MTTR and spare parts – AB/ABP

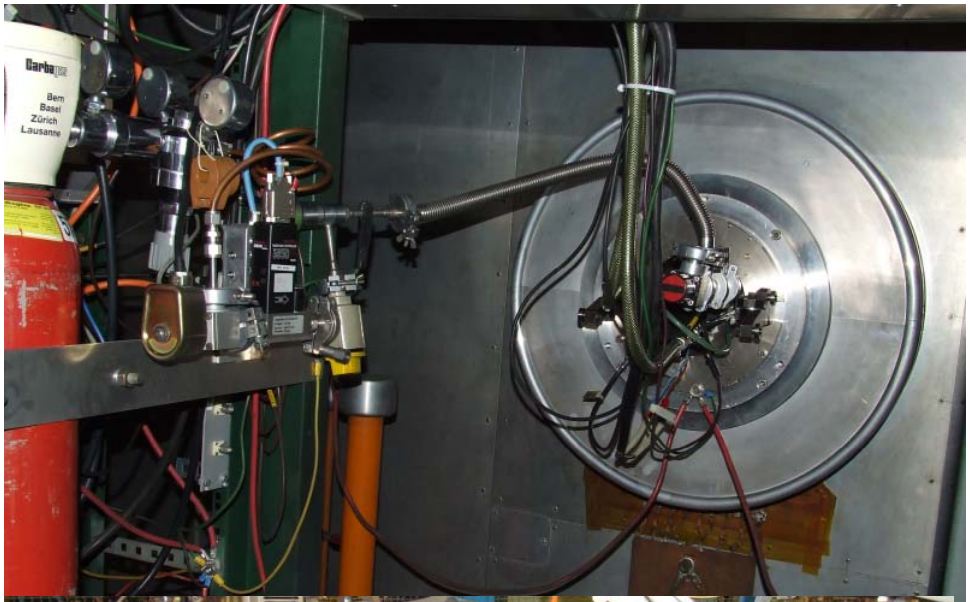
The Sources – R Scrivens

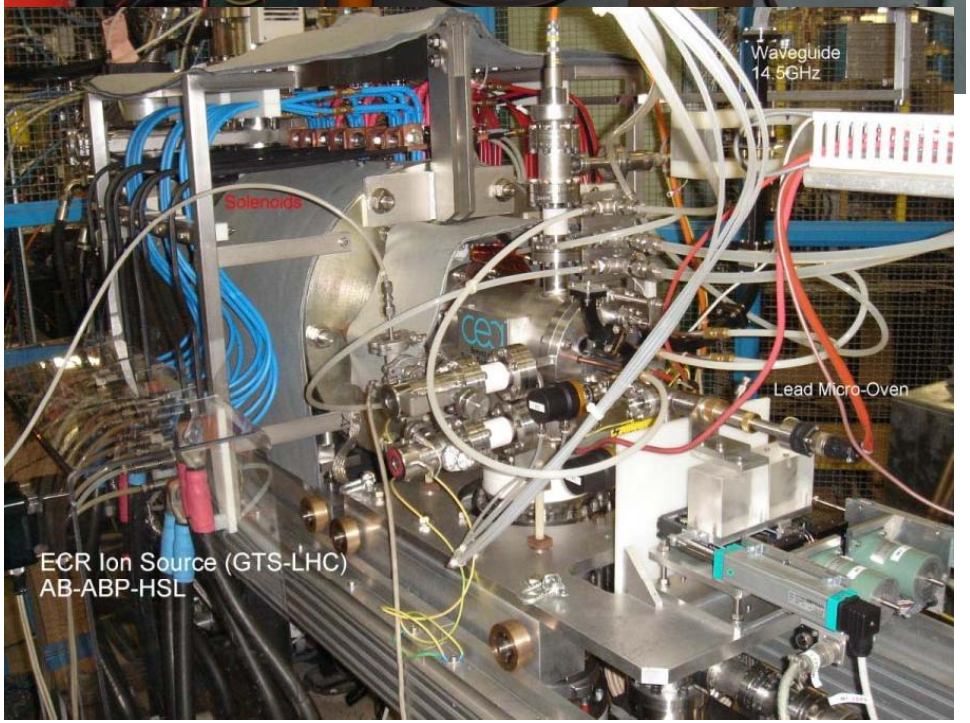
AB/ABP – Ion source MTTR

- Introduction
- Protons
  - Statistics
  - Policy
  - Call out
- Ions
- Spares
- RF drift tube structures of Linac 2/3
- REX Trap and EBIS.

Introduction

- Linac 2 – Duoplamastron
  in service since 1992
  5000-6000 hrs operation/yr
  ~300kchf
- Linac 3 – GTS ECR source
  in service since 2005
  ~600kchf
- REX – Penning Trap and
  EBIS charge breeder
- 3 different solutions, little
  equipment in common.
- No Source = No Beam = No
  physics



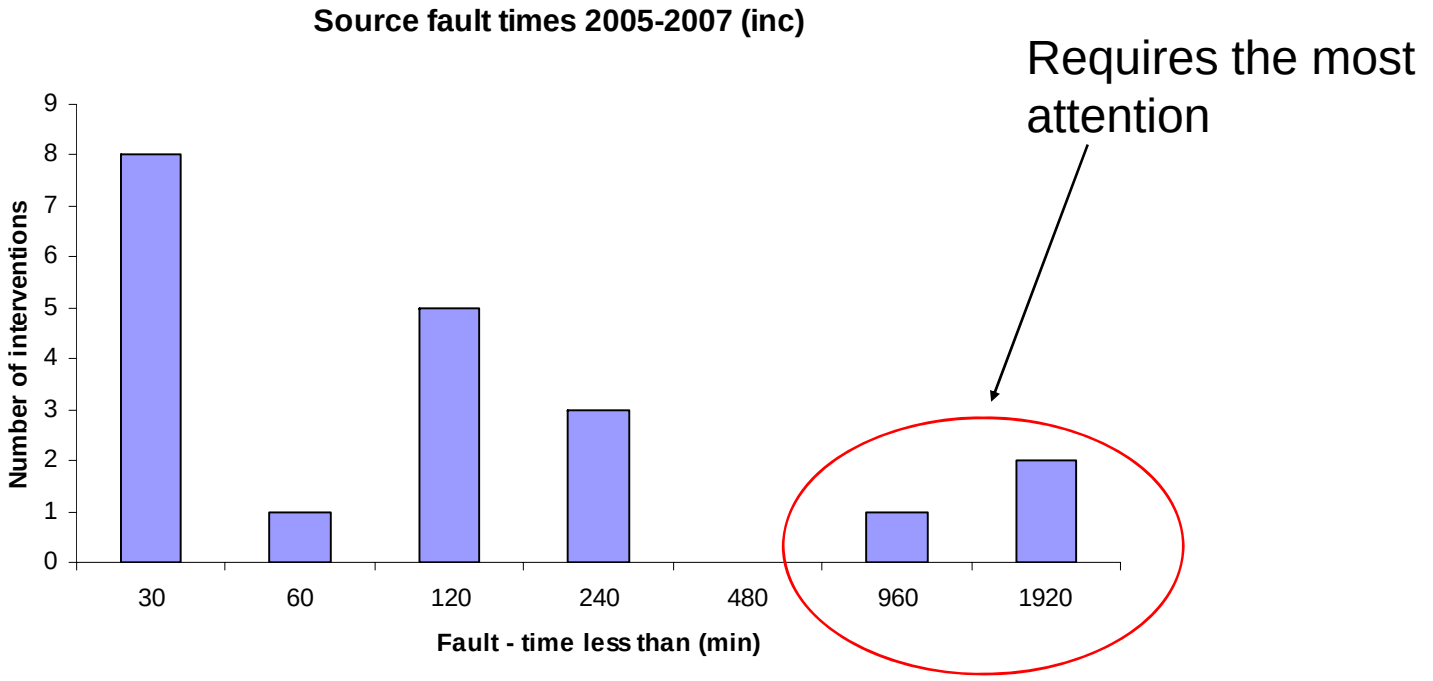


MTTR Statistics - Protons

	Faults	Down Time (hr / %)	MTTR (hr)	Comment
2007	9	7.2 / 0.1%	0.8	No internal faults Not counting flashovers
2006	6	31.1 / 0.6%	5.2	1 cathode change
2005	6	39.3 / 0.7%	6.5	2 cathode/electrode changes
2004	2	0.5 / 0.0%	0.3	
2003	4	3.3 / 0.1%	0.8	

TTR Statistics – Protons

- <30 minutes – planned small interventions and investigations.
- <240 minutes – Real faults (intervention planned and unplanned)
- >240 minutes – Intervention inside vacuum (pump and reconditioning).



High MTTR faults – some examples

- Cathode and Electrode changes (vacuum intervention and reconditioning). MTTR=18hr (3x)
  For 2007 start up, some source components baked + improved source leak detection.
- Arc supply transistor failure (supervisor + specialist call out). TTR=3.5hr.
- Leak test. TTR=2.1hr. Investigation of cathode and electrode.
- Source misfiring. Tuning required. TTR=2.3hr.
- Too much beam from source. RF regulation problem. TTR=3.2hr.

- Most faults not recurring. Electrode and cathode changes fixed?

Policy + Spare parts

- Annual maintenance (dismounting and cleaning, electronics testing).
- Spare parts. (>100 per source, >70% proprietary) – kept in close proximity. *No database*.
- Study unusual situations to anticipate larger failures (facilitated by access to source area during operation – will not be the case with Linac4).
- Long faults – Plan if possible, keep CCC informed.

Other labs

- BNL – H- repair with spare parts (hot spare foreseen, but easier to repair in situ).
  Au- spare source ready to go.
- FNAL – 2x 750keV magnetron-Cockcroft Waltons
- DESY – 2x H- ion sources (2 different types of ion source, 2 RFQs.)

- At CERN we have neither a hot-spare, or a complete source ready to install (as BNL). We rely on spare parts. In view of the small number of faults, we think CERN's policy is valid.

Call out

- Linac supervisor team has 6 members.
- Only 50% are source experts (who can enter the source cage).
- Long vacation planning made to have a source expert in the region (but **not** on stand-by).

Ions ECR

- Statistic with GTS ECR source not yet available (no physics runs).
- Main hardware has improved 2005-2007.

  2007: Only one hardware failure (restricted water flow through connector)

- Source needs tuning ~1 / day (irregular).
  For LHC ion runs will need an expert rota.
  Upgrade of controls required for remote tuning. Resources not identified.

- Oven refill every 3 weeks (2 ovens) => 2 fills per LHC ion run?

Improving spares

- Protons: A few missing spare parts.
- Ions: Large investment in spares: Permenant Hexapole magnet, 18GHz generator and solenoid coils, has been made.
  Spare Injection T, oven + cane required.
  18GHz klystron spare probably required for NOMINAL beam (>50kchf)

- Except for klystron, operation budget 2008/09 sufficient.

Linac 2 and 3 drift tubes.

- Linac 2 internal elements of the DTL tanks (e.g. drift tubes, with their magnets) are a potential source of very long MTTR (>1 month) – Mitigation is Linac 4 (in 2013).
- Linac 3 drift tubes – refurbished spares exist. Replacement has taken 6 weeks.
- Linac 2 tuners. Inspection and repairs made in 2007/8. But spares needed.

REX- Charge Breeder

- Penning TRAP and EBIS.
- ~10 x 1 week runs of REX per year.
- 2006: Test run cancelled – EBIS cathode failure
  2007: 2 runs with reduced intensity due to TRAP sparking.
- REX is still transferring equipment to the groups. The TRAP is foreseen for 2008-9 (see F. Wenander's ATC presentation in Feb 2008).
- After this (2009), review ABP equipment in terms of reliability.
- Many items without spares (e.g. superconducting solenoids).

Conclusions

- Proton source: Very low fault rate. Policy is valid.
- Ion source: Requires tuning and oven changes.
  Some spares still to be purchased.
  Improve remote controlling in the future.
  Ion Source rota for LHC ion run.
- REX charge breeder: Progress is being made to match equipment to groups.