam monitoring
 - Intensimeter for extracted ion beam – **should be designed**
 - Profilometers are under construction
 - Luminosity monitor is under development
3. Targets
 - Station for solid targets is under design
 - H2/D2 target is under construction
4. Recoil detectors
 - Trigger is under tests
 - Spectrometer with PC is under tests
 - TOF is under tests
5. Forward detectors (HCAL, ECAL, HF1,2) **are under consideration**
6. DAQ is under development

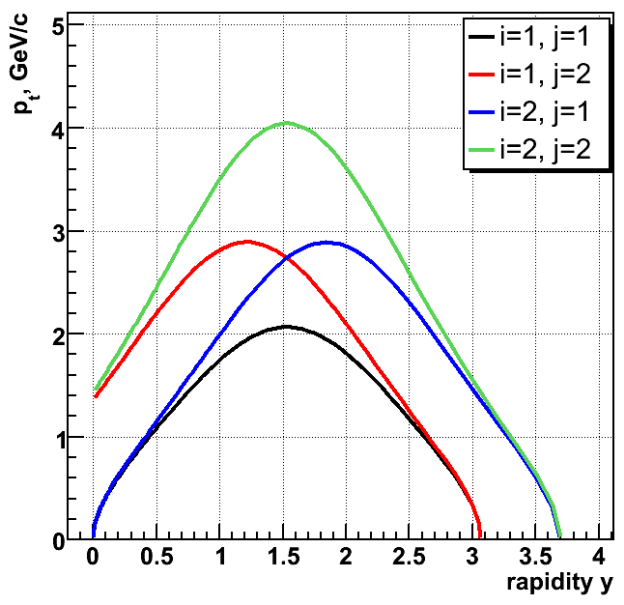
Conclusion

- It is proposed to investigate backward-forward correlations for cumulative particles at high Pt in light ion – nuclear interactions at 10, 20, 30 GeV/A . It is intended to use maximal ion intensity. Selected backward angle of 35° allows to increase cross sections for hard processes compare with 90° c.m. scattering.
- In addition the color transparency can be studied.
- Proposal is under preparation.
- You are welcome to bring new ideas and to participate

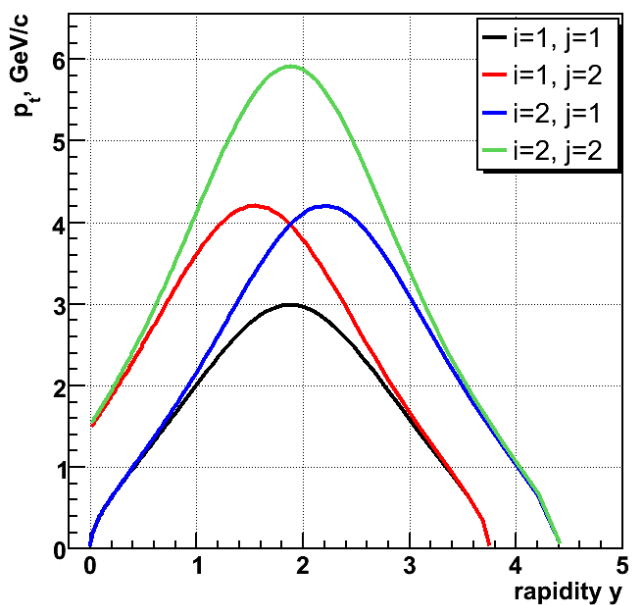
Back up slides

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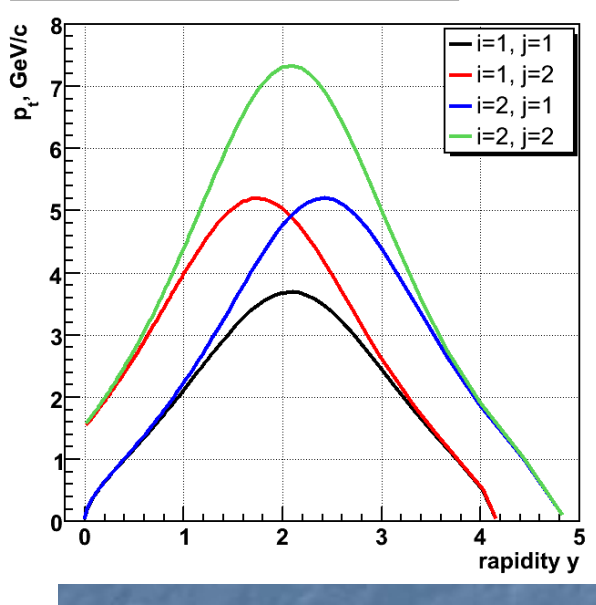
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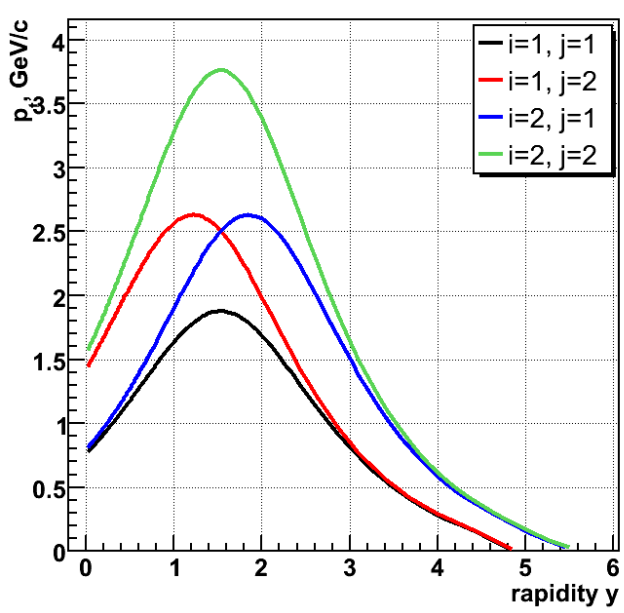
$i \times N + j \times N \rightarrow N + (i+j-1) \times N$, beam - 20 GeV/A



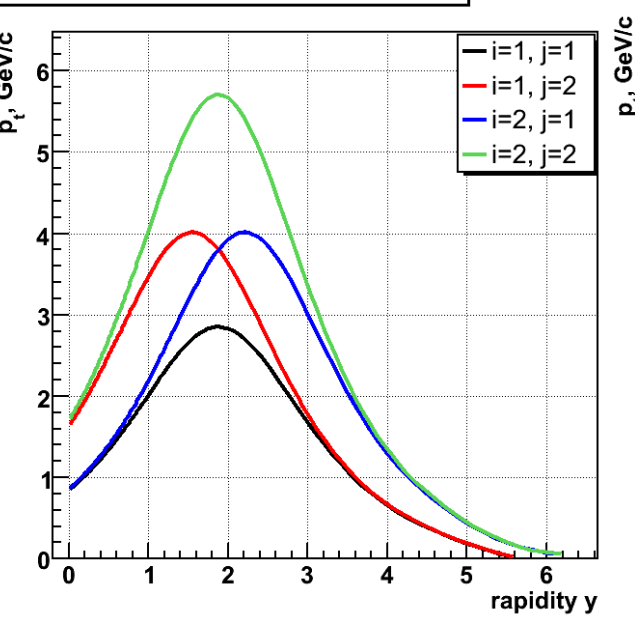
$i \times N + j \times N \rightarrow N + (i+j-1) \times N$, beam - 30 GeV/A



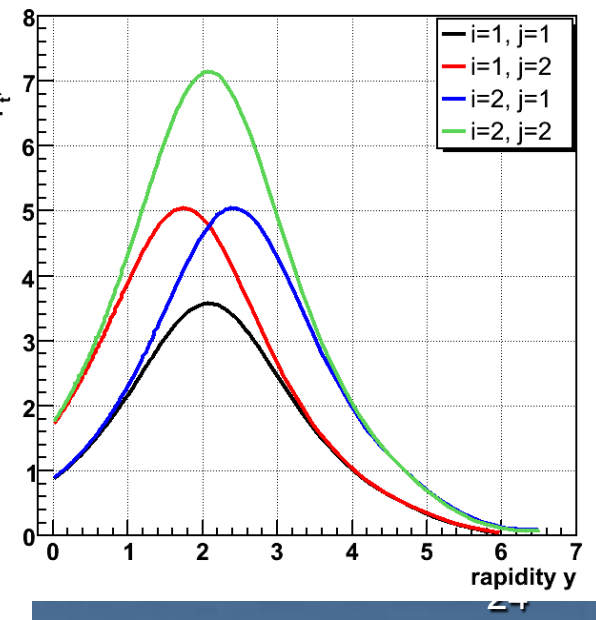
$i \times N + j \times N \rightarrow \pi + (i+j) \times N$, beam - 10 GeV/A



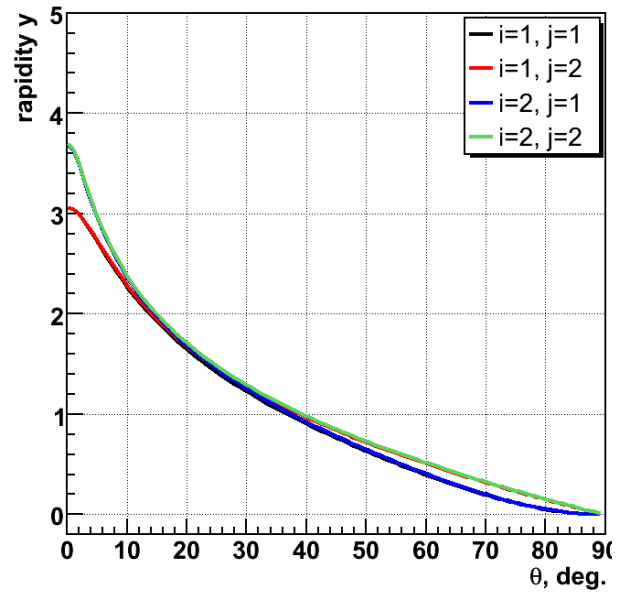
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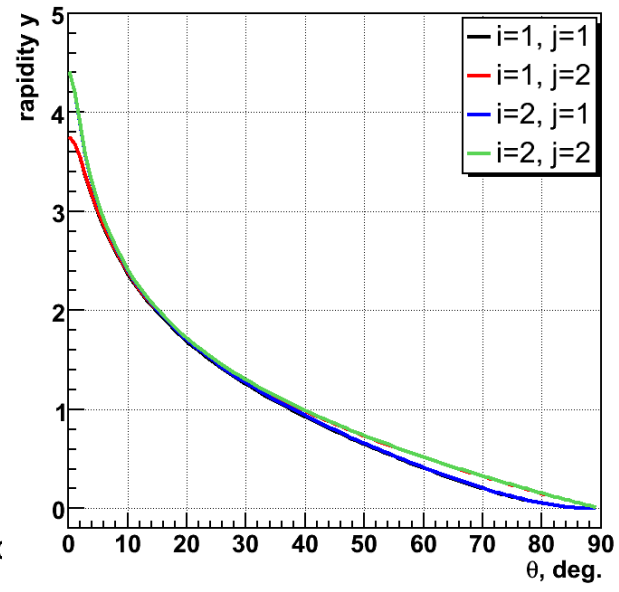
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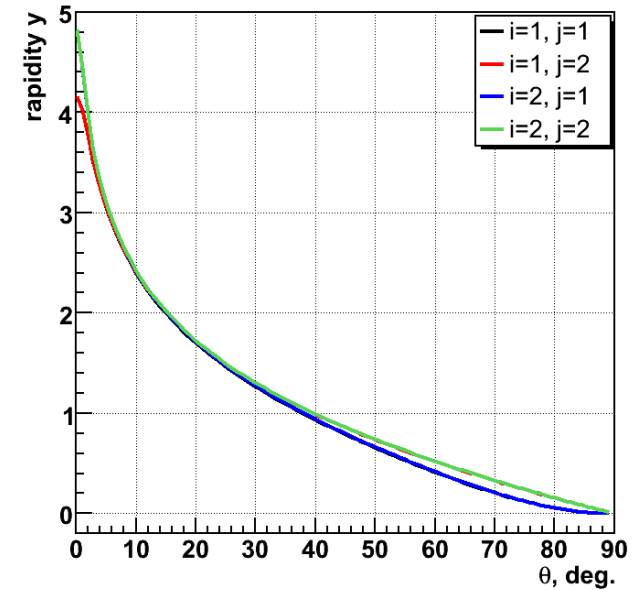
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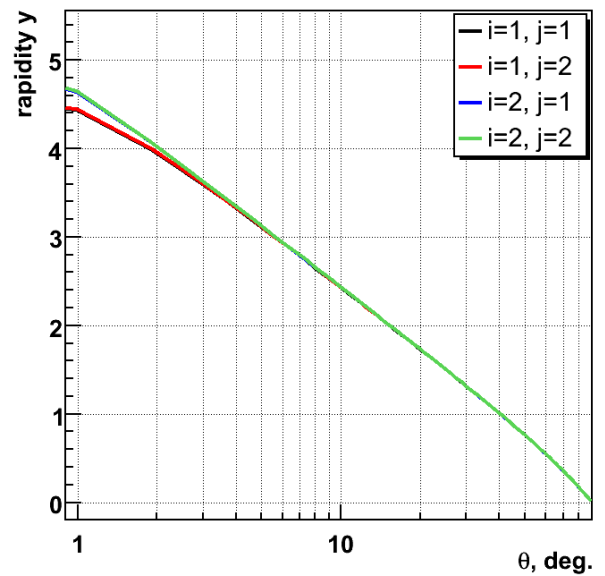
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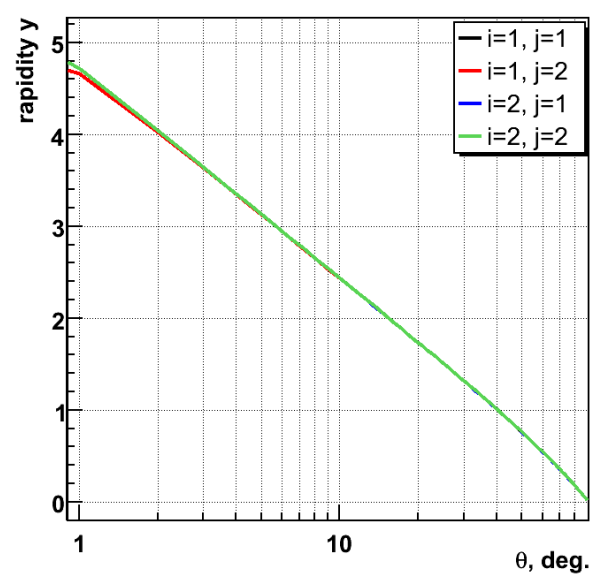
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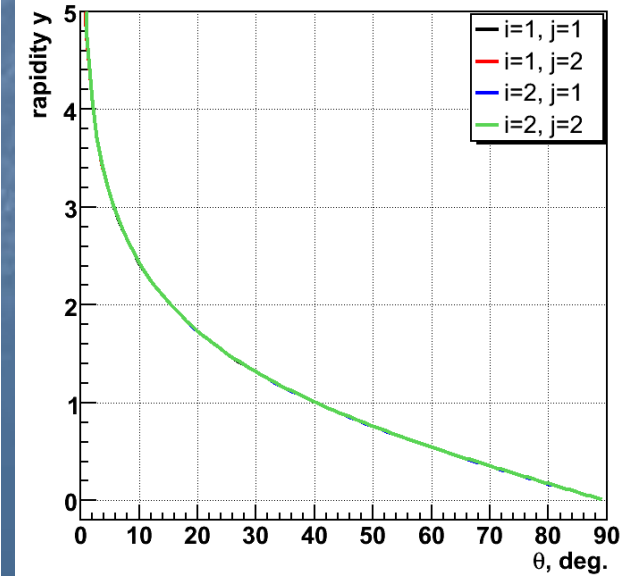
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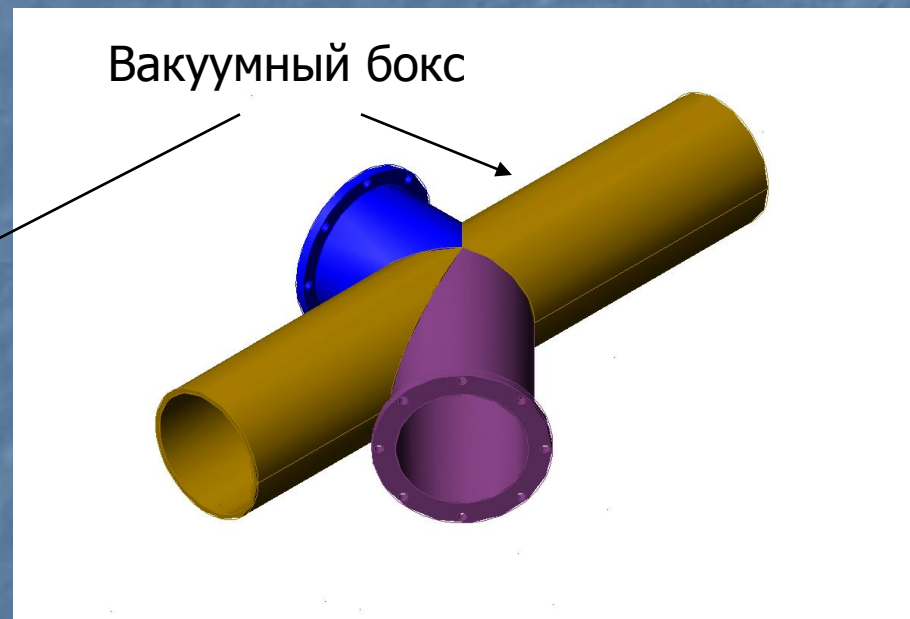
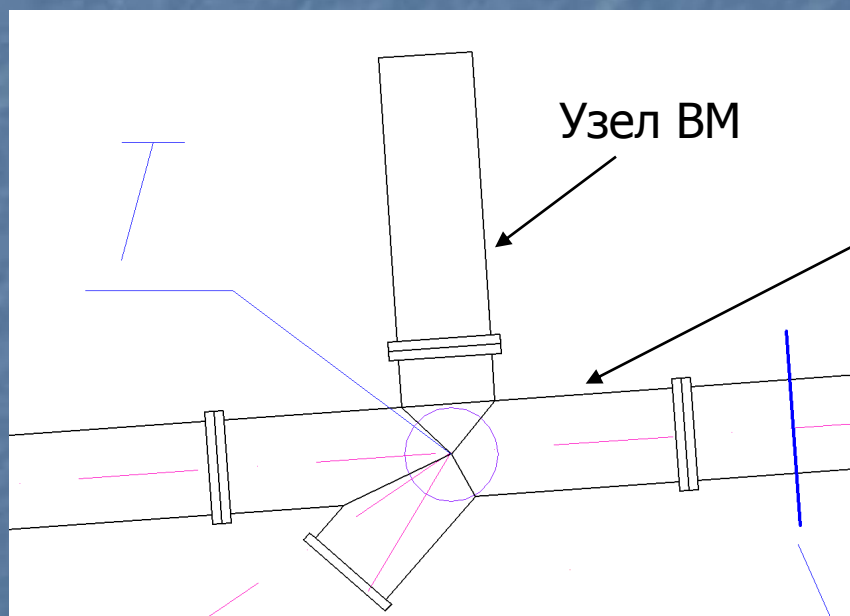


$i \times N + j \times N \rightarrow \pi + (i+j) \times N$, beam - 30 GeV/A



2й потребитель – мишень в вакууме

Узел для ВМ любезно предоставлен ОУ У-70
Еще раз огромное спасибо А.Минченко и Г. Воронину



Использованные мишени

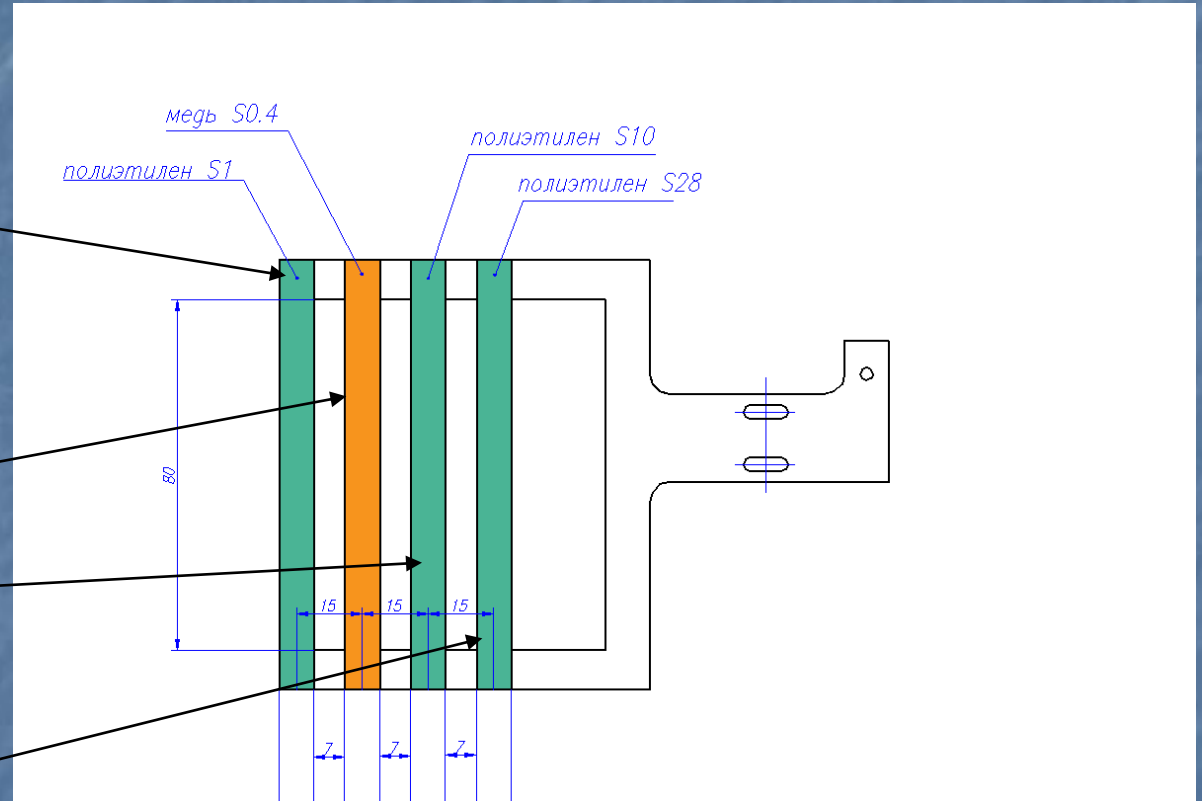
0.1 г/см², ПЭ
Для МВ
5*10**12 пр/сб

Новые для МВ

0.36 г/см², медь

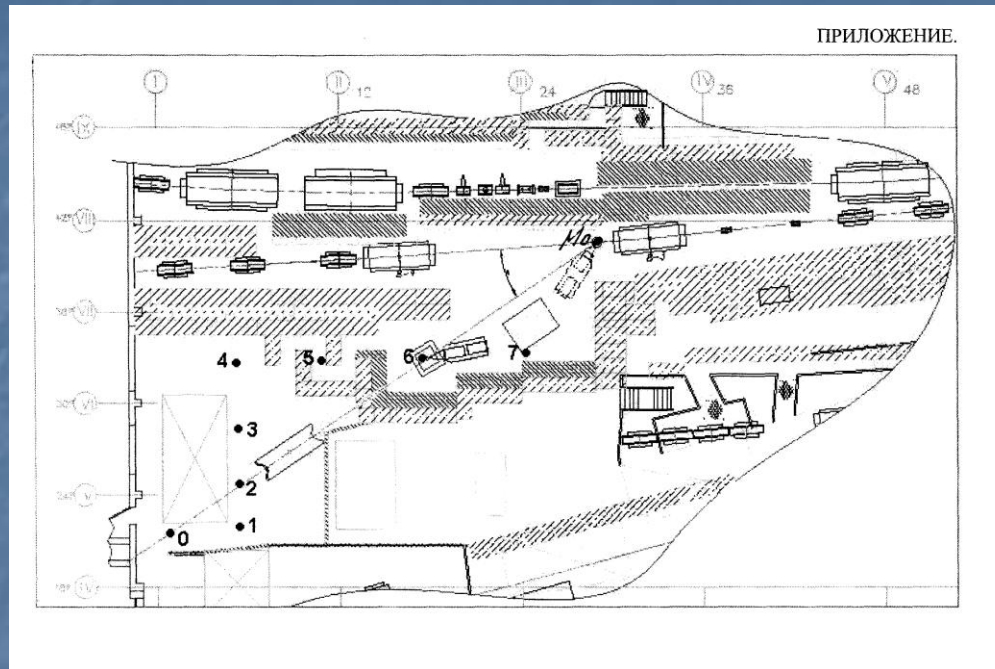
1 г/см², ПЭ

2.8 г/см², ПЭ
Для МВК
3*10**11 пр/сб



V.Ammosov
LINC2008, IHEP - Protvino
20.06.08

Измерения доз обстановки



| вывод | интенсивность | мишень, г/см ² | Мощ дозы, мкзв/час точка 3 |
|-------|---------------|------------------------------|-------------------------------|
| МВ | 0.9*10**12 | 1, ПЭ | 8.5 |
| МВ | 0.9*10**12 | 0.36, медь | 2.5 |

Возможно еще повысить
в 2 раза или Ir или г/см²

Схема установки

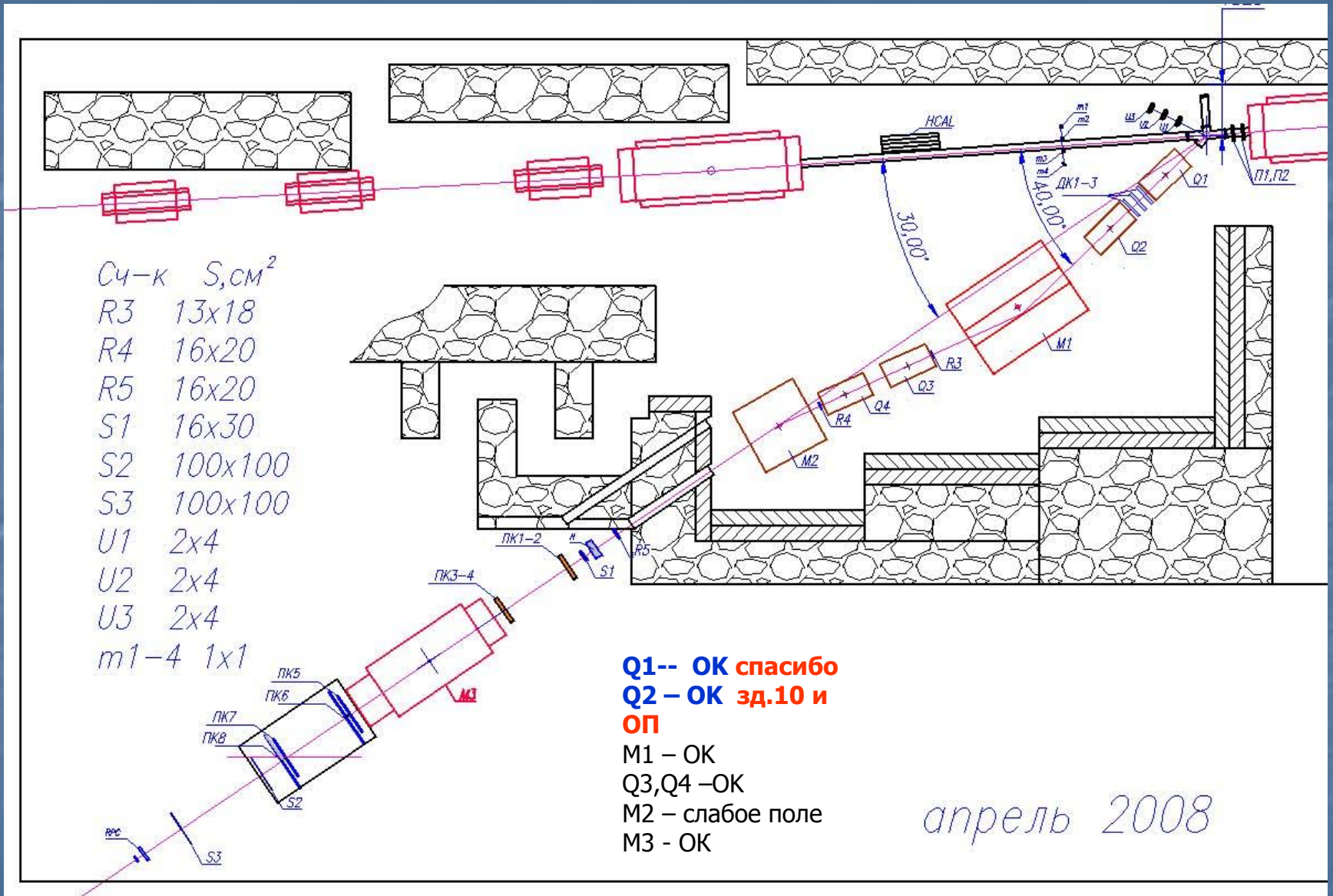
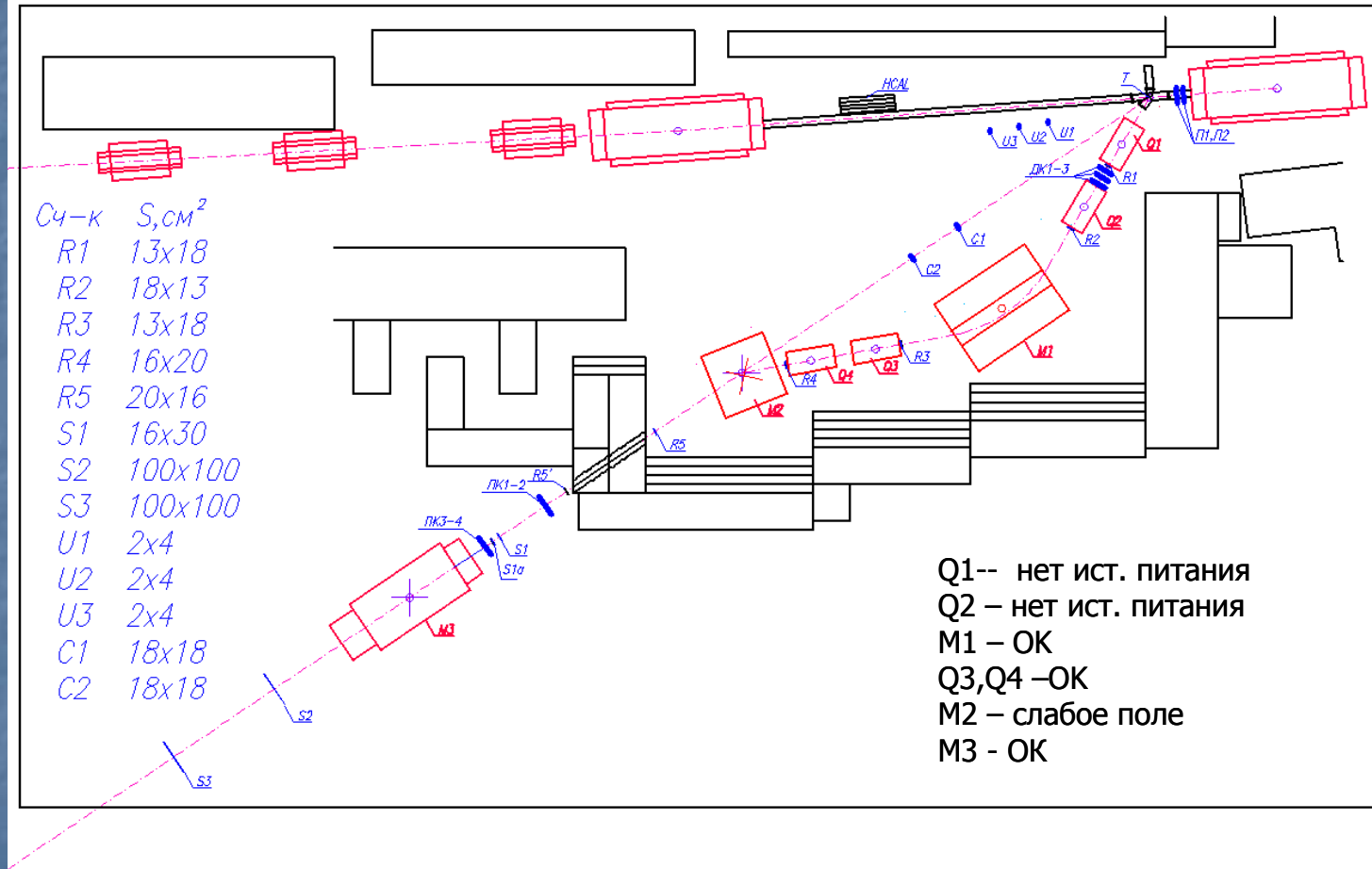


Схема установки в ноябре 2007

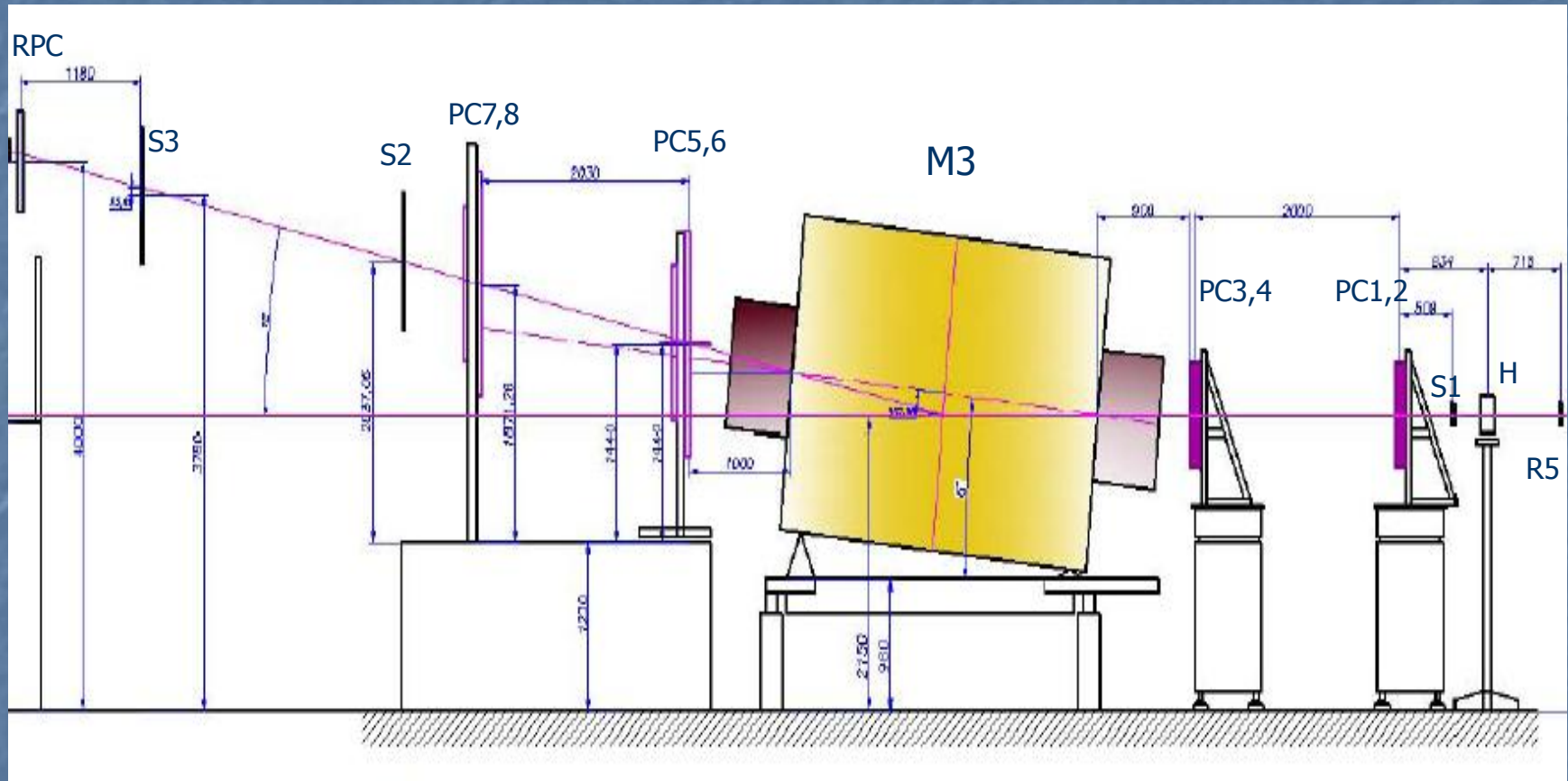


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Спектрометр установки



Trigger R5*S1*S2*S3

V.Ammosov

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20.06.08

Мониторирование протонного пучка

- **Интенсивность р пучка – сырая инфо от СВ**

(**спасибо лаб. Терехова !**)

- **Положение пучка для МВК- по сайту У70**

- **Положение пучка для МВ – сайт ОЭА/ОП ?**

Наводили пучок на мишень – перемещая ее без глаз

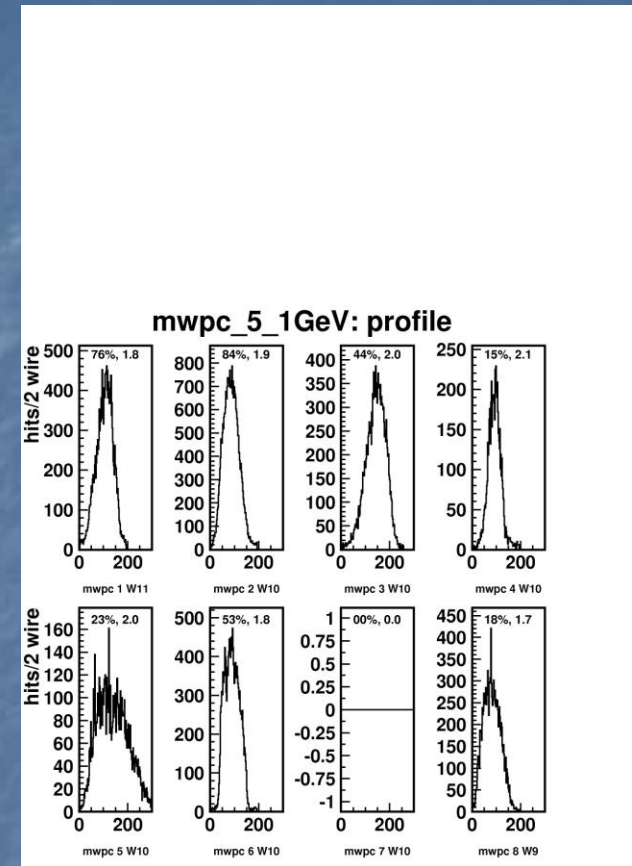
Надо иметь сырую инфо с профилометров на прямую

Отладка детекторов

Проп камеры

Маленькая эфф. на проп камерах

Профили на проп камерах →



Отладка детекторов

Время пролета

$$\Delta T = T_{\text{стоп}} - T_{\text{старт}} \quad \rightarrow$$

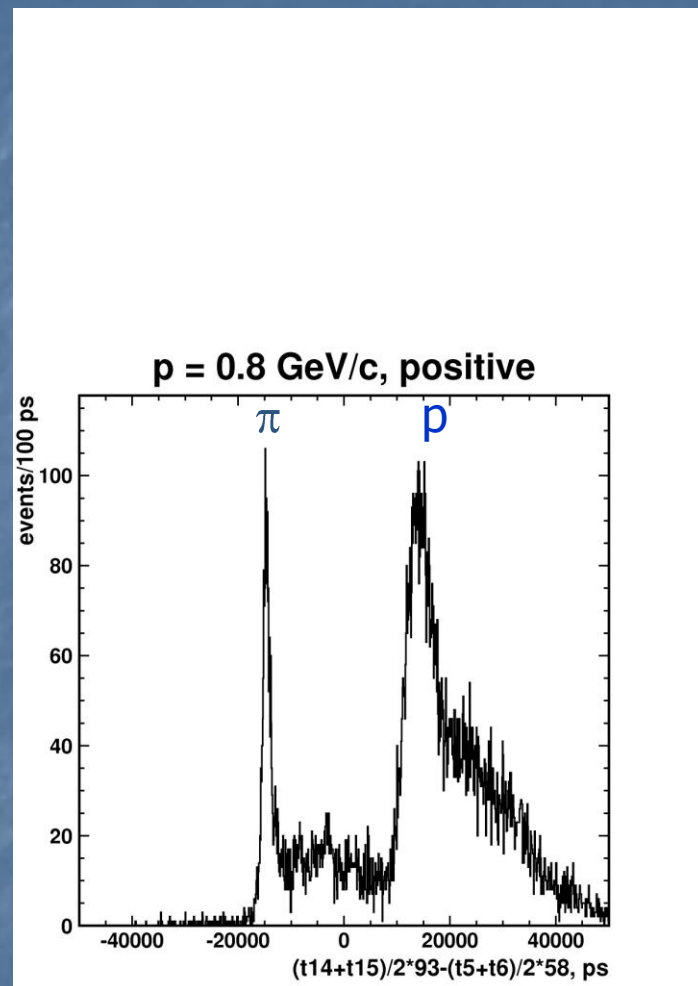
$T_{\text{стоп}}$ - по РПК

$T_{\text{старт}}$ - по сц. годоскопу

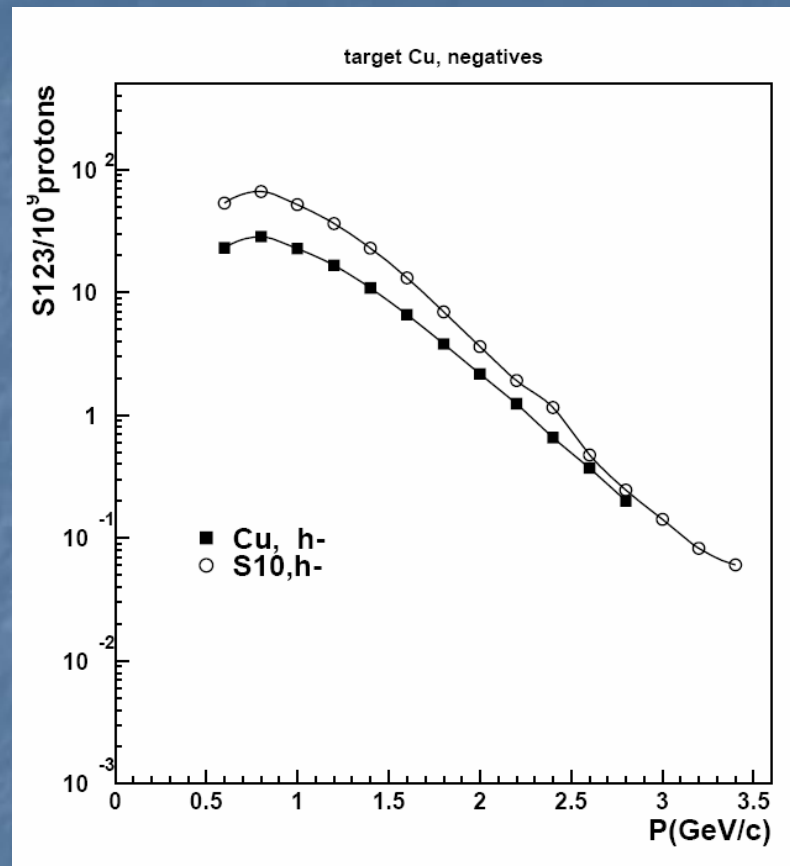
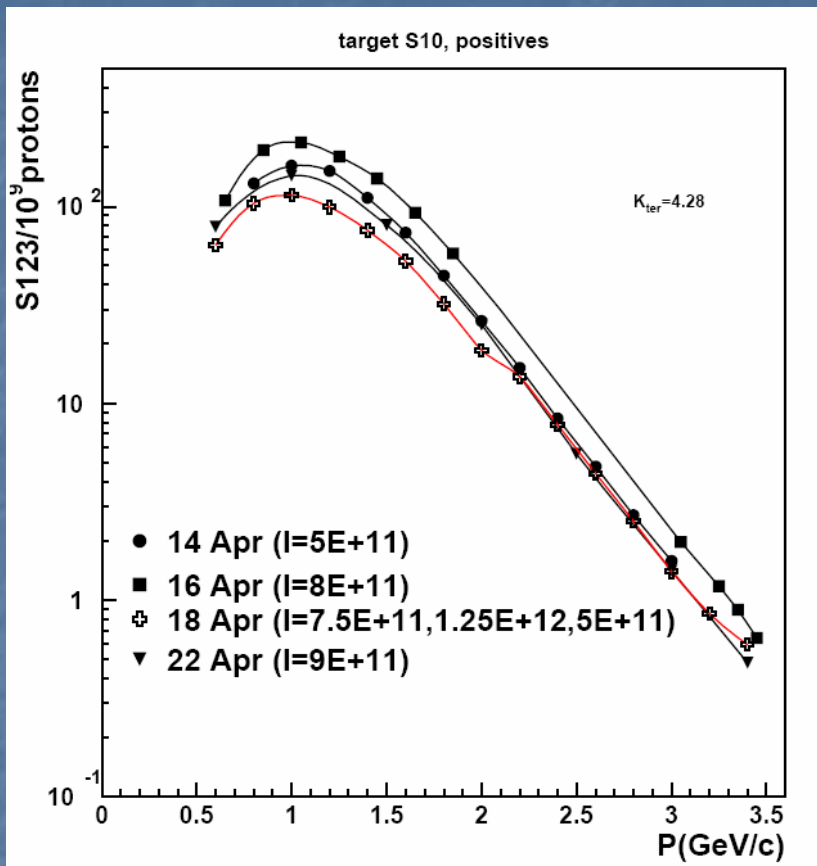
$$\sigma_{\Delta T} \sim 300 \text{ псек}$$

$$\sigma_{T_{\text{стоп}}} \sim 260 \text{ псек} \quad \left| \begin{array}{l} \text{без амплитудной} \\ \text{коррекции} \end{array} \right.$$

$$\sigma_{T_{\text{старт}}} \sim 150 \text{ псек} \quad \left| \begin{array}{l} \text{коррекции} \end{array} \right.$$



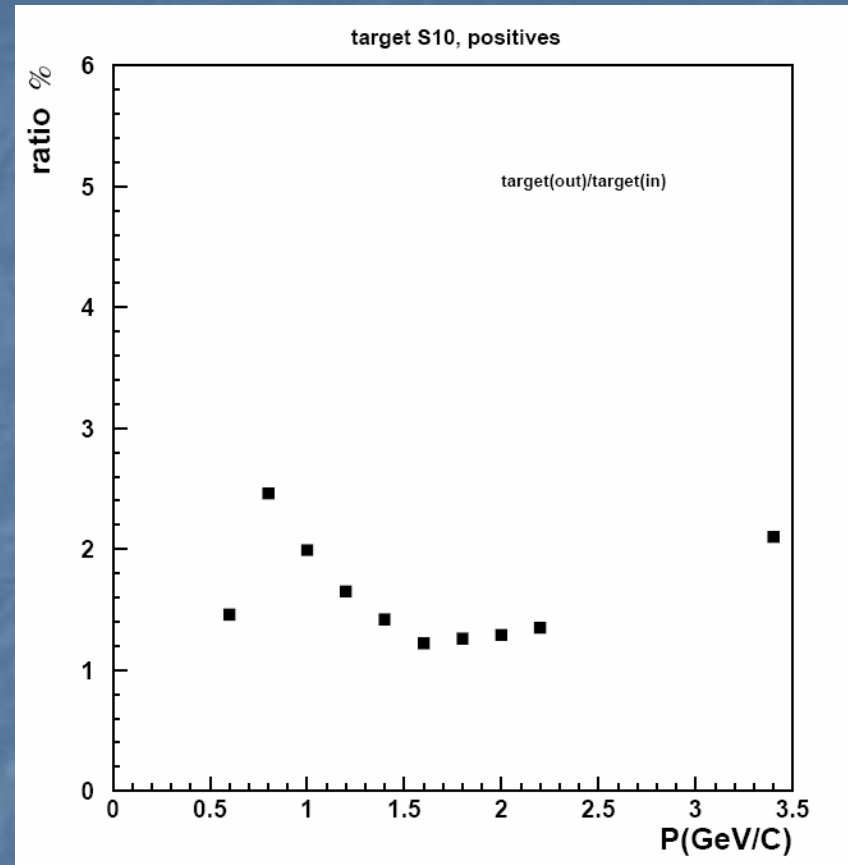
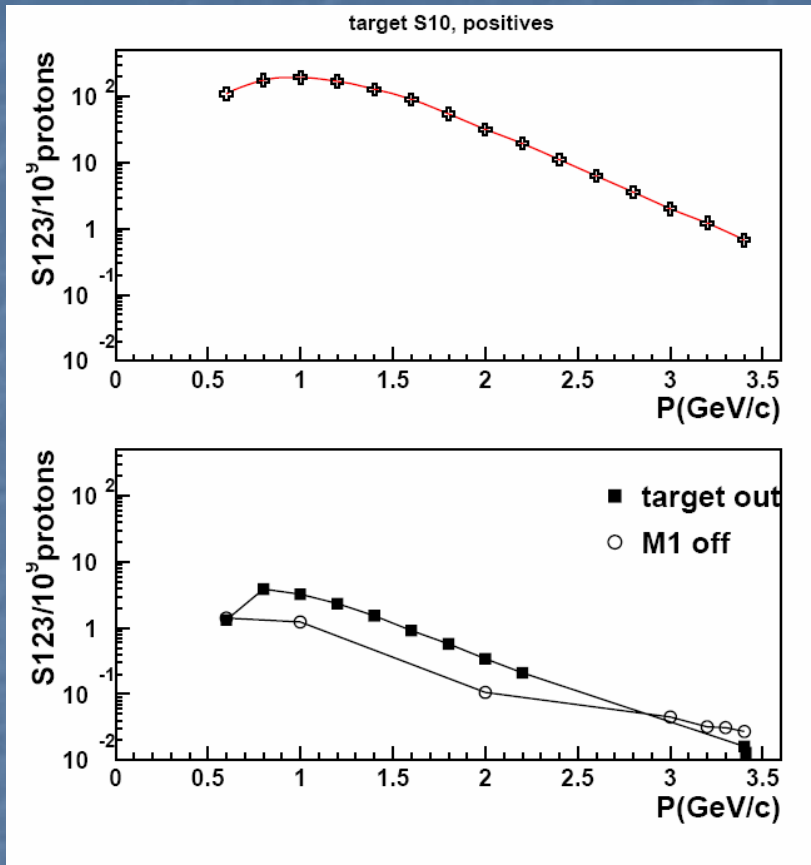
Выходы частиц



Разброс связан
с наводкой на мишень

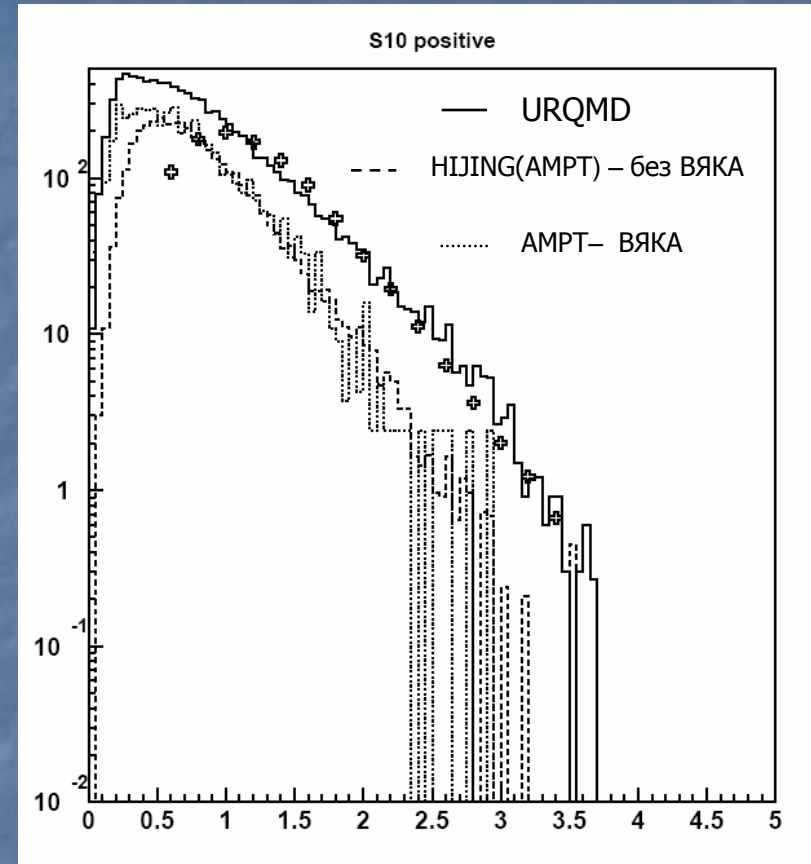
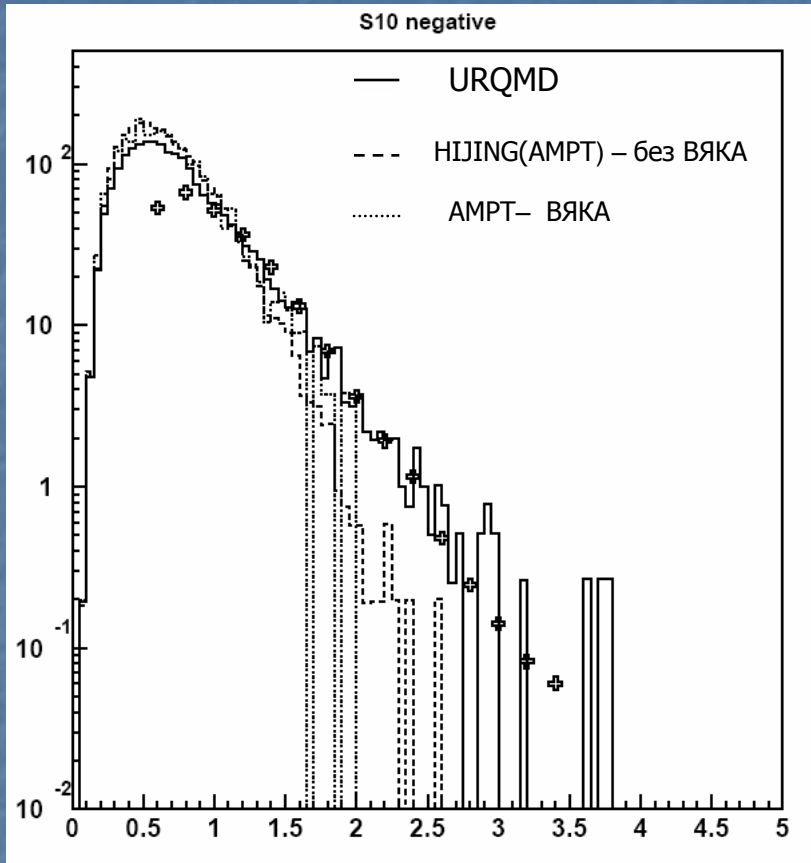
Спектры на ПЭ мягче ?

Выходы частиц

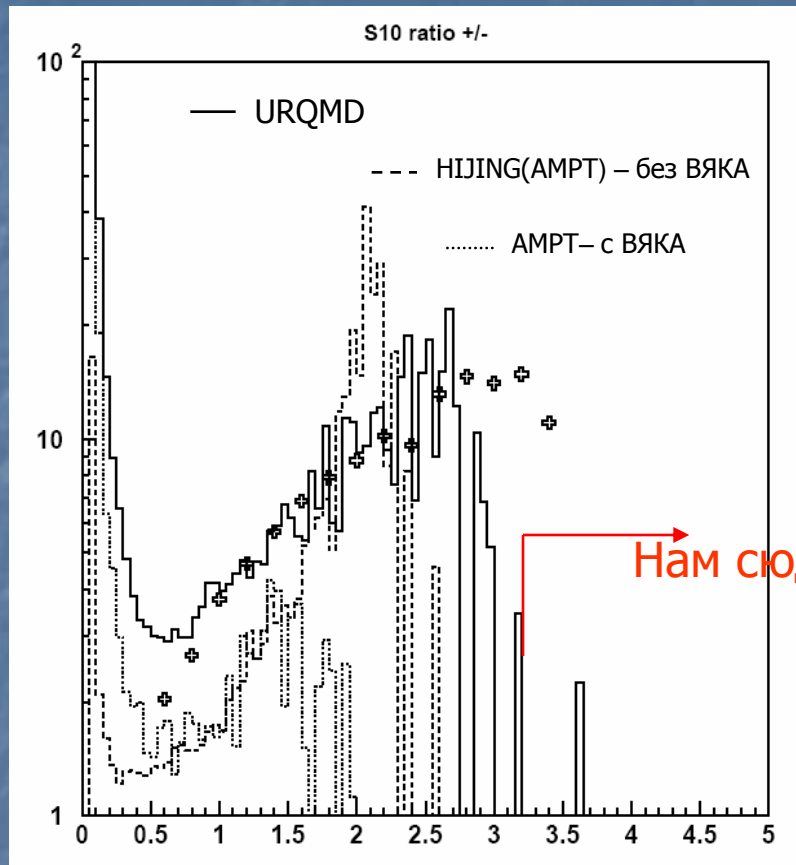


Фоны в области 0.6-3.5 ГэВ составляют (1-2)%

Выходы частиц: сравнение с МК



Выходы частиц: сравнение с МК



Заключение

Выводы

- режим работы СПИН совместно с МВК и МВ **реализуем** при «светимостях» вплоть до **10^{12} пр.г/см²**
- **фон** в плече отдачи при угле 40° **составляет (1-2)%** в диапазоне импульсов **(0.6-3.5) ГэВ** при всех работающих МОЭ
- такой режим может быть использован для измерения выходов частиц при работе СПИНа с 1м приоритетом

(По) Желания

- усилить М2, починить М3
- автоматизация переключения МОЭ
- передняя станция профилометров с авт. сч. (2с 2008), **ЛДП ОУ-У70**
задняя станция профилометров с авт. сч. (2с 2009)
- измерение инклюзива (+и -) со спектрометром и временем пролета во 2м сеансе 2008 года

Под каким углом работать ?

