$2002 \leq$ COMPASS < 2005

- Physics objectives for μ program with present setup.
  Initial (reduced) $\Rightarrow$ modified

- $\delta(\frac{\Delta g}{g})$ (D^0, D^*) expectation for 2002 setup.

- 2002: "figure of Merit"

  1. SPS, Spectrometer, DAQ ...
  2. Tracking efficiency ?
  3. PID efficiency ?

- $\delta(\frac{\Delta g}{g})$ reality vs expectation

  1. from D^0, D^*
  2. from high P_T

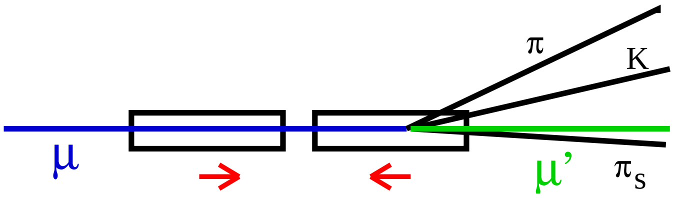
- h_1

- g_1, etc ...

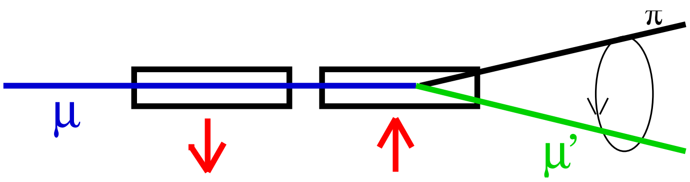
- PROSPECTS and ... HANDICAPS

Physics objectives μ program

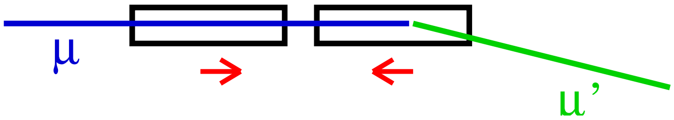
$\frac{\Delta g}{g}$ from D^0, D^*, high P_T



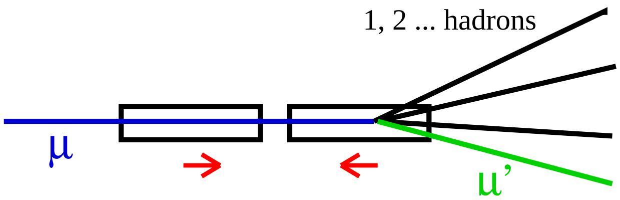
h_1



g_1



$\Delta\vec{q}$



Evaluation of $\frac{\Delta g}{g}$ for D^0 and D^* channels

(Jean Marc Le Goff COMPASS note 2002-02)

- PGF: $\gamma + g \longrightarrow q + \bar{q} \longrightarrow D^0 \longrightarrow K\pi$
  $D^* \longrightarrow D^0\pi_s \longrightarrow K\pi\pi_s$

- $A = \dfrac{N^{\uparrow\downarrow} - N^{\uparrow\uparrow}}{N^{\uparrow\downarrow} + N^{\uparrow\uparrow}}$

- $\Delta g/g = \dfrac{(1 + B/S)}{P_\mu P_T f < a_{LL} >} A$

- Weight each event with $w = \dfrac{< a_{LL} >}{(1 + B/S)}$

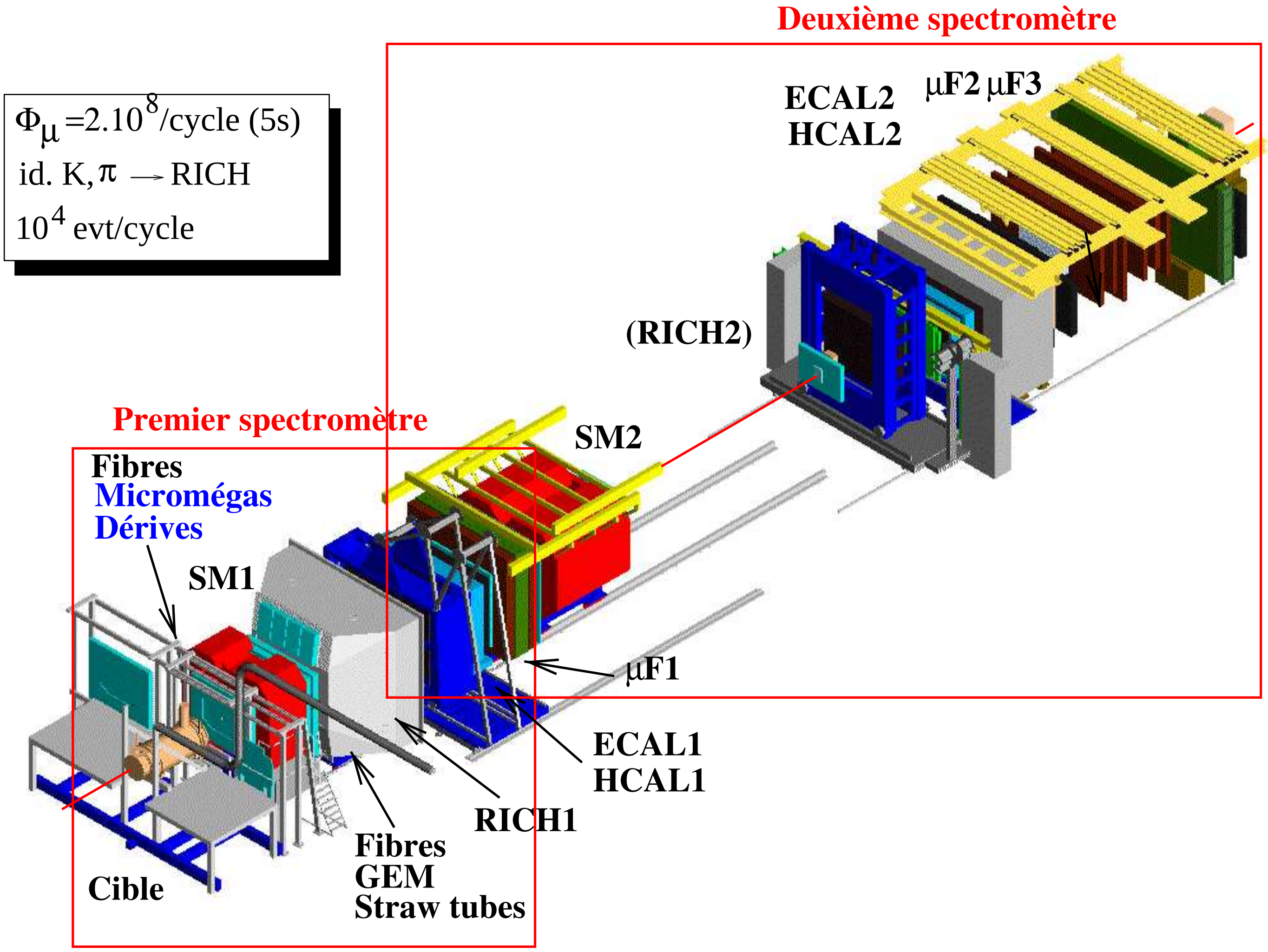
- $\Delta g/g = (\dfrac{1}{P_T P_\mu f}) \dfrac{(\Sigma_i^{\uparrow\downarrow} w_i - \Sigma_i^{\uparrow\uparrow} w_i)}{(\Sigma_i^{\uparrow\downarrow} w_i^2 + \Sigma_i^{\uparrow\uparrow} w_i^2)}$

- $\delta \left(\frac{\Delta g}{g}\right) = \frac{1}{P_T P_\mu f \sqrt{\Sigma_i^{\uparrow\downarrow} w^2 + \Sigma_i^{\uparrow\uparrow} w^2)}}$

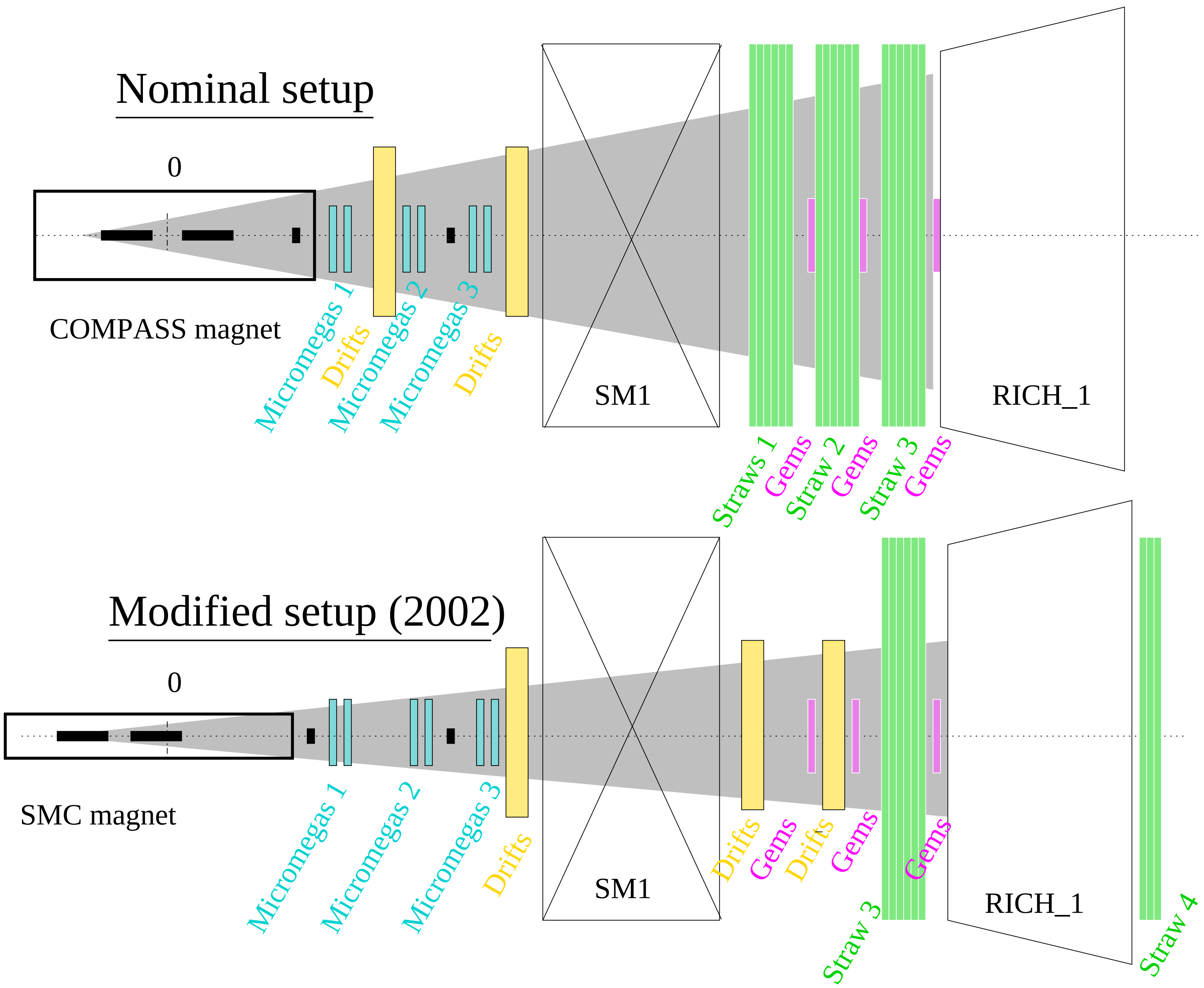
$S \Rightarrow D^{(0/*)}$: (Aroma 2.4/GRV98), $B \Rightarrow$: (Pythia 6.1/GRV94)

Kinematical cuts, $\cos\theta^*$ and z_D, realistic $\sigma M_{D^0} = 17.5$ MeV, $\sigma \Delta M_{D^0/D^*} = 3.83$ MeV at 160 Gev

COMPASS spectrometer



Modified 1st spectrometer



$\frac{\Delta g}{g}$ 2002 setup vs PROPOSAL

- Reduction of Acceptance
  1. OIS magnet $\approx$ (250 mrd) $\Rightarrow$ SMC magnet $\approx$ (100 mrd)
  2. Large Area Tracking (1st Spectro)
     Straws $\approx 2.7 \times 3.2$ m $\Rightarrow$ DCs $\approx 1.2 \times 1.2$ m + Straws

- Realistic $D^{0/*}$ mass resolution
  1. $\delta M(D^0) \Rightarrow 10$ MeV $\Rightarrow 17$ MeV
  2. $\delta M(D^*) \Rightarrow 2.5$ MeV $\Rightarrow 3.8$ MeV

- Attemps to "compensate"
  1. $E_\mu 100 \longrightarrow 160$ GeV
  2. "Weighting method" to calculate A

$\delta(\frac{\Delta g}{g})$ (D^0, D^*) 2002 setup vs PROPOSAL

Statistical resolution on $\Delta g/g$, for $D^{0,*}$

100 days, $2 \times 10^8 \mu$/spill ($E_\mu \leq 160$ GeV)

$\epsilon_{OVERALL} = 25\% \Rightarrow \boxed{25 \text{ days}_{100\%}}$

	D^0		
E_μ GeV	100	160	190
Proposal	$\boxed{0.31}$		
OIS	0.30	0.22	0.25
SMC	0.38	0.24	0.26
Straws + 3DCs	0.39	$\boxed{0.24}$	0.26

	D^*		
E_μ GeV	100	160	190
Proposal	$\boxed{0.26}$		
OIS	0.25	0.20	0.24
SMC	0.31	0.22	0.25
Straws + 3DCs	0.32	$\boxed{0.23}$	0.26

Reduction in acceptance, plus degradation in δM_{D^0} more than compensated by $100 \Rightarrow 160$ GeV and event weighting

“Effective” data taking: PROPOSAL vs 2002

- PROPOSAL:
  1st part $(\frac{\Delta g}{g})$, ^6LiD Assumed 1.5 year and $\boxed{150_{SPS} \text{ days/year}}$
  $\epsilon_{OVERALL} = \boxed{25\%}$
  $\epsilon_{OVERALL\_SMC} \approx 4\%$
  $1.5 \times (150 - 20_{setup}) \times 0.25 = 49 \text{ days}_{100\%}$

- 2002 data taking
  $112_{SPS} \longrightarrow 76_{DATA\_TAKING} = 57_L + 19_T$ days
  $\epsilon_{SPS+Spectro} = 0.59$

  $\epsilon_{TRACKING} > 0.10 \pm (?)$
  (First estimate $D^0(\mu\mu', 2\ h)$ C. Bernet, S. Panebianco)

  $\epsilon_{OVERALL} > \boxed{6\%}$
  $57 \times 0.06 \approx 3.4$ days $\Leftarrow$ L
  $19 \times 0.06 \approx 1.1$ days $\Leftarrow$ T

- Including RICH
  $\epsilon_{RICH}??$
  $\epsilon_{OVERALL\_RICH} \approx \boxed{??\%}$

$\delta(\frac{\Delta g}{g})$ (D^0, D^*) "realistic" from 2002

For 25 $\text{days}_{100\%}$

$D^0 \Rightarrow \delta(\Delta g/g) = \boxed{0.24}$

$D^* \Rightarrow \delta(\Delta g/g) = \boxed{0.23} \Rightarrow$ (without RICH) $= \boxed{0.40}$

2002 "optimistic"

	$\epsilon_{TRACKING}$	ϵ_{PID}	$\text{days}_{100\%}$	$\delta(\frac{\Delta g}{g})$
D^0	$0.30^{(1)}$	$0.30^{(2)}$	3.0	0.69
D^*	$0.30^{(1)}$	$0.30^{(2)}$	3.0	0.67
D^*	$0.30^{(1)}$	RICH out	10.3	0.62
$D^0 + D^*$				$\boxed{0.48}$
$D^0 + D^*$	proposal		49	$\boxed{0.14}$

$^{(1)(2)}$ "optimistic guesses"

$\delta(\frac{\Delta g}{g})$ from high P_T

Analysis of SMC high P_T data
(Preliminary, Ewa Rondio, Kasia Kowalik)

Taking same $\epsilon_{OVERALL}$ as SMC (i.e. $\approx 4\%$)

One gets ($q^2 > 1$ GeV/c^2)

100 days COMPASS WITHOUT (WITH) Outer Trigger

$$\delta(\frac{\Delta g}{g}) \quad \approx \quad \boxed{0.21} \qquad \boxed{(0.15)}$$

2002 $\Rightarrow$ 57 $days$ $\quad \epsilon_{OVERALL} > 7\%$

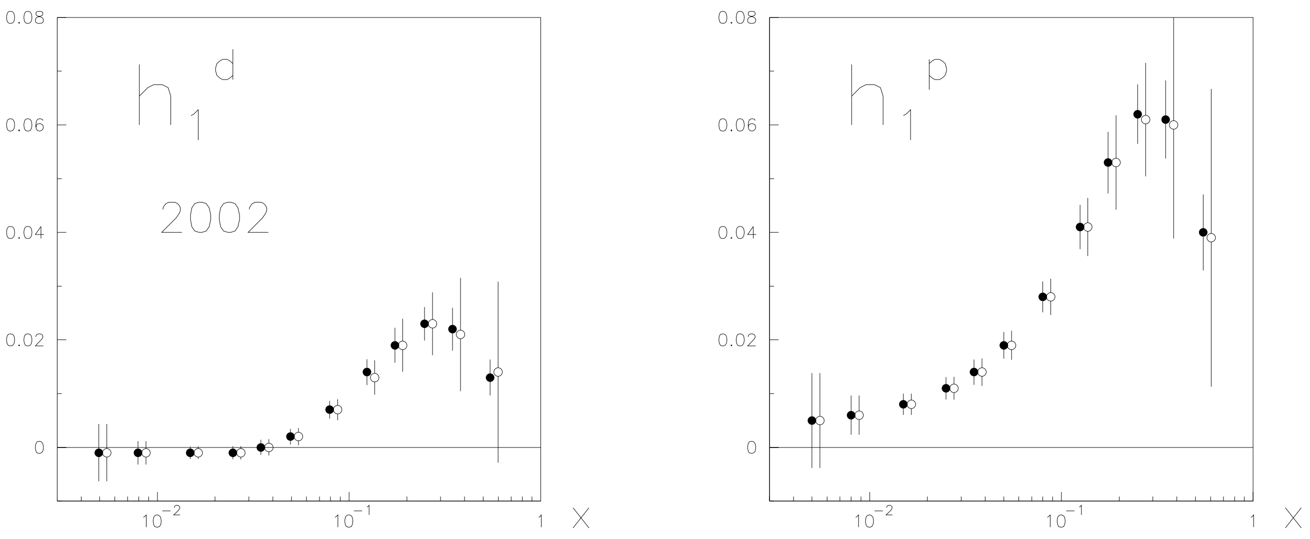
$$\delta(\frac{\Delta g}{g}) < \boxed{0.2}$$

Transversity

- 2002 $\Rightarrow$ 19 days T

  $\epsilon_{SPS\_Spectro} = 0.69\ \epsilon_{TRACKING} \approx 0.30 \Rightarrow 4\ days_{100\%}$

  (Collins angle analysing power $a_c = 0.75 \times z$ and $h_1 = g_1$)
  (gives $A^{SMC} = 0.06$ vs measured $A^{SMC} = 0.11 \pm 0.06$)



  2002 data Integrated over $x \Rightarrow \boxed{5\ \sigma}$

- 2003-2004

  Data on deuterium ($\sigma \times 1/\sqrt{3}$), proton data needed

- Large acceptance ESSENTIAL @ high x

$$\boxed{\text{COMPASS magnet} \gg \text{SMC magnet}}$$

Conclusions

What can we achieved < 2005

For illustration, assume for 2003 and 2004

105 $days$ SPS, 15 $days$ preparation, No T running

90 $days$ running L

$$90 \times 0.8 \times 0.3 \times 0.3 = 6.5\ days_{100\%}$$

$$2002 + 2003 + 2004 \Rightarrow 16.5\ days_{100\%}$$

Proposal $\boxed{49\ days_{100\%}}$

We have to work very hard to:

understand and/or improve

setup time, $\epsilon_{TRACKING}$, ϵ_{RICH}

We will have to set priorities ....