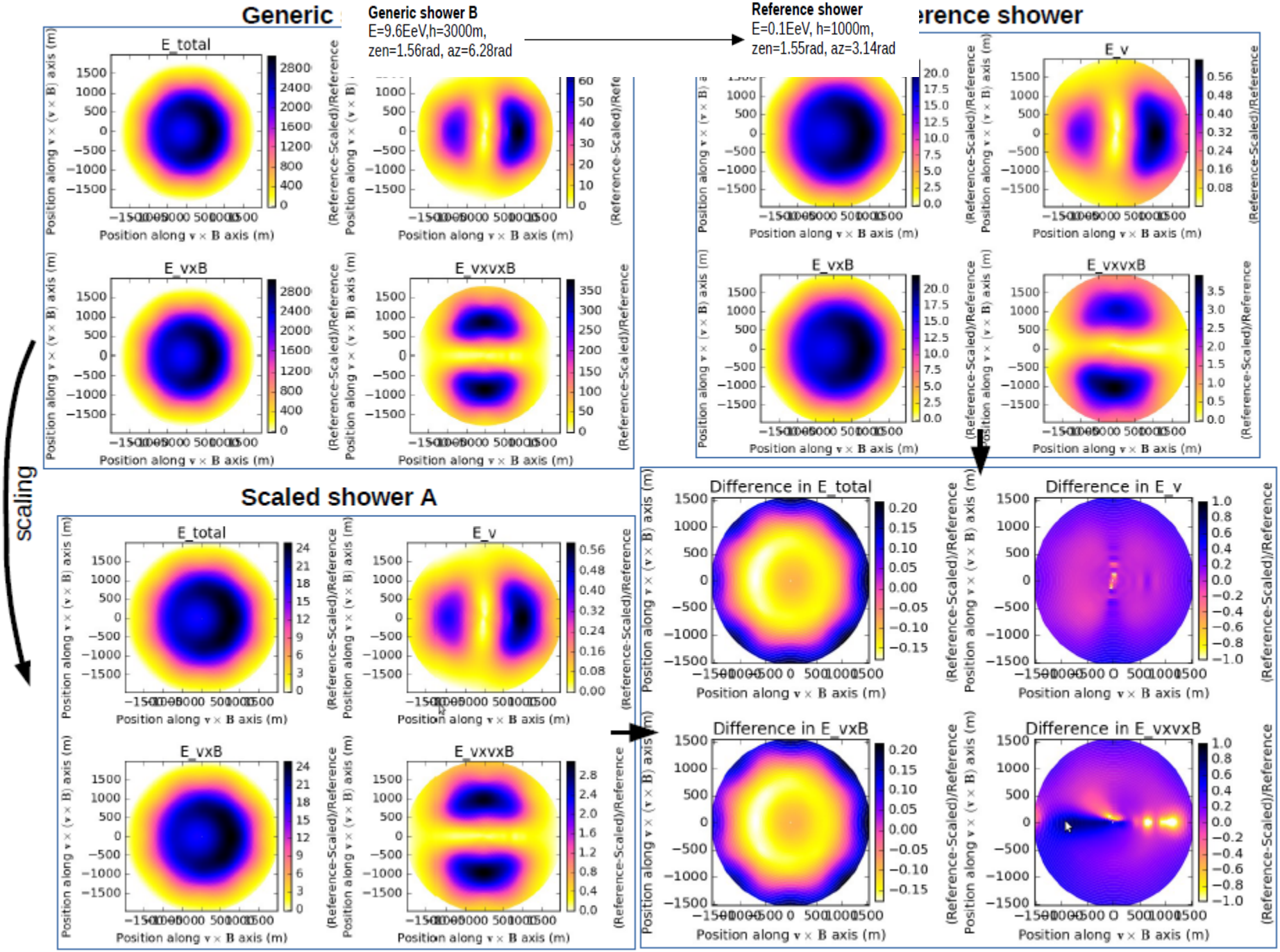
« Design & simulation »
A short summary

Simulation

- On the right track
  - DANTON code nearly ready: [Valentin]
    - Flat Earth model now working in forward MC
    - 1 week more work to implement properly topography
    - 1-2 month for backward MC (factor 100 faster)
  - NuTauSim code available for cross checks [Harm]
  - Radio morphing very promising [Anne]
    - Scaling of pulses to be completed (height) & compared
    - Pulses interpolations in between simulation planes
    - Acceptation criterium to be defined
  - Antennas: see below [Didier]
  - Full chain to be validated on ToyModel [Clementina]
  - **Full sim ready to go in September necessary to match WP timeline**


Generic
Generic shower B
E=9.6EeV,h=3000m,
zen=1.56rad, az=6.28rad
Reference shower
E=0.1EeV, h=1000m,
zen=1.55rad, az=3.14rad
erence shower
scaling
Scaled shower A
E_total
E_v
E_vxB
E_vxvxB
Difference in E_total
Difference in E_v
Difference in E_vxB
Difference in E_vxvxB
Position along v × B axis (m)
Position along v × (v × B) axis (m)
(Reference-Scaled)/Reference

A TOY MODEL...
WHAT WOULD BE THE BEST CONFIGURATION?

Probe the improvement on sensitivity and shower reconstruction with slope > 0

Find the best set of ground parameters (D, α, Zmax) → choose different sites for the expected neutrino flux.

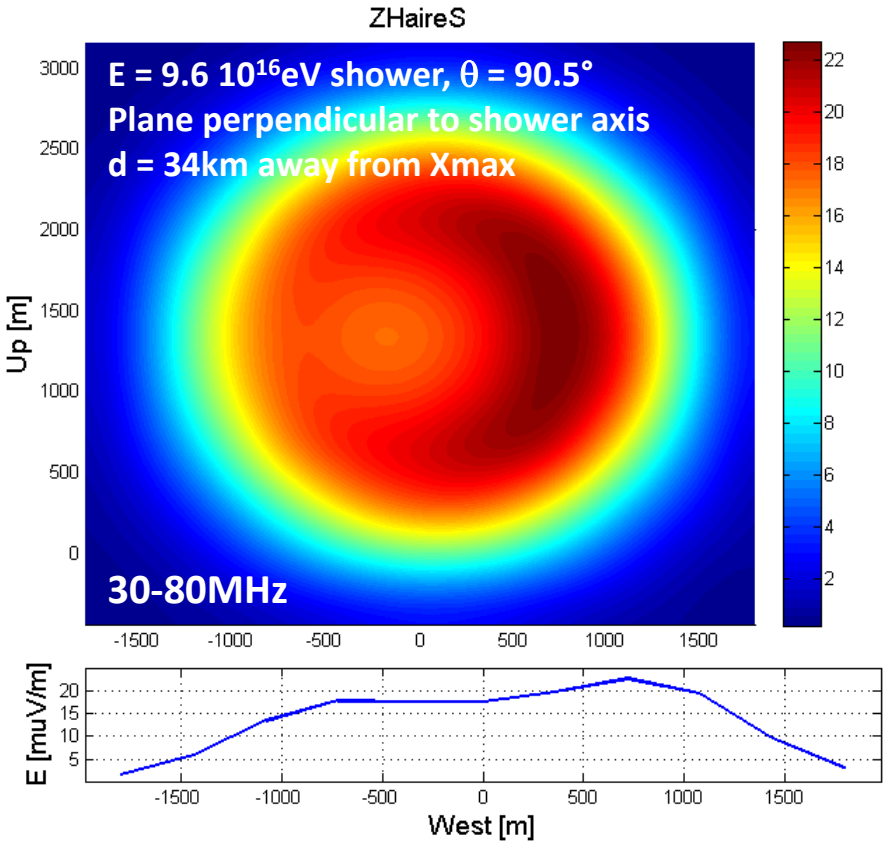
Simulation 3D antenna grid:

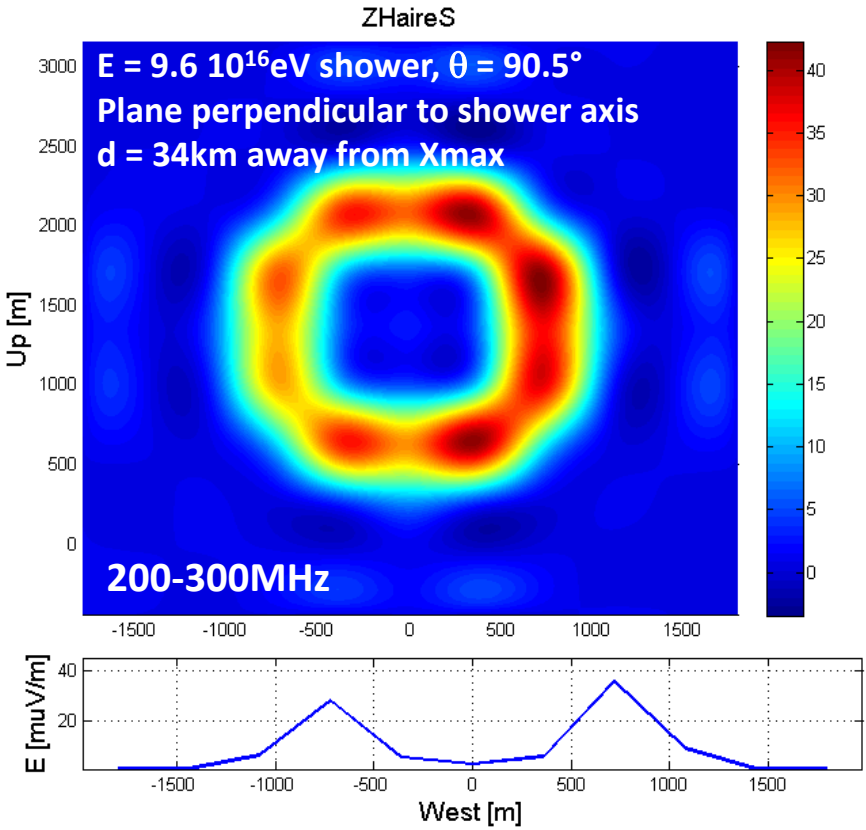
- Conical, with an opening angle of 3° or 5°
- Start ~position of Xmax.
- Density variable with distance

By Clementina Medina

Reconstruction

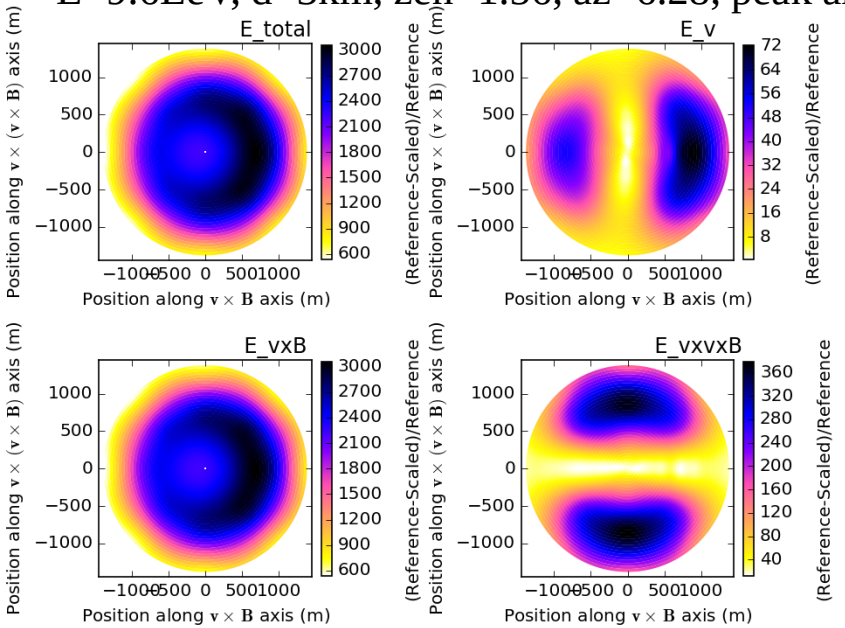
- Precise geometry determination needed to reconstruct direction, energy & Xmax
- Most promising tool: Cerenkov ring. Simulation study needed to determine performances achievable in Cring reconstruction (antenna density? Frequency range? Reconstruction method?)
- **Can only start in September (IAP task force), unless other ressources pop up!**





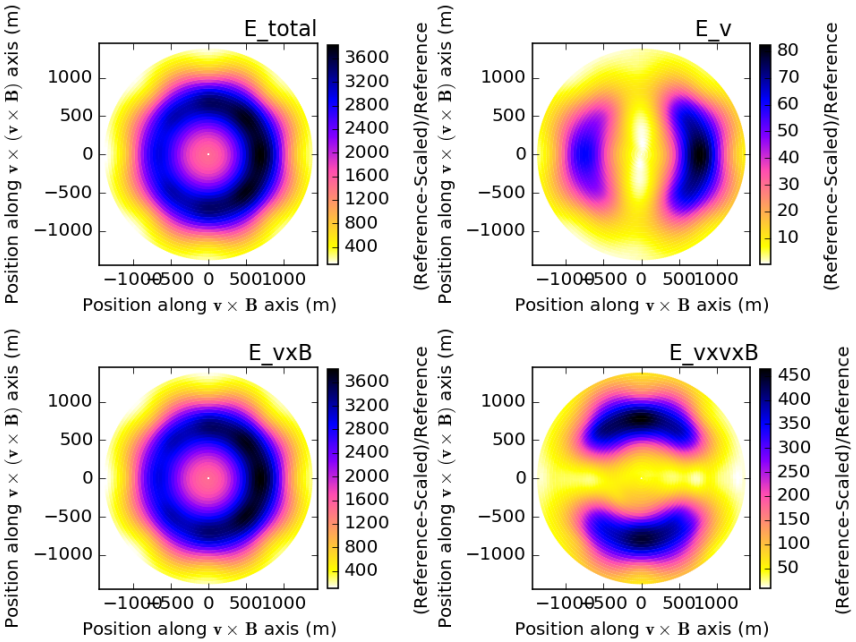
30-80MHz

E=9.6EeV, d=3km, zen=1.56, az=6.28, peak amplitude distribution in shower coord.

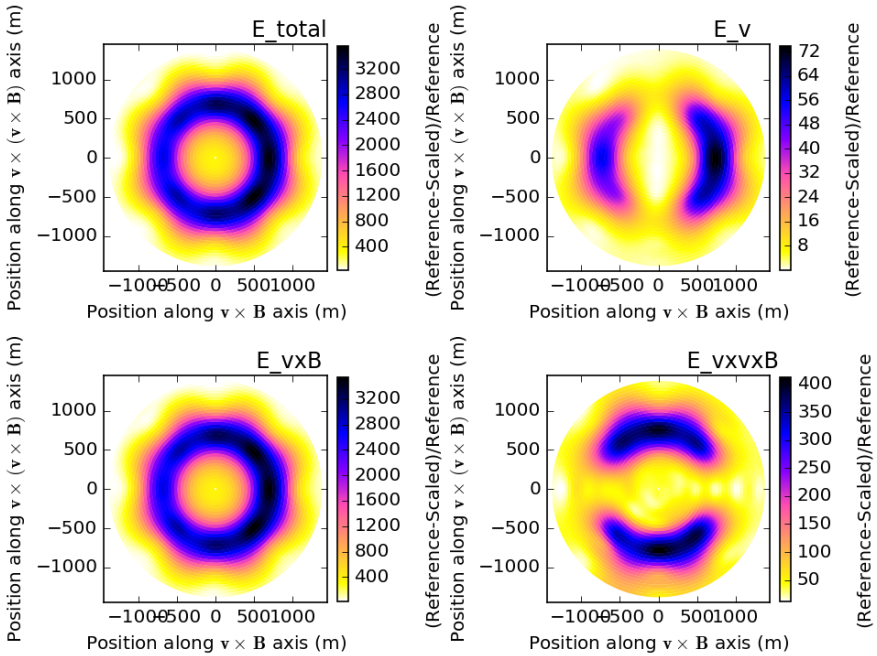


Substructures, especially outside the Cherenkov ring, coming from interpolation method

80-140MHz



140-200MHz



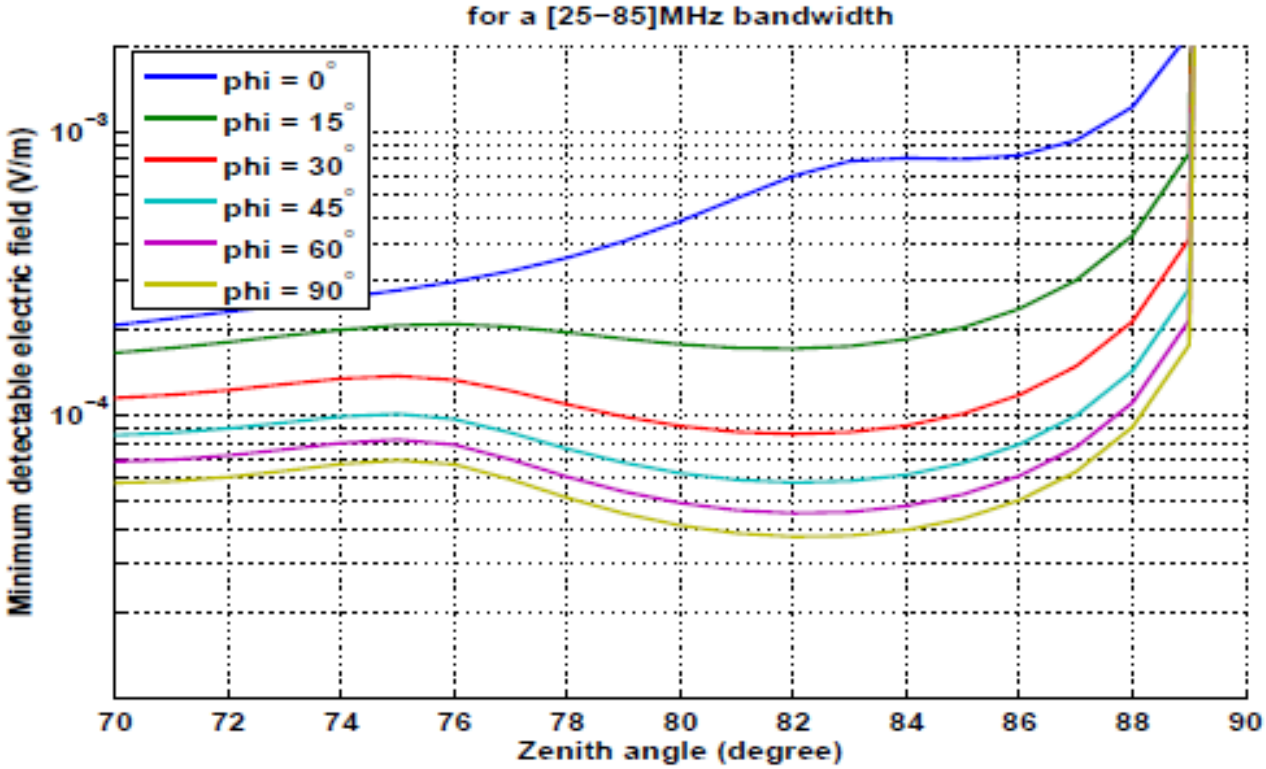
FRBs & GRPs

- FRBs: [Fabrice & Philippe]
  - Very appealing science case in GRAND200k ➔ should be in WP, **as well as status & perspective in the field**.
  - Broad lines of data treatment defined & sensitivity estimates available (precision probably enough for WP… but to be updated with antenna BW, see below).
  - Constraints on DAQ exist (treatment @ local unit & data transfer) but several promising options to try & solve them.
- GRPs: [Philippe]
  - Probably very easy to test with standard DAQ in GRANDProto300 ==> will surely beincluded in GRANDproto300 science case!

Antenna design

- Beautifull design by Didier (single antenna, 9m high)
- Long stimulating discussion Output:
  - 30MHz lower band limit induces large technicall challenge
    and S/N ratio not so obviouly favorable.
  - 60MHz allows same performances for twice lower antenna.
  - Increase upper band limit to 200MHz (300MHz?) to build single wide band antenna ➔ less DAQ channels ➔ cheaper & easier
  - Cost: FRB efficiency reduces by factor 2-4 [**to be recomputed**]
  - **Still not fully converged.**
  - **Work group set up**
  - **Antenna design + response needed by September for neutrino sensitivity simulations.**

minimum detectable Electric field



- for $\theta = [0\text{-}75]\ ^\circ$, $E_{min} \sim 60$ to 100 μV/m for $\phi = [45\text{-}90]\ ^\circ$
- for $\theta = [77\text{-}86]\ ^\circ$, E_{min} is better
- for $\theta = 88\ ^\circ$, E_{min} is still good, ~ 90 to 150 μV/m
- E_{min} should be 1.33 times higher with LNA noise contribution
- **is $\sim$200 μV/m at $\theta = 88\ ^\circ$low enough to detect neutrinos ?**