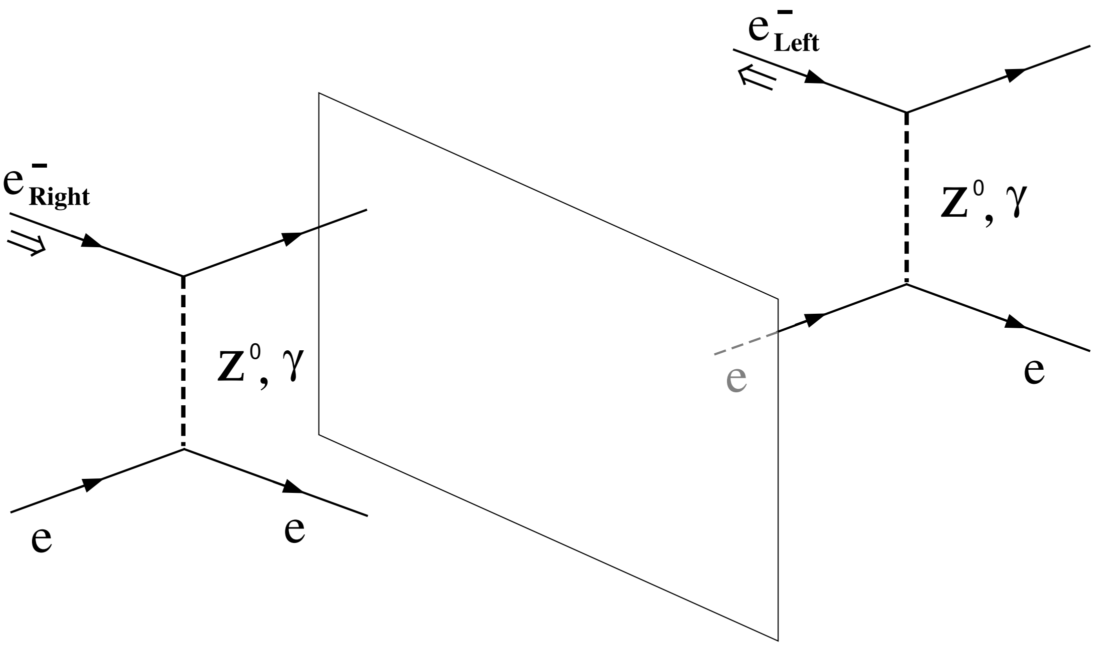
Parity Violation in $e^- - e^-$ Moller Scattering

E158 @ SLAC



CSTS June 2000

What motivates us

- **Powerful test of the Standard Model.**

- **Connection with HAPPEXII:**

  - Source and detector studies necessary for HAPPExII.

  - continuation of the HAPPEx collaboration

Status

- Accepted by the SLAC-PAC in 1997.

- Reviewed by a technical committee in 1999

  - 1.8 M$ assigned for construction

- Cryo-target is in End Station A

  - Installation to be achieved late Oct.

Estimated accuracy

$A_{RAW} = 1.5\times10^{-7}$	$\delta A\times10^{9}$	$\delta A/A$	$\delta\sin^2\Theta_W(0)$
Statistical error	**9**	**6%**	**0.00065**
Beam properties	**< 3**	**< 2%**	**0.00023**
Background sub. (e-p,π)	**1.5**	**1%**	**0.0001**

Normalization	$\delta\sin^2\Theta_W(0)$	
Beam polarization	**0.0003**	$\delta P_e/P_e = 2.7\%$
Radiative corrections	**0.0005 → 0.0001**	$\delta = 40 \pm 3\%$
Estimation of $\langle Q^2 \rangle$	**0.0001**	$\langle Q^2\rangle = 0.03\ GeV^2$

Total: $\delta\sin^2\Theta_W(0) = 0.0008$

Saclay's Contribution

- **Online Analysis**

  - Display of control parameters and relevant physical quantities

  - To be finished for dec. 2000

- **Detectors**

  - Irradiation test in February

  ⟶ Choice of material for HAPPEX II

  - Pion detector: Monte Carlo

  ⟶ Proposal for the design (accepted by E158 collab.)

- **Data taking - Analysis**

  - 3 weeks commissioning in dec. 2000

  - First run March-April 2001

  - Second run 2002 (Happex II April 2002)

- **7 Physicists: C. Cavata, D. Lhuillier, R. Lombard, F. Marie, B.Mayer, D. Neyret, T. Pussieux.**

Pion Detector Specifications

Pion background:

$$A_{exp} = A_{Moller} \times \left(1 - R \times \frac{N_\pi}{N_e} + R \times \frac{N_\pi}{N_e} \times \frac{A_\pi}{A_e}\right) \qquad R = E_{dep}^{\pi} / E_{dep}^{e}$$

Need to measure π Flux & Asym.

Error:

$$\boxed{\delta A_{exp} = R \times \frac{N_\pi}{N_e} \times \delta A_\pi}$$

1% syst. after correction: $\delta A_{exp} \le 1.5 \times 10^{-9}$

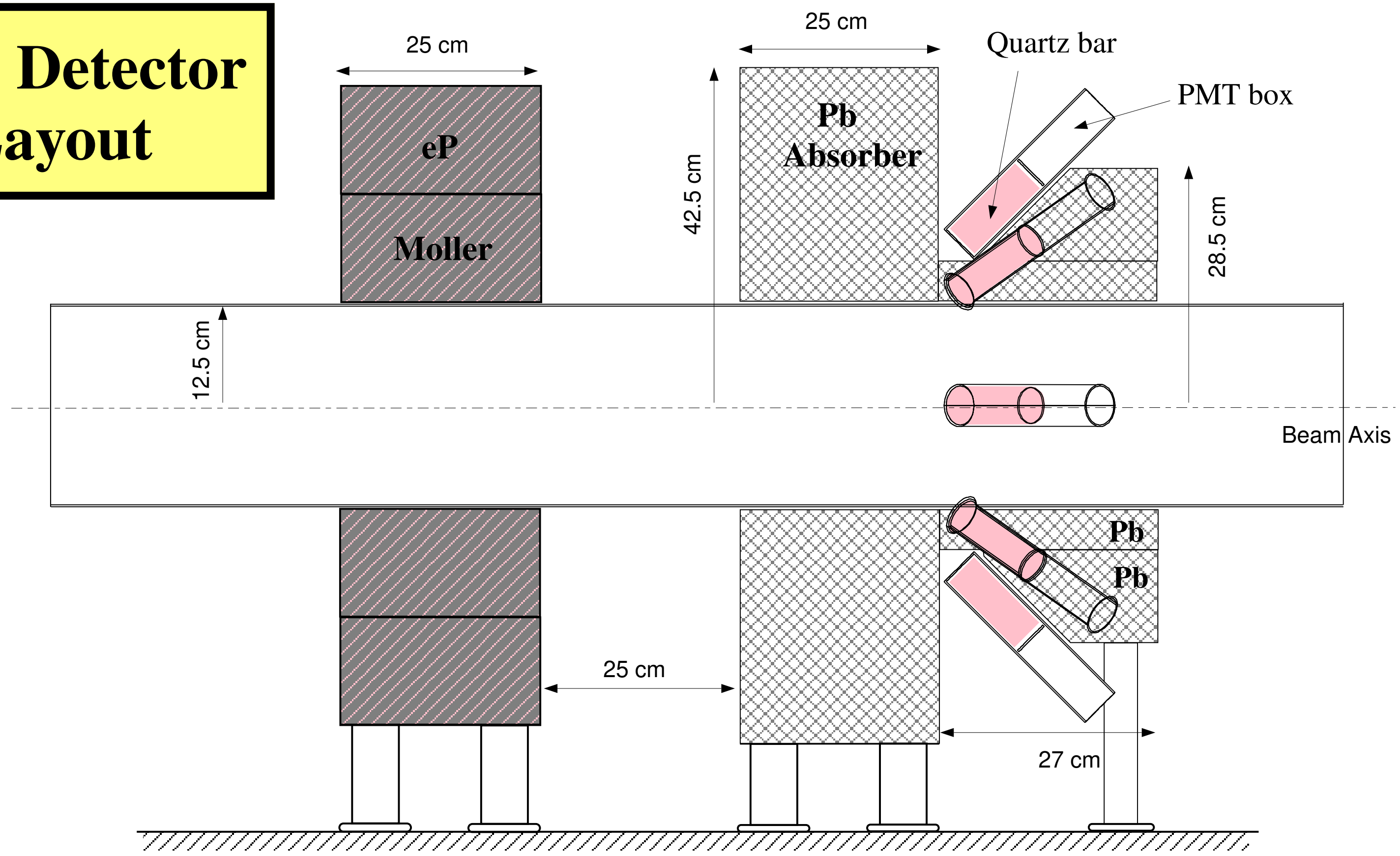
Specifications:

Resolution ~ 200%

π Detection Efficiency > 0.1

Good electron rejection

Pion Detector Layout



- **Fulfils all the specifications:**

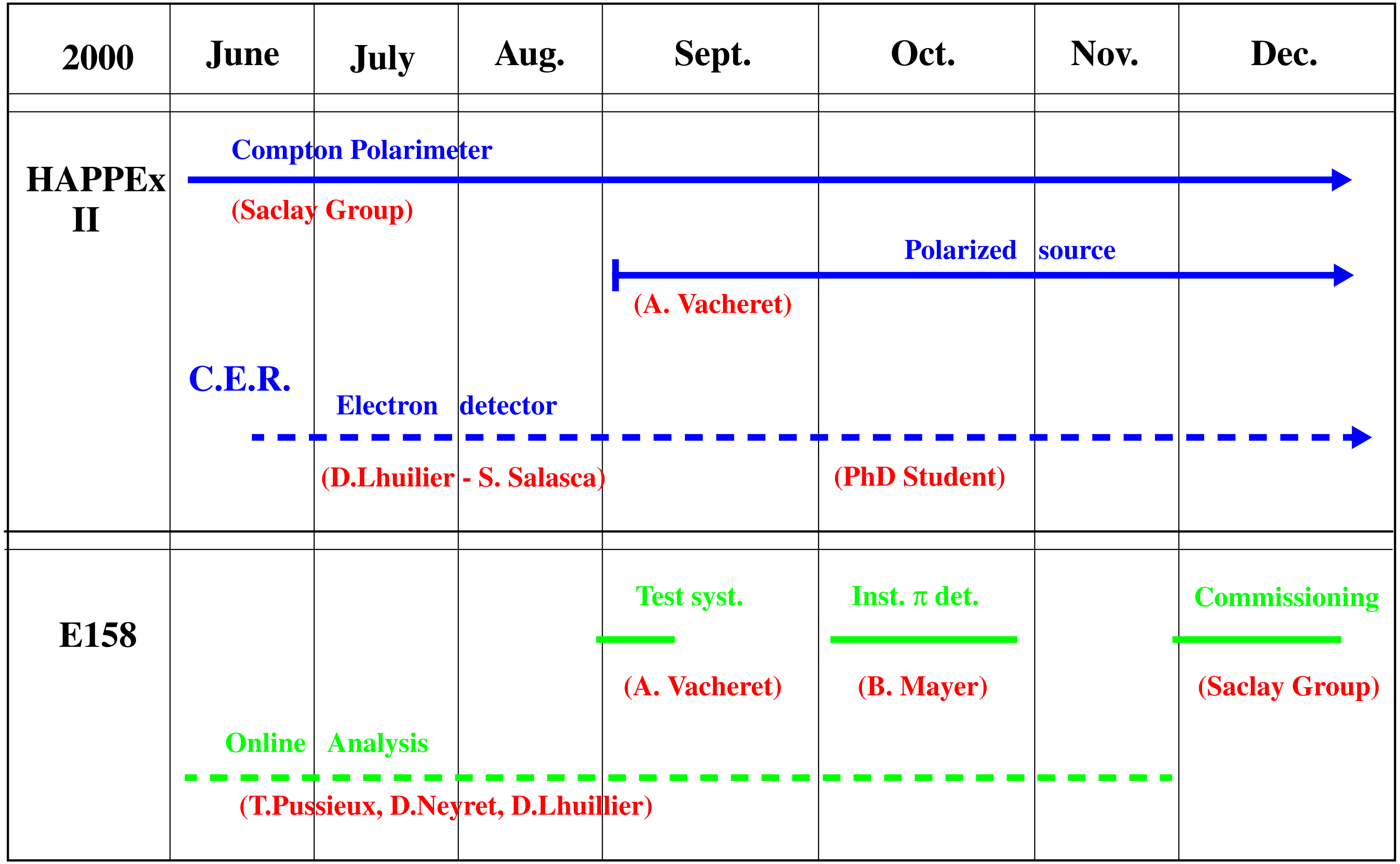
$$\sigma(E)/E = 200\%$$

$$\varepsilon = 23\%$$

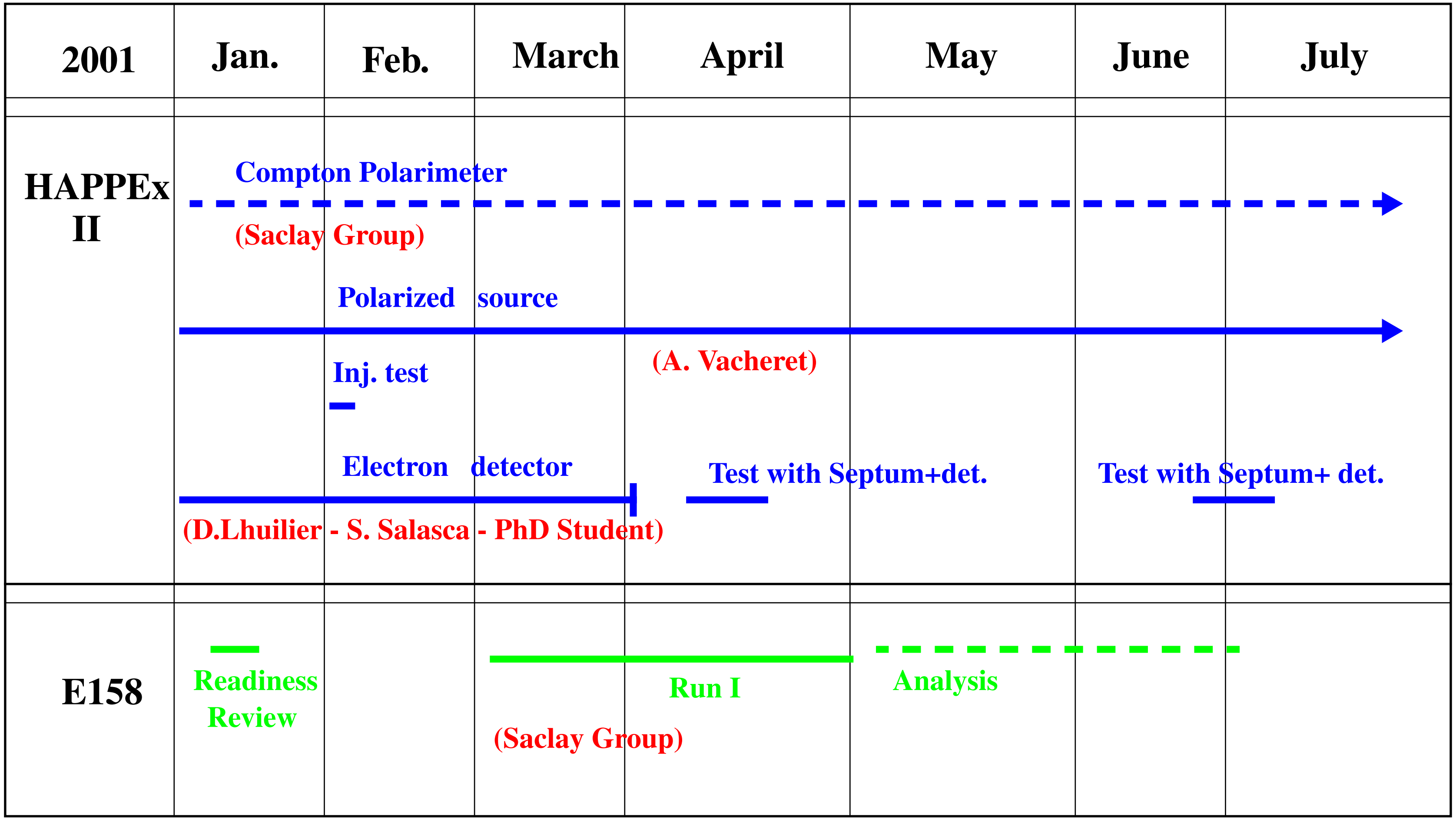
$$e^- \text{ noise} = 4.5\%$$

- **Design : 2 Man-weeks SGPI (quartz-PMT system)**

Planning


2000
June
July
Aug.
Sept.
Oct.
Nov.
Dec.
HAPPEx II
Compton Polarimeter
(Saclay Group)
Polarized source
(A. Vacheret)
C.E.R.
Electron detector
(D.Lhuilier - S. Salasca)
(PhD Student)
E158
Test syst.
(A. Vacheret)
Inst. π det.
(B. Mayer)
Commissioning
(Saclay Group)
Online Analysis
(T.Pussieux, D.Neyret, D.Lhuillier)

Planning



HAPPEx II data taking in spring 2002?

E158 run II, 2002?

Summary

Saclay's participation in E158:

- "Light" investment
- New Man Power in both HAPPEx2 and E158
- No overlap in plannings
- HAPPEx II benefits from E158
  (source development, detector study)