NSE Phase stability

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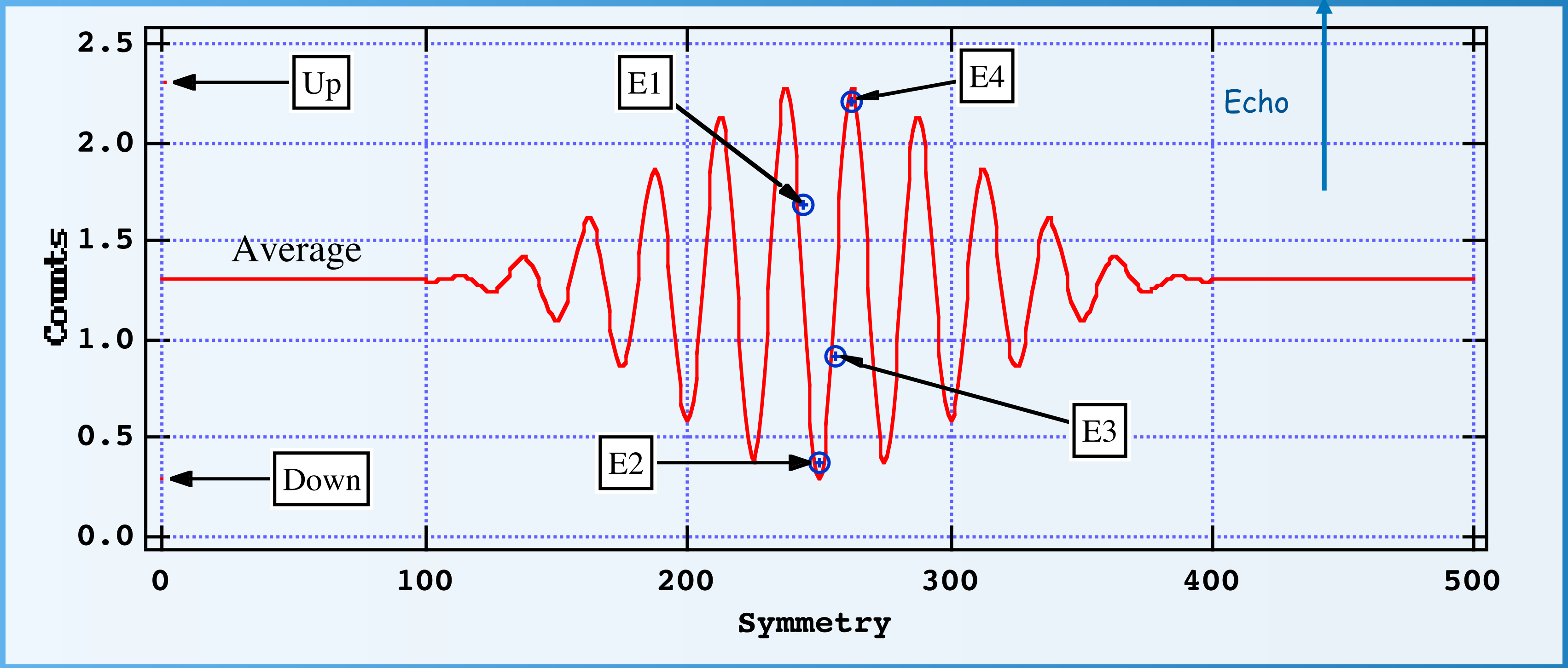
How echo measured

We measure polarized intensity versus field integral difference

We could fit Echo, Average,frequency, phase

Counts=Aver+Echo*sin(I-phase)/frequency)



E1 = Aver+Echo*sin(ϕ)

E2 = Aver-Echo*cos(ϕ)

E3 = Aver-Echo*sin(ϕ)

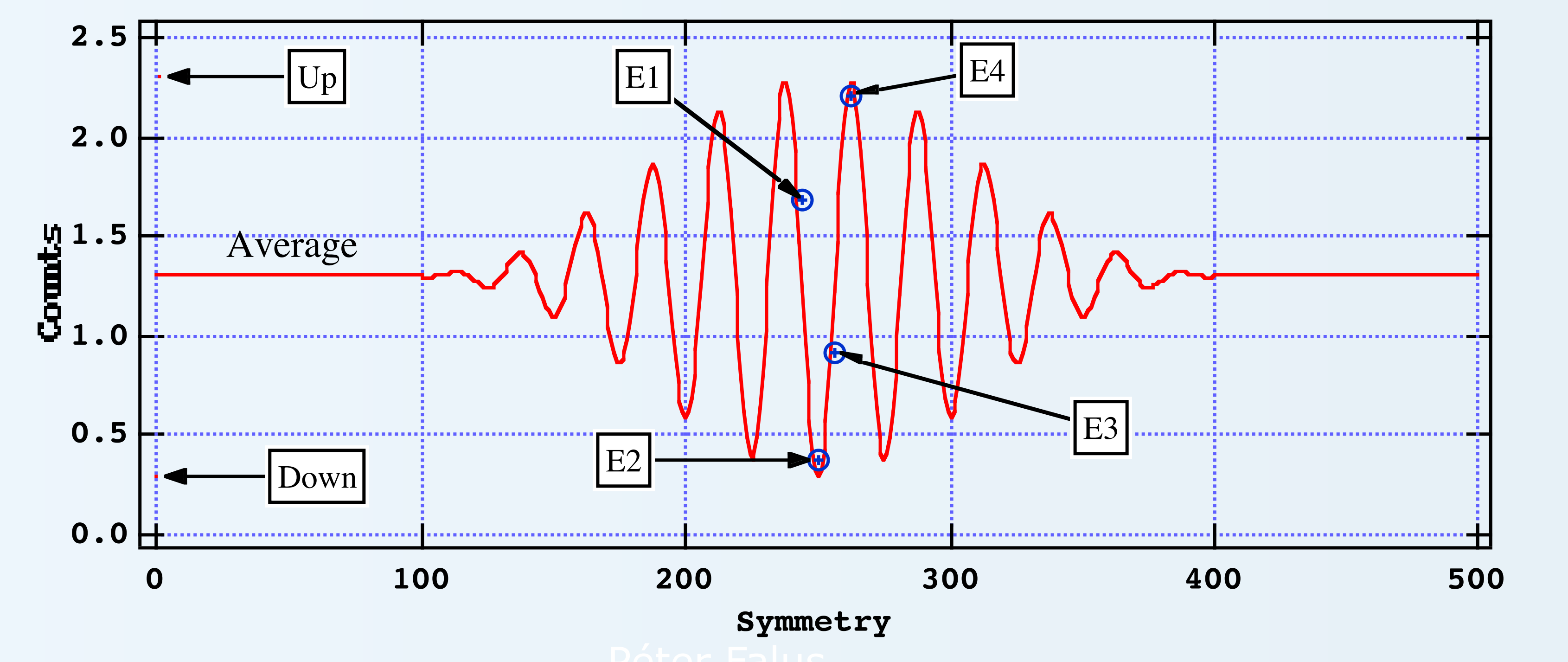
E4 = Aver+Echo*cos(ϕ)

Do we need phase ?

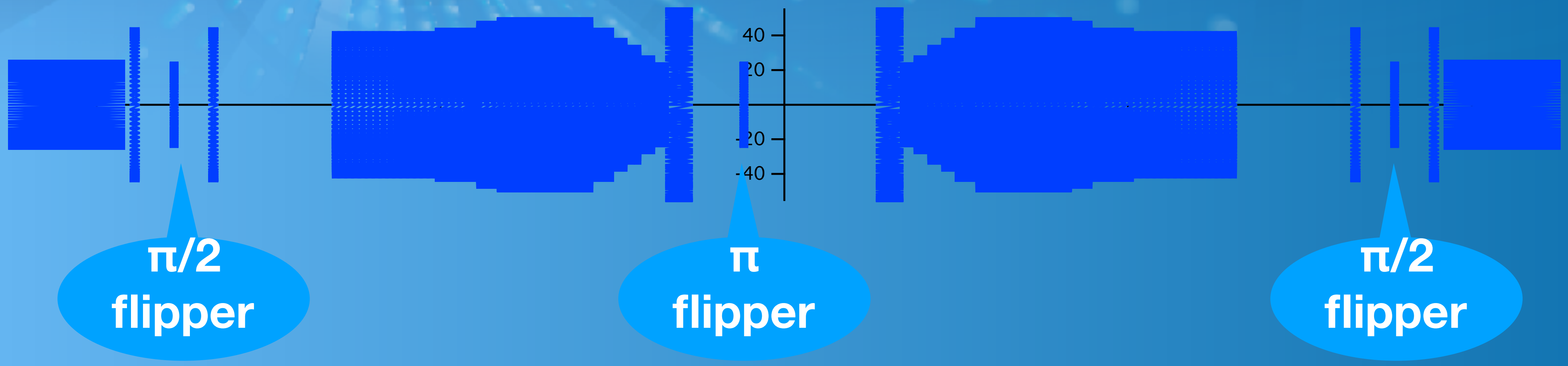
We need echo, know average and frequency fit echo amplitude and phase throw phase way

EXCEPT

- We need the phase to measure speed
- We want to keep resolution stable
- We measure echo close to 0
- We optimize count times



What is Phase ?



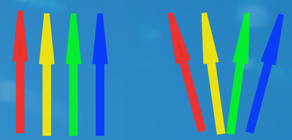
$$\Delta = \int_1 B\,d\ell - \int_2 B\,d\ell$$

Field integral difference:

difference in field or in physical length

We assure 0 difference by SYMMETRY

How much phase difference can we tolerate

We measure $\langle \cos\varphi \rangle$ 

Cos(18°)=0.95 5% loss if phases within +-18°
Attention cos() is quadratic around 0!

Sidebar, subtle: Phase shift during measurement or field integral difference between trajectories will have the same effect; echo loss, same criteria apply.

Field Stability example

We have two 1000 turn solenoids.We need 1,000,100 Amperturns in one coil an 1,000,000 in another . The difference should be stable to 0.1 Amperturn precision

Solution 1: Coil 1 supplied by 1,000.1 A Coil 2 supplied by 1,000A from another supply. Required precision 10^{-7}

Solution 2: Both coils are supplied by 1000A from the same supply, they are in series. We wind 100 extra turns on coil 1 and supply it with 1A. Required precision: no requirement on big supply, 10^{-3} on small supply.

The statement which is a question:

In resonant NSE when geometry determines the field integral, 1% flipper distance change results in 1% field integral change

For classic flippers we have to integrate the field at the flipper position with displacement. Since typically on the flipper we have 100-300x less field then in the precession region, field integral change is 300 times less. They are less sensitive to flipper position/flatness.