DIS 2000
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Proposal for a Very Forward Proton Spectrometer in H1 after 2000

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H1 Collaboration

Proposal for Installation of a Very Forward Proton Spectrometer in H1 after 2000

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Physics Motivation

Diffractive Physics : Present Status

- strong interest
- understanding in terms of QCD
- first "generation" of results (soft/hard transition, g dominance, DGLAP consistency,...)

But limitations:

- selection based on rapidity gap and not tagged scattered proton
- low statistics
- limited $|t|$ measurement, no ϕ measurement

Possibilities offered by the Future

- HERA 2000 - high Luminosity regime
- Major upgrade of the H1 detector
- clean diffractive selection by tagging of the scattered p (elastic/dissociated p separation)
- take advantage of the statistics increase after 2000 (high PS acceptance)
- efficient diffractive trigger

$\rightarrow$ Need of a PS with high acceptance, small $|t|$ and small $x_{I\!P}$

Diffractive Physics Topics

Tagging and measurement of the scattered proton

⇒ Separation of elastic and dissociated p

- "Clean" measurement of diffraction
  - So far (except FPS): $M_Y \leq 1.6$ GeV
  - contamination of at least 10% of dissociated p
  - so far assumed factorisation, i.e. independence of the Y state

Open Charm production

- direct access to the pomeron gluon content (BGF)

assuming 80% efficiency for PS in 2003-2005:

years	until '97	until '99	2003-2005
Lumi (pb^{-1})	21	≈55	≈350
Nb. of events	38	≈100	≈650

High E_T Jets

- important test of the gluon in the IP to discriminate between BGF and 2 gluons models.
- about 35000 events expected ($Q^2 > 4\ GeV^2$)
- enough statistic to measure the **resolved** photon contribution (gap survival probability)

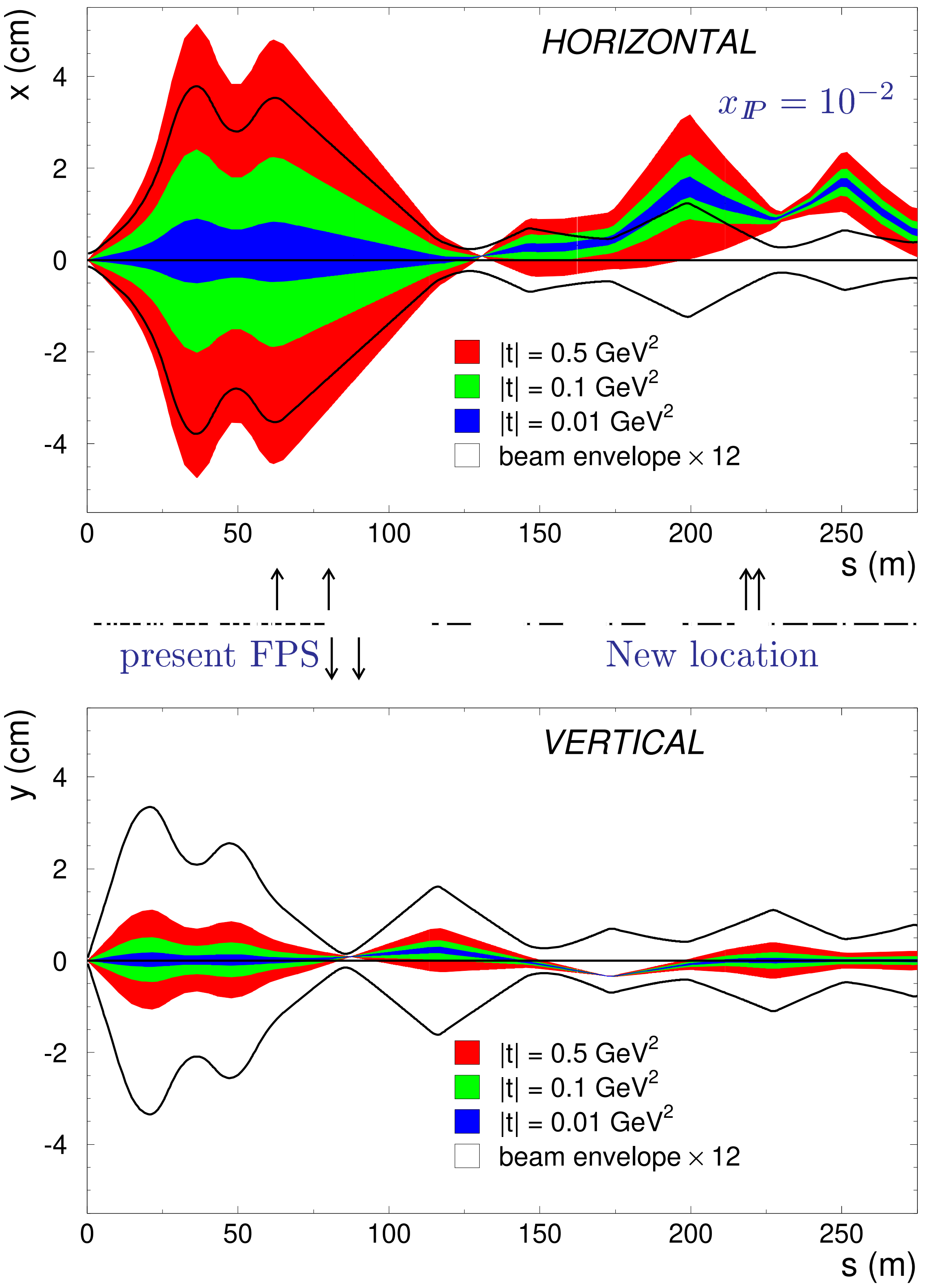
Inclusive Measurements

- $F_2^{D(4)}(\beta, Q^2, x_{I\!P}, t)$
- first estimate of σ_L^D by ϕ measurment (QCD: dominating at large β - indication of higher twist presence in global fits)

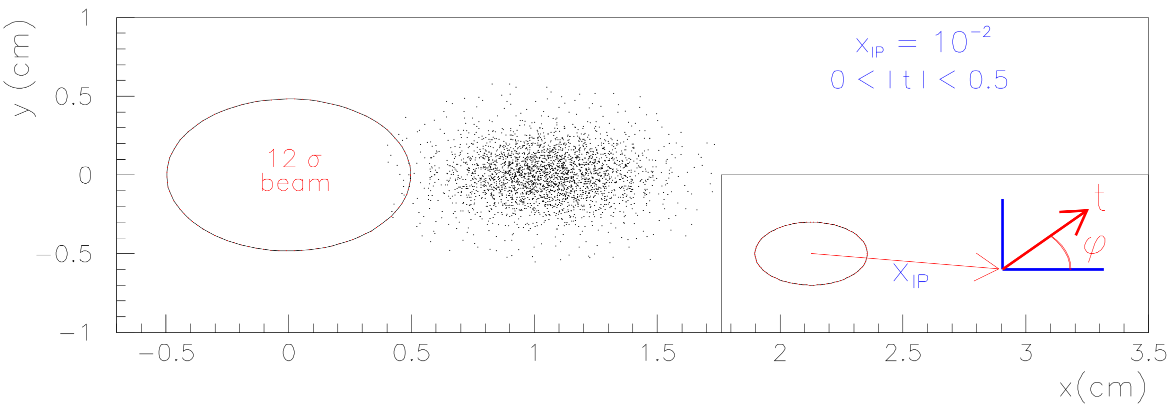
Single and Double Dissotiation

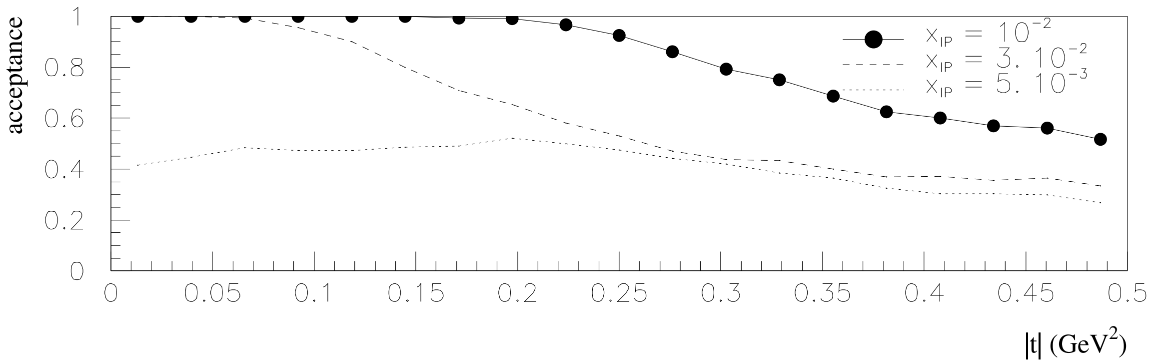
- factorisation breaking, i.e. indep. of the Y state (breaking expected in QCD)
- Shrinkage (Regge / QCD)

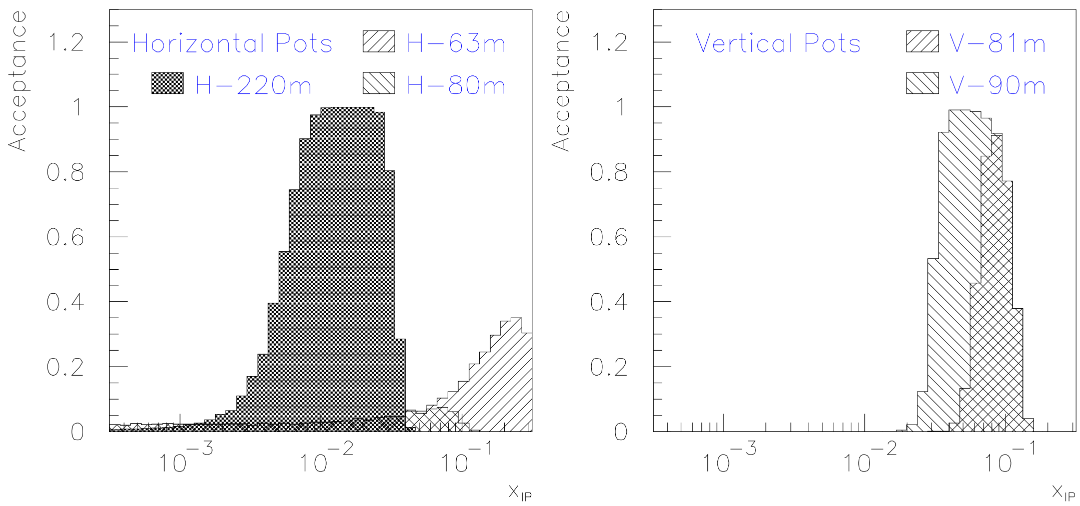
New Roman Pot Location



220 m Roman Pot Acceptance







$\Rightarrow$ Acceptance $(> 80\%)$: $5.10^{-3} < x_{I\!P} <\sim 3.10^{-2}$

$0 < |t| <\sim 0.5$ GeV^2

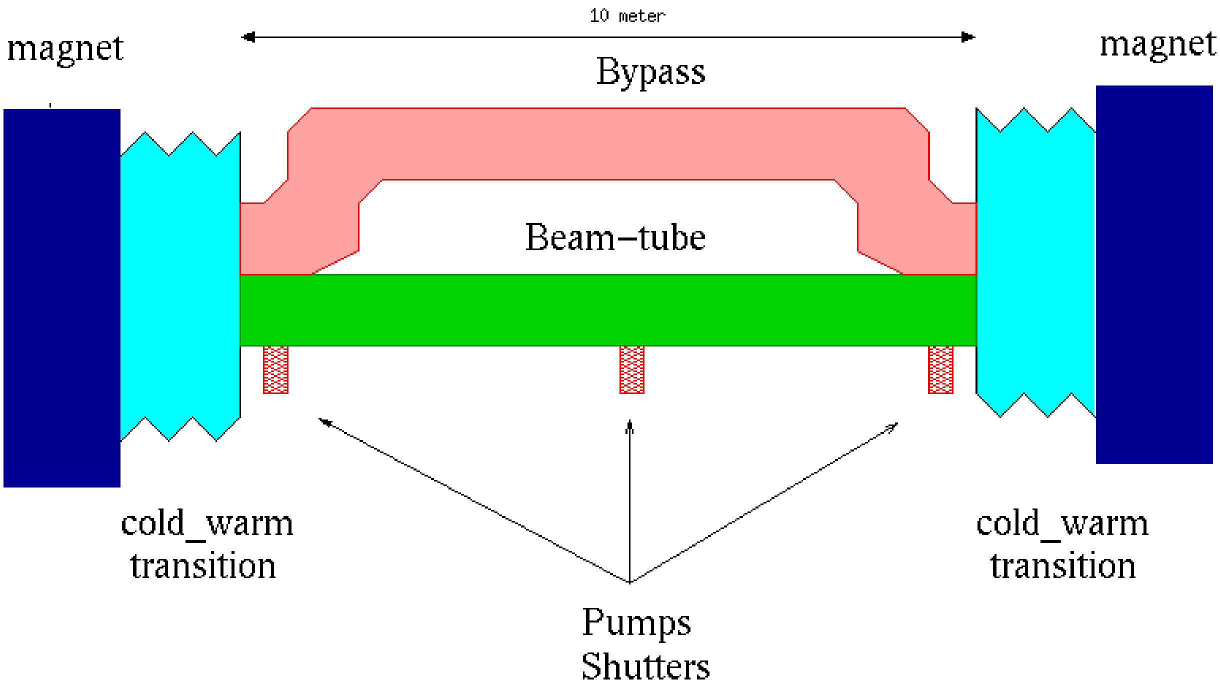
Modification of the Beam Line

In the Cold Section (HPNL-220):

⇒ modification of a 10 m segment:

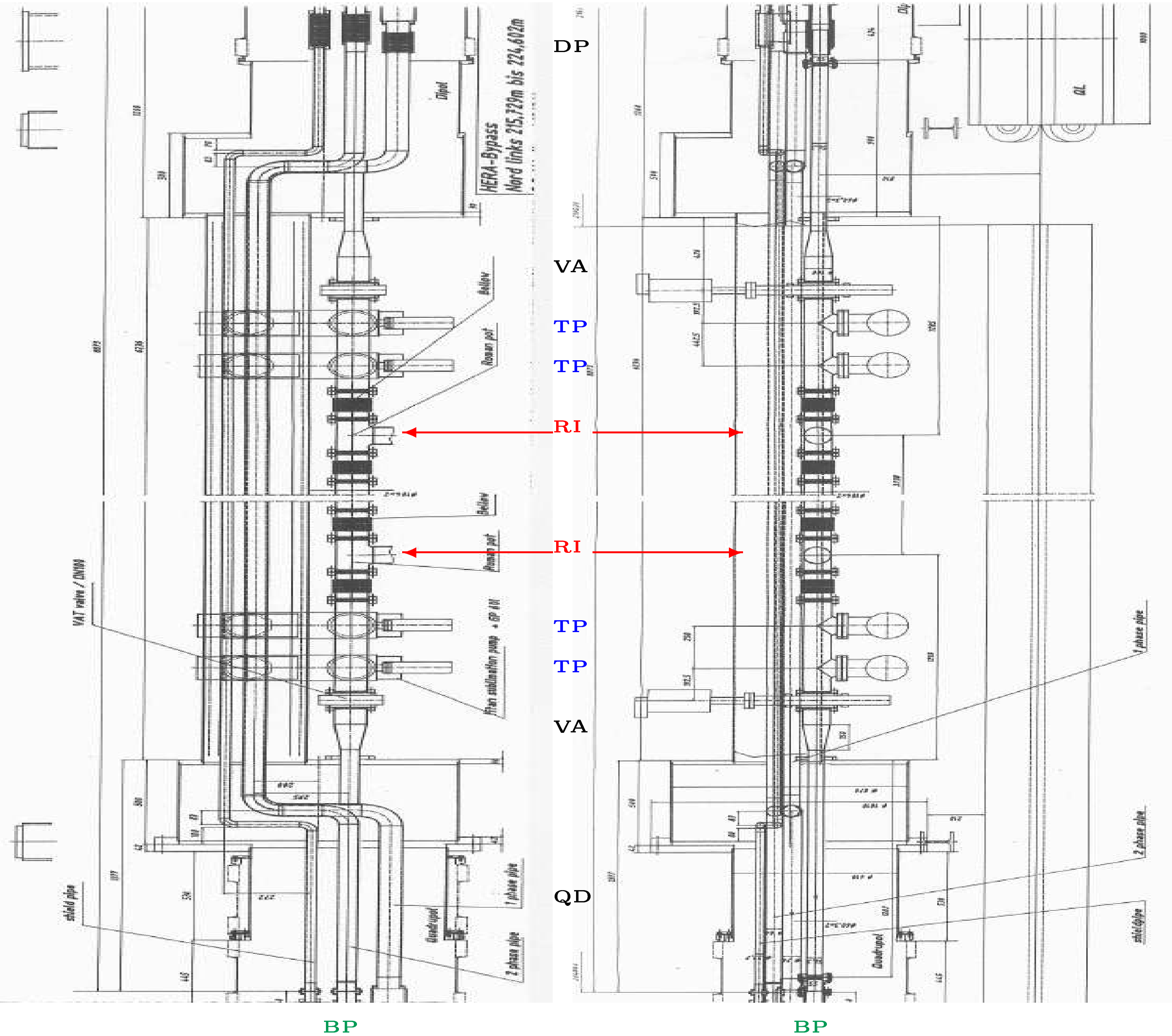
- (horizontal) bypass for the Helium
- new (warm) beam pipe

Sketch of Cold Bypass



VFPS Beam Pipe/Cold Bypass
220 m NL

Horizontal view **Vertical view**



TP = Ti pumps
RI = Roman Pot Insert
DP = Dipole Magnet
QD = Quadrupole Magnet
VA = Shutter Valves
BP = Beam Pipe

Detector and Resolution

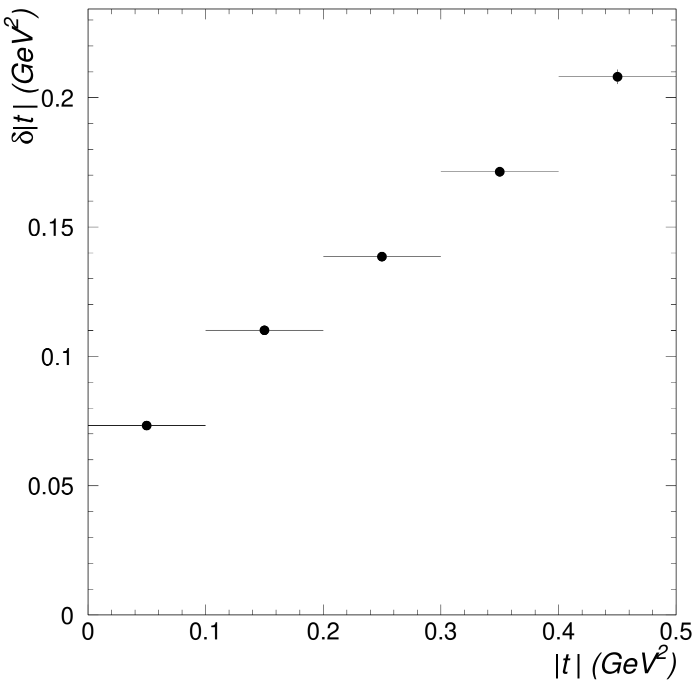
- Two Roman Pots equiped of two detectors each

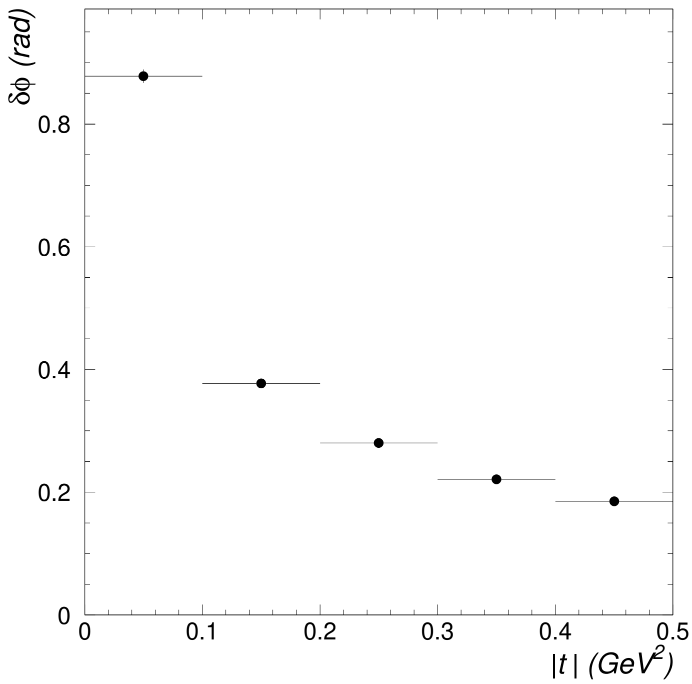
$$(x, y, x', y') \rightarrow t, x_{I\!P}, \phi$$

$x_{I\!P}$ can also be measured in the main detector (20% uncertainty)

- Detectors: Scintillating fiber similar to the present FPS detector.

- Resolution: spacial detector resolution: 100 μm x 100 μm
  $\Delta x_{I\!P} = 7.10^{-4}$ indep. of t (beam spread)





$\Rightarrow$ 4-5 bins in t
5-6 bins in ϕ

Conclusion

- Roman Pots with a large acceptance down to smallest $|t|$ values would provide a decisive improvement of measurements in diffraction compared to first "generation" results
- Location around 220 m provides the conditions for high acceptance for small $x_{I\!P}$ and $0 < |t| < 0.5$ GeV^2
- On top of p tagging, $|t|$ can be measured in 4-5 bins and ϕ in 5-6 bins
- Installation of Roman Pots in this part of the cold region is delicate but feasible
- Installation during shutdown 2001-2002
- Good data taking starting in 2003