

Gas sTOF, or gastof™

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- Introduction: Basic arguments
- Next steps and plans

GasTof: Basic idea

Consider gas Cerenkov as alternative/complementary solution:

- Very simple and robust design
- Very thin and light detector - can be used before the tracking part
- (Very) radiation hard

Basic formula: $N_{pe} \approx 100 \sin^2\theta_c L[\text{cm}]$

To estimate position sensitivity estimate average light spot radius $\langle r \rangle$, at radiator exit:

$$\langle r \rangle \approx 0.5L \tan\theta_c \approx \sin\theta_c L/2$$



$$N_{pe} \approx 200 \langle r \rangle [\text{cm}] \sin\theta_c$$

GasTof: Candidate #1

Use the air (radiator 'for free'):

- $n = 1.0003$, $\sin\theta_c = \sqrt{(n^2-1)/n^2} \approx \sqrt{2(n-1)} \approx 0.024$
- So if we insist on $\langle r \rangle = 2\text{mm}$ then we got $N_{pe}=1\dots$
- It is not therefore possible unless we drop this requirement, then we need a long detector ($> 1\text{m}$); might need separate tubes/sectors - difficult solution and unlikely

GasTof: Candidate #2

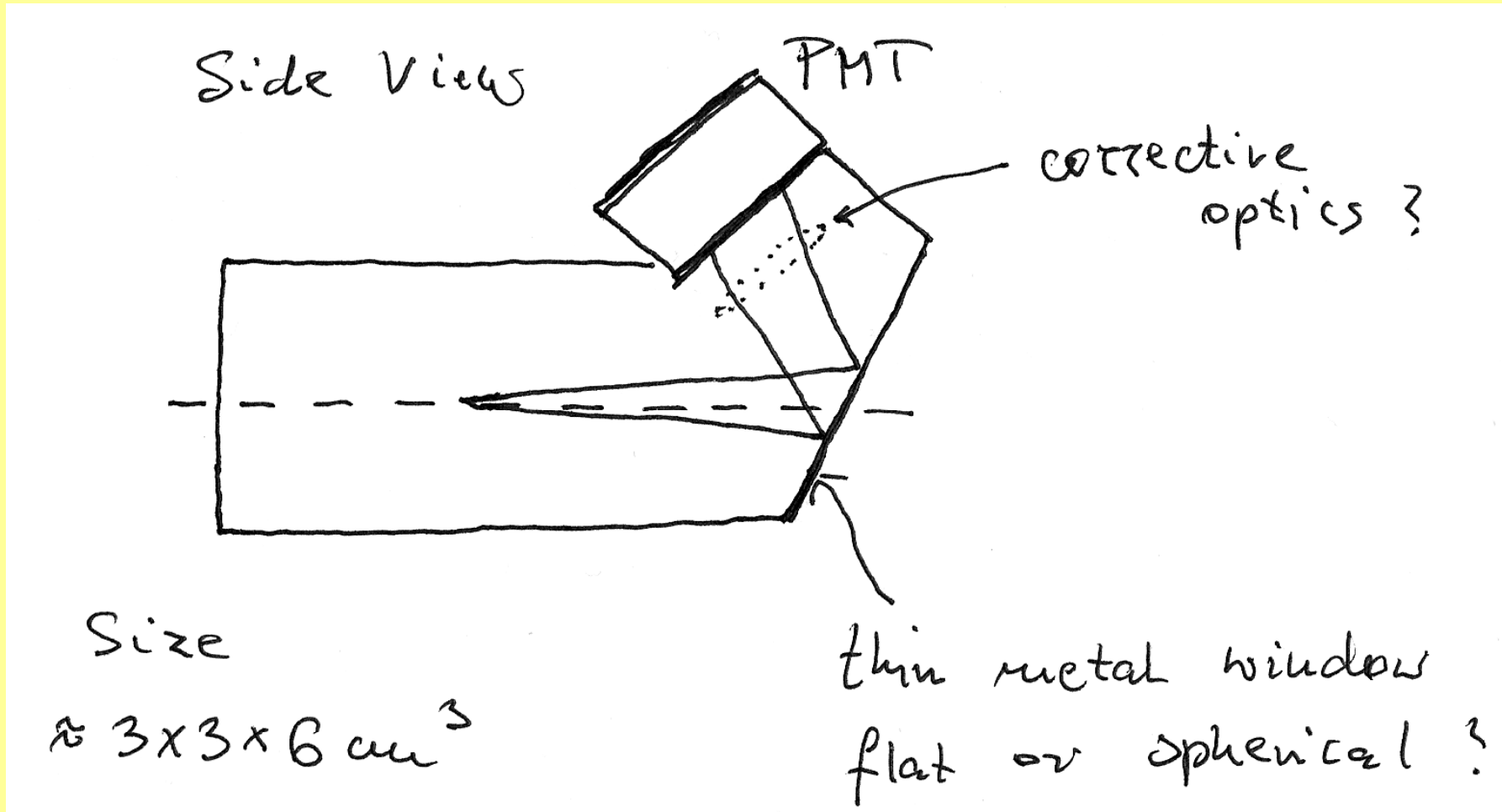
Use dense gas as ethane:

- $n = 1.028$, $\sin\theta_c = \sqrt{(n^2-1)/n^2} \approx 0.23$
- Assume we can use special correction optics that allows larger spots, if
 $\langle r \rangle = 5\text{mm}$ then we got $N_{pe}=23$ OK
- Then $L=2\langle r \rangle/\tan\theta_c \sim 4\text{cm}$



FAVORITE SOLUTION FOR NOW

GasTof: Candidate #2



Alternative idea: Liquid Č

For liquid Cerenkov light spot can be much smaller
($\sin\theta_c \sim 0.5$) but:

- Design and optics more difficult
- Cannot be used before the tracking part
- (Very) radiation hard?

Keep it in mind

$$N_{pe} \approx 100 \sin^2\theta_c L[\text{cm}]$$

$$N_{pe} \approx 200 \langle r \rangle [\text{cm}] \sin\theta_c$$

Next steps/plans

- Pierre Rodeghiero (phd student) has started to learn and study Cerenkov detector - will make MC calculations (ray tracing)
- We would like to buy asap two PMTs to start preparing a test stand with cosmic rays
- We aim at preparing a prototype for the beam tests in spring

Prototyping gastof - first thoughts

- A small team as 100% phd student + ~50% senior, to work on (gas) sTOF for FP420
- Tentative schedule
 - Nov'05: order 2 MCP PMTs (from Burle?) + initial studies/calculations of the gas (and liquid?) TOF counters
 - Nov/Dec'05: continue studies/simulations and prepare setup for cosmic rays test
 - Jan/Feb'05: construction of two prototypes first cosmic tests
 - Mar/Jun'05: prepare new prototype for first beam tests?
 - Summer'05: first conclusions on gastof...
 - Continue according to FP420 recommendations