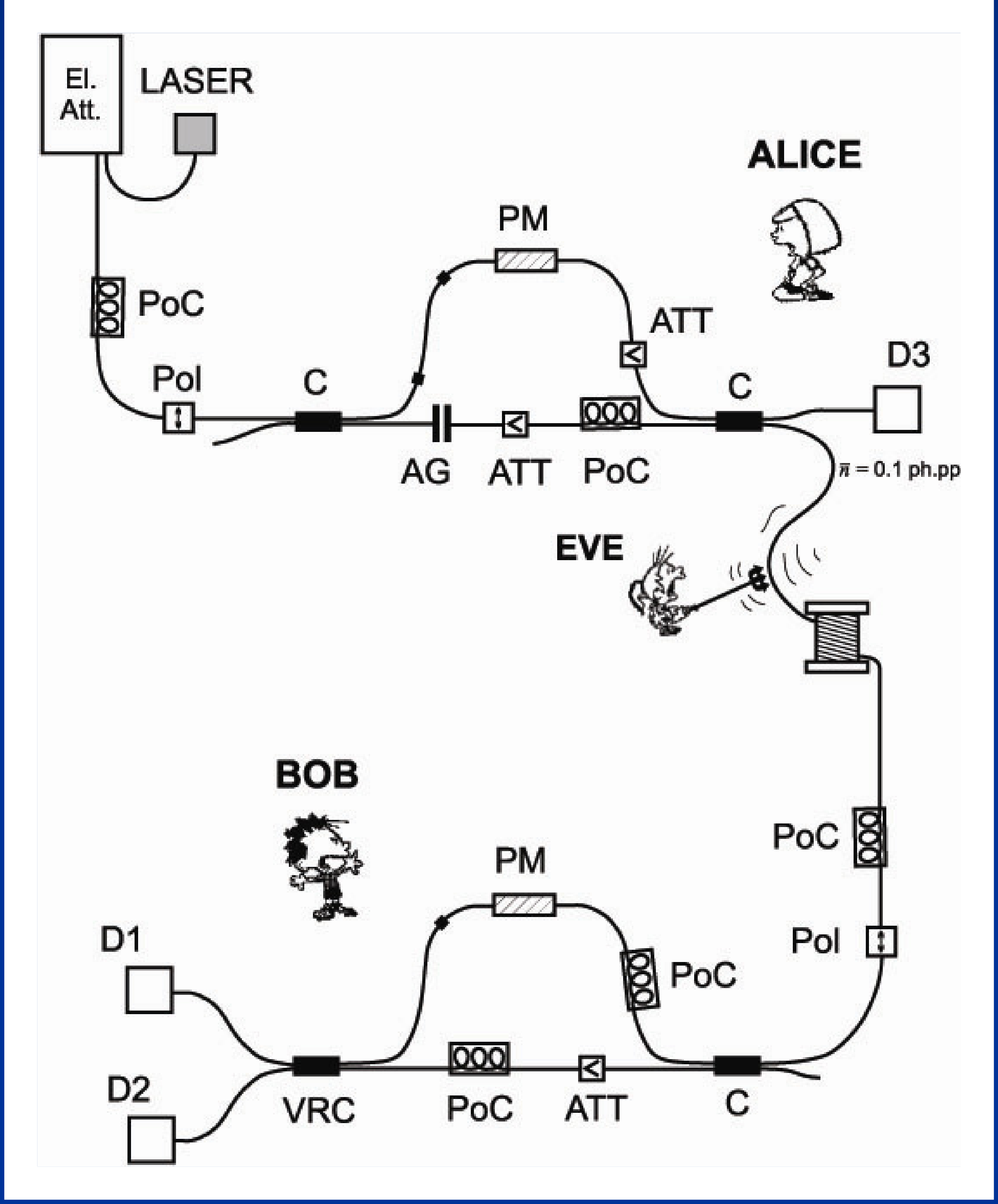
Kvantový identifikační systém

M. Dušek, O. Haderka, M. Hendrych, R. Myška, Phys. Rev. A **60**,149 (1999).



Využití kvantové distribuce klíče pro vzájemnou identifikaci

Přímé měření překryvu kvantových stavů

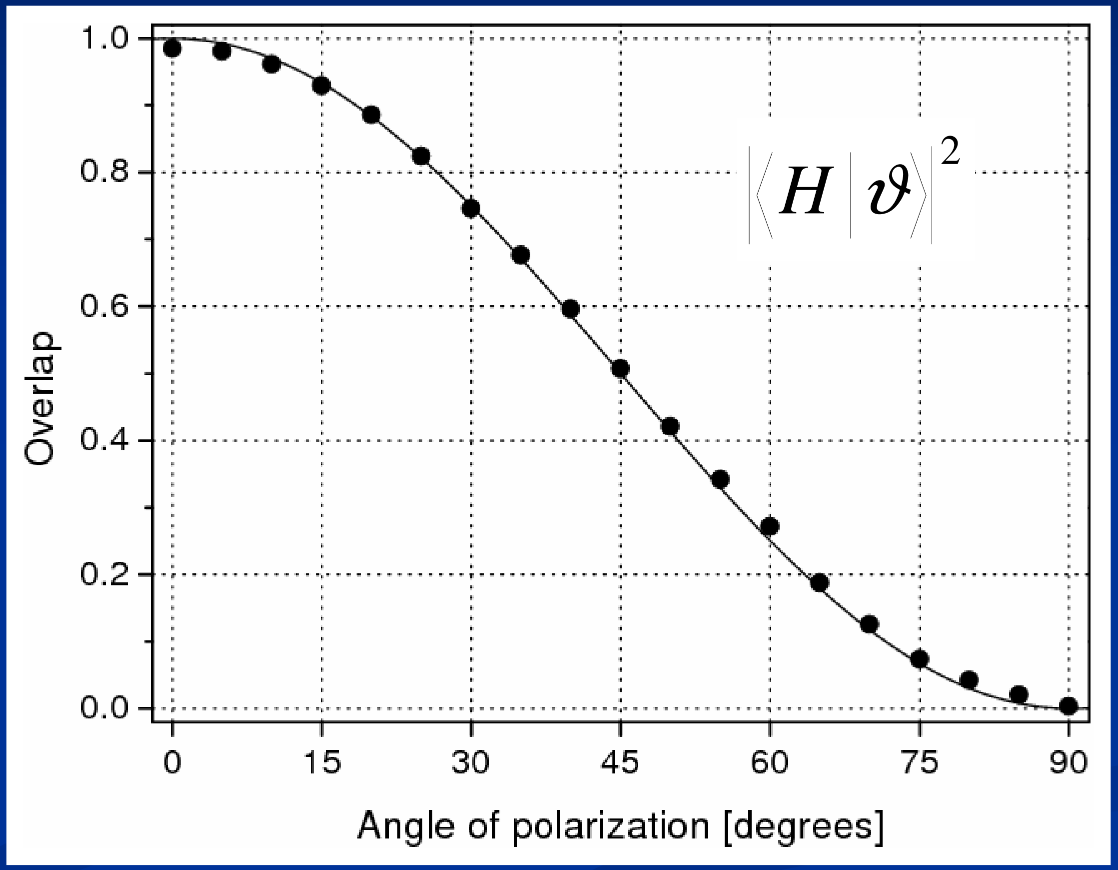
M. Hendrych, M. Dušek, R. Filip, J. Fiurášek, Phys. Lett. A **310**, 95 (2003).

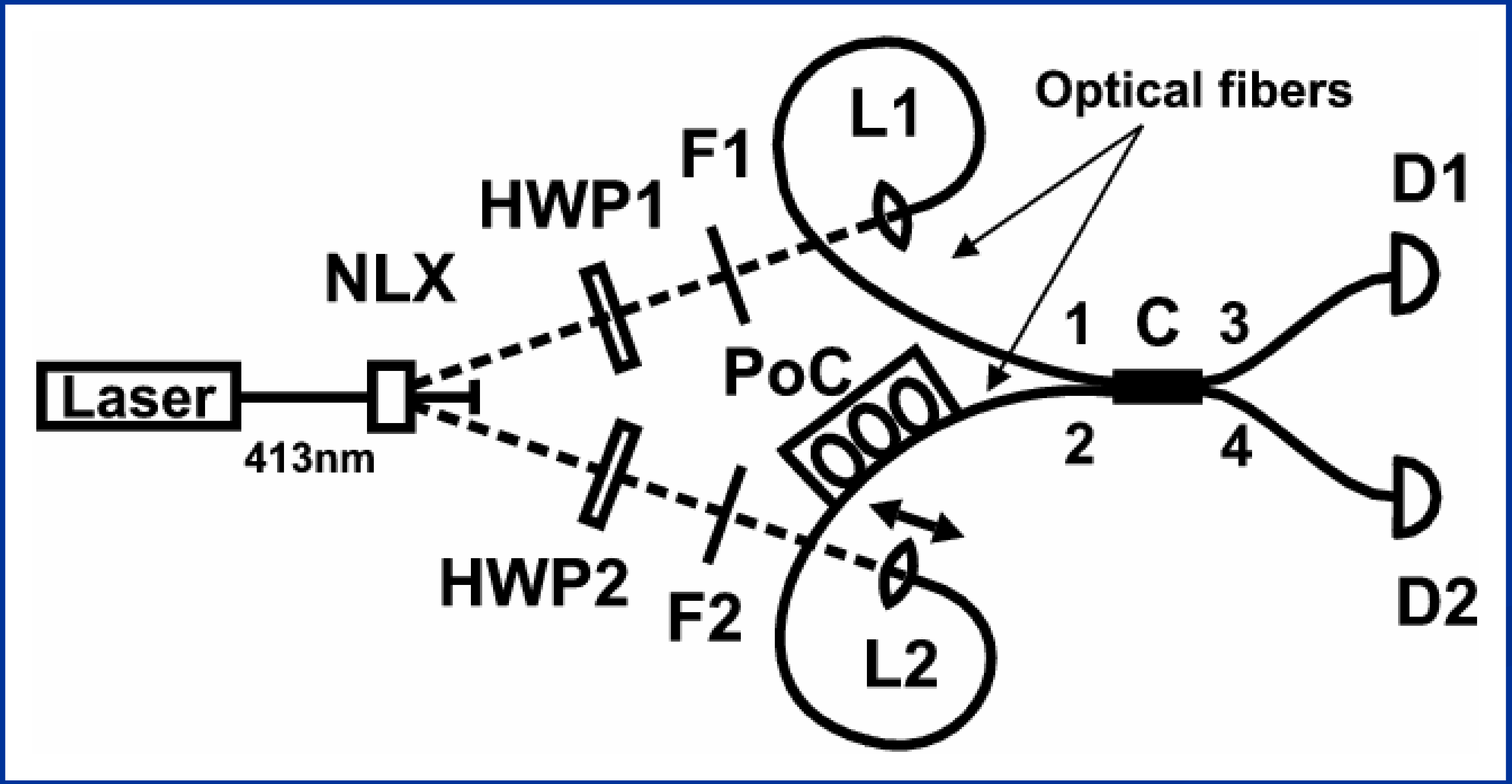
$$\mathrm{Tr}\left(V\rho_A \otimes \rho_B\right) = \mathrm{Tr}\left(\rho_A \rho_B\right)$$

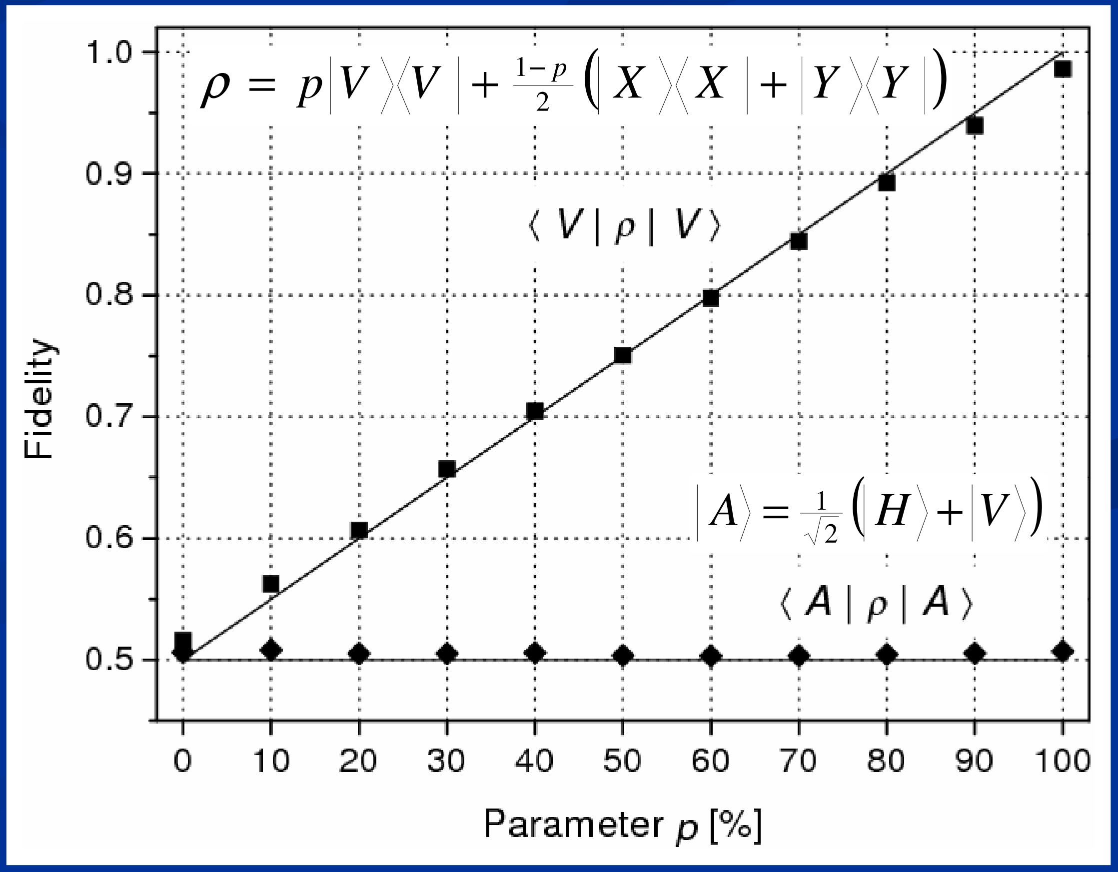
$$V = \Pi^+ - \Pi^-$$

dva qubity: $\Pi^- = \left|\Psi^-\right\rangle\left\langle\Psi^-\right|, \Pi^+ = 1 - \Pi^-$

$$\left|\Psi^-\right\rangle = \frac{1}{\sqrt{2}}\left(\left|H\right\rangle_A \left|V\right\rangle_B - \left|V\right\rangle_A \left|H\right\rangle_B\right)$$







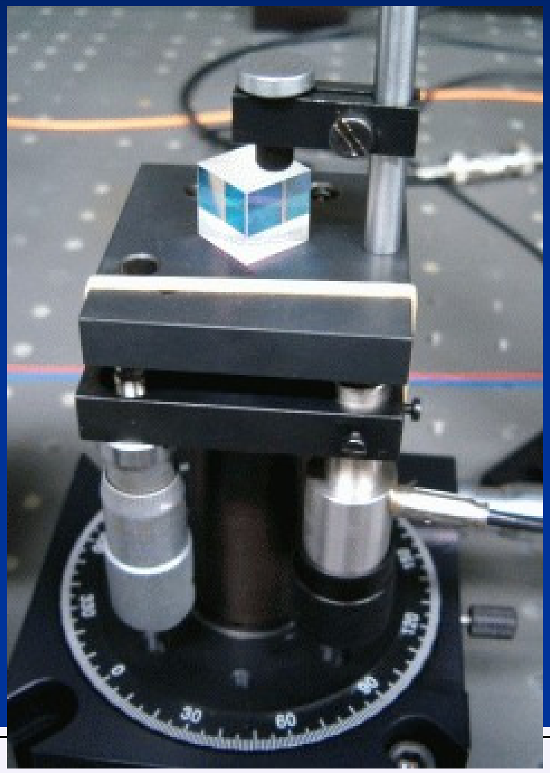
Programovatelný diskriminátor kvantových stavů

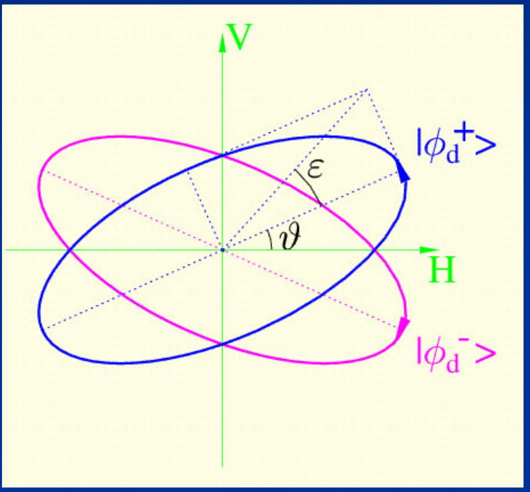
J. Soubusta, A. Černoch, J. Fiurášek, M. Dušek, Phys. Rev. A **69**, 052321 (2004).

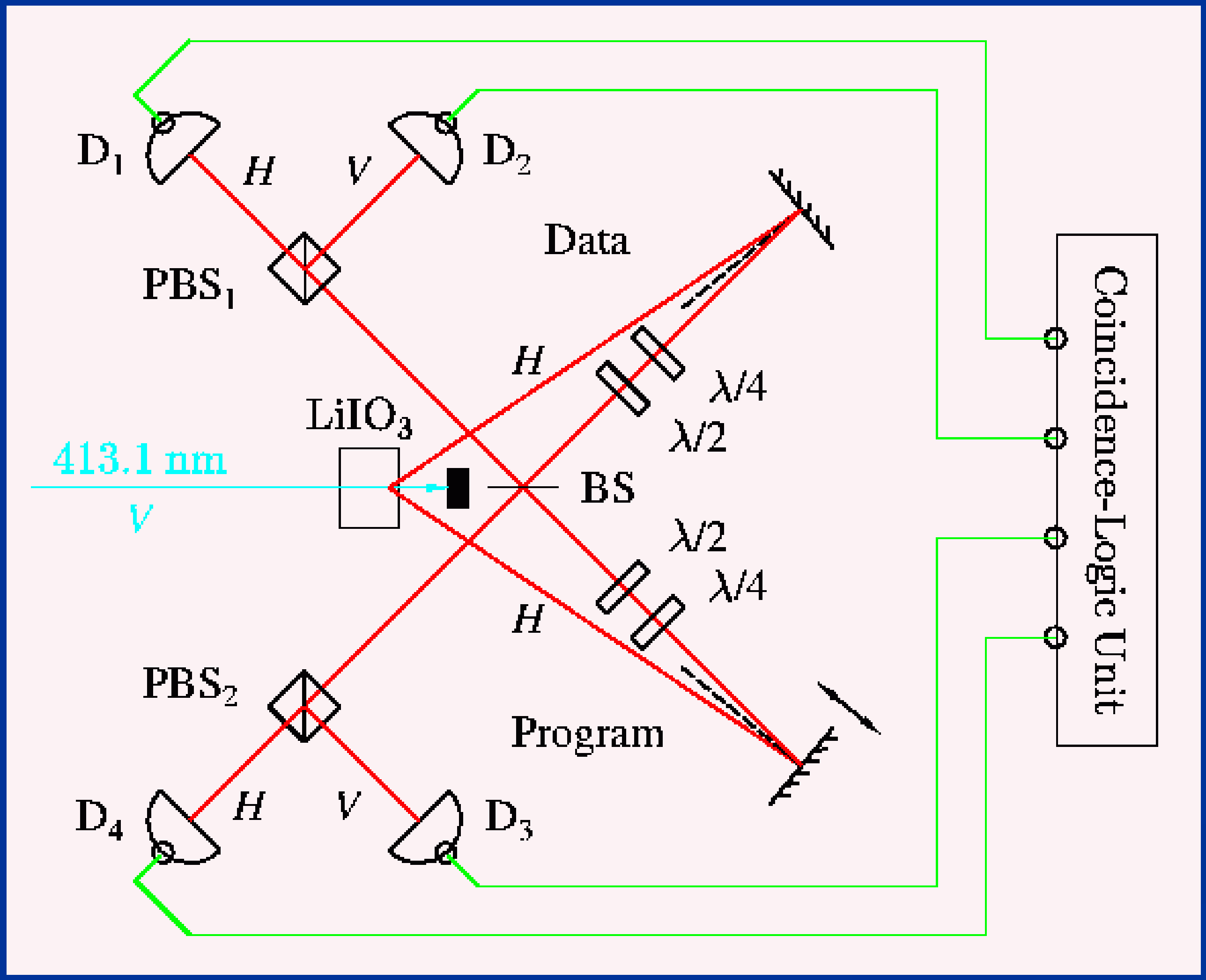
Umožňuje rozlišit dva neortogonální stavy v závislosti na „programu“:

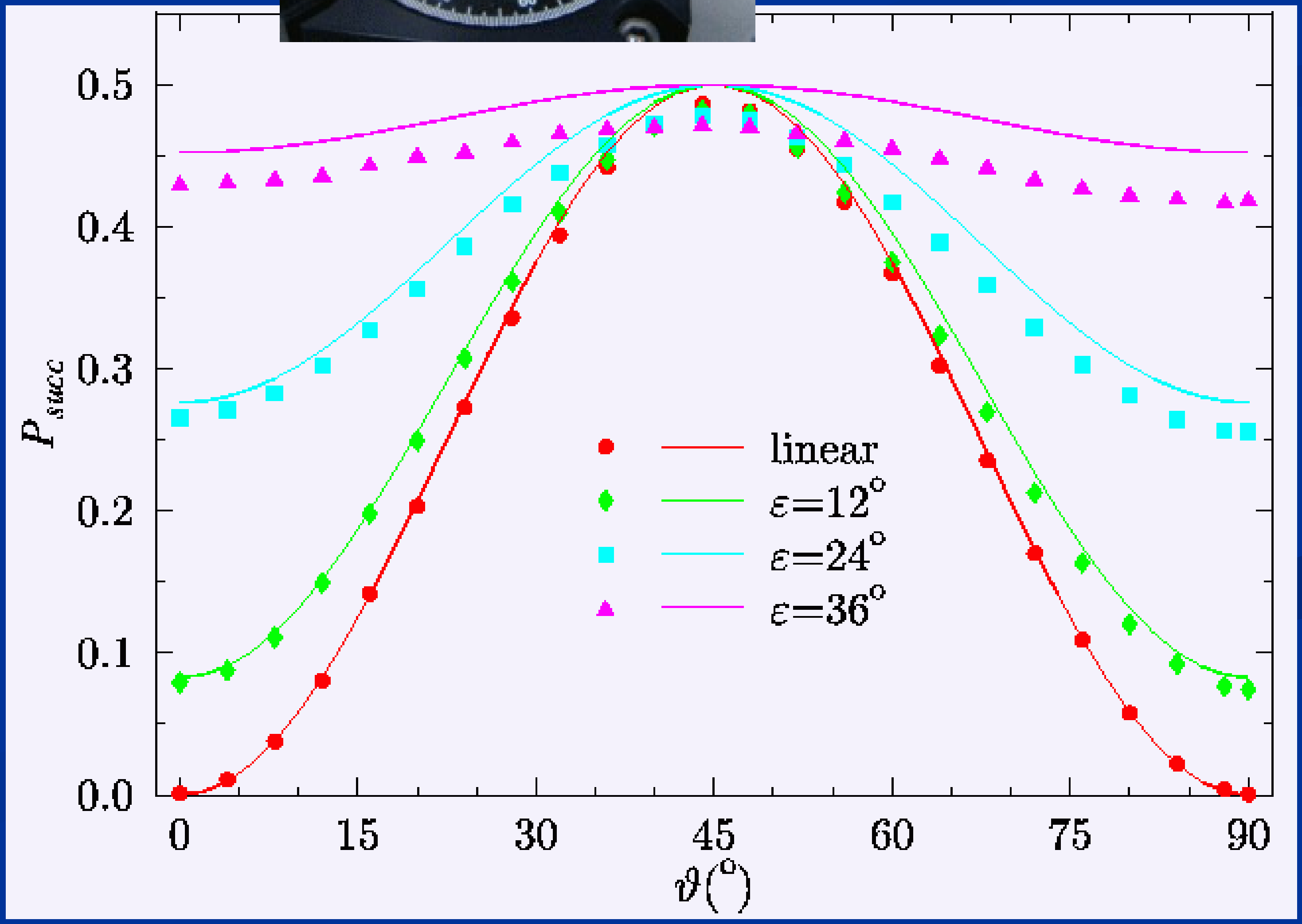
Data: $\left|\phi_d^{\pm}\right\rangle = a\left|H_d\right\rangle \pm b\left|V_d\right\rangle$

Program: $\left|\phi_p\right\rangle = a\left|H_p\right\rangle + b\left|V_p\right\rangle$





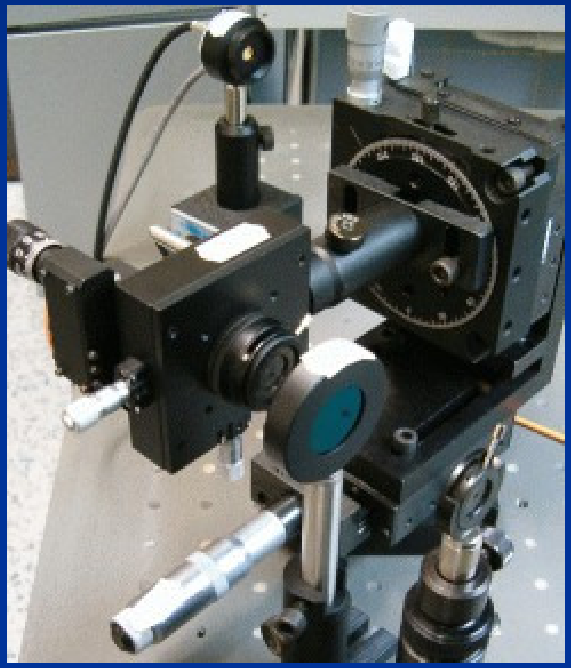


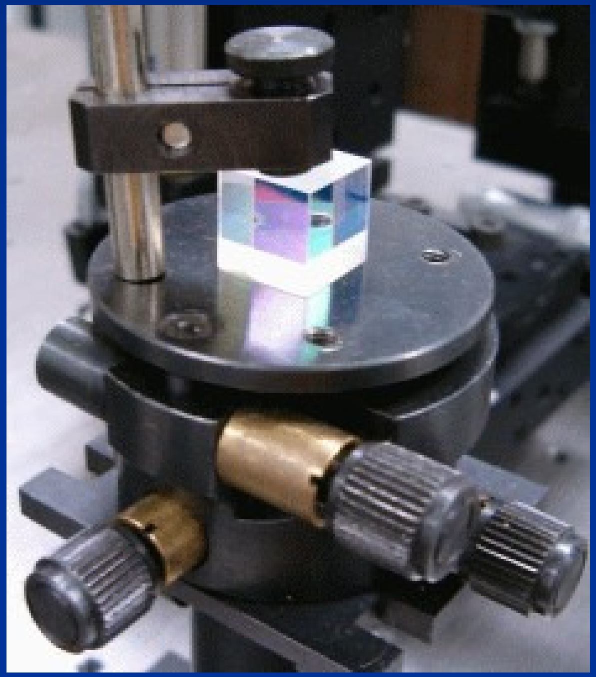


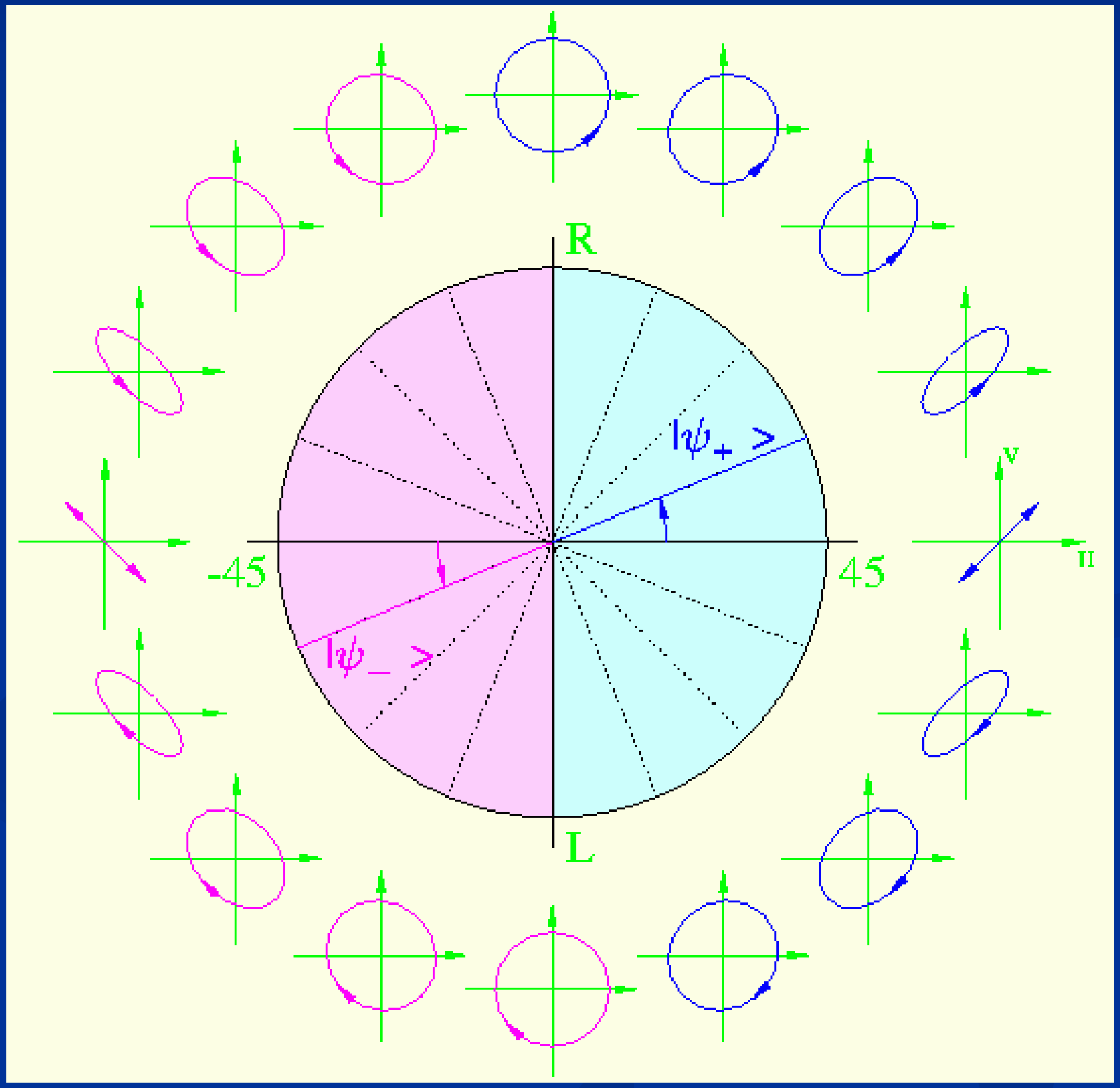
Fázově kovariantní kvantový multimetr

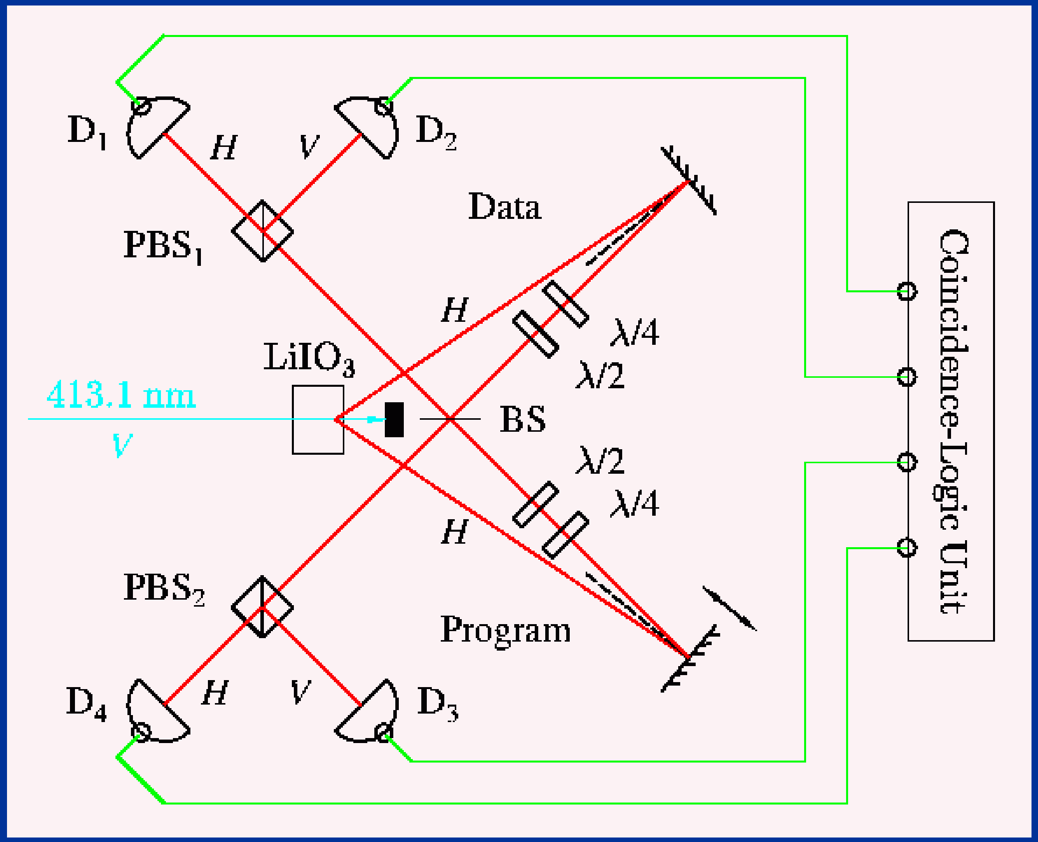
J. Soubusta, A. Černoch, J. Fiurášek, M. Dušek, Phys. Rev. A **69**, 052321 (2004).

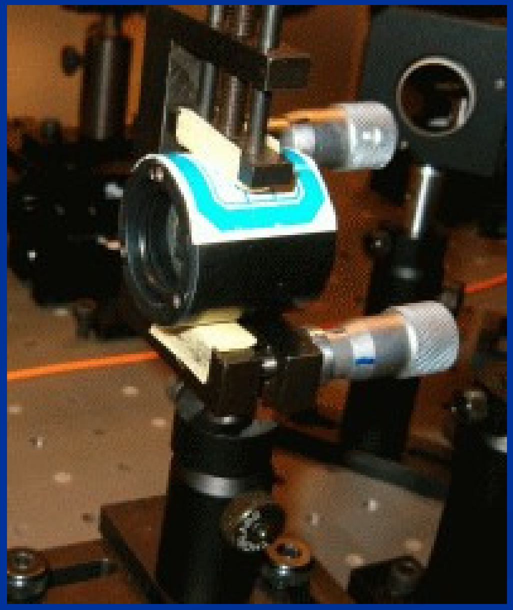
Stav programového qubitu určuje měřicí bazi pro datový qubit

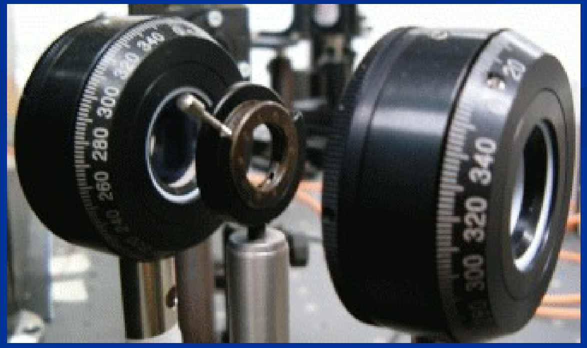










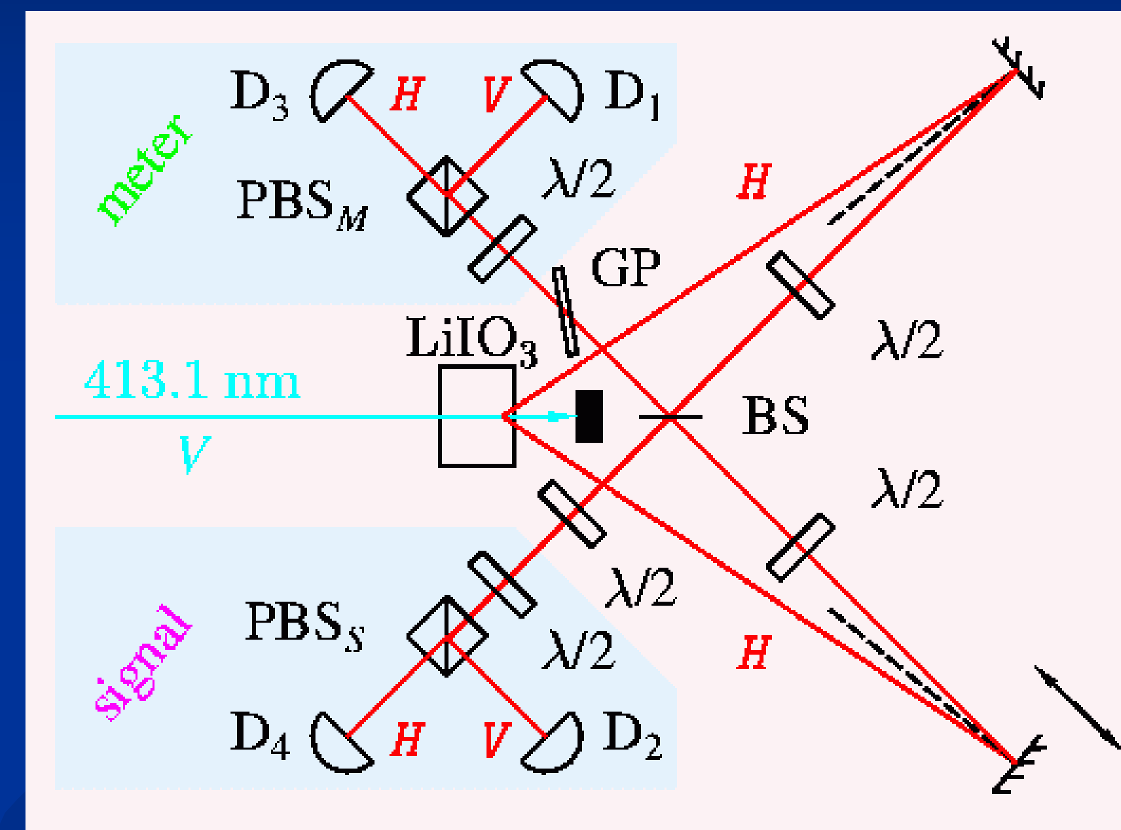


Jak kvantové korelace zlepšují předpovědi pro komplementární měření

R. Filip, M. Gavenda, J. Soubusta, A. Černoch, M. Dušek, Phys. Rev. Lett. **93**, 180404 (2004).

$$\Delta K^2(\Pi_M \to \Pi_S) + \Delta K^2(\Pi'_M \to \Pi'_S) \le \left(\frac{B_{max}}{2}\right)^2$$

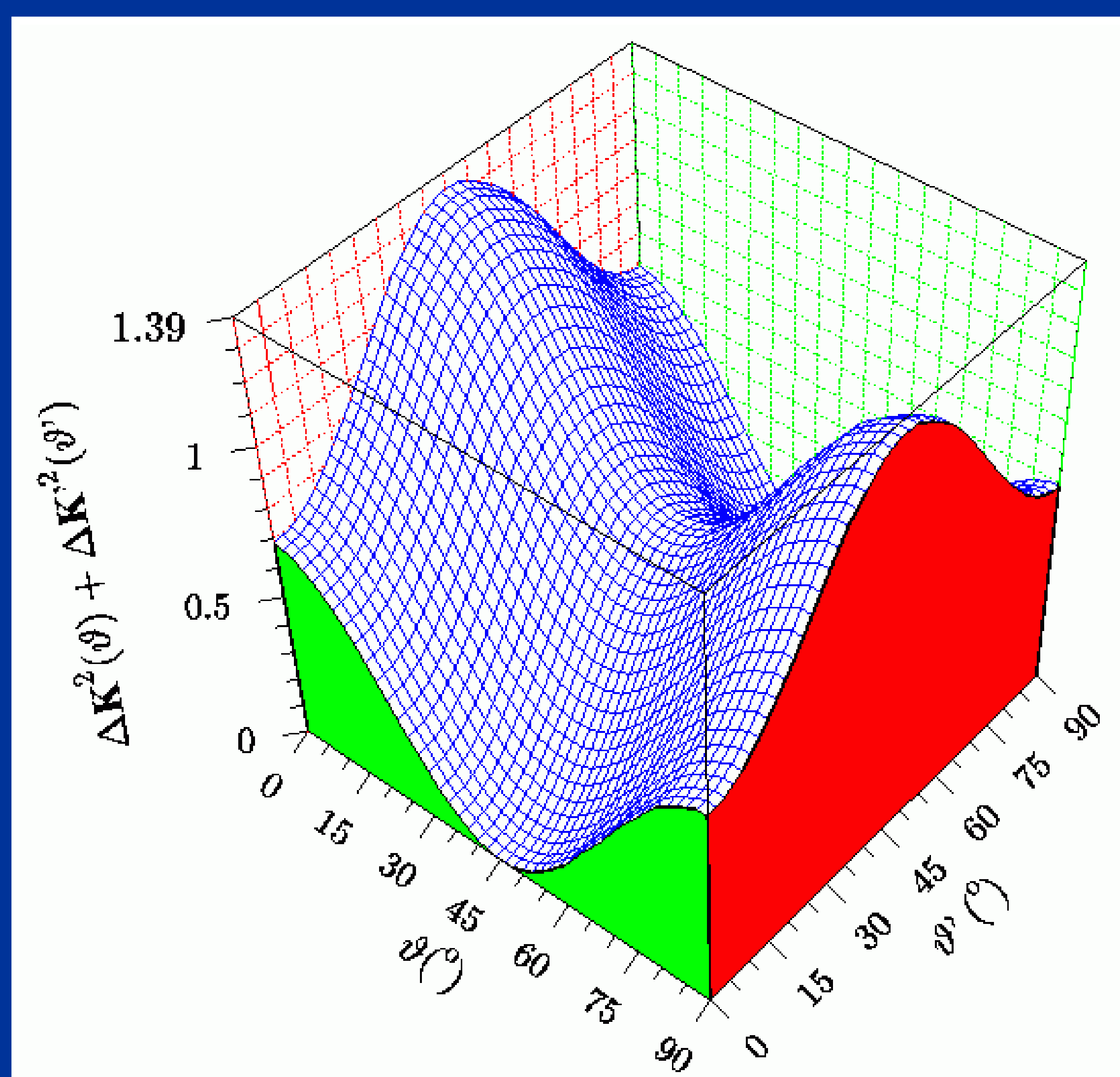
$$B_{max} = \max_{\vec{n}_1,\vec{n}_2} \mathrm{Tr}\left[\rho\left(\vec{n}_1\cdot\hat{\vec{\sigma}}_1\right)\left(\vec{n}_2\cdot\hat{\vec{\sigma}}_2\right)\right]$$

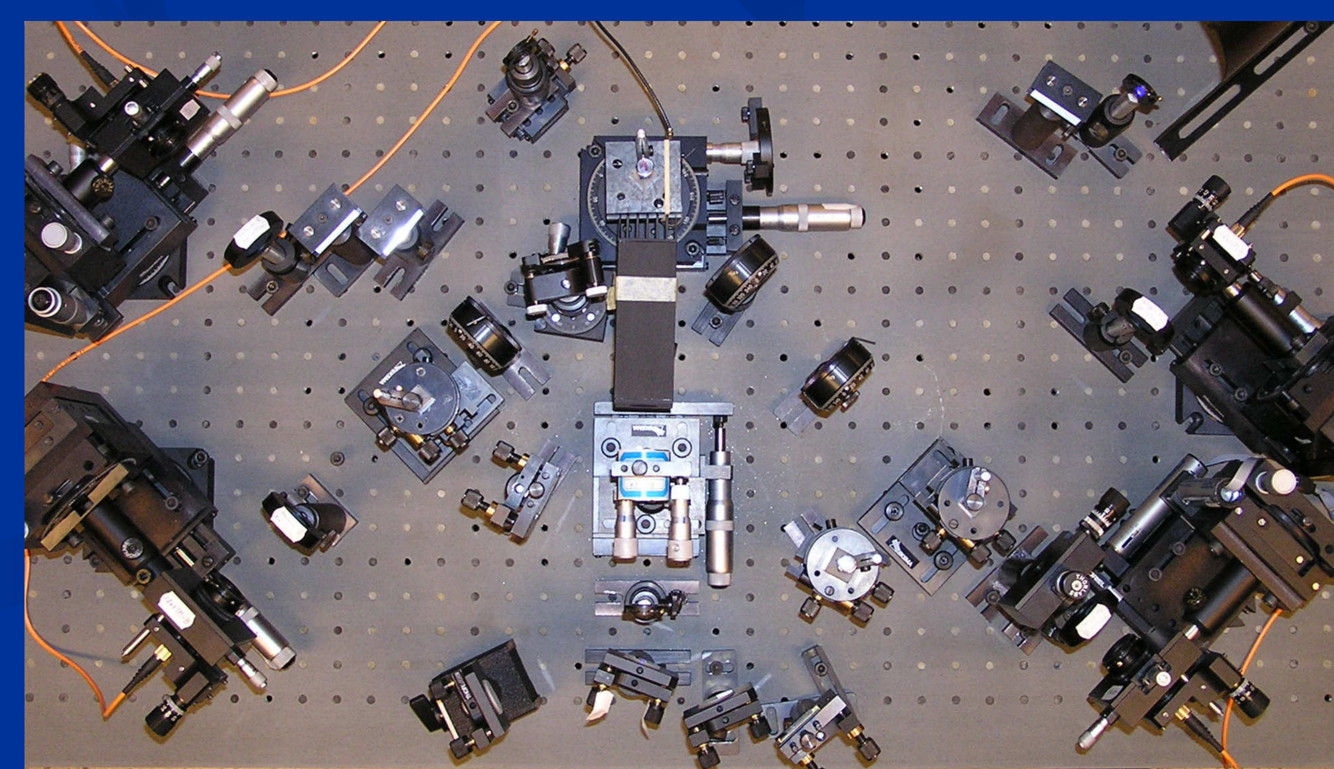


Měření pro Wernerův stav

$p \approx 0.82$

$B_{max} = 2.36$





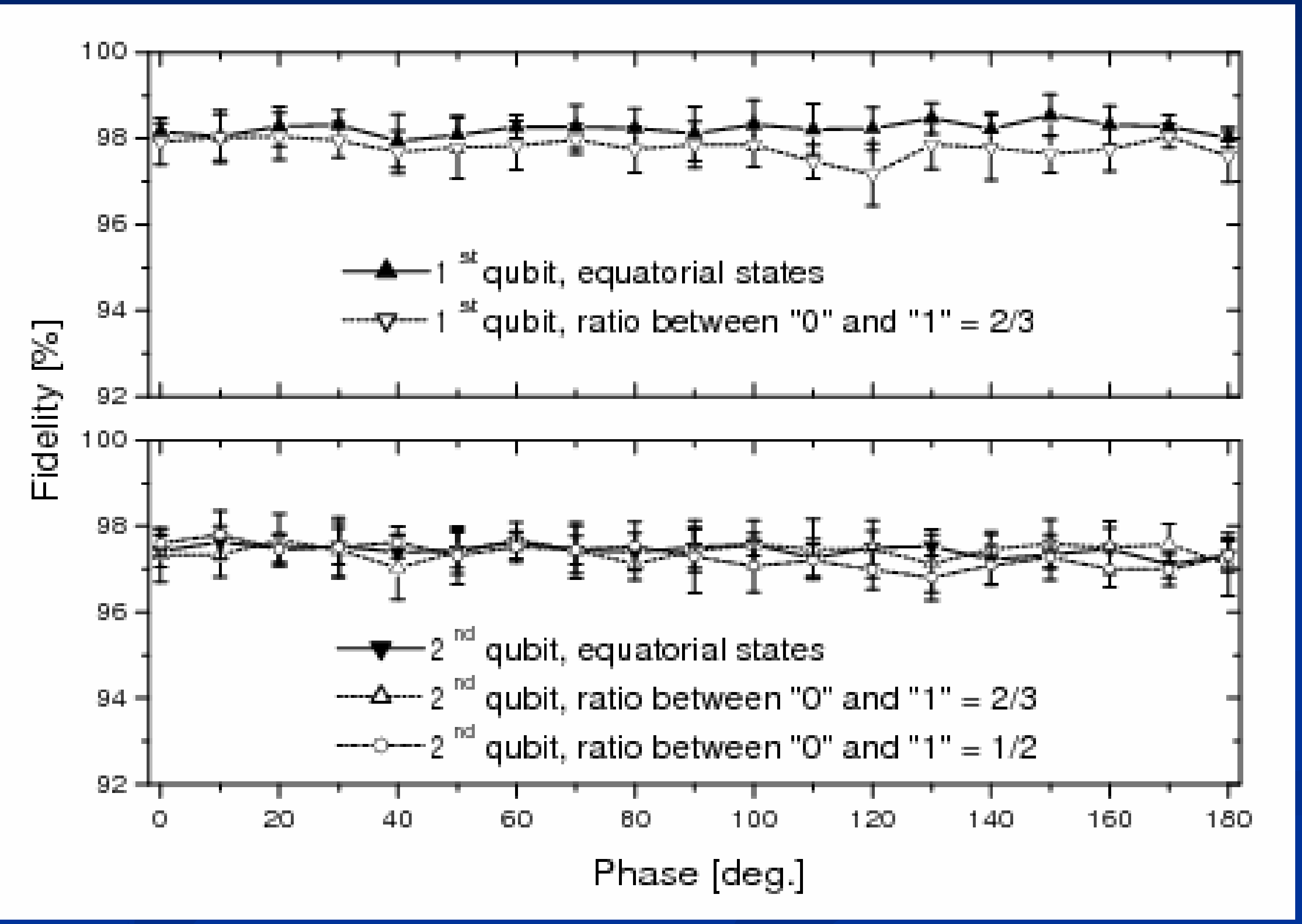
Kódování dvou qubitů na jeden qutrit

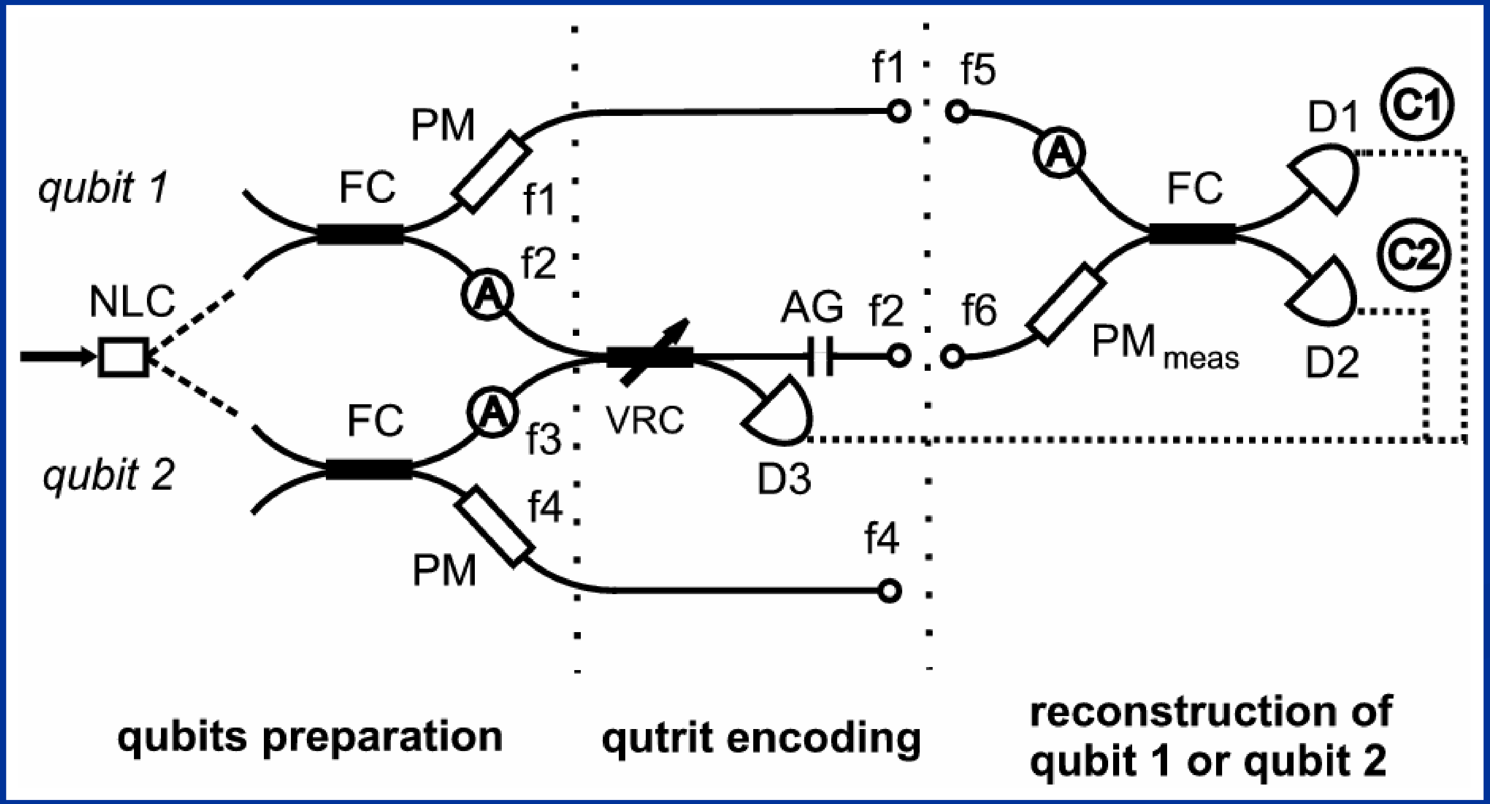
L. Bartůšková, A. Černoch, R. Filip, J. Fiurášek, J. Soubusta, M. Dušek, Phys. Rev. A **74**, 022325 (2006).

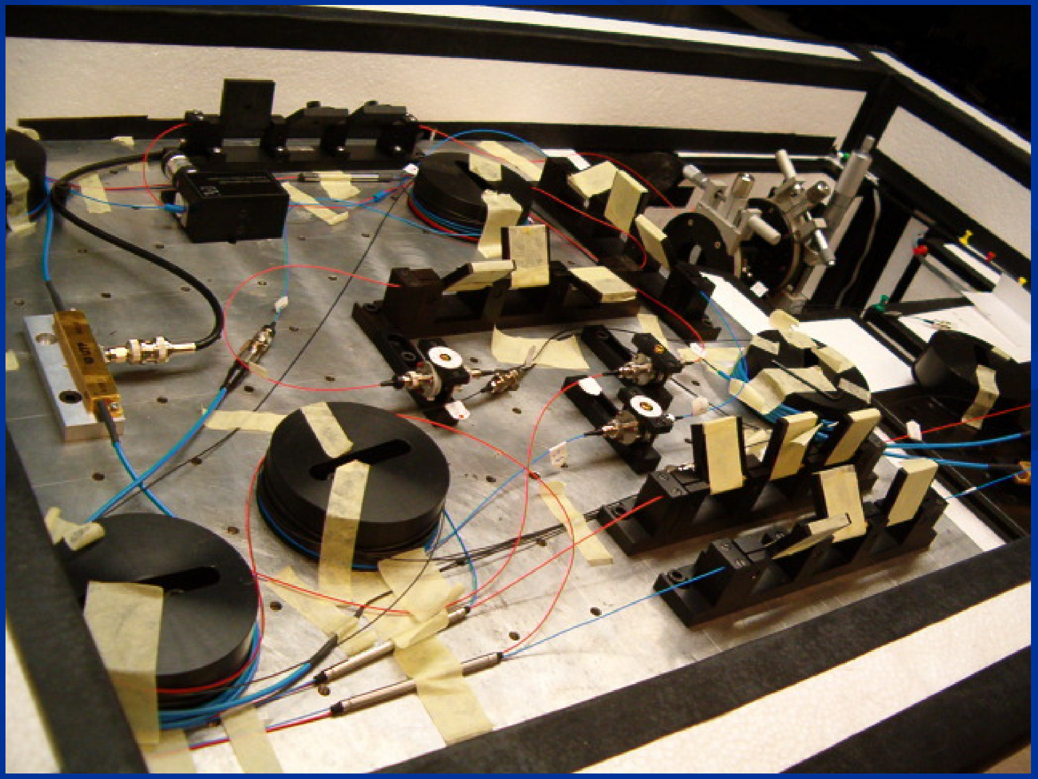
$$\left.\begin{array}{l} |\Psi_1\rangle = \alpha_1 |0\rangle_1 + \beta_1 |1\rangle_1 \\ |\Psi_2\rangle = \alpha_2 |0\rangle_2 + \beta_2 |1\rangle_2 \end{array}\right\} \ |\Psi_1\rangle \otimes |\Psi_2\rangle$$

$$\begin{array}{ccc} |0\rangle_1 |0\rangle_2 & |0\rangle_1 |1\rangle_2 & |1\rangle_1 |1\rangle_2 \\ \Downarrow & \Downarrow & \Downarrow \end{array}$$

$$|\Phi\rangle = \frac{1}{\sqrt{N}} \left(\alpha_1 \alpha_2 |0\rangle + \alpha_1 \beta_2 |1\rangle + \beta_1 \beta_2 |2\rangle \right)$$





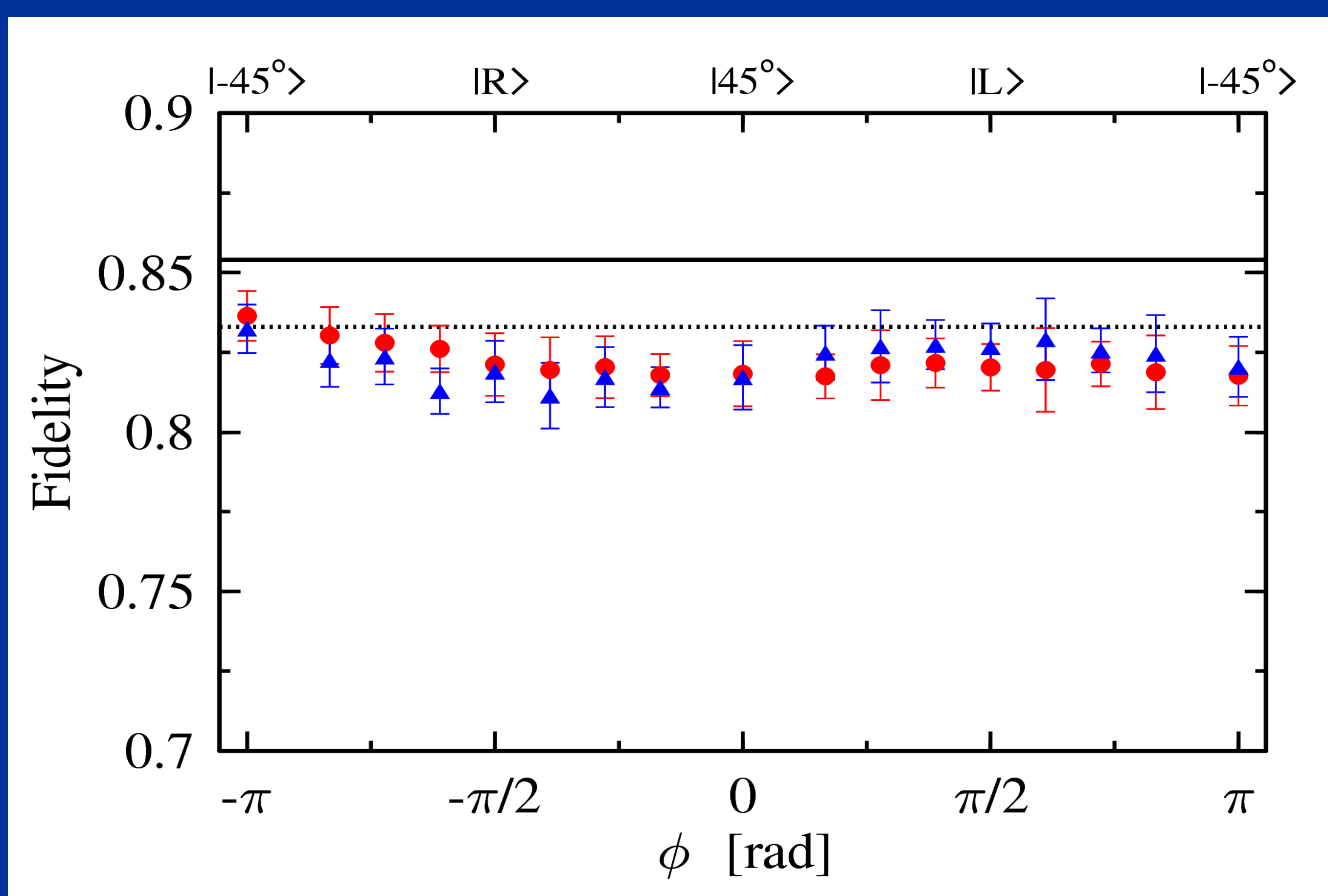


Fázově kovariantní klononování polarizačního stavu fotonu

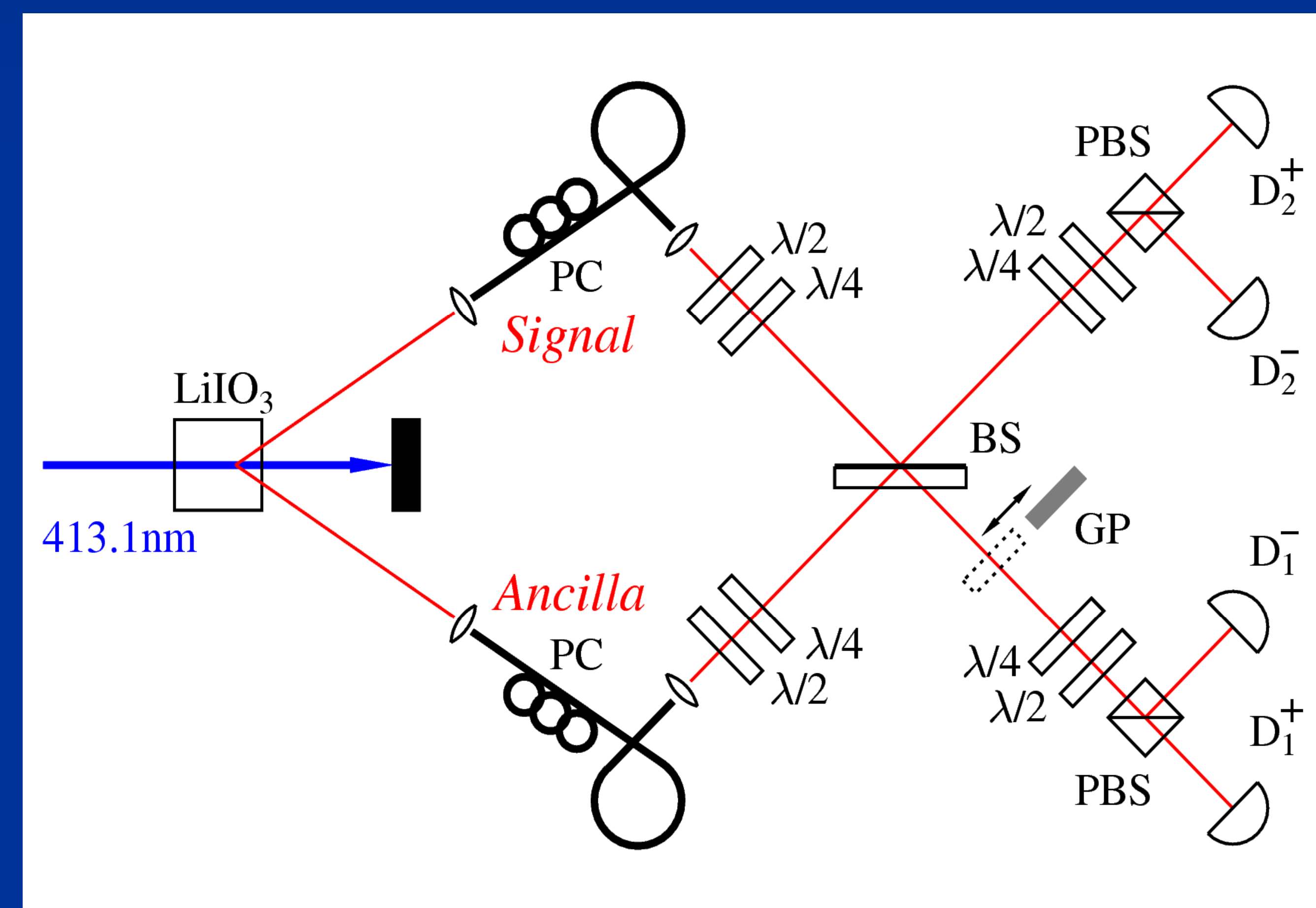
A. Černoch, L. Bartůškova, J. Soubusta, M. Ježek, J. Fiurášek, M. Dušek,
Phys. Rev. A **74**, 042327 (2006).

Z originálu vytvořit dva co nejpřesnější klony $\left(F_{\text{teor}} = 85.4\%\right)$

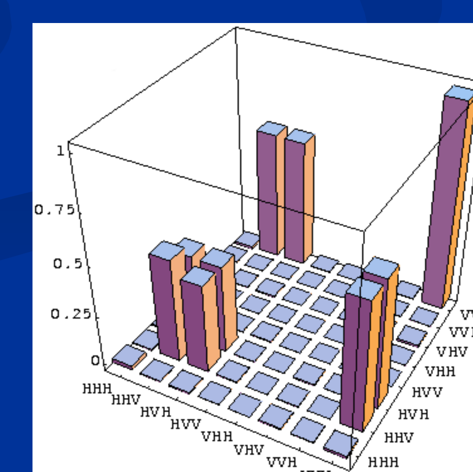
$$|\psi\rangle = \frac{1}{\sqrt{2}}\left(|V\rangle + e^{i\varphi}|H\rangle\right)$$



Dělič svazku: 80:20 pro vert., 20:80 pro horiz. polarizaci

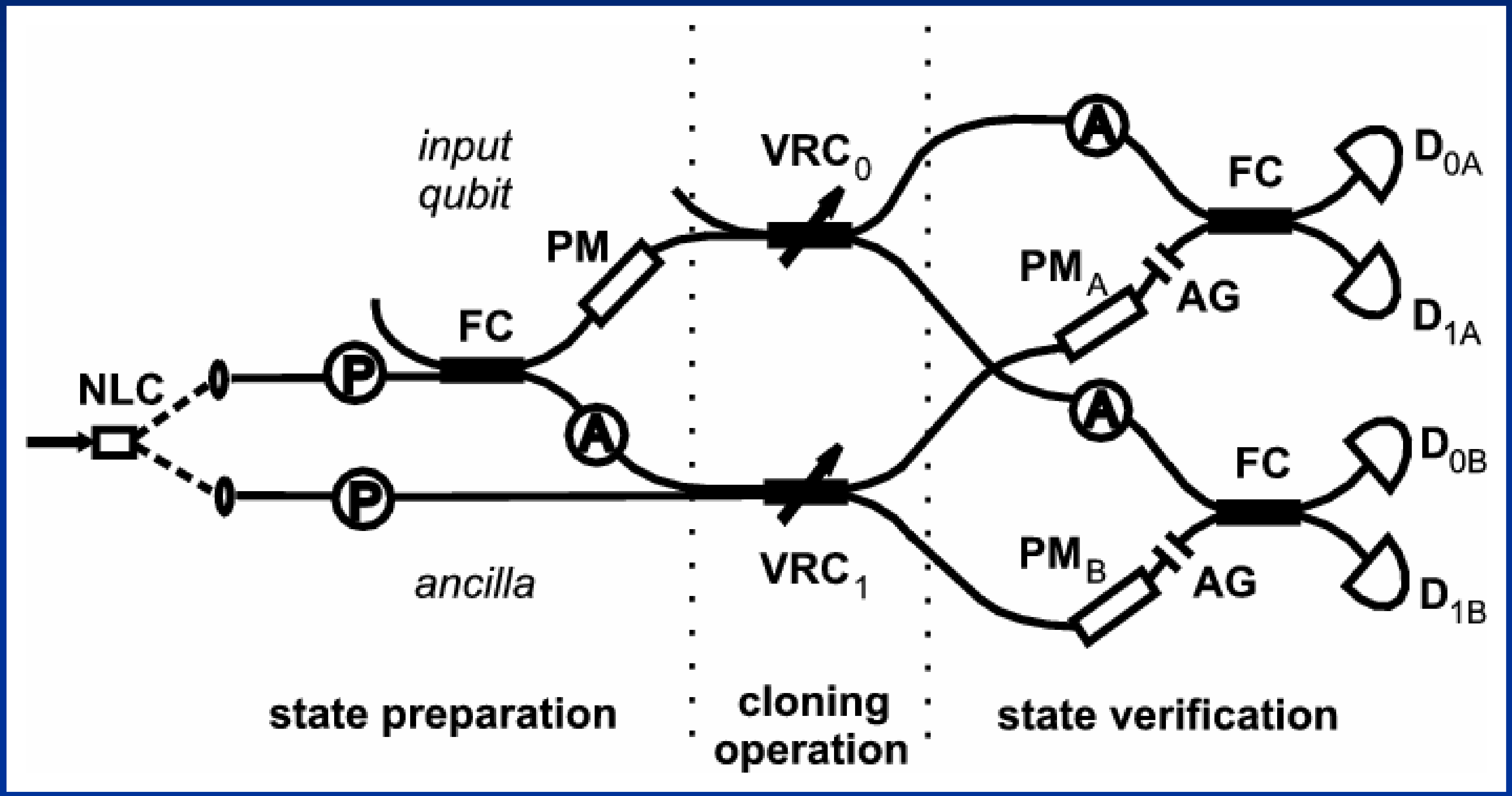


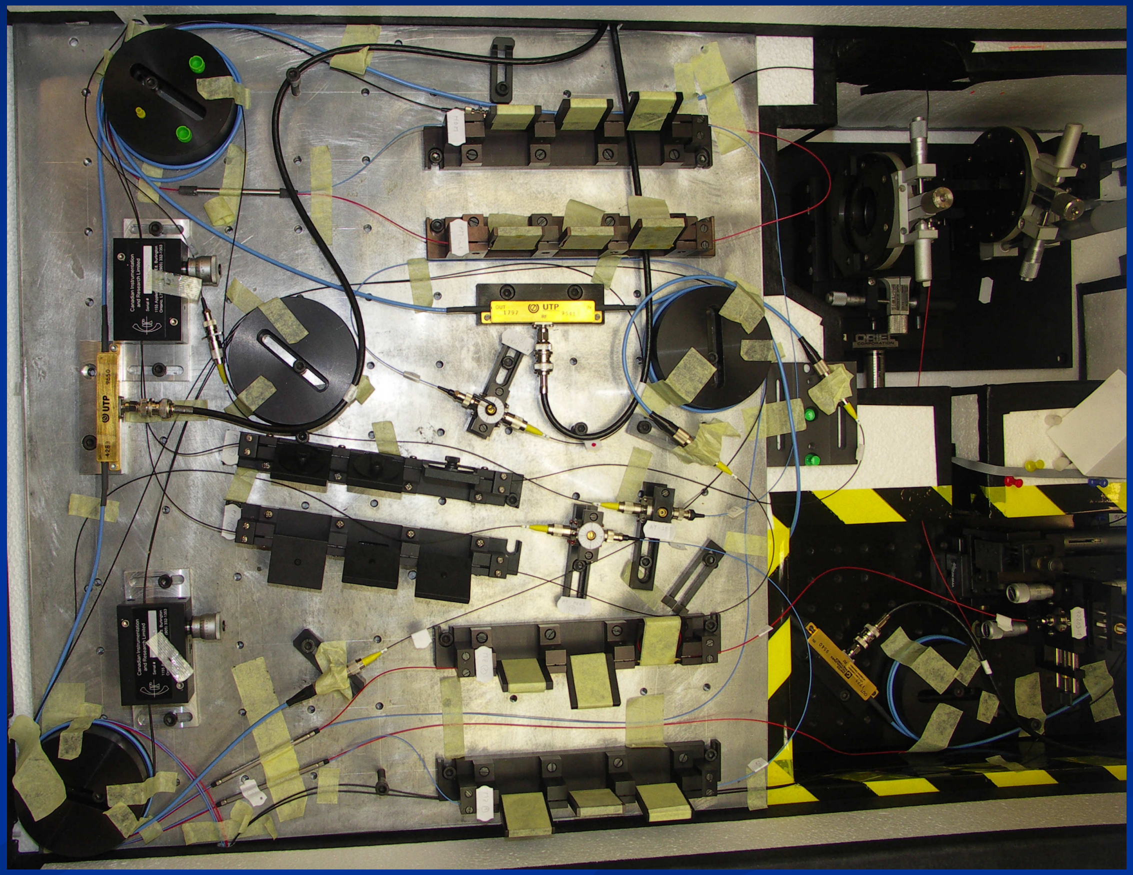
Tomografie procesu:
Fidelita = 94 %



Asymetrické fázově kovariantní klonování s optickými vlákny

L. Bartůšková, M. Dušek, A. Černoch, J. Soubusta, J. Fiurášek, zasláno do Phys. Rev. Lett.





$$|0\rangle \to |00\rangle$$

$$|1\rangle \to \sqrt{q}\,|01\rangle + \sqrt{1-q}\,|10\rangle$$

$q \in [0,1]$ je parametr asymetrie

$$F_1 = \frac{1}{2}\left(1+\sqrt{q}\right)$$

$$F_2 = \frac{1}{2}\left(1+\sqrt{1-q}\right)$$